

# 1 CCPP variables provided by model SCM vs requested by pool of physics

## 1.1 List of variables

[GFS\\_cldprop\\_type](#)  
[GFS\\_cldprop\\_type\\_instance](#)  
[GFS\\_cldprop\\_type\\_instance\\_all\\_blocks](#)  
[GFS\\_control\\_type](#)  
[GFS\\_control\\_type\\_instance](#)  
[GFS\\_coupling\\_type](#)  
[GFS\\_coupling\\_type\\_instance](#)  
[GFS\\_data\\_type](#)  
[GFS\\_diag\\_type](#)  
[GFS\\_diag\\_type\\_instance](#)  
[GFS\\_diag\\_type\\_instance\\_all\\_blocks](#)  
[GFS\\_grid\\_type](#)  
[GFS\\_grid\\_type\\_instance](#)  
[GFS\\_grid\\_type\\_instance\\_all\\_blocks](#)  
[GFS\\_interstitial\\_type](#)  
[GFS\\_interstitial\\_type\\_instance](#)  
[GFS\\_radtend\\_type](#)  
[GFS\\_radtend\\_type\\_instance](#)  
[GFS\\_sfcprop\\_type](#)  
[GFS\\_sfcprop\\_type\\_instance](#)  
[GFS\\_sfcprop\\_type\\_instance\\_all\\_blocks](#)  
[GFS\\_statein\\_type](#)  
[GFS\\_statein\\_type\\_instance](#)  
[GFS\\_statein\\_type\\_instance\\_all\\_blocks](#)  
[GFS\\_stateout\\_type](#)  
[GFS\\_stateout\\_type\\_instance](#)

GFS\_tbd\_type  
GFS\_tbd\_type\_instance  
GFS\_tbd\_type\_instance\_all\_blocks  
Monin\_Obukhov\_similarity\_function\_for\_heat  
Monin\_Obukhov\_similarity\_function\_for\_heat\_at\_2m  
Monin\_Obukhov\_similarity\_function\_for\_heat\_at\_2m\_over\_ice  
Monin\_Obukhov\_similarity\_function\_for\_heat\_at\_2m\_over\_land  
Monin\_Obukhov\_similarity\_function\_for\_heat\_at\_2m\_over\_ocean  
Monin\_Obukhov\_similarity\_function\_for\_heat\_over\_ice  
Monin\_Obukhov\_similarity\_function\_for\_heat\_over\_land  
Monin\_Obukhov\_similarity\_function\_for\_heat\_over\_ocean  
Monin\_Obukhov\_similarity\_function\_for\_momentum  
Monin\_Obukhov\_similarity\_function\_for\_momentum\_at\_10m  
Monin\_Obukhov\_similarity\_function\_for\_momentum\_at\_10m\_over\_ice  
Monin\_Obukhov\_similarity\_function\_for\_momentum\_at\_10m\_over\_land  
Monin\_Obukhov\_similarity\_function\_for\_momentum\_at\_10m\_over\_ocean  
Monin\_Obukhov\_similarity\_function\_for\_momentum\_over\_ice  
Monin\_Obukhov\_similarity\_function\_for\_momentum\_over\_land  
Monin\_Obukhov\_similarity\_function\_for\_momentum\_over\_ocean  
a\_parameter\_of\_the\_hybrid\_coordinate  
accumulated\_change\_of\_air\_temperature\_due\_to\_FA\_scheme  
accumulated\_lwe\_thickness\_of\_convective\_precipitation\_amount\_cnvc90  
accumulated\_lwe\_thickness\_of\_graupel\_amount  
accumulated\_lwe\_thickness\_of\_graupel\_amount\_in\_bucket  
accumulated\_lwe\_thickness\_of\_ice\_amount  
accumulated\_lwe\_thickness\_of\_ice\_amount\_in\_bucket  
accumulated\_lwe\_thickness\_of\_precipitation\_amount  
accumulated\_lwe\_thickness\_of\_precipitation\_amount\_in\_bucket  
accumulated\_lwe\_thickness\_of\_snow\_amount  
accumulated\_lwe\_thickness\_of\_snow\_amount\_in\_bucket  
accumulated\_water\_equivalent\_of\_frozen\_precip

adjusted\_vertical\_layer\_dimension\_for\_radiation  
adjusted\_vertical\_level\_dimension\_for\_radiation  
aerosol\_asymmetry\_parameter\_for\_longwave\_bands\_01\_16  
aerosol\_asymmetry\_parameter\_for\_shortwave\_bands\_01\_16  
aerosol\_aware\_parameter\_deep\_convection  
aerosol\_aware\_parameter\_shallow\_convection  
aerosol\_number\_concentration\_from\_gocart\_aerosol\_climatology  
aerosol\_optical\_depth\_for\_longwave\_bands\_01\_16  
aerosol\_optical\_depth\_for\_shortwave\_bands\_01\_16  
aerosol\_optical\_properties\_for\_longwave\_bands\_01\_16  
aerosol\_optical\_properties\_for\_shortwave\_bands\_01\_16  
aerosol\_single\_scattering\_albedo\_for\_longwave\_bands\_01\_16  
aerosol\_single\_scattering\_albedo\_for\_shortwave\_bands\_01\_16  
air\_pressure  
air\_pressure\_at\_interface  
air\_pressure\_at\_interface\_for\_radiation\_in\_hPa  
air\_pressure\_at\_layer\_for\_radiation\_in\_hPa  
air\_pressure\_at\_lowest\_model\_layer  
air\_pressure\_difference\_between\_midlayers  
air\_temperature  
air\_temperature\_at\_interface\_for\_radiation  
air\_temperature\_at\_layer\_for\_radiation  
air\_temperature\_at\_lowest\_model\_layer  
air\_temperature\_at\_lowest\_model\_layer\_for\_diag  
air\_temperature\_at\_lowest\_model\_layer\_updated\_by\_physics  
air\_temperature\_at\_previous\_time\_step  
air\_temperature\_lapse\_rate\_constant  
air\_temperature\_save  
air\_temperature\_two\_time\_steps\_back  
air\_temperature\_updated\_by\_physics  
angle\_from\_east\_of\_maximum\_subgrid\_orographic\_variations

anisotropy\_of\_subgrid\_orography  
area\_fraction\_of\_wet\_canopy  
array\_dimension\_of\_2d\_arrays\_for\_microphysics  
array\_dimension\_of\_3d\_arrays\_for\_microphysics  
array\_dimension\_of\_random\_number  
asymmetry\_of\_subgrid\_orography  
atmosphere\_boundary\_layer\_thickness  
atmosphere\_diffusivity\_coefficient\_factor  
atmosphere\_heat\_diffusivity  
atmosphere\_heat\_diffusivity\_background  
atmosphere\_heat\_diffusivity\_background\_maximum  
atmosphere\_heat\_diffusivity\_for\_mynnpbl  
atmosphere\_heat\_diffusivity\_from\_shoc  
atmosphere\_momentum\_diffusivity\_background  
atmosphere\_momentum\_diffusivity\_for\_mynnpbl  
atmosphere\_optical\_thickness\_due\_to\_ambient\_aerosol\_particles  
b\_parameter\_of\_the\_hybrid\_coordinate  
baseline\_surface\_roughness\_length  
bounded\_vegetation\_area\_fraction  
bulk\_richardson\_number\_at\_lowest\_model\_level  
bulk\_richardson\_number\_at\_lowest\_model\_level\_over\_ice  
bulk\_richardson\_number\_at\_lowest\_model\_level\_over\_land  
bulk\_richardson\_number\_at\_lowest\_model\_level\_over\_ocean  
canopy\_air\_temperature  
canopy\_air\_vapor\_pressure  
canopy\_intercepted\_ice\_mass  
canopy\_intercepted\_liquid\_water  
canopy\_upward\_latent\_heat\_flux  
canopy\_water\_amount  
ccn\_number\_concentration  
ccpp\_block\_number

ccpp\_error\_flag  
ccpp\_error\_message  
ccpp\_loop\_counter  
ccpp\_t  
ccpp\_t\_instance  
ccpp\_thread\_number  
cell\_area  
cell\_size  
cellular\_automata\_finer\_grid  
cellular\_automata\_lifetime  
cellular\_automata\_seed\_frequency  
cellular\_automata\_seed\_probability  
characteristic\_grid\_length\_scale  
choice\_of\_original\_scale\_aware\_TKE\_moist\_EDMF\_PBL  
choice\_of\_scale\_aware\_TKE\_moist\_EDMF\_PBL  
choice\_of\_updated\_scale\_aware\_TKE\_moist\_EDMF\_PBL  
cloud\_area\_fraction  
cloud\_area\_fraction\_for\_radiation  
cloud\_base\_mass\_flux  
cloud\_condensed\_water\_conversion\_threshold  
cloud\_condensed\_water\_mixing\_ratio  
cloud\_condensed\_water\_mixing\_ratio\_at\_lowest\_model\_layer  
cloud\_condensed\_water\_mixing\_ratio\_at\_surface  
cloud\_condensed\_water\_mixing\_ratio\_convective\_transport\_tracer  
cloud\_condensed\_water\_mixing\_ratio\_save  
cloud\_condensed\_water\_mixing\_ratio\_updated\_by\_physics  
cloud\_decorrelation\_length  
cloud\_droplet\_number\_concentration  
cloud\_droplet\_number\_concentration\_updated\_by\_physics  
cloud\_fraction\_for\_MG  
cloud\_fraction\_updated\_by\_physics

cloud\_ice\_mixing\_ratio  
cloud\_ice\_water\_path  
cloud\_liquid\_water\_mixing\_ratio  
cloud\_liquid\_water\_path  
cloud\_optical\_depth\_layers\_at\_0p55mu\_band  
cloud\_optical\_depth\_layers\_at\_10mu\_band  
cloud\_phase\_transition\_denominator  
cloud\_phase\_transition\_threshold\_temperature  
cloud\_rain\_water\_mixing\_ratio  
cloud\_rain\_water\_path  
cloud\_snow\_mixing\_ratio  
cloud\_snow\_water\_path  
cloud\_specie\_mix\_flag  
cloud\_top\_entrainment\_instability\_value  
cloud\_work\_function  
cloudpdf  
cmpfsw\_type  
coefficient\_c\_0  
coefficient\_c\_d  
coefficient\_for\_evaporation\_of\_rainfall  
coefficient\_from\_cloud\_ice\_to\_snow  
coefficient\_from\_cloud\_water\_to\_rain  
coefficient\_w\_0  
coefficient\_w\_d  
coefficients\_for\_aerosol\_scavenging  
column\_precipitable\_water  
components\_of\_surface\_downward\_shortwave\_fluxes  
conv\_activity\_counter  
convective\_available\_potential\_energy\_for\_coupling  
convective\_cloud\_cover  
convective\_cloud\_cover\_in\_phy\_f3d

convective\_cloud\_fraction\_for\_microphysics  
convective\_cloud\_switch  
convective\_cloud\_volume\_fraction  
convective\_cloud\_water\_mixing\_ratio  
convective\_cloud\_water\_mixing\_ratio\_in\_phy\_f3d  
convective\_precipitation\_rate\_from\_previous\_timestep  
convective\_transportable\_tracers  
convective\_updraft\_area\_fraction  
convective\_updraft\_area\_fraction\_at\_model\_interfaces  
convexity\_of\_subgrid\_orography  
cosine\_of\_latitude  
cosine\_of\_solar\_declination\_angle  
cosine\_of\_zenith\_angle  
countergradient\_mixing\_term\_for\_temperature  
countergradient\_mixing\_term\_for\_water\_vapor  
couple\_sgs\_clouds\_to\_radiation\_flag  
critical\_cloud\_top\_entrainment\_instability\_criteria  
critical\_relative\_humidity  
critical\_relative\_humidity\_at\_PBL\_top  
critical\_relative\_humidity\_at\_surface  
critical\_relative\_humidity\_at\_top\_of\_atmosphere  
cumulative\_atmosphere\_detrainment\_convective\_mass\_flux  
cumulative\_atmosphere\_downdraft\_convective\_mass\_flux  
cumulative\_atmosphere\_updraft\_convective\_mass\_flux  
cumulative\_canopy\_upward\_latent\_heat\_flu\_multiplied\_by\_timestep  
cumulative\_change\_in\_ozone\_concentration\_due\_to\_overhead\_ozone\_column  
cumulative\_change\_in\_ozone\_concentration\_due\_to\_ozone\_mixing\_ratio  
cumulative\_change\_in\_ozone\_concentration\_due\_to\_production\_and\_loss\_rate  
cumulative\_change\_in\_ozone\_concentration\_due\_to\_temperature  
cumulative\_change\_in\_ozone\_mixing\_ratio\_due\_to\_PBL  
cumulative\_change\_in\_temperature\_due\_to\_PBL

cumulative\_change\_in\_temperature\_due\_to\_deep\_convection  
cumulative\_change\_in\_temperature\_due\_to\_longwave\_radiation  
cumulative\_change\_in\_temperature\_due\_to\_microphysics  
cumulative\_change\_in\_temperature\_due\_to\_orographic\_gravity\_wave\_drag  
cumulative\_change\_in\_temperature\_due\_to\_shal\_convection  
cumulative\_change\_in\_temperature\_due\_to\_shortwave\_radiation  
cumulative\_change\_in\_water\_vapor\_specific\_humidity\_due\_to\_PBL  
cumulative\_change\_in\_water\_vapor\_specific\_humidity\_due\_to\_deep\_convection  
cumulative\_change\_in\_water\_vapor\_specific\_humidity\_due\_to\_microphysics  
cumulative\_change\_in\_water\_vapor\_specific\_humidity\_due\_to\_shal\_convection  
cumulative\_change\_in\_x\_wind\_due\_to\_PBL  
cumulative\_change\_in\_x\_wind\_due\_to\_convective\_gravity\_wave\_drag  
cumulative\_change\_in\_x\_wind\_due\_to\_deep\_convection  
cumulative\_change\_in\_x\_wind\_due\_to\_orographic\_gravity\_wave\_drag  
cumulative\_change\_in\_y\_wind\_due\_to\_PBL  
cumulative\_change\_in\_y\_wind\_due\_to\_convective\_gravity\_wave\_drag  
cumulative\_change\_in\_y\_wind\_due\_to\_deep\_convection  
cumulative\_change\_in\_y\_wind\_due\_to\_orographic\_gravity\_wave\_drag  
cumulative\_cloud\_work\_function  
cumulative\_lwe\_thickness\_of\_convective\_precipitation\_amount  
cumulative\_lwe\_thickness\_of\_convective\_precipitation\_amount\_in\_bucket  
cumulative\_snow\_deposition\_sublimation\_upward\_latent\_heat\_flux\_multiplied\_by\_timestep  
cumulative\_snow\_freezing\_rain\_upward\_latent\_heat\_flux\_multiplied\_by\_timestep  
cumulative\_soil\_upward\_latent\_heat\_flux\_multiplied\_by\_timestep  
cumulative\_surface\_downwelling\_diffuse\_near\_infrared\_shortwave\_flux\_for\_coupling\_multiplied\_by\_timestep  
cumulative\_surface\_downwelling\_diffuse\_ultraviolet\_and\_visible\_shortwave\_flux\_for\_coupling\_multiplied\_by\_timestep  
cumulative\_surface\_downwelling\_direct\_near\_infrared\_shortwave\_flux\_for\_coupling\_multiplied\_by\_timestep  
cumulative\_surface\_downwelling\_direct\_ultraviolet\_and\_visible\_shortwave\_flux\_for\_coupling\_multiplied\_by\_timestep  
cumulative\_surface\_downwelling\_longwave\_flux\_for\_coupling\_multiplied\_by\_timestep  
cumulative\_surface\_downwelling\_longwave\_flux\_multiplied\_by\_timestep  
cumulative\_surface\_downwelling\_shortwave\_flux\_for\_coupling\_multiplied\_by\_timestep



cumulative\_surface\_ground\_heat\_flux\_multiplied\_by\_timestep  
cumulative\_surface\_net\_downward\_diffuse\_near\_infrared\_shortwave\_flux\_for\_coupling\_multiplied\_by\_timestep  
cumulative\_surface\_net\_downward\_diffuse\_ultraviolet\_and\_visible\_shortwave\_flux\_for\_coupling\_multiplied\_by\_timestep  
cumulative\_surface\_net\_downward\_direct\_near\_infrared\_shortwave\_flux\_for\_coupling\_multiplied\_by\_timestep  
cumulative\_surface\_net\_downward\_direct\_ultraviolet\_and\_visible\_shortwave\_flux\_for\_coupling\_multiplied\_by\_timestep  
cumulative\_surface\_net\_downward\_longwave\_flux\_for\_coupling\_multiplied\_by\_timestep  
cumulative\_surface\_net\_downward\_shortwave\_flux\_for\_coupling\_multiplied\_by\_timestep  
cumulative\_surface\_pressure\_multiplied\_by\_timestep  
cumulative\_surface\_snow\_area\_fraction\_multiplied\_by\_timestep  
cumulative\_surface\_upward\_latent\_heat\_flux\_for\_coupling\_multiplied\_by\_timestep  
cumulative\_surface\_upward\_latent\_heat\_flux\_for\_diag\_multiplied\_by\_timestep  
cumulative\_surface\_upward\_potential\_latent\_heat\_flux\_multiplied\_by\_timestep  
cumulative\_surface\_upward\_sensible\_heat\_flux\_for\_coupling\_multiplied\_by\_timestep  
cumulative\_surface\_upward\_sensible\_heat\_flux\_for\_diag\_multiplied\_by\_timestep  
cumulative\_surface\_upwelling\_longwave\_flux\_multiplied\_by\_timestep  
cumulative\_surface\_x\_momentum\_flux\_for\_coupling\_multiplied\_by\_timestep  
cumulative\_surface\_x\_momentum\_flux\_for\_diag\_multiplied\_by\_timestep  
cumulative\_surface\_y\_momentum\_flux\_for\_coupling\_multiplied\_by\_timestep  
cumulative\_surface\_y\_momentum\_flux\_for\_diag\_multiplied\_by\_timestep  
cumulative\_transpiration\_flux\_multiplied\_by\_timestep  
date\_and\_time\_at\_model\_initialization  
date\_and\_time\_at\_model\_initialization\_reordered  
daytime\_points  
daytime\_points\_dimension  
deep\_soil\_temperature  
density\_of\_fresh\_water  
density\_of\_frozen\_precipitation  
depth\_of\_soil\_levels\_for\_land\_surface\_model  
detrained\_mass\_flux  
detrainment\_and\_precipitation\_tunable\_parameter\_3\_CS  
detrainment\_and\_precipitation\_tunable\_parameter\_4\_CS

detrainment\_conversion\_parameter\_deep\_convection  
detrainment\_conversion\_parameter\_shallow\_convection  
dewpoint\_temperature\_at\_2m  
diag\_ugwp\_flag  
diagnostics\_control\_for\_chemical\_tracers  
diffusivity\_background\_sigma\_level  
dimensionless\_exner\_function\_at\_lowest\_model\_interface  
dimensionless\_exner\_function\_at\_lowest\_model\_layer  
dimensionless\_exner\_function\_at\_model\_interfaces  
dimensionless\_exner\_function\_at\_model\_layers  
dissipation\_estimate\_of\_air\_temperature\_at\_model\_layers  
diurnal\_thermocline\_layer\_heat\_content  
diurnal\_thermocline\_layer\_thickness  
diurnal\_thermocline\_layer\_x\_current  
diurnal\_thermocline\_layer\_y\_current  
do\_myjpbl  
do\_myjsfc  
do\_mynnedmf  
do\_mynnsfclay  
do\_ugwp  
dominant\_freezing\_rain\_type  
dominant\_rain\_type  
dominant\_sleet\_type  
dominant\_snow\_type  
downdraft\_fraction\_in\_boundary\_layer\_mass\_flux\_scheme  
downdraft\_fraction\_reaching\_surface\_over\_land\_deep\_convection  
downdraft\_fraction\_reaching\_surface\_over\_ocean\_deep\_convection  
duration\_of\_sunshine  
dynamics\_to\_physics\_timestep\_ratio  
eddy\_mixing\_due\_to\_ugwp  
edmf\_flag

edmf\_momentum\_transport\_flag  
edmf\_partition\_flag  
edmf\_tke\_transport\_flag  
effective\_radius\_of\_stratiform\_cloud\_graupel\_particle\_in\_um  
effective\_radius\_of\_stratiform\_cloud\_ice\_particle\_in\_um  
effective\_radius\_of\_stratiform\_cloud\_liquid\_water\_particle\_in\_um  
effective\_radius\_of\_stratiform\_cloud\_rain\_particle\_in\_um  
effective\_radius\_of\_stratiform\_cloud\_snow\_particle\_in\_um  
edmf\_updraft\_area  
edmf\_updraft\_cloud\_water  
edmf\_updraft\_entrainment\_rate  
edmf\_updraft\_theta\_l  
edmf\_updraft\_total\_water  
edmf\_updraft\_vertical\_velocity  
entrainment\_efficiency\_tunable\_parameter\_9\_CS  
entrainment\_rate\_coefficient\_deep\_convection  
entrainment\_rate\_coefficient\_shallow\_convection  
equation\_of\_time  
equilibrium\_soil\_water\_content  
explicit\_rainfall\_rate\_from\_previous\_timestep  
extra\_top\_layer  
fa\_threshold\_relative\_humidity\_for\_onset\_of\_condensation  
fast\_soil\_pool\_mass\_content\_of\_carbon  
fine\_root\_mass  
flag\_TKE\_dissipation\_heating  
flag\_arakawa\_wu\_downdraft  
flag\_convective\_tracer\_transport  
flag\_debug  
flag\_deep\_convection  
flag\_diagnostics  
flag\_diagnostics\_3D

flag\_flip  
flag\_flux\_form\_CS  
flag\_for\_2015\_ozone\_physics  
flag\_for\_Arakawa\_Wu\_adjustment  
flag\_for\_CRICK\_proof\_cloud\_water  
flag\_for\_Chikira\_Sugiyama\_deep\_convection  
flag\_for\_aerosol\_convective\_transport\_and\_PBL\_diffusion  
flag\_for\_aerosol\_input\_MG  
flag\_for\_aerosol\_physics  
flag\_for\_canopy\_heat\_storage  
flag\_for\_canopy\_stomatal\_resistance\_option  
flag\_for\_cellular\_automata  
flag\_for\_chemistry\_coupling  
flag\_for\_cice  
flag\_for\_cloud\_condensate\_normalized\_by\_cloud\_cover  
flag\_for\_cloud\_effective\_radii  
flag\_for\_combination\_of\_sppt\_with\_isppt\_deep  
flag\_for\_convective\_gravity\_wave\_drag  
flag\_for\_convective\_transport\_of\_tracers  
flag\_for\_default\_aerosol\_effect\_in\_shortwave\_radiation  
flag\_for\_dynamic\_vegetation\_option  
flag\_for\_fer\_hires\_microphysics\_scheme  
flag\_for\_first\_time\_step  
flag\_for\_flux\_coupling  
flag\_for\_fractional\_grid  
flag\_for\_frozen\_soil\_permeability\_option  
flag\_for\_frozen\_soil\_physics  
flag\_for\_gaussian\_spatial\_filter  
flag\_for\_gf\_deep\_convection\_scheme  
flag\_for\_gf\_shallow\_convection\_scheme  
flag\_for\_gfdl\_microphysics\_scheme

flag\_for\_global\_cellular\_automata  
flag\_for\_gravity\_wave\_drag  
flag\_for\_ground\_snow\_surface\_albedo\_option  
flag\_for\_guess\_run  
flag\_for\_hedmf  
flag\_for\_hydrostatic\_heating\_from\_physics  
flag\_for\_hydrostatic\_solver  
flag\_for\_in\_ccn\_forcing\_for\_morrison\_gettelman\_microphysics  
flag\_for\_individual\_cloud\_species\_advected  
flag\_for\_initial\_time\_date\_control  
flag\_for\_iteration  
flag\_for\_land\_surface\_scheme  
flag\_for\_lower\_boundary\_soil\_temperature\_option  
flag\_for\_lw\_clouds\_without\_sub\_grid\_approximation  
flag\_for\_mass\_flux\_deep\_convection\_scheme  
flag\_for\_mass\_flux\_shallow\_convection\_scheme  
flag\_for\_max\_random\_overlap\_clouds\_for\_longwave\_radiation  
flag\_for\_max\_random\_overlap\_clouds\_for\_shortwave\_radiation  
flag\_for\_microphysics\_scheme  
flag\_for\_mom4\_coupling  
flag\_for\_moorthi\_stratus  
flag\_for\_morrison\_gettelman\_microphysics\_scheme  
flag\_for\_mountain\_blocking  
flag\_for\_noah\_land\_surface\_scheme  
flag\_for\_noahmp\_land\_surface\_scheme  
flag\_for\_nsstm\_run  
flag\_for\_ntiedtke\_deep\_convection\_scheme  
flag\_for\_ntiedtke\_shallow\_convection\_scheme  
flag\_for\_old\_PBL\_scheme  
flag\_for\_optical\_property\_for\_liquid\_clouds\_for\_shortwave\_radiation  
flag\_for\_output\_of\_longwave\_heating\_rate

flag\_for\_output\_of\_shortwave\_heating\_rate  
flag\_for\_ozone\_physics  
flag\_for\_pdf\_for\_morrison\_gettelman\_microphysics\_scheme  
flag\_for\_precipitation\_effect\_on\_radiation  
flag\_for\_precipitation\_partition\_option  
flag\_for\_precipitation\_type  
flag\_for\_precipitation\_type\_algorithm  
flag\_for\_radar\_reflectivity  
flag\_for\_radiation\_transfer\_option  
flag\_for\_ras\_deep\_convection  
flag\_for\_reading\_leaf\_area\_index\_from\_input  
flag\_for\_reduced\_drag\_coefficient\_over\_sea  
flag\_for\_restart  
flag\_for\_ruc\_land\_surface\_scheme  
flag\_for\_runoff\_and\_groundwater\_option  
flag\_for\_samf\_deep\_convection\_scheme  
flag\_for\_samf\_shallow\_convection\_scheme  
flag\_for\_sas\_deep\_convection\_scheme  
flag\_for\_sas\_shallow\_convection\_scheme  
flag\_for\_scale\_aware\_Shinhong\_PBL  
flag\_for\_scale\_aware\_TKE\_moist\_EDMF\_PBL  
flag\_for\_sgs\_cellular\_automata  
flag\_for\_shallow\_convection  
flag\_for\_shoc  
flag\_for\_shoc\_after\_convection  
flag\_for\_soil\_and\_snow\_temperature\_time\_stepping\_option  
flag\_for\_soil\_moisture\_factor\_stomatal\_resistance\_option  
flag\_for\_solar\_constant  
flag\_for\_stochastic\_shum\_option  
flag\_for\_stochastic\_skeb\_option  
flag\_for\_stochastic\_surface\_perturbations

flag\_for\_stochastic\_surface\_physics\_perturbations  
flag\_for\_supercooled\_liquid\_water\_option  
flag\_for\_surface\_emissivity\_control  
flag\_for\_surface\_layer\_drag\_coefficient\_option  
flag\_for\_surface\_roughness\_option\_over\_ocean  
flag\_for\_sw\_clouds\_without\_sub\_grid\_approximation  
flag\_for\_thompson\_microphysics\_scheme  
flag\_for\_using\_climatology\_albedo  
flag\_for\_using\_prescribed\_global\_mean\_co2\_value  
flag\_for\_vertical\_index\_direction\_control  
flag\_for\_wave\_coupling  
flag\_for\_wsm6\_microphysics\_scheme  
flag\_for\_ysu  
flag\_for\_zhao\_carr\_microphysics\_scheme  
flag\_for\_zhao\_carr\_pdf\_microphysics\_scheme  
flag\_idealized\_physics  
flag\_mg3\_as\_mg2  
flag\_nonzero\_lake\_surface\_fraction  
flag\_nonzero\_land\_surface\_fraction  
flag\_nonzero\_ocean\_surface\_fraction  
flag\_nonzero\_sea\_ice\_surface\_fraction  
flag\_nonzero\_wet\_surface\_fraction  
flag\_print  
flag\_reset\_maximum\_hourly\_fields  
flag\_shallow\_convective\_cloud  
flag\_skip\_macro  
flag\_to\_calc\_lw  
flag\_to\_calc\_sw  
forecast\_date\_and\_time  
forecast\_hour\_of\_the\_day  
forecast\_time

forecast\_time\_at\_previous\_timestep  
fraction\_of\_cellular\_automata\_for\_deep\_convection  
fraction\_of\_cloud\_top\_water\_scavenged  
fraction\_of\_convective\_cloud  
fraction\_of\_grid\_box\_with\_subgrid\_orography\_higher\_than\_critical\_height  
fraction\_of\_ice\_water\_cloud  
fraction\_of\_rain\_water\_cloud  
fraction\_of\_tracer\_scavenged  
free\_convection\_layer\_thickness  
freezing\_point\_temperature\_of\_seawater  
frequency\_for\_longwave\_radiation  
frequency\_for\_shortwave\_radiation  
frozen\_cloud\_threshold\_temperature  
gas\_constant\_dry\_air  
gas\_constant\_water\_vapor  
geopotential  
geopotential\_at\_interface  
geopotential\_difference\_between\_midlayers\_divided\_by\_midlayer\_virtual\_temperature  
gf\_memory\_counter  
graupel\_mixing\_ratio  
graupel\_mixing\_ratio\_updated\_by\_physics  
graupel\_number\_concentration  
graupel\_number\_concentration\_updated\_by\_physics  
graupel\_precipitation\_rate\_from\_previous\_timestep  
grav\_settling  
gravitational\_acceleration  
grid\_sensitive\_critical\_cloud\_top\_entrainment\_instability\_criteria  
grid\_size\_related\_coefficient\_used\_in\_scale\_sensitive\_schemes  
grid\_size\_related\_coefficient\_used\_in\_scale\_sensitive\_schemes\_complement  
ground\_temperature\_for\_noahmp  
gwd\_opt



h2o\_forcing  
heat\_exchange\_coefficient\_for\_MYJ\_schemes  
height\_above\_ground\_at\_lowest\_model\_layer  
height\_of\_launch\_level\_of\_orographic\_gravity\_wave  
height\_of\_low\_level\_wave\_breaking  
height\_of\_mountain\_blocking  
horizontal\_block\_size  
horizontal\_dimension  
horizontal\_index\_of\_printed\_column  
horizontal\_loop\_extent  
humidity\_mixing\_ratio  
ice\_fraction\_in\_convective\_tower  
ice\_friendly\_aerosol\_number\_concentration  
ice\_friendly\_aerosol\_number\_concentration\_updated\_by\_physics  
ice\_number\_concentration  
ice\_number\_concentration\_updated\_by\_physics  
ice\_precipitation\_rate\_from\_previous\_timestep  
ice\_supersaturation\_threshold  
ice\_water\_mixing\_ratio  
ice\_water\_mixing\_ratio\_convective\_transport\_tracer  
ice\_water\_mixing\_ratio\_save  
ice\_water\_mixing\_ratio\_updated\_by\_physics  
in\_number\_concentration  
index\_for\_cloud\_amount  
index\_for\_cloud\_fraction\_in\_3d\_arrays\_for\_microphysics  
index\_for\_cloud\_liquid\_water\_effective\_radius  
index\_for\_convective\_cloud\_cover\_in\_phy\_f3d  
index\_for\_convective\_cloud\_water\_mixing\_ratio\_in\_phy\_f3d  
index\_for\_diagnostic\_printout  
index\_for\_first\_chemical\_tracer  
index\_for\_graupel

[index\\_for\\_graupel\\_effective\\_radius](#)  
[index\\_for\\_graupel\\_number\\_concentration](#)  
[index\\_for\\_ice\\_cloud\\_condensate](#)  
[index\\_for\\_ice\\_cloud\\_condensate\\_vertical\\_diffusion\\_tracer](#)  
[index\\_for\\_ice\\_cloud\\_number\\_concentration](#)  
[index\\_for\\_ice\\_effective\\_radius](#)  
[index\\_for\\_ice\\_friendly\\_aerosols](#)  
[index\\_for\\_liquid\\_cloud\\_condensate](#)  
[index\\_for\\_liquid\\_cloud\\_number\\_concentration](#)  
[index\\_for\\_mass\\_weighted\\_rime\\_factor](#)  
[index\\_for\\_ozone](#)  
[index\\_for\\_rain\\_effective\\_radius](#)  
[index\\_for\\_rain\\_number\\_concentration](#)  
[index\\_for\\_rain\\_water](#)  
[index\\_for\\_snow\\_effective\\_radius](#)  
[index\\_for\\_snow\\_number\\_concentration](#)  
[index\\_for\\_snow\\_water](#)  
[index\\_for\\_turbulent\\_kinetic\\_energy](#)  
[index\\_for\\_turbulent\\_kinetic\\_energy\\_convective\\_transport\\_tracer](#)  
[index\\_for\\_turbulent\\_kinetic\\_energy\\_vertical\\_diffusion\\_tracer](#)  
[index\\_for\\_water\\_friendly\\_aerosols](#)  
[index\\_for\\_water\\_vapor](#)  
[index\\_of\\_atmosphere\\_heat\\_diffusivity\\_from\\_shoc\\_in\\_phy\\_f3d](#)  
[index\\_of\\_dtlm\\_start](#)  
[index\\_of\\_highest\\_temperature\\_inversion](#)  
[index\\_of\\_kinematic\\_buoyancy\\_flux\\_from\\_shoc\\_in\\_phy\\_f3d](#)  
[index\\_of\\_subgrid\\_scale\\_cloud\\_fraction\\_from\\_shoc\\_in\\_phy\\_f3d](#)  
[index\\_of\\_time\\_step](#)  
[instantaneous\\_aerosol\\_column\\_mass\\_densities](#)  
[instantaneous\\_anthropogenic\\_and\\_biomass\\_burning\\_emissions](#)  
[instantaneous\\_atmosphere\\_detrainment\\_convective\\_mass\\_flux](#)

instantaneous\_atmosphere\_downdraft\_convective\_mass\_flux  
instantaneous\_atmosphere\_heat\_diffusivity  
instantaneous\_atmosphere\_updraft\_convective\_mass\_flux  
instantaneous\_change\_in\_x\_wind\_due\_to\_mountain\_blocking\_drag  
instantaneous\_change\_in\_x\_wind\_due\_to\_orographic\_gravity\_wave\_drag  
instantaneous\_change\_in\_x\_wind\_due\_to\_turbulent\_orographic\_form\_drag  
instantaneous\_convective\_scale\_wet\_deposition  
instantaneous\_cosine\_of\_zenith\_angle  
instantaneous\_dry\_deposition  
instantaneous\_dust\_emission\_flux  
instantaneous\_large\_scale\_wet\_deposition  
instantaneous\_momentum\_flux\_due\_to\_mountain\_blocking\_drag  
instantaneous\_momentum\_flux\_due\_to\_nonstationary\_gravity\_wave  
instantaneous\_momentum\_flux\_due\_to\_orographic\_gravity\_wave\_drag  
instantaneous\_momentum\_flux\_due\_to\_turbulent\_orographic\_form\_drag  
instantaneous\_seasalt\_emission\_flux  
instantaneous\_sedimentation  
instantaneous\_specific\_humidity\_at\_2m\_for\_coupling  
instantaneous\_surface\_air\_pressure\_for\_coupling  
instantaneous\_surface\_downwelling\_diffuse\_near\_infrared\_shortwave\_flux\_for\_coupling  
instantaneous\_surface\_downwelling\_diffuse\_ultraviolet\_and\_visible\_shortwave\_flux\_for\_coupling  
instantaneous\_surface\_downwelling\_direct\_near\_infrared\_shortwave\_flux\_for\_coupling  
instantaneous\_surface\_downwelling\_direct\_ultraviolet\_and\_visible\_shortwave\_flux\_for\_coupling  
instantaneous\_surface\_downwelling\_longwave\_flux\_for\_coupling  
instantaneous\_surface\_downwelling\_shortwave\_flux\_for\_coupling  
instantaneous\_surface\_ground\_heat\_flux  
instantaneous\_surface\_net\_downward\_diffuse\_near\_infrared\_shortwave\_flux\_for\_coupling  
instantaneous\_surface\_net\_downward\_diffuse\_ultraviolet\_and\_visible\_shortwave\_flux\_for\_coupling  
instantaneous\_surface\_net\_downward\_direct\_near\_infrared\_shortwave\_flux\_for\_coupling  
instantaneous\_surface\_net\_downward\_direct\_ultraviolet\_and\_visible\_shortwave\_flux\_for\_coupling  
instantaneous\_surface\_net\_downward\_longwave\_flux\_for\_coupling

instantaneous\_surface\_net\_downward\_shortwave\_flux\_for\_coupling  
instantaneous\_surface\_potential\_evaporation  
instantaneous\_surface\_skin\_temperature\_for\_coupling  
instantaneous\_surface\_upward\_latent\_heat\_flux  
instantaneous\_surface\_upward\_latent\_heat\_flux\_for\_coupling  
instantaneous\_surface\_upward\_latent\_heat\_flux\_for\_diag  
instantaneous\_surface\_upward\_sensible\_heat\_flux  
instantaneous\_surface\_upward\_sensible\_heat\_flux\_for\_chemistry\_coupling  
instantaneous\_surface\_upward\_sensible\_heat\_flux\_for\_coupling  
instantaneous\_surface\_upward\_sensible\_heat\_flux\_for\_diag  
instantaneous\_surface\_x\_momentum\_flux  
instantaneous\_surface\_x\_momentum\_flux\_for\_coupling  
instantaneous\_surface\_x\_momentum\_flux\_for\_diag  
instantaneous\_surface\_y\_momentum\_flux  
instantaneous\_surface\_y\_momentum\_flux\_for\_coupling  
instantaneous\_surface\_y\_momentum\_flux\_for\_diag  
instantaneous\_temperature\_at\_2m\_for\_coupling  
instantaneous\_water\_vapor\_specific\_humidity\_tendency\_due\_to\_convection  
instantaneous\_x\_stress\_due\_to\_gravity\_wave\_drag  
instantaneous\_x\_wind\_at\_10m\_for\_coupling  
instantaneous\_y\_stress\_due\_to\_gravity\_wave\_drag  
instantaneous\_y\_wind\_at\_10m\_for\_coupling  
integrated\_x\_momentum\_flux\_from\_blocking\_drag  
integrated\_x\_momentum\_flux\_from\_form\_drag  
integrated\_x\_momentum\_flux\_from\_large\_scale\_gwd  
integrated\_x\_momentum\_flux\_from\_small\_scale\_gwd  
integrated\_y\_momentum\_flux\_from\_blocking\_drag  
integrated\_y\_momentum\_flux\_from\_form\_drag  
integrated\_y\_momentum\_flux\_from\_large\_scale\_gwd  
integrated\_y\_momentum\_flux\_from\_small\_scale\_gwd  
inverse\_scaling\_factor\_for\_critical\_relative\_humidity

iounit\_log  
iounit\_namelist  
joules\_per\_calorie\_constant  
julian\_day  
k\_level\_of\_highest\_reaching\_plume  
kind\_INTEGER  
kind\_LOGICAL  
kind\_dyn  
kind\_grid  
kind\_phys  
kinematic\_buoyancy\_flux\_from\_shoc  
kinematic\_surface\_latent\_heat\_flux  
kinematic\_surface\_upward\_latent\_heat\_flux  
kinematic\_surface\_upward\_latent\_heat\_flux\_over\_ice  
kinematic\_surface\_upward\_latent\_heat\_flux\_over\_land  
kinematic\_surface\_upward\_latent\_heat\_flux\_over\_ocean  
kinematic\_surface\_upward\_sensible\_heat\_flux  
kinematic\_surface\_upward\_sensible\_heat\_flux\_over\_ice  
kinematic\_surface\_upward\_sensible\_heat\_flux\_over\_land  
kinematic\_surface\_upward\_sensible\_heat\_flux\_over\_ocean  
lake\_area\_fraction  
lake\_ice\_minimum  
lake\_water\_storage  
land\_area\_fraction  
land\_area\_fraction\_for\_microphysics  
largest\_cloud\_top\_vertical\_index\_encountered\_thus\_far  
latent\_heat\_of\_fusion\_of\_water\_at\_0C  
latent\_heat\_of\_vaporization\_of\_water\_at\_0C  
latitude  
latitude\_degree  
latitude\_index\_in\_debug\_printouts

layer\_bottom\_depth\_from\_snow\_surface  
layer\_pressure\_thickness\_for\_radiation  
layer\_thickness\_for\_radiation  
leaf\_area\_index  
leaf\_mass  
level\_of\_dividing\_streamline  
limit\_for\_temperature\_tendency\_for\_microphysics  
liquid\_water\_density  
local\_condensed\_water\_number\_concentration  
local\_graupel\_mixing\_ratio  
local\_graupel\_number\_concentration  
local\_ice\_number\_concentration  
local\_rain\_number\_concentration  
local\_rain\_water\_mixing\_ratio  
local\_snow\_number\_concentration  
local\_snow\_water\_mixing\_ratio  
longitude  
lower\_bound\_of\_snow\_vertical\_dimension\_for\_land\_surface\_model  
lw\_fluxes\_sfc  
lw\_fluxes\_top\_atmosphere  
lwe\_thickness\_of\_convective\_precipitation\_amount\_for\_coupling  
lwe\_thickness\_of\_convective\_precipitation\_amount\_from\_previous\_timestep  
lwe\_thickness\_of\_convective\_precipitation\_amount\_on\_dynamics\_timestep  
lwe\_thickness\_of\_deep\_convective\_precipitation\_amount  
lwe\_thickness\_of\_explicit\_precipitation\_amount  
lwe\_thickness\_of\_explicit\_rain\_amount  
lwe\_thickness\_of\_explicit\_rainfall\_amount\_from\_previous\_timestep  
lwe\_thickness\_of\_graupel\_amount  
lwe\_thickness\_of\_graupel\_amount\_from\_previous\_timestep  
lwe\_thickness\_of\_graupel\_amount\_on\_dynamics\_timestep  
lwe\_thickness\_of\_ice\_amount

lwe\_thickness\_of\_ice\_amount\_from\_previous\_timestep  
lwe\_thickness\_of\_ice\_amount\_on\_dynamics\_timestep  
lwe\_thickness\_of\_moist\_convective\_adj\_precipitation\_amount  
lwe\_thickness\_of\_precipitation\_amount\_for\_coupling  
lwe\_thickness\_of\_precipitation\_amount\_on\_dynamics\_timestep  
lwe\_thickness\_of\_shallow\_convective\_precipitation\_amount  
lwe\_thickness\_of\_snow\_amount  
lwe\_thickness\_of\_snow\_amount\_for\_coupling  
lwe\_thickness\_of\_snow\_amount\_from\_previous\_timestep  
lwe\_thickness\_of\_snow\_amount\_on\_dynamics\_timestep  
magnitude\_of\_perturbation\_of\_heat\_to\_momentum\_roughness\_length\_ratio  
magnitude\_of\_perturbation\_of\_leaf\_area\_index  
magnitude\_of\_perturbation\_of\_momentum\_roughness\_length  
magnitude\_of\_perturbation\_of\_soil\_type\_b\_parameter  
magnitude\_of\_perturbation\_of\_vegetation\_fraction  
magnitude\_of\_surface\_albedo\_perturbation  
map\_of\_block\_column\_number\_to\_global\_i\_index  
map\_of\_block\_column\_number\_to\_global\_j\_index  
mass\_fraction\_of\_convective\_cloud\_ice  
mass\_fraction\_of\_convective\_cloud\_liquid\_water  
mass\_weighted\_rime\_factor\_mixing\_ratio  
mass\_weighted\_rime\_factor\_updated\_by\_physics  
maximum\_column\_heating\_rate  
maximum\_critical\_relative\_humidity  
maximum\_mass\_flux  
maximum\_reflectivity\_at\_1km\_agl\_over\_maximum\_hourly\_time\_interval  
maximum\_reflectivity\_at\_minus10c\_over\_maximum\_hourly\_time\_interval  
maximum\_relative\_humidity\_at\_2m\_over\_maximum\_hourly\_time\_interval  
maximum\_scaling\_factor\_for\_critical\_relative\_humidity  
maximum\_specific\_humidity\_at\_2m  
maximum\_subgrid\_orography

maximum\_temperature\_at\_2m  
maximum\_temperature\_at\_2m\_over\_maximum\_hourly\_time\_interval  
maximum\_u\_wind\_at\_10m\_over\_maximum\_hourly\_time\_interval  
maximum\_updraft\_velocity\_at\_cloud\_base  
maximum\_v\_wind\_at\_10m\_over\_maximum\_hourly\_time\_interval  
maximum\_vegetation\_area\_fraction  
maximum\_wind\_at\_10m  
maximum\_wind\_at\_10m\_over\_maximum\_hourly\_time\_interval  
maximum\_x\_wind\_at\_10m  
maximum\_y\_wind\_at\_10m  
mean\_change\_over\_depth\_in\_sea\_water\_temperature  
mean\_effective\_radius\_for\_ice\_cloud  
mean\_effective\_radius\_for\_liquid\_cloud  
mean\_effective\_radius\_for\_rain\_drop  
mean\_effective\_radius\_for\_snow\_flake  
mean\_nir\_albedo\_with\_weak\_cosz\_dependency  
mean\_vis\_albedo\_with\_weak\_cosz\_dependency  
mg\_allow\_supersat\_after\_sed  
mg\_autoconversion\_size\_threshold\_ice\_snow  
mg\_bergeron\_efficiency\_factor  
mg\_cloud\_water\_variance  
mg\_drop\_concentration\_constant  
mg\_flag\_drop\_concentration\_constant  
mg\_flag\_for\_cloud\_ice\_processes  
mg\_flag\_for\_gmao\_ice\_formulation  
mg\_flag\_for\_graupel  
mg\_flag\_for\_hail  
mg\_flag\_for\_heterogeneous\_freezing  
mg\_flag\_for\_liu\_liquid\_treatment  
mg\_flag\_for\_sb2001\_autoconversion  
mg\_flag\_for\_uniform\_subcolumns



mg\_flag\_graupel\_concentration\_constant  
mg\_flag\_ice\_concentration\_constant  
mg\_graupel\_concentration\_constant  
mg\_ice\_concentration\_constant  
mg\_minimum\_cloud\_condensed\_water\_and\_ice\_mixing\_ratio  
mg\_minimum\_cloud\_condensed\_water\_mixing\_ratio  
mg\_minimum\_ice\_mixing\_ratio  
mg\_minimum\_rh\_for\_ice  
mg\_time\_scale\_for\_autoconversion\_of\_ice  
mg\_tuning\_factor\_for\_alphas  
mg\_type\_of\_precip\_fraction\_method  
minimum\_large\_ice\_fraction  
minimum\_relative\_humidity\_at\_2m\_over\_maximum\_hourly\_time\_interval  
minimum\_scaling\_factor\_for\_critical\_relative\_humidity  
minimum\_sea\_ice\_concentration  
minimum\_specific\_humidity\_at\_2m  
minimum\_temperature\_at\_2m  
minimum\_temperature\_at\_2m\_over\_maximum\_hourly\_time\_interval  
minimum\_value\_of\_specific\_humidity  
minimum\_vegetation\_area\_fraction  
mix\_total\_water\_flag  
mixing\_length  
mixing\_length\_flag  
model\_layer\_number\_at\_cloud\_base  
model\_layer\_number\_at\_cloud\_top  
moisture\_from\_previous\_timestep  
moisture\_tendency\_due\_to\_dynamics  
momentum\_exchange\_coefficient\_for\_MYJ\_schemes  
momentum\_transport\_reduction\_factor\_pgf\_deep\_convection  
momentum\_transport\_reduction\_factor\_pgf\_shallow\_convection  
mpi\_comm

mpi\_rank  
mpi\_root  
mpi\_size  
multiplication\_factors\_for\_convective\_gravity\_wave\_drag  
multiplication\_factors\_for\_mountain\_blocking\_and\_orographic\_gravity\_wave\_drag  
namelist\_filename  
namelist\_filename\_for\_internal\_file\_reads  
natural\_log\_of\_h2o\_forcing\_data\_pressure\_levels  
natural\_log\_of\_ozone\_forcing\_data\_pressure\_levels  
netcdf\_float\_fillvalue  
nondimensional\_snow\_age  
nonnegative\_lwe\_thickness\_of\_precipitation\_amount\_on\_dynamics\_timestep  
nonnegative\_lwe\_thickness\_of\_precipitation\_amount\_on\_dynamics\_timestep\_over\_ice  
nonnegative\_lwe\_thickness\_of\_precipitation\_amount\_on\_dynamics\_timestep\_over\_land  
nonnegative\_lwe\_thickness\_of\_precipitation\_amount\_on\_dynamics\_timestep\_over\_ocean  
normalized\_soil\_wetness  
normalized\_soil\_wetness\_for\_land\_surface\_model  
number\_concentration\_of\_cloud\_liquid\_water\_particles\_for\_detrainment  
number\_concentration\_of\_ice\_crystals\_for\_detrainment  
number\_of\_3d\_arrays\_associated\_with\_pdf\_based\_clouds  
number\_of\_aerosol\_bands\_for\_longwave\_radiation  
number\_of\_aerosol\_bands\_for\_shortwave\_radiation  
number\_of\_aerosol\_output\_fields\_for\_longwave\_radiation  
number\_of\_aerosol\_output\_fields\_for\_shortwave\_radiation  
number\_of\_aerosol\_tracers\_MG  
number\_of\_aerosol\_tracers\_for\_convection  
number\_of\_blocks  
number\_of\_chemical\_tracers  
number\_of\_chemical\_tracers\_for\_diagnostics  
number\_of\_cloud\_condensate\_types  
number\_of\_cloud\_types\_CS

number\_of\_coefficients\_in\_h2o\_forcing\_data  
number\_of\_coefficients\_in\_ozone\_forcing\_data  
number\_of\_coefficients\_in\_ozone\_forcing\_data\_plus\_five  
number\_of\_convective\_3d\_cloud\_fields  
number\_of\_days\_in\_year  
number\_of\_dust\_bins\_for\_diagnostics  
number\_of\_equatorial\_longitude\_points  
number\_of\_fields\_in\_phyf2d  
number\_of\_fields\_in\_phyf3d  
number\_of\_frozen\_precipitation\_species  
number\_of\_hydrometeors  
number\_of\_independent\_cellular\_automata  
number\_of\_iterations\_to\_spin\_up\_cellular\_automata  
number\_of\_latitude\_points  
number\_of\_lines\_of\_namelist\_filename\_for\_internal\_file\_reads  
number\_of\_plumes  
number\_of\_seasalt\_bins\_for\_diagnostics  
number\_of\_snow\_layers  
number\_of\_species\_for\_aerosol\_optical\_depth  
number\_of\_spectral\_wave\_truncation\_for\_sas  
number\_of\_statistical\_measures\_of\_subgrid\_orography  
number\_of\_surface\_perturbations  
number\_of\_tile  
number\_of\_timesteps\_between\_longwave\_radiation\_calls  
number\_of\_timesteps\_between\_shortwave\_radiation\_calls  
number\_of\_timesteps\_between\_surface\_cycling\_calls  
number\_of\_total\_tracers  
number\_of\_tracers  
number\_of\_tracers\_for\_CS  
number\_of\_tracers\_for\_cloud\_condensate  
number\_of\_tracers\_for\_convective\_transport

number\_of\_tracers\_for\_samf  
number\_of\_tracers\_plus\_one  
number\_of\_tracers\_scavenged  
number\_of\_vertical\_diffusion\_tracers  
number\_of\_vertical\_layers\_for\_radiation\_calculations  
number\_of\_vertical\_layers\_for\_radiation\_calculations\_plus\_one  
number\_of\_water\_tracers  
ocean\_mixed\_layer\_thickness  
omega  
omp\_threads  
orography  
orography\_unfiltered  
ozone\_concentration\_at\_layer\_for\_radiation  
ozone\_concentration\_updated\_by\_physics  
ozone\_forcing  
ozone\_mixing\_ratio  
perturbation\_of\_heat\_to\_momentum\_roughness\_length\_ratio  
perturbation\_of\_leaf\_area\_index  
perturbation\_of\_momentum\_roughness\_length  
perturbation\_of\_soil\_type\_b\_parameter  
perturbation\_of\_vegetation\_fraction  
physics\_type  
physics\_type\_instance  
pi  
potential\_temperature\_at\_2m  
potential\_temperature\_at\_viscous\_sublayer\_top  
prandtl\_number  
pressure\_at\_bottom\_of\_convective\_cloud  
pressure\_at\_top\_of\_convective\_cloud  
pressure\_cutoff\_for\_rayleigh\_damping  
q\_prime\_squared

radar\_reflectivity\_10cm  
rain\_conversion\_parameter\_deep\_convection  
rain\_conversion\_parameter\_shallow\_convection  
rain\_evaporation\_coefficient\_deep\_convection  
rain\_evaporation\_coefficient\_over\_land\_deep\_convection  
rain\_number\_concentration  
rain\_number\_concentration\_updated\_by\_physics  
rain\_water\_mixing\_ratio  
rain\_water\_mixing\_ratio\_updated\_by\_physics  
random\_number\_array  
ratio\_of\_dry\_air\_to\_water\_vapor\_gas\_constants  
ratio\_of\_dry\_air\_to\_water\_vapor\_gas\_constants\_minus\_one  
ratio\_of\_exner\_function\_between\_midlayer\_and\_interface\_at\_lowest\_model\_layer  
ratio\_of\_snowfall\_to\_rainfall  
ratio\_of\_vapor\_to\_dry\_air\_gas\_constants\_minus\_one  
ratio\_of\_wind\_at\_lowest\_model\_layer\_and\_wind\_at\_10m  
reciprocal\_of\_obukhov\_length  
rime\_factor  
sea\_area\_fraction  
sea\_ice\_concentration  
sea\_ice\_minimum  
sea\_ice\_temperature  
sea\_ice\_temperature\_interstitial  
sea\_ice\_thickness  
sea\_land\_ice\_mask  
sea\_land\_ice\_mask\_cice  
sea\_land\_ice\_mask\_in  
sea\_land\_ice\_mask\_real  
sea\_surface\_reference\_temperature  
sea\_surface\_temperature  
sea\_water\_reference\_density

sea\_water\_salinity  
seconds\_elapsed\_since\_model\_initialization  
seed\_for\_random\_number\_generation\_in\_cellular\_automata\_scheme  
seed\_random\_numbers\_lw  
seed\_random\_numbers\_sw  
sensible\_heat\_flux\_due\_to\_rainfall  
sensitivity\_of\_dtl\_heat\_content\_to\_surface\_temperature  
sensitivity\_of\_dtl\_thickness\_to\_surface\_temperature  
sfcflw\_type  
sfcfsw\_type  
shoc\_flag\_for\_optional\_surface\_TKE\_dissipation  
shoc\_implicit\_TKE\_integration\_uncentering\_term  
shoc\_tke\_dissipation\_pressure\_threshold  
shoc\_tke\_dissipation\_tunable\_parameter  
shoc\_tke\_dissipation\_tunable\_parameter\_near\_surface  
sine\_of\_latitude  
sine\_of\_solar\_declination\_angle  
slope\_of\_subgrid\_orography  
slow\_soil\_pool\_mass\_content\_of\_carbon  
smallest\_cloud\_base\_vertical\_index\_encountered\_thus\_far  
snow\_albedo\_at\_previous\_time\_step  
snow\_deposition\_sublimation\_upward\_latent\_heat\_flux  
snow\_freezing\_rain\_upward\_latent\_heat\_flux  
snow\_layer\_ice  
snow\_layer\_liquid\_water  
snow\_mass\_at\_previous\_time\_step  
snow\_number\_concentration  
snow\_number\_concentration\_updated\_by\_physics  
snow\_precipitation\_rate\_at\_surface  
snow\_precipitation\_rate\_from\_previous\_timestep  
snow\_temperature

snow\_temperature\_bottom\_first\_layer  
snow\_vertical\_dimension\_for\_land\_surface\_model  
snow\_water\_mixing\_ratio  
snow\_water\_mixing\_ratio\_updated\_by\_physics  
soil\_moisture\_content  
soil\_temperature  
soil\_temperature\_for\_land\_surface\_model  
soil\_type\_classification  
soil\_type\_classification\_real  
soil\_type\_dataset\_choice  
soil\_upward\_latent\_heat\_flux  
soil\_vertical\_dimension  
soil\_vertical\_dimension\_for\_land\_surface\_model  
soil\_water\_content\_between\_soil\_bottom\_and\_water\_table  
solar\_constant  
specific\_heat\_of\_dry\_air\_at\_constant\_pressure  
specific\_heat\_of\_liquid\_water\_at\_constant\_pressure  
specific\_heat\_of\_water\_vapor\_at\_constant\_pressure  
specific\_humidity\_at\_2m  
specific\_humidity\_at\_2m\_from\_noahmp  
specific\_humidity\_at\_visous\_sublayer\_top  
specified\_kinematic\_surface\_upward\_latent\_heat\_flux  
specified\_kinematic\_surface\_upward\_sensible\_heat\_flux  
stability\_function\_for\_heat  
standard\_atmospheric\_pressure  
standard\_deviation\_of\_subgrid\_orography  
start\_index\_of\_other\_tracers  
statistical\_measures\_of\_subgrid\_orography  
stefan\_boltzmann\_constant  
stem\_area\_index  
stem\_mass

sub\_layer\_cooling\_amount  
sub\_layer\_cooling\_thickness  
subgrid\_cloud\_fraction\_pbl  
subgrid\_cloud\_mixing\_ratio\_pbl  
subgrid\_scale\_cloud\_fraction\_from\_shoc  
subsurface\_runoff\_flux  
surface\_air\_pressure  
surface\_air\_pressure\_at\_previous\_time\_step  
surface\_air\_pressure\_diag  
surface\_air\_pressure\_two\_time\_steps\_back  
surface\_air\_temperature\_for\_radiation  
surface\_albedo\_due\_to\_UV\_and\_VIS\_diffused  
surface\_albedo\_due\_to\_UV\_and\_VIS\_direct  
surface\_albedo\_due\_to\_near\_IR\_diffused  
surface\_albedo\_due\_to\_near\_IR\_direct  
surface\_albedo\_perturbation  
surface\_condensation\_mass  
surface\_diffused\_shortwave\_albedo  
surface\_downwelling\_diffuse\_near\_infrared\_shortwave\_flux  
surface\_downwelling\_diffuse\_near\_infrared\_shortwave\_flux\_on\_radiation\_time\_step  
surface\_downwelling\_diffuse\_ultraviolet\_and\_visible\_shortwave\_flux  
surface\_downwelling\_diffuse\_ultraviolet\_and\_visible\_shortwave\_flux\_on\_radiation\_time\_step  
surface\_downwelling\_direct\_near\_infrared\_shortwave\_flux  
surface\_downwelling\_direct\_near\_infrared\_shortwave\_flux\_on\_radiation\_time\_step  
surface\_downwelling\_direct\_ultraviolet\_and\_visible\_shortwave\_flux  
surface\_downwelling\_direct\_ultraviolet\_and\_visible\_shortwave\_flux\_on\_radiation\_time\_step  
surface\_downwelling\_longwave\_flux  
surface\_downwelling\_longwave\_flux\_absorbed\_by\_ground  
surface\_downwelling\_longwave\_flux\_absorbed\_by\_ground\_over\_ice  
surface\_downwelling\_longwave\_flux\_absorbed\_by\_ground\_over\_land  
surface\_downwelling\_longwave\_flux\_absorbed\_by\_ground\_over\_ocean



surface\_downwelling\_longwave\_flux\_on\_radiation\_time\_step  
surface\_downwelling\_shortwave\_flux  
surface\_downwelling\_shortwave\_flux\_on\_radiation\_time\_step  
surface\_drag\_coefficient\_for\_heat\_and\_moisture\_for\_noahmp  
surface\_drag\_coefficient\_for\_heat\_and\_moisture\_in\_air  
surface\_drag\_coefficient\_for\_heat\_and\_moisture\_in\_air\_over\_ice  
surface\_drag\_coefficient\_for\_heat\_and\_moisture\_in\_air\_over\_land  
surface\_drag\_coefficient\_for\_heat\_and\_moisture\_in\_air\_over\_ocean  
surface\_drag\_coefficient\_for\_momentum\_for\_noahmp  
surface\_drag\_coefficient\_for\_momentum\_in\_air  
surface\_drag\_coefficient\_for\_momentum\_in\_air\_over\_ice  
surface\_drag\_coefficient\_for\_momentum\_in\_air\_over\_land  
surface\_drag\_coefficient\_for\_momentum\_in\_air\_over\_ocean  
surface\_drag\_mass\_flux\_for\_heat\_and\_moisture\_in\_air  
surface\_drag\_mass\_flux\_for\_heat\_and\_moisture\_in\_air\_over\_ice  
surface\_drag\_mass\_flux\_for\_heat\_and\_moisture\_in\_air\_over\_land  
surface\_drag\_mass\_flux\_for\_heat\_and\_moisture\_in\_air\_over\_ocean  
surface\_drag\_wind\_speed\_for\_momentum\_in\_air  
surface\_drag\_wind\_speed\_for\_momentum\_in\_air\_over\_ice  
surface\_drag\_wind\_speed\_for\_momentum\_in\_air\_over\_land  
surface\_drag\_wind\_speed\_for\_momentum\_in\_air\_over\_ocean  
surface\_exchange\_coefficient\_for\_heat  
surface\_exchange\_coefficient\_for\_heat\_at\_2m  
surface\_exchange\_coefficient\_for\_moisture  
surface\_exchange\_coefficient\_for\_moisture\_at\_2m  
surface\_friction\_velocity  
surface\_friction\_velocity\_drag  
surface\_friction\_velocity\_over\_ice  
surface\_friction\_velocity\_over\_land  
surface\_friction\_velocity\_over\_ocean  
surface\_ground\_temperature\_for\_radiation

surface\_latent\_heat  
surface\_layer\_evaporation\_switch  
surface\_longwave\_emissivity  
surface\_longwave\_emissivity\_over\_ice\_interstitial  
surface\_longwave\_emissivity\_over\_land\_interstitial  
surface\_longwave\_emissivity\_over\_ocean\_interstitial  
surface\_midlayer\_air\_temperature\_in\_longwave\_radiation  
surface\_net\_downwelling\_shortwave\_flux  
surface\_net\_downwelling\_shortwave\_flux\_on\_radiation\_time\_step  
surface\_roughness\_length  
surface\_roughness\_length\_over\_ice\_interstitial  
surface\_roughness\_length\_over\_land  
surface\_roughness\_length\_over\_land\_interstitial  
surface\_roughness\_length\_over\_ocean  
surface\_roughness\_length\_over\_ocean\_interstitial  
surface\_runoff  
surface\_runoff\_flux  
surface\_skin\_temperature  
surface\_skin\_temperature\_after\_iteration  
surface\_skin\_temperature\_after\_iteration\_over\_ice  
surface\_skin\_temperature\_after\_iteration\_over\_land  
surface\_skin\_temperature\_after\_iteration\_over\_ocean  
surface\_skin\_temperature\_for\_nsst  
surface\_skin\_temperature\_over\_ice\_interstitial  
surface\_skin\_temperature\_over\_land  
surface\_skin\_temperature\_over\_land\_interstitial  
surface\_skin\_temperature\_over\_ocean\_interstitial  
surface\_slope\_classification  
surface\_slope\_classification\_real  
surface\_snow\_area\_fraction  
surface\_snow\_area\_fraction\_over\_land

surface\_snow\_melt  
surface\_snow\_thickness\_water\_equivalent  
surface\_snow\_thickness\_water\_equivalent\_over\_ice  
surface\_snow\_thickness\_water\_equivalent\_over\_land  
surface\_snow\_thickness\_water\_equivalent\_over\_ocean  
surface\_specific\_humidity  
surface\_specific\_humidity\_for\_MYJ\_schemes  
surface\_specific\_humidity\_over\_ice  
surface\_specific\_humidity\_over\_land  
surface\_specific\_humidity\_over\_ocean  
surface\_stability\_parameter  
surface\_upward\_latent\_heat\_flux\_for\_coupling  
surface\_upward\_latent\_heat\_flux\_for\_coupling\_interstitial  
surface\_upward\_potential\_latent\_heat\_flux  
surface\_upward\_potential\_latent\_heat\_flux\_over\_ice  
surface\_upward\_potential\_latent\_heat\_flux\_over\_land  
surface\_upward\_potential\_latent\_heat\_flux\_over\_ocean  
surface\_upward\_sensible\_heat\_flux\_for\_coupling  
surface\_upward\_sensible\_heat\_flux\_for\_coupling\_interstitial  
surface\_upwelling\_diffuse\_near\_infrared\_shortwave\_flux  
surface\_upwelling\_diffuse\_near\_infrared\_shortwave\_flux\_on\_radiation\_time\_step  
surface\_upwelling\_diffuse\_ultraviolet\_and\_visible\_shortwave\_flux  
surface\_upwelling\_diffuse\_ultraviolet\_and\_visible\_shortwave\_flux\_on\_radiation\_time\_step  
surface\_upwelling\_direct\_near\_infrared\_shortwave\_flux  
surface\_upwelling\_direct\_near\_infrared\_shortwave\_flux\_on\_radiation\_time\_step  
surface\_upwelling\_direct\_ultraviolet\_and\_visible\_shortwave\_flux  
surface\_upwelling\_direct\_ultraviolet\_and\_visible\_shortwave\_flux\_on\_radiation\_time\_step  
surface\_upwelling\_longwave\_flux  
surface\_upwelling\_longwave\_flux\_for\_coupling  
surface\_upwelling\_longwave\_flux\_for\_coupling\_interstitial  
surface\_upwelling\_longwave\_flux\_over\_ice\_interstitial

surface\_upwelling\_longwave\_flux\_over\_land\_interstitial  
surface\_upwelling\_longwave\_flux\_over\_ocean\_interstitial  
surface\_upwelling\_shortwave\_flux  
surface\_wind\_enhancement\_due\_to\_convection  
surface\_wind\_stress  
surface\_wind\_stress\_over\_ice  
surface\_wind\_stress\_over\_land  
surface\_wind\_stress\_over\_ocean  
surface\_x\_momentum\_flux\_for\_coupling  
surface\_x\_momentum\_flux\_for\_coupling\_interstitial  
surface\_y\_momentum\_flux\_for\_coupling  
surface\_y\_momentum\_flux\_for\_coupling\_interstitial  
sw\_fluxes\_sfc  
sw\_fluxes\_top\_atmosphere  
t\_prime\_q\_prime  
t\_prime\_squared  
temperature\_at\_2m  
temperature\_at\_2m\_from\_noahmp  
temperature\_at\_zero\_celsius  
temperature\_from\_previous\_timestep  
temperature\_tendency\_due\_to\_dynamics  
tendency\_of\_air\_temperature\_due\_to\_deep\_convection\_for\_coupling\_on\_physics\_timestep  
tendency\_of\_air\_temperature\_due\_to\_longwave\_heating\_assuming\_clear\_sky\_on\_radiation\_time\_step  
tendency\_of\_air\_temperature\_due\_to\_longwave\_heating\_assuming\_clear\_sky\_on\_radiation\_timestep  
tendency\_of\_air\_temperature\_due\_to\_longwave\_heating\_for\_idea  
tendency\_of\_air\_temperature\_due\_to\_longwave\_heating\_on\_radiation\_time\_step  
tendency\_of\_air\_temperature\_due\_to\_longwave\_heating\_on\_radiation\_timestep  
tendency\_of\_air\_temperature\_due\_to\_model\_physics  
tendency\_of\_air\_temperature\_due\_to\_radiative\_heating\_assuming\_clear\_sky  
tendency\_of\_air\_temperature\_due\_to\_radiative\_heating\_on\_physics\_time\_step  
tendency\_of\_air\_temperature\_due\_to\_shortwave\_heating\_assuming\_clear\_sky\_on\_radiation\_time\_step

tendency\_of\_air\_temperature\_due\_to\_shortwave\_heating\_assuming\_clear\_sky\_on\_radiation\_timestep  
tendency\_of\_air\_temperature\_due\_to\_shortwave\_heating\_on\_radiation\_time\_step  
tendency\_of\_air\_temperature\_due\_to\_shortwave\_heating\_on\_radiation\_timestep  
tendency\_of\_air\_temperature\_due\_to\_ugwp  
tendency\_of\_cloud\_droplet\_number\_concentration\_due\_to\_model\_physics  
tendency\_of\_cloud\_water\_due\_to\_convective\_microphysics  
tendency\_of\_graupel\_mixing\_ratio\_due\_to\_model\_physics  
tendency\_of\_ice\_cloud\_water\_mixing\_ratio\_due\_to\_model\_physics  
tendency\_of\_ice\_friendly\_aerosol\_number\_concentration\_due\_to\_model\_physics  
tendency\_of\_ice\_friendly\_aerosols\_at\_surface  
tendency\_of\_ice\_number\_concentration\_due\_to\_model\_physics  
tendency\_of\_liquid\_cloud\_water\_mixing\_ratio\_due\_to\_model\_physics  
tendency\_of\_lwe\_thickness\_of\_precipitation\_amount\_for\_coupling  
tendency\_of\_lwe\_thickness\_of\_snow\_amount\_for\_coupling  
tendency\_of\_ozone\_mixing\_ratio\_due\_to\_model\_physics  
tendency\_of\_rain\_water\_mixing\_ratio\_due\_to\_microphysics  
tendency\_of\_rain\_water\_mixing\_ratio\_due\_to\_model\_physics  
tendency\_of\_snow\_water\_mixing\_ratio\_due\_to\_model\_physics  
tendency\_of\_tracers\_due\_to\_model\_physics  
tendency\_of\_turbulent\_kinetic\_energy\_due\_to\_model\_physics  
tendency\_of\_vertically\_diffused\_tracer\_concentration  
tendency\_of\_water\_friendly\_aerosol\_number\_concentration\_due\_to\_model\_physics  
tendency\_of\_water\_friendly\_aerosols\_at\_surface  
tendency\_of\_water\_vapor\_specific\_humidity\_due\_to\_deep\_convection\_for\_coupling\_on\_physics\_timestep  
tendency\_of\_water\_vapor\_specific\_humidity\_due\_to\_model\_physics  
tendency\_of\_x\_wind\_due\_to\_convective\_gravity\_wave\_drag  
tendency\_of\_x\_wind\_due\_to\_deep\_convection\_for\_coupling\_on\_physics\_timestep  
tendency\_of\_x\_wind\_due\_to\_model\_physics  
tendency\_of\_x\_wind\_due\_to\_ugwp  
tendency\_of\_y\_wind\_due\_to\_convective\_gravity\_wave\_drag  
tendency\_of\_y\_wind\_due\_to\_deep\_convection\_for\_coupling\_on\_physics\_timestep

tendency\_of\_y\_wind\_due\_to\_model\_physics  
tendency\_of\_y\_wind\_due\_to\_ugwp  
theta\_star  
threshold\_for\_perturbed\_vertical\_velocity  
threshold\_volume\_fraction\_of\_condensed\_water\_in\_soil  
time\_integral\_of\_change\_in\_x\_wind\_due\_to\_mountain\_blocking\_drag  
time\_integral\_of\_change\_in\_x\_wind\_due\_to\_nonstationary\_gravity\_wave  
time\_integral\_of\_change\_in\_x\_wind\_due\_to\_orographic\_gravity\_wave\_drag  
time\_integral\_of\_change\_in\_x\_wind\_due\_to\_turbulent\_orographic\_form\_drag  
time\_integral\_of\_change\_in\_y\_wind\_due\_to\_nonstationary\_gravity\_wave  
time\_integral\_of\_height\_of\_launch\_level\_of\_orographic\_gravity\_wave  
time\_integral\_of\_height\_of\_low\_level\_wave\_breaking  
time\_integral\_of\_height\_of\_mountain\_blocking  
time\_integral\_of\_momentum\_flux\_due\_to\_mountain\_blocking\_drag  
time\_integral\_of\_momentum\_flux\_due\_to\_nonstationary\_gravity\_wave  
time\_integral\_of\_momentum\_flux\_due\_to\_orographic\_gravity\_wave\_drag  
time\_integral\_of\_momentum\_flux\_due\_to\_turbulent\_orographic\_form\_drag  
time\_integral\_of\_x\_stress\_due\_to\_gravity\_wave\_drag  
time\_integral\_of\_y\_stress\_due\_to\_gravity\_wave\_drag  
time\_interval\_for\_maximum\_hourly\_fields  
time\_scale\_for\_rayleigh\_damping  
time\_since\_diagnostics\_zeroed  
time\_step\_for\_dynamics  
time\_step\_for\_physics  
time\_step\_for\_radiation  
tke\_advect  
tke\_at\_mass\_points  
tke\_budget  
tke\_dissipative\_heating\_factor  
topflw\_type  
topfsw\_type

total\_accumulated\_snowfall  
total\_cloud\_condensate\_mixing\_ratio\_updated\_by\_physics  
total\_cloud\_fraction  
total\_runoff  
tracer\_concentration  
tracer\_concentration\_save  
tracer\_concentration\_updated\_by\_physics  
transpiration\_flux  
triple\_point\_temperature\_of\_water  
turb\_oro\_form\_drag\_flag  
turbulent\_kinetic\_energy  
turbulent\_kinetic\_energy\_convective\_transport\_tracer  
u\_wind\_component\_at\_viscous\_sublayer\_top  
updraft\_fraction\_in\_boundary\_layer\_mass\_flux\_scheme  
updraft\_velocity\_tunable\_parameter\_1\_CS  
updraft\_velocity\_tunable\_parameter\_2\_CS  
upper\_bound\_on\_max\_albedo\_over\_deep\_snow  
upward\_heat\_flux\_in\_soil  
upward\_heat\_flux\_in\_soil\_over\_ice  
upward\_heat\_flux\_in\_soil\_over\_land  
upward\_heat\_flux\_in\_soil\_over\_ocean  
v\_wind\_component\_at\_viscous\_sublayer\_top  
vegetation\_area\_fraction  
vegetation\_temperature  
vegetation\_type\_classification  
vegetation\_type\_classification\_real  
vegetation\_type\_dataset\_choice  
vertical\_dimension  
vertical\_dimension\_minus\_one  
vertical\_dimension\_of\_h2o\_forcing\_data  
vertical\_dimension\_of\_ozone\_forcing\_data

vertical\_dimension\_plus\_one  
vertical\_index\_at\_cloud\_base  
vertical\_index\_at\_cloud\_top  
vertical\_index\_at\_top\_of\_atmosphere\_boundary\_layer  
vertical\_index\_difference\_between\_inout\_and\_local  
vertical\_index\_difference\_between\_layer\_and\_lower\_bound  
vertical\_index\_difference\_between\_layer\_and\_upper\_bound  
vertical\_interface\_dimension  
vertical\_sigma\_coordinate\_for\_radiation\_initialization  
vertical\_temperature\_average\_range\_lower\_bound  
vertical\_temperature\_average\_range\_upper\_bound  
vertical\_velocity\_for\_updraft  
vertically\_diffused\_tracer\_concentration  
volume\_fraction\_of\_condensed\_water\_in\_soil\_at\_wilting\_point  
volume\_fraction\_of\_frozen\_soil\_moisture\_for\_land\_surface\_model  
volume\_fraction\_of\_soil\_moisture  
volume\_fraction\_of\_soil\_moisture\_for\_land\_surface\_model  
volume\_fraction\_of\_unfrozen\_soil\_moisture  
volume\_fraction\_of\_unfrozen\_soil\_moisture\_for\_land\_surface\_model  
volume\_mixing\_ratio\_ccl4  
volume\_mixing\_ratio\_cfc11  
volume\_mixing\_ratio\_cfc113  
volume\_mixing\_ratio\_cfc12  
volume\_mixing\_ratio\_cfc22  
volume\_mixing\_ratio\_ch4  
volume\_mixing\_ratio\_co  
volume\_mixing\_ratio\_co2  
volume\_mixing\_ratio\_n2o  
volume\_mixing\_ratio\_o2  
vonKarman\_constant  
water\_equivalent\_accumulated\_snow\_depth



water\_equivalent\_accumulated\_snow\_depth\_over\_ice  
water\_equivalent\_accumulated\_snow\_depth\_over\_land  
water\_equivalent\_accumulated\_snow\_depth\_over\_ocean  
water\_friendly\_aerosol\_number\_concentration  
water\_friendly\_aerosol\_number\_concentration\_updated\_by\_physics  
water\_storage\_in\_aquifer  
water\_storage\_in\_aquifer\_and\_saturated\_soil  
water\_table\_depth  
water\_table\_recharge\_when\_deep  
water\_table\_recharge\_when\_shallow  
water\_vapor\_mixing\_ratio\_at\_surface  
water\_vapor\_specific\_humidity  
water\_vapor\_specific\_humidity\_at\_layer\_for\_radiation  
water\_vapor\_specific\_humidity\_at\_lowest\_model\_layer  
water\_vapor\_specific\_humidity\_at\_lowest\_model\_layer\_for\_diag  
water\_vapor\_specific\_humidity\_at\_lowest\_model\_layer\_updated\_by\_physics  
water\_vapor\_specific\_humidity\_at\_previous\_time\_step  
water\_vapor\_specific\_humidity\_save  
water\_vapor\_specific\_humidity\_two\_time\_steps\_back  
water\_vapor\_specific\_humidity\_updated\_by\_physics  
weight\_for\_momentum\_at\_viscous\_sublayer\_top  
weight\_for\_potential\_temperature\_at\_viscous\_sublayer\_top  
weight\_for\_specific\_humidity\_at\_viscous\_sublayer\_top  
weights\_for\_stochastic\_shum\_perturbation  
weights\_for\_stochastic\_shum\_perturbation\_flipped  
weights\_for\_stochastic\_skeb\_perturbation\_of\_x\_wind  
weights\_for\_stochastic\_skeb\_perturbation\_of\_x\_wind\_flipped  
weights\_for\_stochastic\_skeb\_perturbation\_of\_y\_wind  
weights\_for\_stochastic\_skeb\_perturbation\_of\_y\_wind\_flipped  
weights\_for\_stochastic\_sppt\_perturbation  
weights\_for\_stochastic\_sppt\_perturbation\_flipped

weights\_for\_stochastic\_surface\_physics\_perturbation  
wind\_speed\_at\_lowest\_model\_layer  
wood\_mass  
x\_momentum\_tendency\_from\_blocking\_drag  
x\_momentum\_tendency\_from\_form\_drag  
x\_momentum\_tendency\_from\_large\_scale\_gwd  
x\_momentum\_tendency\_from\_small\_scale\_gwd  
x\_wind  
x\_wind\_at\_10m  
x\_wind\_at\_lowest\_model\_layer  
x\_wind\_at\_lowest\_model\_layer\_for\_diag  
x\_wind\_at\_lowest\_model\_layer\_updated\_by\_physics  
x\_wind\_save  
x\_wind\_updated\_by\_physics  
y\_momentum\_tendency\_from\_blocking\_drag  
y\_momentum\_tendency\_from\_form\_drag  
y\_momentum\_tendency\_from\_large\_scale\_gwd  
y\_momentum\_tendency\_from\_small\_scale\_gwd  
y\_wind  
y\_wind\_at\_10m  
y\_wind\_at\_lowest\_model\_layer  
y\_wind\_at\_lowest\_model\_layer\_for\_diag  
y\_wind\_at\_lowest\_model\_layer\_updated\_by\_physics  
y\_wind\_save  
y\_wind\_updated\_by\_physics  
zenith\_angle\_temporal\_adjustment\_factor\_for\_shortwave\_fluxes

## 1.2 Description of variables

### GFS\_cldprop\_type

|             |                                     |
|-------------|-------------------------------------|
| long_name   | definition of type GFS_cldprop_type |
| units       | DDT                                 |
| rank        | 0                                   |
| type        | GFS_cldprop_type                    |
| kind        |                                     |
| source      | MODULE GFS_typedefs                 |
| local_name  | GFS_cldprop_type                    |
| requested   | NOT REQUESTED                       |
| physics set |                                     |

### GFS\_cldprop\_type\_instance

|             |   |
|-------------|---|
| long_name   | instance of derived type GFS_cldprop_type   |
| units       | DDT   |
| rank        | 0   |
| type        | GFS_cldprop_type                            |
| kind        |   |
| source      | MODULE gmtb_scm_type_defs TYPE physics_type |
| local_name  | physics%Clprop(cdata%blk_no)                |
| requested   | GFS_phys_time_vary_run<br>GFS_rrtmg_pre_run |
| physics set | physics                                     |

#### GFS\_cldprop\_type\_instance\_all\_blocks

|             |   |
|-------------|---|
| long_name   | instance of derived type GFS_cldprop_type   |
| units       | DDT   |
| rank        | 1   |
| type        | GFS_cldprop_type                            |
| kind        |   |
| source      | MODULE gmtb_scm_type_defs TYPE physics_type |
| local_name  | physics%Cldprop(:)                          |
| requested   | NOT REQUESTED                               |
| physics set |   |

#### GFS\_control\_type

|             |                                     |
|-------------|-------------------------------------|
| long_name   | definition of type GFS_control_type |
| units       | DDT                                 |
| rank        | 0                                   |
| type        | GFS_control_type                    |
| kind        |                                     |
| source      | MODULE GFS_typedefs                 |
| local_name  | GFS_control_type                    |
| requested   | NOT REQUESTED                       |
| physics set |                                     |

#### GFS\_control\_type\_instance

|             |  |
|-------------|--|
| long_name   | instance of derived type GFS_control_type  |
| units       | DDT  |
| rank        | 0  |
| type        | GFS_control_type   |
| kind        |  |
| source      | MODULE gmtb_scm_type_defs TYPE physics_type  |
| local_name  | physics%Model(cdata%blk_no)  |
| requested   | GFS_phys_time_vary_init<br>GFS_phys_time_vary_run<br>GFS_rad_time_vary_run<br>GFS_rrtmg_post_run<br>GFS_rrtmg_pre_run<br>GFS_suite_interstitial_phys_reset_run<br>rrtmg_lw_post_run<br>rrtmg_lw_pre_run<br>rrtmg_sw_post_run<br>rrtmg_sw_pre_run |
| physics set | physics  |

#### GFS\_coupling\_type

|             |                                      |
|-------------|--------------------------------------|
| long_name   | definition of type GFS_coupling_type |
| units       | DDT                                  |
| rank        | 0                                    |
| type        | GFS_coupling_type                    |
| kind        |                                      |
| source      | MODULE GFS_typedefs                  |
| local_name  | GFS_coupling_type                    |
| requested   | NOT REQUESTED                        |
| physics set |                                      |

#### GFS\_coupling\_type\_instance

|             |   |
|-------------|---|
| long_name   | instance of derived type GFS_coupling_type  |
| units       | DDT   |
| rank        | 0   |
| type        | GFS_coupling_type   |
| kind        |   |
| source      | MODULE gmtb_scm_type_defs TYPE physics_type                                       |
| local_name  | physics%Coupling(cdata%blk_no)  |
| requested   | GFS_rrtmg_post_run<br>GFS_rrtmg_pre_run<br>rrtmg_lw_post_run<br>rrtmg_sw_post_run |
| physics set | physics   |

#### GFS\_data\_type

|             |                                  |
|-------------|----------------------------------|
| long_name   | definition of type GFS_data_type |
| units       | DDT                              |
| rank        | 0                                |
| type        | GFS_data_type                    |
| kind        |                                  |
| source      | MODULE GFS_typedefs              |
| local_name  | GFS_data_type                    |
| requested   | NOT REQUESTED                    |
| physics set |                                  |

#### GFS\_diag\_type

|             |                                  |
|-------------|----------------------------------|
| long_name   | definition of type GFS_diag_type |
| units       | DDT                              |
| rank        | 0                                |
| type        | GFS_diag_type                    |
| kind        |                                  |
| source      | MODULE GFS_typedefs              |
| local_name  | GFS_diag_type                    |
| requested   | NOT REQUESTED                    |
| physics set |                                  |

#### GFS\_diag\_type\_instance

|             |   |
|-------------|---|
| long_name   | instance of derived type GFS_diag_type                            |
| units       | DDT   |
| rank        | 0   |
| type        | GFS_diag_type   |
| kind        |   |
| source      | MODULE gmtb_scm_type_defs TYPE physics_type                       |
| local_name  | physics%Diag(cdata%blk_no)  |
| requested   | GFS_phys_time_vary_run<br>GFS_rrtmg_post_run<br>rrtmg_sw_post_run |
| physics set | physics   |

#### GFS\_diag\_type\_instance\_all\_blocks

|             |   |
|-------------|---|
| long_name   | instance of derived type GFS_diag_type      |
| units       | DDT   |
| rank        | 1   |
| type        | GFS_diag_type                               |
| kind        |   |
| source      | MODULE gmtb_scm_type_defs TYPE physics_type |
| local_name  | physics%Diag(:)                             |
| requested   | NOT REQUESTED                               |
| physics set |   |

#### GFS\_grid\_type

|             |                                  |
|-------------|----------------------------------|
| long_name   | definition of type GFS_grid_type |
| units       | DDT                              |
| rank        | 0                                |
| type        | GFS_grid_type                    |
| kind        |                                  |
| source      | MODULE GFS_typedefs              |
| local_name  | GFS_grid_type                    |
| requested   | NOT REQUESTED                    |
| physics set |                                  |



#### GFS\_grid\_type\_instance

|             |  |
|-------------|--|
| long_name   | instance of derived type GFS_grid_type   |
| units       | DDT  |
| rank        | 0  |
| type        | GFS_grid_type  |
| kind        |  |
| source      | MODULE gmtb_scm_type_defs TYPE physics_type  |
| local_name  | physics%Grid(cdata%blk_no)   |
| requested   | GFS_phys_time_vary_init<br>GFS_phys_time_vary_run<br>GFS_rrtmg_post_run<br>GFS_rrtmg_pre_run<br>rrtmg_lw_post_run<br>rrtmg_lw_pre_run<br>rrtmg_sw_post_run<br>rrtmg_sw_pre_run |
| physics set | physics  |

#### GFS\_grid\_type\_instance\_all\_blocks

|             |   |
|-------------|---|
| long_name   | instance of derived type GFS_grid_type      |
| units       | DDT   |
| rank        | 1   |
| type        | GFS_grid_type                               |
| kind        |   |
| source      | MODULE gmtb_scm_type_defs TYPE physics_type |
| local_name  | physics%Grid(:)                             |
| requested   | NOT REQUESTED                               |
| physics set |   |

#### GFS\_interstitial\_type

|             |  |
|-------------|--|
| long_name   | definition of type GFS_interstitial_type |
| units       | DDT                                      |
| rank        | 0  |
| type        | GFS_interstitial_type                    |
| kind        |  |
| source      | MODULE GFS_typedefs                      |
| local_name  | GFS_interstitial_type                    |
| requested   | NOT REQUESTED                            |
| physics set |  |

#### GFS\_interstitial\_type\_instance

|             |  |
|-------------|--|
| long_name   | instance of derived type GFS_interstitial_type   |
| units       | DDT  |
| rank        | 0  |
| type        | GFS_interstitial_type  |
| kind        |  |
| source      | MODULE gmtb_scm_type_defs TYPE physics_type  |
| local_name  | physics%Interstitial(cdata%blk_no)   |
| requested   | GFS_phys_time_vary_init<br>GFS_suite_interstitial_phys_reset_run<br>GFS_suite_interstitial_rad_reset_run |
| physics set | physics  |

#### GFS\_radtend\_type

|             |                                     |
|-------------|-------------------------------------|
| long_name   | definition of type GFS_radtend_type |
| units       | DDT                                 |
| rank        | 0                                   |
| type        | GFS_radtend_type                    |
| kind        |                                     |
| source      | MODULE GFS_typedefs                 |
| local_name  | GFS_radtend_type                    |
| requested   | NOT REQUESTED                       |
| physics set |                                     |

#### GFS\_radtend\_type\_instance

|             |   |
|-------------|---|
| long_name   | instance of derived type GFS_radtend_type   |
| units       | DDT   |
| rank        | 0   |
| type        | GFS_radtend_type  |
| kind        |   |
| source      | MODULE gmtb_scm_type_defs TYPE physics_type   |
| local_name  | physics%Radrend(cdata%blk_no)   |
| requested   | GFS_rrtmg_post_run<br>GFS_rrtmg_pre_run<br>rrtmg_lw_post_run<br>rrtmg_lw_pre_run<br>rrtmg_sw_post_run<br>rrtmg_sw_pre_run |
| physics set | physics   |

#### GFS\_sfcprop\_type

|             |                                     |
|-------------|-------------------------------------|
| long_name   | definition of type GFS_sfcprop_type |
| units       | DDT                                 |
| rank        | 0                                   |
| type        | GFS_sfcprop_type                    |
| kind        |                                     |
| source      | MODULE GFS_typedefs                 |
| local_name  | GFS_sfcprop_type                    |
| requested   | NOT REQUESTED                       |
| physics set |                                     |

#### GFS\_sfcprop\_type\_instance

|             |   |
|-------------|---|
| long_name   | instance of derived type GFS_sfcprop_type   |
| units       | DDT   |
| rank        | 0   |
| type        | GFS_sfcprop_type  |
| kind        |   |
| source      | MODULE gmtb_scm_type_defs TYPE physics_type   |
| local_name  | physics%Sfcprop(cdata%blk_no)   |
| requested   | GFS_phys_time_vary_run<br>GFS_rrtmg_pre_run<br>rrtmg_lw_pre_run<br>rrtmg_sw_pre_run |
| physics set | physics   |

#### GFS\_sfcprop\_type\_instance\_all\_blocks

|             |   |
|-------------|---|
| long_name   | instance of derived type GFS_sfcprop_type   |
| units       | DDT   |
| rank        | 1   |
| type        | GFS_sfcprop_type                            |
| kind        |   |
| source      | MODULE gmtb_scm_type_defs TYPE physics_type |
| local_name  | physics%Sfcprop(:)                          |
| requested   | NOT REQUESTED                               |
| physics set |   |

#### GFS\_statein\_type

|             |                                     |
|-------------|-------------------------------------|
| long_name   | definition of type GFS_statein_type |
| units       | DDT                                 |
| rank        | 0                                   |
| type        | GFS_statein_type                    |
| kind        |                                     |
| source      | MODULE GFS_typedefs                 |
| local_name  | GFS_statein_type                    |
| requested   | NOT REQUESTED                       |
| physics set |                                     |

#### GFS\_statein\_type\_instance

|             |  |
|-------------|--|
| long_name   | instance of derived type GFS_statein_type  |
| units       | DDT  |
| rank        | 0  |
| type        | GFS_statein_type   |
| kind        |  |
| source      | MODULE gmtb_scm_type_defs TYPE physics_type  |
| local_name  | physics%Statein(cdata%blk_no)  |
| requested   | GFS_phys_time_vary_run<br>GFS_rad_time_vary_run<br>GFS_rrtmg_post_run<br>GFS_rrtmg_pre_run |
| physics set | physics  |

#### GFS\_statein\_type\_instance\_all\_blocks

|             |   |
|-------------|---|
| long_name   | instance of derived type GFS_statein_type   |
| units       | DDT   |
| rank        | 1   |
| type        | GFS_statein_type                            |
| kind        |   |
| source      | MODULE gmtb_scm_type_defs TYPE physics_type |
| local_name  | physics%Statein(:)                          |
| requested   | NOT REQUESTED                               |
| physics set |   |

#### GFS\_stateout\_type

|             |                                      |
|-------------|--------------------------------------|
| long_name   | definition of type GFS_stateout_type |
| units       | DDT                                  |
| rank        | 0                                    |
| type        | GFS_stateout_type                    |
| kind        |                                      |
| source      | MODULE GFS_typedefs                  |
| local_name  | GFS_stateout_type                    |
| requested   | NOT REQUESTED                        |
| physics set |                                      |

#### GFS\_stateout\_type\_instance

|             |   |
|-------------|---|
| long_name   | instance of derived type GFS_stateout_type  |
| units       | DDT   |
| rank        | 0   |
| type        | GFS_stateout_type                           |
| kind        |   |
| source      | MODULE gmtb_scm_type_defs TYPE physics_type |
| local_name  | physics%Stateout(cdata%blk_no)              |
| requested   | NOT REQUESTED                               |
| physics set |   |

#### GFS\_tbd\_type

|             |                                 |
|-------------|---------------------------------|
| long_name   | definition of type GFS_tbd_type |
| units       | DDT                             |
| rank        | 0                               |
| type        | GFS_tbd_type                    |
| kind        |                                 |
| source      | MODULE GFS_typedefs             |
| local_name  | GFS_tbd_type                    |
| requested   | NOT REQUESTED                   |
| physics set |                                 |

#### GFS\_tbd\_type\_instance

|             |   |
|-------------|---|
| long_name   | instance of derived type GFS_tbd_type   |
| units       | DDT   |
| rank        | 0   |
| type        | GFS_tbd_type  |
| kind        |   |
| source      | MODULE gmtb_scm_type_defs TYPE physics_type   |
| local_name  | physics%Tbd(cdata%blk_no)   |
| requested   | GFS_phys_time_vary_init<br>GFS_phys_time_vary_run<br>GFS_rad_time_vary_run<br>GFS_rrtmg_pre_run |
| physics set | physics   |

#### GFS\_tbd\_type\_instance\_all\_blocks

|             |   |
|-------------|---|
| long_name   | instance of derived type GFS_tbd_type       |
| units       | DDT   |
| rank        | 1   |
| type        | GFS_tbd_type                                |
| kind        |   |
| source      | MODULE gmtb_scm_type_defs TYPE physics_type |
| local_name  | physics%Tbd(:)                              |
| requested   | NOT REQUESTED                               |
| physics set |   |

#### Monin\_Obukhov\_similarity\_function\_for\_heat

|             |  |
|-------------|--|
| long_name   | Monin-Obukhov similarity function for heat   |
| units       | none   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type  |
| local_name  | physics%Sfcprop(cdata%blk_no)%ffhh   |
| requested   | GFS_surface_composites_post_run<br>gmtb_scm_sfc_flux_spec_run<br>hedmf_run<br>moninshoc_run<br>myjsfc_wrapper_run<br>mynnsfc_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>sfc_diag_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics  |



#### Monin-Obukhov\_similarity\_function\_for\_heat\_at\_2m

|             |  |
|-------------|--|
| long_name   | Monin-Obukhov similarity parameter for heat at 2m  |
| units       | none   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%fh2   |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>mynnsfc_wrapper_run<br>sfc_diag_run |
| physics set | physics  |

#### Monin-Obukhov\_similarity\_function\_for\_heat\_at\_2m\_over\_ice

|             |   |
|-------------|---|
| long_name   | Monin-Obukhov similarity parameter for heat at 2m over ice            |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                        |
| local_name  | physics%Interstitial(cdata%blk_no)%fh2_ice                            |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### Monin\_Obukhov\_similarity\_function\_for\_heat\_at\_2m\_over\_land

|             |   |
|-------------|---|
| long_name   | Monin-Obukhov similarity parameter for heat at 2m over land           |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                        |
| local_name  | physics%Interstitial(cdata%blk_no)%fh2_land                           |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### Monin\_Obukhov\_similarity\_function\_for\_heat\_at\_2m\_over\_ocean

|             |   |
|-------------|---|
| long_name   | Monin-Obukhov similarity parameter for heat at 2m over ocean          |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                        |
| local_name  | physics%Interstitial(cdata%blk_no)%fh2_ocean                          |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### Monin\_Obukhov\_similarity\_function\_for\_heat\_over\_ice

|             |   |
|-------------|---|
| long_name   | Monin-Obukhov similarity function for heat over ice                   |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                        |
| local_name  | physics%Interstitial(cdata%blk_no)%ffhh_ice                           |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### Monin\_Obukhov\_similarity\_function\_for\_heat\_over\_land

|             |   |
|-------------|---|
| long_name   | Monin-Obukhov similarity function for heat over land                  |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                        |
| local_name  | physics%Interstitial(cdata%blk_no)%ffhh_land                          |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### Monin\_Obukhov\_similarity\_function\_for\_heat\_over\_ocean

|             |   |
|-------------|---|
| long_name   | Monin-Obukhov similarity function for heat over ocean                 |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                        |
| local_name  | physics%Interstitial(cdata%blk_no)%ffhh_ocean                         |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### Monin\_Obukhov\_similarity\_function\_for\_momentum

|             |  |
|-------------|--|
| long_name   | Monin-Obukhov similarity function for momentum   |
| units       | none   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type  |
| local_name  | physics%Sfcprop(cdata%blk_no)%ffmm   |
| requested   | GFS_surface_composites_post_run<br>gmtb_scm_sfc_flux_spec_run<br>hedmf_run<br>moninshoc_run<br>myjsfc_wrapper_run<br>mynnsfc_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>sfc_diag_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics  |

#### Monin-Obukhov\_similarity\_function\_for\_momentum\_at\_10m

|             |  |
|-------------|--|
| long_name   | Monin-Obukhov similarity parameter for momentum at 10m                                       |
| units       | none   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%fm10  |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>mynnsfc_wrapper_run<br>sfc_diag_run |
| physics set | physics  |

#### Monin-Obukhov\_similarity\_function\_for\_momentum\_at\_10m\_over\_ice

|             |   |
|-------------|---|
| long_name   | Monin-Obukhov similarity parameter for momentum at 10m over ice       |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                        |
| local_name  | physics%Interstitial(cdata%blk_no)%fm10_ice                           |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### Monin\_Obukhov\_similarity\_function\_for\_momentum\_at\_10m\_over\_land

|             |   |
|-------------|---|
| long_name   | Monin-Obukhov similarity parameter for momentum at 10m over land      |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                        |
| local_name  | physics%Interstitial(cdata%blk_no)%fm10_land                          |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### Monin\_Obukhov\_similarity\_function\_for\_momentum\_at\_10m\_over\_ocean

|             |   |
|-------------|---|
| long_name   | Monin-Obukhov similarity parameter for momentum at 10m over ocean     |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                        |
| local_name  | physics%Interstitial(cdata%blk_no)%fm10_ocean                         |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### Monin\_Obukhov\_similarity\_function\_for\_momentum\_over\_ice

|             |   |
|-------------|---|
| long_name   | Monin-Obukhov similarity function for momentum over ice               |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                        |
| local_name  | physics%Interstitial(cdata%blk_no)%ffmm_ice                           |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### Monin\_Obukhov\_similarity\_function\_for\_momentum\_over\_land

|             |   |
|-------------|---|
| long_name   | Monin-Obukhov similarity function for momentum over land              |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                        |
| local_name  | physics%Interstitial(cdata%blk_no)%ffmm_land                          |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### Monin\_Obukhov\_similarity\_function\_for\_momentum\_over\_ocean

|             |   |
|-------------|---|
| long_name   | Monin-Obukhov similarity function for momentum over ocean             |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                        |
| local_name  | physics%Interstitial(cdata%blk_no)%ffmm_ocean                         |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### a\_parameter\_of\_the\_hybrid\_coordinate

|             |   |
|-------------|---|
| long_name   | a parameter for sigma pressure level calculations |
| units       | Pa  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type         |
| local_name  | physics%Model(cdata%blk_no)%ak                    |
| requested   | cires_ugwp_init                                   |
| physics set | physics   |

#### accumulated\_change\_of\_air\_temperature\_due\_to\_FA\_scheme

|             |   |
|-------------|---|
| long_name   | accumulated change of air temperature due to FA MP scheme |
| units       | K   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                    |
| local_name  | physics%Diag(cdata%blk_no)%train                          |
| requested   | NOT REQUESTED   |
| physics set |   |



accumulated\_lwe\_thickness\_of\_convective\_precipitation\_amount\_cnvc90

|             |  |
|-------------|--|
| long_name   | accumulated convective rainfall amount for cnvc90 only |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type                  |
| local_name  | physics%Tbd(cdata%blk_no)%acv                          |
| requested   | cnvc90_run   |
| physics set | physics  |

accumulated\_lwe\_thickness\_of\_graupel\_amount

|             |  |
|-------------|--|
| long_name   | accumulated graupel precipitation      |
| units       | kg m-2                                 |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%totgrp      |
| requested   | GFS_MP_generic_post_run                |
| physics set | physics                                |

accumulated\_lwe\_thickness\_of\_graupel\_amount\_in\_bucket

|             |   |
|-------------|---|
| long_name   | accumulated graupel precipitation in bucket |
| units       | kg m-2                                      |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys                                   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type      |
| local_name  | physics%Diag(cdata%blk_no)%totgrpb          |
| requested   | GFS_MP_generic_post_run                     |
| physics set | physics                                     |

#### accumulated\_lwe\_thickness\_of\_ice\_amount

|             |  |
|-------------|--|
| long_name   | accumulated ice precipitation          |
| units       | kg m-2                                 |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%totice      |
| requested   | GFS_MP_generic_post_run                |
| physics set | physics                                |

#### accumulated\_lwe\_thickness\_of\_ice\_amount\_in\_bucket

|             |   |
|-------------|---|
| long_name   | accumulated ice precipitation in bucket |
| units       | kg m-2                                  |
| rank        | 1                                       |
| type        | real                                    |
| kind        | kind_phys                               |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type  |
| local_name  | physics%Diag(cdata%blk_no)%toticeb      |
| requested   | GFS_MP_generic_post_run                 |
| physics set | physics                                 |

#### accumulated\_lwe\_thickness\_of\_precipitation\_amount

|             |  |
|-------------|--|
| long_name   | accumulated total precipitation        |
| units       | m                                      |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%totprcp     |
| requested   | GFS_MP_generic_post_run                |
| physics set | physics                                |

#### accumulated\_lwe\_thickness\_of\_precipitation\_amount\_in\_bucket

|             |   |
|-------------|---|
| long_name   | accumulated total precipitation in bucket |
| units       | m   |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type    |
| local_name  | physics%Diag(cdata%blk_no)%totprcpb       |
| requested   | GFS_MP_generic_post_run                   |
| physics set | physics                                   |

#### accumulated\_lwe\_thickness\_of\_snow\_amount

|             |  |
|-------------|--|
| long_name   | accumulated snow precipitation         |
| units       | kg m-2                                 |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%totsnw      |
| requested   | GFS_MP_generic_post_run                |
| physics set | physics                                |

#### accumulated\_lwe\_thickness\_of\_snow\_amount\_in\_bucket

|             |  |
|-------------|--|
| long_name   | accumulated snow precipitation in bucket |
| units       | kg m-2                                   |
| rank        | 1  |
| type        | real                                     |
| kind        | kind_phys                                |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type   |
| local_name  | physics%Diag(cdata%blk_no)%totsnwb       |
| requested   | GFS_MP_generic_post_run                  |
| physics set | physics                                  |

#### accumulated\_water\_equivalent\_of\_frozen\_precip

|             |  |
|-------------|--|
| long_name   | snow water equivalent of run-total frozen precip |
| units       | kg m-2   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type        |
| local_name  | physics%Sfcprop(cdata%blk_no)%acsnow             |
| requested   | lsm_ruc_run                                      |
| physics set | physics  |

#### adjusted\_vertical\_layer\_dimension\_for\_radiation

|             |  |
|-------------|--|
| long_name   | adjusted number of vertical layers for radiation |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%lmk           |
| requested   | GFS_rrtmg_pre_run                                |
|             | rrtmg_lw_run                                     |
|             | rrtmg_sw_run                                     |
| physics set | physics  |

#### adjusted\_vertical\_level\_dimension\_for\_radiation

|             |   |
|-------------|---|
| long_name   | adjusted number of vertical levels for radiation  |
| units       | count   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type    |
| local_name  | physics%Interstitial(cdata%blk_no)%lmp            |
| requested   | GFS_rrtmg_pre_run<br>rrtmg_lw_run<br>rrtmg_sw_run |
| physics set | physics   |

#### aerosol\_asymmetry\_parameter\_for\_longwave\_bands\_01\_16

|             |   |
|-------------|---|
| long_name   | aerosol asymmetry parameter for longwave bands 01-16  |
| units       | none  |
| rank        | 3   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type        |
| local_name  | physics%Interstitial(cdata%blk_no)%faerlw(:, :, :, 3) |
| requested   | GFS_rrtmg_pre_run                                     |
| physics set | physics   |

#### aerosol\_asymmetry\_parameter\_for\_shortwave\_bands\_01\_16

long\_name aerosol asymmetry parameter for shortwave bands 01-16  
units none  
rank 3  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%faersw(:, :, :, 3)  
requested GFS\_rrtmg\_pre\_run  
rrtmg\_sw\_run  
physics set physics

#### aerosol\_aware\_parameter\_deep\_convection

long\_name aerosol-aware parameter inversely proportional to CCN number concentraion from Lim (2011) for deep convection  
units none  
rank 0  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name physics%Model(cdata%blk\_no)%asolfac\_deep  
requested samfdeepcnv\_run  
physics set physics

#### aerosol\_aware\_parameter\_shallow\_convection

long\_name aerosol-aware parameter inversely proportional to CCN number concentraion from Lim (2011) for shallow convection  
units none  
rank 0  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name physics%Model(cdata%blk\_no)%asolfac\_shal  
requested samfshalcnv\_run  
physics set physics

#### aerosol\_number\_concentration\_from\_gocart\_aerosol\_climatology

long\_name GOCART aerosol climatology number concentration  
units kg-1?  
rank 3  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name physics%Tbd(cdata%blk\_no)%aer\_nm  
requested m\_micro\_run  
physics set physics

#### aerosol\_optical\_depth\_for\_longwave\_bands\_01\_16

long\_name aerosol optical depth for longwave bands 01-16  
units none  
rank 3  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%faerlw(:,:,:,1)  
requested GFS\_rrtmg\_pre\_run  
rrtmg\_lw\_run  
physics set physics

#### aerosol\_optical\_depth\_for\_shortwave\_bands\_01\_16

long\_name aerosol optical depth for shortwave bands 01-16  
units none  
rank 3  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%faersw(:,:,:,1)  
requested GFS\_rrtmg\_pre\_run  
rrtmg\_sw\_run  
physics set physics

#### aerosol\_optical\_properties\_for\_longwave\_bands\_01\_16

long\_name aerosol optical properties for longwave bands 01-16  
units various  
rank 4  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%faerlw  
requested GFS\_rrtmg\_setup\_init  
physics set physics

#### aerosol\_optical\_properties\_for\_shortwave\_bands\_01\_16

long\_name aerosol optical properties for shortwave bands 01-16  
units various  
rank 4  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%faersw  
requested GFS\_rrtmg\_setup\_init  
physics set physics

#### aerosol\_single\_scattering\_albedo\_for\_longwave\_bands\_01\_16

long\_name aerosol single scattering albedo for longwave bands 01-16  
units frac  
rank 3  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%faerlw(:, :, :, 2)  
requested GFS\_rrtmg\_pre\_run  
rrtmg\_lw\_run  
physics set physics



#### aerosol\_single\_scattering\_albedo\_for\_shortwave\_bands\_01\_16

|             |  |
|-------------|--|
| long_name   | aerosol single scattering albedo for shortwave bands 01-16 |
| units       | frac   |
| rank        | 3  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type             |
| local_name  | physics%Interstitial(cdata%blk_no)%faersw(:, :, :, 2)      |
| requested   | GFS_rrtmg_pre_run  |
|             | rrtmg_sw_run   |
| physics set | physics  |

## air\_pressure

|            |  |
|------------|--|
| long_name  | mean layer pressure  |
| units      | Pa   |
| rank       | 2  |
| type       | real   |
| kind       | kind_phys  |
| source     | MODULE GFS_typedefs TYPE GFS_statein_type  |
| local_name | physics%Statein(cdata%blk_no)%prsl   |
| requested  | GFS_MP_generic_post_run<br>GFS_PBL_generic_post_run<br>GFS_suite_interstitial_2_run<br>GFS_suite_interstitial_3_run<br>cires_ugwp_run<br>cs_conv_run<br>cu_gf_driver_run<br>cu_ntiedtke_run<br>drag_suite_run<br>gfdl_cloud_microphys_run<br>gwdc_run<br>gwdps_run<br>h2ophys_run<br>hedmf_run<br>m_micro_run<br>moninshoc_run<br>mp_thompson_pre_run<br>mp_thompson_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>mynnedmf_wrapper_run<br>mynnsfc_wrapper_run<br>ozphys_2015_run<br>ozphys_run<br>rayleigh_damp_run<br>samfdeepcnv_run<br>samfshalcnv_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>shoc_run |

#### air\_pressure\_at\_interface

|             |  |
|-------------|--|
| long_name   | air pressure at model layer interfaces   |
| units       | Pa   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type  |
| local_name  | physics%Statein(cdata%blk_no)%prsi   |
| requested   | GFS_MP_generic_post_run<br>GFS_suite_interstitial_2_run<br>GFS_suite_interstitial_3_run<br>cires_ugwp_run<br>cnvc90_run<br>cs_conv_aw_adj_run<br>cs_conv_run<br>cu_ntiedtke_run<br>drag_suite_run<br>get_prs_fv3_run<br>gwdc_run<br>gwdps_run<br>hedmf_run<br>m_micro_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics  |

#### air\_pressure\_at\_interface\_for\_radiation\_in\_hPa

long\_name      air pressure at vertical interface for radiation calculation  
units          hPa  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%plvl  
requested     GFS\_rrtmg\_pre\_run  
              rrtmg\_lw\_run  
              rrtmg\_sw\_run  
physics set   physics

#### air\_pressure\_at\_layer\_for\_radiation\_in\_hPa

long\_name      air pressure at vertical layer for radiation calculation  
units          hPa  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%plyr  
requested     GFS\_rrtmg\_pre\_run  
              rrtmg\_lw\_run  
              rrtmg\_sw\_run  
physics set   physics

#### air\_pressure\_at\_lowest\_model\_layer

|             |  |
|-------------|--|
| long_name   | mean pressure at lowest model layer  |
| units       | Pa   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type  |
| local_name  | physics%Statein(cdata%blk_no)%prsl(:,1)  |
| requested   | gmtb_scm_sfc_flux_spec_run<br>lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run<br>sfc_cice_run<br>sfc_diff_run<br>sfc_nst_run<br>sfc_ocean_run<br>sfc_sice_run |
| physics set | physics  |

#### air\_pressure\_difference\_between\_midlayers

|             |  |
|-------------|--|
| long_name   | air pressure difference between midlayers  |
| units       | Pa   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%del   |
| requested   | GFS_MP_generic_post_run<br>cires_ugwp_run<br>drag_suite_run<br>get_prs_fv3_run<br>gfdl_cloud_microphys_run<br>gwdc_pre_run<br>gwdc_run<br>gwdps_run<br>hedmf_run<br>moninshoc_run<br>ozphys_2015_run<br>ozphys_run<br>samfdeepcnv_run<br>samfshalcnv_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>zhaocarr_precpd_run |
| physics set | physics  |

## air\_temperature

|             |  |
|-------------|--|
| long_name   | model layer mean temperature   |
| units       | K  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type  |
| local_name  | physics%Statein(cdata%blk_no)%tgrs   |
| requested   | GFS_suite_interstitial_2_run<br>GFS_suite_stateout_reset_run<br>GFS_suite_stateout_update_run<br>cires_ugwp_run<br>cu_gf_driver_pre_run<br>cu_gf_driver_run<br>cu_ntiedtke_pre_run<br>drag_suite_run<br>get_prs_fv3_run<br>gwdc_run<br>gwdps_run<br>hedmf_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>mynnedmf_wrapper_run<br>mynnrad_pre_run<br>mynnsfc_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics  |

#### air\_temperature\_at\_interface\_for\_radiation

|             |   |
|-------------|---|
| long_name   | air temperature at vertical interface for radiation calculation |
| units       | K   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                  |
| local_name  | physics%Interstitial(cdata%blk_no)%tlvl                         |
| requested   | GFS_rrtmg_pre_run<br>rrtmg_lw_run<br>rrtmg_sw_run               |
| physics set | physics   |

#### air\_temperature\_at\_layer\_for\_radiation

|             |   |
|-------------|---|
| long_name   | air temperature at vertical layer for radiation calculation |
| units       | K   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type              |
| local_name  | physics%Interstitial(cdata%blk_no)%tlyr                     |
| requested   | GFS_rrtmg_pre_run<br>rrtmg_lw_run<br>rrtmg_sw_run           |
| physics set | physics   |



#### air\_temperature\_at\_lowest\_model\_layer

|             |   |
|-------------|---|
| long_name   | mean temperature at lowest model layer  |
| units       | K   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type   |
| local_name  | physics%Statein(cdata%blk_no)%tgrs(:,1)   |
| requested   | GFS_surface_generic_post_run<br>dcyc2t3_run<br>gmtb_scm_sfc_flux_spec_run<br>lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run<br>sfc_cice_run<br>sfc_diff_run<br>sfc_nst_run<br>sfc_ocean_run<br>sfc_sice_run |
| physics set | physics   |

#### air\_temperature\_at\_lowest\_model\_layer\_for\_diag

|             |  |
|-------------|--|
| long_name   | layer 1 temperature for diag                             |
| units       | K  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                   |
| local_name  | physics%Diag(cdata%blk_no)%t1                            |
| requested   | GFS_PBL_generic_post_run<br>GFS_surface_generic_post_run |
| physics set | physics  |

#### air\_temperature\_at\_lowest\_model\_layer\_updated\_by\_physics

|             |  |
|-------------|--|
| long_name   | temperature at lowest model layer updated by physics |
| units       | K  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_stateout_type           |
| local_name  | physics%Stateout(cdata%blk_no)%gt0(:,1)              |
| requested   | sfc_diag_run   |
| physics set | physics  |

#### air\_temperature\_at\_previous\_time\_step

|             |  |
|-------------|--|
| long_name   | air temperature at previous time step      |
| units       | K  |
| rank        | 2  |
| type        | real                                       |
| kind        | kind_phys                                  |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type      |
| local_name  | physics%Tbd(cdata%blk_no)%phy_f3d(:, :, 3) |
| requested   | NOT REQUESTED                              |
| physics set |  |

#### air\_temperature\_lapse\_rate\_constant

|             |   |
|-------------|---|
| long_name   | environmental air temperature lapse rate constant |
| units       | K m-1   |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE gmtb_scm_physical_constants                |
| local_name  | rlapse  |
| requested   | sfc_nst_post_run                                  |
| physics set | physics   |

#### air\_temperature\_save

|             |  |
|-------------|--|
| long_name   | air temperature before entering a physics scheme   |
| units       | K  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%save_t  |
| requested   | GFS_DCNV_generic_post_run<br>GFS_DCNV_generic_pre_run<br>GFS_MP_generic_post_run<br>GFS_MP_generic_pre_run<br>GFS_SCNV_generic_post_run<br>GFS_SCNV_generic_pre_run<br>cs_conv_aw_adj_run<br>gwdc_pre_run<br>mp_thompson_post_run<br>mp_thompson_pre_run |
| physics set | physics  |

#### air\_temperature\_two\_time\_steps\_back

|             |  |
|-------------|--|
| long_name   | air temperature two time steps back        |
| units       | K  |
| rank        | 2  |
| type        | real                                       |
| kind        | kind_phys                                  |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type      |
| local_name  | physics%Tbd(cdata%blk_no)%phy_f3d(:, :, 1) |
| requested   | NOT REQUESTED                              |
| physics set |  |

#### air\_temperature\_updated\_by\_physics

|            |  |
|------------|--|
| long_name  | temperature updated by physics   |
| units      | K  |
| rank       | 2  |
| type       | real   |
| kind       | kind_phys  |
| source     | MODULE GFS_typedefs TYPE GFS_stateout_type   |
| local_name | physics%Stateout(cdata%blk_no)%gt0   |
| requested  | GFS_DCNV_generic_post_run<br>GFS_DCNV_generic_pre_run<br>GFS_MP_generic_post_run<br>GFS_MP_generic_pre_run<br>GFS_SCNV_generic_post_run<br>GFS_SCNV_generic_pre_run<br>GFS_suite_stateout_reset_run<br>GFS_suite_stateout_update_run<br>cs_conv_aw_adj_run<br>cs_conv_run<br>cu_gf_driver_post_run<br>cu_gf_driver_run<br>cu_ntiedtke_post_run<br>cu_ntiedtke_run<br>get_phi_fv3_run<br>gfdl_cloud_microphys_run<br>gwdc_post_run<br>gwdc_pre_run<br>m_micro_pre_run<br>m_micro_run<br>maximum_hourly_diagnostics_run<br>mp_thompson_post_run<br>mp_thompson_pre_run<br>mp_thompson_run<br>ozphys_2015_run<br>ozphys_run<br>samfdeepcnv_run<br>samfshalcnv_run<br>shoc_run<br>zhaocarr_gscond_run<br>zhaocarr_precpd_run |

#### angle\_from\_east\_of\_maximum\_subgrid\_orographic\_variations

|             |  |
|-------------|--|
| long_name   | angle with_respect to east of maximum subgrid orographic variations      |
| units       | degrees  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                           |
| local_name  | physics%Interstitial(cdata%blk_no)%theta                                 |
| requested   | GFS_GWD_generic_pre_run<br>cires_ugwp_run<br>drag_suite_run<br>gwdps_run |
| physics set | physics  |

#### anisotropy\_of\_subgrid\_orography

|             |  |
|-------------|--|
| long_name   | anisotropy of subgrid orography  |
| units       | none   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                           |
| local_name  | physics%Interstitial(cdata%blk_no)%gamma                                 |
| requested   | GFS_GWD_generic_pre_run<br>cires_ugwp_run<br>drag_suite_run<br>gwdps_run |
| physics set | physics  |

#### area\_fraction\_of\_wet\_canopy

|             |   |
|-------------|---|
| long_name   | area fraction of canopy that is wetted/snowed |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys                                     |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type     |
| local_name  | physics%Sfcprop(cdata%blk_no)%fwetxy          |
| requested   | NOT REQUESTED                                 |
| physics set |   |

#### array\_dimension\_of\_2d\_arrays\_for\_microphysics

|             |   |
|-------------|---|
| long_name   | number of 2D arrays needed for microphysics |
| units       | count                                       |
| rank        | 0   |
| type        | integer                                     |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%num_p2d         |
| requested   | GFS_rrtmg_setup_init                        |
| physics set | physics                                     |

#### array\_dimension\_of\_3d\_arrays\_for\_microphysics

|             |  |
|-------------|--|
| long_name   | number of 3D arrays needed for microphysics                                    |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                                      |
| local_name  | physics%Model(cdata%blk_no)%num_p3d  |
| requested   | GFS_DCNV_generic_post_run<br>GFS_SCNV_generic_post_run<br>GFS_rrtmg_setup_init |
| physics set | physics  |

#### array\_dimension\_of\_random\_number

|             |  |
|-------------|--|
| long_name   | second dimension of random number stream for RAS |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type        |
| local_name  | physics%Model(cdata%blk_no)%nrcm                 |
| requested   | GFS_MP_generic_post_run                          |
| physics set | physics  |

```

asymmetry_of_subgrid_orography
  long_name      asymmetry of subgrid orography
  units          none
  rank           2
  type           real
  kind           kind_phys
  source         MODULE GFS_typedefs TYPE GFS_interstitial_type
  local_name     physics%Interstitial(cdata%blk_no)%oa4
  requested      GFS_GWD_generic_pre_run
                  cires_ugwp_run
                  drag_suite_run
                  gwdps_run
  physics set    physics

```



#### atmosphere\_boundary\_layer\_thickness

|             |   |
|-------------|---|
| long_name   | pbl height  |
| units       | m   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type  |
| local_name  | physics%Diag(cdata%blk_no)%hpbl   |
| requested   | cu_gf_driver_run<br>drag_suite_run<br>hedmf_run<br>m_micro_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>mynnedmf_wrapper_run<br>mynnsfc_wrapper_run<br>samfshalcnv_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics   |

#### atmosphere\_diffusivity\_coefficient\_factor

|             |   |
|-------------|---|
| long_name   | multiplicative constant for atmospheric diffusivities |
| units       | none  |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type             |
| local_name  | physics%Model(cdata%blk_no)%moninq_fac                |
| requested   | hedmf_init  |
|             | hedmf_run   |
| physics set | physics   |

#### atmosphere\_heat\_diffusivity

|             |  |
|-------------|--|
| long_name   | diffusivity for heat                           |
| units       | m2 s-1   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%dkt         |
| requested   | GFS_PBL_generic_post_run                       |
|             | hedmf_run                                      |
|             | moninshoc_run                                  |
|             | myjpbl_wrapper_run                             |
| physics set | physics  |

#### atmosphere\_heat\_diffusivity\_background

|             |   |
|-------------|---|
| long_name   | background vertical diffusion for heat q  |
| units       | m2 s-1  |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%xkzm_h  |
| requested   | hedmf_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run |
| physics set | physics   |

#### atmosphere\_heat\_diffusivity\_background\_maximum

|             |  |
|-------------|--|
| long_name   | maximum background value of heat diffusivity |
| units       | m2 s-1                                       |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys                                    |
| source      | MODULE GFS_typedefs TYPE GFS_control_type    |
| local_name  | physics%Model(cdata%blk_no)%xkzminv          |
| requested   | hedmf_run<br>moninshoc_run                   |
| physics set | physics                                      |

#### atmosphere\_heat\_diffusivity\_for\_mynnpbl

long\_name      diffusivity for heat for MYNN PBL (defined for all mass levels)  
units           m2 s-1  
rank           2  
type           real  
kind           kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name      physics%Diag(cdata%blk\_no)%exch\_h  
requested       mynnedmf\_wrapper\_run  
physics set     physics

#### atmosphere\_heat\_diffusivity\_from\_shoc

long\_name      diffusivity for heat from the SHOC scheme  
units           m2 s-1  
rank           2  
type           real  
kind           kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name      physics%Tbd(cdata%blk\_no)%phy\_f3d(:, :, physics%Model(cdata%blk\_no)%nahdshoc)  
requested       NOT REQUESTED  
physics set

#### atmosphere\_momentum\_diffusivity\_background

long\_name background vertical diffusion for momentum  
units m2 s-1  
rank 0  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name physics%Model(cdata%blk\_no)%xkzm\_m  
requested hedmf\_run  
moninshoc\_run  
myjpbl\_wrapper\_run  
satmedmfvdif\_run  
satmedmfvdifq\_run  
physics set physics

#### atmosphere\_momentum\_diffusivity\_for\_mynnpbl

long\_name diffusivity for momentum for MYNN PBL (defined for all mass levels)  
units m2 s-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%exch\_m  
requested mynnedmf\_wrapper\_run  
physics set physics

#### atmosphere\_optical\_thickness\_due\_to\_ambient\_aerosol\_particles

|             |   |
|-------------|---|
| long_name   | vertical integrated optical depth for various aerosol species   |
| units       | none  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                  |
| local_name  | physics%Interstitial(cdata%blk_no)%aerodp                       |
| requested   | GFS_rrtmg_post_run<br>GFS_rrtmg_pre_run<br>GFS_rrtmg_setup_init |
| physics set | physics   |

#### b\_parameter\_of\_the\_hybrid\_coordinate

|             |   |
|-------------|---|
| long_name   | b parameter for sigma pressure level calculations |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type         |
| local_name  | physics%Model(cdata%blk_no)%bk                    |
| requested   | cires_ugwp_init                                   |
| physics set | physics   |

#### baseline\_surface\_roughness\_length

|             |   |
|-------------|---|
| long_name   | baseline surface roughness length for momentum in meter |
| units       | m   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type                   |
| local_name  | physics%Tbd(cdata%blk_no)%phy_myj_z0base                |
| requested   | NOT REQUESTED   |
| physics set |   |

#### bounded\_vegetation\_area\_fraction

|             |  |
|-------------|--|
| long_name   | areal fractional cover of green vegetation bounded on the bottom |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                   |
| local_name  | physics%Interstitial(cdata%blk_no)%sigmaf                        |
| requested   | GFS_surface_generic_pre_run                                      |
|             | lsm_noah_run   |
|             | noahmpdrv_run  |
|             | sfc_diff_run   |
| physics set | physics  |

#### bulk\_richardson\_number\_at\_lowest\_model\_level

|             |  |
|-------------|--|
| long_name   | bulk Richardson number at the surface  |
| units       | none   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%rb  |
| requested   | GFS_surface_composites_post_run<br>drag_suite_run<br>gmtb_scm_sfc_flux_spec_run<br>hedmf_run<br>moninshoc_run<br>myjsfc_wrapper_run<br>mynnedmf_wrapper_run<br>mynnsfc_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics  |



#### bulk\_richardson\_number\_at\_lowest\_model\_level\_over\_ice

|             |   |
|-------------|---|
| long_name   | bulk Richardson number at the surface over ice                        |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                        |
| local_name  | physics%Interstitial(cdata%blk_no)%rb_ice                             |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### bulk\_richardson\_number\_at\_lowest\_model\_level\_over\_land

|             |   |
|-------------|---|
| long_name   | bulk Richardson number at the surface over land                       |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                        |
| local_name  | physics%Interstitial(cdata%blk_no)%rb_land                            |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### bulk\_richardson\_number\_at\_lowest\_model\_level\_over\_ocean

|             |   |
|-------------|---|
| long_name   | bulk Richardson number at the surface over ocean                      |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                        |
| local_name  | physics%Interstitial(cdata%blk_no)%rb_ocean                           |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### canopy\_air\_temperature

|             |   |
|-------------|---|
| long_name   | canopy air temperature                    |
| units       | K   |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%tahxy       |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### canopy\_air\_vapor\_pressure

|             |   |
|-------------|---|
| long_name   | canopy air vapor pressure                 |
| units       | Pa  |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%eahxy       |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### canopy\_intercepted\_ice\_mass

long\_name canopy intercepted ice mass  
units mm  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name physics%Sfcprop(cdata%blk\_no)%canicxy  
requested NOT REQUESTED  
physics set

#### canopy\_intercepted\_liquid\_water

long\_name canopy intercepted liquid water  
units mm  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name physics%Sfcprop(cdata%blk\_no)%canliqxy  
requested NOT REQUESTED  
physics set

#### canopy\_upward\_latent\_heat\_flux

|             |  |
|-------------|--|
| long_name   | canopy upward latent heat flux   |
| units       | W m-2  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                               |
| local_name  | physics%Interstitial(cdata%blk_no)%evcw                                      |
| requested   | GFS_surface_generic_post_run<br>lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run |
| physics set | physics  |

#### canopy\_water\_amount

|             |  |
|-------------|--|
| long_name   | canopy water amount                          |
| units       | kg m-2                                       |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                    |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type    |
| local_name  | physics%Sfcprop(cdata%blk_no)%canopy         |
| requested   | lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run |
| physics set | physics                                      |

#### ccn\_number\_concentration

|             |                                       |
|-------------|---------------------------------------|
| long_name   | CCN number concentration              |
| units       | kg-1?                                 |
| rank        | 2                                     |
| type        | real                                  |
| kind        | kind_phys                             |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type |
| local_name  | physics%Tbd(cdata%blk_no)%ccn_nm      |
| requested   | m_micro_run                           |
| physics set | physics                               |

#### ccpp\_block\_number

|             |  |
|-------------|--|
| long_name   | number of block for explicit data blocking in CCPP |
| units       | index  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE ccpp_types TYPE ccpp_t                      |
| local_name  | cdata%blk_no                                       |
| requested   | mp_thompson_pre_run                                |
| physics set | physics  |

## ccpp\_error\_flag

|            |   |
|------------|---|
| long_name  | error flag for error handling in CCpp   |
| units      | flag  |
| rank       | 0   |
| type       | integer   |
| kind       |   |
| source     | MODULE ccpp_types TYPE ccpp_t   |
| local_name | cdata%errflg  |
| requested  | GFS_DCNV_generic_post_run<br>GFS_DCNV_generic_pre_run<br>GFS_GWD_generic_post_run<br>GFS_GWD_generic_pre_run<br>GFS_MP_generic_post_run<br>GFS_MP_generic_pre_run<br>GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_SCNV_generic_post_run<br>GFS_SCNV_generic_pre_run<br>GFS_phys_time_vary_finalize<br>GFS_phys_time_vary_init<br>GFS_phys_time_vary_run<br>GFS_rad_time_vary_run<br>GFS_rrtmg_post_run<br>GFS_rrtmg_pre_run<br>GFS_rrtmg_setup_finalize<br>GFS_rrtmg_setup_init<br>GFS_rrtmg_setup_run<br>GFS_suite_interstitial_1_run<br>GFS_suite_interstitial_2_run<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>GFS_suite_interstitial_phys_reset_run<br>GFS_suite_interstitial_rad_reset_run<br>GFS_suite_stateout_reset_run<br>GFS_suite_stateout_update_run<br>GFS_surface_composites_inter_run<br>GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>GFS_surface_generic_post_run |



#### ccpp\_error\_message

|            |   |
|------------|---|
| long_name  | error message for error handling in CCpp  |
| units      | none  |
| rank       | 0   |
| type       | character   |
| kind       | len=512   |
| source     | MODULE ccpp_types TYPE ccpp_t   |
| local_name | cdata%errmsg  |
| requested  | GFS_DCNV_generic_post_run<br>GFS_DCNV_generic_pre_run<br>GFS_GWD_generic_post_run<br>GFS_GWD_generic_pre_run<br>GFS_MP_generic_post_run<br>GFS_MP_generic_pre_run<br>GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_SCNV_generic_post_run<br>GFS_SCNV_generic_pre_run<br>GFS_phys_time_vary_finalize<br>GFS_phys_time_vary_init<br>GFS_phys_time_vary_run<br>GFS_rad_time_vary_run<br>GFS_rrtmg_post_run<br>GFS_rrtmg_pre_run<br>GFS_rrtmg_setup_finalize<br>GFS_rrtmg_setup_init<br>GFS_rrtmg_setup_run<br>GFS_suite_interstitial_1_run<br>GFS_suite_interstitial_2_run<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>GFS_suite_interstitial_phys_reset_run<br>GFS_suite_interstitial_rad_reset_run<br>GFS_suite_stateout_reset_run<br>GFS_suite_stateout_update_run<br>GFS_surface_composites_inter_run<br>GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>GFS_surface_generic_post_run |



#### ccpp\_loop\_counter

|             |  |
|-------------|--|
| long_name   | loop counter for subcyclng loops in CCpp   |
| units       | index  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE ccpp_types TYPE ccpp_t  |
| local_name  | cdata%loop_cnt   |
| requested   | GFS_surface_loop_control_part1_run<br>GFS_surface_loop_control_part2_run<br>lsm_ruc_run<br>myjsfc_wrapper_run<br>mynnsfc_wrapper_run |
| physics set | physics  |

#### ccpp\_t

|             |                           |
|-------------|---------------------------|
| long_name   | definition of type ccpp_t |
| units       | DDT                       |
| rank        | 0                         |
| type        | ccpp_t                    |
| kind        |                           |
| source      | MODULE ccpp_types         |
| local_name  | ccpp_t                    |
| requested   | NOT REQUESTED             |
| physics set |                           |

#### ccpp\_t\_instance

|             |                                      |
|-------------|--------------------------------------|
| long_name   | instance of derived data type ccpp_t |
| units       | DDT                                  |
| rank        | 0                                    |
| type        | ccpp_t                               |
| kind        |                                      |
| source      | MODULE gmtb_scm_type_defs            |
| local_name  | cdata                                |
| requested   | NOT REQUESTED                        |
| physics set |                                      |

#### ccpp\_thread\_number

|             |  |
|-------------|--|
| long_name   | number of thread for threading in CCPP |
| units       | index                                  |
| rank        | 0                                      |
| type        | integer                                |
| kind        |  |
| source      | MODULE ccpp_types TYPE ccpp_t          |
| local_name  | cdata%thrd_no                          |
| requested   | NOT REQUESTED                          |
| physics set |  |

```

cell_area
  long_name    area of the grid cell
  units        m2
  rank         1
  type         real
  kind         kind_phys
  source       MODULE GFS_typedefs TYPE GFS_grid_type
  local_name   physics%Grid(cdata%blk_no)%area
  requested    GFS_suite_interstitial_1_run
               cires_ugwp_run
               cu_gf_driver_run
               gfdl_cloud_microphys_run
               mp_thompson_pre_run
               myjpbl_wrapper_run
               samfdeepcnv_run
               samfshalcnv_run
               satmedmfvdif_run
               satmedmfvdifq_run
  physics set  physics

```

#### cell\_size

|             |  |
|-------------|--|
| long_name   | relative dx for the grid cell  |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_grid_type   |
| local_name  | physics%Grid(cdata%blk_no)%dx  |
| requested   | cu_ntiedtke_run<br>drag_suite_run<br>gwdc_pre_run<br>mynnedmf_wrapper_run<br>mynnsfc_wrapper_run<br>shinhongvdif_run |
| physics set | physics  |

#### cellular\_automata\_finer\_grid

|             |   |
|-------------|---|
| long_name   | cellular automata finer grid              |
| units       | count                                     |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%ncells        |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### cellular\_automata\_lifetime

|             |   |
|-------------|---|
| long_name   | cellular automata lifetime                |
| units       | count                                     |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%nlives        |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### cellular\_automata\_seed\_frequency

|             |   |
|-------------|---|
| long_name   | cellular automata seed frequency in units of time steps |
| units       | count   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type               |
| local_name  | physics%Model(cdata%blk_no)%nseed                       |
| requested   | NOT REQUESTED   |
| physics set |   |

#### cellular\_automata\_seed\_probability

|             |   |
|-------------|---|
| long_name   | cellular automata seed probability        |
| units       | fraction                                  |
| rank        | 0   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%nfracseed     |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### characteristic\_grid\_length\_scale

|             |  |
|-------------|--|
| long_name   | representative horizontal length scale of grid box |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type     |
| local_name  | physics%Interstitial(cdata%blk_no)%dlength         |
| requested   | NOT REQUESTED                                      |
| physics set |  |

#### choice\_of\_original\_scale\_aware\_TKE\_moist\_EDMF\_PBL

|             |  |
|-------------|--|
| long_name   | choice of original scale-aware TKE moist EDMF PBL scheme |
| units       | none   |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                |
| local_name  | physics%Model(cdata%blk_no)%isatmedmf_vdif               |
| requested   | NOT REQUESTED  |
| physics set |  |

#### choice\_of\_scale\_aware\_TKE\_moist\_EDMF\_PBL

|             |   |
|-------------|---|
| long_name   | choice of scale-aware TKE moist EDMF PBL scheme |
| units       | none  |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type       |
| local_name  | physics%Model(cdata%blk_no)%isatmedmf           |
| requested   | satmedmfvdif_init<br>satmedmfvdifq_init         |
| physics set | physics   |

#### choice\_of\_updated\_scale\_aware\_TKE\_moist\_EDMF\_PBL

|             |   |
|-------------|---|
| long_name   | choice of updated scale-aware TKE moist EDMF PBL scheme |
| units       | none  |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type               |
| local_name  | physics%Model(cdata%blk_no)%isatmedmf_vdifq             |
| requested   | satmedmfvdifq_init                                      |
| physics set | physics   |

#### cloud\_area\_fraction

|             |   |
|-------------|---|
| long_name   | fraction of grid box area in which updrafts occur |
| units       | frac  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type    |
| local_name  | physics%Interstitial(cdata%blk_no)%cldf           |
| requested   | NOT REQUESTED                                     |
| physics set |   |

#### cloud\_area\_fraction\_for\_radiation

|             |  |
|-------------|--|
| long_name   | fraction of clouds for low, middle, high, total and BL |
| units       | frac   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type         |
| local_name  | physics%Interstitial(cdata%blk_no)%cldsa               |
| requested   | GFS_rrtmg_post_run<br>GFS_rrtmg_pre_run                |
| physics set | physics  |

#### cloud\_base\_mass\_flux

|             |  |
|-------------|--|
| long_name   | cloud base mass flux for CS convection |
| units       | kg m-2 s-1                             |
| rank        | 2                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type  |
| local_name  | physics%Tbd(cdata%blk_no)%phy_fctd     |
| requested   | cs_conv_run                            |
| physics set | physics                                |

#### cloud\_condensed\_water\_conversion\_threshold

|             |   |
|-------------|---|
| long_name   | water and ice minimum threshold for Zhao  |
| units       | none                                      |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%wminco        |
| requested   | NOT REQUESTED                             |
| physics set |   |



#### cloud\_condensed\_water\_mixing\_ratio

long\_name moist (dry+vapor, no condensates) mixing ratio of cloud water (condensate)  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_statein\_type  
local\_name physics%Statein(cdata%blk\_no)%qgrs(:, :, physics%Model(cdata%blk\_no)%ntcw)  
requested GFS\_suite\_interstitial\_2\_run  
mynnedmf\_wrapper\_run  
mynnrad\_post\_run  
mynnrad\_pre\_run  
mynnsfc\_wrapper\_run  
physics set physics

#### cloud\_condensed\_water\_mixing\_ratio\_at\_lowest\_model\_layer

long\_name moist (dry+vapor, no condensates) mixing ratio of cloud water at lowest model layer  
units kg kg-1  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_statein\_type  
local\_name physics%Statein(cdata%blk\_no)%qgrs(:, 1, physics%Model(cdata%blk\_no)%ntcw)  
requested lsm\_ruc\_run  
physics set physics

#### cloud\_condensed\_water\_mixing\_ratio\_at\_surface

long\_name moist cloud water mixing ratio at surface  
units kg kg-1  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name physics%Sfcprop(cdata%blk\_no)%clw\_surf  
requested lsm\_ruc\_run  
physics set physics

#### cloud\_condensed\_water\_mixing\_ratio\_convective\_transport\_tracer

long\_name moist (dry+vapor, no condensates) mixing ratio of cloud water (condensate) in the convectively transported tracer a  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%clw(:, :, 2)  
requested GFS\_DCNV\_generic\_post\_run  
cs\_conv\_pre\_run  
cu\_gf\_driver\_run  
m\_micro\_pre\_run  
m\_micro\_run  
shoc\_run  
zhaocarr\_gscond\_run  
physics set physics

#### cloud\_condensed\_water\_mixing\_ratio\_save

long\_name moist (dry+vapor, no condensates) mixing ratio of cloud water (condensate) before entering a physics scheme  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%save\_q(:, :, physics%Model(cdata%blk\_no)%ntcw)  
requested GFS\_suite\_interstitial\_3\_run  
GFS\_suite\_interstitial\_4\_run  
cs\_conv\_pre\_run  
mynnrad\_post\_run  
mynnrad\_pre\_run  
physics set physics

#### cloud\_condensed\_water\_mixing\_ratio\_updated\_by\_physics

long\_name moist (dry+vapor, no condensates) mixing ratio of cloud condensed water updated by physics  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_stateout\_type  
local\_name physics%Stateout(cdata%blk\_no)%gq0(:, :, physics%Model(cdata%blk\_no)%ntcw)  
requested gfdl\_cloud\_microphys\_run  
m\_micro\_pre\_run  
m\_micro\_run  
mp\_thompson\_pre\_run  
mp\_thompson\_run  
shoc\_run  
zhaocarr\_gscond\_run  
zhaocarr\_precpd\_run  
physics set physics

#### cloud\_decorrelation\_length

|             |   |
|-------------|---|
| long_name   | cloud decorrelation length                        |
| units       | km  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type    |
| local_name  | physics%Interstitial(cdata%blk_no)%de_lgth        |
| requested   | GFS_rrtmg_pre_run<br>rrtmg_lw_run<br>rrtmg_sw_run |
| physics set | physics   |

#### cloud\_droplet\_number\_concentration

|             |   |
|-------------|---|
| long_name   | number concentration of cloud droplets (liquid)                             |
| units       | kg-1  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type                                   |
| local_name  | physics%Statein(cdata%blk_no)%qgrs(:, :, physics%Model(cdata%blk_no)%ntlnc) |
| requested   | mynnedmf_wrapper_run  |
| physics set | physics   |

#### cloud\_droplet\_number\_concentration\_updated\_by\_physics

|             |   |
|-------------|---|
| long_name   | number concentration of cloud droplets updated by physics                   |
| units       | kg-1  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_stateout_type                                  |
| local_name  | physics%Stateout(cdata%blk_no)%gq0(:, :, physics%Model(cdata%blk_no)%ntlnc) |
| requested   | m_micro_run<br>mp_thompson_pre_run<br>mp_thompson_run<br>shoc_run           |
| physics set | physics   |

#### cloud\_fraction\_for\_MG

|             |   |
|-------------|---|
| long_name   | cloud fraction used by Morrison-Gettelman MP                                |
| units       | frac  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type                                       |
| local_name  | physics%Tbd(cdata%blk_no)%phy_f3d(:, :, physics%Model(cdata%blk_no)%indcld) |
| requested   | cs_conv_aw_adj_run<br>m_micro_pre_run<br>m_micro_run                        |
| physics set | physics   |

#### cloud\_fraction\_updated\_by\_physics

long\_name cloud fraction updated by physics  
units frac  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_stateout\_type  
local\_name physics%Stateout(cdata%blk\_no)%gq0(:, :, physics%Model(cdata%blk\_no)%ntclamt)  
requested gfdl\_cloud\_microphys\_run  
physics set physics

#### cloud\_ice\_mixing\_ratio

long\_name the ratio of the mass of ice to the mass of dry air  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%qi\_r  
requested NOT REQUESTED  
physics set

#### cloud\_ice\_water\_path

long\_name      layer cloud ice water path  
units          g m-2  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%clouds(:, :, 4)  
requested     GFS\_rrtmg\_pre\_run  
             mynnrad\_pre\_run  
             rrtmg\_lw\_run  
             rrtmg\_sw\_run  
physics set   physics

#### cloud\_liquid\_water\_mixing\_ratio

long\_name      the ratio of the mass of liquid water to the mass of dry air  
units          kg kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%qc\_r  
requested     NOT REQUESTED  
physics set

#### cloud\_liquid\_water\_path

|             |  |
|-------------|--|
| long_name   | layer cloud liquid water path  |
| units       | g m-2  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                       |
| local_name  | physics%Interstitial(cdata%blk_no)%clouds(:, :, 2)                   |
| requested   | GFS_rrtmg_pre_run<br>mynnrad_pre_run<br>rrtmg_lw_run<br>rrtmg_sw_run |
| physics set | physics  |

#### cloud\_optical\_depth\_layers\_at\_0p55mu\_band

|             |  |
|-------------|--|
| long_name   | approx .55mu band layer cloud optical depth    |
| units       | none   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%cldtausw    |
| requested   | GFS_rrtmg_post_run<br>rrtmg_sw_run             |
| physics set | physics  |



#### cloud\_optical\_depth\_layers\_at\_10mu\_band

|             |  |
|-------------|--|
| long_name   | approx 10mu band layer cloud optical depth     |
| units       | none   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%cldtaulw    |
| requested   | GFS_rrtmg_post_run<br>rrtmg_lw_run             |
| physics set | physics  |

#### cloud\_phase\_transition\_denominator

|             |  |
|-------------|--|
| long_name   | denominator in cloud phase transition = $1/(tcr-tf)$ |
| units       | K-1  |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type            |
| local_name  | physics%Model(cdata%blk_no)%tcrf                     |
| requested   | m_micro_pre_run<br>shoc_run                          |
| physics set | physics  |

#### cloud\_phase\_transition\_threshold\_temperature

long\_name     threshold temperature below which cloud starts to freeze  
units         K  
rank          0  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%tcr  
requested     m\_micro\_pre\_run  
              shoc\_run  
physics set   physics

#### cloud\_rain\_water\_mixing\_ratio

long\_name     the ratio of the mass rain water to the mass of dry air  
units         kg kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%qr\_r  
requested     NOT REQUESTED  
physics set

#### cloud\_rain\_water\_path

long\_name      cloud rain water path  
units          g m-2  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%clouds(:, :, 6)  
requested     GFS\_rrtmg\_pre\_run  
              rrtmg\_lw\_run  
              rrtmg\_sw\_run  
physics set   physics

#### cloud\_snow\_mixing\_ratio

long\_name      the ratio of the mass of snow to mass of dry air  
units          kg kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%qs\_r  
requested     NOT REQUESTED  
physics set

#### cloud\_snow\_water\_path

|             |  |
|-------------|--|
| long_name   | cloud snow water path                              |
| units       | g m-2  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type     |
| local_name  | physics%Interstitial(cdata%blk_no)%clouds(:, :, 8) |
| requested   | GFS_rrtmg_pre_run<br>rrtmg_lw_run<br>rrtmg_sw_run  |
| physics set | physics  |

#### cloud\_specie\_mix\_flag

|             |  |
|-------------|--|
| long_name   | flag to activate mixing of cloud species     |
| units       | flag   |
| rank        | 0  |
| type        | integer                                      |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type    |
| local_name  | physics%Model(cdata%blk_no)%bl_mynn_cloudmix |
| requested   | mynnedmf_wrapper_run                         |
| physics set | physics                                      |

#### cloud\_top\_entrainment\_instability\_value

|             |  |
|-------------|--|
| long_name   | cloud top entrainment instability value        |
| units       | none   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%ctei_r      |
| requested   | GFS_suite_interstitial_2_run                   |
| physics set | physics  |

#### cloud\_work\_function

|             |  |
|-------------|--|
| long_name   | cloud work function  |
| units       | m2 s-2   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                   |
| local_name  | physics%Interstitial(cdata%blk_no)%cldid                         |
| requested   | GFS_DCNV_generic_post_run<br>cu_gf_driver_run<br>samfdeepcnv_run |
| physics set | physics  |

#### cloudpdf

|             |  |
|-------------|--|
| long_name   | flag to determine which cloud PDF to use     |
| units       | flag   |
| rank        | 0  |
| type        | integer                                      |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type    |
| local_name  | physics%Model(cdata%blk_no)%bl_mynn_cloudpdf |
| requested   | mynnedmf_wrapper_run<br>mynnsfc_wrapper_run  |
| physics set | physics                                      |

#### cmpfsw\_type

|             |                                |
|-------------|--------------------------------|
| long_name   | definition of type cmpfsw_type |
| units       | DDT                            |
| rank        | 0                              |
| type        | cmpfsw_type                    |
| kind        |                                |
| source      | MODULE module_radsw_parameters |
| local_name  | cmpfsw_type                    |
| requested   | NOT REQUESTED                  |
| physics set |                                |

#### coefficient\_c\_0

|             |  |
|-------------|--|
| long_name   | coefficient 1 to calculate $d(T_z)/d(T_s)$ |
| units       | none                                       |
| rank        | 1  |
| type        | real                                       |
| kind        | kind_phys                                  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type  |
| local_name  | physics%Sfcprop(cdata%blk_no)%c_0          |
| requested   | sfc_nst_run                                |
| physics set | physics                                    |

#### coefficient\_c\_d

|             |  |
|-------------|--|
| long_name   | coefficient 2 to calculate $d(T_z)/d(T_s)$ |
| units       | none                                       |
| rank        | 1  |
| type        | real                                       |
| kind        | kind_phys                                  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type  |
| local_name  | physics%Sfcprop(cdata%blk_no)%c_d          |
| requested   | sfc_nst_run                                |
| physics set | physics                                    |

#### coefficient\_for\_evaporation\_of\_rainfall

|             |   |
|-------------|---|
| long_name   | coeff for evaporation of largescale rain  |
| units       | none                                      |
| rank        | 0   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%evpc0         |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### coefficient\_from\_cloud\_ice\_to\_snow

|             |   |
|-------------|---|
| long_name   | auto conversion coeff from ice to snow    |
| units       | none                                      |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%psautco       |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### coefficient\_from\_cloud\_water\_to\_rain

long\_name auto conversion coeff from cloud to rain  
units none  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name physics%Model(cdata%blk\_no)%prautco  
requested NOT REQUESTED  
physics set

#### coefficient\_w\_0

long\_name coefficient 3 to calculate  $d(T_z)/d(T_s)$   
units none  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name physics%Sfcprop(cdata%blk\_no)%w\_0  
requested sfc\_nst\_run  
physics set physics

#### coefficient\_w\_d

long\_name coefficient 4 to calculate  $d(T_z)/d(T_s)$   
units none  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name physics%Sfcprop(cdata%blk\_no)%w\_d  
requested sfc\_nst\_run  
physics set physics



#### coefficients\_for\_aerosol\_scavenging

|             |   |
|-------------|---|
| long_name   | array of aerosol scavenging coefficients  |
| units       | none                                      |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%fscav         |
| requested   | samfdeepcnv_run<br>samfshalcnv_run        |
| physics set | physics                                   |

#### column\_precipitable\_water

|             |  |
|-------------|--|
| long_name   | precipitable water                     |
| units       | kg m-2                                 |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%pwat        |
| requested   | GFS_MP_generic_post_run                |
| physics set | physics                                |

#### components\_of\_surface\_downward\_shortwave\_fluxes

|             |  |
|-------------|--|
| long_name   | derived type for special components of surface downward shortwave fluxes |
| units       | W m-2  |
| rank        | 1  |
| type        | cmpfsw_type  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                           |
| local_name  | physics%Interstitial(cdata%blk_no)%scmpsw                                |
| requested   | GFS_rrtmg_post_run<br>rrtmg_sw_post_run<br>rrtmg_sw_run                  |
| physics set | physics  |

#### conv\_activity\_counter

|             |   |
|-------------|---|
| long_name   | convective activity memory  |
| units       | none  |
| rank        | 1   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type                             |
| local_name  | physics%Tbd(cdata%blk_no)%cactiv                                  |
| requested   | cu_gf_driver_post_run<br>cu_gf_driver_pre_run<br>cu_gf_driver_run |
| physics set | physics   |

#### convective\_available\_potential\_energy\_for\_coupling

|             |  |
|-------------|--|
| long_name   | convective available potential energy for coupling |
| units       | m2 s-2   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type         |
| local_name  | physics%Coupling(cdata%blk_no)%cape                |
| requested   | GFS_DCNV_generic_post_run                          |
| physics set | physics  |

#### convective\_cloud\_cover

|             |  |
|-------------|--|
| long_name   | convective cloud cover   |
| units       | frac   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%cnvc  |
| requested   | GFS_DCNV_generic_post_run<br>GFS_SCNV_generic_post_run<br>cu_gf_driver_run<br>cu_ntiedtke_run<br>m_micro_pre_run<br>samfdeepcnv_run<br>samfshalcnv_run |
| physics set | physics  |

#### convective\_cloud\_cover\_in\_phy\_f3d

|             |  |
|-------------|--|
| long_name   | convective cloud cover in the phy_f3d array                                |
| units       | frac   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type                                      |
| local_name  | physics%Tbd(cdata%blk_no)%phy_f3d(:, :, physics%Model(cdata%blk_no)%ncnvc) |
| requested   | GFS_DCNV_generic_post_run<br>GFS_SCNV_generic_post_run                     |
| physics set | physics  |

#### convective\_cloud\_fraction\_for\_microphysics

|             |  |
|-------------|--|
| long_name   | convective cloud fraction for microphysics                       |
| units       | frac   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                   |
| local_name  | physics%Interstitial(cdata%blk_no)%cf_upi                        |
| requested   | cs_conv_run<br>m_micro_pre_run<br>m_micro_run<br>samfdeepcnv_run |
| physics set | physics  |

#### convective\_cloud\_switch

|             |  |
|-------------|--|
| long_name   | index used by cnvc90 (for convective clouds) |
| units       | none   |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys                                    |
| source      | MODULE GFS_typedefs TYPE GFS_control_type    |
| local_name  | physics%Model(cdata%blk_no)%clstp            |
| requested   | cnvc90_run                                   |
| physics set | physics                                      |

#### convective\_cloud\_volume\_fraction

|             |  |
|-------------|--|
| long_name   | convective cloud volume fraction                                 |
| units       | frac   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                   |
| local_name  | physics%Interstitial(cdata%blk_no)%clcn                          |
| requested   | cs_conv_run<br>m_micro_pre_run<br>m_micro_run<br>samfdeepcnv_run |
| physics set | physics  |

#### convective\_cloud\_water\_mixing\_ratio

|             |  |
|-------------|--|
| long_name   | moist convective cloud water mixing ratio  |
| units       | kg kg-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%cnvw  |
| requested   | GFS_DCNV_generic_post_run<br>GFS_SCNV_generic_post_run<br>cu_gf_driver_run<br>cu_ntiedtke_run<br>m_micro_pre_run<br>samfdeepcnv_run<br>samfshalcnv_run |
| physics set | physics  |

#### convective\_cloud\_water\_mixing\_ratio\_in\_phy\_f3d

|             |  |
|-------------|--|
| long_name   | convective cloud water mixing ratio in the phy_f3d array                   |
| units       | kg kg-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type                                      |
| local_name  | physics%Tbd(cdata%blk_no)%phy_f3d(:, :, physics%Model(cdata%blk_no)%ncnvw) |
| requested   | GFS_DCNV_generic_post_run<br>GFS_SCNV_generic_post_run                     |
| physics set | physics  |

#### convective\_precipitation\_rate\_from\_previous\_timestep

|             |  |
|-------------|--|
| long_name   | convective precipitation rate from previous timestep |
| units       | mm s-1   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type            |
| local_name  | physics%Sfcprop(cdata%blk_no)%draincprv              |
| requested   | GFS_MP_generic_post_run<br>noahmpdrv_run             |
| physics set | physics  |

#### convective\_transportable\_tracers

|             |   |
|-------------|---|
| long_name   | array to contain cloud water and other convective trans. tracers  |
| units       | kg kg-1   |
| rank        | 3   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%clw  |
| requested   | GFS_SCNV_generic_post_run<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>cs_conv_run<br>cu_ntiedtke_run<br>samfdeepcnv_run<br>samfshalcnv_run |
| physics set | physics   |

#### convective\_updraft\_area\_fraction

|             |  |
|-------------|--|
| long_name   | convective updraft area fraction               |
| units       | frac   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%sigmafrac   |
| requested   | cs_conv_aw_adj_run                             |
|             | cs_conv_post_run                               |
| physics set | physics  |

#### convective\_updraft\_area\_fraction\_at\_model\_interfaces

|             |  |
|-------------|--|
| long_name   | convective updraft area fraction at model interfaces |
| units       | frac   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type       |
| local_name  | physics%Interstitial(cdata%blk_no)%sigmatot          |
| requested   | cs_conv_post_run                                     |
|             | cs_conv_run  |
| physics set | physics  |



#### convexity\_of\_subgrid\_orography

|             |  |
|-------------|--|
| long_name   | convexity of subgrid orography   |
| units       | none   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                           |
| local_name  | physics%Interstitial(cdata%blk_no)%oc                                    |
| requested   | GFS_GWD_generic_pre_run<br>cires_ugwp_run<br>drag_suite_run<br>gwdps_run |
| physics set | physics  |

#### cosine\_of\_latitude

|             |  |
|-------------|--|
| long_name   | cosine of latitude                     |
| units       | none                                   |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_grid_type |
| local_name  | physics%Grid(cdata%blk_no)%coslat      |
| requested   | cires_ugwp_run<br>dcyc2t3_run          |
| physics set | physics                                |

#### cosine\_of\_solar\_declination\_angle

|             |   |
|-------------|---|
| long_name   | cos of the solar declination angle        |
| units       | none                                      |
| rank        | 0   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%cdec          |
| requested   | GFS_rrtmg_setup_run<br>dcyc2t3_run        |
| physics set | physics                                   |

#### cosine\_of\_zenith\_angle

|             |   |
|-------------|---|
| long_name   | mean cos of zenith angle over rad call period |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys                                     |
| source      | MODULE GFS_typedefs TYPE GFS_radtend_type     |
| local_name  | physics%Radtend(cdata%blk_no)%coszen          |
| requested   | dcyc2t3_run<br>rrtmg_sw_run                   |
| physics set | physics                                       |

#### countergradient\_mixing\_term\_for\_temperature

|             |  |
|-------------|--|
| long_name   | countergradient mixing term for temperature    |
| units       | K  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%gamt        |
| requested   | hedmf_run                                      |
|             | myjpbl_wrapper_run                             |
| physics set | physics  |

#### countergradient\_mixing\_term\_for\_water\_vapor

|             |  |
|-------------|--|
| long_name   | countergradient mixing term for water vapor    |
| units       | kg kg-1  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%gamq        |
| requested   | hedmf_run                                      |
|             | myjpbl_wrapper_run                             |
| physics set | physics  |

#### `couple_sgs_clouds_to_radiation_flag`

|                          |   |
|--------------------------|---|
| <code>long_name</code>   | flag for coupling sgs clouds to radiation   |
| <code>units</code>       | flag  |
| <code>rank</code>        | 0   |
| <code>type</code>        | integer                                     |
| <code>kind</code>        |   |
| <code>source</code>      | MODULE GFS_typedefs TYPE GFS_control_type   |
| <code>local_name</code>  | physics%Model(cdata%blk_no)%icloud_bl       |
| <code>requested</code>   | mynnedmf_wrapper_run<br>mynnsfc_wrapper_run |
| <code>physics set</code> | physics                                     |

#### `critical_cloud_top_entrainment_instability_criteria`

|                          |   |
|--------------------------|---|
| <code>long_name</code>   | critical cloud top entrainment instability criteria |
| <code>units</code>       | none  |
| <code>rank</code>        | 1   |
| <code>type</code>        | real  |
| <code>kind</code>        | kind_phys   |
| <code>source</code>      | MODULE GFS_typedefs TYPE GFS_control_type           |
| <code>local_name</code>  | physics%Model(cdata%blk_no)%ctei_rm                 |
| <code>requested</code>   | GFS_suite_interstitial_2_run                        |
| <code>physics set</code> | physics   |

#### critical\_relative\_humidity

|             |   |
|-------------|---|
| long_name   | critical relative humidity  |
| units       | frac  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%rhc  |
| requested   | GFS_suite_interstitial_3_run<br>m_micro_run<br>shoc_run<br>zhaocarr_gscond_run<br>zhaocarr_precpd_run |
| physics set | physics   |

#### critical\_relative\_humidity\_at\_PBL\_top

|             |   |
|-------------|---|
| long_name   | critical relative humidity at the PBL top |
| units       | frac                                      |
| rank        | 0   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%crtrh(2)      |
| requested   | GFS_suite_interstitial_3_run              |
| physics set | physics                                   |

#### critical\_relative\_humidity\_at\_surface

|             |   |
|-------------|---|
| long_name   | critical relative humidity at the surface |
| units       | frac                                      |
| rank        | 0   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%crtrh(1)      |
| requested   | GFS_suite_interstitial_3_run              |
| physics set | physics                                   |

#### critical\_relative\_humidity\_at\_top\_of\_atmosphere

|             |   |
|-------------|---|
| long_name   | critical relative humidity at the top of atmosphere |
| units       | frac  |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type           |
| local_name  | physics%Model(cdata%blk_no)%crtrh(3)                |
| requested   | GFS_suite_interstitial_3_run                        |
| physics set | physics   |

#### cumulative\_atmosphere\_detrainment\_convective\_mass\_flux

|             |  |
|-------------|--|
| long_name   | cumulative detrainment mass flux       |
| units       | Pa                                     |
| rank        | 2                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%det_mf      |
| requested   | GFS_DCNV_generic_post_run              |
| physics set | physics                                |

#### `cumulative_atmosphere_downdraft_convective_mass_flux`

long\_name cumulative downdraft mass flux  
units Pa  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dwn\_mf  
requested GFS\_DCNV\_generic\_post\_run  
physics set physics

#### `cumulative_atmosphere_updraft_convective_mass_flux`

long\_name cumulative updraft mass flux  
units Pa  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%upd\_mf  
requested GFS\_DCNV\_generic\_post\_run  
physics set physics

#### `cumulative_canopy_upward_latent_heat_flu_multiplied_by_timestep`

long\_name cumulative canopy upward latent heat flux multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%evcwa  
requested GFS\_surface\_generic\_post\_run  
physics set physics

#### `cumulative_change_in_ozone_concentration_due_to_overhead_ozone_column`

|                          |   |
|--------------------------|---|
| <code>long_name</code>   | cumulative change in ozone concentration due to overhead ozone column |
| <code>units</code>       | kg kg-1   |
| <code>rank</code>        | 2   |
| <code>type</code>        | real  |
| <code>kind</code>        | kind_phys   |
| <code>source</code>      | MODULE GFS_typedefs TYPE GFS_diag_type                                |
| <code>local_name</code>  | physics%Diag(cdata%blk_no)%dq3dt(:, :, 9)                             |
| <code>requested</code>   | ozphys_2015_run   |
|                          | ozphys_run  |
| <code>physics set</code> | physics   |

#### `cumulative_change_in_ozone_concentration_due_to_ozone_mixing_ratio`

|                          |  |
|--------------------------|--|
| <code>long_name</code>   | cumulative change in ozone concentration due to ozone mixing ratio |
| <code>units</code>       | kg kg-1  |
| <code>rank</code>        | 2  |
| <code>type</code>        | real   |
| <code>kind</code>        | kind_phys  |
| <code>source</code>      | MODULE GFS_typedefs TYPE GFS_diag_type                             |
| <code>local_name</code>  | physics%Diag(cdata%blk_no)%dq3dt(:, :, 7)                          |
| <code>requested</code>   | ozphys_2015_run  |
|                          | ozphys_run   |
| <code>physics set</code> | physics  |



#### `cumulative_change_in_ozone_concentration_due_to_production_and_loss_rate`

|             |  |
|-------------|--|
| long_name   | cumulative change in ozone concentration due to production and loss rate |
| units       | kg kg-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                                   |
| local_name  | physics%Diag(cdata%blk_no)%dq3dt(:, :, 6)                                |
| requested   | ozphys_2015_run  |
|             | ozphys_run   |
| physics set | physics  |

#### `cumulative_change_in_ozone_concentration_due_to_temperature`

|             |   |
|-------------|---|
| long_name   | cumulative change in ozone concentration due to temperature |
| units       | kg kg-1   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                      |
| local_name  | physics%Diag(cdata%blk_no)%dq3dt(:, :, 8)                   |
| requested   | ozphys_2015_run   |
|             | ozphys_run  |
| physics set | physics   |

#### `cumulative_change_in_ozone_mixing_ratio_due_to_PBL`

|             |  |
|-------------|--|
| long_name   | cumulative change in ozone mixing ratio due to PBL |
| units       | kg kg-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type             |
| local_name  | physics%Diag(cdata%blk_no)%dq3dt(:, :, 5)          |
| requested   | GFS_PBL_generic_post_run                           |
| physics set | physics  |

#### `cumulative_change_in_temperature_due_to_PBL`

|                          |  |
|--------------------------|--|
| <code>long_name</code>   | cumulative change in temperature due to PBL                                      |
| <code>units</code>       | K  |
| <code>rank</code>        | 2  |
| <code>type</code>        | real   |
| <code>kind</code>        | kind_phys  |
| <code>source</code>      | MODULE GFS_typedefs TYPE GFS_diag_type   |
| <code>local_name</code>  | physics%Diag(cdata%blk_no)%dt3dt(:, :, 3)  |
| <code>requested</code>   | GFS_PBL_generic_post_run<br>GFS_suite_interstitial_2_run<br>mynnedmf_wrapper_run |
| <code>physics set</code> | physics  |

#### `cumulative_change_in_temperature_due_to_deep_convection`

|                          |   |
|--------------------------|---|
| <code>long_name</code>   | cumulative change in temperature due to deep convection   |
| <code>units</code>       | K   |
| <code>rank</code>        | 2   |
| <code>type</code>        | real  |
| <code>kind</code>        | kind_phys   |
| <code>source</code>      | MODULE GFS_typedefs TYPE GFS_diag_type                    |
| <code>local_name</code>  | physics%Diag(cdata%blk_no)%dt3dt(:, :, 4)                 |
| <code>requested</code>   | GFS_DCNV_generic_post_run<br>GFS_suite_interstitial_2_run |
| <code>physics set</code> | physics   |

#### `cumulative_change_in_temperature_due_to_longwave_radiation`

long\_name cumulative change in temperature due to longwave radiation  
units K  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dt3dt(:, :, 1)  
requested GFS\_suite\_interstitial\_2\_run  
physics set physics

#### `cumulative_change_in_temperature_due_to_microphysics`

long\_name cumulative change in temperature due to microphysics  
units K  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dt3dt(:, :, 6)  
requested GFS\_MP\_generic\_post\_run  
GFS\_suite\_interstitial\_2\_run  
physics set physics

#### `cumulative_change_in_temperature_due_to_orographic_gravity_wave_drag`

long\_name cumulative change in temperature due to orographic gravity wave drag  
units K  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dt3dt(:, :, 7)  
requested GFS\_GWD\_generic\_post\_run  
GFS\_GWD\_generic\_pre\_run  
physics set physics

#### `cumulative_change_in_temperature_due_to_shal_convection`

long\_name cumulative change in temperature due to shallow convection  
units K  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dt3dt(:, :, 5)  
requested GFS\_SCNV\_generic\_post\_run  
GFS\_suite\_interstitial\_2\_run  
physics set physics

#### `cumulative_change_in_temperature_due_to_shortwave_radiation`

long\_name cumulative change in temperature due to shortwave radiation  
units K  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dt3dt(:, :, 2)  
requested GFS\_suite\_interstitial\_2\_run  
physics set physics

#### `cumulative_change_in_water_vapor_specific_humidity_due_to_PBL`

long\_name cumulative change in water vapor specific humidity due to PBL  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dq3dt(:, :, 1)  
requested GFS\_PBL\_generic\_post\_run  
physics set physics

#### `cumulative_change_in_water_vapor_specific_humidity_due_to_deep_convection`

long\_name cumulative change in water vapor specific humidity due to deep convection  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dq3dt(:, :, 2)  
requested GFS\_DCNV\_generic\_post\_run  
physics set physics

#### `cumulative_change_in_water_vapor_specific_humidity_due_to_microphysics`

long\_name cumulative change in water vapor specific humidity due to microphysics  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dq3dt(:, :, 4)  
requested GFS\_MP\_generic\_post\_run  
physics set physics

#### `cumulative_change_in_water_vapor_specific_humidity_due_to_shal_convection`

long\_name cumulative change in water vapor specific humidity due to shallow convection  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dq3dt(:, :, 3)  
requested GFS\_SCNV\_generic\_post\_run  
physics set physics

#### `cumulative_change_in_x_wind_due_to_PBL`

```
long_name    cumulative change in x wind due to PBL
units        m s-1
rank         2
type         real
kind         kind_phys
source       MODULE GFS_typedefs TYPE GFS_diag_type
local_name   physics%Diag(cdata%blk_no)%du3dt(:, :, 1)
requested    GFS_PBL_generic_post_run
             mynnedmf_wrapper_run
physics set  physics
```

#### `cumulative_change_in_x_wind_due_to_convective_gravity_wave_drag`

```
long_name    cumulative change in x wind due to convective gravity wave drag
units        m s-1
rank         2
type         real
kind         kind_phys
source       MODULE GFS_typedefs TYPE GFS_diag_type
local_name   physics%Diag(cdata%blk_no)%du3dt(:, :, 4)
requested    NOT REQUESTED
physics set
```

#### `cumulative_change_in_x_wind_due_to_deep_convection`

```
long_name    cumulative change in x wind due to deep convection
units        m s-1
rank         2
type         real
kind         kind_phys
source       MODULE GFS_typedefs TYPE GFS_diag_type
local_name   physics%Diag(cdata%blk_no)%du3dt(:, :, 3)
requested    GFS_DCNV_generic_post_run
physics set  physics
```

#### `cumulative_change_in_x_wind_due_to_orographic_gravity_wave_drag`

|                          |  |
|--------------------------|--|
| <code>long_name</code>   | cumulative change in x wind due to orographic gravity wave drag              |
| <code>units</code>       | m s-1  |
| <code>rank</code>        | 2  |
| <code>type</code>        | real   |
| <code>kind</code>        | kind_phys  |
| <code>source</code>      | MODULE GFS_typedefs TYPE GFS_diag_type                                       |
| <code>local_name</code>  | physics%Diag(cdata%blk_no)%du3dt(:, :, 2)                                    |
| <code>requested</code>   | GFS_GWD_generic_post_run<br>GFS_PBL_generic_post_run<br>mynnedmf_wrapper_run |
| <code>physics set</code> | physics  |

#### `cumulative_change_in_y_wind_due_to_PBL`

|                          |  |
|--------------------------|--|
| <code>long_name</code>   | cumulative change in y wind due to PBL           |
| <code>units</code>       | m s-1  |
| <code>rank</code>        | 2  |
| <code>type</code>        | real   |
| <code>kind</code>        | kind_phys  |
| <code>source</code>      | MODULE GFS_typedefs TYPE GFS_diag_type           |
| <code>local_name</code>  | physics%Diag(cdata%blk_no)%dv3dt(:, :, 1)        |
| <code>requested</code>   | GFS_PBL_generic_post_run<br>mynnedmf_wrapper_run |
| <code>physics set</code> | physics  |

#### `cumulative_change_in_y_wind_due_to_convective_gravity_wave_drag`

long\_name cumulative change in y wind due to convective gravity wave drag  
units m s-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dv3dt(:, :, 4)  
requested NOT REQUESTED  
physics set

#### `cumulative_change_in_y_wind_due_to_deep_convection`

long\_name cumulative change in y wind due to deep convection  
units m s-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dv3dt(:, :, 3)  
requested GFS\_DCNV\_generic\_post\_run  
physics set physics



#### `cumulative_change_in_y_wind_due_to_orographic_gravity_wave_drag`

|             |  |
|-------------|--|
| long_name   | cumulative change in y wind due to orographic gravity wave drag              |
| units       | m s-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                                       |
| local_name  | physics%Diag(cdata%blk_no)%dv3dt(:, :, 2)                                    |
| requested   | GFS_GWD_generic_post_run<br>GFS_PBL_generic_post_run<br>mynnedmf_wrapper_run |
| physics set | physics  |

#### `cumulative_cloud_work_function`

|             |  |
|-------------|--|
| long_name   | cumulative cloud work function (valid only with sas) |
| units       | m2 s-1   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type               |
| local_name  | physics%Diag(cdata%blk_no)%cldwrk                    |
| requested   | GFS_DCNV_generic_post_run                            |
| physics set | physics  |

**cumulative\_lwe\_thickness\_of\_convective\_precipitation\_amount**

long\_name cumulative convective precipitation  
units m  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%cnvprcp  
requested GFS\_MP\_generic\_post\_run  
GFS\_SCNV\_generic\_post\_run  
physics set physics

**cumulative\_lwe\_thickness\_of\_convective\_precipitation\_amount\_in\_bucket**

long\_name cumulative convective precipitation in bucket  
units m  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%cnvprcpb  
requested GFS\_MP\_generic\_post\_run  
GFS\_SCNV\_generic\_post\_run  
physics set physics

**cumulative\_snow\_deposition\_sublimation\_upward\_latent\_heat\_flux\_multiplied\_by\_timestep**

long\_name cumulative latent heat flux from snow depo/subl multiplied by timestep  
units W m<sup>-2</sup> s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%sbsnoa  
requested GFS\_surface\_generic\_post\_run  
physics set physics

#### `cumulative_snow_freezing_rain_upward_latent_heat_flux_multiplied_by_timestep`

long\_name cumulative latent heat flux due to snow and frz rain multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%snohfa  
requested GFS\_surface\_generic\_post\_run  
physics set physics

#### `cumulative_soil_upward_latent_heat_flux_multiplied_by_timestep`

long\_name cumulative soil upward latent heat flux multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%evbsa  
requested GFS\_surface\_generic\_post\_run  
physics set physics

#### `cumulative_surface_downwelling_diffuse_near_infrared_shortwave_flux_for_coupling_multiplied_by_timestep`

long\_name cumulative sfc nir diff downward sw flux multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%dnirdf\_cpl  
requested GFS\_surface\_generic\_post\_run  
physics set physics

**cumulative\_surface\_downwelling\_diffuse\_ultraviolet\_and\_visible\_shortwave\_flux\_for\_coupling\_multiplied\_by\_timestep**

long\_name cumulative sfc uv+vis diff dnwd sw flux multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%dvisdf\_cpl  
requested GFS\_surface\_generic\_post\_run  
physics set physics

**cumulative\_surface\_downwelling\_direct\_near\_infrared\_shortwave\_flux\_for\_coupling\_multiplied\_by\_timestep**

long\_name cumulative sfc nir beam downward sw flux multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%dnirbm\_cpl  
requested GFS\_surface\_generic\_post\_run  
physics set physics

**cumulative\_surface\_downwelling\_direct\_ultraviolet\_and\_visible\_shortwave\_flux\_for\_coupling\_multiplied\_by\_timestep**

long\_name cumulative sfc uv+vis beam dnwd sw flux multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%dvisbm\_cpl  
requested GFS\_surface\_generic\_post\_run  
physics set physics

**cumulative\_surface\_downwelling\_longwave\_flux\_for\_coupling\_multiplied\_by\_timestep**

long\_name cumulative sfc downward lw flux mulitplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%dlwsfc\_cpl  
requested GFS\_surface\_generic\_post\_run  
physics set physics

**cumulative\_surface\_downwelling\_longwave\_flux\_multiplied\_by\_timestep**

long\_name cumulative surface downwelling LW flux multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dlwsfc  
requested GFS\_suite\_interstitial\_2\_run  
physics set physics

**cumulative\_surface\_downwelling\_shortwave\_flux\_for\_coupling\_multiplied\_by\_timestep**

long\_name cumulative sfc downward sw flux multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%dswsfc\_cpl  
requested GFS\_surface\_generic\_post\_run  
physics set physics

#### `cumulative_surface_ground_heat_flux_multiplied_by_timestep`

|             |  |
|-------------|--|
| long_name   | cumulative groud conductive heat flux multiplied by timestep |
| units       | W m-2 s  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                       |
| local_name  | physics%Diag(cdata%blk_no)%gflux                             |
| requested   | GFS_surface_generic_post_run                                 |
| physics set | physics  |

#### `cumulative_surface_net_downward_diffuse_near_infrared_shortwave_flux_for_coupling_multiplied_by_timestep`

|             |   |
|-------------|---|
| long_name   | cumulative net nir diff downward sw flux multiplied by timestep |
| units       | W m-2 s   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type                      |
| local_name  | physics%Coupling(cdata%blk_no)%nnirdf_cpl                       |
| requested   | GFS_surface_generic_post_run                                    |
| physics set | physics   |

#### `cumulative_surface_net_downward_diffuse_ultraviolet_and_visible_shortwave_flux_for_coupling_multiplied_by_timestep`

|             |  |
|-------------|--|
| long_name   | cumulative net uv+vis diff downward sw rad flux multiplied by timestep |
| units       | W m-2 s  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type                             |
| local_name  | physics%Coupling(cdata%blk_no)%nvisdf_cpl                              |
| requested   | GFS_surface_generic_post_run   |
| physics set | physics  |

**cumulative\_surface\_net\_downward\_direct\_near\_infrared\_shortwave\_flux\_for\_coupling\_multiplied\_by\_timestep**

long\_name cumulative net nir beam downward sw flux multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%nnirbm\_cpl  
requested GFS\_surface\_generic\_post\_run  
physics set physics

**cumulative\_surface\_net\_downward\_direct\_ultraviolet\_and\_visible\_shortwave\_flux\_for\_coupling\_multiplied\_by\_timestep**

long\_name cumulative net uv+vis beam downward sw rad flux multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%nvisbm\_cpl  
requested GFS\_surface\_generic\_post\_run  
physics set physics

**cumulative\_surface\_net\_downward\_longwave\_flux\_for\_coupling\_multiplied\_by\_timestep**

long\_name cumulative net downward lw flux multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%nlwsfc\_cpl  
requested GFS\_surface\_generic\_post\_run  
physics set physics

#### `cumulative_surface_net_downward_shortwave_flux_for_coupling_multiplied_by_timestep`

long\_name cumulative net downward sw flux multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%nswsfc\_cpl  
requested GFS\_surface\_generic\_post\_run  
physics set physics

#### `cumulative_surface_pressure_multiplied_by_timestep`

long\_name cumulative surface pressure multiplied by timestep  
units Pa s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%psmean  
requested GFS\_suite\_interstitial\_2\_run  
physics set physics

#### `cumulative_surface_snow_area_fraction_multiplied_by_timestep`

long\_name cumulative surface snow area fraction multiplied by timestep  
units s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%snowca  
requested GFS\_surface\_generic\_post\_run  
physics set physics



**cumulative\_surface\_upward\_latent\_heat\_flux\_for\_coupling\_multiplied\_by\_timestep**

long\_name cumulative sfc latent heat flux multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%dqsfc\_cpl  
requested GFS\_PBL\_generic\_post\_run  
physics set physics

**cumulative\_surface\_upward\_latent\_heat\_flux\_for\_diag\_multiplied\_by\_timestep**

long\_name cumulative sfc latent heat flux multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dqsfc  
requested GFS\_PBL\_generic\_post\_run  
mynnedmf\_wrapper\_run  
physics set physics

**cumulative\_surface\_upward\_potential\_latent\_heat\_flux\_multiplied\_by\_timestep**

long\_name cumulative surface upward potential latent heat flux multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%ep  
requested GFS\_surface\_generic\_post\_run  
physics set physics

**cumulative\_surface\_upward\_sensible\_heat\_flux\_for\_coupling\_multiplied\_by\_timestep**

long\_name cumulative sfc sensible heat flux multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%dtsfc\_cpl  
requested GFS\_PBL\_generic\_post\_run  
physics set physics

**cumulative\_surface\_upward\_sensible\_heat\_flux\_for\_diag\_multiplied\_by\_timestep**

long\_name cumulative sfc sensible heat flux multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dtsfc  
requested GFS\_PBL\_generic\_post\_run  
mynnedmf\_wrapper\_run  
physics set physics

**cumulative\_surface\_upwelling\_longwave\_flux\_multiplied\_by\_timestep**

long\_name cumulative surface upwelling LW flux multiplied by timestep  
units W m-2 s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%ulwsfc  
requested GFS\_suite\_interstitial\_2\_run  
physics set physics

#### `cumulative_surface_x_momentum_flux_for_coupling_multiplied_by_timestep`

|             |   |
|-------------|---|
| long_name   | cumulative sfc x momentum flux multiplied by timestep |
| units       | Pa s  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type            |
| local_name  | physics%Coupling(cdata%blk_no)%dusfc_cpl              |
| requested   | GFS_PBL_generic_post_run                              |
| physics set | physics   |

#### `cumulative_surface_x_momentum_flux_for_diag_multiplied_by_timestep`

|             |   |
|-------------|---|
| long_name   | cumulative sfc x momentum flux multiplied by timestep |
| units       | Pa s  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                |
| local_name  | physics%Diag(cdata%blk_no)%dusfc                      |
| requested   | GFS_PBL_generic_post_run                              |
|             | m_micro_run   |
| physics set | physics   |

#### `cumulative_surface_y_momentum_flux_for_coupling_multiplied_by_timestep`

|             |   |
|-------------|---|
| long_name   | cumulative sfc y momentum flux multiplied by timestep |
| units       | Pa s  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type            |
| local_name  | physics%Coupling(cdata%blk_no)%dvsfc_cpl              |
| requested   | GFS_PBL_generic_post_run                              |
| physics set | physics   |

#### `cumulative_surface_y_momentum_flux_for_diag_multiplied_by_timestep`

|             |   |
|-------------|---|
| long_name   | cumulative sfc y momentum flux multiplied by timestep |
| units       | Pa s  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                |
| local_name  | physics%Diag(cdata%blk_no)%dvsfc                      |
| requested   | GFS_PBL_generic_post_run                              |
|             | m_micro_run   |
| physics set | physics   |

#### `cumulative_transpiration_flux_multiplied_by_timestep`

|             |  |
|-------------|--|
| long_name   | cumulative total plant transpiration rate multiplied by timestep |
| units       | kg m-2   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                           |
| local_name  | physics%Diag(cdata%blk_no)%transa                                |
| requested   | GFS_surface_generic_post_run                                     |
| physics set | physics  |

#### `date_and_time_at_model_initialization`

|             |   |
|-------------|---|
| long_name   | initialization date and time              |
| units       | none                                      |
| rank        | 1   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%idat          |
| requested   | GFS_rrtmg_setup_run                       |
|             | GFS_time_vary_pre_run                     |
| physics set | physics                                   |

#### date\_and\_time\_at\_model\_initialization\_reordered

|             |   |
|-------------|---|
| long_name   | initial date with different size and ordering |
| units       | none  |
| rank        | 1   |
| type        | integer                                       |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type     |
| local_name  | physics%Model(cdata%blk_no)%idate             |
| requested   | GFS_rrtmg_setup_init                          |
|             | GFS_time_vary_pre_run                         |
| physics set | physics                                       |

#### daytime\_points

|             |  |
|-------------|--|
| long_name   | daytime points                                 |
| units       | index  |
| rank        | 1  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%idxday      |
| requested   | rrtmg_sw_pre_run                               |
|             | rrtmg_sw_run                                   |
| physics set | physics  |

#### daytime\_points\_dimension

|             |   |
|-------------|---|
| long_name   | daytime points dimension                              |
| units       | count   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type        |
| local_name  | physics%Interstitial(cdata%blk_no)%nday               |
| requested   | rrtmg_sw_post_run<br>rrtmg_sw_pre_run<br>rrtmg_sw_run |
| physics set | physics   |

#### deep\_soil\_temperature

|             |  |
|-------------|--|
| long_name   | deep soil temperature                        |
| units       | K  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                    |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type    |
| local_name  | physics%Sfcprop(cdata%blk_no)%tg3            |
| requested   | lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run |
| physics set | physics                                      |

#### density\_of\_fresh\_water

long\_name density of fresh water  
units ???  
rank 0  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name physics%Model(cdata%blk\_no)%rho\_h2o  
requested NOT REQUESTED  
physics set

#### density\_of\_frozen\_precipitation

long\_name density of frozen precipitation  
units kg m-3  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name physics%Sfcprop(cdata%blk\_no)%rho\_fr  
requested lsm\_ruc\_run  
physics set physics

#### depth\_of\_soil\_levels\_for\_land\_surface\_model

long\_name depth of soil levels for land surface model  
units m  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name physics%Sfcprop(cdata%blk\_no)%zs  
requested lsm\_ruc\_run  
physics set physics

#### **detrained\_mass\_flux**

long\_name      detrained mass flux  
units          kg m-2 s-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%cnv\_mfd  
requested     cs\_conv\_run  
              m\_micro\_run  
              samfdeepcnv\_run  
physics set   physics

#### **detrainment\_and\_precipitation\_tunable\_parameter\_3\_CS**

long\_name      partition water between detrainment and precipitation (decrease for more precipitation)  
units          m  
rank          0  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%cs\_parm(3)  
requested     cs\_conv\_run  
physics set   physics

#### **detrainment\_and\_precipitation\_tunable\_parameter\_4\_CS**

long\_name      partition water between detrainment and precipitation (decrease for more precipitation)  
units          m  
rank          0  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%cs\_parm(4)  
requested     cs\_conv\_run  
physics set   physics



#### detrainment\_conversion\_parameter\_deep\_convection

|             |   |
|-------------|---|
| long_name   | convective detrainment conversion parameter for deep convection |
| units       | m-1   |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                       |
| local_name  | physics%Model(cdata%blk_no)%c1_deep                             |
| requested   | samfdeepcnv_run   |
| physics set | physics   |

#### detrainment\_conversion\_parameter\_shallow\_convection

|             |  |
|-------------|--|
| long_name   | convective detrainment conversion parameter for shallow convection |
| units       | m-1  |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                          |
| local_name  | physics%Model(cdata%blk_no)%c1_shal                                |
| requested   | samfshalcnv_run  |
| physics set | physics  |

#### dewpoint\_temperature\_at\_2m

|             |  |
|-------------|--|
| long_name   | 2 meter dewpoint temperature           |
| units       | K                                      |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%dpt2m       |
| requested   | sfc_diag_post_run                      |
| physics set | physics                                |

#### diag\_ugwp\_flag

|             |   |
|-------------|---|
| long_name   | flag for CIRES UGWP Diagnostics           |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%ldiag_ugwp    |
| requested   | cires_ugwp_post_run<br>cires_ugwp_run     |
| physics set | physics                                   |

#### diagnostics\_control\_for\_chemical\_tracers

|             |   |
|-------------|---|
| long_name   | array to control diagnostics for chemical tracers |
| units       | flag  |
| rank        | 1   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type         |
| local_name  | physics%Model(cdata%blk_no)%ntdiag                |
| requested   | NOT REQUESTED                                     |
| physics set |   |

#### diffusivity\_background\_sigma\_level

|             |   |
|-------------|---|
| long_name   | sigma threshold for background mom. diffusion   |
| units       | none  |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%xkzm_s  |
| requested   | hedmf_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run |
| physics set | physics   |

#### dimensionless\_exner\_function\_at\_lowest\_model\_interface

|             |   |
|-------------|---|
| long_name   | dimensionless Exner function at lowest model interface  |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type   |
| local_name  | physics%Statein(cdata%blk_no)%prsik(:,1)  |
| requested   | GFS_surface_generic_pre_run<br>hedmf_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>sfc_diff_run<br>sfc_nst_run<br>sfc_sice_run |
| physics set | physics   |

#### dimensionless\_exner\_function\_at\_lowest\_model\_layer

|             |  |
|-------------|--|
| long_name   | dimensionless Exner function at lowest model layer   |
| units       | none   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type  |
| local_name  | physics%Statein(cdata%blk_no)%prslk(:,1)   |
| requested   | GFS_surface_generic_pre_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>sfc_diff_run<br>sfc_nst_run<br>sfc_sice_run |
| physics set | physics  |

#### dimensionless\_exner\_function\_at\_model\_interfaces

|             |  |
|-------------|--|
| long_name   | dimensionless Exner function at model layer interfaces |
| units       | none   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type              |
| local_name  | physics%Statein(cdata%blk_no)%prsik                    |
| requested   | NOT REQUESTED  |
| physics set |  |

#### dimensionless\_exner\_function\_at\_model\_layers

|             |  |
|-------------|--|
| long_name   | dimensionless Exner function at model layer centers  |
| units       | none   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type  |
| local_name  | physics%Statein(cdata%blk_no)%prslk  |
| requested   | GFS_suite_interstitial_2_run<br>GFS_suite_interstitial_3_run<br>cires_ugwp_run<br>drag_suite_run<br>gwdps_run<br>hedmf_run<br>moninshoc_run<br>mp_thompson_post_run<br>mynnedmf_wrapper_run<br>mynnsfc_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics  |

#### dissipation\_estimate\_of\_air\_temperature\_at\_model\_layers

long\_name      dissipation estimate model layer mean temperature  
units           K  
rank           2  
type           real  
kind           kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_statein\_type  
local\_name      physics%Statein(cdata%blk\_no)%diss\_est  
requested       NOT REQUESTED  
physics set

#### diurnal\_thermocline\_layer\_heat\_content

long\_name      heat content in diurnal thermocline layer  
units           K m  
rank           1  
type           real  
kind           kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name      physics%Sfcprop(cdata%blk\_no)%xt  
requested       sfc\_nst\_post\_run  
                 sfc\_nst\_pre\_run  
                 sfc\_nst\_run  
physics set     physics

#### diurnal\_thermocline\_layer\_thickness

|             |  |
|-------------|--|
| long_name   | diurnal thermocline layer thickness                |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type          |
| local_name  | physics%Sfcprop(cdata%blk_no)%xz                   |
| requested   | sfc_nst_post_run<br>sfc_nst_pre_run<br>sfc_nst_run |
| physics set | physics  |

#### diurnal\_thermocline\_layer\_x\_current

|             |  |
|-------------|--|
| long_name   | u-current content in diurnal thermocline layer |
| units       | m2 s-1   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type      |
| local_name  | physics%Sfcprop(cdata%blk_no)%xu               |
| requested   | sfc_nst_run                                    |
| physics set | physics  |

#### diurnal\_thermocline\_layer\_y\_current

|             |  |
|-------------|--|
| long_name   | v-current content in diurnal thermocline layer |
| units       | m2 s-1   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type      |
| local_name  | physics%Sfcprop(cdata%blk_no)%xv               |
| requested   | sfc_nst_run                                    |
| physics set | physics  |



#### do\_myjpbl

long\_name      flag to activate MYJ PBL scheme  
units          flag  
rank          0  
type          logical  
kind  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%do\_myjpbl  
requested     NOT REQUESTED  
physics set

#### do\_myjsfc

long\_name      flag to activate MYJ surface layer scheme  
units          flag  
rank          0  
type          logical  
kind  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%do\_myjsfc  
requested     NOT REQUESTED  
physics set

#### do\_mynnedmf

long\_name      flag to activate MYNN-EDMF  
units          flag  
rank          0  
type          logical  
kind  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%do\_mynnedmf  
requested     NOT REQUESTED  
physics set

#### do\_mynnsfclay

|             |   |
|-------------|---|
| long_name   | flag to activate MYNN surface layer       |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%do_mynnsfclay |
| requested   | lsm_ruc_run                               |
|             | mynnedmf_wrapper_run                      |
| physics set | physics                                   |

#### do\_ugwp

|             |   |
|-------------|---|
| long_name   | flag to activate CIRES UGWP               |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%do_ugwp       |
| requested   | cires_ugwp_init                           |
|             | cires_ugwp_run                            |
| physics set | physics                                   |

#### dominant\_freezing\_rain\_type

|             |  |
|-------------|--|
| long_name   | dominant freezing rain type            |
| units       | none                                   |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%tdomzr      |
| requested   | GFS_MP_generic_post_run                |
| physics set | physics                                |

#### dominant\_rain\_type

|             |  |
|-------------|--|
| long_name   | dominant rain type                     |
| units       | none                                   |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%tdomr       |
| requested   | GFS_MP_generic_post_run                |
| physics set | physics                                |

#### dominant\_sleet\_type

|             |  |
|-------------|--|
| long_name   | dominant sleet type                    |
| units       | none                                   |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%tdomip      |
| requested   | GFS_MP_generic_post_run                |
| physics set | physics                                |

#### dominant\_snow\_type

|             |  |
|-------------|--|
| long_name   | dominant snow type                     |
| units       | none                                   |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%tdoms       |
| requested   | GFS_MP_generic_post_run                |
| physics set | physics                                |

#### downdraft\_fraction\_in\_boundary\_layer\_mass\_flux\_scheme

|             |   |
|-------------|---|
| long_name   | downdraft fraction in boundary layer mass flux scheme |
| units       | none  |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type             |
| local_name  | physics%Model(cdata%blk_no)%bl_dnfr                   |
| requested   | satmedmfvdifq_run                                     |
| physics set | physics   |

#### downdraft\_fraction\_reaching\_surface\_over\_land\_deep\_convection

|             |   |
|-------------|---|
| long_name   | downdraft fraction reaching surface over land for deep convection |
| units       | frac  |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                         |
| local_name  | physics%Model(cdata%blk_no)%betal_deep                            |
| requested   | samfdeepcnv_run   |
| physics set | physics   |

#### downdraft\_fraction\_reaching\_surface\_over\_ocean\_deep\_convection

|             |  |
|-------------|--|
| long_name   | downdraft fraction reaching surface over ocean for deep convection |
| units       | frac   |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                          |
| local_name  | physics%Model(cdata%blk_no)%betas_deep                             |
| requested   | samfdeepcnv_run  |
| physics set | physics  |

#### duration\_of\_sunshine

|             |  |
|-------------|--|
| long_name   | sunshine duration time                 |
| units       | s                                      |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%suntim      |
| requested   | GFS_suite_interstitial_2_run           |
| physics set | physics                                |

#### dynamics\_to\_physics\_timestep\_ratio

|             |   |
|-------------|---|
| long_name   | ratio of dynamics timestep to physics timestep                                    |
| units       | none  |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                                    |
| local_name  | physics%Interstitial(cdata%blk_no)%frain  |
| requested   | GFS_DCNV_generic_post_run<br>GFS_MP_generic_post_run<br>GFS_SCNV_generic_post_run |
| physics set | physics   |

#### eddy\_mixing\_due\_to\_ugwp

|             |  |
|-------------|--|
| long_name   | eddy mixing due to UGWP                        |
| units       | m <sup>2</sup> s <sup>-1</sup>                 |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%gw_kdis     |
| requested   | cires_ugwp_run                                 |
| physics set | physics  |

#### edmf\_flag

|             |   |
|-------------|---|
| long_name   | flag to activate the mass-flux scheme     |
| units       | flag                                      |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%bl_mynn_edmf  |
| requested   | mynnedmf_wrapper_run                      |
| physics set | physics                                   |

#### edmf\_momentum\_transport\_flag

|             |  |
|-------------|--|
| long_name   | flag to activate the transport of momentum   |
| units       | flag   |
| rank        | 0  |
| type        | integer                                      |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type    |
| local_name  | physics%Model(cdata%blk_no)%bl_mynn_edmf_mom |
| requested   | mynnedmf_wrapper_run                         |
| physics set | physics                                      |

#### edmf\_partition\_flag

|             |   |
|-------------|---|
| long_name   | flag to partitioning og the MF and ED areas   |
| units       | flag  |
| rank        | 0   |
| type        | integer                                       |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type     |
| local_name  | physics%Model(cdata%blk_no)%bl_mynn_edmf_part |
| requested   | mynnedmf_wrapper_run                          |
| physics set | physics                                       |

#### edmf\_tke\_transport\_flag

long\_name     flag to activate the transport of TKE  
units         flag  
rank          0  
type          integer  
kind  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%bl\_mynn\_edmf\_tke  
requested     mynnedmf\_wrapper\_run  
physics set   physics

#### effective\_radius\_of\_stratiform\_cloud\_graupel\_particle\_in\_um

long\_name     eff. radius of cloud graupel particle in micrometer  
units         um  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name    physics%Tbd(cdata%blk\_no)%phy\_f3d(:, :, physics%Model(cdata%blk\_no)%ngeffr)  
requested     gfdl\_cloud\_microphys\_run  
              m\_micro\_run  
physics set   physics

#### effective\_radius\_of\_stratiform\_cloud\_ice\_particle\_in\_um

```
long_name    eff.  radius of cloud ice water particle in micrometer
units        um
rank         2
type         real
kind         kind_phys
source       MODULE GFS_typedefs TYPE GFS_tbd_type
local_name   physics%Tbd(cdata%blk_no)%phy_f3d(:, :, physics%Model(cdata%blk_no)%nieffr)
requested    gfdl_cloud_microphys_run
              m_micro_run
              mp_thompson_run
physics set  physics
```

#### effective\_radius\_of\_stratiform\_cloud\_liquid\_water\_particle\_in\_um

```
long_name    eff.  radius of cloud liquid water particle in micrometer
units        um
rank         2
type         real
kind         kind_phys
source       MODULE GFS_typedefs TYPE GFS_tbd_type
local_name   physics%Tbd(cdata%blk_no)%phy_f3d(:, :, physics%Model(cdata%blk_no)%nleffr)
requested    gfdl_cloud_microphys_run
              m_micro_run
              mp_thompson_run
physics set  physics
```



#### effective\_radius\_of\_stratiform\_cloud\_rain\_particle\_in\_um

|             |   |
|-------------|---|
| long_name   | effective radius of cloud rain particle in micrometers                      |
| units       | um  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type                                       |
| local_name  | physics%Tbd(cdata%blk_no)%phy_f3d(:, :, physics%Model(cdata%blk_no)%nreffr) |
| requested   | gfdl_cloud_microphys_run  |
|             | m_micro_run   |
| physics set | physics   |

#### effective\_radius\_of\_stratiform\_cloud\_snow\_particle\_in\_um

|             |   |
|-------------|---|
| long_name   | effective radius of cloud snow particle in micrometers                      |
| units       | um  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type                                       |
| local_name  | physics%Tbd(cdata%blk_no)%phy_f3d(:, :, physics%Model(cdata%blk_no)%nseffr) |
| requested   | gfdl_cloud_microphys_run  |
|             | m_micro_run   |
|             | mp_thompson_run   |
| physics set | physics   |

#### emdf\_updraft\_area

long\_name updraft area from mass flux scheme  
units frac  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%edmf\_a  
requested mynnedmf\_wrapper\_run  
physics set physics

#### emdf\_updraft\_cloud\_water

long\_name updraft cloud water from mass flux scheme  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%edmf\_qc  
requested mynnedmf\_wrapper\_run  
physics set physics

#### emdf\_updraft\_entrainment\_rate

long\_name updraft entrainment rate from mass flux scheme  
units s-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%edmf\_ent  
requested mynnedmf\_wrapper\_run  
physics set physics

#### emdf\_updraft\_theta\_1

long\_name updraft theta-1 from mass flux scheme  
units K  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%edmf\_th1  
requested mynnedmf\_wrapper\_run  
physics set physics

#### emdf\_updraft\_total\_water

long\_name updraft total water from mass flux scheme  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%edmf\_qt  
requested mynnedmf\_wrapper\_run  
physics set physics

#### emdf\_updraft\_vertical\_velocity

long\_name updraft vertical velocity from mass flux scheme  
units m s-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%edmf\_w  
requested mynnedmf\_wrapper\_run  
physics set physics

#### entrainment\_efficiency\_tunable\_parameter\_9\_CS

|             |   |
|-------------|---|
| long_name   | entrainment efficiency                    |
| units       | none                                      |
| rank        | 0   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%cs_parm(9)    |
| requested   | cs_conv_run                               |
| physics set | physics                                   |

#### entrainment\_rate\_coefficient\_deep\_convection

|             |  |
|-------------|--|
| long_name   | entrainment rate coefficient for deep convection |
| units       | none   |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type        |
| local_name  | physics%Model(cdata%blk_no)%clam_deep            |
| requested   | samfdeepcnv_run                                  |
| physics set | physics  |

#### entrainment\_rate\_coefficient\_shallow\_convection

|             |   |
|-------------|---|
| long_name   | entrainment rate coefficient for shallow convection |
| units       | none  |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type           |
| local_name  | physics%Model(cdata%blk_no)%clam_shal               |
| requested   | samfshalcnv_run                                     |
| physics set | physics   |

#### equation\_of\_time

|             |   |
|-------------|---|
| long_name   | equation of time (radian)                 |
| units       | radians                                   |
| rank        | 0   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%slag          |
| requested   | GFS_rrtmg_setup_run<br>dcyc2t3_run        |
| physics set | physics                                   |

#### equilibrium\_soil\_water\_content

|             |   |
|-------------|---|
| long_name   | equilibrium soil water content            |
| units       | m3 m-3                                    |
| rank        | 2   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%smoiseq     |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### explicit\_rainfall\_rate\_from\_previous\_timestep

|             |   |
|-------------|---|
| long_name   | explicit rainfall rate previous timestep  |
| units       | mm s-1                                    |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%drainncprv  |
| requested   | GFS_MP_generic_post_run<br>noahmpdrv_run  |
| physics set | physics                                   |

#### extra\_top\_layer

|             |  |
|-------------|--|
| long_name   | extra top layer for radiation                                |
| units       | none   |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs  |
| local_name  | LTP  |
| requested   | GFS_rrtmg_post_run<br>rrtmg_lw_post_run<br>rrtmg_sw_post_run |
| physics set | physics  |

#### fa\_threshold\_relative\_humidity\_for\_onset\_of\_condensation

|             |  |
|-------------|--|
| long_name   | relative humidity threshold parameter for condensation for FA scheme |
| units       | none   |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                            |
| local_name  | physics%Model(cdata%blk_no)%rhgrd                                    |
| requested   | NOT REQUESTED  |
| physics set |  |

#### fast\_soil\_pool\_mass\_content\_of\_carbon

long\_name short-lived carbon in shallow soil  
units g m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name physics%Sfcprop(cdata%blk\_no)%fastcpy  
requested NOT REQUESTED  
physics set

#### fine\_root\_mass

long\_name fine root mass  
units g m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name physics%Sfcprop(cdata%blk\_no)%rtmassxy  
requested NOT REQUESTED  
physics set

#### flag\_TKE\_dissipation\_heating

long\_name flag for tke dissipative heating  
units flag  
rank 0  
type logical  
kind  
source MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name physics%Model(cdata%blk\_no)%dspheat  
requested hedmf\_run  
satmedmfvdif\_run  
satmedmfvdifq\_run  
physics set physics

#### flag\_arakawa\_wu\_downdraft

|             |  |
|-------------|--|
| long_name   | AW scale-aware option in cs convection downdraft |
| units       | flag   |
| rank        | 0  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type        |
| local_name  | physics%Model(cdata%blk_no)%do_awdd              |
| requested   | cs_conv_run                                      |
| physics set | physics  |

#### flag\_convective\_tracer\_transport

|             |  |
|-------------|--|
| long_name   | flag to enable tracer transport by updrafts/downdrafts[:,1] or subsidence[:,2] |
| units       | flag   |
| rank        | 2  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                                 |
| local_name  | physics%Interstitial(cdata%blk_no)%otspt                                       |
| requested   | cs_conv_run  |
| physics set | physics  |

#### flag\_debug

|             |   |
|-------------|---|
| long_name   | control flag for debug                    |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%debug         |
| requested   | GFS_time_vary_pre_run                     |
| physics set | physics                                   |



#### flag\_deep\_convection

|             |  |
|-------------|--|
| long_name   | flag indicating whether convection occurs in column (0 or 1)   |
| units       | flag   |
| rank        | 1  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%kcnv  |
| requested   | cs_conv_run<br>cu_gf_driver_run<br>cu_ntiedtke_run<br>gwdc_run<br>samfdeepcnv_run<br>samfshalcnv_run |
| physics set | physics  |

#### flag\_diagnostics

|             |   |
|-------------|---|
| long_name   | logical flag for storing diagnostics  |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%lssav   |
| requested   | GFS_DCNV_generic_post_run<br>GFS_GWD_generic_post_run<br>GFS_GWD_generic_pre_run<br>GFS_MP_generic_post_run<br>GFS_PBL_generic_post_run<br>GFS_SCNV_generic_post_run<br>GFS_suite_interstitial_2_run<br>GFS_surface_generic_post_run<br>GFS_time_vary_pre_run<br>gwdc_post_run<br>mynnedmf_wrapper_run<br>sfc_diag_post_run |
| physics set | physics   |

### flag\_diagnostics\_3D

|             |   |
|-------------|---|
| long_name   | flag for 3d diagnostic fields   |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%ldiag3d   |
| requested   | GFS_DCNV_generic_post_run<br>GFS_DCNV_generic_pre_run<br>GFS_GWD_generic_post_run<br>GFS_GWD_generic_pre_run<br>GFS_MP_generic_post_run<br>GFS_MP_generic_pre_run<br>GFS_PBL_generic_post_run<br>GFS_SCNV_generic_post_run<br>GFS_SCNV_generic_pre_run<br>GFS_suite_interstitial_2_run<br>gwdc_post_run<br>h2ophys_run<br>mynnedmf_wrapper_run<br>ozphys_2015_run<br>ozphys_run |
| physics set | physics   |

#### flag\_flip

|             |   |
|-------------|---|
| long_name   | vertical flip logical                     |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%flipv         |
| requested   | m_micro_run                               |
| physics set | physics                                   |

#### flag\_flux\_form\_CS

|             |   |
|-------------|---|
| long_name   | enable use of flux form of equations in CS scheme |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type         |
| local_name  | physics%Model(cdata%blk_no)%flx_form              |
| requested   | cs_conv_run                                       |
| physics set | physics   |

#### flag\_for\_2015\_ozone\_physics

|             |   |
|-------------|---|
| long_name   | flag for new (2015) ozone physics         |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%oz_phys_2015  |
| requested   | ozphys_2015_init                          |
| physics set | physics                                   |

#### flag\_for\_Arakawa\_Wu\_adjustment

|             |   |
|-------------|---|
| long_name   | flag for Arakawa Wu scale-aware adjustment                                      |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                                       |
| local_name  | physics%Model(cdata%blk_no)%do_aw   |
| requested   | GFS_MP_generic_pre_run<br>cs_conv_aw_adj_run<br>cs_conv_post_run<br>cs_conv_run |
| physics set | physics   |

#### flag\_for\_CRICK\_proof\_cloud\_water

|             |   |
|-------------|---|
| long_name   | flag for CRICK-Proof cloud water          |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%crick_proof   |
| requested   | GFS_rrtmg_setup_init                      |
| physics set | physics                                   |

#### flag\_for\_Chikira\_Sugiyama\_deep\_convection

|             |   |
|-------------|---|
| long_name   | flag for Chikira-Sugiyama convection  |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                                       |
| local_name  | physics%Model(cdata%blk_no)%cscnv   |
| requested   | GFS_DCNV_generic_post_run<br>GFS_suite_interstitial_3_run<br>cs_conv_aw_adj_run |
| physics set | physics   |

#### flag\_for\_aerosol\_convective\_transport\_and\_PBL\_diffusion

|             |   |
|-------------|---|
| long_name   | flag for aerosol convective transport and PBL diffusion |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type          |
| local_name  | physics%Interstitial(cdata%blk_no)%trans_aero           |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run     |
| physics set | physics   |

#### flag\_for\_aerosol\_input\_MG

|             |  |
|-------------|--|
| long_name   | flag for using aerosols in Morrison-Gettelman MP |
| units       | flag   |
| rank        | 0  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type        |
| local_name  | physics%Model(cdata%blk_no)%aero_in              |
| requested   | m_micro_run                                      |
| physics set | physics  |

#### flag\_for\_aerosol\_physics

|             |   |
|-------------|---|
| long_name   | flag for aerosol physics  |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%ltaerosol   |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>mp_thompson_init<br>mp_thompson_pre_run<br>mp_thompson_run<br>mynnedmf_wrapper_run |
| physics set | physics   |

#### flag\_for\_canopy\_heat\_storage

|             |   |
|-------------|---|
| long_name   | flag for canopy heat storage parameterization |
| units       | flag  |
| rank        | 0   |
| type        | logical                                       |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type     |
| local_name  | physics%Model(cdata%blk_no)%lheatstrg         |
| requested   | lsm_noah_run<br>noahmpdrv_run                 |
| physics set | physics                                       |

#### flag\_for\_canopy\_stomatal\_resistance\_option

|             |   |
|-------------|---|
| long_name   | choice for canopy stomatal resistance option (see noahmp module for definition) |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                                       |
| local_name  | physics%Model(cdata%blk_no)%iopt_crs  |
| requested   | NOT REQUESTED   |
| physics set |   |



#### flag\_for\_cellular\_automata

|             |  |
|-------------|--|
| long_name   | cellular automata main switch  |
| units       | flag   |
| rank        | 0  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                                |
| local_name  | physics%Model(cdata%blk_no)%do_ca  |
| requested   | GFS_DCNV_generic_post_run<br>GFS_DCNV_generic_pre_run<br>samfdeepcnv_run |
| physics set | physics  |

#### flag\_for\_chemistry\_coupling

|             |   |
|-------------|---|
| long_name   | flag controlling cplchm collection (default off)  |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%cplchm  |
| requested   | GFS_MP_generic_post_run<br>GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_SCNV_generic_post_run<br>GFS_suite_interstitial_4_run<br>sfc_cice_run<br>sfc_sice_run |
| physics set | physics   |

#### flag\_for\_cice

|             |  |
|-------------|--|
| long_name   | flag for cice  |
| units       | flag   |
| rank        | 1  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%flag_cice   |
| requested   | GFS_suite_interstitial_2_run<br>GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>GFS_surface_generic_pre_run<br>sfc_cice_run<br>sfc_sice_run |
| physics set | physics  |

#### flag\_for\_cloud\_condensate\_normalized\_by\_cloud\_cover

|             |   |
|-------------|---|
| long_name   | flag for cloud condensate normalized by cloud cover |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type           |
| local_name  | physics%Model(cdata%blk_no)%ccnorm                  |
| requested   | GFS_rrtmg_setup_init                                |
| physics set | physics   |

#### flag\_for\_cloud\_effective\_radii

|             |  |
|-------------|--|
| long_name   | flag for cloud effective radii calculations in GFDL microphysics |
| units       |  |
| rank        | 0  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                        |
| local_name  | physics%Model(cdata%blk_no)%effr_in                              |
| requested   | gfdl_cloud_microphys_run   |
| physics set | physics  |

#### flag\_for\_combination\_of\_sppt\_with\_isppt\_deep

|             |   |
|-------------|---|
| long_name   | switch for combination with isppt_deep.               |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type             |
| local_name  | physics%Model(cdata%blk_no)%isppt_deep                |
| requested   | GFS_DCNV_generic_post_run<br>GFS_DCNV_generic_pre_run |
| physics set | physics   |

#### flag\_for\_convective\_gravity\_wave\_drag

|             |   |
|-------------|---|
| long_name   | flag for convective gravity wave drag (gwd) |
| units       | flag  |
| rank        | 0   |
| type        | logical                                     |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%do_cnv_gwd      |
| requested   | GFS_DCNV_generic_pre_run<br>gwdc_pre_run    |
| physics set | physics                                     |

#### flag\_for\_convective\_transport\_of\_tracers

|             |   |
|-------------|---|
| long_name   | flag for convective transport of tracers  |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%trans_trac    |
| requested   | GFS_suite_interstitial_3_run              |
| physics set | physics                                   |

#### flag\_for\_default\_aerosol\_effect\_in\_shortwave\_radiation

|             |   |
|-------------|---|
| long_name   | default aerosol effect in sw only         |
| units       | flag                                      |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%iaer          |
| requested   | GFS_rrtmg_setup_init                      |
| physics set | physics                                   |

#### flag\_for\_dynamic\_vegetation\_option

|             |   |
|-------------|---|
| long_name   | choice for dynamic vegetation option (see noahmp module for definition) |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                               |
| local_name  | physics%Model(cdata%blk_no)%iopt_dveg                                   |
| requested   | NOT REQUESTED   |
| physics set |   |

#### flag\_for\_fer\_hires\_microphysics\_scheme

|             |   |
|-------------|---|
| long_name   | choice of Ferrier-Aligo microphysics scheme       |
| units       | flag  |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type         |
| local_name  | physics%Model(cdata%blk_no)%imp_physics_fer_hires |
| requested   | NOT REQUESTED                                     |
| physics set |   |

#### flag\_for\_first\_time\_step

|             |  |
|-------------|--|
| long_name   | flag for first time step for time integration loop (cold/warmstart)  |
| units       | flag   |
| rank        | 0  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%first_time_step  |
| requested   | GFS_phys_time_vary_run<br>cu_gf_driver_pre_run<br>cu_ntiedtke_pre_run<br>lsm_ruc_run<br>mynnedmf_wrapper_run<br>mynnrad_post_run<br>mynnrad_pre_run<br>mynnsfc_wrapper_run |
| physics set | physics  |

#### flag\_for\_flux\_coupling

|             |  |
|-------------|--|
| long_name   | flag controlling cplflx collection (default off)   |
| units       | flag   |
| rank        | 0  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%cplflx   |
| requested   | GFS_MP_generic_post_run<br>GFS_PBL_generic_post_run<br>GFS_suite_interstitial_2_run<br>GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>GFS_surface_generic_post_run<br>GFS_surface_generic_pre_run<br>sfc_cice_run<br>sfc_nst_pre_run<br>sfc_sice_run |
| physics set | physics  |

#### flag\_for\_fractional\_grid

|             |   |
|-------------|---|
| long_name   | flag for fractional grid  |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%frac_grid   |
| requested   | GFS_suite_interstitial_2_run<br>GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run |
| physics set | physics   |

#### flag\_for\_frozen\_soil\_permeability\_option

|             |   |
|-------------|---|
| long_name   | choice for frozen soil permeability option (see noahmp module for definition) |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                                     |
| local_name  | physics%Model(cdata%blk_no)%iopt_inf  |
| requested   | NOT REQUESTED   |
| physics set |   |

#### flag\_for\_frozen\_soil\_physics

|             |   |
|-------------|---|
| long_name   | flag for frozen soil physics (RUC)        |
| units       | flag                                      |
| rank        | 2   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%flag_frsoil |
| requested   | lsm_ruc_run                               |
| physics set | physics                                   |

#### flag\_for\_gaussian\_spatial\_filter

|             |   |
|-------------|---|
| long_name   | switch for gaussian spatial filter        |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%ca_smooth     |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### flag\_for\_gf\_deep\_convection\_scheme

long\_name      flag for Grell-Freitas deep convection scheme  
units            flag  
rank            0  
type            integer  
kind  
source          MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name      physics%Model(cdata%blk\_no)%imfdeepcnv\_gf  
requested       NOT REQUESTED  
physics set

#### flag\_for\_gf\_shallow\_convection\_scheme

long\_name      flag for Grell-Freitas shallow convection scheme  
units            flag  
rank            0  
type            integer  
kind  
source          MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name      physics%Model(cdata%blk\_no)%imfshalcnv\_gf  
requested       NOT REQUESTED  
physics set



#### flag\_for\_gfdl\_microphysics\_scheme

|             |  |
|-------------|--|
| long_name   | choice of GFDL microphysics scheme   |
| units       | flag   |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%imp_physics_gfdl   |
| requested   | GFS_MP_generic_post_run<br>GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>gfdl_cloud_microphys_init<br>lsm_ruc_run<br>maximum_hourly_diagnostics_run<br>mynnedmf_wrapper_run<br>shoc_run |
| physics set | physics  |

#### flag\_for\_global\_cellular\_automata

|             |   |
|-------------|---|
| long_name   | switch for global ca                      |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%ca_global     |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### flag\_for\_gravity\_wave\_drag

|             |   |
|-------------|---|
| long_name   | flag for gravity wave drag (gwd)          |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%do_gwd        |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### flag\_for\_ground\_snow\_surface\_albedo\_option

|             |   |
|-------------|---|
| long_name   | choice for ground snow surface albedo option (see noahmp module for definition) |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                                       |
| local_name  | physics%Model(cdata%blk_no)%iopt_alb  |
| requested   | NOT REQUESTED   |
| physics set |   |

#### flag\_for\_guess\_run

|             |   |
|-------------|---|
| long_name   | flag for guess run  |
| units       | flag  |
| rank        | 1   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%flag_guess   |
| requested   | GFS_surface_loop_control_part1_run<br>GFS_surface_loop_control_part2_run<br>lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run<br>sfc_nst_run |
| physics set | physics   |

#### flag\_for\_hedmf

|             |   |
|-------------|---|
| long_name   | flag for hybrid edmf pbl scheme (moninedmf)         |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type           |
| local_name  | physics%Model(cdata%blk_no)%hybedmf                 |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run |
| physics set | physics   |

#### flag\_for\_hydrostatic\_heating\_from\_physics

|             |   |
|-------------|---|
| long_name   | flag for use of hydrostatic heating in physics      |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type      |
| local_name  | physics%Interstitial(cdata%blk_no)%phys_hydrostatic |
| requested   | gfdl_cloud_microphys_run                            |
| physics set | physics   |

#### flag\_for\_hydrostatic\_solver

|             |   |
|-------------|---|
| long_name   | flag for hydrostatic solver from dynamics |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%hydrostatic   |
| requested   | gfdl_cloud_microphys_run                  |
| physics set | physics                                   |

#### flag\_for\_in\_ccn\_forcing\_for\_morrison\_gettelman\_microphysics

|             |   |
|-------------|---|
| long_name   | flag for IN and CCN forcing for morrison gettelman microphysics |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                       |
| local_name  | physics%Model(cdata%blk_no)%iccn                                |
| requested   | m_micro_run   |
| physics set | physics   |

#### flag\_for\_individual\_cloud\_species\_advected

|             |  |
|-------------|--|
| long_name   | flag for individual cloud species advected |
| units       | flag                                       |
| rank        | 0  |
| type        | logical                                    |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%spec_adv       |
| requested   | NOT REQUESTED                              |
| physics set |  |

#### flag\_for\_initial\_time\_date\_control

|             |   |
|-------------|---|
| long_name   | flag for initial conditions and forcing   |
| units       | flag                                      |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%ictm          |
| requested   | GFS_rrtmg_setup_init                      |
| physics set | physics                                   |

#### flag\_for\_iteration

|             |  |
|-------------|--|
| long_name   | flag for iteration   |
| units       | flag   |
| rank        | 1  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%flag_iter   |
| requested   | GFS_surface_loop_control_part2_run<br>lsm_noah_run<br>lsm_ruc_run<br>myjsfc_wrapper_run<br>noahmpdrv_run<br>sfc_cice_run<br>sfc_diff_run<br>sfc_nst_run<br>sfc_ocean_run<br>sfc_sice_run |
| physics set | physics  |

#### flag\_for\_land\_surface\_scheme

|             |  |
|-------------|--|
| long_name   | flag for land surface model  |
| units       | flag   |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%lsm  |
| requested   | GFS_MP_generic_post_run<br>GFS_time_vary_pre_run<br>lsm_ruc_run<br>sfc_diag_post_run |
| physics set | physics  |

#### flag\_for\_lower\_boundary\_soil\_temperature\_option

|             |  |
|-------------|--|
| long_name   | choice for lower boundary soil temperature option (see noahmp module for definition) |
| units       | index  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%iopt_tbot  |
| requested   | NOT REQUESTED  |
| physics set |  |

#### flag\_for\_lw\_clouds\_without\_sub\_grid\_approximation

|             |   |
|-------------|---|
| long_name   | flag for lw clouds without sub-grid approximation |
| units       | flag  |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type         |
| local_name  | physics%Model(cdata%blk_no)%isubc_lw              |
| requested   | GFS_rrtmg_setup_init                              |
| physics set | physics   |

#### flag\_for\_mass\_flux\_deep\_convection\_scheme

|             |   |
|-------------|---|
| long_name   | flag for mass-flux deep convection scheme |
| units       | flag                                      |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%imfdeepcnv    |
| requested   | GFS_suite_interstitial_4_run              |
| physics set | physics                                   |

#### flag\_for\_mass\_flux\_shallow\_convection\_scheme

|             |   |
|-------------|---|
| long_name   | flag for mass-flux shallow convection scheme                                  |
| units       | flag  |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                                     |
| local_name  | physics%Model(cdata%blk_no)%imfshalcnv  |
| requested   | GFS_SCNV_generic_post_run<br>GFS_suite_interstitial_2_run<br>cu_gf_driver_run |
| physics set | physics   |

#### flag\_for\_max\_random\_overlap\_clouds\_for\_longwave\_radiation

|             |   |
|-------------|---|
| long_name   | lw: max-random overlap clouds             |
| units       | flag                                      |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%iovr_lw       |
| requested   | GFS_rrtmg_setup_init                      |
| physics set | physics                                   |



```
flag_for_max_random_overlap_clouds_for_shortwave_radiation
  long_name      sw:  max-random overlap clouds
  units          flag
  rank          0
  type          integer
  kind
  source        MODULE GFS_typedefs TYPE GFS_control_type
  local_name     physics%Model(cdata%blk_no)%iovr_sw
  requested      GFS_rrtmg_setup_init
  physics set    physics
```

#### flag\_for\_microphysics\_scheme

|             |  |
|-------------|--|
| long_name   | choice of microphysics scheme  |
| units       | flag   |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%imp_physics  |
| requested   | GFS_MP_generic_post_run<br>GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_rrtmg_setup_init<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>cs_conv_aw_adj_run<br>cs_conv_run<br>cu_gf_driver_run<br>gfdl_cloud_microphys_init<br>lsm_ruc_run<br>m_micro_init<br>maximum_hourly_diagnostics_run<br>mp_thompson_init<br>mynnedmf_wrapper_run<br>samfdeepcnv_run<br>shoc_run |
| physics set | physics  |

#### flag\_for\_mom4\_coupling

|             |   |
|-------------|---|
| long_name   | flag controls mom4 sea ice                |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%mom4ice       |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### flag\_for\_moorthi\_stratus

|             |   |
|-------------|---|
| long_name   | flag for moorthi approach for stratus     |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%mstrat        |
| requested   | GFS_suite_interstitial_2_run              |
| physics set | physics                                   |

#### flag\_for\_morrison\_gettelman\_microphysics\_scheme

|             |   |
|-------------|---|
| long_name   | choice of Morrison-Gettelman microphysics scheme  |
| units       | flag  |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%imp_physics_mg  |
| requested   | GFS_MP_generic_post_run<br>GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_suite_interstitial_3_run<br>cs_conv_aw_adj_run<br>m_micro_init<br>samfdeepcnv_run<br>shoc_run |
| physics set | physics   |

#### flag\_for\_mountain\_blocking

|             |   |
|-------------|---|
| long_name   | flag for mountain blocking                |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%use_zmtnbck   |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### flag\_for\_noah\_land\_surface\_scheme

|             |   |
|-------------|---|
| long_name   | flag for NOAH land surface model          |
| units       | flag                                      |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%lsm_noah      |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### flag\_for\_noahmp\_land\_surface\_scheme

|             |   |
|-------------|---|
| long_name   | flag for NOAH MP land surface model                                   |
| units       | flag  |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                             |
| local_name  | physics%Model(cdata%blk_no)%lsm_noahmp                                |
| requested   | GFS_MP_generic_post_run<br>GFS_time_vary_pre_run<br>sfc_diag_post_run |
| physics set | physics   |

#### flag\_for\_nsstm\_run

long\_name NSSTM flag: off/uncoupled/coupled=0/1/2  
units flag  
rank 0  
type integer  
kind  
source MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name physics%Model(cdata%blk\_no)%nstf\_name(1)  
requested GFS\_surface\_loop\_control\_part2\_run  
sfc\_nst\_post\_run  
sfc\_nst\_run  
physics set physics

#### flag\_for\_ntiedtke\_deep\_convection\_scheme

long\_name flag for new Tiedtke deep convection scheme  
units flag  
rank 0  
type integer  
kind  
source MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name physics%Model(cdata%blk\_no)%imfdeepcnv\_ntiedtke  
requested NOT REQUESTED  
physics set

#### flag\_for\_ntiedtke\_shallow\_convection\_scheme

long\_name flag for new Tiedtke shallow convection scheme  
units flag  
rank 0  
type integer  
kind  
source MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name physics%Model(cdata%blk\_no)%imfshalcnv\_gf  
requested NOT REQUESTED  
physics set

#### flag\_for\_old\_PBL\_scheme

long\_name      flag for using old PBL schemes  
units            flag  
rank            0  
type            logical  
kind  
source          MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name      physics%Model(cdata%blk\_no)%old\_monin  
requested       GFS\_suite\_interstitial\_2\_run  
physics set     physics

#### flag\_for\_optical\_property\_for\_liquid\_clouds\_for\_shortwave\_radiation

long\_name      sw optical property for liquid clouds  
units            flag  
rank            0  
type            integer  
kind  
source          MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name      physics%Model(cdata%blk\_no)%icliq\_sw  
requested       GFS\_rrtmg\_setup\_init  
physics set     physics

#### flag\_for\_output\_of\_longwave\_heating\_rate

long\_name      flag to output lw heating rate (Radtend%lwhe)  
units            flag  
rank            0  
type            logical  
kind  
source          MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name      physics%Model(cdata%blk\_no)%lwhe  
requested       NOT REQUESTED  
physics set

#### flag\_for\_output\_of\_shortwave\_heating\_rate

long\_name      flag to output sw heating rate (Radtend%swhc)  
units            flag  
rank            0  
type            logical  
kind  
source          MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name      physics%Model(cdata%blk\_no)%swhtr  
requested       NOT REQUESTED  
physics set

#### flag\_for\_ozone\_physics

long\_name      flag for old (2006) ozone physics  
units            flag  
rank            0  
type            logical  
kind  
source          MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name      physics%Model(cdata%blk\_no)%oz\_phys  
requested       NOT REQUESTED  
physics set

#### flag\_for\_pdf\_for\_morrison\_gettelman\_microphysics\_scheme

long\_name      pdf flag for MG macrophysics  
units            flag  
rank            0  
type            integer  
kind  
source          MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name      physics%Model(cdata%blk\_no)%pdfflag  
requested       m\_micro\_run  
physics set     physics



#### flag\_for\_precipitation\_effect\_on\_radiation

|             |   |
|-------------|---|
| long_name   | radiation precip flag for Ferrier/Moorthi |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%norad_precip  |
| requested   | GFS_rrtmg_setup_init                      |
| physics set | physics                                   |

#### flag\_for\_precipitation\_partition\_option

|             |  |
|-------------|--|
| long_name   | choice for precipitation partition option (see noahmp module for definition) |
| units       | index  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                                    |
| local_name  | physics%Model(cdata%blk_no)%iopt_snf   |
| requested   | NOT REQUESTED  |
| physics set |  |

#### flag\_for\_precipitation\_type

|             |   |
|-------------|---|
| long_name   | snow/rain flag for precipitation          |
| units       | flag                                      |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%srflag      |
| requested   | GFS_MP_generic_post_run                   |
|             | lsm_noah_run                              |
|             | lsm_ruc_run                               |
|             | noahmpdrv_run                             |
|             | sfc_sice_run                              |
| physics set | physics                                   |

#### flag\_for\_precipitation\_type\_algorithm

|             |   |
|-------------|---|
| long_name   | flag controls precip type algorithm       |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%cal_pre       |
| requested   | GFS_MP_generic_post_run                   |
| physics set | physics                                   |

#### flag\_for\_radar\_reflectivity

|             |   |
|-------------|---|
| long_name   | flag for radar reflectivity   |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                                     |
| local_name  | physics%Model(cdata%blk_no)%lradar  |
| requested   | gfdl_cloud_microphys_run<br>maximum_hourly_diagnostics_run<br>mp_thompson_run |
| physics set | physics   |

#### flag\_for\_radiation\_transfer\_option

|             |   |
|-------------|---|
| long_name   | choice for radiation transfer option (see noahmp module for definition) |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                               |
| local_name  | physics%Model(cdata%blk_no)%iopt_rad                                    |
| requested   | NOT REQUESTED   |
| physics set |   |

#### flag\_for\_ras\_deep\_convection

|             |   |
|-------------|---|
| long_name   | flag for ras convection scheme            |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%ras           |
| requested   | GFS_DCNV_generic_post_run                 |
| physics set | physics                                   |

#### flag\_for\_reading\_leaf\_area\_index\_from\_input

|             |  |
|-------------|--|
| long_name   | flag for reading leaf area index from initial conditions for RUC LSM |
| units       | flag   |
| rank        | 0  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                            |
| local_name  | physics%Model(cdata%blk_no)%rdlai                                    |
| requested   | NOT REQUESTED  |
| physics set |  |

#### flag\_for\_reduced\_drag\_coefficient\_over\_sea

|             |   |
|-------------|---|
| long_name   | flag for reduced drag coeff. over sea     |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%redrag        |
| requested   | sfc_diff_run                              |
| physics set | physics                                   |

#### flag\_for\_restart

|             |  |
|-------------|--|
| long_name   | flag for restart (warmstart) or coldstart  |
| units       | flag   |
| rank        | 0  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%restart  |
| requested   | cu_gf_driver_pre_run<br>cu_ntiedtke_pre_run<br>lsm_ruc_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>mynnedmf_wrapper_run<br>mynnrad_post_run<br>mynnrad_pre_run<br>mynnsfc_wrapper_run |
| physics set | physics  |

#### flag\_for\_ruc\_land\_surface\_scheme

|             |   |
|-------------|---|
| long_name   | flag for RUC land surface model           |
| units       | flag                                      |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%lsm_ruc       |
| requested   | GFS_MP_generic_post_run<br>lsm_ruc_run    |
| physics set | physics                                   |

#### flag\_for\_runoff\_and\_groundwater\_option

|             |   |
|-------------|---|
| long_name   | choice for runoff and groundwater option (see noahmp module for definition) |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                                   |
| local_name  | physics%Model(cdata%blk_no)%iopt_run  |
| requested   | NOT REQUESTED   |
| physics set |   |

#### flag\_for\_samf\_deep\_convection\_scheme

|             |   |
|-------------|---|
| long_name   | flag for SAMF deep convection scheme        |
| units       | flag  |
| rank        | 0   |
| type        | integer                                     |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%imfdeepcnv_samf |
| requested   | NOT REQUESTED                               |
| physics set |   |

#### flag\_for\_samf\_shallow\_convection\_scheme

|             |   |
|-------------|---|
| long_name   | flag for SAMF shallow convection scheme     |
| units       | flag  |
| rank        | 0   |
| type        | integer                                     |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%imfshalcnv_samf |
| requested   | NOT REQUESTED                               |
| physics set |   |

#### flag\_for\_sas\_deep\_convection\_scheme

|             |  |
|-------------|--|
| long_name   | flag for SAS deep convection scheme        |
| units       | flag                                       |
| rank        | 0  |
| type        | integer                                    |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%imfdeepcnv_sas |
| requested   | NOT REQUESTED                              |
| physics set |  |

#### flag\_for\_sas\_shallow\_convection\_scheme

|             |  |
|-------------|--|
| long_name   | flag for SAS shallow convection scheme     |
| units       | flag                                       |
| rank        | 0  |
| type        | integer                                    |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%imfshalcnv_sas |
| requested   | NOT REQUESTED                              |
| physics set |  |

#### flag\_for\_scale\_aware\_Shinhong\_PBL

|             |   |
|-------------|---|
| long_name   | flag for scale-aware Shinhong PBL scheme  |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%shinhong      |
| requested   | GFS_PBL_generic_post_run                  |
| physics set | physics                                   |

#### flag\_for\_scale\_aware\_TKE\_moist\_EDMF\_PBL

|             |   |
|-------------|---|
| long_name   | flag for scale-aware TKE moist EDMF PBL scheme                                      |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%satmedmf  |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_suite_interstitial_3_run |
| physics set | physics   |

#### flag\_for\_sgs\_cellular\_automata

|             |   |
|-------------|---|
| long_name   | switch for sgs ca                         |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%ca_sgs        |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### flag\_for\_shallow\_convection

|             |   |
|-------------|---|
| long_name   | flag for calling shallow convection       |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%shal_cnv      |
| requested   | GFS_suite_interstitial_2_run              |
| physics set | physics                                   |



#### flag\_for\_shoc

|             |   |
|-------------|---|
| long_name   | flag for SHOC   |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%do_shoc   |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_suite_interstitial_2_run<br>GFS_suite_interstitial_3_run<br>cs_conv_aw_adj_run<br>gfdl_cloud_microphys_init<br>m_micro_pre_run<br>shoc_run |
| physics set | physics   |

#### flag\_for\_shoc\_after\_convection

|             |   |
|-------------|---|
| long_name   | flag to execute SHOC after convection     |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%shocaftercnv  |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### flag\_for\_soil\_and\_snow\_temperature\_time\_stepping\_option

|             |  |
|-------------|--|
| long_name   | choice for soil and snow temperature time stepping option (see noahmp module for definition) |
| units       | index  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%iopt_stc   |
| requested   | NOT REQUESTED  |
| physics set |  |

#### flag\_for\_soil\_moisture\_factor\_stomatal\_resistance\_option

|             |  |
|-------------|--|
| long_name   | choice for soil moisture factor for canopy stomatal resistance option (see noahmp module for definition) |
| units       | index  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%iopt_btr   |
| requested   | NOT REQUESTED  |
| physics set |  |

#### flag\_for\_solar\_constant

|             |   |
|-------------|---|
| long_name   | use prescribed solar constant             |
| units       | flag                                      |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%isol          |
| requested   | GFS_rrtmg_setup_init                      |
| physics set | physics                                   |

#### flag\_for\_stochastic\_shum\_option

|             |   |
|-------------|---|
| long_name   | flag for stochastic shum option           |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%do_shum       |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### flag\_for\_stochastic\_skeb\_option

|             |   |
|-------------|---|
| long_name   | flag for stochastic skeb option           |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%do_skeb       |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### flag\_for\_stochastic\_surface\_perturbations

|             |  |
|-------------|--|
| long_name   | flag for stochastic surface perturbations option |
| units       | flag   |
| rank        | 0  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type        |
| local_name  | physics%Model(cdata%blk_no)%do_sfcperfs          |
| requested   | GFS_surface_generic_pre_run                      |
| physics set | physics  |

#### flag\_for\_stochastic\_surface\_physics\_perturbations

|             |  |
|-------------|--|
| long_name   | flag for stochastic surface physics perturbations      |
| units       | flag   |
| rank        | 0  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type              |
| local_name  | physics%Model(cdata%blk_no)%do_sppt                    |
| requested   | GFS_MP_generic_post_run<br>GFS_surface_generic_pre_run |
| physics set | physics  |

#### flag\_for\_supercooled\_liquid\_water\_option

|             |   |
|-------------|---|
| long_name   | choice for supercooled liquid water option (see noahmp module for definition) |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                                     |
| local_name  | physics%Model(cdata%blk_no)%iopt_frz  |
| requested   | NOT REQUESTED   |
| physics set |   |

#### flag\_for\_surface\_emissivity\_control

|             |   |
|-------------|---|
| long_name   | surface emissivity control flag, use fixed value of 1 |
| units       | flag  |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type             |
| local_name  | physics%Model(cdata%blk_no)%iems                      |
| requested   | GFS_rrtmg_setup_init                                  |
| physics set | physics   |

#### flag\_for\_surface\_layer\_drag\_coefficient\_option

|             |   |
|-------------|---|
| long_name   | choice for surface layer drag coefficient option (see noahmp module for definition) |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%iopt_sfc  |
| requested   | NOT REQUESTED   |
| physics set |   |

#### flag\_for\_surface\_roughness\_option\_over\_ocean

|             |   |
|-------------|---|
| long_name   | surface roughness options over ocean      |
| units       | flag                                      |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%sfc_z0_type   |
| requested   | sfc_diff_run                              |
| physics set | physics                                   |

#### flag\_for\_sw\_clouds\_without\_sub\_grid\_approximation

|             |   |
|-------------|---|
| long_name   | flag for sw clouds without sub-grid approximation |
| units       | flag  |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type         |
| local_name  | physics%Model(cdata%blk_no)%isubc_sw              |
| requested   | GFS_rrtmg_setup_init                              |
| physics set | physics   |

#### flag\_for\_thompson\_microphysics\_scheme

|             |   |
|-------------|---|
| long_name   | choice of Thompson microphysics scheme  |
| units       | flag  |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%imp_physics_thompson  |
| requested   | GFS_MP_generic_post_run<br>GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>cu_gf_driver_run<br>lsm_ruc_run<br>maximum_hourly_diagnostics_run<br>mp_thompson_init<br>mynnedmf_wrapper_run |
| physics set | physics   |

#### flag\_for\_using\_climatology\_albedo

|             |   |
|-------------|---|
| long_name   | flag for using climatology alb, based on sfc type |
| units       | flag  |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type         |
| local_name  | physics%Model(cdata%blk_no)%ialb                  |
| requested   | GFS_rrtmg_setup_init                              |
| physics set | physics   |

#### flag\_for\_using\_prescribed\_global\_mean\_co2\_value

long\_name     prescribed global mean value (old opernl)  
units         flag  
rank          0  
type          integer  
kind  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%ico2  
requested     GFS\_rrtmg\_setup\_init  
physics set   physics

#### flag\_for\_vertical\_index\_direction\_control

long\_name     iflip - is not the same as flipv  
units         flag  
rank          0  
type          integer  
kind  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%iflip  
requested     GFS\_rrtmg\_setup\_init  
physics set   physics

#### flag\_for\_wave\_coupling

long\_name     flag controlling cplwav collection (default off)  
units         flag  
rank          0  
type          logical  
kind  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%cplwav  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics

#### flag\_for\_wsm6\_microphysics\_scheme

|             |   |
|-------------|---|
| long_name   | choice of WSM6 microphysics scheme  |
| units       | flag  |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%imp_physics_wsm6  |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_suite_interstitial_3_run<br>mynnedmf_wrapper_run |
| physics set | physics   |

#### flag\_for\_ysu

|             |   |
|-------------|---|
| long_name   | flag for YSU PBL scheme                   |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%do_ysu        |
| requested   | GFS_PBL_generic_post_run                  |
| physics set | physics                                   |



#### flag\_for\_zhao\_carr\_microphysics\_scheme

|             |   |
|-------------|---|
| long_name   | choice of Zhao-Carr microphysics scheme   |
| units       | flag  |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%imp_physics_zhao_carr   |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>shoc_run |
| physics set | physics   |

#### flag\_for\_zhao\_carr\_pdf\_microphysics\_scheme

|             |  |
|-------------|--|
| long_name   | choice of Zhao-Carr microphysics scheme with PDF clouds                  |
| units       | flag   |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                                |
| local_name  | physics%Model(cdata%blk_no)%imp_physics_zhao_carr_pdf                    |
| requested   | GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>shoc_run |
| physics set | physics  |

#### flag\_idealized\_physics

|             |   |
|-------------|---|
| long_name   | flag for idealized physics  |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%lsidea  |
| requested   | GFS_PBL_generic_post_run<br>GFS_suite_interstitial_2_run<br>mynnedmf_wrapper_run<br>rayleigh_damp_run |
| physics set | physics   |

#### flag\_mg3\_as\_mg2

|             |   |
|-------------|---|
| long_name   | flag for controlling prep for Morrison-Gettelman microphysics |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                |
| local_name  | physics%Interstitial(cdata%blk_no)%mg3_as_mg2                 |
| requested   | m_micro_post_run<br>m_micro_pre_run<br>shoc_run               |
| physics set | physics   |

#### flag\_nonzero\_lake\_surface\_fraction

|             |   |
|-------------|---|
| long_name   | flag indicating presence of some lake surface area fraction |
| units       | flag  |
| rank        | 1   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type              |
| local_name  | physics%Interstitial(cdata%blk_no)%lake                     |
| requested   | GFS_surface_composites_pre_run                              |
| physics set | physics   |

#### flag\_nonzero\_land\_surface\_fraction

|             |   |
|-------------|---|
| long_name   | flag indicating presence of some land surface area fraction   |
| units       | flag  |
| rank        | 1   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%dry  |
| requested   | GFS_PBL_generic_post_run<br>GFS_suite_interstitial_2_run<br>GFS_surface_composites_inter_run<br>GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>GFS_surface_generic_pre_run<br>GFS_surface_loop_control_part2_run<br>dcyc2t3_run<br>lsm_noah_run<br>lsm_ruc_run<br>lsm_ruc_sfc_sice_post_run<br>lsm_ruc_sfc_sice_pre_run<br>noahmpdrv_run<br>sfc_diag_post_run<br>sfc_diff_run |
| physics set | physics   |

#### flag\_nonzero\_ocean\_surface\_fraction

|             |  |
|-------------|--|
| long_name   | flag indicating presence of some ocean surface area fraction |
| units       | flag   |
| rank        | 1  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type               |
| local_name  | physics%Interstitial(cdata%blk_no)%ocean                     |
| requested   | GFS_surface_composites_pre_run                               |
| physics set | physics  |

#### flag\_nonzero\_sea\_ice\_surface\_fraction

|             |   |
|-------------|---|
| long_name   | flag indicating presence of some sea ice surface area fraction  |
| units       | flag  |
| rank        | 1   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%icy  |
| requested   | GFS_PBL_generic_post_run<br>GFS_suite_interstitial_2_run<br>GFS_surface_composites_inter_run<br>GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>GFS_surface_generic_post_run<br>GFS_surface_generic_pre_run<br>GFS_surface_loop_control_part2_run<br>dcyc2t3_run<br>sfc_diff_run<br>sfc_nst_post_run |
| physics set | physics   |

### flag\_nonzero\_wet\_surface\_fraction

|             |  |
|-------------|--|
| long_name   | flag indicating presence of some ocean or lake surface area fraction   |
| units       | flag   |
| rank        | 1  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%wet   |
| requested   | GFS_PBL_generic_post_run<br>GFS_suite_interstitial_2_run<br>GFS_surface_composites_inter_run<br>GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>GFS_surface_generic_post_run<br>GFS_surface_generic_pre_run<br>GFS_surface_loop_control_part2_run<br>dcyc2t3_run<br>sfc_diff_run<br>sfc_nst_post_run<br>sfc_nst_pre_run<br>sfc_nst_run<br>sfc_ocean_run |
| physics set | physics  |

### flag\_print

|             |  |
|-------------|--|
| long_name   | control flag for diagnostic print out  |
| units       | flag   |
| rank        | 0  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%lprnt  |
| requested   | GFS_time_vary_pre_run<br>cires_ugwp_run<br>cs_conv_run<br>drag_suite_run<br>gwdc_run<br>gwdps_run<br>hedmf_run<br>m_micro_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>mynnedmf_wrapper_run<br>mynnsfc_wrapper_run<br>rrtmg_lw_run<br>rrtmg_sw_run<br>sfc_nst_run<br>sfc_sice_run<br>zhaocarr_gscond_run<br>zhaocarr_precpd_run |
| physics set | physics  |

#### flag\_reset\_maximum\_hourly\_fields

|             |  |
|-------------|--|
| long_name   | flag for resetting maximum hourly fields       |
| units       | flag   |
| rank        | 0  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%reset       |
| requested   | gfdl_cloud_microphys_run                       |
|             | maximum_hourly_diagnostics_run                 |
| physics set | physics  |

#### flag\_shallow\_convective\_cloud

|             |   |
|-------------|---|
| long_name   | flag for shallow convective cloud         |
| units       |   |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%shcnvcw       |
| requested   | GFS_SCNV_generic_post_run                 |
| physics set | physics                                   |



```

flag_skip_macro
  long_name    flag to skip cloud macrophysics in Morrison scheme
  units        flag
  rank         0
  type         logical
  kind
  source       MODULE GFS_typedefs TYPE GFS_interstitial_type
  local_name   physics%Interstitial(cdata%blk_no)%skip_macro
  requested    m_micro_pre_run
               m_micro_run
               shoc_run
  physics set  physics

```

```

flag_to_calc_lw
  long_name    logical flags for lw radiation calls
  units        flag
  rank         0
  type         logical
  kind
  source       MODULE GFS_typedefs TYPE GFS_control_type
  local_name   physics%Model(cdata%blk_no)%lslwr
  requested    GFS_time_vary_pre_run
               rrtmg_lw_run
  physics set  physics

```

#### flag\_to\_calc\_sw

|             |  |
|-------------|--|
| long_name   | logical flags for sw radiation calls                         |
| units       | flag   |
| rank        | 0  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                    |
| local_name  | physics%Model(cdata%blk_no)%lsswr                            |
| requested   | GFS_rrtmg_setup_run<br>GFS_time_vary_pre_run<br>rrtmg_sw_run |
| physics set | physics  |

#### forecast\_date\_and\_time

|             |  |
|-------------|--|
| long_name   | current forecast date and time               |
| units       | none   |
| rank        | 1  |
| type        | integer                                      |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type    |
| local_name  | physics%Model(cdata%blk_no)%jdat             |
| requested   | GFS_rrtmg_setup_run<br>GFS_time_vary_pre_run |
| physics set | physics                                      |

#### forecast\_hour\_of\_the\_day

|             |   |
|-------------|---|
| long_name   | time in hours after 00z at the current timestep     |
| units       | h   |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type           |
| local_name  | physics%Model(cdata%blk_no)%solhr                   |
| requested   | GFS_time_vary_pre_run<br>dcyc2t3_run<br>sfc_nst_run |
| physics set | physics   |

#### forecast\_time

|             |  |
|-------------|--|
| long_name   | current forecast time  |
| units       | h  |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%fhour  |
| requested   | GFS_time_vary_pre_run<br>cu_gf_driver_pre_run<br>cu_ntiedtke_pre_run<br>gwdc_run |
| physics set | physics  |

#### forecast\_time\_at\_previous\_timestep

|             |   |
|-------------|---|
| long_name   | forecast time at the previous timestep    |
| units       | h   |
| rank        | 0   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%phour         |
| requested   | GFS_time_vary_pre_run                     |
| physics set | physics                                   |

#### fraction\_of\_cellular\_automata\_for\_deep\_convection

|             |   |
|-------------|---|
| long_name   | fraction of cellular automata for deep convection |
| units       | frac  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type        |
| local_name  | physics%Coupling(cdata%blk_no)%ca_deep            |
| requested   | GFS_DCNV_generic_pre_run<br>samfdeepcnv_run       |
| physics set | physics   |

#### fraction\_of\_cloud\_top\_water\_scavenged

|             |  |
|-------------|--|
| long_name   | fraction of the tracer (cloud top water) that is scavenged by convection |
| units       | km-1   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                           |
| local_name  | physics%Interstitial(cdata%blk_no)%fswtr                                 |
| requested   | cs_conv_pre_run<br>cs_conv_run   |
| physics set | physics  |

#### `fraction_of_convective_cloud`

|                          |  |
|--------------------------|--|
| <code>long_name</code>   | <code>fraction of convective cloud</code>              |
| <code>units</code>       | <code>frac</code>                                      |
| <code>rank</code>        | <code>1</code>   |
| <code>type</code>        | <code>real</code>                                      |
| <code>kind</code>        | <code>kind_phys</code>                                 |
| <code>source</code>      | <code>MODULE GFS_typedefs TYPE GFS_cldprop_type</code> |
| <code>local_name</code>  | <code>physics%Clprop(cdata%blk_no)%cv</code>           |
| <code>requested</code>   | <code>cnvc90_run</code>                                |
| <code>physics set</code> | <code>physics</code>                                   |

#### `fraction_of_grid_box_with_subgrid_orography_higher_than_critical_height`

|                          |  |
|--------------------------|--|
| <code>long_name</code>   | <code>frac. of grid box with by subgrid orography higher than critical height</code> |
| <code>units</code>       | <code>frac</code>  |
| <code>rank</code>        | <code>2</code>   |
| <code>type</code>        | <code>real</code>  |
| <code>kind</code>        | <code>kind_phys</code>   |
| <code>source</code>      | <code>MODULE GFS_typedefs TYPE GFS_interstitial_type</code>                          |
| <code>local_name</code>  | <code>physics%Interstitial(cdata%blk_no)%clx</code>                                  |
| <code>requested</code>   | <code>GFS_GWD_generic_pre_run</code>   |
|                          | <code>cires_ugwp_run</code>  |
|                          | <code>drag_suite_run</code>  |
|                          | <code>gwdps_run</code>   |
| <code>physics set</code> | <code>physics</code>   |

#### `fraction_of_ice_water_cloud`

long\_name      fraction of ice water cloud  
units            frac  
rank            2  
type            real  
kind            kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name      physics%Interstitial(cdata%blk\_no)%f\_ice  
requested       NOT REQUESTED  
physics set

#### `fraction_of_rain_water_cloud`

long\_name      fraction of rain water cloud  
units            frac  
rank            2  
type            real  
kind            kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name      physics%Interstitial(cdata%blk\_no)%f\_rain  
requested       NOT REQUESTED  
physics set

#### `fraction_of_tracer_scavenged`

long\_name      fraction of the tracer (aerosols) that is scavenged by convection  
units            km-1  
rank            1  
type            real  
kind            kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name      physics%Interstitial(cdata%blk\_no)%fscav  
requested       cs\_conv\_pre\_run  
                 cs\_conv\_run  
physics set     physics

#### free\_convection\_layer\_thickness

|             |   |
|-------------|---|
| long_name   | thickness of free convection layer (FCL)  |
| units       | m   |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%d_conv      |
| requested   | sfc_nst_run                               |
| physics set | physics                                   |

#### freezing\_point\_temperature\_of\_seawater

|             |  |
|-------------|--|
| long_name   | freezing point temperature of seawater |
| units       | K                                      |
| rank        | 0                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE gmtb_scm_physical_constants     |
| local_name  | con_tice                               |
| requested   | GFS_surface_composites_pre_run         |
|             | sfc_sice_run                           |
| physics set | physics                                |

#### frequency\_for\_longwave\_radiation

|             |   |
|-------------|---|
| long_name   | frequency for longwave radiation          |
| units       | s   |
| rank        | 0   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%fhlwr         |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### frequency\_for\_shortwave\_radiation

|             |   |
|-------------|---|
| long_name   | frequency for shortwave radiation         |
| units       | s   |
| rank        | 0   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%fhswr         |
| requested   | GFS_rrtmg_setup_run<br>dcyc2t3_run        |
| physics set | physics                                   |

#### frozen\_cloud\_threshold\_temperature

|             |  |
|-------------|--|
| long_name   | threshold temperature below which all cloud is ice |
| units       | K  |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type          |
| local_name  | physics%Model(cdata%blk_no)%tf                     |
| requested   | NOT REQUESTED                                      |
| physics set |  |



### gas\_constant\_dry\_air

|             |  |
|-------------|--|
| long_name   | ideal gas constant for dry air   |
| units       | J kg <sup>-1</sup> K <sup>-1</sup>   |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE gmtb_scm_physical_constants   |
| local_name  | con_rd   |
| requested   | GFS_PBL_generic_post_run<br>cires_ugwp_run<br>cu_gf_driver_run<br>drag_suite_run<br>gfdl_cloud_microphys_run<br>gmtb_scm_sfc_flux_spec_run<br>gwdc_run<br>gwdps_run<br>lsm_noah_run<br>lsm_ruc_run<br>m_micro_init<br>moninshoc_run<br>mp_thompson_pre_run<br>mp_thompson_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>noahmpdrv_run<br>samfdeepcnv_run<br>samfshalcnv_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>sfc_cice_run<br>sfc_nst_run<br>sfc_ocean_run<br>sfc_sice_run<br>shinhongvdif_run<br>shoc_run<br>ysuvdif_run |
| physics set | physics  |

#### gas\_constant\_water\_vapor

|             |  |
|-------------|--|
| long_name   | ideal gas constant for water vapor   |
| units       | J kg-1 K-1   |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE gmtb_scm_physical_constants   |
| local_name  | con_rv   |
| requested   | cires_ugwp_run<br>drag_suite_run<br>gwdps_run<br>lsm_ruc_run<br>m_micro_init<br>samfdeepcnv_run<br>samfshalcnv_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>shoc_run<br>ysuvdif_run |
| physics set | physics  |

## geopotential

|             |   |
|-------------|---|
| long_name   | geopotential at model layer centers   |
| units       | m2 s-2  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type   |
| local_name  | physics%Statein(cdata%blk_no)%phil  |
| requested   | GFS_surface_generic_pre_run<br>cires_ugwp_run<br>cs_conv_run<br>cu_gf_driver_run<br>cu_ntiedtke_run<br>drag_suite_run<br>get_phi_fv3_run<br>gwdps_run<br>hedmf_run<br>m_micro_run<br>maximum_hourly_diagnostics_run<br>moninshoc_run<br>mp_thompson_pre_run<br>samfdeepcnv_run<br>samfshalcnv_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>shoc_run<br>ysuvdif_run |
| physics set | physics   |

### geopotential\_at\_interface

|             |   |
|-------------|---|
| long_name   | geopotential at model layer interfaces  |
| units       | m2 s-2  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type   |
| local_name  | physics%Statein(cdata%blk_no)%phii  |
| requested   | GFS_MP_generic_post_run<br>cires_ugwp_run<br>cs_conv_run<br>cu_ntiedtke_run<br>drag_suite_run<br>get_phi_fv3_run<br>get_prs_fv3_run<br>gfdl_cloud_microphys_run<br>gwdps_run<br>hedmf_run<br>m_micro_run<br>moninshoc_run<br>mp_thompson_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>mynnedmf_wrapper_run<br>mynnsfc_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>shoc_run<br>ysuvdif_run |
| physics set | physics   |

#### geopotential\_difference\_between\_midlayers\_divided\_by\_midlayer\_virtual\_temperature

long\_name difference between mid-layer geopotentials divided by mid-layer virtual temperature  
units m2 s-2 K-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%del\_gz  
requested get\_phi\_fv3\_run  
get\_prs\_fv3\_run  
physics set physics

#### gf\_memory\_counter

long\_name Memory counter for GF  
units none  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name physics%Sfcprop(cdata%blk\_no)%conv\_act  
requested cu\_gf\_driver\_post\_run  
cu\_gf\_driver\_pre\_run  
physics set physics

#### graupel\_mixing\_ratio

long\_name moist (dry+vapor, no condensates) mixing ratio of graupel  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_statein\_type  
local\_name physics%Statein(cdata%blk\_no)%qgrs(:, :, physics%Model(cdata%blk\_no)%ntgl)  
requested NOT REQUESTED  
physics set

#### graupel\_mixing\_ratio\_updated\_by\_physics

|             |   |
|-------------|---|
| long_name   | moist (dry+vapor, no condensates) mixing ratio of graupel updated by physics  |
| units       | kg kg-1   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_stateout_type  |
| local_name  | physics%Stateout(cdata%blk_no)%gq0(:, :, physics%Model(cdata%blk_no)%ntgl)  |
| requested   | gfdl_cloud_microphys_run<br>m_micro_post_run<br>m_micro_pre_run<br>mp_thompson_pre_run<br>mp_thompson_run<br>shoc_run |
| physics set | physics   |

#### graupel\_number\_concentration

|             |   |
|-------------|---|
| long_name   | number concentration of graupel   |
| units       | kg-1  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type                                   |
| local_name  | physics%Statein(cdata%blk_no)%qgrs(:, :, physics%Model(cdata%blk_no)%ntgnc) |
| requested   | NOT REQUESTED   |
| physics set |   |

#### graupel\_number\_concentration\_updated\_by\_physics

long\_name     number concentration of graupel updated by physics  
units         kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_stateout\_type  
local\_name    physics%Stateout(cdata%blk\_no)%gq0(:, :, physics%Model(cdata%blk\_no)%ntgnc)  
requested     m\_micro\_post\_run  
              m\_micro\_pre\_run  
physics set   physics

#### graupel\_precipitation\_rate\_from\_previous\_timestep

long\_name     graupel precipitation rate from previous timestep  
units         mm s-1  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name    physics%Sfcprop(cdata%blk\_no)%dgraupelprv  
requested     GFS\_MP\_generic\_post\_run  
              noahmpdrv\_run  
physics set   physics

#### grav\_settling

long\_name     flag to activate gravitational setting of fog  
units         flag  
rank          0  
type          integer  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%grav\_settling  
requested     mynnedmf\_wrapper\_run  
physics set   physics





### gravitational\_acceleration

|            |  |
|------------|--|
| long_name  | gravitational acceleration   |
| units      | m s-2  |
| rank       | 0  |
| type       | real   |
| kind       | kind_phys  |
| source     | MODULE gmtb_scm_physical_constants   |
| local_name | con_g  |
| requested  | GFS_DCNV_generic_post_run<br>GFS_MP_generic_post_run<br>GFS_surface_generic_pre_run<br>cires_ugwp_run<br>cs_conv_aw_adj_run<br>drag_suite_run<br>gfdl_cloud_microphys_run<br>gmtb_scm_sfc_flux_spec_run<br>gwdc_run<br>gwdps_run<br>lsm_noah_run<br>lsm_ruc_run<br>m_micro_init<br>maximum_hourly_diagnostics_run<br>moninshoc_run<br>mp_thompson_pre_run<br>mp_thompson_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>ozphys_2015_run<br>ozphys_run<br>samfdeepcnv_run<br>samfshalcnv_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>sfc_diag_run<br>sfc_diff_run<br>sfc_sice_run<br>shinhongvdif_run<br>shoc_run<br>uswdif_run |

#### grid\_sensitive\_critical\_cloud\_top\_entrainment\_instability\_criteria

|             |  |
|-------------|--|
| long_name   | grid sensitive critical cloud top entrainment instability criteria |
| units       | none   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                     |
| local_name  | physics%Interstitial(cdata%blk_no)%ctei_rml                        |
| requested   | GFS_suite_interstitial_2_run                                       |
| physics set | physics  |

#### grid\_size\_related\_coefficient\_used\_in\_scale\_sensitive\_schemes

|             |  |
|-------------|--|
| long_name   | grid size related coefficient used in scale-sensitive schemes  |
| units       | none   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%work1   |
| requested   | GFS_suite_interstitial_1_run<br>GFS_suite_interstitial_2_run<br>GFS_suite_interstitial_3_run<br>cs_conv_pre_run<br>gwdc_pre_run<br>zhaocarr_precpd_run |
| physics set | physics  |

#### grid\_size\_related\_coefficient\_used\_in\_scale\_sensitive\_schemes\_complement

|             |   |
|-------------|---|
| long_name   | complement to work1   |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%work2  |
| requested   | GFS_suite_interstitial_1_run<br>GFS_suite_interstitial_2_run<br>GFS_suite_interstitial_3_run<br>cs_conv_pre_run<br>gwdc_pre_run |
| physics set | physics   |

#### ground\_temperature\_for\_noahmp

|             |   |
|-------------|---|
| long_name   | ground temperature for noahmp             |
| units       | K   |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%tgxy        |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### gwd\_opt

|             |   |
|-------------|---|
| long_name   | flag to choose gwd scheme                 |
| units       | flag                                      |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%gwd_opt       |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### h2o\_forcing

|             |                                       |
|-------------|---------------------------------------|
| long_name   | water forcing data                    |
| units       | various                               |
| rank        | 3                                     |
| type        | real                                  |
| kind        | kind_phys                             |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type |
| local_name  | physics%Tbd(cdata%blk_no)%h2opl       |
| requested   | h2ophys_run                           |
| physics set | physics                               |

#### heat\_exchange\_coefficient\_for\_MYJ\_schemes

|             |   |
|-------------|---|
| long_name   | surface heat exchange_coefficient for MYJ schemes |
| units       | m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type             |
| local_name  | physics%Tbd(cdata%blk_no)%phy_myj_akhs            |
| requested   | NOT REQUESTED                                     |
| physics set |   |

#### height\_above\_ground\_at\_lowest\_model\_layer

|             |   |
|-------------|---|
| long_name   | layer 1 height above ground (not MSL)   |
| units       | m   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type  |
| local_name  | physics%Diag(cdata%blk_no)%zlvl   |
| requested   | GFS_surface_generic_pre_run<br>gmtb_scm_sfc_flux_spec_run<br>lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run<br>sfc_diff_run |
| physics set | physics   |

#### height\_of\_launch\_level\_of\_orographic\_gravity\_wave

|             |   |
|-------------|---|
| long_name   | height of launch level of orographic gravity wave |
| units       | m   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type    |
| local_name  | physics%Interstitial(cdata%blk_no)%zogw           |
| requested   | cires_ugwp_post_run<br>cires_ugwp_run             |
| physics set | physics   |

#### height\_of\_low\_level\_wave\_breaking

|             |  |
|-------------|--|
| long_name   | height of drag due to low level wave breaking  |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%zlwb        |
| requested   | cires_ugwp_post_run<br>cires_ugwp_run          |
| physics set | physics  |

#### height\_of\_mountain\_blocking

|             |  |
|-------------|--|
| long_name   | height of mountain blocking drag               |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%zmtb        |
| requested   | cires_ugwp_post_run<br>cires_ugwp_run          |
| physics set | physics  |

#### horizontal\_block\_size

|             |   |
|-------------|---|
| long_name   | for explicit data blocking: block sizes of all blocks |
| units       | count   |
| rank        | 1   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type             |
| local_name  | physics%Model(cdata%blk_no)%blksize                   |
| requested   | NOT REQUESTED   |
| physics set |   |



#### horizontal\_dimension

|            |   |
|------------|---|
| long_name  | horizontal dimension  |
| units      | count   |
| rank       | 0   |
| type       | integer   |
| kind       |   |
| source     | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name | physics%Model(cdata%blk_no)%blksz2(cdata%blk_no)  |
| requested  | GFS_MP_generic_post_run<br>cnvc90_run<br>cs_conv_aw_adj_run<br>cs_conv_post_run<br>cs_conv_pre_run<br>cs_conv_run<br>cu_gf_driver_run<br>cu_ntiedtke_run<br>dcyc2t3_run<br>drag_suite_run<br>get_phi_fv3_run<br>get_prs_fv3_run<br>gwdc_run<br>gwdps_run<br>h2ophys_run<br>hedmf_run<br>m_micro_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>mynnedmf_wrapper_run<br>mynnrad_post_run<br>mynnrad_pre_run<br>mynnsfc_wrapper_run<br>noahmpdrv_run<br>ozphys_2015_run<br>ozphys_run<br>rayleigh_damp_run<br>samfdeepcnv_run<br>samfshalcnv_run<br>satmedmfvdif_run |



#### horizontal\_index\_of\_printed\_column

|             |  |
|-------------|--|
| long_name   | horizontal index of printed column   |
| units       | index  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%ipr   |
| requested   | cires_ugwp_run<br>cs_conv_run<br>drag_suite_run<br>gwdc_run<br>gwdps_run<br>hedmf_run<br>m_micro_run<br>moninshoc_run<br>sfc_nst_run<br>sfc_sice_run<br>zhaocarr_gscond_run<br>zhaocarr_precpd_run |
| physics set | physics  |

### horizontal\_loop\_extent

|            |  |
|------------|--|
| long_name  | horizontal loop extent   |
| units      | count  |
| rank       | 0  |
| type       | integer  |
| kind       |  |
| source     | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name | physics%Model(cdata%blk_no)%blksz(cdata%blk_no)  |
| requested  | GFS_DCNV_generic_post_run<br>GFS_DCNV_generic_pre_run<br>GFS_GWD_generic_pre_run<br>GFS_MP_generic_post_run<br>GFS_MP_generic_pre_run<br>GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_SCNV_generic_post_run<br>GFS_SCNV_generic_pre_run<br>GFS_rrtmg_post_run<br>GFS_rrtmg_pre_run<br>GFS_rrtmg_setup_init<br>GFS_suite_interstitial_1_run<br>GFS_suite_interstitial_2_run<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>GFS_suite_stateout_reset_run<br>GFS_suite_stateout_update_run<br>GFS_surface_composites_inter_run<br>GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>GFS_surface_generic_post_run<br>GFS_surface_generic_pre_run<br>GFS_surface_loop_control_part1_run<br>GFS_surface_loop_control_part2_run<br>cires_ugwp_post_run<br>cires_ugwp_run<br>cnvc90_run<br>cs_conv_run<br>cu_gf_driver_post_run<br>cu_gf_driver_run |

#### humidity\_mixing\_ratio

long\_name     the ratio of the mass of water vapor to the mass of dry air  
units         kg kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%qv\_r  
requested     NOT REQUESTED  
physics set

#### ice\_fraction\_in\_convective\_tower

long\_name     ice fraction in convective tower  
units         frac  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%cnv\_fice  
requested     cs\_conv\_run  
              m\_micro\_run  
              samfdeepcnv\_run  
physics set   physics

#### ice\_friendly\_aerosol\_number\_concentration

long\_name     number concentration of ice-friendly aerosols  
units         kg-1  
rank          2  
type         real  
kind         kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_statein\_type  
local\_name    physics%Statein(cdata%blk\_no)%qgrs(:, :, physics%Model(cdata%blk\_no)%ntia)  
requested     mp\_thompson\_init  
              mynnedmf\_wrapper\_run  
physics set   physics

#### ice\_friendly\_aerosol\_number\_concentration\_updated\_by\_physics

long\_name     number concentration of ice-friendly aerosols updated by physics  
units         kg-1  
rank          2  
type         real  
kind         kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_stateout\_type  
local\_name    physics%Stateout(cdata%blk\_no)%gq0(:, :, physics%Model(cdata%blk\_no)%ntia)  
requested     mp\_thompson\_pre\_run  
              mp\_thompson\_run  
physics set   physics

#### ice\_number\_concentration

long\_name     number concentration of ice  
units         kg-1  
rank          2  
type         real  
kind         kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_statein\_type  
local\_name    physics%Statein(cdata%blk\_no)%qgrs(:, :, physics%Model(cdata%blk\_no)%ntinc)  
requested     mynnedmf\_wrapper\_run  
physics set   physics

#### ice\_number\_concentration\_updated\_by\_physics

|             |   |
|-------------|---|
| long_name   | number concentration of ice updated by physics                              |
| units       | kg-1  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_stateout_type                                  |
| local_name  | physics%Stateout(cdata%blk_no)%gq0(:, :, physics%Model(cdata%blk_no)%ntinc) |
| requested   | m_micro_run<br>mp_thompson_pre_run<br>mp_thompson_run<br>shoc_run           |
| physics set | physics   |

#### ice\_precipitation\_rate\_from\_previous\_timestep

|             |   |
|-------------|---|
| long_name   | ice precipitation rate from previous timestep |
| units       | mm s-1  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys                                     |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type     |
| local_name  | physics%Sfcprop(cdata%blk_no)%diceprv         |
| requested   | GFS_MP_generic_post_run<br>noahmpdrv_run      |
| physics set | physics                                       |

#### ice\_supersaturation\_threshold

long\_name ice supersaturation parameter for PDF clouds  
units none  
rank 0  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name physics%Model(cdata%blk\_no)%sup  
requested NOT REQUESTED  
physics set

#### ice\_water\_mixing\_ratio

long\_name moist (dry+vapor, no condensates) mixing ratio of ice water  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_statein\_type  
local\_name physics%Statein(cdata%blk\_no)%qgrs(:, :, physics%Model(cdata%blk\_no)%ntiw)  
requested mynnedmf\_wrapper\_run  
mynnrad\_post\_run  
mynnrad\_pre\_run  
physics set physics

#### ice\_water\_mixing\_ratio\_convective\_transport\_tracer

long\_name moist (dry+vapor, no condensates) mixing ratio of ice water in the convectively transported tracer array  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%clw(:, :, 1)  
requested GFS\_DCNV\_generic\_post\_run  
cs\_conv\_pre\_run  
cu\_gf\_driver\_run  
m\_micro\_pre\_run  
m\_micro\_run  
shoc\_run  
zhaocarr\_gscond\_run  
physics set physics

#### ice\_water\_mixing\_ratio\_save

long\_name cloud ice water mixing ratio before entering a physics scheme  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%save\_q(:, :, physics%Model(cdata%blk\_no)%ntiw)  
requested GFS\_suite\_interstitial\_3\_run  
GFS\_suite\_interstitial\_4\_run  
cs\_conv\_pre\_run  
mynnrad\_post\_run  
mynnrad\_pre\_run  
physics set physics

#### ice\_water\_mixing\_ratio\_updated\_by\_physics

|             |  |
|-------------|--|
| long_name   | moist (dry+vapor, no condensates) mixing ratio of ice water updated by physics   |
| units       | kg kg-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_stateout_type   |
| local_name  | physics%Stateout(cdata%blk_no)%gq0(:, :, physics%Model(cdata%blk_no)%ntiw)   |
| requested   | gfdl_cloud_microphys_run<br>m_micro_post_run<br>m_micro_pre_run<br>m_micro_run<br>mp_thompson_pre_run<br>mp_thompson_run<br>shoc_run |
| physics set | physics  |

#### in\_number\_concentration

|             |                                       |
|-------------|---------------------------------------|
| long_name   | IN number concentration               |
| units       | kg-1?                                 |
| rank        | 2                                     |
| type        | real                                  |
| kind        | kind_phys                             |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type |
| local_name  | physics%Tbd(cdata%blk_no)%in_nm       |
| requested   | m_micro_run                           |
| physics set | physics                               |



#### index\_for\_cloud\_amount

long\_name     tracer index for cloud amount integer  
units         index  
rank          0  
type          integer  
kind  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%ntclamt  
requested     GFS\_suite\_interstitial\_3\_run  
              GFS\_suite\_interstitial\_4\_run  
              cs\_conv\_aw\_adj\_run  
physics set   physics

#### index\_for\_cloud\_fraction\_in\_3d\_arrays\_for\_microphysics

long\_name     index of cloud fraction in phyf3d (used only for SHOC or MG)  
units         index  
rank          0  
type          integer  
kind  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%indcld  
requested     NOT REQUESTED  
physics set

#### index\_for\_cloud\_liquid\_water\_effective\_radius

long\_name     the index of cloud liquid water effective radius in phy\_f3d  
units  
rank          0  
type          integer  
kind  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%nleffr  
requested     NOT REQUESTED  
physics set

#### index\_for\_convective\_cloud\_cover\_in\_phy\_f3d

long\_name the index of convective cloud cover in phy f3d  
units  
rank 0  
type integer  
kind  
source MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name physics%Model(cdata%blk\_no)%ncnvc  
requested NOT REQUESTED  
physics set

#### index\_for\_convective\_cloud\_water\_mixing\_ratio\_in\_phy\_f3d

long\_name the index of convective cloud water mixing ratio in phy f3d  
units  
rank 0  
type integer  
kind  
source MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name physics%Model(cdata%blk\_no)%ncnvw  
requested NOT REQUESTED  
physics set

#### index\_for\_diagnostic\_printout

long\_name horizontal index for point used for diagnostic printout  
units  
rank 0  
type integer  
kind  
source MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name physics%Model(cdata%blk\_no)%ipt  
requested GFS\_time\_vary\_pre\_run  
physics set physics

#### index\_for\_first\_chemical\_tracer

|             |   |
|-------------|---|
| long_name   | tracer index for first chemical tracer              |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type           |
| local_name  | physics%Model(cdata%blk_no)%ntchs                   |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run |
| physics set | physics   |

#### index\_for\_graupel

|             |   |
|-------------|---|
| long_name   | tracer index for graupel  |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%ntgl  |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run |
| physics set | physics   |

#### index\_for\_graupel\_effective\_radius

long\_name the index of graupel effective radius in phy\_f3d  
units  
rank 0  
type integer  
kind  
source MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name physics%Model(cdata%blk\_no)%ngeffr  
requested NOT REQUESTED  
physics set

#### index\_for\_graupel\_number\_concentration

long\_name tracer index for graupel number concentration  
units index  
rank 0  
type integer  
kind  
source MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name physics%Model(cdata%blk\_no)%ntgnc  
requested GFS\_PBL\_generic\_post\_run  
GFS\_PBL\_generic\_pre\_run  
GFS\_suite\_interstitial\_3\_run  
GFS\_suite\_interstitial\_4\_run  
physics set physics

#### index\_for\_ice\_cloud\_condensate

|             |  |
|-------------|--|
| long_name   | tracer index for ice water   |
| units       | index  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%ntiw   |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics  |

#### index\_for\_ice\_cloud\_condensate\_vertical\_diffusion\_tracer

|             |  |
|-------------|--|
| long_name   | index for ice cloud condensate in the vertically diffused tracer array |
| units       | index  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                         |
| local_name  | physics%Interstitial(cdata%blk_no)%ntiwx                               |
| requested   | satmedmfvdif_run<br>satmedmfvdifq_run                                  |
| physics set | physics  |

#### index\_for\_ice\_cloud\_number\_concentration

|             |   |
|-------------|---|
| long_name   | tracer index for ice number concentration   |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%ntinc   |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_suite_interstitial_4_run<br>cu_gf_driver_run |
| physics set | physics   |

#### index\_for\_ice\_effective\_radius

|             |  |
|-------------|--|
| long_name   | the index of ice effective radius in phy_f3d |
| units       |  |
| rank        | 0  |
| type        | integer                                      |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type    |
| local_name  | physics%Model(cdata%blk_no)%nieffr           |
| requested   | NOT REQUESTED                                |
| physics set |  |

#### index\_for\_ice\_friendly\_aerosols

|             |   |
|-------------|---|
| long_name   | tracer index for ice friendly aerosol     |
| units       | index                                     |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%ntia          |
| requested   | GFS_PBL_generic_post_run                  |
|             | GFS_PBL_generic_pre_run                   |
| physics set | physics                                   |

#### index\_for\_liquid\_cloud\_condensate

|             |  |
|-------------|--|
| long_name   | tracer index for cloud condensate (or liquid water)  |
| units       | index  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%ntcw   |
| requested   | GFS_MP_generic_post_run<br>GFS_MP_generic_pre_run<br>GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_rrtmg_setup_init<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>cs_conv_aw_adj_run<br>hedmf_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics  |



#### index\_for\_liquid\_cloud\_number\_concentration

|             |   |
|-------------|---|
| long_name   | tracer index for liquid number concentration  |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%ntlnc   |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_suite_interstitial_4_run<br>cu_gf_driver_run |
| physics set | physics   |

#### index\_for\_mass\_weighted\_rime\_factor

|             |  |
|-------------|--|
| long_name   | tracer index for mass weighted rime factor |
| units       | index                                      |
| rank        | 0  |
| type        | integer                                    |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%nqrimef        |
| requested   | NOT REQUESTED                              |
| physics set |  |

#### index\_for\_ozone

|             |   |
|-------------|---|
| long_name   | tracer index for ozone mixing ratio   |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                                   |
| local_name  | physics%Model(cdata%blk_no)%ntoz  |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_rrtmg_setup_init |
| physics set | physics   |

#### index\_for\_rain\_effective\_radius

|             |   |
|-------------|---|
| long_name   | the index of rain effective radius in phy_f3d |
| units       |   |
| rank        | 0   |
| type        | integer                                       |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type     |
| local_name  | physics%Model(cdata%blk_no)%nreffr            |
| requested   | NOT REQUESTED                                 |
| physics set |   |

#### index\_for\_rain\_number\_concentration

|             |   |
|-------------|---|
| long_name   | tracer index for rain number concentration  |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%ntrnc   |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run |
| physics set | physics   |

#### index\_for\_rain\_water

|             |   |
|-------------|---|
| long_name   | tracer index for rain water   |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%ntrw  |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run |
| physics set | physics   |

#### index\_for\_snow\_effective\_radius

|             |   |
|-------------|---|
| long_name   | the index of snow effective radius in phy_f3d |
| units       |   |
| rank        | 0   |
| type        | integer                                       |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type     |
| local_name  | physics%Model(cdata%blk_no)%nseffr            |
| requested   | NOT REQUESTED                                 |
| physics set |   |

#### index\_for\_snow\_number\_concentration

|             |   |
|-------------|---|
| long_name   | tracer index for snow number concentration  |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%ntsnc   |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run |
| physics set | physics   |

#### index\_for\_snow\_water

|             |   |
|-------------|---|
| long_name   | tracer index for snow water   |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%ntsw  |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run |
| physics set | physics   |

#### index\_for\_turbulent\_kinetic\_energy

|             |   |
|-------------|---|
| long_name   | tracer index for turbulent kinetic energy   |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%ntke  |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>cires_ugwp_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run |
| physics set | physics   |

#### `index_for_turbulent_kinetic_energy_convective_transport_tracer`

|                          |   |
|--------------------------|---|
| <code>long_name</code>   | index for turbulent kinetic energy in the convectively transported tracer array |
| <code>units</code>       | index   |
| <code>rank</code>        | 0   |
| <code>type</code>        | integer   |
| <code>kind</code>        |   |
| <code>source</code>      | MODULE GFS_typedefs TYPE GFS_interstitial_type                                  |
| <code>local_name</code>  | physics%Interstitial(cdata%blk_no)%ntk  |
| <code>requested</code>   | samfdeepcnv_run<br>samfshalcnv_run  |
| <code>physics set</code> | physics   |

#### `index_for_turbulent_kinetic_energy_vertical_diffusion_tracer`

|                          |   |
|--------------------------|---|
| <code>long_name</code>   | index for turbulent kinetic energy in the vertically diffused tracer array                                    |
| <code>units</code>       | index   |
| <code>rank</code>        | 0   |
| <code>type</code>        | integer   |
| <code>kind</code>        |   |
| <code>source</code>      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| <code>local_name</code>  | physics%Interstitial(cdata%blk_no)%ntkev  |
| <code>requested</code>   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>moninshoc_run<br>satmedmfvdif_run<br>satmedmfvdifq_run |
| <code>physics set</code> | physics   |

#### index\_for\_water\_friendly\_aerosols

|             |   |
|-------------|---|
| long_name   | tracer index for water friendly aerosol             |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type           |
| local_name  | physics%Model(cdata%blk_no)%ntwa                    |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run |
| physics set | physics   |

#### index\_for\_water\_vapor

|             |   |
|-------------|---|
| long_name   | tracer index for water vapor (specific humidity)    |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type           |
| local_name  | physics%Model(cdata%blk_no)%ntqv                    |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run |
| physics set | physics   |

#### index\_of\_atmosphere\_heat\_diffusivity\_from\_shoc\_in\_phy\_f3d

|             |   |
|-------------|---|
| long_name   | the index of diffusivity for heat from from SHOC in phy_f3d |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                   |
| local_name  | physics%Model(cdata%blk_no)%nahdshoc                        |
| requested   | NOT REQUESTED   |
| physics set |   |

#### index\_of\_dtlm\_start

|             |   |
|-------------|---|
| long_name   | index to start dtlm run or not            |
| units       | index                                     |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%ifd         |
| requested   | sfc_nst_run                               |
| physics set | physics                                   |

#### index\_of\_highest\_temperature\_inversion

|             |   |
|-------------|---|
| long_name   | index of highest temperature inversion  |
| units       | index   |
| rank        | 1   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%kinver   |
| requested   | GFS_suite_interstitial_2_run<br>GFS_suite_interstitial_3_run<br>hedmf_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run |
| physics set | physics   |



#### index\_of\_kinematic\_buoyancy\_flux\_from\_shoc\_in\_phy\_f3d

|             |  |
|-------------|--|
| long_name   | the index of upward kinematic buoyancy flux from SHOC in phy_f3d |
| units       | index  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                        |
| local_name  | physics%Model(cdata%blk_no)%nkbfsnoc                             |
| requested   | NOT REQUESTED  |
| physics set |  |

#### index\_of\_subgrid\_scale\_cloud\_fraction\_from\_shoc\_in\_phy\_f3d

|             |   |
|-------------|---|
| long_name   | the index of subgrid-scale cloud fraction from from SHOC in phy_f3d |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                           |
| local_name  | physics%Model(cdata%blk_no)%nscfsnoc                                |
| requested   | NOT REQUESTED   |
| physics set |   |

#### index\_of\_time\_step

|             |  |
|-------------|--|
| long_name   | current forecast iteration   |
| units       | index  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%kdt  |
| requested   | GFS_MP_generic_post_run<br>GFS_time_vary_pre_run<br>cires_ugwp_run<br>cs_conv_run<br>cu_gf_driver_pre_run<br>cu_ntiedtke_pre_run<br>drag_suite_run<br>gwdps_run<br>lsm_ruc_run<br>m_micro_run<br>mp_thompson_post_run<br>mp_thompson_pre_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>noahmpdrv_run<br>sfc_nst_run |
| physics set | physics  |

#### instantaneous\_aerosol\_column\_mass\_densities

long\_name      instantaneous aerosol column mass densities for pm2.5, black carbon, organic carbon, sulfate, dust, sea salt  
units            g m-2  
rank            2  
type            real  
kind            kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name      physics%Diag(cdata%blk\_no)%aecm  
requested       NOT REQUESTED  
physics set

#### instantaneous\_anthropogenic\_and\_biomass\_burning\_emissions

long\_name      instantaneous anthropogenic and biomass burning emissions for black carbon, organic carbon, and sulfur dioxide  
units            ug m-2 s-1  
rank            2  
type            real  
kind            kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name      physics%Diag(cdata%blk\_no)%abem  
requested       NOT REQUESTED  
physics set

```

instantaneous_atmosphere_detrainment_convective_mass_flux
    long_name      (detrainment mass flux) * delt
    units          kg m-2
    rank           2
    type           real
    kind           kind_phys
    source         MODULE GFS_typedefs TYPE GFS_interstitial_type
    local_name     physics%Interstitial(cdata%blk_no)%dt_mf
    requested      GFS_DCNV_generic_post_run
                  cs_conv_run
                  cu_gf_driver_run
                  cu_ntiedtke_run
                  samfdeepcnv_run
                  samfshalcnv_run
    physics set    physics

```

```

instantaneous_atmosphere_downdraft_convective_mass_flux
    long_name      (downdraft mass flux) * delt
    units          kg m-2
    rank           2
    type           real
    kind           kind_phys
    source         MODULE GFS_typedefs TYPE GFS_interstitial_type
    local_name     physics%Interstitial(cdata%blk_no)%dd_mf
    requested      GFS_DCNV_generic_post_run
                  cs_conv_run
                  cu_gf_driver_run
                  cu_ntiedtke_run
                  samfdeepcnv_run
    physics set    physics

```

#### instantaneous\_atmosphere\_heat\_diffusivity

long\_name      instantaneous atmospheric heat diffusivity  
units          m2 s-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%dkt  
requested     GFS\_PBL\_generic\_post\_run  
physics set   physics

#### instantaneous\_atmosphere\_updraft\_convective\_mass\_flux

long\_name      (updraft mass flux) \* delt  
units          kg m-2  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%ud\_mf  
requested     GFS\_DCNV\_generic\_post\_run  
              cs\_conv\_run  
              cu\_gf\_driver\_run  
              cu\_ntiedtke\_run  
              samfdeepcnv\_run  
              samfshalcnv\_run  
physics set   physics

#### instantaneous\_change\_in\_x\_wind\_due\_to\_mountain\_blocking\_drag

long\_name      instantaneous change in x wind due to mountain blocking drag  
units          m s-2  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%dudt\_mtb  
requested     cires\_ugwp\_post\_run  
              cires\_ugwp\_run  
physics set   physics

#### instantaneous\_change\_in\_x\_wind\_due\_to\_orographic\_gravity\_wave\_drag

long\_name      instantaneous change in x wind due to orographic gw drag  
units          m s-2  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%dudt\_ogw  
requested     cires\_ugwp\_post\_run  
              cires\_ugwp\_run  
physics set   physics

#### instantaneous\_change\_in\_x\_wind\_due\_to\_turbulent\_orographic\_form\_drag

long\_name      instantaneous change in x wind due to TOFD  
units          m s-2  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%dudt\_tms  
requested     cires\_ugwp\_post\_run  
              cires\_ugwp\_run  
physics set   physics

#### instantaneous\_convective\_scale\_wet\_deposition

long\_name      instantaneous convective-scale wet deposition  
units          kg m-2 s-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%wetdpc  
requested     NOT REQUESTED  
physics set

#### instantaneous\_cosine\_of\_zenith\_angle

|             |   |
|-------------|---|
| long_name   | cosine of zenith angle at current time  |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%xcosz  |
| requested   | GFS_suite_interstitial_2_run<br>GFS_surface_generic_post_run<br>dcyc2t3_run<br>noahmpdrv_run<br>sfc_nst_run |
| physics set | physics   |

#### instantaneous\_dry\_deposition

|             |  |
|-------------|--|
| long_name   | instantaneous dry deposition           |
| units       | kg m <sup>-2</sup> s <sup>-1</sup>     |
| rank        | 2                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%drydep      |
| requested   | NOT REQUESTED                          |
| physics set |  |



#### instantaneous\_dust\_emission\_flux

long\_name      instantaneous dust emission flux  
units           kg m-2 s-1  
rank           2  
type           real  
kind           kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name      physics%Diag(cdata%blk\_no)%duem  
requested       NOT REQUESTED  
physics set

#### instantaneous\_large\_scale\_wet\_deposition

long\_name      instantaneous large-scale wet deposition  
units           kg m-2 s-1  
rank           2  
type           real  
kind           kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name      physics%Diag(cdata%blk\_no)%wetdpl  
requested       NOT REQUESTED  
physics set

#### instantaneous\_momentum\_flux\_due\_to\_mountain\_blocking\_drag

long\_name      instantaneous momentum flux due to mountain blocking drag  
units           Pa  
rank           1  
type           real  
kind           kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name      physics%Interstitial(cdata%blk\_no)%tau\_mtb  
requested       cires\_ugwp\_post\_run  
                 cires\_ugwp\_run  
physics set     physics

#### instantaneous\_momentum\_flux\_due\_to\_nonstationary\_gravity\_wave

long\_name      instantaneous momentum flux due to nonstationary gravity waves  
units          Pa  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%tau\_ngw  
requested     cires\_ugwp\_post\_run  
              cires\_ugwp\_run  
physics set   physics

#### instantaneous\_momentum\_flux\_due\_to\_orographic\_gravity\_wave\_drag

long\_name      instantaneous momentum flux due to orographic gravity wave drag  
units          Pa  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%tau\_ogw  
requested     cires\_ugwp\_post\_run  
              cires\_ugwp\_run  
physics set   physics

#### instantaneous\_momentum\_flux\_due\_to\_turbulent\_orographic\_form\_drag

long\_name      instantaneous momentum flux due to TOFD  
units          Pa  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%tau\_tofd  
requested     cires\_ugwp\_post\_run  
              cires\_ugwp\_run  
physics set   physics

#### instantaneous\_seasalt\_emission\_flux

long\_name      instantaneous sea salt emission flux  
units          kg m-2 s-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%ssem  
requested     NOT REQUESTED  
physics set

#### instantaneous\_sedimentation

long\_name      instantaneous sedimentation  
units          kg m-2 s-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%sedim  
requested     NOT REQUESTED  
physics set

#### instantaneous\_specific\_humidity\_at\_2m\_for\_coupling

long\_name      instantaneous Q2m  
units          kg kg-1  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%q2mi\_cpl  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics

#### instantaneous\_surface\_air\_pressure\_for\_coupling

long\_name      instantaneous sfc pressure  
units          Pa  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%psurfi\_cpl  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics

#### instantaneous\_surface\_downwelling\_diffuse\_near\_infrared\_shortwave\_flux\_for\_coupling

long\_name      instantaneous sfc nir diff downward sw flux  
units          W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%dnirdfi\_cpl  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics

#### instantaneous\_surface\_downwelling\_diffuse\_ultraviolet\_and\_visible\_shortwave\_flux\_for\_coupling

long\_name      instantaneous sfc uv+vis diff downward sw flux  
units          W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%dvisdfl\_cpl  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics

#### instantaneous\_surface\_downwelling\_direct\_near\_infrared\_shortwave\_flux\_for\_coupling

long\_name      instantaneous sfc nir beam downward sw flux  
units          W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%dnirbmi\_cpl  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics

#### instantaneous\_surface\_downwelling\_direct\_ultraviolet\_and\_visible\_shortwave\_flux\_for\_coupling

long\_name      instantaneous sfc uv+vis beam downward sw flux  
units          W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%dvisbmi\_cpl  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics

#### instantaneous\_surface\_downwelling\_longwave\_flux\_for\_coupling

long\_name      instantaneous sfc downward lw flux  
units          W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%dlwsfci\_cpl  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics

#### instantaneous\_surface\_downwelling\_shortwave\_flux\_for\_coupling

long\_name      instantaneous sfc downward sw flux  
units          W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%dswsfci\_cpl  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics

#### instantaneous\_surface\_ground\_heat\_flux

long\_name      instantaneous sfc ground heat flux  
units          W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%gfluxi  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics

#### instantaneous\_surface\_net\_downward\_diffuse\_near\_infrared\_shortwave\_flux\_for\_coupling

long\_name      instantaneous net nir diff sfc downward sw flux  
units          W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%nnirdfi\_cpl  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics

#### instantaneous\_surface\_net\_downward\_diffuse\_ultraviolet\_and\_visible\_shortwave\_flux\_for\_coupling

long\_name      instantaneous net uv+vis diff downward sw flux  
units          W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%nvisdfl\_cpl  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics

#### instantaneous\_surface\_net\_downward\_direct\_near\_infrared\_shortwave\_flux\_for\_coupling

long\_name      instantaneous net nir beam sfc downward sw flux  
units          W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%nnirbmi\_cpl  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics

#### instantaneous\_surface\_net\_downward\_direct\_ultraviolet\_and\_visible\_shortwave\_flux\_for\_coupling

long\_name      instantaneous net uv+vis beam downward sw flux  
units          W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%nvisbmi\_cpl  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics

#### instantaneous\_surface\_net\_downward\_longwave\_flux\_for\_coupling

long\_name      instantaneous net sfc downward lw flux  
units          W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%nlwsfci\_cpl  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics

#### instantaneous\_surface\_net\_downward\_shortwave\_flux\_for\_coupling

long\_name      instantaneous net sfc downward sw flux  
units          W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%nswsfci\_cpl  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics



#### instantaneous\_surface\_potential\_evaporation

long\_name      instantaneous sfc potential evaporation  
units            W m-2  
rank            1  
type            real  
kind            kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name      physics%Diag(cdata%blk\_no)%epi  
requested       GFS\_surface\_generic\_post\_run  
physics set     physics

#### instantaneous\_surface\_skin\_temperature\_for\_coupling

long\_name      instantaneous sfc temperature  
units            K  
rank            1  
type            real  
kind            kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name      physics%Coupling(cdata%blk\_no)%tsfci\_cpl  
requested       GFS\_surface\_generic\_post\_run  
physics set     physics

```

instantaneous_surface_upward_latent_heat_flux
    long_name    surface upward latent heat flux
    units        W m-2
    rank         1
    type         real
    kind         kind_phys
    source       MODULE GFS_typedefs TYPE GFS_interstitial_type
    local_name   physics%Interstitial(cdata%blk_no)%dqsfc1
    requested    GFS_PBL_generic_post_run
                hedmf_run
                moninshoc_run
                myjpbl_wrapper_run
                mynnedmf_wrapper_run
                satmedmfvdif_run
                satmedmfvdifq_run
                shinhongvdif_run
                ysuvdif_run
    physics set  physics

instantaneous_surface_upward_latent_heat_flux_for_coupling
    long_name    instantaneous sfc latent heat flux
    units        W m-2
    rank         1
    type         real
    kind         kind_phys
    source       MODULE GFS_typedefs TYPE GFS_coupling_type
    local_name   physics%Coupling(cdata%blk_no)%dqsfc1_cpl
    requested    GFS_PBL_generic_post_run
    physics set  physics

```

#### instantaneous\_surface\_upward\_latent\_heat\_flux\_for\_diag

long\_name      instantaneous sfc latent heat flux multiplied by timestep  
units          W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%dqsfc1  
requested     GFS\_PBL\_generic\_post\_run  
             mynnedmf\_wrapper\_run  
physics set   physics

#### instantaneous\_surface\_upward\_sensible\_heat\_flux

long\_name      surface upward sensible heat flux  
units          W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%dtsfc1  
requested     GFS\_PBL\_generic\_post\_run  
             hedmf\_run  
             moninshoc\_run  
             myjpbl\_wrapper\_run  
             mynnedmf\_wrapper\_run  
             satmedmfvdif\_run  
             satmedmfvdifq\_run  
             shinhongvdif\_run  
             ysuvdif\_run  
physics set   physics

#### instantaneous\_surface\_upward\_sensible\_heat\_flux\_for\_chemistry\_coupling

long\_name      instantaneous upward sensible heat flux for chemistry coupling  
units            W m-2  
rank            1  
type            real  
kind            kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name      physics%Coupling(cdata%blk\_no)%ushfsfci  
requested       GFS\_PBL\_generic\_post\_run  
physics set     physics

#### instantaneous\_surface\_upward\_sensible\_heat\_flux\_for\_coupling

long\_name      instantaneous sfc sensible heat flux  
units            W m-2  
rank            1  
type            real  
kind            kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name      physics%Coupling(cdata%blk\_no)%dtsfci\_cpl  
requested       GFS\_PBL\_generic\_post\_run  
physics set     physics

#### instantaneous\_surface\_upward\_sensible\_heat\_flux\_for\_diag

long\_name      instantaneous sfc sensible heat flux multiplied by timestep  
units            W m-2  
rank            1  
type            real  
kind            kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name      physics%Diag(cdata%blk\_no)%dtsfci  
requested       GFS\_PBL\_generic\_post\_run  
                 mynnedmf\_wrapper\_run  
physics set     physics

#### instantaneous\_surface\_x\_momentum\_flux

|             |   |
|-------------|---|
| long_name   | x momentum flux   |
| units       | Pa  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%dusfc1   |
| requested   | GFS_PBL_generic_post_run<br>hedmf_run<br>m_micro_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics   |

#### instantaneous\_surface\_x\_momentum\_flux\_for\_coupling

|             |  |
|-------------|--|
| long_name   | instantaneous sfc x momentum flux          |
| units       | Pa   |
| rank        | 1  |
| type        | real                                       |
| kind        | kind_phys                                  |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type |
| local_name  | physics%Coupling(cdata%blk_no)%dusfci_cpl  |
| requested   | GFS_PBL_generic_post_run                   |
| physics set | physics                                    |

#### instantaneous\_surface\_x\_momentum\_flux\_for\_diag

long\_name      instantaneous sfc x momentum flux multiplied by timestep  
units          Pa  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%dusfci  
requested     GFS\_PBL\_generic\_post\_run  
physics set   physics

#### instantaneous\_surface\_y\_momentum\_flux

long\_name      y momentum flux  
units          Pa  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%dvsfc1  
requested     GFS\_PBL\_generic\_post\_run  
              hedmf\_run  
              m\_micro\_run  
              moninshoc\_run  
              myjpbl\_wrapper\_run  
              satmedmfvdif\_run  
              satmedmfvdifq\_run  
              shinhongvdif\_run  
              ysuvdif\_run  
physics set   physics

#### instantaneous\_surface\_y\_momentum\_flux\_for\_coupling

long\_name      instantaneous sfc y momentum flux  
units          Pa  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%dvsfci\_cpl  
requested     GFS\_PBL\_generic\_post\_run  
physics set   physics

#### instantaneous\_surface\_y\_momentum\_flux\_for\_diag

long\_name      instantaneous sfc y momentum flux multiplied by timestep  
units          Pa  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%dvsfci  
requested     GFS\_PBL\_generic\_post\_run  
physics set   physics

#### instantaneous\_temperature\_at\_2m\_for\_coupling

long\_name      instantaneous T2m  
units          K  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%t2mi\_cpl  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics

#### instantaneous\_water\_vapor\_specific\_humidity\_tendency\_due\_to\_convection

long\_name      instantaneous moisture tendency due to convection  
units          kg kg-1 s-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%dqdti  
requested     GFS\_SCNV\_generic\_post\_run  
              GFS\_suite\_interstitial\_4\_run  
physics set   physics

#### instantaneous\_x\_stress\_due\_to\_gravity\_wave\_drag

long\_name      zonal surface stress due to orographic gravity wave drag  
units          Pa  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%dusfcg  
requested     GFS\_GWD\_generic\_post\_run  
              cires\_ugwp\_run  
              drag\_suite\_run  
              gwdc\_post\_run  
              gwdc\_run  
              gwdps\_run  
physics set   physics



#### instantaneous\_x\_wind\_at\_10m\_for\_coupling

long\_name      instantaneous U10m  
units          m s-1  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%u10mi\_cpl  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics

#### instantaneous\_y\_stress\_due\_to\_gravity\_wave\_drag

long\_name      meridional surface stress due to orographic gravity wave drag  
units          Pa  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%dvsfcg  
requested     GFS\_GWD\_generic\_post\_run  
              cires\_ugwp\_run  
              drag\_suite\_run  
              gwdc\_post\_run  
              gwdc\_run  
              gwdps\_run  
physics set   physics

#### instantaneous\_y\_wind\_at\_10m\_for\_coupling

long\_name      instantaneous V10m  
units          m s-1  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%v10mi\_cpl  
requested     GFS\_surface\_generic\_post\_run  
physics set   physics

#### integrated\_x\_momentum\_flux\_from\_blocking\_drag

long\_name      integrated x momentum flux from blocking drag  
units          Pa s  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%dusfc\_bl  
requested     NOT REQUESTED  
physics set

#### integrated\_x\_momentum\_flux\_from\_form\_drag

long\_name      integrated x momentum flux from form drag  
units          Pa s  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%dusfc\_fd  
requested     NOT REQUESTED  
physics set

#### integrated\_x\_momentum\_flux\_from\_large\_scale\_gwd

long\_name integrated x momentum flux from large scale gwd  
units Pa s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dusfc\_ls  
requested NOT REQUESTED  
physics set

#### integrated\_x\_momentum\_flux\_from\_small\_scale\_gwd

long\_name integrated x momentum flux from small scale gwd  
units Pa s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dusfc\_ss  
requested NOT REQUESTED  
physics set

#### integrated\_y\_momentum\_flux\_from\_blocking\_drag

long\_name integrated y momentum flux from blocking drag  
units Pa s  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dvsfc\_bl  
requested NOT REQUESTED  
physics set

#### integrated\_y\_momentum\_flux\_from\_form\_drag

long\_name      integrated y momentum flux from form drag  
units          Pa s  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%dvsfc\_fd  
requested     NOT REQUESTED  
physics set

#### integrated\_y\_momentum\_flux\_from\_large\_scale\_gwd

long\_name      integrated y momentum flux from large scale gwd  
units          Pa s  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%dvsfc\_ls  
requested     NOT REQUESTED  
physics set

#### integrated\_y\_momentum\_flux\_from\_small\_scale\_gwd

long\_name      integrated y momentum flux from small scale gwd  
units          Pa s  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%dvsfc\_ss  
requested     NOT REQUESTED  
physics set

#### inverse\_scaling\_factor\_for\_critical\_relative\_humidity

|             |   |
|-------------|---|
| long_name   | inverse scaling factor for critical relative humidity |
| units       | rad2 m-2  |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type             |
| local_name  | physics%Model(cdata%blk_no)%dxinv                     |
| requested   | GFS_suite_interstitial_1_run                          |
| physics set | physics   |

#### iounit\_log

|             |   |
|-------------|---|
| long_name   | fortran unit number for logfile           |
| units       | none                                      |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%logunit       |
| requested   | cires_ugwp_init                           |
|             | gfdl_cloud_microphys_init                 |
| physics set | physics                                   |

#### iounit\_namelist

|             |   |
|-------------|---|
| long_name   | fortran unit number for file opens  |
| units       | none  |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%nlunit  |
| requested   | cires_ugwp_init<br>gfdl_cloud_microphys_init<br>lsm_noah_init<br>lsm_ruc_init<br>noahmpdrv_init |
| physics set | physics   |

#### joules\_per\_calorie\_constant

|             |                                    |
|-------------|------------------------------------|
| long_name   | joules per calorie constant        |
| units       | J cal-1                            |
| rank        | 0                                  |
| type        | real                               |
| kind        | kind_phys                          |
| source      | MODULE gmtb_scm_physical_constants |
| local_name  | con_jcal                           |
| requested   | noahmpdrv_run<br>sfc_nst_run       |
| physics set | physics                            |

#### julian\_day

|             |   |
|-------------|---|
| long_name   | julian day                                |
| units       | days                                      |
| rank        | 0   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%julian        |
| requested   | GFS_time_vary_pre_run                     |
|             | noahmpdrv_run                             |
| physics set | physics                                   |

#### k\_level\_of\_highest\_reaching\_plume

|             |   |
|-------------|---|
| long_name   | k-level of highest reaching plume       |
| units       | count                                   |
| rank        | 1                                       |
| type        | integer                                 |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type  |
| local_name  | physics%Diag(cdata%blk_no)%ktop_shallow |
| requested   | mynnedmf_wrapper_run                    |
| physics set | physics                                 |

#### kind\_INTEGER

|             |                            |
|-------------|----------------------------|
| long_name   | definition of kind_INTEGER |
| units       | none                       |
| rank        | 0                          |
| type        | integer                    |
| kind        |                            |
| source      | MODULE machine             |
| local_name  | kind_INTEGER               |
| requested   | NOT REQUESTED              |
| physics set |                            |

#### kind\_LOGICAL

|             |                            |
|-------------|----------------------------|
| long_name   | definition of kind_LOGICAL |
| units       | none                       |
| rank        | 0                          |
| type        | integer                    |
| kind        |                            |
| source      | MODULE machine             |
| local_name  | kind_LOGICAL               |
| requested   | NOT REQUESTED              |
| physics set |                            |

#### kind\_dyn

|             |                        |
|-------------|------------------------|
| long_name   | definition of kind_dyn |
| units       | none                   |
| rank        | 0                      |
| type        | integer                |
| kind        |                        |
| source      | MODULE machine         |
| local_name  | kind_dyn               |
| requested   | NOT REQUESTED          |
| physics set |                        |

#### kind\_grid

|             |                         |
|-------------|-------------------------|
| long_name   | definition of kind_grid |
| units       | none                    |
| rank        | 0                       |
| type        | integer                 |
| kind        |                         |
| source      | MODULE machine          |
| local_name  | kind_grid               |
| requested   | NOT REQUESTED           |
| physics set |                         |



#### kind\_phys

|             |                         |
|-------------|-------------------------|
| long_name   | definition of kind_phys |
| units       | none                    |
| rank        | 0                       |
| type        | integer                 |
| kind        |                         |
| source      | MODULE machine          |
| local_name  | kind_phys               |
| requested   | NOT REQUESTED           |
| physics set |                         |

#### kinematic\_buoyancy\_flux\_from\_shoc

|             |   |
|-------------|---|
| long_name   | upward kinematic buoyancy flux from the SHOC scheme                           |
| units       | K m s-1   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type   |
| local_name  | physics%Tbd(cdata%blk_no)%phy_f3d(:, :, physics%Model(cdata%blk_no)%nkbfsnoc) |
| requested   | NOT REQUESTED   |
| physics set |   |

#### kinematic\_surface\_latent\_heat\_flux

|             |   |
|-------------|---|
| long_name   | kinematic surface latent heat flux      |
| units       | m s-1 kg kg-1                           |
| rank        | 1                                       |
| type        | real                                    |
| kind        | kind_phys                               |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type   |
| local_name  | physics%Tbd(cdata%blk_no)%phy_myj_elflx |
| requested   | NOT REQUESTED                           |
| physics set |   |

#### kinematic\_surface\_upward\_latent\_heat\_flux

|             |   |
|-------------|---|
| long_name   | kinematic surface upward latent heat flux   |
| units       | kg kg-1 m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%evap   |
| requested   | GFS_surface_composites_post_run<br>cu_gf_driver_run<br>cu_ntiedtke_run<br>gmtb_scm_sfc_flux_spec_run<br>hedmf_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>mynnedmf_wrapper_run<br>mynnsfc_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>sfc_diag_run<br>shinhongvdif_run<br>shoc_run<br>ysuvdif_run |
| physics set | physics   |

#### kinematic\_surface\_upward\_latent\_heat\_flux\_over\_ice

|             |   |
|-------------|---|
| long_name   | kinematic surface upward latent heat flux over ice              |
| units       | kg kg-1 m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                  |
| local_name  | physics%Interstitial(cdata%blk_no)%evap_ice                     |
| requested   | GFS_surface_composites_post_run<br>sfc_cice_run<br>sfc_sice_run |
| physics set | physics   |

#### kinematic\_surface\_upward\_latent\_heat\_flux\_over\_land

|             |   |
|-------------|---|
| long_name   | kinematic surface upward latent heat flux over land                             |
| units       | kg kg-1 m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                                  |
| local_name  | physics%Interstitial(cdata%blk_no)%evap_land                                    |
| requested   | GFS_surface_composites_post_run<br>lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run |
| physics set | physics   |

#### kinematic\_surface\_upward\_latent\_heat\_flux\_over\_ocean

|             |   |
|-------------|---|
| long_name   | kinematic surface upward latent heat flux over ocean  |
| units       | kg kg-1 m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%evap_ocean   |
| requested   | GFS_PBL_generic_post_run<br>GFS_surface_composites_post_run<br>sfc_nst_run<br>sfc_ocean_run |
| physics set | physics   |

#### kinematic\_surface\_upward\_sensible\_heat\_flux

|             |   |
|-------------|---|
| long_name   | kinematic surface upward sensible heat flux   |
| units       | K m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%hflx   |
| requested   | GFS_PBL_generic_post_run<br>GFS_surface_composites_post_run<br>cu_gf_driver_run<br>cu_ntiedtke_run<br>gmtb_scm_sfc_flux_spec_run<br>hedmf_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>mynnedmf_wrapper_run<br>mynnsfc_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>shoc_run<br>ysuvdif_run |
| physics set | physics   |

#### kinematic\_surface\_upward\_sensible\_heat\_flux\_over\_ice

|             |   |
|-------------|---|
| long_name   | kinematic surface upward sensible heat flux over ice            |
| units       | K m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                  |
| local_name  | physics%Interstitial(cdata%blk_no)%hflx_ice                     |
| requested   | GFS_surface_composites_post_run<br>sfc_cice_run<br>sfc_sice_run |
| physics set | physics   |

#### kinematic\_surface\_upward\_sensible\_heat\_flux\_over\_land

|             |   |
|-------------|---|
| long_name   | kinematic surface upward sensible heat flux over land                           |
| units       | K m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                                  |
| local_name  | physics%Interstitial(cdata%blk_no)%hflx_land                                    |
| requested   | GFS_surface_composites_post_run<br>lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run |
| physics set | physics   |

#### kinematic\_surface\_upward\_sensible\_heat\_flux\_over\_ocean

|             |   |
|-------------|---|
| long_name   | kinematic surface upward sensible heat flux over ocean                                      |
| units       | K m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%hflx_ocean   |
| requested   | GFS_PBL_generic_post_run<br>GFS_surface_composites_post_run<br>sfc_nst_run<br>sfc_ocean_run |
| physics set | physics   |

#### lake\_area\_fraction

|             |   |
|-------------|---|
| long_name   | fraction of horizontal grid area occupied by lake                                       |
| units       | frac  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type   |
| local_name  | physics%Sfcprop(cdata%blk_no)%lakefrac  |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>myjsfc_wrapper_run |
| physics set | physics   |

#### lake\_ice\_minimum

long\_name    minimum lake ice value  
units        ???  
rank        0  
type        real  
kind        kind\_phys  
source       MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name   physics%Model(cdata%blk\_no)%min\_lakeice  
requested    GFS\_surface\_composites\_pre\_run  
             sfc\_sice\_run  
physics set   physics

#### lake\_water\_storage

long\_name    lake water storage  
units        mm  
rank        1  
type        real  
kind        kind\_phys  
source       MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name   physics%Sfcprop(cdata%blk\_no)%wslakexy  
requested    NOT REQUESTED  
physics set



#### land\_area\_fraction

|             |   |
|-------------|---|
| long_name   | fraction of horizontal grid area occupied by land                                       |
| units       | frac  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type   |
| local_name  | physics%Sfcprop(cdata%blk_no)%landfrac  |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>myjsfc_wrapper_run |
| physics set | physics   |

#### land\_area\_fraction\_for\_microphysics

|             |   |
|-------------|---|
| long_name   | land area fraction used in microphysics schemes   |
| units       | frac  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%frland   |
| requested   | GFS_suite_interstitial_2_run<br>GFS_surface_composites_pre_run<br>gfdl_cloud_microphys_run<br>m_micro_run |
| physics set | physics   |

#### largest\_cloud\_top\_vertical\_index\_encountered\_thus\_far

|             |   |
|-------------|---|
| long_name   | largest cloud top vertical index encountered thus far |
| units       | index   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type                 |
| local_name  | physics%Tbd(cdata%blk_no)%acvt                        |
| requested   | cnvc90_run  |
| physics set | physics   |

#### latent\_heat\_of\_fusion\_of\_water\_at\_0C

|             |                                    |
|-------------|------------------------------------|
| long_name   | latent heat of fusion              |
| units       | J kg-1                             |
| rank        | 0                                  |
| type        | real                               |
| kind        | kind_phys                          |
| source      | MODULE gmtb_scm_physical_constants |
| local_name  | con_hfus                           |
| requested   | m_micro_init                       |
|             | noahmpdrv_run                      |
|             | satmedmfvdif_run                   |
|             | satmedmfvdifq_run                  |
|             | sfc_nst_run                        |
|             | shoc_run                           |
| physics set | physics                            |

#### latent\_heat\_of\_vaporization\_of\_water\_at\_0C

|             |   |
|-------------|---|
| long_name   | latent heat of evaporation/sublimation  |
| units       | J kg-1  |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE gmtb_scm_physical_constants  |
| local_name  | con_hvap  |
| requested   | GFS_PBL_generic_post_run<br>GFS_suite_interstitial_2_run<br>gmtb_scm_sfc_flux_spec_run<br>lsm_noah_run<br>lsm_ruc_run<br>m_micro_init<br>moninshoc_run<br>noahmpdrv_run<br>samfdeepcnv_run<br>samfshalcnv_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>sfc_cice_run<br>sfc_nst_run<br>sfc_ocean_run<br>sfc_sice_run<br>shinhongvdif_run<br>shoc_run<br>ysuvdif_run |
| physics set | physics   |

#### latitude

|             |   |
|-------------|---|
| long_name   | latitude  |
| units       | radians   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_grid_type  |
| local_name  | physics%Grid(cdata%blk_no)%xlat   |
| requested   | GFS_MP_generic_post_run<br>GFS_suite_interstitial_3_run<br>cires_ugwp_run<br>m_micro_run<br>noahmpdrv_run |
| physics set | physics   |

#### latitude\_degree

|             |  |
|-------------|--|
| long_name   | latitude in degrees                    |
| units       | degree                                 |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_grid_type |
| local_name  | physics%Grid(cdata%blk_no)%xlat_d      |
| requested   | cires_ugwp_run                         |
| physics set | physics                                |

#### latitude\_index\_in\_debug\_printouts

|             |  |
|-------------|--|
| long_name   | latitude index in debug printouts              |
| units       | index  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%latidxprnt  |
| requested   | cs_conv_run                                    |
|             | gwdc_run                                       |
| physics set | physics  |

#### layer\_bottom\_depth\_from\_snow\_surface

|             |   |
|-------------|---|
| long_name   | depth from the top of the snow surface at the bottom of the layer |
| units       | m   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type                         |
| local_name  | physics%Sfcprop(cdata%blk_no)%zsnsoxy                             |
| requested   | NOT REQUESTED   |
| physics set |   |

#### layer\_pressure\_thickness\_for\_radiation

|             |  |
|-------------|--|
| long_name   | layer pressure thickness on radiation levels                         |
| units       | hPa  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                       |
| local_name  | physics%Interstitial(cdata%blk_no)%delr                              |
| requested   | GFS_rrtmg_pre_run<br>mynnrad_pre_run<br>rrtmg_lw_run<br>rrtmg_sw_run |
| physics set | physics  |

#### layer\_thickness\_for\_radiation

|             |   |
|-------------|---|
| long_name   | layer thickness on radiation levels               |
| units       | km  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type    |
| local_name  | physics%Interstitial(cdata%blk_no)%dzlyr          |
| requested   | GFS_rrtmg_pre_run<br>rrtmg_lw_run<br>rrtmg_sw_run |
| physics set | physics   |

#### leaf\_area\_index

|             |   |
|-------------|---|
| long_name   | leaf area index                           |
| units       | none                                      |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%xlaixy      |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### leaf\_mass

|             |   |
|-------------|---|
| long_name   | leaf mass                                 |
| units       | g m-2                                     |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%lfmassxy    |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### level\_of\_dividing\_streamline

|             |   |
|-------------|---|
| long_name   | level of the dividing streamline              |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys                                     |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type        |
| local_name  | physics%Diag(cdata%blk_no)%zmtnbck            |
| requested   | cires_ugwp_run<br>drag_suite_run<br>gwdps_run |
| physics set | physics                                       |

#### limit\_for\_temperature\_tendency\_for\_microphysics

long\_name     temperature tendency limiter per physics time step  
units         K s-1  
rank          0  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%ttendlim  
requested     mp\_thompson\_post\_init  
physics set   physics

#### liquid\_water\_density

long\_name     density of liquid water  
units         kg m-3  
rank          0  
type          real  
kind          kind\_phys  
source        MODULE gmtb\_scm\_physical\_constants  
local\_name    rhowater  
requested     NOT REQUESTED  
physics set  

#### local\_condensed\_water\_number\_concentration

long\_name     number concentration of condensed water local to physics  
units         kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%ncpl  
requested     NOT REQUESTED  
physics set



#### local\_graupel\_mixing\_ratio

long\_name moist (dry+vapor, no condensates) mixing ratio of graupel local to physics  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%qgl  
requested m\_micro\_post\_run  
m\_micro\_pre\_run  
m\_micro\_run  
physics set physics

#### local\_graupel\_number\_concentration

long\_name number concentration of graupel local to physics  
units kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%ncgl  
requested m\_micro\_post\_run  
m\_micro\_pre\_run  
m\_micro\_run  
physics set physics

#### local\_ice\_number\_concentration

|             |  |
|-------------|--|
| long_name   | number concentration of ice local to physics   |
| units       | kg-1   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%ncpi        |
| requested   | NOT REQUESTED                                  |
| physics set |  |

#### local\_rain\_number\_concentration

|             |  |
|-------------|--|
| long_name   | number concentration of rain local to physics      |
| units       | kg-1   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type     |
| local_name  | physics%Interstitial(cdata%blk_no)%ncpr            |
| requested   | m_micro_post_run<br>m_micro_pre_run<br>m_micro_run |
| physics set | physics  |

#### local\_rain\_water\_mixing\_ratio

long\_name moist (dry+vapor, no condensates) mixing ratio of rain water local to physics  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%qrn  
requested m\_micro\_post\_run  
m\_micro\_pre\_run  
m\_micro\_run  
physics set physics

#### local\_snow\_number\_concentration

long\_name number concentration of snow local to physics  
units kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%ncps  
requested m\_micro\_post\_run  
m\_micro\_pre\_run  
m\_micro\_run  
physics set physics

#### local\_snow\_water\_mixing\_ratio

|             |   |
|-------------|---|
| long_name   | moist (dry+vapor, no condensates) mixing ratio of snow water local to physics |
| units       | kg kg-1   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                                |
| local_name  | physics%Interstitial(cdata%blk_no)%qsnw                                       |
| requested   | m_micro_post_run<br>m_micro_pre_run<br>m_micro_run                            |
| physics set | physics   |

#### longitude

|             |  |
|-------------|--|
| long_name   | longitude  |
| units       | radians  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_grid_type   |
| local_name  | physics%Grid(cdata%blk_no)%xlon  |
| requested   | GFS_MP_generic_post_run<br>dcyc2t3_run<br>m_micro_run<br>sfc_nst_post_run<br>sfc_nst_run |
| physics set | physics  |

#### lower\_bound\_of\_snow\_vertical\_dimension\_for\_land\_surface\_model

|             |  |
|-------------|--|
| long_name   | lower bound of of snow-related arrays for land surface model |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                    |
| local_name  | physics%Model(cdata%blk_no)%lsnow_lsm_lbound                 |
| requested   | NOT REQUESTED  |
| physics set |  |

#### lw\_fluxes\_sfc

|             |   |
|-------------|---|
| long_name   | lw radiation fluxes at sfc                |
| units       | W m-2                                     |
| rank        | 1   |
| type        | sfcflw_type                               |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_radtend_type |
| local_name  | physics%Radtend(cdata%blk_no)%sfcflw      |
| requested   | rrtmg_lw_run                              |
| physics set | physics                                   |

#### lw\_fluxes\_top\_atmosphere

|             |  |
|-------------|--|
| long_name   | lw radiation fluxes at top             |
| units       | W m-2                                  |
| rank        | 1                                      |
| type        | topflw_type                            |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%topflw      |
| requested   | rrtmg_lw_run                           |
| physics set | physics                                |

#### `lwe_thickness_of_convective_precipitation_amount_for_coupling`

|             |  |
|-------------|--|
| long_name   | total convective precipitation             |
| units       | m  |
| rank        | 1  |
| type        | real                                       |
| kind        | kind_phys                                  |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type |
| local_name  | physics%Coupling(cdata%blk_no)%rainc_cpl   |
| requested   | GFS_MP_generic_post_run                    |
| physics set | physics                                    |

#### `lwe_thickness_of_convective_precipitation_amount_from_previous_timestep`

|             |  |
|-------------|--|
| long_name   | convective_precipitation_amount from previous timestep |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type              |
| local_name  | physics%Sfcprop(cdata%blk_no)%raincprv                 |
| requested   | GFS_MP_generic_post_run                                |
|             | lsm_ruc_run  |
| physics set | physics  |

#### lwe\_thickness\_of\_convective\_precipitation\_amount\_on\_dynamics\_timestep

|             |   |
|-------------|---|
| long_name   | convective rain at this time step   |
| units       | m   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type  |
| local_name  | physics%Diag(cdata%blk_no)%rainc  |
| requested   | GFS_DCNV_generic_post_run<br>GFS_MP_generic_post_run<br>GFS_SCNV_generic_post_run<br>cnvc90_run |
| physics set | physics   |

#### lwe\_thickness\_of\_deep\_convective\_precipitation\_amount

|             |  |
|-------------|--|
| long_name   | deep convective rainfall amount on physics timestep  |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%raincd  |
| requested   | GFS_DCNV_generic_post_run<br>cs_conv_run<br>cu_gf_driver_run<br>cu_ntiedtke_run<br>samfdeepcnv_run |
| physics set | physics  |

#### lwe\_thickness\_of\_explicit\_precipitation\_amount

|             |  |
|-------------|--|
| long_name   | explicit precipitation (rain, ice, snow, graupel, ...) on physics timestep   |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%prcpmp  |
| requested   | GFS_MP_generic_post_run<br>cs_conv_aw_adj_run<br>gfdl_cloud_microphys_run<br>m_micro_run<br>mp_thompson_run<br>zhaocarr_precpd_run |
| physics set | physics  |

#### lwe\_thickness\_of\_explicit\_rain\_amount

|             |  |
|-------------|--|
| long_name   | explicit rain on physics timestep                                      |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                         |
| local_name  | physics%Interstitial(cdata%blk_no)%rainmp                              |
| requested   | GFS_MP_generic_post_run<br>gfdl_cloud_microphys_run<br>mp_thompson_run |
| physics set | physics  |



#### lwe\_thickness\_of\_explicit\_rainfall\_amount\_from\_previous\_timestep

|             |   |
|-------------|---|
| long_name   | explicit rainfall from previous timestep  |
| units       | m   |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%rainncprv   |
| requested   | GFS_MP_generic_post_run                   |
|             | lsm_ruc_run                               |
| physics set | physics                                   |

#### lwe\_thickness\_of\_graupel\_amount

|             |  |
|-------------|--|
| long_name   | explicit graupel fall on physics timestep      |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%graupelmp   |
| requested   | GFS_MP_generic_post_run                        |
|             | gfdl_cloud_microphys_run                       |
|             | mp_thompson_run                                |
| physics set | physics  |

#### lwe\_thickness\_of\_graupel\_amount\_from\_previous\_timestep

|             |   |
|-------------|---|
| long_name   | graupel amount from previous timestep     |
| units       | m   |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%graupelprv  |
| requested   | GFS_MP_generic_post_run                   |
|             | lsm_ruc_run                               |
| physics set | physics                                   |

#### lwe\_thickness\_of\_graupel\_amount\_on\_dynamics\_timestep

|             |  |
|-------------|--|
| long_name   | graupel fall at this time step         |
| units       | m                                      |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%graupel     |
| requested   | GFS_MP_generic_post_run                |
|             | m_micro_post_run                       |
| physics set | physics                                |

#### lwe\_thickness\_of\_ice\_amount

|             |  |
|-------------|--|
| long_name   | explicit ice fall on physics timestep                                  |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                         |
| local_name  | physics%Interstitial(cdata%blk_no)%icemp                               |
| requested   | GFS_MP_generic_post_run<br>gfdl_cloud_microphys_run<br>mp_thompson_run |
| physics set | physics  |

#### lwe\_thickness\_of\_ice\_amount\_from\_previous\_timestep

|             |   |
|-------------|---|
| long_name   | ice amount from previous timestep         |
| units       | m   |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%iceprv      |
| requested   | GFS_MP_generic_post_run<br>lsm_ruc_run    |
| physics set | physics                                   |

#### lwe\_thickness\_of\_ice\_amount\_on\_dynamics\_timestep

|             |  |
|-------------|--|
| long_name   | ice fall at this time step             |
| units       | m                                      |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%ice         |
| requested   | GFS_MP_generic_post_run                |
|             | m_micro_post_run                       |
| physics set | physics                                |

#### lwe\_thickness\_of\_moist\_convective\_adj\_precipitation\_amount

|             |   |
|-------------|---|
| long_name   | adjusted moist convective rainfall amount on physics timestep |
| units       | m   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                |
| local_name  | physics%Interstitial(cdata%blk_no)%rainmcdj                   |
| requested   | NOT REQUESTED   |
| physics set |   |

#### lwe\_thickness\_of\_precipitation\_amount\_for\_coupling

|             |  |
|-------------|--|
| long_name   | total rain precipitation                   |
| units       | m  |
| rank        | 1  |
| type        | real                                       |
| kind        | kind_phys                                  |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type |
| local_name  | physics%Coupling(cdata%blk_no)%rain_cpl    |
| requested   | GFS_MP_generic_post_run                    |
|             | GFS_surface_generic_pre_run                |
| physics set | physics                                    |

#### `lwe_thickness_of_precipitation_amount_on_dynamics_timestep`

|             |  |
|-------------|--|
| long_name   | total rain at this time step           |
| units       | m                                      |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%rain        |
| requested   | GFS_MP_generic_post_run                |
|             | cires_ugwp_run                         |
| physics set | physics                                |

#### `lwe_thickness_of_shallow_convective_precipitation_amount`

|             |  |
|-------------|--|
| long_name   | shallow convective rainfall amount on physics timestep |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type         |
| local_name  | physics%Interstitial(cdata%blk_no)%raincs              |
| requested   | GFS_SCNV_generic_post_run                              |
|             | samfshalcnv_run  |
| physics set | physics  |

#### lwe\_thickness\_of\_snow\_amount

|             |  |
|-------------|--|
| long_name   | explicit snow fall on physics timestep                                 |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                         |
| local_name  | physics%Interstitial(cdata%blk_no)%snowmp                              |
| requested   | GFS_MP_generic_post_run<br>gfdl_cloud_microphys_run<br>mp_thompson_run |
| physics set | physics  |

#### lwe\_thickness\_of\_snow\_amount\_for\_coupling

|             |  |
|-------------|--|
| long_name   | total snow precipitation                               |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type             |
| local_name  | physics%Coupling(cdata%blk_no)%snow_cpl                |
| requested   | GFS_MP_generic_post_run<br>GFS_surface_generic_pre_run |
| physics set | physics  |

#### lwe\_thickness\_of\_snow\_amount\_from\_previous\_timestep

|             |   |
|-------------|---|
| long_name   | snow amount from previous timestep        |
| units       | m   |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%snowprv     |
| requested   | GFS_MP_generic_post_run                   |
|             | lsm_ruc_run                               |
| physics set | physics                                   |

#### lwe\_thickness\_of\_snow\_amount\_on\_dynamics\_timestep

|             |  |
|-------------|--|
| long_name   | snow fall at this time step            |
| units       | m                                      |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%snow        |
| requested   | GFS_MP_generic_post_run                |
|             | m_micro_post_run                       |
| physics set | physics                                |

#### magnitude\_of\_perturbation\_of\_heat\_to\_momentum\_roughness\_length\_ratio

|             |  |
|-------------|--|
| long_name   | magnitude of perturbation of heat to momentum roughness length ratio |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                            |
| local_name  | physics%Model(cdata%blk_no)%pertz                                    |
| requested   | GFS_surface_generic_pre_run  |
| physics set | physics  |

#### magnitude\_of\_perturbation\_of\_leaf\_area\_index

|             |  |
|-------------|--|
| long_name   | magnitude of perturbation of leaf area index |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                    |
| source      | MODULE GFS_typedefs TYPE GFS_control_type    |
| local_name  | physics%Model(cdata%blk_no)%pertlai          |
| requested   | GFS_surface_generic_pre_run                  |
| physics set | physics                                      |

#### magnitude\_of\_perturbation\_of\_momentum\_roughness\_length

|             |  |
|-------------|--|
| long_name   | magnitude of perturbation of momentum roughness length |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type              |
| local_name  | physics%Model(cdata%blk_no)%pertz0                     |
| requested   | GFS_surface_generic_pre_run                            |
| physics set | physics  |

#### magnitude\_of\_perturbation\_of\_soil\_type\_b\_parameter

|             |  |
|-------------|--|
| long_name   | magnitude of perturbation of soil type b parameter |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type          |
| local_name  | physics%Model(cdata%blk_no)%pertshc                |
| requested   | GFS_surface_generic_pre_run                        |
| physics set | physics  |



#### magnitude\_of\_perturbation\_of\_vegetation\_fraction

|             |  |
|-------------|--|
| long_name   | magnitude of perturbation of vegetation fraction |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type        |
| local_name  | physics%Model(cdata%blk_no)%pertvegf             |
| requested   | GFS_surface_generic_pre_run                      |
|             | lsm_noah_run                                     |
| physics set | physics  |

#### magnitude\_of\_surface\_albedo\_perturbation

|             |   |
|-------------|---|
| long_name   | magnitude of surface albedo perturbation  |
| units       | frac                                      |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%pertalb       |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### map\_of\_block\_column\_number\_to\_global\_i\_index

|             |  |
|-------------|--|
| long_name   | map of local index ix to global index i for this block |
| units       | none   |
| rank        | 1  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type                  |
| local_name  | physics%Tbd(cdata%blk_no)%imap                         |
| requested   | NOT REQUESTED  |
| physics set |  |

#### map\_of\_block\_column\_number\_to\_global\_j\_index

|             |  |
|-------------|--|
| long_name   | map of local index ix to global index j for this block |
| units       | none   |
| rank        | 1  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type                  |
| local_name  | physics%Tbd(cdata%blk_no)%jmap                         |
| requested   | NOT REQUESTED  |
| physics set |  |

#### mass\_fraction\_of\_convective\_cloud\_ice

|             |  |
|-------------|--|
| long_name   | mass fraction of convective cloud ice water                      |
| units       | kg kg-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                   |
| local_name  | physics%Interstitial(cdata%blk_no)%qicn                          |
| requested   | cs_conv_run<br>m_micro_pre_run<br>m_micro_run<br>samfdeepcnv_run |
| physics set | physics  |

#### mass\_fraction\_of\_convective\_cloud\_liquid\_water

|             |  |
|-------------|--|
| long_name   | mass fraction of convective cloud liquid water                   |
| units       | kg kg-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                   |
| local_name  | physics%Interstitial(cdata%blk_no)%qlcn                          |
| requested   | cs_conv_run<br>m_micro_pre_run<br>m_micro_run<br>samfdeepcnv_run |
| physics set | physics  |

#### mass\_weighted\_rime\_factor\_mixing\_ratio

|             |   |
|-------------|---|
| long_name   | the ratio of the mass of rime factor to mass of dry air |
| units       | kg kg-1   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type          |
| local_name  | physics%Interstitial(cdata%blk_no)%qg_r                 |
| requested   | NOT REQUESTED   |
| physics set |   |

#### mass\_weighted\_rime\_factor\_updated\_by\_physics

long\_name mass weighted rime factor updated by physics  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_stateout\_type  
local\_name physics%Stateout(cdata%blk\_no)%gq0(:, :, physics%Model(cdata%blk\_no)%nqrimef)  
requested NOT REQUESTED  
physics set

#### maximum\_column\_heating\_rate

long\_name maximum heating rate in column  
units K s-1  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%cumabs  
requested NOT REQUESTED  
physics set

#### maximum\_critical\_relative\_humidity

long\_name maximum critical relative humidity  
units frac  
rank 0  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name physics%Model(cdata%blk\_no)%rhcmx  
requested GFS\_suite\_interstitial\_3\_run  
physics set physics

#### maximum\_mass\_flux

|             |  |
|-------------|--|
| long_name   | maximum mass flux within a column      |
| units       | m s-1                                  |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%maxMF       |
| requested   | mynnedmf_wrapper_run                   |
| physics set | physics                                |

#### maximum\_reflectivity\_at\_1km\_agl\_over\_maximum\_hourly\_time\_interval

|             |   |
|-------------|---|
| long_name   | maximum reflectivity at 1km agl over maximum hourly time interval |
| units       | dBZ   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                            |
| local_name  | physics%Diag(cdata%blk_no)%refdmax                                |
| requested   | maximum_hourly_diagnostics_run                                    |
| physics set | physics   |

#### maximum\_reflectivity\_at\_minus10c\_over\_maximum\_hourly\_time\_interval

|             |  |
|-------------|--|
| long_name   | maximum reflectivity at minus10c over maximum hourly time interval |
| units       | dBZ  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                             |
| local_name  | physics%Diag(cdata%blk_no)%refdmax263k                             |
| requested   | maximum_hourly_diagnostics_run                                     |
| physics set | physics  |

#### maximum\_relytive\_humidity\_at\_2m\_over\_maximum\_hourly\_time\_interval

|             |   |
|-------------|---|
| long_name   | maximum relative humidity at 2m over maximum hourly time interval |
| units       | %   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                            |
| local_name  | physics%Diag(cdata%blk_no)%rh02max                                |
| requested   | maximum_hourly_diagnostics_run                                    |
| physics set | physics   |

#### maximum\_scaling\_factor\_for\_critical\_relative\_humidity

|             |   |
|-------------|---|
| long_name   | maximum scaling factor for critical relative humidity |
| units       | m2 rad-2  |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type             |
| local_name  | physics%Model(cdata%blk_no)%dxmax                     |
| requested   | NOT REQUESTED   |
| physics set |   |

#### maximum\_specific\_humidity\_at\_2m

|             |  |
|-------------|--|
| long_name   | maximum specific humidity at 2m height |
| units       | kg kg-1                                |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%spfhmax     |
| requested   | sfc_diag_post_run                      |
| physics set | physics                                |

#### maximum\_subgrid\_orography

|             |  |
|-------------|--|
| long_name   | maximum of subgrid orography   |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                           |
| local_name  | physics%Interstitial(cdata%blk_no)%elvmax                                |
| requested   | GFS_GWD_generic_pre_run<br>cires_ugwp_run<br>drag_suite_run<br>gwdps_run |
| physics set | physics  |

#### maximum\_temperature\_at\_2m

|             |  |
|-------------|--|
| long_name   | max temperature at 2m height           |
| units       | K                                      |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%tmpmax      |
| requested   | sfc_diag_post_run                      |
| physics set | physics                                |

#### maximum\_temperature\_at\_2m\_over\_maximum\_hourly\_time\_interval

|             |   |
|-------------|---|
| long_name   | maximum temperature at 2m over maximum hourly time interval |
| units       | K   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                      |
| local_name  | physics%Diag(cdata%blk_no)%t02max                           |
| requested   | maximum_hourly_diagnostics_run                              |
| physics set | physics   |

#### maximum\_u\_wind\_at\_10m\_over\_maximum\_hourly\_time\_interval

|             |   |
|-------------|---|
| long_name   | maximum u wind at 10m over maximum hourly time interval |
| units       | m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                  |
| local_name  | physics%Diag(cdata%blk_no)%u10max                       |
| requested   | maximum_hourly_diagnostics_run                          |
| physics set | physics   |

#### maximum\_updraft\_velocity\_at\_cloud\_base

|             |  |
|-------------|--|
| long_name   | maximum updraft velocity at cloud base         |
| units       | m s-1  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%wcbmax      |
| requested   | cs_conv_pre_run                                |
|             | cs_conv_run                                    |
| physics set | physics  |



#### maximum\_v\_wind\_at\_10m\_over\_maximum\_hourly\_time\_interval

|             |   |
|-------------|---|
| long_name   | maximum v wind at 10m over maximum hourly time interval |
| units       | m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                  |
| local_name  | physics%Diag(cdata%blk_no)%v10max                       |
| requested   | maximum_hourly_diagnostics_run                          |
| physics set | physics   |

#### maximum\_vegetation\_area\_fraction

|             |  |
|-------------|--|
| long_name   | max fractional coverage of green vegetation                  |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type                    |
| local_name  | physics%Sfcprop(cdata%blk_no)%shdmax                         |
| requested   | lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run<br>sfc_diff_run |
| physics set | physics  |

#### maximum\_wind\_at\_10m

|             |  |
|-------------|--|
| long_name   | maximum wind speed at 10 m             |
| units       | m s-1                                  |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%wind10mmax  |
| requested   | sfc_diag_post_run                      |
| physics set | physics                                |

#### maximum\_wind\_at\_10m\_over\_maximum\_hourly\_time\_interval

|             |   |
|-------------|---|
| long_name   | maximum wind at 10m over maximum hourly time interval |
| units       | m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                |
| local_name  | physics%Diag(cdata%blk_no)%spd10max                   |
| requested   | maximum_hourly_diagnostics_run                        |
| physics set | physics   |

#### maximum\_x\_wind\_at\_10m

|             |  |
|-------------|--|
| long_name   | maximum x wind at 10 m                 |
| units       | m s-1                                  |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%u10mmax     |
| requested   | sfc_diag_post_run                      |
| physics set | physics                                |

#### maximum\_y\_wind\_at\_10m

|             |  |
|-------------|--|
| long_name   | maximum y wind at 10 m                 |
| units       | m s-1                                  |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%v10mmax     |
| requested   | sfc_diag_post_run                      |
| physics set | physics                                |

#### mean\_change\_over\_depth\_in\_sea\_water\_temperature

|             |  |
|-------------|--|
| long_name   | mean of dT(z) (zsea1 to zsea2)                 |
| units       | K  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%dtzm        |
| requested   | sfc_nst_post_run                               |
| physics set | physics  |

#### mean\_effective\_radius\_for\_ice\_cloud

|             |  |
|-------------|--|
| long_name   | mean effective radius for ice cloud                                  |
| units       | micron   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                       |
| local_name  | physics%Interstitial(cdata%blk_no)%clouds(:, :, 5)                   |
| requested   | GFS_rrtmg_pre_run<br>mynnrad_pre_run<br>rrtmg_lw_run<br>rrtmg_sw_run |
| physics set | physics  |

#### mean\_effective\_radius\_for\_liquid\_cloud

|             |  |
|-------------|--|
| long_name   | mean effective radius for liquid cloud                               |
| units       | micron   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                       |
| local_name  | physics%Interstitial(cdata%blk_no)%clouds(:, :, 3)                   |
| requested   | GFS_rrtmg_pre_run<br>mynnrad_pre_run<br>rrtmg_lw_run<br>rrtmg_sw_run |
| physics set | physics  |

#### mean\_effective\_radius\_for\_rain\_drop

|             |  |
|-------------|--|
| long_name   | mean effective radius for rain drop                |
| units       | micron   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type     |
| local_name  | physics%Interstitial(cdata%blk_no)%clouds(:, :, 7) |
| requested   | GFS_rrtmg_pre_run<br>rrtmg_lw_run<br>rrtmg_sw_run  |
| physics set | physics  |

#### mean\_effective\_radius\_for\_snow\_flake

|             |  |
|-------------|--|
| long_name   | mean effective radius for snow flake               |
| units       | micron   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type     |
| local_name  | physics%Interstitial(cdata%blk_no)%clouds(:, :, 9) |
| requested   | GFS_rrtmg_pre_run<br>rrtmg_lw_run<br>rrtmg_sw_run  |
| physics set | physics  |

#### mean\_nir\_albedo\_with\_weak\_cosz\_dependency

|             |   |
|-------------|---|
| long_name   | mean nir albedo with weak cosz dependency |
| units       | frac                                      |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%alnwf       |
| requested   | lsm_ruc_run                               |
| physics set | physics                                   |

#### mean\_vis\_albedo\_with\_weak\_cosz\_dependency

|             |   |
|-------------|---|
| long_name   | mean vis albedo with weak cosz dependency |
| units       | frac                                      |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%alvwf       |
| requested   | lsm_ruc_run                               |
| physics set | physics                                   |

#### mg\_allow\_supersat\_after\_sed

|             |   |
|-------------|---|
| long_name   | allow supersaturation after sedimentation for MG microphysics |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                     |
| local_name  | physics%Model(cdata%blk_no)%sed_supersat                      |
| requested   | m_micro_init  |
| physics set | physics   |

#### mg\_autoconversion\_size\_threshold\_ice\_snow

|             |   |
|-------------|---|
| long_name   | autoconversion size threshold for cloud ice to snow for MG microphysics |
| units       | um  |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                               |
| local_name  | physics%Model(cdata%blk_no)%mg_dcs                                      |
| requested   | m_micro_init  |
| physics set | physics   |

#### mg\_bergeron\_efficiency\_factor

|             |  |
|-------------|--|
| long_name   | bergeron efficiency factor for MG microphysics |
| units       | frac   |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_control_type      |
| local_name  | physics%Model(cdata%blk_no)%mg_berg_eff_factor |
| requested   | m_micro_init                                   |
| physics set | physics  |

#### mg\_cloud\_water\_variance

|             |   |
|-------------|---|
| long_name   | cloud water relative variance for MG microphysics |
| units       |   |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type         |
| local_name  | physics%Model(cdata%blk_no)%mg_qcvar              |
| requested   | m_micro_init                                      |
| physics set | physics   |

#### mg\_drop\_concentration\_constant

|             |  |
|-------------|--|
| long_name   | droplet concentration constant for MG microphysics |
| units       | m-3  |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type          |
| local_name  | physics%Model(cdata%blk_no)%mg_ncnst               |
| requested   | m_micro_init                                       |
| physics set | physics  |

#### mg\_flag\_drop\_concentration\_constant

|             |   |
|-------------|---|
| long_name   | flag for constant droplet concentration for MG microphysics |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                   |
| local_name  | physics%Model(cdata%blk_no)%mg_nccons                       |
| requested   | m_micro_init  |
| physics set | physics   |

#### mg\_flag\_for\_cloud\_ice\_processes

|             |  |
|-------------|--|
| long_name   | flag for cloud ice processes for MG microphysics |
| units       | flag   |
| rank        | 0  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type        |
| local_name  | physics%Model(cdata%blk_no)%do_cldice            |
| requested   | m_micro_init                                     |
| physics set | physics  |



#### mg\_flag\_for\_gmao\_ice\_formulation

|             |  |
|-------------|--|
| long_name   | flag for gmao ice formulation              |
| units       | flag                                       |
| rank        | 0  |
| type        | logical                                    |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%mg_do_ice_gmao |
| requested   | m_micro_init                               |
| physics set | physics                                    |

#### mg\_flag\_for\_graupel

|             |   |
|-------------|---|
| long_name   | flag for graupel for MG microphysics (hail possible if false) |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                     |
| local_name  | physics%Model(cdata%blk_no)%mg_do_graupel                     |
| requested   | m_micro_init  |
| physics set | physics   |

#### mg\_flag\_for\_hail

|             |   |
|-------------|---|
| long_name   | flag for hail for MG microphysics (graupel possible if false) |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                     |
| local_name  | physics%Model(cdata%blk_no)%mg_do_hail                        |
| requested   | m_micro_init  |
| physics set | physics   |

#### mg\_flag\_for\_heterogeneous\_freezing

|             |   |
|-------------|---|
| long_name   | flag for heterogeneous freezing for MG microphysics |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type           |
| local_name  | physics%Model(cdata%blk_no)%hetfrz_classnuc         |
| requested   | m_micro_init  |
| physics set | physics   |

#### mg\_flag\_for\_liu\_liquid\_treatment

|             |   |
|-------------|---|
| long_name   | flag for liu liquid treatment             |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%mg_do_liq_liu |
| requested   | m_micro_init                              |
| physics set | physics                                   |

#### mg\_flag\_for\_sb2001\_autoconversion

|             |  |
|-------------|--|
| long_name   | flag for SB 2001 autoconversion or accretion for MG microphysics |
| units       | flag   |
| rank        | 0  |
| type        | logical  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                        |
| local_name  | physics%Model(cdata%blk_no)%do_sb_physics                        |
| requested   | m_micro_init   |
| physics set | physics  |

#### mg\_flag\_for\_uniform\_subcolumns

|             |   |
|-------------|---|
| long_name   | flag for uniform subcolumns for MG microphysics |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type       |
| local_name  | physics%Model(cdata%blk_no)%microp_uniform      |
| requested   | m_micro_init                                    |
| physics set | physics   |

#### mg\_flag\_graupel\_concentration\_constant

|             |   |
|-------------|---|
| long_name   | flag for constant graupel concentration for MG microphysics |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                   |
| local_name  | physics%Model(cdata%blk_no)%mg_ngcons                       |
| requested   | m_micro_init  |
| physics set | physics   |

#### mg\_flag\_ice\_concentration\_constant

|             |   |
|-------------|---|
| long_name   | flag for constant ice concentration for MG microphysics |
| units       | flag  |
| rank        | 0   |
| type        | logical   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type               |
| local_name  | physics%Model(cdata%blk_no)%mg_nicons                   |
| requested   | m_micro_init  |
| physics set | physics   |

#### mg\_graupel\_concentration\_constant

|             |  |
|-------------|--|
| long_name   | graupel concentration constant for MG microphysics |
| units       | m-3  |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type          |
| local_name  | physics%Model(cdata%blk_no)%mg_ngnst               |
| requested   | m_micro_init                                       |
| physics set | physics  |

#### mg\_ice\_concentration\_constant

|             |  |
|-------------|--|
| long_name   | ice concentration constant for MG microphysics |
| units       | m-3  |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_control_type      |
| local_name  | physics%Model(cdata%blk_no)%mg_ninst           |
| requested   | m_micro_init                                   |
| physics set | physics  |

#### mg\_minimum\_cloud\_condensed\_water\_and\_ice\_mixing\_ratio

|             |   |
|-------------|---|
| long_name   | minimum cloud condensed water and ice mixing ratio in MG macro clouds |
| units       | kg kg-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                             |
| local_name  | physics%Model(cdata%blk_no)%mg_qcmin                                  |
| requested   | m_micro_run   |
| physics set | physics   |

#### mg\_minimum\_cloud\_condensed\_water\_mixing\_ratio

|             |   |
|-------------|---|
| long_name   | minimum cloud condensed water mixing ratio in MG macro clouds |
| units       | kg kg-1   |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                     |
| local_name  | physics%Model(cdata%blk_no)%mg_qcmin(1)                       |
| requested   | NOT REQUESTED   |
| physics set |   |

#### mg\_minimum\_ice\_mixing\_ratio

|             |   |
|-------------|---|
| long_name   | minimum ice mixing ratio in MG macro clouds |
| units       | kg kg-1                                     |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys                                   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%mg_qcmin(2)     |
| requested   | NOT REQUESTED                               |
| physics set |   |

#### mg\_minimum\_rh\_for\_ice

|             |  |
|-------------|--|
| long_name   | relative humidity threshold parameter for nucleating ice for MG microphysics |
| units       | none   |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                                    |
| local_name  | physics%Model(cdata%blk_no)%mg_rhmini  |
| requested   | m_micro_init   |
| physics set | physics  |

#### mg\_time\_scale\_for\_autoconversion\_of\_ice

|             |   |
|-------------|---|
| long_name   | autoconversion time scale for ice for MG microphysics |
| units       | s   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type             |
| local_name  | physics%Model(cdata%blk_no)%mg_ts_auto_ice            |
| requested   | m_micro_init  |
| physics set | physics   |

#### mg\_tuning\_factor\_for\_alphas

|             |   |
|-------------|---|
| long_name   | tuning factor for alphas (alpha = 1 - critical relative humidity) |
| units       | none  |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                         |
| local_name  | physics%Model(cdata%blk_no)%mg_alf                                |
| requested   | m_micro_run   |
| physics set | physics   |

#### mg\_type\_of\_precip\_fraction\_method

|             |  |
|-------------|--|
| long_name   | type of precip fraction method for MG microphysics (in_cloud or max_overlap) |
| units       | none   |
| rank        | 0  |
| type        | character  |
| kind        | len=16   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                                    |
| local_name  | physics%Model(cdata%blk_no)%mg_precip_frac_method                            |
| requested   | m_micro_init   |
| physics set | physics  |

#### minimum\_large\_ice\_fraction

|             |   |
|-------------|---|
| long_name   | minimum large ice fraction in F-A mp scheme |
| units       | frac  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys                                   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%flgmin          |
| requested   | NOT REQUESTED                               |
| physics set |   |

#### minimum\_relative\_humidity\_at\_2m\_over\_maximum\_hourly\_time\_interval

|             |   |
|-------------|---|
| long_name   | minumum relative humidity at 2m over maximum hourly time interval |
| units       | %   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                            |
| local_name  | physics%Diag(cdata%blk_no)%rh02min                                |
| requested   | maximum_hourly_diagnostics_run                                    |
| physics set | physics   |

#### minimum\_scaling\_factor\_for\_critical\_relative\_humidity

|             |   |
|-------------|---|
| long_name   | minimum scaling factor for critical relative humidity |
| units       | m2 rad-2  |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type             |
| local_name  | physics%Model(cdata%blk_no)%dxmin                     |
| requested   | GFS_suite_interstitial_1_run                          |
| physics set | physics   |

#### minimum\_sea\_ice\_concentration

|             |                                    |
|-------------|------------------------------------|
| long_name   | minimum sea ice concentration      |
| units       | frac                               |
| rank        | 0                                  |
| type        | real                               |
| kind        | kind_phys                          |
| source      | MODULE gmtb_scm_physical_constants |
| local_name  | cimin                              |
| requested   | GFS_surface_composites_pre_run     |
| physics set | physics                            |

#### minimum\_specific\_humidity\_at\_2m

|             |  |
|-------------|--|
| long_name   | minimum specific humidity at 2m height |
| units       | kg kg-1                                |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%spfhmin     |
| requested   | sfc_diag_post_run                      |
| physics set | physics                                |

#### minimum\_temperature\_at\_2m

|             |  |
|-------------|--|
| long_name   | min temperature at 2m height           |
| units       | K                                      |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%tmpmin      |
| requested   | sfc_diag_post_run                      |
| physics set | physics                                |



#### minimum\_temperature\_at\_2m\_over\_maximum\_hourly\_time\_interval

|             |   |
|-------------|---|
| long_name   | minumum temperature at 2m over maximum hourly time interval |
| units       | K   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                      |
| local_name  | physics%Diag(cdata%blk_no)%t02min                           |
| requested   | maximum_hourly_diagnostics_run                              |
| physics set | physics   |

#### minimum\_value\_of\_specific\_humidity

|             |                                    |
|-------------|------------------------------------|
| long_name   | floor value for specific humidity  |
| units       | kg kg-1                            |
| rank        | 0                                  |
| type        | real                               |
| kind        | kind_phys                          |
| source      | MODULE gmtb_scm_physical_constants |
| local_name  | con_epsq                           |
| requested   | NOT REQUESTED                      |
| physics set |                                    |

#### minimum\_vegetation\_area\_fraction

|             |  |
|-------------|--|
| long_name   | min fractional coverage of green vegetation  |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                    |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type    |
| local_name  | physics%Sfcprop(cdata%blk_no)%shdmin         |
| requested   | lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run |
| physics set | physics                                      |

#### mix\_total\_water\_flag

|             |   |
|-------------|---|
| long_name   | flag to mix total water or individual species |
| units       | flag  |
| rank        | 0   |
| type        | integer                                       |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type     |
| local_name  | physics%Model(cdata%blk_no)%bl_mynn_mixqt     |
| requested   | mynnedmf_wrapper_run                          |
| physics set | physics                                       |

#### `mixing_length`

|                          |   |
|--------------------------|---|
| <code>long_name</code>   | mixing length in meters                     |
| <code>units</code>       | m   |
| <code>rank</code>        | 2   |
| <code>type</code>        | real  |
| <code>kind</code>        | kind_phys                                   |
| <code>source</code>      | MODULE GFS_typedefs TYPE GFS_tbd_type       |
| <code>local_name</code>  | physics%Tbd(cdata%blk_no)%el_pbl            |
| <code>requested</code>   | mynnedmf_wrapper_run<br>mynnsfc_wrapper_run |
| <code>physics set</code> | physics                                     |

#### `mixing_length_flag`

|                          |   |
|--------------------------|---|
| <code>long_name</code>   | flag to determine which mixing length form to use |
| <code>units</code>       | flag  |
| <code>rank</code>        | 0   |
| <code>type</code>        | integer   |
| <code>kind</code>        |   |
| <code>source</code>      | MODULE GFS_typedefs TYPE GFS_control_type         |
| <code>local_name</code>  | physics%Model(cdata%blk_no)%bl_mynn_mixlength     |
| <code>requested</code>   | mynnedmf_wrapper_run                              |
| <code>physics set</code> | physics   |

#### `model_layer_number_at_cloud_base`

|                          |   |
|--------------------------|---|
| <code>long_name</code>   | vertical indices for low, middle and high cloud bases |
| <code>units</code>       | index   |
| <code>rank</code>        | 2   |
| <code>type</code>        | integer   |
| <code>kind</code>        |   |
| <code>source</code>      | MODULE GFS_typedefs TYPE GFS_interstitial_type        |
| <code>local_name</code>  | physics%Interstitial(cdata%blk_no)%mbota              |
| <code>requested</code>   | GFS_rrtmg_post_run<br>GFS_rrtmg_pre_run               |
| <code>physics set</code> | physics   |

#### model\_layer\_number\_at\_cloud\_top

long\_name     vertical indices for low, middle and high cloud tops  
units         index  
rank          2  
type          integer  
kind  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%mtopa  
requested     GFS\_rrtmg\_post\_run  
              GFS\_rrtmg\_pre\_run  
physics set   physics

#### moisture\_from\_previous\_timestep

long\_name     moisture from previous time step  
units         kg kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name    physics%Tbd(cdata%blk\_no)%prevsq  
requested     cu\_gf\_driver\_post\_run  
              cu\_gf\_driver\_pre\_run  
              cu\_ntiedtke\_post\_run  
              cu\_ntiedtke\_pre\_run  
physics set   physics

#### moisture\_tendency\_due\_to\_dynamics

long\_name moisture tendency due to dynamics only  
units kg kg-1 s-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name physics%Tbd(cdata%blk\_no)%forceq  
requested cu\_gf\_driver\_pre\_run  
cu\_gf\_driver\_run  
cu\_ntiedtke\_pre\_run  
cu\_ntiedtke\_run  
physics set physics

#### momentum\_exchange\_coefficient\_for\_MYJ\_schemes

long\_name surface momentum exchange\_coefficient for MYJ schemes  
units m s-1  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name physics%Tbd(cdata%blk\_no)%phy\_myj\_akms  
requested NOT REQUESTED  
physics set

#### momentum\_transport\_reduction\_factor\_pgf\_deep\_convection

|             |   |
|-------------|---|
| long_name   | reduction factor in momentum transport due to deep convection induced pressure gradient force |
| units       | frac  |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%pgcon_deep  |
| requested   | samfdeepcnv_run   |
| physics set | physics   |

#### momentum\_transport\_reduction\_factor\_pgf\_shallow\_convection

|             |  |
|-------------|--|
| long_name   | reduction factor in momentum transport due to shallow convection induced pressure gradient force |
| units       | frac   |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%pgcon_shal   |
| requested   | samfshalcnv_run  |
| physics set | physics  |

```

mpi_comm
  long_name    MPI communicator
  units        index
  rank         0
  type         integer
  kind
  source       MODULE GFS_typedefs TYPE GFS_control_type
  local_name   physics%Model(cdata%blk_no)%communicator
  requested    mp_thompson_init
               mp_thompson_post_run
               mp_thompson_run
  physics set  physics

```

## mpi\_rank

|             |  |
|-------------|--|
| long_name   | current MPI-rank   |
| units       | index  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%me   |
| requested   | GFS_rrtmg_setup_init<br>GFS_rrtmg_setup_run<br>GFS_time_vary_pre_run<br>cires_ugwp_init<br>cires_ugwp_run<br>cs_conv_run<br>cu_gf_driver_init<br>cu_ntiedtke_init<br>drag_suite_run<br>gfdl_cloud_microphys_init<br>gwdps_run<br>h2ophys_run<br>lsm_noah_init<br>lsm_ruc_init<br>lsm_ruc_run<br>moninshoc_run<br>mp_thompson_init<br>mp_thompson_post_run<br>mp_thompson_pre_run<br>mp_thompson_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>noahmpdrv_init<br>ozphys_2015_run<br>ozphys_run<br>shoc_run |
| physics set | physics  |



#### mpi\_root

|             |   |
|-------------|---|
| long_name   | master MPI-rank   |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%master  |
| requested   | GFS_time_vary_pre_run<br>cires_ugwp_init<br>cires_ugwp_run<br>cu_gf_driver_init<br>cu_ntiedtke_init<br>drag_suite_run<br>gfdl_cloud_microphys_init<br>lsm_ruc_run<br>mp_thompson_init<br>mp_thompson_post_run<br>mp_thompson_pre_run<br>mp_thompson_run |
| physics set | physics   |

#### mpi\_size

|             |   |
|-------------|---|
| long_name   | number of MPI tasks in communicator       |
| units       | count                                     |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%ntasks        |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### `multiplication_factors_for_convective_gravity_wave_drag`

|                          |   |
|--------------------------|---|
| <code>long_name</code>   | <code>multiplication factor for convective GWD</code>     |
| <code>units</code>       | <code>none</code>   |
| <code>rank</code>        | <code>1</code>  |
| <code>type</code>        | <code>real</code>   |
| <code>kind</code>        | <code>kind_phys</code>                                    |
| <code>source</code>      | <code>MODULE GFS_typedefs TYPE GFS_control_type</code>    |
| <code>local_name</code>  | <code>physics%Model(cdata%blk_no)%cgwf</code>             |
| <code>requested</code>   | <code>cires_ugwp_init</code><br><code>gwdc_pre_run</code> |
| <code>physics set</code> | <code>physics</code>                                      |

#### `multiplication_factors_for_mountain_blocking_and_orographic_gravity_wave_drag`

|                          |  |
|--------------------------|--|
| <code>long_name</code>   | <code>multiplication factors for cdmf and gwd</code>   |
| <code>units</code>       | <code>none</code>  |
| <code>rank</code>        | <code>1</code>   |
| <code>type</code>        | <code>real</code>  |
| <code>kind</code>        | <code>kind_phys</code>   |
| <code>source</code>      | <code>MODULE GFS_typedefs TYPE GFS_control_type</code>   |
| <code>local_name</code>  | <code>physics%Model(cdata%blk_no)%cdmbgwd</code>   |
| <code>requested</code>   | <code>cires_ugwp_init</code><br><code>cires_ugwp_run</code><br><code>drag_suite_run</code><br><code>gwdps_run</code> |
| <code>physics set</code> | <code>physics</code>   |

#### namelist\_filename

|             |  |
|-------------|--|
| long_name   | namelist filename                            |
| units       | none   |
| rank        | 0  |
| type        | character                                    |
| kind        | len=64                                       |
| source      | MODULE GFS_typedefs TYPE GFS_control_type    |
| local_name  | physics%Model(cdata%blk_no)%fn_nml           |
| requested   | cires_ugwp_init<br>gfdl_cloud_microphys_init |
| physics set | physics                                      |

#### namelist\_filename\_for\_internal\_file\_reads

|             |  |
|-------------|--|
| long_name   | namelist filename for internal file reads    |
| units       | none   |
| rank        | 1  |
| type        | character                                    |
| kind        | len=256                                      |
| source      | MODULE GFS_typedefs TYPE GFS_control_type    |
| local_name  | physics%Model(cdata%blk_no)%input_nml_file   |
| requested   | cires_ugwp_init<br>gfdl_cloud_microphys_init |
| physics set | physics                                      |

#### natural\_log\_of\_h2o\_forcing\_data\_pressure\_levels

|             |   |
|-------------|---|
| long_name   | natural log of h2o forcing data pressure levels |
| units       | log(Pa)   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys                                       |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%h2o_pres     |
| requested   | h2ophys_run                                     |
| physics set | physics   |

#### natural\_log\_of\_ozone\_forcing\_data\_pressure\_levels

|             |   |
|-------------|---|
| long_name   | natural log of ozone forcing data pressure levels |
| units       | log(Pa)   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type    |
| local_name  | physics%Interstitial(cdata%blk_no)%oz_pres        |
| requested   | ozphys_2015_run                                   |
|             | ozphys_run  |
| physics set | physics   |

#### netcdf\_float\_fillvalue

|             |                                      |
|-------------|--------------------------------------|
| long_name   | definition of NetCDF float FillValue |
| units       | none                                 |
| rank        | 0                                    |
| type        | real                                 |
| kind        | kind_phys                            |
| source      | MODULE GFS_typedefs                  |
| local_name  | huge                                 |
| requested   | GFS_suite_interstitial_2_run         |
| physics set | physics                              |

#### nondimensional\_snow\_age

|             |   |
|-------------|---|
| long_name   | non-dimensional snow age                  |
| units       | none                                      |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%taussxy     |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### nonnegative\_lwe\_thickness\_of\_precipitation\_amount\_on\_dynamics\_timestep

|             |  |
|-------------|--|
| long_name   | total precipitation amount in each time step   |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type  |
| local_name  | physics%Sfcprop(cdata%blk_no)%tprcp  |
| requested   | GFS_MP_generic_post_run<br>GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run |
| physics set | physics  |

#### nonnegative\_lwe\_thickness\_of\_precipitation\_amount\_on\_dynamics\_timestep\_over\_ice

|             |   |
|-------------|---|
| long_name   | total precipitation amount in each time step over ice                             |
| units       | m   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                                    |
| local_name  | physics%Interstitial(cdata%blk_no)%tprcp_ice                                      |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>sfc_sice_run |
| physics set | physics   |

nonnegative\_lwe\_thickness\_of\_precipitation\_amount\_on\_dynamics\_timestep\_over\_land

|             |  |
|-------------|--|
| long_name   | total precipitation amount in each time step over land   |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%tprcp_land  |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>lsm_noah_run<br>noahmpdrv_run |
| physics set | physics  |

nonnegative\_lwe\_thickness\_of\_precipitation\_amount\_on\_dynamics\_timestep\_over\_ocean

|             |  |
|-------------|--|
| long_name   | total precipitation amount in each time step over ocean                          |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                                   |
| local_name  | physics%Interstitial(cdata%blk_no)%tprcp_ocean                                   |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>sfc_nst_run |
| physics set | physics  |

#### normalized\_soil\_wetness

|             |  |
|-------------|--|
| long_name   | normalized soil wetness                |
| units       | frac                                   |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%wet1        |
| requested   | lsm_noah_run                           |
|             | noahmpdrv_run                          |
| physics set | physics                                |

#### normalized\_soil\_wetness\_for\_land\_surface\_model

|             |   |
|-------------|---|
| long_name   | normalized soil wetness for lsm           |
| units       | frac                                      |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%wetness     |
| requested   | lsm_ruc_run                               |
| physics set | physics                                   |

#### number\_concentration\_of\_cloud\_liquid\_water\_particles\_for\_detrainment

|             |  |
|-------------|--|
| long_name   | droplet number concentration in convective detrainment |
| units       | m-3  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type         |
| local_name  | physics%Interstitial(cdata%blk_no)%cnv_ndrop           |
| requested   | cs_conv_run<br>m_micro_run<br>samfdeepcnv_run          |
| physics set | physics  |

#### number\_concentration\_of\_ice\_crystals\_for\_detrainment

|             |  |
|-------------|--|
| long_name   | crystal number concentration in convective detrainment |
| units       | m-3  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type         |
| local_name  | physics%Interstitial(cdata%blk_no)%cnv_nice            |
| requested   | cs_conv_run<br>m_micro_run<br>samfdeepcnv_run          |
| physics set | physics  |



#### number\_of\_3d\_arrays\_associated\_with\_pdf\_based\_clouds

|             |  |
|-------------|--|
| long_name   | number of 3d arrays associated with pdf based clouds/mp                        |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                                      |
| local_name  | physics%Model(cdata%blk_no)%npdf3d   |
| requested   | GFS_DCNV_generic_post_run<br>GFS_SCNV_generic_post_run<br>GFS_rrtmg_setup_init |
| physics set | physics  |

#### number\_of\_aerosol\_bands\_for\_longwave\_radiation

|             |  |
|-------------|--|
| long_name   | number of aerosol bands for longwave radiation |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%nbdlw       |
| requested   | NOT REQUESTED                                  |
| physics set |  |

#### number\_of\_aerosol\_bands\_for\_shortwave\_radiation

|             |   |
|-------------|---|
| long_name   | number of aerosol bands for shortwave radiation |
| units       | count   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%nbdsw        |
| requested   | NOT REQUESTED                                   |
| physics set |   |

#### number\_of\_aerosol\_output\_fields\_for\_longwave\_radiation

long\_name     number of aerosol output fields for longwave radiation  
units         count  
rank          0  
type          integer  
kind  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%nf\_aelw  
requested     NOT REQUESTED  
physics set

#### number\_of\_aerosol\_output\_fields\_for\_shortwave\_radiation

long\_name     number of aerosol output fields for shortwave radiation  
units         count  
rank          0  
type          integer  
kind  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%nf\_aesw  
requested     NOT REQUESTED  
physics set

#### number\_of\_aerosol\_tracers\_MG

long\_name     number of aerosol tracers for Morrison Gettelman MP  
units         count  
rank          0  
type          integer  
kind  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%ntrcaer  
requested     NOT REQUESTED  
physics set

#### number\_of\_aerosol\_tracers\_for\_convection

|             |   |
|-------------|---|
| long_name   | number of aerosol tracers transported/scavenged by convection |
| units       | count   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                |
| local_name  | physics%Interstitial(cdata%blk_no)%itc                        |
| requested   | samfdeepcnv_run<br>samfshalcnv_run                            |
| physics set | physics   |

#### number\_of\_blocks

|             |  |
|-------------|--|
| long_name   | for explicit data blocking: number of blocks |
| units       | count  |
| rank        | 0  |
| type        | integer                                      |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type    |
| local_name  | physics%Model(cdata%blk_no)%nblks            |
| requested   | NOT REQUESTED                                |
| physics set |  |

#### number\_of\_chemical\_tracers

|             |   |
|-------------|---|
| long_name   | number of chemical tracers  |
| units       | count   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%ntchm   |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>samfdeepcnv_run<br>samfshalcnv_run |
| physics set | physics   |

#### number\_of\_chemical\_tracers\_for\_diagnostics

|             |  |
|-------------|--|
| long_name   | number of chemical tracers for diagnostic output |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type           |
| local_name  | physics%Diag(cdata%blk_no)%ntchmdiag             |
| requested   | NOT REQUESTED                                    |
| physics set |  |

#### number\_of\_cloud\_condensate\_types

|             |   |
|-------------|---|
| long_name   | number of cloud condensate types          |
| units       | count                                     |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%ncnd          |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### number\_of\_cloud\_types\_CS

|             |  |
|-------------|--|
| long_name   | number of cloud types in Chikira-Sugiyama scheme |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type        |
| local_name  | physics%Model(cdata%blk_no)%nctp                 |
| requested   | cs_conv_run                                      |
| physics set | physics  |

#### number\_of\_coefficients\_in\_h2o\_forcing\_data

|             |  |
|-------------|--|
| long_name   | number of coefficients in h2o forcing data     |
| units       | index  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%h2o_coeff   |
| requested   | h2ophys_run                                    |
| physics set | physics  |

#### number\_of\_coefficients\_in\_ozone\_forcing\_data

|             |  |
|-------------|--|
| long_name   | number of coefficients in ozone forcing data   |
| units       | index  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%oz_coeff    |
| requested   | ozphys_2015_run                                |
|             | ozphys_run                                     |
| physics set | physics  |

#### number\_of\_coefficients\_in\_ozone\_forcing\_data\_plus\_five

|             |  |
|-------------|--|
| long_name   | number of coefficients in ozone forcing data plus five |
| units       | index  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type         |
| local_name  | physics%Interstitial(cdata%blk_no)%oz_coeffp5          |
| requested   | NOT REQUESTED  |
| physics set |  |

#### number\_of\_convective\_3d\_cloud\_fields

|             |   |
|-------------|---|
| long_name   | number of convective 3d clouds fields     |
| units       | count                                     |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%ncnvcld3d     |
| requested   | GFS_DCNV_generic_post_run                 |
|             | GFS_SCNV_generic_post_run                 |
| physics set | physics                                   |

#### number\_of\_days\_in\_year

|             |   |
|-------------|---|
| long_name   | number of days in a year                  |
| units       | days                                      |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%yearlen       |
| requested   | GFS_time_vary_pre_run                     |
|             | noahmpdrv_run                             |
| physics set | physics                                   |

#### number\_of\_dust\_bins\_for\_diagnostics

|             |  |
|-------------|--|
| long_name   | number of dust bins for diagnostics    |
| units       | count                                  |
| rank        | 0                                      |
| type        | integer                                |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%ndust       |
| requested   | NOT REQUESTED                          |
| physics set |  |

#### number\_of\_equatorial\_longitude\_points

|             |  |
|-------------|--|
| long_name   | number of global points in x-dir (i) along the equator           |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                        |
| local_name  | physics%Model(cdata%blk_no)%lonr                                 |
| requested   | cires_ugwp_init<br>cires_ugwp_run<br>drag_suite_run<br>gwdps_run |
| physics set | physics  |

#### number\_of\_fields\_in\_phyf2d

|             |   |
|-------------|---|
| long_name   | total number of variables for phyf2d      |
| units       | count                                     |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%ntot2d        |
| requested   | NOT REQUESTED                             |
| physics set |   |



#### number\_of\_fields\_in\_phyf3d

|             |   |
|-------------|---|
| long_name   | total number of variables for phyf3d      |
| units       | count                                     |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%ntot3d        |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### number\_of\_frozen\_precipitation\_species

|             |  |
|-------------|--|
| long_name   | number of frozen precipitation species   |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                                      |
| local_name  | physics%Model(cdata%blk_no)%fprcp  |
| requested   | m_micro_init<br>m_micro_post_run<br>m_micro_pre_run<br>m_micro_run<br>shoc_run |
| physics set | physics  |

#### number\_of\_hydrometeors

|             |  |
|-------------|--|
| long_name   | choice of cloud scheme / number of hydrometeors  |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%ncld   |
| requested   | GFS_MP_generic_post_run<br>cs_conv_aw_adj_run<br>cs_conv_pre_run<br>samfdeepcnv_run<br>samfshalcnv_run |
| physics set | physics  |

#### number\_of\_independent\_cellular\_automata

|             |   |
|-------------|---|
| long_name   | number of independent cellular automata   |
| units       | count                                     |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%nca           |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### number\_of\_iterations\_to\_spin\_up\_cellular\_automata

|             |   |
|-------------|---|
| long_name   | number of iterations to spin up the ca    |
| units       | count                                     |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%nspinup       |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### number\_of\_latitude\_points

|             |   |
|-------------|---|
| long_name   | number of global points in y-dir (j) along the meridian |
| units       | count   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type               |
| local_name  | physics%Model(cdata%blk_no)%latr                        |
| requested   | cires_ugwp_init   |
| physics set | physics   |

#### number\_of\_lines\_of\_namelist\_filename\_for\_internal\_file\_reads

|             |   |
|-------------|---|
| long_name   | lines in namelist file for internal file reads    |
| units       | count   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type         |
| local_name  | physics%Model(cdata%blk_no)%input_nml_file_length |
| requested   | NOT REQUESTED                                     |
| physics set |   |

#### number\_of\_plumes

|             |  |
|-------------|--|
| long_name   | number of plumes per grid column       |
| units       | count                                  |
| rank        | 1                                      |
| type        | integer                                |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%nupdraft    |
| requested   | mynnedmf_wrapper_run                   |
| physics set | physics                                |

#### number\_of\_seasalt\_bins\_for\_diagnostics

|             |  |
|-------------|--|
| long_name   | number of seasalt bins for diagnostics |
| units       | count                                  |
| rank        | 0                                      |
| type        | integer                                |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%nseasalt    |
| requested   | NOT REQUESTED                          |
| physics set |  |

#### number\_of\_snow\_layers

|             |   |
|-------------|---|
| long_name   | number of snow layers                     |
| units       | count                                     |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%snowxy      |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### number\_of\_species\_for\_aerosol\_optical\_depth

|             |   |
|-------------|---|
| long_name   | number of species for output aerosol optical depth plus total |
| units       | count   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                |
| local_name  | physics%Interstitial(cdata%blk_no)%nspc1                      |
| requested   | NOT REQUESTED   |
| physics set |   |

#### number\_of\_spectral\_wave\_truncation\_for\_sas

|             |  |
|-------------|--|
| long_name   | number of spectral wave truncation used only by sascnv and shalcnv |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                          |
| local_name  | physics%Model(cdata%blk_no)%jcap                                   |
| requested   | NOT REQUESTED  |
| physics set |  |

#### number\_of\_statistical\_measures\_of\_subgrid\_orography

|             |  |
|-------------|--|
| long_name   | number of topographic variables in GWD                 |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type              |
| local_name  | physics%Model(cdata%blk_no)%nmtvr                      |
| requested   | GFS_GWD_generic_pre_run<br>cires_ugwp_run<br>gwdps_run |
| physics set | physics  |

#### number\_of\_surface\_perturbations

|             |   |
|-------------|---|
| long_name   | number of surface perturbations           |
| units       | count                                     |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%nsfcpert      |
| requested   | GFS_surface_generic_pre_run               |
| physics set | physics                                   |

#### number\_of\_tile

|             |   |
|-------------|---|
| long_name   | tile number                               |
| units       | none                                      |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%tile_num      |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### number\_of\_timesteps\_between\_longwave\_radiation\_calls

|             |  |
|-------------|--|
| long_name   | number of timesteps between longwave radiation calls |
| units       |  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type            |
| local_name  | physics%Model(cdata%blk_no)%nslwr                    |
| requested   | GFS_time_vary_pre_run                                |
| physics set | physics  |

#### number\_of\_timesteps\_between\_shortwave\_radiation\_calls

|             |   |
|-------------|---|
| long_name   | number of timesteps between shortwave radiation calls |
| units       |   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type             |
| local_name  | physics%Model(cdata%blk_no)%nsswr                     |
| requested   | GFS_time_vary_pre_run                                 |
| physics set | physics   |

#### number\_of\_timesteps\_between\_surface\_cycling\_calls

|             |   |
|-------------|---|
| long_name   | number of timesteps between surface cycling calls |
| units       |   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type         |
| local_name  | physics%Model(cdata%blk_no)%nscyc                 |
| requested   | GFS_time_vary_pre_run                             |
| physics set | physics   |

#### number\_of\_total\_tracers

|             |  |
|-------------|--|
| long_name   | total number of tracers                          |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%tracers_total |
| requested   | GFS_suite_interstitial_4_run                     |
|             | cu_ntiedtke_run                                  |
| physics set | physics  |



#### number\_of\_tracers

|             |   |
|-------------|---|
| long_name   | number of tracers   |
| units       | count   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%ntrac   |
| requested   | GFS_MP_generic_post_run<br>GFS_MP_generic_pre_run<br>GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_suite_interstitial_1_run<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>GFS_suite_stateout_reset_run<br>GFS_suite_stateout_update_run<br>cires_ugwp_run<br>cs_conv_aw_adj_run<br>cs_conv_pre_run<br>cu_gf_driver_run<br>myjsfc_wrapper_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics   |

#### number\_of\_tracers\_for\_CS

|             |   |
|-------------|---|
| long_name   | number of convectively transported tracers in Chikira-Sugiyama deep convection scheme |
| units       | count   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%ncstrac  |
| requested   | cs_conv_run   |
| physics set | physics   |

#### number\_of\_tracers\_for\_cloud\_condensate

|             |  |
|-------------|--|
| long_name   | number of tracers for cloud condensate   |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%nncl  |
| requested   | GFS_MP_generic_post_run<br>GFS_MP_generic_pre_run<br>cs_conv_aw_adj_run<br>moninshoc_run |
| physics set | physics  |

#### number\_of\_tracers\_for\_convective\_transport

|             |  |
|-------------|--|
| long_name   | number of tracers for convective transport   |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%nn  |
| requested   | GFS_SCNV_generic_post_run<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>cs_conv_run |
| physics set | physics  |

#### number\_of\_tracers\_for\_samf

|             |   |
|-------------|---|
| long_name   | number of tracers for scale-aware mass flux schemes |
| units       | count   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type      |
| local_name  | physics%Interstitial(cdata%blk_no)%nsamftrac        |
| requested   | samfdeepcnv_run<br>samfshalcnv_run                  |
| physics set | physics   |

#### number\_of\_tracers\_plus\_one

|             |   |
|-------------|---|
| long_name   | number of tracers plus one                |
| units       | count                                     |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%ntracp1       |
| requested   | cs_conv_run                               |
| physics set | physics                                   |

#### number\_of\_tracers\_scavenged

|             |  |
|-------------|--|
| long_name   | number of tracers scavenged                    |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%nscav       |
| requested   | NOT REQUESTED                                  |
| physics set |  |

#### number\_of\_vertical\_diffusion\_tracers

|             |   |
|-------------|---|
| long_name   | number of tracers to diffuse vertically   |
| units       | count   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%nvdiff   |
| requested   | GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>hedmf_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics   |

#### number\_of\_vertical\_layers\_for\_radiation\_calculations

|             |  |
|-------------|--|
| long_name   | number of vertical levels for radiation calculations   |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%levr   |
| requested   | GFS_rrtmg_post_run<br>GFS_rrtmg_pre_run<br>GFS_rrtmg_setup_init<br>rayleigh_damp_run<br>rrtmg_lw_post_run<br>rrtmg_sw_post_run |
| physics set | physics  |

#### number\_of\_vertical\_layers\_for\_radiation\_calculations\_plus\_one

|             |  |
|-------------|--|
| long_name   | number of vertical levels for radiation calculations + 1 |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                |
| local_name  | physics%Model(cdata%blk_no)%levrp1                       |
| requested   | NOT REQUESTED  |
| physics set |  |

#### number\_of\_water\_tracers

|             |  |
|-------------|--|
| long_name   | number of water-related tracers                  |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%tracers_water |
| requested   | NOT REQUESTED                                    |
| physics set |  |

#### ocean\_mixed\_layer\_thickness

|             |   |
|-------------|---|
| long_name   | mixed layer thickness                     |
| units       | m   |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%zm          |
| requested   | sfc_nst_run                               |
| physics set | physics                                   |

#### omega

|             |   |
|-------------|---|
| long_name   | layer mean vertical velocity  |
| units       | Pa s-1  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type   |
| local_name  | physics%Statein(cdata%blk_no)%vvl   |
| requested   | cu_gf_driver_run<br>cu_ntiedtke_run<br>gfdl_cloud_microphys_run<br>m_micro_run<br>mp_thompson_run<br>mynnedmf_wrapper_run<br>samfdeepcnv_run<br>samfshalcnv_run<br>shoc_run |
| physics set | physics   |

#### omp\_threads

|             |  |
|-------------|--|
| long_name   | number of OpenMP threads available for physics schemes |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type              |
| local_name  | physics%Model(cdata%blk_no)%nthreads                   |
| requested   | mp_thompson_init                                       |
| physics set | physics  |



#### orography

|             |   |
|-------------|---|
| long_name   | orography                                 |
| units       | m   |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%oro         |
| requested   | cires_ugwp_run<br>sfc_nst_post_run        |
| physics set | physics                                   |

#### orography\_unfiltered

|             |   |
|-------------|---|
| long_name   | unfiltered orography                      |
| units       | m   |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%oro_uf      |
| requested   | cires_ugwp_run<br>sfc_nst_post_run        |
| physics set | physics                                   |

#### ozone\_concentration\_at\_layer\_for\_radiation

|             |   |
|-------------|---|
| long_name   | ozone concentration layer                         |
| units       | kg kg-1   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type    |
| local_name  | physics%Interstitial(cdata%blk_no)%olvr           |
| requested   | GFS_rrtmg_pre_run<br>rrtmg_lw_run<br>rrtmg_sw_run |
| physics set | physics   |

#### ozone\_concentration\_updated\_by\_physics

|             |  |
|-------------|--|
| long_name   | ozone concentration updated by physics                                     |
| units       | kg kg-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_stateout_type                                 |
| local_name  | physics%Stateout(cdata%blk_no)%gq0(:, :, physics%Model(cdata%blk_no)%ntoz) |
| requested   | ozphys_2015_run<br>ozphys_run  |
| physics set | physics  |

#### ozone\_forcing

|             |                                       |
|-------------|---------------------------------------|
| long_name   | ozone forcing data                    |
| units       | various                               |
| rank        | 3                                     |
| type        | real                                  |
| kind        | kind_phys                             |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type |
| local_name  | physics%Tbd(cdata%blk_no)%ozpl        |
| requested   | ozphys_2015_run<br>ozphys_run         |
| physics set | physics                               |

#### ozone\_mixing\_ratio

|             |  |
|-------------|--|
| long_name   | ozone mixing ratio   |
| units       | kg kg-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type                                  |
| local_name  | physics%Statein(cdata%blk_no)%qgrs(:, :, physics%Model(cdata%blk_no)%ntoz) |
| requested   | mynnedmf_wrapper_run   |
| physics set | physics  |

#### perturbation\_of\_heat\_to\_momentum\_roughness\_length\_ratio

|             |   |
|-------------|---|
| long_name   | perturbation of heat to momentum roughness length ratio |
| units       | frac  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type          |
| local_name  | physics%Interstitial(cdata%blk_no)%ztld                 |
| requested   | GFS_surface_generic_pre_run<br>sfc_diff_run             |
| physics set | physics   |

#### perturbation\_of\_leaf\_area\_index

|             |  |
|-------------|--|
| long_name   | perturbation of leaf area index                |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%xlai1d      |
| requested   | GFS_surface_generic_pre_run                    |
|             | lsm_noah_run                                   |
| physics set | physics  |

#### perturbation\_of\_momentum\_roughness\_length

|             |  |
|-------------|--|
| long_name   | perturbation of momentum roughness length      |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%z01d        |
| requested   | GFS_surface_generic_pre_run                    |
|             | sfc_diff_run                                   |
| physics set | physics  |

#### perturbation\_of\_soil\_type\_b\_parameter

|             |  |
|-------------|--|
| long_name   | perturbation of soil type "b" parameter        |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%bexp1d      |
| requested   | GFS_surface_generic_pre_run                    |
|             | lsm_noah_run                                   |
| physics set | physics  |

#### perturbation\_of\_vegetation\_fraction

|             |  |
|-------------|--|
| long_name   | perturbation of vegetation fraction            |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%vegfid      |
| requested   | GFS_surface_generic_pre_run                    |
|             | lsm_noah_run                                   |
| physics set | physics  |

#### physics\_type

|             |                                 |
|-------------|---------------------------------|
| long_name   | definition of type physics_type |
| units       | DDT                             |
| rank        | 0                               |
| type        | physics_type                    |
| kind        |                                 |
| source      | MODULE gmtb_scm_type_defs       |
| local_name  | physics_type                    |
| requested   | NOT REQUESTED                   |
| physics set |                                 |

#### physics\_type\_instance

|             |  |
|-------------|--|
| long_name   | instance of derived data type physics_type |
| units       | DDT  |
| rank        | 0  |
| type        | physics_type                               |
| kind        |  |
| source      | MODULE gmtb_scm_type_defs                  |
| local_name  | physics                                    |
| requested   | NOT REQUESTED                              |
| physics set |  |

#### pi

|             |  |
|-------------|--|
| long_name   | ratio of a circle's circumference to its diameter  |
| units       | radians  |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE gmtb_scm_physical_constants   |
| local_name  | con_pi   |
| requested   | GFS_suite_interstitial_4_run<br>cires_ugwp_run<br>drag_suite_run<br>gwdc_run<br>lsm_ruc_run<br>sfc_nst_run<br>shoc_run |
| physics set | physics  |

#### `potential_temperature_at_2m`

long\_name 2 meter potential temperature  
units K  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name physics%Sfcprop(cdata%blk\_no)%th2m  
requested NOT REQUESTED  
physics set

#### `potential_temperature_at_viscous_sublayer_top`

long\_name potential temperature at viscous sublayer top over water  
units K  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name physics%Tbd(cdata%blk\_no)%phy\_myj\_thz0  
requested NOT REQUESTED  
physics set

#### `prandtl_number`

long\_name turbulent Prandtl number  
units none  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%prnum  
requested NOT REQUESTED  
physics set

#### pressure\_at\_bottom\_of\_convective\_cloud

long\_name      convective cloud bottom pressure  
units          Pa  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_cldprop\_type  
local\_name    physics%Cldprop(cdata%blk\_no)%cvb  
requested     cnvc90\_run  
physics set   physics

#### pressure\_at\_top\_of\_convective\_cloud

long\_name      convective cloud top pressure  
units          Pa  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_cldprop\_type  
local\_name    physics%Cldprop(cdata%blk\_no)%cvt  
requested     cnvc90\_run  
physics set   physics

#### pressure\_cutoff\_for\_rayleigh\_damping

long\_name      pressure level from which Rayleigh Damping is applied  
units          Pa  
rank          0  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%prslrd0  
requested     cires\_ugwp\_init  
              rayleigh\_damp\_run  
physics set   physics



#### q\_prime\_squared

|             |   |
|-------------|---|
| long_name   | water vapor fluctuation squared             |
| units       | kg2 kg-2                                    |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys                                   |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type       |
| local_name  | physics%Tbd(cdata%blk_no)%qsq               |
| requested   | mynnedmf_wrapper_run<br>mynnsfc_wrapper_run |
| physics set | physics                                     |

#### radar\_reflectivity\_10cm

|             |   |
|-------------|---|
| long_name   | instantaneous refl_10cm   |
| units       | dBZ   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type  |
| local_name  | physics%Diag(cdata%blk_no)%refl_10cm  |
| requested   | gfdl_cloud_microphys_run<br>maximum_hourly_diagnostics_run<br>mp_thompson_run |
| physics set | physics   |

#### rain\_conversion\_parameter\_deep\_convection

|             |  |
|-------------|--|
| long_name   | convective rain conversion parameter for deep convection |
| units       | m-1  |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                |
| local_name  | physics%Model(cdata%blk_no)%c0s_deep                     |
| requested   | samfdeepcnv_run  |
| physics set | physics  |

#### rain\_conversion\_parameter\_shallow\_convection

|             |   |
|-------------|---|
| long_name   | convective rain conversion parameter for shallow convection |
| units       | m-1   |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                   |
| local_name  | physics%Model(cdata%blk_no)%c0s_shal                        |
| requested   | samfshalcnv_run   |
| physics set | physics   |

#### rain\_evaporation\_coefficient\_deep\_convection

|             |   |
|-------------|---|
| long_name   | convective rain evaporation coefficient for deep convection |
| units       | frac  |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                   |
| local_name  | physics%Model(cdata%blk_no)%evfact_deep                     |
| requested   | samfdeepcnv_run   |
| physics set | physics   |

#### rain\_evaporation\_coefficient\_over\_land\_deep\_convection

long\_name convective rain evaporation coefficient over land for deep convection  
units frac  
rank 0  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name physics%Model(cdata%blk\_no)%evfactl\_deep  
requested samfdeepcnv\_run  
physics set physics

#### rain\_number\_concentration

long\_name number concentration of rain  
units kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_statein\_type  
local\_name physics%Statein(cdata%blk\_no)%qgrs(:, :, physics%Model(cdata%blk\_no)%ntrnc)  
requested NOT REQUESTED  
physics set

#### rain\_number\_concentration\_updated\_by\_physics

long\_name     number concentration of rain updated by physics  
units         kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_stateout\_type  
local\_name    physics%Stateout(cdata%blk\_no)%gq0(:, :, physics%Model(cdata%blk\_no)%ntrnc)  
requested     m\_micro\_post\_run  
              m\_micro\_pre\_run  
              mp\_thompson\_pre\_run  
              mp\_thompson\_run  
physics set   physics

#### rain\_water\_mixing\_ratio

long\_name     moist (dry+vapor, no condensates) mixing ratio of rain water  
units         kg kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_statein\_type  
local\_name    physics%Statein(cdata%blk\_no)%qgrs(:, :, physics%Model(cdata%blk\_no)%ntrw)  
requested     NOT REQUESTED  
physics set

#### rain\_water\_mixing\_ratio\_updated\_by\_physics

|             |   |
|-------------|---|
| long_name   | moist (dry+vapor, no condensates) mixing ratio of rain water updated by physics                                       |
| units       | kg kg-1   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_stateout_type  |
| local_name  | physics%Stateout(cdata%blk_no)%gq0(:, :, physics%Model(cdata%blk_no)%ntrw)  |
| requested   | gfdl_cloud_microphys_run<br>m_micro_post_run<br>m_micro_pre_run<br>mp_thompson_pre_run<br>mp_thompson_run<br>shoc_run |
| physics set | physics   |

#### random\_number\_array

|             |                                       |
|-------------|---------------------------------------|
| long_name   | random number array (0-1)             |
| units       | none                                  |
| rank        | 2                                     |
| type        | real                                  |
| kind        | kind_phys                             |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type |
| local_name  | physics%Tbd(cdata%blk_no)%rann        |
| requested   | GFS_MP_generic_post_run               |
| physics set | physics                               |

#### ratio\_of\_dry\_air\_to\_water\_vapor\_gas\_constants

|             |                                    |
|-------------|------------------------------------|
| long_name   | rd/rv                              |
| units       | none                               |
| rank        | 0                                  |
| type        | real                               |
| kind        | kind_phys                          |
| source      | MODULE gmtb_scm_physical_constants |
| local_name  | con_eps                            |
| requested   | lsm_noah_run                       |
|             | noahmpdrv_run                      |
|             | samfdeepcnv_run                    |
|             | samfshalcnv_run                    |
|             | satmedmfvdif_run                   |
|             | satmedmfvdifq_run                  |
|             | sfc_diag_post_run                  |
|             | sfc_diag_run                       |
|             | sfc_diff_run                       |
|             | sfc_nst_run                        |
|             | sfc_ocean_run                      |
|             | sfc_sice_run                       |
|             | shinhongvdif_run                   |
|             | ysuvdif_run                        |
| physics set | physics                            |

ratio\_of\_dry\_air\_to\_water\_vapor\_gas\_constants\_minus\_one

|             |                                    |
|-------------|------------------------------------|
| long_name   | (rd/rv) - 1                        |
| units       | none                               |
| rank        | 0                                  |
| type        | real                               |
| kind        | kind_phys                          |
| source      | MODULE gmtb_scm_physical_constants |
| local_name  | con_epsm1                          |
| requested   | lsm_noah_run                       |
|             | noahmpdrv_run                      |
|             | samfdeepcnv_run                    |
|             | samfshalcnv_run                    |
|             | satmedmfvdif_run                   |
|             | satmedmfvdifq_run                  |
|             | sfc_diag_post_run                  |
|             | sfc_diag_run                       |
|             | sfc_diff_run                       |
|             | sfc_nst_run                        |
|             | sfc_ocean_run                      |
|             | sfc_sice_run                       |
| physics set | physics                            |

```

ratio_of_exner_function_between_midlayer_and_interface_at_lowest_model_layer
    long_name    Exner function ratio bt midlayer and interface at 1st layer
    units        ratio
    rank         1
    type         real
    kind         kind_phys
    source       MODULE GFS_typedefs TYPE GFS_interstitial_type
    local_name   physics%Interstitial(cdata%blk_no)%work3
    requested    GFS_surface_generic_pre_run
                gmtb_scm_sfc_flux_spec_run
                lsm_noah_run
                myjpbl_wrapper_run
                noahmpdrv_run
                sfc_diag_run
                sfc_diff_run
                sfc_nst_run
                sfc_ocean_run
                sfc_sice_run
physics set    physics

```



#### ratio\_of\_snowfall\_to\_rainfall

|             |  |
|-------------|--|
| long_name   | snow ratio: ratio of snow to total precipitation (explicit only)   |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type   |
| local_name  | physics%Diag(cdata%blk_no)%sr  |
| requested   | GFS_MP_generic_post_run<br>gfdl_cloud_microphys_run<br>m_micro_run<br>mp_thompson_run<br>zhaocarr_precpd_run |
| physics set | physics  |

ratio\_of\_vapor\_to\_dry\_air\_gas\_constants\_minus\_one

|             |   |
|-------------|---|
| long_name   | (rv/rd) - 1 (rv = ideal gas constant for water vapor)   |
| units       | none  |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE gmtb_scm_physical_constants  |
| local_name  | con_fvirt   |
| requested   | GFS_PBL_generic_post_run<br>cires_ugwp_run<br>drag_suite_run<br>gfdl_cloud_microphys_run<br>gmtb_scm_sfc_flux_spec_run<br>gwdc_run<br>lsm_noah_run<br>lsm_ruc_run<br>moninshoc_run<br>noahmpdrv_run<br>samfdeepcnv_run<br>samfshalcnv_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>sfc_cice_run<br>sfc_diff_run<br>sfc_nst_run<br>sfc_ocean_run<br>sfc_sice_run<br>shinhongvdif_run<br>shoc_run<br>ysuvdif_run |
| physics set | physics   |

#### ratio\_of\_wind\_at\_lowest\_model\_layer\_and\_wind\_at\_10m

|             |   |
|-------------|---|
| long_name   | ratio of sigma level 1 wind and 10m wind  |
| units       | ratio                                     |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%f10m        |
| requested   | sfc_diag_run                              |
| physics set | physics                                   |

#### reciprocal\_of\_obukhov\_length

|             |   |
|-------------|---|
| long_name   | one over obukhov length                     |
| units       | m-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys                                   |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type   |
| local_name  | physics%Sfcprop(cdata%blk_no)%rmol          |
| requested   | mynnedmf_wrapper_run<br>mynnsfc_wrapper_run |
| physics set | physics                                     |

#### rime\_factor

|             |  |
|-------------|--|
| long_name   | rime factor                                    |
| units       | frac   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%f_rimef     |
| requested   | NOT REQUESTED                                  |
| physics set |  |

#### sea\_area\_fraction

|             |   |
|-------------|---|
| long_name   | fraction of horizontal grid area occupied by ocean  |
| units       | frac  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type   |
| local_name  | physics%Sfcprop(cdata%blk_no)%oceanfrac   |
| requested   | GFS_PBL_generic_post_run<br>GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>myjsfc_wrapper_run |
| physics set | physics   |

#### sea\_ice\_concentration

|             |   |
|-------------|---|
| long_name   | ice fraction over open water  |
| units       | frac  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type   |
| local_name  | physics%Sfcprop(cdata%blk_no)%fice  |
| requested   | GFS_PBL_generic_post_run<br>GFS_suite_interstitial_2_run<br>GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>GFS_surface_generic_pre_run<br>lsm_ruc_run<br>myjsfc_wrapper_run<br>sfc_sice_run |
| physics set | physics   |

#### sea\_ice\_minimum

|             |   |
|-------------|---|
| long_name   | minimum sea ice value                     |
| units       | ???                                       |
| rank        | 0   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%min_seaice    |
| requested   | GFS_surface_composites_pre_run            |
| physics set | physics                                   |

#### sea\_ice\_temperature

|             |  |
|-------------|--|
| long_name   | sea ice surface skin temperature   |
| units       | K  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type  |
| local_name  | physics%Sfcprop(cdata%blk_no)%tisfc  |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>GFS_surface_generic_pre_run |
| physics set | physics  |

#### sea\_ice\_temperature\_interstitial

|             |  |
|-------------|--|
| long_name   | sea ice surface skin temperature use as interstitial   |
| units       | K  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%tice  |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>lsm_ruc_run<br>sfc_sice_run |
| physics set | physics  |

#### sea\_ice\_thickness

|             |  |
|-------------|--|
| long_name   | sea ice thickness  |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type                                      |
| local_name  | physics%Sfcprop(cdata%blk_no)%hice   |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_generic_pre_run<br>sfc_sice_run |
| physics set | physics  |

#### sea\_land\_ice\_mask

|             |   |
|-------------|---|
| long_name   | sea/land/ice mask (=0/1/2)  |
| units       | flag  |
| rank        | 1   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%islmsk   |
| requested   | GFS_suite_interstitial_1_run<br>GFS_suite_interstitial_3_run<br>GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>GFS_surface_generic_pre_run<br>cu_gf_driver_run<br>cu_ntiedtke_run<br>gfdl_cloud_microphys_run<br>lsm_ruc_run<br>samfdeepcnv_run<br>samfshalcnv_run<br>sfc_sice_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics   |

#### sea\_land\_ice\_mask\_cice

long\_name     sea/land/ice mask cice (=0/1/2)  
units         flag  
rank          1  
type          integer  
kind  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%islmsk\_cice  
requested     GFS\_surface\_generic\_pre\_run  
              sfc\_sice\_run  
physics set   physics

#### sea\_land\_ice\_mask\_in

long\_name     sea/land/ice mask input (=0/1/2)  
units         flag  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name    physics%Coupling(cdata%blk\_no)%slimskin\_cpl  
requested     GFS\_surface\_generic\_pre\_run  
physics set   physics



#### sea\_land\_ice\_mask\_real

|             |  |
|-------------|--|
| long_name   | landmask: sea/land/ice=0/1/2   |
| units       | flag   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type  |
| local_name  | physics%Sfcprop(cdata%blk_no)%slmsk  |
| requested   | GFS_suite_interstitial_1_run<br>drag_suite_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>mynnedmf_wrapper_run<br>mynnrad_pre_run<br>mynnsfc_wrapper_run |
| physics set | physics  |

#### sea\_surface\_reference\_temperature

|             |  |
|-------------|--|
| long_name   | sea surface reference temperature                  |
| units       | K  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type          |
| local_name  | physics%Sfcprop(cdata%blk_no)%tref                 |
| requested   | sfc_nst_post_run<br>sfc_nst_pre_run<br>sfc_nst_run |
| physics set | physics  |

#### sea\_surface\_temperature

|             |  |
|-------------|--|
| long_name   | sea surface temperature  |
| units       | K  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type  |
| local_name  | physics%Sfcprop(cdata%blk_no)%tsfco  |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>GFS_surface_generic_pre_run |
| physics set | physics  |

#### sea\_water\_reference\_density

|             |                                    |
|-------------|------------------------------------|
| long_name   | sea water reference density        |
| units       | kg m-3                             |
| rank        | 0                                  |
| type        | real                               |
| kind        | kind_phys                          |
| source      | MODULE gmtb_scm_physical_constants |
| local_name  | con_rhw0                           |
| requested   | sfc_nst_run                        |
| physics set | physics                            |

#### sea\_water\_salinity

|             |   |
|-------------|---|
| long_name   | salinity content in diurnal thermocline layer |
| units       | ppt m   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys                                     |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type     |
| local_name  | physics%Sfcprop(cdata%blk_no)%xs              |
| requested   | sfc_nst_run                                   |
| physics set | physics                                       |

#### seconds\_elapsed\_since\_model\_initialization

|             |  |
|-------------|--|
| long_name   | seconds elapsed since model initialization |
| units       | s  |
| rank        | 0  |
| type        | real                                       |
| kind        | kind_phys                                  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type  |
| local_name  | physics%Model(cdata%blk_no)%sec            |
| requested   | GFS_time_vary_pre_run                      |
| physics set | physics                                    |

#### seed\_for\_random\_number\_generation\_in\_cellular\_automata\_scheme

|             |  |
|-------------|--|
| long_name   | seed for random number generation in ca scheme |
| units       | none   |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type      |
| local_name  | physics%Model(cdata%blk_no)%iseed_ca           |
| requested   | NOT REQUESTED                                  |
| physics set |  |

#### seed\_random\_numbers\_lw

long\_name random seeds for sub-column cloud generators lw  
units none  
rank 1  
type integer  
kind  
source MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name physics%Tbd(cdata%blk\_no)%icsdlw  
requested rrtmg\_lw\_run  
physics set physics

#### seed\_random\_numbers\_sw

long\_name random seeds for sub-column cloud generators sw  
units none  
rank 1  
type integer  
kind  
source MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name physics%Tbd(cdata%blk\_no)%icsdsw  
requested rrtmg\_sw\_run  
physics set physics

#### sensible\_heat\_flux\_due\_to\_rainfall

long\_name sensible heat flux due to rainfall  
units W  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name physics%Sfcprop(cdata%blk\_no)%grain  
requested sfc\_nst\_run  
physics set physics

#### sensitivity\_of\_dtl\_heat\_content\_to\_surface\_temperature

|             |   |
|-------------|---|
| long_name   | $d(xt)/d(ts)$                             |
| units       | m   |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%xtts        |
| requested   | sfc_nst_run                               |
| physics set | physics                                   |

#### sensitivity\_of\_dtl\_thickness\_to\_surface\_temperature

|             |   |
|-------------|---|
| long_name   | $d(xz)/d(ts)$                             |
| units       | m K-1                                     |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%xzts        |
| requested   | sfc_nst_run                               |
| physics set | physics                                   |

#### sfcflw\_type

|             |                                |
|-------------|--------------------------------|
| long_name   | definition of type sfcflw_type |
| units       | DDT                            |
| rank        | 0                              |
| type        | sfcflw_type                    |
| kind        |                                |
| source      | MODULE module_radlw_parameters |
| local_name  | sfcflw_type                    |
| requested   | NOT REQUESTED                  |
| physics set |                                |

#### sfcfsw\_type

|             |                                |
|-------------|--------------------------------|
| long_name   | definition of type sfcfsw_type |
| units       | DDT                            |
| rank        | 0                              |
| type        | sfcfsw_type                    |
| kind        |                                |
| source      | MODULE module_radsw_parameters |
| local_name  | sfcfsw_type                    |
| requested   | NOT REQUESTED                  |
| physics set |                                |

#### shoc\_flag\_for\_optional\_surface\_TKE\_dissipation

|             |  |
|-------------|--|
| long_name   | flag for alt. TKE diss. near surface in SHOC (>0 = ON) |
| units       | none   |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type              |
| local_name  | physics%Model(cdata%blk_no)%shoc_parm(5)               |
| requested   | NOT REQUESTED  |
| physics set |  |

#### shoc\_implicit\_TKE\_integration\_uncentering\_term

|             |  |
|-------------|--|
| long_name   | uncentering term for TKE integration in SHOC |
| units       | none   |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys                                    |
| source      | MODULE GFS_typedefs TYPE GFS_control_type    |
| local_name  | physics%Model(cdata%blk_no)%shoc_parm(4)     |
| requested   | NOT REQUESTED                                |
| physics set |  |

#### shoc\_tke\_dissipation\_pressure\_threshold

long\_name     pressure below which extra TKE diss.    is applied in SHOC  
units         Pa  
rank          0  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%shoc\_parm(1)  
requested     NOT REQUESTED  
physics set

#### shoc\_tke\_dissipation\_tunable\_parameter

long\_name     mult.   tuning parameter for TKE diss.    in SHOC  
units         none  
rank          0  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%shoc\_parm(2)  
requested     NOT REQUESTED  
physics set

#### shoc\_tke\_dissipation\_tunable\_parameter\_near\_surface

long\_name     mult.   tuning parameter for TKE diss.    at surface in SHOC  
units         none  
rank          0  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%shoc\_parm(3)  
requested     NOT REQUESTED  
physics set

#### sine\_of\_latitude

|             |  |
|-------------|--|
| long_name   | sine of latitude                             |
| units       | none   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                    |
| source      | MODULE GFS_typedefs TYPE GFS_grid_type       |
| local_name  | physics%Grid(cdata%blk_no)%sinlat            |
| requested   | cires_ugwp_run<br>dcyc2t3_run<br>sfc_nst_run |
| physics set | physics                                      |

#### sine\_of\_solar\_declination\_angle

|             |   |
|-------------|---|
| long_name   | sin of the solar declination angle        |
| units       | none                                      |
| rank        | 0   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%sdec          |
| requested   | GFS_rrtmg_setup_run<br>dcyc2t3_run        |
| physics set | physics                                   |



#### slope\_of\_subgrid\_orography

|             |  |
|-------------|--|
| long_name   | slope of subgrid orography   |
| units       | none   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                           |
| local_name  | physics%Interstitial(cdata%blk_no)%sigma                                 |
| requested   | GFS_GWD_generic_pre_run<br>cires_ugwp_run<br>drag_suite_run<br>gwdps_run |
| physics set | physics  |

#### slow\_soil\_pool\_mass\_content\_of\_carbon

|             |   |
|-------------|---|
| long_name   | stable carbon in deep soil                |
| units       | g m-2                                     |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%stblcpxy    |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### smallest\_cloud\_base\_vertical\_index\_encountered\_thus\_far

|             |   |
|-------------|---|
| long_name   | smallest cloud base vertical index encountered thus far |
| units       | index   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type                   |
| local_name  | physics%Tbd(cdata%blk_no)%acvb                          |
| requested   | cnvc90_run  |
| physics set | physics   |

#### snow\_albedo\_at\_previous\_time\_step

|             |   |
|-------------|---|
| long_name   | snow albedo at previous time step         |
| units       | frac                                      |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%alboldxy    |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### snow\_deposition\_sublimation\_upward\_latent\_heat\_flux

|             |  |
|-------------|--|
| long_name   | latent heat flux from snow depo/subl   |
| units       | W m-2  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                               |
| local_name  | physics%Interstitial(cdata%blk_no)%sbsno                                     |
| requested   | GFS_surface_generic_post_run<br>lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run |
| physics set | physics  |

#### snow\_freezing\_rain\_upward\_latent\_heat\_flux

|             |   |
|-------------|---|
| long_name   | latent heat flux due to snow and frz rain                     |
| units       | W m-2   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                |
| local_name  | physics%Interstitial(cdata%blk_no)%snohf                      |
| requested   | GFS_surface_generic_post_run<br>lsm_noah_run<br>noahmpdrv_run |
| physics set | physics   |

#### snow\_layer\_ice

long\_name      snow layer ice  
units           mm  
rank           2  
type           real  
kind           kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name      physics%Sfcprop(cdata%blk\_no)%snicxy  
requested       NOT REQUESTED  
physics set

#### snow\_layer\_liquid\_water

long\_name      snow layer liquid water  
units           mm  
rank           2  
type           real  
kind           kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name      physics%Sfcprop(cdata%blk\_no)%snliqxy  
requested       NOT REQUESTED  
physics set

#### snow\_mass\_at\_previous\_time\_step

long\_name      snow mass at previous time step  
units           mm  
rank           1  
type           real  
kind           kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name      physics%Sfcprop(cdata%blk\_no)%sneqvoxy  
requested       NOT REQUESTED  
physics set

#### snow\_number\_concentration

|             |   |
|-------------|---|
| long_name   | number concentration of snow  |
| units       | kg-1  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type                                   |
| local_name  | physics%Statein(cdata%blk_no)%qgrs(:, :, physics%Model(cdata%blk_no)%ntsnc) |
| requested   | NOT REQUESTED   |
| physics set |   |

#### snow\_number\_concentration\_updated\_by\_physics

|             |   |
|-------------|---|
| long_name   | number concentration of snow updated by physics                             |
| units       | kg-1  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_stateout_type                                  |
| local_name  | physics%Stateout(cdata%blk_no)%gq0(:, :, physics%Model(cdata%blk_no)%ntsnc) |
| requested   | m_micro_post_run<br>m_micro_pre_run   |
| physics set | physics   |

#### snow\_precipitation\_rate\_at\_surface

|             |   |
|-------------|---|
| long_name   | snow precipitation rate at surface        |
| units       | mm s-1                                    |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%qsnowxy     |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### snow\_precipitation\_rate\_from\_previous\_timestep

|             |  |
|-------------|--|
| long_name   | snow precipitation rate from previous timestep |
| units       | mm s-1   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type      |
| local_name  | physics%Sfcprop(cdata%blk_no)%dsnowprv         |
| requested   | GFS_MP_generic_post_run                        |
|             | noahmpdrv_run                                  |
| physics set | physics  |

#### snow\_temperature

|             |   |
|-------------|---|
| long_name   | snow_temperature                          |
| units       | K   |
| rank        | 2   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%tsnoxy      |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### snow\_temperature\_bottom\_first\_layer

|             |  |
|-------------|--|
| long_name   | snow temperature at the bottom of the first snow layer |
| units       | K  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type              |
| local_name  | physics%Sfcprop(cdata%blk_no)%tsnow                    |
| requested   | lsm_ruc_run  |
| physics set | physics  |

#### snow\_vertical\_dimension\_for\_land\_surface\_model

|             |  |
|-------------|--|
| long_name   | maximum number of snow layers for land surface model |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type            |
| local_name  | physics%Model(cdata%blk_no)%lsnow_lsm                |
| requested   | NOT REQUESTED  |
| physics set |  |

#### snow\_water\_mixing\_ratio

|             |  |
|-------------|--|
| long_name   | moist (dry+vapor, no condensates) mixing ratio of snow water               |
| units       | kg kg-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type                                  |
| local_name  | physics%Statein(cdata%blk_no)%qgrs(:, :, physics%Model(cdata%blk_no)%ntsw) |
| requested   | NOT REQUESTED  |
| physics set |  |

#### snow\_water\_mixing\_ratio\_updated\_by\_physics

|             |   |
|-------------|---|
| long_name   | moist (dry+vapor, no condensates) mixing ratio of snow water updated by physics                                       |
| units       | kg kg-1   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_stateout_type  |
| local_name  | physics%Stateout(cdata%blk_no)%gq0(:, :, physics%Model(cdata%blk_no)%ntsw)  |
| requested   | gfdl_cloud_microphys_run<br>m_micro_post_run<br>m_micro_pre_run<br>mp_thompson_pre_run<br>mp_thompson_run<br>shoc_run |
| physics set | physics   |

#### soil\_moisture\_content

|             |  |
|-------------|--|
| long_name   | soil moisture                                |
| units       | kg m-2                                       |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                    |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type       |
| local_name  | physics%Diag(cdata%blk_no)%soilm             |
| requested   | lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run |
| physics set | physics                                      |



#### soil\_temperature

|             |   |
|-------------|---|
| long_name   | soil temperature  |
| units       | K   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type   |
| local_name  | physics%Sfcprop(cdata%blk_no)%stc   |
| requested   | lsm_noah_run<br>lsm_ruc_run<br>lsm_ruc_sfc_sice_post_run<br>lsm_ruc_sfc_sice_pre_run<br>noahmpdrv_run<br>sfc_sice_run |
| physics set | physics   |

#### soil\_temperature\_for\_land\_surface\_model

|             |  |
|-------------|--|
| long_name   | soil temperature for land surface model                              |
| units       | K  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type                            |
| local_name  | physics%Sfcprop(cdata%blk_no)%tslb                                   |
| requested   | lsm_ruc_run<br>lsm_ruc_sfc_sice_post_run<br>lsm_ruc_sfc_sice_pre_run |
| physics set | physics  |

#### soil\_type\_classification

|             |  |
|-------------|--|
| long_name   | soil type at each grid cell                    |
| units       | index  |
| rank        | 1  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%soiltype    |
| requested   | GFS_surface_generic_pre_run                    |
|             | lsm_noah_run                                   |
|             | lsm_ruc_run                                    |
|             | noahmpdrv_run                                  |
| physics set | physics  |

#### soil\_type\_classification\_real

|             |   |
|-------------|---|
| long_name   | soil type for lsm                         |
| units       | index                                     |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%stype       |
| requested   | GFS_surface_generic_pre_run               |
| physics set | physics                                   |

#### soil\_type\_dataset\_choice

|             |   |
|-------------|---|
| long_name   | soil type dataset choice  |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%isot  |
| requested   | GFS_surface_generic_pre_run<br>lsm_noah_init<br>lsm_noah_run<br>lsm_ruc_init<br>lsm_ruc_run<br>noahmpdrv_init |
| physics set | physics   |

#### soil\_upward\_latent\_heat\_flux

|             |  |
|-------------|--|
| long_name   | soil upward latent heat flux   |
| units       | W m-2  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                               |
| local_name  | physics%Interstitial(cdata%blk_no)%evbs                                      |
| requested   | GFS_surface_generic_post_run<br>lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run |
| physics set | physics  |

#### soil\_vertical\_dimension

|             |   |
|-------------|---|
| long_name   | number of soil layers   |
| units       | count   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%lsoil   |
| requested   | lsm_noah_run<br>lsm_ruc_run<br>lsm_ruc_sfc_sice_post_run<br>lsm_ruc_sfc_sice_pre_run<br>noahmpdrv_run<br>sfc_sice_run |
| physics set | physics   |

#### soil\_vertical\_dimension\_for\_land\_surface\_model

|             |  |
|-------------|--|
| long_name   | number of soil layers internal to land surface model                 |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type                            |
| local_name  | physics%Model(cdata%blk_no)%lsoil_lsm                                |
| requested   | lsm_ruc_run<br>lsm_ruc_sfc_sice_post_run<br>lsm_ruc_sfc_sice_pre_run |
| physics set | physics  |

#### soil\_water\_content\_between\_soil\_bottom\_and\_water\_table

|             |   |
|-------------|---|
| long_name   | soil water content between the bottom of the soil and the water table |
| units       | m3 m-3  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type                             |
| local_name  | physics%Sfcprop(cdata%blk_no)%smcwtdxy                                |
| requested   | NOT REQUESTED   |
| physics set |   |

#### solar\_constant

|             |   |
|-------------|---|
| long_name   | solar constant (sun-earth distant adjusted) |
| units       | W m-2                                       |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys                                   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%solcon          |
| requested   | GFS_rrtmg_setup_run                         |
|             | rrtmg_sw_run                                |
| physics set | physics                                     |

### specific\_heat\_of\_dry\_air\_at\_constant\_pressure

|             |  |
|-------------|--|
| long_name   | specific heat of dry air at constant pressure  |
| units       | J kg-1 K-1   |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE gmtb_scm_physical_constants   |
| local_name  | con_cp   |
| requested   | GFS_PBL_generic_post_run<br>GFS_suite_interstitial_2_run<br>cires_ugwp_run<br>drag_suite_run<br>gmtb_scm_sfc_flux_spec_run<br>gwdc_post_run<br>gwdc_run<br>gwdps_run<br>lsm_noah_run<br>lsm_ruc_run<br>m_micro_init<br>moninshoc_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>noahmpdrv_run<br>rayleigh_damp_run<br>samfdeepcnv_run<br>samfshalcnv_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>sfc_cice_run<br>sfc_diag_run<br>sfc_nst_run<br>sfc_ocean_run<br>sfc_sice_run<br>shinhongvdif_run<br>shoc_run<br>ysuvdif_run |
| physics set | physics  |

#### specific\_heat\_of\_liquid\_water\_at\_constant\_pressure

|             |  |
|-------------|--|
| long_name   | specific heat of liquid water at constant pressure |
| units       | J kg <sup>-1</sup> K <sup>-1</sup>                 |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE gmtb_scm_physical_constants                 |
| local_name  | con_cliq   |
| requested   | samfdeepcnv_run<br>samfshalcnv_run                 |
| physics set | physics  |

#### specific\_heat\_of\_water\_vapor\_at\_constant\_pressure

|             |   |
|-------------|---|
| long_name   | specific heat of water vapor at constant pressure |
| units       | J kg <sup>-1</sup> K <sup>-1</sup>                |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE gmtb_scm_physical_constants                |
| local_name  | con_cvap  |
| requested   | samfdeepcnv_run<br>samfshalcnv_run                |
| physics set | physics   |

#### specific\_humidity\_at\_2m

|             |  |
|-------------|--|
| long_name   | 2 meter specific humidity  |
| units       | kg kg-1  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type  |
| local_name  | physics%Sfcprop(cdata%blk_no)%q2m  |
| requested   | GFS_surface_generic_post_run<br>gmtb_scm_sfc_flux_spec_run<br>maximum_hourly_diagnostics_run<br>mynnsfc_wrapper_run<br>sfc_diag_post_run<br>sfc_diag_run |
| physics set | physics  |

#### specific\_humidity\_at\_2m\_from\_noahmp

|             |  |
|-------------|--|
| long_name   | 2 meter specific humidity from noahmp          |
| units       | kg kg-1  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%q2mp        |
| requested   | noahmpdrv_run<br>sfc_diag_post_run             |
| physics set | physics  |



#### specific\_humidity\_at\_viscous\_sublayer\_top

long\_name specific humidity at\_viscous sublayer top over water  
units kg kg-1  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name physics%Tbd(cdata%blk\_no)%phy\_myj\_qz0  
requested NOT REQUESTED  
physics set

#### specified\_kinematic\_surface\_upward\_latent\_heat\_flux

long\_name specified kinematic surface upward latent heat flux  
units kg kg-1 m s-1  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name physics%Sfcprop(cdata%blk\_no)%spec\_lh\_flux  
requested gmtb\_scm\_sfc\_flux\_spec\_run  
physics set physics

#### specified\_kinematic\_surface\_upward\_sensible\_heat\_flux

long\_name specified kinematic surface upward sensible heat flux  
units K m s-1  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name physics%Sfcprop(cdata%blk\_no)%spec\_sh\_flux  
requested gmtb\_scm\_sfc\_flux\_spec\_run  
physics set physics

#### stability\_function\_for\_heat

|             |   |
|-------------|---|
| long_name   | stability function for heat                 |
| units       | none  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys                                   |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type       |
| local_name  | physics%Tbd(cdata%blk_no)%Sh3D              |
| requested   | mynnedmf_wrapper_run<br>mynnsfc_wrapper_run |
| physics set | physics                                     |

#### standard\_atmospheric\_pressure

|             |                                    |
|-------------|------------------------------------|
| long_name   | standard atmospheric pressure      |
| units       | Pa                                 |
| rank        | 0                                  |
| type        | real                               |
| kind        | kind_phys                          |
| source      | MODULE gmtb_scm_physical_constants |
| local_name  | con_p0                             |
| requested   | cires_ugwp_init                    |
| physics set | physics                            |

#### standard\_deviation\_of\_subgrid\_orography

|             |   |
|-------------|---|
| long_name   | standard deviation of subgrid orography                             |
| units       | m   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type                           |
| local_name  | physics%Sfcprop(cdata%blk_no)%hprime(:,1)                           |
| requested   | cires_ugwp_run<br>drag_suite_run<br>gwdps_run<br>myjpbl_wrapper_run |
| physics set | physics   |

#### start\_index\_of\_other\_tracers

|             |  |
|-------------|--|
| long_name   | beginning index of the non-water tracer species        |
| units       | index  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type         |
| local_name  | physics%Interstitial(cdata%blk_no)%tracers_start_index |
| requested   | NOT REQUESTED  |
| physics set |  |

#### statistical\_measures\_of\_subgrid\_orography

long\_name      orographic metrics  
units          various  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name    physics%Sfcprop(cdata%blk\_no)%hprime  
requested     GFS\_GWD\_generic\_pre\_run  
physics set   physics

#### stefan\_boltzmann\_constant

long\_name      Steffan-Boltzmann constant  
units          W m-2 K-4  
rank          0  
type          real  
kind          kind\_phys  
source        MODULE gmtb\_scm\_physical\_constants  
local\_name    con\_sbc  
requested     sfc\_nst\_run  
              sfc\_sice\_run  
physics set   physics

#### stem\_area\_index

long\_name      stem area index  
units          none  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name    physics%Sfcprop(cdata%blk\_no)%xsaixy  
requested     NOT REQUESTED  
physics set   physics

#### stem\_mass

|             |   |
|-------------|---|
| long_name   | stem mass                                 |
| units       | g m-2                                     |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%stmassxy    |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### sub\_layer\_cooling\_amount

|             |  |
|-------------|--|
| long_name   | sub-layer cooling amount                           |
| units       | K  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type          |
| local_name  | physics%Sfcprop(cdata%blk_no)%dt_cool              |
| requested   | sfc_nst_post_run<br>sfc_nst_pre_run<br>sfc_nst_run |
| physics set | physics  |

#### sub\_layer\_cooling\_thickness

|             |  |
|-------------|--|
| long_name   | sub-layer cooling thickness                        |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type          |
| local_name  | physics%Sfcprop(cdata%blk_no)%z_c                  |
| requested   | sfc_nst_post_run<br>sfc_nst_pre_run<br>sfc_nst_run |
| physics set | physics  |

#### subgrid\_cloud\_fraction\_pbl

|             |  |
|-------------|--|
| long_name   | subgrid cloud fraction from PBL scheme                         |
| units       | frac   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type                          |
| local_name  | physics%Tbd(cdata%blk_no)%CLDFRA_BL                            |
| requested   | mynnedmf_wrapper_run<br>mynnrad_pre_run<br>mynnsfc_wrapper_run |
| physics set | physics  |

#### subgrid\_cloud\_mixing\_ratio\_pbl

|             |  |
|-------------|--|
| long_name   | subgrid cloud cloud mixing ratio from PBL scheme               |
| units       | kg kg-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type                          |
| local_name  | physics%Tbd(cdata%blk_no)%QC_BL                                |
| requested   | mynnedmf_wrapper_run<br>mynnrad_pre_run<br>mynnsfc_wrapper_run |
| physics set | physics  |

#### subgrid\_scale\_cloud\_fraction\_from\_shoc

|             |   |
|-------------|---|
| long_name   | subgrid-scale cloud fraction from the SHOC scheme                             |
| units       | frac  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type   |
| local_name  | physics%Tbd(cdata%blk_no)%phy_f3d(:, :, physics%Model(cdata%blk_no)%nscfshoc) |
| requested   | cs_conv_aw_adj_run<br>m_micro_pre_run<br>shoc_run                             |
| physics set | physics   |

#### subsurface\_runoff\_flux

|             |  |
|-------------|--|
| long_name   | subsurface runoff flux                         |
| units       | kg m-2 s-1                                     |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%drain       |
| requested   | GFS_surface_generic_post_run                   |
|             | lsm_noah_run                                   |
|             | lsm_ruc_run                                    |
|             | noahmpdrv_run                                  |
| physics set | physics  |



#### surface\_air\_pressure

|             |  |
|-------------|--|
| long_name   | surface pressure   |
| units       | Pa   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type  |
| local_name  | physics%Statein(cdata%blk_no)%pgr  |
| requested   | GFS_suite_interstitial_1_run<br>GFS_suite_interstitial_2_run<br>GFS_surface_generic_post_run<br>cu_gf_driver_run<br>lsm_noah_run<br>maximum_hourly_diagnostics_run<br>mynnedmf_wrapper_run<br>mynnsfc_wrapper_run<br>noahmpdrv_run<br>rayleigh_damp_run<br>samfdeepcnv_run<br>samfshalcnv_run<br>sfc_diag_post_run<br>sfc_diag_run<br>sfc_diff_run<br>sfc_nst_run<br>sfc_ocean_run<br>sfc_sice_run<br>shinhongvdif_run<br>ysuvdif_run<br>zhaocarr_gscond_run |
| physics set | physics  |

#### surface\_air\_pressure\_at\_previous\_time\_step

long\_name     surface air pressure at previous time step  
units         Pa  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name    physics%Tbd(cdata%blk\_no)%phy\_f2d(:,2)  
requested     NOT REQUESTED  
physics set

#### surface\_air\_pressure\_diag

long\_name     surface air pressure diagnostic  
units         Pa  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%psurf  
requested     GFS\_suite\_interstitial\_1\_run  
physics set   physics

#### surface\_air\_pressure\_two\_time\_steps\_back

long\_name     surface air pressure two time steps back  
units         Pa  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name    physics%Tbd(cdata%blk\_no)%phy\_f2d(:,1)  
requested     NOT REQUESTED  
physics set

#### surface\_air\_temperature\_for\_radiation

|             |  |
|-------------|--|
| long_name   | lowest model layer air temperature for radiation                               |
| units       | K  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                                 |
| local_name  | physics%Interstitial(cdata%blk_no)%tsfa  |
| requested   | GFS_rrtmg_pre_run<br>rrtmg_lw_post_run<br>rrtmg_lw_pre_run<br>rrtmg_sw_pre_run |
| physics set | physics  |

#### surface\_albedo\_due\_to\_UV\_and\_VIS\_diffused

|             |   |
|-------------|---|
| long_name   | surface albedo due to UV+VIS diffused beam            |
| units       | frac  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type        |
| local_name  | physics%Interstitial(cdata%blk_no)%sfcalb(:,4)        |
| requested   | rrtmg_sw_post_run<br>rrtmg_sw_pre_run<br>rrtmg_sw_run |
| physics set | physics   |

#### surface\_albedo\_due\_to\_UV\_and\_VIS\_direct

long\_name     surface albedo due to UV+VIS direct beam  
units         frac  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%sfcalb(:,3)  
requested     rrtmg\_sw\_post\_run  
              rrtmg\_sw\_pre\_run  
              rrtmg\_sw\_run  
physics set   physics

#### surface\_albedo\_due\_to\_near\_IR\_diffused

long\_name     surface albedo due to near IR diffused beam  
units         frac  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%sfcalb(:,2)  
requested     rrtmg\_sw\_post\_run  
              rrtmg\_sw\_pre\_run  
              rrtmg\_sw\_run  
physics set   physics

#### surface\_albedo\_due\_to\_near\_IR\_direct

|             |   |
|-------------|---|
| long_name   | surface albedo due to near IR direct beam             |
| units       | frac  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type        |
| local_name  | physics%Interstitial(cdata%blk_no)%sfcalb(:,1)        |
| requested   | rrtmg_sw_post_run<br>rrtmg_sw_pre_run<br>rrtmg_sw_run |
| physics set | physics   |

#### surface\_albedo\_perturbation

|             |  |
|-------------|--|
| long_name   | surface albedo perturbation                    |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%alb1d       |
| requested   | GFS_rrtmg_pre_run<br>rrtmg_sw_pre_run          |
| physics set | physics  |

#### surface\_condensation\_mass

|             |   |
|-------------|---|
| long_name   | surface condensation mass                 |
| units       | kg m-2                                    |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%cndm_surf   |
| requested   | lsm_ruc_run                               |
| physics set | physics                                   |

#### surface\_diffused\_shortwave\_albedo

|             |  |
|-------------|--|
| long_name   | mean surface diffused sw albedo              |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                    |
| source      | MODULE GFS_typedefs TYPE GFS_radtend_type    |
| local_name  | physics%Radtend(cdata%blk_no)%sfalb          |
| requested   | lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run |
| physics set | physics                                      |

#### surface\_downwelling\_diffuse\_near\_infrared\_shortwave\_flux

long\_name surface downwelling diffuse near-infrared shortwave flux at current time  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%adjnirdfd  
requested GFS\_surface\_generic\_post\_run  
dcyc2t3\_run  
physics set physics

#### surface\_downwelling\_diffuse\_near\_infrared\_shortwave\_flux\_on\_radiation\_time\_step

long\_name sfc nir diff sw downward flux  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%nirdfdi  
requested dcyc2t3\_run  
physics set physics

#### surface\_downwelling\_diffuse\_ultraviolet\_and\_visible\_shortwave\_flux

long\_name surface downwelling diffuse ultraviolet plus visible shortwave flux at current time  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%adjvisdfd  
requested GFS\_surface\_generic\_post\_run  
dcyc2t3\_run  
physics set physics

#### surface\_downwelling\_diffuse\_ultraviolet\_and\_visible\_shortwave\_flux\_on\_radiation\_time\_step

long\_name sfc uv+vis diff sw downward flux  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%visdfdi  
requested dcyc2t3\_run  
physics set physics

#### surface\_downwelling\_direct\_near\_infrared\_shortwave\_flux

long\_name surface downwelling beam near-infrared shortwave flux at current time  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%adjnirbmd  
requested GFS\_surface\_generic\_post\_run  
dcyc2t3\_run  
physics set physics

#### surface\_downwelling\_direct\_near\_infrared\_shortwave\_flux\_on\_radiation\_time\_step

long\_name sfc nir beam sw downward flux  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%nirbmdi  
requested dcyc2t3\_run  
physics set physics



#### surface\_downwelling\_direct\_ultraviolet\_and\_visible\_shortwave\_flux

long\_name surface downwelling beam ultraviolet plus visible shortwave flux at current time  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%adjvisbmd  
requested GFS\_surface\_generic\_post\_run  
dcyc2t3\_run  
physics set physics

#### surface\_downwelling\_direct\_ultraviolet\_and\_visible\_shortwave\_flux\_on\_radiation\_time\_step

long\_name sfc uv+vis beam sw downward flux  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%visbmdi  
requested dcyc2t3\_run  
physics set physics

#### surface\_downwelling\_longwave\_flux

long\_name     surface downwelling longwave flux at current time  
units         W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%dlwsfci  
requested     GFS\_suite\_interstitial\_2\_run  
              GFS\_surface\_composites\_inter\_run  
              GFS\_surface\_generic\_post\_run  
              dcyc2t3\_run  
              lsm\_ruc\_run  
physics set   physics

#### surface\_downwelling\_longwave\_flux\_absorbed\_by\_ground

long\_name     total sky surface downward longwave flux absorbed by the ground  
units         W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%gabsbdlw  
requested     NOT REQUESTED  
physics set

#### surface\_downwelling\_longwave\_flux\_absorbed\_by\_ground\_over\_ice

long\_name     total sky surface downward longwave flux absorbed by the ground over ice  
units         W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%gabsbdlw\_ice  
requested     GFS\_surface\_composites\_inter\_run  
              sfc\_sice\_run  
physics set   physics

#### surface\_downwelling\_longwave\_flux\_absorbed\_by\_ground\_over\_land

long\_name     total sky surface downward longwave flux absorbed by the ground over land  
units         W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%gabsbdlw\_land  
requested     GFS\_surface\_composites\_inter\_run  
              lsm\_noah\_run  
              noahmpdrv\_run  
physics set   physics

#### surface\_downwelling\_longwave\_flux\_absorbed\_by\_ground\_over\_ocean

|             |  |
|-------------|--|
| long_name   | total sky surface downward longwave flux absorbed by the ground over ocean |
| units       | W m-2  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                             |
| local_name  | physics%Interstitial(cdata%blk_no)%gabsbdlw_ocean                          |
| requested   | GFS_surface_composites_inter_run   |
|             | sfc_nst_run  |
| physics set | physics  |

#### surface\_downwelling\_longwave\_flux\_on\_radiation\_time\_step

|             |  |
|-------------|--|
| long_name   | total sky sfc downward lw flux             |
| units       | W m-2                                      |
| rank        | 1  |
| type        | real                                       |
| kind        | kind_phys                                  |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type |
| local_name  | physics%Coupling(cdata%blk_no)%sfcdlw      |
| requested   | dcyc2t3_run                                |
| physics set | physics                                    |

#### surface\_downwelling\_shortwave\_flux

|             |   |
|-------------|---|
| long_name   | surface downwelling shortwave flux at current time  |
| units       | W m-2   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type  |
| local_name  | physics%Diag(cdata%blk_no)%dswsfci  |
| requested   | GFS_suite_interstitial_2_run<br>GFS_surface_generic_post_run<br>dcyc2t3_post_run<br>dcyc2t3_run<br>lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run<br>sfc_sice_run |
| physics set | physics   |

#### surface\_downwelling\_shortwave\_flux\_on\_radiation\_time\_step

|             |  |
|-------------|--|
| long_name   | total sky sfc downward sw flux             |
| units       | W m-2                                      |
| rank        | 1  |
| type        | real                                       |
| kind        | kind_phys                                  |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type |
| local_name  | physics%Coupling(cdata%blk_no)%sfcdsw      |
| requested   | dcyc2t3_run                                |
| physics set | physics                                    |

#### surface\_drag\_coefficient\_for\_heat\_and\_moisture\_for\_noahmp

long\_name            surface exchange coeff heat  
moisture for noahmp  
units                none  
rank                 1  
type                 real  
kind                 kind\_phys  
source               MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name           physics%Sfcprop(cdata%blk\_no)%chxy  
requested            NOT REQUESTED  
physics set

#### surface\_drag\_coefficient\_for\_heat\_and\_moisture\_in\_air

long\_name           surface exchange coeff heat  
moisture  
units                none  
rank                 1  
type                 real  
kind                 kind\_phys  
source               MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name           physics%Interstitial(cdata%blk\_no)%cdq  
requested            GFS\_surface\_composites\_post\_run  
                     gmtb\_scm\_sfc\_flux\_spec\_run  
                     myjpbl\_wrapper\_run  
                     myjsfc\_wrapper\_run  
                     mynnsfc\_wrapper\_run  
physics set          physics

#### surface\_drag\_coefficient\_for\_heat\_and\_moisture\_in\_air\_over\_ice

|                   |   |
|-------------------|---|
| long_name         | surface exchange coeff heat   |
| moisture over ice |   |
| units             | none  |
| rank              | 1   |
| type              | real  |
| kind              | kind_phys   |
| source            | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name        | physics%Interstitial(cdata%blk_no)%cdq_ice  |
| requested         | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_cice_run<br>sfc_diff_run<br>sfc_sice_run |
| physics set       | physics   |

#### surface\_drag\_coefficient\_for\_heat\_and\_moisture\_in\_air\_over\_land

|                    |   |
|--------------------|---|
| long_name          | surface exchange coeff heat   |
| moisture over land |   |
| units              | none  |
| rank               | 1   |
| type               | real  |
| kind               | kind_phys   |
| source             | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name         | physics%Interstitial(cdata%blk_no)%cdq_land   |
| requested          | GFS_surface_composites_post_run<br>lsm_noah_run<br>lsm_ruc_run<br>myjsfc_wrapper_run<br>noahmpdrv_run<br>sfc_diff_run |
| physics set        | physics   |

```

surface_drag_coefficient_for_heat_and_moisture_in_air_over_ocean
  long_name      surface exchange coeff heat
  moisture over ocean
  units          none
  rank           1
  type           real
  kind           kind_phys
  source         MODULE GFS_typedefs TYPE GFS_interstitial_type
  local_name     physics%Interstitial(cdata%blk_no)%cdq_ocean
  requested      GFS_surface_composites_post_run
                  myjsfc_wrapper_run
                  sfc_diff_run
                  sfc_nst_run
                  sfc_ocean_run
  physics set    physics

```

```

surface_drag_coefficient_for_momentum_for_noahmp
  long_name      surface drag coefficient for momentum for noahmp
  units          none
  rank           1
  type           real
  kind           kind_phys
  source         MODULE GFS_typedefs TYPE GFS_sfcprop_type
  local_name     physics%Sfcprop(cdata%blk_no)%cmxy
  requested      NOT REQUESTED
  physics set

```



#### surface\_drag\_coefficient\_for\_momentum\_in\_air

|             |  |
|-------------|--|
| long_name   | surface exchange coeff for momentum  |
| units       | none   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%cd  |
| requested   | GFS_surface_composites_post_run<br>gmtb_scm_sfc_flux_spec_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>mynnsfc_wrapper_run |
| physics set | physics  |

#### surface\_drag\_coefficient\_for\_momentum\_in\_air\_over\_ice

|             |   |
|-------------|---|
| long_name   | surface exchange coeff for momentum over ice  |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%cd_ice   |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_cice_run<br>sfc_diff_run<br>sfc_sice_run |
| physics set | physics   |

#### surface\_drag\_coefficient\_for\_momentum\_in\_air\_over\_land

|             |   |
|-------------|---|
| long_name   | surface exchange coeff for momentum over land   |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%cd_land  |
| requested   | GFS_surface_composites_post_run<br>lsm_noah_run<br>lsm_ruc_run<br>myjsfc_wrapper_run<br>noahmpdrv_run<br>sfc_diff_run |
| physics set | physics   |

#### surface\_drag\_coefficient\_for\_momentum\_in\_air\_over\_ocean

|             |   |
|-------------|---|
| long_name   | surface exchange coeff for momentum over ocean  |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%cd_ocean   |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run<br>sfc_nst_run<br>sfc_ocean_run |
| physics set | physics   |

#### surface\_drag\_mass\_flux\_for\_heat\_and\_moisture\_in\_air

long\_name      thermal exchange coefficient  
units           kg m-2 s-1  
rank           1  
type           real  
kind           kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name      physics%Diag(cdata%blk\_no)%chh  
requested       GFS\_surface\_composites\_post\_run  
physics set     physics

#### surface\_drag\_mass\_flux\_for\_heat\_and\_moisture\_in\_air\_over\_ice

long\_name      thermal exchange coefficient over ice  
units           kg m-2 s-1  
rank           1  
type           real  
kind           kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name      physics%Interstitial(cdata%blk\_no)%chh\_ice  
requested       GFS\_surface\_composites\_post\_run  
                 sfc\_cice\_run  
                 sfc\_sice\_run  
physics set     physics

```

surface_drag_mass_flux_for_heat_and_moisture_in_air_over_land
    long_name    thermal exchange coefficient over land
    units        kg m-2 s-1
    rank         1
    type         real
    kind         kind_phys
    source       MODULE GFS_typedefs TYPE GFS_interstitial_type
    local_name    physics%Interstitial(cdata%blk_no)%chh_land
    requested    GFS_surface_composites_post_run
                lsm_noah_run
                lsm_ruc_run
                noahmpdrv_run
    physics set   physics

```

```

surface_drag_mass_flux_for_heat_and_moisture_in_air_over_ocean
    long_name    thermal exchange coefficient over ocean
    units        kg m-2 s-1
    rank         1
    type         real
    kind         kind_phys
    source       MODULE GFS_typedefs TYPE GFS_interstitial_type
    local_name    physics%Interstitial(cdata%blk_no)%chh_ocean
    requested    GFS_surface_composites_post_run
                sfc_nst_run
                sfc_ocean_run
    physics set   physics

```

#### surface\_drag\_wind\_speed\_for\_momentum\_in\_air

|             |  |
|-------------|--|
| long_name   | momentum exchange coefficient  |
| units       | m s-1  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type   |
| local_name  | physics%Diag(cdata%blk_no)%cmm   |
| requested   | GFS_surface_composites_post_run<br>mynnedmf_wrapper_run<br>mynnsfc_wrapper_run |
| physics set | physics  |

#### surface\_drag\_wind\_speed\_for\_momentum\_in\_air\_over\_ice

|             |   |
|-------------|---|
| long_name   | momentum exchange coefficient over ice                          |
| units       | m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                  |
| local_name  | physics%Interstitial(cdata%blk_no)%cmm_ice                      |
| requested   | GFS_surface_composites_post_run<br>sfc_cice_run<br>sfc_sice_run |
| physics set | physics   |

#### surface\_drag\_wind\_speed\_for\_momentum\_in\_air\_over\_land

|             |  |
|-------------|--|
| long_name   | momentum exchange coefficient over land        |
| units       | m s-1  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%cmm_land    |
| requested   | GFS_surface_composites_post_run                |
|             | lsm_noah_run                                   |
|             | lsm_ruc_run                                    |
|             | noahmpdrv_run                                  |
| physics set | physics  |

#### surface\_drag\_wind\_speed\_for\_momentum\_in\_air\_over\_ocean

|             |  |
|-------------|--|
| long_name   | momentum exchange coefficient over ocean       |
| units       | m s-1  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%cmm_ocean   |
| requested   | GFS_surface_composites_post_run                |
|             | sfc_nst_run                                    |
|             | sfc_ocean_run                                  |
| physics set | physics  |

#### surface\_exchange\_coefficient\_for\_heat

long\_name     surface exchange coefficient for heat  
units         W m-2 K-1  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name    physics%Sfcprop(cdata%blk\_no)%flhc  
requested     NOT REQUESTED  
physics set

#### surface\_exchange\_coefficient\_for\_heat\_at\_2m

long\_name     exchange coefficient for heat at 2 meters  
units         m s-1  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name    physics%Sfcprop(cdata%blk\_no)%chs2  
requested     NOT REQUESTED  
physics set

#### surface\_exchange\_coefficient\_for\_moisture

long\_name     surface exchange coefficient for moisture  
units         kg m-2 s-1  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name    physics%Sfcprop(cdata%blk\_no)%flqc  
requested     NOT REQUESTED  
physics set

#### surface\_exchange\_coefficient\_for\_moisture\_at\_2m

long\_name      exchange coefficient for moisture at 2 meters  
units           m s-1  
rank           1  
type           real  
kind           kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name      physics%Sfcprop(cdata%blk\_no)%cqs2  
requested       NOT REQUESTED  
physics set

#### surface\_friction\_velocity

long\_name      boundary layer parameter  
units           m s-1  
rank           1  
type           real  
kind           kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name      physics%Sfcprop(cdata%blk\_no)%uustar  
requested       GFS\_surface\_composites\_post\_run  
                 GFS\_surface\_composites\_pre\_run  
                 gmtb\_scm\_sfc\_flux\_spec\_run  
                 myjpbl\_wrapper\_run  
                 myjsfc\_wrapper\_run  
                 mynnedmf\_wrapper\_run  
                 mynnsfc\_wrapper\_run  
physics set     physics



#### surface\_friction\_velocity\_drag

long\_name friction velocity isolated for momentum only  
units m s-1  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name physics%Sfcprop(cdata%blk\_no)%ustm  
requested NOT REQUESTED  
physics set

#### surface\_friction\_velocity\_over\_ice

long\_name surface friction velocity over ice  
units m s-1  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%uustar\_ice  
requested GFS\_surface\_composites\_post\_run  
GFS\_surface\_composites\_pre\_run  
myjsfc\_wrapper\_run  
sfc\_diff\_run  
physics set physics

#### surface\_friction\_velocity\_over\_land

|             |   |
|-------------|---|
| long_name   | surface friction velocity over land   |
| units       | m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%uustar_land  |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### surface\_friction\_velocity\_over\_ocean

|             |   |
|-------------|---|
| long_name   | surface friction velocity over ocean                                  |
| units       | m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                        |
| local_name  | physics%Interstitial(cdata%blk_no)%uustar_ocean                       |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### surface\_ground\_temperature\_for\_radiation

|             |   |
|-------------|---|
| long_name   | surface ground temperature for radiation                                  |
| units       | K   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                            |
| local_name  | physics%Interstitial(cdata%blk_no)%tsfg                                   |
| requested   | GFS_rrtmg_pre_run<br>rrtmg_lw_pre_run<br>rrtmg_lw_run<br>rrtmg_sw_pre_run |
| physics set | physics   |

#### surface\_latent\_heat

|             |   |
|-------------|---|
| long_name   | latent heating at the surface (pos = up)  |
| units       | W m-2                                     |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%lh          |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### surface\_layer\_evaporation\_switch

|             |  |
|-------------|--|
| long_name   | surface layer evaporation switch         |
| units       | none                                     |
| rank        | 1  |
| type        | real                                     |
| kind        | kind_phys                                |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type    |
| local_name  | physics%Tbd(cdata%blk_no)%phy_myj_chkqlm |
| requested   | NOT REQUESTED                            |
| physics set |  |

#### surface\_longwave\_emissivity

|             |   |
|-------------|---|
| long_name   | surface lw emissivity in fraction         |
| units       | frac                                      |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_radtend_type |
| local_name  | physics%Radtend(cdata%blk_no)%semis       |
| requested   | GFS_surface_composites_pre_run            |
|             | rrtmg_lw_run                              |
| physics set | physics                                   |

#### surface\_longwave\_emissivity\_over\_ice\_interstitial

long\_name     surface lw emissivity in fraction over ice (temporary use as interstitial)  
units         frac  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%semis\_ice  
requested     GFS\_surface\_composites\_inter\_run  
              GFS\_surface\_composites\_pre\_run  
              dcyc2t3\_run  
              sfc\_sice\_run  
physics set   physics

#### surface\_longwave\_emissivity\_over\_land\_interstitial

long\_name     surface lw emissivity in fraction over land (temporary use as interstitial)  
units         frac  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%semis\_land  
requested     GFS\_surface\_composites\_inter\_run  
              GFS\_surface\_composites\_pre\_run  
              dcyc2t3\_run  
              lsm\_noah\_run  
              lsm\_ruc\_run  
              noahmpdrv\_run  
physics set   physics

#### surface\_longwave\_emissivity\_over\_ocean\_interstitial

|             |  |
|-------------|--|
| long_name   | surface lw emissivity in fraction over ocean (temporary use as interstitial)                     |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%semis_ocean   |
| requested   | GFS_surface_composites_inter_run<br>GFS_surface_composites_pre_run<br>dcyc2t3_run<br>sfc_nst_run |
| physics set | physics  |

#### surface\_midlayer\_air\_temperature\_in\_longwave\_radiation

|             |   |
|-------------|---|
| long_name   | surface air temp during lw calculation    |
| units       | K   |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_radtend_type |
| local_name  | physics%Radtend(cdata%blk_no)%tsflw       |
| requested   | dcyc2t3_run                               |
| physics set | physics                                   |

#### surface\_net\_downwelling\_shortwave\_flux

|             |  |
|-------------|--|
| long_name   | surface net downwelling shortwave flux at current time   |
| units       | W m-2  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type   |
| local_name  | physics%Diag(cdata%blk_no)%nswsfci   |
| requested   | dcyc2t3_post_run<br>dcyc2t3_run<br>lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run<br>sfc_nst_run<br>sfc_sice_run |
| physics set | physics  |

#### surface\_net\_downwelling\_shortwave\_flux\_on\_radiation\_time\_step

|             |  |
|-------------|--|
| long_name   | total sky sfc netsw flx into ground        |
| units       | W m-2                                      |
| rank        | 1  |
| type        | real                                       |
| kind        | kind_phys                                  |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type |
| local_name  | physics%Coupling(cdata%blk_no)%sfcnsf      |
| requested   | dcyc2t3_run                                |
| physics set | physics                                    |

### surface\_roughness\_length

|             |  |
|-------------|--|
| long_name   | surface roughness length   |
| units       | cm   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type  |
| local_name  | physics%Sfcprop(cdata%blk_no)%zorl   |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>gmtb_scm_sfc_flux_spec_run<br>hedmf_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>mynnedmf_wrapper_run<br>mynnsfc_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics  |



#### surface\_roughness\_length\_over\_ice\_interstitial

|             |   |
|-------------|---|
| long_name   | surface roughness length over ice (temporary use as interstitial)                                       |
| units       | cm  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%zorl_ice   |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### surface\_roughness\_length\_over\_land

|             |   |
|-------------|---|
| long_name   | surface roughness length over land                                |
| units       | cm  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type                         |
| local_name  | physics%Sfcprop(cdata%blk_no)%zorll                               |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run |
| physics set | physics   |

#### surface\_roughness\_length\_over\_land\_interstitial

|             |   |
|-------------|---|
| long_name   | surface roughness length over land (temporary use as interstitial)  |
| units       | cm  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%zorl_land  |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>lsm_noah_run<br>lsm_ruc_run<br>myjsfc_wrapper_run<br>noahmpdrv_run<br>sfc_diff_run |
| physics set | physics   |

#### surface\_roughness\_length\_over\_ocean

|             |   |
|-------------|---|
| long_name   | surface roughness length over ocean                               |
| units       | cm  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type                         |
| local_name  | physics%Sfcprop(cdata%blk_no)%zorlo                               |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run |
| physics set | physics   |

#### surface\_roughness\_length\_over\_ocean\_interstitial

|             |   |
|-------------|---|
| long_name   | surface roughness length over ocean (temporary use as interstitial)                                     |
| units       | cm  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%zorl_ocean   |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### surface\_runoff

|             |   |
|-------------|---|
| long_name   | surface water runoff (from lsm)             |
| units       | kg m-2                                      |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys                                   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type      |
| local_name  | physics%Diag(cdata%blk_no)%srunoff          |
| requested   | GFS_surface_generic_post_run<br>lsm_ruc_run |
| physics set | physics                                     |

#### surface\_runoff\_flux

|             |  |
|-------------|--|
| long_name   | surface runoff flux                            |
| units       | kg m-2 s-1                                     |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%runoff      |
| requested   | GFS_surface_generic_post_run                   |
|             | lsm_noah_run                                   |
|             | lsm_ruc_run                                    |
|             | noahmpdrv_run                                  |
| physics set | physics  |

### surface\_skin\_temperature

|             |   |
|-------------|---|
| long_name   | surface skin temperature  |
| units       | K   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type   |
| local_name  | physics%Sfcprop(cdata%blk_no)%tsfc  |
| requested   | GFS_MP_generic_post_run<br>GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>GFS_surface_generic_post_run<br>GFS_surface_generic_pre_run<br>gmtb_scm_sfc_flux_spec_run<br>hedmf_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>mynnedmf_wrapper_run<br>mynnsfc_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>sfc_diag_run |
| physics set | physics   |

#### surface\_skin\_temperature\_after\_iteration

|             |  |
|-------------|--|
| long_name   | surface skin temperature after iteration   |
| units       | K  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%tsurf   |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>GFS_surface_generic_pre_run |
| physics set | physics  |

#### surface\_skin\_temperature\_after\_iteration\_over\_ice

|             |   |
|-------------|---|
| long_name   | surface skin temperature after iteration over ice                                 |
| units       | K   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                                    |
| local_name  | physics%Interstitial(cdata%blk_no)%tsurf_ice                                      |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>sfc_diff_run |
| physics set | physics   |

#### surface\_skin\_temperature\_after\_iteration\_over\_land

|             |   |
|-------------|---|
| long_name   | surface skin temperature after iteration over land  |
| units       | K   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%tsurf_land   |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run<br>sfc_diff_run |
| physics set | physics   |

#### surface\_skin\_temperature\_after\_iteration\_over\_ocean

|             |   |
|-------------|---|
| long_name   | surface skin temperature after iteration over ocean   |
| units       | K   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%tsurf_ocean  |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>sfc_diff_run<br>sfc_nst_post_run<br>sfc_nst_pre_run<br>sfc_nst_run |
| physics set | physics   |

#### surface\_skin\_temperature\_for\_nsst

|             |  |
|-------------|--|
| long_name   | ocean surface skin temperature                 |
| units       | K  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%tseal       |
| requested   | sfc_nst_pre_run<br>sfc_nst_run                 |
| physics set | physics  |

#### surface\_skin\_temperature\_over\_ice\_interstitial

|             |  |
|-------------|--|
| long_name   | surface skin temperature over ice (temporary use as interstitial)  |
| units       | K  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%tsfc_ice  |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>dcyc2t3_run<br>sfc_diff_run<br>sfc_sice_run |
| physics set | physics  |



#### surface\_skin\_temperature\_over\_land

|             |   |
|-------------|---|
| long_name   | surface skin temperature over land                                |
| units       | K   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type                         |
| local_name  | physics%Sfcprop(cdata%blk_no)%tsfc_l                              |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run |
| physics set | physics   |

#### surface\_skin\_temperature\_over\_land\_interstitial

|             |  |
|-------------|--|
| long_name   | surface skin temperature over land (temporary use as interstitial)   |
| units       | K  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%tsfc_land   |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>dcyc2t3_run<br>lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run<br>sfc_diff_run |
| physics set | physics  |

#### surface\_skin\_temperature\_over\_ocean\_interstitial

|             |   |
|-------------|---|
| long_name   | surface skin temperature over ocean (temporary use as interstitial)   |
| units       | K   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%tsfc_ocean   |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>GFS_surface_generic_post_run<br>dcyc2t3_run<br>lsm_ruc_run<br>sfc_diff_run<br>sfc_nst_post_run<br>sfc_nst_pre_run<br>sfc_ocean_run |
| physics set | physics   |

#### surface\_slope\_classification

|             |  |
|-------------|--|
| long_name   | surface slope type at each grid cell                         |
| units       | index  |
| rank        | 1  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type               |
| local_name  | physics%Interstitial(cdata%blk_no)%slopetype                 |
| requested   | GFS_surface_generic_pre_run<br>lsm_noah_run<br>noahmpdrv_run |
| physics set | physics  |

#### surface\_slope\_classification\_real

|             |   |
|-------------|---|
| long_name   | sfc slope type for lsm                    |
| units       | index                                     |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%slope       |
| requested   | GFS_surface_generic_pre_run               |
| physics set | physics                                   |

#### surface\_snow\_area\_fraction

|             |  |
|-------------|--|
| long_name   | surface snow area fraction                     |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%snowc       |
| requested   | GFS_surface_generic_post_run                   |
|             | lsm_noah_run                                   |
|             | noahmpdrv_run                                  |
| physics set | physics  |

#### surface\_snow\_area\_fraction\_over\_land

|             |  |
|-------------|--|
| long_name   | surface snow area fraction                   |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                    |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type    |
| local_name  | physics%Sfcprop(cdata%blk_no)%sncovr         |
| requested   | lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run |
| physics set | physics                                      |

#### surface\_snow\_melt

|             |  |
|-------------|--|
| long_name   | snow melt during timestep                      |
| units       | m  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%snowmt      |
| requested   | sfc_sice_run                                   |
| physics set | physics  |

#### surface\_snow\_thickness\_water\_equivalent

|             |  |
|-------------|--|
| long_name   | water equivalent snow depth  |
| units       | mm   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type  |
| local_name  | physics%Sfcprop(cdata%blk_no)%snowd  |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>myjpbl_wrapper_run<br>mynnsfc_wrapper_run |
| physics set | physics  |

#### surface\_snow\_thickness\_water\_equivalent\_over\_ice

|             |   |
|-------------|---|
| long_name   | water equivalent snow depth over ice  |
| units       | mm  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%snowd_ice  |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>sfc_diff_run<br>sfc_sice_run |
| physics set | physics   |

#### surface\_snow\_thickness\_water\_equivalent\_over\_land

|             |   |
|-------------|---|
| long_name   | water equivalent snow depth over land   |
| units       | mm  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%snowd_land   |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run<br>sfc_diff_run |
| physics set | physics   |

#### surface\_snow\_thickness\_water\_equivalent\_over\_ocean

|             |   |
|-------------|---|
| long_name   | water equivalent snow depth over ocean  |
| units       | mm  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                                    |
| local_name  | physics%Interstitial(cdata%blk_no)%snowd_ocean                                    |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>sfc_diff_run |
| physics set | physics   |

#### surface\_specific\_humidity

|             |  |
|-------------|--|
| long_name   | surface air saturation specific humidity   |
| units       | kg kg-1  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%qss   |
| requested   | GFS_surface_composites_post_run<br>gmtb_scm_sfc_flux_spec_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>mynnedmf_wrapper_run<br>mynnsfc_wrapper_run<br>sfc_diag_run |
| physics set | physics  |

#### surface\_specific\_humidity\_for\_MYJ\_schemes

|             |  |
|-------------|--|
| long_name   | surface air saturation specific humidity for MYJ schemes |
| units       | kg kg-1  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type                    |
| local_name  | physics%Tbd(cdata%blk_no)%phy_myj_qsfc                   |
| requested   | NOT REQUESTED  |
| physics set |  |

#### surface\_specific\_humidity\_over\_ice

|             |   |
|-------------|---|
| long_name   | surface air saturation specific humidity over ice               |
| units       | kg kg-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                  |
| local_name  | physics%Interstitial(cdata%blk_no)%qss_ice                      |
| requested   | GFS_surface_composites_post_run<br>sfc_cice_run<br>sfc_sice_run |
| physics set | physics   |

#### surface\_specific\_humidity\_over\_land

|             |   |
|-------------|---|
| long_name   | surface air saturation specific humidity over land                              |
| units       | kg kg-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                                  |
| local_name  | physics%Interstitial(cdata%blk_no)%qss_land                                     |
| requested   | GFS_surface_composites_post_run<br>lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run |
| physics set | physics   |



#### surface\_specific\_humidity\_over\_ocean

long\_name surface air saturation specific humidity over ocean  
units kg kg-1  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%qss\_ocean  
requested GFS\_surface\_composites\_post\_run  
sfc\_nst\_run  
sfc\_ocean\_run  
physics set physics

#### surface\_stability\_parameter

long\_name monin obukhov surface stability parameter  
units none  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name physics%Sfcprop(cdata%blk\_no)%zol  
requested NOT REQUESTED  
physics set

#### surface\_upward\_latent\_heat\_flux\_for\_coupling

long\_name sfc latent heat flux input for coupling  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%dqsfcin\_cpl  
requested GFS\_surface\_generic\_pre\_run  
physics set physics

#### surface\_upward\_latent\_heat\_flux\_for\_coupling\_interstitial

long\_name     surface latent heat flux for coupling interstitial  
units         W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%dqsfc\_cice  
requested     GFS\_PBL\_generic\_post\_run  
              GFS\_surface\_generic\_pre\_run  
              sfc\_cice\_run  
physics set   physics

#### surface\_upward\_potential\_latent\_heat\_flux

long\_name     surface upward potential latent heat flux  
units         W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%ep1d  
requested     GFS\_surface\_composites\_post\_run  
              GFS\_surface\_generic\_post\_run  
physics set   physics

#### surface\_upward\_potential\_latent\_heat\_flux\_over\_ice

|             |   |
|-------------|---|
| long_name   | surface upward potential latent heat flux over ice                                |
| units       | W m-2   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                                    |
| local_name  | physics%Interstitial(cdata%blk_no)%ep1d_ice                                       |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>sfc_sice_run |
| physics set | physics   |

#### surface\_upward\_potential\_latent\_heat\_flux\_over\_land

|             |  |
|-------------|--|
| long_name   | surface upward potential latent heat flux over land              |
| units       | W m-2  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                   |
| local_name  | physics%Interstitial(cdata%blk_no)%ep1d_land                     |
| requested   | GFS_surface_composites_post_run<br>lsm_noah_run<br>noahmpdrv_run |
| physics set | physics  |

#### surface\_upward\_potential\_latent\_heat\_flux\_over\_ocean

|             |   |
|-------------|---|
| long_name   | surface upward potential latent heat flux over ocean            |
| units       | W m-2   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                  |
| local_name  | physics%Interstitial(cdata%blk_no)%ep1d_ocean                   |
| requested   | GFS_surface_composites_post_run<br>sfc_nst_run<br>sfc_ocean_run |
| physics set | physics   |

#### surface\_upward\_sensible\_heat\_flux\_for\_coupling

|             |  |
|-------------|--|
| long_name   | sfc sensible heat flux input               |
| units       | W m-2                                      |
| rank        | 1  |
| type        | real                                       |
| kind        | kind_phys                                  |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type |
| local_name  | physics%Coupling(cdata%blk_no)%dtsfcin_cpl |
| requested   | GFS_surface_generic_pre_run                |
| physics set | physics                                    |

#### surface\_upward\_sensible\_heat\_flux\_for\_coupling\_interstitial

long\_name      sfc sensible heat flux for coupling interstitial  
units          W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%dtsfc\_cice  
requested     GFS\_PBL\_generic\_post\_run  
              GFS\_surface\_generic\_pre\_run  
              sfc\_cice\_run  
physics set   physics

#### surface\_upwelling\_diffuse\_near\_infrared\_shortwave\_flux

long\_name      surface upwelling diffuse near-infrared shortwave flux at current time  
units          W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%adjnirdfu  
requested     GFS\_surface\_generic\_post\_run  
              dcyc2t3\_run  
physics set   physics

#### surface\_upwelling\_diffuse\_near\_infrared\_shortwave\_flux\_on\_radiation\_time\_step

long\_name sfc nir diff sw upward flux  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%nirdfui  
requested dcyc2t3\_run  
physics set physics

#### surface\_upwelling\_diffuse\_ultraviolet\_and\_visible\_shortwave\_flux

long\_name surface upwelling diffuse ultraviolet plus visible shortwave flux at current time  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%adjvisdfu  
requested GFS\_surface\_generic\_post\_run  
dcyc2t3\_run  
physics set physics

#### surface\_upwelling\_diffuse\_ultraviolet\_and\_visible\_shortwave\_flux\_on\_radiation\_time\_step

long\_name sfc uv+vis diff sw upward flux  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%visdfui  
requested dcyc2t3\_run  
physics set physics

#### surface\_upwelling\_direct\_near\_infrared\_shortwave\_flux

long\_name surface upwelling beam near-infrared shortwave flux at current time  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%adjnirbmu  
requested GFS\_surface\_generic\_post\_run  
dcyc2t3\_run  
physics set physics

#### surface\_upwelling\_direct\_near\_infrared\_shortwave\_flux\_on\_radiation\_time\_step

long\_name sfc nir beam sw upward flux  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%nirbmu  
requested dcyc2t3\_run  
physics set physics

#### surface\_upwelling\_direct\_ultraviolet\_and\_visible\_shortwave\_flux

long\_name surface upwelling beam ultraviolet plus visible shortwave flux at current time  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%adjvisbmu  
requested GFS\_surface\_generic\_post\_run  
dcyc2t3\_run  
physics set physics

#### surface\_upwelling\_direct\_ultraviolet\_and\_visible\_shortwave\_flux\_on\_radiation\_time\_step

long\_name sfc uv+vis beam sw upward flux  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%visbmui  
requested dcyc2t3\_run  
physics set physics

#### surface\_upwelling\_longwave\_flux

long\_name surface upwelling longwave flux at current time  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%ulwsfci  
requested GFS\_suite\_interstitial\_2\_run  
GFS\_surface\_generic\_post\_run  
physics set physics

#### surface\_upwelling\_longwave\_flux\_for\_coupling

long\_name surface upwelling LW flux for coupling  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%ulwsfcin\_cpl  
requested GFS\_suite\_interstitial\_2\_run  
GFS\_surface\_generic\_pre\_run  
physics set physics



#### surface\_upwelling\_longwave\_flux\_for\_coupling\_interstitial

long\_name surface upwelling longwave flux for coupling\_interstitial  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%ulwsfc\_cice  
requested GFS\_surface\_generic\_pre\_run  
physics set physics

#### surface\_upwelling\_longwave\_flux\_over\_ice\_interstitial

long\_name surface upwelling longwave flux at current time over ice (temporary use as interstitial)  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%adjsfculw\_ice  
requested GFS\_suite\_interstitial\_2\_run  
dcyc2t3\_run  
physics set physics

#### surface\_upwelling\_longwave\_flux\_over\_land\_interstitial

long\_name surface upwelling longwave flux at current time over land (temporary use as interstitial)  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%adjsfculw\_land  
requested GFS\_suite\_interstitial\_2\_run  
dcyc2t3\_run  
physics set physics

#### surface\_upwelling\_longwave\_flux\_over\_ocean\_interstitial

long\_name surface upwelling longwave flux at current time over ocean (temporary use as interstitial)  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%adjsfculw\_ocean  
requested GFS\_suite\_interstitial\_2\_run  
GFS\_surface\_generic\_post\_run  
dcyc2t3\_run  
physics set physics

#### surface\_upwelling\_shortwave\_flux

long\_name surface upwelling shortwave flux at current time  
units W m-2  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%uswsfci  
requested dcyc2t3\_post\_run  
physics set physics

#### surface\_wind\_enhancement\_due\_to\_convection

long\_name     surface wind enhancement due to convection  
units         m s-1  
rank          1  
type         real  
kind         kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name    physics%Tbd(cdata%blk\_no)%phy\_f2d(:,physics%Model(cdata%blk\_no)%num\_p2d)  
requested     GFS\_surface\_generic\_pre\_run  
              mynnsfc\_wrapper\_run  
physics set   physics

#### surface\_wind\_stress

long\_name     surface wind stress  
units         m2 s-2  
rank          1  
type         real  
kind         kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%stress  
requested     GFS\_surface\_composites\_post\_run  
              gmtb\_scm\_sfc\_flux\_spec\_run  
              hedmf\_run  
              moninshoc\_run  
              myjsfc\_wrapper\_run  
              mynnsfc\_wrapper\_run  
              satmedmfvdif\_run  
              satmedmfvdifq\_run  
              shinhongvdif\_run  
              ysuvdif\_run  
physics set   physics

#### surface\_wind\_stress\_over\_ice

|             |   |
|-------------|---|
| long_name   | surface wind stress over ice  |
| units       | m2 s-2  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%stress_ice   |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_cice_run<br>sfc_diff_run |
| physics set | physics   |

#### surface\_wind\_stress\_over\_land

|             |   |
|-------------|---|
| long_name   | surface wind stress over land   |
| units       | m2 s-2  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                        |
| local_name  | physics%Interstitial(cdata%blk_no)%stress_land                        |
| requested   | GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run |
| physics set | physics   |

#### surface\_wind\_stress\_over\_ocean

|             |  |
|-------------|--|
| long_name   | surface wind stress over ocean   |
| units       | m2 s-2   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%stress_ocean  |
| requested   | GFS_PBL_generic_post_run<br>GFS_surface_composites_post_run<br>myjsfc_wrapper_run<br>sfc_diff_run<br>sfc_nst_run |
| physics set | physics  |

#### surface\_x\_momentum\_flux\_for\_coupling

|             |  |
|-------------|--|
| long_name   | sfc x momentum flux for coupling           |
| units       | Pa   |
| rank        | 1  |
| type        | real                                       |
| kind        | kind_phys                                  |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type |
| local_name  | physics%Coupling(cdata%blk_no)%dusfcin_cpl |
| requested   | GFS_surface_generic_pre_run                |
| physics set | physics                                    |

#### surface\_x\_momentum\_flux\_for\_coupling\_interstitial

|             |   |
|-------------|---|
| long_name   | sfc x momentum flux for coupling interstitial                           |
| units       | Pa  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                          |
| local_name  | physics%Interstitial(cdata%blk_no)%dusfc_cice                           |
| requested   | GFS_PBL_generic_post_run<br>GFS_surface_generic_pre_run<br>sfc_cice_run |
| physics set | physics   |

#### surface\_y\_momentum\_flux\_for\_coupling

|             |  |
|-------------|--|
| long_name   | sfc y momentum flux for coupling           |
| units       | Pa   |
| rank        | 1  |
| type        | real                                       |
| kind        | kind_phys                                  |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type |
| local_name  | physics%Coupling(cdata%blk_no)%dvsfcin_cpl |
| requested   | GFS_surface_generic_pre_run                |
| physics set | physics                                    |

#### surface\_y\_momentum\_flux\_for\_coupling\_interstitial

|             |   |
|-------------|---|
| long_name   | sfc y momentum flux for coupling interstitial                           |
| units       | Pa  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                          |
| local_name  | physics%Interstitial(cdata%blk_no)%dvsfc_cice                           |
| requested   | GFS_PBL_generic_post_run<br>GFS_surface_generic_pre_run<br>sfc_cice_run |
| physics set | physics   |

#### sw\_fluxes\_sfc

|             |   |
|-------------|---|
| long_name   | sw radiation fluxes at sfc                |
| units       | W m-2                                     |
| rank        | 1   |
| type        | sfcsw_type                                |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_radtend_type |
| local_name  | physics%Radtend(cdata%blk_no)%sfcsw       |
| requested   | rrtmg_sw_run                              |
| physics set | physics                                   |

#### sw\_fluxes\_top\_atmosphere

|             |  |
|-------------|--|
| long_name   | sw radiation fluxes at toa             |
| units       | W m-2                                  |
| rank        | 1                                      |
| type        | topfsw_type                            |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%topfsw      |
| requested   | rrtmg_sw_run                           |
| physics set | physics                                |

**t\_prime\_q\_prime**

|             |  |
|-------------|--|
| long_name   | covariance of temperature and moisture |
| units       | K kg kg-1                              |
| rank        | 2                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type  |
| local_name  | physics%Tbd(cdata%blk_no)%cov          |
| requested   | mynnedmf_wrapper_run                   |
|             | mynnsfc_wrapper_run                    |
| physics set | physics                                |

**t\_prime\_squared**

|             |                                       |
|-------------|---------------------------------------|
| long_name   | temperature fluctuation squared       |
| units       | K2                                    |
| rank        | 2                                     |
| type        | real                                  |
| kind        | kind_phys                             |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type |
| local_name  | physics%Tbd(cdata%blk_no)%tsq         |
| requested   | mynnedmf_wrapper_run                  |
|             | mynnsfc_wrapper_run                   |
| physics set | physics                               |



#### temperature\_at\_2m

|             |  |
|-------------|--|
| long_name   | 2 meter temperature  |
| units       | K  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type  |
| local_name  | physics%Sfcprop(cdata%blk_no)%t2m  |
| requested   | GFS_surface_generic_post_run<br>gmtb_scm_sfc_flux_spec_run<br>maximum_hourly_diagnostics_run<br>mynnsfc_wrapper_run<br>sfc_diag_post_run<br>sfc_diag_run |
| physics set | physics  |

#### temperature\_at\_2m\_from\_noahmp

|             |  |
|-------------|--|
| long_name   | 2 meter temperature from noahmp                |
| units       | K  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%t2mmp       |
| requested   | noahmpdrv_run<br>sfc_diag_post_run             |
| physics set | physics  |

#### temperature\_at\_zero\_celsius

|             |  |
|-------------|--|
| long_name   | temperature at 0 degrees Celsius                   |
| units       | K  |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE gmtb_scm_physical_constants                 |
| local_name  | con_t0c  |
| requested   | samfdeepcnv_run<br>samfshalcnv_run<br>sfc_sice_run |
| physics set | physics  |

#### temperature\_from\_previous\_timestep

|             |  |
|-------------|--|
| long_name   | temperature from previous time step  |
| units       | K  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type  |
| local_name  | physics%Tbd(cdata%blk_no)%prevst   |
| requested   | cu_gf_driver_post_run<br>cu_gf_driver_pre_run<br>cu_ntiedtke_post_run<br>cu_ntiedtke_pre_run |
| physics set | physics  |

#### temperature\_tendency\_due\_to\_dynamics

|             |  |
|-------------|--|
| long_name   | temperature tendency due to dynamics only  |
| units       | K s-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type  |
| local_name  | physics%Tbd(cdata%blk_no)%forcet   |
| requested   | cu_gf_driver_pre_run<br>cu_gf_driver_run<br>cu_ntiedtke_pre_run<br>cu_ntiedtke_run |
| physics set | physics  |

#### tendency\_of\_air\_temperature\_due\_to\_deep\_convection\_for\_coupling\_on\_physics\_timestep

|             |  |
|-------------|--|
| long_name   | tendency of air temperature due to deep convection |
| units       | K  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type         |
| local_name  | physics%Coupling(cdata%blk_no)%tconvtend           |
| requested   | GFS_DCNV_generic_post_run                          |
| physics set | physics  |

tendency\_of\_air\_temperature\_due\_to\_longwave\_heating\_assuming\_clear\_sky\_on\_radiation\_time\_step

long\_name      clear sky heating rate due to longwave radiation  
units          K s-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name    physics%Tbd(cdata%blk\_no)%htlw0  
requested     dcyc2t3\_run  
              rrtmg\_lw\_post\_run  
              rrtmg\_lw\_run  
physics set   physics

tendency\_of\_air\_temperature\_due\_to\_longwave\_heating\_assuming\_clear\_sky\_on\_radiation\_timestep

long\_name      clear sky lw heating rates  
units          K s-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_radtend\_type  
local\_name    physics%Radtend(cdata%blk\_no)%lwhe  
requested     NOT REQUESTED  
physics set

tendency\_of\_air\_temperature\_due\_to\_longwave\_heating\_for\_idea

|             |   |
|-------------|---|
| long_name   | idea sky lw heating rates                 |
| units       | K s-1                                     |
| rank        | 3   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_radtend_type |
| local_name  | physics%Radtend(cdata%blk_no)%lwhtd       |
| requested   | GFS_suite_interstitial_2_run              |
| physics set | physics                                   |

tendency\_of\_air\_temperature\_due\_to\_longwave\_heating\_on\_radiation\_time\_step

|             |   |
|-------------|---|
| long_name   | total sky heating rate due to longwave radiation  |
| units       | K s-1   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type   |
| local_name  | physics%Tbd(cdata%blk_no)%htlwc   |
| requested   | dcyc2t3_run<br>hedmf_run<br>mynnedmf_wrapper_run<br>rrtmg_lw_post_run<br>rrtmg_lw_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>ysuvdif_run |
| physics set | physics   |

tendency\_of\_air\_temperature\_due\_to\_longwave\_heating\_on\_radiation\_timestep

|             |   |
|-------------|---|
| long_name   | total sky lw heating rate   |
| units       | K s-1   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_radtend_type   |
| local_name  | physics%Radtend(cdata%blk_no)%htrlw   |
| requested   | GFS_PBL_generic_post_run<br>GFS_suite_interstitial_2_run<br>m_micro_run<br>mynnedmf_wrapper_run |
| physics set | physics   |

#### tendency\_of\_air\_temperature\_due\_to\_model\_physics

|             |  |
|-------------|--|
| long_name   | air temperature tendency due to model physics  |
| units       | K s-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%dtdt  |
| requested   | GFS_GWD_generic_post_run<br>GFS_GWD_generic_pre_run<br>GFS_PBL_generic_post_run<br>GFS_suite_interstitial_1_run<br>GFS_suite_stateout_update_run<br>cires_ugwp_post_run<br>cires_ugwp_run<br>dcyc2t3_run<br>drag_suite_run<br>gwdps_run<br>hedmf_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>mynnedmf_wrapper_run<br>rayleigh_damp_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics  |

#### tendency\_of\_air\_temperature\_due\_to\_radiative\_heating\_assuming\_clear\_sky

long\_name      clear sky radiative (shortwave + longwave) heating rate at current time  
units          K s-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%dtdtc  
requested     GFS\_MP\_generic\_post\_run  
              GFS\_suite\_interstitial\_1\_run  
              dcyc2t3\_run  
physics set   physics

#### tendency\_of\_air\_temperature\_due\_to\_radiative\_heating\_on\_physics\_time\_step

long\_name      temp. change due to radiative heating per time step  
units          K  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name    physics%Tbd(cdata%blk\_no)%dtdtr  
requested     GFS\_MP\_generic\_post\_run  
              GFS\_surface\_generic\_pre\_run  
physics set   physics



tendency\_of\_air\_temperature\_due\_to\_shortwave\_heating\_assuming\_clear\_sky\_on\_radiation\_time\_step

long\_name      clear sky heating rates due to shortwave radiation  
units          K s-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name    physics%Tbd(cdata%blk\_no)%htsw0  
requested     dcyc2t3\_run  
              rrtmg\_sw\_post\_run  
              rrtmg\_sw\_run  
physics set   physics

tendency\_of\_air\_temperature\_due\_to\_shortwave\_heating\_assuming\_clear\_sky\_on\_radiation\_timestep

long\_name      clear sky sw heating rates  
units          K s-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_radtend\_type  
local\_name    physics%Radtend(cdata%blk\_no)%swhc  
requested     NOT REQUESTED  
physics set

tendency\_of\_air\_temperature\_due\_to\_shortwave\_heating\_on\_radiation\_time\_step

|             |   |
|-------------|---|
| long_name   | total sky heating rate due to shortwave radiation   |
| units       | K s-1   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type   |
| local_name  | physics%Tbd(cdata%blk_no)%htswc   |
| requested   | dcyc2t3_run<br>hedmf_run<br>rrtmg_sw_post_run<br>rrtmg_sw_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>ysuvdif_run |
| physics set | physics   |

tendency\_of\_air\_temperature\_due\_to\_shortwave\_heating\_on\_radiation\_timestep

|             |   |
|-------------|---|
| long_name   | total sky sw heating rate   |
| units       | K s-1   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_radtend_type   |
| local_name  | physics%Radtend(cdata%blk_no)%htrsw   |
| requested   | GFS_PBL_generic_post_run<br>GFS_suite_interstitial_2_run<br>m_micro_run<br>mynnedmf_wrapper_run |
| physics set | physics   |

#### tendency\_of\_air\_temperature\_due\_to\_ugwp

|             |  |
|-------------|--|
| long_name   | air temperature tendency due to UGWP           |
| units       | K s-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%gw_dtdt     |
| requested   | cires_ugwp_post_run<br>cires_ugwp_run          |
| physics set | physics  |

#### tendency\_of\_cloud\_droplet\_number\_concentration\_due\_to\_model\_physics

|             |  |
|-------------|--|
| long_name   | number concentration of cloud droplets (liquid) tendency due to model physics    |
| units       | kg-1 s-1   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                                   |
| local_name  | physics%Interstitial(cdata%blk_no)%dqdt(:, :, physics%Model(cdata%blk_no)%ntlnc) |
| requested   | mynnedmf_wrapper_run   |
| physics set | physics  |

#### tendency\_of\_cloud\_water\_due\_to\_convective\_microphysics

long\_name tendency of cloud water due to convective microphysics  
units kg m-2 s-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%cnv\_dqldt  
requested cs\_conv\_run  
m\_micro\_run  
samfdeepcnv\_run  
physics set physics

#### tendency\_of\_graupel\_mixing\_ratio\_due\_to\_model\_physics

long\_name moist (dry+vapor, no condensates) mixing ratio of graupel tendency due to model physics  
units kg kg-1 s-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%dqdt(:, :, physics%Model(cdata%blk\_no)%ntgl)  
requested NOT REQUESTED  
physics set

#### tendency\_of\_ice\_cloud\_water\_mixing\_ratio\_due\_to\_model\_physics

long\_name cloud condensed water mixing ratio tendency due to model physics  
units kg kg-1 s-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%dqdt(:, :, physics%Model(cdata%blk\_no)%ntiw)  
requested mynnedmf\_wrapper\_run  
physics set physics

#### tendency\_of\_ice\_friendly\_aerosol\_number\_concentration\_due\_to\_model\_physics

long\_name number concentration of ice-friendly aerosols tendency due to model physics  
units kg-1 s-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%dqdt(:, :, physics%Model(cdata%blk\_no)%ntia)  
requested mynnedmf\_wrapper\_run  
physics set physics

#### tendency\_of\_ice\_friendly\_aerosols\_at\_surface

long\_name      instantaneous ice-friendly sfc aerosol source  
units           kg-1 s-1  
rank           1  
type           real  
kind           kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name      physics%Coupling(cdata%blk\_no)%nifa2d  
requested       mp\_thompson\_init  
                 mp\_thompson\_pre\_run  
                 mp\_thompson\_run  
physics set     physics

#### tendency\_of\_ice\_number\_concentration\_due\_to\_model\_physics

long\_name      number concentration of ice tendency due to model physics  
units           kg-1 s-1  
rank           2  
type           real  
kind           kind\_phys  
source          MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name      physics%Interstitial(cdata%blk\_no)%dqdt(:, :, physics%Model(cdata%blk\_no)%ntinc)  
requested       mynnedmf\_wrapper\_run  
physics set     physics

#### tendency\_of\_liquid\_cloud\_water\_mixing\_ratio\_due\_to\_model\_physics

long\_name cloud condensed water mixing ratio tendency due to model physics  
units kg kg-1 s-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%dqdt(:, :, physics%Model(cdata%blk\_no)%ntcw)  
requested mynnedmf\_wrapper\_run  
physics set physics

#### tendency\_of\_lwe\_thickness\_of\_precipitation\_amount\_for\_coupling

long\_name change in rain\_cpl (coupling\_type)  
units m  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name physics%Tbd(cdata%blk\_no)%drain\_cpl  
requested GFS\_MP\_generic\_post\_run  
GFS\_surface\_generic\_pre\_run  
physics set physics

#### tendency\_of\_lwe\_thickness\_of\_snow\_amount\_for\_coupling

long\_name change in show\_cpl (coupling\_type)  
units m  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name physics%Tbd(cdata%blk\_no)%dsnow\_cpl  
requested GFS\_MP\_generic\_post\_run  
GFS\_surface\_generic\_pre\_run  
physics set physics

#### tendency\_of\_ozone\_mixing\_ratio\_due\_to\_model\_physics

long\_name ozone mixing ratio tendency due to model physics  
units kg kg-1 s-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%dqdt(:, :, physics%Model(cdata%blk\_no)%ntoz)  
requested mynnedmf\_wrapper\_run  
physics set physics

#### tendency\_of\_rain\_water\_mixing\_ratio\_due\_to\_microphysics

long\_name tendency of rain water mixing ratio due to microphysics  
units kg kg-1 s-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%rainp  
requested NOT REQUESTED  
physics set

#### tendency\_of\_rain\_water\_mixing\_ratio\_due\_to\_model\_physics

long\_name moist (dry+vapor, no condensates) mixing ratio of rain water tendency due to model physics  
units kg kg-1 s-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%dqdt(:, :, physics%Model(cdata%blk\_no)%ntrw)  
requested NOT REQUESTED  
physics set



#### tendency\_of\_snow\_water\_mixing\_ratio\_due\_to\_model\_physics

|             |  |
|-------------|--|
| long_name   | moist (dry+vapor, no condensates) mixing ratio of snow water tendency due to model physics |
| units       | kg kg-1 s-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%dqdt(:, :, physics%Model(cdata%blk_no)%ntsw)            |
| requested   | NOT REQUESTED  |
| physics set |  |

#### tendency\_of\_tracers\_due\_to\_model\_physics

|             |  |
|-------------|--|
| long_name   | updated tendency of the tracers due to model physics   |
| units       | kg kg-1 s-1  |
| rank        | 3  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%dqdt  |
| requested   | GFS_PBL_generic_post_run<br>GFS_suite_interstitial_1_run<br>GFS_suite_stateout_update_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics  |

#### tendency\_of\_turbulent\_kinetic\_energy\_due\_to\_model\_physics

|             |   |
|-------------|---|
| long_name   | turbulent kinetic energy tendency due to model physics                          |
| units       | J s-1   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                                  |
| local_name  | physics%Interstitial(cdata%blk_no)%dqdt(:, :, physics%Model(cdata%blk_no)%ntke) |
| requested   | cires_ugwp_run  |
| physics set | physics   |

#### tendency\_of\_vertically\_diffused\_tracer\_concentration

|             |   |
|-------------|---|
| long_name   | updated tendency of the tracers due to vertical diffusion in PBL scheme   |
| units       | kg kg-1 s-1   |
| rank        | 3   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%dvdiftra   |
| requested   | GFS_PBL_generic_post_run<br>hedmf_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>satmedmfvdif_run<br>satmedmfvdifq_run |
| physics set | physics   |

#### tendency\_of\_water\_friendly\_aerosol\_number\_concentration\_due\_to\_model\_physics

|             |   |
|-------------|---|
| long_name   | number concentration of water-friendly aerosols tendency due to model physics   |
| units       | kg-1 s-1  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                                  |
| local_name  | physics%Interstitial(cdata%blk_no)%dqdt(:, :, physics%Model(cdata%blk_no)%ntwa) |
| requested   | mynnedmf_wrapper_run  |
| physics set | physics   |

#### tendency\_of\_water\_friendly\_aerosols\_at\_surface

|             |  |
|-------------|--|
| long_name   | instantaneous water-friendly sfc aerosol source            |
| units       | kg-1 s-1   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type                 |
| local_name  | physics%Coupling(cdata%blk_no)%nwfa2d                      |
| requested   | mp_thompson_init<br>mp_thompson_pre_run<br>mp_thompson_run |
| physics set | physics  |

#### tendency\_of\_water\_vapor\_specific\_humidity\_due\_to\_deep\_convection\_for\_coupling\_on\_physics\_timestep

long\_name tendency of specific humidity due to deep convection  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%qconvtend  
requested GFS\_DCNV\_generic\_post\_run  
physics set physics

#### tendency\_of\_water\_vapor\_specific\_humidity\_due\_to\_model\_physics

long\_name water vapor specific humidity tendency due to model physics  
units kg kg-1 s-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%dqdt(:, :, physics%Model(cdata%blk\_no)%ntqv)  
requested mynnedmf\_wrapper\_run  
physics set physics

#### tendency\_of\_x\_wind\_due\_to\_convective\_gravity\_wave\_drag

long\_name zonal wind tendency due to convective gravity wave drag  
units m s-2  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%gwdcu  
requested NOT REQUESTED  
physics set

tendency\_of\_x\_wind\_due\_to\_deep\_convection\_for\_coupling\_on\_physics\_timestep

|             |  |
|-------------|--|
| long_name   | tendency_of_x_wind_due_to_deep_convection  |
| units       | m s-1                                      |
| rank        | 2  |
| type        | real                                       |
| kind        | kind_phys                                  |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type |
| local_name  | physics%Coupling(cdata%blk_no)%uconvtend   |
| requested   | GFS_DCNV_generic_post_run                  |
| physics set | physics                                    |

#### tendency\_of\_x\_wind\_due\_to\_model\_physics

|             |  |
|-------------|--|
| long_name   | zonal wind tendency due to model physics   |
| units       | m s-2  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%dudt  |
| requested   | GFS_GWD_generic_post_run<br>GFS_PBL_generic_post_run<br>GFS_suite_interstitial_1_run<br>GFS_suite_stateout_update_run<br>cires_ugwp_post_run<br>cires_ugwp_run<br>drag_suite_run<br>gwdps_run<br>hedmf_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>mynnedmf_wrapper_run<br>rayleigh_damp_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics  |

#### tendency\_of\_x\_wind\_due\_to\_ugwp

|             |  |
|-------------|--|
| long_name   | zonal wind tendency due to UGWP                |
| units       | m s-2  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%gw_dudt     |
| requested   | cires_ugwp_post_run<br>cires_ugwp_run          |
| physics set | physics  |

#### tendency\_of\_y\_wind\_due\_to\_convective\_gravity\_wave\_drag

|             |  |
|-------------|--|
| long_name   | meridional wind tendency due to convective gravity wave drag |
| units       | m s-2  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type               |
| local_name  | physics%Interstitial(cdata%blk_no)%gwdcv                     |
| requested   | NOT REQUESTED  |
| physics set |  |

#### tendency\_of\_y\_wind\_due\_to\_deep\_convection\_for\_coupling\_on\_physics\_timestep

|             |  |
|-------------|--|
| long_name   | tendency_of_y_wind_due_to_deep_convection  |
| units       | m s-1                                      |
| rank        | 2  |
| type        | real                                       |
| kind        | kind_phys                                  |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type |
| local_name  | physics%Coupling(cdata%blk_no)%vconvtend   |
| requested   | GFS_DCNV_generic_post_run                  |
| physics set | physics                                    |

#### tendency\_of\_y\_wind\_due\_to\_model\_physics

|             |  |
|-------------|--|
| long_name   | meridional wind tendency due to model physics  |
| units       | m s-2  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%dvd   |
| requested   | GFS_GWD_generic_post_run<br>GFS_PBL_generic_post_run<br>GFS_suite_interstitial_1_run<br>GFS_suite_stateout_update_run<br>cires_ugwp_post_run<br>cires_ugwp_run<br>drag_suite_run<br>gwdps_run<br>hedmf_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>mynnedmf_wrapper_run<br>rayleigh_damp_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics  |



#### tendency\_of\_y\_wind\_due\_to\_ugwp

|             |  |
|-------------|--|
| long_name   | meridional wind tendency due to UGWP           |
| units       | m s-2  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%gw_dvdt     |
| requested   | cires_ugwp_post_run<br>cires_ugwp_run          |
| physics set | physics  |

#### theta\_star

|             |   |
|-------------|---|
| long_name   | temperature flux divided by ustar (temperature scale) |
| units       | K   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type             |
| local_name  | physics%Sfcprop(cdata%blk_no)%mol                     |
| requested   | NOT REQUESTED   |
| physics set |   |

#### threshold\_for\_perturbed\_vertical\_velocity

|             |  |
|-------------|--|
| long_name   | threshold used for perturbed vertical velocity |
| units       | m s-1  |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_control_type      |
| local_name  | physics%Model(cdata%blk_no)%nthresh            |
| requested   | NOT REQUESTED                                  |
| physics set |  |

#### threshold\_volume\_fraction\_of\_condensed\_water\_in\_soil

|             |  |
|-------------|--|
| long_name   | soil moisture threshold (volumetric)         |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                    |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type       |
| local_name  | physics%Diag(cdata%blk_no)%smcref2           |
| requested   | lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run |
| physics set | physics                                      |

#### time\_integral\_of\_change\_in\_x\_wind\_due\_to\_mountain\_blocking\_drag

|             |   |
|-------------|---|
| long_name   | time integral of change in x wind due to mountain blocking drag |
| units       | m s-2   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                          |
| local_name  | physics%Diag(cdata%blk_no)%du3dt_mtb                            |
| requested   | cires_ugwp_post_run<br>cires_ugwp_run                           |
| physics set | physics   |

`time_integral_of_change_in_x_wind_due_to_nonstationary_gravity_wave`

long\_name     time integral of change in x wind due to NGW  
units         m s-2  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%du3dt\_ngw  
requested     cires\_ugwp\_post\_run  
physics set   physics

`time_integral_of_change_in_x_wind_due_to_orographic_gravity_wave_drag`

long\_name     time integral of change in x wind due to orographic gw drag  
units         m s-2  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%du3dt\_ogw  
requested     cires\_ugwp\_post\_run  
              cires\_ugwp\_run  
physics set   physics

`time_integral_of_change_in_x_wind_due_to_turbulent_orographic_form_drag`

long\_name     time integral of change in x wind due to TOFD  
units         m s-2  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%du3dt\_tms  
requested     cires\_ugwp\_post\_run  
              cires\_ugwp\_run  
physics set   physics

#### time\_integral\_of\_change\_in\_y\_wind\_due\_to\_nonstationary\_gravity\_wave

long\_name     time integral of change in y wind due to NGW  
units         m s-2  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%dv3dt\_ngw  
requested     cires\_ugwp\_post\_run  
physics set   physics

#### time\_integral\_of\_height\_of\_launch\_level\_of\_orographic\_gravity\_wave

long\_name     time integral of height of launch level of orographic gravity wave  
units         m  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%zogw  
requested     cires\_ugwp\_post\_run  
physics set   physics

#### time\_integral\_of\_height\_of\_low\_level\_wave\_breaking

long\_name     time integral of height of drag due to low level wave breaking  
units         m  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%zlw  
requested     cires\_ugwp\_post\_run  
physics set   physics

#### time\_integral\_of\_height\_of\_mountain\_blocking

|             |   |
|-------------|---|
| long_name   | time integral of height of mountain blocking drag |
| units       | m   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type            |
| local_name  | physics%Diag(cdata%blk_no)%zmtb                   |
| requested   | cires_ugwp_post_run                               |
| physics set | physics   |

#### time\_integral\_of\_momentum\_flux\_due\_to\_mountain\_blocking\_drag

|             |  |
|-------------|--|
| long_name   | time integral of momentum flux due to mountain blocking drag |
| units       | Pa   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                       |
| local_name  | physics%Diag(cdata%blk_no)%tau_mtb                           |
| requested   | cires_ugwp_post_run  |
| physics set | physics  |

#### time\_integral\_of\_momentum\_flux\_due\_to\_nonstationary\_gravity\_wave

|             |   |
|-------------|---|
| long_name   | time integral of momentum flux due to nonstationary gravity waves |
| units       | Pa  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type                            |
| local_name  | physics%Diag(cdata%blk_no)%tau_ngw                                |
| requested   | cires_ugwp_post_run   |
| physics set | physics   |

`time_integral_of_momentum_flux_due_to_orographic_gravity_wave_drag`

long\_name    time integral of momentum flux due to orographic gravity wave drag  
units        Pa  
rank        1  
type        real  
kind        kind\_phys  
source       MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name   physics%Diag(cdata%blk\_no)%tau\_ogw  
requested    cires\_ugwp\_post\_run  
physics set   physics

`time_integral_of_momentum_flux_due_to_turbulent_orographic_form_drag`

long\_name    time integral of momentum flux due to TOFD  
units        Pa  
rank        1  
type        real  
kind        kind\_phys  
source       MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name   physics%Diag(cdata%blk\_no)%tau\_tofd  
requested    cires\_ugwp\_post\_run  
physics set   physics

`time_integral_of_x_stress_due_to_gravity_wave_drag`

long\_name    vertically integrated u change by OGWD  
units        Pa s  
rank        1  
type        real  
kind        kind\_phys  
source       MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name   physics%Diag(cdata%blk\_no)%dugwd  
requested    GFS\_GWD\_generic\_post\_run  
             gwdc\_post\_run  
physics set   physics

#### time\_integral\_of\_y\_stress\_due\_to\_gravity\_wave\_drag

long\_name   vertically integrated v change by OGWD  
units       Pa s  
rank        1  
type        real  
kind        kind\_phys  
source       MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name   physics%Diag(cdata%blk\_no)%dvgwd  
requested    GFS\_GWD\_generic\_post\_run  
             gwdc\_post\_run  
physics set   physics

#### time\_interval\_for\_maximum\_hourly\_fields

long\_name   reset time interval for maximum hourly fields  
units       s  
rank        0  
type        real  
kind        kind\_phys  
source       MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name   physics%Model(cdata%blk\_no)%avg\_max\_length  
requested    NOT REQUESTED  
physics set

#### time\_scale\_for\_rayleigh\_damping

long\_name   time scale for Rayleigh damping in days  
units       d  
rank        0  
type        real  
kind        kind\_phys  
source       MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name   physics%Model(cdata%blk\_no)%ral\_ts  
requested    cires\_ugwp\_init  
             rayleigh\_damp\_run  
physics set   physics

#### time\_since\_diagnostics\_zeroed

|             |   |
|-------------|---|
| long_name   | time since diagnostics variables have been zeroed |
| units       | h   |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type         |
| local_name  | physics%Model(cdata%blk_no)%zhour                 |
| requested   | GFS_time_vary_pre_run                             |
| physics set | physics   |



#### time\_step\_for\_dynamics

|             |   |
|-------------|---|
| long_name   | dynamics timestep   |
| units       | s   |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name  | physics%Model(cdata%blk_no)%dtf   |
| requested   | GFS_DCNV_generic_post_run<br>GFS_GWD_generic_post_run<br>GFS_GWD_generic_pre_run<br>GFS_MP_generic_post_run<br>GFS_PBL_generic_post_run<br>GFS_rrtmg_setup_run<br>GFS_suite_interstitial_1_run<br>GFS_suite_interstitial_2_run<br>GFS_suite_interstitial_4_run<br>GFS_surface_generic_post_run<br>cires_ugwp_post_run<br>cs_conv_run<br>dcyc2t3_run<br>gwdc_post_run<br>lsm_noah_run<br>lsm_ruc_run<br>mynnedmf_wrapper_run<br>noahmpdrv_run<br>sfc_diag_post_run<br>sfc_nst_run<br>sfc_sice_run<br>zhaocarr_gscond_run |
| physics set | physics   |

### time\_step\_for\_physics

|            |   |
|------------|---|
| long_name  | physics timestep  |
| units      | s   |
| rank       | 0   |
| type       | real  |
| kind       | kind_phys   |
| source     | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name | physics%Model(cdata%blk_no)%dtp   |
| requested  | GFS_MP_generic_post_run<br>GFS_suite_interstitial_1_run<br>GFS_suite_stateout_update_run<br>GFS_time_vary_pre_run<br>cires_ugwp_init<br>cires_ugwp_run<br>cs_conv_run<br>cu_gf_driver_pre_run<br>cu_gf_driver_run<br>cu_ntiedtke_pre_run<br>cu_ntiedtke_run<br>drag_suite_run<br>gfdl_cloud_microphys_run<br>gwdc_post_run<br>gwdc_pre_run<br>gwdc_run<br>gwdps_run<br>h2ophys_run<br>hedmf_run<br>m_micro_post_run<br>m_micro_run<br>moninshoc_run<br>mp_thompson_post_run<br>mp_thompson_run<br>myjpbl_wrapper_run<br>mynnedmf_wrapper_run<br>mynnsfc_wrapper_run<br>ozphys_2015_run<br>ozphys_run<br>rayleigh_damp_run<br>samfdecomp_run |

#### time\_step\_for\_radiation

|             |  |
|-------------|--|
| long_name   | radiation time step                            |
| units       | s  |
| rank        | 0  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%raddt       |
| requested   | GFS_rrtmg_post_run<br>GFS_rrtmg_pre_run        |
| physics set | physics  |

#### tke\_advect

|             |   |
|-------------|---|
| long_name   | flag for activating TKE advection             |
| units       | flag  |
| rank        | 0   |
| type        | logical                                       |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type     |
| local_name  | physics%Model(cdata%blk_no)%bl_mynn_tkeadvect |
| requested   | mynnedmf_wrapper_run                          |
| physics set | physics                                       |

#### tke\_at\_mass\_points

|             |                                       |
|-------------|---------------------------------------|
| long_name   | 2 x tke at mass points                |
| units       | m2 s-2                                |
| rank        | 2                                     |
| type        | real                                  |
| kind        | kind_phys                             |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type |
| local_name  | physics%Tbd(cdata%blk_no)%qke         |
| requested   | mynnedmf_wrapper_run                  |
| physics set | physics                               |

#### tke\_budget

|             |   |
|-------------|---|
| long_name   | flag for activating TKE budget                |
| units       | flag  |
| rank        | 0   |
| type        | integer                                       |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type     |
| local_name  | physics%Model(cdata%blk_no)%bl_mynn_tkebudget |
| requested   | mynnedmf_wrapper_run                          |
| physics set | physics                                       |

#### tke\_dissipative\_heating\_factor

|             |   |
|-------------|---|
| long_name   | tke dissipative heating factor            |
| units       | none                                      |
| rank        | 0   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%dspfac        |
| requested   | satmedmfvdifq_run                         |
| physics set | physics                                   |

#### topflw\_type

|             |                                |
|-------------|--------------------------------|
| long_name   | definition of type topflw_type |
| units       | DDT                            |
| rank        | 0                              |
| type        | topflw_type                    |
| kind        |                                |
| source      | MODULE module_radlw_parameters |
| local_name  | topflw_type                    |
| requested   | NOT REQUESTED                  |
| physics set |                                |

#### topfsw\_type

|             |                                |
|-------------|--------------------------------|
| long_name   | definition of type topfsw_type |
| units       | DDT                            |
| rank        | 0                              |
| type        | topfsw_type                    |
| kind        |                                |
| source      | MODULE module_radsw_parameters |
| local_name  | topfsw_type                    |
| requested   | NOT REQUESTED                  |
| physics set |                                |

#### total\_accumulated\_snowfall

|             |   |
|-------------|---|
| long_name   | run-total snow accumulation on the ground |
| units       | kg m-2                                    |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%snowfallac  |
| requested   | lsm_ruc_run                               |
| physics set | physics                                   |

#### total\_cloud\_condensate\_mixing\_ratio\_updated\_by\_physics

|             |   |
|-------------|---|
| long_name   | total cloud condensate mixing ratio (except water vapor) updated by physics |
| units       | kg kg-1   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                              |
| local_name  | physics%Interstitial(cdata%blk_no)%cwm                                      |
| requested   | NOT REQUESTED   |
| physics set |   |

#### total\_cloud\_fraction

|             |  |
|-------------|--|
| long_name   | layer total cloud fraction   |
| units       | frac   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%clouds(:, :, 1)   |
| requested   | GFS_rrtmg_post_run<br>GFS_rrtmg_pre_run<br>mynnrad_pre_run<br>rrtmg_lw_run<br>rrtmg_sw_run |
| physics set | physics  |

#### total\_runoff

|             |   |
|-------------|---|
| long_name   | total water runoff                          |
| units       | kg m-2                                      |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys                                   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type      |
| local_name  | physics%Diag(cdata%blk_no)%runoff           |
| requested   | GFS_surface_generic_post_run<br>lsm_ruc_run |
| physics set | physics                                     |

#### tracer\_concentration

|             |   |
|-------------|---|
| long_name   | model layer mean tracer concentration   |
| units       | kg kg-1   |
| rank        | 3   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type   |
| local_name  | physics%Statein(cdata%blk_no)%qgrs  |
| requested   | GFS_PBL_generic_pre_run<br>GFS_suite_stateout_reset_run<br>GFS_suite_stateout_update_run<br>cires_ugwp_run<br>myjsfc_wrapper_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics   |

#### tracer\_concentration\_save

|             |   |
|-------------|---|
| long_name   | tracer concentration before entering a physics scheme |
| units       | kg kg-1   |
| rank        | 3   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type        |
| local_name  | physics%Interstitial(cdata%blk_no)%save_q             |
| requested   | GFS_MP_generic_pre_run<br>cs_conv_aw_adj_run          |
| physics set | physics   |

#### tracer\_concentration\_updated\_by\_physics

|             |  |
|-------------|--|
| long_name   | tracer concentration updated by physics  |
| units       | kg kg-1  |
| rank        | 3  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_stateout_type   |
| local_name  | physics%Stateout(cdata%blk_no)%gq0   |
| requested   | GFS_MP_generic_post_run<br>GFS_MP_generic_pre_run<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>GFS_suite_stateout_reset_run<br>GFS_suite_stateout_update_run<br>cs_conv_aw_adj_run<br>cu_gf_driver_run |
| physics set | physics  |

#### transpiration\_flux

|             |  |
|-------------|--|
| long_name   | total plant transpiration rate   |
| units       | W m-2  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                               |
| local_name  | physics%Interstitial(cdata%blk_no)%trans                                     |
| requested   | GFS_surface_generic_post_run<br>lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run |
| physics set | physics  |



#### triple\_point\_temperature\_of\_water

|             |                                    |
|-------------|------------------------------------|
| long_name   | triple point temperature of water  |
| units       | K                                  |
| rank        | 0                                  |
| type        | real                               |
| kind        | kind_phys                          |
| source      | MODULE gmtb_scm_physical_constants |
| local_name  | con_ttp                            |
| requested   | m_micro_init                       |
| physics set | physics                            |

#### turb\_oro\_form\_drag\_flag

|             |   |
|-------------|---|
| long_name   | flag for turbulent orographic form drag   |
| units       | flag                                      |
| rank        | 0   |
| type        | logical                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%do_tofd       |
| requested   | cires_ugwp_run                            |
| physics set | physics                                   |

#### turbulent\_kinetic\_energy

|             |  |
|-------------|--|
| long_name   | turbulent kinetic energy   |
| units       | J  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type                                  |
| local_name  | physics%Statein(cdata%blk_no)%qgrs(:, :, physics%Model(cdata%blk_no)%ntke) |
| requested   | cires_ugwp_run<br>mynnedmf_wrapper_run                                     |
| physics set | physics  |

#### turbulent\_kinetic\_energy\_convective\_transport\_tracer

long\_name     turbulent kinetic energy in the convectively transported tracer array  
units         m2 s-2  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%clw(:, :, physics%Interstitial(cdata%blk\_no)%ntk)  
requested     NOT REQUESTED  
physics set

#### u\_wind\_component\_at\_viscous\_sublayer\_top

long\_name     u wind component at viscous sublayer top over water  
units         m s-1  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name    physics%Tbd(cdata%blk\_no)%phy\_myj\_uz0  
requested     NOT REQUESTED  
physics set

#### updraft\_fraction\_in\_boundary\_layer\_mass\_flux\_scheme

long\_name     updraft fraction in boundary layer mass flux scheme  
units         none  
rank          0  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_control\_type  
local\_name    physics%Model(cdata%blk\_no)%bl\_upfr  
requested     satmedmfvdifq\_run  
physics set   physics

#### updraft\_velocity\_tunable\_parameter\_1\_CS

|             |   |
|-------------|---|
| long_name   | tunable parameter 1 for Chikira-Sugiyama convection |
| units       | m s-1   |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type           |
| local_name  | physics%Model(cdata%blk_no)%cs_parm(1)              |
| requested   | cs_conv_pre_run                                     |
| physics set | physics   |

#### updraft\_velocity\_tunable\_parameter\_2\_CS

|             |   |
|-------------|---|
| long_name   | tunable parameter 2 for Chikira-Sugiyama convection |
| units       | m s-1   |
| rank        | 0   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type           |
| local_name  | physics%Model(cdata%blk_no)%cs_parm(2)              |
| requested   | cs_conv_pre_run                                     |
| physics set | physics   |

#### upper\_bound\_on\_max\_albedo\_over\_deep\_snow

|             |  |
|-------------|--|
| long_name   | maximum snow albedo                          |
| units       | frac   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                    |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type    |
| local_name  | physics%Sfcprop(cdata%blk_no)%snoalb         |
| requested   | lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run |
| physics set | physics                                      |

#### upward\_heat\_flux\_in\_soil

|             |   |
|-------------|---|
| long_name   | soil heat flux  |
| units       | W m-2   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                  |
| local_name  | physics%Interstitial(cdata%blk_no)%gflx                         |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_generic_post_run |
| physics set | physics   |

#### upward\_heat\_flux\_in\_soil\_over\_ice

long\_name     soil heat flux over ice  
units         W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%gflx\_ice  
requested     GFS\_surface\_composites\_post\_run  
              GFS\_surface\_composites\_pre\_run  
              sfc\_sice\_run  
physics set   physics

#### upward\_heat\_flux\_in\_soil\_over\_land

long\_name     soil heat flux over land  
units         W m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%gflx\_land  
requested     GFS\_surface\_composites\_post\_run  
              lsm\_noah\_run  
              lsm\_ruc\_run  
              noahmpdrv\_run  
physics set   physics

#### upward\_heat\_flux\_in\_soil\_over\_ocean

|             |  |
|-------------|--|
| long_name   | soil heat flux over ocean                      |
| units       | W m-2  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys                                      |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%gflx_ocean  |
| requested   | GFS_surface_composites_post_run                |
|             | sfc_nst_run                                    |
|             | sfc_ocean_run                                  |
| physics set | physics  |

#### v\_wind\_component\_at\_viscous\_sublayer\_top

|             |   |
|-------------|---|
| long_name   | v wind component at viscous sublayer top over water |
| units       | m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_tbd_type               |
| local_name  | physics%Tbd(cdata%blk_no)%phy_myj_vz0               |
| requested   | NOT REQUESTED                                       |
| physics set |   |

#### vegetation\_area\_fraction

|             |  |
|-------------|--|
| long_name   | areal fractional cover of green vegetation |
| units       | frac                                       |
| rank        | 1  |
| type        | real                                       |
| kind        | kind_phys                                  |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type  |
| local_name  | physics%Sfcprop(cdata%blk_no)%vfrac        |
| requested   | GFS_surface_generic_pre_run                |
|             | lsm_ruc_run                                |
| physics set | physics                                    |

#### vegetation\_temperature

|             |   |
|-------------|---|
| long_name   | vegetation temperature                    |
| units       | K   |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%tvxy        |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### vegetation\_type\_classification

|             |  |
|-------------|--|
| long_name   | vegetation type at each grid cell              |
| units       | index  |
| rank        | 1  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%vegtype     |
| requested   | GFS_surface_generic_pre_run                    |
|             | lsm_noah_run                                   |
|             | lsm_ruc_run                                    |
|             | noahmpdrv_run                                  |
|             | sfc_diff_run                                   |
| physics set | physics  |

#### vegetation\_type\_classification\_real

|             |   |
|-------------|---|
| long_name   | vegetation type for lsm                   |
| units       | index                                     |
| rank        | 1   |
| type        | real                                      |
| kind        | kind_phys                                 |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type |
| local_name  | physics%Sfcprop(cdata%blk_no)%vtype       |
| requested   | GFS_surface_generic_pre_run               |
| physics set | physics                                   |



#### vegetation\_type\_dataset\_choice

|             |   |
|-------------|---|
| long_name   | land use dataset choice                   |
| units       | index                                     |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%ivegsr        |
| requested   | GFS_surface_generic_pre_run               |
|             | lsm_noah_init                             |
|             | lsm_noah_run                              |
|             | lsm_ruc_init                              |
|             | lsm_ruc_run                               |
|             | noahmpdrv_init                            |
|             | sfc_diff_run                              |
| physics set | physics                                   |

## vertical\_dimension

|            |   |
|------------|---|
| long_name  | number of vertical levels   |
| units      | count   |
| rank       | 0   |
| type       | integer   |
| kind       |   |
| source     | MODULE GFS_typedefs TYPE GFS_control_type   |
| local_name | physics%Model(cdata%blk_no)%levs  |
| requested  | GFS_DCNV_generic_post_run<br>GFS_DCNV_generic_pre_run<br>GFS_GWD_generic_pre_run<br>GFS_MP_generic_post_run<br>GFS_MP_generic_pre_run<br>GFS_PBL_generic_post_run<br>GFS_PBL_generic_pre_run<br>GFS_SCNV_generic_post_run<br>GFS_SCNV_generic_pre_run<br>GFS_suite_interstitial_1_run<br>GFS_suite_interstitial_2_run<br>GFS_suite_interstitial_3_run<br>GFS_suite_interstitial_4_run<br>GFS_suite_stateout_reset_run<br>GFS_suite_stateout_update_run<br>GFS_surface_generic_pre_run<br>cires_ugwp_init<br>cires_ugwp_post_run<br>cires_ugwp_run<br>cnvc90_run<br>cs_conv_aw_adj_run<br>cs_conv_post_run<br>cs_conv_pre_run<br>cs_conv_run<br>cu_gf_driver_run<br>cu_ntiedtke_run<br>dcyc2t3_run<br>drag_suite_run<br>get_phi_fv3_run<br>get_prs_fv3_run<br>gfdl_cloud_microphys_run |

#### vertical\_dimension\_minus\_one

|             |   |
|-------------|---|
| long_name   | number of vertical levels minus one       |
| units       | count                                     |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%levsm1        |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### vertical\_dimension\_of\_h2o\_forcing\_data

|             |  |
|-------------|--|
| long_name   | number of vertical layers in h2o forcing data  |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%levh2o      |
| requested   | h2ophys_run                                    |
| physics set | physics  |

#### vertical\_dimension\_of\_ozone\_forcing\_data

|             |   |
|-------------|---|
| long_name   | number of vertical layers in ozone forcing data |
| units       | count   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%levozp       |
| requested   | ozphys_2015_run                                 |
|             | ozphys_run                                      |
| physics set | physics   |

#### vertical\_dimension\_plus\_one

|             |   |
|-------------|---|
| long_name   | number of vertical levels plus one        |
| units       | count                                     |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%levsp1        |
| requested   | NOT REQUESTED                             |
| physics set |   |

#### vertical\_index\_at\_cloud\_base

|             |  |
|-------------|--|
| long_name   | vertical index at cloud base   |
| units       | index  |
| rank        | 1  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%kbot  |
| requested   | cnvc90_run<br>cu_gf_driver_run<br>cu_ntiedtke_run<br>gwdc_pre_run<br>gwdc_run<br>m_micro_run<br>samfdeepcnv_run<br>samfshalcnv_run |
| physics set | physics  |

```

vertical_index_at_cloud_top
    long_name    vertical index at cloud top
    units        index
    rank         1
    type         integer
    kind
    source       MODULE GFS_typedefs TYPE GFS_interstitial_type
    local_name   physics%Interstitial(cdata%blk_no)%ktop
    requested    cnvc90_run
                cu_gf_driver_run
                cu_ntiedtke_run
                gwdc_pre_run
                gwdc_run
                samfdeepcnv_run
                samfshalcnv_run
    physics set  physics

```

#### vertical\_index\_at\_top\_of\_atmosphere\_boundary\_layer

|             |  |
|-------------|--|
| long_name   | vertical index at top atmospheric boundary layer |
| units       | index  |
| rank        | 1  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%kpbl          |
| requested   | GFS_suite_interstitial_3_run                     |
|             | cires_ugwp_run                                   |
|             | drag_suite_run                                   |
|             | gwdps_run  |
|             | hedmf_run  |
|             | moninshoc_run                                    |
|             | myjpbl_wrapper_run                               |
|             | mynnedmf_wrapper_run                             |
|             | satmedmfvdif_run                                 |
|             | satmedmfvdifq_run                                |
|             | shinhongvdif_run                                 |
|             | ysuvdif_run                                      |
| physics set | physics  |

#### vertical\_index\_difference\_between\_inout\_and\_local

|             |   |
|-------------|---|
| long_name   | vertical index difference between in/out and local                                |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                                    |
| local_name  | physics%Interstitial(cdata%blk_no)%kd   |
| requested   | GFS_rrtmg_post_run<br>GFS_rrtmg_pre_run<br>rrtmg_lw_post_run<br>rrtmg_sw_post_run |
| physics set | physics   |

#### vertical\_index\_difference\_between\_layer\_and\_lower\_bound

|             |   |
|-------------|---|
| long_name   | vertical index difference between layer and lower bound |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type          |
| local_name  | physics%Interstitial(cdata%blk_no)%kb                   |
| requested   | GFS_rrtmg_post_run<br>GFS_rrtmg_pre_run                 |
| physics set | physics   |

#### vertical\_index\_difference\_between\_layer\_and\_upper\_bound

|             |   |
|-------------|---|
| long_name   | vertical index difference between layer and upper bound |
| units       | index   |
| rank        | 0   |
| type        | integer   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type          |
| local_name  | physics%Interstitial(cdata%blk_no)%kt                   |
| requested   | GFS_rrtmg_post_run<br>GFS_rrtmg_pre_run                 |
| physics set | physics   |

#### vertical\_interface\_dimension

|             |  |
|-------------|--|
| long_name   | vertical interface dimension                   |
| units       | count  |
| rank        | 0  |
| type        | integer  |
| kind        |  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type |
| local_name  | physics%Interstitial(cdata%blk_no)%levi        |
| requested   | NOT REQUESTED                                  |
| physics set |  |

#### vertical\_sigma\_coordinate\_for\_radiation\_initialization

|             |  |
|-------------|--|
| long_name   | vertical sigma coordinate for radiation initialization |
| units       | none   |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_control_type              |
| local_name  | physics%Model(cdata%blk_no)%si                         |
| requested   | GFS_rrtmg_setup_init                                   |
| physics set | physics  |



#### vertical\_temperature\_average\_range\_lower\_bound

|             |   |
|-------------|---|
| long_name   | zsea1 in mm                               |
| units       | mm  |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%nstf_name(4)  |
| requested   | sfc_nst_post_run                          |
|             | sfc_nst_run                               |
| physics set | physics                                   |

#### vertical\_temperature\_average\_range\_upper\_bound

|             |   |
|-------------|---|
| long_name   | zsea2 in mm                               |
| units       | mm  |
| rank        | 0   |
| type        | integer                                   |
| kind        |   |
| source      | MODULE GFS_typedefs TYPE GFS_control_type |
| local_name  | physics%Model(cdata%blk_no)%nstf_name(5)  |
| requested   | sfc_nst_post_run                          |
|             | sfc_nst_run                               |
| physics set | physics                                   |

#### vertical\_velocity\_for\_updraft

long\_name vertical velocity for updraft  
units m s-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%w\_upi  
requested cs\_conv\_run  
m\_micro\_run  
samfdeepcnv\_run  
physics set physics

#### vertically\_diffused\_tracer\_concentration

long\_name tracer concentration diffused by PBL scheme  
units kg kg-1  
rank 3  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%vdftra  
requested GFS\_PBL\_generic\_pre\_run  
hedmf\_run  
moninshoc\_run  
myjpbl\_wrapper\_run  
satmedmfvdif\_run  
satmedmfvdifq\_run  
physics set physics

#### volume\_fraction\_of\_condensed\_water\_in\_soil\_at\_wilting\_point

long\_name wilting point (volumetric)  
units frac  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%smcwlt2  
requested lsm\_noah\_run  
lsm\_ruc\_run  
noahmpdrv\_run  
physics set physics

#### volume\_fraction\_of\_frozen\_soil\_moisture\_for\_land\_surface\_model

long\_name volume fraction of frozen soil moisture for lsm  
units frac  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name physics%Sfcprop(cdata%blk\_no)%keepsufr  
requested lsm\_ruc\_run  
physics set physics

#### volume\_fraction\_of\_soil\_moisture

|             |  |
|-------------|--|
| long_name   | total soil moisture                          |
| units       | frac   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys                                    |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type    |
| local_name  | physics%Sfcprop(cdata%blk_no)%smc            |
| requested   | lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run |
| physics set | physics                                      |

#### volume\_fraction\_of\_soil\_moisture\_for\_land\_surface\_model

|             |  |
|-------------|--|
| long_name   | volumetric fraction of soil moisture for lsm |
| units       | frac   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys                                    |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type    |
| local_name  | physics%Sfcprop(cdata%blk_no)%smois          |
| requested   | lsm_ruc_run                                  |
| physics set | physics                                      |

#### volume\_fraction\_of\_unfrozen\_soil\_moisture

|             |  |
|-------------|--|
| long_name   | liquid soil moisture                         |
| units       | frac   |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys                                    |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type    |
| local_name  | physics%Sfcprop(cdata%blk_no)%slc            |
| requested   | lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run |
| physics set | physics                                      |

#### volume\_fraction\_of\_unfrozen\_soil\_moisture\_for\_land\_surface\_model

|             |   |
|-------------|---|
| long_name   | volume fraction of unfrozen soil moisture for lsm |
| units       | frac  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type         |
| local_name  | physics%Sfcprop(cdata%blk_no)%sh2o                |
| requested   | lsm_ruc_run                                       |
| physics set | physics   |

#### volume\_mixing\_ratio\_ccl4

long\_name     volume mixing ratio ccl4  
units         kg kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%gasvmr(:, :, 9)  
requested     GFS\_rrtmg\_pre\_run  
              rrtmg\_lw\_run  
              rrtmg\_sw\_run  
physics set   physics

#### volume\_mixing\_ratio\_cfc11

long\_name     volume mixing ratio cfc11  
units         kg kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%gasvmr(:, :, 6)  
requested     GFS\_rrtmg\_pre\_run  
              rrtmg\_lw\_run  
              rrtmg\_sw\_run  
physics set   physics

#### volume\_mixing\_ratio\_cfc113

long\_name     volume mixing ratio cfc113  
units         kg kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%gasvmr(:, :, 10)  
requested     GFS\_rrtmg\_pre\_run  
physics set   physics

#### volume\_mixing\_ratio\_cfc12

long\_name     volume mixing ratio cfc12  
units         kg kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%gasvmr(:, :, 7)  
requested     GFS\_rrtmg\_pre\_run  
              rrtmg\_lw\_run  
              rrtmg\_sw\_run  
physics set   physics

#### volume\_mixing\_ratio\_cfc22

long\_name      volume mixing ratio cfc22  
units          kg kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%gasvmr(:, :, 8)  
requested     GFS\_rrtmg\_pre\_run  
              rrtmg\_lw\_run  
              rrtmg\_sw\_run  
physics set   physics

#### volume\_mixing\_ratio\_ch4

long\_name      volume mixing ratio ch4  
units          kg kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%gasvmr(:, :, 3)  
requested     GFS\_rrtmg\_pre\_run  
              rrtmg\_lw\_run  
              rrtmg\_sw\_run  
physics set   physics



#### volume\_mixing\_ratio\_co

long\_name     volume mixing ratio co  
units         kg kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%gasvmr(:, :, 5)  
requested     GFS\_rrtmg\_pre\_run  
              rrtmg\_lw\_run  
              rrtmg\_sw\_run  
physics set   physics

#### volume\_mixing\_ratio\_co2

long\_name     volume mixing ratio co2  
units         kg kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%gasvmr(:, :, 1)  
requested     GFS\_rrtmg\_pre\_run  
              rrtmg\_lw\_run  
              rrtmg\_sw\_run  
physics set   physics

#### volume\_mixing\_ratio\_n2o

long\_name     volume mixing ratio no2  
units         kg kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%gasvmr(:, :, 2)  
requested     GFS\_rrtmg\_pre\_run  
              rrtmg\_lw\_run  
              rrtmg\_sw\_run  
physics set   physics

#### volume\_mixing\_ratio\_o2

long\_name     volume mixing ratio o2  
units         kg kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%gasvmr(:, :, 4)  
requested     GFS\_rrtmg\_pre\_run  
              rrtmg\_lw\_run  
              rrtmg\_sw\_run  
physics set   physics

#### vonKarman\_constant

|             |                                    |
|-------------|------------------------------------|
| long_name   | vonKarman constant                 |
| units       | none                               |
| rank        | 0                                  |
| type        | real                               |
| kind        | kind_phys                          |
| source      | MODULE gmtb_scm_physical_constants |
| local_name  | con_vonKarman                      |
| requested   | gmtb_scm_sfc_flux_spec_run         |
| physics set | physics                            |

#### water\_equivalent\_accumulated\_snow\_depth

|             |   |
|-------------|---|
| long_name   | water equiv of acc snow depth over land and sea ice               |
| units       | mm  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_sfcprop_type                         |
| local_name  | physics%Sfcprop(cdata%blk_no)%weasd                               |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run |
| physics set | physics   |

#### water\_equivalent\_accumulated\_snow\_depth\_over\_ice

|             |   |
|-------------|---|
| long_name   | water equiv of acc snow depth over ice  |
| units       | mm  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type                                    |
| local_name  | physics%Interstitial(cdata%blk_no)%weasd_ice                                      |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>sfc_sice_run |
| physics set | physics   |

#### water\_equivalent\_accumulated\_snow\_depth\_over\_land

|             |   |
|-------------|---|
| long_name   | water equiv of acc snow depth over land   |
| units       | mm  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type  |
| local_name  | physics%Interstitial(cdata%blk_no)%weasd_land   |
| requested   | GFS_surface_composites_post_run<br>GFS_surface_composites_pre_run<br>lsm_noah_run<br>lsm_ruc_run<br>noahmpdrv_run |
| physics set | physics   |

#### water\_equivalent\_accumulated\_snow\_depth\_over\_ocean

long\_name     water equiv of acc snow depth over ocean  
units         mm  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%weasd\_ocean  
requested     GFS\_surface\_composites\_post\_run  
              GFS\_surface\_composites\_pre\_run  
physics set   physics

#### water\_friendly\_aerosol\_number\_concentration

long\_name     number concentration of water-friendly aerosols  
units         kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_statein\_type  
local\_name    physics%Statein(cdata%blk\_no)%qgrs(:, :, physics%Model(cdata%blk\_no)%ntwa)  
requested     cu\_gf\_driver\_run  
              mp\_thompson\_init  
              mynnedmf\_wrapper\_run  
physics set   physics

#### water\_friendly\_aerosol\_number\_concentration\_updated\_by\_physics

long\_name     number concentration of water-friendly aerosols updated by physics  
units         kg-1  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_stateout\_type  
local\_name    physics%Stateout(cdata%blk\_no)%gq0(:, :, physics%Model(cdata%blk\_no)%ntwa)  
requested     mp\_thompson\_pre\_run  
              mp\_thompson\_run  
physics set   physics

#### water\_storage\_in\_aquifer

long\_name     water storage in aquifer  
units         mm  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name    physics%Sfcprop(cdata%blk\_no)%waxy  
requested     NOT REQUESTED  
physics set

#### water\_storage\_in\_aquifer\_and\_saturated\_soil

long\_name     water storage in aquifer and saturated soil  
units         mm  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name    physics%Sfcprop(cdata%blk\_no)%wtxy  
requested     NOT REQUESTED  
physics set

#### water\_table\_depth

long\_name     water table depth  
units         m  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name    physics%Sfcprop(cdata%blk\_no)%zwtxy  
requested     NOT REQUESTED  
physics set

#### water\_table\_recharge\_when\_deep

long\_name     recharge to or from the water table when deep  
units         m  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name    physics%Sfcprop(cdata%blk\_no)%deeprechxy  
requested     NOT REQUESTED  
physics set

#### water\_table\_recharge\_when\_shallow

long\_name     recharge to or from the water table when shallow  
units         m  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name    physics%Sfcprop(cdata%blk\_no)%rechxy  
requested     NOT REQUESTED  
physics set

#### water\_vapor\_mixing\_ratio\_at\_surface

long\_name water vapor mixing ratio at surface  
units kg kg-1  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name physics%Sfcprop(cdata%blk\_no)%qwv\_surf  
requested lsm\_ruc\_run  
physics set physics

#### water\_vapor\_specific\_humidity

long\_name water vapor specific humidity  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_statein\_type  
local\_name physics%Statein(cdata%blk\_no)%qgrs(:, :, physics%Model(cdata%blk\_no)%ntqv)  
requested GFS\_suite\_interstitial\_2\_run  
cu\_gf\_driver\_pre\_run  
cu\_gf\_driver\_run  
cu\_ntiedtke\_pre\_run  
drag\_suite\_run  
get\_prs\_fv3\_run  
gwdc\_run  
gwdps\_run  
mynnedmf\_wrapper\_run  
mynnsfc\_wrapper\_run  
physics set physics



#### water\_vapor\_specific\_humidity\_at\_layer\_for\_radiation

long\_name specific humidity layer  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name physics%Interstitial(cdata%blk\_no)%qlyr  
requested GFS\_rrtmg\_pre\_run  
rrtmg\_lw\_run  
rrtmg\_sw\_run  
physics set physics

#### water\_vapor\_specific\_humidity\_at\_lowest\_model\_layer

long\_name water vapor specific humidity at lowest model layer  
units kg kg-1  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_statein\_type  
local\_name physics%Statein(cdata%blk\_no)%qgrs(:,1,physics%Model(cdata%blk\_no)%ntqv)  
requested GFS\_surface\_generic\_post\_run  
gmtb\_scm\_sfc\_flux\_spec\_run  
lsm\_noah\_run  
lsm\_ruc\_run  
noahmpdrv\_run  
sfc\_cice\_run  
sfc\_diff\_run  
sfc\_nst\_run  
sfc\_ocean\_run  
sfc\_sice\_run  
physics set physics

#### water\_vapor\_specific\_humidity\_at\_lowest\_model\_layer\_for\_diag

long\_name layer 1 specific humidity for diag  
units kg kg-1  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%q1  
requested GFS\_PBL\_generic\_post\_run  
GFS\_surface\_generic\_post\_run  
physics set physics

#### water\_vapor\_specific\_humidity\_at\_lowest\_model\_layer\_updated\_by\_physics

long\_name water vapor specific humidity at lowest model layer updated by physics  
units kg kg-1  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_stateout\_type  
local\_name physics%Stateout(cdata%blk\_no)%gq0(:,1,physics%Model(cdata%blk\_no)%ntqv)  
requested sfc\_diag\_run  
physics set physics

#### water\_vapor\_specific\_humidity\_at\_previous\_time\_step

long\_name water vapor specific humidity at previous time step  
units kg kg-1  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name physics%Tbd(cdata%blk\_no)%phy\_f3d(:, :, 4)  
requested NOT REQUESTED  
physics set

#### water\_vapor\_specific\_humidity\_save

long\_name     water vapor specific humidity before entering a physics scheme  
units         kg kg-1  
rank          2  
type         real  
kind         kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_interstitial\_type  
local\_name    physics%Interstitial(cdata%blk\_no)%save\_q(:, :, physics%Model(cdata%blk\_no)%ntqv)  
requested     GFS\_DCNV\_generic\_post\_run  
              GFS\_DCNV\_generic\_pre\_run  
              GFS\_MP\_generic\_post\_run  
              GFS\_SCNV\_generic\_post\_run  
              GFS\_SCNV\_generic\_pre\_run  
              cs\_conv\_pre\_run  
physics set   physics

#### water\_vapor\_specific\_humidity\_two\_time\_steps\_back

long\_name     water vapor specific humidity two time steps back  
units         kg kg-1  
rank          2  
type         real  
kind         kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name    physics%Tbd(cdata%blk\_no)%phy\_f3d(:, :, 2)  
requested     NOT REQUESTED  
physics set

#### water\_vapor\_specific\_humidity\_updated\_by\_physics

|             |   |
|-------------|---|
| long_name   | water vapor specific humidity updated by physics  |
| units       | kg kg-1   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_stateout_type  |
| local_name  | physics%Stateout(cdata%blk_no)%gq0(:, :, physics%Model(cdata%blk_no)%ntqv)  |
| requested   | GFS_DCNV_generic_post_run<br>GFS_DCNV_generic_pre_run<br>GFS_SCNV_generic_post_run<br>GFS_SCNV_generic_pre_run<br>cs_conv_pre_run<br>cs_conv_run<br>cu_gf_driver_post_run<br>cu_gf_driver_run<br>cu_ntiedtke_post_run<br>cu_ntiedtke_run<br>get_phi_fv3_run<br>gfdl_cloud_microphys_run<br>h2ophys_run<br>m_micro_run<br>mp_thompson_pre_run<br>mp_thompson_run<br>samfdeepcnv_run<br>samfshalcnv_run<br>shoc_run<br>zhaocarr_gscond_run<br>zhaocarr_precpd_run |
| physics set | physics   |

#### weight\_for\_momentum\_at\_viscous\_sublayer\_top

long\_name weight for momentum at viscous layer top  
units none  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name physics%Tbd(cdata%blk\_no)%phy\_myj\_a1u  
requested NOT REQUESTED  
physics set

#### weight\_for\_potential\_temperature\_at\_viscous\_sublayer\_top

long\_name weight for potential temperature at viscous layer top  
units none  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name physics%Tbd(cdata%blk\_no)%phy\_myj\_a1t  
requested NOT REQUESTED  
physics set

#### weight\_for\_specific\_humidity\_at\_viscous\_sublayer\_top

long\_name weight for Specfic Humidity at viscous layer top  
units none  
rank 1  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_tbd\_type  
local\_name physics%Tbd(cdata%blk\_no)%phy\_myj\_a1q  
requested NOT REQUESTED  
physics set

#### weights\_for\_stochastic\_shum\_perturbation

long\_name weights for stochastic shum perturbation  
units none  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%shum\_wts  
requested NOT REQUESTED  
physics set

#### weights\_for\_stochastic\_shum\_perturbation\_flipped

long\_name weights for stochastic shum perturbation, flipped  
units none  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%shum\_wts  
requested NOT REQUESTED  
physics set

#### weights\_for\_stochastic\_skeb\_perturbation\_of\_x\_wind

long\_name weights for stochastic skeb perturbation of x wind  
units none  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%skebu\_wts  
requested NOT REQUESTED  
physics set

#### weights\_for\_stochastic\_skeb\_perturbation\_of\_x\_wind\_flipped

long\_name weights for stochastic skeb perturbation of x wind, flipped  
units none  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%skebu\_wts  
requested NOT REQUESTED  
physics set

#### weights\_for\_stochastic\_skeb\_perturbation\_of\_y\_wind

long\_name weights for stochastic skeb perturbation of y wind  
units none  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_coupling\_type  
local\_name physics%Coupling(cdata%blk\_no)%skebv\_wts  
requested NOT REQUESTED  
physics set

#### weights\_for\_stochastic\_skeb\_perturbation\_of\_y\_wind\_flipped

long\_name weights for stochastic skeb perturbation of y wind, flipped  
units none  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%skebv\_wts  
requested NOT REQUESTED  
physics set

#### weights\_for\_stochastic\_sppt\_perturbation

|             |  |
|-------------|--|
| long_name   | weights for stochastic sppt perturbation   |
| units       | none                                       |
| rank        | 2  |
| type        | real                                       |
| kind        | kind_phys                                  |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type |
| local_name  | physics%Coupling(cdata%blk_no)%sppt_wts    |
| requested   | NOT REQUESTED                              |
| physics set |  |

#### weights\_for\_stochastic\_sppt\_perturbation\_flipped

|             |   |
|-------------|---|
| long_name   | weights for stochastic sppt perturbation, flipped |
| units       | none  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type            |
| local_name  | physics%Diag(cdata%blk_no)%sppt_wts               |
| requested   | NOT REQUESTED                                     |
| physics set |   |

#### weights\_for\_stochastic\_surface\_physics\_perturbation

|             |   |
|-------------|---|
| long_name   | weights for stochastic surface physics perturbation |
| units       | none  |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_coupling_type          |
| local_name  | physics%Coupling(cdata%blk_no)%sfc_wts              |
| requested   | GFS_surface_generic_pre_run                         |
| physics set | physics   |



#### wind\_speed\_at\_lowest\_model\_layer

|             |  |
|-------------|--|
| long_name   | wind speed at lowest model level   |
| units       | m s-1  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type   |
| local_name  | physics%Interstitial(cdata%blk_no)%wind  |
| requested   | GFS_PBL_generic_post_run<br>GFS_surface_generic_pre_run<br>GFS_surface_loop_control_part1_run<br>GFS_surface_loop_control_part2_run<br>gmtb_scm_sfc_flux_spec_run<br>hedmf_run<br>lsm_noah_run<br>lsm_ruc_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>mynnedmf_wrapper_run<br>mynnsfc_wrapper_run<br>noahmpdrv_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>sfc_cice_run<br>sfc_diff_run<br>sfc_nst_run<br>sfc_ocean_run<br>sfc_sice_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics  |

#### wood\_mass

long\_name     wood mass including woody roots  
units         g m-2  
rank          1  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_sfcprop\_type  
local\_name    physics%Sfcprop(cdata%blk\_no)%woodxy  
requested     NOT REQUESTED  
physics set

#### x\_momentum\_tendency\_from\_blocking\_drag

long\_name     x momentum tendency from blocking drag  
units         m s-2  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%dtaux2d\_bl  
requested     NOT REQUESTED  
physics set

#### x\_momentum\_tendency\_from\_form\_drag

long\_name     x momentum tendency from form drag  
units         m s-2  
rank          2  
type          real  
kind          kind\_phys  
source        MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name    physics%Diag(cdata%blk\_no)%dtaux2d\_fd  
requested     NOT REQUESTED  
physics set

#### x\_momentum\_tendency\_from\_large\_scale\_gwd

|             |  |
|-------------|--|
| long_name   | x momentum tendency from large scale gwd |
| units       | m s-2                                    |
| rank        | 2  |
| type        | real                                     |
| kind        | kind_phys                                |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type   |
| local_name  | physics%Diag(cdata%blk_no)%dtaux2d_ls    |
| requested   | NOT REQUESTED                            |
| physics set |  |

#### x\_momentum\_tendency\_from\_small\_scale\_gwd

|             |  |
|-------------|--|
| long_name   | x momentum tendency from small scale gwd |
| units       | m s-2                                    |
| rank        | 2  |
| type        | real                                     |
| kind        | kind_phys                                |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type   |
| local_name  | physics%Diag(cdata%blk_no)%dtaux2d_ss    |
| requested   | NOT REQUESTED                            |
| physics set |  |

#### x\_wind

|             |  |
|-------------|--|
| long_name   | zonal wind   |
| units       | m s-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type  |
| local_name  | physics%Statein(cdata%blk_no)%ugrs   |
| requested   | GFS_suite_stateout_reset_run<br>GFS_suite_stateout_update_run<br>cires_ugwp_run<br>drag_suite_run<br>gwdc_run<br>gwdps_run<br>hedmf_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>mynnedmf_wrapper_run<br>mynnsfc_wrapper_run<br>rayleigh_damp_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics  |

```

x_wind_at_10m
  long_name      10 meter u wind speed
  units          m s-1
  rank          1
  type          real
  kind          kind_phys
  source        MODULE GFS_typedefs TYPE GFS_diag_type
  local_name    physics%Diag(cdata%blk_no)%u10m
  requested     GFS_surface_generic_post_run
                gmtb_scm_sfc_flux_spec_run
                hedmf_run
                maximum_hourly_diagnostics_run
                moninshoc_run
                mynnsfc_wrapper_run
                satmedmfvdif_run
                satmedmfvdifq_run
                sfc_diag_post_run
                sfc_diag_run
                sfc_diff_run
                shinhongvdif_run
                ysuvdif_run
  physics set   physics

```

#### `x_wind_at_lowest_model_layer`

|             |   |
|-------------|---|
| long_name   | zonal wind at lowest model layer  |
| units       | m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type   |
| local_name  | physics%Statein(cdata%blk_no)%ugrs(:,1)   |
| requested   | GFS_PBL_generic_post_run<br>GFS_surface_generic_post_run<br>GFS_surface_generic_pre_run<br>gmtb_scm_sfc_flux_spec_run<br>noahmpdrv_run<br>sfc_nst_run |
| physics set | physics   |

#### `x_wind_at_lowest_model_layer_for_diag`

|             |  |
|-------------|--|
| long_name   | layer 1 x wind for diag                |
| units       | m s-1                                  |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%u1          |
| requested   | GFS_surface_generic_post_run           |
| physics set | physics                                |

#### x\_wind\_at\_lowest\_model\_layer\_updated\_by\_physics

|             |   |
|-------------|---|
| long_name   | zonal wind at lowest model layer updated by physics |
| units       | m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_stateout_type          |
| local_name  | physics%Stateout(cdata%blk_no)%gu0(:,1)             |
| requested   | sfc_diag_run  |
| physics set | physics   |

#### x\_wind\_save

|             |   |
|-------------|---|
| long_name   | x-wind before entering a physics scheme               |
| units       | m s-1   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type        |
| local_name  | physics%Interstitial(cdata%blk_no)%save_u             |
| requested   | GFS_DCNV_generic_post_run<br>GFS_DCNV_generic_pre_run |
| physics set | physics   |

#### x\_wind\_updated\_by\_physics

|             |  |
|-------------|--|
| long_name   | zonal wind updated by physics  |
| units       | m s-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_stateout_type   |
| local_name  | physics%Stateout(cdata%blk_no)%gu0   |
| requested   | GFS_DCNV_generic_post_run<br>GFS_DCNV_generic_pre_run<br>GFS_suite_stateout_reset_run<br>GFS_suite_stateout_update_run<br>cs_conv_run<br>cu_gf_driver_run<br>cu_ntiedtke_run<br>gfdl_cloud_microphys_run<br>gwdc_post_run<br>m_micro_run<br>samfdeepcnv_run<br>samfshalcnv_run<br>shoc_run |
| physics set | physics  |

#### y\_momentum\_tendency\_from\_blocking\_drag

|             |  |
|-------------|--|
| long_name   | y momentum tendency from blocking drag |
| units       | m s-2                                  |
| rank        | 2                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%dtauy2d_b1  |
| requested   | NOT REQUESTED                          |
| physics set |  |



#### y\_momentum\_tendency\_from\_form\_drag

long\_name y momentum tendency from form drag  
units m s-2  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dtauy2d\_fd  
requested NOT REQUESTED  
physics set

#### y\_momentum\_tendency\_from\_large\_scale\_gwd

long\_name y momentum tendency from large scale gwd  
units m s-2  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dtauy2d\_ls  
requested NOT REQUESTED  
physics set

#### y\_momentum\_tendency\_from\_small\_scale\_gwd

long\_name y momentum tendency from small scale gwd  
units m s-2  
rank 2  
type real  
kind kind\_phys  
source MODULE GFS\_typedefs TYPE GFS\_diag\_type  
local\_name physics%Diag(cdata%blk\_no)%dtauy2d\_ss  
requested NOT REQUESTED  
physics set

## y\_wind

|             |  |
|-------------|--|
| long_name   | meridional wind  |
| units       | m s-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type  |
| local_name  | physics%Statein(cdata%blk_no)%vgrs   |
| requested   | GFS_suite_stateout_reset_run<br>GFS_suite_stateout_update_run<br>cires_ugwp_run<br>drag_suite_run<br>gwdc_run<br>gwdps_run<br>hedmf_run<br>moninshoc_run<br>myjpbl_wrapper_run<br>myjsfc_wrapper_run<br>mynnedmf_wrapper_run<br>mynnsfc_wrapper_run<br>rayleigh_damp_run<br>satmedmfvdif_run<br>satmedmfvdifq_run<br>shinhongvdif_run<br>ysuvdif_run |
| physics set | physics  |

```

y_wind_at_10m
  long_name      10 meter v wind speed
  units          m s-1
  rank           1
  type           real
  kind           kind_phys
  source         MODULE GFS_typedefs TYPE GFS_diag_type
  local_name     physics%Diag(cdata%blk_no)%v10m
  requested      GFS_surface_generic_post_run
                  gmtb_scm_sfc_flux_spec_run
                  hedmf_run
                  maximum_hourly_diagnostics_run
                  moninshoc_run
                  mynnsfc_wrapper_run
                  satmedmfvdif_run
                  satmedmfvdifq_run
                  sfc_diag_post_run
                  sfc_diag_run
                  sfc_diff_run
                  shinhongvdif_run
                  ysuvdif_run
  physics set    physics

```

#### y\_wind\_at\_lowest\_model\_layer

|             |   |
|-------------|---|
| long_name   | meridional wind at lowest model layer   |
| units       | m s-1   |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_statein_type   |
| local_name  | physics%Statein(cdata%blk_no)%vgrs(:,1)   |
| requested   | GFS_PBL_generic_post_run<br>GFS_surface_generic_post_run<br>GFS_surface_generic_pre_run<br>gmtb_scm_sfc_flux_spec_run<br>noahmpdrv_run<br>sfc_nst_run |
| physics set | physics   |

#### y\_wind\_at\_lowest\_model\_layer\_for\_diag

|             |  |
|-------------|--|
| long_name   | layer 1 y wind for diag                |
| units       | m s-1                                  |
| rank        | 1                                      |
| type        | real                                   |
| kind        | kind_phys                              |
| source      | MODULE GFS_typedefs TYPE GFS_diag_type |
| local_name  | physics%Diag(cdata%blk_no)%v1          |
| requested   | GFS_surface_generic_post_run           |
| physics set | physics                                |

#### y\_wind\_at\_lowest\_model\_layer\_updated\_by\_physics

|             |  |
|-------------|--|
| long_name   | meridional wind at lowest model layer updated by physics |
| units       | m s-1  |
| rank        | 1  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_stateout_type               |
| local_name  | physics%Stateout(cdata%blk_no)%gv0(:,1)                  |
| requested   | sfc_diag_run   |
| physics set | physics  |

#### y\_wind\_save

|             |   |
|-------------|---|
| long_name   | y-wind before entering a physics scheme               |
| units       | m s-1   |
| rank        | 2   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type        |
| local_name  | physics%Interstitial(cdata%blk_no)%save_v             |
| requested   | GFS_DCNV_generic_post_run<br>GFS_DCNV_generic_pre_run |
| physics set | physics   |

#### y\_wind\_updated\_by\_physics

|             |  |
|-------------|--|
| long_name   | meridional wind updated by physics   |
| units       | m s-1  |
| rank        | 2  |
| type        | real   |
| kind        | kind_phys  |
| source      | MODULE GFS_typedefs TYPE GFS_stateout_type   |
| local_name  | physics%Stateout(cdata%blk_no)%gv0   |
| requested   | GFS_DCNV_generic_post_run<br>GFS_DCNV_generic_pre_run<br>GFS_suite_stateout_reset_run<br>GFS_suite_stateout_update_run<br>cs_conv_run<br>cu_gf_driver_run<br>cu_ntiedtke_run<br>gfdl_cloud_microphys_run<br>gwdc_post_run<br>m_micro_run<br>samfdeepcnv_run<br>samfshalcnv_run<br>shoc_run |
| physics set | physics  |

#### zenith\_angle\_temporal\_adjustment\_factor\_for\_shortwave\_fluxes

|             |   |
|-------------|---|
| long_name   | zenith angle temporal adjustment factor for shortwave |
| units       | none  |
| rank        | 1   |
| type        | real  |
| kind        | kind_phys   |
| source      | MODULE GFS_typedefs TYPE GFS_interstitial_type        |
| local_name  | physics%Interstitial(cdata%blk_no)%xmu                |
| requested   | GFS_PBL_generic_post_run                              |
|             | GFS_suite_interstitial_2_run                          |
|             | dcyc2t3_run   |
|             | hedmf_run   |
|             | mynnedmf_wrapper_run                                  |
|             | satmedmfvdif_run                                      |
|             | satmedmfvdifq_run                                     |
|             | ysuvdif_run   |
| physics set | physics   |