

single_vs_double_precision_output

May 29, 2024

```
[1]: import xarray as xr
import numpy as np
import matplotlib.pyplot as plt
```

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[2]: output_dir1 = './output32'
output_dir2 = './output64'
case_output = '/output_twipice_SCM_RAP'

f32 = output_dir1 + case_output + '/output.nc'
f64 = output_dir2 + case_output + '/output.nc'

ds32 = xr.open_dataset(f32)
ds64 = xr.open_dataset(f64)
```

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[3]: ds32.identical(ds64)
```

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[3]: False
```

```
[33]: # compare variables across full run
for var in ds32.variables:
    if (not ds32[var].identical(ds64[var])):
        if (len(ds32[var].shape) == 2):
            re = (abs(ds32[var] - ds64[var])[:,:]) / abs(ds64[var][:,:])
            max_re = max(abs(re.min().data), re.max().data)
            if (max_re > .05):
                print(var, ": max_re", max_re)
                fig, ax = plt.subplots(nrows=1, ncols=1, figsize=(6, 4))
                re.transpose().plot(ax=ax)
                plt.show()
        else:
            re = (abs(ds32[var] - ds64[var])[:, :, 0]) / abs(ds64[var][: :, 0])

            max_re = max(abs(re.min().data), re.max().data)
            if (max_re > .05):
                fig, axes = plt.subplots(nrows=1, ncols=2, figsize=(12, 4))
```

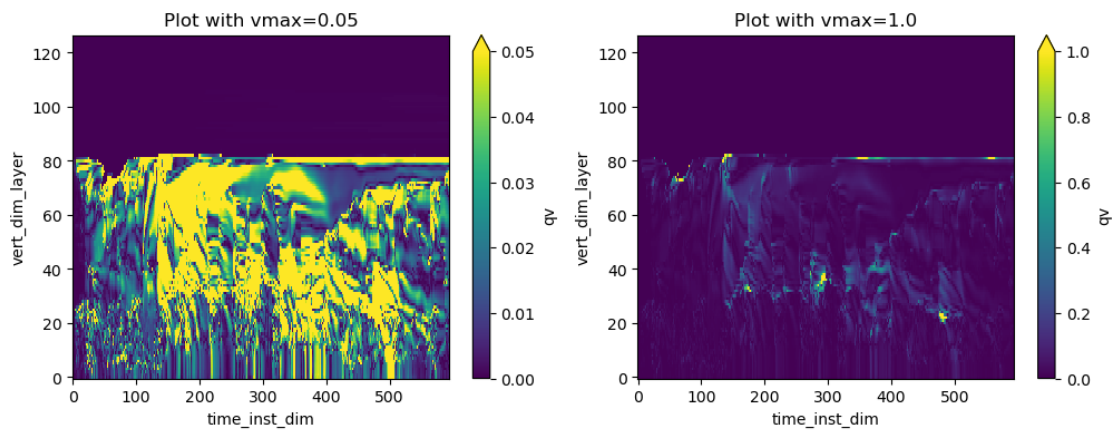
```

print("-----")
print(var, ": max_re", max_re)
re.transpose().plot(ax=axes[0], vmax=0.05)
axes[0].set_title('Plot with vmax=0.05')
re.transpose().plot(ax=axes[1], vmax=1.0)
axes[1].set_title('Plot with vmax=1.0')

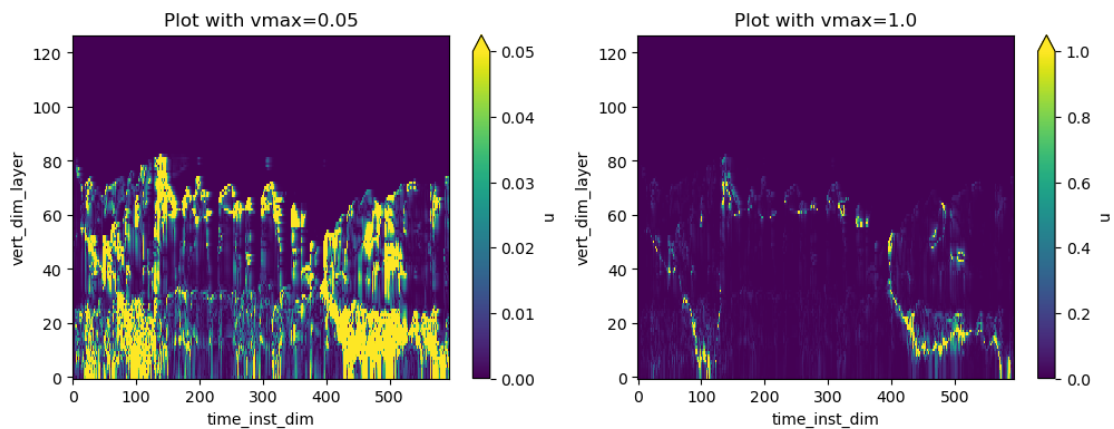
#re.transpose().plot(vmax=1.0)
plt.show()

```

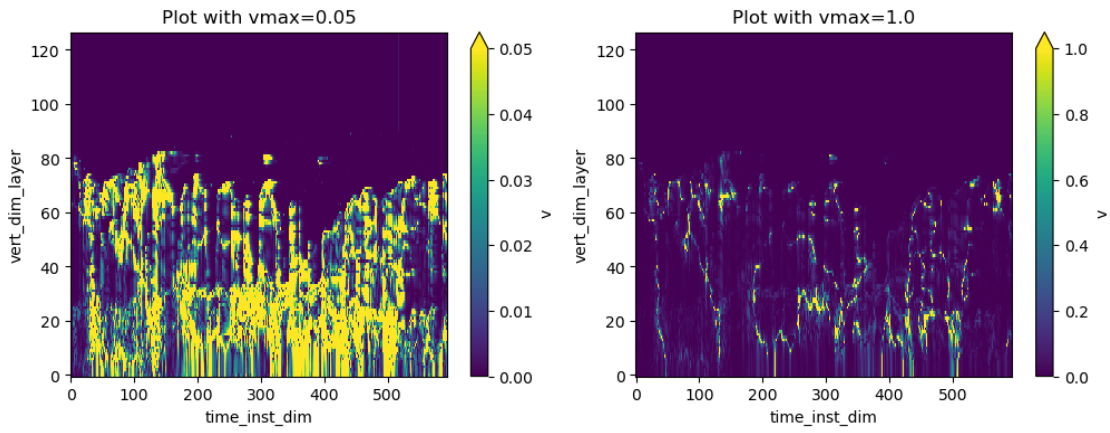
qv : max_re 3539196.5



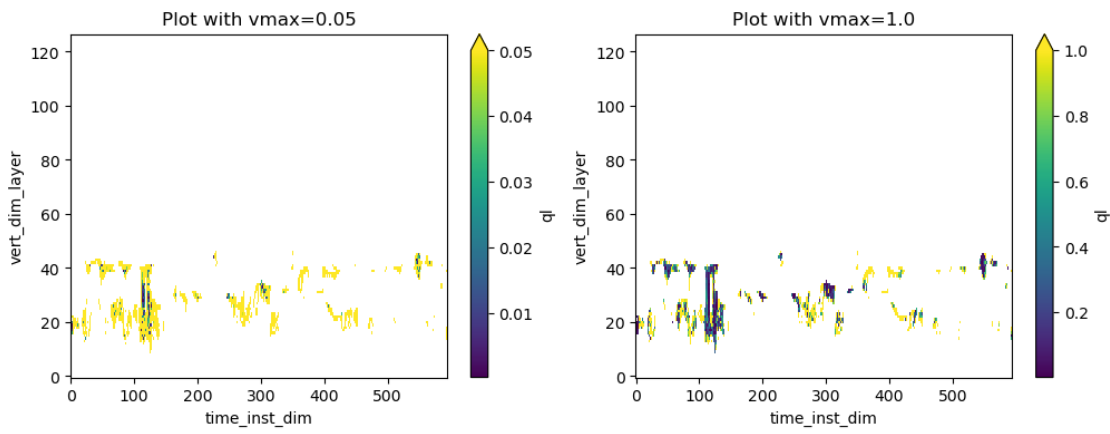
u : max_re 462.285400390625



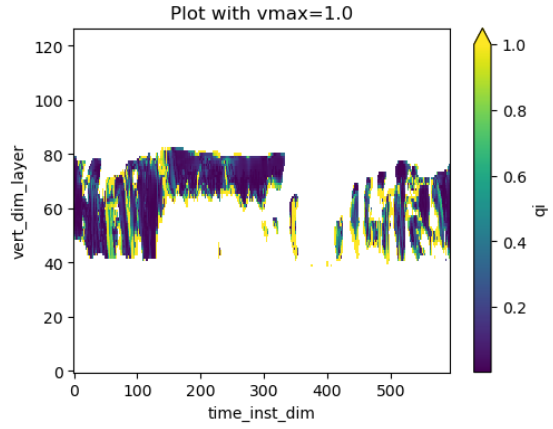
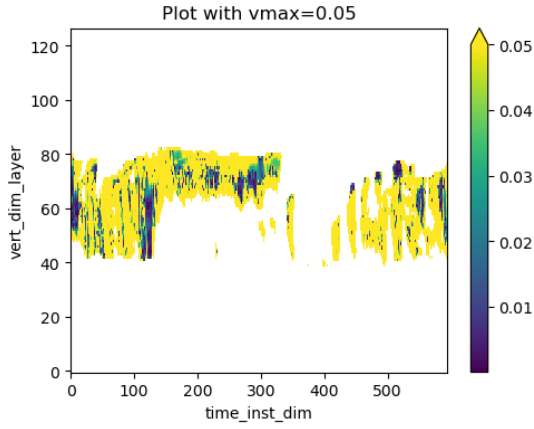
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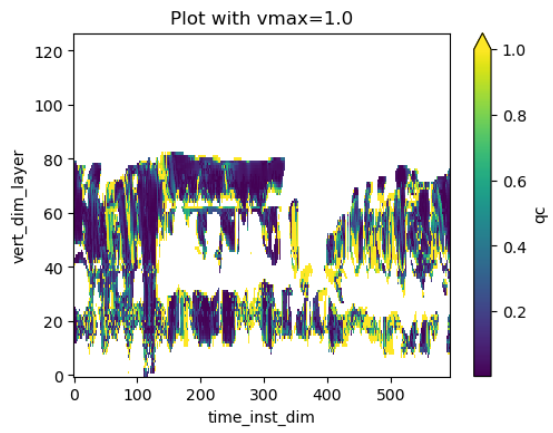
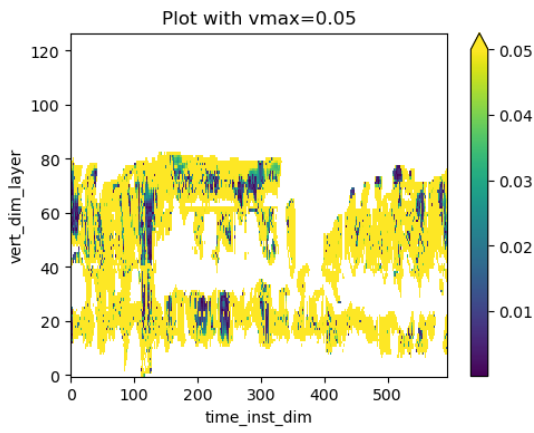
ql : max_re inf



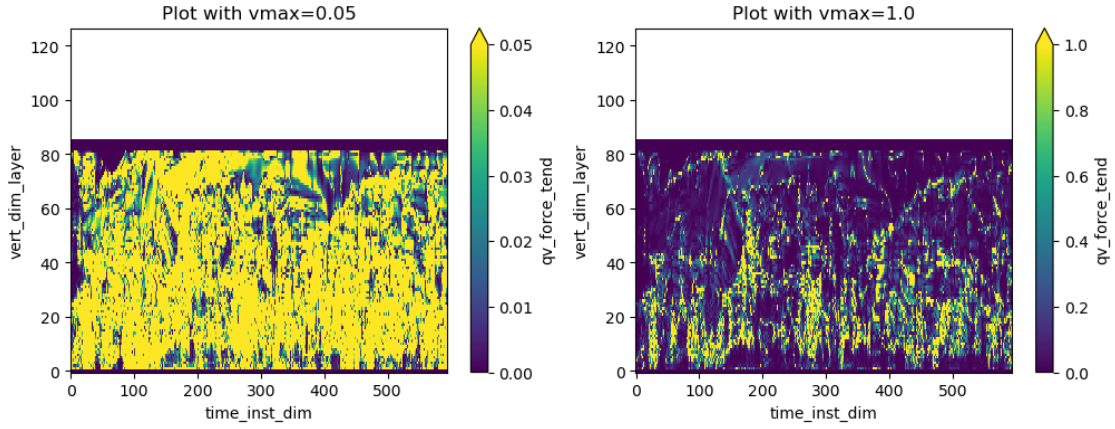
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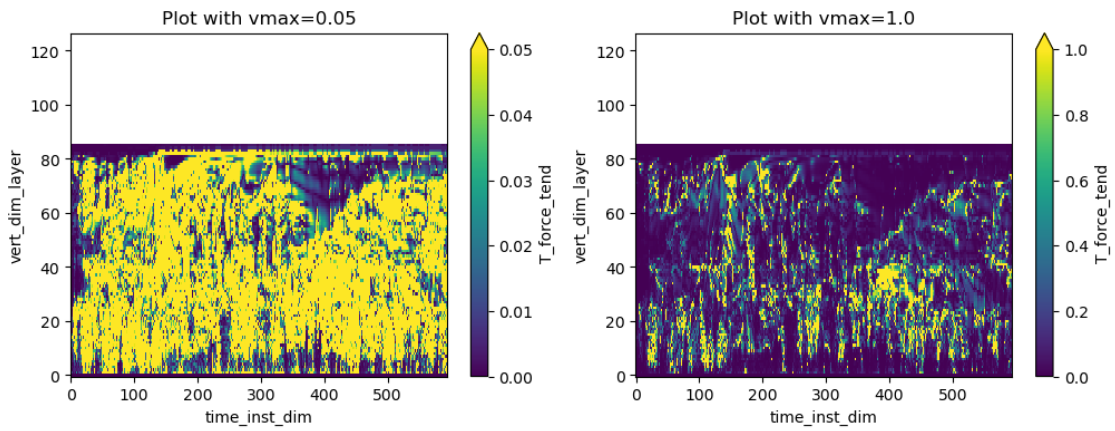
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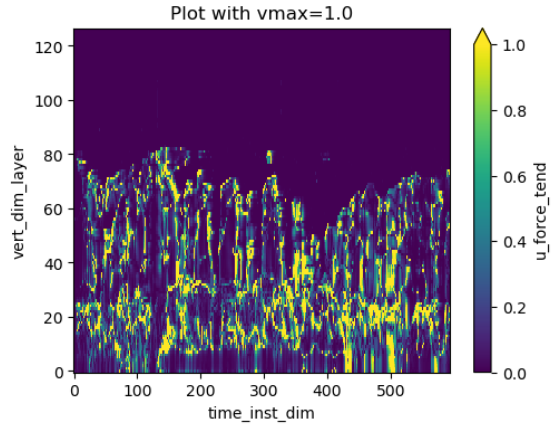
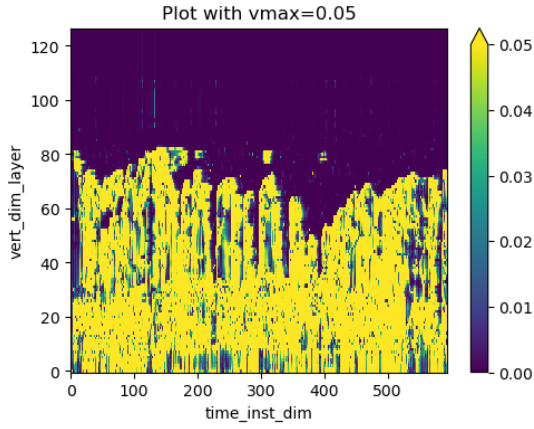
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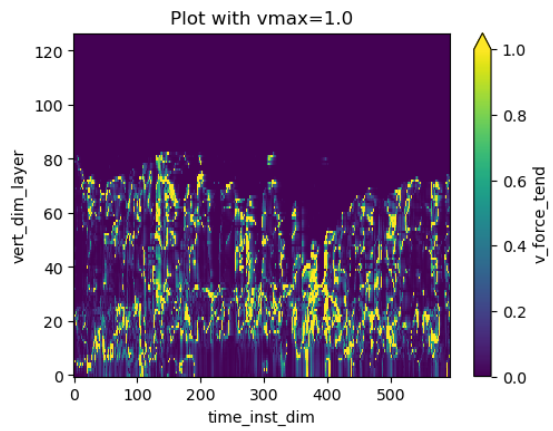
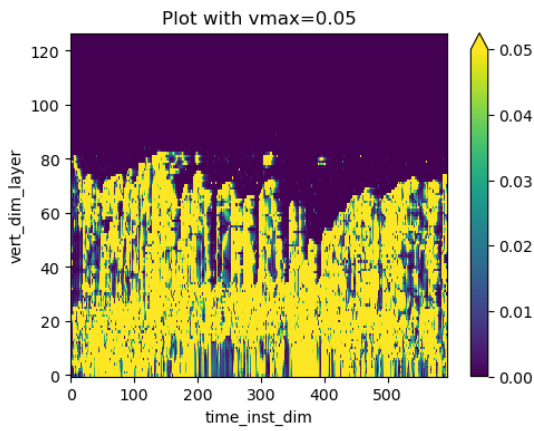
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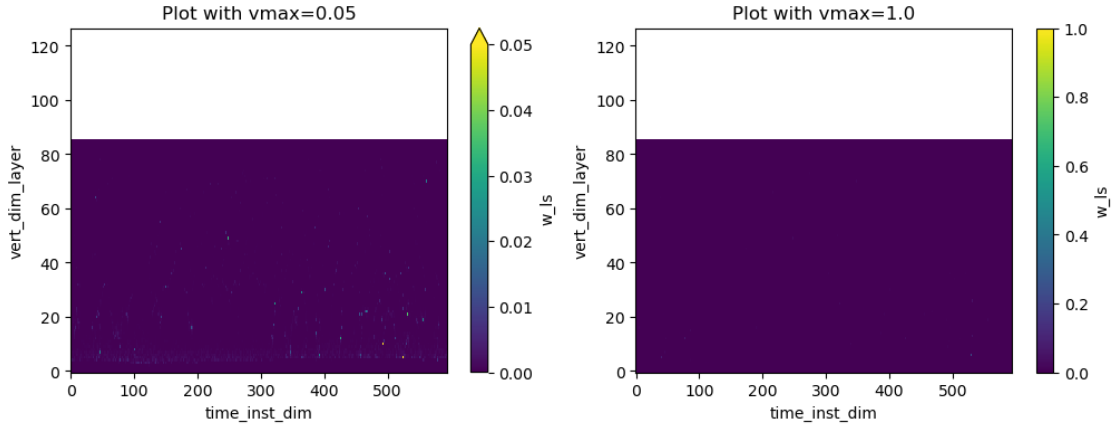
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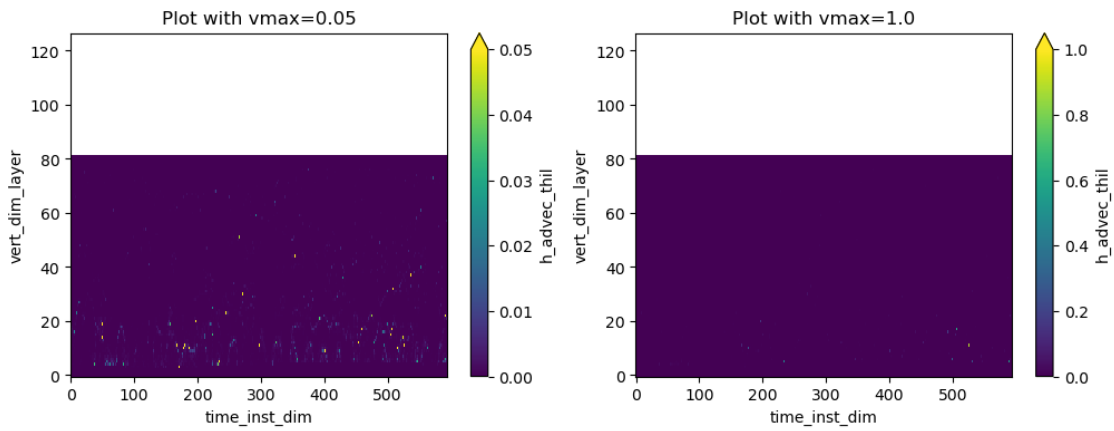
v_force_tend : max_re 5785.07958984375



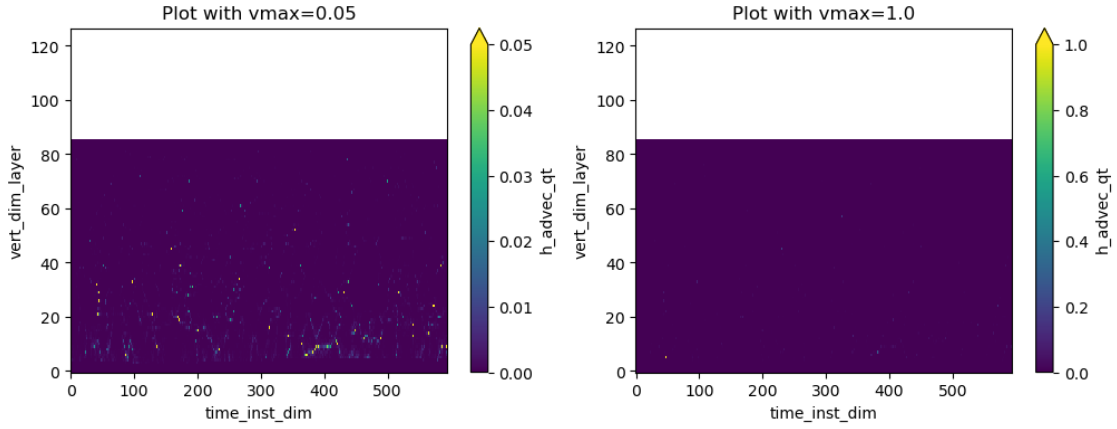
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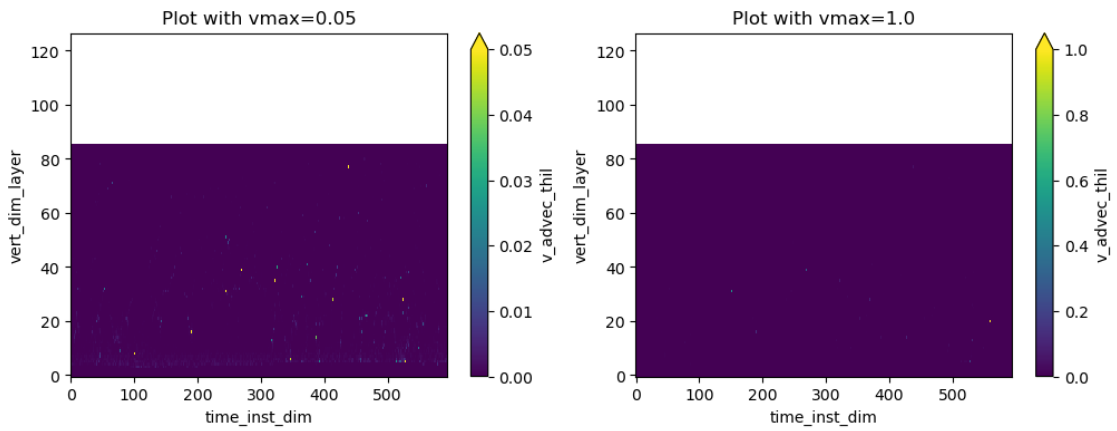
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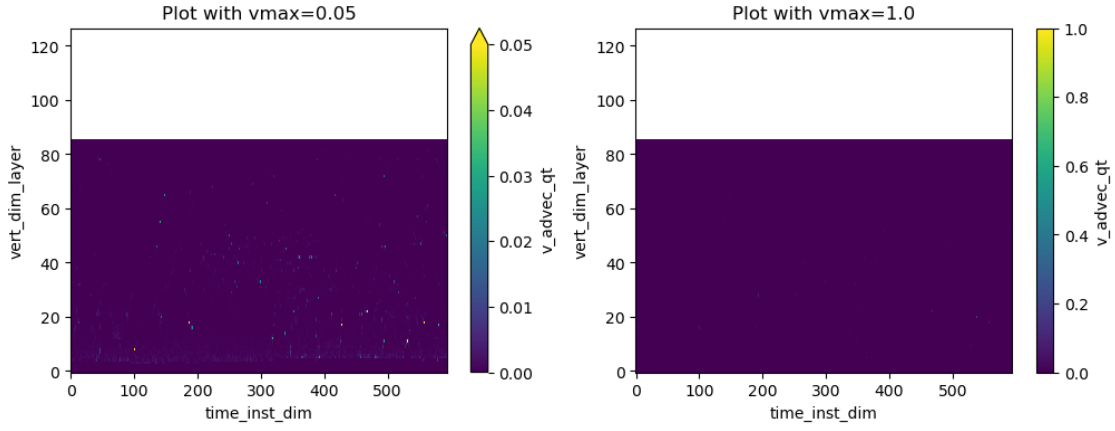
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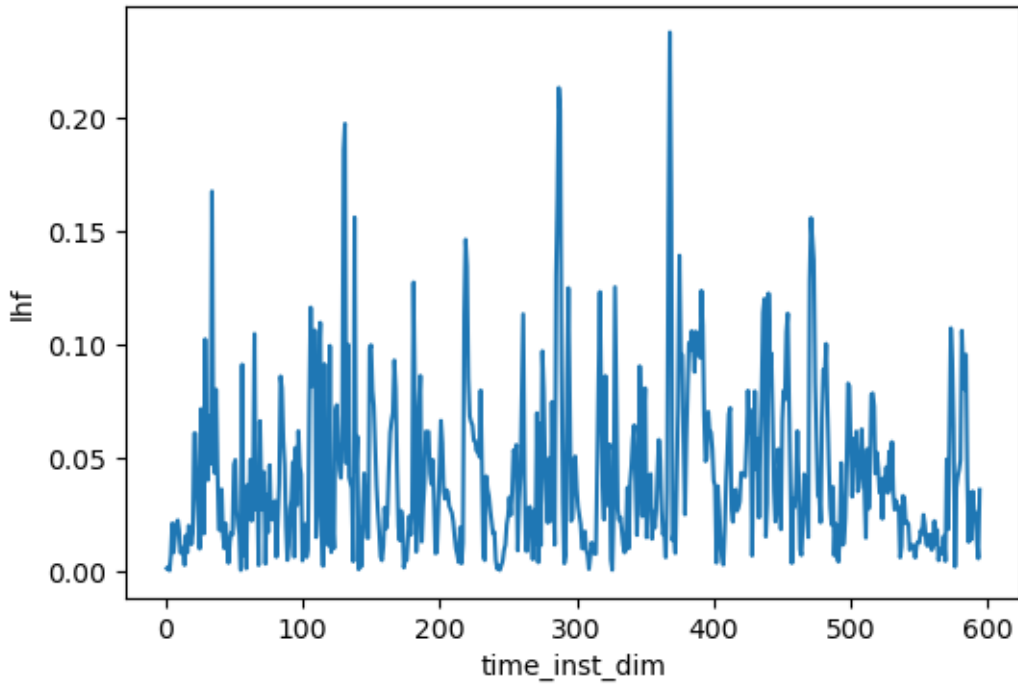
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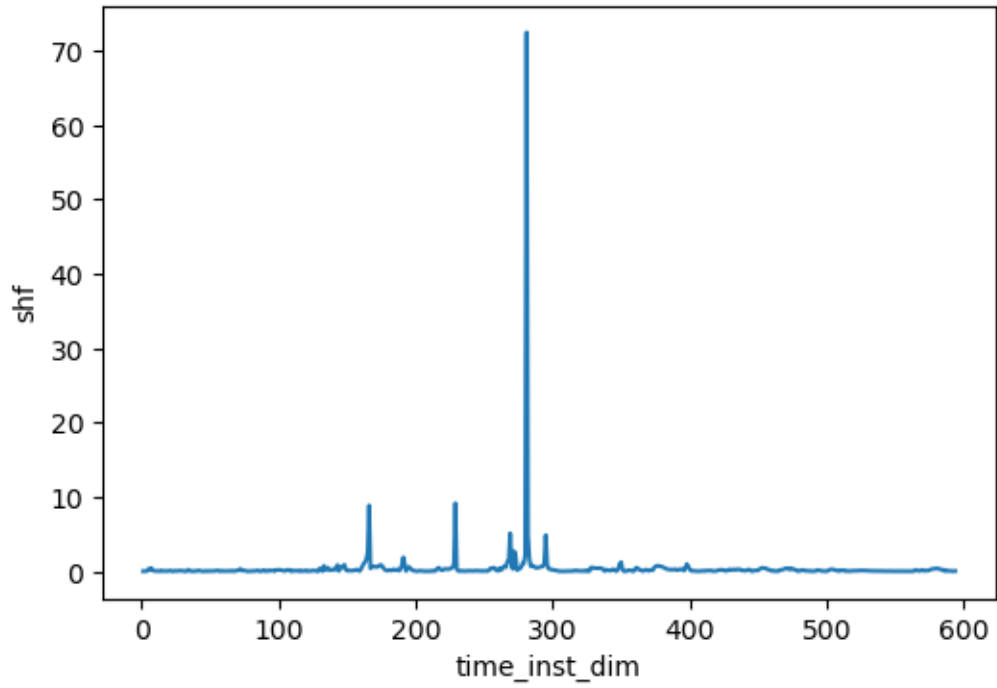
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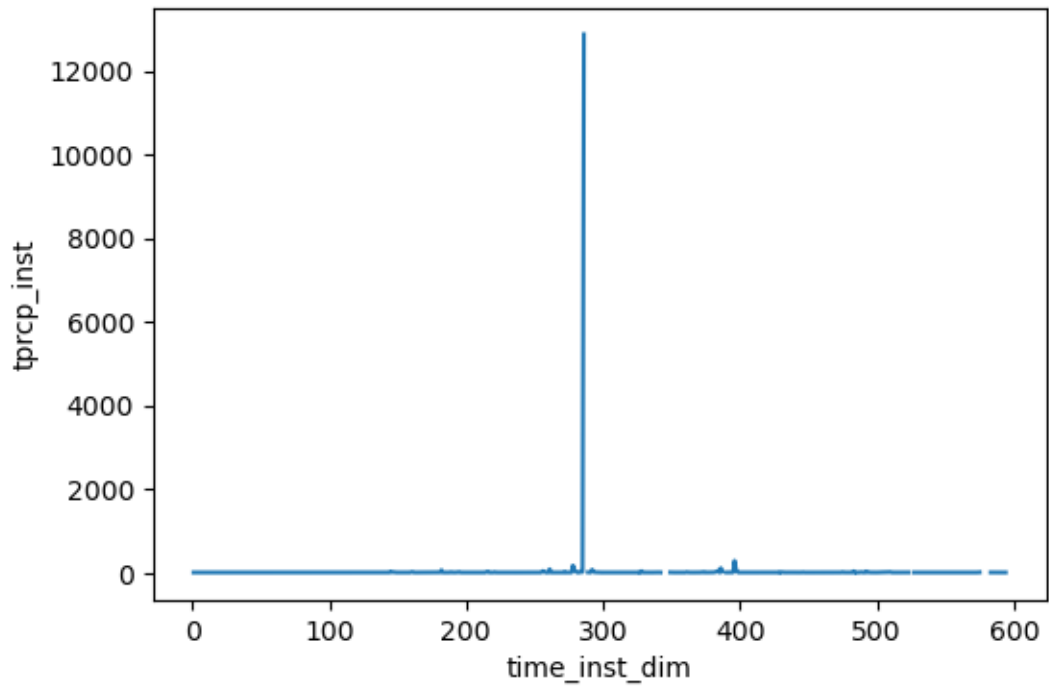
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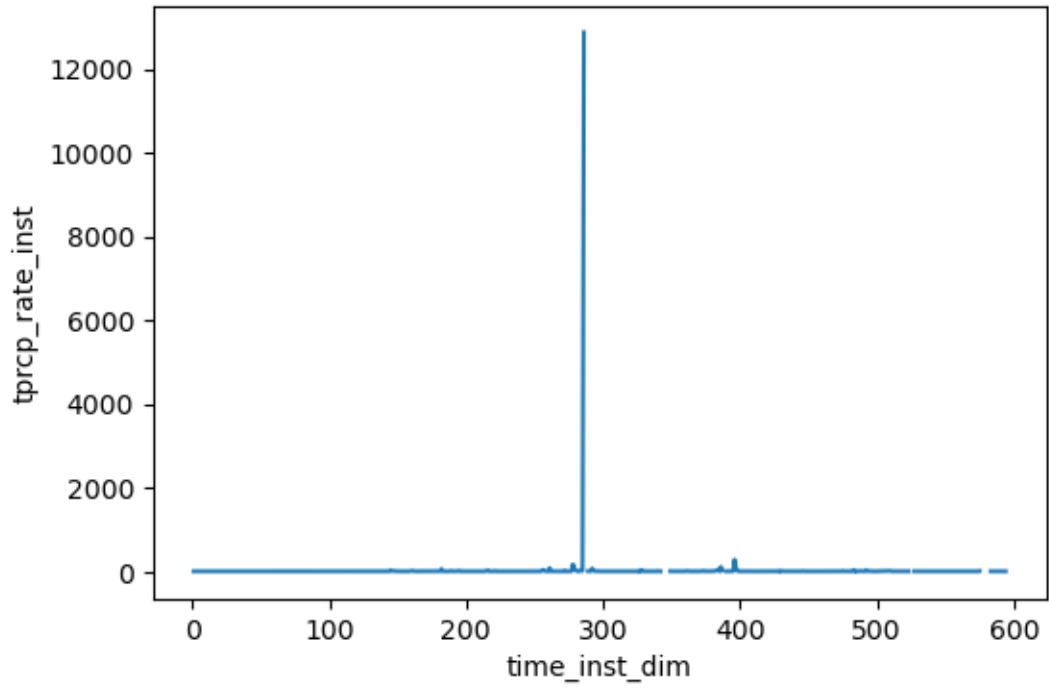
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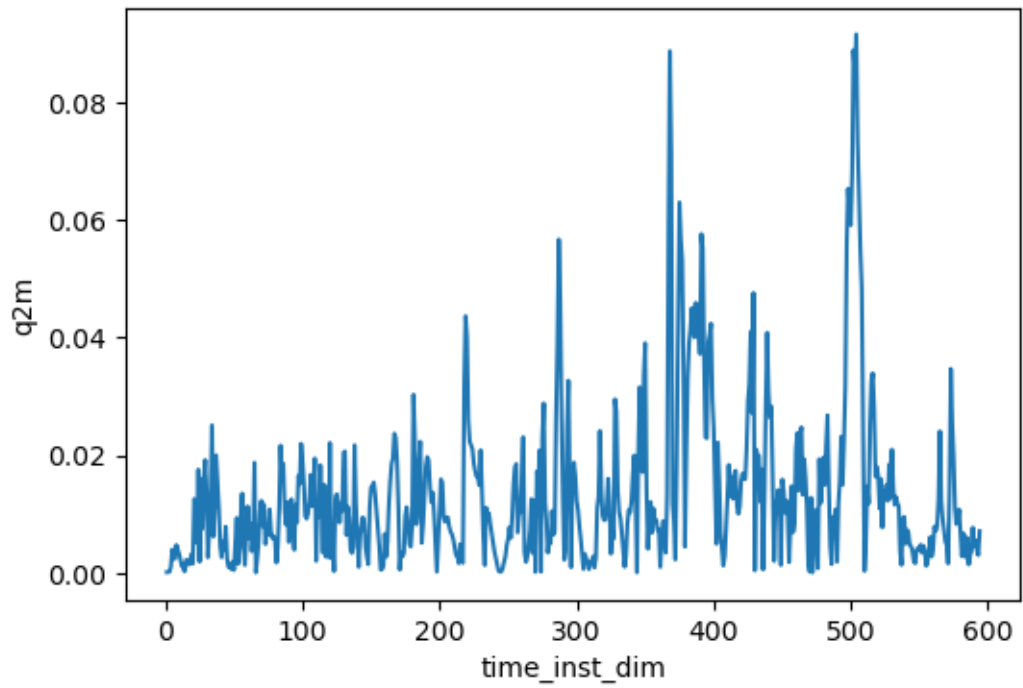
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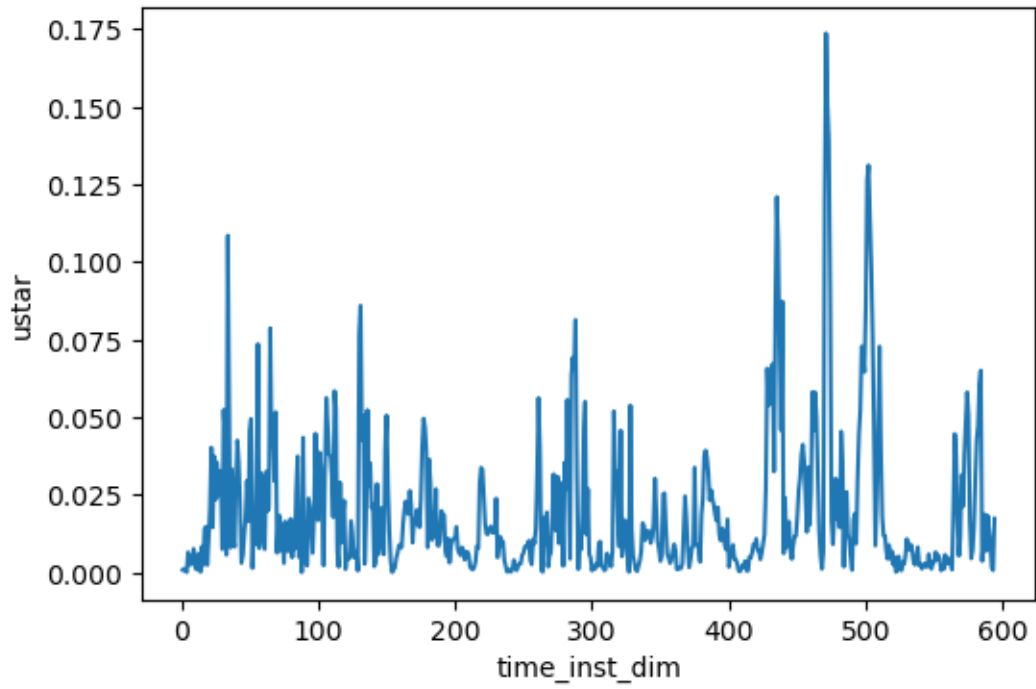
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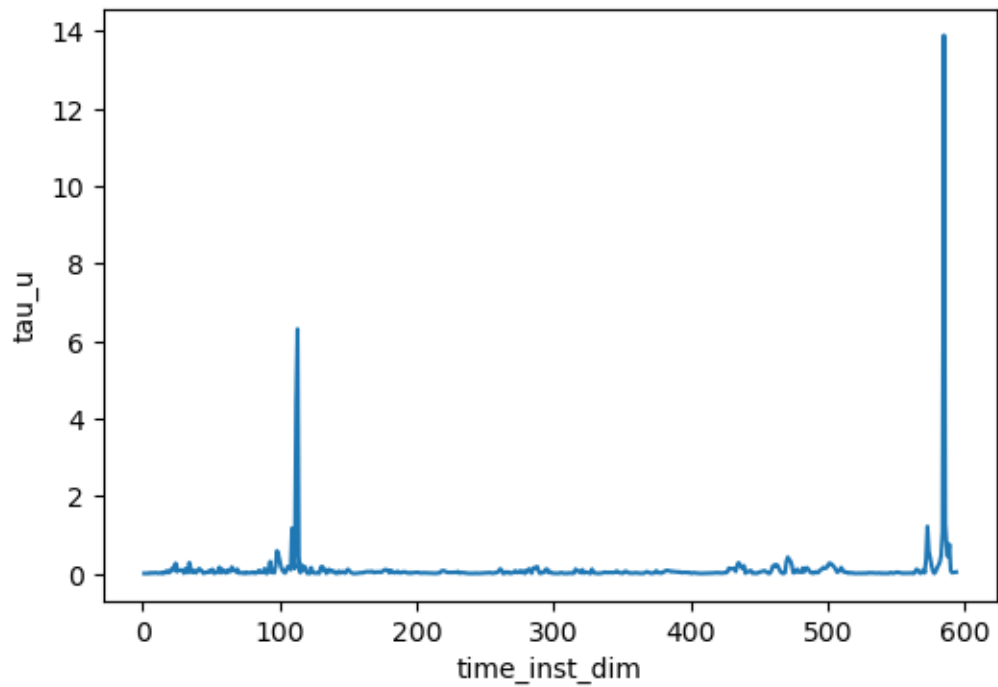
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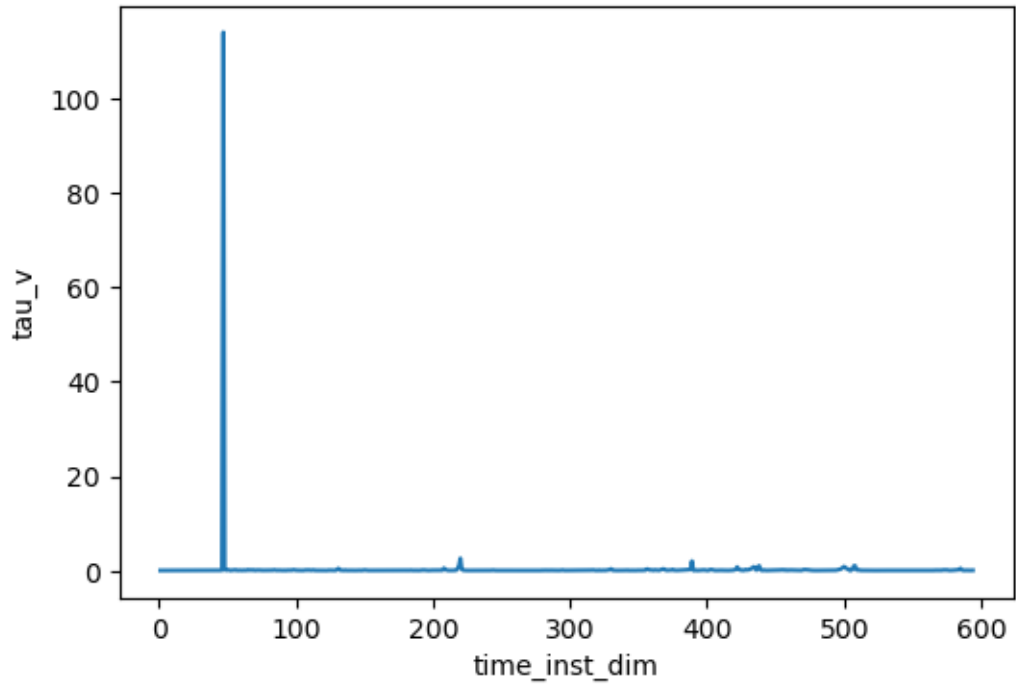
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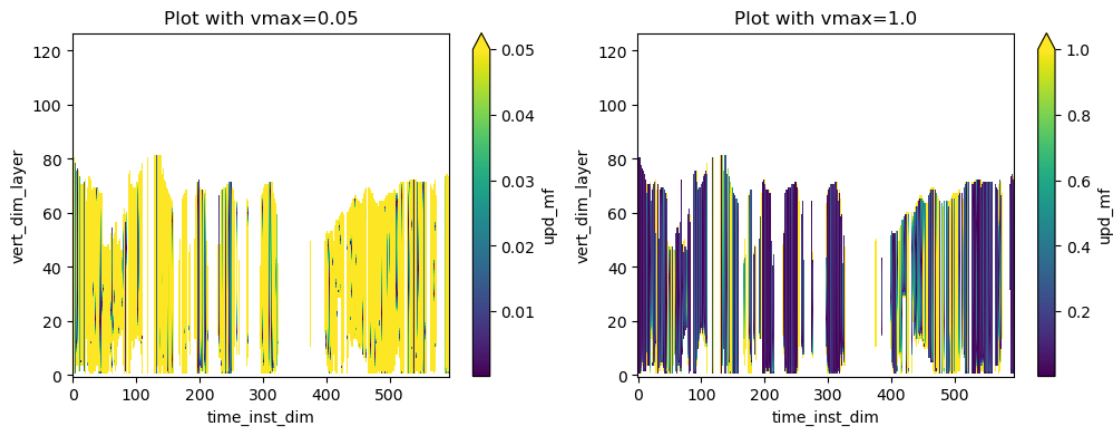
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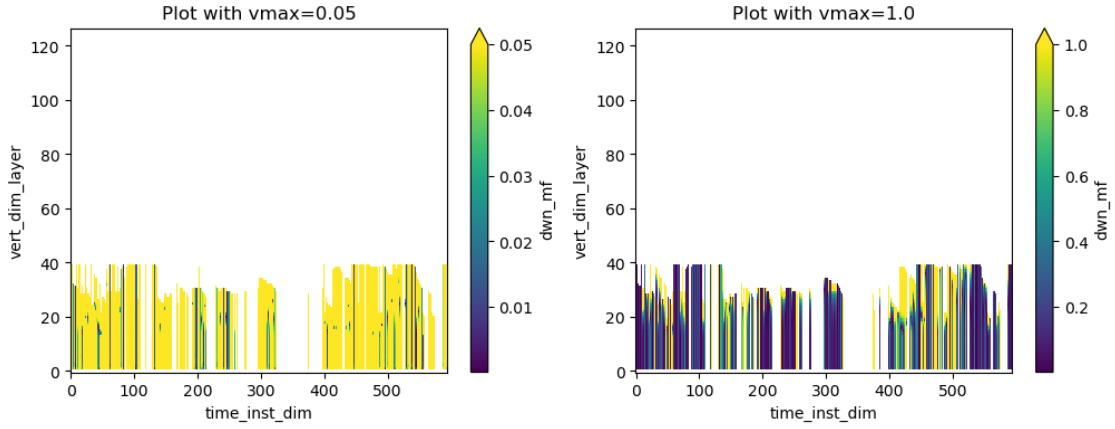
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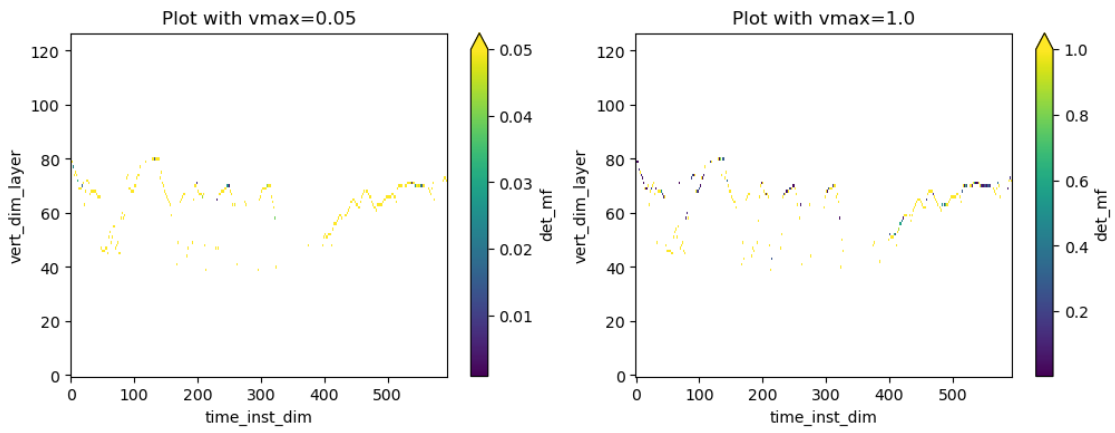
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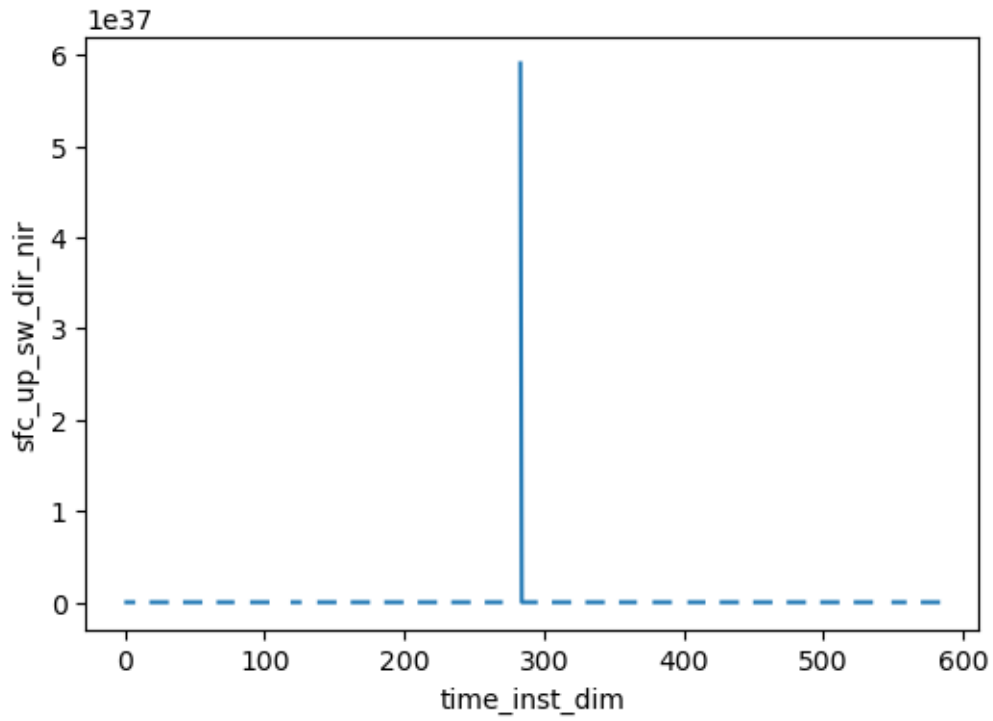
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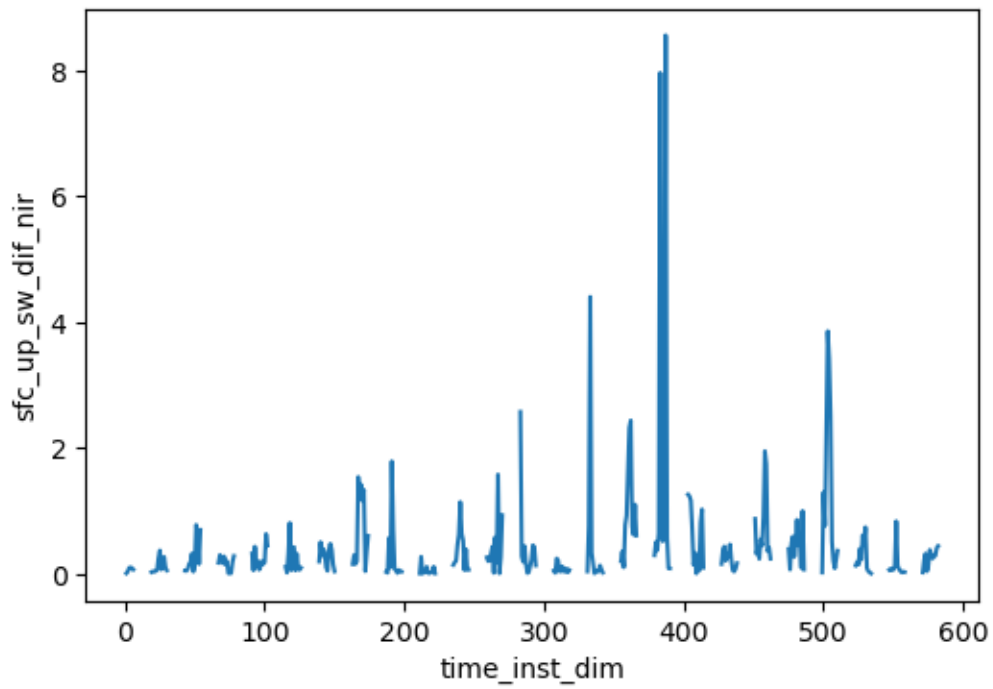
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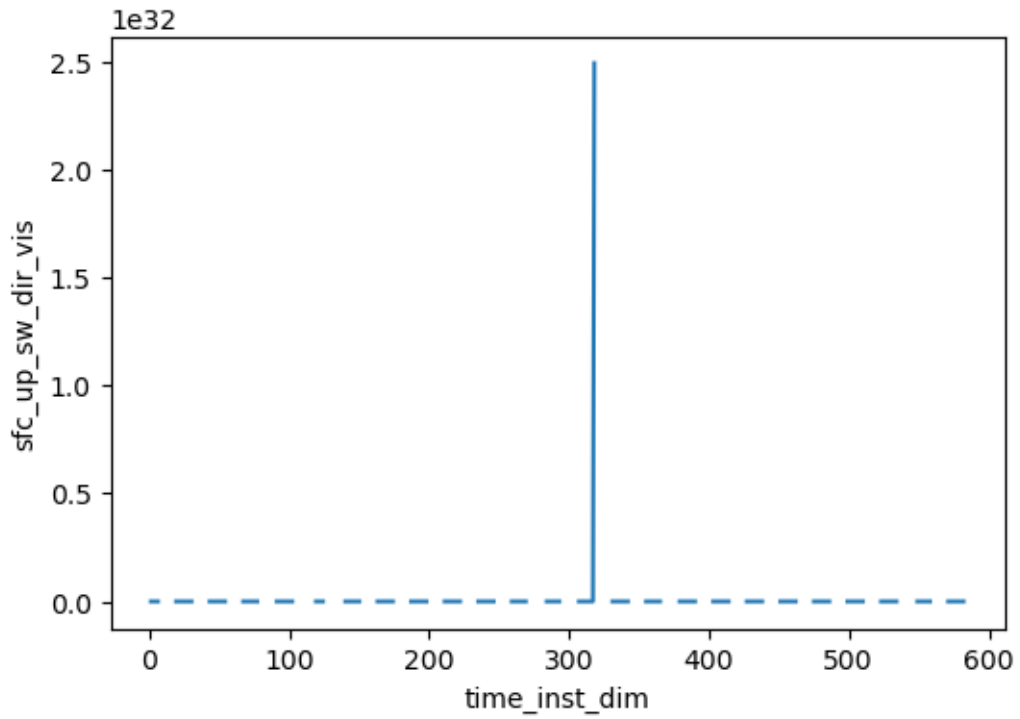
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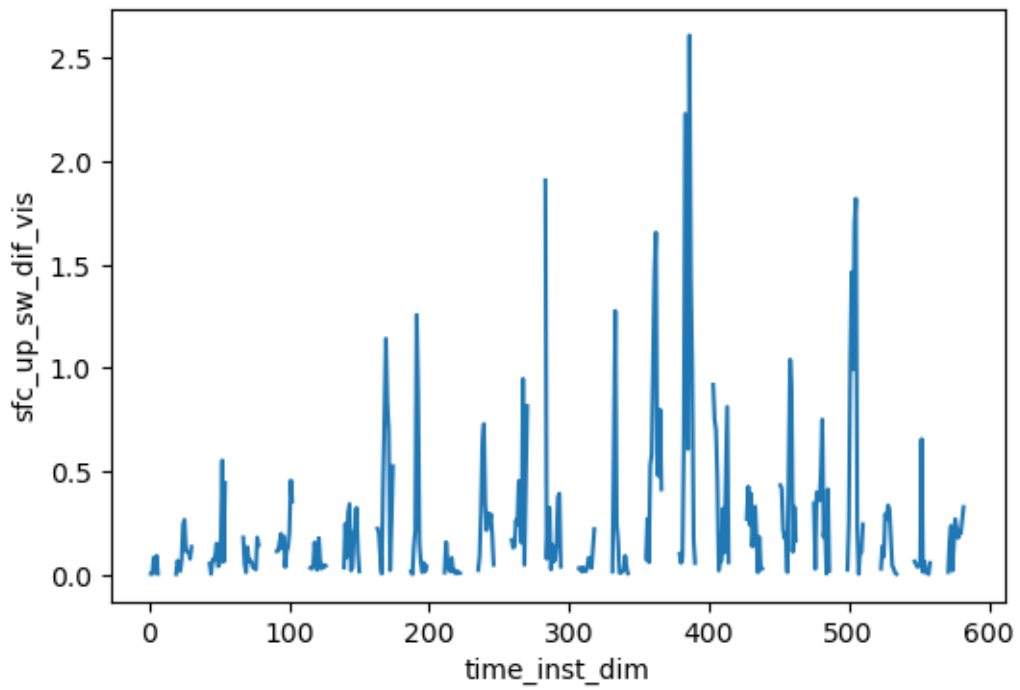
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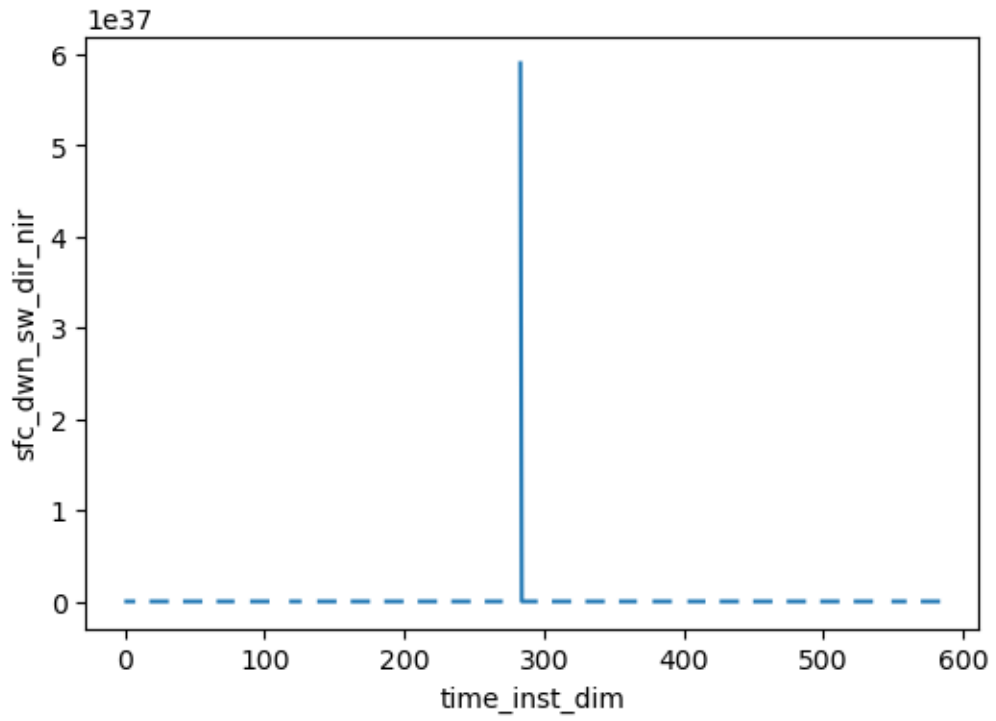
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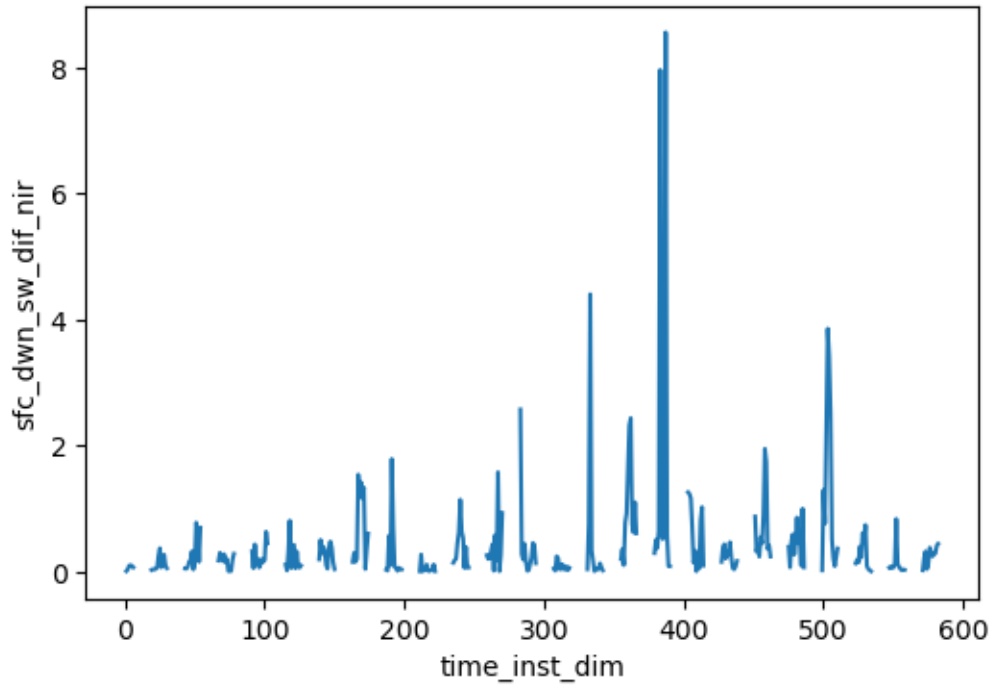
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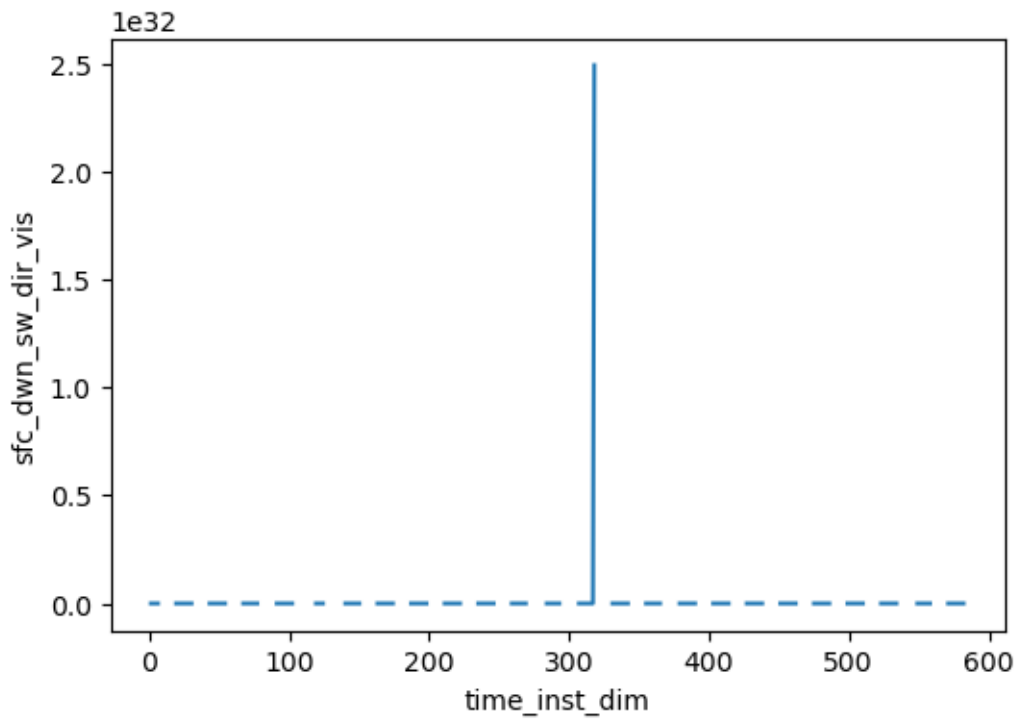
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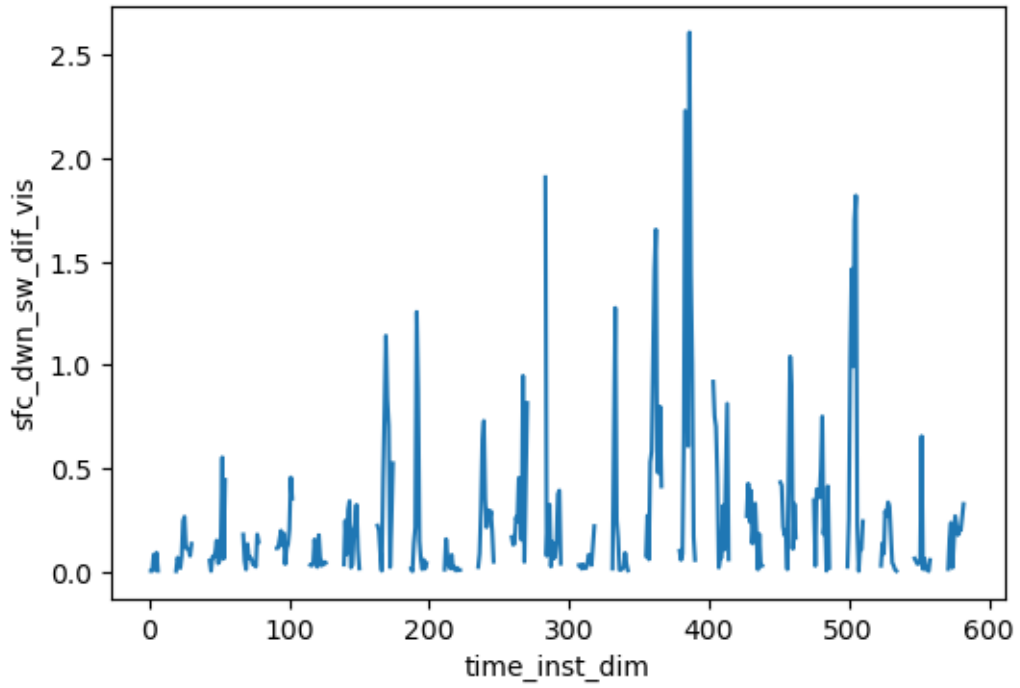
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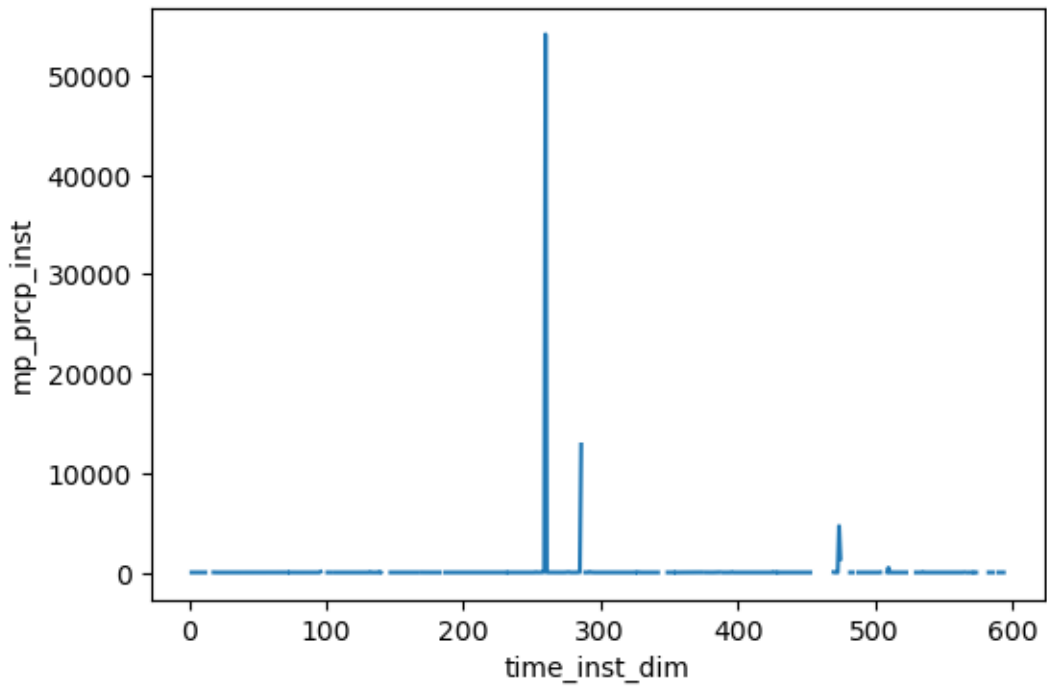
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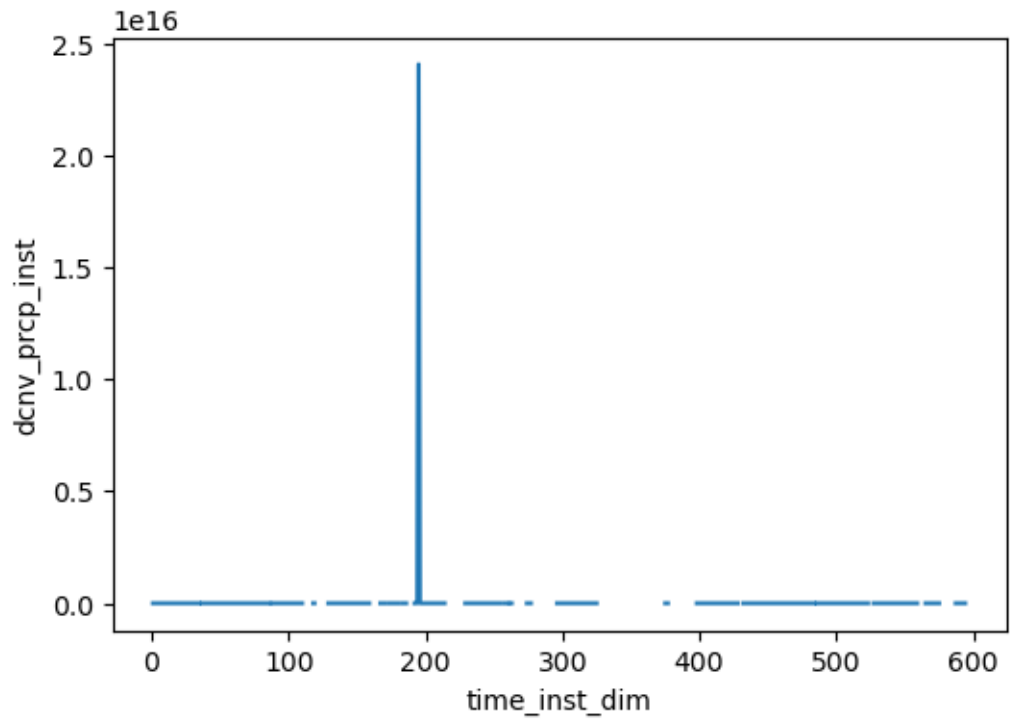
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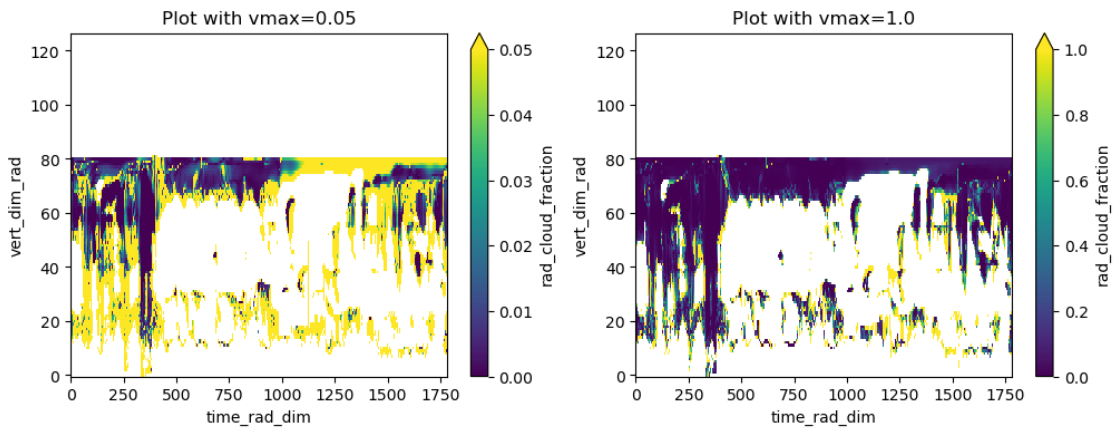
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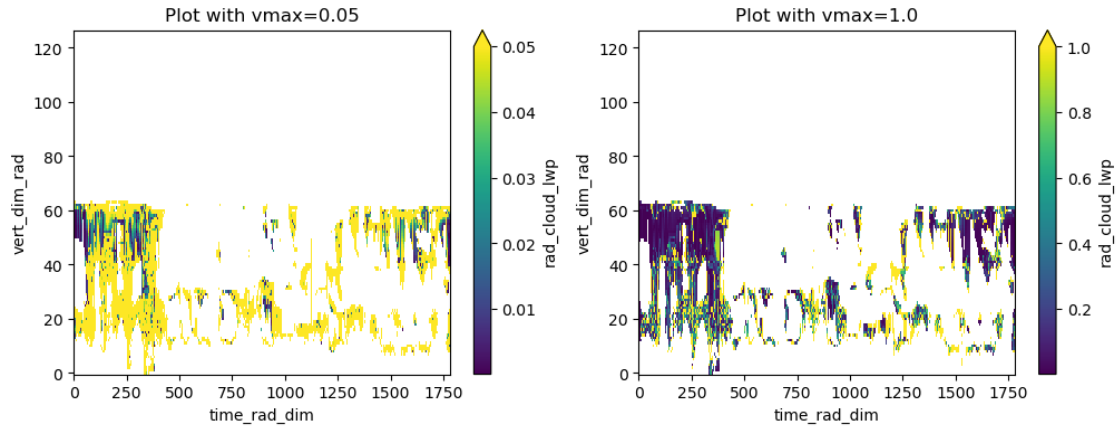
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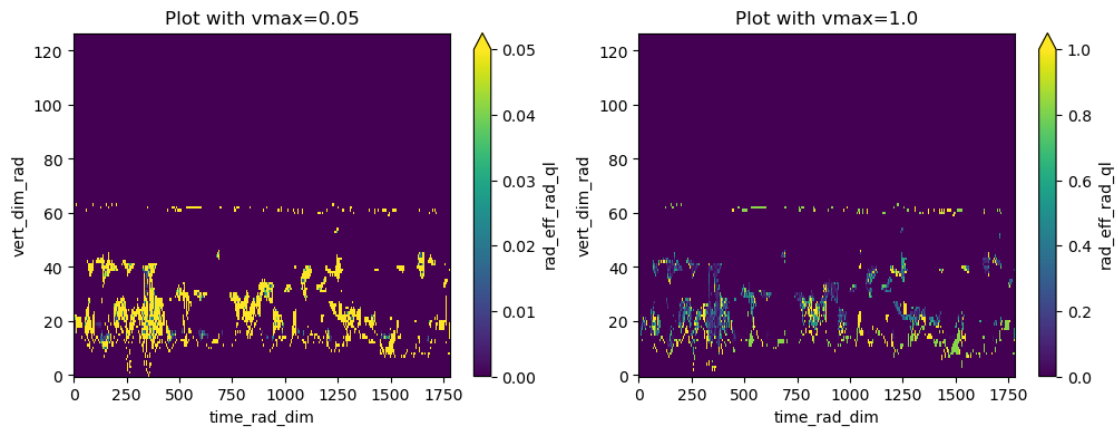
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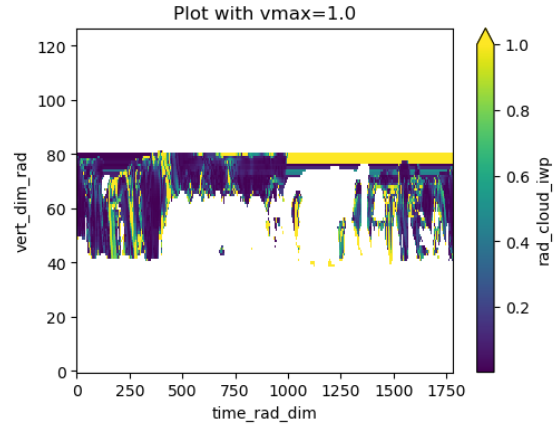
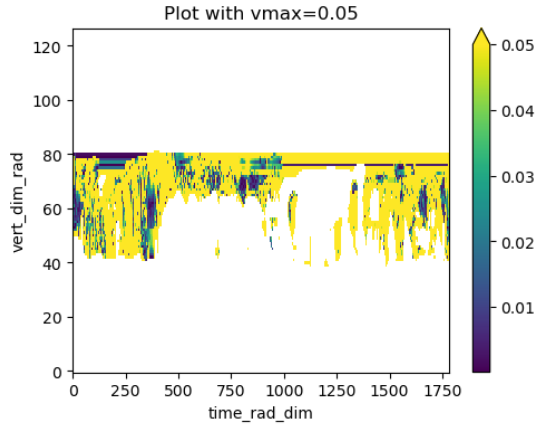
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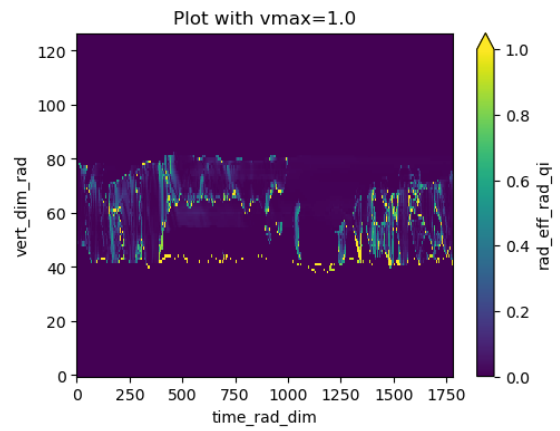
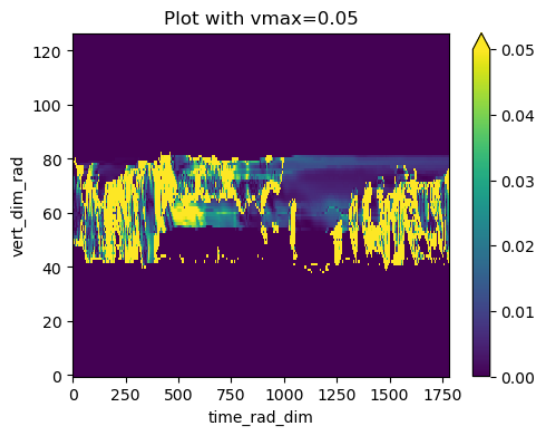
rad_eff_rad_ql : max_re 13.53562068939209



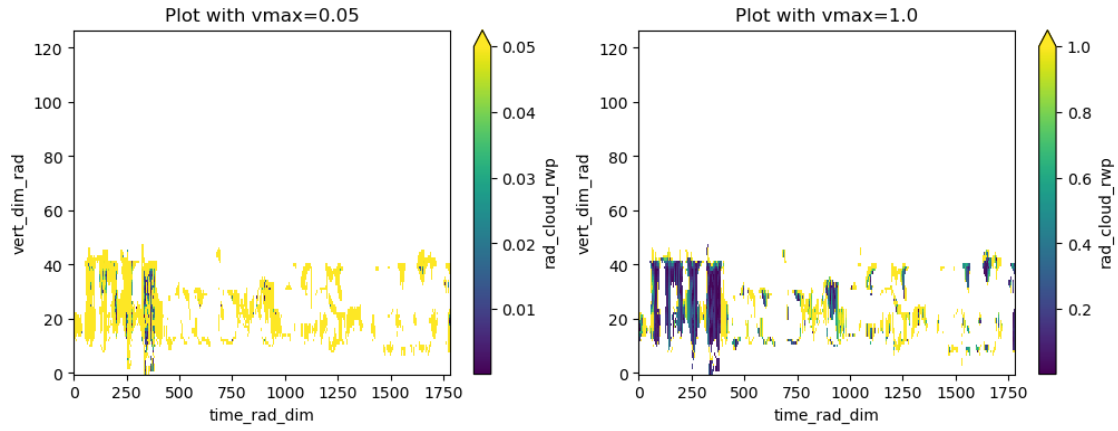
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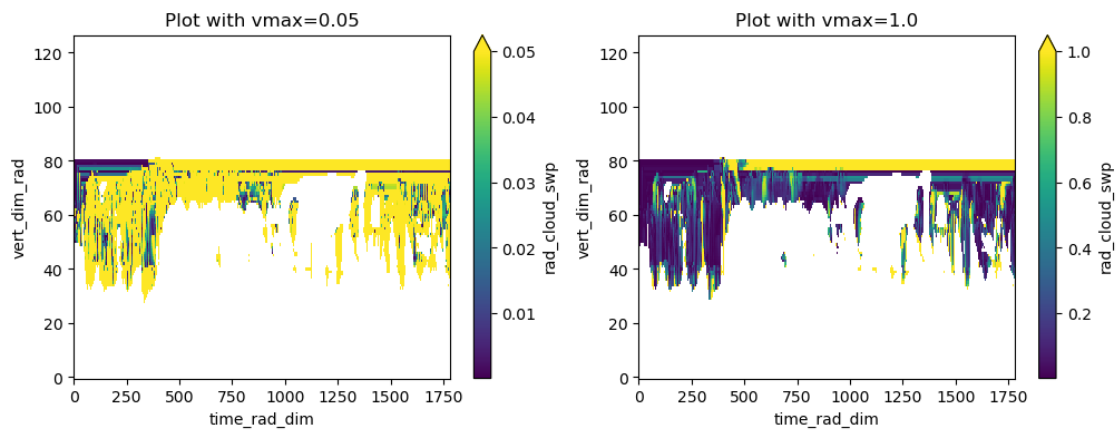
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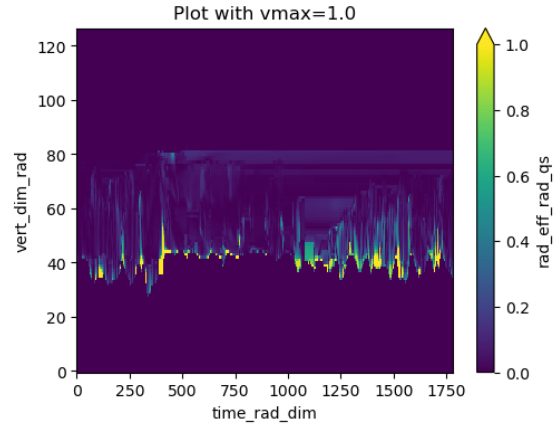
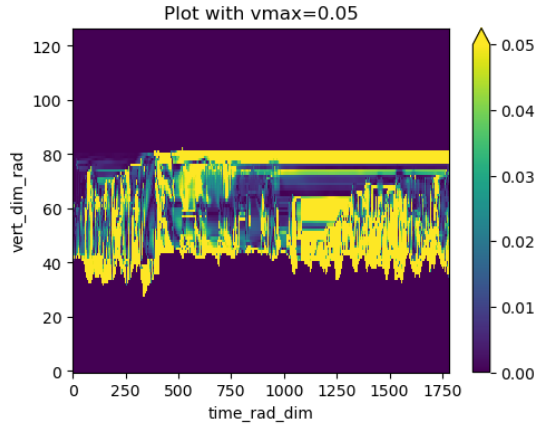
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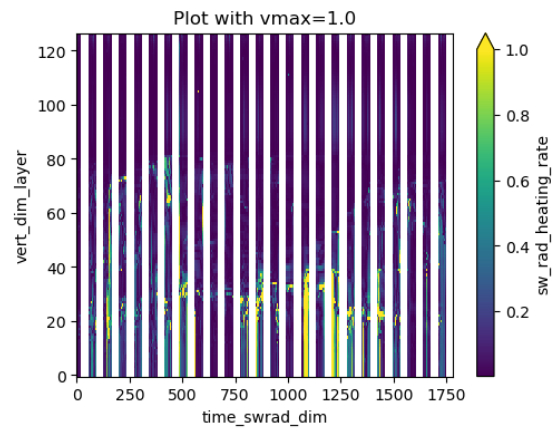
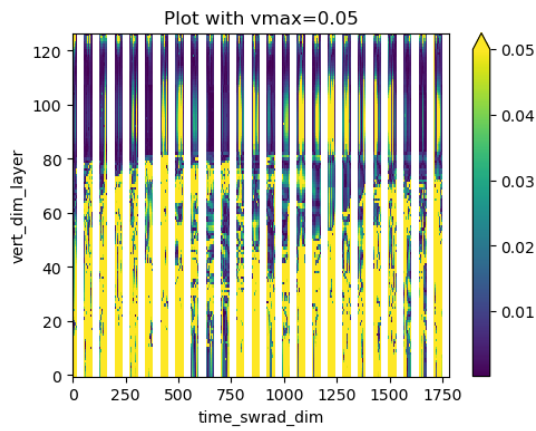
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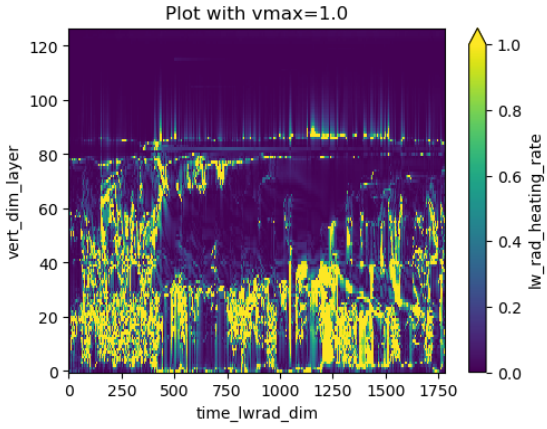
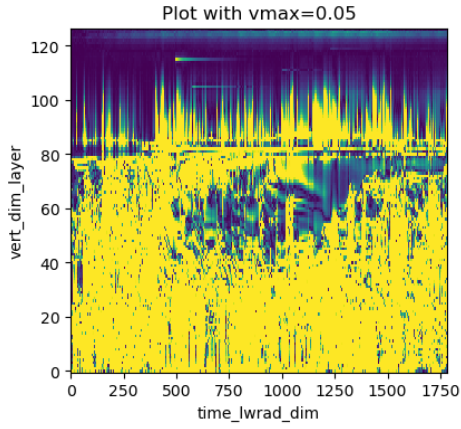
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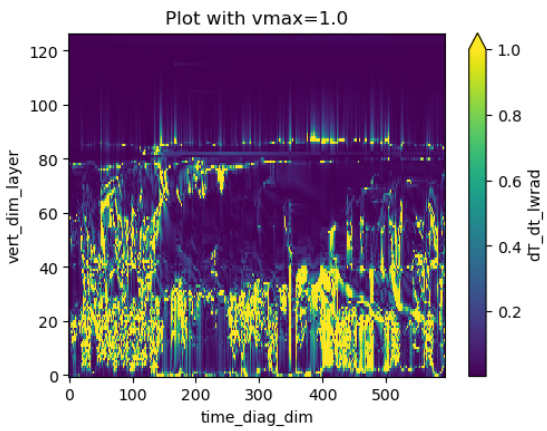
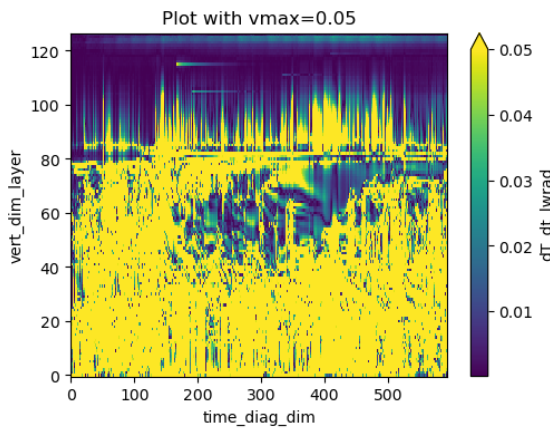
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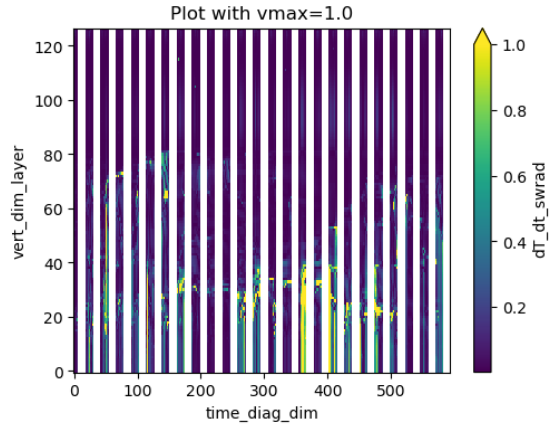
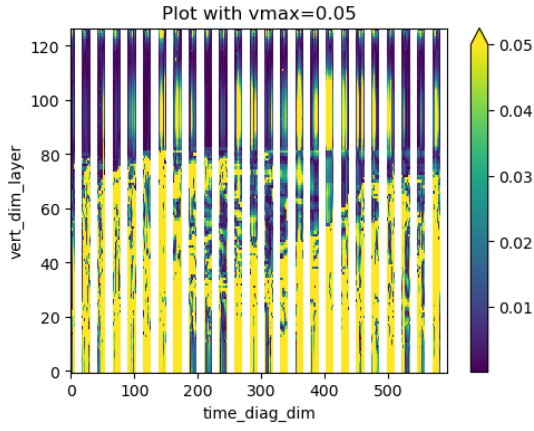
lw_rad_heating_rate : max_re 118503.796875



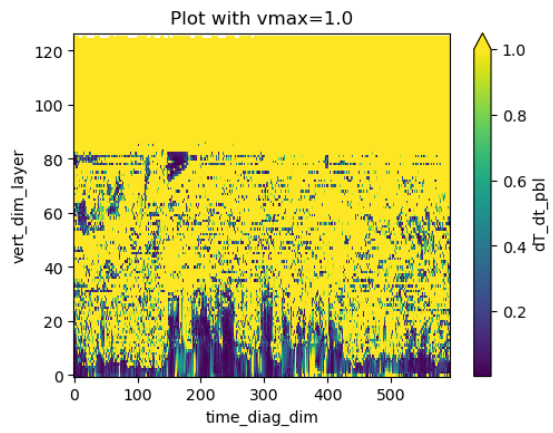
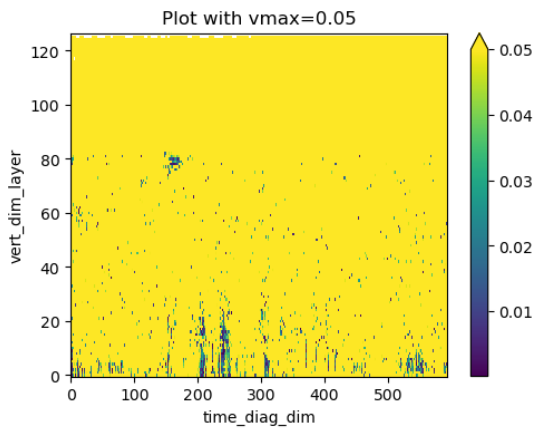
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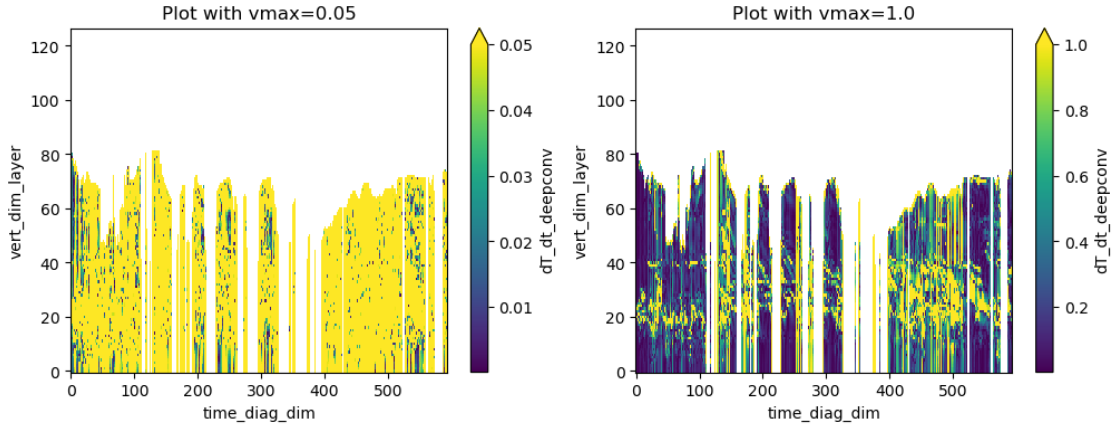
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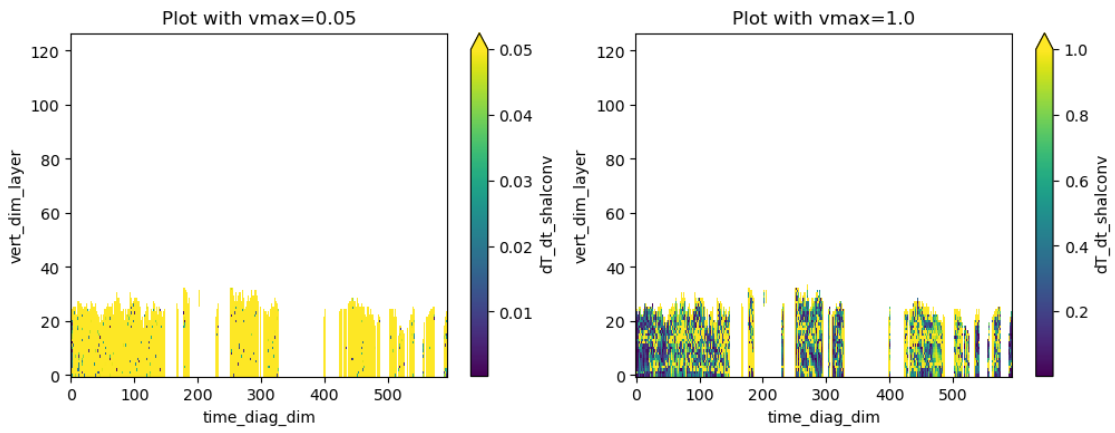
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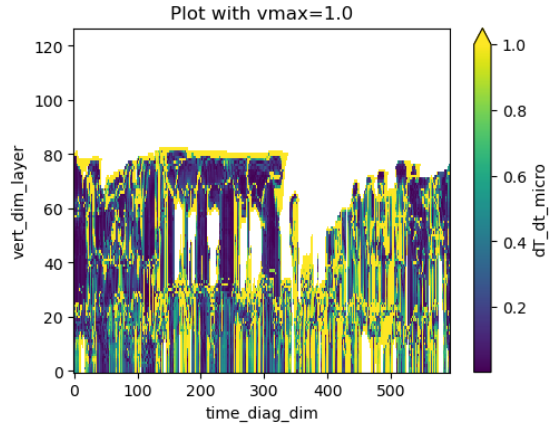
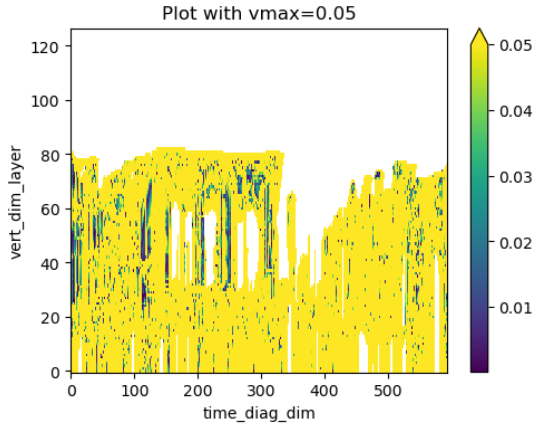
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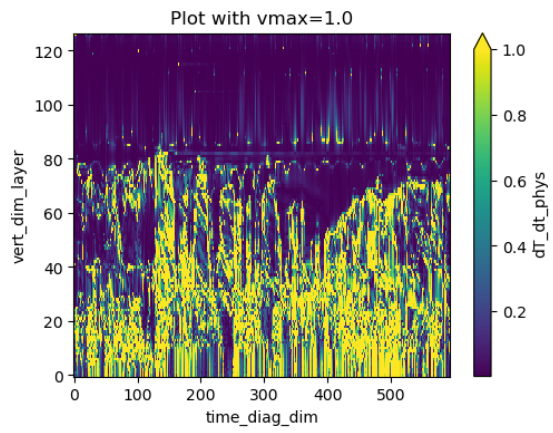
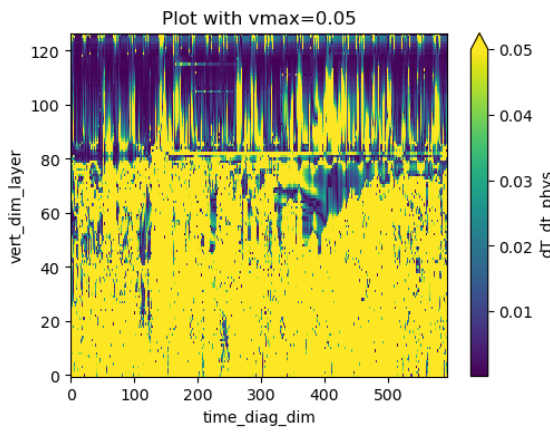
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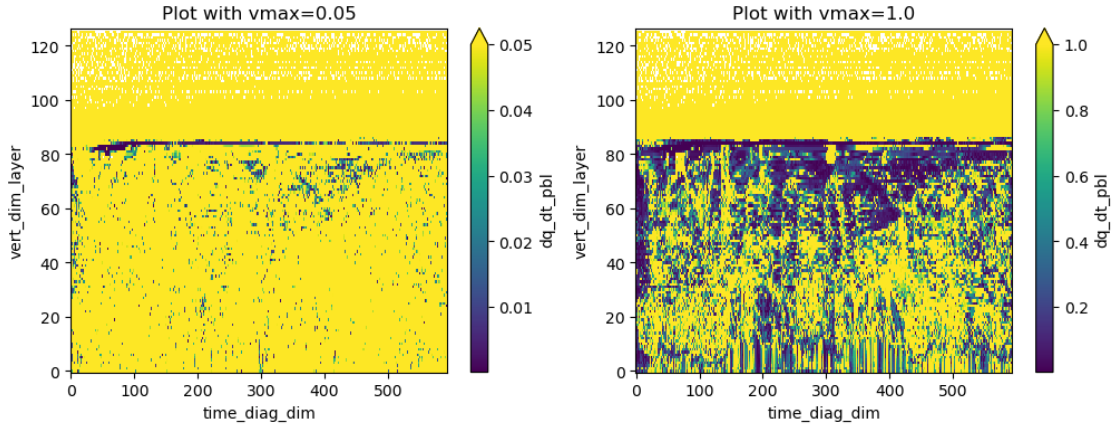
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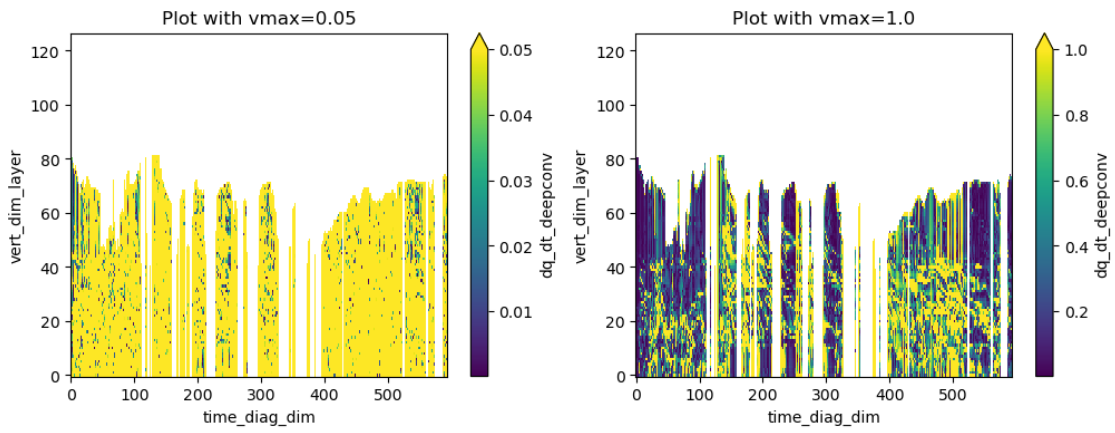
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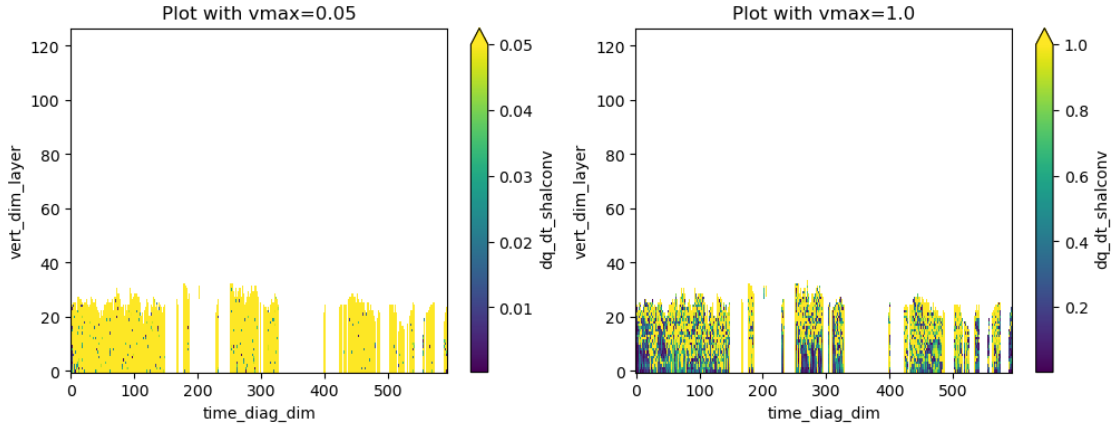
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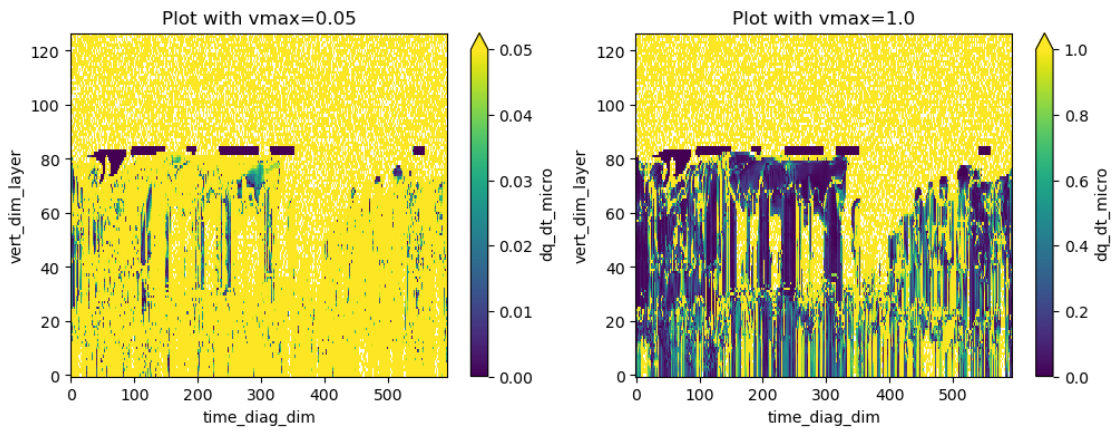
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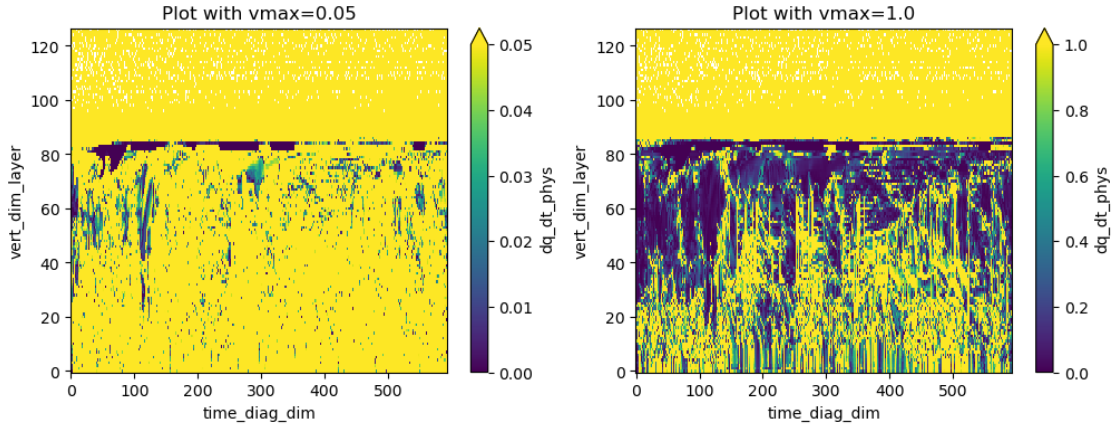
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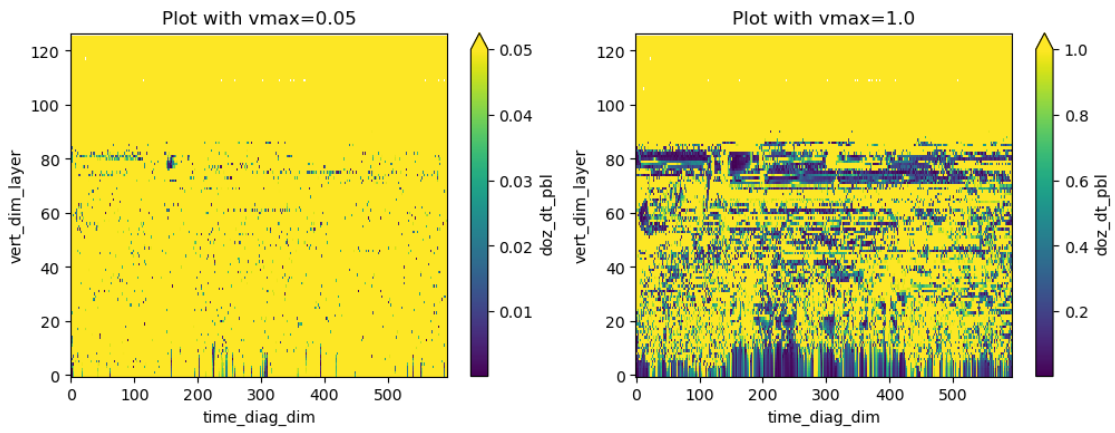
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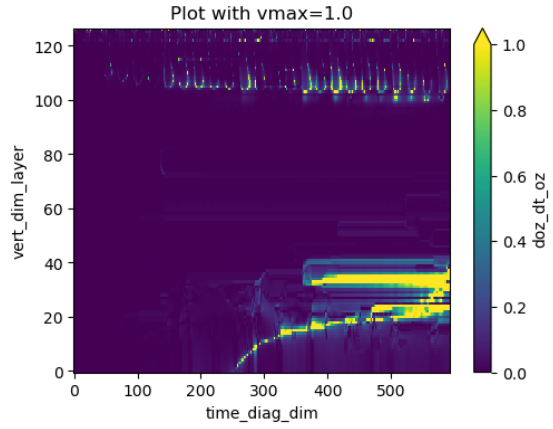
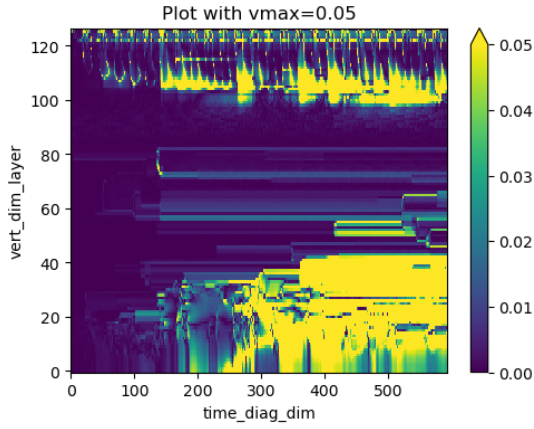
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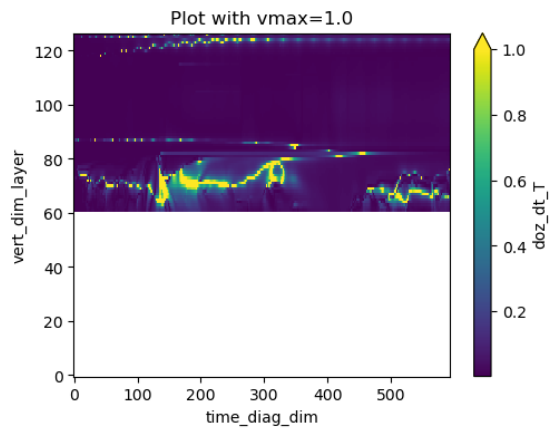
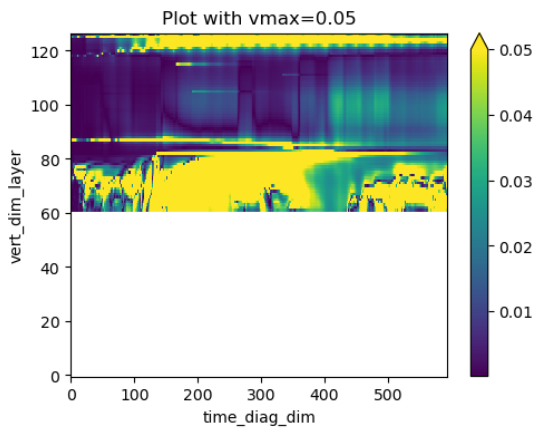
doz_dt_pbl : max_re 418711.96875



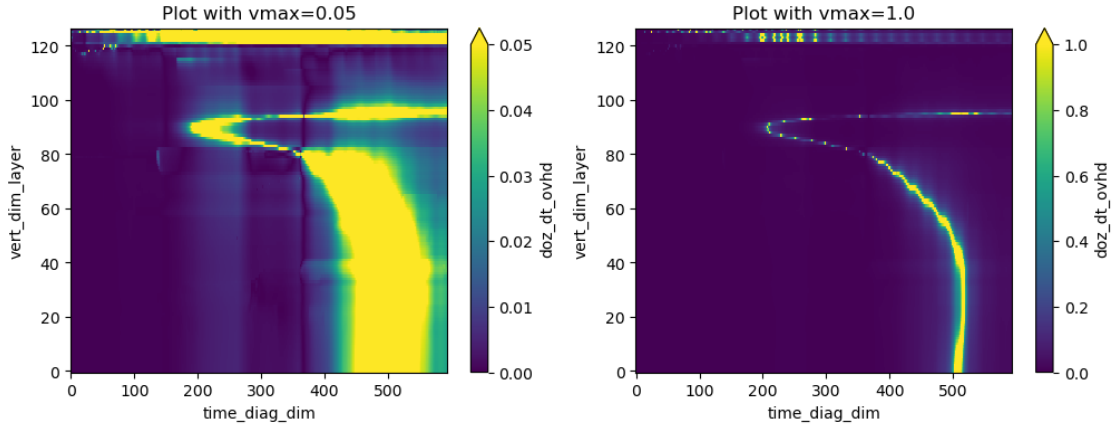
doz_dt_oz : max_re 1276.9296875



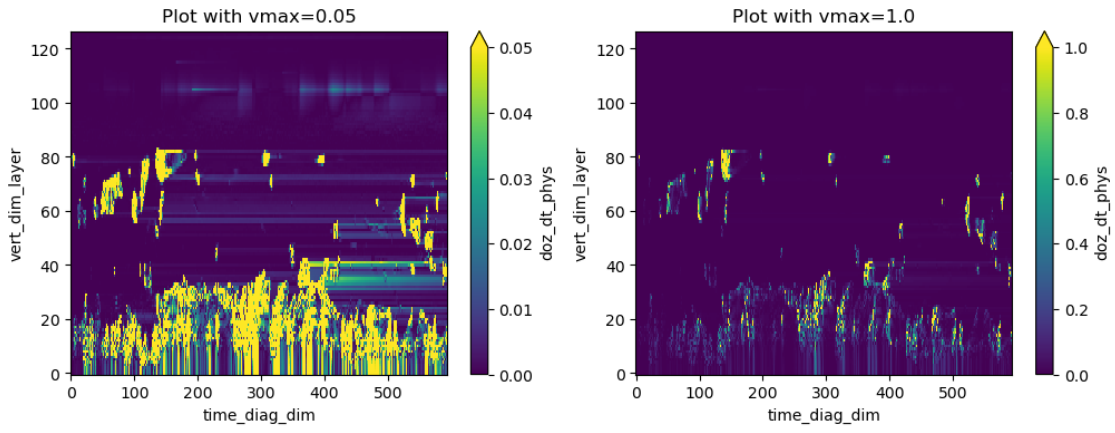
doz_dt_T : max_re 2815.12744140625



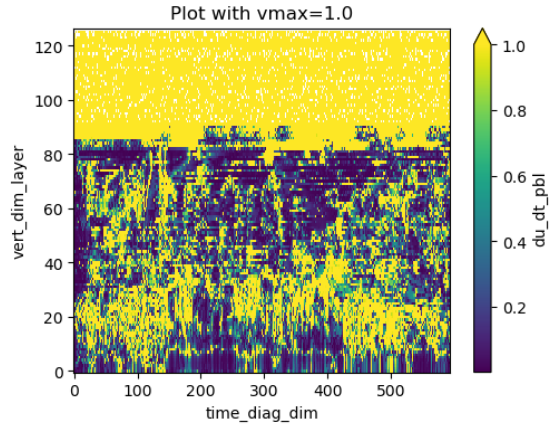
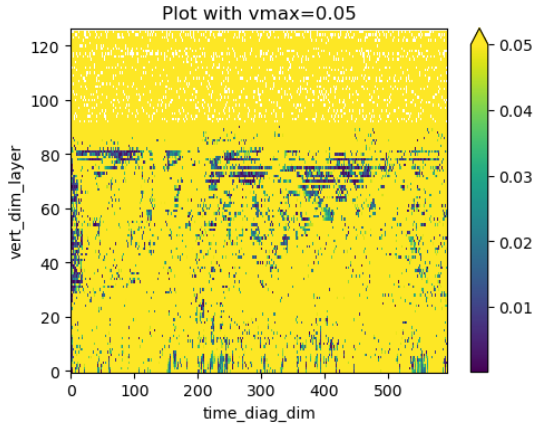
doz_dt_ovhd : max_re 11285.208984375



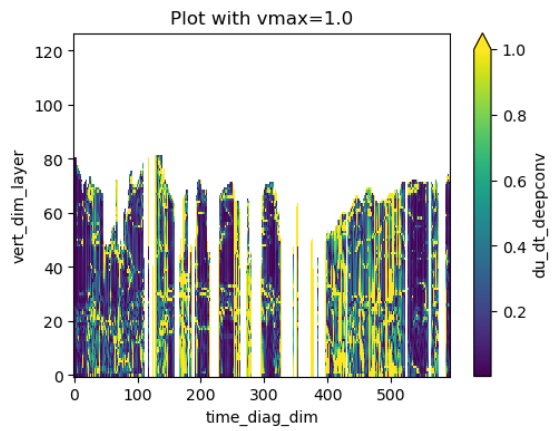
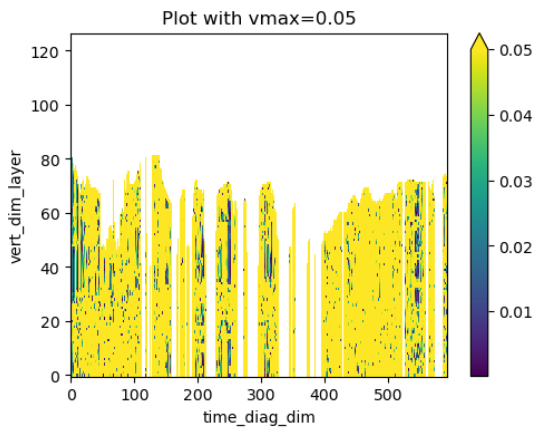
doz_dt_phys : max_re 13789.1123046875



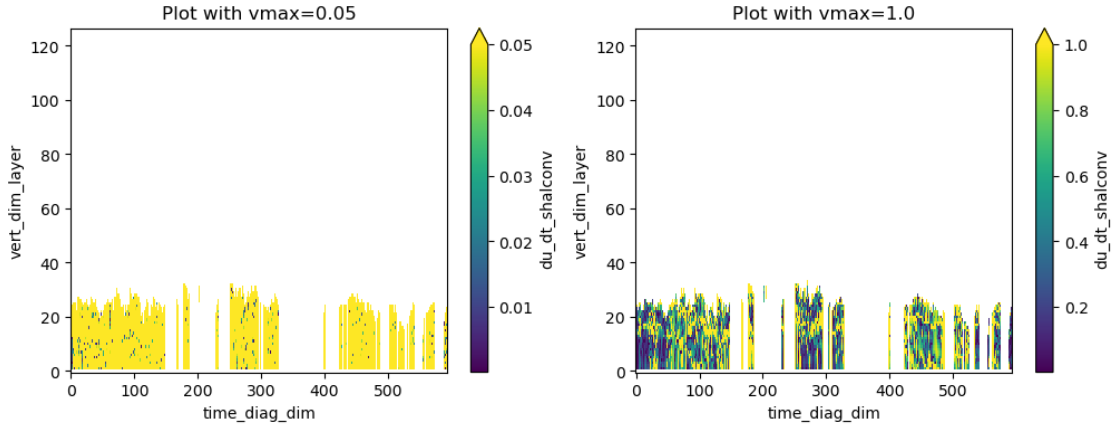
du_dt_pbl : max_re inf



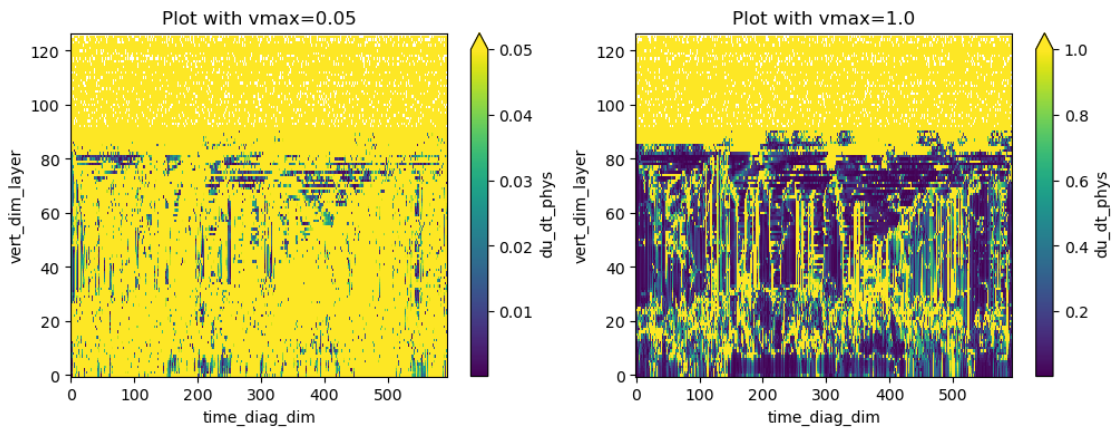
du_dt_deepconv : max_re inf



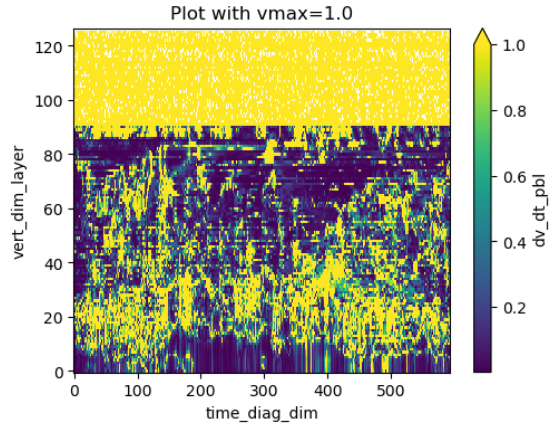
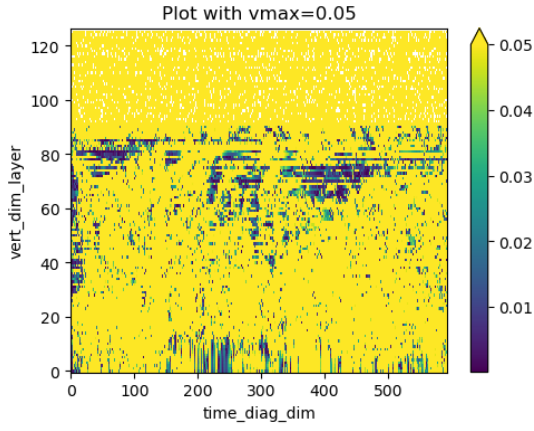
du_dt_shalconv : max_re inf



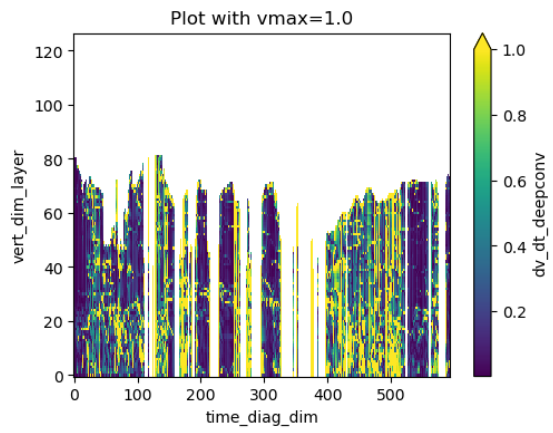
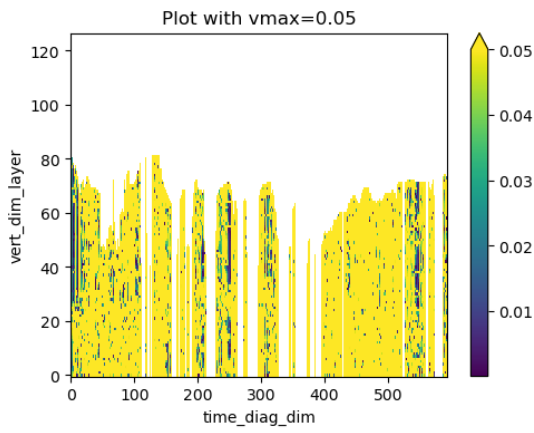
du_dt_phys : max_re inf



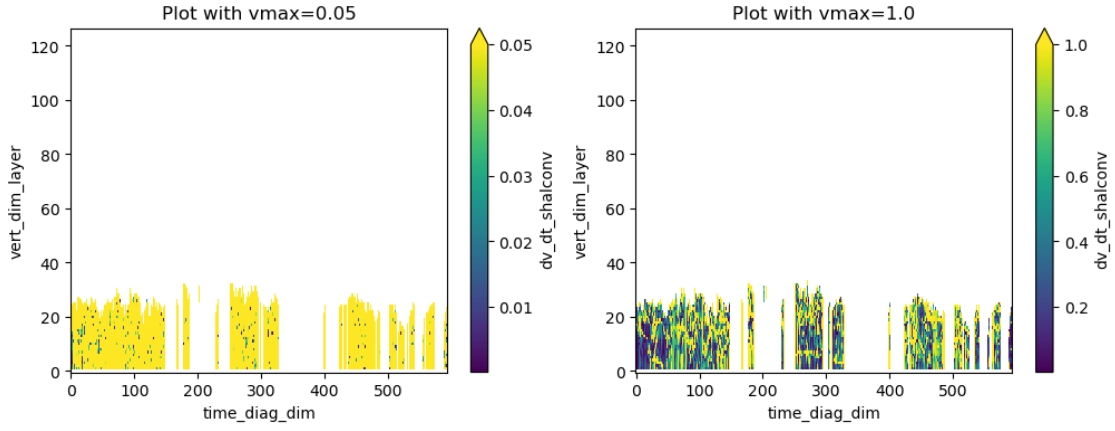
dv_dt_pbl : max_re inf



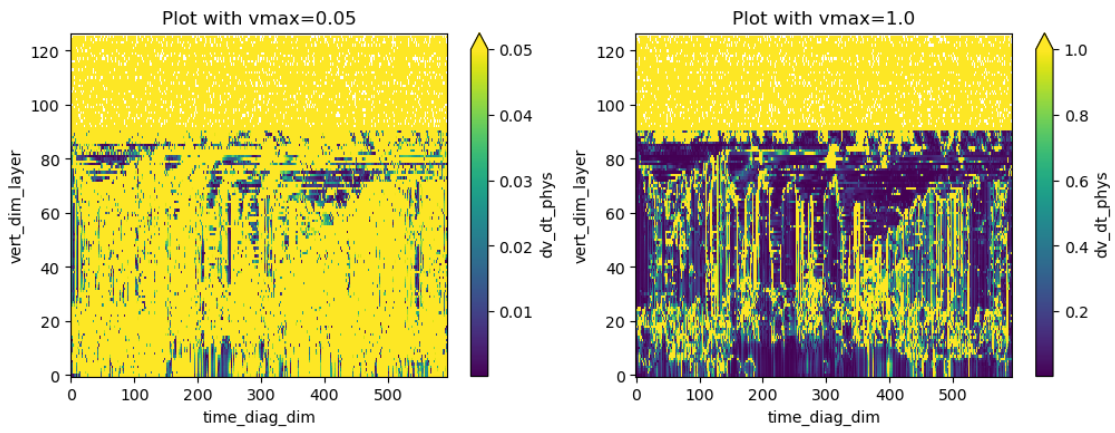
dv_dt_deepconv : max_re inf



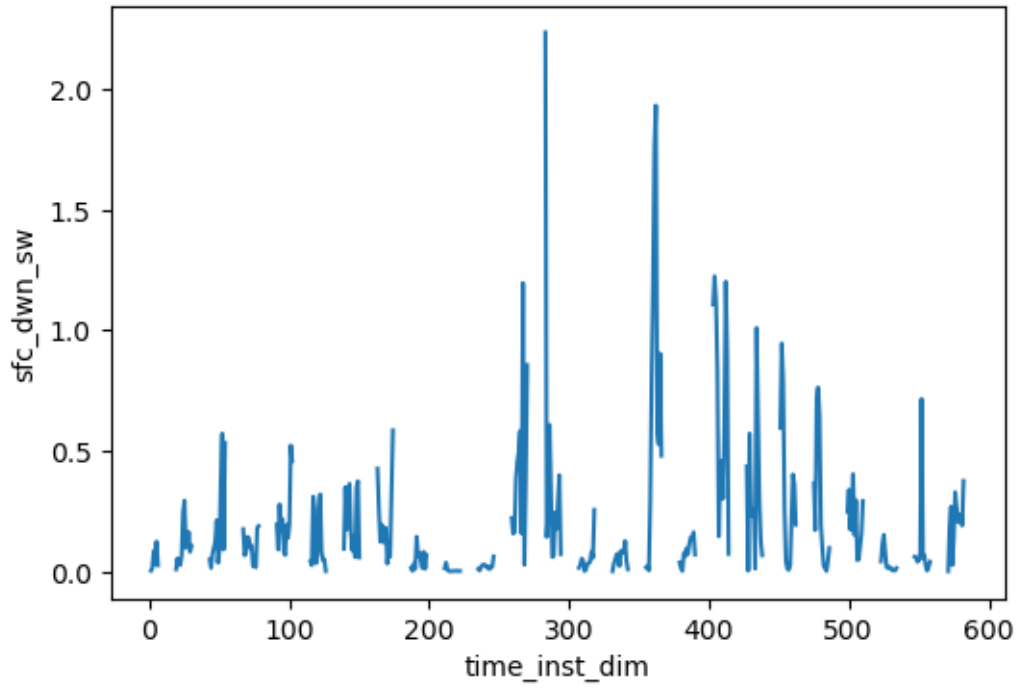
dv_dt_shalconv : max_re inf



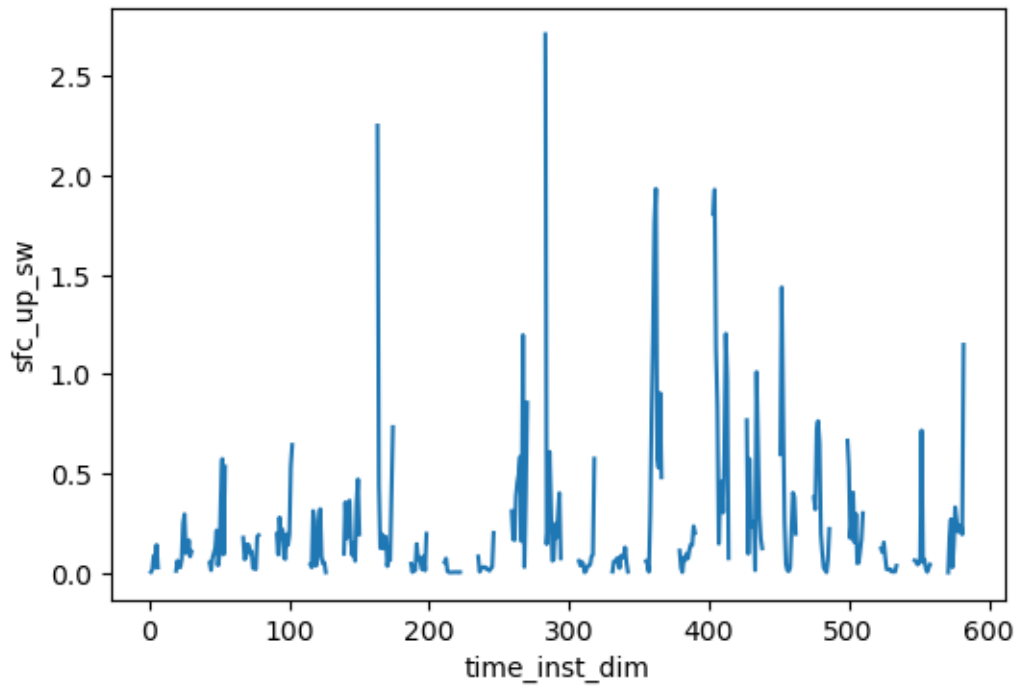
 dv_dt_phys : max_re inf



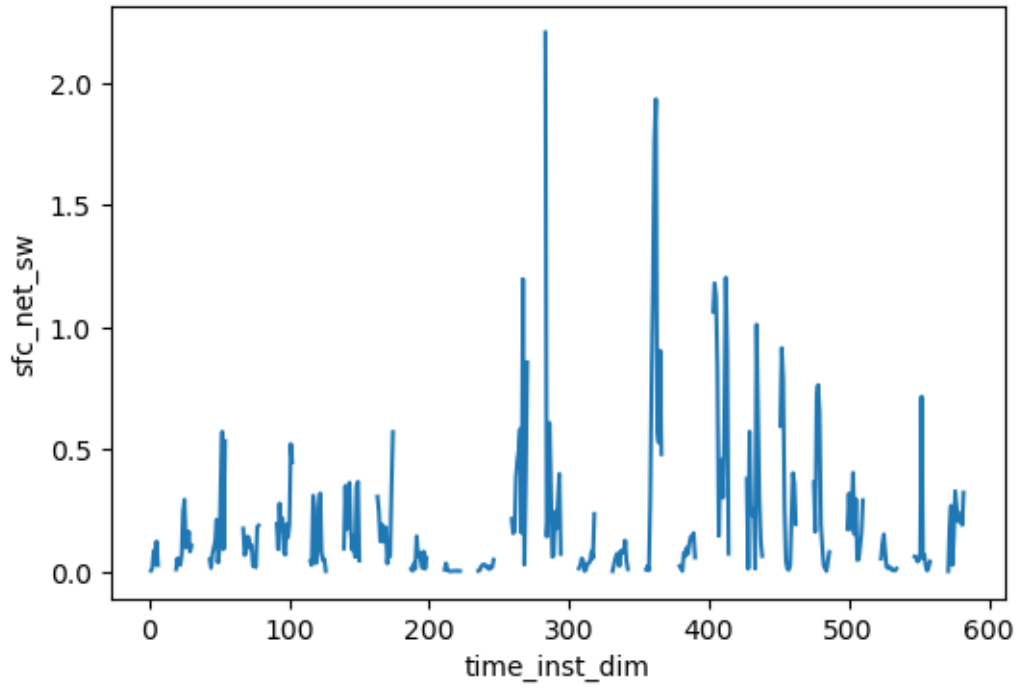
sfc_dwn_sw : max_re 2.236006259918213



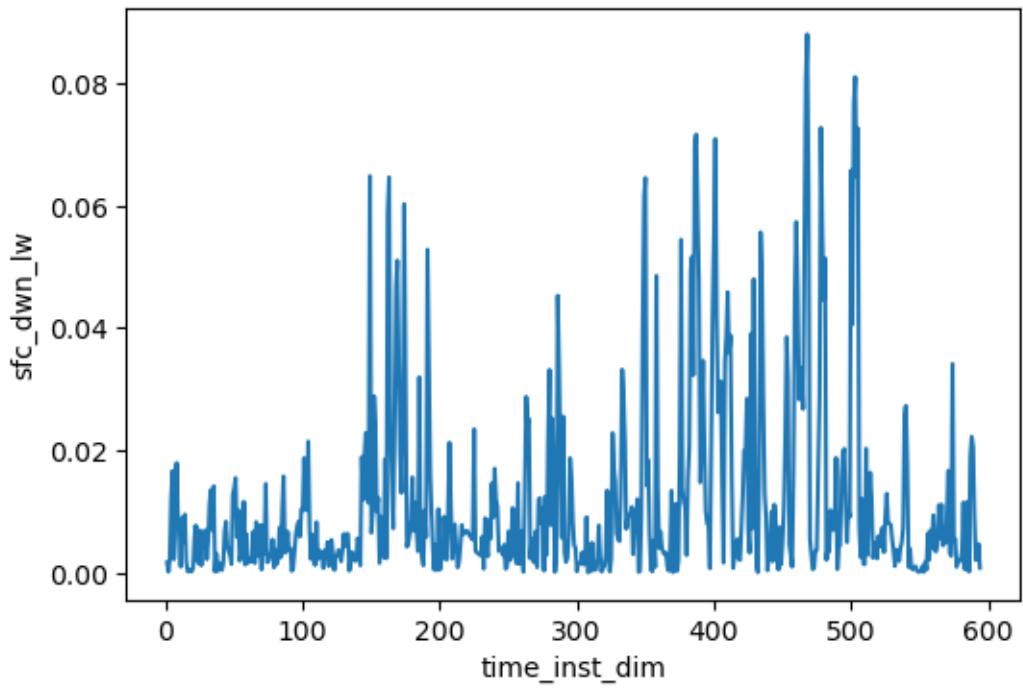
`sfc_up_sw` : max_re 2.7105841636657715



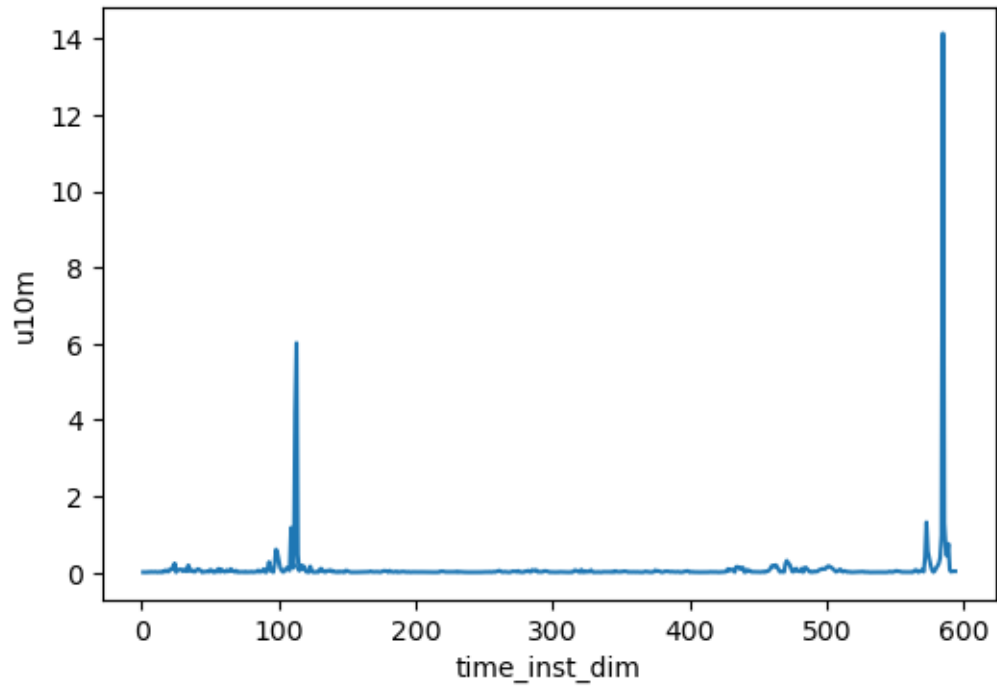
sfc_net_sw : max_re 2.205713987350464



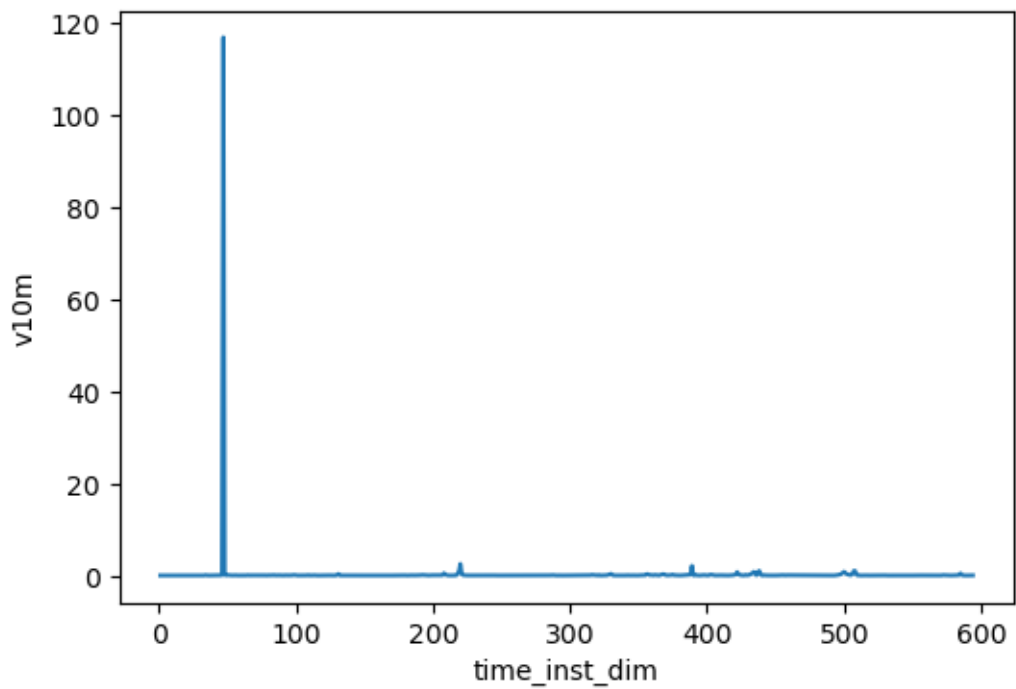
sfc_dwn_lw : max_re 0.0881018191576004



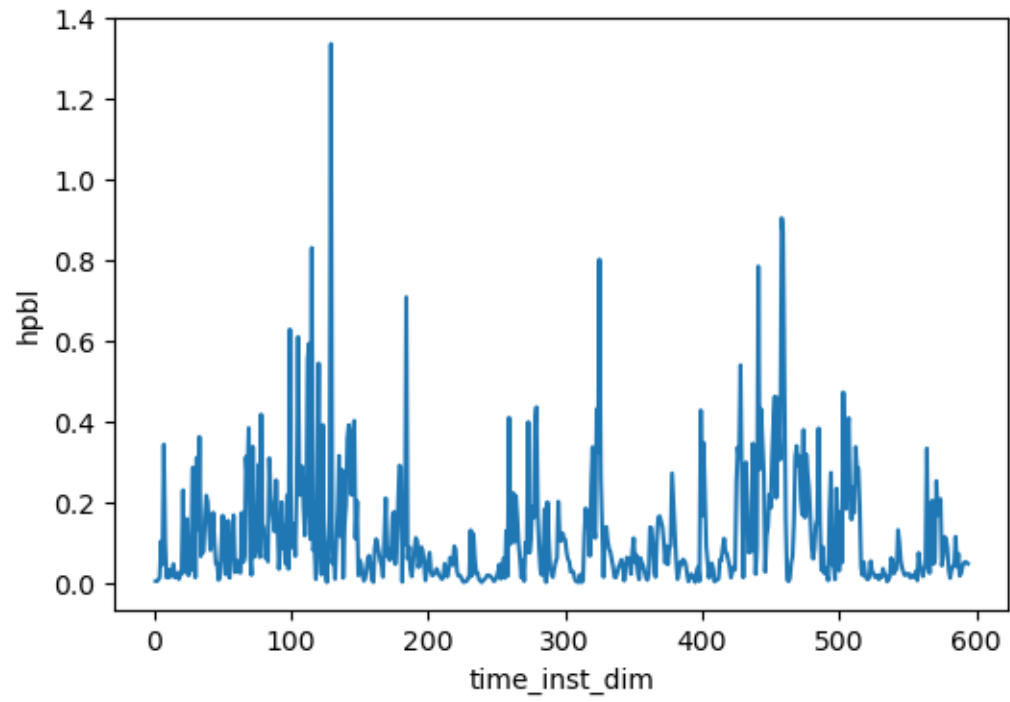
u10m : max_re 14.136149406433105



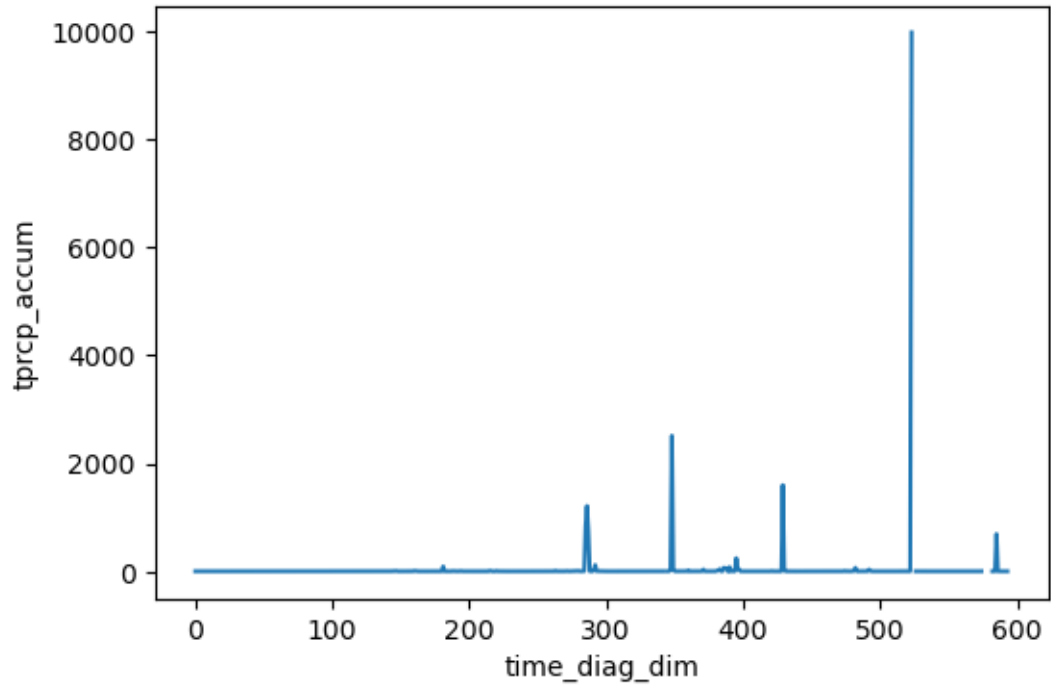
v10m : max_re 116.78922271728516



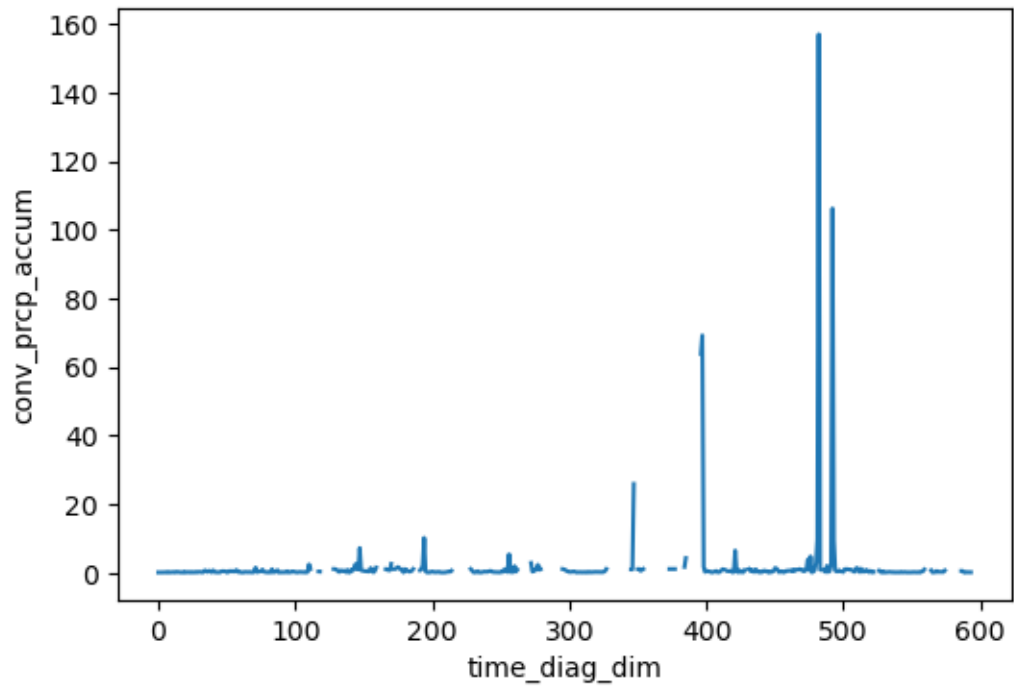
hpbl : max_re 1.3348208665847778



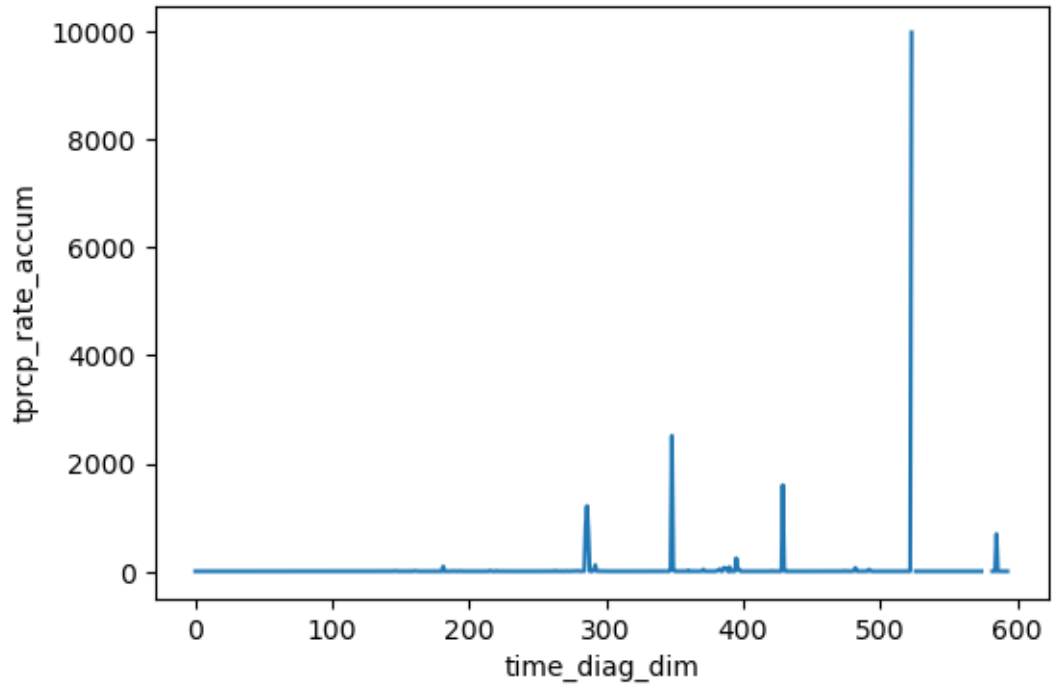
tprcp_accum : max_re inf



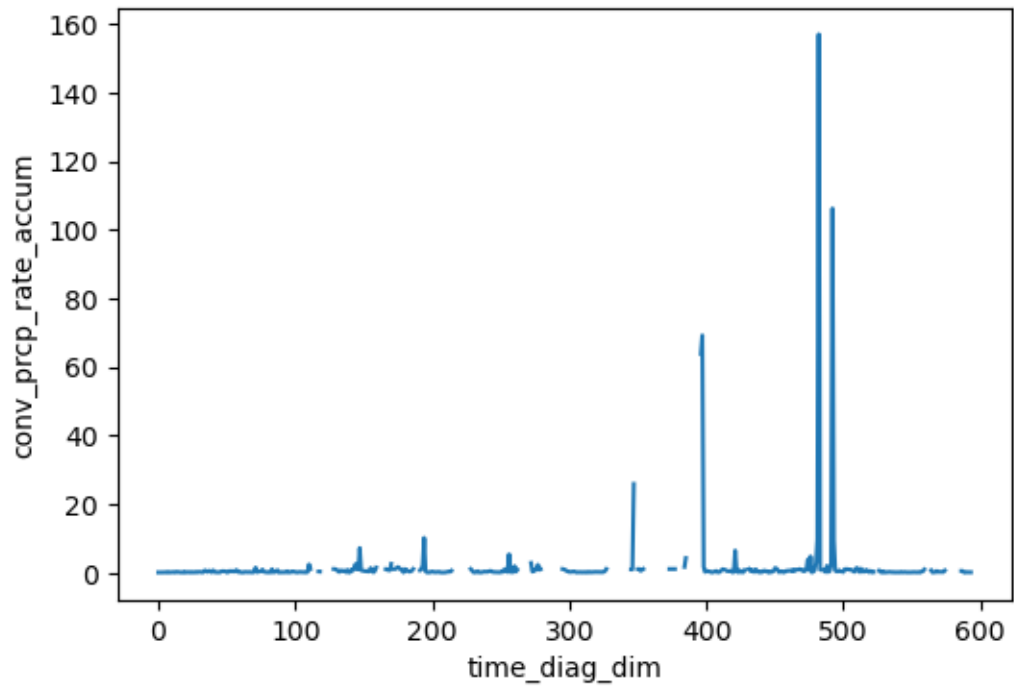
conv_prcp_accum : max_re inf



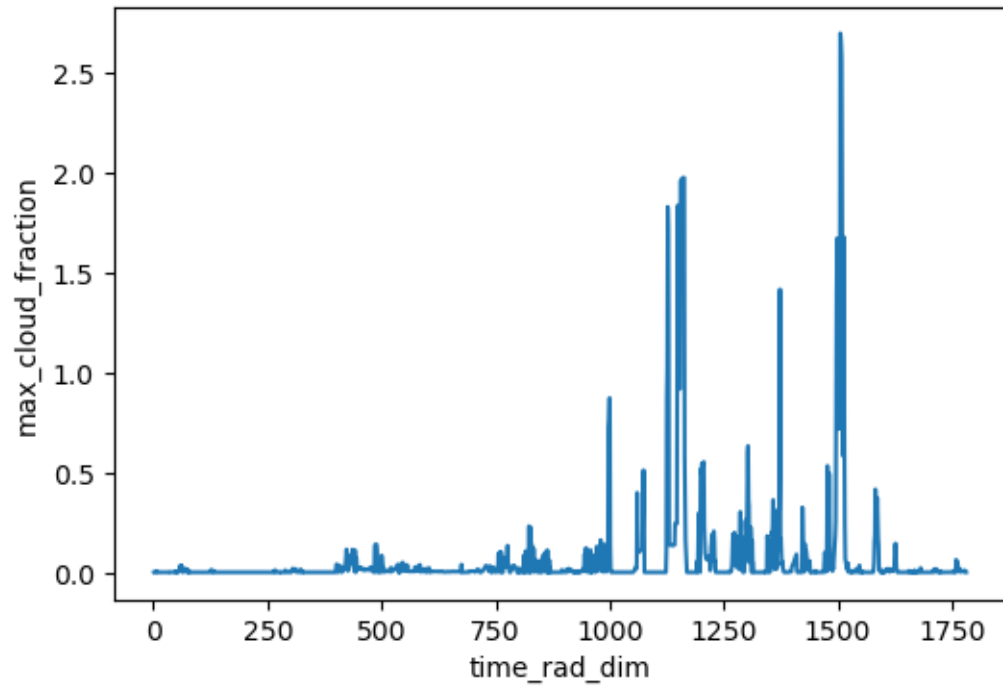
tprcp_rate_accum : max_re inf



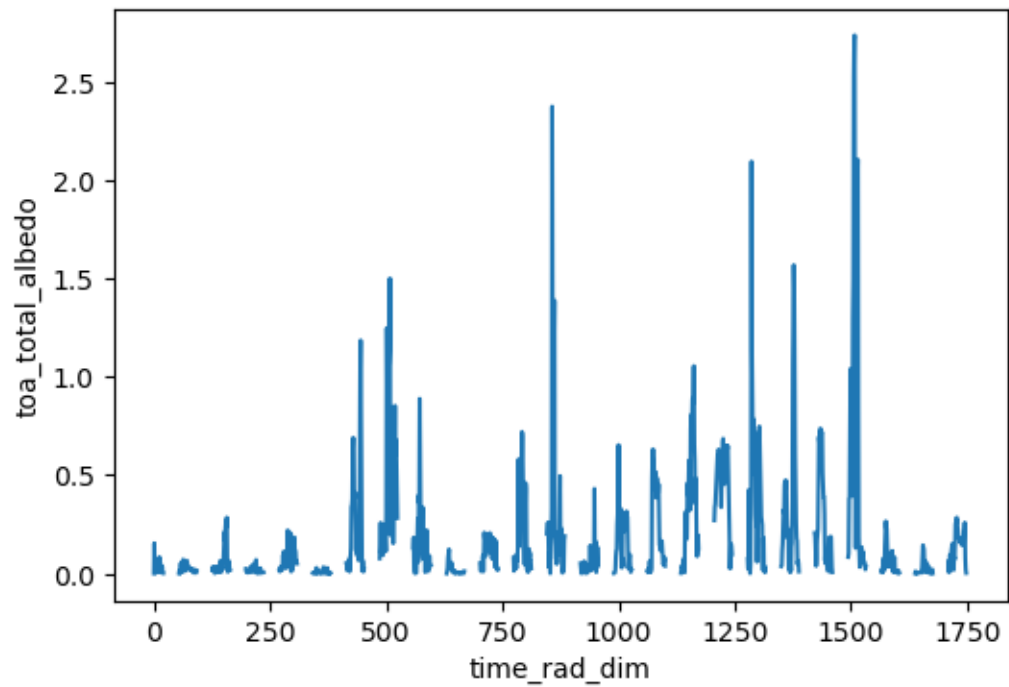
conv_prcp_rate_accum : max_re inf



max_cloud_fraction : max_re 2.700918674468994



toa_total_albedo : max_re 2.7386631965637207

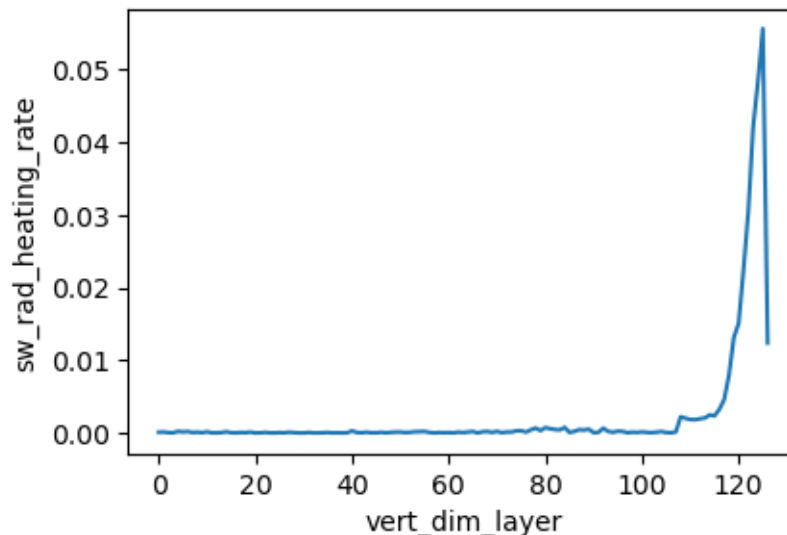


```
[35]: # compare variable at initial timestep
for var in ds32.variables:
    if (not ds32[var].identical(ds64[var])):
        if (len(ds32[var].shape) == 2):
            re = (abs(ds32[var] - ds64[var])[0,:]) / ds64[var][0,:]
        else:
            #re = (abs(ds32[var] - ds64[var]))[:, :, 0] / ds64[var][:, :, 0]
            re = (abs(ds32[var] - ds64[var])[0,:,:]) / ds64[var][0,:,:]

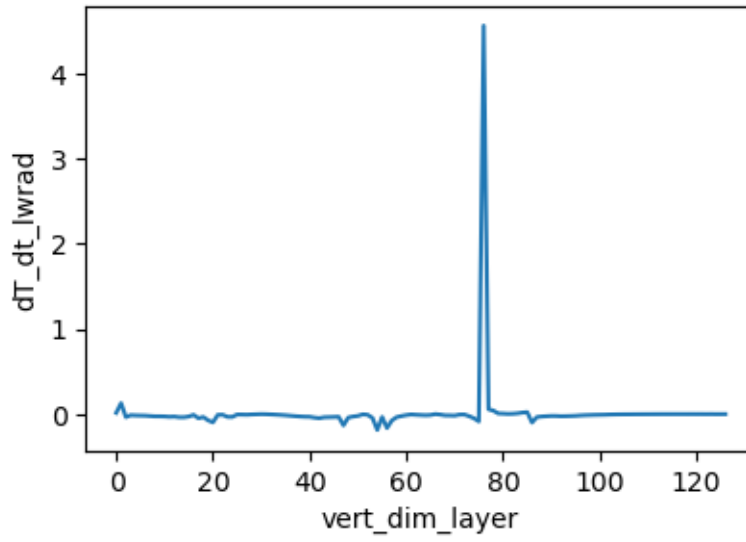
        max_re = max(abs(re.min().data), re.max().data)
        if (max_re > .05):
            □
            print("-----")
            print(var, ": max_re", max_re)
            fig, ax = plt.subplots(nrows=1, ncols=1, figsize=(4.5, 3))
            re.plot(ax=ax)
            plt.show()

            # (ds32[var] - ds64[var]))[:, :, 0].plot(); plt.show()
            #sys.exit()
```

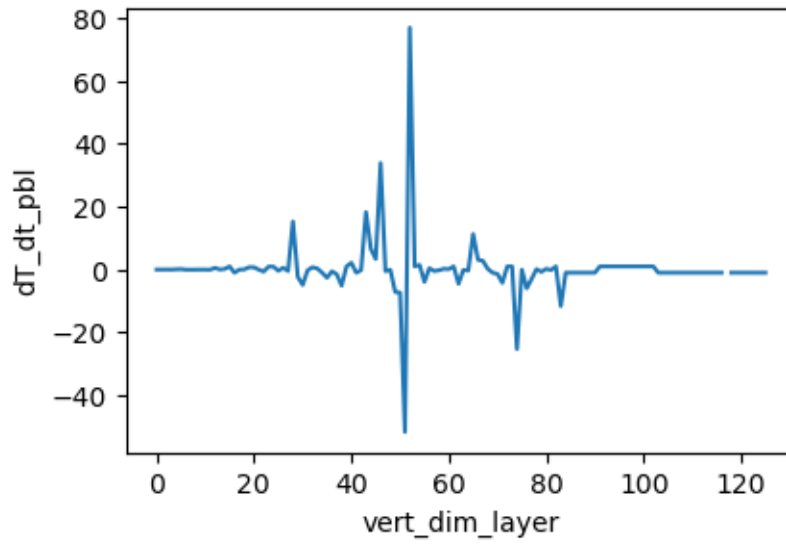
sw_rad_heating_rate : max_re 0.05562635511159897



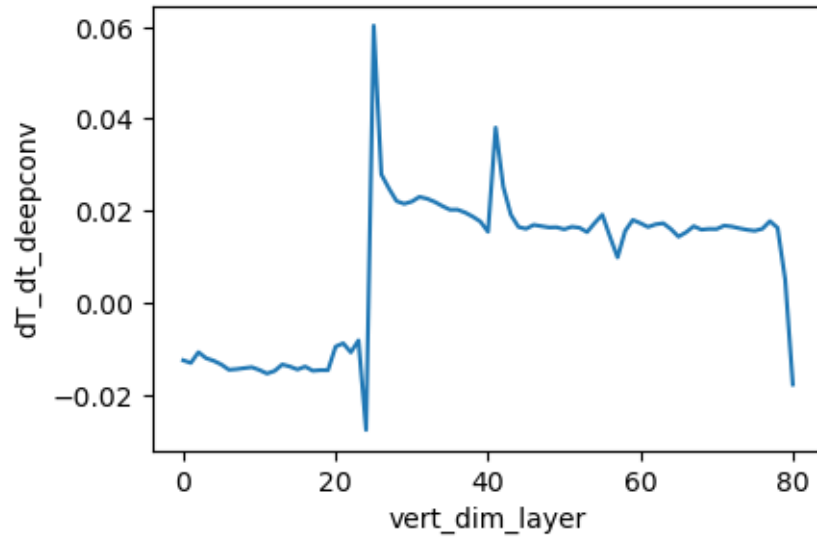
dT_dt_lwrad : max_re 4.558602809906006



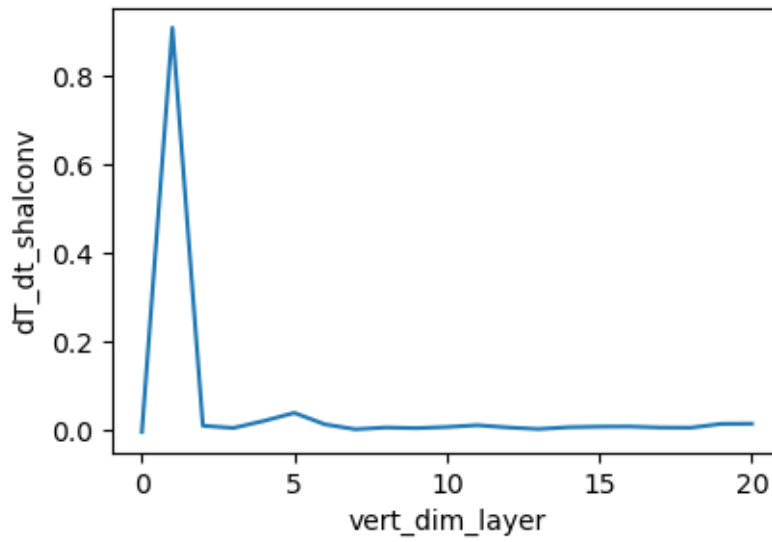
dT_dt_pbl : max_re 76.87767028808594



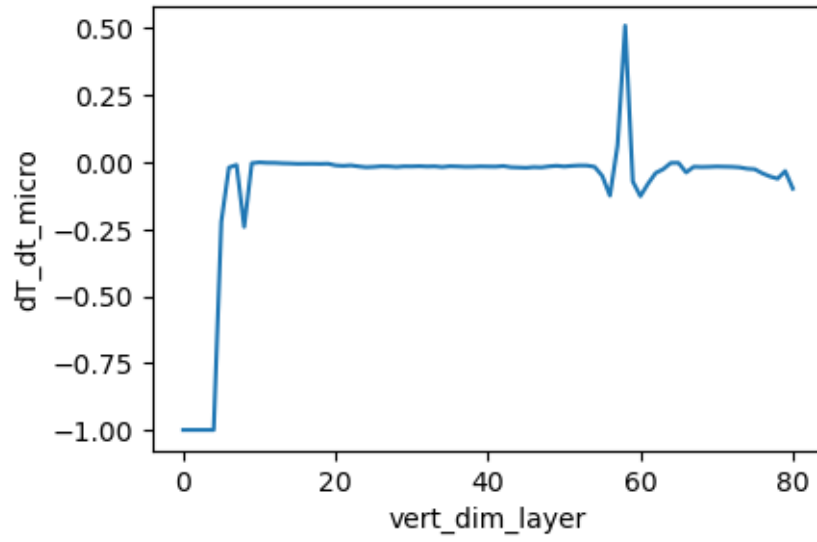
$dT_dt_deepconv$: max_re 0.060232311487197876



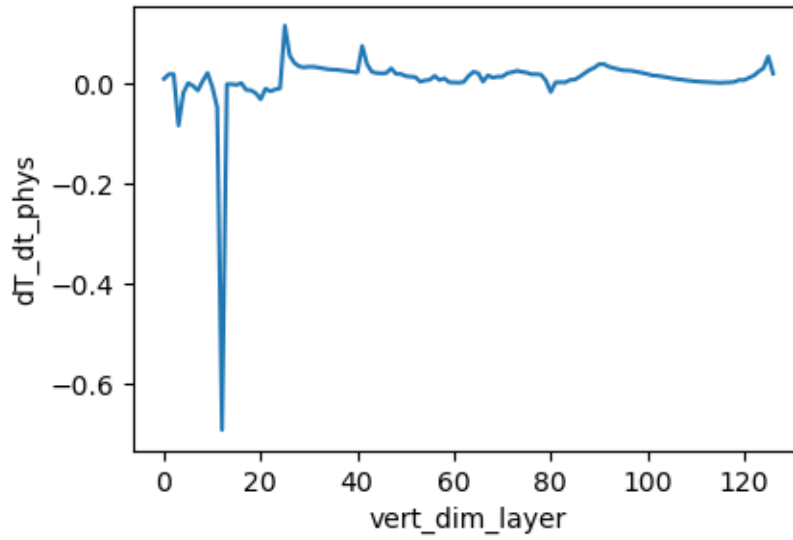
dT_dt_shalconv : max_re 0.9087555408477783



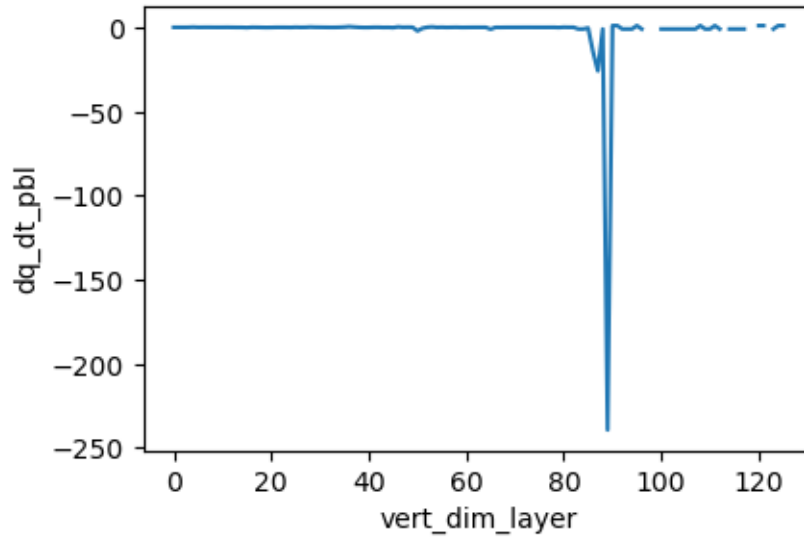
dT_dt_micro : max_re 1.0



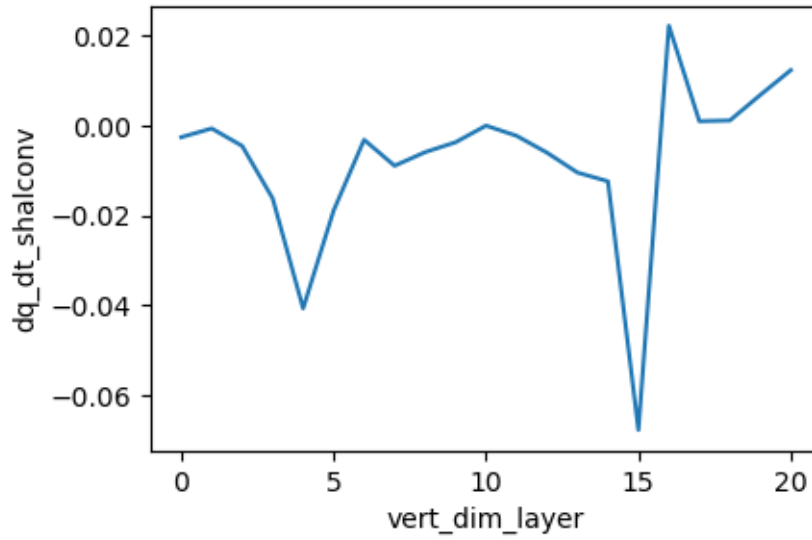
dT_{dt_phys} : max_re 0.6906252503395081



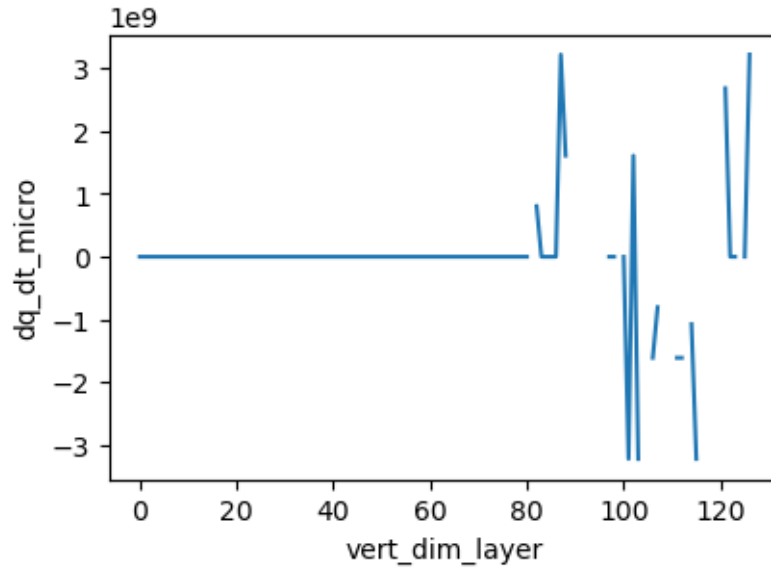
dq_{dt_pbl} : max_re 239.51063537597656



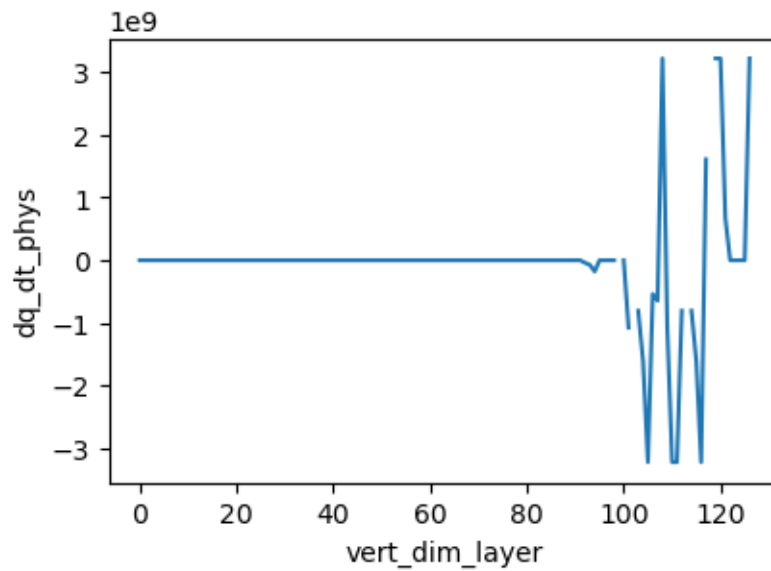
dq_dt_shalconv : max_re 0.06775882095098495



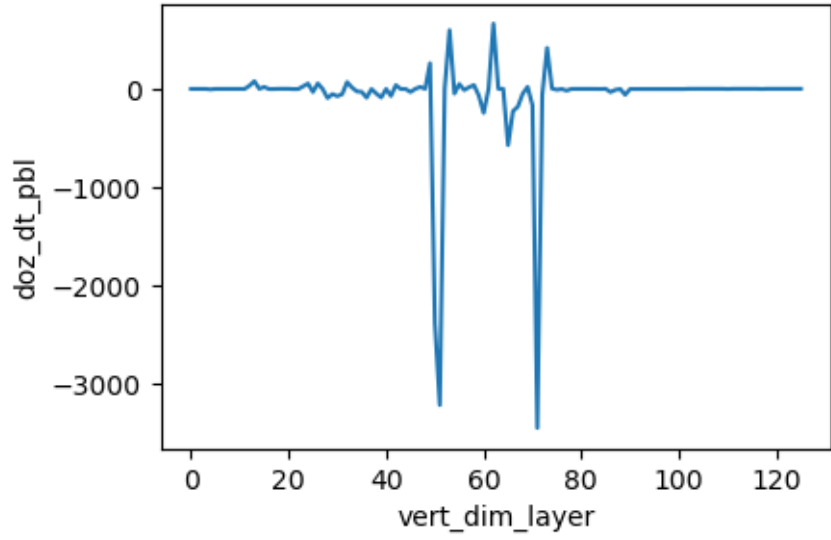
dq_dt_micro : max_re inf



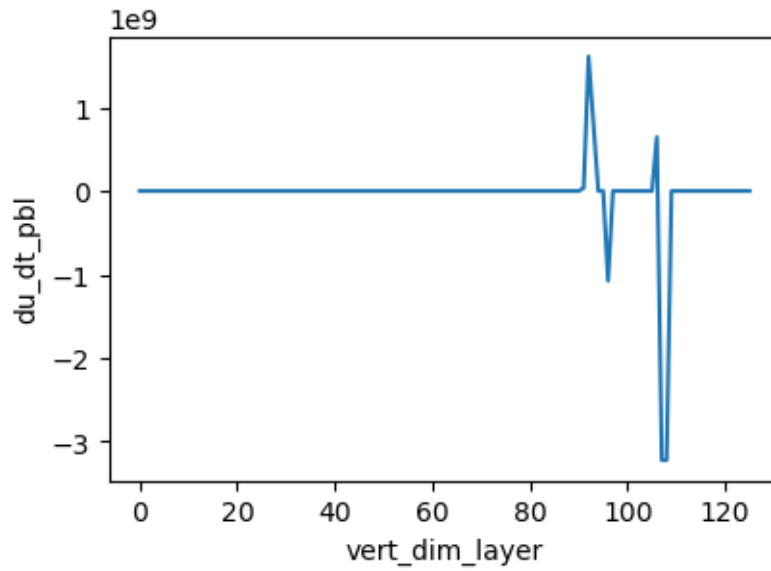
dq_dt_phys : max_re inf



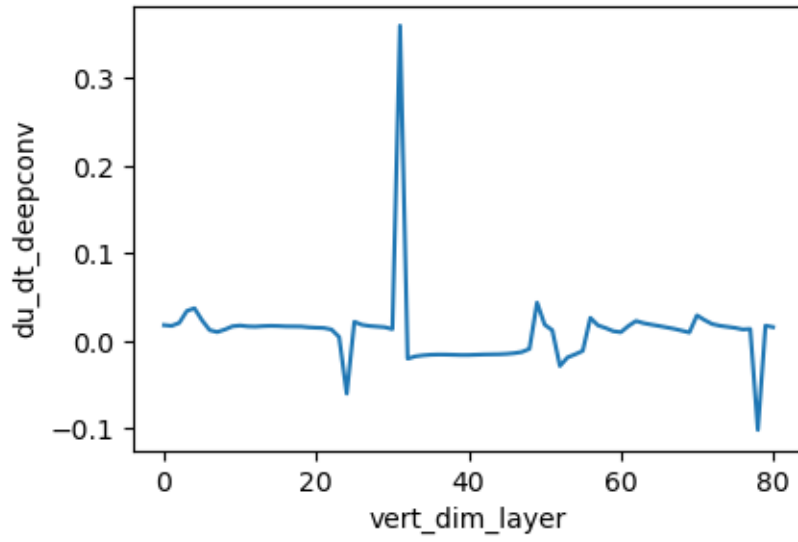
doz_dt_pbl : max_re 3443.158935546875



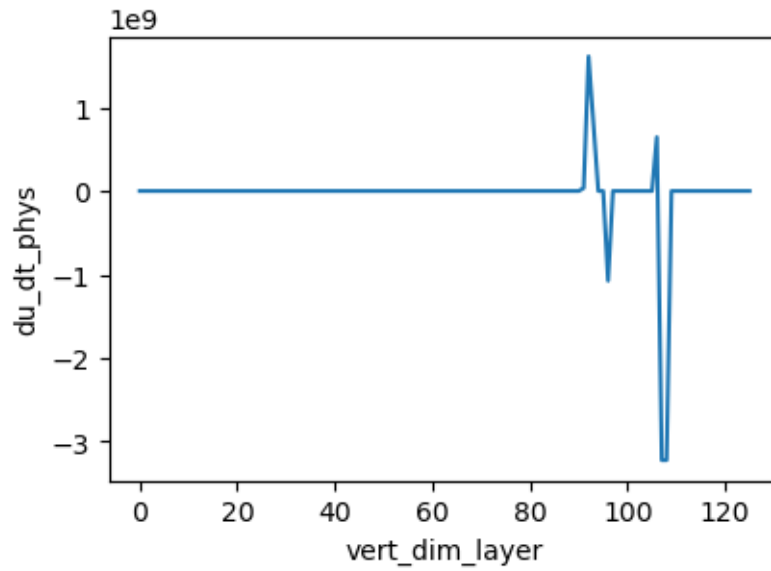
`du_dt_pbl` : max_re 3221225472.0



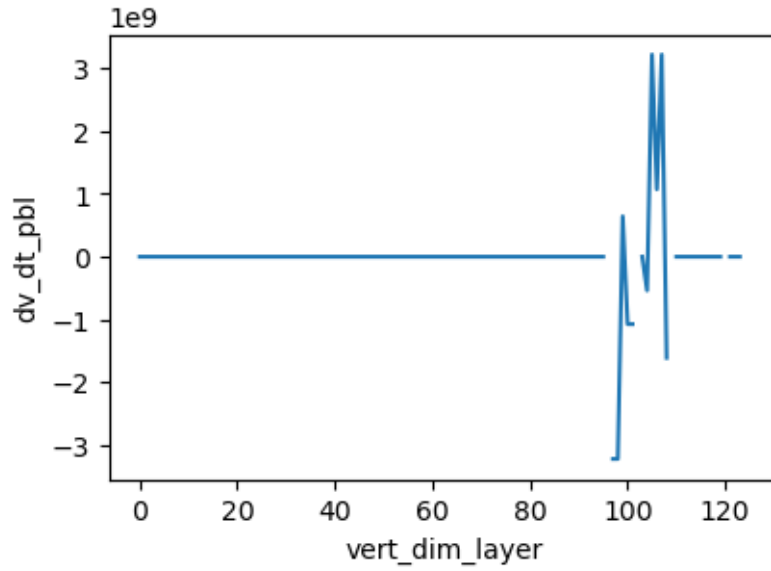
`du_dt_deepconv` : max_re 0.35968348383903503



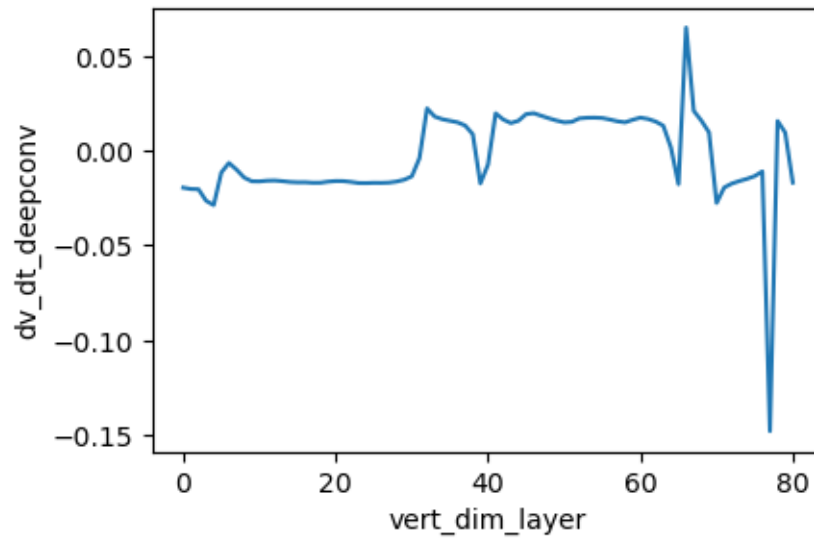
`du_dt_phys` : max_re 3221225472.0



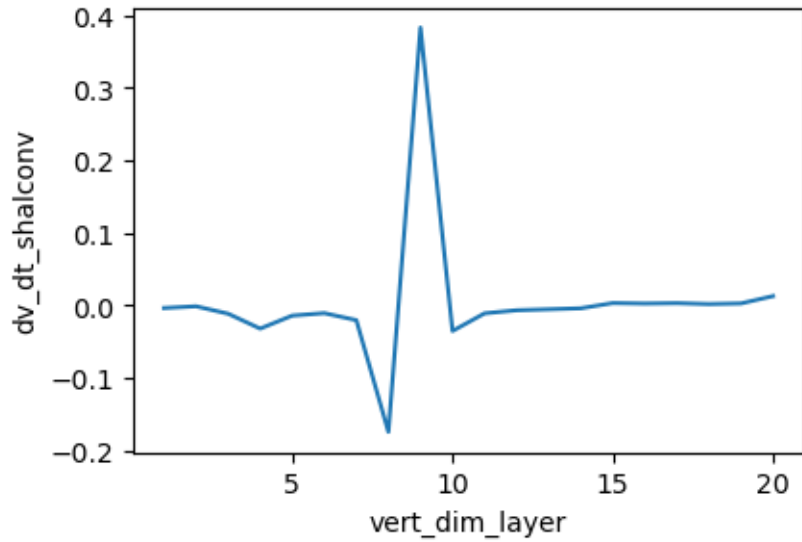
`dv_dt_pbl` : max_re 3221225472.0



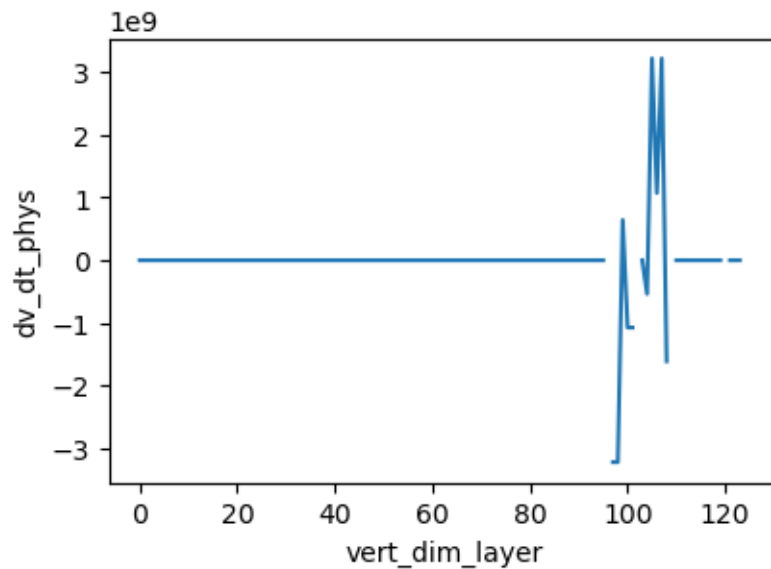
dv_dt_deepconv : max_re 0.14795039594173431



dv_dt_shalconv : max_re 0.3830767869949341



 dv_dt_phys : max_re 3221225472.0



```
[32]: #for var in ds32.variables:
#      print(var, ':', ds32[var].identical(ds64[var]))
identical_count = 0; dif_count = 0;
for var in ds32.variables:
    if (ds32[var].identical(ds64[var])):
        identical_count += 1
```

```

else:
    dif_count +=1

print("Summary:", identical_count, "identical variables", dif_count, "differing_
↳variables")
print("=====", identical_count, "Identical Variables =====")
for var in ds32.variables:
    if (ds32[var].identical(ds64[var])):
        print(var,':',ds32[var].identical(ds64[var]))
print("")
print("=====", dif_count, "Differing Variables =====")
for var in ds32.variables:
    if (not ds32[var].identical(ds64[var])):
        print(var,':',ds32[var].identical(ds64[var]))

```

Summary: 40 identical variables 96 differing variables

===== 40 Identical Variables =====

```

time_inst : True
time_diag : True
time_swrad : True
time_lwrad : True
time_rad : True
sigmab : True
u_g : True
v_g : True
dT_dt_rad_forc : True
sfc_up_lw_land : True
sfc_up_lw_ice : True
scnv_prcp_inst : True
rad_eff_rad_qr : True
dT_dt_ogwd : True
dT_dt_cgwd : True
dT_dt_nonphys : True
dq_dt_nonphys : True
doz_dt_nonphys : True
du_dt_ogwd : True
du_dt_cgwd : True
du_dt_nonphys : True
dv_dt_ogwd : True
dv_dt_cgwd : True
dv_dt_nonphys : True
gflux : True
ice_accum : True
snow_accum : True
graupel_accum : True
ice_rate_accum : True
snow_rate_accum : True

```

graupel_rate_accum : True
vert_int_lwp_mp : True
vert_int_iwp_mp : True
vert_int_lwp_cf : True
vert_int_iwp_cf : True
init_year : True
init_month : True
init_day : True
init_hour : True
init_minute : True

===== 96 Differing Variables =====

pres : False
pres_i : False
sigma : False
sigma_i : False
pres_s : False
qv : False
T : False
u : False
v : False
ql : False
qi : False
qc : False
qv_force_tend : False
T_force_tend : False
u_force_tend : False
v_force_tend : False
w_ls : False
h_advec_thil : False
h_advec_qt : False
v_advec_thil : False
v_advec_qt : False
T_s : False
lhf : False
shf : False
tprcp_inst : False
tprcp_rate_inst : False
t2m : False
q2m : False
ustar : False
tsfc : False
tau_u : False
tau_v : False
upd_mf : False
dwn_mf : False
det_mf : False
sfc_up_lw_water : False

sfc_up_sw_dir_nir : False
sfc_up_sw_dif_nir : False
sfc_up_sw_dir_vis : False
sfc_up_sw_dif_vis : False
sfc_dwn_sw_dir_nir : False
sfc_dwn_sw_dif_nir : False
sfc_dwn_sw_dir_vis : False
sfc_dwn_sw_dif_vis : False
mp_prcp_inst : False
dcnv_prcp_inst : False
rad_cloud_fraction : False
rad_cloud_lwp : False
rad_eff_rad_ql : False
rad_cloud_iwp : False
rad_eff_rad_qi : False
rad_cloud_rwp : False
rad_cloud_swp : False
rad_eff_rad_qs : False
sw_rad_heating_rate : False
lw_rad_heating_rate : False
pwat : False
dT_dt_lwrad : False
dT_dt_swrad : False
dT_dt_pbl : False
dT_dt_deepconv : False
dT_dt_shalconv : False
dT_dt_micro : False
dT_dt_phys : False
dq_dt_pbl : False
dq_dt_deepconv : False
dq_dt_shalconv : False
dq_dt_micro : False
dq_dt_phys : False
doz_dt_pbl : False
doz_dt_prodlloss : False
doz_dt_oz : False
doz_dt_T : False
doz_dt_ovhd : False
doz_dt_phys : False
du_dt_pbl : False
du_dt_deepconv : False
du_dt_shalconv : False
du_dt_phys : False
dv_dt_pbl : False
dv_dt_deepconv : False
dv_dt_shalconv : False
dv_dt_phys : False
sfc_dwn_sw : False

```
sfc_up_sw : False
sfc_net_sw : False
sfc_dwn_lw : False
u10m : False
v10m : False
hpbl : False
tprcp_accum : False
conv_prcp_accum : False
tprcp_rate_accum : False
conv_prcp_rate_accum : False
max_cloud_fraction : False
toa_total_albedo : False
```

```
[5]: var = 'T'
(ds32[var] - ds64[var])[:, :, 0].plot()
```

```
[5]: <matplotlib.collections.QuadMesh at 0x146d60c87490>
```

