December 31, 2003

Contents of NARR output AWIPS GRIB files

Sea Level

a) analysis and first guess

Mean sea level pressure (ETA model) [Pa]
Pressure reduced to MSL [Pa]

Surface

a) analysis and first guess

* Downward shortwave radiation flux [W/m^2]
* Downward longwave radiation flux [W/m^2]
* Upward short wave radiation flux [W/m^2]
* Upward long wave radiation flux [W/m^2]
* Plant canopy surface water [kg/m^2]
* Accum. snow [kg/m^2]
* Snow cover [%]
* Snow depth [m]
* Surface friction velocity [m/s]
* Surface drag coefficient [non-dim]
* Zonal momentum flux [N/m^2]
* Meridional momentum flux [N/m^2]
* Sensible heat flux [W/m^2]
* Latent heat flux [W/m^2]
* Exchange coefficient [(kg/m^3)(m/s)]
* Vegetation [%]
* Ground Heat Flux [W/m^2]
* Canopy conductance [m/s]
* Temperature parameter in canopy conductance [fraction]
* Solar parameter in canopy conductance [fraction]
* Soil moisture parameter in canopy conductance [fraction]
* Humidity parameter in canopy conductance [fraction]
* Albedo [%]

Visibility [m]
Planetary boundary layer height [m]
Pressure [Pa]

* Pressure (nearest grid point) [Pa]
* Temp. [K]
* Potential temp. [K]

Precipitation rate [kg/m^2/s]

* Categorical snow [yes=1;no=0]
* Categorical ice pellets [yes=1;no=0]
* Categorical freezing rain [yes=1;no=0]
* Categorical rain [yes=1;no=0]

b) first guess only

ave * Latent heat flux [W/m^2]
ave * Sensible heat flux [W/m^2]
ave * Ground Heat Flux [W/m^2]
ave * Snow phase-change heat flux [W/m^2]
accum * Evaporation [kg/m^2]
accum * Potential evaporation [kg/m^2]
ave * Downward shortwave radiation flux [W/m^2]

ave	* Downward longwave radiation flux [W/m^2]
ave	* Upward short wave radiation flux [W/m^2]
ave	* Upward long wave radiation flux [W/m^2]
accum	Total precipitation [kg/m^2]
accum	* Total precipitation (nearest grid point) [kg/m^2]
accum	Convective precipitation [kg/m^2]
accum	* Snow melt [kg/m^2]
accum	* Surface runoff (non-infiltrating) [kg/m^2]
accum	* Subsurface runoff (baseflow) [kg/m^2]

Pressure levels (1000, 975, 950, 925, 900, 875, 850, 825, 800, 775, 750, 725, 700, 650, 600, 550, 500, 450, 400, 350, 300, 275, 250, 225, 200, 175, 150, 125, 100)

a) analysis and first guess

Geopotential height [gpm]
Temp. [K]
Specific humidity [kg/kg]
Pressure vertical velocity [Pa/s]
u wind [m/s]
v wind [m/s]
Cloud water [kg/kg]
Ice mixing ratio [kg/kg]
Turbulent Kinetic Energy [J/kg] (up to 600 mb)

Height above ground

a) analysis and first guess

***** Temp. [K]	(2m,10m,30m)
***** Potential temp. [K]	(10m,30m)
***** Specific humidity [kg/kg]	(2m,10m,30m)
***** Dew point temp. [K]	(2m,)
***** Relative humidity [%]	(2m,)
***** Pressure [Pa]	(2m,10m,30m)
***** u wind [m/s]	(10m,30m)
***** v wind [m/s]	(10m,30m)

Hybrid level

a) analysis and first guess

***** Pressure [Pa]
***** Geopotential height [gpm]
***** Temp. [K]
***** Potential temp. [K]
***** Relative humidity [%]
***** Specific humidity [kg/kg]
***** Horizontal moisture divergence [kg/kg/s]
***** u wind [m/s]
***** v wind [m/s]
***** Pressure vertical velocity [Pa/s]
***** Turbulent Kinetic Energy [J/kg]
Blackadars mixing length scale [m]
Richardson number [non-dim]

Below surface

a) analysis and first guess

	***** Soil temp. [K]	(0-10, 10-40, 40-100, 100-200 cm)
	***** Volumetric soil moisture (frozen + liquid) [fraction]	(0-10, 10-40, 40-100, 100-200 cm)
	***** Liquid volumetric soil moisture (non-frozen) [fraction]	(0-10, 10-40, 40-100, 100-200 cm)
	***** Moisture availability [%]	(0-100 cm)
	***** Soil moisture content [kg/m^2]	(0-200 cm)

PBL 30mb averages (30-0 mb,60-30 mb,90-60 mb,120-90 mb,150-120 mb,180-150 mb)

a) analysis and first guess

***** Temp. [K]
***** Specific humidity [kg/kg]
***** Horizontal moisture divergence [kg/kg/s]
***** u wind [m/s]
***** v wind [m/s]
***** Pressure vertical velocity [Pa/s]

Maximum wind level

a) analysis and first guess

Pressure [Pa]
Geopotential height [gpm]
u wind [m/s]
v wind [m/s]

Tropopause

a) analysis and first guess

Pressure [Pa]
Geopotential height [gpm]
Temp. [K]
u wind [m/s]
v wind [m/s]
Vertical speed shear [1/s]

Atmospheric column

a) analysis and first guess

Precipitable water [kg/m^2]

b) first guess only

accum	Water vapor flux convergence (vertical int) [kg/m^2]	(total atm, 0-700mb)
accum	Water condensate flux convergence (vertical int) [kg/m^2]	(total atm, 0-700mb)
accum	Water vapor zonal flux (vertical int)[kg/m]	(total atm, 0-700mb)
accum	Water vapor meridional flux (vertical int) [kg/m]	(total atm, 0-700mb)
accum	Water condensate zonal flux (vertical int)[kg/m]	(total atm, 0-700mb)
accum	Water condensate meridional flux (vertical int) [kg/m]	(total atm, 0-700mb)
accum	Water vapor added by precip assimilation [kg/m^2]	(total atm, 0-700mb)
accum	Water condensate added by precip assimilaition [kg/m^2]	(total atm, 0-700mb)

Cloud related

a) analysis and first guess

Low level cloud cover [%]
Mid level cloud cover [%]

	High level cloud cover [%]	
	Total cloud cover [%]	
	* Pressure [Pa]	(cloud top, cloud base)
	* Geopotential height [gpm]	(cloud top, cloud base)
	* Temp. [K]	(cloud top)

b) first guess only

ave	Total cloud cover [%]	
ave	Non-convective cloud [%]	
ave	Convective cloud cover [%]	

Misc

a) analysis and first guess

	Storm relative helicity [m^2/s^2]	3000-0 m above gnd
	u-component of storm motion [m/s]	6000-0 m above gnd
	v-component of storm motion [m/s]	6000-0 m above gnd
	Geopotential height [gpm]	0C isotherm
	Relative humidity [%]	0C isotherm
	Best (4-layer) lifted index [K]	180-0 mb above gnd
	Convective available potential energy [J/kg]	180-0 mb above gnd
	Convective inhibition [J/kg]	180-0 mb above gnd
	Pressure [Pa]	cond level
	Surface lifted index [K]	
	Convective available potential energy [J/kg]	
	Convective inhibition [J/kg]	
	Horizontal moisture divergence [kg/kg/s]	850 mb

b) first guess only

ave	Upward short wave radiation flux [W/m^2]	TOA
ave	Upward long wave radiation flux [W/m^2]	TOA

*) asterisk indicates field interpolated using nearest neighbor

averages	13 variables
accumulates	24 variables
nearest n.	92 variables

number of variables in first guess file	433
number of variables in analysis file	396 (433-13-24)

Contents of NARR output AWIPS GRIB fixed fields file

Geopotential height [gpm]
* Surface roughness [m]
* Vegetation type [Index]
* Soil type [Index]
* Surface slope type [Index]
Land cover (land=1;sea=0) [fraction]
* Land cover (land=1;sea=0) [fraction]
Latitude (-90 to +90) [deg]
* Latitude (-90 to +90) [deg]
East longitude (0-360) [deg]
* East longitude (0-360) [deg]
* Soil temp. [K] (300 cm down)
* Maximum snow albedo [%]
* Direct evaporation cease (soil moisture) [fraction]
* Soil porosity [fraction]
* Minimal stomatal resistance [s/m]
* Number of soil layers in root zone [non-dim]
* Wilting point [fraction]
* Transpiration stress-onset (soil moisture) [fraction]
* Geopotential Height (nearest grid point) [gpm]
* Snow-free albedo [%]

Estimate of the volume of various NARR output files

1. EDAS

AWIPS Grid 221	*E-GRID*
a) <u>analysis files</u>	
52 Mb single file	48 Mb
420 Mb daily (8 times per day, every 3 hr)	385 Mb
12.6 Gb monthly	11.5 Gb
151 Gb yearly	140 Gb
3.7 Tb entire RR period (25 years)	3.4 Tb
b) <u>3-hour first-guess forecast files</u>	
58 Mb single file	53 Mb
464 Mb daily (8 times per day, every 3 hr)	424 Mb
14 Gb monthly	12.8 Gb
168 Gb yearly	155 Gb
4.1 Tb entire RR period (25 years)	3.7 Tb

Restart file

265 Mb single file (277756860 bytes exactly)
4.1 Gb daily (16 files per day; 8 analysis and 8 first-guess files, every 3 hr)
130 Gb monthly
1.5 Tb yearly
37 Tb entire RR period (25 years)

2. Free forecast

AWIPS Grid 221	*E-GRID*
(same as first-guess files, saved every 2.5 days up to 72hr every 3 hr.)	
25 file * 58 Mb = 1.4 Gb per run	1.3 Gb
205 Gb yearly (365/2.5=146 free forecasts per year)	190 Gb
5 Tb entire RR period (25 years)	4.7 Tb

- Terminology used for NARR output files

	Horizontal grid	*Vertical grid*	*Format*
restart	Native E grid	Eta (η) levels	binary
E-GRID	Native E grid	Pressure levels	GRIB
AWIPS	Lambert grid 221	Pressure levels	GRIB

MOLTS (1438 station location)

EDAS
- 2.5 Mb single file
- 20 Mb daily (8 times per day, every 3 hr)
- 620 Mb monthly
- 7.3 Gb yearly
- 180 Gb entire RR period (25 years)

Free forecast
- 30 Mb per run
- 4.3 Gb yearly (365/2.5=146 free forecasts per year)
- 106 Gb entire RR period (25 years)