



WRF Utilities

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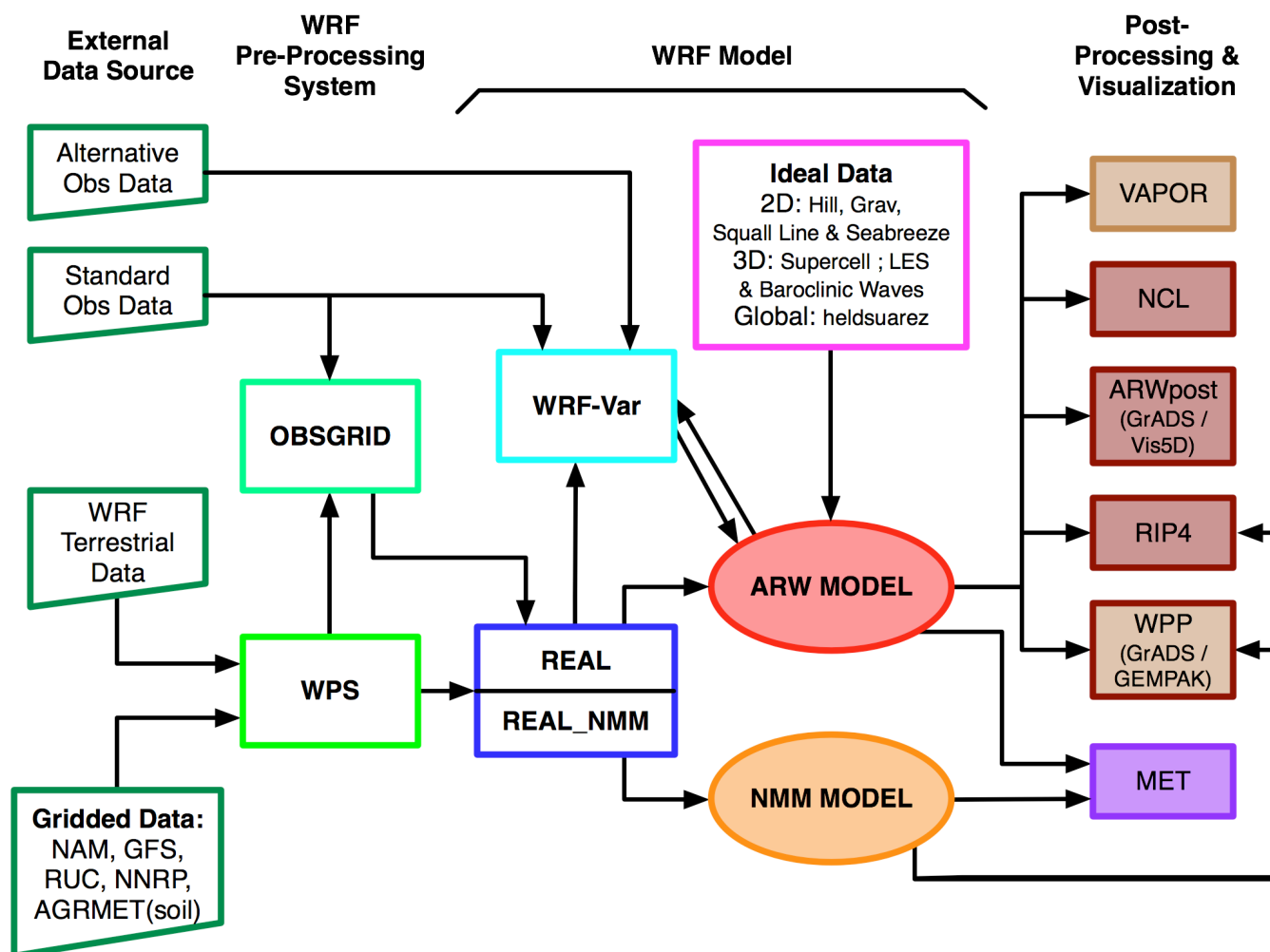


Overview

- **Graphical Tools**
- **WRF Model Domain Design**
- **Intermediate Files**
- **netCDF**
- **GRIB1 / GRIB2**
- **Verification Tools**
- **Domain Wizard**

Graphics

WRF Modeling System Flow Chart





Graphics

- **NCL**
 - Graphical package
 - *WRF-ARW Only*
- **ARWpost**
 - Converter (GrADS & vis5d)
 - *WRF-ARW Only*
- **RIP4**
 - Converter and interface to graphical package NCAR Graphics
- **VAPOR**
 - Converter and graphical package
 - *WRF-ARW Only*
- **WPP**
 - Converter (GrADS & GEMPAK)
- **IDL**
- **IDV**
- **MatLab**
- **GEMPAK**

Graphics : *ctrans*

- **Convert NCAR Graphics files (.ncgm) to ras format**

- Single Frame in **.ncgm** file

```
ctrans -d sun file.ncgm > file.ras
```

- Multiple Frames in **.ncgm** file
(med = metafile frame editor)

```
med -e '1,$ split $' file.cgm
```

```
ctrans -d sun med001.ncgm > med001.ras
```

Graphics : ImageMagick

- **Convert graphical files from one format to another**

- Many options available (*rotate* frames, *trim* white space, etc.)
- Can be used for files with single or multiple frames
- Cannot deal with **.ncgm** files
- <http://www.imagemagick.org>

convert
convert
convert
convert

file.pdf
file.png
file.pdf
file.ras

file.png
file.bmp
file.gif
file.png



WRF Model Domain Design

- **WPS util/ directory**

- **plotgrids.exe**

- quick look at domains you want to create
(reads namelist information to generate plot)*

- create an NCAR Graphics file called 'gmeta'*

- use 'idt' to view*

WPS Intermediate Files

- Output format of ungrid
- WPS util/ directory
 - **plotfmt.exe**
graphical interface to view intermediate file
- Create your own intermediate files
 - http://www.mmm.ucar.edu/wrf/OnLineTutorial/WPS/IM_files.htm

netCDF

- netCDF stands for **network Common Data Form**
- netCDF is one of the current supported data formats chosen for WRF I/O API
 - WRF I/O supports netCDF (*not fully CF compliant - Climate and Forecast Metadata Convention*)/binary/GRIB/HDF
 - Most support graphical packages currently only support netCDF file format
- <http://www.unidata.ucar.edu> (*documentation*)
- <http://www.unidata.ucar.edu/software/netcdf/fguide.pdf> (*writing Fortran programs to read/write netCDF files*)

netCDF

- **Advantages of using netCDF?**

- Platform-independent (*big_endian* / *little_endian*)
- A lot of software already exist which can be used to process netCDF data

- **netCDF operators**

- <http://nco.sourceforge.net/>
- Stand alone programs to, which can be used to manipulate data (*performing grid point averaging / file differencing / file 'appending'*)

NCO tools

<http://nco.sourceforge.net/>

- **ncdiff**

- Difference two file

ncdiff input1.nc input2.nc output.nc

- **ncrcat** (*nc cat*)

- Write specified variables / times to a new file

ncrcat -v RAINNC wrfout RAINNC.nc*

ncrcat -d Time,0,231 -v RAINNC wrfout RAINNC.nc*

- **ncra** (*nc average*)

- Average variables and write to a new file

ncra -v OLR wrfout OLR.nc*

- **ncks** (*nc kitchen sink*)

- Combination of NCO tools all in one (*handy: one tool for multiple operations*)



netCDF : Utilities

- **ncdump**

- reads a netCDF dataset and prints information from the dataset
- `ncdump -h file`
print header (inc. list of variables in the file)
- `ncdump -v VAR file`
print data of the variable VAR
`ncdump -v Times file`

netCDF : *ncdump -h*

```
netcdf wrfinput_d01 {  
dimensions:  
    Time = UNLIMITED ; // (1 currently)  
    DateStrLen = 19 ;  
    west_east = 73 ;  
    south_north = 60 ;  
    west_east_stag = 74 ;  
    bottom_top = 27 ;  
    south_north_stag = 61 ;  
    bottom_top_stag = 28 ;  
variables:  
    char Times(Time, DateStrLen) ;  
    float LU_INDEX(Time, south_north, west_east) ;  
        LU_INDEX:FieldType = 104 ;  
        LU_INDEX:MemoryOrder = "XY " ;  
        LU_INDEX:description = "LAND USE CATEGORY" ;  
        LU_INDEX:units = "" ;  
        LU_INDEX:stagger = "" ;
```

.....

netCDF : *ncdump -h*

.....

// global attributes:

```
:TITLE = " OUTPUT FROM REAL_EM V3.0 PREPROCESSOR";  
:START_DATE = "2000-01-24_12:00:00" ;  
:SIMULATION_START_DATE = "2000-01-24_12:00:00" ;  
:WEST-EAST_GRID_DIMENSION = 74 ;  
:SOUTH-NORTH_GRID_DIMENSION = 61 ;  
:BOTTOM-TOP_GRID_DIMENSION = 28 ;  
:DX = 30000.f ;  
:DY = 30000.f ;  
:GRIDTYPE = "C" ;  
:DYN_OPT = 2 ;  
:DIFF_OPT = 0 ;  
:MP_PHYSICS = 3 ;  
:SF_SFCLAY_PHYSICS = 1 ;  
:SF_SURFACE_PHYSICS = 1 ;  
:BL_PBL_PHYSICS = 1 ;  
:CU_PHYSICS = 1 ;
```



netCDF : *ncdump -v Times*

.....

data:

Times =

```
"2000-01-24_12:00:00",  
"2000-01-24_18:00:00",  
"2000-01-25_00:00:00",  
"2000-01-25_06:00:00" ;  
}
```


ncview

http://meteora.ucsd.edu/~pierce/ncview_home_page.html

no variable selected

Ncview 1.93a David W. Pierce 1 Feb 2006

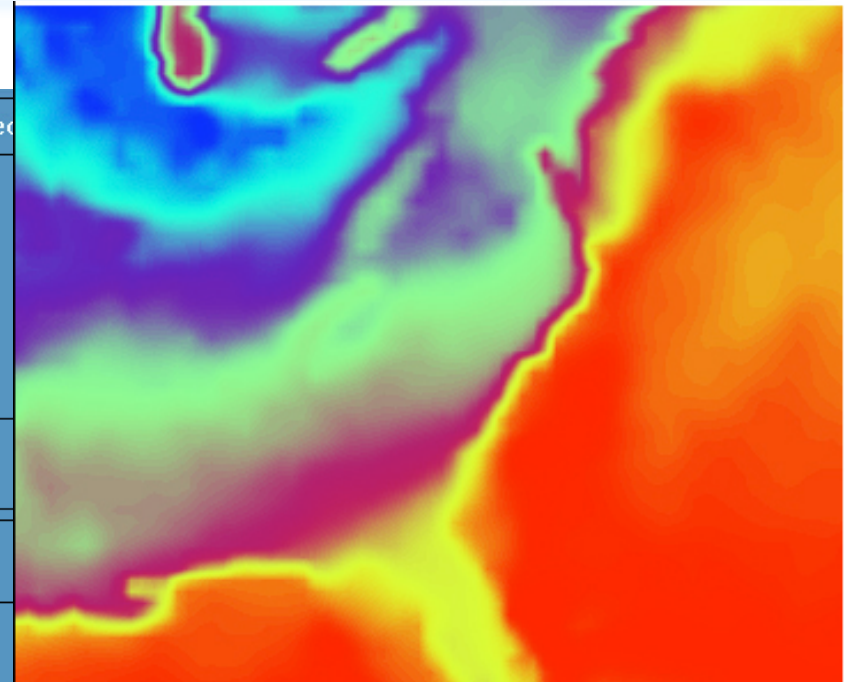
*** SELECT A VARIABLE TO START ***

Quit --> << < || > >> Edit ? Delay: Opts

3gauss Inv P Inv C Mag XI Linear Axes Range blowup Print

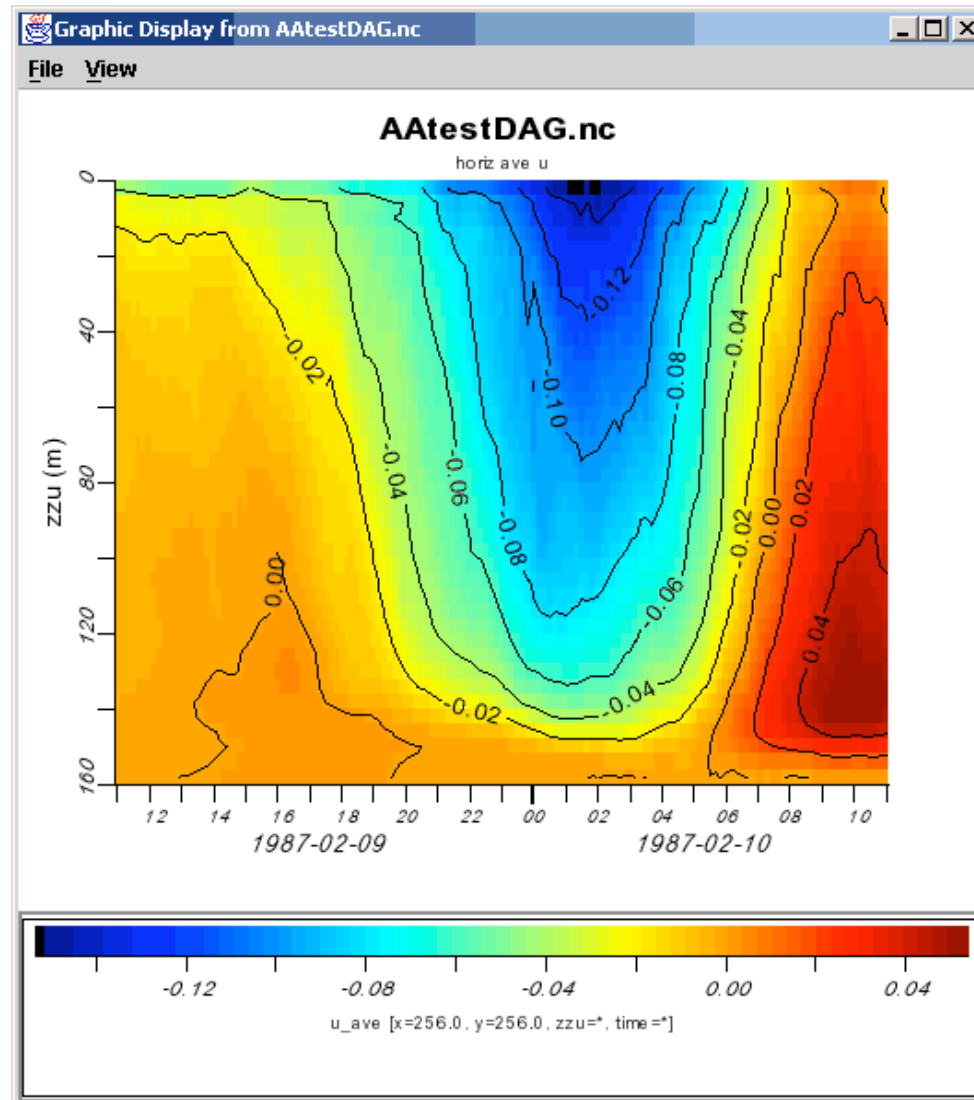
(18) 1d vars (48) 2d vars (13) 3d vars

Dim:	Name:	Min:	Current:	Max:	Units:
	Time	Min:	Current:	Max:	Units:
	bottom_top	Min:	Current:	Max:	Units:
	south_north	Min:	Current:	Max:	Units:
	west_east_st	Min:	Current:	Max:	Units:



ncBrowse

<http://www.epic.noaa.gov/java/ncBrowse/>





Other Utilities

- **Developed / Supported by NCAR**
- **FORTRAN program**
 - Easy to use
 - Easy to add your own code
 - Only for netCDF datasets
- **<http://www.mmm.ucar.edu/wrf/users/utilities/util.htm>**



Other Utilities

- **read_wrf_nc (ARW & NMM)**
 - Display data inside a wrfout netCDF file
 - Specific points; min/max of fields; time series; edit data in file
- **iowrf (ARW)**
 - Thinning of netCDF data; extracting a area; destaggering grid
- **p_interp (ARW)**
 - Interpolate to pressure levels
- **v_interp (ARW)**
 - Add vertical levels in wrf input and boundary files
 - For use with ndown

GRIB

- <http://dss.ucar.edu/docs/formats/grib/gribdoc/>
- **g1print.exe & g2print.exe**
 - Show data available in GRIB1 & GRIB2 files
 - Available from **util/** directory in WPS
- **grib2ctl.pl**
 - Create .ctl and .idx files, so one can plot GRIB files with GrADS (*available on web*)
- **wgrib (for GRIB 1 data files)**
 - wgrib -v file
 - wgrib -V file
 - <http://www.cpc.ncep.noaa.gov/products/wesley/wgrib.html>

GRIB2

- **Documentation**

http://www.nco.ncep.noaa.gov/pmb/docs/grib2/grib2_doc.shtml

- **GRIB2 - GRIB1 parameter conversion table**

http://www.nco.ncep.noaa.gov/pmb/docs/grib2/GRIB2_parmeter_conversion_table.html

Product	Category	Parameter		Parameter
0	2	2	U	33
0	2	3	V	34

- **wgrib2**

<http://www.cpc.ncep.noaa.gov/products/wesley/wgrib2/>

MET & Domain Wizard

- **DTC's Model Evaluation Tool Kit (MET)**

- Version 1.1 released July 2008
- <http://www.dtcenter.org/met/users/>

- **Domain Wizard**

- GUI to create model domain and run WPS executables
- Jeff Smith (jeff.s.smith@noaa.gov) (NOAA)
- Tutorials and code are available from:
<http://www.wrfportal.org/tutorial.html>
<http://www.wrfportal.org/DomainWizard.html>
- Suggestion – **if you are interested in using Domain Wizard**, first get familiar with WPS by running it manually