Post-processing Tools (4): ARWpost & VAPOR *(WRF-ARW)*

Cindy Bruyère

ARWpost

- **Converter**
  - Requires GrADS / vis5d to display data.
- **GrADS software only needed to display data.**
- **If vis5d output is required, vis5sd libraries are needed to compile the code.**
- **Generate a number of graphical plots**
  - *Horizontal, cross-section, skewT, meteogram, panel*

General

- **Download Code**
  - http://www.mmm.ucar.edu/wrf/users
- **OnLine Tutorial**
  - http://www.mmm.ucar.edu/wrf/users/graphics/ARWpost/ARWpost.htm

General

- **MUST have WRF compiled *(similar to WPS)***

- **For GrADS output**
  - GrADS libraries only needed to display data
  - ***http://grads.iges.org/grads/grads.html***
  - GrADS libraries are free

- **For vis5d output**
  - vis5d libraries needed for compilation
  - ***http://www.ssec.wisc.edu/~billh/vis5d.html***
  - vis5d libraries are free

Configure & Compile

./configure

Make sure this is correct. If not, set environment variable NETCDF

```
Will use NETCDF in dir: /usr/local/netcdf-pgi
------------------------------------------------
Please select from among the following supported
platforms.
1. PC Linux i486 i586 i686, PGI compiler
   (no vis5d)
2. PC Linux i486 i586 i686, PGI compiler
   (vis5d)
3. PC Linux i486 i586 i686, Intel compiler
   (no vis5d)
4. PC Linux i486 i586 i686, Intel compiler
   (vis5d)

Enter selection [1-4] :
```

Configure & Compile

- **configure.arwp,** will be created
- If your WRF code is not compiled under **../WRFV3,** edit **configure.arwp,** and set **"WRF_DIR"** to the correct location of your WRFV3 code
- **./compile**
  - This will create **ARWpost.exe**

namelist.ARWpost

&datetime	
start_date ***end_date***	Start & end date Format: *YYYY-MM-DD_HH:mm:ss*
interval_seconds	Seconds between times to process. *Code will skip times not required.* *Data can be in multiple files.*
tacc	If model output is not at regular intervals, use next time if within *tacc* seconds of time requested. *2008-04-10_12:00:00* *2008-04-10_13:00:10* *tacc=10*
debug_level	Set high for extra information

namelist.ARWpost

&io	
io_form_input	2=netCDF, 5=GRIB1
input_root_name	**Path** and **root** name of files to use as input. *Do not only provide directory name.* Can use wild characters.
output_root_name	Output root name. output_root_name.**dat** & output_root_name.**ctl**, OR output_root_name.**v5d**
output_type	Options are 'grads' (*default*) or 'v5d'
mercator_defs	Set to true if mercator plots are distorted

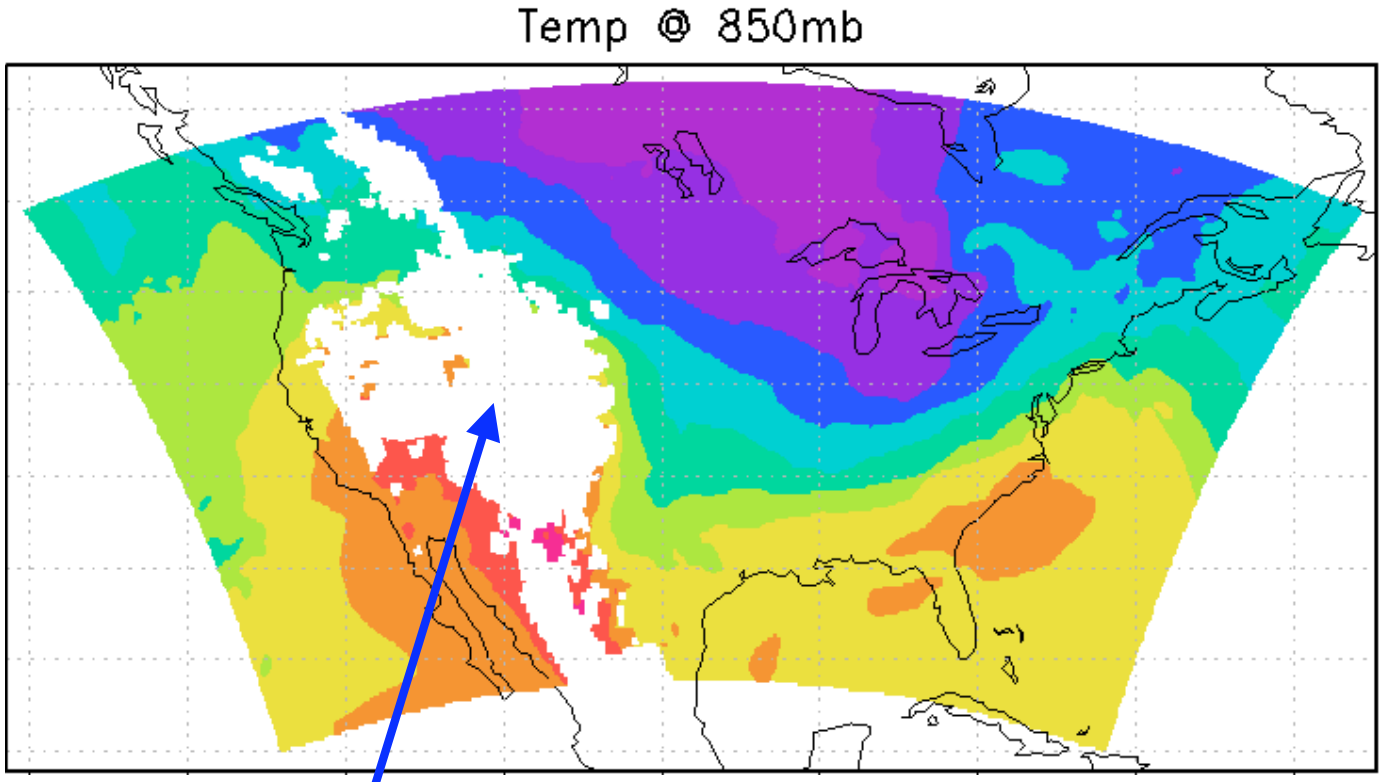
namelist.ARWpost

&io	
split_output	Split your GrADS output files into a number of smaller files *(a common .ctl file will be used for all .dat files).*
frames_per_outfile	If *split_output* is **.True.**, how many time periods are required per output (.dat) file.
plot	Which fields to process. *all, list, all_list* Order has no effect, i.e., "all_list" and "list_all" are similar. "**list**" - list variables in "**fields**"
fields	Fields to plot. Only used is list was used in the "plot" variable.
***Available diagnostics*:** cape, cin, mcape, mcin, clfr, dbz, max_dbz, height, lcl, lfc, pressure, rh, rh2, theta ,tc, tk, td, td2, slp, umet, vmet, u10m, v10m, wdir, wspd, wd10, ws10	

namelist.ARWpost

&interp	
interp_method	0 = sigma levels, -1 = code defined "nice" height levels, 1 = user defined height or pressure levels
interp_levels	Only used if interp_method=1 Supply levels to interpolate to, in hPa (*pressure*) or km (*height above sea level*) Supply levels bottom to top **NOTE**: *NO extrapolation below ground*

Interpolation



NO extrapolation below ground

Run

- **./ARWpost.exe**
- **Will create either,**

***output_root_name*.dat & *output_root_name*.ctl**

OR

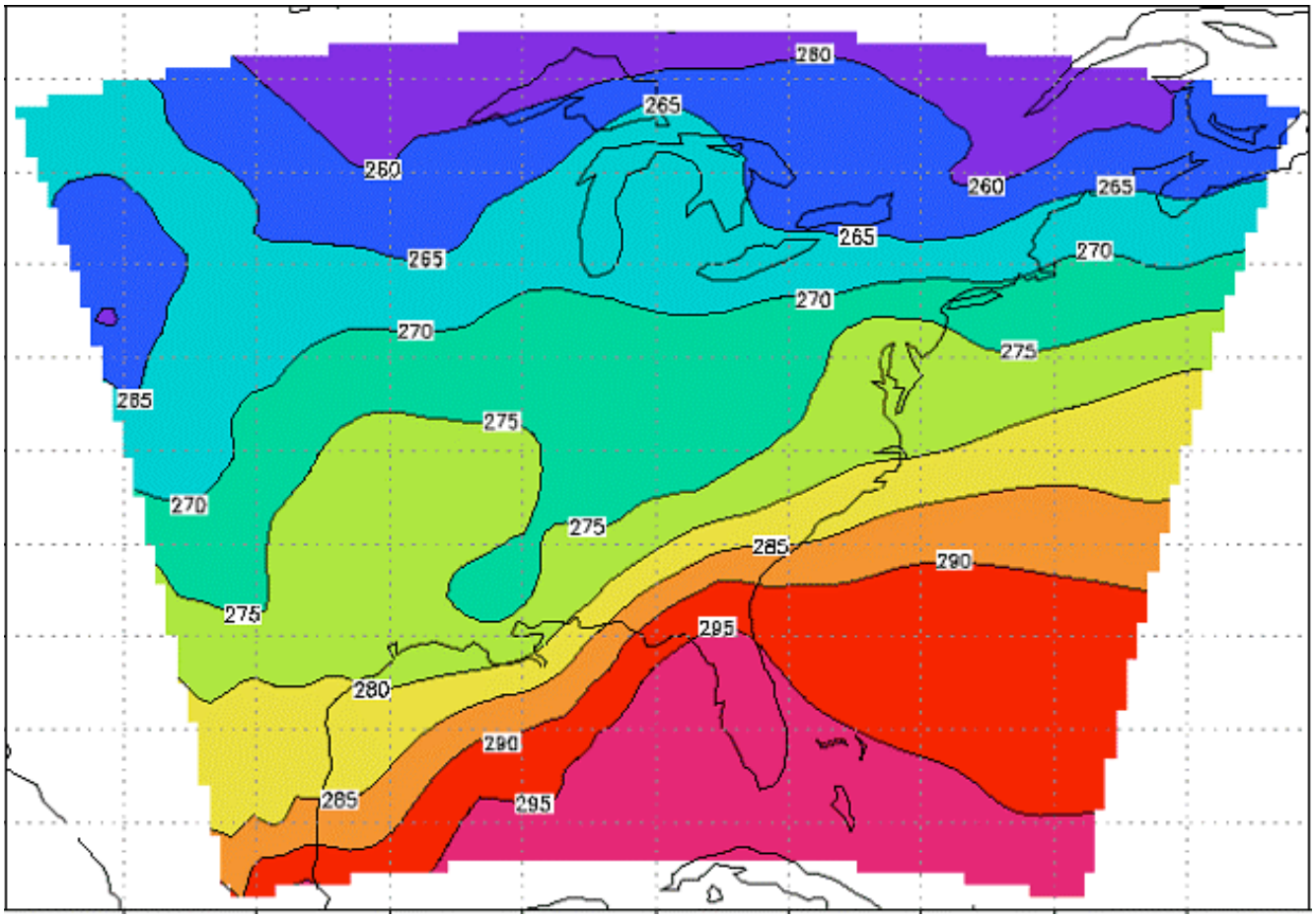
***output_root_name*.v5d**

GrADS specific notes

- **To display images requires GrADS software**
  freely available from
  http://grads.iges.org/grads/grads.html

- **Documentation:**
  http://grads.iges.org/grads/gadoc/index.html

GrADS - projections



GrADS - .ctl file

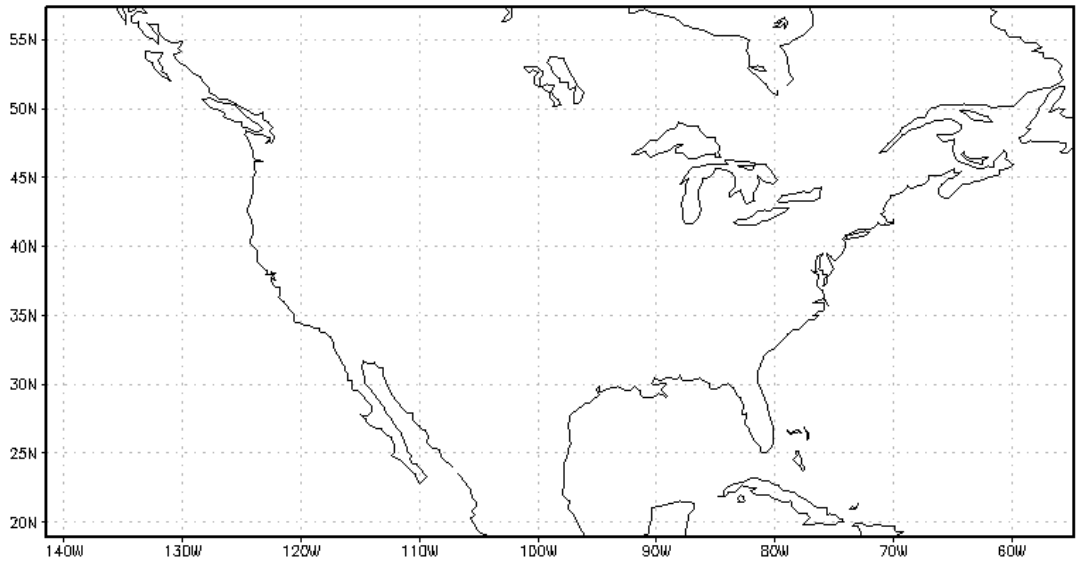
```
dset ^test.dat
options byteswapped
undef 1.e37
title  OUTPUT FROM WRF V2.2 MODEL
pdef  259 163 lcc  40.000  -98.000  130.000   82.000
      60.00000  30.00000  -98.00000  22000.000  22000.000
xdef  877 linear -141.49254   0.09909910
ydef  389 linear   18.88639   0.09909910
```

options byteswapped

Needed on some machines - if you get NaNs when you plot, ***remove*** *this line from .ctl file*

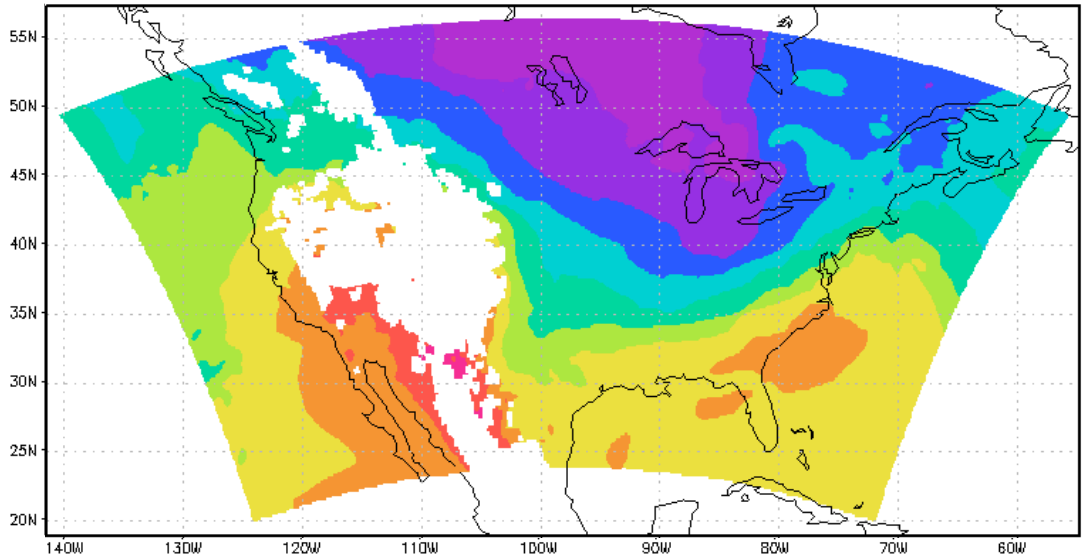
GrADS - .ctl file

```
dset ^test.dat
options byteswapped
undef 1.e37
title  OUTPUT FROM WRF V2.2 MODEL
pdef  259 163 lcc  40.000  -98.000  130.000   82.000
      60.00000  30.00000  -98.00000  22000.000  22000.000
xdef  877 linear -141.49254   0.09909910
ydef  389 linear   18.88639   0.09909910
```



GrADS - .ctl file

dset ^test.dat
options byteswapped
undef 1.e37
title OUTPUT FROM WRF V2.2 MODEL
pdef 259 163 lcc 40.000 -98.000 130.000 82.000
60.00000 30.00000 -98.00000 22000.000 22000.000
xdef 877 linear -141.49254 0.09909910
ydef 389 linear 18.88639 0.09909910

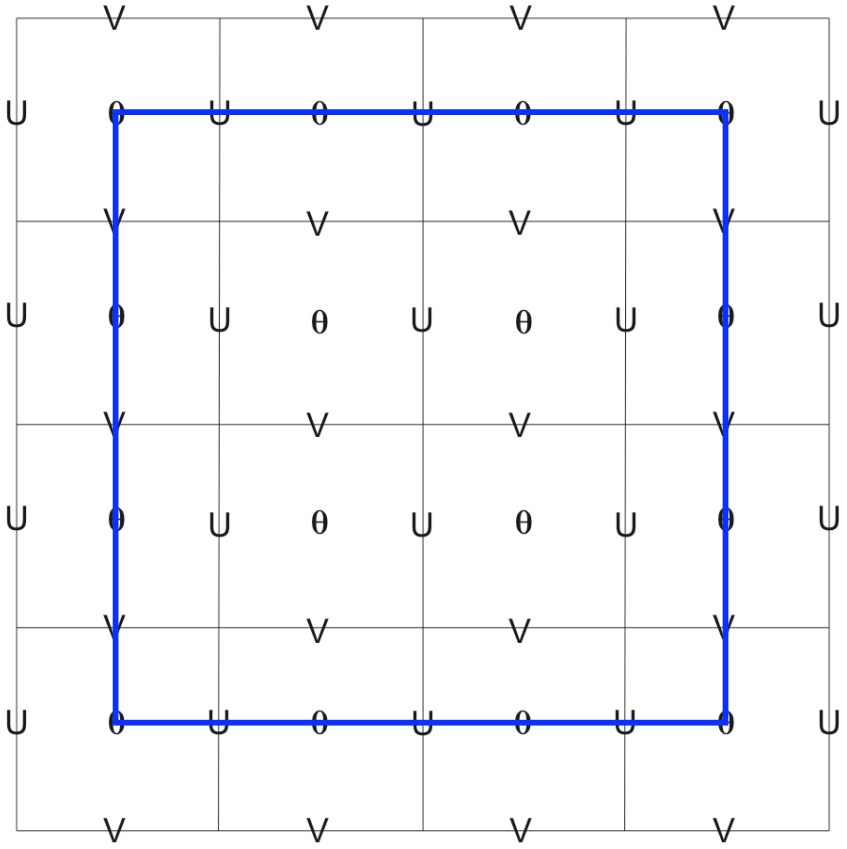


GrADS conversion - question

- **Why is a converter needed if GrADS can display netCDF files?**
  - Can only display model surface coordinates
  - Cannot interpolate to height or pressure levels
  - All diagnostics must be added via GrADS script files
  - *GRIB1 model output can also be read directly by GrADS, but above issues are still valid*
  - *For GRIB1, there is also a stagger problem*

GrADS conversion - question

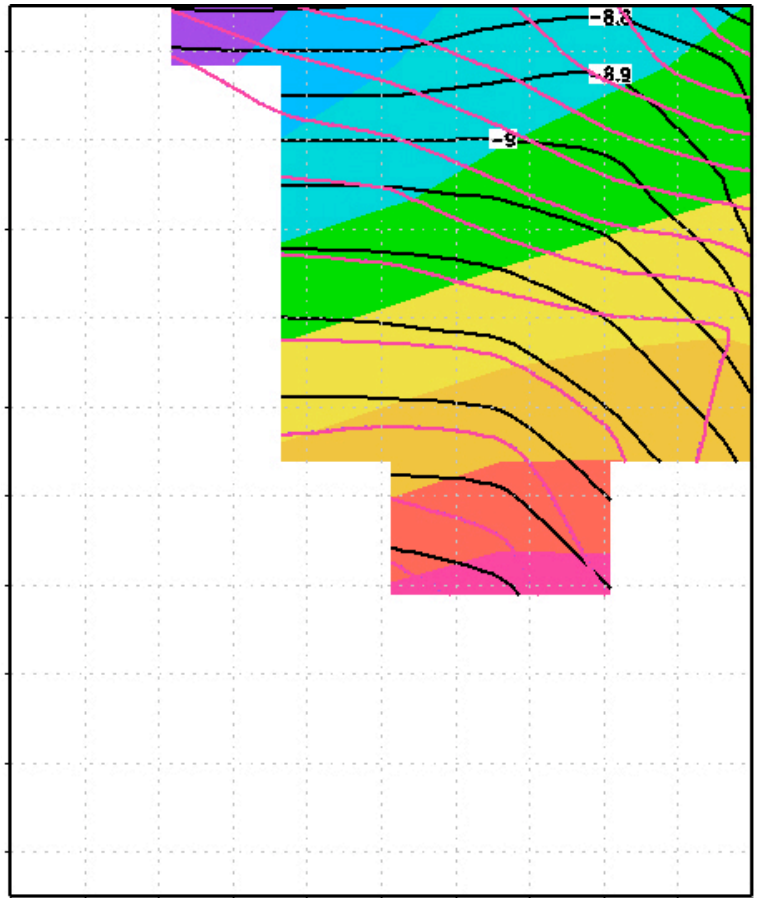
- **Why is a converter needed if GrADS can display netCDF files?**

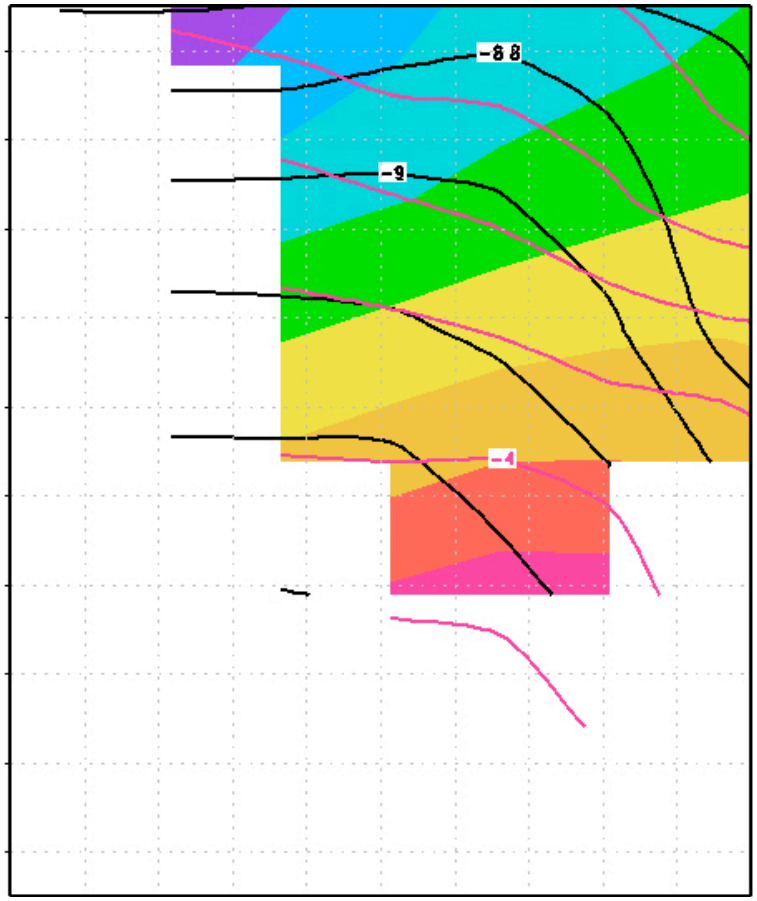


WRF staggered grid

Staggering

shaded=T ; black=U ; red=V



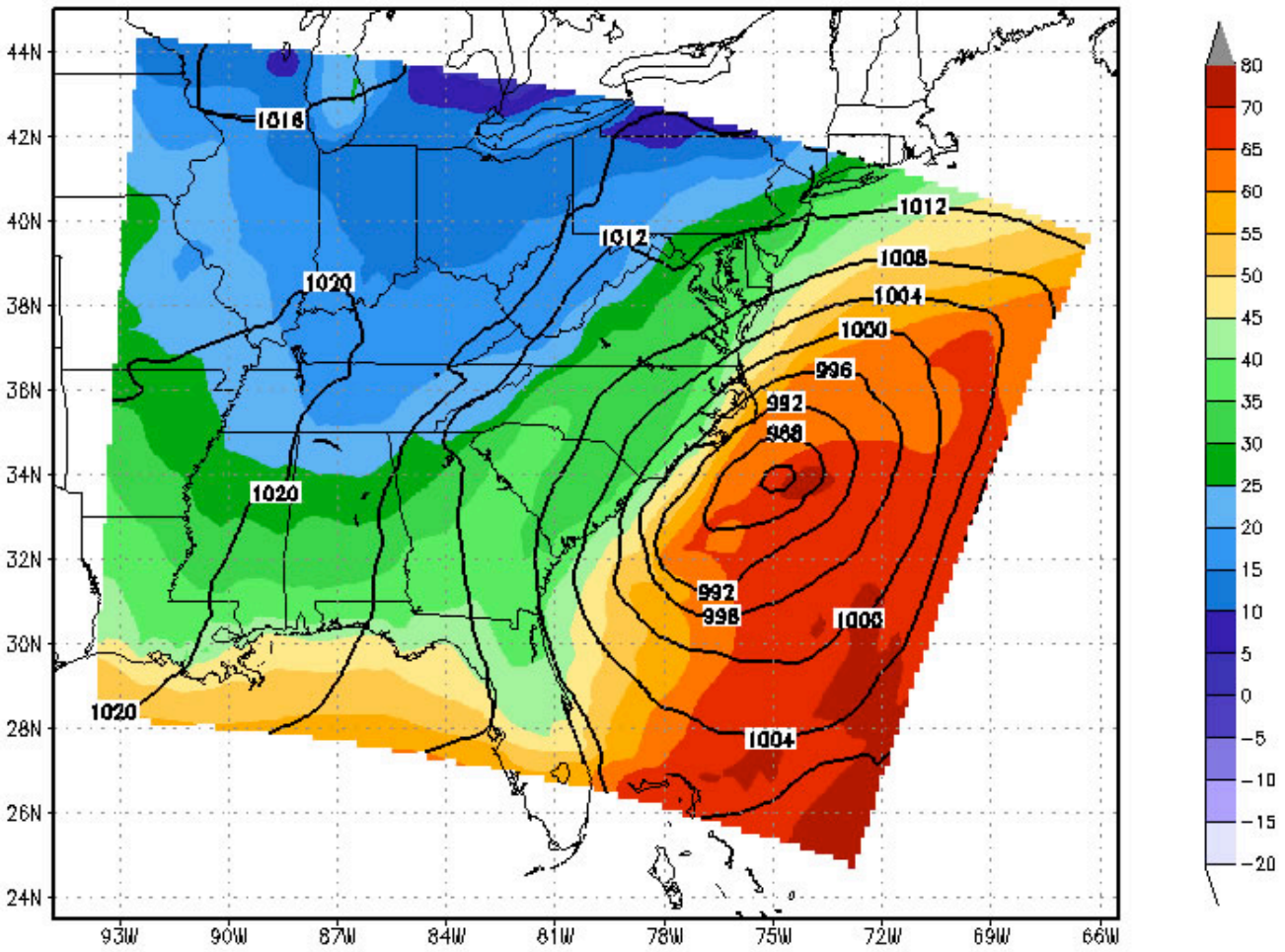


Staggering

- **Since GrADS version 1.9**
  - a new **gradsnc** interface is available *created by GrADS developers for WRF*
- **To USE**
  - must create 4 .ctl files (M ; U ; V ; W)
  - must open the all at once
- **Utility**
  - ARWpost/util/WRFnc2ctl.f

Creating a Plot

Surface Temperature (F)
Sea Level Pressure (mb)



Creating a Plot

```
open em_real.ctl
set mpdset hires
set display color white

define tf=1.8*tc + 32
set gxout shaded
set z 1
d tf
run cbar.gs

set gxout contour
set ccolor 1
set cint 4
d slvl
```

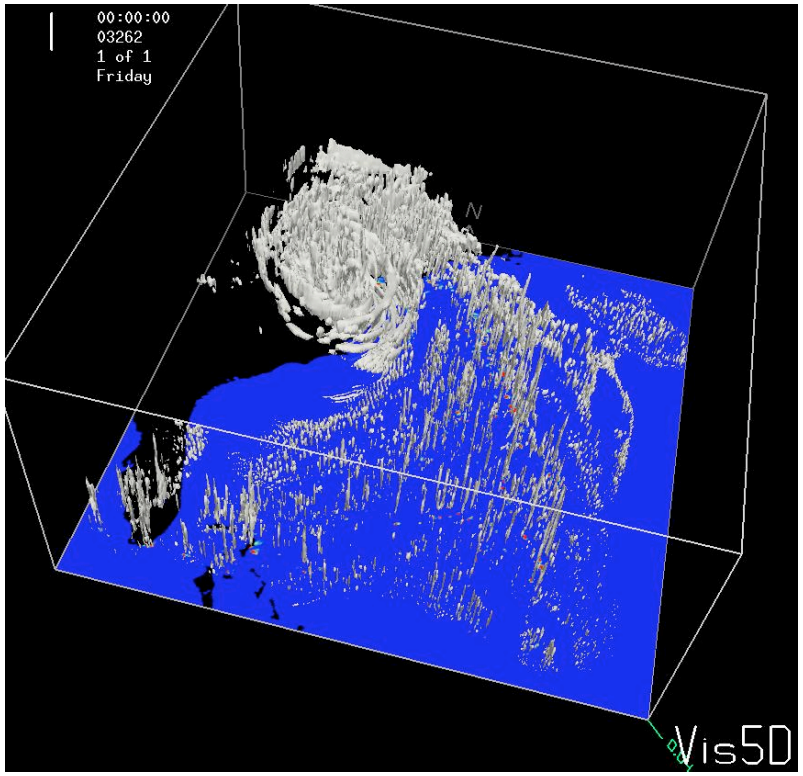
vis5d specific notes

- **vis5d is a three-dimensional visualization software**
- **vis5d is free and can be downloaded from:** http://www.ssec.wisc.edu/~billh/vis5d.html
- **Run**

  vis5d *output_root_name*.v5d

- **Graphical Interface**

vis5d graphical interface



VAPOR
Visualization and Analysis Platform for Oceanic, atmospheric and solar Research

Alan Norton
alan@ucar.edu
vapor@ucar.edu
National Center for Atmospheric Research

Computational and Information Systems Laboratory
National Center for Atmospheric Research

WRF in VAPOR

- **Interactive 3D visualization of WRF-ARW data *(wrfout files only)***
- **WRF functionality has been added in v1.2**
- **Available free on Linux, Windows, Mac**
- **Interactive rendering and animation (using GPU acceleration)**
- **Simple 2-step data conversion from WRF output to VAPOR**
  - wrfvdfcreate & wrf2vdf
- **Volume rendering**
- **Intuitive color/opacity editor**
- **Isosurface rendering**

WRF in VAPOR

- Steady and unsteady flow integration
- Interactive seed placement
- Data probing
- Contour plotting
- Terrain surface image render
- Interactive performance on terabyte datasets

- Downloads, documentation, examples at: http://www.vapor.ucar.edu

- http://www.vapor.ucar.edu/doc/WRFsupport.pdf

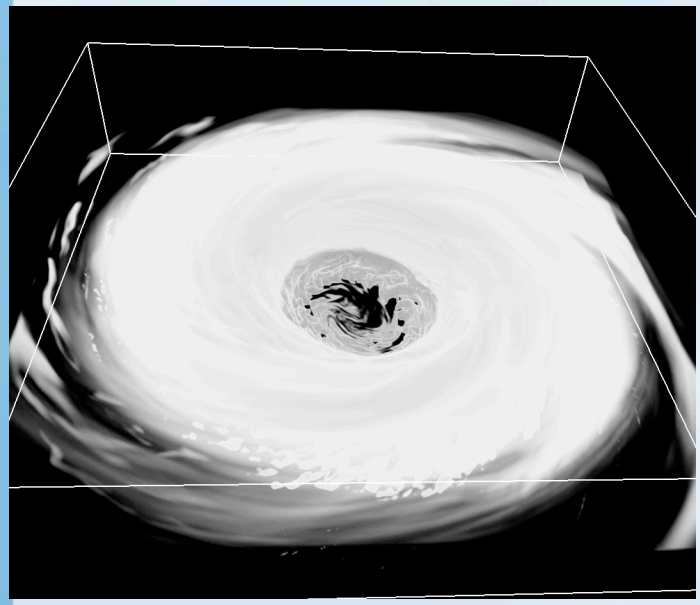
WRF in VAPOR

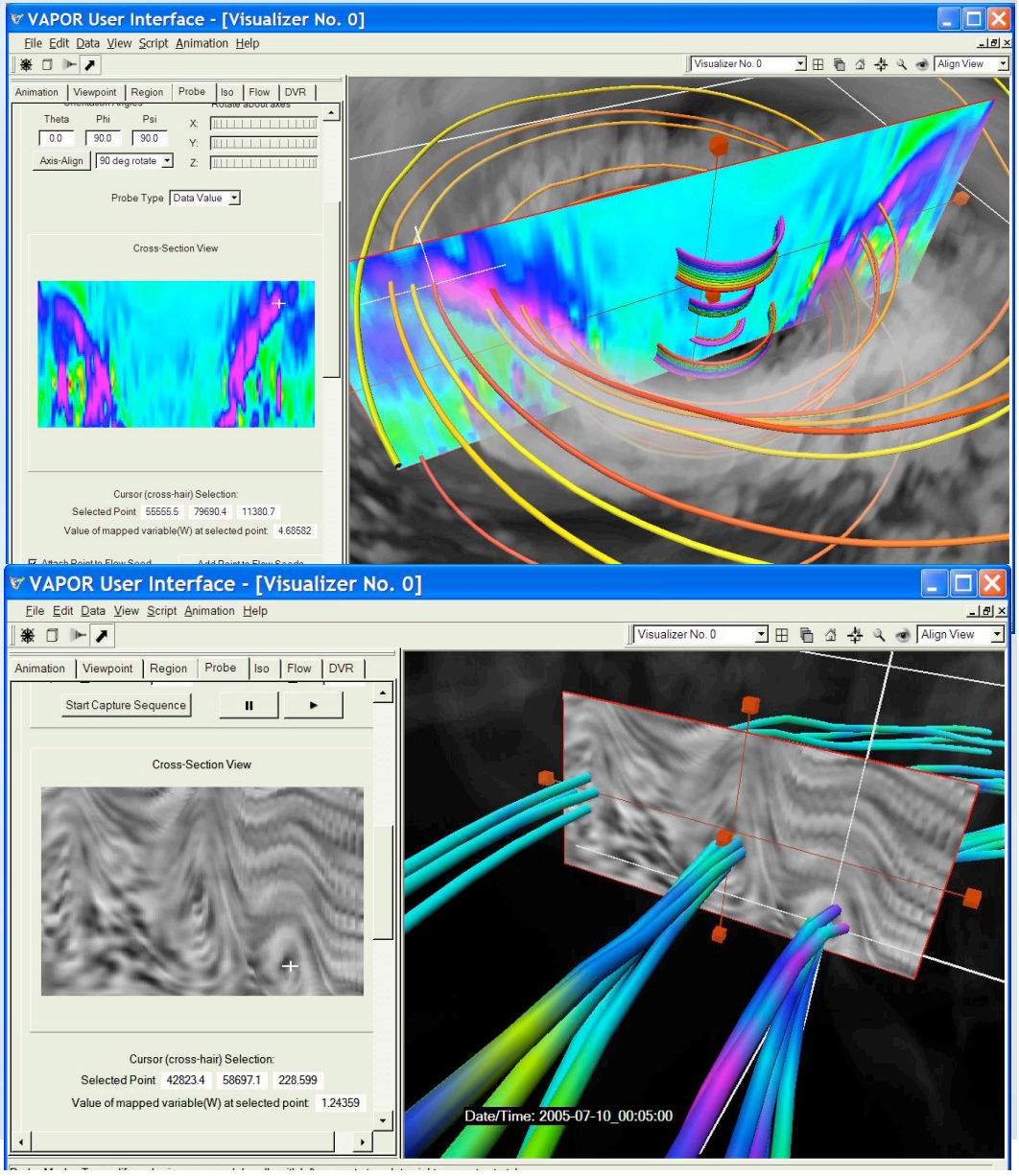
- Steady and unsteady flow integration
- Interactive seed placement
- Data probing
- Contour plotting
- Terrain surface image render
- Interactive performance on terabyte datasets

- Downloads, documentation, examples at: http://www.vapor.ucar.edu

- http://www.vapor.ucar.edu/doc/WRFsupport.pdf

WRF in VAPOR





CISL Computational and Information Systems Laboratory
National Center for Atmospheric Research