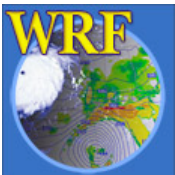


Running the WRF Preprocessing System

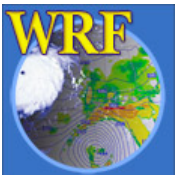
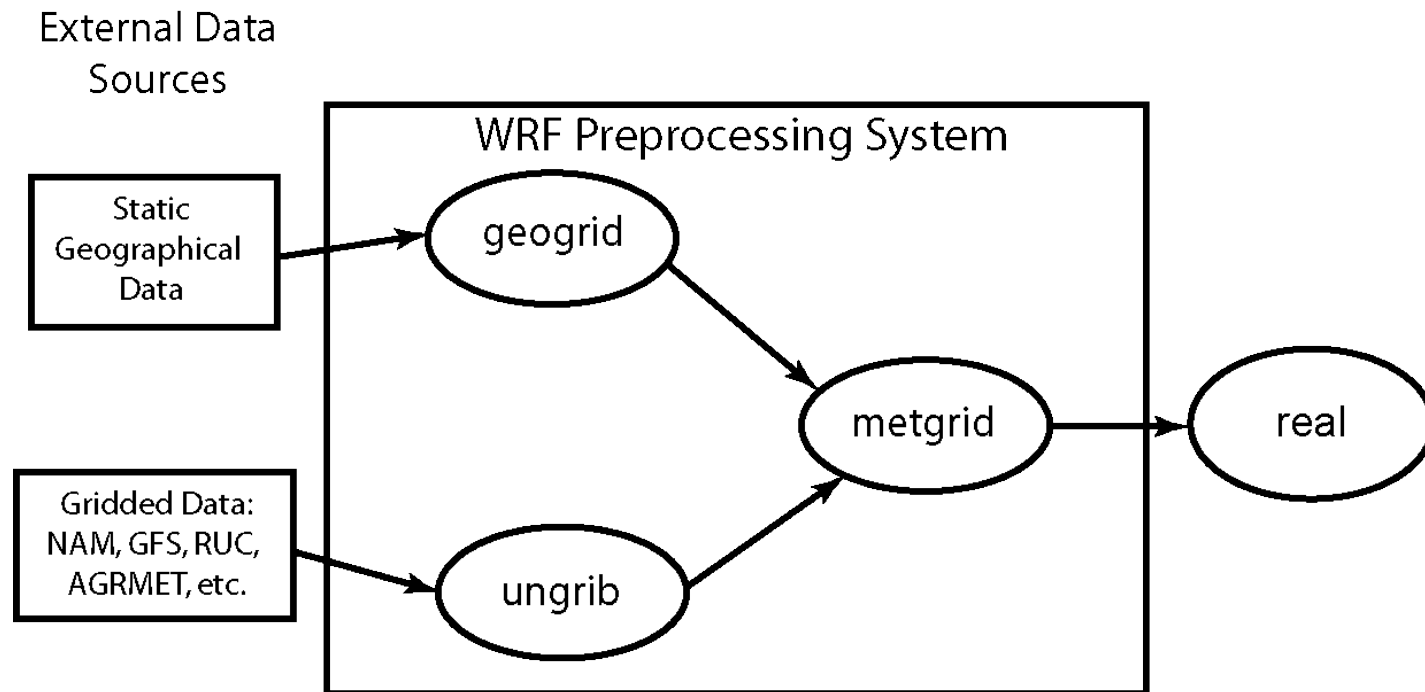
Michael Duda



Winter 2008 WRF Users Tutorial

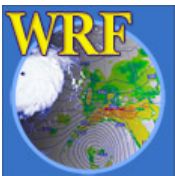
Review

- Briefly recall the data flow among programs:



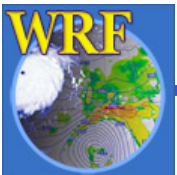
Review

- geogrid (think geographical)
 - Define size/location of model domains and interpolate static terrestrial fields to simulation grids
- ungrib (think un+grib)
 - Extract meteorological fields from GRIB files
- metgrid (think meteorological)
 - Horizontally interpolate meteorological fields (from ungrib) to simulation grids (defined by geogrid)



Overview

- How to run through the WPS for basic cases
 - Basic steps for running WPS
 - Live demonstration
- WPS utility programs
- Common WPS pitfalls



Running geogrid

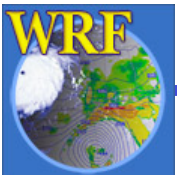
Basic steps to run geogrid

1) Edit `namelist.wps`

- set WRF core (either 'ARW' or 'NMM')
- define projection and domain locations
- specify path to static terrestrial data

A note about editing `namelist.wps`:

When running the WPS program `<program_name>`, it is only necessary to set variables in the sections `&share` and `&<program_name>`



Running geogrid

2) In the geogrid directory, link `GEOGRID.TBL` to the correct `GEOGRID.TBL` file

- For ARW, link to `GEOGRID.TBL.ARW`
- For NMM, link to `GEOGRID.TBL.NMM`

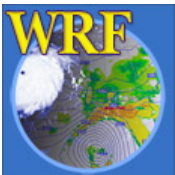
3) Run geogrid

4) Check geogrid output

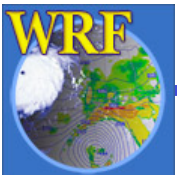
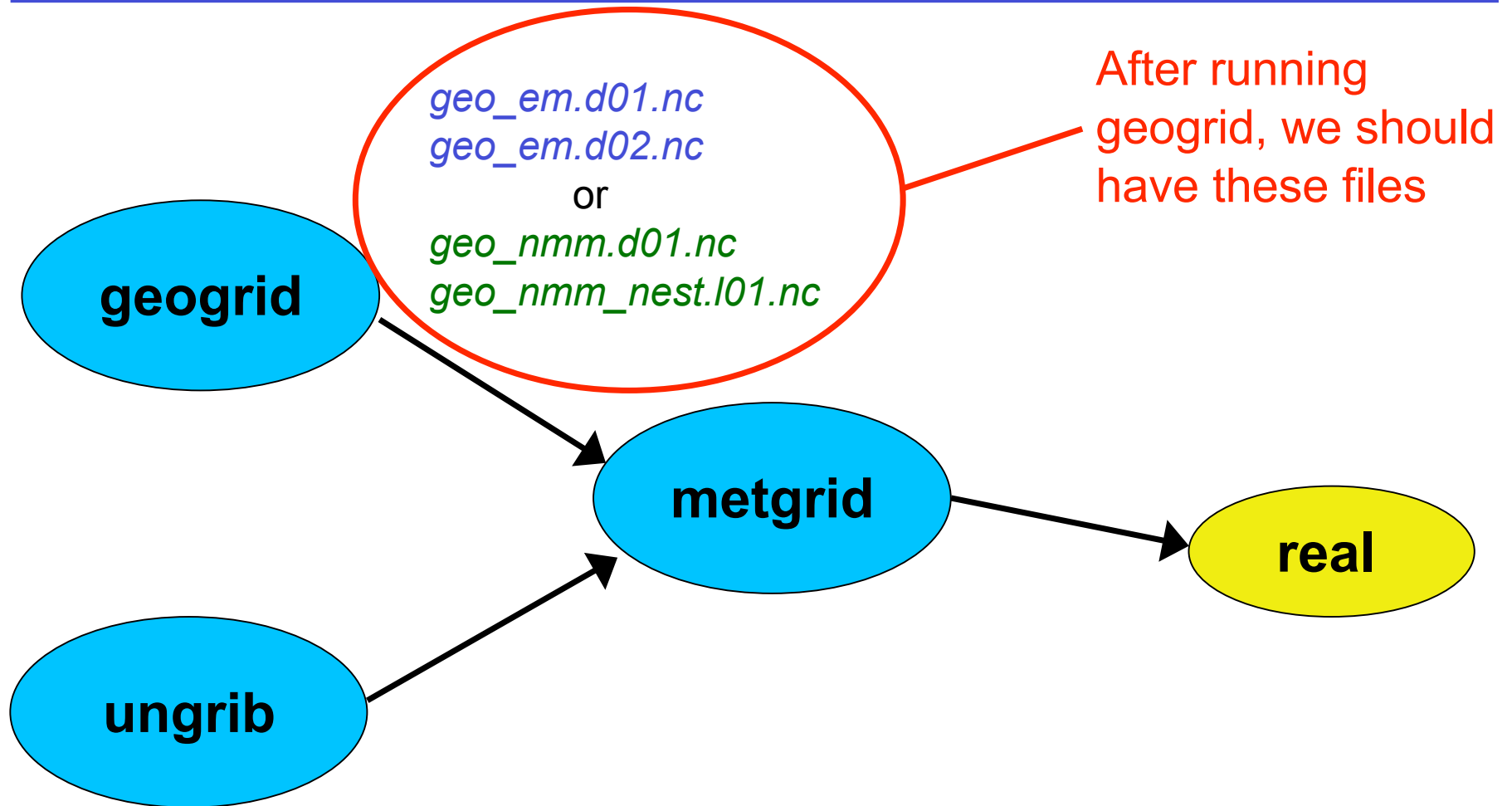
- Did geogrid run successfully?

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!  
!   Successful completion of geogrid.                        !  
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

- Do `geo_em*` or `geo_nmm*` files exist?



Running geogrid



Running ungrib

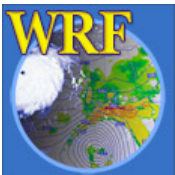
Basic steps to run ungrib

1) Edit `namelist.wps`

- specify starting and ending times for domains
- specify interval between output times
(ungrib can temporally interpolate)

2) Link the proper Vtable to the file `Vtable`

3) Link first-guess GRIB files to `GRIBFILE.AAA`,
`GRIBFILE.AAB`, ...



Running ungrib

4) Run ungrib

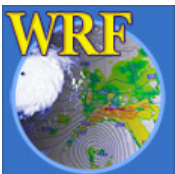
5) Check ungrib output

- Did ungrib run successfully?

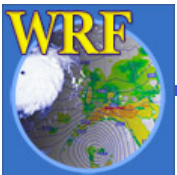
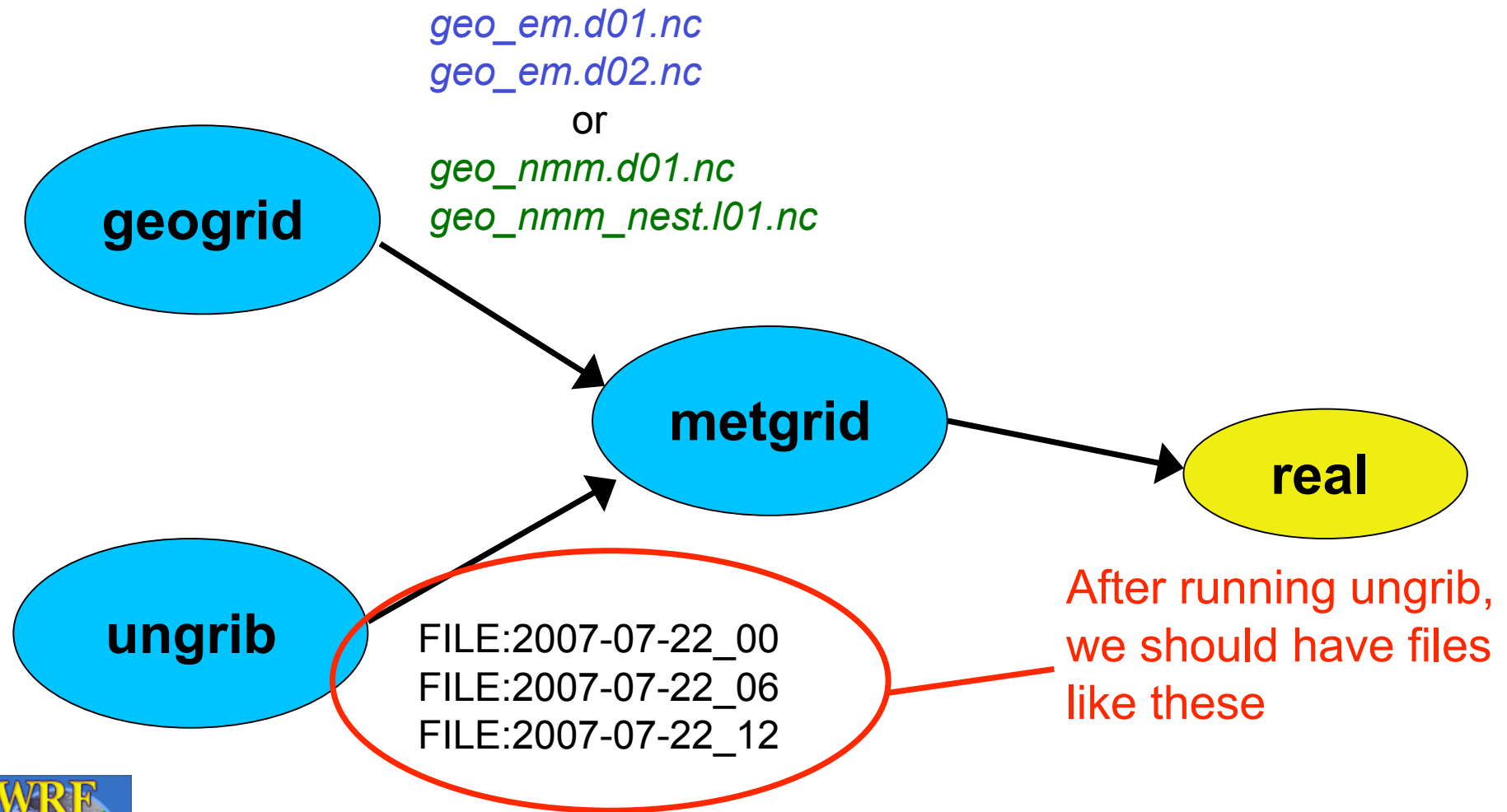
```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!  
!   Successful completion of ungrib.                                !  
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

- Do `FILE:YYYY-MM-DD_HH` files exist?

- Are all of the expected fields in the ungrib output files?



Running ungrib



Running metgrid

Basic steps to run metgrid

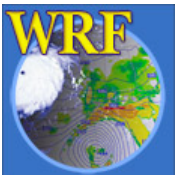
1) Edit `namelist.wps`

- specify starting and ending times for all grids
- specify paths and prefixes of ungrib output

2) In the metgrid directory, link to the correct METGRID.TBL file

- For ARW, link to `METGRID.TBL.ARW`
- For NMM, link to `METGRID.TBL.NMM`

3) Run metgrid



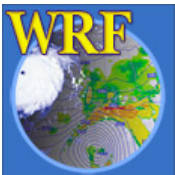
Running metgrid

4) Check metgrid output

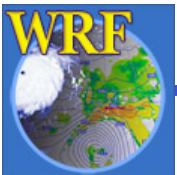
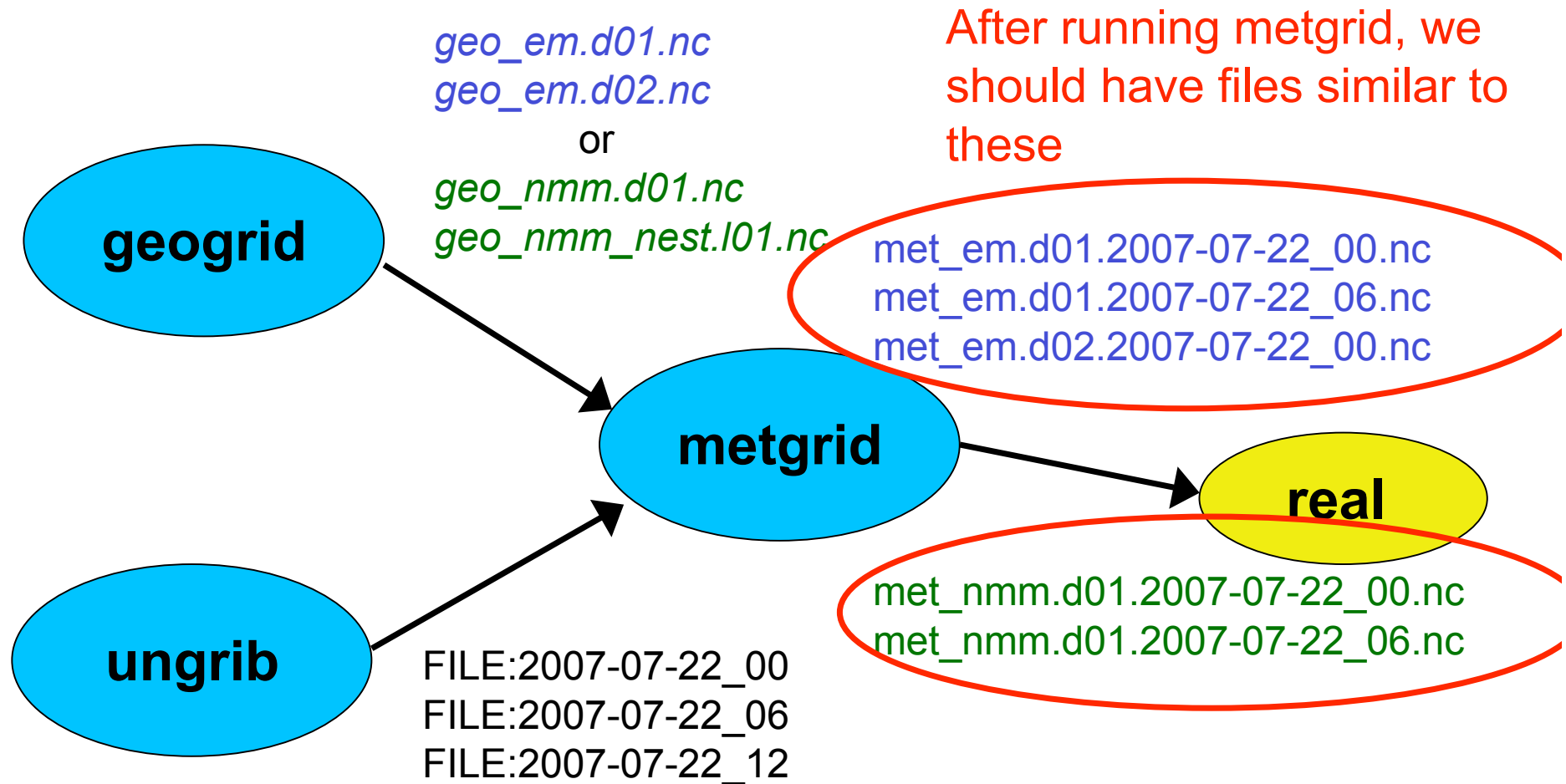
- Did metgrid run successfully?

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!  
!   Successful completion of metgrid.                        !  
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

- Do `met_em.d0n.YYYY-MM-DD_HH.nc` or
`met_nmm.d01.YYYY-MM-DD_HH.nc` files exist?

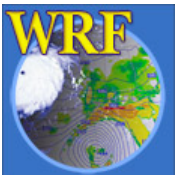


Running metgrid



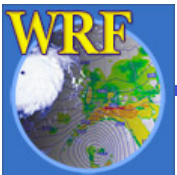
Running WPS: Summary

- The basic steps to run each WPS program can be summarized as:
 - Set variables in the `&share` and `&<program name>` sections in the `namelist.wps` file
 - E.g., for metgrid, edit `&share` and `&metgrid` sections
 - For geogrid/metgrid, link `GEOGRID.TBL/METGRID.TBL`
 - For ungrib, link `Vtable` and `GRIBFILE.??? files`
 - Run the program executable
 - Check that the proper output files exist and contain good data



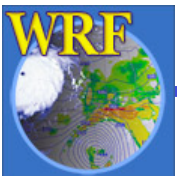
DEMONSTRATION: Basic test case

- For this demonstration:
 - Assume we're given an NMM domain specification
 - We will only use a single source of GRIB data
 - Basically, we'll just run each component to see what files are created during a successful WPS run for NMM



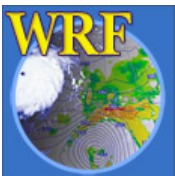
DEMONSTRATION: Typical case

- What new things will we do?
 - Run this time for ARW
 - We need to come up with ARW domain specification “from scratch”
 - The meteorological data come in three pieces: 3-d fields, surface fields, and fixed fields
 - AWIP data
 - We also want to use a separate SST field



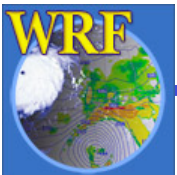
DEMONSTRATION: Summary

- What steps did we take?
 - 1) Edit `&geogrid` namelist and refine the location of our coarse domain and nests
 - 2) Set dates in `&share` namelist, and run `ungrib.exe` separately for each piece of data, changing the prefix in the `&ungrib` namelist each time
 - 3) List all data sources in the `&metgrid` namelist before running `metgrid`



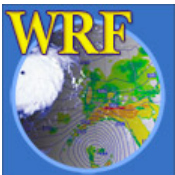
Overview

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WPS Utility Programs

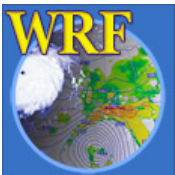
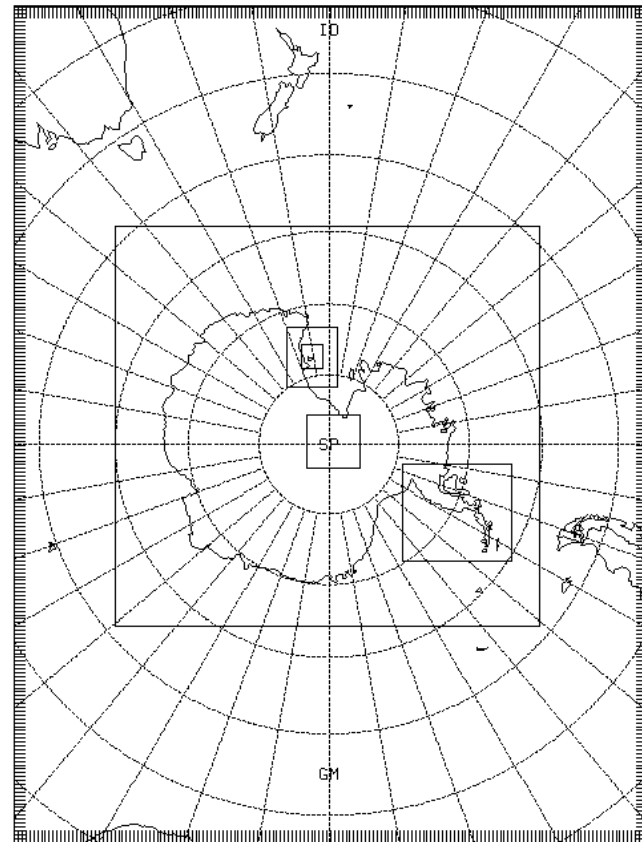
- Besides geogrid, ungrib, and metgrid, some simple utility programs are distributed with WPS:
 - For checking contents of intermediate format files
 - For listing contents of GRIB1 & GRIB2 files
 - To assist in locating domains
- Some programs use NCAR Graphics libraries for plotting
 - For these utilities, NCAR Graphics must be installed



Utility: plotgrids

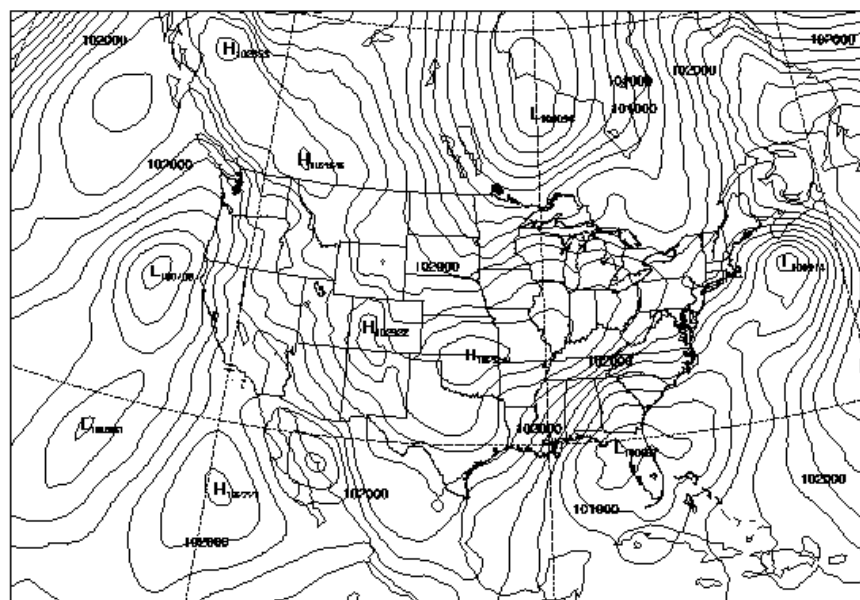
The *plotgrids* program plots the location of grids defined in *namelist.wps*

The plotgrids program can be used to iteratively refine the locations of grids.



Utility: plotfmt

The plotfmt program plots the contents of ungrib intermediate-format files



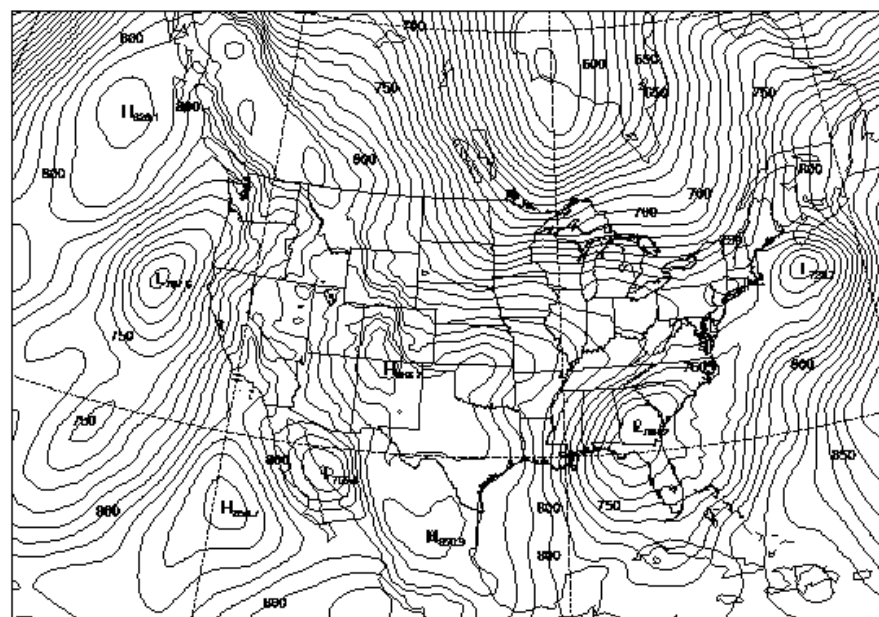
201300 PMSL

Pa

Sea-level Pressure
WPS intermediate format

CONTOUR FROM 100200 TO 103200 BY 200

unknown model from NCEP GRID 212



92500 GHT

m

Height
WPS intermediate format

CONTOUR FROM 580 TO 880 BY 10

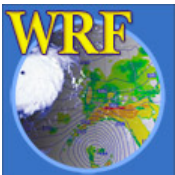
unknown model from NCEP GRID 212



Utility: rd_intermediate

The rd_intermediate lists information about the fields found in an intermediate-format file

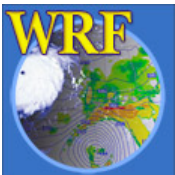
```
=====
FIELD = TT
UNITS = K DESCRIPTION = Temperature
DATE = 2000-01-24_12:00:00 FCST = 0.000000
SOURCE = unknown model from NCEP GRID 212
LEVEL = 200100.000000
I,J DIMS = 185, 129
IPROJ = 1
  REF_X, REF_Y = 1.000000, 1.000000
  REF_LAT, REF_LON = 12.190000, -133.459000
  DX, DY = 40.635250, 40.635250
  TRUELAT1 = 25.000002
DATA(1,1)=295.910950
=====
```



Utility: g1print and g2print

The *g1print* and *g2print* programs list the contents of a GRIB1 or GRIB2 file:

rec num	Prod Disc	Cat	Param num	Lvl code	Lvl one	Lvl two	Name	Time	Fcst hour
1	0	3	5	100	100000	0	HGT	2006-08-16_12:00:00	00
2	0	3	5	100	97500	0	HGT	2006-08-16_12:00:00	00
3	0	3	5	100	95000	0	HGT	2006-08-16_12:00:00	00
4	0	3	5	100	92500	0	HGT	2006-08-16_12:00:00	00
5	0	3	5	100	90000	0	HGT	2006-08-16_12:00:00	00
6	0	3	5	100	85000	0	HGT	2006-08-16_12:00:00	00
7	0	3	5	100	80000	0	HGT	2006-08-16_12:00:00	00
8	0	3	5	100	75000	0	HGT	2006-08-16_12:00:00	00
9	0	3	5	100	70000	0	HGT	2006-08-16_12:00:00	00
10	0	3	5	100	65000	0	HGT	2006-08-16_12:00:00	00



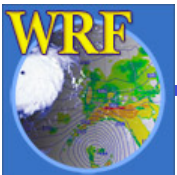
WPS Utility Programs

The utility programs that come with WPS can be helpful when diagnosing problems with WPS output

- All utilities are found in the WPS/util directory
- Users are encouraged to make use of these utilities to examine WPS input and output files

LIVE DEMONSTRATION OF UTILITIES

(time permitting)

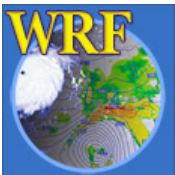


Common WPS Pitfalls

- 1) All 3-d fields must have same number of levels in metgrid

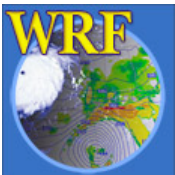
```
WRF_DEBUG: Warning DIM              4 , NAME
num_metgrid_levels REDefined by var GHT              27
26 in wrf_io.F90 line              2347
ERROR: Error in ext_pkg_write_field
```

- This is usually corrected by ensuring that all 3-d meteorological fields have surface level data



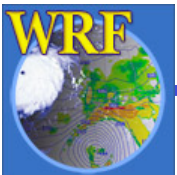
Common WPS Pitfalls

- 2) When using a regional data set (e.g., NAM), ensure that model domain is completely covered by the data
 - Points of missing data in domain will cause the real program to fail with seemingly unrelated messages
- 3) For native vertical coordinate data sets (e.g., RUCb), ensure that pressure and geopotential height fields are available



Common WPS Pitfalls

- 4) When switching dynamical cores, don't forget to change the links in the geogrid and metgrid directories to the correct versions of the GEOGRID.TBL and METGRID.TBL files



Questions?

