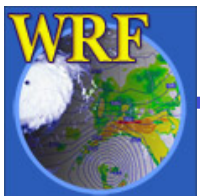




# Running the WRF Preprocessing System



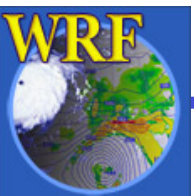
The Basic WRF Users' Tutorial  
27 – 31 January 2014, Boulder, CO

\*NCAR is sponsored by the  
National Science Foundation

# Overview

---

- How to run through the WPS for basic cases
  - Basic steps for running the WPS
    - Geogrid
    - Ungrib
    - Metgrid
- WPS utility programs
- Common WPS mistakes



# Running geogrid

## STEP 1: Edit `namelist.wps`

For geogrid, only the `&share` and `&geogrid` namelists need to be edited in `namelist.wps`

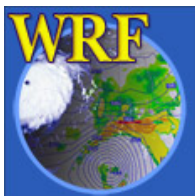
### `&share`

```
wrf_core = 'ARW',  
max_dom = 2,  
io_form_geogrid = 2,
```

### `&geogrid`

```
parent_id           = 1,      1,  
parent_grid_ratio   = 1,      3,  
i_parent_start      = 1,     20,  
j_parent_start      = 1,     17,  
e_we                = 220,   181,  
e_sn                = 175,   181,  
geog_data_res       = '5m',  '2m',  
dx                  = 15000,  
dy                  = 15000,  
map_proj            = 'lambert',  
ref_lat             = 37.0,  
ref_lon             = -97.0,  
truelat1            = 45.0,  
truelat2            = 30.0,  
stand_lon           = -97.0,  
geog_data_path      = '/data/static/geog/'
```

/



# Running geogrid

## STEP 1: Edit `namelist.wps`

`&share`

```
wrf_core = 'ARW',  
max_dom = 2,  
io_form_geogrid = 2,  
/
```

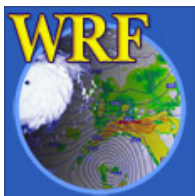
Which WRF core?

For ARW, set to 'ARW'  
For NMM, set to 'NMM'

Total number of model domains,  
including nests, for ARW.

Format for geogrid output files;  
2=netCDF is recommended.

*See p. 3-8 and 3-37*



# Running geogrid

## STEP 1: Edit `namelist.wps`

### `&geogrid`

```
parent_id           = 1, 1,
parent_grid_ratio   = 1, 3,
i_parent_start      = 1, 20,
j_parent_start      = 1, 17,
```

```
e_we               = 220, 181,
e_sn               = 175, 181,
dx                 = 15000,
dy                 = 15000,
```

```
geog_data_res      = '5m', '2m',
```

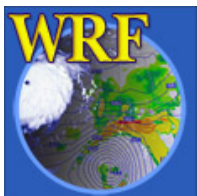
....

*See p. 3-9, 3-19, and 3-38*

**Nesting:** Who is the parent?  
What is the grid ratio for each nest? Where is it located in its parent?

**Domain sizes:** How many grid points does the domain have? What is the grid spacing?

**Static data:** What resolution of source data to interpolate from for each domain?  
'30s', '2m', '5m', or '10m'?



# Running geogrid

## STEP 1: Edit `namelist.wps`

`&geogrid`

...

```
map_proj      = 'lambert',  
ref_lat       = 37.0,  
ref_lon       = -97.0,  
truelat1      = 45.0,  
truelat2      = 30.0,  
stand_lon     = -97.0,
```

**Map projection:** What projection to use? What are the parameters of the projection?

*See p. 3-9 and 3-40*

```
geog_data_path = '/data/static/geog/'
```

**Static data:** Where are the data directories (e.g., `topo_30s`) located?

*See p. 3-41*



# Running geogrid

---

**STEP 2**: Make sure GEOGRID.TBL is linked to the correct version of GEOGRID.TBL

- There are multiple GEOGRID.TBL files to support multiple dynamical cores in WRF
- GEOGRID.TBL.ARW must be used for ARW
- GEOGRID.TBL.NMM must be used for NMM

```
> ls geogrid/GEOGRID.TBL  
GEOGRID.TBL -> GEOGRID.TBL.ARW
```



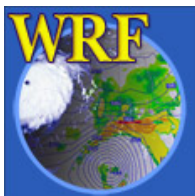
# Running geogrid

## STEP 3: Run geogrid.exe

```
Parsed 11 entries in GEOGRID.TBL
Processing domain 1 of 2
  Processing XLAT and XLONG
  Processing MAPFAC
  Processing F and E
  Processing ROTANG
  Processing LANDUSEF
  Calculating landmask from LANDUSEF
  Processing HGT_M
...
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
! Successful completion of geogrid.                                     !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

Geogrid processes each domain individually. There will be one section of messages for each domain.

As each field is processed, a message will be written to the screen and to the geogrid.log file.





# Running geogrid

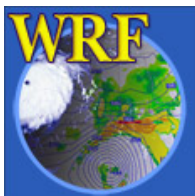
---

## STEP 4: Check that geogrid ran successfully

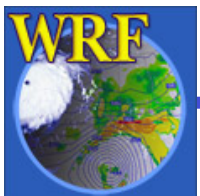
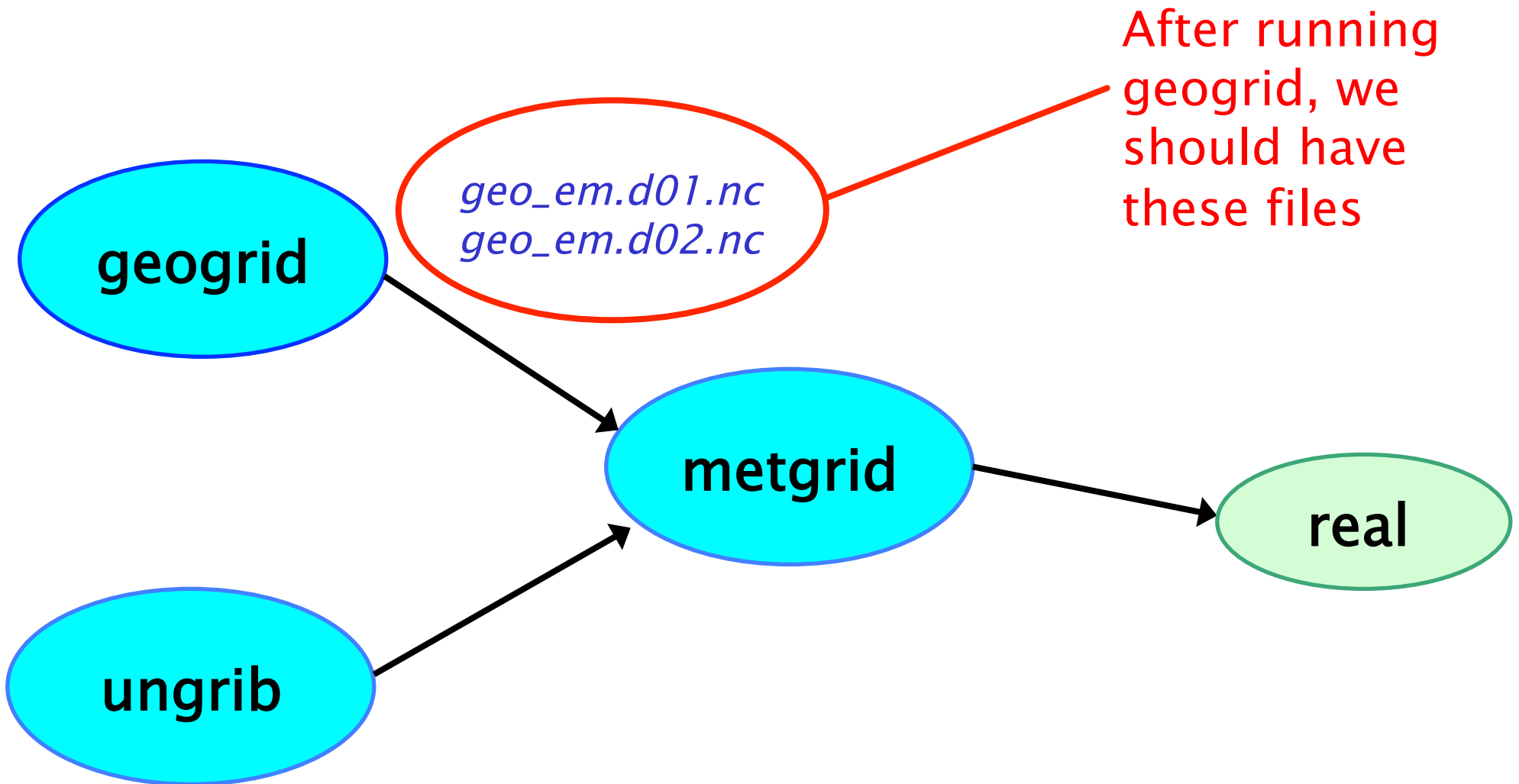
If geogrid ran successfully, this message should be printed:

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

If there was an error, check for an **ERROR** or **WARNING** message in the `geogrid.log` file, or for a system error, like “Segmentation fault”.



# Running geogrid



# Running ungrib

---

## STEP 1: Edit `namelist.wps`

For ungrib, only the `&share` and `&ungrib` namelists need to be edited

### `&share`

```
wrf_core = 'ARW',  
max_dom = 2,  
start_date = '2006-04-01_00:00:00',  
end_date = '2006-04-01_12:00:00',  
interval_seconds = 21600  
io_form_geogrid = 2,  
/
```

### `&ungrib`

```
out_format = 'WPS',  
prefix = 'GFS',  
/
```



# Running ungrib

## STEP 1: Edit `namelist.wps`

### &share

```
wrf_core = 'ARW',  
max_dom = 2,
```

```
start_date = '2006-04-01_00:00:00',  
end_date   = '2006-04-01_12:00:00',
```

```
interval_seconds = 21600
```

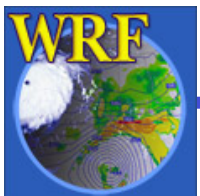
```
io_form_geogrid = 2,
```

/

**Data time range:** Between which times should ungrib process GRIB data?

**Data frequency:** How many seconds between output files for ungrib? E.g., 10800 s = 3 hrs

*See p. 3-14, and 3-38*



# Running ungrib

## STEP 1: Edit `namelist.wps`

`&ungrib`

`out_format = 'WPS',`

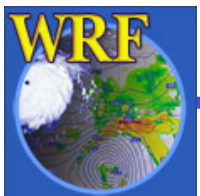
`prefix = 'GFS',`

`/`

**Intermediate file format:** Which format to use for intermediate files? 'WPS', 'SI', or 'MM5' are possible; 'WPS' is recommended.

**Intermediate file names:** Gives prefix for intermediate files.  
Prefix can include a path.  
E.g., 'XZY' would give intermediate files named `XYZ:yyyy-mm-dd_hh`.

*See p. 3-14, 3-23, and 3-41*



# Running ungrib

---

**STEP 2**: Link the correct Vtable to the file name “Vtable” in the run directory

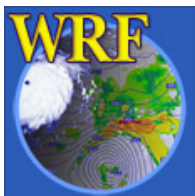
- Some Vtables are provided with WPS in the **WPS/ungrib/Variable\_Tables** directory
  - E.g., Vtable.GFS, Vtable.SST, Vtable.ECMWF
- Ungrib always expects to find a file named **vtable** in the run directory

*See p. 3-15*

> In -s ungrib/Variable\_Tables/Vtable.GFS Vtable

> ls Vtable

Vtable -> ungrib/Variable\_Tables/Vtable.GFS



# Running ungrib

## STEP 3: Link GRIB files to the correct file names in the run directory

- Ungrib always expects GRIB files to be named GRIBFILE.AAA, GRIBFILE.AAB, GRIBFILE.AAC, etc., in the run directory
- The `link_grib.csh` script can be used to link GRIB files to these file names:

```
> link_grib.csh /data/GRIB/GFS/gfs*
```

*See p. 3-15*

```
> ls GRIBFILE.*
```

```
GRIBFILE.AAA -> /data/GRIB/GFS/gfs_060401_00_00
```



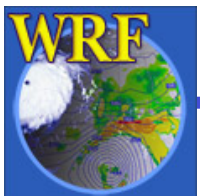
# Running ungrrib

## STEP 4: Run ungrrib.exe

```
*** Starting program ungrrib.exe ***
Start_date = 2006-08-16_12:00:00 ,      End_date = 2006-08-16_12:00:00
output format is WPS
Path to intermediate files is ./
ungrrib - grib edition num          2
```

```
#####
Inventory for date = 2006-08-16 12:00:00
```

PRES	TT	UU	VV	RH	HGT	
2013.0	O	O	O	O	O	O
2001.0	X	X	X	X	O	X
1000.0	X	X	X	X	X	
975.0	X	X	X	X	X	
950.0	X	X	X	X	X	
925.0	X	X	X	X	X	
900.0	X	X	X	X	X	





# Running ungrib

---

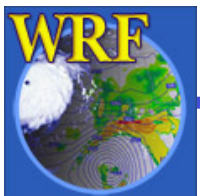
## STEP 5: Check that ungrib ran successfully

If ungrib ran successfully, this message should be printed:

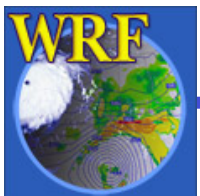
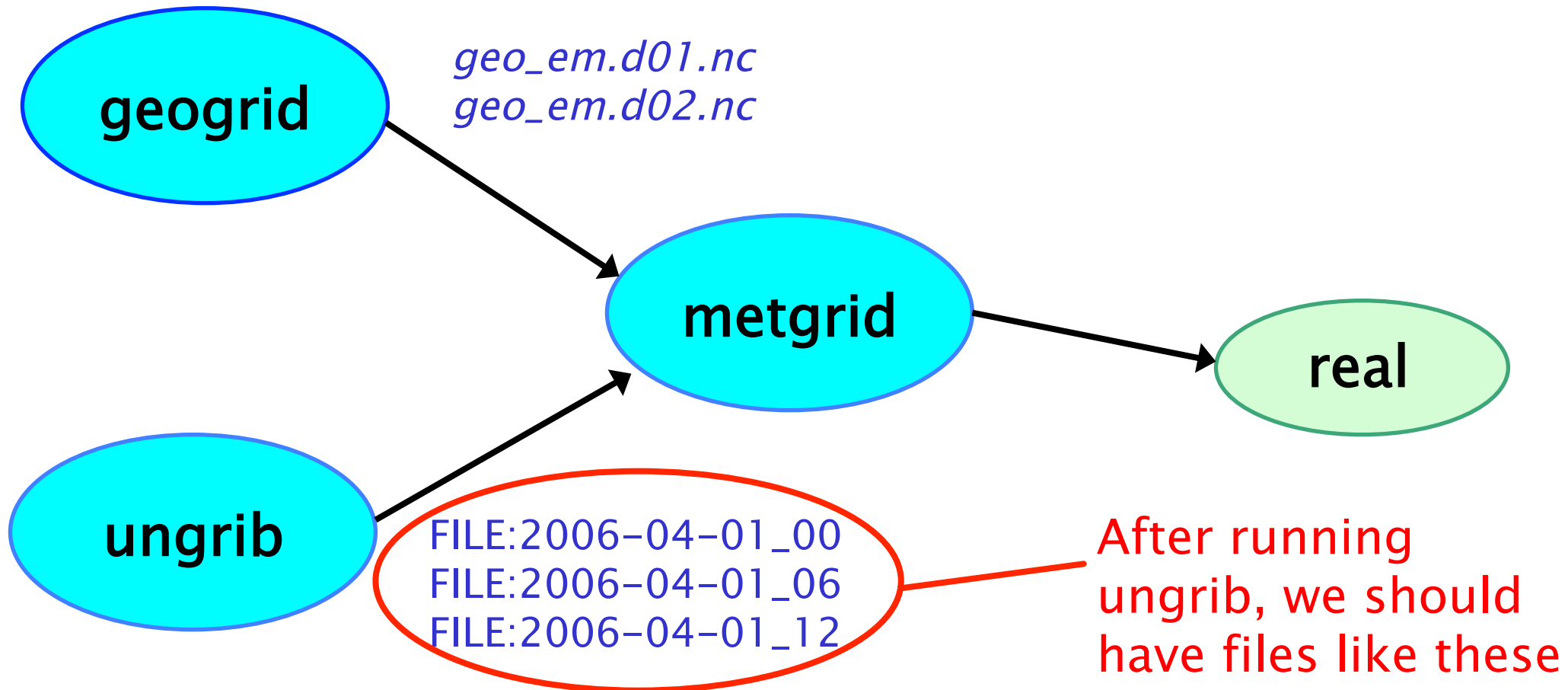
```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!  
! Successful completion of ungrib. !  
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

If there was an error, check for error message in ungrib's printout or in the `ungrid.log` file.

Common errors are related to incorrect date specifications in the `&share` namelist, or because GRIB2 data was used with a version of WPS compiled without GRIB2 libraries.



# Running ungrib



# Running metgrid

---

## STEP 1: Edit `namelist.wps`

For metgrid, only the `&share` and `&metgrid` namelists need to be edited

### `&share`

```
wrf_core = 'ARW',  
max_dom = 2,  
start_date = '2006-04-01_00:00:00', '2006-04-01_00:00:00',  
end_date   = '2006-04-01_12:00:00', '2006-04-01_00:00:00',  
interval_seconds = 21600  
io_form_geogrid = 2,
```

### `&metgrid`

```
fg_name = 'GFS',  
constants_name = 'SST:2006-04-01_00',  
io_form_metgrid = 2,
```



# Running metgrid

## STEP 1: Edit `namelist.wps`

`&share`

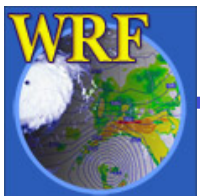
```
wrf_core = 'ARW',  
max_dom = 2,
```

```
start_date = '2006-04-01_00:00:00', '2006-04-01_00:00:00',  
end_date   = '2006-04-01_12:00:00', '2006-04-01_00:00:00',
```

```
interval_seconds = 21600  
io_form_geogrid = 2,
```

**Data time range:** Time range to process *for each domain*. Usually, only the initial time is needed for ARW nested domains.

See p. 3-17 and 3-37



# Running metgrid

## STEP 1: Edit `namelist.wps`

**Intermediate file prefixes:** Prefix (or prefixes) of intermediate files to interpolate to model domain. Should match prefix given to `ungrib`.

*See p. 3-17 and 3-24*

`&metgrid`

`fg_name = 'GFS',`

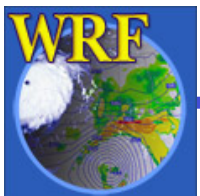
`constants_name = 'SST:2006-04-01_00',`

`io_form_metgrid = 2,`

**Constant fields:** Optional name of an intermediate file with fields to be used for every time period.

**Metgrid I/O format:** Which I/O format to use for metgrid output? 2=netCDF is recommended.

*See p. 3-17, and 3-41*



# Running metgrid

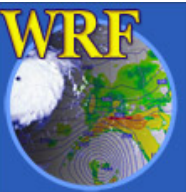
---

**STEP 2**: Make sure METGRID.TBL is linked to the correct version of METGRID.TBL

- There are multiple METGRID.TBL files to support multiple dynamical cores in WRF
- METGRID.TBL.ARW should be used for ARW
- METGRID.TBL.NMM should be used for NMM

```
> ls metgrid/METGRID.TBL
```

```
METGRID.TBL -> METGRID.TBL.ARW
```



# Running metgrid

## STEP 3: Run metgrid.exe

```
Processing domain 1 of 2
  SST:2006-04-01_00
  Processing 2006-04-01_00
    GFS
  Processing 2006-04-01_06
    GFS
  Processing 2006-04-01_12
    GFS
Processing domain 2 of 2
  SST:2006-04-01_00
  Processing 2006-04-01_00
    GFS
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!  Successful completion of metgrid.  !
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

Fields from constant files  
(given using `constants_name`)  
are processed before any time  
varying fields.

Metgrid processes all time  
period for one domain before  
processing for the next  
domain



# Running metgrid

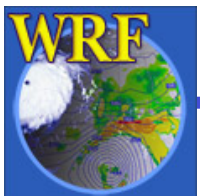
---

## STEP 4: Check that metgrid ran successfully

If metgrid ran successfully, this message should be printed:

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

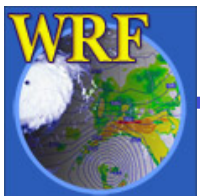
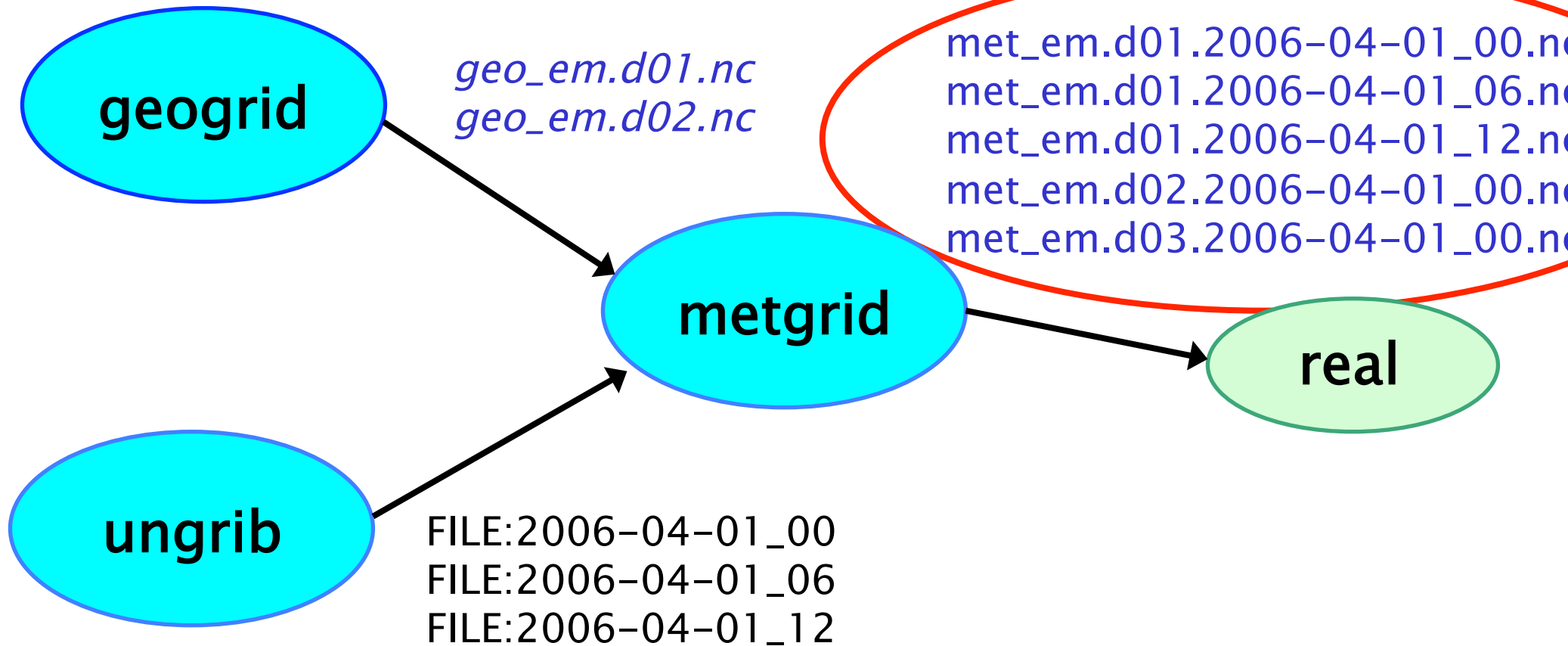
If there was an error, check for an **ERROR** or **WARNING** message in the `metgrid.log` file, or for a system error, like “Segmentation fault”.





# Running metgrid

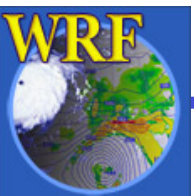
After running metgrid, we should have files similar to these



# Overview

---

- How to run through the WPS for basic cases
  - Basic steps for running WPS
    - Geogrid
    - Ungrib
    - Metgrid
- WPS utility programs
- Common WPS mistakes

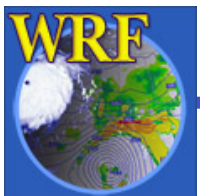


# WPS Utility Programs

---

- 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
  - For computing 3d pressure field for ECMWF data
- Some programs use NCAR Graphics libraries for plotting
  - For these utilities, *NCAR Graphics must be installed*

See p. 3-27

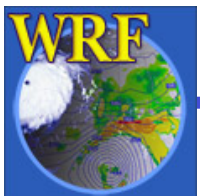


# WPS Utility Programs

---

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

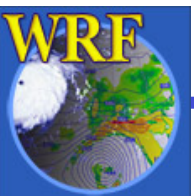
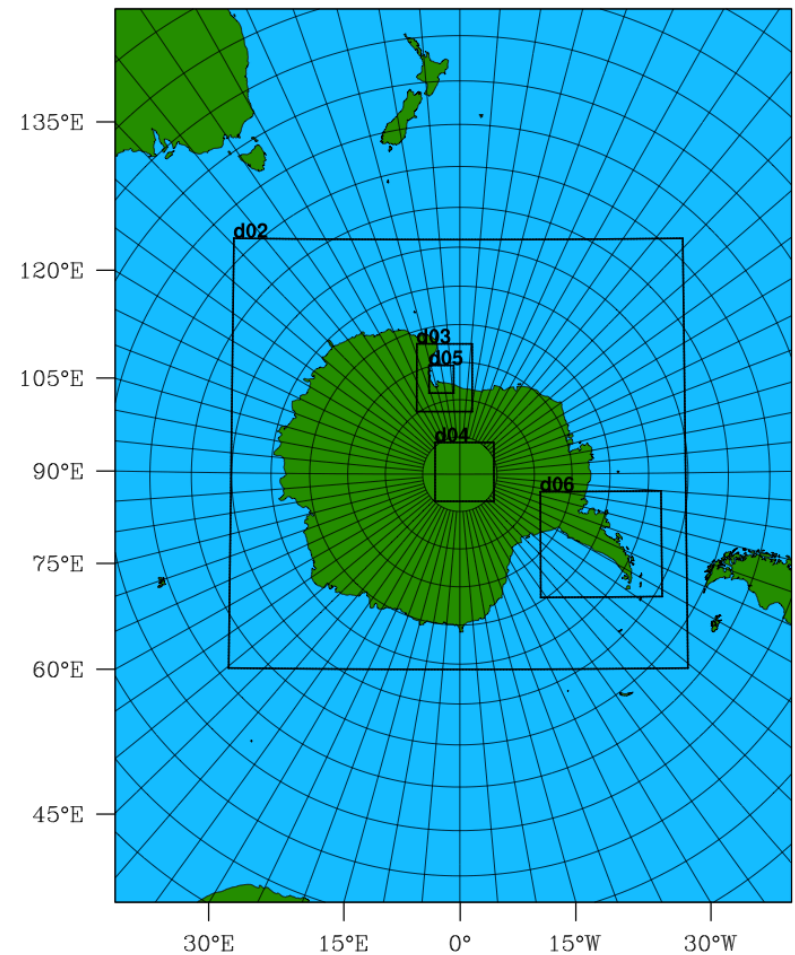
- All utilities are found in the `WPS/uti1` directory
- Users are encouraged to make use of these utilities to examine WPS input and output files



# Utility: `plotgrids.ncl`

The *plotgrids.ncl* script plots the locations of grids defined in *namelist.wps*

- *plotgrids* can be used to iteratively refine the locations of grids.
- *plotgrids.ncl* uses the *namelist.wps* file only, so there is no need to run *geogrid* first!



# 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
=====
```

