DEPARTMENT OF METEOROLOGY UNIVERSITY OF UTAH

The Abdus Salam International Centre for Theoretical Physics

Running WRF-Sfire with real data

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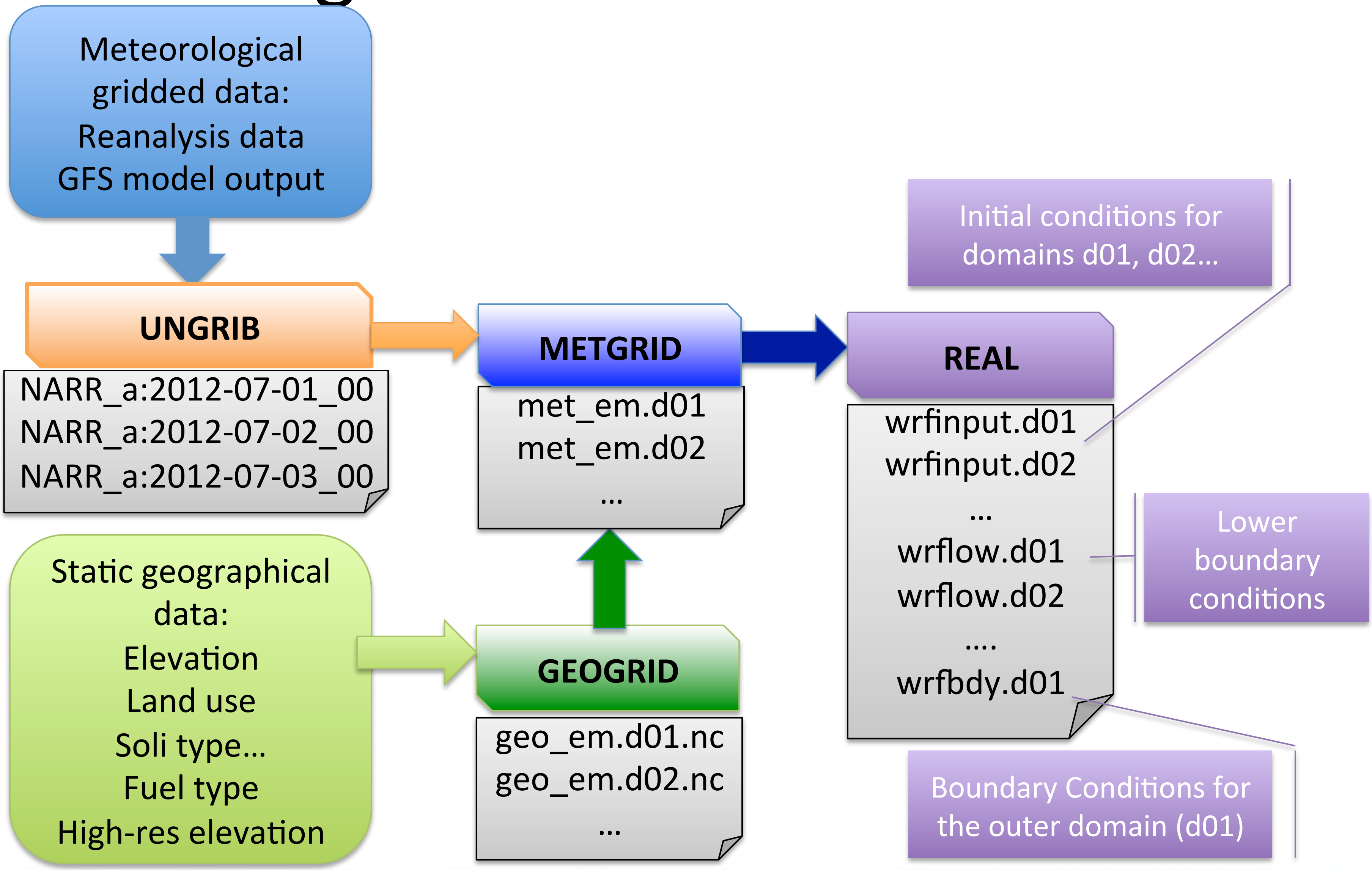
Running WRF-Sfire with real data

Process of running real WRF-Sfire case is very similar to running the regular WRF and consists of the following steps:

1. Getting needed data
2. Defining the domain setup in `namelist.wps`
3. linking meteorological files in grib format using `linkgrib.sh`
4. Uncompressing (ungribing) meteorological files using `ungrib.exe`
5. Preparing high-resolution fire data using `convert_geotiff`
6. Preparing `geo_em.d0X` files containing all static data for the WRF domains using `geogrid.exe`
7. Interpolating meteorological data to WRF domains defined by `geo_em.d0X` files using `metgrid.exe`
8. Defining simulation setup in `namelist.input` and `namelist.fire` and creating `wrfinput_d0X and wrfbdy_d0X` files using `real.exe`

Running WRF-Sfire with real data



Obtaining data for geogrid

- Geogrid needs the static data available from:

http://www2.mmm.ucar.edu/wrf/src/wps_files/geog_v3.1.tar.gz

- This dataset must be extracted (tar –xvf geog_v3.1.tar.gz)

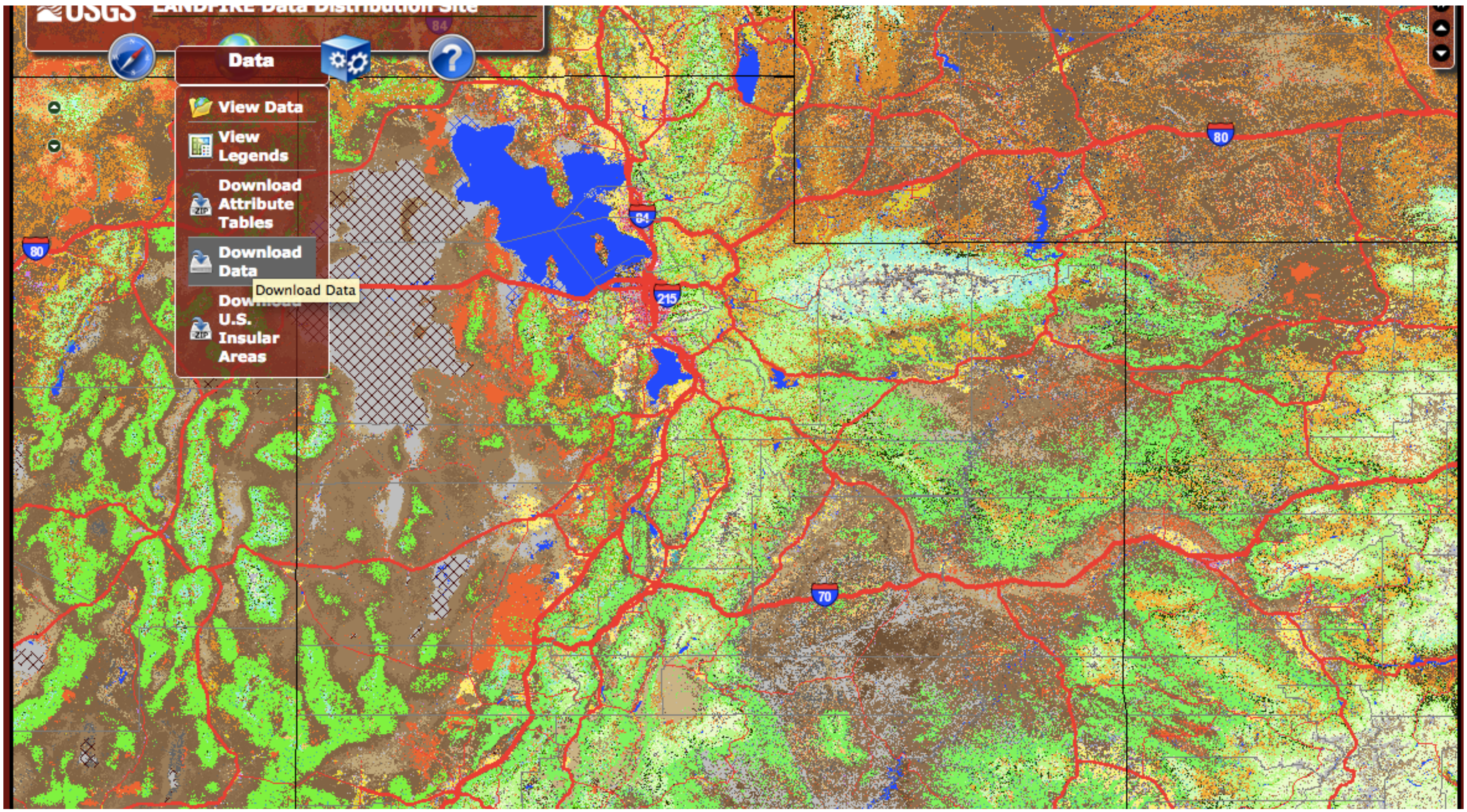
- Its location must be specified as `geog_data_path` in `namelist.wps`

  for instance:

  `geog_data_path = /home/jsmith/geog/`
- additionally high resolution elevation data and fuel data are needed in geotiff format
- for US they are available from: http://landfire.cr.usgs.gov/viewer/

Obtaining fire data for geogrid

http://landfire.cr.usgs.gov/viewer/



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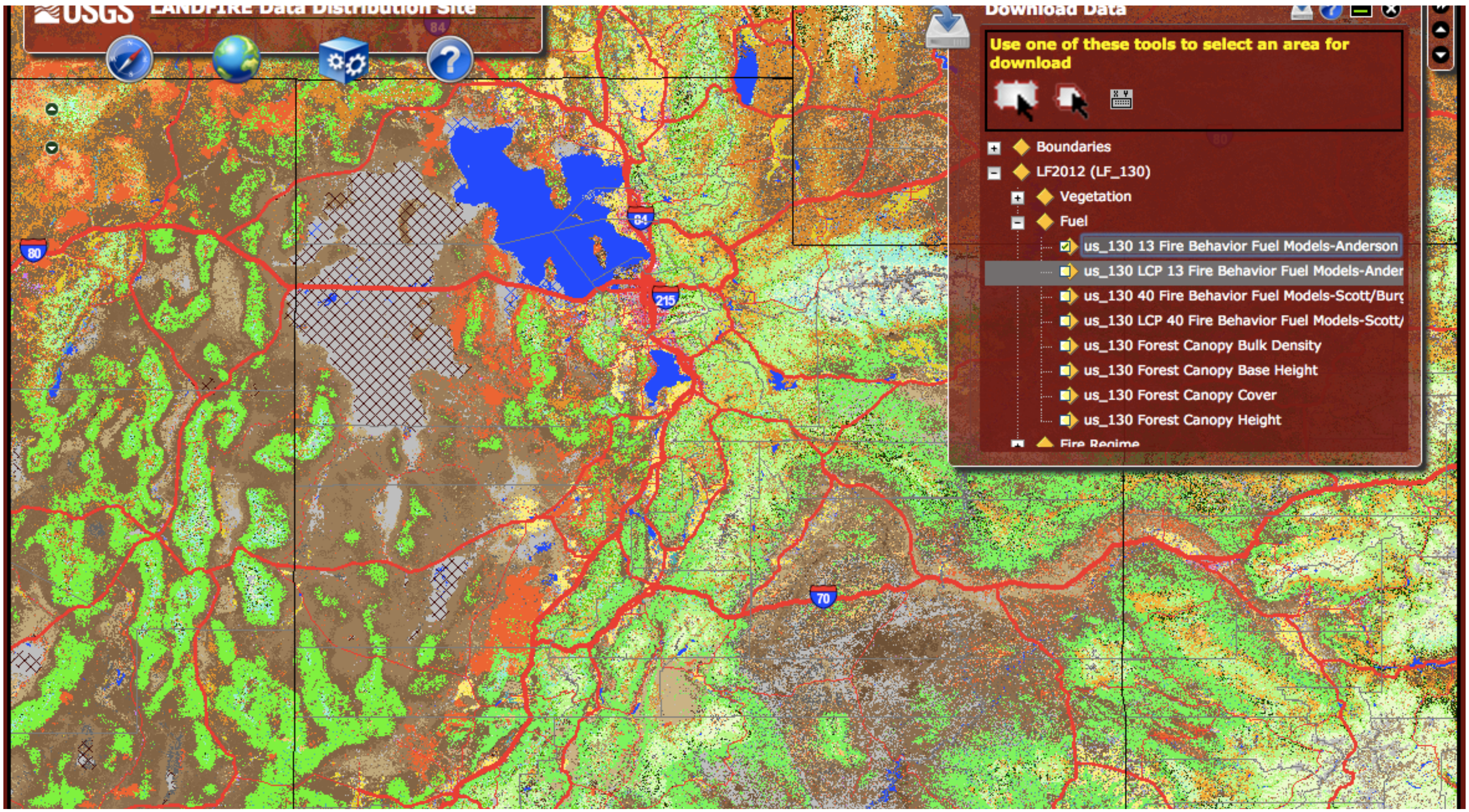
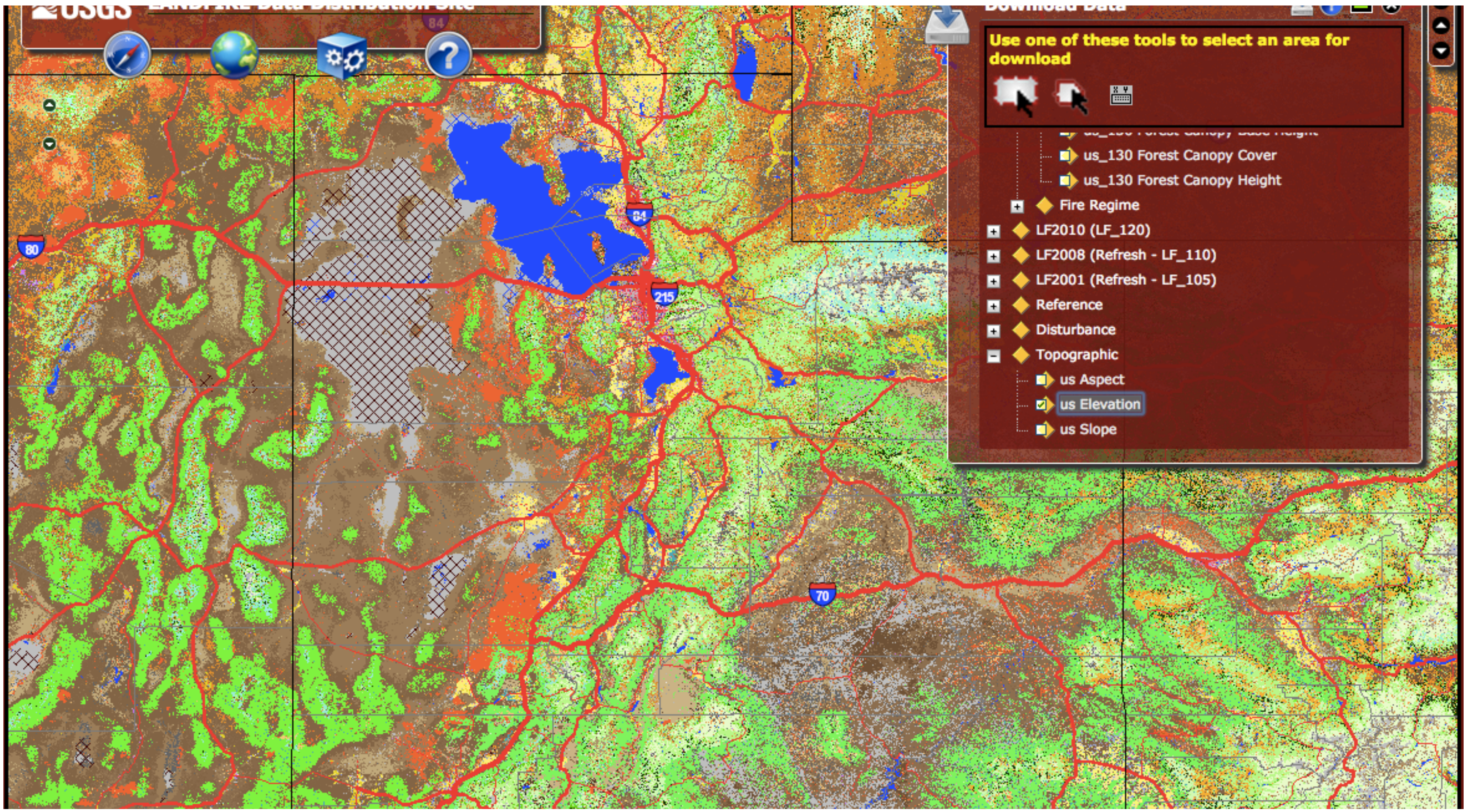
Obtaining fire data for geogrid

http://landfire.cr.usgs.gov/viewer/



Obtaining fire data for geogrid

http://landfire.cr.usgs.gov/viewer/



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Obtaining fire data for geogrid

landfire.cr.usgs.gov/Website/distreq/RequestOptions.jsp

☐ us_120 Succession Classes	Not selected.		
☑ us_130 13 Fire Behavior Fuel Models-Anderson	GeoTIFF_with_attribs	ZIP	HTML
☐ us_130 40 Fire Behavior Fuel Models-Scott/Burgan	Not selected.		
☐ us_130 Biophysical Settings	Not selected.		
☐ us_130 Environmental Site Potential	Not selected.		
☐ us_130 Existing Vegetation Cover	Not selected.		
☐ us_130 Existing Vegetation Height	Not selected.		
☐ us_130 Existing Vegetation Type	Not selected.		
☐ us_130 Fire Regime Groups	Not selected.		
☐ us_130 Forest Canopy Base Height	Not selected.		
☐ us_130 Forest Canopy Bulk Density	Not selected.		
☐ us_130 Forest Canopy Cover	Not selected.		
☐ us_130 Forest Canopy Height	Not selected.		
☐ us_130 LCP 13 Fire Behavior Fuel Models-Anderson	Not selected.		
☐ us_130 LCP 40 Fire Behavior Fuel Models-Scott/Burgan	Not selected.		
☐ us_130 Mean Fire Return Interval	Not selected.		
☐ us_130 Percent Low-severity Fire	Not selected.		
☐ us_130 Percent Mixed-severity Fire	Not selected.		
☐ us_130 Percent Replacement-severity Fire	Not selected.		
☐ us Aspect	Not selected.		
☑ us Elevation	GeoTIFF	ZIP	HTML
☐ us Slope	Not selected.		
☐ Fire Planning Units	Not selected.		
☐ LANDFIRE Zones	Not selected.		
☐ LANDFIRE ECOMAP Subsections Map	Not selected.		

Delivery Options:

Maximum size (MB) per piece: 250

Cancel All Changes & Return to Summary

Save Changes & Return to Summary

Converting fire data to WPS format

- Conversion of the fuel data and high resolution topography can be performed using convert_geotiff program available from https://github.com/jbeezley/convert_geotiff
- Conversion of the fuel data provided in geotiff format can be performred using the following command:

```
./convert_geotiff.x -c 13 -w 1 -u "fuel category" -d
"Anderson 13 fire behavior categories" ../your_fuel.tiff
```

- Conversion of the high resolution topogrpahy provided as a geotiff file can performes similarily using the following command:

```
./convert_geotiff.x -u meters -d 'National Elevation Dataset
1/3 arcsecond resolution' ../your_elevation.tiff
```

- note that `convert_geotiff.x` should be executed from the locations where the fuel and elevation data are to be stored

Converting fire data to WPS format

- convert_geotiff works should support all WRF projections but lat-lon is the safest choice EPSG 4326 WGS84.
- Convert_geotiff will generate an index file and a set of files in WPS intermediate format containing the fuel and elevation data ready to be processed by geogrid.exe
- Here is an example of the content of the folder where convert_geotiff generated a set of WPS intermediate files:

Converting fire data to WPS format

The index file for fuel should look like below:

```
projection = albers_nad83
truelat1 = 29.500000
truelat2 = 45.500000
stdlon = -96.000000
known_x = 1
known_y = 606
known_lat = 39.747818
known_lon = -107.373398
dx = 3.000000e+01
dy = 3.000000e+01
type = categorical
signed = yes
units = "fuel category"
description = "Anderson 13 fire behavior categories"
wordsize = 1
tile_x = 100
tile_y = 100
tile_z = 1
category_min = 1
category_max = 14
tile_bdr = 3
missing_value = 0.000000
scale_factor = 1.000000
row_order = bottom_top
endian = little
```

Domain configuration in WPS

- The physical domain is configured in the geogrid section of `namelist.wps` in the `WPS` directory. In this section, you should define the geographic projection with `map_proj, truelat1, truelat2`, and `stand_lon`. Available projections include `'lambert', 'polar', 'mercator'`, and `'lat-lon'`.
- The lower left corner of the domain is located at `ref_lon` longitude and `ref_lat` latitude. The computational grid is defined by `e_we/e_sn`, the number of (staggered) grid points in the west-east/south-north direction, and the grid resolution is defined by `dx` and `dy` in meters.
- We also specify a path to where we will put the static dataset that geogrid will read from, and we specify the resolution of the data we plan to use.

```
&geogrid
 e_we              =  43,
 e_sn              =  43,
 geog_data_res     = '30s',
 dx = 60,
 dy = 60,
 map_proj  = 'lambert',
 ref_lat   =  39.70537,
 ref_lon   = -107.2907,
 truelat1  =  39.338,
 truelat2  =  39.338,
 stand_lon = -106.807,
 geog_data_path = '../../wrfdata/geog'
/
```

configuration in `namelist.input`

```
&time_control
 run_days                             = 0,
 run_hours                            = 0,
 run_minutes                          = 20,
 run_seconds                          = 0,
 start_year                           = 2006, 0001, 0001,
 start_month                          = 02,   01,   01,
 start_day                            = 23,   01,   01,
 start_hour                           = 12,   00,   00,
 start_minute                         = 43,   01,   01,
 start_second                         = 00,   00,   00,
 end_year                             = 2006, 0001, 0001,
 end_month                            = 02,   01,   01,
 end_day                              = 23,   01,   01,
 end_hour                             = 13,   00,   00,
 end_minute                           = 00,   600,   600,
 end_second                           = 0,   00,   00,
 history_interval_s                   = 5,   30,   30,
 frames_per_outfile                   = 1000, 1000, 1000,
 restart                              = .false.,
 restart_interval                     = 5
 io_form_history                      = 2
 io_form_restart                      = 2
 io_form_input                        = 2
 io_form_boundary                     = 2
 debug_level                          = 1
/
```

↑ d01 ↑ d02 ↑ d03

configuration in `namelist.input`

```
&domains
 time_step                          = 0,
 time_step_fract_num                = 3,
 time_step_fract_den                = 10,
 max_dom                            = 1,
 s_we                               = 1,      1,      1,
 e_we                               = 20,     43,     43,
 s_sn                               = 1,      1,      1,
 e_sn                               = 32,     43,     43,
 s_vert                             = 1,      1,      1,
 e_vert                             = 41,     41,     41,
 dx                                 = 50,     30,     10,
 dy                                 = 50,     30,     10,
 ztop                               = 600, 1500, 1500,
 grid_id                            = 1,      2,      3,
 parent_id                          = 0,      1,      2,
 i_parent_start                     = 0,      1,     1,
 j_parent_start                     = 0,      1,     1,
 parent_grid_ratio                  = 1,      2,      3,
 parent_time_step_ratio             = 1,      2,      3,
 feedback                           = 1,
 smooth_option                      = 0
 sr_x                               = 10,     0,      0
 sr_y                               = 10,     0,      0
/
```

configuration in `namelist.input`

```
&physics
 mp_physics                          = 1,     1,     1,
 ra_lw_physics                       = 1,     1,     1,
 ra_sw_physics                       = 1,     1,     1,
 radt                                = 30,    30,    30,
 sf_sfclay_physics                   = 1,     1,     1,
 sf_surface_physics                  = 1,     1,     1,
 bl_pbl_physics                      = 1,     1,     1,
 bldt                                = 0,     0,     0,
 cu_physics                          = 1,     1,     0,
 cudt                                = 0,     0,     0,
 isfflx                              = 1,
 ifsnow                              = 1,
 icloud                              = 1,
 num_soil_layers                     = 5,
 mp_zero_out                         = 0,
 /
```

configuration in `namelist.input`

```
&dynamics
 rk_ord                              = 3,
 diff_opt                            = 2,
 km_opt                              = 2,
 damp_opt                            = 2 ,
 zdamp                               = 5000.,  5000.,  5000.,
 dampcoef                            = 0.2,    0.2,    0.2
 khdif                               = 0.05,   0.05,   0.05,
 kvdif                               = 0.05,   0.05,   0.05,
 smdiv                               = 0.1,    0.1,    0.1,
 emdiv                               = 0.01,   0.01,   0.01,
 epssm                               = 0.1,    0.1,    0.1
 mix_full_fields                     = .true., .true., .true.,
 non_hydrostatic                     = .true., .true., .true.,
 h_mom_adv_order                     = 5,      5,      5,
 v_mom_adv_order                     = 3,      3,      3,
 h_sca_adv_order                     = 5,      5,      5,
 v_sca_adv_order                     = 3,      3,      3,
 time_step_sound                     = 20,     20,     20,
 moist_adv_opt                       = 1,      1,      1,
 scalar_adv_opt                      = 1,      1,      1,
 tracer_opt                          = 2,      2,      2,
 /
```

Tracer for smoke representation (requires namelist.fire_emissions)

configuration in namelist.input

```
&bdy_control
periodic_x                      = .false., .false.,.false.,
symmetric_xs                    = .false., .false.,.false.,
symmetric_xe                    = .false., .false.,.false.,
open_xs                         = .false., .false.,.false.,
open_xe                         = .false., .false.,.false.,
periodic_y                      = .false., .false.,.false.,
symmetric_ys                    = .false., .false.,.false.,
symmetric_ye                    = .false., .false.,.false.,
open_ys                         = .false., .false.,.false.,
open_ye                         = .false., .false.,.false.,
spec_bdy_width                  = 5,
spec_zone                       = 1,
relax_zone                      = 4,
specified                       = .true.,.false.,.false.,
nested                          = .false.,.true.,.true.,
/

/
```

settings for ideal cases

configuration in `namelist.input`

Fire model will be run in d03 in this case

```
&fire
ifire                        = 0, 0, 2,   ! integer, = 0: no fire, = 2: SFIRE
fire_fuel_read               = 0, 0,-1,   ! integer, -1: read in from wrfinput
fire_fuel_cat                = 3,         ! integer, if specified which fuel category?

! ignition

fire_num_ignitions =           0, 0, 1,   ! integer, only the first fire_num_ignition used, up to 5
fire_ignition_start_lon1=      0, 0,-107.293,  ! start points of ignition lines, longitude
fire_ignition_start_lat1 =     0, 0, 39.6986,  ! start points of ignition lines,latitude
fire_ignition_end_lon1 =       0, 0,-107.293,  ! end points of ignition lines
fire_ignition_end_lat1 =       0, 0, 39.7109,  ! end points of ignition lines
fire_ignition_radius1 =        0, 0, 18, ! all within this radius (m) will ignite, > fire mesh step
fire_ignition_start_time1  = 0, 0, 2, ! sec for ignition from the start
fire_ignition_end_time1  =     0, 0, 2, ! sec for ignition from the start
```

Ignition parameters set for the fire domain only

```
fire_topo_from_atm= 0, 0, 0,    ! 0 = expect fire mesh topo , 1 = from atmosphere
fmoist_run =         .false., .false., .true.,
fmoist_interp        .false., .false., .true.,
fire_fmc_read =       0, 0, 0,    ! 0 not set use wrfinput, 1 from namelist.fire, 2 read from file
in ideal!
```

Setting up geogrid to process fire data

All the static data being processed by `geogrid.exe` are defined in `GEOGRID.TBL`

In order to enable fire data processing in geogrid.exe :

1. `GEOGRID.TBL` should be linked to `GEOGROD.TBL.FIRE`
   `ln -s GEOGRID.TBL.FIRE GEOGRID.TBL` or copied to WPS directory

2. Fuel and high-resolution height section of **`GEOGRID.TBL`** have to be edited so the paths correspond to the actual locations of fuel and elevation data processed using `convert_geotiff` (in our case ned_data, landfire_data)

Setting up geogrid to process fire data

Editing `GEOGRID.TBL (WPS/geogrid/GEOGRID.TBL)`

```
===============================
name=NFUEL_CAT
        priority=1
    dest_type=categorical
    dominant_only=NFUEL_CAT
    z_dim_name=fuel_cat
    halt_on_missing=yes
    interp_option=default:nearest_neighbor
    abs_path=./path_to_your_fuel_data
    subgrid=yes
==============================
name=ZSF
        priority = 1
        dest_type = continuous
        df_dx=DZDXF
        df_dy=DZDYF
        smooth_option = smth-desmth_special; smooth_passes=1
    halt_on_missing=yes
        interp_option = default:average_gcell(4.0)+four_pt+average_4pt
    abs_path=./path_to_your_elevation_data
    subgrid=yes
==============================
```

Domain configuration in WPS

- The share section of the `namelist.wps` defines the fire subgrid refinement in `subgrid_ratio_x` and `subgrid_ratio_y`. This means that the fire grid will be a 10 time refined grid at a resolution of 6 meters by 6 meters. The `start_date` and `end_date` parameters specify the time window that the simulation will be run in. Atmospheric data must be available at both temporal boundaries. The `interval_seconds` defines the time interval between atmospheric data. For our example, we will be using the NARR dataset which is released daily every three hours or 10,800 seconds.

```
&share
 wrf_core = 'ARW',
 max_dom = 1,
 start_date = '2005-08-28_12:00:00',
 end_date   = '2005-08-28_15:00:00',
 interval_seconds = 10800,
 io_form_geogrid = 2,
 subgrid_ratio_x = 10,
 subgrid_ratio_y = 10,
/
```

Domain configuration in WPS

Once the domain(s) is (are) configured in `namelist.wps` the `geogrid.exe` can be executed in order to process static data.

Typing:

```
./geogrid.exe
```

should start geoegrid and generate a set of `geo_em.d0X.nc` files in the number corresponding to the number of domains configured in `namelist.wps` (paramter `max_dom`)

Open generated geo_em.d0X.nc files and verify that the data got processed correctly (check `NFUEL_CAT`, `ZSF` etc)

Processing meteorological data

In real cases WRF need meteorological data in order to generate initial and boundary conditions:

`wrfinput_d01`
`wrfinput_d02`
…
`wrfinput_d0X` — initial conditions

`wrfbdy_d02` — boundary conditions

Preparation of the meteorological data is done in two steps:

1. Ungribing meteorological files provided in grib or grib2 format which is done by **`ungrib.exe`**
2. Horizontal interpolation of the meteorological data to WRF domains defined by **`geo_em.d0X.nc`** files generated earlier which is performed by **`metgrid.exe`**.

Processing meteorological data

Before the ungrib can decompress grib meteorological files they must be linked to the location where `ungrib.exe` is running.

The linking is performed using the `linkgrib.sh` script:

```
./link_grib.csh path_to_your_grib_files
```

This command should generate links to your grib files in a form:

```
GRIBFILE.AAA -> your_metfile1.grb2
GRIBFILE.AAB -> your_metfile2.grb2
GRIBFILE.AAC -> your_metfile3.grb2
```

…

Before running ungrib.exe make sure the correct Vtable is linked to your directory. For instance, if you are using NARR data you link `./ungrib/Variable_Tables/Vtable.NARR` to your `WPS` directory by typing:

```
ln -s ./ungrib/Variable_Tables/Vtable.NARR ./Vtable
```

you should have now in your WPS directory:

```
Vtable -> ./ungrib/Variable_Tables/Vtable.NARR
```

Processing meteorological data

Once the met files and `Vtable` are linked you can ready to ungrib your met data (create intermediate met files in WPS format). The name of the output intermediate files are defined in the `ungrib` section of `namelist.wps`

```
&ungrib
 out_format = 'WPS',
 prefix = 'NARR_b',
! prefix = 'NARR_a',
/
```

Executing: `./ungrib.exe` will start ungribing process which will generate intermediate met files:

```
NARR_a:2012-06-23_18
NARR_a:2012-06-24_00
NARR_a:2012-06-26_06
```

…

Processing meteorological data

Once the intermediate met files are generated, they are ready to be processed further by `metgrid.exe`.

Executing:

```
./metgrid.exe
```

should generate a list of `met_em.d0X` files:

```
met_em.d01.2012-06-23_00:00:00.nc
met_em.d01.2012-06-23_06:00:00.nc
met_em.d01.2012-06-23_12:00:00.nc
...
```

The next step is generating the WRF input files from met_em files using `real.exe` in `./wrf-fire/WRFV3/test/em_real/` directory

Processing meteorological data

Before `real.exe` is executed, all simulation parameters must be set in `namelist.input`, similarly as it was done for `WPS` in `namelist.wps`

Once the simulation parameters are set, the WRF input files are generated from met_em files using `real.exe` in `./wrf-fire/WRFV3/test/em_real/` directory.

After execution of `real.exe` the following set of files should be generated:

```
wrfinput_d01
wrfinput_d02
wrfinput_d03
…
wrfbdy_d01
```

the next step after generating these files is configuring fire parameters in `namelist.fire` and running `wrf.exe`

Configuration of fire parameters in namelist.fire

```
&fuel_scalars                        ! scalar fuel constants
cmbcnst  = 17.433e+06,               ! J/kg combustion heat dry fuel
hfgl     = 17.e4 ,                   ! W/m^2 heat flux to ignite canopy
fuelmc_g = 0.18,                     ! ground fuel moisture, set = 0 for dry
!jc fuelmc_g = 0.09,                    ! ground fuel moisture, set = 0 for dry
fuelmc_c = 1.00,                     ! canopy fuel moisture, set = 0 for dry
nfuelcats = 13,                      ! number of fuel categories used
no_fuel_cat = 14                     ! extra category for no fuel
/

&fuel_categories
 fuel_name =
'1: Short grass (1 ft)',
'2: Timber (grass and understory)',
'3: Tall grass (2.5 ft)',
'4: Chaparral (6 ft)',
'5: Brush (2 ft) ',
'6: Dormant brush, hardwood slash',
'7: Southern rough',
'8: Closed timber litter',
'9: Hardwood litter',
'10: Timber (litter + understory)',
'11: Light logging slash',
'12: Medium logging slash',
'13: Heavy logging slash',
'14: no fuel'
```

Configuration of fire parameters in `namelist.fire`

```
  fmc_gw01 = 1.00000, 0.15385, 1.00000, 0.31253, 0.28571, 0.25000, 0.23203,
             0.30000, 0.06625, 0.25042, 0.13021, 0.11600, 0.12065, 0.00000,
  fmc_gw02 = 0.00000, 0.07692, 0.00000, 0.25016, 0.14286, 0.41667, 0.38398,
             0.20000, 0.93034, 0.16639, 0.39149, 0.40584, 0.39656, 0.00000,
  fmc_gw03 = 0.00000, 0.38462, 0.00000, 0.12477, 0.00000, 0.33333, 0.30801,
             0.50000, 0.00341, 0.41680, 0.47830, 0.47816, 0.48279, 0.00000,
  fmc_gw04 = 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
             0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
  fmc_gw05 = 0.00000, 0.38462, 0.00000, 0.31254, 0.57143, 0.00000, 0.07598,
             0.00000, 0.00000, 0.16639, 0.00000, 0.00000, 0.00000, 0.00000,
 /
&moisture
moisture_class_name =
'1 hour fuel',
'10 hour fuel',
'100 hour fuel',
'1000 hour fuel',
'live fuel'
moisture_classes=         5,
drying_model=             1,     1,     1,    1,     1, ! number of model - only 1= equilibrium
moisture Van Wagner (1972) per Viney (1991)  allowed
drying_lag=               1,    10,   100,  1000,   1e9, ! so-called 10hr and 100hr fuel
wetting_model=            1,     1,     1,    1,     1, !
wetting_lag=             14,   1e9,   1e9,  1e9,   1e9, ! 14 is callibrated to
VanWagner&Pickett 1985, Canadian fire danger rating system
saturation_moisture=    2.5,   2.5,   2.5,  2.5,   2.5, !
saturation_rain =       8.0,   8.0,   8.0,  8.0,   8.0, ! (mm/h)
rain_threshold =       0.05,  0.05,  0.05,  0.05,  0.05,! mm/h rain too weak to wet anything.
fmc_gc_initialization =   0,     0,     0,     0,     0,! 0 = from input, 1 = from fuelmc_g in
namelist.input 2 = from equibrium
/
```

Configuration of emission parameters in `namelist.fire_emissions`

Depending on the level of chemistry used appropriate namelist.fire_emissions file must be used. For no-chemistry runs, only passive tracer option is available.s

To use passive tracers for smoke visualization (no chemistry) make sure you link appropriate emission configuration file:

`namelist.fire_emissions -> namelist.fire_emissions.tracers`

```
&emissions
! Tracer emissions table
! Classification:Grasslands,Grasslands,Grasslands,Open Shrublands,Open Shrublands,Open
Shrublands,Open Shrublands,Mixed Forests,Mixed Forests,Mixed Forests,Evergreen Forest,Evergreen
Forest,Evergreen Forest,
compatible_chem_opt=0,
printsums=1, ! print sums of fuel burned and total emitted into the atmosphere
!Fuel Cat,   1, 2, 3, 4, 5, 6, 7, 8, 9,  10, 11, 12, 13,
! tracer emissions [g/kg burnt]
     tr17_1=59,59,59,68,68,68,68,102,102,102,118,118,118
     tr17_2=59,59,59,68,68,68,68,102,102,102,118,118,118
     tr17_3=59,59,59,68,68,68,68,102,102,102,118,118,118
     tr17_4=59,59,59,68,68,68,68,102,102,102,118,118,118
     tr17_5=59,59,59,68,68,68,68,102,102,102,118,118,118
     tr17_6=59,59,59,68,68,68,68,102,102,102,118,118,118
     tr17_7=59,59,59,68,68,68,68,102,102,102,118,118,118
     tr17_8=59,59,59,68,68,68,68,102,102,102,118,118,118
/
```

That is the place to define your tracer emission factors

Running WRF-Sfire in real cases

- If you have:
  - generated `wrfinput_d0X` and `wrfbdy_d01` files
  - make sure the fire data are there (NFUEL_CAT, ZSF)
  - configure your meteorological and fire parameters in `namelist.input` and `nemelist.fire`
  - You are ready to start your simulation executing:

```
./wrf.exe
```

Experiment6

1. Go to WPS dierectory
2. Copy files to WPS folder
3. Untar NARR, fuel and topo data
4. Run geogrid.exe (generation of geo_em.d01.nc …)
5. Link Vtable
6. Link NARR_a met data
7. Link NARR_b met data
8. Run ungrib.exe (generation of NARR_a/b interm. files)
9. Run metgrid.exe (generation of met_em.d01_xx files)
10. Run real.exe (generation of wrfinput and wrfbdy files)
11. Run wrf.exe

Experiment6

1. Go to `/scratch/wrf-fire/WPS`
2. Copy files to WPS folder:

```
cp /home/netapp-clima-scratch/smr2717/lab_sessions/Experiment6/namelist.wps .
cp /home/netapp-clima-scratch/smr2717/lab_sessions/Experiment6/namelist.input .
cp /home/netapp-clima-scratch/smr2717/lab_sessions/Experiment6/NARR.tgz .
cp /home/netapp-clima-scratch/smr2717/lab_sessions/Experiment6/landfire_data.tgz .
cp /home/netapp-clima-scratch/smr2717/lab_sessions/Experiment6/ned_data.tgz .
cp /home/netapp-clima-scratch/smr2717/lab_sessions/Experiment6/GEOGRID.TBL .
```

3. Untar NARR fuel and topo data

```
tar –xvf NARR.tgz
tar –xvf  landfire_data.tgz
tar –xvf ned_data.tgz
```

4.Run `./geogrid.exe`

it should generate:

```
geo_em.d01.nc geo_em.d02.nc geo_em.d03.nc geo_d04.nc
```

5. Link Vtable:

```
ln -s ./ungrib/Variable_Tables/Vtable.NARR ./Vtable
```

6. Link NARR_a met data

```
./linkgrib ./NARR_a/*
```

Experiment6

6. Link NARR_a met data

```
./linkgrib ./NARR_a/*
```

That will generate a lot of GRIBFILE links:

```
GRIBFILE.AAA  GRIBFILE.AAE  GRIBFILE.AAI  GRIBFILE.AAM
GRIBFILE.AAB  GRIBFILE.AAF  GRIBFILE.AAJ  GRIBFILE.AAN
GRIBFILE.AAC  GRIBFILE.AAG  GRIBFILE.AAK  GRIBFILE.AAO
GRIBFILE.AAD  GRIBFILE.AAH  GRIBFILE.AAL  GRIBFILE.AAP
```

7. Modify namelist.wps (f.e `emacs namelist.wps`) to have:

```
end_date   = '2012-06-24_18:00:00', '2012-06-24_18:00:00',
'2012-06-24_18:00:00','2012-06-24_18:00:00',
```

8. Run ungrib to extract the met data

```
./ungrib.exe
```

That will generate ungribed NARR_a files:

```
NARR_a:2012-06-23_18
NARR_a:2012-06-24_00
NARR_a:2012-06-26_06
```

Experiment6

7. Remove old GRIBFILE links: `rm GRIBFILE.*` and link NARR_b met data

```
./linkgrib ./NARR_b/*
```

That will generate again a lot of GRIBFILE links linked to NARR_b:

```
GRIBFILE.AAA  GRIBFILE.AAE  GRIBFILE.AAI  GRIBFILE.AAM
GRIBFILE.AAB  GRIBFILE.AAF  GRIBFILE.AAJ  GRIBFILE.AAN
GRIBFILE.AAC  GRIBFILE.AAG  GRIBFILE.AAK  GRIBFILE.AAO
GRIBFILE.AAD  GRIBFILE.AAH  GRIBFILE.AAL  GRIBFILE.AAP
```

8. Edit namelist.wps

```
emacs namelist.wps
change:
   ! prefix = 'NARR_b',
    prefix = 'NARR_a',
   to
    prefix = 'NARR_b',
   ! prefix = 'NARR_a',
```

9. Run ungrib again to extract the second set of meteo data

```
./ungrib.exe
```

That will generate ungribed NARR_b files:

```
NARR_b:2012-06-23_18
NARR_b:2012-06-24_00
NARR_b:2012-06-26_06
```

Experiment6

10. Link METGRID.TBL to WPS directory:

```
ln -s ./metgrid/METGRID.TBL ./
```

11. Run metgrid.exe

```
./metgrid.exe
```

That will generate a lot of met_em.d0X.xxxx files

12. Go to `/wrf-fire/WRFV3/test/em_real/`, and copy `namelist.input` there

```
cd /wrf-fire/WRFV3/test/em_real/
cp ../../../WPS/namelist.input ./
```

13. link met_em files to `/wrf-fire/WRFV3/test/em_real/`

```
ln -s ../../../WPS/met_em.* ./
```

14. Edit namelist.input to set the simulation end time to:

```
end_year                        = 2012, 2012, 2012, 2012,
end_month                       = 06,   06,   06,   06,
end_day                         = 24,   24,   24,   24,
end_hour                        = 06,   06,   06,   06,
```

15. Run ./`real.exe` to generate

```
wrfinput_d01, wrfinput_d02, wrfinout_d03, wrfinput_d04,
wrfbdy_d01
```

16. Run `wrf.exe`