

How to create an ensemble of WRF runs forced by GEFS/R2 ensemble members.

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(With assistance from an anonymous WRF-Help helper)

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Prerequisites:

Python w/ numpy package (for downloading GEFS data - basically a glorified shell script. This can be rewritten in e.g. a shell script if python is unavailable)

wgrib2 UNIX package (essential for rearranging GEFS data)

Note: This method results in perturbation ensemble members with identical soil temperatures and moistures (from GFS); hence this method may only be suitable for strongly-forced cases where soil profiles are largely irrelevant.

This method allows WRF to run when forced with ensemble members from GEFS/R2. The stumbling block of only one soil layer is avoided by fusing GFS soil data with GEFS atmospheric data.

1. First, go to **METGRID.TBL** (usually within WPS/metgrid/), and in this file, search for the **name=SPECHUMD** section. Insert this line at the bottom of the section:

```
output=no
```

2. Back in WPS, create a WPS/<name> folder to hold GEFS data.
3. Type the following into your new subfolder (one line) to get the **getgefs** script:

```
wget https://dl.dropboxusercontent.com/u/9239893/getgefs.py  
--no-check-certificate
```

4. Edit the script settings as required; run it with:

```
python getgefs.py
```

5. This will download all variables at all forecast times up to T192 (or further if requested), and break everything little grib files, each containing one ensemble member's variables for that forecast time. WRF likes it this way, it seems.
6. In the same subdirectory, or another, use your favourite method to download GFS reanalysis files for the same times you plan to run your WRF simulation over.
7. Move to your Vtable directory (usually WPS/ungrib/Variable_Tables)
8. Download these two scripts, one for GEFS, one for getting soil data from GFS (again, each is one line):

```
wget https://dl.dropboxusercontent.com/u/9239893/Vtable.GEFR2
--no-check-certificate
```

```
wget https://dl.dropboxusercontent.com/u/9239893/Vtable.GFS_soilonly
--no-check-certificate
```

9. Go back to WPS. Run through your standard process. In your namelist.wps, make sure the **&ungrib** section has this line:

```
prefix = 'FILE_SOIL'
```

10. Stop upon arrival at the ungrib stage.
11. First, link to the **Vtable.GFS_soilonly** script. (e.g. `ln -sf <path/to/Vtable> Vtable`)
12. When you use **link_grib.csh**, link to the GFS files you have downloaded.
13. Run **ungrib.exe**.
14. Change the namelist.wps **&ungrib** section's line to the following:

```
prefix = 'FILE_ATMOS'
```

15. Link to the **Vtable.GEFR2** Vtable.
16. Use **link_grib.csh** to link to the ensemble member you want to run WRF with, created from GEFS files you have downloaded/modified with the `getgefs.py` script. This would be achieved with something like this (let's assume you want the first perturbation, p01, for data initialised on 28 November 2011, for all forecast times up to T192):

```
./link_grib.csh ./gefs_data/20111128_p01_f*
```

17. Run **ungrib.exe** again.
18. You should now have a group of files with the prefix `FILE_SOIL`. These contain the GFS soil data for your forthcoming WRF run. Likewise, there'll be the same number of `FILE_ATMOS` files for one GEFS ensemble member's atmospheric data. We now want to fuse these two datasets within **metgrid.exe**. Change the namelist.wps **&metgrid** section's line to the following:

```
fg_name = 'FILE_SOIL', 'FILE_ATMOS'
```

19. Running `metgrid.exe` may throw up some errors about soil levels - this is from the GEFS data. The important thing is that you see something like this :

```
Processing 2011-11-29_06
```

FILE_SOIL

FILE_ATMOS

20. Carrying on with your usual process all the way through to real.exe and wrf.exe, you will now be forcing WRF with one ensemble member's reforecasts from GEFS, with soil data from GFS.
21. Note the namelist.input in WRF requires 12 num_metgrid_levels and 4 num_metgrid_soil_levels.
22. If you want to create an ensemble of runs, after completion of one member's corresponding WRF run, return to step 16 and pick another group of ensemble member files, leaving the other settings the same, and metgrid will continue to fuse the same GFS soil data with a GEFS member of your choice.