Script for EXP01: Hurricane Harvey landfall

ATM419/563 Fovell Fall 2024

*** ---------- synopsis ---------- ***

This experiment uses the generic WRF REAL setup package to simulate Harvey's landfall in 2017 over 2 days, initialized with GFS. **Modifications necessary**.

*** ---------- preliminaries ---------- ***

* make a directory in your lab space called **HARVEY**, copy into it **$LAB/SCRIPTS/WRF_REAL_SETUP.TAR** and unpack it (tar -xvf …)

* execute **sh make_all_links.sh**

*** ---------- alterations ---------- ***

* Our experiment will use the configuration detailed below
* One domain used, so only first column matters
* Keep in mind changes need to be consistent between the two namelists!

start_date = 2017-08-25_12:00:00 [watch difference between dashes
end_date = 2017-08-27_12:00:00 ... and underscores]
interval_seconds =10800

max_dom = 1
e_we = 54
e_sn = 48
dx = 36000
dy = 36000
map_proj = 'lambert'
ref_lat = 27.
ref_lon = -94.
truelat1 = 27.
truelat2 = 27.
stand_lon = -94.

* GFS initialization data are: $LAB/DATA/GFS_2017082512/gfs*

*** ---------- TASKS ---------- ***

1. **Edit namelist.wps** for new configuration
2. Visualize domain with plot_WRF_domain.ipynb
3. Create your new domain with geogrid.exe. Look for "successful completion"
4. Use link_grib.csh to link to the GFS parent model data
5. Make sure you're using Vtable.GFS as Vtable
6. Unpack your GFS data with ungrib.exe. Consider the batch script.
7. Execute metgrid.exe using srun. **Check num_metgrid_levels.**
8. **Edit namelist.input** for new configuration, including num_metgrid_levels
9. Execute real.exe, either via srun or using batch script. Look for "SUCCESS"
10. Submit wrf batch job and monitor progress. Look for "SUCCESS"

*** ---------- DETAILS ---------- ***

See also: "The real-data WRF checklist" on class web page for general guidance

*** ---------- geogrid ---------- ***

Run plot_WRF_domain.ipynb to visualize domain first ← sanity check

srun -p burst-daes geogrid.exe Look for: "*Successful completion of geogrid*."

* Consider using ncview on your geo_em.d01.nc to check your map factors
[or $LAB/SOFTWARE/max.csh as shown in class]

ncview geo_em.d01.nc
[select 2D variable MAPFAC_M from drop down menu]

Visualize your domain topography with plot_WRF_terrain.ipynb. You may want to adjust the "norm = plt.Normalize(0, 1200)" line to fit the range of elevations in this domain

*** ---------- ungrib ---------- ***

link_grib.csh $LAB/DATA/GFS_2017082512/gfs.* . *(space & dot needed)*

cp Vtable.GFS Vtable

Run ungrib:

Option (A): Run ungrib using srun
srun -p burst-daes ungrib.exe ***(output goes to screen)***

Option (B): Submit ungrib as a batch job
sbatch -p burst-daes submit_ungrib
tail -f ug.srun.out *(checks output as created)*

Ungrib is done when you see: *"Successful completion of ungrib."*

*** ---------- metgrid ---------- ***

Run metgrid:

Option (A): Run metgrid using srun
srun -p burst-daes metgrid.exe ***(output goes to screen)***

Option (B): Submit metgrid as a batch job
sbatch -p burst-daes submit_metgrid
tail -f metgrid.srun.out *(checks output as created)*

Metgrid is done when you see: *"Successful completion of metgrid."*

ls met_em*

* Use ncdump on one of your met_em.d01* files to look for **num_metgrid_levels, num_st_layers, num_sm_layers**

*** ---------- real.exe ---------- ***

• EDIT THE namelist.input file. Watch for

- **run_days (here, 2 days)**
- **Start year/month/day/hour**
- **End year/month/day/hour**
- **Interval_seconds**
- **num_metgrid_levels**
- **num_metgrid_soil_levels** (= num_st_layers, num_sm_layers)
- **max_dom, e_sn, e_we, dx, dy**

sbatch -p burst-daes submit_real
[NOTE JOB NUMBER ASSIGNED. Example: Submitted batch job 774952]

* check job status
myjobs

* "trsl" is short for "tail -f rsl.out.0000". Look for "SUCCESS". Ctrl-c to exit.

*** ---------- wrf.exe CONTROL RUN ---------- ***

sbatch -p burst-daes submit_wrf
[NOTE JOB NUMBER ASSIGNED.]
myjobs
trsl

*** ---------- when WRF job finishes ---------- ***

* Your wrf output file should be named: `wrfout_d01_2017-08-25_12:00:00`

Copy **$LAB/SCRIPTS/WRF_plot_HARVEY.ipynb** to your HARVEY folder.

- Use it to make various plots and animations.
- Observe how the hurricane stalls after making landfall.
- Observe that total precipitation from microphysics (RAINNC) and from the cumulus scheme (RAINC) do not overlap much spatially.
- Observe that the gridpoint corresponding to Houston receives mainly cumulus precipitation.

*** ---------- EXPERIMENT 01 ---------- ***

At grid spacings like 36 km, we need both microphysics and cumulus schemes to handle the evolution of water substance from resolved and subgrid scale clouds, respectively. So what happens if we do not use one of those schemes? How does total precipitation at Houston change? Does the simulated TC change?

We will run the model twice more, once deactivating microphysics and once deactivating the cumulus scheme. First, create a new folder, called **CONTROL**, and move your wrfout file into it. Also copy (do not move) your namelist.input file, to archive it.

Then:

(1) Run **MICRO**: Edit namelist.input, make cu_physics=0. Rerun real.exe and submit the WRF run. For the time series plot of Houston precipitation, change the title to contain your last name and "MICRO". Capture/save this plot for submission.

(2) Run **CUMULUS**: Edit namelist.input, make cu_physics=1 again but mp_physics=0. Rerun real.exe and submit the WRF run. For the time series plot of Houston precipitation, change the title to contain your last name and "CUMULUS". Capture/save this plot for submission.

Send both plots to Liam and myself.

Due date: Wednesday, September 25, before start of class.