Script for EXP01: Hurricane Harvey landfall
ATM419/563 Torn Fall 2025

* ---------- 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 submit_metgrid. Check num_metgrid_levels.
8. Edit namelist.input for new configuration, including num_metgrid_levels

9. Execute real.exe via 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
qsub submit_geogrid Look for: “Successful completion of geogrid.”

- Consider using ncview on your geo_em.d01.nc to check your map factors [or max.csh as shown in class]

Visualize your domain topography and check your map factors [or max.csh] 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): Submit ungrib as a batch job
qsub submit_ungrib
tail -f ungrib.out (checks output as created)

Option (B): Run ungrib on the terminal
./ungrib.exe (output goes to screen)

Ungrib is done when you see: “Successful completion of ungrib.”

* ---------- metgrid ---------- *
Run metgrid:
Option (A): Submit metgrid as a batch job
qsub submit_metgrid
tail -f metgrid.out (checks output as created)

Option (B): Run metgrid on terminal
./metgrid.exe (output goes to screen)

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

qsub 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 ---------- *

qsub_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.

Submit the plots through Brightspace.

Due date: Tuesday, October 7, before start of class.