HAFS Coordination Meeting Summary
August 21, 2019 (2-3 pm ET)

EMC (Regional Workflow Code Sprint- Bin Liu and Test on gravity wave drag parameterization in HAFS - Jili Dong)

- Bin Lui gave updates on the regional workflow code sprint held on July 15-19, 2019 at Foothills Lab 3, NCAR, Boulder.
    - The major objectives of the code sprint was to unify/merge the community-developed and EMC-developed regional workflow systems.
    - In terms of the model source code, both workflow systems currently point to the same set of external VLab/GitHub repositories as submodules. They even share the same branch for some of the submodules (e.g., the feature/HAFS branch in the UFS_UTILS repo).
    - The build system for both the regional and HAFS workflows are also very similar.
    - In terms of the rocoto workflow definition and generation, as well as the support of multi-platforms, the merged regional FV3-SAR workflow now uses very similar techniques/methods utilized in HAFS.
    - Had the mutual understanding that, the regional FV3-SAR workflow and the HAFS workflow have their own specific requirements due to their specific applications (model regions, focused weather phenomena, DA and model initializations, post-processing and products, etc.). For example, the HAFS system is meant to be specialized for hurricane specific applications:
        - ➢ Support event-triggered configurations for forecasting active storms as well as continuously-cycled configuration TC genesis forecasting.
        - ➢ Suitable for high-resolution TC modeling with various grid nesting/refinement capabilities
        - ➢ Optimized for TC dynamics and physics
        - ➢ Sophisticated vortex initialization for warm-starting and cycling of the storm
        - ➢ Advanced data assimilation techniques for high-resolution innercore DA
        - ➢ Take into account air-sea-wave interaction and coupling (eventually, earth system coupling)
        - ➢ Generate TC specific products (track, intensity, size, swath, etc.)
        - ➢ Conduct TC specific diagnoses.

- Jili Dong presented on ‘Test on gravity wave drag (GWD) parameterization in HAFS’.
- To test the GWD parameterization in HAFS, the options considered were
    - Convective GWD (CGWD): off
    - Orographic GWD (OGWD): on
- GFDL microphysics, EDMF PBL and GFS surface drag with HWRF modification, RRTMG radiation were included while cumulus convection was turned off.

- Two experiments with HAFS-OGWD-ON (CGWD off and OGWD on) and HAFS-OGWD-OFF (both CGWD and OGWD off) were tested for hurricane Michael (2018) and hurricane Florence (2018) cases.
- Results from hurricane Florence showed no significant difference in the track forecast; while OGWD-off was closer to best track in the intensity forecast.
- In the case of hurricane Michael, track forecasts were quite similar in both experiments while OGWD-off moved a little further than OGWD-on. For intensity forecast, again OGWD-off was closer to the best track.
- HAFS intensity forecasts were found to be sensitive to orographic GWD at 3 km resolution in these two particular cases (even if storms not directly over mountains).
- A question was raised, if GWD (orographic GWD) be turned off in cloud resolving high resolution (3 km) hurricane simulation.
- A few other applications on how GWD is currently being used:
    - Operation HRRR v3 (3km) uses OGWD specifically designed for high-res
    - Current GWD in FV3 are tuned on coarser resolution
    - A parameter could be added into namelist to turn off GWD. For example: Moorthi has added an option in his branch to turn off GWD if both cdmbgwd are zero.

A discussion followed on the GWD:
Comment (Frank): GWD is a terrain feature, and if the variability obtained in the results may be the kind of spread that may be seen in high resolution ensembles (meaning how much of the variance could be attributed to model uncertainty). Do we really need GWD in in cloud resolving models?
Comment (Jili): CAM is using GWD at 3 km, near the mountains beyond the ocean.
Comment (Curtis): Even at 1-3 km, HRRR found evidence of the importance of GWD.
Question: How does this affect DA? Though they have not tested it particularly, but it can be also be affected as other factors such as observations, model simulations, background field.
Comment (Lucas): Gravity wave influence on the larger scale on longer time scale and not just topographic impact. Also need to access the impact by looking into stratospheric and tropospheric influences. The effect on tropical cyclones are indirect but there is a cascade that affects the system.
Comment: Unresolved gravity can be treated vertically; local effects like turbulence over hilly terrain and mountain drag can be seen in the troposphere still at 13km.
Question (Avichal): Has AOML tried any experiment with GWD in HAFS v0.B? Plans to test once they fully transition to HERA.

AOML/HRD - Xuejin Zhang

- Moving nest: working with Lucas on pre-processing code merge with GFDL repository and FMS upgrade to GFDL latest public repository.
- Real-time HAFS demo: Andy Hazelton presented on HAFS v0.B results on Barry at HRD HFP.
- Updated products are available at AOML product viewer for both HAFS v0.A and v0.B as well as operational forecasts.

- Hera transition from Theia: currently working on moving the codes to Hera.

GFDL (GFDL HAFS Progress - Lucas Harris and Tim Marchok)

- Providing support for new nesting functionality in cubed-sphere domain implemented in FMS and re-wrote FV3 core front-end to support new changes.
- Met with AOML scientists (Xuejin, Bill R.) in July to discuss collaboration and development, Bill R's changes for multiple nests in pre-processing tools being integrated into FRETools on GitHub.
- Transitioning FV3 codes to EMC master repository in GitHub.
- Plans to test telescoping and cross-edge capability in FV3 and FRETools with new hire in place.
- T.C. Tracker update: Modified code to fix bug that was preventing Vmax from being reported for storms very close to the grid boundary in T-SHiELD forecasts being run by HRD.
- T.C. Tracker update: Modified code to fix bug that was crashing HAFS forecasts being run at EMC due to out-of-memory issues when processing GRIB2 data.
- Currently analyzing tracker configurations to determine which one produces the most skillful and most reliable guidance.

GSD/GMTB (Implement HWRF physics into CCPP - Ligia Bernardet)

- This project is supported by HSUP and NGGPS.
- Project started on Oct 1, with Ferrier-Aligo microphysics (F-A in HWRF uses total condensate advection).
- Identified F-A mp source codes: WRF repo (used in HWRF), NMMB repo (used in NAM and HMON), FV3 repo (used in FV3 with namphysics suite)
- First steps in adding F-A to CCPP:
    - Identify F-A primary and interstitial subroutines (pre/post)
    - Identify need for model start (_init) and end (_finalize)
    - Wrap subroutines in module
    - Adjust parallelization
- Next to identify I/O in F-A and define/allocate missing variables in FV3, new variables in FV3 needs to be defined.
- Further plans are to identify other interstitials that need to be modified or created to connect F-A to rest of suite, e.g., radiation, PBL, LSM, devise a strategy to deal with total/separate advection, prepare Suite Definition File (SDF) for CCPP, test software and evaluate constants that differ between HWRF/NAM/FV3.

Question: What are the 'constants' difference?
Ligia: The name of the constants is different in each model, A WG is in place looking into the constants difference.
Question (Lucas): HWRF physics suite is not much different than the GFS Physics, why not add from there?

Ligia: GFS physics is included in CCPP. The way forward is to integrate all physics in CCPP, for testing and distribution as one physics package across NOAA.
Comment (Avichal): New findings have evolved in time for HWRF, GFS evolved differently from HWRF, advancing parameterization in CCPP is to support that work.

GMTB (Update on Improving HAFS Workflow Usability, Portability, and Testing - Evan Kalina)

- For a collaborative development environment in GitHub, planning to integrate critical component - CROW, CIME and HAFS, into the same repository
- Outline of the steps to connect HAFS, CROW and CIME:
    - Use CROW to configure the HAFS workflow
    - Use CIME to build the coupled model executable and configure the forecast step
    - Use the CMEPS coupler to couple FV3, HYCOM, WW3
    - Use the HAFS workflow to execute the jobs, including the forecast job setup by CIME.

GSD (Curtis Alexander)

- Currently setting up the stretched-grid version of regional FV3 to start running the SAR domain for Atlantic Basin.

NESII (Rocky Dunlap)

- Continuing to deal with instability in the FV3GFS-MOM6-CICE5 coupled system when moving from CMEPS 0.3 to 0.4.
- Preparing for the sprint with EMC next week. Plan to discuss how to integrate the CMEPS mediator with current EMC systems, connecting HYCOM and code management.