HFIP Team Telecon Minutes
1400 EST, Wednesday, 12 October 2011

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Bob Gall led the HFIP telecon held on October 12, 2011 from 1400 -1500 EST. The following items were discussed:

- Real time reservations
- Annual Meeting
- Presentation by Jim Doyle (COAMPS-TC Development and Real Time Tests))
- Next telecon is scheduled for **October 26, 2011 @ 1400EST**

Participants from NHC, NESDIS, ESRL, GFDL, NCAR, GSD, NRL, DTC, Oregon, HRD, University of Wisconsin, Craig Tierney (tjet), University of Albany, URI, and Penn State were present.

Reservations

The reservations were finally completed two weeks ago and now include the high res global ensemble. The machine is are full with the reservations, therefore other jobs are not getting through. Real time runs will continue through the end of October. All reservations will be brought down at the beginning of November to allow others to continue development. The real time 3km (Vijay) will continue passed November 1.

> **Question**: Can we remove reservations a little earlier or continue reservations passed November 1 if a system is brewing? Yes.

Annual Meeting

There has been ongoing discussion over the past two weeks concerning the Annual Meeting (November 8-9, 2011). Frank Marks sent out an email to team leads with a list of six questions he would like entertained for the team summaries. The intent is to focus on the key questions that have arisen over the past year and workshops to facilitate discussion on priorities for FY12.

NRL Presentation

Jim Doyle presented “An overview of COAMPS-TC Development and Real-Time Tests” which focused on COAMPS-TC analysis and physics, stream 1.5 demonstration, and the stream 2 development and demo. The research is supported by the NOAA HFIP program and NAVY. Jim provided an overview of the system (Slide 3). The goal is to improve model forecast intensity with focus on rapid intensity changes, structure and ocean very important. The COAMPS-TC model uses a 3D-VAR (Navy’s 3D-VAR = NAVDAS), ocean modeling system, data assimilation, wave model options and some ensemble system. It uses GFS or NOGAPS boundary conditions with a configuration of 45-15-5 km. The observational GFS was used for the real time HFIP test. Slide 4 provided the analysis and initialization of tropical cyclones for COAMPS-TC. The synthetic observations are based on warning messages from NHC or JTWC. Typically start with 41 observations generated from 1000 mb to 400 mb and include mean wind and previous storm motion. The 3D-VAR NAVDAS is used to blend with relaxed geostrophic constraints and reduced correlation lengths within TC circulation. Use cold start and GFS for first storm followed by warm start cycling (previous 6h forecast used for first-guess). Slide 5 highlight changes that helped the system in deep tropics (assimilation of precipitable water from the SSMI satellite). Changes in 3D-VAR that allowed for changes in satellite winds and more scatterometer winds also resulted in significant improvement in the track skill. Jim gave a summary of the physical parameterizations and options for stream 1.5 and 2 (slide 6). This is included the parameters for **surface and boundary layer** (modified Louis, force restore Land sfc, Bougeault TKE 1.5), **moist physics** (Kain Fritsch, modified Lin bulk microphysics), **clouds/radiation** (explicit type cloud fraction, Harshvardhan radiation with Tiedke type shallow convection), and **ocean physics** (navy coastal model, only used in stream 2 runs). For general physics development nearly every parameterization was evaluated and changed for TC specifically the microphysics, PBL and surface fluxes. Jim also stated code complexity is a major issue. Slides 7 discussed the mixing length formulation. COAMPS-TC switched from a classic Mellor-Yamada (MY) mixing length to Bougeault mixing length. The TKE is too small in the boundary and cloud layer when using the MY. The Bougeault results in stronger mixing and stronger turbulence intensity. Dissipative heating coupled with PBL has also been useful (data not shown). Results from Hurricane Bill demonstrated that modifications to cloud diffusion resulted in quicker spin up, more banding, better intensity, and a tighter eye (slide 8). For Hurricane Katrina, changes in the ice nucleation microphysics helps to organize the inner core structure and the reduction in the upper level cloud ice resulting in a positive bias (slide 9). Microphysics and PBL are both extremely important components.

Jim continued his presentation with results from COAMPS-TC stream 1.5 (slides 11 – 22). The stream 1.5 for 2010 -2011 ran on a nesting grid (45/15/5 km grid) for WATL, EPAC and WPAC basins. Stream 1.5 ran automatically with observations 4x daily using GFS for cold start and LBC. The output is posted on the NRL website (www.nrlmry.navy.mil/coamps-web/web/tc) and the forecast is sent to DTC and JTWC (slide 11). Jim provided a summary of the results from real time runs in 2010 (slide 12). He reiterated that the changes made to COAMPS-TC between 2010 and 2011 were pretty modest but lead to improvements. He presented data that demonstrated COAMPS-TC showed improvement in intensity over GFDN, another NAVY model. In 2011, COAMPS-TC seemed to do better in capturing overall intensity of Irene and Katia (slides 14-16) than other models (HWRF, GFDL, GFDN). Additional testing is required to have a better understanding of why. Although COAMPS-TC performed well for intensity, it did not capture rapid intensification or track very well. Slide 17 provided 2011 W. Atlantic Intensity Statistics (James Franklin). The low sample size included official, statistical and stream 1.5 models. The operational HWRF, GFDL, Wisconsin and COAMPS-TC models performed pretty well for intensity. Statistics from a larger sample size (106 samples) demonstrated COAMPS-TC performed similar to operational models up to 48 hrs and improved beyond (slide 18). COAMPS-TC tended to manage to control bias a bit better relative to previous years runs. The track in the West Atlantic Basin lagged other models (slide 19). The track error of COAMPS-TC in the Eastern Pacific was comparable to other models with intensity error reasonably good after 18 hours (slide 22). Studies including directional decomposition are underway to investigate why they are having problem with recurving storms, possibly related to how the bogus and 3D-VAR are interacting. Bob said he has seen this a lot with other models and it may be related to systems in mid-latitudes and are related to the global model and not the hurricane per se. Jim agreed and stated that the timing of the tough affected whether it would recurve. This was seen with several storms in the West Pacific. Extending the domain a bit to the north tended to help some of the forecasts. He also noted that soon after initialization, the model immediately goes to the right and that may be related to the storm. Frank also stated the speed error seems to be related to the curvature. Jim followed by explaining the storms that were slow and to the right seemed to affect the re-curvature.

> **Question**: With the deep convective, there is a huge sensitivity to the curvature at least in the In GFDL model. It really had an impact on how the environmental field was being resolved in time. Have you tried SAS convective parameterization? Experiments have demonstrated SAS definitely improves aspect of the track for some of the storms.
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> **Question**: In slide 11 does the grid really go to 55N? GFS model there might be a conflict with the physics and COAMPS on a larger scale. Large scale affected by bilateral boundaries and the physics. Limited area models have boundaries and looked at extending it a bit more north. Meso scale model people skill of the synoptic 5 day forecast is not as good as the global models. (physics and data assimilation)

There was additional discussion about the re-curvature issue. Sim stated 98% of the runs with the G4 had data that increased the intensity of the subtropical ridge. The low bias in the subtropical ridge caused the storms to curve faster. Jim has done diagnostics on COAMPS-TC tackling synoptic high and seen deflates with time by 5 days. Sim has seen it with 6 hr forecast.

Jim also discussed the stream 2 development and real time demo. In slides 24-25, an overview of the COAMPS-TC run in real time using the data assimilation test bed, EnKF was provided. The model is an 80 member ensemble with 6 hour update scale with GFS-EnKF lateral boundary conditions and 45-15-5 km 2 way interactive nests for each storm. Forecast has 10 members with 20 member option, 120 hour lead time GFS-EnKF, and initial condition perturbations members 1-10. Summary plots are available on the net http://www.nrlmry.navy.mil/coamps-web/web/ens?&spg=1. Results from Hurricane Irene demonstrated the capabilities of the COAMPS-TC ensemble (10 member) in real time (slide 26). The coupled version of COAMPS-TC is built on the

ESMF (slide 27) and includes an atmospheric model and ocean model. Plans are underway for a community based ESMF coupler to facilitate exchange among the components. The coupled system has been evaluated using the ITOP dataset in W. Pacific (slide 28) to show the affect typhoons have on the ocean. The impact of synthetic observations is also being investigated (slide 29). New methodology places the synthetic observations at radius of maximum winds at 34 knots. The new synthetics represent the size and structure of tropical cyclones better and the track is improved. Some cases were worse as seen with Typhoon Megi. Tropical Cyclone Dynamical Initialization (TCDI) is also being investigated (slide 30). In TCDI, the initialization cyclone vortex is spun up on a separate model outside of the system and a look up table is created based on intensity and the storm is surgically removed from the model and replaced with the new spun up system. There have been promising results for intensity forecast. Physics improvements with the Thomas Microphysics scheme (slide 31), microphysics mixing and new SAS procedures (slide 32) have also shown some improvement in terms of intensity.

It was suggested that surface winds and the LGEM model be evaluated. The LGEM model with the diagnostic file was not included in the ensemble because it did not work in the retrospective runs. Plan to include for next year.

> **Question**: Did you see improvement in intensity with the ensemble compared to the deterministic mean? Performance was comparable up to 72 hours. The ensemble had 100 knot less the mean absolute error after 72 hours.

Jim concluded his presentation with a summary stating the real time test in 2011 using improved COAMPS-TC demonstrated some promising intensity predictions and will transition to FNMOC in FY2012. He also noted the importance of continuing to work with the multi-model ensemble of ensembles, coupled systems and new physics.

Upcoming HFIP Telecon

There next telecon is scheduled for the October 26, 2011 1400 – 1500 EST.