Hurricane Model Transitions to Operations at NCEP/EMC

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Six month report
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Work Plan, Time Line and Progress

The work plan for this JHT project has three basic thrusts: 1) Evaluate the addition of the NOAH land surface model (LSM) into the HWRF system; 2) Collaboration with EMC personnel in improving intensity forecasts through improvements in the initial condition and model physics; and 3) Troubleshoot the HWRF forecast system. This collaborative project with EMC is on a half-time basis.

Spring 2010 – Summer 2010

1. Collaborate in the implementation of the NOAH LSM and upgraded initial conditions for the 2010 tropical season.

- Preliminary experiments were run by Tuleya for several Atlantic 2008 cases utilizing the NOAH LSM. Results in Fig. 1 indicated some increased track skill. Subsequently, LSM changes in the code were implemented into the current operational 2010 HWRF system. Results from the early 2010 season (e.g. Alex) are now being analyzed.
- HLSM now saves runoff data as well as low level wind and rainfall data hourly to WRF auxiliary output.
- A new post-processing script now interpolates hourly model runoff grid data directly to the routing Conus grid for stream model input.
- Work is continuing to initialize HWRF with more realistic initial conditions of soil moisture from NAM and NLDAS, rather than GFS. It is unclear whether this will lead improved atmospheric forecasts, but this should improve stream flow forecasts.
- Further refinements to HLSM system are planned by Tuleya.
- With the inclusion of the Noah LSM into the 2010 system, more objective verification of landfall decay and rainfall is planned.

2. Collaboration with EMC personnel in improving intensity forecasts through improvements in the initial condition and model physics.

- One defect of the Kwon surface physics HWRF 2010 update may be that stability is not used in the present formulation and that the formulation is cast in terms of CD & CH. To generalize this formulation, Tuleya reformulated the Kwon surface physics in terms of thermal and momentum roughness lengths and coded this reformulation into a revised surface flux routine for HWRF. This revision should also prove useful for future use in the implementation of wave and current coupling into the operational HWRF. Fig.2 shows that at low wind speed the effective enthalpy and momentum coefficients are affected by stability. The spread of points are due to stability changes.

- Tuleya released this generalized surface code to the HWRF group and several runs were made successfully. It is not obvious at this time whether this will lead to substantial improvement in the overall intensity or track forecasts of HWRF. More experiments will be needed to assess this new formulation.

3. Troubleshoot the HWRF forecast system.

- Tuleya was the author of the scientific physics documentation of the HWRF system for the DTC HWRF tutorial. See http://www.dtcenter.org/HurrWRF/users/docs/scientific_documents/HWRF_final_2-2_cm.pdf. This documentation has already proved helpful both for in-house and the user community. Several bugs have been discovered in developing this physics package documentation.
- Tuleya continues to participate in physics and diagnostic HFIP committees to improve the capabilities of HWRF and other regional hurricane models.
- Tuleya continues to work with the HWRF group in suggesting changes in the HWRF initialization technique and comparing it with the GFDL initialization code.

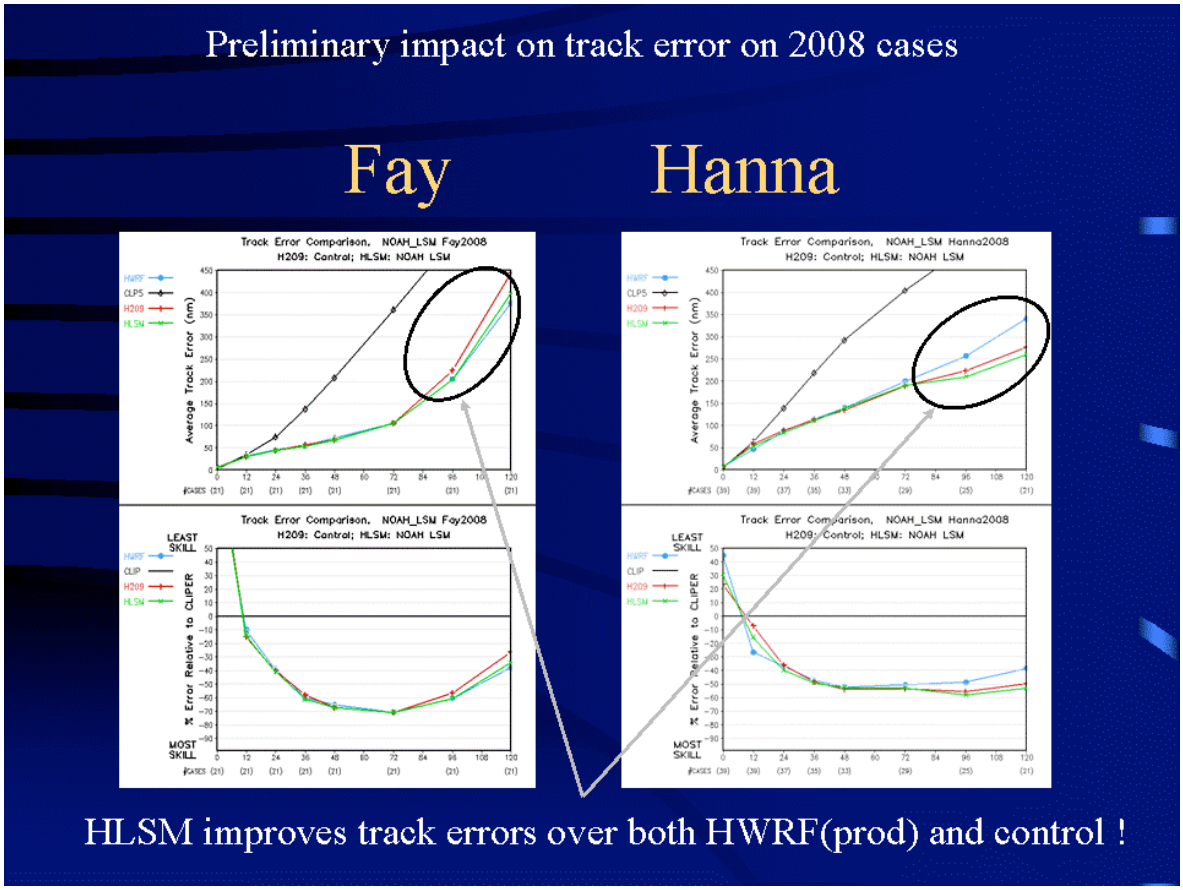

Fig. 1 Preliminary results showing improvement using the Noah land surface model in HWRF. Improvements tended to be at larger forecast times. Forecasts are now being carried out using the present 2010 operational code.

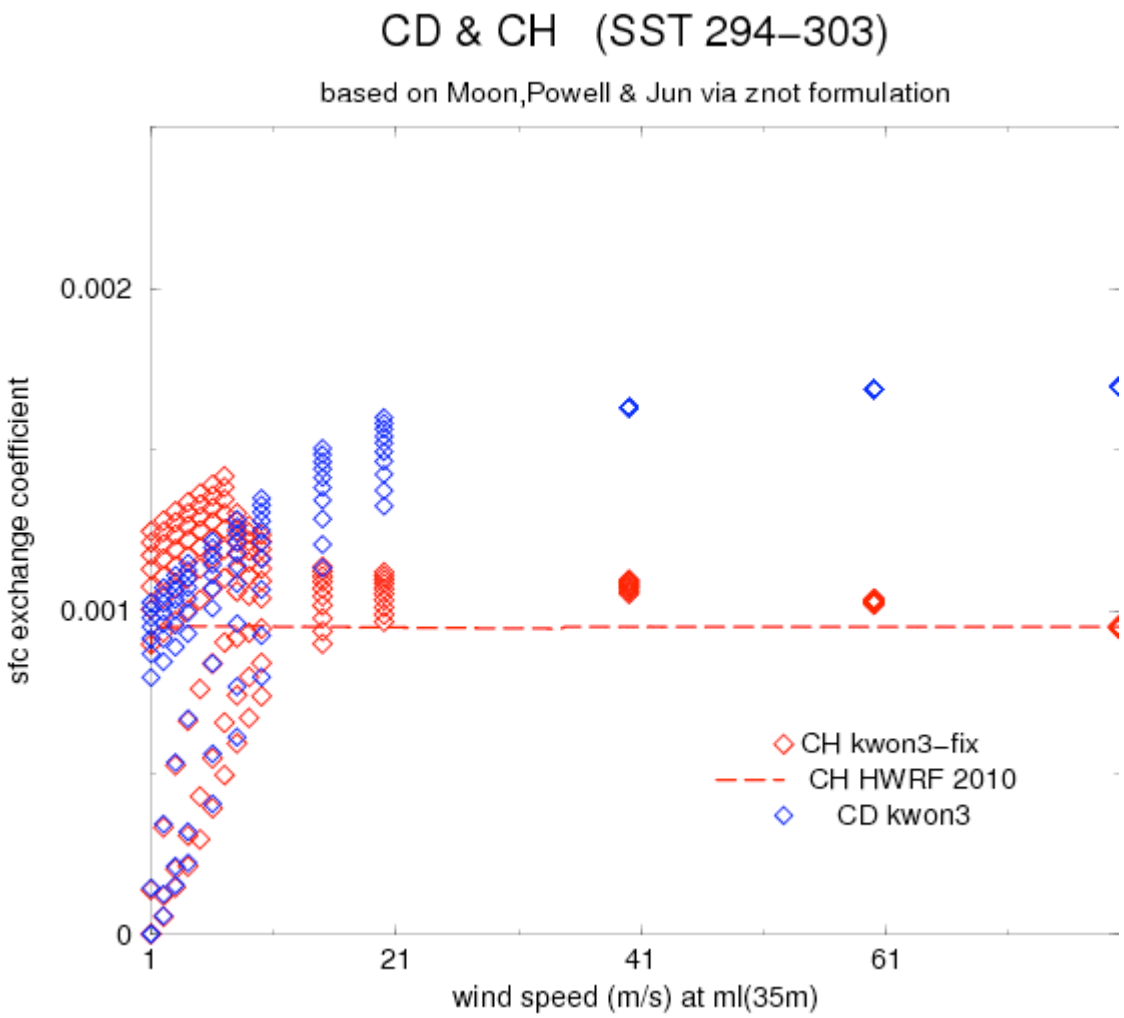

Fig.2 A revised off-line calculation of surface exchange coefficients for various stabilities of the enthalpy fluxes (red points) and momentum fluxes (blue points). Note at high wind speeds results conform to those of the 2010 HWF Kwon formulation with little spread due to stability.