Hurricane Model Transitions to Operations at NCEP/EMC

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6 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. A one year review was made at the recent 65th IHC meeting.

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

- For the past several years, preliminary experiments were run by Tuleya for several Atlantic 2008-2010 cases utilizing the NOAH LSM. Results varied but unfortunately indicated some degradation in track skill especially using the 2009-2010 HWRF model. These results were complicated and the degradations were initially exasperated in the recent transition to the standard WRF-V3R2 software. Unfortunately this transition to WRF V3 caused additional problems in causing warm temperature noise in the nest grid over land. Recently, the integrity of the code is being investigated with some improvements shown when certain word format options are used. Tuleya has been running a revised version of the HWRF model with NOAH LSM using the operational 2011 HWRF but with the Netcdf option. Apparently there are issues with the binary format option in the operational HWRF when using the NOAH LSM option. Using this revised format option apparently alleviates most of the issues of boundary noise (Fig.1), and track degradation (Fig.2). Note in the Table below for Hurricane Irene for the HWRF version with the LSM (i.e. H11L). Red numbers indicate improved forecast times showing a modest track improvement over the operational HWRF. This version of the HWRF is being run in parallel for the 2011 Atlantic hurricane season.

TABLE for 31 cases of Irene(2011) showing track error in nm

#,	FHR,	HWRF,	GFDL,	CLP5,	AVNO,	H11L
31,	00,	5.2,	5.7,	4.6,	6.0,	5.0,
29,	12,	28.8,	32.5,	37.7,	23.5,	27.9,
27,	24,	43.1,	47.5,	65.3,	31.6,	41.0,
25,	36,	52.0,	66.9,	92.1,	44.9,	50.6,
23,	48,	56.5,	93.0,	111.9,	54.5,	57.7,
20,	72,	74.6,	157.1,	173.0,	72.6,	73.2,
16,	96,	116.3,	218.4,	220.6,	88.7,	107.0,
12,	120,	206.5,	366.5,	243.3,	146.4,	206.5

- Several enhancements to the HWRF system were made earlier to accommodate the inclusion of the NOAH LSM including runoff data hourly to WRF auxiliary output and connecting this hourly model runoff grid data directly to a routing stream model. This technique is now being updated for the operational 2011 HWRF. With the inclusion of the Noah LSM into the HWRF 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.

- As previously reported Tuleya reformulated the Kwon HWRF operational surface physics in terms of thermal and momentum roughness lengths and coded this formulation into a revised surface flux routine for HWRF. This revision was used in the transition of HWRF V3R2 code to DTC and will serves as the basis for the 2011 operational surface code method. Results indicated some improvement in intensity and track skill in the Atlantic 2011 season so far, especially for Irene.

3. Troubleshoot the HWRF forecast system.

- Tuleya has recently revised and written the 2011 scientific physics documentation of the HWRF system for the DTC HWRF tutorial. He gave the presentation of the HWRF physics at the WRF hurricane tutorial in Boulder this past Spring. See http://www.dtcenter.org/HurrWRF/ and http://www.dtcenter.org/HurrWRF/users/docs/scientific_documents/HWRF_final_2-2_cm.pdf. This documentation has proved helpful both for in-house and the user community. Tuleya has recently recommended a bug fix for a benign bug in the surface flux code discovered by DTC.

- As mentioned, the introduction of the NOAH LSM into HWRF has been troublesome. This summer, Tuleya has changed the input file format which apparently has improved the HWRF forecast performance in track and intensity. Much of the long standing noise problems have been eliminated. Further test are needed to identify the reasons for this positive change and to transition back to the operational binary format.

- Tuleya continues to participate in physics and diagnostic HFIP committees to improve the capabilities of HWRF and other regional hurricane models. He continues to work with the HWRF group in suggesting changes in the HWRF initialization technique and comparing it with the GFDL initialization code. Tuleya also participates and collaborates with HRD scientists in the improvements of the HWRF system.

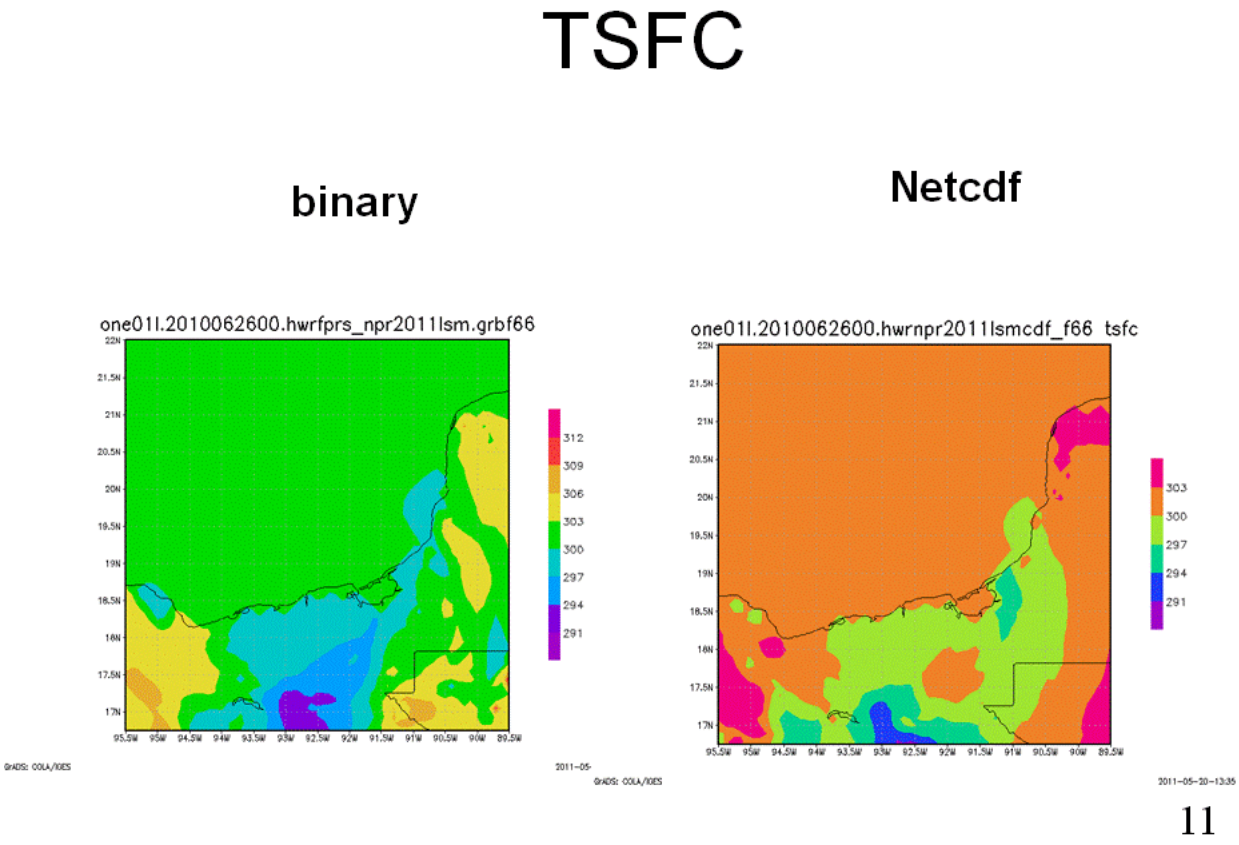

Fig. 1 An example of NOAH LSM boundary problems in the NEST domain for the HWRF 2011binary code(left) compared with the HWRF 2011 Netcdf (right). The surface temperature is plotted for a case of Alex as the model vortex leaves the Yucatan peninsula. Note the distinctly difference patterns and the larger Tsfc range in the binary code. Note that the left and right patterns should be nearly identical.

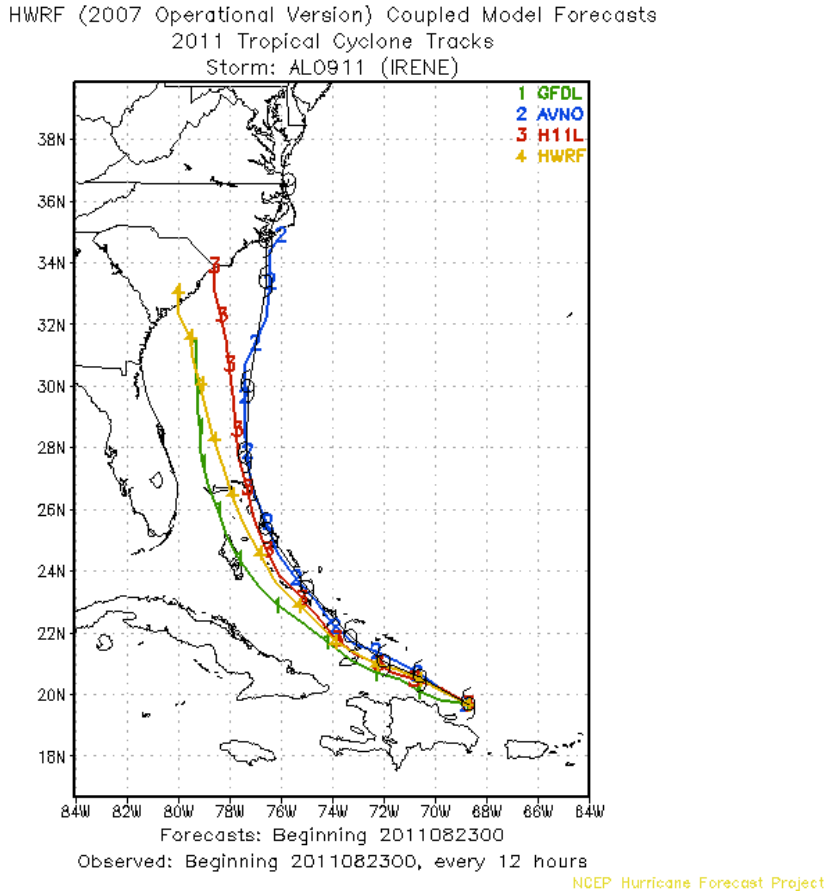

Fig.2 An example of the NOAH LSM (H11L,red) track improvement over the operational HWRF(yellow) model for the 2011082300 case of Irene (2011). The operational GFS(AVNO, blue) shows a superior forecast while the GFDL(green) and operational HWRF have a spurious westward movement.