Hurricane Model Transitions to Operations

2nd mid-year report
Dec 15, 2008

By Robert Tuleya
Science Applications International Corporation
Email: Robert.Tuleya@noaa.gov

The HWRF system continued to make advancements in the 2008 tropical Atlantic season. SAIC and PI Tuleya were integral members in this progress. As can be seen in Fig.1 HWRF performed better in intensity forecasts than the GFDL dynamical model up to 84h and had nearly the same skill as the baseline Decay SHIPS statistical model throughout the 120h forecast time period. HWRF was also quite competitive in the 2008 track forecasts being among the best dynamical models for this active Atlantic season.

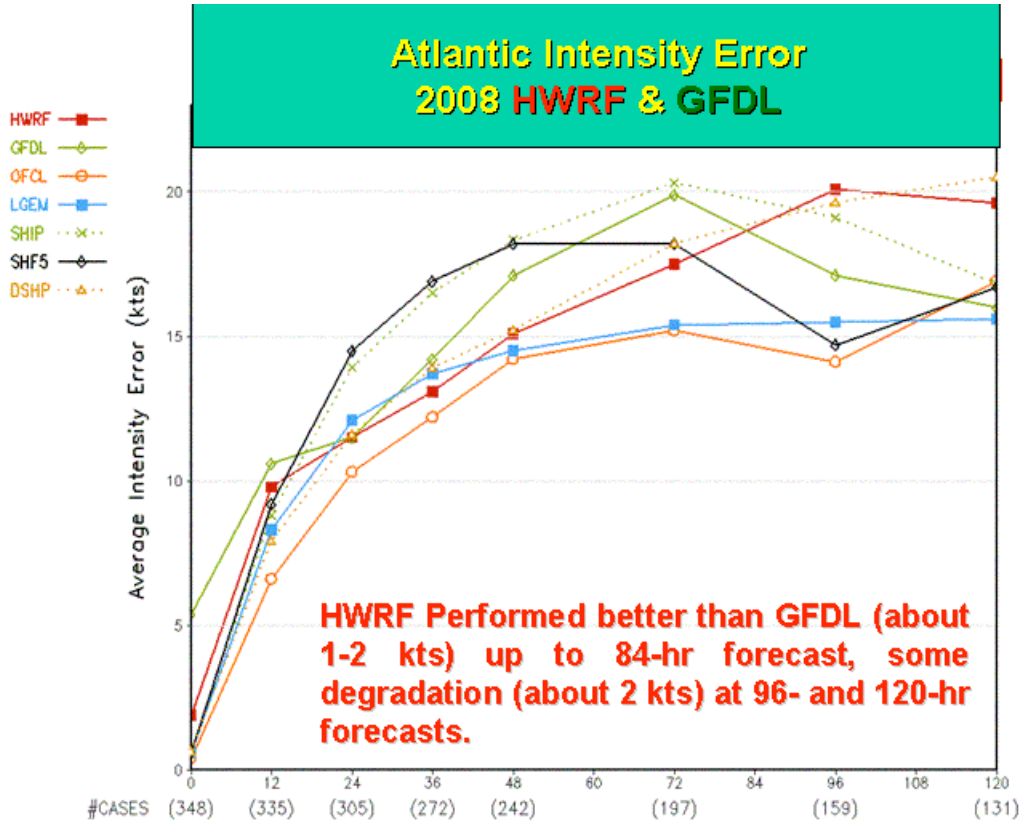

Fig.1. Intensity forecasts for a suite of production guidance for the 2008 Atlantic season including the HWRF system (red). 348 homogeneous cases were evaluated.

In the following, the 2nd year time line is shown with the work progress in these areas:

Year Two: 1 September 2008 through 30 August 2009

1. Continue to evaluate the physics and dynamics packages in HWRF, which lead to improvements over/above the 2007 HWRF system.

One nagging problem noticed was the unrealistic land surface temperatures predicted during the 2008 tropical season in HWRF. This was an especially taxing problem in that most diagnostics failed to indicate the extent of the problem. It was discovered that this was a sporadic problems involving the radiative surface fluxes that sporadically set to zero in the nest domain when the nest domain was moved. It was discovered that this could be resolved by calling radiation for the nest domain at frequent (9min) constant intervals (see Fig.2 below).

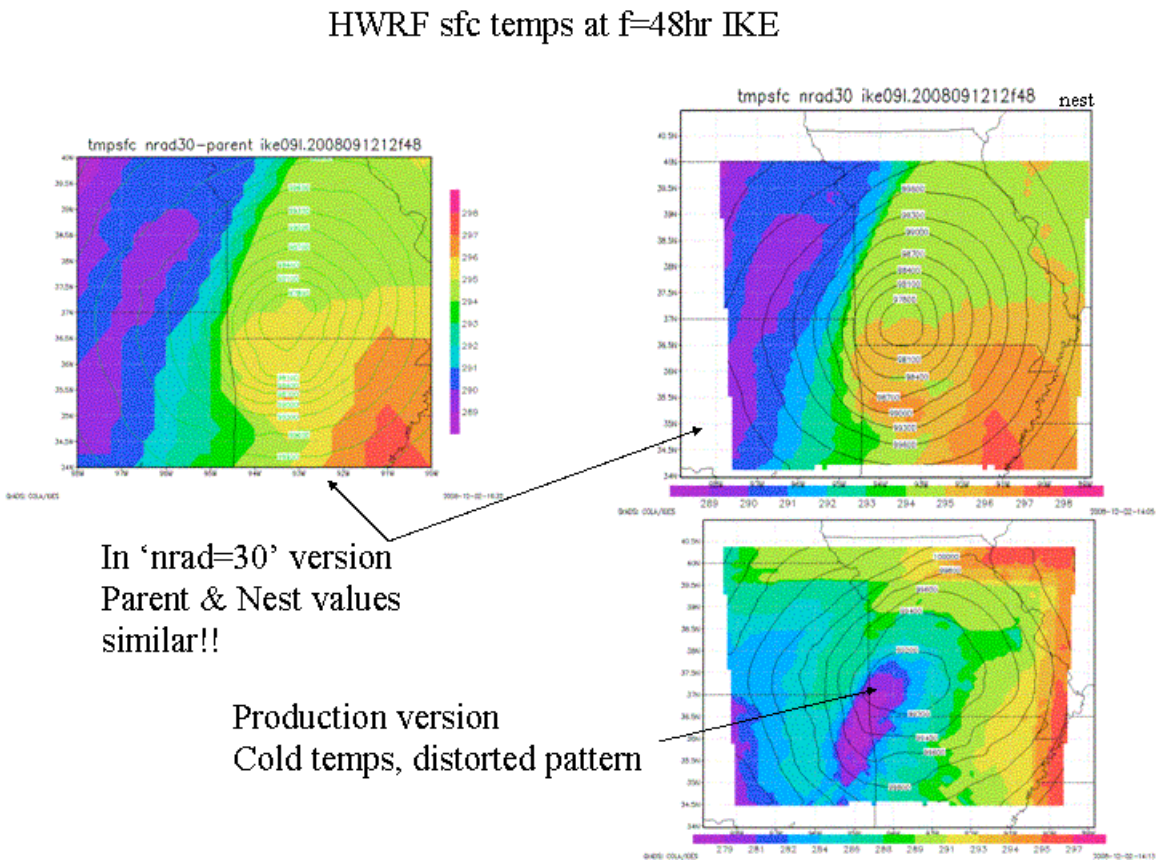

Fig.2. HWRF plots of 48h surface temperature forecasts from hurricane IKE started from Sep. 12, 12UTC for both the production version (lower right, nest) and test version with radiation called every 9min in the nest. Parent(upper left) and Nest (upper right) are shown for the same area indicating no spurious cold temperatures.

In addition, work continues on several issues including refinements to the surface flux parameterization for reduced drag over the ocean at high wind speeds. Other work continues on the evaluation of the environmental flow and the PDF of maximum forecasts winds and comparison of HWRF with GFDL.

2. Investigate the feasibility of higher resolution HWRF.

The HWRF group has made advances in developing a high resolution version of the production version of HWRF. The first task was to be able to split up the 5 day integration into separate 12h-24h forecasts chained together. This was a challenging task for a 2-nest system to allow WRF restart options and obtain identical answers. The forecast shown below (Fig.3) shows the track forecast of DEAN where restarts were performed at 24 and 36h. More recently, the system has been upgraded to double the resolution (4.5km inner nest) with ocean coupling included. A high resolution case of hurricane Rita was run with an apparent increase in skill in both track and intensity. Tuleya has been working with Zack Zhang of EMC on this task.

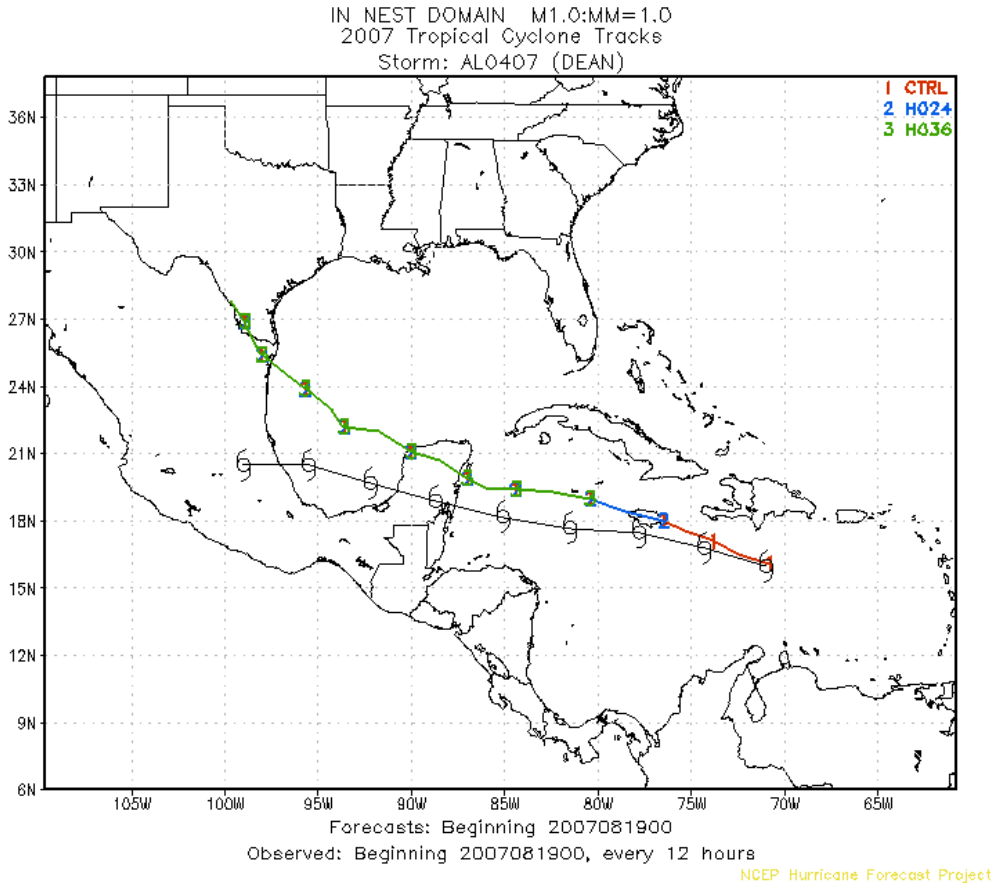

Fig.3. Comparison of HWRF tracks for a control run and for cases in which HWRF was restarted at 24 and 36h. Notice that tracks are identical in either case indicating that HWRF model can now be split into several separate forecasts.

3. December 12, 2008 – Mid-year report due

4. Investigate the skill of the HWRF system in forecasting landfall: the overall decay rate as well as the distribution of winds.

As reported last time, the NOAH LSM has been implemented into the HWRF forecast system in test mode. As an additional benefit, the runoff from the LSM was used to drive a basic stream flow model. Additional refinements are taking place. The surface temperature problem fix mentioned above is being integrated into the NOAH LSM system as well. This work is being done in collaboration with Yihua Wu of EMC.