Evaluation of Tropical Cyclone Forecasts From a High-Resolution Version of fvGFS

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The FV3 dynamical core has been selected to replace the GFS dynamical core in the Next Generation Global Prediction System (NGGPS) project. A nested version of the FV3 core with GFS physics and initial conditions (fvGFS) allows for simulation of convection and other features such as tropical cyclones (TCs) at relatively high resolutions (up to 2-3 km in the current version). Here, a version of the model with 3 km resolution is evaluated for its ability to simulate TC track, intensity, and structure. Different versions of the model are tested, including versions with the SAS convective parameterization turned on and off on the inner nest over the Atlantic. A new microphysics scheme developed at GFDL is also evaluated compared to the Zhao-Carr microphysics currently in the GFS model. The structure is evaluated through comparison of the model forecasts with 3-dimensional Doppler radar from NOAA P-3 radar data from NOAA's Hurricane Research Division (HRD). Structural metrics evaluated include the 2-km radius of maximum wind (RMW), slope of the radius of maximum wind, and depth of the TC vortex.

Several TCs from the 2010-2016 seasons are evaluated, including Earl (2010), Irene (2011), Edouard (2014), Gonzalo (2014), and Matthew (2016). Results show that track forecasts are best when SAS is turned off on the inner nest, but intensity is much better forecast when SAS is turned on. This version of the model produced skillful rapid intensification (RI) forecasts for Earl and Edouard. While all versions of the model tend to have too large RMW and slightly too shallow of a vortex compared to observations, the cases with SAS turned on have better forecasts of structure. In addition, although it does not significantly alter the intensity, the new GFDL microphysics lead to improvements in both individual structure forecast and also composite structural forecasts. Further work will explore the impacts to TC structure on using a higher resolution nest (~2 km) and further physics changes.