7A.8 Hurricane WRF model transition to operations at NCEP/EMC: Sensitivity of results to surface fluxes and convection

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1. INTRODUCTION

It has long been recognized that hurricane models are sensitive to surface energy fluxes, momentum drag and both resolvable and parameterized convective schemes. Recent generation research models such as MM5 and WRF (Weather Research and Forecasting Model) have physical schemes more advanced than the present operational GFDL hurricane model. Despite this fact it hasn't been shown that these new generation models lead to improved forecasts of track and intensity on an operational basis.

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2. PLANS AND DISCUSSION

In transitioning to NCEP's next generational Hurricane WRF model, the benchmark physics will be the physics package presently used in the GFDL model. This physics package includes the Simplified Arakawa convective scheme and a Monin-Obukov surface scheme. These schemes will be compared to the present Global Forecasts System (GFS) parameterizations as well as with some other parameterizations deemed appropriate for meso-scale forecasting. One example of the difference between the GFDL and GFS model can be seen in Fig 1. Emphasis will be placed on the surface package presently used in the GFDL model and it's comparison with schemes that have separate surface roughness estimates for heat and momentum. This is especially important since intensity is known to be quite sensitive to these parameterizations and that hurricane maintenance can only be sustained through surface energy fluxes, especially that of moisture. On the other hand, surface friction has a retarding effect on hurricanes.

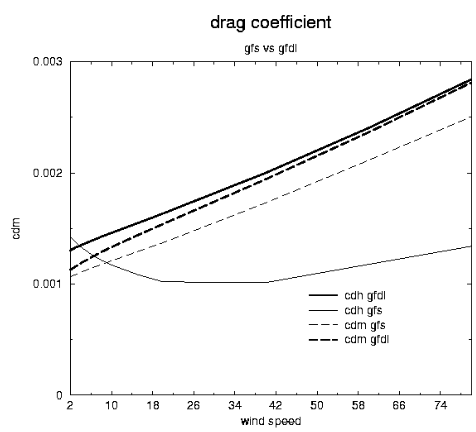

Fig.1 Comparison of exchange coefficients of heat/moisture and momentum for the GFDL and GFS models.

The surface exchange processes are still poorly understood and still under investigation. Recently, wave models and observations appear to indicate that the long used parameterizations that increase drag with wind speed may not apply under hurricane conditions. On the other hand, surface evaporation is complicated due to the effect of spray and the chaotic nature of

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the ocean interface under hurricane conditions.

HWRF Offline and model code comparisons indicate that surface evaporation in the GFDL model increases monotonically with wind speed while the GFS physics package increases evaporation at a lesser rate. Furthermore, the GFDL surface drag appears to be more dissipative even with a reduced coefficient

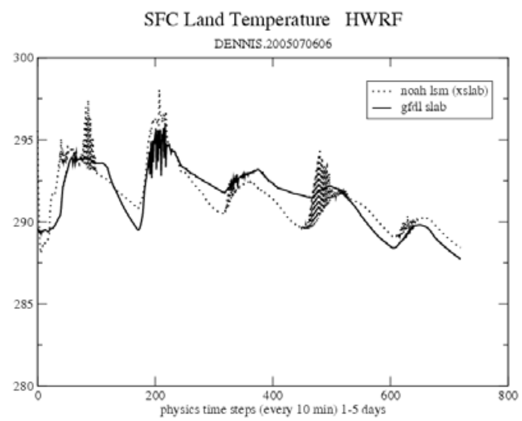

Fig.2 Comparison between surface temperatures predicted using the NOAH LSM and the GFDL slab.

in the Charnock's formulation over water. The effect of the subsurface land parameterization in HWRF will also be discussed. Fig.2 presents a comparison of the sensitivity of the surface temperature using the NOAH LSM model and the more simple GFDL slab model in HWRF for a case of Dennis (2005). Comparisons will be shown in real data cases of HWRF for the 2005 Atlantic season. The effect of surface and convective parameterization on storm track and intensity will also be shown.