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## Assessing the Predictability of Tropical Cyclone Intensity Using HWRF

Numerical model predictions of tropical cyclone (TC) intensity and structure suffer from deficiencies associated with initial conditions and model formulation. Here, we propose to study how errors in the HWRF model's initial conditions impact subsequent forecasts of TC intensity and wind structure using ensemble forecasts and the ensemble-based sensitivity method. This study will utilize the semi-operational HWRF ensemble forecasts to understand the role of vortex structure and the large-scale environment in producing forecasts characterized by large variability in intensity and structure, which implies lower predictability. In particular, this work will compare the ensembles standard deviation in maximum wind speed between different forecasts to determine whether TC intensity, size, vertical shear direction and magnitude, sea-surface temperature, and large-scale moisture lead to systematic differences in the predictability of TC intensity. For those forecasts with the largest variability in the maximum wind speed, we will apply the ensemble sensitivity technique to HWRF ensemble forecasts to determine how initial condition errors associated with the vortex structure and environment impact intensity and structure forecast. The role of wind and moisture errors in different locations will be evaluated by comparing ensemble members that produce the largest and smallest intensity at a particular lead time and evaluating how the differences in forecast fields between the different subsets evolve with time. This method will also be used to evaluate what processes might be responsible for the large intensity errors observed for TCs characterized by moderate vertical wind shear. The potential applicability of targeted observations for TC intensity will be tested by assimilating different sets of dropsonde observations for a set of retrospective cases. The three experiments will involve running the HWRF

Hybrid data assimilation system where either no dropsondes, all dropsondes, or a limited set of targeted dropsondes identified by an objective method are assimilated and comparing the resulting forecasts against one another. Finally, this project will attempt to develop a statistical algorithm that provides a priori predictions of TC intensity errors based on the TC intensity forecast, structure, and environment, which could be used by forecasters to place confidence bounds on their forecast and suggest situations where the model could benefit from additional development. The outcome from this work will provide greater insight into the predictability of TC intensity and guidance for future observation strategies for TCs.