Assessing the Impact of Initial Condition Errors on Forecasts of Hurricane Katia (2011)

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The poor representation of tropical cyclones (TCs) in the initial conditions (IC) of numerical models is one possible reason for the lack of improvement of TC intensity forecasts. Therefore, it is important to understand how uncertainty in the vortex and its environment impacts TC intensity forecasts. Assessing this issue would broaden our knowledge of the dynamics of TC intensity, and reveal the location and type of observations that when assimilated into the numerical models could reduce TC intensity errors.

This study examines how initial-time errors associated with the vortex and its environment impacted intensity forecasts for Hurricane Katia (2011). This particular case showed some of the largest forecast intensity variability within three years worth of retrospective ensemble forecasts from the Advanced Hurricane Weather Research and Forecasting (AHW) model. To evaluate the impact of different factors on this particular case, we have identified ten members that forecasted the largest rate of intensification (named strongest members) and ten members that predicted the least or no intensification (named weakest members). Composites of these two subgroups indicate that the strongest members were characterized by weaker wind shear in the analysis, particularly between the 700 and 850 hPa levels. Furthermore, the weakest members exhibited a drier lower troposphere in the northern side of the storm, thus inhibiting the intensification of the cyclone. Ensemble-based sensitivity analysis also showed that changing the initial low-level moisture influenced the storm intensity. These preliminary results suggest that errors in lower tropospheric fields near the TC modulated the AHW ensemble intensity forecasts of Katia. An evaluation of vortex-scale metrics will also be completed to understand if and how vortex-scale features also affected AHW intensity forecasts of this storm.