

Understanding the Response of Tropical Cyclone Structure to the Assimilation of Synthetic Wind Profiles

L. R. Bucci, S. J. Majumdar, R. Atlas, S. Greco and G.D. Emmitt

Abstract

The launch of the first space-based Doppler Wind Lidar, ESA's ADM-Aeolus, has reinvigorated the conversation on the importance of high-resolution, accurate wind profiles. The debate often revolves around the spatial and temporal resolutions needed to produce a sufficient analyses and reliable forecasts. The meteorological community has a particular interest in understanding the wind observations needed to improve tropical cyclone (TC) prediction. This study examines how varying wind profile coverages in the TC core, near-environment and broader synoptic scale effect the structure and evolution of a hypothetical Atlantic hurricane.

Three sets of experiments are examined in this presentation. The first experiment set establishes the upper threshold of predictability for the case study. This is accomplished by placing perfect profiles throughout the forecast domain. The second set presents how the TC analyses and forecasts respond to the varying coverage of swaths of perfect wind profiles. The final set introduces realism to the observation coverage by allowing cloud attenuation and assimilating line-of-sight winds. All observations were simulated from a high-resolution regional "Nature Run" of a hurricane and the tropical atmosphere, assimilated using a 30-member Ensemble Square-Root Kalman Filter, cycled every 6 hours for 5 days, and forecasts produced using the Hurricane Weather and Research Forecast (HWRF) regional model. Results compare observation impact to the analyses, domain-wide and TC centric error statistics, and TC structural differences between the experiments. Conclusions highlight the importance of wind observations and the role of inner-core surveillance when analyzing and forecasting realistic TC structure.

Amer. Meteor. Soc. 100th Ann. Meeting, Boston, MA

24th Conference on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface (IOAS-AOLS)

Monday, January 13, 2020 10:45-11:00 AM