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Department of Atmospheric Sciences Seminar Announcement

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SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY

A COMPARISON AND VALIDATION OF MICROPHYSICAL PARAMETERIZATIONS IN SIMULATED HURRICANES ARTHUR and ANA (2014)

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Date: **Wednesday, October 21, 2015**
Seminar Time: **3:30pm**
Location: **Marine Sciences Building, MSB 100**

Abstract:

Numerical weather prediction has seen a proliferation of increasingly complex microphysical parameterizations, but it is unclear if the added complexity actually improves the representation of key physical processes in tropical cyclone (TC) simulations and whether the potential forecast improvements outweigh the computational cost. The work to be presented is a preliminary validation of several single-moment, double-moment and spectral bin microphysical parameterizations available in the WRF-ARW model for TC simulation using newly available radar products. The United States' Doppler radar network upgrade to dual-polarization from 2011-2013 provides new observations for estimating the microphysical properties of precipitation. Dual-polarimetric radar observations can provide a targeted validation of the drop size distribution (DSD) by estimating the phase, size, and number concentration of precipitation at high resolution over a broad area. The radar upgrade allows for new assessments of the structure of TCs that approach the U.S. coastline to both improve our understanding of microphysical processes and validate the performance of numerical models.

New simulated dual-polarization radar observations are created from WRF simulations of Hurricanes Arthur and Ana (both 2014) using different microphysical parameterizations and compared to NEXRAD observations. Traditional metrics of track and intensity are also compared with Best Track archives. Hurricane Arthur formed in the Atlantic basin and impacted the southeast U.S. coast, while Hurricane Ana formed in the Central Pacific and impacted the Hawaiian Islands. We find in both cases that the overall track, structure, and intensity of the storms is reasonably well simulated. However, the single-moment microphysics parameterizations do not simulate the range of DSDs well, resulting in frequency distributions that are too narrow. On the other hand, double-moment schemes vary in their accuracy, with some schemes producing reflectivity and differential reflectivity that are too large compared to the observations. The spectral bin model most accurately reproduces the observed DSDs and the Best Track intensity for both storms. However, the bin model requires approximately 16 times the computational power compared to the bulk schemes, making it a valuable research tool but currently unfeasible for operational TC prediction.