MMM SEMINAR SERIES

Biases and Limitations in the Estimation of Tropical Cyclone Intensity

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While the average errors of tropical cyclone track forecasts have been steadily declining over the last two decades, intensity forecasts have only marginally improved. For North Atlantic forecasts, the 24-hour intensity forecast has shown no improvement, with mean errors of peak wind speed forecasts remaining around 10 knots for the last 20 years. Some recent studies have suggested that, given the current "observing system" of satellites, aircraft reconnaissance, and subjective analysis, the actual peak wind speed cannot be measured to an accuracy greater than about 10 knots. In this study, we use an Observing System Simulation Experiment (OSSE) approach to test the limitations of even nearly perfect observing systems to capture the peak wind speed occurring within a tropical storm or hurricane. The data set is provided by a 1-km resolution simulation of an Atlantic hurricane with surface wind speeds saved every 10 seconds. An optimal observing system consisting of a dense field of fixed anemometers is placed in the path of the storm: this provides a perfect measurement of the peak 1-minute wind speed. In reality, reliable surface observations are very rare in tropical cyclones. Therefore suboptimal observing systems consisting of a small number of anemometers are sampled and compared to the truth provided by the optimal observing system. Results show that a single, perfect anemometer experiencing a direct hit by the right side of the eyewall will still underestimate the actual peak intensity by 10-20%. Even an unusually large number of anemometers (e.g., 3-5) experiencing direct hits by the storm will together underestimate the peak wind speeds by 5-10%. However, the peak intensity of just one or two anemometers will provide, on average, a good estimate of the true peak intensity averaged over several hours, which is in fact more consistent with operational definitions of intensity. If the mean bias were known perfectly for each case, it could be used to correct the wind speeds, leaving only mean absolute errors of 3-5%.

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Thursday, 7 January 2016, 3:30 PM
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