Further Studies of Observational Undersampling of the Surface Wind and Pressure Fields in the Hurricane Inner-Core

David S. Nolan[1]; Bradley Klotz[2]

[1]Univ. of Miami, RSMAS; [2]Univ. of Miami, CIMAS

Obtaining the best estimate of tropical cyclone (TC) intensity is vital for operational forecasting centers to produce accurate forecasts and to issue appropriate warnings. Aircraft data traditionally provide the most reliable information about the TC inner core and surrounding environment, but sampling strategies and observing platforms associated with reconnaissance aircraft have inherent deficiencies that contribute to the uncertainty of the intensity estimate. One such instrument, the stepped frequency microwave radiometer (SFMR) on the NOAA WP-3D aircraft, provides surface wind speeds along the aircraft flight track. However, the standard “figure-4” flight pattern substantially limits the azimuthal coverage of the eyewall, such that the chance of observing the true peak wind speeds is actually quite small. By simulating flights through a high-resolution simulation of Hurricane Isabel (2003), a previous study found that the 1-minute mean (maximum) SFMR winds underestimate a 6-hour running mean maximum wind (i.e. best track) by 7.5-10%.

This project applies the same methodology to a suite of hurricane simulations with even higher resolution and more sophisticated physical parameterizations. These include the hurricane nature run of Nolan et al. (2013), the second hurricane nature run, a simulation of Hurricane Bill (2009), and additional idealized simulations. For the nature run cases, we find that the mean underestimate of the best-track estimate is 12-15%, considerably higher than determined from the Isabel simulation, while the other cases are similar to the previous result. Comparisons of the various cases indicates that the primary factors that affect the undersampling percentage are storm size (resulting in greater undersampling) and storm intensity (resulting in reduced undersampling). Minimum surface pressure is also frequently estimated from pressures reported by dropsondes released into the eye, with a standard correction of 1 hPa per 10 knots of wind at the time of “splash.” Statistics from thousands of simulated splash points show that this rule is quite good for large wind speeds, but for low wind speeds there is still a positive bias to the pressure estimate, because the chance of hitting the true pressure minimum is quite small.