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Observations of Ocean Winds and Waves within Tropical Cyclons from CYGNSS

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The cyclone global navigation satellite system (CYGNSS), launched on December 15, 2016, represents the first dedicated GNSS-R satellite mission specifically designed to retrieve ocean surface wind speeds in the Tropical Cyclone (TC) environment. CYGNSS uses a constellation of eight microsatellite observatories that can receive both the direct and reflected signals from the GPS system. The CYGNSS observatories are capable of collecting up to four simultaneous reflections each, thus providing high temporal-resolution of ocean surface observations. Thus far, most CYGNSS studies have utilized simulated data from the CYGNSS End to End Simulator E2ES. The current setup of the E2ES assumes the surface slope variances and correlation are completely locally wind-driven, and they are calculated solely based on the local wind speed and wind direction. Analysis of the actual CYGNSS measurements during the course of the calibration and validation process indicates that this assumption is not valid over a large portion of the measurements. While the primary objective of the CYGNSS mission is the retrieval of ocean winds in tropical cyclones, examination of collected GNSS-R signal has shown that the measured signal is a function of both winds and waves. This paper will discuss the CYGNSS measurement dependency on both winds and waves over the ocean, as well as provide comprehensive evaluation of its measurement capability within tropical cyclone environment. This will include investigation of the CYGNSS GNSS-R signal sensitivity to ocean winds and waves, and evaluation of the released CYGNSS wind speed retrieval products. The remaining sources of significant error will also be discussed, and a coupled wind and wave GMF will be proposed.