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NASA CYGNSS Tropical Cyclone Mission

Chris Ruf (1), Robert Atlas (2), Sharan Majumdar (3), Suhas Ettammal (4), and Duane Waliser (5)

(1) University of Michigan, Ann Arbor, United States (cruf@umich.edu), (2) NOAA/AOML, Miami, United States (Robert.Atlas@noaa.gov), (3) University of Miami, Miami, United States (smajumdar@rsmas.miami.edu), (4) Indian Institute of Science Education and Research, Pune, India (suhase@gmail.com), (5) NASA Jet Propulsion Laboratory, Pasadena, United States (duane.e.waliser@jpl.nasa.gov)

The NASA Cyclone Global Navigation Satellite System (CYGNSS) mission consists of a constellation of eight microsatellites that were launched into low-Earth orbit on 15 December 2016. Each observatory carries a four-channel bistatic scatterometer receiver to measure near surface wind speed over the ocean. The transmitter half of the scatterometer is the constellation of GPS satellites. CYGNSS is designed to address the inadequacy in observations of the inner core of tropical cyclones (TCs) that result from two causes: 1) much of the TC inner core is obscured from conventional remote sensing instruments by intense precipitation in the eye wall and inner rain bands; and 2) the rapidly evolving (genesis and intensification) stages of the TC life cycle are poorly sampled in time by conventional polar-orbiting, wide-swath surface wind imagers. The retrieval of wind speed by CYGNSS in the presence of heavy precipitation is possible due to the long operating wavelength used by GPS (19 cm), at which scattering and attenuation by rain are negligible. Improved temporal sampling by CYGNSS is possible due to the use of eight spacecraft with 4 scatterometer channels on each one. Median and mean revisit times everywhere in the tropics are 3 and 7 hours, respectively.

Wind speed referenced to 10m height above the ocean surface is retrieved from CYGNSS measurements of bistatic radar cross section in a manner roughly analogous to that of conventional ocean wind scatterometers. The technique has been demonstrated previously from space by the UK-DMC and UK-TDS missions. Wind speed is retrieved with 25 km spatial resolution and an uncertainty of 2 m/s at low wind speeds and 10% at wind speeds above 20 m/s. Extensive simulation studies conducted prior to launch indicate that there will be a significant positive impact on TC forecast skill for both track and intensity with CYGNSS measurements assimilated into HWRF numerical forecasts. Simulations of CYGNSS spatial and temporal sampling properties for observing the Madden-Julian Oscillation (MJO) and Convectively Coupled Equatorial Waves (CCEW) indicate that it will allow for improved characterization of MJO temporal variability and of the major CCEW modes.

The EGU 2017 presentation will include an overview of the CYGNSS mission, a report on current mission status, and summaries of the simulation studies performed regarding TC forecasts and MJO and CCEW characterization.