CYGNSS: New Satellite Mission to Probe Ocean Waves and Winds

Valery Zavorotny[(1)], Scott Gleason[(2)], Christopher Ruf[(3)], Maria-Paola Clarizia[(3)], Randy Rose[(2)], John Scherrer[(2)], Paul Chang[(4)], and Zorana Jelenak[(4)]
(1) NOAA/ESRL, Boulder, CO USA
(2) Southwest Research Institute, Boulder, CO USA
(3) University of Michigan, Ann Arbor, MI USA
(4) NOAA/NESDIS/StAR, College Park, MD USA

The Cyclone Global Navigation Satellite System (CYGNSS) is a new NASA Earth science mission selected in June 2012 and scheduled to be launched in 2016. Its main focus will be on the study of tropical cyclones (TC) and tropical convection. A constellation of eight equally spaced microsatellites will be deployed in a low inclination (35°) circular orbit. Such an orbit maximizes coverage and sampling in the tropics. This mission will use a technique based on bistatic quasi-specular reflections of the Global Positioning System (GPS) signals from the ocean surface. For this, each CYGNSS spacecraft is equipped with a 4-channel bistatic L-band radar receiver that measures the scattered signal using two nadir left-hand circularly polarized antennas. The receiver performs cross-correlation of the scattered signal with a replica of the direct GPS signals and, as a result, generates delay-Doppler maps (DDM). These maps represent bistatic scattering cross section images in the vicinity of the nominal specular point on the Earth's surface as a function of time lag and Doppler shift. The distribution of the power in the DDMs depends on the mean-square slope of the rough ocean surface, which, in turn, is related to the surface wind. Regression-based wind retrievals from DDMs are developed using empirical geophysical model functions that are derived from NDBC buoy wind matchups.

The mission's goal is to support significant improvements in our ability to forecast TC track, intensity and storm surge through observations with sufficient temporal resolution. This will be achieved by deploying a constellation of eight satellites. The high temporal sampling allows resolving short time scale processes such as the rapid intensification phase of TC development, and, ultimately, better understanding of inner core processes. Use of L-band GPS signals enables surface observations under the extremely high precipitation rates typically encountered in the TC inner core. Additionally, CYGNSS will have the ability to generate measurements over land surfaces, allowing researchers further validation of GNSS-R land-sensing techniques such as the estimation of near surface soil moisture, snow and vegetation.