CYGNSS MISSION OVERVIEW AND IMPLEMENTATION UPDATE

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ABSTRACT

The Cyclone Global Navigation Satellite System (CYGNSS) project, NASA's first Earth Venture Mission, will implement a spaceborne earth observation system designed to collect measurements of ocean surface winds through measurements of variations in the direct vs. reflected Global Positioning System (GPS) signals. The mission is designed to provide data to enable the study of the relationship between ocean surface properties, moist atmospheric thermodynamics and convective dynamics. These factors are thought to be fundamental to the genesis and intensification of tropic storms. Key information about the ocean surface under and around a tropical storm is hidden from existing space borne observatories due to signal attenuation in the frequency bands in which they operate by the intense tropical cyclone precipitation, thus obscuring the ocean’s surface. This is a driving factor behind the fact that while tropical storm track forecasts have improved in accuracy by ~50% since 1990, there has been essentially no improvement in the accuracy of the storm’s intensity prediction [1]. Because L-band signal attenuation is only a minor factor by even the strongest of tropical cyclones, GNSS-based bi-static scatterometry performed by a constellation of micro-satellites offers remote sensing of ocean waves and wind with unprecedented temporal resolution and spatial coverage across the full dynamic range of ocean wind speeds in all precipitating conditions. A better understanding of these relationships and their effects should advance our ability to forecast tropical storm intensity and its closely related storm surge.

Consistent oceanic surface wind data of high quality and high temporal and spatial resolution are also required to understand and predict the large scale air-sea interactions that influence both the atmosphere and ocean. Such observations are needed to drive ocean models and surface wave

models, calculate surface fluxes of heat, moisture, momentum, and CO2. Surface wind stress provides the most important forcing of the ocean circulation, while the fluxes of heat, moisture and momentum across the air-sea boundary are important factors in the formation, movement, and modification of water masses and the intensification of storms near coasts and over the open oceans [1].

Achieving the required temporal and spatial resolution for tropical cyclone remote sensing has not been possible previously due to technology and cost limitations. Modeling techniques developed over the past 20 years combined with recent developments in nano-satellite technology and an increased risk tolerance by NASA have enabled the CYGNSS mission. The mission will combine all-weather performance of GNSS bi-static ocean surface scatterometry with the sampling properties of a satellite constellation to provide science measurements never before available to the tropical cyclone research community. CYGNSS consists of 8 GPS bi-static radar receivers deployed on 8 micro-satellites to be launched in October 2016. The CYGNSS Observatories are enabled by modern electronic technology; it is an example of how "off the shelf" nanosatellite technology can be applied to replace traditional “old school” solutions at significantly reduced cost while providing an increase in performance. The CYGNSS IGARSS 2015 paper will provide an overview of the mission system, discuss operational concepts uniquely associated with cost-effective constellation management, and present implementation status of the CYGNSS system.

BIBLIOGRAPHY

[1] NOAA, "Herricane Forecast Improvement Project," NOAA, 2008.

[2] R. Atlas, A. J. Busalacchi, E. Kalnay and S. Bloom, "Global surface wind and flux fields from model assimilation of Seasat data," *Journal of Geophysical Research,* vol. 92, no. (C6), pp. 6477-6487, 1987.