

121Conference

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Abstract Title

Exploring the utility of the planned CYGNSS mission for investigating the initiation and development of the Madden-Julian Oscillation

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Abstract

CYGNSS is a planned constellation consisting of multiple micro-satellites that leverage the Global Positioning System (GPS) to provide rapidly updated, high-resolution (~15-50 km, ~4 h) surface wind speeds (via bi-static scatterometry) over the tropical oceans in any weather condition, including heavy rainfall. The approach of the work to be presented at this conference is to utilize a limited-domain, cloud-system resolving model (Weather Research and Forecasting or WRF) and its attendant data assimilation scheme (Three-Dimensional Variational Assimilation or 3DVAR) to investigate the utility of the CYGNSS mission for helping characterize key convective-to-mesoscale processes - such as surface evaporation, moisture advection and convergence, and upscale development of precipitation systems - that help drive the initiation and development of the Madden-Julian Oscillation (MJO) in the equatorial Indian Ocean.

The proposed work will focus on three scientific objectives. Objective 1 is to produce a high-resolution surface wind dataset resolution (~0.5 h, ~1-4 km) for multiple MJO onsets using WRF-assimilated winds and other data from the DYNAMics of the MJO (DYNAMO) field campaign, which took place during October 2011 - March 2012. Objective 2 is to study the variability of surface winds during MJO onsets at temporal and spatial scales of finer resolution than future CYGNSS data. The goal is to understand how sub-CYGNSS-resolution processes will shape the observations made by the satellite constellation. Objective 3 is to ingest simulated CYGNSS data into the WRF model in order to perform observing system simulation experiments (OSSEs). These will be used to test and quantify the potential beneficial effects provided by CYGNSS, particularly for characterizing the physical processes driving convective organization and upscale development during the initiation and development of the MJO. The proposed research is ideal for answering important questions about the CYGNSS mission, such as the representativeness of surface wind retrievals in the context of the complex airflow processes that occur during heavy precipitation, as well as the tradeoffs in retrieval accuracy that result from finer spatial resolution of the CYGNSS winds versus increased errors/noisiness in those data. Research plans and initial progress toward these objectives will be presented.