Using CYGNSS to Observe Convectively Driven Near-Surface Winds in Tropical Precipitation Systems during Madden-Julian Oscillation Events
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1. Introduction

The Cyclone Global Navigation Satellite System (CYGNSS) is a multi-satellite constellation that launched 15 December 2016. The primary objective of CYGNSS is to use bistatic Global Positioning System (GPS) reflectometry to accurately measure near-surface wind speeds within the heavily raining inner core of tropical cyclones.

CYGNSS also features rapid revisit times over a given region in the tropics - ranging from several minutes to a few hours, depending on the constellation geometry at that time. Despite the focus on tropical cyclones, the ability of CYGNSS to provide rapid updates of winds, unbiased by the presence of precipitation, has many other potential applications related to general tropical convection.

2. Data and Methodology

MJO Simulations
MJO short periods during October, November, December 2011
Tropical-storm analysis during MJO
Callisto®-produced products
Callisto®-produced products
Enhanced surface winds with CYGNSS

CYGNSS OSSE
• Single-nest
• MJO tropical storm

GEOS-5 Nature Run
• 7-km resolution, 30-minute updates
• Simulates tropical convection but not MJO
• Apply CYGNSS End-To-End Simulator (E2ES)

3. Simulated CYGNSS Views of Convection

October 2011
Example from October 2016 MJO event
CYGNSS E2ES observed simulated Westerly Wind Burst (WWB) southwest of India
Enhanced surface winds in WWB associated with convectively driven downdrafts

December 2011
1800 UTC
1830 UTC

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CYGNSS should detect mesoscale wind features such as Westerly Wind Bursts and gust fronts, even in the presence of heavy precipitation. CYGNSS likely will provide benefits to future tropical oceanic field campaigns that should be considered during their planning processes.

4. CYGNSS OSSE of MJO Convection

10-m Wind Speed at 0500 UTC 2011-11-27

Forecast: SLP and wind vector at 18 UTC 2011-11-28

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This was a tropical storm during an MJO onset that did not develop further. CYGNSS Data Assimilation helped the model to resist the tendency of the Control Run to further strengthen the storm. In addition, storm track position was significantly improved over the Control.

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