Geophysical Research Abstracts
Vol. 15, EGU2013-10395, 2013
EGU General Assembly 2013

Typhoon Observations with the PARIS In-Orbit Demonstration Mission

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The PARIS In-Orbit Demonstration (PARIS IoD) mission is a small-class mission under study by the European Space Agency which aims at demonstrating scientific applications of the GNSS reflected signals, with particular focus on mesoscale ocean altimetry. It carries a single payload, a PARIS Ocean Altimeter, featuring the correlation between the direct and reflected GNSS signals received through high gain beam steering antennas. From the temporal position of the correlation waveforms and their amplitude characteristics, the sea surface height and several geophysical parameters of the ocean, land and ice can be extracted, in addition to the total electron content through the ionosphere. A practical application of this mission is the measurement of tsunami waves travelling in the ocean which would provide first-ever direct synoptic observations of this phenomenon.

Another application of the PARIS IoD is the observation of Typhoons. A Typhoon is a mature Tropical Cyclone (wind speed $\geq$32.7m/s according to the World Meteorological Organization) that develops in the northwestern part of the Pacific Ocean between 180°E and 100°E (the same phenomenon, when develops in the Atlantic Ocean, East Pacific Ocean and the Caribbean Sea, is usually referred to as Hurricane). GNSS reflectometry observations of Typhoons might help scientists better model these phenomena, understand their genealogy and improve the predictions about their intensification and path route.

A brief study has been conducted on the capability of the PARIS IoD mission to observe different physical parameters of a Typhoon, including wind speed at the sea surface, significant wave height and sea surface height. This research has included three tasks: (a) a review of the physical characteristics of a Typhoon like pressure profile, wind speed, significant wave height, spatial extent, temporal duration and geographical occurrence; (b) the sensitivity of the PARIS IoD observations to these different physical parameters, like for example, wind speed estimated precision for a given measurement signal to noise ratio; and finally (c) a simple simulation to show the sampling and tracking capability of a given Typhoon with the PARIS IoD mission, assuming its nominal orbital parameters, and reflected signals from GALILEO, BEIDOU, GPS and GLONASS satellites. This contribution aims at presenting the main results of this study.