# Objective Mapping GNSS-R Altimetry for Tsunami Detection

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The massive destruction caused by tsunamis in recent history demonstrates the need for better tsunami detection methods that can provide early warnings to coastal residents and save lives. The Global Navigation Satellite System (GNSS) reflectometry (GNSS-R) technology has long been theorized as a plausible space-based approach to detect tsunamis in real-time. The CYGNSS mission, although originally designed to improve sampling of ocean surface winds in tropical cyclones, provides metadata related to the timing of the signal propagation from the GPS transmitter to the Earth's surface, and from the surface to the CYGNSS receivers. This timing information permits a modified type of ocean surface altimetry, and therefore provides a unique opportunity to demonstrate the GNSS-R altimetry for tsunami detection. Here we propose an Objective Mapping GNSS-R Altimetry method for detecting tsunami heights using the long-wave characteristics of tsunamis. An algorithm is developed and demonstrated based on the CYGNSS metadata. Retrieval uncertainty and the associated error budget are simulated based on historical tsunamis [Song et al., 2005; 2012] in comparison with conventional radar altimetry measurements (e.g., Jason series) and in-situ (DART buoys) measurements are presented.

Reference:

Song, Y. T., I. Fukumori, C. K. Shum, and Y. Yi (2012), Merging tsunamis of the 2011 Tohoku-Oki earthquake detected over the open ocean, *Geophys. Res. Lett.*, doi:10.1029/2011GL050767 (**Nature Highlights, March 8, 2012**).

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