

# Potential SmallSat GNSS-Reflectometry Flood Inundation Mapping Applications

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## Abstract

NASA's Cyclone Global Navigation Satellite System (CYGNSS), launched in 2016, is a GNSS-Reflectometry (GNSS-R) small satellite constellation mission designed to measure ocean surface wind speed in hurricanes and tropical cyclones. As part of NOAA/NESDIS/Office of Projects, Planning and Analysis (OPPA) Technology Maturation Program (TMP), this study explores additional capabilities for GNSS-R CYGNSS applications over land surface. The objectives is to investigate the capabilities and limitations of using CYGNSS data to map flood inundation, which could be potentially useful in NOAA National Weather Service's hydrologic predictions.

Our effort began by validating existing efforts to detect surface waters using CYGNSS Level 1 data and to improve upon existing methods. Our study shows that although the published methodologies worked in simple landscapes, an improved technique would be required in the diversified landscapes such as those around population centers or agriculture areas. We found that the CYGNSS is sensitive to surface waters, vegetation types, and seasonal growth periods. We developed a new methodology utilizing machine learning to identify water covered land uses. The use of machine learning enabled us to increase our detection rate slightly and greatly reduced our false positive and error rates. We will discuss our findings and results from investigating CYGNSS's signal to noise ratio (SNR) to water and non-water surface types in the east central coast of Texas in the US.