



## **Progress Report on the GROWTH (GNSS Reflectometry for Ocean Waves, Tides, and Height) Research Project**

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There has been considerable interest in GNSS Reflectometry (GNSS-R) as a new remote-sensing method. We have started a research program for GNSS-R applications on oceanographic observations under the contract with MEXT (Ministry of Education Culture, Sports, Science and Technology, JAPAN) and launched a Japanese research consortium, GROWTH. It is aiming to evaluate the capabilities of GNSS-R observations for oceanographic phenomena with different time scales, such as ocean waves (1/10 to tens of seconds), tides (one or half days), and sea surface dynamic height (a few days to years). In situ observations of ocean wave spectrum, wind speed vertical profile, and sea surface height will be quantitatively compared with equivalent estimates from simultaneous GNSS-R measurements.

The GROWTH project will utilize different types of observation platforms; marine observation towers (about 20 m height), multi-copters (about 100 to 200 m height), and much higher-altitude CYGNSS data. Cross-platform data, together with in situ oceanographic observations, will be compared after adequate temporal averaging that accounts differences of the footprint sizes and temporal and spatial scales of oceanographic phenomena.

This paper will provide overview of the GROWTH project, preliminary test results obtained by the multi-sensor platform at observation towers, and preparation status of a ground station that will be supplied to receive CYGNSS data at Japan.