

## Proposal of GNSS Buoy Array in the Ocean for a Synthetic Disaster Mitigation

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A system of GNSS buoy for detecting tsunami has been developed for more than 15 years in Japan. The buoys deployed around the Japanese coasts have successfully detected tsunamis with amplitudes of about 10 centimeters or bigger, including a large tsunami due to the 2011 Tohoku-Oki earthquake. The present study tries to extend the GNSS buoys for a wide variety of applications for monitoring disaster related signals in the ocean, such as ocean bottom crustal deformation, atmospheric water vapor detection for weather monitoring, and ionospheric disturbance detection for space weather monitoring as well as tsunamis.

One problem of the GNSS buoy system that we have developed is the limitation of baseline distance to at most less than 20km, as the system uses so-called Real-Time Kinematic algorithm which requires a base station on land. Recent developments of real-time GNSS technology enabled us to estimate position of a moving platform like buoy in a few centimeter accuracy in real-time without a base station on land, so that the buoy is now able to be deployed at much far offshore.

Combination of precise point positioning with acoustic ranging to the ocean bottom transponder stations enables positioning of the ocean bottom station in continuous manner. Moreover, GNSS data on the buoy provide us with accurate estimation of atmospheric water vapor and total electron content in the ionosphere. These geophysical data on the ocean surface, together with land based sensors, will serve us with unprecedented invaluable datasets for better understanding of ocean bottom crustal deformation, atmospheric and ionospheric disturbances as well as sea surface disturbances. Combined this GNSS buoy technology with satellite data transmission and long-term safe and secure operation of GNSS buoy in outer ocean is a key for materializing the capability of GNSS buoy. We propose to establish an array of GNSS buoy in the Japanese EEZ area for a synthetic geodetic and geophysical infrastructure of earth science and as well as disaster mitigation.

Keywords: GNSS, GNSS buoy, tsunami, ocean bottom crustal movement, meteorology, ionosphere