

GNSS-based height positioning derived from multiple ships for measuring and forecasting great tsunamis

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We investigate GNSS-based ship height positioning for measuring and forecasting great tsunamis. We first examined a GNSS height positioning record of a running research vessel. If we use the Precise Point Positioning (PPP), tsunamis greater than  $10^1$  cm will be detected by ship height positioning. We refer an Automatic Identification System (AIS) data, and find that tens of tankers and cargos are usually navigating over the Nankai Trough. We assume that a future Nankai Trough great earthquake tsunami is measured by PPP-based height positioning of the AIS-derived ship distribution, and examine the tsunami forecast skill of the tsunami measurement by the PPP-based ship height. A method of Tsushima et al. (2009, 2012) is used for the forecast. The tsunami forecast tests were carried out using simulated tsunami data by the PPP-based ship height of 92 tankers/cargos, and by existing ocean-bottom-pressure and GPS-buoy observations over the Nankai Trough at 71 stations. The forecast skill using the PPP-based height of the 92 ships is shown to be comparable to that using the existing offshore observatories at the 71 stations. During the great earthquakes, we suppose that stations along a certain coast that receive successive ship information (AIS data) would fail and obtain no ship data due to the strong ground motion, especially near the epicenter. Such a situation will significantly worsen the skill of the tsunami forecast above. On the other hand, real-time analysis of seismic/geodetic data would be carried out for estimating a tsunamigenic fault model, independently from analyzing offshore tsunami data. Incorporating the seismic/geodetic fault model estimation into the tsunami forecast above possibly compensates the deteriorated forecast skill.

Keywords: GNSS, ship height, tsunami forecast