Estimation of the Characterized Tsunami Source Model by Using the observed waveforms of GPS Buoys in the Nankai Trough

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In the 2011 Tohoku earthquake tsunami disaster, the delay of understanding damages state increased the human damage. To solve this problem, it is important to develop the method to estimate the area with severe damage. Koshimura (2007) showed the method to estimate the regional impact of a tsunami using a numerical model and the world population database. In this method, the accuracy of the external force conditions in the calculation of tsunami greatly affected the result of the estimation. Therefore, it is important to estimate the tsunami source quickly and precisely after the earthquake. Satake (1987) showed the method for estimating fault heterogeneity by an inversion of tsunami waveforms. Recently, many researches based on this inversion method have been reported (e.g. Tsushima et al., 2009; Takagawa and Tomita, 2012; Fuji et al., 2013; Tsushima et al., 2014). The previous studies needed a lot of data of tsunami observation, such as GPS Buoys, DART stations, DONET and tidal gauges, to estimate the distribution of dislocation on tsunami source. The reason is that the tsunami source is segmented by small faults.
In this study, we examined the new method to estimate the characterized tsunami source model. The model consists of three zones. They are Large slip zone (LSZ), Super large slip zone (SLSZ) and background rupture zone (BZ) as the Cabinet Office, Government of Japan (2012) reported after the Tohoku tsunami. The characteristic of the proposed method is that the tsunami fault is segmented by the three zones and this segmentation reduces the amount of observed data required estimating the characterized tsunami source model. The targeted fault parameters to estimate are fault length, fault width, dislocation and forming location in each zone. At the beginning of this method, the rectangular fault model is assumed based on the seismic magnitude and hypocenter reported right after an earthquake. By using the fault model, tsunami propagation is simulated numerically, and the fault model is improved after comparing the computed data with the observed data repeatedly. In the comparison, correlation coefficient and regression coefficient are used as indexes. They are calculated with the observed and the computed tsunami wave profiles. This repetition is conducted to get the two coefficients close to 1.0, which makes the precise of the fault model higher.
We analyzed sensitivity of the indexes to fault length, fault width and dislocation. Further, we examined influences of LSZ and SLSZ on the indexes, and the following two results are obtained. (1) The correlation coefficient corresponds to fault length and fault width. On the other hand, the regression coefficient corresponds to fault length, fault width and dislocation. (2) The two coefficients decrease at close to LSZ and SLSZ when estimation of BZ. Therefore, the estimation of BZ is carried out as a first step, and LSZ and SLSZ are estimated next. The proposed method by using GPS buoy was applied for a tsunami scenario in the Nankai Trough. LSZ and SLSZ in BZ could be estimated well.

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