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Multiple Tsunami Scenarios considering Large Slip Zone, Super Large Slip Zone, Hypocenter and Seismic Magnitude

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In the 2011 Tohoku Earthquake Tsunami Disaster, the actual tsunami heights had exceeded the estimated heights extremely and the underestimation caused serious damages in Japan. This tsunami shows a disaster beyond assumption increase damages greatly. Multiple scenarios might be effective in reducing the risk beyond assumption and they have been studied for the tsunami disaster mitigation (e.g. Takahashi et al., 1995 ; Kawata et al., 2003 ; Suzuka et al., 2004 ; Tomioka et al., 2005 ; Suzuki and Kawata, 2012). However, many researches have focused on the macroscopic fault parameters and the microscopic fault parameters have not been considered sufficiently.

After the Tohoku tsunami, Cabinet office government of Japan reported 'Large slip zone (LSZ) and Super large slip zone (SLSZ)' related with asperity and the assumed tsunami faults models (e.g. Cabinet office government of Japan, 2012). After that, some organizations consider a new assumption about fault model. However, the idea about a shape or location of LSZ and SLSZ is different. And the standard method has not been decided. Assumption of their shape or location could be different in the case of same hypocentral region, and the characteristic of occurred tsunami might be different. Therefore, the general model to assume LSZ and SLSZ is required.

Seto and Takahashi (2014) proposed a model to assume multiple tsunami scenarios considering uncertainly of LSZ and SLSZ, and the model was applied to the Nankai trough. The model consists of background rupture zone (BZ), LSZ and SLSZ. The main feature of this model is to enable to make the multiple tsunami scenarios systematically after determining some parameters such as the ratios of area and dislocation of LSZ to a tsunami fault. As a result, Seto and Takahashi (2014) showed 15 tsunami scenarios. However, it was indicated as the improvement that the model is not examined several LSZ and SLSZ, the uncertainly of hypocenter and seismic magnitude.

In this study, the improved general model considering more the above 3 points is proposed. Compared with the model of Seto and Takahashi (2014), the characteristic of this proposed model is as follows. (1) The uncertainly of seismic magnitude considered by a scaling law can be examined. (2) The two couples of LSZ and SLSZ can be examined. (3) The uncertainly of hypocenter can be examined. The proposed model was applied for the Nankai Trough to assume multiple tsunami scenarios and its detailed procedure was shown. As a result, several hundreds scenarios were assumed. By using these tsunami scenarios, tsunami propagation was simulated numerically and the maximum variation of water level observed within 24 hours on GPS buoys is examined comparing with the previous model.

Keywords: Tsunami fault, Uncertainly, Nankai trough, GPS buoy