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Tsunami simulation using fault model from strong motion records of the 2011 off the Pacific coast of Tohoku Earthquake

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Many source models for the 2011 off the Pacific coast of Tohoku Earthquake are proposed from the inversion analyses of seismic observations or from those of tsunami observations. Most of these models show similar features, which large amount of slip is located at the shallower part of fault area near the Japan Trench. That indicates that seismic wave propagation and tsunami can be evaluated by the single source model.

We have been examining the possibility of the tsunami prediction, using the fault model estimated from seismic observation record. In the previous study, we have carried out the tsunami simulation for the 2011 off the Pacific coast of Tohoku Earthquake, using the displacement of oceanic movements calculated from the ground motion simulation due to the fault model based on the teleseismic body wave by Yoshida et al.(2011). Comparisons of synthetic waveform and observation of the GPS wave gauge showed that the tsunami simulation underestimates the maximum tsunami height in most observing stations. This was because the tsunami due to the large slip in the shallower part of the fault plane near the Japan trench was not calculated in the last simulation.

On the other hand, the fault model estimated from the regional strong motion record by Yoshida et al.(2011) has a large slip in the shallower part of the fault plane near the Japan trench. Therefore it is suggested that the maximum wave height of the tsunami which was not able to be reproduced in the last simulation can be evaluated by the tsunami simulation using this fault model. In this paper, the tsunami simulation using the fault model due to the regional strong motion data is performed. First, the large-scale ground motion simulation based on the voxel finite element method is performed for the whole eastern Japan. Next, the tsunami simulation is performed by the finite difference calculation based on the shallow water theory. The initial wave height for tsunami generation is estimated from the vertical displacement of ocean bottom due to the crustal movements, which is obtained from the ground motion simulation mentioned above.

Keywords: the 2011 off the Pacific coast of Tohoku Earthquake, tsunami, strong motion record, fault model, simulation