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Tsunami simulation using seabed displacement due to fault slip obtained by boundary integration

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Initial water level of tsunami is generally considered equal to seabed displacement due to fault slip in simulation of tsunami which is generated by earthquake. Exact solution for displacement due to rectangular fault slip in elastic half space (Okada, 1985) has been widely applied to obtain the seabed displacement numerically.

On the other hand, we developed a new method to calculate the seabed displacement using boundary integration (Akiyama, et al. 2014). Our proposed method has advantages to calculate the seabed displacement easily only with the boundary integration for the fault surface, considering the seabed as an elastic half space and applying the Green's function which satisfies the free surface boundary condition, and to calculate the displacement adopting the irregular fault plane faithfully. The proposed method also has a feature that we can remove perfectly the influence of singularity of Green's function applying the Projection and Angular & Radial Transformation (PART) method (Hayami and Brebbia, 1988), when a fault plane is near from a seabed surface.

In this study, first, we calculate the seabed displacement due to the fault slip which is expected to occur in the plate boundary of the subduction area around Japan using the exact solution by Okada and the proposed method to compare the both results. Second, we execute tsunami simulations which the initial water level is considered equal to these displacements obtained above, and examine the difference between both results.

This research was carried out as part of Tsunami Hazard Assessment for Japan by National Research Institute for Earth Science and Disaster Prevention (NIED).

Reference

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Hayami, K. and C.A. Brebbia (1988) Quadrature methods for singular and nearly singular integrals in 3-D boundary element method, (Invited paper), Proc. 10th Int. Conf. on Boundary Elements, Southampton, Computational Mechanics Publication with Springer-Verlag, Vol. 1, pp. 237-264

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