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Modeling Real Structure with FDM using In-equally Spaced Grids - Effects of Seafloor Topography on Tsunami Propagation-

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When we use numerical simulation to understand geophysical phenomena, topography often affects those phenomena. It is necessary for understanding them to explain those phenomena in realistic structure models. In this study, we consider to use the Finite Difference Method (FDM) with in-equally spaced grids as a method for modeling realistic structures. We apply our method to tsunami disaster mitigation, considering the effects of the seafloor topography on the tsunami propagation.

Tsunami simulations are widely used to predict tsunami behavior occurred by an earthquake. The simulated tsunami, however, does not show good agreement with the observed one so often, especially in later phases. In this study, we make a hypothesis; the simulation of tsunami propagation including the effects of the seafloor topography can solve the difficulty of prediction of tsunami in later phases. We simulated tsunami propagation by solving three dimensional Navier-Stokes equations and by using FDM with in-equally spaced grids for realistic seafloor topography model. Comparing tsunami propagation in our method with that based on the conventional long wave theory, we discuss the effects of seafloor topography on tsunami propagation. We find that the tsunami propagation is influenced by two effects; effects of real changes in water depths and those of nonlinear terms in N-S equations. As a result, we conclude that our method, considering realistic seafloor topography on tsunami propagation, leads to the prediction of tsunami including later phases with much higher accuracy than the present.

Keywords: simulation of tsunami propagation, seafloor topography, modeling, in-equally spaced grids, later phases of tsunami, The Tohoku earthquake