Investigation of variation in multiple tsunami inundation modelling

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Many researchers have developed numerical models based on the nonlinear shallow water equations to estimate the propagation and inundation of tsunamis. Several models have been distributed as the software packages including source code, thus tsunami inundation simulation can be performed easily with bathymetric and topographic data available free. However, the tsunami modelling researchers also empirically understand that no tsunami simulation results agree perfectly with that of other research institutes even if the same numerical model is used. The maximum inundation depth, flow velocity and inundated area are different to a certain extent. To clarify the variation in tsunami simulation is very important to establish the standard method that confirm the reliability of tsunami inundation models and it will be useful for the tsunami countermeasure/mitigation planning.

The present study aims to evaluate magnitude of the variation in tsunami inundation simulation quantitatively. We conducted tsunami simulations under the same input data: the initial source model of tsunami, bathymetry, topography and land-use model provided by Cabinet Office, Government of Japan are adopted. A total of eight research institutes participated this project using four kinds of numerical models that are widely employed for the tsunami hazard/risk assessment. Comparison of the time history of water surface elevation and flow velocity at the specific points indicated that a significant difference was confirmed among the model results to the maximum value of physical quantities. The spatial distribution maps of the maximum inundation depth also showed that large variation occurs around the front of tsunami run-up. In order to explain the variation in tsunami inundation model quantitatively, the total flooded volume and the total momentum flux were newly defined. By statistical procedures using these variables, we were able to show the mean value, confidence interval and coefficient of variation of the tsunami inundation models.

Keywords: tsunami, numerical model, variation

