

Numerical Model Validation for Tsunami Force by FDM and FEM

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ABSTRACT

Many buildings has damaged by the tsunami run up of the 2011 off the Pacific coast of Tohoku Earthquake. In Japan, the estimation of tsunami force has been studying and revising for this reason. In recent study, several formulas to estimate a tsunami force easily have been developed by using hydraulic model test and numerical simulation. The tsunami force can be estimated either the method which is multiplied by the coefficient to the hydrostatic pressure or the method which is based on the Morison formula defined as drag and inertia force. The accuracy of estimated tsunami force, however, depends on the scale of tsunami. Furthermore, it is necessary to investigate the general versatility of tsunami force estimation which takes into account the applicability limits.

This paper presents the study of a tsunami force around building. We have estimated the tsunami force for buildings by using 2-D shallow water model based on Finite Difference Method (FDM) and Finite Element method (FEM). We have compared the results obtained by FDM and FEM with the results by several formulas. In order to validate several formulas, comparison between the 2-D shallow water models, 3-D free-surface model based on OpenFOAM and estimation by several formula have been carried out.

As a result, the tsunami force results by numerical model were good agreement with the results obtained by the tsunami force formulas. The results by 2-D shallow water model were equivalent to both 3-D model and formulas.

REFERENCES

- [1] FEMA : Guidelines for Design of Structures for Vertical Evacuation from Tsunamis, FEMA P646, 2008