

Hydraulic experiment and numerical modeling on tsunami deposit aiming tsunami source estimation

TAKAHASHI, Tomoyuki^{1*}

¹Faculty of Safety Science, Kansai University

Tsunamis generate large amounts of bed load and suspended load because of strong tractive force and turbulence in shallow seas. The sediment transport due to tsunamis have caused various damages such as collapsing coastal structures, shoaling navigation channels in ports and blocking water intakes in power plants. A risk assessment of the sediment transport is important for tsunami disaster mitigation, and a numerical model to analyze the phenomena has been required. Many hydraulic experiments and field investigations on the sediment transport and the bathymetry change caused by tsunamis have been carried out, and the measured data have contributed to constructing the numerical model. However, because such damages occur in the water, almost all of the researches on the tsunami sediment transport have assumed an inundated condition. They focused on the sediment transport and the bathymetry change when tsunamis arrive in the shallow seas. On the other hand, the sediment transport can make tsunami deposit on land, lakes and marshes. Some analysis of the tsunami deposit have obtained invaluable knowledge of historical and paleo-tsunamis. Therefore, the hydraulic experiments on the tsunami sediment transport on land are also carried out and the numerical model is attempted to extend to tsunami run-ups recently.

The present numerical model can cover tsunami source, propagation and sediment transport in the sea. The model can predict bathymetry changes due to tsunamis in coastal areas if fault models of earthquakes are given. A small fishing port, for example, has complicated coastal structures like breakwaters, and generates numerical instability easily. However, the practical and detailed simulation on tsunami sediment transport using a two meters grid was conducted stably. Therefore, if the numerical model is upgraded to simulate the sediment transport and the tsunami deposit by tsunami run-up, the model is expected to enable to analyze tsunami sources using the tsunami deposit distribution on land, lakes and marshes.

Based on the background described above, the hydraulic experiments and the numerical modeling on sediment transport under the inundated condition are explained firstly. Besides, the hydraulic experiments on land aiming to extend the numerical model to tsunami run-up are introduced. From simulation on the tsunami sediment transport in actual sea areas, present state and issues of the numerical model are organized. Finally, a method to estimate tsunami sources using tsunami deposit distribution is investigated.

Keywords: tsunami run-up, sediment transport, bed load, suspended load, topography change, inverse analysis