

Tsunami simulations for expected great earthquakes and risk evaluation of tsunami disaster at PelabuhanRatu in Indonesia

Yuichiro Tanioka^{1*}, Shunichi Koshimura², Hamzah Latief³, Haris Sundendar³, Yushiro Fujii⁵, Aditya Gusman¹, Kenji Satake⁴

¹Hokkaido University, ²Tohoku University, ³ITB, ⁴University of Tokyo, ⁵Building Research Institute

As a part of the JST-JICA project, "Multi-disciplinary Hazard Reduction from Earthquake and Volcanoes in Indonesia", tsunamis from expected great earthquakes are computed and a risk of disaster from those tsunamis at populated areas along the coast are planned to be evaluated. Pelabuhan Ratu is one of the most populated towns in the Indian coast of Western Java. Recently, large underthrust earthquakes occurred along the Java subduction zone generated large tsunamis and caused the severe tsunami disasters along the Indian coast of Java such as 1994 East Java earthquake (Mw 7.8) or 2006 West Java earthquake (Mw 7.7). Fortunately, those large earthquakes are a little too far to cause a large tsunami disaster at Pelabuhan Ratu. In this paper, the tsunami inundation heights and areas are estimated at Pelabuhan Ratu from several underthrust earthquake source models along the Java subduction zone are presented. For this research, available bathymetry data (such as ETOPO1, navigation charts and detailed survey data) and topography data (such as SRTM data and topography data from Bakosurtanal) were first collected for the detailed tsunami computation. Seven domains of gridded bathymetry data were created near Pelabuhan Ratu. The largest grid spacing was 1853 m. The smallest grid spacing at the populated area was 2.54 m which is small enough to evaluate heights of tsunami at each house. To evaluate a risk of tsunami, the shapes of 6464 houses and 495 governmental buildings in Pelabuhan Ratu are digitized from the satellite images as polygons. We also took many photos at each crossing of large roads at the town to classify houses which were digitized from satellite images. A risk of tsunami disaster is evaluated using those data with results of tsunami computation.

The non-linear shallow water equations were numerically solved on a staggered grid system using a finite difference method applying a moving boundary condition. Nested grids were also used for the tsunami computation. To make a realistic source model, we first study tsunami generated by the 2006 West Java earthquake. We estimate the best source model which explains the inundation heights along the coast of Pangandaran Based on the source model of the 2006 West Java earthquake, several fault models off Pelabuhan Ratu along the Java subduction zone are assumed. Preliminary results show that the source model with a moment magnitude of 8.0 generates the large tsunami with a maximum tsunami height of 5.8 m. The port of Pelabuhan Ratu is completely inundated and many houses near the port are also flooded by this tsunami.

Keywords: JST-JICA project, Tsunami, Indonesia