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The July 17, 2006 Java Tsunami: Tsunami Modeling and the Probable Causes of the Extreme Run-up

W. Kongko (1,3) and T. Schlurmann (2)

(1) PhD Student Franzius Institute for Hydraulic, Waterways and Coastal Engineering, Leibniz Universität Hannover (FI-LUH), Nienburger Str. 4, 30167 Hannover, Germany, kongko@fi.uni-hannover.de , (2) Director Franzius Institute for Hydraulic, Waterways and Coastal Engineering, Leibniz Universität Hannover (FI-LUH), Nienburger Str. 4, 30167 Hannover, Germany, (3) Resident Scholar Institute for Environment and Human Security, United Nations University, UN Campus, Hermann Ehlers Str.10 D-53113 Bonn Germany

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Abstract

On 17 July 2006, an Earthquake magnitude Mw 7.8 off the south coast of west Java, Indonesia generated tsunami that affected over 300 km of south Java coastline and killed more than 600 people. Observed tsunami heights and field measurement of run-up distributions were uniformly scattered approximately 5 to 7 m along a 200 km coastal stretch; remarkably, a locally focused tsunami run-up height exceeding 20 m at Nusakambangan Island has been observed. Within the framework of the German Indonesia Tsunami Early Warning System (GITEWS) Project, a high-resolution near-shore bathymetrical survey equipped by multi-beam echo-sounder has been recently conducted. Additional geodata have been collected using Intermap Technologies STAR-4 airborne interferometric SAR data acquisition system on a 5 m ground sample distance basis in order to establish a most-sophisticated Digital Terrain Model (DTM).

This paper describes the outcome of tsunami modelling approaches using high resolution data of bathymetry and topography being part of a general case study in Cilacap, Indonesia, and medium resolution data for other area along coastline of south Java Island. By means of two different seismic deformation models to mimic the tsunami source generation, a numerical code based on the 2D nonlinear shallow water equations is used to simulate probable tsunami run-up scenarios. Several model tests are done and virtual points in offshore, near-shore, coastline, as well as tsunami run-up on the coast are collected. For the purpose of validation, the model results are compared with field observations and sea level data observed at several tide gauges stations. The performance of numerical simulations and correlations with observed field data are highlighted, and probable causes for the extreme wave heights and run-ups are outlined.

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