



Numerical Simulation of the 2004 Indian Ocean Tsunami: Accurate Flooding and drying in Banda Aceh

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The Indian Ocean Tsunami on December 26, 2004 caused one of the largest tsunamis in recent times and led to widespread devastation and loss of life. One of the worst hit regions was Banda Aceh, which is the capital of the Aceh province, located in the northern part of Sumatra, 150km from the source of the earthquake. A German-Indonesian Tsunami Early Warning System (GITEWS) (www.gitews.de) is currently under active development. The work presented here is carried out within the GITEWS framework. One of the aims of this project is the development of accurate models with which to simulate the propagation, flooding and drying, and run-up of a tsunami. In this context, TsunAWI has been developed by the Alfred Wegener Institute; it is an explicit, () finite element model. However, the accurate numerical simulation of flooding and drying requires the conservation of mass and momentum. This is not possible in the current version of TsunAWI. The $P1^{NC} - P1$ element guarantees mass conservation in a global sense, yet as we show here it is important to guarantee mass conservation at the local level, that is within each individual cell. Here an unstructured grid, finite volume ocean model is presented. It is derived from the $P1^{NC} - P1$ element, and is shown to be mass and momentum conserving. Then a number of simulations are presented, including dam break problems flooding over both a wet and a dry bed. Excellent agreement is found. Then we present simulations for Banda Aceh, and compare the results to on-site survey data, as well as to results from the original TsunAWI code.