Geophysical Research Abstracts,
Vol. 11, EGU2009-12635, 2009
EGU General Assembly 2009

Using Multi-Scenario Tsunami Modelling Results combined with Probabilistic Analyses to provide Hazard Information for the South-WestCoast of Indonesia

K. Zosseder, J. Post, T. Steinmetz, S. Wegscheider, and G. Strunz
German Aerospace Center (DLR), German Remote Sensing Data Center, Wessling, Germany (kai.zosseder@dlr.de, +49 8153281445)

Indonesia is located at one of the most active geological subduction zones in the world. Following the most recent seaquakes and their subsequent tsunamis in December 2004 and July 2006 it is expected that also in the near future tsunamis are likely to occur due to increased tectonic tensions leading to abrupt vertical seafloor alterations after a century of relative tectonic silence. To face this devastating threat tsunami hazard maps are very important as base for evacuation planning and mitigation strategies.

In terms of a tsunami impact the hazard assessment is mostly covered by numerical modelling because the model results normally offer the most precise database for a hazard analysis as they include spatially distributed data and their influence to the hydraulic dynamics. Generally a model result gives a probability for the intensity distribution of a tsunami at the coast (or run up) and the spatial distribution of the maximum inundation area depending on the location and magnitude of the tsunami source used. The boundary condition of the source used for the model is mostly chosen by a worst case approach. Hence the location and magnitude which are likely to occur and which are assumed to generate the worst impact are used to predict the impact at a specific area.

But for a tsunami hazard assessment covering a large coastal area, as it is demanded in the GITEWS (German Indonesian Tsunami Early Warning System) project in which the present work is embedded, this approach is not practicable because a lot of tsunami sources can cause an impact at the coast and must be considered. Thus a multi-scenario tsunami model approach is developed to provide a reliable hazard assessment covering large areas. For the Indonesian Early Warning System many tsunami scenarios were modelled by the Alfred Wegener Institute (AWI) at different probable tsunami sources and with different magnitudes along the Sunda Trench. Every modelled scenario delivers the spatial distribution of the inundation for a specific area, the wave height at coast at this area and the estimated times of arrival (ETAs) of the waves, caused by one tsunamigenic source with a specific magnitude. These parameters from the several scenarios can overlap each other along the coast and must be combined to get one comprehensive hazard assessment for all possible future tsunamis at the region under observation. The simplest way to derive the inundation probability along the coast using the multiscenario approach is to overlay all scenario inundation results and to determine how often a point on land will be significantly inundated from the various scenarios. But this does not take into account that the used tsunamigenic sources for the modeled scenarios have different likelihoods of causing a tsunami.

Hence a statistical analysis of historical data and geophysical investigation results based on numerical modelling results is added to the hazard assessment, which clearly improves the significance of the hazard assessment. For this purpose the present method is developed and contains a complex logical combination of the diverse probabilities assessed like probability of occurrence for different earthquake magnitudes at different localities, probability of occurrence for a specific wave height at the coast and the probability for every point on land likely to get hit by a tsunami. The values are combined by a logical tree technique and quantified by statistical analysis of historical data and of the tsunami modelling results as mentioned before. This results in a tsunami inundation probability map covering the South West Coast of Indonesia which nevertheless shows a significant spatial diversity offering a good base for evacuation planning and mitigation strategies.

Keywords: tsunami hazard assessment, tsunami modelling, probabilistic analysis, early warning