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Modelling tsunami inundation for risk analysis at the Andaman Sea Coast of Thailand

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The mega-tsunami of Dec. 26, 2004 strongly impacted the Andaman Sea coast of Thailand and devastated coastal ecosystems as well as towns, settlements and tourism resorts. In addition to the tragic loss of many lives, the destruction or damage of life-supporting infrastructure, such as buildings, roads, water & power supply etc. caused high economic losses in the region. To mitigate future tsunami impacts there is a need to assess the tsunami hazard and vulnerability in flood prone areas at the Andaman Sea coast in order to determine the spatial distribution of risk and to develop risk management strategies. In the bilateral German-Thai project TRAIT research is performed on integrated risk assessment for the Provinces Phang Nga and Phuket in southern Thailand, including a hazard analysis, i.e. modelling tsunami propagation to the coast, tsunami wave breaking and inundation characteristics, as well as vulnerability analysis of the socio-economic and the ecological system in order to determine the scenario-based, specific risk for the region.
In this presentation results of the hazard analysis and the inundation simulation are presented and discussed.

Numerical modelling of tsunami propagation and inundation simulation is an inevitable tool for risk analysis, risk management and evacuation planning. While numerous investigations have been made to model tsunami wave generation and propagation in the Indian Ocean, there is still a lack in determining detailed inundation patterns, i.e. water depth and flow dynamics. However, for risk management and evacuation planning this knowledge is essential. As the accuracy of the inundation simulation is strongly depending on the available bathymetric and the topographic data, a multi-scale approach is chosen in this work. The ETOPO Global Relief Model as a bathymetric basis and the Shuttle Radar Topography Mission (SRTM90) have been widely applied in tsunami modelling approaches as these data are free and almost world-wide available. However, to model tsunami-induced inundation for risk analysis and management purposes the accuracy of these data is not sufficient as the processes in the near-shore zone cannot be modelled accurately enough and the spatial resolution of the topography is weak. Moreover, the SRTM data provide a digital surface model which includes vegetation and buildings in the surface description. To improve the data basis additional bathymetric data were used in the near shore zone of the Phang Nga and Phuket coastlines and various remote sensing techniques as well as additional GPS measurements were applied to derive a high resolution topography from satellite and airborne data. Land use classifications and filter methods were developed to correct the digital surface models to digital elevation models.
Simulations were then performed with a non-linear shallow water model to model the 2004 Asian Tsunami and to simulate possible future ones. Results of water elevation near the coast were compared with field measurements and observations, and the influence of the resolution of the topography on inundation patterns like water depth, velocity, dispersion and duration of the flood were analysed. The inundation simulation provides detailed hazard maps and is considered a reliable basis for risk assessment and risk zone mapping. Results are regarded vital for estimation of tsunami induced damages and evacuation planning.

Results of the aforementioned simulations will be discussed during the conference. Differences of the numerical results using topographic data of different scales and modified by different post processing techniques will be analysed and explained. Further use of the results with respect to tsunami risk analysis and management will also be demonstrated.