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Tsunami inundation modelling based on detailed roughness maps of densely populated areas

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Abstract. An important part within the German-Indonesian Tsunami Warning System (GITEWS) project was the detailed numerical investigation of the impact of tsunamis in densely populated coastal areas of Indonesia. This work, carried out by the German Research Centre Geesthacht in co-operation with DHI-WASY, also provides the basis for the preparation of high resolution hazard and risk maps by the German Aerospace (DLR).

In this paper a method is described of how to prepare very detailed roughness maps for scenario computations performed with the MIKE Flow Model FM in three highly resolved (~10 m) priority regions, namely Kuta (Bali), Padang (West-Sumatra), and Cilacap (southern coast of Java). Roughness values are assigned to 43 land use classes, e.g. different types of buildings, rural and urban sub-areas, by using equivalent coefficients found in literature or by performing numerical experiments.

Comparisons of simulations using differentiated roughness maps versus simulations using constant values (a widely used approach) are presented and it is demonstrated that roughness takes considerable influence on run-up and inundation.

Out of all simulations, the results of the worst case scenarios for each of the three priority areas are discussed. Earthquakes with magnitude $M_w=8.5$ or higher lead to considerable inundation in all study sites. A spatially distinguished consideration of roughness has been found to be necessary for detailed modelling onshore.

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