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Systematic comparison of different numerical approaches for tsunami simulations at the Chilean coast as part of the RIESGOS project

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There is a growing number of numerical models for tsunami propagation and inundation available, based on different spatial discretizations and numerical approaches. Since simulations carried out with such models are used to generate warning products in an early warning context, it is crucial to investigate differences emerging from the chosen algorithms for simulation and warning product determination. Uncertainties regarding the source determination within the first minutes after a tsunami generation might be of major concern for an appropriate warning at the coast, still, the sensitivity of warning products with respect to pre-computed simulation database contents or on-the-fly calculations are of crucial importance as well.

In this study, we investigate the performance of three models (TsunAWI, HySEA, COMCOT) in the oceanic region offshore central and northern Chile with inundation studies in Valparaíso and Viña del Mar. The investigation forms part of the tsunami component in the RIESGOS project dealing more general with multi hazard assessments in the Andes region. The numerical implementation of the models include both a finite element approach with triangular meshes of variable resolution as well as finite difference implementations with nested grids for the coastal area. The tsunami sources are identical in all models and chosen from an ensemble of events used in an earlier probabilistic study of the region. Additionally, two historic events are considered as well to validate the models against the corresponding measurements.

We compare results in virtual gauges as well as actual tide gauge locations at the Chilean coast. Inundation areas are determined with high resolution and employing the model specific wetting and drying implementations. We compare the model results and sensitivities with respect to spatial resolution and parameters like bottom friction and bathymetry representation in the varying mesh geometries.