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Simulation of the Tsunami Resulting from the M 9.2 2004 Sumatra-Andaman Earthquake - Dynamic Rupture vs. Seismic Inversion Source Model

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Simulations of historic tsunami events such as the 2004 Sumatra or the 2011 Tohoku event are usually initialized using earthquake sources resulting from inversion of seismic data. Also, other data from ocean buoys etc. is sometimes included in the derivation of the source model. The associated tsunami event can often be well simulated in this way, and the results show high correlation with measured data. However, it is unclear how the derived source model compares to the particular earthquake event.

In this study we use the results from dynamic rupture simulations obtained with SeisSol, a software package based on an ADER-DG discretization solving the spontaneous dynamic earthquake rupture problem with high-order accuracy in space and time. The tsunami model is based on a second-order Runge-Kutta discontinuous Galerkin (RKDG) scheme on triangular grids and features a robust wetting and drying scheme for the simulation of inundation events at the coast. Adaptive mesh refinement enables the efficient computation of large domains, while at the same time it allows for high local resolution and geometric accuracy. The results are compared to measured data and results using earthquake sources based on inversion.

With the approach of using the output of actual dynamic rupture simulations, we can estimate the influence of different earthquake parameters. Furthermore, the comparison to other source models enables a thorough comparison and validation of important tsunami parameters, such as the runup at the coast. This work is part of the ASCETE (Advanced Simulation of Coupled Earthquake and Tsunami Events) project, which aims at an improved understanding of the coupling between the earthquake and the generated tsunami event.