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Dynamic Rupture Model of the 2004 Sumatra-Andaman Megathrust Earthquake

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The M 9.1-9.3 Sumatra-Andaman earthquake of 26 December 2004 caused violent shaking and generated a tsunami wave that was up to 50 m high along the northern coast of Sumatra. While various finite-source models have been proposed, here we present a physically realistic dynamic rupture model of the megathrust earthquake. To accomplish this, we use SeisSol, a highly parallelized software package that runs on modern supercomputers. Numerically, it follows an ADER-DG scheme to solve the spontaneous dynamic earthquake rupture problem with high-order accuracy in space and time. SeisSol accommodates unstructured tetrahedral meshes that decrease computational expense by allowing for a high-resolution mesh where required, including along the non-planar subducting fault and to capture the bathymetry, as well as a lower resolution mesh in other regions. In the SeisSol model, the slip interface follows the geometry of Slab1.0 to the south and aftershock locations to the north. 4 km resolution bathymetry from GEBCO is incorporated at the ocean floor. Material properties are taken from Crust1.0 and are laterally homogeneous, but vertically varying. The model results are constrained by the overall characteristics of the rupture, including the magnitude, propagation speed, and extent along strike, as well as surface displacements recorded with GPS satellites. We aim to resolve the influence of source dynamics on ground displacement and the potential impacts on tsunami generation in the framework of the ASCETE project ("Advanced Simulation of Coupled Earthquake and Tsunami Events", www.ascete.de).