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Simulated strong ground motions for the great Sumatra-Andaman earthquake of December 26, 2004 M=9.3

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On December 26, 2004, a devastating earthquake of M=9.3 occurred offshore Northern Sumatra. Due to the size of this earthquake and the accompanying tsunami wave, disastrous consequences have been observed in several countries around the Indian Ocean. The tectonics in the region are characterized by the oblique, NNE oriented subduction of the Indian-Australian plate under the Sunda microplate with a rate of 6-6.5 cm/yr. This oblique convergence results in strain partitioning, where the trench perpendicular thrust faulting along the subducting slab accommodates the E-W component of the motion, whereas the N-S component of the motion is probably accommodated by the right-lateral strike slip faulting along the Great Sumatran Fault and the Mentawi fault. Source parameters of the December 26, 2004 event have been used for modeling the resulting ground motions in the nearby affected regions. Results give an insight on the importance of ground shaking in the total destruction of places like Banda Aceh, Northern Sumatra, Indonesia. The modeling is performed for a multi-asperity finite fault using a hybrid procedure combining deterministic modeling at low frequencies and semi-stochastic modeling at high frequencies. Results show that strong shaking was distributed over a large area including northwestern Sumatra and its off-shore islands. In Banda Aceh, which experienced significant damage, bedrock velocities reached 60 cm/s with duration of the shaking of ca 150 s. The largest ground motions occurred near the strongest asperities of the fault plane, where velocities of 200 cm/s are modeled for bedrock conditions.