

Dynamic Rupture Models for the Southern San Andreas Fault

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We simulate dynamic ruptures, and resultant ground motions up to 0.25 Hz, for a Mw7.6 earthquake on the southern San Andreas Fault. Spontaneous rupture is modeled with slip-weakening friction, and viscoelastic wave solutions are computed with an explicit support-operator method. Piecewise planar geometry is used for the fault surface. We choose initial traction conditions derived from inversions of the Mw7.3 1992 Landers strong ground motion records. The fault geometry and traction distribution borrow heavily from the TeraShake2 simulations by Olsen et al. (2007). Heterogeneity in the traction model leads to focusing of the rupture front, in some cases producing super-shear rupture velocity in areas of high initial traction (asperities). Rupture focusing also occurs sometimes between the asperities, with the notable result that the highest peak slip rates occur in areas of low initial traction. Low frequency ground motion agrees with TeraShake2, though amplitudes are smaller due to the lower overall event size (TeraShake2 simulated a Mw7.7 event). We computed separate solutions for version 3.0 and 4.0, respectively, of the Southern California Earthquake Center Community Velocity Model (SCEC-CVM). We also compare the case of a flat ground surface (a common simplification made for finite difference calculations such as TeraShake) to the case of a ground surface conformed to regional topography. We find that the differences in the velocity models and the ground surface representations have minimal effect on the early stages of rupture (before the event has reached its full size) but the effects become substantial in the later stages of rupture. As first seen in the TeraShake1 simulations (Olsen, et al., 2006), stronger than expected ground motions occur at the site of Montebello, due to a basin wave guide, though this effect is not as strong with version 4.0 of the SCEC-CVM relative to version 3.0. The overall distribution of simulated peak ground velocities is consistent with those derived from the empirical model of Campbell and Bozorgnia (2007) for Mw7.6, in the sense that the bulk of simulated PGVs are within the