EARTHQUAKE RUPTURE AND GROUND MOTION MODELING OF THE 2016 CENTRAL ITALY SEISMIC SEQUENCE CONSTRAINED BY BAYESIAN DYNAMIC FINITE-FAULT INVERSION

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The unusual evolution of the earthquake ruptures related to the 2016 Central Italy seismic sequence and the uniquely dense seismological recordings provide an opportunity to better understand the processes controlling earthquake dynamics, strong ground motion, and the relation between earthquakes. We here use initial stress and friction conditions constrained by a novel Bayesian dynamic source inversion (Gallovic et. al., 2019) as a starting point for high-resolution dynamic rupture scenarios. The inferred heterogeneous dynamic models on the planar dipping fault fit very well waveforms recorded at seismic stations. Here we extend the best-fit dynamic source inversion result by taking into account non-planar (e.g. listric) fault geometries, inelastic off-fault rheology, and topography. We utilize the open source software package SeisSol (www.seissol.org) which is specifically suited for incorporating geometrical complexity and high-resolution simulations performed on modern supercomputers. We investigate the effects of including subsequently more realistic modeling ingredients on rupture dynamics and surface ground motions including waveforms at stations that recorded the event. PGV maps show that ground motion amplitudes decreased by about 50 percent on the foot-wall and increased by about 150 percent on the hanging-wall as a consequence of the wave-focusing effect caused by the curvature of the listric fault. However, the effect of the listricity on the PGV is seen only for distances up to 10 km from the fault. Our study thus suggests that the complexity of the fault should not be neglected for the seismic hazard assessment for regions adjacent to active faults.