Geophysical Research Abstracts
Vol. 19, EGU2017-5349, 2017
EGU General Assembly 2017

3D Dynamic Rupture Simulations along the Wasatch Fault, Utah, Incorporating Rough-fault Topography

Kyle Withers and Morgan Moschetti
United States (kwithers@usgs.gov)

Studies have found that the Wasatch Fault has experienced successive large magnitude (>Mw 7.2) earthquakes, with an average recurrence interval near 350 years. To date, no large magnitude event has been recorded along the fault, with the last rupture along the Salt Lake City segment occurring ∼1300 years ago. Because of this, as well as the lack of strong ground motion records in basins and from normal-faulting earthquakes worldwide, seismic hazard in the region is not well constrained. Previous numerical simulations have modeled deterministic ground motion in the heavily populated regions of Utah, near Salt Lake City, but were primarily restricted to low frequencies (∼ 1 Hz). Our goal is to better assess broadband ground motions from the Wasatch Fault Zone. Here, we extend deterministic ground motion prediction to higher frequencies (∼ 5 Hz) in this region by using physics-based spontaneous dynamic rupture simulations along a normal fault with characteristics derived from geologic observations. We use a summation by parts finite difference code (Waveqlab3D) with rough-fault topography following a self-similar fractal distribution (over length scales from ∼100 m to the size of the fault) and include off-fault plasticity to simulate ruptures > Mw 6.5. Geometric complexity along fault planes has previously been shown to generate broadband sources with spectral energy matching that of observations. We investigate the impact of varying the hypocenter location, as well as the influence that multiple realizations of rough-fault topography have on the rupture process and resulting ground motion. We utilize Waveqlab3's computational efficiency to model wave-propagation to a significant distance from the fault with media heterogeneity at both long and short spatial wavelengths. These simulations generate a synthetic dataset of ground motions to compare with GMPEs, in terms of both the median and inter and intraevent variability.