SENSITIVITY TESTS OF TOPOGRAPHIC EFFECTS ON 3D SIMULATED GROUND MOTIONS IN RENO, NEVADA

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The availability of increased compute power has enabled the construction of 3d physics-based models that facilitate the exploration of the effects of geologic basins on the intensity and duration of shaking from earthquakes. As the resolution of these simulations improves, surface topography may have increasingly pronounced effects on modeled ground motions. We have constructed two material property models of the Reno-area basin in Northern Nevada. A framework using Python, pySW4, Dask, HDF5, and sklearn streamlines the construction of these material models, as binary “rfiles” at 35 m resolution. The rfiles are the geologic-model input to seismic computations with the SW4 code from Lawrence Livermore National Laboratory and the Computational Infrastructure for Geodynamics. Both models include basin geometry as estimated by gravimetry. One model includes the almost 2 km of topographic features that surround the urban area. The other is a flat-earth model having the same basin thicknesses. Previous work has explored flat-earth basin models by comparing 3.3 Hz synthetics generated with SW4 against recorded ground motion from the 2008 M4.9 Mogul earthquake. Many of the synthetic seismograms showed significant mismatches to recordings. We extend this analysis with sensitivity tests contrasting the flat-earth and the topographic models, and adding an examination of recordings of the 2015 M4.3 Thomas Creek earthquake. This current work examines the role of topography in improving the fit of the synthetics to the recordings. Increasing the maximum frequency of the synthetics from 2.2 Hz to 3.3 Hz increases the effects of topography. The topographic models show somewhat longer shaking durations, though still not approaching the recorded durations in and near the basin.

2015 M4.3 Thomas Creek Earthquake Models