Analysis of the Far-Field Motion From an Underground Chemical Explosion

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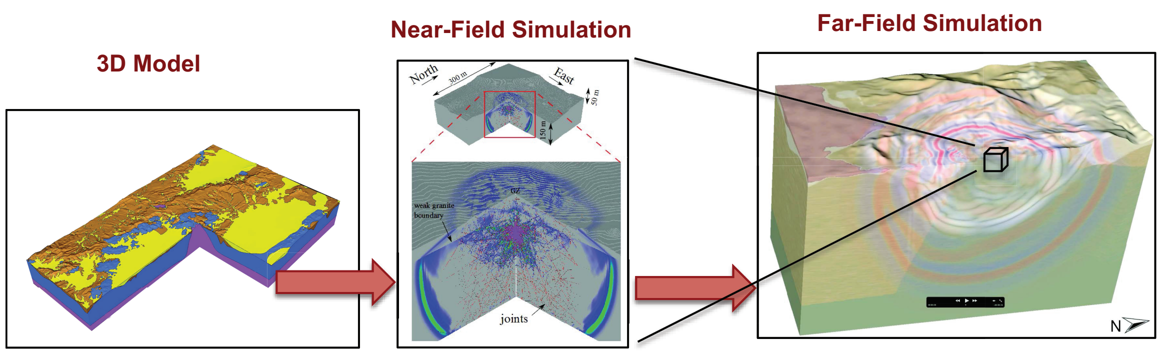
Three dimensional numerical simulations of the motions generated by the Source Physics Experiments (SPE) of chemical underground explosions conducted at the Nevada National Security Site (NNSS) have shown that the observed near-field shear motion can be generated by sliding on the joints due to spherical wave propagation. In this study we carried the sensitivity analysis to far-field motion using a hybrid physics-based approach that combines hydro-regime modeling of the near-field source with the far-field elastic modeling of wave propagation. We analyzed the effect of the near-source structural complexities on the simulated near-field source motions. The simulations are performed in the frequency range of 0.1-10 Hz. The near-field ground motions simulated for several source realizations of the SPE3 explosion, using different equally probable joint realizations, were propagated out to far-field distances using an elastic wave propagation code, WPP. The simulated motions were used to investigate wave scattering effects due to structural complexities. The underlying far-field velocity model was constrained by available geological and geophysical data. In our model the wave scattering is a consequence of combined large-scale and random small-scale structural features, and surface topography. Our numerical investigations suggest that depending on the degree of structural complexities in the near-source region the wave scattering acts as an additional cause for shear motion generation. Wave conversions at geological model discontinuities create distinguish waveform that are seen in the SPE data.



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