ANALYSIS OF SIMULATED AND RECORDED FAR-FIELD GROUND MOTIONS FOR THE SPE AND DAG UNDERGROUND CHEMICAL EXPLOSIONS

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We investigate the far-field ground motion from underground chemical explosions of Phase I and Phase II of the Source Physics Experiment (SPE), recorded at the Nevada National Security Site (NNSS). Previous studies of SPE far-field seismic data largely focused on shear motion at distances less than 2 km from the source. In our analysis we investigate wave propagation effects using seismic recordings from several linear arrays of broadband seismometers, including two arrays across the Yucca Flat basin, covering epicentral distances up to 25 km. To analyze wave propagation characteristics affected by the underground basin structure, we performed several simulations using 3D velocity models covering an area of 37 km x 22 km. All simulations are performed using isotropic point sources in the frequency range 0-5Hz. Simulated waveforms for SPE-5 are used to test the quality of the 3D geologic model, especially in southern Yucca Flat where recorded data are characterized by very long duration; a clear indicator of basin reverberations. Analysis of coda-envelope amplitude ratios from different explosions and stations of equal epicentral distance suggests significant path and site effects and a potential source depth dependence of coda wave amplitude. Comparisons of recorded and simulated waveforms using 1D and 3D models of shallow structure demonstrate that the 3D basin structure contributes to generation of shear motion observed at basin sites. The inclusion of 3D wave scattering, simulated by correlated small scale stochastic velocity perturbations in the 3D model, improves the fit between the simulated and recorded ground motions. Attenuation analysis using recorded and simulated coda envelopes informs future model iterations and isolates the scattering effects.