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Shear Wave Generation and Modeling Ground Motion From a Source Physics Experiment (SPE) Underground Explosion

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We investigate the excitation and propagation of far-field (epicentral distance larger than 20 m) seismic waves by analyzing and modeling ground motion from an underground chemical explosion recorded during the Source Physics Experiment (SPE), Nevada. The far-field recorded ground motion is characterized by complex features, such as large azimuthal variations in P- and S-wave amplitudes, as well as substantial energy on the tangential component of motion. Shear wave energy is also observed on the tangential component of the near-field motion (epicentral distance smaller than 20 m) suggesting that shear waves were generated at or very near the source. These features become more pronounced as the waves propagate away from the source. We address the shear wave generation during the explosion by modeling ground motion waveforms recorded in the frequency range 0.01-20 Hz, at distances of up to 1 km. We used a physics based approach that combines hydrodynamic modeling of the source with anelastic modeling of wave propagation in order to separate the contributions from the source and near-source wave scattering on shear motion generation. We found that wave propagation scattering caused by the near-source geological environment, including surface topography, contributes to enhancement of shear waves generated from the explosion source.

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