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shear content in seismic source functions to scaled depth-of burial for a series of buried chemical explosions

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We have previously used data from the Source Physics Experiment (SPE) to relate evidence of joint slip in the near field to the yield-scaled depth-of-burial (SDOB) of buried chemical explosions in granite. A sudden surge in tangential velocity occurs in velocity records just after the passage of the peak radial shock for moderately overburied tests. This surge does not appear for nominal SDOB tests or for the "over-buried" Green's function test. Further, we related this phenomenon to the estimated range of declared Democratic People's Republic of Korea tests in granite and the likelihood of those tests to confuse MS:mb earthquake/explosion discrimination methods.

To render these results practical for monitoring we studied SPE seismic data to identify a SDOB effect. Through constraining the known SPE test parameters (e.g., hypocenter, velocity model) we perform a suite of source inversions with varying tensor source components. Goodness-of-fit trends between recorded seismic data and synthetic waveforms identify the source parameters, such as unexpectedly large shear contributions, that give rise to the observed tangential response in the near field. The results provide an indication that near-field joint release can contribute to the far-field waveforms as excess shear energy. LA-UR-20-29210

Promotional text

This work supports the objective of improving nuclear test monitoring and verification by using chemical explosion test data to develop a geomechanical model to explain production in the near-source regime of unexpected shear content seen in the seismic monitoring regime.

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