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Near-source mechanism for creating shear content from buried explosions

The buried chemical explosion tests of the Source Physics Experiment (SPE) includes a near-source three-axis borehole accelerometer array. Data analysis combined with numerical modeling promotes a better understanding of ground shock phenomenology with particular emphasis on anomalous shear motion. SPE includes Phase I tests in a jointed medium (granite) and Phase II tests in a relatively homogeneous medium (alluvium). Both phases included a wide range of yield-scaled depth-of-burial (SDOB).

Inspection of Phase I velocity traces indicated initially quiescent non-radial components which undergo a sudden amplitude surge immediately following the peak radial pulse. We describe our hypothesis of a granite joint slip mechanism resulting from loading and subsequent unloading of the joints. Data traces and results of explicitly-jointed finite element calculations are presented to illustrate the mechanism. We illustrate that this phenomenon is evident only in Phase I tests within a range of SDOB. We contrast these results to the Phase II data where there are no natural joints, and where data indicate an absence of non-radial motion.

We correlate the relation between Phase I SDOB and shear release observations to the DPRK announced tests, also in granite, and the likelihood of those tests to confuse MS:mb earthquake/explosion discrimination.

Primary author: STEEDMAN, David (U.S. Department of Energy, National Nuclear Security Administration)

Presenter: STEEDMAN, David (U.S. Department of Energy, National Nuclear Security Administration)

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