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and Analyses of Source Physics Experiments: Impact on Explosion Monitoring and Discrimination

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The Source Physics Experiments (SPE) are a series of controlled chemical explosions at the Nevada National Security Site to gather observations, validate physics-based numerical models and understand the genesis of shear waves to improve nuclear discrimination and monitoring capabilities. Executed between 2011 and 2016, Phase I of SPE encompassed six collocated chemical explosions executed in hard granite with different yields at different depths. Phase II included four chemical explosions executed in 2018 and 2019 in soft dry alluvium. Phase III, however, includes two planned chemical explosions in a dominant dolomite geology and collocated with a 1993 shallow earthquake. LLNL has developed a comprehensive numerical framework to simulate from source-to-receivers, the waves generated from the non-linear explosion source-region to linear-elastic seismoacoustic distances. We present the analysis of SPE Phases I & II collected data, summarize how modeling predictions compared to observed data and draw lessons learned. We share insight on the main mechanisms of generating shear motions in granite, alluvium and dolomite. Moreover, we developed schemes of uncertainty propagation of the geological characterization and geophysical parameters. We present impacts of those uncertainties on designing of Phase III tests, predicting the near-field responses of planned tests, and enhancing source discrimination.

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Promotional text

First, we bring numerical solutions to. Continuously. improve nuclear test discrimination, monitoring, and verification. Second, through broader scientific collaborations, support (inter)national needs, and help validating and verifying the CTBT decision and monitoring tools.

Oral preference format

in-person

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