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Source Models and Scattering Origin of Regional Phases from Coda Spectral Ratios

The Source Physics Experiment (SPE) chemical explosions provide ground truth, and near-source recordings that are unavailable in typical monitoring scenarios. We examine coda source spectral ratios of near-source, local and regional distance recordings to isolate source and propagation effects, and to potentially improve monitoring at distance. Classical source models (Mueller and Murphy, 1971, MM71; Denny and Johnson, 1991, DJ91) predict the source ratios poorly; however, a hybrid model (MM71 with DJ91 cavity radii) performs better, and by varying cavity and elastic radii we obtain models that fit spectral ratios to within measurement precision. Based on this, the best predictive model for the SPE suite is the hybrid model with cavity and elastic radii decreased to 95%, and 75% of their original values, respectively. Finally, we observe a distinct spectral modulation at 6-9 Hz that is not predicted by classical models, most likely caused by short period surface waves, such as Rg, interfering with those produced by spallation of near surface layers. The same modulation is observed for compressional (P) and shear (S) waves at distance, indicating that local and regional phases originate as near-source Rg that is scattered into body waves.

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