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Time-Domain Source Function (TDSF) for Nuclear and Chemical Explosions: Analysis Around Nevada National Security Site (NNSS)

Displacement spectra from explosion accelerograms within a few kilometers (<3.5 km) of shot points indicate that the spectral level increases gradually from the fc towards the zero frequency. In this paper, we present a time-domain expression (TDSF) which has two deformation terms: “static” and “dynamic”, supporting this observation. For f<fc, the static contribution dominates the dynamic contribution and leads to the gradual increase. For low-yield explosions, fc is high; this effect is more pronounced. For f> fc, the “dynamic” term contributions dominate and decay approximately as f**(-2). For seismic waves propagating from the elastic boundary Rel to large distances, these two wavefields are affected identically by attenuation and spreading. Hence, the corrected spectra should exhibit these spectral features. P-wave explosion seismogram analysis indicates a likely presence of this effect and provides evidence of a yield equivalence by a factor of 2 between the nuclear and chemical explosions. By convolving the proposed TDSF with [exp(-C/Rel) H(t)], where C is the material velocity at the shot point, one can calculate the RDP at Rel of the source. We use this proposed RDP to investigate the influence of yield and depth of burial (DOB) on the spectral overshoot and fc of explosion sources.

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