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Reflection Arrivals from Shallow Small Magnitude Explosions Using the Cepstrum Technique: A Numerical Analysis

The Cepstrum technique is often applied to estimate arrival times of the depth phases which is an increasingly difficult task, as the event depth becomes small. For the shallow events, the delay time of the depth phase from the first onset can be small (<1s). Influence of path attenuation, low Q values within the weathering layers near the surface, topography and ever present noise make the task even more problematic. Here, we attempt to determine the extent to which the cepstrum algorithm can be used. We constructed suites of frequency-wavenumber P seismograms for both up-going and down-going wavefields at regional and teleseimic distances for depths up to1000m. Two wavefields allow to incorporate an accurate surface reflection coefficient for the pP phase and precisely predict the delay time. The up-going and down-going wavefields were added together to generate the full P-wave seismograms, which were then analyzed using the cepstrum technique to recover the delay time of the up-going relative to the down-going wavefield. Our preliminary studies on noise-free synthetic waveforms suggest that the cepstral method may produce reliable estimates for events deeper than 250m. Additional results will be presented from investigations with noise-contaminated synthetic waveforms, using complex digital signal processing techniques.

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