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Applying calibrations to digitized historical analog seismograms of nuclear explosions and other important events

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Digitization of analog seismograms from past nuclear tests are critical for monitoring because many historical tests occur within unique geologic environments. To utilize this digitized data, it is important to know the frequency characteristics of the seismic channel that generated the seismogram to accurately correct for instrument response and recover ground motion. Calibrations can vary significantly with time and location, thus a single generic calibration for a station or instrument type is insufficient. Focusing on stations and instrumentation from the former Soviet Union, we developed software to accurately translate the original published yearly station calibration parameters into modern dataless SEED files. We compare Power Spectral Density (PSD) measurements of digitized SKM short-period analog records against co-located digital broadband instruments to demonstrate that the process yields an accurate picture of ground motion from 0.3-5 Hz. The resulting transformation of the digitized analog seismogram into a faithful digital rendering of ground motion can be used for advanced seismic analysis, including waveform transformation between displacement to velocity domains, frequency-based discrimination studies, and more. We are now applying the correct station calibrations to several seismogram recovery and digitization projects in northern Eurasia.

Promotional text

Historical seismograms, when accurately digitized, also require a modern description of channel response. We have developed techniques to translate historical calibration parameters and metadata into modern response files that correct for channel response to yield ground motion.

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