

Data Analysis for the Discrimination, Detection, and Location of Seismic Events of the People's Democratic Republic of Korea

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The main purpose of this study consists in applying discrimination methods to distinguish known nuclear tests conducted by the Democratic People's Republic of Korea from surrounding natural seismicity, based on various seismic signal processing algorithms. To characterize the Democratic People's Republic of Korea's seismic activity between 2006 and 2022, spectral analysis, waveforms cross-correlation techniques and amplitude ratios of Pg/Lg and Pn/Sn waves computed in different frequency bands were applied. For the selected events, we analysed waveforms recorded by seismic stations with epicentral distances going up to 70 degrees. The Democratic People's Republic of Korea's nuclear tests were relocated using relative algorithms to validate and calibrate these methods. Additionally, we investigated continuous recordings of nearby stations (epicentral distances below three degrees) using waveforms cross-correlation techniques to identify possible microearthquakes induced by the the Democratic People's Republic of Korea's nuclear tests. The proposed discriminants successfully separate tectonic events from nuclear tests, but its success rate is heavily influenced by the epicentral distance. The relocations of the Democratic People's Republic of Korea's nuclear tests showed differences of up to 5 km compared to the results of previous studies, highlighting a good accuracy of the proposed methods. These findings represent the first step in the development of future artificial intelligence algorithms.

Promotional text

The purpose of this study is to improve nuclear-test-ban monitoring. The performed techniques were able to analyse the Democratic People's Republic of Korea's nuclear tests and discriminate between seismic sources.

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