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Use of Romanian Seismic Network to monitor nuclear explosions

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During the last decade, three underground nuclear tests were conducted by the Democratic People's Republic of Korea (DPRK): on October 9, 2006, May 25, 2009, and February 12, 2013. The magnitude of the events, estimated by International Data Centre (IDC) as 4.1, 4.5 and 4.9, indicates that the latest was more powerful than its predecessors.
We analyze seismic signals generated by the DPRK tests and recorded with Romanian Seismic Network (RSN). The location estimates performed at Romania National Data Centre (NDC) using RSN data, were compared with those obtained at IDC. As a consequence of the global superior coverage with seismic stations included in the International Monitoring System, IDC locations are better constrained. The signals generated by 2006 DPRK nuclear test were observed on 8 RSN stations, the 2009 test on 33, and the 2013 test on 47. This continuous increase is due to the rise in the number of stations installed during last five years, as well as to the larger magnitude of the 2013 test. The recent development of RSN has enabled NDC to locate the events with more accuracy, based on the higher-quality parameters estimated from data processing.
For all three events, a high signal coherency is observed for the data recorded by the Romanian seismic array, BURAR, reconfirming the superiority of the arrays to single stations for detecting and characterizing signals from nuclear explosions. Array processing techniques are applied for signal detection and to estimate the slowness vector (back-azimuth and apparent velocity).
The comparison of vertical displacement seismograms recorded at RSN stations shows a remarkably similarity of the signals generated by the three events analyzed. The records are nearly identical, except that the amplitude is directly proportional to the event magnitude. Spectrograms of the recorded RSN data were examined, showing that the nuclear explosions produce seismic signals with a high energy in the 0.5 to 2.0 Hz frequency range. Investigation of the background noise conditions for the RSN stations showed seasonal variation of the detection capability. At higher frequencies, the increased noise level during summer period, could affect the detection performance for teleseismic distances, reducing the number of the detections for the three events studied.