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Single-array location and magnitude estimation for the Korean nuclear tests (9 October 2006 and 25 May 2009) at BURAR (Romania)

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We use waveforms recorded at BURAR (Bucovina seismic array) to estimate location and magnitude for the nuclear tests detonated on 2006/10/09 01:35:28 and 2009/05/25 00:54:43 in the Korean Peninsula. BURAR, a small aperture array (∼5 km) having 9 short period elements, with vertical components and 1 broadband element with three components, is monitoring regional and teleseismic events since 2002. We find that BURAR is effective as a small aperture teleseismic array for monitoring events in and close to North Korea, the recent location of an underground nuclear test. We explain this by low ambient noise and energy efficient propagation paths (the nuclear explosion and nearby deep earthquakes show dominant frequencies between 0.9 and 2.5 Hz). From the total number of 19 events located on and near the Korean Peninsula with mb from 3.3 to 5.7 recorded by International Agencies, for 11 events the first arrival (direct P wave) is detected at BURAR.
The direct P phase is confidently identified using horizontal velocity and backazimuth estimated with crosscorrelation and frequency-wavenumber (fk) methods. Static time corrections for beamforming are estimated using nine deep earthquakes within 300 km of the nuclear explosion. We calibrate the nuclear explosion single-array location to the NEIC location, using relative time corrections derived for the nine earthquakes. A similar magnitude correction was performed using the Veith-Clawson formula.