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Maximum-likelihood magnitudes for DPRK announced underground nuclear tests from NEIS PDE and CTBTO REB bulletins

Sheila Peacock, David Bowers, and Neil Selby
AWE Blacknest, Brimpton, Reading, United Kingdom (geophyspeacock@myphone.coop)

The six announced underground nuclear tests (up to September 2017) by the Democratic People's Republic of Korea (DPRK) produced seismic signals that were widely recorded on stations contributing to the US Geological Survey National Earthquake Information Service (NEIS) Preliminary Determination of Epicentres (PDE) bulletin. A few of these stations are common to the International Monitoring System (IMS) of the Comprehensive Nuclear-Test Ban Treaty (CTBT), but many are not. A subset of PDE stations was selected as a "stable network" from which maximum-likelihood body-wave magnitudes (mb) were derived, along with station corrections, by a joint maximum-likelihood inversion. Station thresholds were derived from the 2006-2017 bulletin assuming that a Gutenberg-Richter magnitude-frequency relationship also applies to the reported station P-wave amplitudes. These thresholds were used in the maximum-likelihood inversion to correct network-averaged mb values for upward bias caused by non-reporting of signals submerged in noise. The bias is greater at lower magnitudes, so the maximum-likelihood mb of the smallest test (2006-10-09) is reduced most relative to network average mb. The mb values are compared with maximum-likelihood mb values derived using CTBTO Reviewed Event Bulletin (REB) amplitudes, to evaluate the effect of differences in automatic processing procedures between the two bulletins.