



## **Regional Observations of North Korea Explosions: 1st and 2nd Tests**

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Through data exchanging with China, Russia and Japan, KIGAM could monitor North Korea explosion tests in near real time with azimuthally full coverage from the test site. Except for the East Sea (Japan Sea) side, the seismic stations are distributed uniformly along the boundaries of North Korea and adjacent countries. The error ellipses of epicentral determination of test site for 1st and 2nd tests showed almost identical pattern if they were separately calculated with the same configuration of stations. But the combined use of the 1st and the 2nd test data showed that the 2nd test site was moved approximately 2 Km westward from 1st site. The Pn/Lg spectral ratio clearly discriminate these events from two nearby natural earthquakes above 4 Hz. Full moment tensor inversion also indicate the 2nd test had a very large isotropic component. But mb-Ms discrimination, which has been considered one of the most reliable discriminants for separating explosions and earthquakes, did not show apparently the known pattern of explosion for both tests. Body wave magnitude, mb(Pn) of the 2nd test, which was evaluated as 4.5 by KIGAM, varies with directional location of stations widely from 4.1 to 5.2. The magnitude obtained from Lg, mb(Lg), showed narrow variation between 4.3 to 4.7 with the average of 4.5. In the case of both 1st and 2nd tests, both mb(Pn) and mb(Lg) showed equivalently large variation with directional station location. These variations are mainly due to lateral variation of crustal structures surrounding the test site. Remarkably mb(Lg) showed very linear relationship with mb(Pn). By considering attenuation characteristics according to the propagation path, the variations could be effectively reduced. The cut-off frequencies of P wave of both tests showed no or negligible difference even though the estimated yield of the 2nd test were much larger than that of the 1st one. The ratio of P-wave amplitudes of two tests showed from 2 to 3.1 times. Correspondingly the estimated energy or yield were ranged from 4 to roughly 10 times. KIGAM evaluated the yield of the 2nd test were 8 times in the average larger than that of the 1st one.