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Waveform analyses of the 2006 and 2009 North Korea Explosions

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Korea Meteorological Administration(KMA) currently monitors seismic events including earthquakes and explosions recorded at KMA seismic network. To determine seismic activity precisely, it is required to distinguish explosion signal from recorded waveform. The objective of this study is to discriminate between earthquake and explosion. National Institution of Meteorological Researches (NIMR) collected broadband seismic data of 2006 and 2009 North Korea explosion events from seismic network of KMA for this study.

First, Pn and Lg phases were extracted from the seismic records which were band-passed at 0.1-Hz intervals from 0.6 to 2.2 Hz. Body wave magnitudes were also estimated from the extracted Pn (MPn) and Lg phases (MLg). Because explosions generate only P-wave energy and the associated small S-wave energy, the ratio of the P-wave energy to S-wave energy could be used to discriminate explosions from earthquakes. Then, we compared the MPn/MLg ratios to discriminate explosions and earthquakes.

Since the most reliable discriminant for events in the magnitude range of decoupled explosions have high frequency spectral ratios of the amplitudes of the seismic shear phases Sn and Lg to Pn or Pg (Taylor 1991), it is important to understand and quantify the sources of shear wave generated by decoupled explosion. Threrefore, We performed Pn/Sn, Pn/Lg, Pg/Sn, Pg/Lg spectrum ratios at frequency ranges from 1 to 10Hz and then separated earthquake and explosion. The spectral ratio of Pn/Lg clearly discriminate the difference between earthquake and explosion.

Lastly, We tried to apply a formula, f(t)=Bt*exp(-At), which is used for earthquake early warning system in Japan with P amplitude envelope to investigate if the parameter A and B are different between explosion and earthquake.