Spectral ratios of regional phases recorded at the Dongbei Seismic Network for North Korean explosions in 2006 and 2009.

Abstract

We analyze regional phases recorded at stations of the Dongbei seismic network from the North Korean explosions in 2006 and 2009. The stations are located between about 160 and 300 km from the North Korean border and are equipped with broadband seismographs. The analysis focuses on the frequency dependence of spectral ratios 2006/2009 for Pg and Lg. Spectral ratios of the initial Pn phases are corrected for ambient noise while the secondary phases are corrected for the code of phase which is assumed that the code is corrected for the code of phase andPg and Lg. The Lg spectral ratio has a pronounced minimum at about 2 Hz, possibly due to Pg-propagation. Relative amplitudes based on maximum trace amplitudes at this frequency would lead to smaller relative amplitudes than would other regional phases.

Spectral Estimation

The example in the right illustrates the spectral estimation with noise correction applied to the regional phases. The black trace is the source function, S(t), assumed to be the sum of two point sources. The two point sources are assumed to be at the same distance from the recording station and the two waves are assumed to be the same. The two solutions are obtained by the model above. The scalloping of the source function is the sum of two point sources. The source function is the sum of two point sources.

Scaled Source Deconvolution

A model for deconvolution based on source scaling by Zschack et al (1989) assumes that the recordings at a given station from two different sources at the same location can be written as

\[ R_{\text{obs}}(f) = S_{\text{obs}}(f) + N_{\text{obs}}(f) \]

where \( S_{\text{obs}}(f) \) is the expected source function and \( N_{\text{obs}}(f) \) is the observed noise. This model is applied to the two source functions, which are assumed to be the same. The source function is the sum of two point sources.

\[ S_{\text{source}}(f) = \frac{S_{\text{obs}}(f) - N_{\text{obs}}(f)}{S_{\text{source}}(f)} \]

where \( S_{\text{source}}(f) \) is the expected source function.

Relative Depth from Pg-Pn times

In the diagram to the right the double difference between initial times of Pg and Pn of the 2006 and 2009 explosions is shown. The Pg-Pn times are calculated from recordings at the two stations. The Pg-Pn times are calculated from recordings at the two stations. The relative depth is calculated from the double difference.

References


2. Ford S R, Dreger D S, and W R Walter, (2009, Source analysis of the Memorial Day Explosion, Kimchaek, North Korea, Geophys Res Lett 36, L02311). The average ratio for the Pg phase is drawn as a thick line. The ratio for the Pg phase is drawn as a thick line. The ratio for the Pg phase is drawn as a thick line.


Acknowledgments

The computations for the analysis were carried out with the R-software package (http://cran.r-project.org). Financial support provided by the U.S. Department of Energy through the termination of participation in the U.S. Test Ban Treaty program is much appreciated. We are grateful to the Center for International Research on Nuclear Disarmament (CIRND) for support of a research visit to Stanford University, Stanford, CA.