Geophysical Research Abstracts
Vol. 18, EGU2016-8836, 2016
EGU General Assembly 2016

Explosion Source Similarity Analysis via SVD

Matthew Yedlin (1), Yochai Ben Horin (2), and Gary Margrave (3)

(1) University of British Columbia, Electrical and Computer Engineering, Electrical and Computer Engineering, Vancouver, Canada (matt.yedlin@gmail.com), (2) National Data Center, SOREQ Nuclear Research Center (SNRC), Yavneh, Israel, (3) Geoscience Services, Devon Canada Corporation, Calgary, Alberta, Canada

An important seismological ingredient for establishing a regional seismic nuclear discriminant is the similarity analysis of a sequence of explosion sources. To investigate source similarity, we are fortunate to have access to a sequence of 1805 three-component recordings of quarry blasts, shot from March 2002 to January 2015. The centroid of these blasts has an estimated location 36.3E and 29.9N. All blasts were detonated by JPMC (Jordan Phosphate Mines Co.) All data were recorded at the Israeli NDC, HFRI, located at 30.03N and 35.03E. Data were first winnowed based on the distribution of maximum amplitudes in the neighborhood of the P-wave arrival. The winnowed data were then detrended using the algorithm of Cleveland et al (1990). The detrended data were bandpass filtered between .1 to 12 Hz using an eighth order Butterworth filter. Finally, data were sorted based on maximum trace amplitude.

Two similarity analysis approaches were used. First, for each component, the entire suite of traces was decomposed into its eigenvector representation, by employing singular-valued decomposition (SVD). The data were then reconstructed using 10 percent of the singular values, with the resulting enhancement of the S-wave and surface wave arrivals. The results of this first method are then compared to the second analysis method based on the eigenface decomposition analysis of Turk and Pentland (1991). While both methods yield similar results in enhancement of data arrivals and reduction of data redundancy, more analysis is required to calibrate the recorded data to charge size, a quantity that was not available for the current study.

References

Cleveland, R. B., Cleveland, W. S., McRae, J. E., and Terpenning, I., Stl: A seasonal-trend decomposition procedure based on loess, Journal of Official Statistics, 6, No. 1, 3–73, 1990.

Turk, M. and Pentland, A., Eigenfaces for recognition. Journal of cognitive neuroscience, 3(1), 71-86, 1991.