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Source spectral inversion using a seismic cluster method

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The study of the seismic source parameters (such as the corner frequency, seismic moment, stress drop and radiated energy) gives us relevant information regarding the rupture process of an earthquake. One of many ways to obtain these parameters is through the analysis of earthquake source spectra. However, to find these parameters, it is first necessary to remove the effects produced by the path from source to station.

In this work, a non-linear inversion of the earthquake source spectrum was performed, using an implementation of the Neighborhood Algorithm. Following Ko et al. (2012), using sets of a clusters of nearby earthquakes, we assume that the outgoing seismic ray of each cluster travels basically the same path to the each station that register it, as well as, imposing a single corner frequency per event. This method, unlike simple inversion methods, takes advantage of "multiple-earthquake multiple-station" redundancy, reducing the degrees of freedom in the inversion. The method was tested using a simple theoretical spectra and theoretical spectra with added noise, obtaining a better restriction for the parameters of attenuation (Q value), spectrum decay (n), and corner frequency (fc), compared to methods with individual-earthquake fitting.

Recent studies have shown a strong tectonic relationship between the occurrence of a large subduction earthquake and the intraplate seismicity that occurred before. In this study, we apply the previously described method to study the source parameters events from 2008 to 2015, including the last earthquake of Iquique 2014 (Mw 8.1) and the intermediate-depth seismicity from 2011 to 2013, in Northern Chile. The aim of this work is to use these parameters for the estimation of stress drops and radiated energy for these events, looking for differences in both types of earthquakes and their temporal and spatial relationships.