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Retrieving Source-Time Function and Seismic Moment Tensor From Near Field Records

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Retrieve earthquake source parameters from seismological or geodetic data is an important aspect in the rapid characterization of the earthquake source, which is particularly relevant in real-time operations. The inversion of seismic moment tensors and slip distributions of large earthquakes is a recurrent and important topic in seismology because it allows to know the source properties and rupture process. Several methodologies allow to make these inferences assuming different levels of complexity of the earthquake source, for instance, the Global Centroid Moment Tensor compute routinely the centroid moment tensor from global seismic data, on the other hand, agencies such as the National Earthquake Information Center have implemented methodologies to retrieve the moment tensor in real-time (e.g the W-Phase). However, the joint inversion of the moment tensor and the source-time function using regional and near-field data is a promising approach to characterize source parameters. Several methodologies allow to invert the seismic moment tensor using broadband regional data assuming a simple source-time function (e.g. impulsive, or with a triangular shape), but are usually limited because broadband stations get saturated near the source for moderate and large earthquakes. Yagi and Nishimura (2011) proposed a method that inverts the moment tensor and the half duration using strong motion data. Weber (2009) computes the seismic moment tensor as a function of time using broadband regional data, applying a inverse method that minimize the L1-norm, and then retrieves the source-time function. The aim of this study is to develop a method and a computational tool that allows to jointly invert the moment tensor and the source-time function using strong motion and broadband regional data. The inverse method is applied in two steps, (1) we invert the moment tensor assuming a triangular source-time function and, (2) minimizing the L2-norm, we invert the amplitude of a series of basis functions that describes a more complex source-time function. We apply this methodology to moderate and large aftershocks of the 2014, Mw 8.2, Pisagua earthquake. The idea is to characterize the complexity of the moment-rate function and to study the physics of earthquakes that occurs mainly at seismogenic zone interface in northern Chile.