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Scaling relationship for source parameters of the seismicity of the Corinth Rift (Greece)

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The improvements in high-density, high-dynamics and broadband seismic observation make it possible to investigate the proprieties of microearthquake source parameters at very small scales, in order to better understand the earthquake process similarity over a broad magnitude range. The issue of earthquake source scaling continues to draw considerable debate within the seismological community: both supporting and refuting that systematic differences between the source processes of small and large earthquakes may exist. It motivates the study of how source parameters, such as seismic moment, corner frequency, radiated seismic energy, and apparent stress, scale over a wide range of magnitudes.

On the other hand the estimation of the heterogeneous distribution of seismic attenuation from the dispersion of amplitude with frequency is important for the characterization of rock and fluid properties, e.g., saturation, porosity, permeability, and viscosity, because attenuation is more sensitive than velocity to some of these properties.

To address these questions, we analyze the seismicity recorded from 2000 to 2011 by the Corinth Rift Laboratory european project (http:/crlab.eu) covering the western part of the Corinth Rift (Greece). The network was composed in 2000 of 12 recording stations, with short period three component seismometers. Over the years 6 broadband stations have been added. The Corinth Rift (Western Greece) is one of the most seismic active area in Europe with several instrumental and historical earthquakes (at least 5 earthquakes with magnitude larger than 5.8 in the last 35 years), several seismic swarms and significant background seismicity.

The database consists in about 100,000 events with prevalent normal faulting focal mechanism and covers five orders of magnitude of seismic moment M_0 (10^10 – 10^15 Nm).

We investigate scaling relationships of the source parameters from S-wave signals.

We use a frequency domain parametric approach to estimate seismic moment, corner frequency and the high-frequency spectral fall-off parameter from earthquake S-wave displacement spectra. We assume a Brune-type (1970) source, with an inverse omega-square spectral decay. The data set enables to investigate the scaling of source size and stress drops as a function of the seismic moment in a wide magnitude range in a dominant extensional tectonic environment.

A by-product of our study is a Ml vs Mw relationship, which is inferred for events in the whole analyzed magnitude range (0<Mw<5).