Geophysical Research Abstracts
Vol. 19, EGU2017-11793, 2017
EGU General Assembly 2017
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Source scaling properties in the upper segment of the Vrancea subcrustal nest (Romania)

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The Vrancea seismic nest (located at the South-Eastern Carpathians Arc bend, in Romania) is one of the well-defined clusters of seismicity at intermediate depth in the World. During the last 100 years four major shocks were recorded in the lithosphere body descending almost vertically beneath the Vrancea region: 10 November 1940 (Mw 7.7, depth 150 km), 4 March 1977 (Mw 7.4, depth 94 km), 30 August 1986 (Mw 7.1, depth 131 km) and a double shock on 30 and 31 May 1990 (Mw 6.9, depth 91 km and Mw 6.4, depth 87 km, respectively). The second shock on May 1990 was produced half a day after the first shock. Apparently, the tectonic deformation in the system is released alternatively between two active segments, one in the upper side ($\sim$ 90 km depth) and the other in the lower side of the focal volume ($\sim$ 140 km depth). The source scaling properties are essential elements to understand and model the tectonic processes responsible for generating earthquakes in such a confined lithospheric volume. The purpose of the present paper is to investigate source properties for the earthquake activity in the upper segment of the Vrancea focal volume since the last major shock of May 1990. To this aim, we re-compute the source parameters of the moderate-size earthquakes occurred during this time interval. In order to constrain as much as possible source parameters, we applied spectral ratios technique and empirical Green's function deconvolution. Therefore, we selected a set of earthquakes as templates for different co-located groups of events. For most of the earthquakes, the application of relative deconvolution techniques show relative simple source time function and source spectrum, compatible with a circular source model with homogeneous rupture process. The scaling of seismic moment with source dimension and the stress drop scaling as determined from observations are matching well (within inherent deconvolution errors) the theoretical scaling for generally adopted source models. We analyze also if tendencies in the seismic regime (in space, time and size distribution) can be detected within a time window of 27 years and can be considered as viable indicators of the future major rupture event in the upper segment of the Vrancea subcrustal domain.