Geophysical Research Abstracts
Vol. 20, EGU2018-1666, 2018
EGU General Assembly 2018

Use of tomographic techniques to investigate the seismic attenuation in the Carpathian orogen and adjacent regions (Romania)

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Romania, located in the south-eastern sector of the Carpathians and its East-European foreland, is an area of a great diversity of geology and tectonic interactions. It thus represents a unique opportunity to study the interaction of tectonic processes in the crust and convective overturn in the upper mantle. In contrast with the stable margins of the East European Craton (EEC), the Carpathian belt represents the evolution of two colliding continental blocks. This leads to a hypothetical north-to-south slab break-off, Neogene volcanism, and anomalous intense mantle seismicity in the SE Carpathians (Vrancea region). In the western part of Romania, the presence of the Pannonian and Transylvanian Basins is related to the interaction between the Adriatic microplate and the European continent and complex post-collisional processes. It has been recently shown that the Adriatic convergence could trigger gravitational instability of continental lithosphere, down-welling beneath the Carpathians and extension of the Pannonian Basin.
The goal of the present study is to measure for this region the decay rate of coda waves at late lapse times from the earthquake origin time, to model seismic coda attenuation (Qc) in space and frequency. For this purpose, we selected 150 crustal- and intermediate-depth seismic events recorded by the permanent stations of the Romanian Seismic Network between 2015 and 2017 with moment magnitude from 1.5 to 5.7. We carry out a tomographic approach using spatial frequency-dependent kernels derived from radiative transfer theory, providing a physics-grounded sensitivity map for each source-station pair. The results outline the structural complexity of the study region through the lateral variation and dimensions of absorption features. The deeper layers, sampled by the lower frequencies, reveal an increased absorption to the northwest and southeast relative to Vrancea region. High-frequency shallower high-absorption features are prevalent in the deepest sedimentary areas and stable regions (platforms).