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Spatial distribution of scattering and absorption features revealed by coda waves from intermediate depth earthquakes in the Vrancea region (Romania)

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The Vrancea region, located at the southeastern (SE) edge of the Carpathians arc bend, is a region of intense seismicity, whose major earthquakes produce hazard in SE Europe. Despite the consequent focus of the geophysical and geological community on providing accurate structural and dynamical models, the region is still subject to numerous controversies and debates. In the present study, we use intermediate-depth seismicity recorded by the broadband stations of the Romanian Seismic Network between 2009 and 2011 to measure S-wave peak delay times (Tpd) and late-time coda quality factors (Qc). These two quantities have been mapped in space and used as data in a cluster analysis to obtain a quantitative structural interpretation of the medium in terms of different attenuation mechanisms affecting the seismic wave field, i.e. seismic scattering and seismic absorption. The results provide novel insight into the structural characteristic of Vrancea, with low-frequency waves more sensitive to smooth deeper crustal structures and higher frequencies influenced by stronger small-scale heterogeneities, characteristic of the area. Scattering is higher NW of Vrancea, while absorption is prevalent in the Focsani Basin, located in the forearc region. In general, we obtain higher absorption in stable regions, a result attributed to the presence of hydrocarbons and natural gases in the upper crustal layers and affecting high-frequency absorption/scattering patterns. Regions characterized by active seismicity and structural heterogeneity show an opposite behavior, with high scattering spatially correlated with highest velocity variability and lowest density. The results of the cluster analysis highlight scattering/absorption patterns possibly linked to volcanism with high-frequency observations clearly depicting the direction of the sinking lithospheric fragment into asthenosphere, corresponding to the main SE-NE seismic epicentral trend.