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Ambient noise tomography in the Carpathian-Pannonian region

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The Carpathian-Pannonian system includes the Pannonian and Transylvanian Basins, and the surrounding Eastern Alpine, Carpathian and Dinaric mountain belts. During the evolution of the Carpathian-Pannonian region, extension of the crust and lithosphere created several inter-related basins of which the Pannonian basin is the largest. Imaging the seismic velocity structure of the crust and the upper mantle may help us understand the structure and geodynamic evolution of this part of central Europe. Here, we use ambient noise tomography to investigate the crust and uppermost mantle structures in the region. We have collected and processed continuous data from 54 temporary stations deployed in the South Carpathian Project (2009-2011), 56 temporary stations deployed in the Carpathian Basins Project (2005-2007), and about 100 permanent broadband stations of national networks; this dataset enables the most well-resolved images of the S-wave structure of the region yet obtained in the crust and uppermost mantle. We computed the cross-correlation between vertical component seismograms from pairs of stations and stacked the correlated waveforms over 1-2 years for the temporary stations and up to 5 years for permanent stations, to estimate the Rayleigh wave Green's function. Frequency-time analysis is used to measure the group velocity dispersion curves, which are then inverted for the group velocity maps in the periods range between 4 s and 40 s. Our 4-10 s group velocity maps exhibit low velocity anomalies which clearly define the major sediment depo-centers in the Carpathian region. A broad low velocity anomaly in the center of the 5 s group velocity map can be associated with the Pannonian Basin, whereas another slow anomaly in the southeastern region is related to the Moesian platform. Further east, the Vienna Basin can also be seen on our maps. A fast anomaly in the central region is associated with the Mid-Hungarian line. At periods from 18 to 24 seconds, group velocities become increasingly sensitive to crustal thickness. The maps also reveal low-velocity anomalies associated with the Carpathians. These low velocity anomalies are probably caused by deeper crustal roots beneath the mountain ranges which occur due to isostatic compensation of the Carpathian topography.