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Mantle Transition Zone structure beneath the Central and Eastern European region based on P-to-S Receiver Function analysis

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The depths of mineralogical phase transitions in the mantle (at ~410 and ~660 km depth) offer crucial insights into the thermal conditions of the mantle transition zone and, by extension, the upper mantle's state and circulation. Our approach involves conducting P-to-S receiver function analysis to determine the mantle transition zone's thickness and the absolute depths of the ~410 km and ~660 km discontinuities in the Central and Eastern European region.

Our workflow meticulously attends to each step, starting from data download, quality control, and culminating in the calculation of P-to-S receiver functions. We use data from multiple sources, including the AlpArray and AdriaArray Seismic Networks, the PACASE, Carpathian Basin, and South Carpathian Project temporary seismic networks, as well as the permanent stations of the Hungarian National Seismological network and of the neighboring countries. This analysis covers the time period from 2002 to 2023, involving over 860 seismological stations. Our extensive dataset, consisting of approximately 2 million three-component waveforms and over 120,000 high-quality P-to-S radial receiver functions, coupled with dense piercing-point coverage, allows us to achieve unprecedented resolution.

We present Common Conversion Point cross-sections migrated with a 3D tomographic velocity model underneath the Alps, Carpathians, and the Pannonian Basin. Additionally, we aim to offer new insights into the mantle transition zone's thickness beneath intriguing regions (e.g., Vrancea zone, Alpine Tethys Ocean zone, Eastern Alps–Pannonian Basin transition zone). For a precise understanding of geodynamic processes such as slabs, mantle plumes, and volcanism, it is imperative to accurately map these boundaries.