Geophysical Research Abstracts
Vol. 15, EGU2013-6972, 2013
EGU General Assembly 2013

Imaging the lithosphere-asthenosphere boundary across the transition from Phanerozoic Europe to the East-European Craton with S-receiver functions

Brigitte Knapmeyer-Endrun, Frank Krüger, and the PASSEQ Working Group Team
University Potsdam, Institute of Earth and Environmental Sciences, Karl-Liebknecht-Str. 24-25, Potsdam, 14476 Germany (brigitte.endrun@geo.uni-potsdam.de)

Cratons are characterized by their thick lithospheric roots. In the case of the Eastern European Craton, high seismic velocities have been imaged tomographically to more than 200 km depth. However, the exact depth extent of the cratonic lithosphere and especially the properties of the transition to a much thinner lithosphere beneath Phanerozoic central Europe still remain under discussion. Whereas a number of recent seismic campaigns has significantly increased the knowledge about crustal structure and Moho topography in central Europe, comparably detailed, 3-D information on upper mantle structure, e.g. the lithosphere-asthenosphere boundary (LAB), is yet missing. The international PASSEQ experiment, which was conducted from 2006 to 2008, strived to fill this gap with the deployment of 196 seismological stations, roughly a quarter of which were equipped with broad-band sensors, between eastern Germany and Lithuania. With a mean inter-station distance of 60 km, reduced to about 20 km along the central profile, PASSEQ offers the densest coverage for a passive experiment in this region yet. Here, we present first S-receiver function results for this data set, complemented by additional data from national and regional networks and other temporary deployments. This increases the number of available broad-band stations to almost 300, though mostly located to the west of the Trans-European Suture Zone (TESZ). Besides, we also process data from short-period (1 s and 5 s) sensors.

The visibility of mantle-transition zone phases, even in single-station data, provides confidence in the quality of the obtained S-receiver functions. Moho conversions can be confidently identified for all stations. In case of a low-velocity sedimentary cover, as found for example in the Polish Basin, the S-receiver functions even provide clearer information on Moho depth than the P-receiver functions, which are heavily disturbed by shallow reverberations. For stations west of the TESZ, a clear negative conversion, indicative of a velocity decrease with depth and identified as the LAB, is detected from an average depth of 90 km. This is in good agreement with estimates of the lithospheric thickness beneath Phanerozoic Europe from surface waves. Highest amplitudes of this conversion are obtained when the data are low-passed around 3 s. This indicates that the corresponding interface is less sharp than the Moho, which shows highest amplitudes for a 1 s-lowpass, but still limited in width to about 15 km. For stations located on the East European Craton, we likewise observe a negative conversion caused by a velocity reduction at about 100 km depth. However, in this case, the cause cannot be the tomographically imaged LAB. We rather explain the observation as mid-lithospheric discontinuity, which has also been found in S-receiver functions from other cratonic areas worldwide. At some of the cratonic stations, we observe a negative conversion of similar size that could be related to a velocity decrease at 190 km to 230 km depth, in agreement with depth estimates for the cratonic LAB. The lack of this observation for the other cratonic stations might imply spatial variations in the sharpness of the corresponding velocity change.