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Lithosphere structure of the NE Bohemian Massif (Sudetes) – A teleseismic receiver function study

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In 2004 and 2005 a passive seismic experiment with 32 temporary and 12 permanent seismological observatories was carried out in the northern and northeastern part of the Bohemian Massif to study the structure of the lithosphere. The Bohemian Massif belongs to the eastern part of the Variscan orogenic belt. Geological studies recognized four distinctive tectonometamorphic (crustal) units forming the Bohemian Massif: Saxothuringian in the north, Teplá-Barrandian in the central part, Moldanubian mainly in the south, and Moravo-Silesian in the southeast. Further to the southeast, the Brunovistulian unit is situated, which has a completely different geological history as a part of a separate microcontinent. Our study mainly covers the Sudetes, which are normally associated with the Saxothuringian unit.

In our contribution we present results from Ps and Sp receiver function analyses. We obtained good observations of converted phases at most of the 33 broadband stations in the study area and also at most of the short-period stations. With one exception, Moho depth at stations in the northwestern part of the study area vary between 27 und 32 km. Thicker crust up to 35 km was mapped towards the south (Moldanubian unit) and towards the east (Moravo-Silesian and Brunovistulian units) confirming results from previous active seismic measurements. There exists a relatively sharp step in Moho depth between the Sudetes (30 km) and the Moravosilesian unit (35 km). The vp/vs ratios inverted from primary and multiple Moho Ps conversions hint for different crustal composition of the units. Towards the Carpathian thrust we have no clear indications for any crustal root or slab beneath the Western Carpathians. However, our data might indicate a deepening of the Moho or at least a complicated crust-mantle transition in this area. Additional Ps phases were observed between 6 and 10 s delay time in the Sudetes, in the area where Permo-Carboniferous basins (Sudetic basins) on probably Tepla-Barrandian crust are present. The phases between 6 and 10 s delay time cannot be explained by Moho reverberations, but most probably by low velocity zones in the middle crust or lithospheric mantle as we will show by modelling of theoretical receiver function. The group of stations showing these abnormal phases are located in the area where Permo-Carboniferous basins are present. Therefore we assume that the phases hint for a mid-crustal low velocity zone at 16-20 km depth which could be interpreted as a felsic solidified magma reservoir of the Permo-Carboniferous volcanism beneath the Sudetic Basins. Sp receiver functions show phases with negative polarity at 9 to 12 s lead time in average. If these phases are actually converted phases from the lithosphere-asthenosphere boundary, it would be at about 80 to 110 km depth beneath the study area.