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Mantle anisotropy of the Bohemian Massif as seen by SKS-wave splitting

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The Bohemian Massif (BM) assembled during the collision of Laurasia (Laurentia-Baltica) and Gondwana as a part of the Armorican Terrane Assemblage. It represents the estern-most outcrop of the European Variscan belt. The detailed tomographic and seismic anisotropy research of the deep structure of the BM has proceeded in several passive seismic experiments: BOHEMA I (2001-2003), BOHEMA II (2004-2005), BOHEMA III (2005-2006), PASSEQ (2006-2008) and Eger Rift (2007-2011). During these periods, the whole massif was stepwise covered by networks of temporal short-period and broad-band stations that recorded large amount of data from teleseismic events. The inferences from seismic anisotropy image the Bohemian Massif as a mosaic of microplates with a rigid mantle lithosphere preserving a fossil olivine fabric. The mantle domains can be associated with the tectonic units recognized by geological studies: Saxothuringian (ST), Teplá–Barrandian (TB), Moldanubian (MB) and finally Moravian (M) and Silesian (S) parts of the MS Zone, overlying the Brunovistulian mantle lithosphere.

In this contribution, we concetrate on the large-scale mantle anisotropy modelled from splitting of SKS waves and their particle motion (PM). An advantage of using PM analysis is its ability to employ even events with lower signal-to-noise ratio (SNR) that are otherwise not usable for splitting analysis. To improve results of splitting analysis of signals distorted by noise, we use stacking of individual splitting measurements from waves closely propagating through the mantle. Another way of improving our analysis is a stacking of individual splittings of a single event measured at nearby stations.

On average, the fast shear waves are polarized in the E-W direction in the ST, MD, TB units, but exhibit different regional variations of the splitting parameters in dependence on back-azimuths. Thus, different lithosphere mantle fabrics in the ST, MD and TB units were modelled. Moreover, the ST unit can be divided in two parts differing by about 30° in the fast S polarization directions. The boundary correlates with the geologically mapped Saxonian Lineament. To the north of the BM, the fast S polarizations significantly change. Within the BM, mean azimuths of fast S polarizations calculated for opposite back-azimuths differ. This is one of indications of the directional dependence of shear-wave splitting due to wave propagation through an anisotropic medium with a generally inclined symmetry axis. Anisotropic models with inclined symmetry axes are consistent with results derived from modelling directional variations of P-wave residuals.