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Shallow crustal anisotropy studied from S-wave splitting observed at records of local micro-earthquakes in West Bohemia, Czech Republic

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Most of S-wave particle motions of local micro-earthquakes that occurred in the West Bohemia region, Czech Republic, display S-wave splitting. The split S waves recorded at local seismic stations of the WEBNET network are usually well defined, being separated in time and polarized in roughly perpendicular directions in the horizontal projection. In most cases, the polarization of the fast S wave is aligned NW-SE (referred to as the 'normal splitting'), which is close to the direction of the maximum horizontal compression in the region. However, for some ray directions, the polarization of the fast S wave is aligned NE-SW (referred to as the 'reverse splitting'). The pattern of normal/reverse splitting on a focal sphere is station-dependent, indicating the presence of inhomogeneities in anisotropy. For some stations, the normal/reverse splitting pattern is asymmetric with respect to the vertical axis, indicating the symmetry axes of anisotropy are probably inclined. The presence of inclined anisotropy is confirmed by observations of azimuthally dependent delay times between split S waves. A complex and station-dependent anisotropy pattern is probably the result of a complicated anisotropic crust characterized by diverse geological structures. The spatial variation of anisotropy probably reflects the presence of a variety of different types of anisotropic rocks in the region.

A very intriguing phenomenon is the observation of the so-called '90º-flips' of the split S waves, i.e. the observation of normal as well as reverse splitting in one fixed ray direction, or in two directions which are very close to one another. So far, we have detected several 90º-flips, but only in rather rare cases. A more detailed and thorough analysis is needed to decide whether the observed flips are the result of a temporal variation of anisotropy or not. Since the seismic activity in the West Bohemia region is probably triggered or driven by crustal fluids, the 90º-flips of the split S waves would become an attractive tool for monitoring fluid migration and long-term fluid flow.