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High-resolution SKS anisotropy indicates asthenospheric flow below SW Germany

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Using SKS splitting measurements at 64 stations in Southwest Germany and adjacent regions, it is possible to determine mantle anisotropy with high spatial resolution. The measurements are based on the method by Silver and Chan (JGR, 1991). The results provide the delay time dt between the fast and slow shear waves and the angle phi which points into the direction of fast wave propagation relative to north. We analyse SKS waveforms from 32 mobile KABBA stations (KArlsruhe BroadBand Array) which were operated during the TIMO experiment (Tiefenstruktur des mittleren Oberrheingrabens – Deep Structure of the Central Upper Rhine Graben, Dec. 2004 – May 2006). Additionally we analyse recordings from permanent stations in the region and the eastern stations of the Eifel Plume Project (1997/98).

A comparison of our SKS splitting results between permanent and temporary stations demonstrates that few measurements with high signal-to-noise ratio at temporary stations allow to interpolate phi between the permanent stations where recordings of better quantity and quality are available. The determined direction of fast wave propagation in Southwest Germany indicates a smooth spatial variation mainly towards NE-SW. This smooth pattern prevails, although four different tectonic regimes are covered (Saxothuringian and Moldaunubian lithospheric terranes, the Neogene Upper Rhine Graben and the eastern range of the active Eifel plume). This smooth variation in phi is interpreted to result from recent orientation of minerals in the asthenosphere due to flow-induced shearing. Fossil mineral alignment in the lithospheric mantle may be also present, but it seems to be of lower importance in our SKS splitting observations.