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Analysis of Seismic Anisotropy Across Central Anatolia by Shear Wave Splitting

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Analysis of Seismic Anisotropy Across Central Anatolia
by Shear Wave Splitting
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Central Anatolia holds the key to connect the theories about the ongoing tectonic escape, the African Plate subduction along Cyprus Arc and the indenter-style collision of Arabian Plate along Bitlis Suture. However, the shear wave splitting measurements which are needed to characterize seismic anisotropy are very sparse in the region. Recently, seismic data recorded by national seismic networks (KOERI, ERI-DAD) with dense coverage, provided a unique opportunity to analyze the effect of present slab geometry (slab tears, slab break-off) on mantle deformation and test different models of anisotropy forming mechanisms. In this study, the anisotropic structure beneath the Central Anatolia is investigated via splitting of SKS and SKKS phases recorded at 46 broadband seismic stations. Our measurements yielded 1171 well-constrained splitting and 433 null results. Overall, the region displays NE-SW trending fast splitting directions and delay times on the order of 1 sec. On the other hand, a large number of stations which are spatially correlated with Cyprus Slab, Neogene volcanism and major tectonic structures present significant back azimuthal variations on splitting parameters that cannot be explained by one-layered anisotropy with horizontal symmetry. Thus, we have modeled anisotropy for two-layered structures using a forward approach and identified NE-SW trending fast splitting directions with delay times close to 1 sec at the lower layer and N-S, NW-SE trending fast splitting with limited time delays (0.1 - 0.3 sec) at the upper layer. Fast directions and delay times of the lower layer are similar to one-layered anisotropy and parallel or sub-parallel to the absolute plate motions which favors asthenospheric flow model associated to basal drag. In contrast, weak upper layer anisotropy is likely related to the internal deformation of Central Anatolian lithosphere.