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Investigation of the Upper Mantle Anisotropy Beneath the Anatolian Plate and Surroundings by Shear Wave Splitting Analysis

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The Anatolia, one of the most actively deforming continental regions of the Earth, is considered to be a natural laboratory for studying tectonic structures, complex deformation patterns, and intense seismicity at various scales. Active tectonics of this plate has been shaped by complex interactions between the Arabian, African and Eurasian plates. In the region, there are several suture zones associated with the closure of Tethys Ocean, large-scale transform faults (e.g. North Anatolian Fault) and geological structures developed in relation to extensional and compressional tectonics. Seismic anisotropy studies are needed to better understand the relationship between surface deformation and mantle dynamics, and to establish a connection between the involved deformation models and anisotropic structures in the lithosphere and asthenosphere layers beneath Anatolia. To evaluate lateral and vertical variations in the upper mantle anisotropy and thus underlying geodynamic processes, we apply teleseismic shear wave splitting (e.g. SKS, PKS, SKKS) analyses using about 500 broad-band seismic stations located throughout Anatolia, which belong to AFAD, KOERI and NOA seismic networks. Splitting intensities (SI) were calculated for the entire data set to compare piercing parameters obtained from both SI and SWS techniques. Overall, the NE-SW fast directions were observed for the entire Anatolia. Local changes in FPDs and DTs should be interpreted with caution as they will give important clues about the correlation between existing tectonic forces and upper mantle deformation. In particular, complex anisotropy signature along the large-scale transform faults (NAF and EAF) was investigated by using multisplit approach (e.g., Eken and Tilmann, 2014) that uses a grid search over four splitting parameters of two-layer anisotropy. A bootstrap-based analysis was performed to statistically evaluate the possible variations in two-layer models. Preliminary results reveal that a two-layer anisotropy exists at the western part of the Anatolia along the NAF. The obtained two-layer anisotropy models imply that signatures of lithospheric deformation and of asthenospheric flow driven shearing remarkably differ in NW Anatolia. In this part of the Anatolian plate, we observed large time delays up to ~2.2 sec, and fast polarization directions: i) mainly consistent with the strike of NAF in the lithosphere, ii) N-S oriented in the asthenosphere that is likely attributed to the mantle flow regime under the influence of slab roll-back and trench retreat along the Hellenic subduction zone.