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New Splitting Measurements based on Teleseismic Direct S-wave Analysis for Turkey

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An accurate interpretation of the dynamic forces responsible for plate motions is particularly important for understanding the processes (e.g. mountain building, convergence of the plates, etc.) in Turkey. Hence, a reliable estimate of seismic anisotropy can be helpful to gain a better understanding of the role of various types of plate-mantle interaction, i.e. the retreat of the slab in the Aegean, the alleged tear in the subducting slab close to the Cyprian Trench and the breakoff in the slab in eastern Turkey since it can present clues about possible deformation history in the past and present. We supplement the existing database of SKS measurement by applying the reference station technique that is less sensitive to the effects of source-side anisotropy. The method overcomes possible contamination from source-side anisotropy on direct S-wave signals recorded at a station pair in a stepwise manner; i) correcting the reference stations for known receiver-side anisotropy, ii) correcting the target stations for arbitrary splitting parameters correcting, and iii) optimizing the final splitting parameters at a given target station by maximizing the correlation between the corrected seismic traces at reference and target stations in a grid search scheme. Finally, robust results are obtained by averaging over many events and station pairs. We estimated splitting parameters at 130 broadband stations with good-quality S-wave signals extracted from 130 teleseismic events. Station-averaged fast polarization directions (FPDs) indicate an overall trend with a NE-SW orientation, consistent with previous SKS splitting studies. As a measure of anisotropic strength, splitting time delays vary between 1.0 s and 1.7 s. Our results verify that the major contribution to the observed anisotropy is the mantle flow and associated lattice-preferred orientation of olivine induced by the roll-back of the slab. A significant discrepancy from this regional trend occurs in southwest Anatolia where our FPDs rotate from NE-SW to NNW-SSE, implying that the mantle flow pattern is disturbed by entrainment of asthenospheric material through a slab tear.