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Large-scale variation in seismic anisotropy in the crust and upper mantle beneath Anatolia, Turkey

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Seismic anisotropy beneath Anatolia is complex, with several layers of different anisotropy.
The average anisotropy is well constrained by shear-wave splitting measurements [Kaviani et al., 2009], suggesting very strong anisotropy (over 1.5s delay time). However, the vertical layering of anisotropy and the contribution of each layer is still an open question.

We construct anisotropic phase-velocity maps of fundamental-mode Rayleigh waves for the Anatolia region using records from several regional seismic stations, using both earthquake and ambient noise data.
The collision between the Arabia and Eurasia plates leads to the westward extrusion (and EW anisotropy) of the Anatolian crust, consistent with the seismic anisotropy patterns we found in the crust (1%, EW fast axis) and with previous studies [Mutlu et al., 2011; Legendre et al., 2020].
The Aegean/Anatolian subduction system with slab tearing and breakoff induces a complex flow pattern and anisotropy in the upper mantle [van Hinsbergen et al., 2010; Kaviani et al., 2018].
This is in agreement with the anisotropy we image in the lithosphere (1%, N020E and N100E fast axes) and asthenosphere (1%, N120E). However, the anisotropy in these layers display limited amplitudes.
At deeper depth, remnant Bitlis and Tethyan slabs are lying flat above the 660-km discontinuity [Berk Biryol et al., 2011].

The uniform pattern of anisotropy from shear-wave splitting observations can not be explained solely by a single anisotropic layer, and is not consistent with the anisotropy observed in the crustl lithospheric and asthenospheric mantle. This suggests that main contribution of the anisotropy likely originates from a deep source around the mantle transition zone [Legendre et al., 2021].