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# Seismic anisotropy and mantle flow in the Hellenic subduction zone: The possible effects of trench retreat and slab tear at both ends.

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The upper mantle anisotropy pattern in the entire area of the Hellenic subduction zone have been analyzed for fast polarization directions and delay times to investigate the complex 3D pattern of mantle flow around the subducting slab. All previous studies do incorporate a significant number of measurements in the backarc area of the Aegean and in two cross-sections along the Hellenic subduction system. However, the transitional area from oceanic to continental subduction in the Western Hellenic trench has not been adequately sampled so far. Moreover, the eastern termination of the Hellenic subduction and the possible origin of a trench parallel anisotropy remains unclear. Here, I focus on the two possible ends of the high curvature Hellenic arc. I have now measured SKS splitting parameters from all broadband stations of the Hellenic Unified Seismic Network (HUSN), that they have not been measured before, specially concentrated in the transitional area from oceanic to continental subduction system. Complementary, using the Source-Side splitting technique to teleseismic S-wave records from intermediate depth earthquake in the Hellenic trench, the anisotropy measurements are increased in regions where no stations are installed.
In western Greece, the Hellenic subduction system is separated by the Cephalonia Transform Fault (CTF), a dextral offset of $\sim$100 km, into the northern and southern segments, which are characterized by different convergence rates and slab composition. Recent seismic data show that north of CTF there is a subducted continental lithosphere in contrast to the region south of CTF where the on-going subduction is oceanic. The new measurements, combined with previously published observations, provide the most complete up-to-date spatial coverage for the area. Generally, the pronounced zonation of seismic anisotropy across the subduction zone, as inferred from other studies, is also observed here. Fast SKS splitting directions are trench-normal in the region nearest to the trench. The fast splitting directions change abruptly to trench-parallel above the corner of the mantle wedge and rotate back to trench-normal over the back-arc. Additionally, beneath western Greece, between the western Gulf of Corinth in the south and the Epirus-Thessaly area in the north, a transitional anisotropy pattern emerges that possibly depicts the passage from the continental to the oceanic subducted slabs and the subslab mantle flow due to the trench retreat.
At the eastern side of the Hellenic arc, from eastern Crete to the Dodecanese Islands, the inferred subslab measurements of anisotropy show a general trench perpendicular pattern. This area is characterized as a STEP fault region with multiple trench normal strike slip faults. The difference between the fast roll-back in the Aegean and the slow lithospheric processes in the western Anatolia is accommodated by a broad shear zone of lithospheric deformation and a possible slab tear inferred from seismic tomography and geophysical studies but with a relative unknown geometry. Thus, the observed anisotropy pattern possibly resembles the 3D return flow around the slab edge that is caused by the inferred slab break.