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Seismic anisotropy and mantle deformation in western Iran inferred from shear-wave splitting analysis

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The Iranian plateau as a part of the Alpine-Himalayan mountain belt is comprised of several tectonic units. These are; the Zagros, Alborz, Talesh and Kopeh-Dagh active thrust and fold belts, the Sannandaj-Sirjan and Urmieh-Dhoktar metamorphic and magmatic belts, and the Makran subduction zone. Much of the structural and deformational characteristics of these units have been formed during the subduction of the Neo-Tethys in the Mesozoic and the subsequent Arabia - Eurasia collision in the Cenozoic. Understanding the pattern of past and present deformation at depth provides a valuable key for enhancing our knowledge about the evolution of the collisional boundary in the Iran region. Here we use measurements of seismic anisotropy to understand this pattern. We use data from a temporary seismic network in western Iran to calculate shear-wave splitting parameters. The network was in operation for one year in 2013 and 2014 and consisted of 63 broadband seismometers installed along three parallel profiles that crossed the western Zagros Mountains, central Iran and the western Alborz Mountains.We present ourresults as splitting measurements of the teleseismic SKS/SKKS core-refracted phases. Our results show an average delay time of about 1.3 sec. The fast polarization orientation of the measurements varies significantly along the profile, indicating important changes in style of deformation across different tectonic units. A range-parallel trend is observed in the Zagros, while the orientations of the fast axes are perpendicular to the strike in the Alborz. We compared our fast polarization orientations with GPS velocity vectors in different reference frames. The fast directions in the Alborz are subparallel to the absolute plate motion GPS directions, indicating that the asthenospheric flow might be the influencing factor in the observed anisotropy. The complicated splitting pattern in the Zagros can be either due to contributions from both lithospheric and asthenospheric deformation patterns, or to lateral changes in anisotropic structure.