Variations of Azimuthal Anisotropy of Shear-wave Splitting in the Caucasus Region of West Asia

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The Caucasus in west Asia is a natural laboratory to study dynamics of continental collision between the Arabian and Eurasian Plates that initiated ~25 Ma. The new seismic arrays in Armenia and Georgia provide a unique opportunity to constrain seismic anisotropy beneath the region for further exploration on the relationship between lithosphere and asthenosphere associated with the post-collisional volcanisms.

We use the shear-wave splitting (SWS) of SK(K)S phases to estimate the fast-direction and delay time for events recorded during 2010-2020. Moreover, we apply principal components analysis to improve our SWS measurements on accessing linearity of particle motion. Totally, we accomplish 46 stations and 1346 high-quality SWS measurements to map out the lateral variation of azimuthal anisotropy below the study area. The variation along depth, although difficult to constrain, is also investigated with 1-D forward modeling.

In the Lesser-Greater Caucasus, our results of SWS indicate that the fast-direction is oriented primarily at azimuth of NE-SW which is subparallel with the absolute plate motion and similar to the results in the Anatolia block just west of the Caucasus. However, the delay time significantly decreases from 1.06 s in western Caucasus to nearly 0.70 s in southeastern Caucasus where Quaternary-Holocene volcanoes are still active in Armenia. We propose that the prevailing NE-SW seismic anisotropy corresponds to long-term & large-scale asthenospheric flow in the Caucasus region; while the reduction in delay time in Armenia may be disturbed by sub-vertical flow of small-scale convection under the thinned lithosphere associated with post-collisional volcanoes.

Keywords: Caucasus, seismic anisotropy, shear-wave splitting, asthenosphere

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