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Constraining the shear zone along the Dead Sea transform fault in the crust and upper mantle using seismic anisotropy

Ayoub Kaviani (1), Georg Rümpker (1), Günter Asch (2), and DESIRE group ()

(1) Institut für Geowissenschaften, Facheinheit Geophysik, Johann Wolfgang Goethe-Universität, Frankfurt, Germany, (Kaviani@geophysik.uni-frankfurt.de), (2) GFZ Potsdam, Potsdam, Germany

We study seismic anisotropy along the Dead Sea Transform fault (DST) by shear-wave splitting analysis of SKS and SKKS waveforms recorded at a dense network of broad-band and short-period stations of the DESIRE experiment. The DST accommodates the relative motion between Africa and Arabia through a sinistral strike-slip motion. The Dead Sea is a pull-apart basin formed along the DST as a result of stepwise fault-normal displacement. The DESIRE array of stations cover this portion of the DST.

We measured the splitting parameters (delay times between the fast and slow components of the shear wave and fast polarization direction) in different period bands. We observed consistent fast polarization directions varying from N14W to N19E at different stations and delay times ranging between 1.0 and 2.5 s. Our preliminary examination reveals that the splitting parameters do not exhibit significant frequency dependence. However, we observe variations in the splitting parameters (mostly delay times) along an E-W profile crossing the DST, with smaller delay times in the middle of the profile, within the surface exposure of the DST shear zone, and with two lobes of relatively large delay times on both sides of the central region. The fast polarization directions along this profile change from a dominant NNW trend in the western side of the DST to a general N-S orientation in the central part and a dominant NNE trend to the east. Waveform modeling is required to infer the lateral and depth variations of the strength and orientation of anisotropy in the crust and upper mantle from these observations.

We will also complement our results with the data from the DESERT experiment to provide an overall pattern of seismic anisotropy and structural fabric beneath the DST and surrounding regions from the north of the Dead Sea down to the Red sea.