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Investigation of mantle anisotropy in NW Namibia by shear-wave splitting analysis: evidence for large-scale mantle flow and fossil-anisotropy

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Presence of the Etendeka continental flood basalts in northwestern Namibia, at the eastern extension of Walvis Ridge toward the African coast, is taken as evidence for the assumption that this region was affected by the Tristan da Cunha mantle plume during the rifting/break-up process between Africa and South America. Investigation of seismic anisotropy can provide further evidence for the cause-and-effect relationship between mantle flow, lithospheric deformation and surface structures. We investigate seismic anisotropy beneath NW Namibia by splitting analysis of core-refracted teleseismic shear waves (SKS family). The waveform data was obtained from two different GEOFON seismic networks in the region. The XC network with 5 stations, which has been operating for two years since 1998 and 6A network with 40 stations including both land and off-shore (OBS) stations, operated for longer than two years in 2010-2012.

The data was analyzed using the SplitRacer software and the results of joint splitting analysis assuming a one-layer of anisotropy are presented here. The less-noisy waveform data from the land stations provide reliable and consistent measurements. We obtained few reliable measurements from the OBS stations due to higher noise level and ambiguity about the sensor orientation. The majority of our fast directions exhibit an NE-SW direction consistent with the regional trend of seismic anisotropy in western Africa compatible with a model of large-scale mantle flow due to the NE-ward motion of the African plate. In the northern part of the study area, we observe an anti-clockwise rotation of the splitting polarization directions that seems to be caused by the Kaoko belt and the Puros shear zone. Based on the short-scale variation of the splitting parameters in this region, we believe that the cause of the lateral variation in SKS-splitting observation is the shallow lithospheric structure rather than a variation of deep mantle flow. Our results does not show any direct plume related observations in the study region.