Lithosphere-asthenosphere decoupling in the Central/Eastern Alps from seismic anisotropy beneath the dense SWATH-D network

Frederik Link and Georg Rümpker
Goethe-University Frankfurt, Institute of Geosciences, Frankfurt am Main, Germany (link@geophysik.uni-frankfurt.de)

The Alpine orogeny is characterized by tectonic sequences of subduction and collision accompanied by break-off events and possibly preceded by a flip of subduction polarity. The tectonic evolution of the transition to the Eastern Alps has thus been under debate. The dense Swath-D seismic network as complementary experiment to the AlpArray network provides unprecedented lateral resolution to address this open discussion. We analyze shear wave splitting of this data set to get insights into the deformation at depth by studying seismic anisotropy. Previous studies indicate two-layer anisotropy in the Eastern Alps. This is supported by azimuthal pattern of the measured fast axis direction across all stations of the network. The temporary character of the deployment requires a joint analysis of multiple stations to increase the number of events adding complementary information of the anisotropic property of the mantle. We perform a cluster analysis based on a correlation of the remaining transverse energy between all stations. The energy tensor is calculated in the grid search for the best fitting two-layer splitting parameters to the ensemble of events at each station. This leads to two main groups of different two-layer properties separated at 12.5 degrees Longitude. We identify a layer with constant fast axis direction of 60° over the whole area, with a possible dip from West to East. The lower layer in the West shows N-S direction and upper layer in the East 115° alignment. We propose two likely scenarios, both accompanied by a slab break-off in the Eastern part. The continuous layer can either be interpreted as frozen-in anisotropy with lithospheric origin or an asthenospheric flow evading the retreat of the European slab that would precede the break-off event. In both scenarios the upper layer in the East is result of a channel flow through the gap formed in the slab break-off. The N-S direction is interpreted as asthenospheric flow mainly driven by the subduction of the European plate below Adria.