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Crustal anisotropy in the European Alps inferred from an improved splitting analysis of crustal phases in receiver functions

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The fast axes from SKS-splitting measurements in the European Alps show a very simple pattern following the strike of the mountain belt (Kummerow & Kind 2006; Barruol et al. 2011; Bokelmann et al. 2013; Quorbani et al. 2015). That has been interpreted to directly reflect the mantle flow in this region.

However, the convergence of the European and African plates, with the Adrian plate trapped in between (Platt et al. 1989), may suggest a more complex pattern of mantle flow, possibly disturbed by the subducting slabs (Handy et al. 2010).

To investigate the possibility of a crustal contribution to the anisotropy as obtained from SKS-splitting analyses, we analyze the crustal anisotropy in the alpine region using an improved receiver-function method that accounts for anisotropic properties of the crust.

The H-κ-stacking algorithm of Zhu and Kanamori (2000) is a standard tool to infer the thickness of the crust, H, and the average P to S-wave velocity ratio, κ, from receiver functions. An extension of this method to anisotropic media has been proposed by Kaviani & Rümpker (2015). We modify and extend their approach to simultaneously invert for structural and anisotropic properties of the crust such as the H, κ, the fast-axis orientation, φ, and the percentage of anisotropy, a. A possible dip of the crust/mantle boundary can also be taken into account during the inversion.

Furthermore, instead of using the ZRT- or the LQT-coordinates, we rotate the receiver functions into fast/slow-coordinate system. That enables to separate the energy of the fast and slow traveling Ps- and PpPs-phases and stabilizes the inversion. We apply this method to the permanent stations within the region of the AlpArray network resulting in a data set of about 270 stations. The layer dip is taken from tomographic Moho-maps in the region showing a strong topography.

We discuss our results in view of the origin of the crustal anisotropy and its possible influence on SKS-splitting measurements.