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Shear-Wave Splitting in the Alpine Region

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To constrain seismic anisotropy under and around the Alps in Europe, we study SKS shear-wave splitting from the region densely covered by the AlpArray seismic network. We apply a technique based on measuring the splitting intensity, constraining well both the fast orientation and the splitting delay. 4 years of teleseismic earthquake data were processed automatically (without human intervention), from 724 temporary and permanent broadband stations of the AlpArray deployment including ocean-bottom seismometers. We have obtained an objective image of anisotropic structure in and around the Alpine region, at a spatial resolution that is unprecedented. As in earlier studies, we observe a coherent rotation of fast axes in the western part of the Alpine chain, and a region of homogeneous fast orientation in the central Alps. The spatial variation of splitting delay times is particularly interesting. On one hand, there is a clear positive correlation with Alpine topography, suggesting that part of the seismic anisotropy (deformation) is caused by the Alpine orogeny. On the other hand, anisotropic strength around the mountain chain shows a distinct contrast between western and eastern Alps. This difference is best explained by the more active mantle flow around the Western Alps. We discuss earlier concepts of Alpine geodynamics in the light of these new observational constraints.