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Upper mantle structure beneath the Dinarides and the Alps from surface wave tomography

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The Alpine-Dinarides are a complex orogenic system, with its tectonic evolution controlled by the ongoing convergence between Eurasian and African plates with the Adriatic microplate wedged between them. Our study focuses on the upper mantle of the wider Alpine-Dinarides region, and we present surface-wave tomography of two overlapping subregions, interpreting the seismic velocity features in the context of regional geodynamics.

In the first part, we use records of 151 teleseismic earthquakes (2010-2018) at 98 stations distributed across the wider Dinarides region. Surface-wave phase velocities are measured in the range of 30 – 160 s by the two-station method at pairs of stations aligned along the great circle paths with the epicenters. We apply several data-quality tests before the dispersion curves are measured. We use Rayleigh waves recorded on both radial and vertical components. Only the dispersions measured coherently at both components are used for the tomography. In total, we reach the number of 9000 phase velocity measurements for the period of 50 s. Tomographic results including resolution estimates are provided for various frequencies; the local dispersion curves are inverted for depths from the surface down to 300 km. Results are shown as maps for various depths and as cross-sections along several profiles of shear-wave velocities in the whole region.

The other study focuses on the Alps. The AlpArray seismic network stretches hundreds of kilometers in width and more than thousand kilometers in length. It is distributed over the greater Alpine region (Europe) and consists of around 250 temporary and around 400 permanent broadband stations with interstation distances around 40 km. The earthquakes are selected between years 2016-2019. The methodology differs from the Dinarides case in a sense, that while before we used many earthquakes and less stations pairs (due to sparser station coverage), for the Alps, we use less earthquakes (32) and many more stations pairs (tens of thousands) making use of the dense station coverage of the AlpArray network.

Results of the depth inversion of the local dispersion measurements for the Alps are compared with local surface-wave phase-velocity measurement obtained from the (sub)array approach.