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Probing the 3D crustal structure of Eastern Alps with ambient noise surface wave tomography

Irene Molinari (1), Anne Obermann (2), Edi Kissling (1), György Hetényi (3), and AlpArray-EASI Working Group (4)

(1) Institute of Geophysics, ETH Zürich, Zürich, Switzerland (irene.molinari@erdw.ethz.ch), (2) Swiss Seismological Service, ETH Zürich, Zürich, Switzerland, (3) Institute of Earth Sciences, University of Lausanne, UNIL-Mouline Géopolis, Lausanne, Switzerland, (4) AlpArray Seismic Network (www.alparray.ethz.ch)

Eastern Alps tectonic evolution within the Alpine orogen is still under debate. The link between the surface, crustal and mantle structures, the exhumation of upper and lower crust and the thickness of the collision wedge, the nature of the Moho hole between the two plates, the anisotropic nature of the lower crust, the relationship between the Alpine orogen and the adjacent foreland basin and the lithospheric blocks of the Bohemian Massif are still open questions.

We provide here new geophysical constraints on the crustal structure of the Eastern Alps by exploiting surface wave group velocity from seismic ambient noise. We collected one year of continuous data recorded by $\sim$ 250 broadband stations – 54 of which are temporary stations installed between 2014 and 2015 within the EASI-AlpArray collaborative project – in the area ranging from $8°E$ to $19°E$ and from $45°N$ to $52°N$ to obtain high resolution 3D crustal model of this area. We first construct a database of ambient noise Rayleigh-wave group-velocity observations from 4s to 40s and we conduct a suite of linear least squares inversion of the group-velocity data, resulting in 2-D maps of Rayleigh-wave group velocity with a resolution of $\sim$ 15 km. The Rayleigh group-velocity maps are next inverted via the Neighborhood Algorithm to determine a set of one-dimensional shear-velocity models (one per group-velocity pixel), resulting in a new three-dimensional model of shear velocity (v_S) with associated uncertainties. The vertical parameterization is a 3-layers crust and the velocity in each layer is described by a linear gradient.

Our final model is able to constrain key features like the 3D geometry of the Molasse basin, the 3D structure of the lower crust, and the Moho topography. We present here results and interpretations based on our new high resolution crustal structure model of the entire region. We compare our findings with other studies discussing geological and geodynamic implications.