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3-D shear velocity model of the Eastern and Southern Alps from ambient noise tomography

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While the upper crustal velocity structure of the Eastern and Southern Alps is not well-studied by earthquake data and active seismology, we present in this study high-resolution 3-D shear velocity models from ambient noise tomography. We have used two years of continuous data recorded at 71 permanent stations and 19 stations of the AlpArray-EASI profile during 2014 and 2015. Cross-correlations of ambient noise are computed to estimate the Green's functions of surface waves propagating between the station pairs. Dispersion curves of Rayleigh and Love waves are constructed between 1 and 50 seconds, and are then inverted to obtain group velocity maps as a function of frequency. We first show 2-D maps of both Rayleigh and Love-wave group velocity. These group velocity measurements are then inverted to obtain shear-wave velocity models. These models show that velocity variations at short periods correlate very well with surface geology and tectonic units. The results clearly show low-velocity zones associated with the sedimentary basins, the Po-Plain and the Molasse Basin. We find large high-velocity zones associated with the crystalline core zone of the Alps. Small-scale velocity anomalies also position a number of geological units such as the Ötztal metamorphic block, the Koralpe crystalline basement, and the Gurktal block. We observe a clear velocity contrast in the Tauern Window. Vertical cross-sections derived from the velocity model show the depth extent of the geological units and faults, as well as a pronounced mid-crust seismic discontinuity mainly under the Southern Alps.