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

Qorbani, Ehsan (International Data Center, CTBTO; Institut für Meteorologie und Geophysik, Wien, AUT);
Zigone, Dimitri (Institut de Physique du Globe de Strasbourg, EOST, Strasbourg University, Strasbourg, FRA);
Bokelmann, Goetz (Department of Meteorology and Geophysics, University of Vienna, Vienna, AUT)

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.