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Surface wave tomography of Europe from ambient seismic noise

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We present a European scale high-resolution 3-D shear wave velocity model derived from ambient seismic noise tomography. In this study, we collect 4 years of continuous seismic recordings from 1293 stations across much of the European region (10˚W-35˚E, 30˚N-75˚N), which yields more than 0.8 million virtual station pairs. This data set compiles records from 67 seismic networks, both permanent and temporary from the EIDA (European Integrated Data Archive). Rayleigh wave group velocity are measured at each station pair using the multiple-filter analysis technique. Group velocity maps are estimated through a linearized tomographic inversion algorithm at period from 5s to 100s. Adaptive parameterization is used to accommodate heterogeneity in data coverage. We then apply a two-step data-driven inversion method to obtain the shear wave velocity model. The two steps refer to a Monte Carlo inversion to build the starting model, followed by a linearized inversion for further improvement. Finally, Moho depth (and its uncertainty) are determined over most of our study region by identifying and analysing sharp velocity discontinuities (and sharpness).

The resulting velocity model shows good agreement with main geological features and previous geophyical studies. Moho depth coincides well with that obtained from active seismic experiments. A focus on the Greater Alpine region (covered by the AlpArray seismic network) displays a clear crustal thinning that follows the arcuate shape of the Alps from the southern French Massif Central to southern Germany.