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3-D shear-velocity model of the Alps, Apennines and Dinarides

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The formation of the Alpine arc is the result of a complex plate tectonic history that left its imprint on the structure of the mantle. Several high-resolution P-velocity models image the geometry of the subduction slabs, yet some first-order questions remain unresolved such as the proposed slab break-offs in the western, central and eastern Alps or the reversal of subduction polarity under the eastern Alps.
We compile a new seismic surface-wave database using more than 25,000 station pairs around the European Alps, combining ambient-noise and earthquake-based two-station measurements of surface-wave phase velocities of both Love and Rayleigh waves, over a broad frequency band. In areas that are well sampled by the data, this leads to a lateral resolution of 20 km close to the surface, which then slowly declines with increasing depth. In a two-step process, we next determine 2-D phase-velocity maps at various frequency, and 3-D shear-velocity structure down to depths of 150 km or more.
Our model suggests a detachment of the European slab below 80 km in the western and eastern Alps. The onset of the slab detachment in the eastern Alps coincides spatially with the Giudicarie fault. The central Alpine slab is continuous down to the bottom of our model at 200 km depth. The Apenninic slab shows a clear gap south of 43°N.