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Italian and Alpine crustal structure: results from ambient-noise surface-wave imaging.

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Surface-wave dispersion measurements based on seismic background signal (ambient noise) are a very effective means to image S-wave velocity at crustal and lithospheric depths. The goal of our study is to integrate new ambient noise data for central Europe with more traditional models of crustal heterogeneity and discontinuity depths.
We exploit the large database of one-year-long records of European ambient noise compiled by Verbeke et al. (2012) to test the surface wave dispersion predicted by the most recent crustal models, such as EPcrust (Molinari and Morelli, 2011), CRUST2.0 and LITHO1.0 (Pasyanos et al, 2014). We use the same data to further improve EPcrust, obtaining a new three-dimensional model of Italian and Alpine crustal structure (with a resolution of 0.25 degrees x 0.25 degrees). We obtain a set of Rayleigh-wave group and phase velocity maps at periods between 5 and 37 s as a resulting of a linear least squares inversion of the available phase and group-velocity measurements. At relatively short periods, these maps clearly reflect the surface geology of the region, e.g. low velocity zones at the Po Plain; longer-period maps reveal deeper structures such as Moho topography under Alps and Apennines, and lower crustal anomalies. The phase and group-velocity maps are next jointly inverted via the Neighborhood Algorithm to determine a set of one-dimensional shear-velocity models (one per surface wave velocity pixel), which are in turn interpolated to build a new three-dimensional model and Moho depth. The reconstructed model shows the low velocity area beneath the Po Plain; the contrast between the low-velocity crust of the Adriatic domain and the high-velocity crust of the Tyrrhenian domain is clearly seen, as well as an almost uniform crystalline crust beneath the Alpine belt. Our results are physically consistent with the information for velocity structure and Moho depth independently obtained by other seismic methods.