



Reflection of seismic surface waves at the Northern Apennines

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We show that seismic surface waves with periods of 15 to 20 s are reflected laterally at the northern Apennines. For earthquakes originated and recorded in the wider Alpine area, a few hundred kilometres north of the Apennines, we observe late arrivals of reflected surface waves, with characteristic polarization of particle motion, that frequently dominate the intermediate-period surface wave coda. Love waves are the most prominent coda arrivals, while reflected Rayleigh waves show smaller amplitudes, and become clear only after rotation of the records to the instantaneous incidence direction. Discrepancies between the signal polarisation and the earthquake back-azimuth, as well as the large delay of the arrival, indicate that these wave groups have propagated at relevant distance from the direct great-circle path between epicentre and station. We can also track the development of the Love wave reflection, and a matching depletion of signal in the transmitted wave field, along a temporary broad-band transect across the northern Apennines, indicating the location of the reflector near the highest topography. To learn more about surface wave reflection at the Northern Apennines, we compare observed coda waveforms to spectral element simulations in a synthetic 3D structure. This leads us to attribute the reflection to a continuous, ~250 km long offset in the crust-mantle boundary under the mountain belt, with vertical throw of ~20km, thus supporting a deep crustal root under the outer side of the Apennines fold and thrust belt, and significant crustal thinning on the inner side.