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Ellipticity of Rayleigh waves and crustal structure in northern Italy

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Horizontal-to-vertical amplitude ratio of elliptically-polarised ground motion of Rayleigh waves depends on the local crustal structure. Its measurement therefore adds another, seldom used, tool to image shallow earth structure. Frequency-dependent sensitivity kernels are dominated by shear-wave velocity and are rather shallow, so they are a convenient tool to model sedimentary layers that nicely complement surface wave studies. We perform extensive measurements, in the period range between 10 and 110 s, on traces from about 500 globally-distributed earthquakes, occurred in years $2008 \div 2014$, recorded by 95 stations in northern Italy —- a region including the wide basin of the Po Plain and encircling Alps and northern Apennines. The observations are well correlated with known strucure: high ellipticity correlates well with low seismic velocity (such as in the Po Plain), and low ellipticity corresponds to fast seismic velocity in hard rock environments in correspondence of Alps and Apennines. Comparison between observations and predicted ellipticity from a reference crustal model of the region (Molinari et al., 2015) shows substantial fit. Sensitivity to v_S is quite non linear, but inversion is possible and may provide very useful complementary information to, *e.g.*, surface wave phase or group velocity or receiver functions.