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Crustal structure of the Iberian Peninsula and Morocco obtained by joint inversion of seismic and gravity data

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We present a model of the three-dimensional shear wave velocity structure underneath the Iberian Peninsula and Moroco obtained by joint inversion of surface-wave dispersion measurements and gravity observations. Surface-wave dispersion measurements are sensitive to smooth lateral variations of shear-wave velocities; gravity measurements provide information on shallow, broad-wavenumber and and deep, long-wavenumber density variations. We use an empirical relationship between density and seismic velocities to allow the single, joint inversion of both datasets. By combining these two independent types of observations we obtain a self-consistent three-dimensional shear-velocity-density model with increased resolution of shallow structures. The dispersion dataset consists of high-resolution group and phase velocity maps of Rayleigh waves at periods from 6 to 35 s. These maps were obtained from cross-correlations of seismic ambient noise between stations from temporary broadband experiments in the region (IberArray, PICASSO) complemented with stations from permanent regional networks. Gravity observations are extracted from the global gravity model derived from the GRACE satellite mission as well as gravity anomaly maps provided by the Spanish Instituto Geográfico Nacional (IGN) and other regional studies. Preliminary results show the main structural elements of the Iberian crust, including the Iberian Massif, Alpine orogens (Pyrenees, Betics) and major sedimentary basins (Gulf of Cadiz, Valencia Trough, Guadalquivir and Ebro). The Pyrenees and the Iberian Chain are imaged as relatively high velocities, in contrast with the Betic Cordillera, which is characterized by low velocities. The most prominent low velocity anomalies in the Iberian Peninsula are related to the Guadalquivir basin, the flysch units of the Campo de Gibraltar, and the sediments of the Gulf of Cadiz. Other smaller features such as the Ronda Peridotite and West Alboran basin are also well imaged. This high-resolution model will not only help improve the understanding of the geodynamic evolution of the westernmost Mediterranean but also serve as starting model for time-consuming full 3D waveform inversions.