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Seismic microzonation and velocity models of El Ejido area (SE Spain) from the diffuse-field H/V method

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El Ejido town is located in the Campo de Dalías coastal plain (Almería province, SE Spain), emplaced in one of the most seismically active regions of Spain. The municipality has 84000 inhabitants and presented a high growth rate during the last twenty years. The most recent intense seismic activity occurred close to this town was in 1993 and 1994, with events of Mb = 4.9 and Mb = 5.0, respectively.

To provide a basis for site-specific hazard analysis, we first carried out a seismic microzonation of this town in terms of predominant periods and geotechnical properties. The predominant periods map was obtained from ambient noise observations on a grid of 250 x 250 m in the main urban area, and sparser measurements on the outskirts. These broad-band records, of about 20 minutes long each, were analyzed by using the horizontal-to-vertical spectral ratio technique (H/V). Dispersion curves obtained from two array measurements of ambient noise and borehole data provided additional geophysical information.
All the surveyed points in the town were found to have relatively long predominant periods ranging from 0.8 to 2.3 s and growing towards the SE. Secondary high-frequency (> 2Hz) peaks were found at about the 10% of the points only. On the other hand, Vs30 values of 550 - 650 m/s were estimated from the array records, corresponding to cemented sediments and medium-hard rocks.

The local S-wave velocity structure has been inverted from the H/V curves for a subset of the measurement sites. We used an innovative full-wavefield method based on the diffuse-wavefield approximation (Sánchez-Sesma et al., 2011) combined with the simulated annealing algorithm. Shallow seismic velocities and deep boreholes data were used as constraints.

The results show that the low-frequency resonances are related with the impedance contrast between several hundred meters of medium-hard sedimentary rocks (marls and calcarenites) with the stiffer basement of the basin, which dips to the SE. These results illustrate the case of relatively long resonance periods capable to influence high-rise buildings, the existence of which could not be properly evaluated attending to the geotechnical description at surface.

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