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Low frequency amplification in deep alluvial basin and consequences for site specific PSHA: an example in the Po Plain (Northern Italy)

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This study focuses on the seismic local response at Castelleone (Northern Italy), a locality seated in the central part of the Po alluvial basin, where a seismic station, which is part of the Italian National Seismic Network, is installed since 2009. In order to define a detailed shear wave velocity (VS) profile, different active and passive geophysical surveys were carried out. Main prominence was given to the passive surveys, which consisted in ambient vibration measurements, executed both in single and arrays configurations. In particular, three microtremor arrays were performed with increasing aperture, allowing capturing an experimental dispersion curve down to 0.2 Hz. To obtain the Vs profile, a joint inversion procedure was computed involving both the experimental phase velocity dispersion curve and the noise horizontal to vertical (H/V) spectral ratio amplification function, showing two main peaks, the first at 0.17 Hz and the second at 0.7 Hz. The Vs profile shows two main discontinuities: the shallower, around 160 m, is related to the H/V peak at 0.7 Hz and might be ascribed to the seismic bedrock (i.e. Vs > 800 m/s, according to the Italian and European seismic codes for building). The deeper discontinuity, around 1350 m, corresponds to the transition between the Quaternary-Pliocenic deposits and Miocenic marls and it seems to be related to the H/V peak at 0.17 Hz. Finally, with the aim to investigate the impact of the deep soil discontinuities on the ground motion amplification, a preliminary site-specific seismic hazard analysis was performed in term of displacement response spectra (DRS) for period up to 10s. The results show that neglecting the effects of the deeper discontinuity might imply hazard underestimation as large as 30%, with possible consequences on the design of very tall building and large bridges.