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Effects of surface geology deduced from ambient noise measurements in the town of Avellino, Irpinia Region (Italy)

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An important tool in seismic hazard studies is represented by the effects of surface geology on the ground motion. It is well known as the presence of soft sediments can amplify the ground motion at surface, particularly when a sharp impedance contrast is present at depth. We present the results obtained from seismic noise measurements carried out in the urban area of Avellino, to evaluate the effects of the local geology on the amplification of ground motion. The town of Avellino is located in an area characterized by high seismicity, about 30 kilometres from the epicentre of the 23 November 1980 Southern Italy earthquake (M=6.9). PGA for 100-year-return-period is estimated for the studied area equal to 0.1g (INGV-DPC S1 project, 2006, http://esse1.mi.ingv.it). Moreover, the local geology is characterized by a strong heterogeneity of surface deposits, with sharp impedance contrasts at shallow depth. We select 16 sites in the urban area characterized by different geology for which we defined a surface S-wave velocity model, on the basis of downhole and seismic data. H/V noise spectral ratios have been evaluated and compared to the theoretical 1D response, computed for the sites on the basis of the estimated velocity models, in terms of amplification function for vertical SH incident waves and ellipticity function for Rayleigh waves. Results show a good correspondence between experimental and theoretical data in terms of predominant resonance frequencies, confirming the influence of the surface deposits on seismic ground motion. The interpretation of noise data in terms of amplification seems to be more difficult, as we observe significant differences in the peak spectral values, especially for the higher resonance frequencies. This study confirms the validity of the noise HVSR measurements to estimate the resonance effects produced on the ground motion from local geology, when sharp discontinuity are presents at depth.