

Seismic site effects in the area of Tortora (Northern Calabria)

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Seismic noise and earthquakes recorded at more than 70 sites in an area of about 50 km² have been used to investigate site effects at Tortora (Northern Calabria - CS). The aim of this work is the evaluation of the seismic response in various morphological context. In fact, the investigated area includes coastal plain, marine terraces, alluvial fans, fluvial environments and reliefs. Our efforts were focused to estimate the seismic resonance of the shallow geological structure through the HVSR analysis performed on seismic noise and, in some cases, even on earthquakes. In about 30 cases the HVSR curves are characterized by significant peaks in the frequency range from 1 Hz to 3 Hz. This type of result, which is observed at any sites along the coastal plain, has been interpreted as representative of a local seismic resonance. In other cases the results show quite flat HVSR curves, usually at bedrock sites. Some unclear results, e.g. HVSR curves without clear peaks but not flat, have also been found. While the most of seismic noise recordings lasted only about 1 hour, in five sites continuous recordings from many days to a couple of months were acquired. Tens of local and regional earthquakes were recorded at these sites. The HVSR analysis have been applied also to earthquake recordings, and results have been compared with those obtained from seismic noise. Results are very similar for sites on sediments, while they appear quite different at the sites on bedrock. The continuous recordings allowed for studying the relationship between HVSR curves and the properties of the noise wavefield, such as rms and polarization, as they may change in time depending on weather conditions. Results of this analysis show that the height of the resonance peak depends on both signal amplitude and polarization. On the other hand, sites on bedrock that are characterized by flat HVSR curve in good weather conditions, show the presence of HVSR peaks in case of strong wind and rough sea. This result is well correlated with the hill slope, therefore we interpret it as a topographical effect. During many weeks continuous signals were recorded by two instruments at two different sites, one near the coast on sediments, and another one upon the hill on the bedrock. The spectral ratio between earthquakes recorded at sites on sediments and at sites on bedrock gives an estimation of the local amplification of ground motion as a function of frequency. From this analysis we found that the local amplification is frequency dependent, with the maximum at the resonance frequency found from the HVSR analysis.