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Analysis and modeling of HVSR in the presence of a velocity inversion. The case of Venosa (Italy)

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The aim of this work is to check the stability of the horizontal-to-vertical spectral ratios (HVSR) calculated at the Venosa station site (Italy). This site lies over a layer of anthropogenic fill (4 m thick), a rigid layer of conglomerates (15 m thick) and a thick layer of clays (about 300 m) above the seismic bedrock. The velocity inversion. which takes place at the conglomerates-clays interface, is of main importance for the amplification behaviour of this site. We have analysed nearly two years of data, composed of 244 triggered noise records and 44 earthquakes. The results obtained by the two data sets show different site response characteristics. In particular, the earthquake HVSR is not de-amplified in the frequency range 1-9 Hz like the triggered noise HVSR. In order to find out the origin of this difference, we modelled both the triggered noise and the earthquakes taking advantage of an improved version of the Thomson-Haskell propagation matrix method. The differences between triggered noise and earthquakes amplification functions might be explained by the difference in composition and propagation of the seismic wave fields. Moreover, we show that the nonlinear behaviour of the anthropogenic fill might explain the presence of the misfit of the resonance frequency attributed to this layer between triggered noise and earthquakes.