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Effect of stiff-soft alternanting layers in volcanic areas on seismic site response

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The seismic subsoil response in terms of amplification or attenuation of the ground motion is the result of a complex combination of factors, including the vertical and horizontal subsoil heterogeneities (Fabozzi et al., 2021). In volcanic areas in particular, the vertical subsoil heterogeneities are well identified by characteristic superposition of stiffer volcanic horizons on softer levels, giving rise to stiff-soft alternating layers, also in the form of multiple Vs inversions with the depth. This condition is typical of sheet-like blankets of lava or pyroclastic deposits, extensively covering the sedimentary substratum, frequent in the peripheral areas of large basaltic stratovolcanos or in areas adjacent to large explosive acidic volcanic edifices. The aim of the present work is to study the effect of such vertical heterogeneities on the seismic site response. With this end, in correspondence of volcanic areas identified by means of a preliminary geological screening in the Italian territory, subsoil properties relevant for seismic site response analyses were extracted from the Italian database of the seismic microzonation studies (DB-SMs in DPC, 2018), which is available at www.webms.it and is developed and maintained by CNR IGAG (National Research Council of Italy, Institute of Environmental Geology and Geoengineering, www.igag.cnr.it). The collection of input data was used for an extensive one-dimensional equivalent linear numerical site response analyses, in order to evaluate the influence of stiffness inversions on ground motion at surface. In particular, different idealized subsoil 1D models of the identified geological areas were defined in terms of variation of layers thickness, shear wave velocity and nonlinear properties. The effect of the variability of these parameters on the seismic site response in terms of amplification factors (ICMS, 2008) was studied parametrically.

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