

Earth modeling and estimation of the local seismic ground motion due to site geology in complex volcanoclastic areas

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Abstract

Volcanic areas often show complex behaviour as far as seismic waves propagation and seismic motion at surface are concerned. In fact, the finite lateral extent of surface layers such as lava flows, blocks, differential welding and/or zeolitization within pyroclastic deposits, introduces in the propagation of seismic waves effects such as the generation of surface waves at the edge, resonance in lateral direction, diffractions and scattering of energy, which tend to modify the amplitude as well as the duration of the ground motion. The irregular topographic surface, typical of volcanic areas, also strongly influences the seismic site response. Despite this heterogeneity, it is unfortunately a common geophysical and engineering practice to evaluate even in volcanic environments the subsurface velocity field with monodimensional investigation method (i.e. geognostic soundings, refraction survey, down-hole, etc.) prior to the seismic site response computation which in a such cases is obviously also made with 1D algorithms. This approach often leads to highly inaccurate results. In this paper we use a different approach, i.e. a fully 2D P-wave turning ray tomographic survey followed by 2D seismic site response modeling. We report here the results of this approach in three sites located at short distance from Mt. Vesuvius and Campi Flegrei and characterized by overburdens constituted by volcanoclastic deposits with large lateral and vertical variations of their elastic properties. Comparison between 1D and 2D Dynamic Amplification Factor shows in all reported cases entirely different results, both in terms of peak period and spectral contents, as expected from the clear bidimensionality of the geological section. Therefore, these studies suggest evaluating carefully the subsoil geological structures in areas characterized by possible large lateral and vertical variations of the elastic properties in order to reach correct seismic site response curves to be used for engineering projects.

Keywords

dynamic amplification factor; seismic; tomography; pyroclastic rocks; finite element method

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References

DOI: <https://doi.org/10.4401/ag-3540>

Published by INGV, Istituto Nazionale di Geofisica e Vulcanologia - ISSN: 2037-416X

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
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