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The analysis of local site effect in an Alpine valley: an application in the Pellice valley (To)

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The goal of this work is to define the seismic response of an Alpine valley through the analysis of the seismological data recorded from a dense accelerometric network.

The Pellice valley is geographically located in the North-Western area of the Piemonte Region, few kilometres far from Pinerolo (TO).

It is a fluvial-glacial valley, in which the bedrock belongs to the Massive of the Dora Maira, mostly characterised by gneiss and mica schists. The shallow formations are characterized by Pleistocenic gravel deposits of alluvial-colluvial origin, whereas the deepest are represented by metric alternations of Pliocenic sand-silty deposits, lacustrine and fluvio-lacustrine sands and gravels.

Preliminary surveys, carried out to evaluate the noise level, allow determining, with the application of the HVSR method (Nakamura technique), the existence of local amplification phenomena for the sites situated in the middle of the valley, where the thickness of the alluvial deposits increases.

On the base of noise measurements and the geologic-geotechnical information collected for the area, have been selected seven sites for the installation of the permanent network. The sites have been equipped with six accelerometers and one velocimeter. The geometry of the network was designed in order to study the seismic response variation considering different geological-geomorphological conditions: 2 stations were installed on the river bed (PE01 and PE07), two stations on alluvial terraces (PE04 and PE06), one station on colluvial fan (PE02) and one on the outcropping rock (PE03). The velocimetric station (PE05) was also installed near the PE06 accelerometric station, in order to acquire teleseismic and regional data.

The data analysis was developed as follow:

- Analysis of the frequency and amplitude characteristics of the events recorded by the 7 stations in order to underlying the different seismic propagation features inside the valley;
- Evaluation of the H/V spectral ratio for each site considering all the recorded events;
- Evaluation of the H/Href spectral ratio, using as the reference site the station PE03;

The H/V spectral ratios show different amplification picks:

- PE01-PE07 (river bed): 1-1.5 Hz
- PE04-PE05-PE06 (alluvial terraces): 2-2.5 Hz

The reference station (PE03) and the station installed on the colluvial fan do not evidence local site effects.

Based on the geophysical and geotechnical information collected for the valley it has been possible to perform seismic ground response analysis using the code Shake91, and to reconstruct the geometry of the bedrock from the results of the seismic reflection profiles.