



A probabilistic method for evaluation of seismic amplification at a regional scale - A case study in some high seismic risk areas of the Northern Apennines (Italy)

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Seismic amplification caused by local geological conditions has an important role in seismic risk assessment. The main parameters controlling seismic amplification are the shear wave velocities of shallow sub-surface (V_s) and the thickness of soft sediments (h). However, the knowledge of shear wave velocity profile is usually sparse and can not be measured over large areas.

In this study we propose a method that integrates data from surface geological maps with data from subsurface seismo-stratigraphic well-logs, and is aimed to estimate seismic amplification over large areas ($\sim 100 \text{ km}^2$) through a probabilistic approach. The methodology we developed is characterized by the following steps:

1. Analysis of the geological framework and definition of Seismic Units;
2. 1-D seismic modeling of each Seismic Unit;
3. Probability analysis of Seismic Amplification.

Probability function of seismic amplification for each Seismic Unit is calculated for all the possible combinations of the expected values of V_s and thickness (h). We apply this approach to seismic areas in the Northern Apennines (Italy).

Finally, the results of this analysis have been validated by seismic amplification measurements using local and regional earthquakes and with macro-seismic data. The comparison between the predicted amplification using this probabilistic approach and the measured seismic amplification shows a general agreement. This work is not intended as an alternative to the standard methodologies to calculate site effect, but offers a new approach to identify areas potentially more vulnerable.