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Preliminary mapping of the Po Plain (Northern Italy) seismic bedrock from passive geophysical surveys and stratigraphic evidence

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According to the actual Italian and European seismic codes, the transition between soft and hard soil is ascribable where the shear-wave velocity exceeds 800 m/s. This interface represents the seismic bedrock and it is of relevant importance for the seismic site effects evaluation. In Italy, this issue is particularly significant in the Po Plain alluvial basin, one of the most exploited and populated area at national scale.
The aim of this work is to preliminary map the Po Plain seismic bedrock through the association of the available passive geophysical analysis and the known regional stratigraphic discontinuities. In particular, ambient vibration data, recorded by all permanent and temporary seismic stations installed in the target region, were collected and then analyzed with the Nakamura technique (Nakamura, 1989), to determine the H/V amplification function. Moreover, if available, the velocity profile obtained from ambient vibration array were also taken into account.
The H/V results show in correspondence of all the considered stations, the presence of a low frequency amplification peak, in general moving from about 0.4 Hz, in the eastern part of the plain, to about 1.0 Hz in the central and western part. Based on the available seismic array results, this amplification peak seems to be correlated to a velocity discontinuity, located in general between 100 m and 250 m of depth, where the Vs exceed 800 m/s.
This interface is ascribed to the seismic bedrock and seems related to the base of the upper sedimentary unit of the Po Plain, which is characterized by coarse and loose sediments, and also contains the largest aquifer system (RER-ENI, 1998; Carcano and Piccin, 2002; De Donatis et al., 2006; Molinari et al., 2015; Scardia et al., 2012).
In order to verify the supposed correspondence between geophysical and geological data also for the site not characterized by a Vs profile, a two-step inversion approach, as described in Poggi et al. (2012) was applied. In the first step, a gradient velocity model was established for the soft sediments and in the second step, the singularity or peak of the H/V amplification function was used, together with the derived generic gradient model, to constrain the bedrock depth at each measuring location.