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Assessment of ground-motion amplification in the Fucino Basin (Central Italy) through seismic data

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The Fucino basin (Central Italy) is one of the largest intermountain alluvial plain in the Appennines range. It has a tectonic origin related to the presence of important systems of faults located in its northern and eastern edges. Some of these faults are still active and capable of generating strong seismic events as the January 13th 1915 Ms 7.0 Avezzano earthquake (about 30000 casualties). Site effects related to the soft soils filling the basin can be very important also taking into account the presence of historical villages located at the edges of the basin and new settlements developed in the area.
In this paper we show the preliminary results of a seismic network installed in the Fucino area in order to collect information about site amplification effects and geometry of the basin. A lake occupied the Fucino basin for many thousands of years and it was completely drained at the end of the 19th century.
We analyze ambient seismic vibrations and recordings of about 150 local earthquakes mainly related to the seismic sequence of the April 6th 2009 Mw 6.3 L'Aquila event. Moreover the strongest events of L'Aquila sequence were analyzed at the three strong-motion permanent stations operating in the area. Using standard spectral techniques we investigate the variation of resonance frequencies within the basin. The ground motion recorded in the Fucino plain is mainly characterized by strong energy at low-frequencies (f < 1 Hz) affecting both horizontal and vertical components. This is particularly evident for stations deployed in correspondence of very thick deposits of sedimentary filling, where a significant increase of ground-motion amplitude and duration is caused by locally generated surface waves. The amplification at low-frequencies (< 1 Hz) on the horizontal components can reach up a factor of 10 in comparison to nearby stiff sites. However, we found evidences of seismic amplification phenomena also for stiff sites surrounding the basin, including stations of the Italian strong motion network. The independent geological information, the shallow shear-velocity profiles available for the basin can be combined with resonance frequencies of the sites for deriving representative geological sections to be used as base for future numerical 2D-3D modeling of the seismic wave propagation in the basin. Seismic modeling can be important to reduce the seismic hazard in the area.