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Seismic response of the Gubbio basin during the 26 September 1997 (Mw 6), Umbria-Marche (Central Italy) Earthquake

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After the Umbria-Marche seismic sequence (Central Italy) of September-October 1997, the alluvial basin of Gubbio was deeply investigated in order to better understand and define the 3D structure of the shallow soft-soil deposits and of the underlying bedrock (Italian Project S3 DPC-INGV).
In this contribution we first present and summarize the most recent results regarding the geological structure of the Gubbio sedimentary plain. Based on these data we constructed an updated numerical model of the basin with respect to previous studies carried out in the framework of the
Italian Project S5 DPC-INGV, to simulate the strong-motion time histories recorded at two accelerometric stations during the main shock (Mw 6.0) of the Umbria-Marche seismic sequence (1997). Ground-motion waveforms were computed using the spectral element method (SEM) based GeoELSE code (Stupazzini et al., 2009; http://geoelse.stru.polimi.it). The source parameters and the slip distribution of the fault plane were taken from Hernandez et al. (2004). The crustal velocity model adopted combines the description given by the same authors, with that suggested in Mirabella et al. (2004); a smooth decrease in the rock properties with decreasing depth was also introduced to properly account for near-surface alteration (Cotton et al., 2006). The numerical simulations account for 3D variations of seismic wave speeds and density, topography and attenuation. The combination of a detailed sedimentary basin model and an accurate numerical technique is capable to compute numerical time histories up to 3.0 Hz inside the basin. Peak ground displacement, velocity, and acceleration maps illustrate that significant amplification occurs in the basin, showing a good agreement with observed waveforms, especially in terms of long period spectral ordinates, that would not have been excited by standard 1D approaches for seismic wave propagation analysis. Similar results were found by the analysis of weak motion records obtained during the monitoring activity carried out in the framework of the S3 Project.

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