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Geological factors controlling the site response in the historical centre of Rome: insights from updated modelling of the subsoil and seismic noise measurements

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The historical centre of Rome enclosed by the Aurelian Walls is built above a complex geological substratum shaped by Plio-Pleistocene sedimentary and volcanic processes (Marra & Rosa, 1995; Marra et al., 1998; Funiciello & Giordano, 2008). Subsoil lithologies distribution determined different site responses during seismic events, with damages mainly concentrated within the Tiber alluvial plain where Holocene unconsolidated terrains experienced the strongest seismic amplification (e.g. Ambrosini et al., 1986; Basili et al., 1996; Molin et al., 1986; Funiciello et al., 1995; Tertulliani & Riguzzi, 1995; Tertulliani et al., 1996; Cifelli et a., 2000; Bozzano et al., 2008).
Nevertheless, heavy damages caused by earthquakes were also reported for historical buildings sited above Middle Pleistocene consolidated sediments and Middle to Late Pleistocene volcanic rocks, far from the Tiber valley (Molin et al., 1995).
Using about 400 well data and the recently released Geological Map of Rome (Funiciello & Giordano, 2008), we built a geological model of the downtown area. We also stored in a GIS layer the position of the damaged historical buildings. Their location shows clearly that the buried fluvial morphology inherited from the Pleistocene drainage pattern has played a role in the local seismic amplification.
In support of this evidence, measurements of ambient noise were acquired using four tromographs (Tromino®) deployed along 20-m profiles crossing the Colle Oppio, Esquilino, Terme di Diocleziano, and Quirinale areas. The obtained tromographic sections display the variation of the H/V spectral ratio along corresponding geological profiles. Measurements were acquired at different frequencies to focus on different depths. From shear-wave velocity data the spatial variation of the limit between the shallower units and the seismic bedrock was inferred.
Our study will hopefully contribute to the increasing knowledge of seismic hazard in historical city centres, where risk is increased by the considerable vulnerability and exposition of historical buildings.

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