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Geophysical surveys to reconstruct the geological model of the urban area of Palermo, Italy.

Alessandro Canzoneri, Raffaele Martorana, Mauro Agate, Patrizia Capizzi, Maurizio Gasparo Morticelli, and Carollo Alessandra
Dipartimento delle Scienze della Terra e del Mare, Università degli Studi di Palermo, Palermo, Italy (dipartimento.distem@unipa.it)

The plain of Palermo, located along the coastal belt of North-West Sicily, hosts one of the largest and most populous Italian cities. The city experienced a continuous expansion from the 8th century BC, increasing, over time, its population and extent under the control of different dominations; the expansion took place firstly within the historic walls, subsequently outside them. Finally, during the 20th century, the urban area covered most of the plain. The succession of different dominations has produced a clear mutation of the original urban landscape. Numerous streams that once dominated the plain have undergone changes in path, reduced flow, or have been partially embedded or drained. In addition, after the Second World War, many ruins were accumulated in areas close to the sea causing a deep morphological variation of the coast. Considering that it was only in 1962 that the city had a master plan, the expansion has led to the exacerbation of the natural hazards related to the geological with extensive damage in the neighborhoods where ancient watercourse originally flowed. Moreover, the intense extraction of building stones from underground, which lasted for centuries, has determined the widespread presence of underground cavities in many areas of the city, with negative effects on the stability and safety of buildings. Finally, both because of the uncontrolled urbanization and the geomorphological and geological features of the plain, characterized by important lateral variations of facies, many residential buildings and infrastructure are located in areas subject to seismic risk related to site effects. For all those reasons, defining a geological and geophysical model as much detail as possible is a tool that helps both in the definition of the geological hazard and the associated risk and in planning, design and construction of important civil works. The Department of Earth and Sea Sciences of the University of Palermo is working on the 3D geological modelling of the area of Palermo Plain. The model was built by integrating the numerous borehole data collected in a database and several geophysical acquisitions. The interpolation of the lithological data has allowed to define an initial subsurface model, characterized by strips of alluvial deposits filling incised valleys scoured in a Pleistocene coastal to neritic bioclastic succession. The model has been integrated using non-invasive geophysical methodologies: recordings of seismic microtremors analyzed according to the Horizontal to Vertical Spectral Ratio technique (HVSR) and Multichannel Analysis of Surface Waves (MASW). These techniques allow to estimate important physical parameters of the subsoil detailing the model without necessarily having to use new drilling and excavations. Indeed, the HVSR data have been inverted in

seismographic columns constraining the inversion by means of the S-wave velocities obtained by MASW carried out for the main lithologies outcropping in the plain. The integration of stratigraphic and geophysical data has provided a useful tool for the reconstruction of the geometry and thickness of the geological bodies of the subsoil of Palermo and to define the depth of the seismic bedrock, highlighting the areas subject to geological and seismic risk.