

A geological model of the urban area of Palermo realized by a multidisciplinary approach

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Geophysical techniques are becoming increasingly important in the reconstruction of geological models of the subsoil in urban areas. These surveys are fundamental considering that direct investigations are strongly invasive due to possible interference with the subservices of the urban networks. Moreover, carrying out a direct investigation, such as a drilling or a trench, requires several authorizations and complex and costly management of the yard. For these reasons active and passive seismic methods are nowadays widely used in urban areas.

Therefore, the geological modeling of an urban area requires working with a regular mesh of direct and indirect surveys. This approach is useful where local geology does not exhibit large lateral variations. Considering these stratigraphic contexts, several surface geophysical surveys can detail the geometry and volume of the deposits without the need to carry out further direct investigations.

From this perspective, the plain of Palermo is a natural laboratory of great interest. It is located in North Western Sicily and hosts the fifth largest city in Italy by population. In this work we present the reconstruction of a more accurate geological model of the plain close to the Oreto River, the main river crossing the urban area. This is produced by integrating several investigation techniques.

Firstly, a drill holes database property of the University of Palermo has been used. The database collects stratigraphic data from more than 2000 cores provided by several companies, freelance professionals geologists and engineers. These data have been collected since the early 2000 and have been homogenized and inserted in a consulting software (Giammarinaro et al., 2001).

Secondly, several microtremor acquisitions were considered. Noise recording stations have been located according to a regular mesh throughout the area and have been analyzed using Horizontal to Vertical Spectral Ratio (HVSr) technique (Nakamura, 1989). By inverting the HVSr curves, stratigraphic models were obtained, constraining the inversions with the nearest drill hole stratigraphic data and with shear velocity values obtained by Multichannel Analysis of Surface Waves (MASW) surveys (Park et al., 1999). These latter were carried out in the surrounding areas or within some previously studied sector of the plain in which the same lithologies outcrop (Martorana et al., 2018).

In addition, photogrammetric Digital Outcrop Models (DOMs) have been obtained on outcrops along the Oreto River. These will be used to develop qualitative sedimentological scenarios relevant for subsurface models, and possibly as training images for quantitative geostatistical models of coastal to alluvial facies geometries and spatial distribution.

Connecting all data available, a 3D model of the Oreto River area has been generated. Multidisciplinary data integration has resulted useful to describe the depth of the bedrock and the thickness variation of the near surface deposits.

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