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Coupling historical maps and Lidar data to recognize man-made landforms in urban areas

Martino Terrone[1], Guido Paliaga[2], Pietro Piana[3], and Francesco Faccini[1,2]
[1]Earth, Environmental and Life Sciences Department, University of Genoa, Genoa, Italy
[2]National Research Council, Research Institute for Geo-Hydrological Protection, Turin, Italy
[3]Politics Department, University of Genoa, Genoa, Italy

In the last years there is growing interest on urban geomorphology both for the links with landscape planning and for its historical, cultural and scientific interest.

The identification of landforms in urban contexts is particularly difficult due to the progressive stratification of urban phases: the foundation of cities in the Mediterranean area dates back to ancient times and their growth in size is generally significant from the Middle Ages. This makes it frequent to find landforms which date back to more than 1000 years ago: they can be new, man-made landforms or modifications of natural ones, particularly coastal or fluvial features. Land modifications are particularly significant in the last 2 centuries, notably in the second half of the C19th and in the second half of the C20th, two periods identified as the potential start of the Anthropocene.

Anthropogenic terrain features are generally due to excavation and fill: unlike natural landforms which are generally identifiable through field surveys, the former require field observations, cartographical comparisons, multitemporal comparison of topographical views and historical photographs, geognostic investigations and geophysical surveys.

This research presents the results of a multitemporal analysis of the city of Genoa carried out by superimposing data from nineteenth-century historical cartography and topographical data from Remote Sensing. The 1:2.000 scale map of Ignazio Porro, dating back to the first half of the C19th, has been digitalised on Lidar images from 2019 and with 1 m resolution, provided by Genoa Municipality. This methodology, developed with QGIS, has been applied on 5 sample areas particularly significant for their anthropogenic modifications: the area around Sant'Agata bridge in Val Bisagno, the area of Morandi Bridge in Val Polcevera, the road called Circonvallazione a Monte, the Promontory of the Lighthouse and the Via Digione area. Through the overlaying of multitemporal cartographies it was possible to identify and quantify with great precision excavation, landfill and mixed areas, allowing the identification of the most significant anthropogenic landforms. The obtained results have been validated through direct observations and supported by data from the geognostic regional database, revealing the potential of this approach for other urban areas.