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## 421 - THERMAL FEATURES AND ANTHROPOGENIC WARMING OF SHALLOW AQUIFERS IN PIEDMONT REGION (NW ITALY)

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This work analyses the thermal trend of the shallow aquifer in the Piedmont Region with a specific focus on Turin town and its Province, one of the biggest urbanized areas of NW Italy. The dataset consists in two surveys of thermal logs. The first survey was carried out in 2008 on 100 observation points of the whole Piedmont Region territory. The second survey was performed in 2014 on 40 points in the Turin Province. Each survey consists of spring and autumn measurements of groundwater temperature, acquired in piezometers screened mostly in the shallow aquifer.

Both the areal and the vertical trend of groundwater temperatures were assessed from the dataset. The areal distribution reveals an inhomogeneous pattern in the Piedmont plain, largely attributable to geological and hydrogeological features. The 2014 survey, focused on the Turin Province, highlighted a significant concentration of warmer temperatures in the Turin urban area. The difference with the rural area, more evident in spring, reaches +2°C. The groundwater warming in Turin urban area was attributed to localized sources (sewer/wastewater discharges, factory districts, geothermal plants, etc) and extensive sources (soil sealing, buildings, intense traffic). These latter are expected to cause air and ground heating and hence groundwater warming.

The vertical distribution of temperatures displays a seasonal fluctuation, whose amplitude ranges 0.1÷8°C with respect to the undisturbed value. A statistical approach highlights several differences between rural and urban area in Turin Province. For example, the depth where the seasonal effects disappear is deeper in rural areas: in the Lanzo alluvial fan -about 10 km N from Turin- this depth is found at around 40 m from ground level, while in Turin is about 35 m (the water table being respectively at 6.5 and 15.6 m from ground level). Even the expected temperature below the seasonal fluctuation zone is different, displaying higher temperatures in Turin urban area than in rural area.

From the outlined scenario, the necessity of analyzing the groundwater thermal features, as well as the study of anthropogenic footprints, appears to be very important for the management of the shallow aquifer as a geothermal resource.