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Changes in physical-thermal properties of soil related to very shallow geothermal systems in urban areas

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In the near future the population living in urban areas is expected to increase. This worldwide trend will lead to a high concentrations of infrastructures in confined areas, whose impact on land use and shallow subsurface must be well evaluated.

Since shallow geothermal energy resource is becoming increasingly important as renewable energy resource, due to its huge potential in providing thermal energy for residential and tertiary buildings and in contributing to reduce greenhouse gas emission, the number of installed geothermal systems is expected to continue to rise in the near future.
However, a leading question concerns the short and long-term effect of an intensive thermal use of the shallow subsurface for heat generation, cooling and thermal energy storage. From an environmental and technical point of view, changes on ground temperatures can influence the physical-thermal properties of soil and groundwater as well as their chemical and biological features.

In this study the preliminary results of ITER Project are presented. This project, funded by European Union, focuses on improving heat transfer efficiency of very shallow geothermal systems, as horizontal collector systems or special forms (i.e. helix system), interesting the first 2 m of depth from ground level.
Given the heterogeneity of sedimentary deposits in alluvial plain and the uncertainties related to the estimation of thermal parameters for unconsolidated material affected by thermal use, physical-thermal parameters (i.e. moisture content, bulk density, thermal conductivity...) where determined in laboratory for sand, clay and loamy sand samples. In addition, preliminary results from a field test site located within an urban area will be also shown. The main aim is to improve our knowledge of heat transfer process in the soil body in order (i) to create a reference database to compare subsequently the impact of temperature variations on the same properties and (ii) to provide reliable data for model parameterization.