ABSTRACT VOLUME

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HEAT TRANSFER IN SEDIMENTARY DEPOSITS: EFFECT OF CHANGE IN WATER SATURATION CONDITIONS ON THE THERMAL PROPERTIES OF SOILS INTERESTED BY VERY SHALLOW GEOTHERMAL SYSTEMS

DI SIPIO, Eloisa*; BERTERMANN, David

Friedrich-Alexander-University Erlangen-Nürnberg, Germany

eloisa.di.sipio@fau.de

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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.

Leading questions concern the short and long-term effect of an intensive thermal use of the shallow subsurface for heat generation, cooling and thermal energy storage and how to improve the performance of ground heat exchangers.

This research, belonging to ITER Project, funded by European Union, focuses on improving heat transfer efficiency of very shallow geothermal systems, as horizontal collector systems or special forms, interesting the first 2 m of depth from ground level (http://iter-geo.eu/). A key challenge is to understand how to enhance the heat transfer of the sediments surrounding the pipes, negatively affected in case of unsaturated soil conditions.

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 and loamy sand samples under different degree of water content. In addition, preliminary results from a field test site located within an urban area are also shown.

The first outcomes consist of (i) a reference database taking into account the effect of change in water saturation conditions on the thermal properties of soils interested by very shallow geothermal systems, (ii) a collection of reliable data for model parameterization and (iii) suggestion on how to modify in a natural way the soil mixture in order to improve its thermal behaviour.