

Mapping Thermal Properties Using Resistivity, Lithology and Thermal Conductivity Measurements

Authors : Riccardo Pasquali, Keith Harlin, Mark Muller

Abstract : The ShallowTherm project is focussed on developing and applying a methodology for extrapolating relatively sparsely sampled thermal conductivity measurements across Ireland using mapped Litho-Electrical (LE) units. The primary data used consist of electrical resistivities derived from the Geological Survey Ireland Tellus airborne electromagnetic dataset, GIS-based maps of Irish geology, and rock thermal conductivities derived from both the current Irish Ground Thermal Properties (IGTP) database and a new programme of sampling and laboratory measurement. The workflow has been developed across three case-study areas that sample a range of different calcareous, arenaceous, argillaceous, and volcanic lithologies. Statistical analysis of resistivity data from individual geological formations has been assessed and integrated with detailed lithological descriptions to define distinct LE units. Thermal conductivity measurements from core and hand samples have been acquired for every geological formation within each study area. The variability and consistency of thermal conductivity measurements within each LE unit is examined with the aim of defining a characteristic thermal conductivity (or range of thermal conductivities) for each LE unit. Mapping of LE units, coupled with characteristic thermal conductivities, provides a method of defining thermal conductivity properties at a regional scale and facilitating the design of ground source heat pump closed-loop collectors.

Keywords : thermal conductivity, ground source heat pumps, resistivity, heat exchange, shallow geothermal, Ireland

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