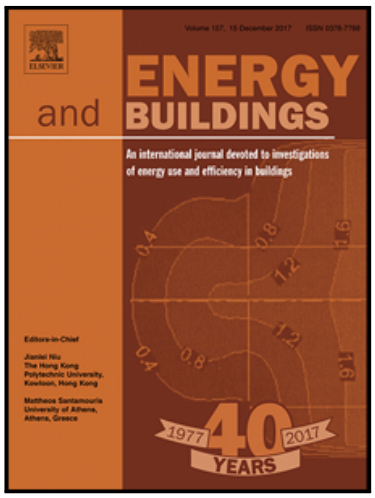

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Comparison of test methods for shallow layered rock thermal conductivity between in situ distributed thermal response tests and laboratory test based on drilling in northeast China

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Abstract

The development and utilization of shallow geothermal energy have rapidly improved worldwide. The thermal physical parameters of rock and soil layers must be accurately measured to design a ground source heat pump system. The obtained thermal conductivity of rock and soil play a critical role in optimizing heat pump system and cost-saving design. In this study, detailed tests were performed on a borehole in Jixi City, Heilongjiang Province in northeast China. In situ geotechnical comprehensive thermal conductivity and layered rock thermal conductivities were obtained by traditional thermal response test (TRT) and distributed thermal response test (DTRT), respectively. A series of laboratory tests were also conducted on rock samples obtained from drilling and the thermal conductivities were compared with that obtained through DTRT. Changes in groundwater environment, moisture content contribute to the deviation of the laboratory experimental results from the value derived through in situ test. The influence of different factors and the analytic hierarchy process (AHP) method was analyzed to determine the weight value for correcting the thermal conductivity tested in the laboratory. The accuracy of the layered conductivity obtained by DTRT, and laboratory test before and after modification was examined by the numerical model based on TOUGH2-MP code. The heat exchange power was predicted on the basis of thermal conductivity obtained by TRT (2.29 kW), DTRT (2.197 kW) and laboratory test before and after being corrected (1.917 kW and 2.180 kW, respectively). The proposed method was proven to be useful in determining layered rock thermal conductivity.

Key Words: distributed thermal response test; thermal conductivity; laboratory test; ground source heat pump

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