



## Influence of Water Saturation on Thermal Conductivity in Sandstones

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Information on thermal conductivity of rocks and soils is essential in applied geothermal and hydrocarbon maturation research. In this study, we investigate the dependence of thermal conductivity on the degree of water saturation. Measurements were made on five sandstones from different outcrops in Germany. In a first step, we characterized the samples with respect to mineralogical composition, porosity, and microstructure by nuclear magnetic resonance (NMR) and mercury injection. We measured thermal conductivity with an optical scanner at different levels of water saturation. Finally we present a simple and easy model for the correlation of thermal conductivity and water saturation.

Thermal conductivity decreases in the course of the drying of the rock. This behaviour is not linear and depends on the microstructure of the studied rock. We studied different mixing models for three phases: mineral skeleton, water and air. For argillaceous sandstones a modified arithmetic model works best which considers the irreducible water volume and different pore sizes. For pure quartz sandstones without clay minerals, we use the same model for low water saturations, but for high water saturations a modified geometric model. A clayey sandstone rich in feldspar shows a different behaviour which cannot be explained by simple models. A better understanding will require measurements on additional samples which will help to improve the derived correlations and substantiate our findings.