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Thermal properties of representative soils of the Czech Republic

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Knowledge of soil thermal properties is essential when assessing heat transport in soils. Thermal regime of soils is associated with many other soil processes (water evaporation and diffusion, plant transpiration, contaminants behaviour etc.). Knowledge of thermal properties is needed when assessing effectivity of energy gathering from soil profiles using horizontal ground heat exchangers, which is a topic of our research project. The study is focused on measuring of thermal properties (thermal conductivity and heat capacity) of representative soils of the Czech Republic. Measurements were performed on soil samples taken from the surface horizons of 13 representative soil types and from 4 soil substrates, and on mulch (bark chips) sample using KD2 PRO device with TR-1 and SH-1 sensors. The measured relationships between the thermal conductivity and volumetric soil-water content were described by the non-linear equations and those between the volumetric heat capacity and volumetric soil-water content were expressed using the linear equations. The highest thermal conductivities were measured in soils on quartz sand substrates. The lowest thermal conductivities were measured in the Stagnic Chernozem Siltic on marlite and the Dystric Cambisol on orthogneiss. The opposite trend was observed for maximal heat capacities, i.e. the highest values were measured in the Stagnic Chernozem Siltic and the lowest in sand and soils on sand and sandy gravel substrate.

Keywords:

heat capacity; laboratory measurements; sensor comparison; soil thermal properties; soil-water content; soil types; thermal conductivity

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