Geophysical Research Abstracts
Vol. 15, EGU2013-8137, 2013
EGU General Assembly 2013

Experimental and mathematical modeling of soil water and heat regime in selected soils

Radka Kodesova, Miroslav Fer, Ales Klement, Antonin Nikodem, Mirka Vlasakova, Daniela Tepla, and Ondrej Jaksik

University of Life Sciences Prague, Dept. of Soil Science and Soil Protection, Prague, Czech Republic (kodesova@af.czu.cz)

Knowledge of soil thermal (heat) properties is essential when assessing heat transport in soils. Heat regime in soils associates with many other soil processes (like water evaporation and diffusion, plant transpiration, contaminants behavior etc.). Thermal properties are needed when assessing affectivity of energy gathering from soil profiles using horizontal ground heat exchangers, which is a main goal of this study. Study is focused on measuring of thermal properties (heat capacity and heat conductivity) in representative soils of the Czech Republic. Measurements were performed on soil samples taken from the surface horizons of 11 representative soil types and from 2 soil substrates (sand and loess). The measured relationships between the heat conductivity and volumetric soil-water content were described by non-linear equations (Chung and Horton, 1987). The measured relationships between the heat capacity and volumetric soil-water content were expressed using the linear equations. The greatest values of the heat conductivity were measured in sandy soils (sandy and gravely sand substrates). The average values were obtained in soils on loess substrates. Lower values were obtained for all Cambisols (variable substrates). The lowest values were measured in Stagnic Chernozem Siltic on marlite. Opposite trend was observed for the maximal heat capacity, which was mostly impacted by water content.
A soil water and heat regime within the soil profile was monitored at one location. In addition the impact of various soil cover at the soil top on soil water content and temperature was measured. Soil hydraulic properties were measured using the multistep-outflow technique. The saturated hydraulic conductivities were also measured using the Guelph permeameter. Programs HYDRUS-1D and 2D/3D were used for a mathematical interpretation of the observed soil water and heat regime.

Acknowledgment: Authors acknowledge the financial support of the Technology Agency of the Czech Republic (TA02020991). Work was also partly supported by the Ministry of Agriculture of the Czech Republic (QJ1230319).

Literature

Chung, S.O., Horton, R. 1987. Soil heat and water flow with a partial surface mulch, Water Resour. Res., 23(12), 2175-2186, 1987.