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Influence of root-water-uptake parameterization on simulated heat transport in a structured forest soil

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Coupled simulations of soil water flow and associated transport of substances have become a useful and increasingly popular tool of subsurface hydrology. Quality of such simulations is directly affected by correctness of its hydraulic part. When near-surface processes under vegetation cover are of interest, appropriate representation of the root water uptake becomes essential.
Simulation study of coupled water and heat transport in soil profile under natural conditions was conducted. One-dimensional dual-continuum model (S1D code) with semi-separate flow domains representing the soil matrix and the network of preferential pathways was used. A simple root water uptake model based on water-potential-gradient (WPG) formulation was applied. As demonstrated before [1], the WPG formulation – capable of simulating both the compensatory root water uptake (in situations when reduced uptake from dry layers is compensated by increased uptake from wetter layers), and the root-mediated hydraulic redistribution of soil water – enables simulation of more natural soil moisture distribution throughout the root zone. The potential effect on heat transport in a soil profile is the subject of the present study.

[1] Vogel T., M. Dohnal, J. Dusek, J. Votrubova, and M. Tesar. 2013. Macroscopic modeling of plant water uptake in a forest stand involving root-mediated soil-water redistribution. Vadose Zone Journal, 12, 10.2136/vzj2012.0154.

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