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Hillslope soil profile water regime by dual domain modeling with the use of ^{18}O isotope

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Several studies focused on the runoff generation have been carried out to evaluate the water regime of the shallow hillslope soils. Overland flow and shallow saturated subsurface flow are two important components of the watershed response to the intensive rainfall. The interaction between the surface water, ground water and the stream outflow during a storm event is an important issue in the contemporary hydrology. One of the possible approaches to study this relationship is observing content of the stable oxygen isotope (^{18}O) which is the most common method in hydrological natural tracing.

At the experimental watershed Uhlirska in the Jizera Mountains, Czech Republic, isotope ^{18}O is sampled at selected observation points since the spring 2006. These observations involve rainfall, snowmelt, snow cover, shallow subsurface stormflow, groundwater, soil water from suction lysimeters, and the stream outflow at two gauging stations.

To evaluate the isotope and water transport processes at the watershed, a one-dimensional variably saturated flow model S_1D_DUAL was applied. The model is based on formulation of the Richard's equation in two communicating flow domains: the soil matrix domain and the preferential flow domain. Concentrations of the isotope ^{18}O and simulated fluxes at the boundaries are compared with the observed data at the soil profile.

The analysis of the isotope data suggests that the quick subsurface flow has major impact on the outflow from the watershed. The simulated and observed dynamics of the

shallow saturated subsurface flow corresponds to the dynamics of the watershed outflow. The simulated and observed transports of the isotope ^{18}O evidence the dominant impact of the shallow subsurface flow on the watershed outflow.

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