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Combined Approach in the Watershed Response Examination Employing Stable Isotopes

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Uhlírská (1.78 km^2), is a typical watershed with the crystalline bedrock covered by Cambisols. It is situated in a humid mountainous region where soils are typically shallow and highly permeable with preferential pathways. As a result, the outflow caused by storms can be of a quick response and high magnitude. Monitoring of the hydrological processes in the subsurface detected the leading role of the vadose zone preferential flow on the transformation of the outflow hydrograph. Dynamic thresholds of the soil moisture content manage the ratio and the magnitude of the hypodermic, deeper subsurface and rare surface outflow components. To obtain the time series of components of the hydrological cycle, the site is equipped with the climatic station. The nests of soil tensiometers, the frequency domain reflectometers monitor the water regime above the subsurface water collection trench. In order to reduce uncertainties of the principal flow patterns in several scales (soil profile, hillslope segment to the watershed scale), additional techniques are utilized. New multi-electrode resistivity tomography was employed to give spatial picture of the shallow quaternary geology.

In the study the isotopes ^{18}O, ^{2}H and ^{3}H and the silica in SiO_2 form have been employed as natural tracers to follow their temporal and spatial variation in the particular components of the hydrological process. To determine the time residence of water within the watershed, standard approaches are used, combining mixing (dispersion) and piston flow (advection) into a time lagged transfer function. Based on the courses of the stable isotopes concentration, the outflow components of the hydrological cycle (quick and long term ones) are separated. The sine function has been fitted to the serii of seasonal fluctuations of the isotopes measured in the rainfall and stream out-

flow records. Distributed hydrogeological model (using MODFLOW) has been built, evaluating the residence time of the groundwater. Time series of recharge and outflow tagged with the ^{18}O markers enlarge the possibilities of deeper specification of the watershed response via transient transport modeling.

Based on the observation and preliminary results of the simulations, soils on the hillslopes exhibit limited transformation effect regarding the isotope temporal distribution. On contrary to, the glacial sediments in the valley aquifer containing a large amount of water serve as a significant buffer for mixing of the water volumes of varying signature of ^{18}O during the seasons.

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