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Runoff generation mechanism at two distinct headwater catchments – isotopic evidence

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Data from two headwater catchments indicate considerably different runoff formation mechanisms. The contributions of different surface and subsurface runoff mechanisms to the catchment discharge formation at these two small forested headwater catchments are studied with help of the natural isotopic signatures of the observed fluxes. The Uhlirska catchment (1.78 sq. km, Jizera Mts., Czech Republic) is situated in headwater area of Cerna Nisa stream. Deluviofluvial granitic sediments in the valley bottom areas (riparian zones/wetlands) are surrounded by gentle hillslopes with shallow soils developed on crystalline bedrock. The Liz catchment (0.99 sq. km, Bohemian Forest, Czech Republic) belongs to hillslope-type catchments without riparian zones situated in headwater area of Volynka River. The soil at Liz is developed on biotite paragneiss bedrock.
Autocorrelation analysis of the measured catchment discharge rates reveals different hydrograph characteristics for each of the two catchments. Estimated autocorrelation lengths differ by an order of magnitude. Variations of oxygen-18 isotope concentrations in precipitation, groundwater and streamflow were analyzed. Several significant rainfall-runoff events at each of the two catchments were analyzed in detail. These events exhibit substantial difference in isotopic compositions of event and pre-event water, which facilitates hydrograph separation. Clockwise and counterclockwise hysteretic relationships between the stream discharge and its isotope concentration were identified. Results were confronted with the previously published concepts of the runoff formation at the catchments under study.

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