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Modeling mountainous fens water regime using 18-O.

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Mountainous fens are important hydrological component of the headwater catchments in Jizera Mountains, The Czech Republic. Experimental catchment Uhlířská (1.78 km^2) is formed by paleozolic crystalline bedrock overlaid by shallow highly permeable Cambisol on the hillslopes, whereas the thick saturated glacial deposits in the valley are overlaid by Histosols. Standard meteorological and hydrological monitoring is supplemented by measurements of the soil moisture, soil pore water suction, water table fluctuation in the saturated riparian zone of Černá Nisa creek. Water sampling for the ^{18}O and ^{2}H isotopes is performed throughout the catchment.

Numerical simulation was performed with S1D code for the period May 2007-September 2008. The model is based on Richards' equation for vertical soil water flow and the advection-dispersion equation for transport of stable oxygen isotope ^{18}O. Hourly rainfall or daily snowmelt intensities are introduced as an upper boundary condition, the measured groundwater table fluctuation serves as a time variable prescribed head at the bottom boundary. The intensity of the root water uptake due to transpiration is assumed as a zone sink term. Daily values of $\delta^{18}O$ in the rain and weekly $\delta^{18}O$ values of the melting snow, together with the hourly interpolated monthly values of $\delta^{18}O$ in the groundwater, serve as the transport boundary conditions. Measured soil hydraulic parameters were adjusted based on suction heads and $\delta^{18}O$ variations in observation points representing the soil tensiometers and suction cups.

Results of the model demonstrate a strong mixing of water in the root zone of the peat profile, where evapotranspiration takes place. Process of deeper percolation is limited by the high degree of saturation of the peat in combination with its low hydraulic conductivity. The seasonal water percolation is estimated according to the results of the isotope transport down to 70 cm below the surface. The S1D model with the use of environmental isotope as a natural tracer is a useful tool to asses the flow in the porous media where environmental isotopes help to constrain hydrological hypotheses.

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