Abstract:

Stable water isotopes are used as a natural tracer for hydrograph separation, allowing for distinction between various water sources. Snow isotopic composition can be influenced by a number of meteorological, hydrological, and physical processes. A better understanding of how snow water isotopes change during the snowmelt process can improve hydrograph separation methods and provide insight into the processes that influence snowmelt and the resulting runoff. During the winter season of 2024, four snow pits were conducted at the Ptačí brook in the Šumava Mountains. The physical properties of the snow, such as snow water equivalent, hardness, grain type and temperature, were measured at approximately 3-week intervals. In addition, samples of stable water isotopes in the snow, specifically $^{18}O/^{16}O$ and $^{2}H/^{1}H$, were taken from identified stratigraphic layers. It was found that the snow depth in the open plot was, on average, 54% higher than in the forest plot, and the snow water equivalent was, on average, 36% higher in the open plot than in the forest plot. The open plot snowpack showed greater physical and isotopic stratigraphic heterogeneity as well as increased depletion in heavy isotopes, in comparison to the forest snowpack. The isotopic samples from the open site snowpack varied between δ^{18} O = -20.37‰; $\delta^{2}H$ = 154.28‰ and $\delta^{18}O$ = -9.79‰; $\delta^{2}H$ = -70.09‰, while the forest samples varied between $\delta^{18}O$ = -14.67‰; $\delta^{2}H$ = -110.86‰ and $\delta^{18}O$ = -9.24‰; $\delta^{2}H$ = -65.33‰. The stratigraphy of the open site snowpack remained relatively stable even after the occurrence of rain-on-snow events. Furthermore, the melting of layers was observed to occur without isotopically affecting adjacent layers below, indicating the occurrence of lateral flow patterns.

Key words: snow water isotopes, snow water equivalent, snow profile, physical properties of snow