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Detail isotopic stratigraphy of snowpack - case study from Julian Alps (Slovenia)

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In temperate humid catchments the storage of precipitation in snowpack, and the subsequent melting, both highly variable in space and time, substantially impacts the water cycle. Recent climate warming and changes in atmospheric circulation patterns have resulted in reductions in the duration of the snow cover season, the amount of water stored in the snowpack, as well as a widespread trend toward earlier melt. Comparison of water balance for periods 1961-90 and 1971-2000 showed that in Slovenia average precipitation amount remained the same in both periods while runoff decreased and the evaporation increased recently.

The area of Julian Alps (NW Slovenia) represents the upper catchment area of river Sava. The area is locally characterised as one with the highest annual precipitation amount in Europe, rapid runoffs and low evaporation. Snow cover is regular, starts to accumulate in late autumn and lasts more than 100 days, at the upper tree line usually more than 150 days. Due to positive air temperature trend snow cover period is changing and consequently the discharge regime is affected. Spatial and temporal variability of snow, as well as snow cover contribution to the water balance in Julian Alps remains poorly investigated.

Isotopes of O and H have been used to study snow deposition and the subsequent alteration of snowpack and its influence on runoff. Despite their potential, environmental isotopes were only rarely used in investigations of water cycle in mountain areas of Slovenia in the past.

To improve the knowledge on snowpack isotope characteristics and processes in it, and consequently to enable better understanding of water balance with emphasize on recharge of important Slovene aquifers, in 2011 at selected site in the area of Triglav National Park (Planina Javornik) the first isotope research of snowpack has been started. We performed detail sampling of snowpack at two locations with different canopy structures (e.g. clearing and forest stand). Snowpack was characterised according to international UNESCO-IHP snow classification (FIERZ et al., 2009). Samples for determination of stable isotopic composition of snow were collected at 2-3 cm intervals from the surface to the bottom of snow profile.

First results of performed isotopic research show considerable variability of isotopic composition through investigated snow profiles. Observed variability is related to different precipitation events and to processes that influenced the initial isotopic signal of the snow layers. These processes will be evaluated more precisely in future research.

Fierz, C., Armstrong, R. L., Durand, Y., Etchevers, P., Greene, E., McMlung, D. M., Nishimura, K., Satyawali, P. K. & Sokratov, S. 2009: The International Classification for the Seasonal Snow on the Ground. IHP-VII Technical Documents in Hydrology N°83, IACS Contribution N°1, UNESCO-IHP, Paris, 80 pp.