EGU2020-9413
https://doi.org/10.5194/egusphere-egu2020-9413
EGU General Assembly 2020

Reduced fraction of young water in Alpine catchments with increased seasonal snow cover

Natalie Ceperley[1,2], Giulia Zuecco[3], Harsh Beria[1], Luca Carturan[3,4], Anthony Michelon[1], Daniele Penna[5], Joshua Larsen[6,7], and Bettina Schaefli[1,2]

[1]Institute of Earth Surface Processes, Department of Geosciences, University of Lausanne, Lausanne, Switzerland (natalie.ceperley@unil.ch)

[2]Institute of Geography, University of Bern, Bern, Switzerland

[3]Department of Land, Environment, Agriculture and Forestry, University of Padova, Italy

[4]Department of Geosciences, University of Padova, Italy

[5]Department of Agriculture, Food, Environment and Forestry, University of Florence, Italy

[6]School of Geography, Earth and Environmental Sciences, University of Birmingham, United Kingdom

[7]The Birmingham Institute of Forest Research (BIFoR), University of Birmingham, United Kingdom

Effective water resource management can benefit from estimations of when water entered the catchment and how long it takes to flow to the outlet. In this context, the so-called young water fraction (F_{yw}) based on seasonal input and output tracer cycles is becoming increasingly used as robust tool to compare the hydrological function of catchments. In seasonally cold environments, this F_{yw} estimation is complicated by the fact that a large part of the precipitation will be in the form of snow, will be stored before melting and becoming available as water, resulting in a distinct winter low flow and summer high flow season. Nevertheless, F_{yw} might enclose extremely interesting information in such environments since they incorporate the relationship between late summer and autumn flow and the previous winter's snow input. However, most currently available methods for F_{yw} estimation do not explicitly account for the seasonal shift of water input from snow. Therefore, we propose a novel framework to explicitly account for this "snowmelt" delay in F_{yw} and explore related uncertainties using experimental data from three high-elevation Alpine catchments, the Vallon de Nant in Switzerland, and the Noce Bianco at Pian Venezia and the Bridge Creek Catchments in Italy. Experimental data from these environments expose some limitations of existing methods in accounting for unavoidable sampling inconsistencies. Using our method that explicitly accounts for snowmelt, we found extremely low F_{yw} in these three Alpine catchments: 6%, 13%, and 31%. In this contribution, we will present our method in detail and highlight emerging challenges and implications of the F_{yw} estimation.