



Catchment water storage increases with elevation

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One of the most important functions of catchments is the storage of water. Catchment storage attenuates meteorological extremes and inter-annual streamflow variability and controls the partitioning between evaporation as well as transit times of water. Hence, the estimation of catchment storage can help us understand the sensitivity of catchments to extremes and to pollution.

In this presentation, we focus on the dynamic storage, defined to control streamflow dynamics, which can be completely different to the total or mobile catchment storage. We estimated dynamic storage in pre-alpine and alpine catchments, using a set of Swiss catchments comprising different elevation ranges. For each catchment, the dynamic storage was estimated with different approaches: water balance analysis, streamflow recession analysis and calibration of two different bucket-type hydrological models. The absolute estimates of the different approaches differed up to one order of magnitude. Nevertheless, the ranks of dynamic catchment storage among the approaches was similar. Surprisingly, we found both the largest dynamic and mobile storage estimates in high-elevation catchments.

An obvious explanation for the increase of storage with elevation may be the seasonally storage of water in the snowpack that is increasing at higher elevations. With the HBV model, we quantified the contributions of snow, soil and groundwater storages compared to the dynamic catchment storage. A closer look at these simulated storages reveals that besides an increasing snow storage with increasing elevation, groundwater storage remains in the same order of magnitude over the whole elevation gradient. Contradicting the general assumption that less water is stored underground at higher elevation, groundwater appears to contribute considerably to the overall dynamic storage for all investigated catchments. Dynamic storage in high-elevation catchments was found to be larger than expected. There is still a need for confirmation and further research of this finding with independent information.