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Eawag Seminar Invitation

Physiographic controls on catchment hydrological functions of water collection, storage and release

Speakers **Dr. habil. Laurent Pfister,** *Luxembourg Institute of Science and Technology (LIST), Luxemburg*

When **Thursday, May 20, 16.00 – 17.00, CEST**

Where **Online via Zoom, contact seminars@eawag.ch for access details.**

Abstract Early pioneering work in the 1970s and 80s laid the foundation for using the stable isotopes of O and H ($\delta^{18}O$ & $\delta^{2}H$) in the water molecule for flow paths analysis and stream water source apportionment. Time series of precipitation and stream water isotope composition are now a standard tool for quantifying catchment transit times (TT) via mathematical convolution techniques.

However, the way how basin geology, catchment water collection/mixing, storage and release are connected remains poorly understood to date. Most investigations on the influence of catchment geology on catchment mean transit time were based on flow and isotope tracer data and rarely exceeded 2-3 bedrock types.

Here, we present data from 16 nested catchments located in the Alzette River basin (Luxembourg, Europe), spanning a wide range of sizes (0.47 to 285 km^2) and contrasted bedrock geology. We have analysed 9 years' worth of precipitation and discharge data (for all 16 nested catchments), 6 years of fortnightly stable isotope and chemistry data in streamflow (for a subset of 12 catchments). Our aim was to investigate bedrock geology controls on (1) streamflow regime metrics, (2) catchment storage, (3) stream chemistry and (4) isotope response and catchment mean transit time.

While isotope records of streamflow are pivotal for improving our understanding and modelling of hydrological, ecological, biogeochemical and atmospheric processes, their full potential is hindered by short and truncated time series. Access to long series of $\delta^{18}O$ and $\delta^{2}H$ in stream water (in combination with long precipitation isotope data series) is a crucial problem in hydrology and environmental sciences.

Here we propose an innovative solution to the problem of stream isotope record limitations: the use of freshwater molluscs as long-term stream water isotope recorders. We have done pilot work by completing a meta-analysis of mollusc shell $\delta^{18}O$ data (from 10 individual studies), spanning a latitudinal sequence of 18 sampling sites on 16 streams around the globe. We found strong links between isotope signatures in precipitation, stream water and freshwater molluscs – both stream water and mollusc signals showing a strong damping of the precipitation signal.