Drought affects export patterns across solutes

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Motivation

Droughts can substantially affect stream water quality via various hydrological and biogeochemical processes, such as increasing evapoconcentation and travel times, decreasing hydrological connectivity and changing uptake and reaction rates[1,2,3]. To quantify the impact drought can have on our freshwater resources and to disentangle the underlying mechanisms, we analyzed solute export patterns across a wide range of solutes in a small pre-alpine catchment.

Study site & Data

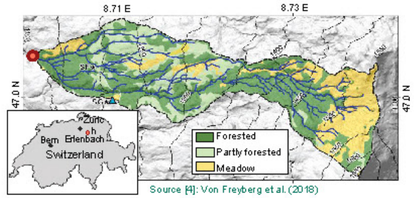
The pre-alpine Erlenbach catchment

Area: 0.7 km²

Elevation: 1000 – 1655 m.a.s.l.

Geology: Flysch

Groundwater chemistry: Ca, Mg, HCO_3



Data

30 min to hourly hydro-meteorological data and concentrations of NO_3, Cl, Fe, Cr, SO_4, Ca (and many more from 2017 to 2020), measured via IC or ICPMS[3,5]

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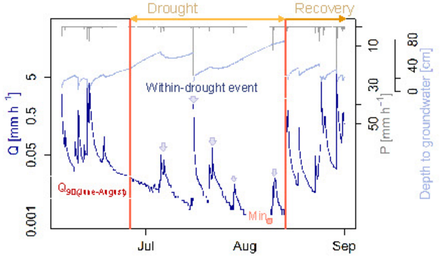
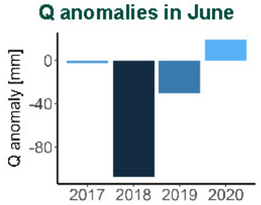
Results

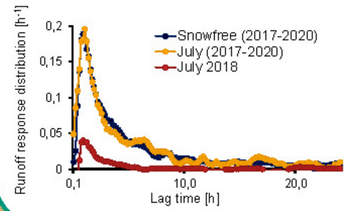
Hydrological drought

Summer drought in 2018 from June 26th to August 13th





Ensemble Rainfall-Runoff Analysis (ERRA)

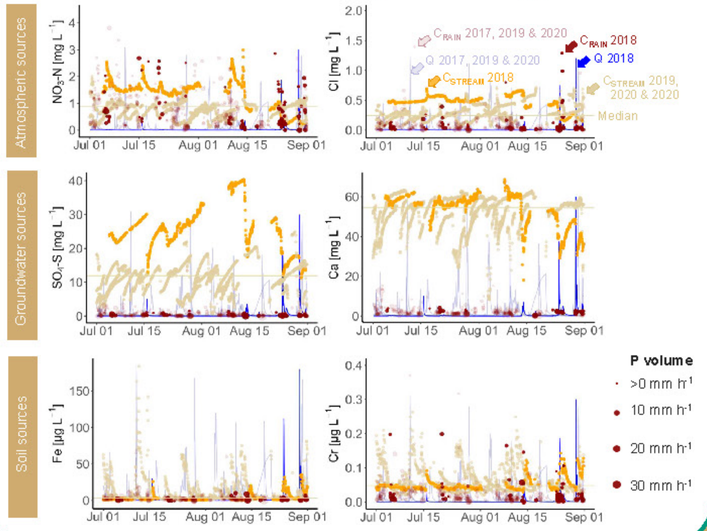


Dampened runoff response for July 2018 compared to normal conditions in July or the entire snow free period.

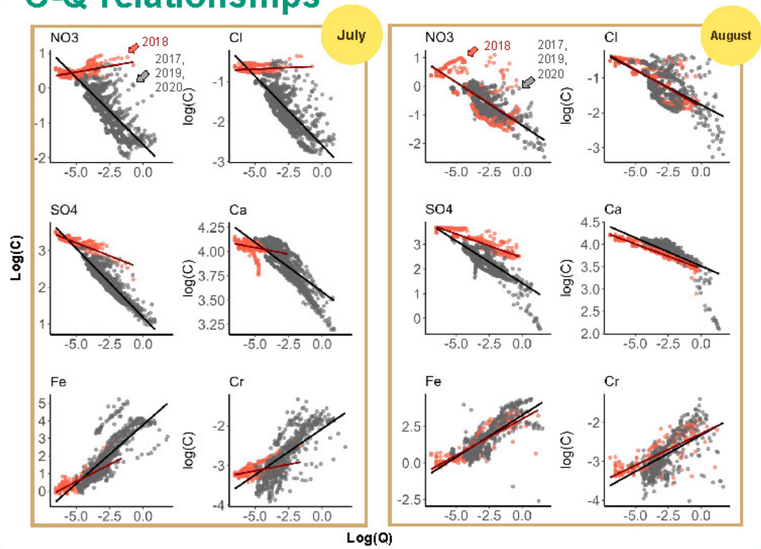
→ Less rainfall is turned into streamflow.

Time series

Solute concentrations over the drought and recovery period



C-Q relationships



→ **Emerging chemostasis during drought? Fast recovery?**

References

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Take home

- All solute concentrations were strongly affected by the drought, showing either higher or lower than normal concentrations.
- Solute export patterns showed emerging chemostasis during the drought and a fast recovery with rewetting, indicating a temporary change in the underlying hydrological processes.

Next steps

- Quantification of the drought impact on stream water composition and quality.
- Disentangling the impact of biogeo-chemical and hydrological processes during and immediately after the drought.

Abstract

Sharing is encouraged

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