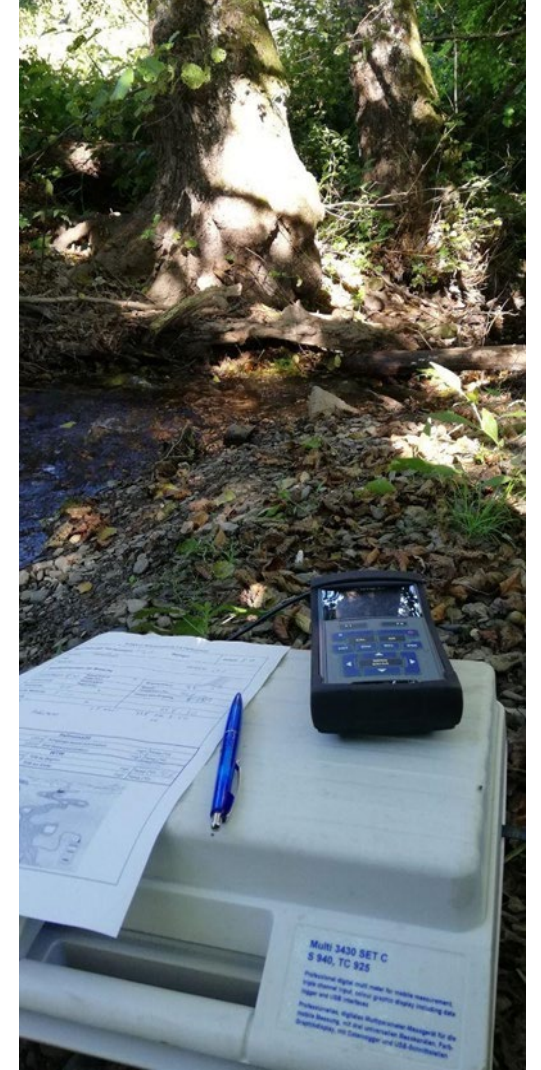
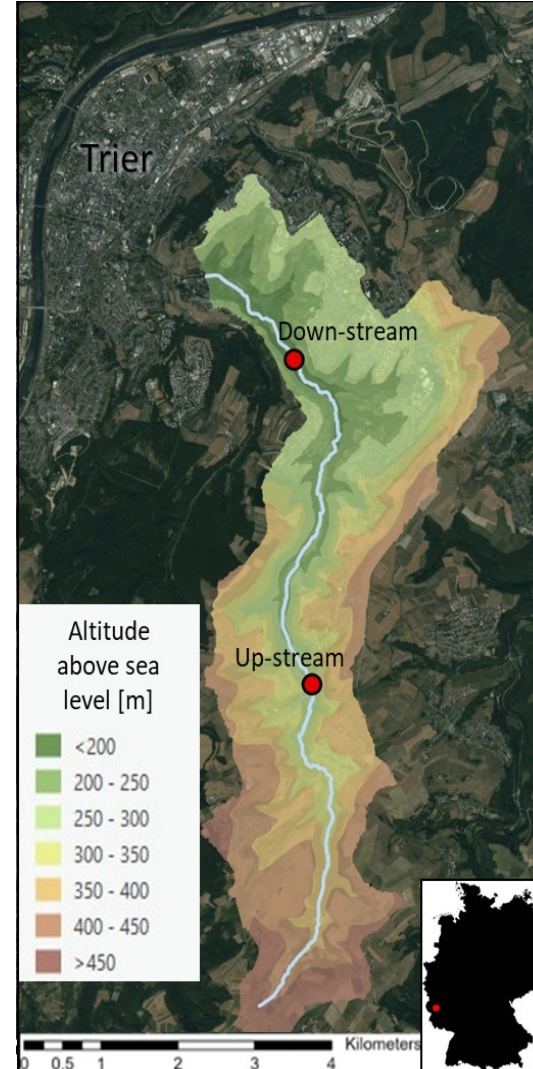
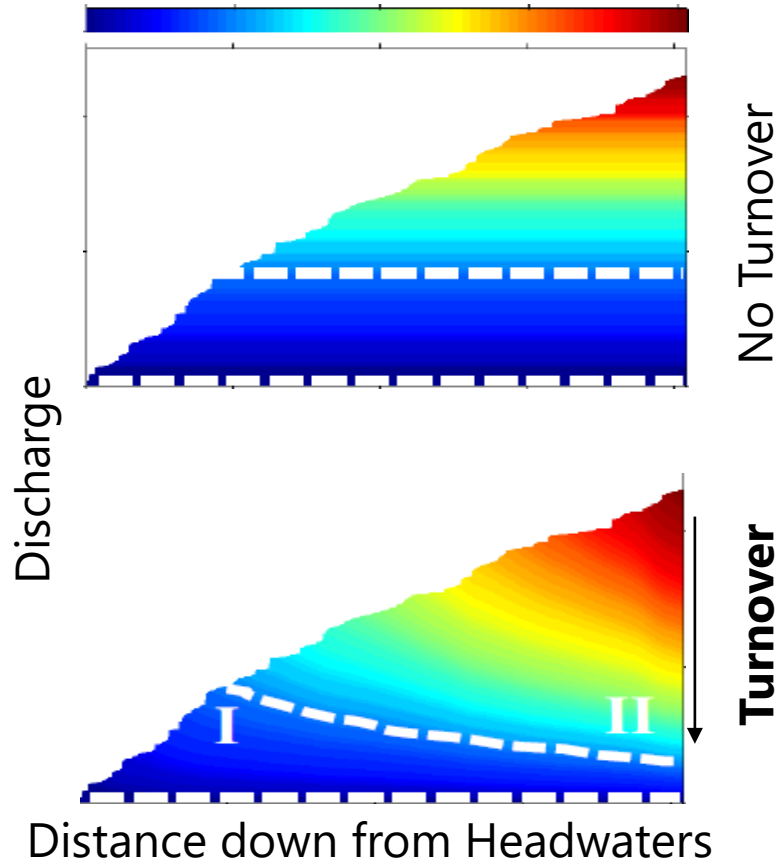


How catchment properties shape variation in groundwater- surface water interaction: Using geogenic silicate as a tracer in hydrological Turnover research

Bäthke Lars, Schuetz Tobias (2023)

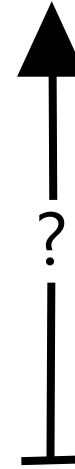


Turnover effect on source water composition



Edited from **Mallard**, McGlynn, Covino, 2014, WRR

Catchment



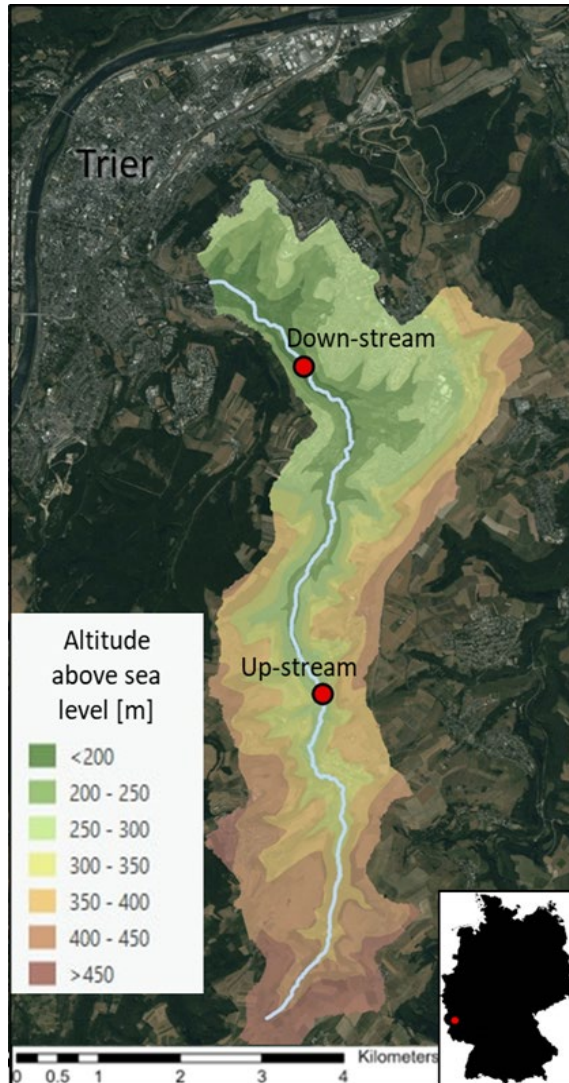
Questions

Where does my water physically come from?

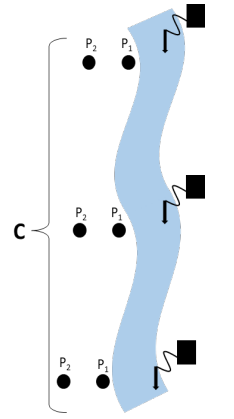
Additional Marker
SiO₂

Can we distinguish between streamflow recycling and Turnover induced mixing with groundwater?

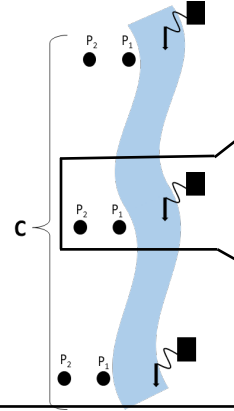
Olewigerbach Catchment



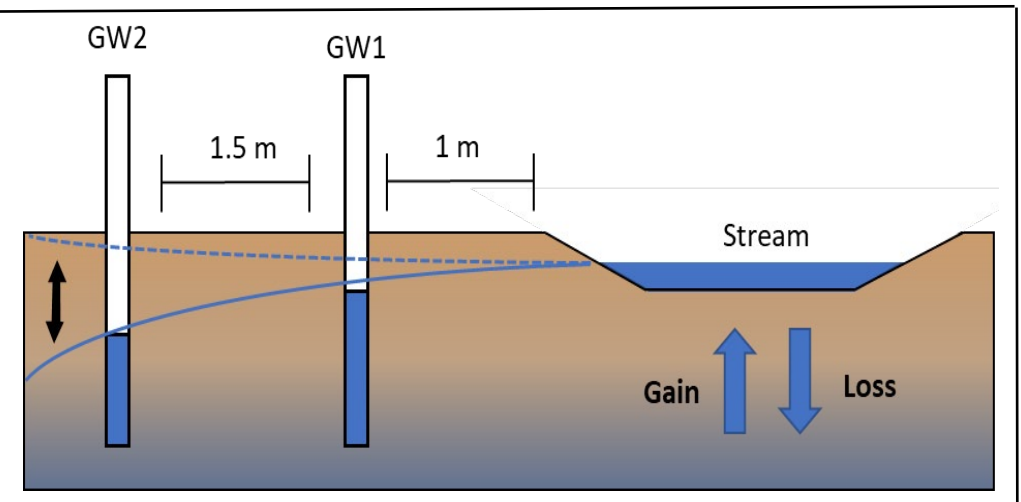
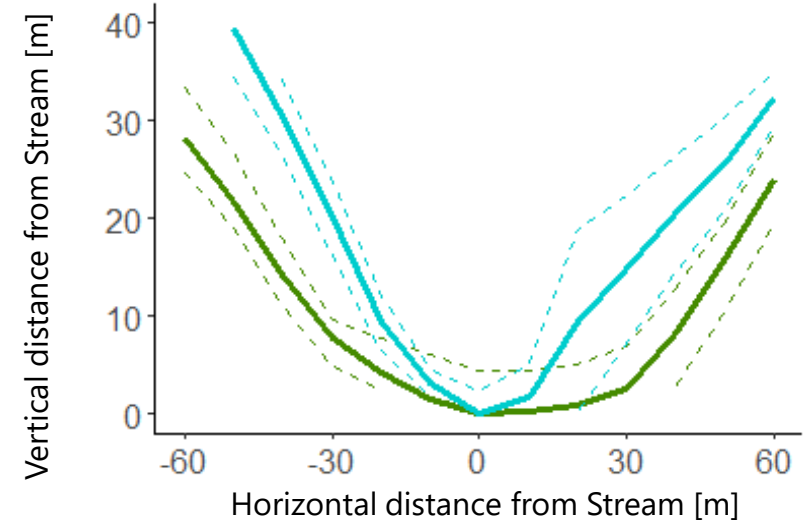
Down-Stream



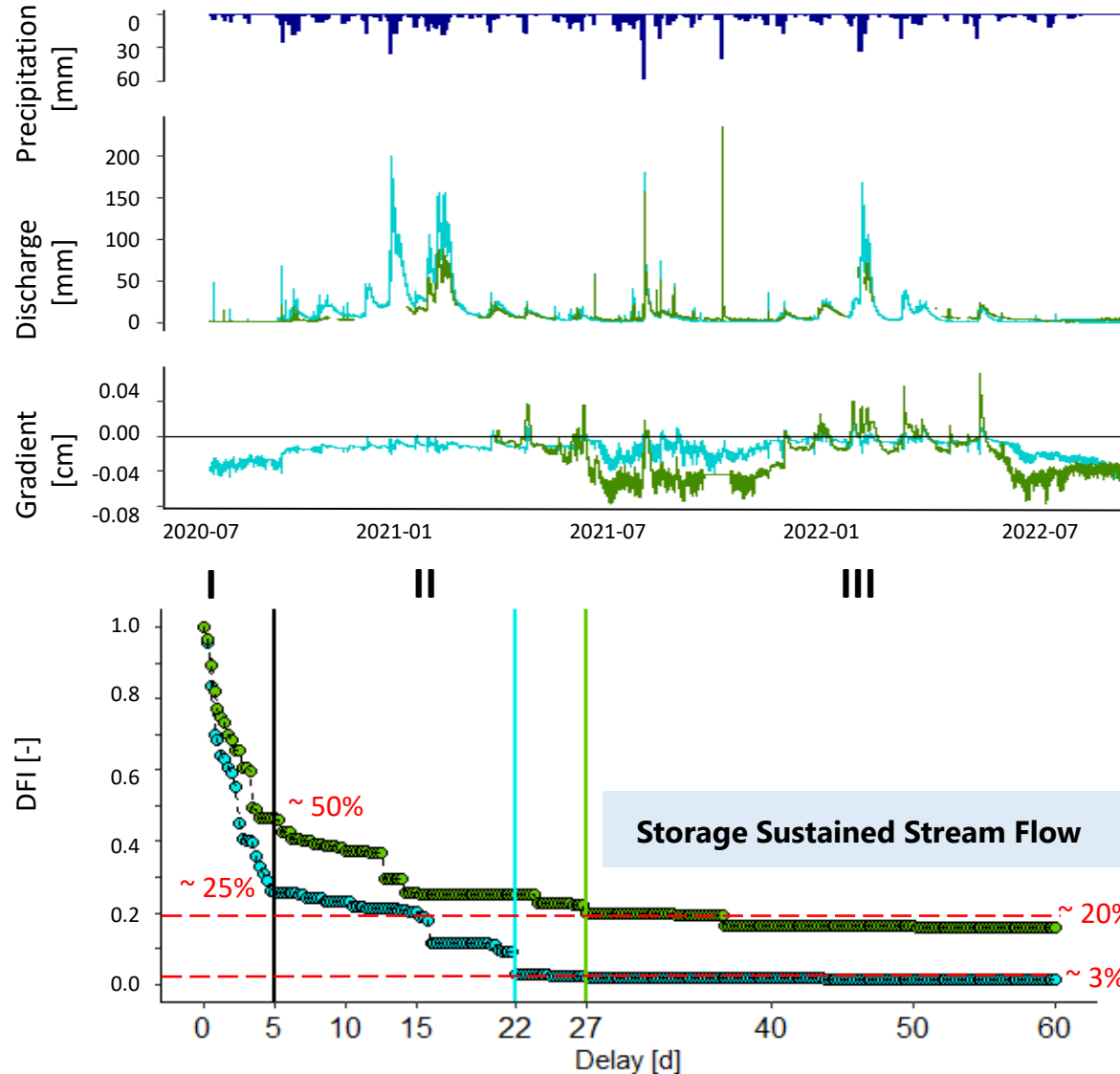
Up-Stream



Valley Shape



Site specific discharge dynamics



Geology

Hunsrück lower mountain range

- Devonian schist, quartzite inclusions
- SiO₂ as a geogenic tracer of water exposure to bedrock (deeper Groundwater)

Sampling

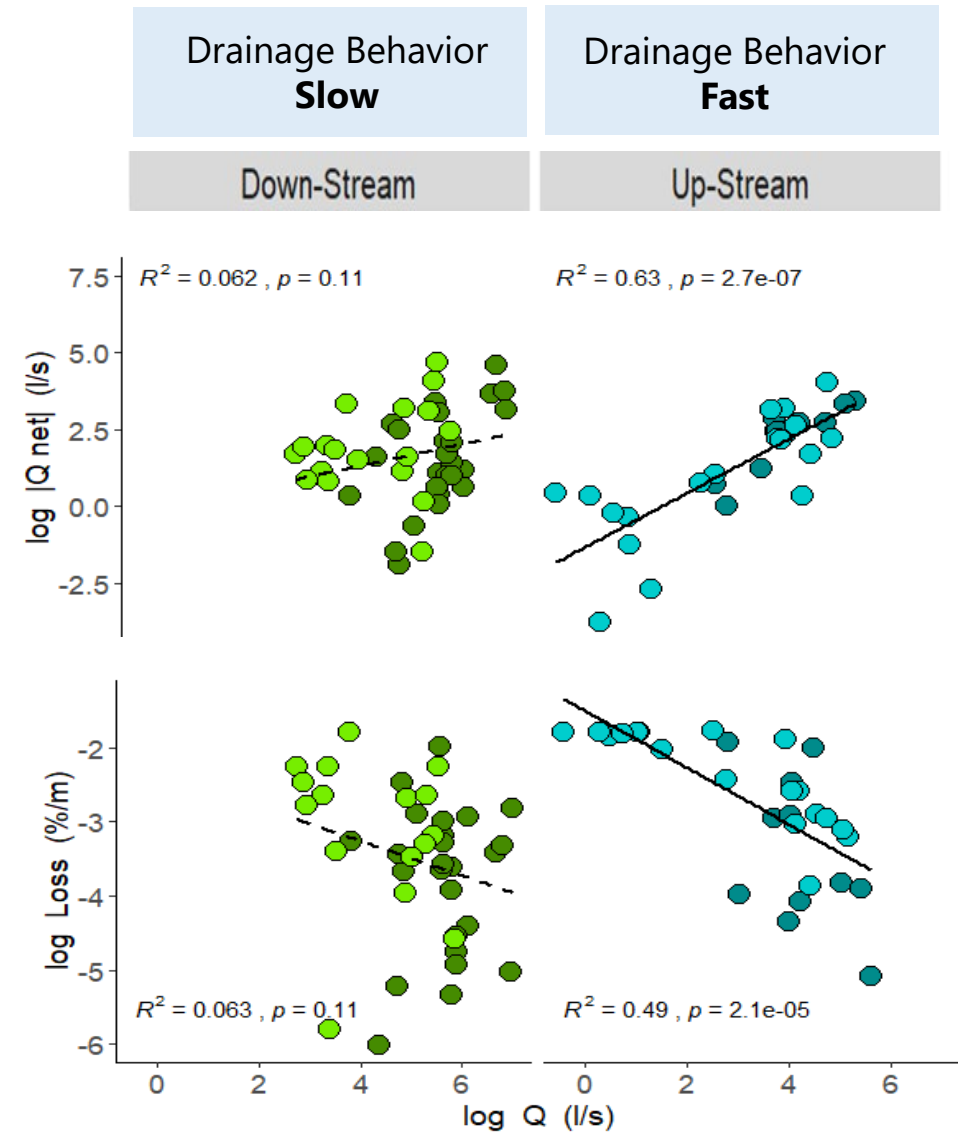
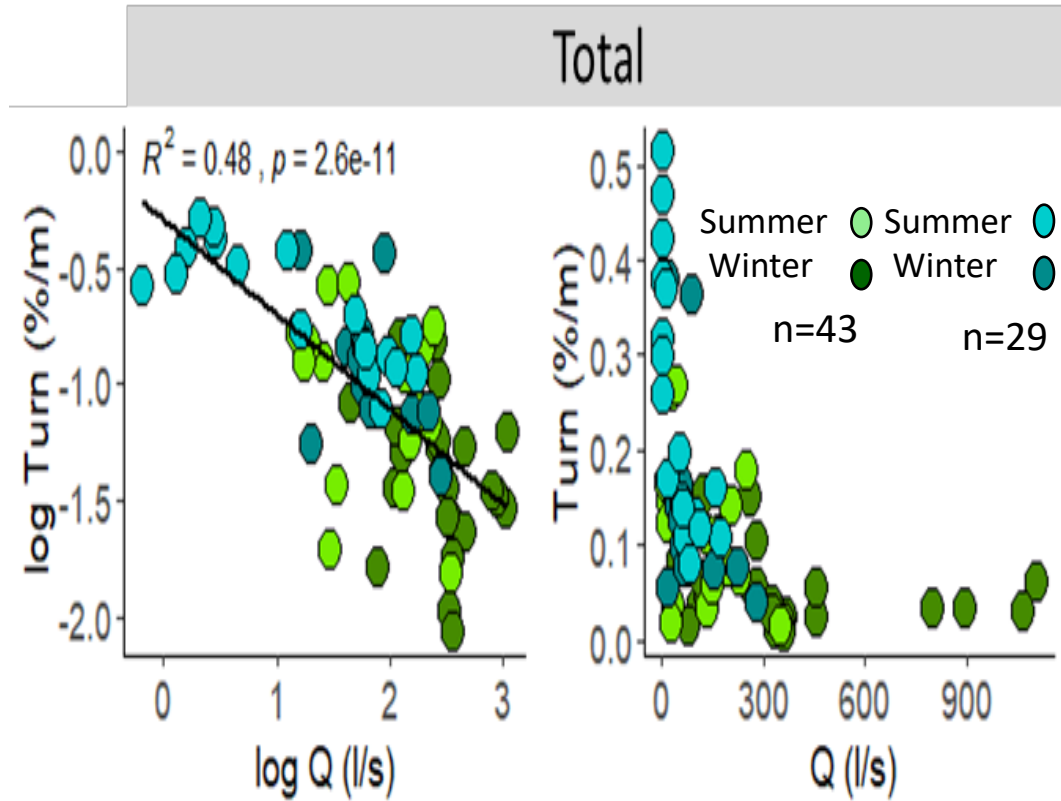
- Turnover estimation by dilution gauging
- Measuring Turnover: 72 (06th August 2020 - 07th December 2022)
- SiO₂ Samples: 270 (9/Turnover measurement)

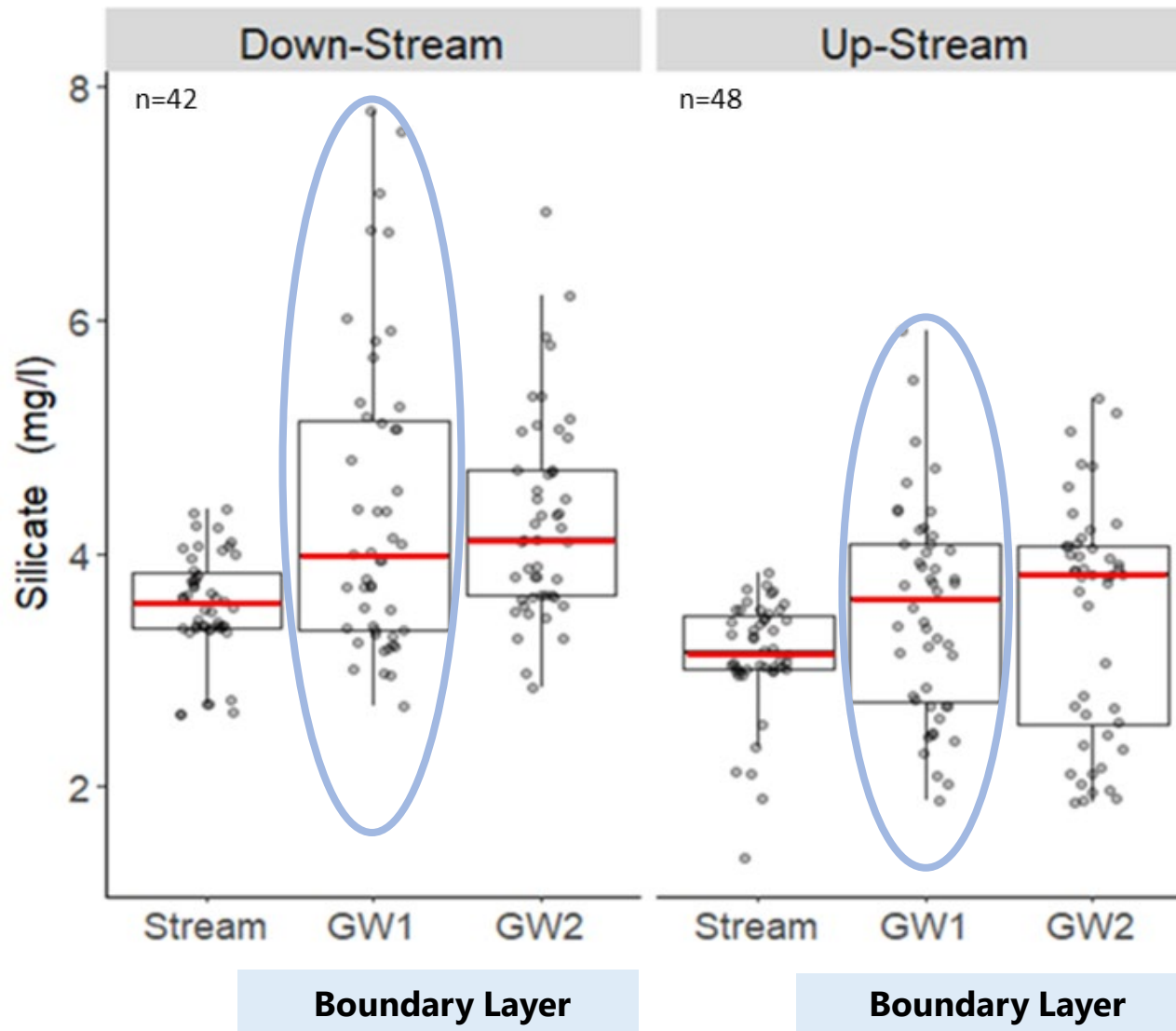
Delayed Flow Index

Enhanced graphical baseflow separation, identifying delayed contribution of event water towards stream flow

Stoelzle et al. 2020, HESS

- Four-year hydrograph data in six-hour resolution.
- I Quick-flow defined as delay < 5 days
- II Intermediary-flow
- III Storage sustained flow



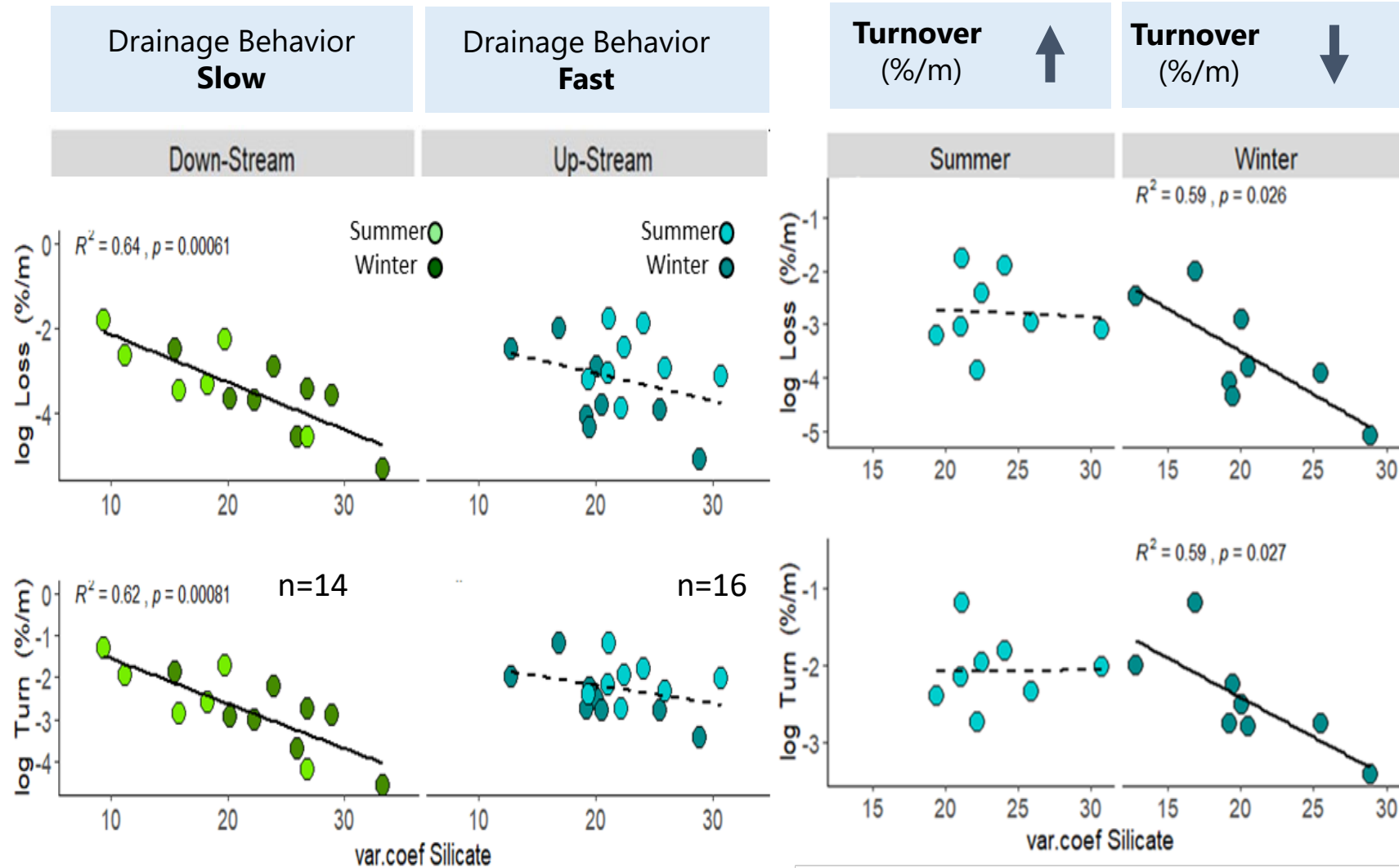


Until now hydrological turnover is only measured via tracer experiments.

Hypothesis:

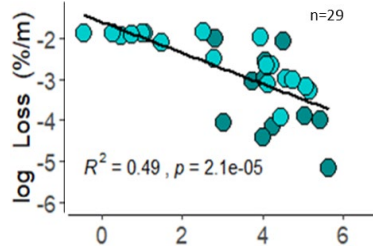
Change in SiO₂ variability is caused by Turnover induced mixing between different groundwater storages and recycled stream water.

- SiO₂ as a proxy of prolonged underground contact.
- Using large **variation and memory effect** of sampled groundwater wells in SiO₂ concentrations by analyzing **Variation Coefficients**:

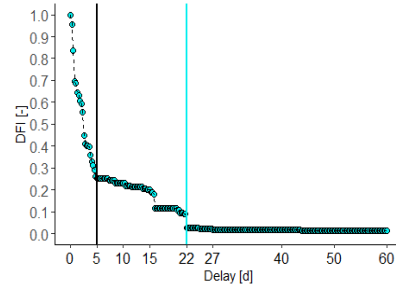


Up-Stream

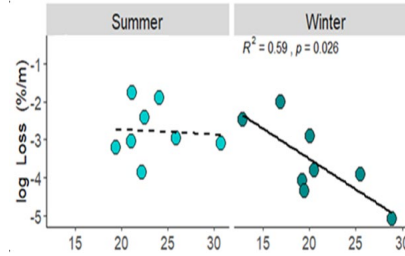
Turnover
(%/m) ↑



Drainage Behavior
Fast



SiO₂ Signal
Seasonal



Storage
DFI | Drainage Behavior

fast
~ 75%

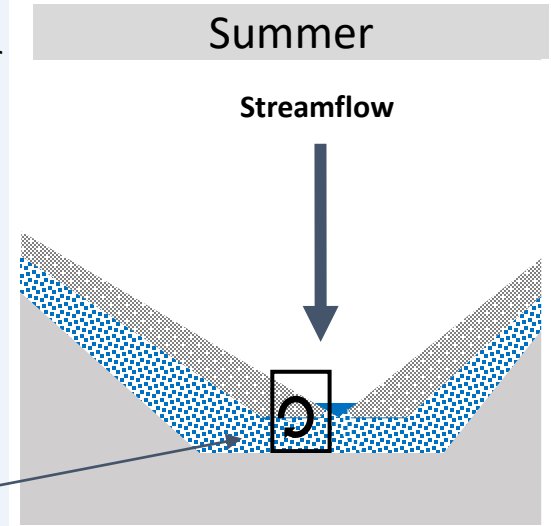
medium
~ 17%

slow
~ 3%

fast
~ 50%

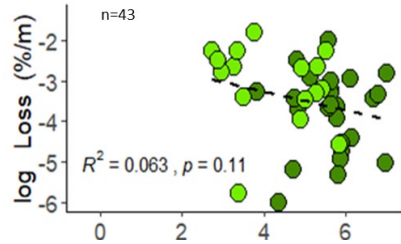
medium
~ 30%

slow
~ 20%

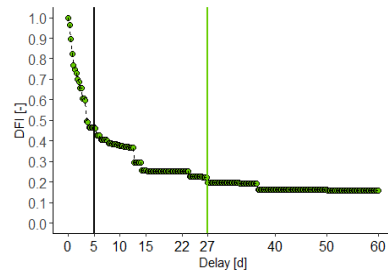


Down-Stream

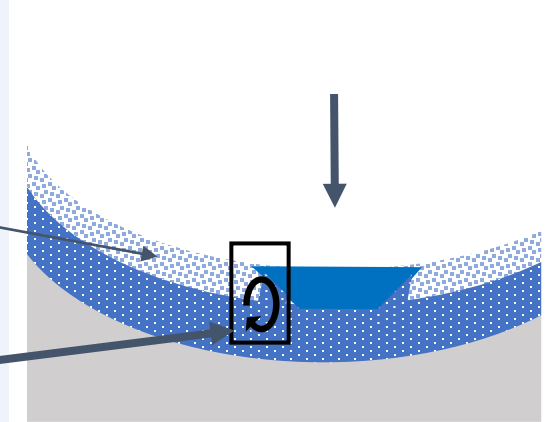
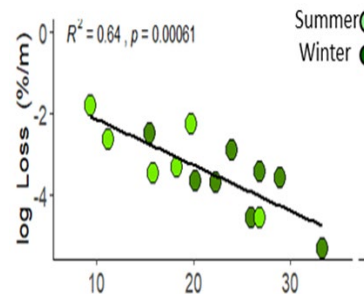
Turnover
(%/m) ↓



Drainage Behavior
Slow



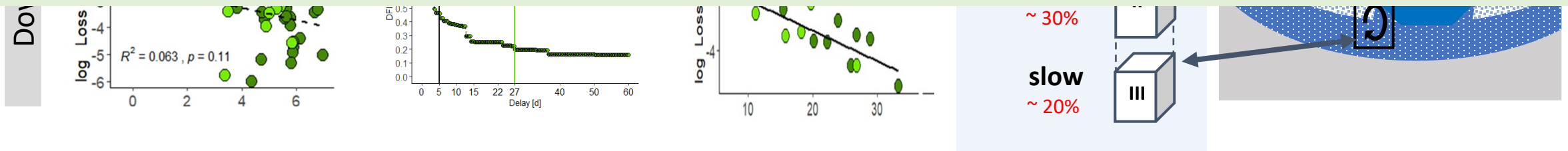
SiO₂ Signal
Permanent





Bidirectional exchange flows in streams are apparent in geogenic marker variability in near stream groundwater.

However, SiO₂ signals indicating turnover induced mixing is seasonal and depends on reach drainage behaviour and varies within the same catchment.



Thank you for your Attention

