

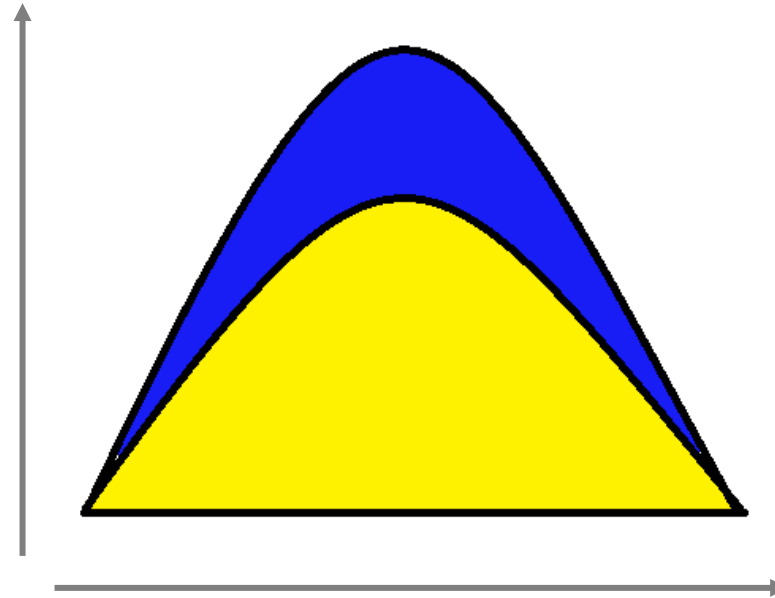
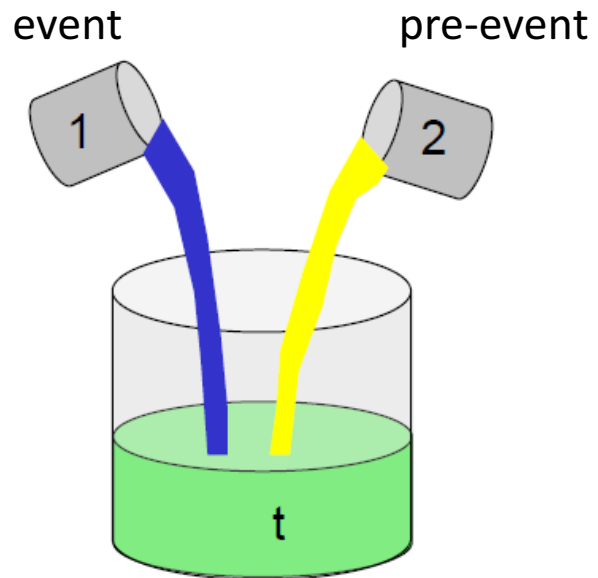


# Spatial variability in shallow groundwater chemistry in a small pre-alpine catchment

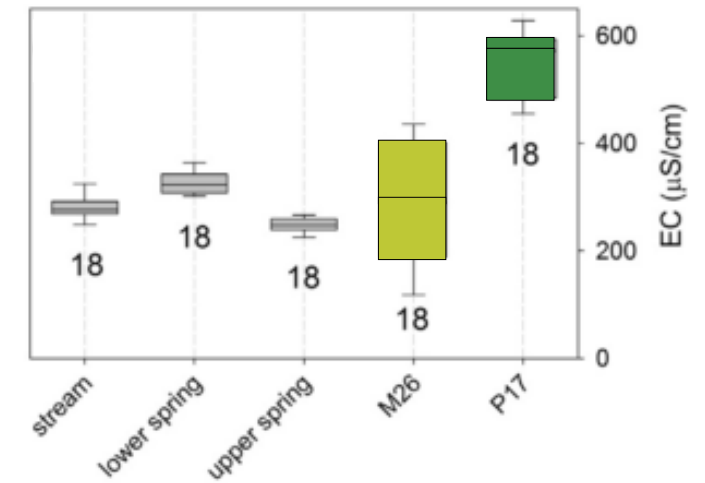
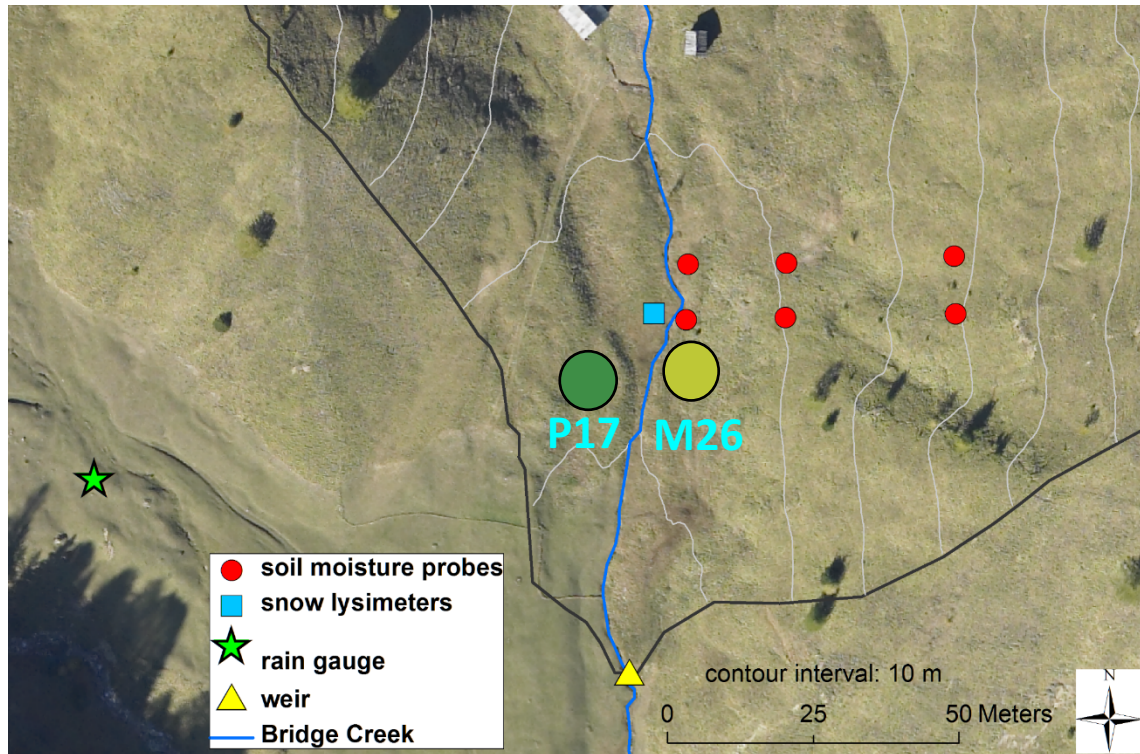
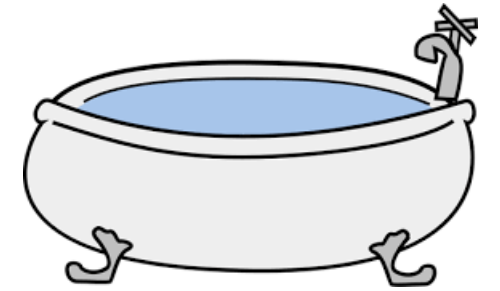
How valid is the assumption of a homogeneous groundwater aquifer?

Leonie Kiewiet – [leonie.kiewiet@geo.uzh.ch](mailto:leonie.kiewiet@geo.uzh.ch)  
Hydrology and Climate – University of Zurich  
Swiss Geoscience Meeting 2017

# Importance of groundwater for streamflow



# Heterogeneous subsurface aquifer

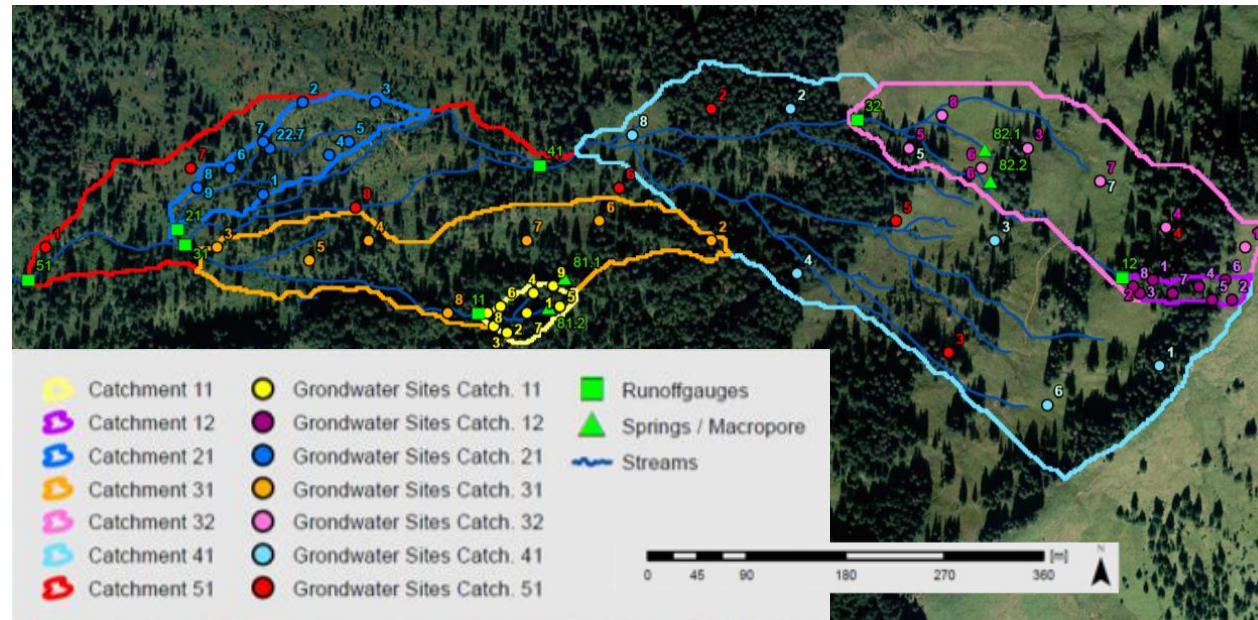




# The Alptal research catchment



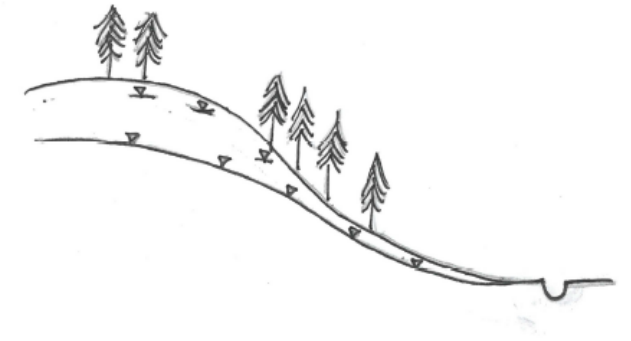
Zwäckentobel catchment



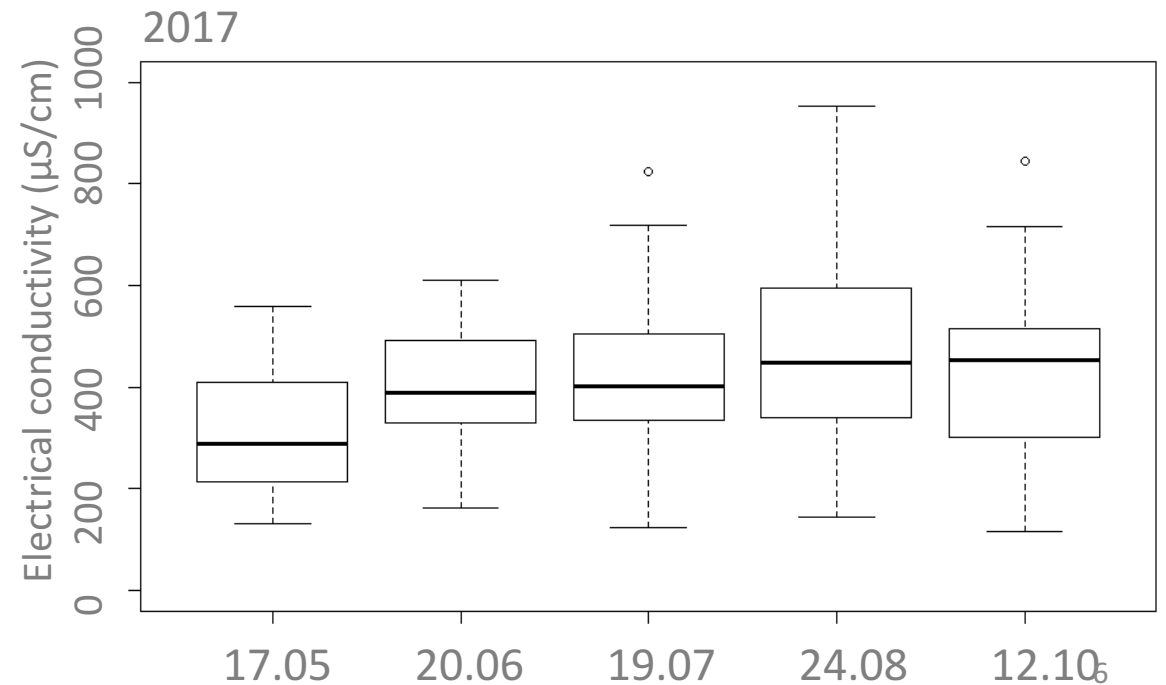
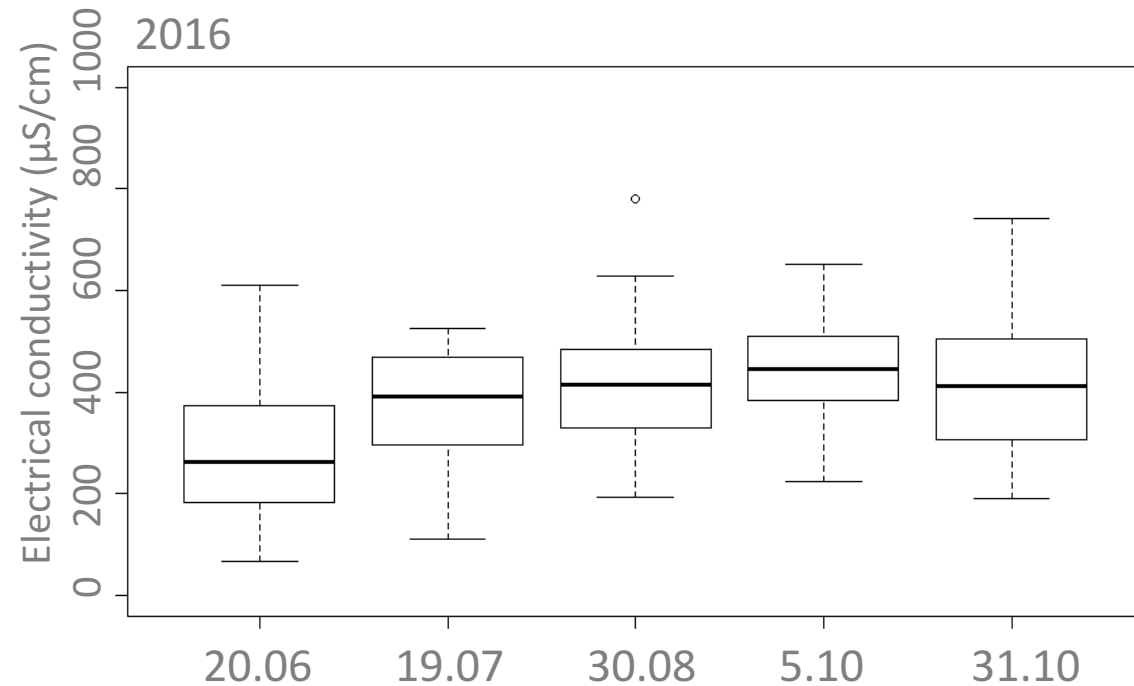
~20 ha  
 $\pm 2300 \text{ mmy}^{-1}$  precipitation



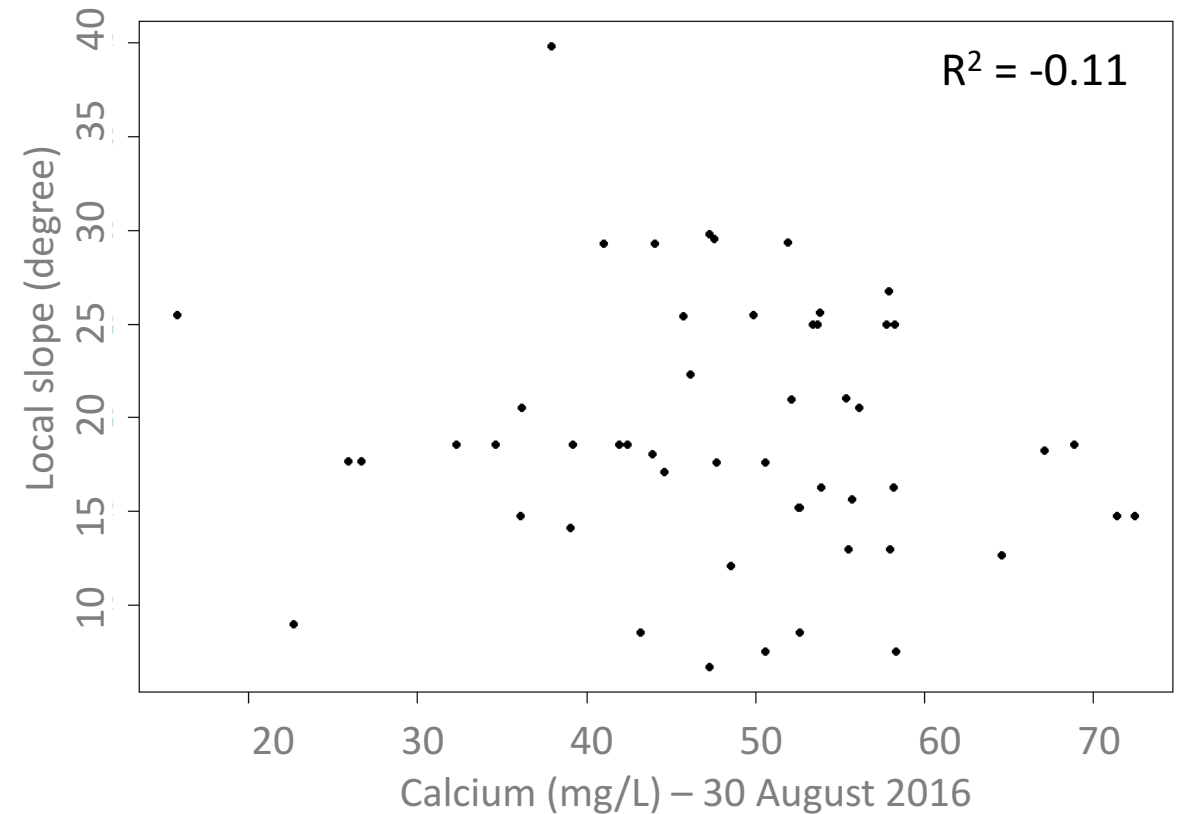
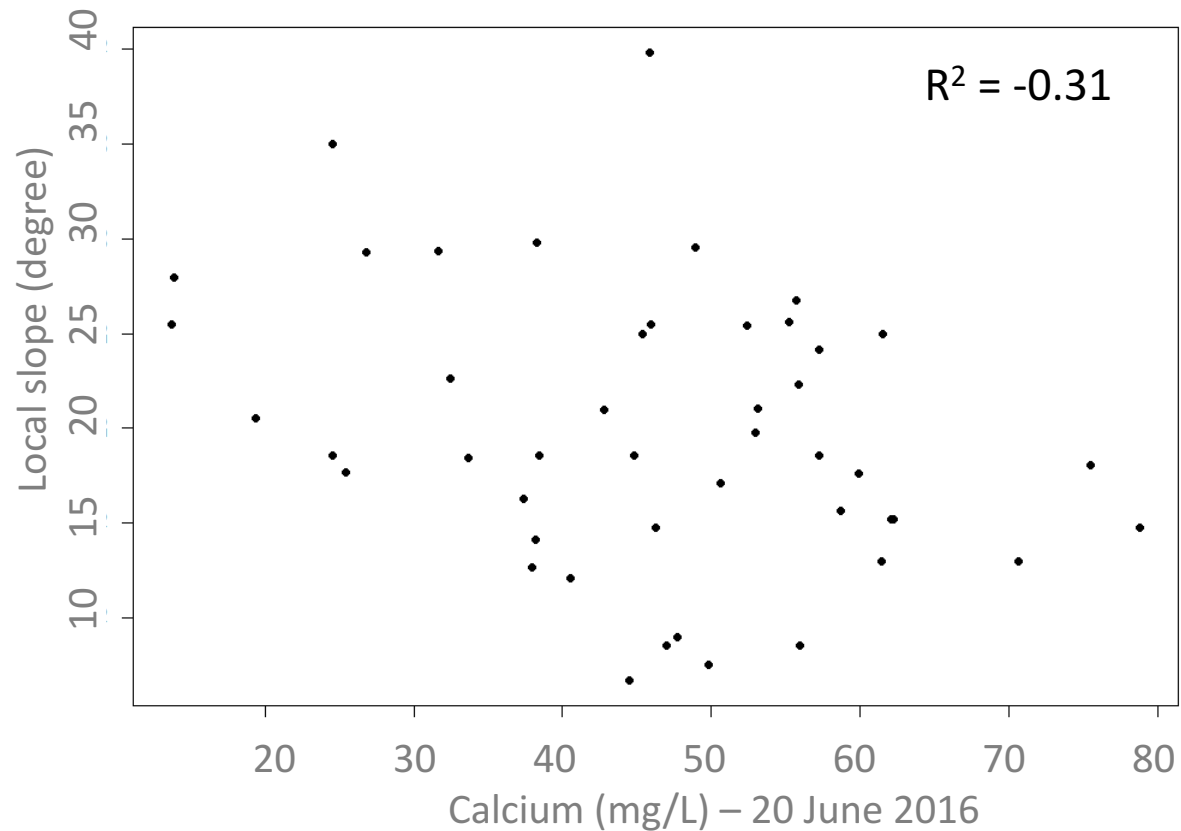
# Baseflow vs. stormflow



# What is the spatial variability in shallow groundwater chemistry?



# Topographic indices as a descriptor for chemistry?



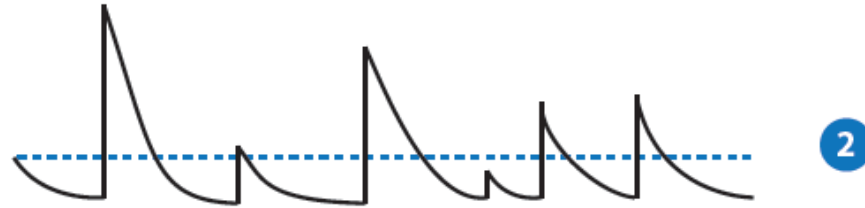


# Influence of landscape on hydrology

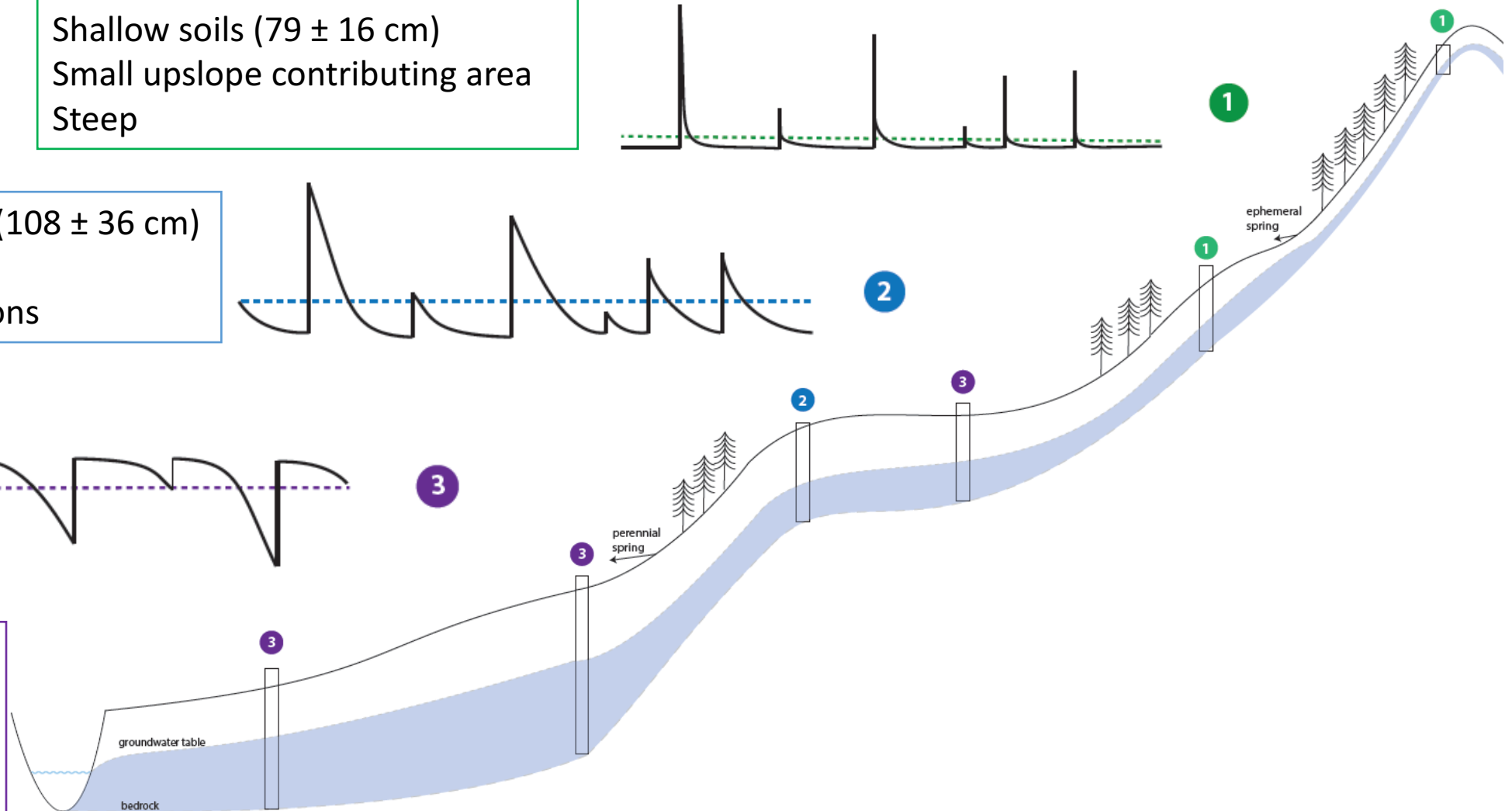
Shallow soils ( $79 \pm 16$  cm)  
Small upslope contributing area  
Steep



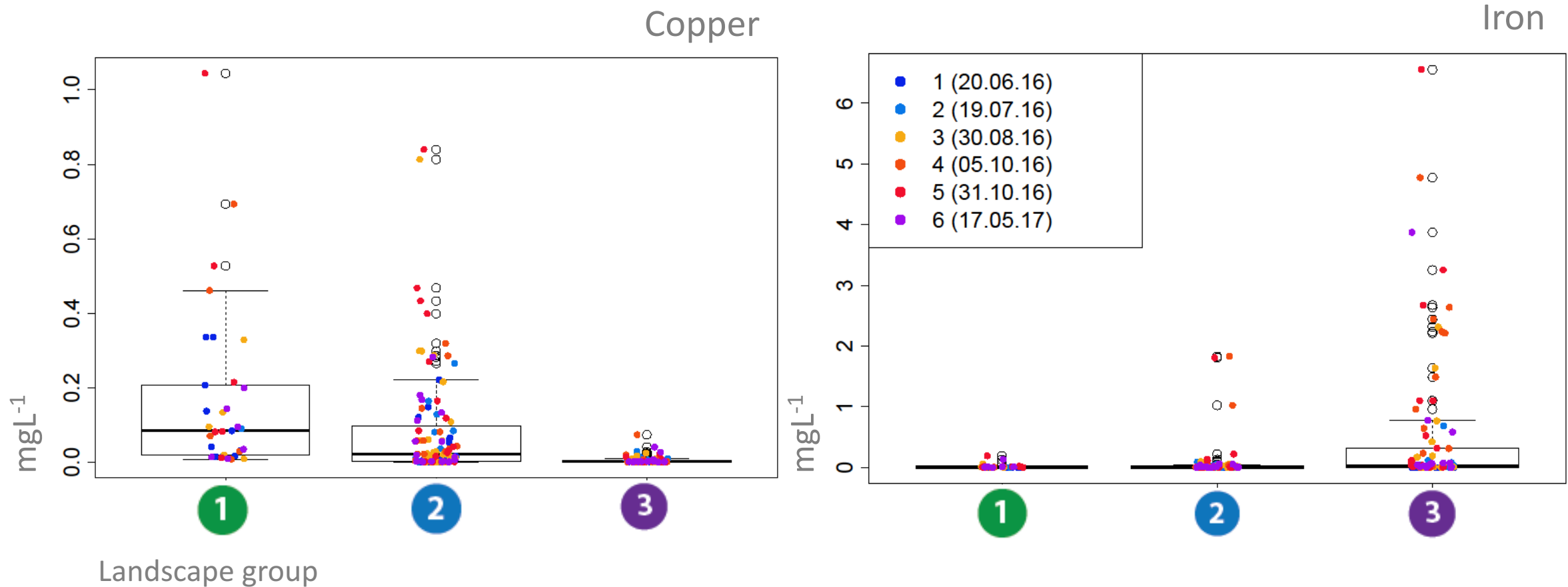
Intermediate soil depth ( $108 \pm 36$  cm)  
Slow recession  
Upslope flow contributions



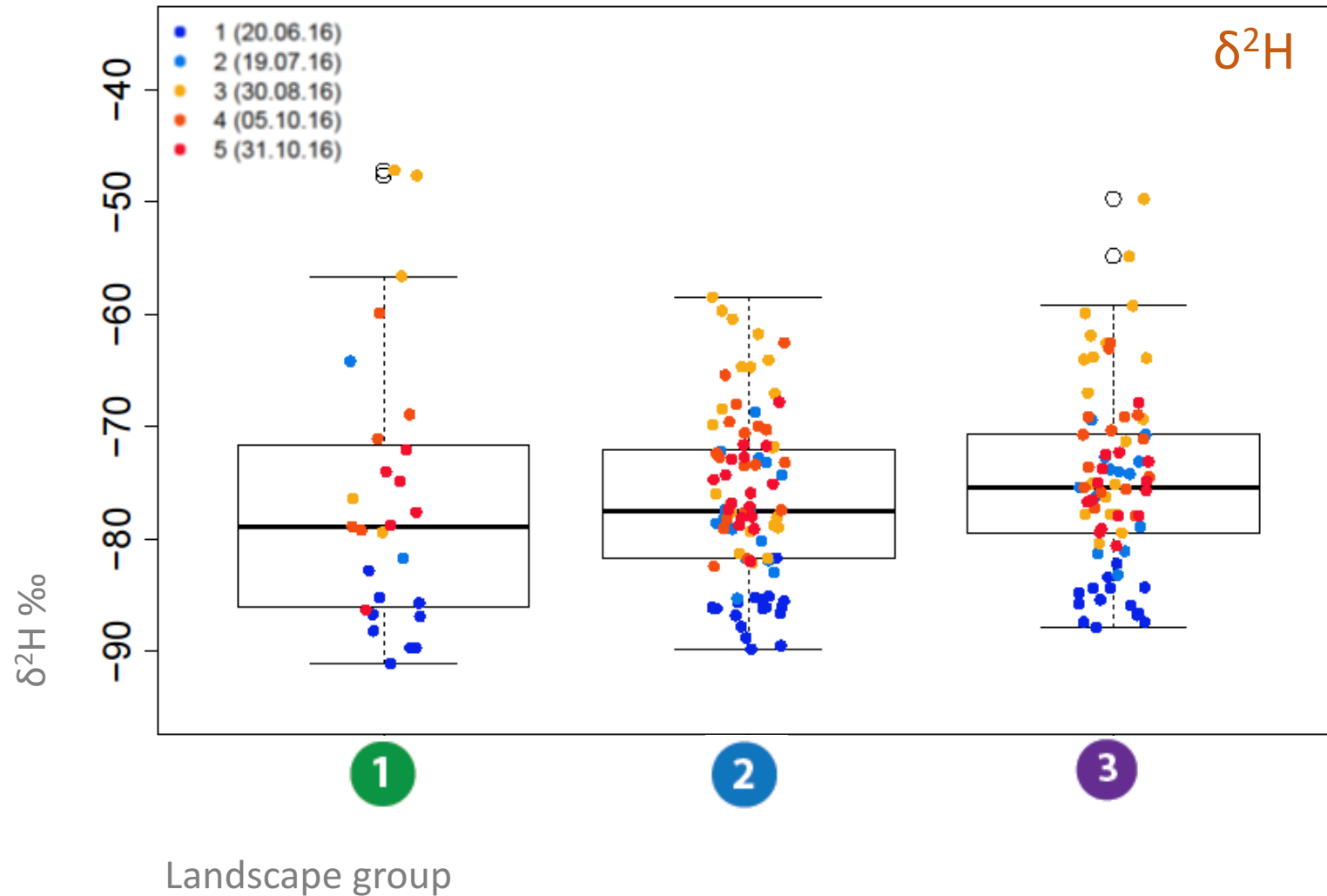
Deep soils ( $120 \pm 43$  cm)  
Persistent groundwater  
tables  
Flat



# Linking hydrological regime and chemistry

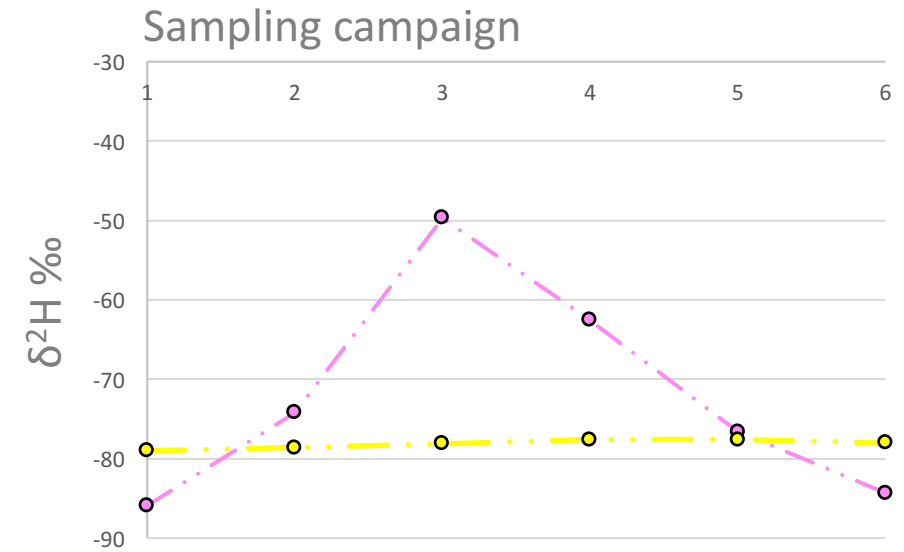
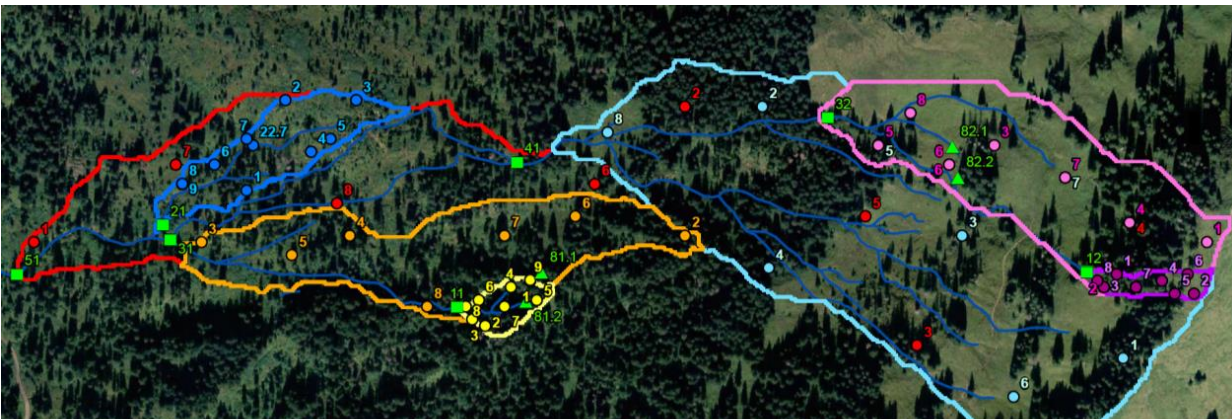
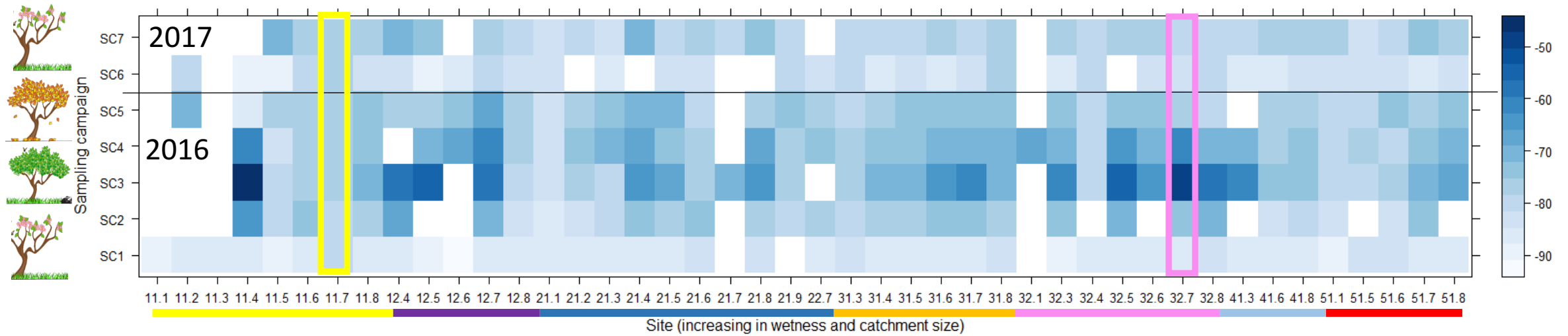


# Stable isotopes

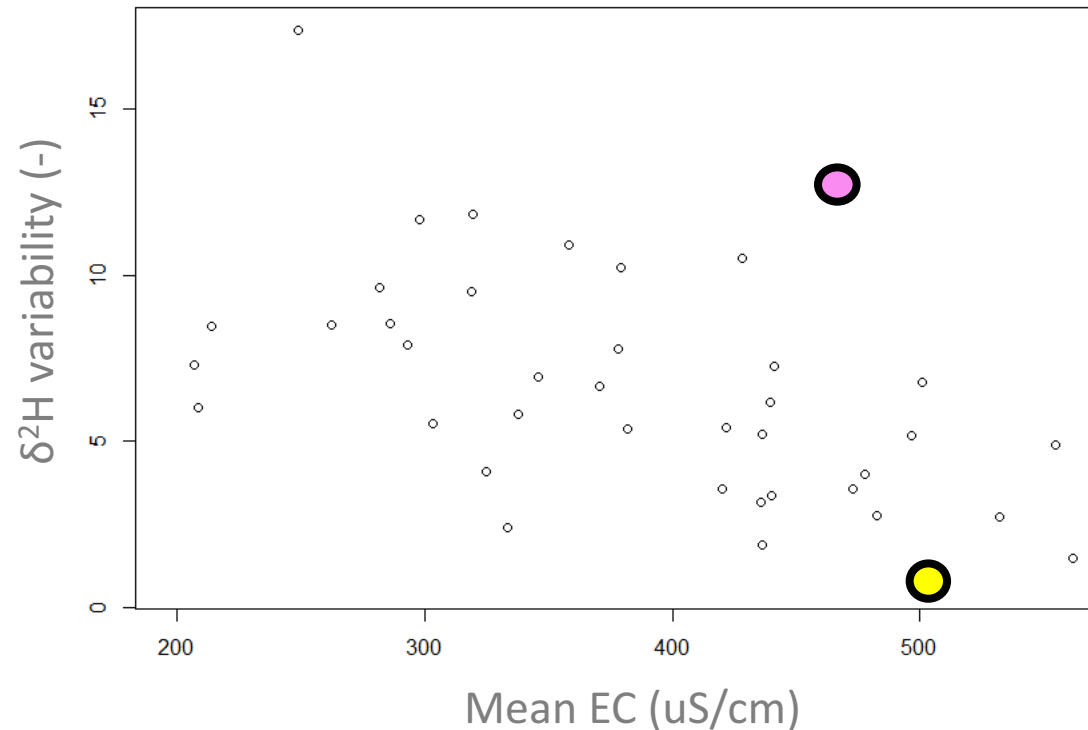
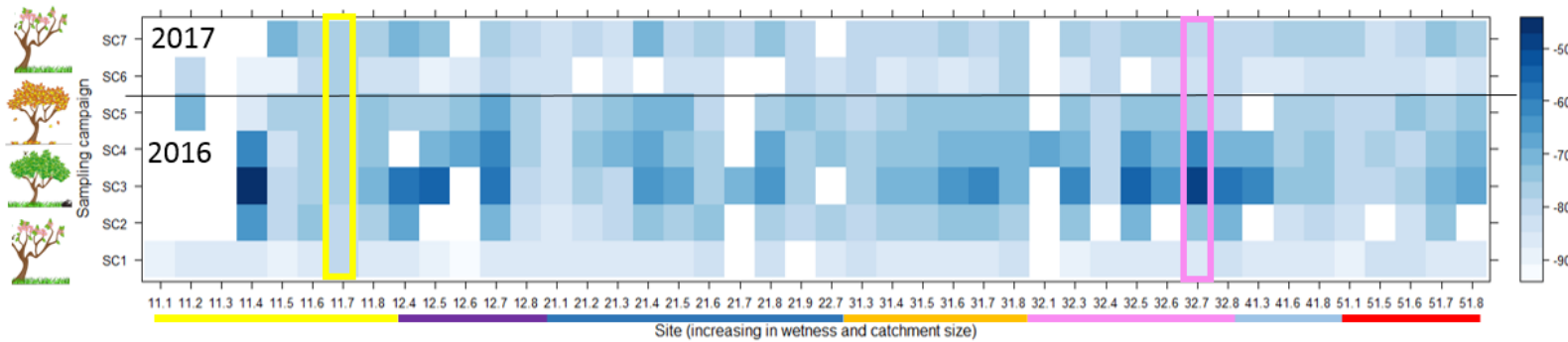




# Spatiotemporal variability stable isotopes



# Spatiotemporal variability stable isotopes



# Conclusions

We expect that:

source material + hydrological regime = groundwater chemistry

But... small-scale variability makes the picture less clear

Spatial variability in groundwater can be large over small distances which highlights the need of sampling in multiple locations!





How does this variability change during events?

What does this variability mean for hydrograph separation results?

What groundwater do we see in the stream?



Sample at multiple locations to capture the ‘real’ groundwater signal

Leonie Kiewiet  
Hydrology and Climate  
[leonie.kiewiet@geo.uzh.ch](mailto:leonie.kiewiet@geo.uzh.ch)

# What causes spatial variability?

## **Soil/rock-water interaction**

Mineral dissolution

Ion exchange

Diffusion

Redox

Chemical precipitation

Biological processes



## **Hydrological dynamics**

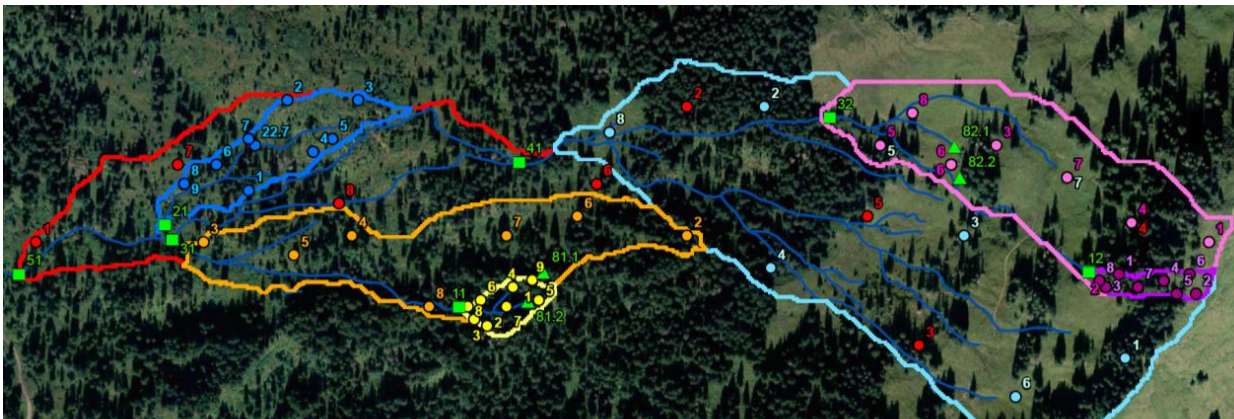
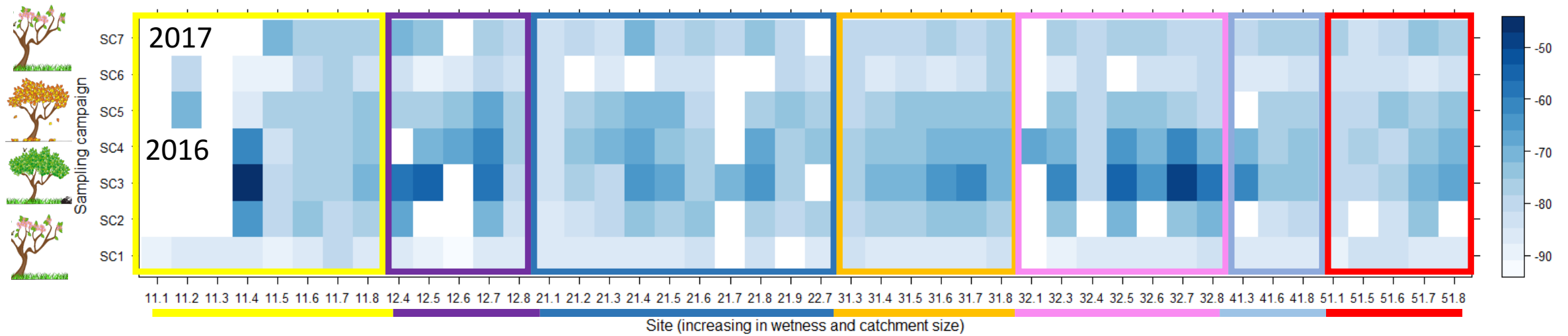
Soil heterogeneity

Preferential flow

Subsurface flow conditions

Mixing

# Spatiotemporal variability stable isotopes





- Eventueel EC slide after spatiotemporal variability stable isotopes