

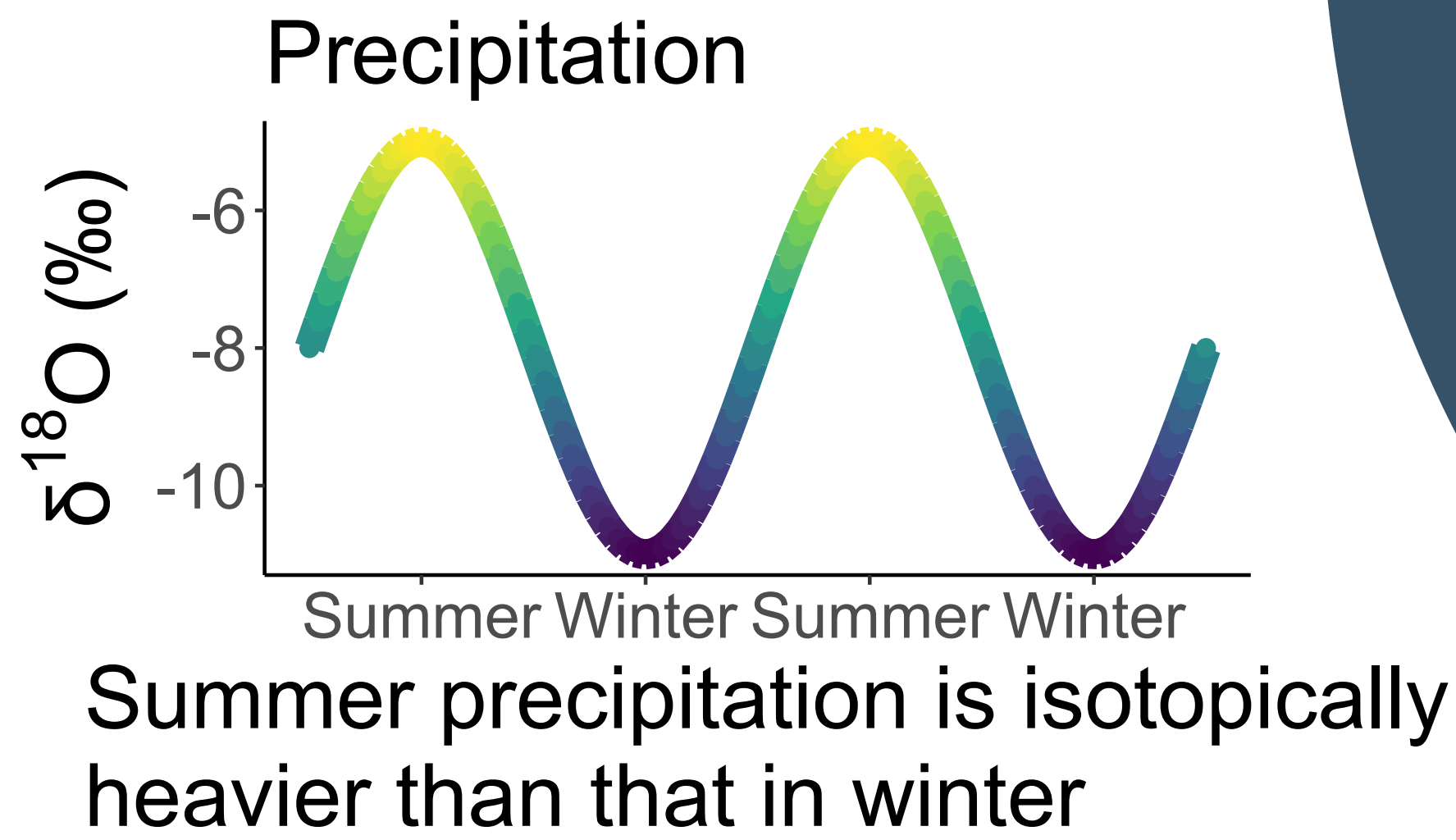
# Detecting the occurrence of preferential flow in soils with stable water isotopes

by Jonas Pyschik & Markus Weiler

## Background

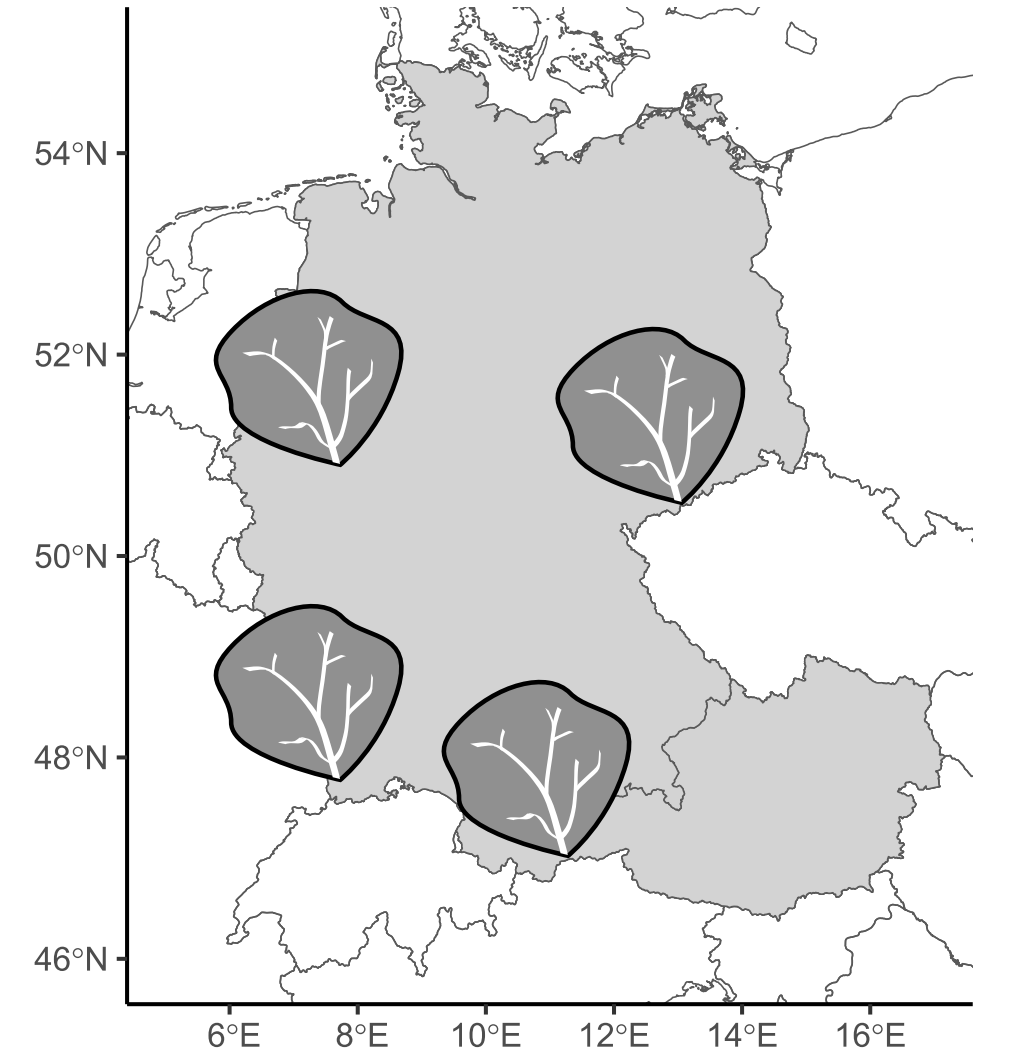
- 80% of the world's streams are within headwaters
- most headwaters are hillslopes.
- understanding hillslope runoff processes = better understanding most hydrological systems
- isotopes can be used to detect otherwise hard-to-measure processes in hillslope soils

## Isotope Seasonality



## Study Sites

Ore Mountains  
Black Forest  
Sauerland  
Alps

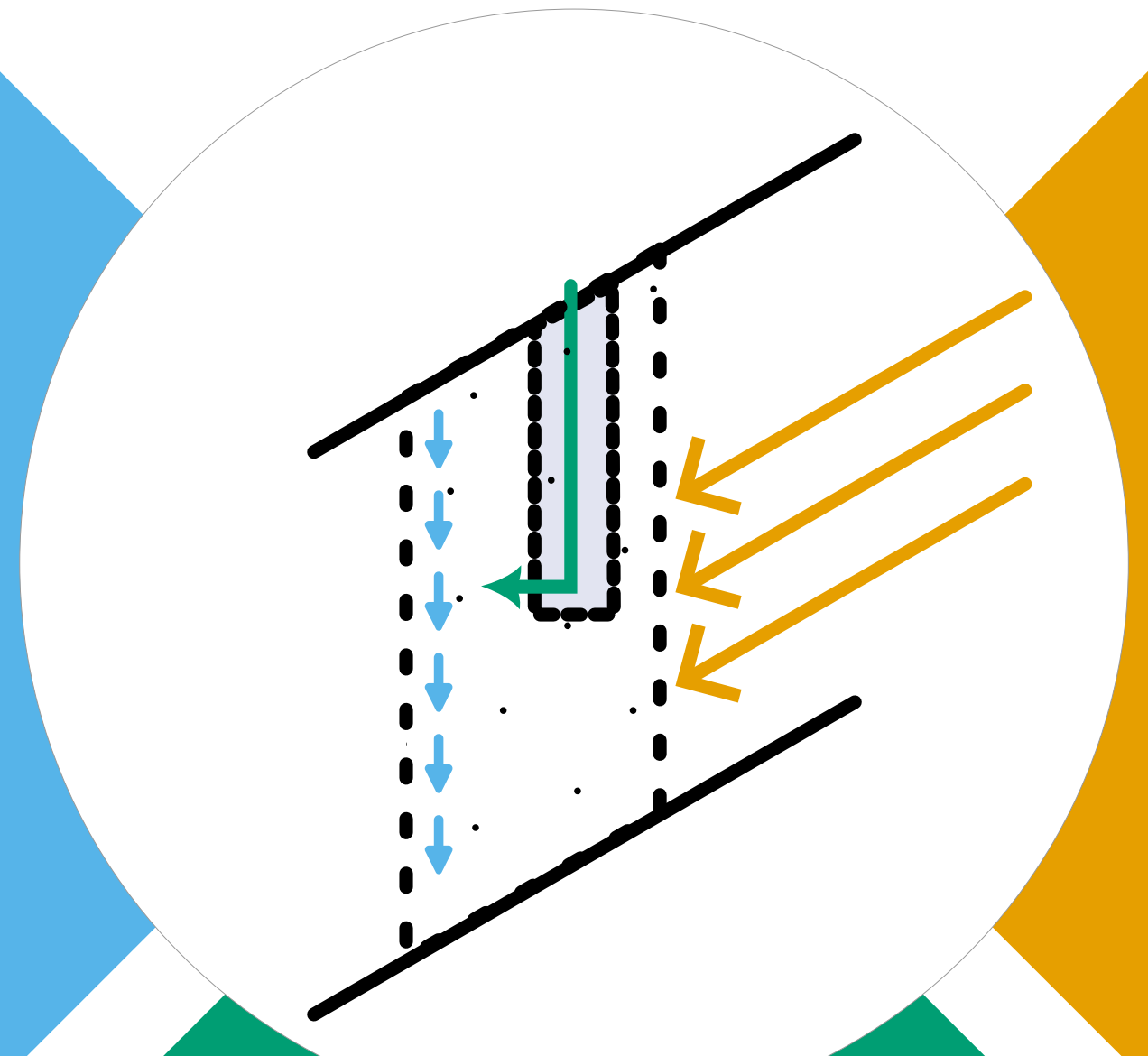


## 3 processes of hillslope soil water movement

Vertical flow

Lateral flow

Preferential flow



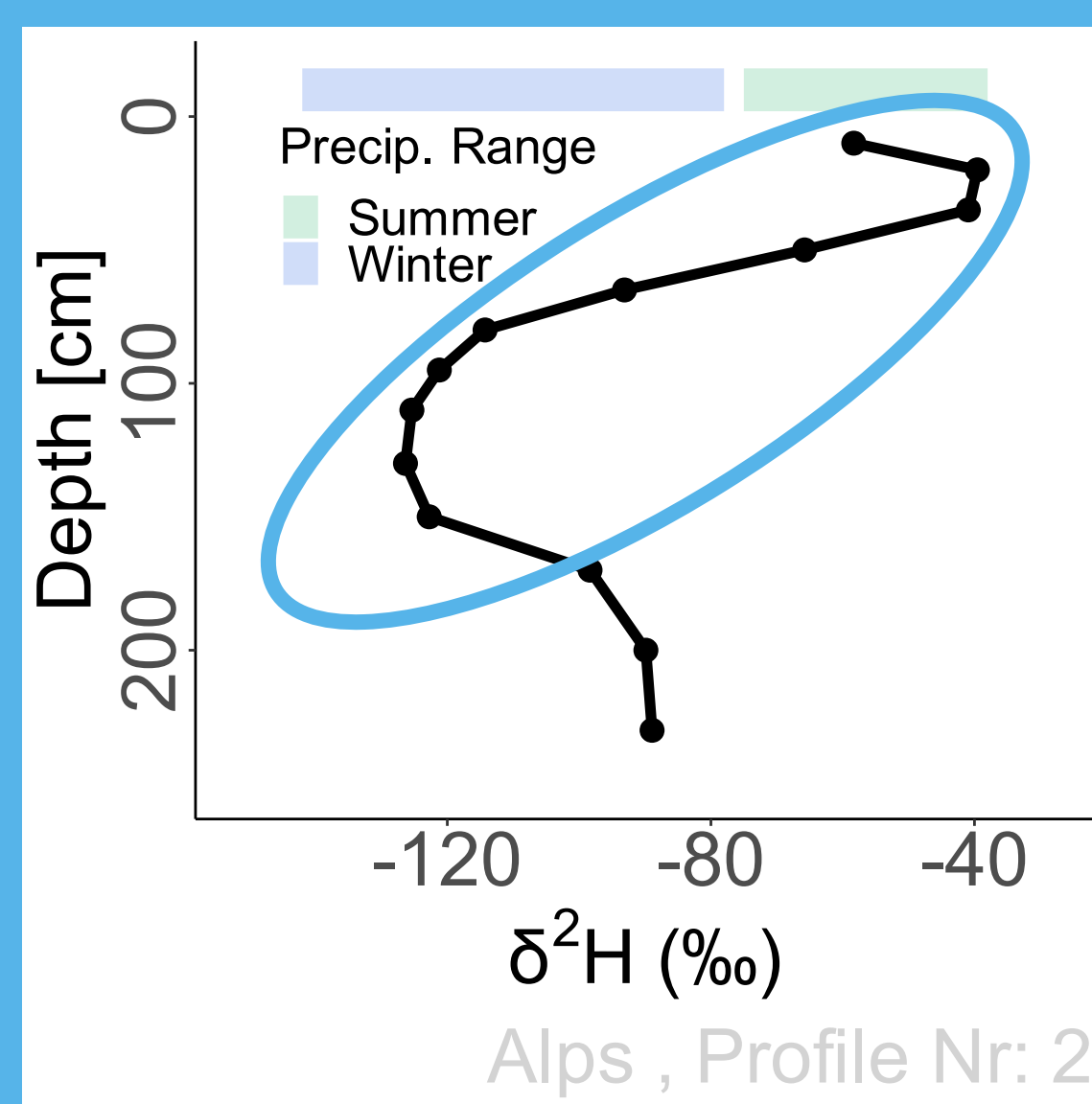
## Sampling Methods

1. Drilling to bedrock depth (1-4 m) with an auger
2. Sampling in consecutive intervals in Aluminium bags
3. Equilibration: inflate with dry air & wait 48 h
4. Analysis of  $^2\text{H}$  &  $^{18}\text{O}$ : cavity ring down spectrometer

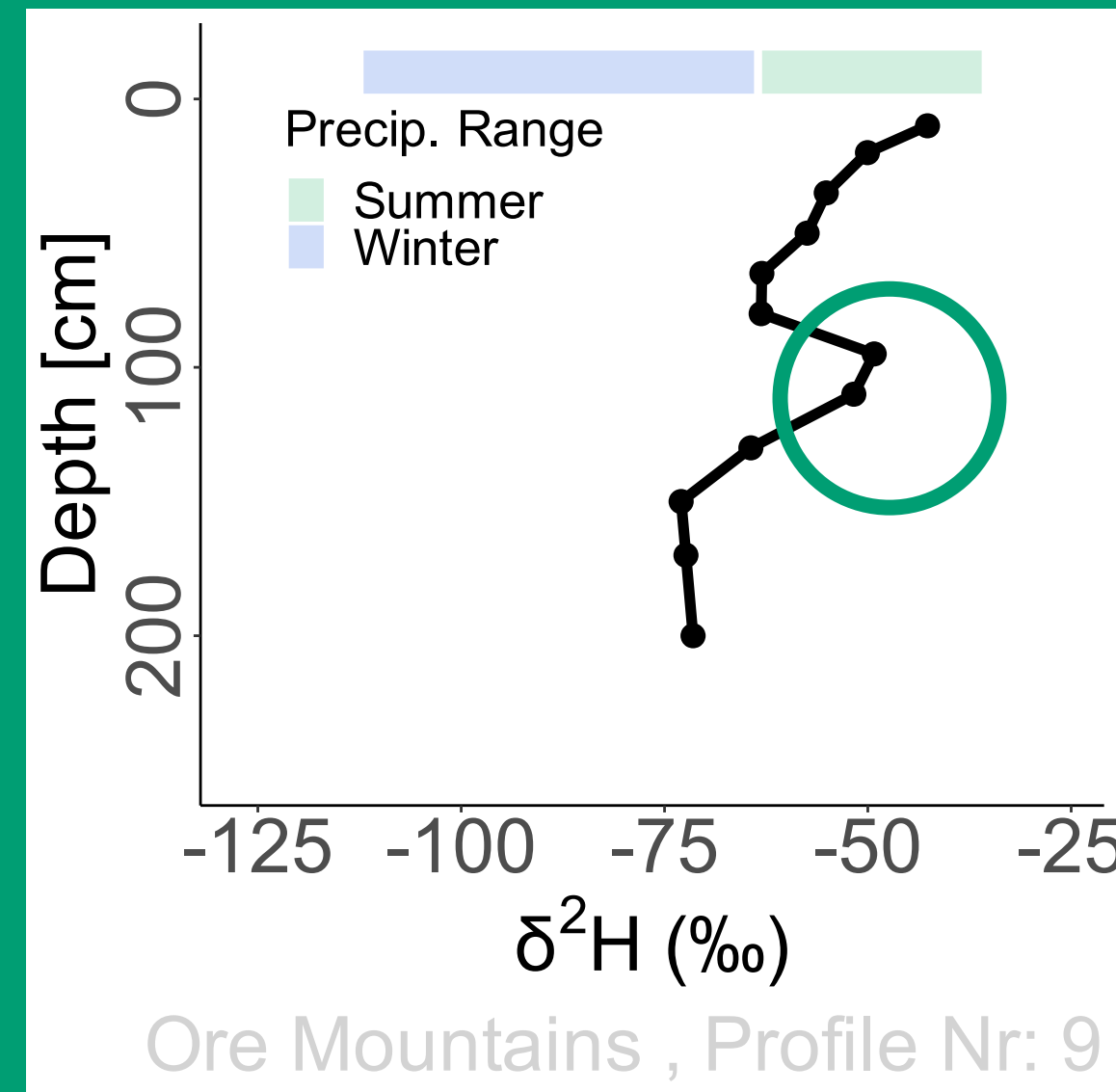
Are the 3 processes visible in soil water isotope profiles?  
Does their occurrence differ between catchments?

## Results

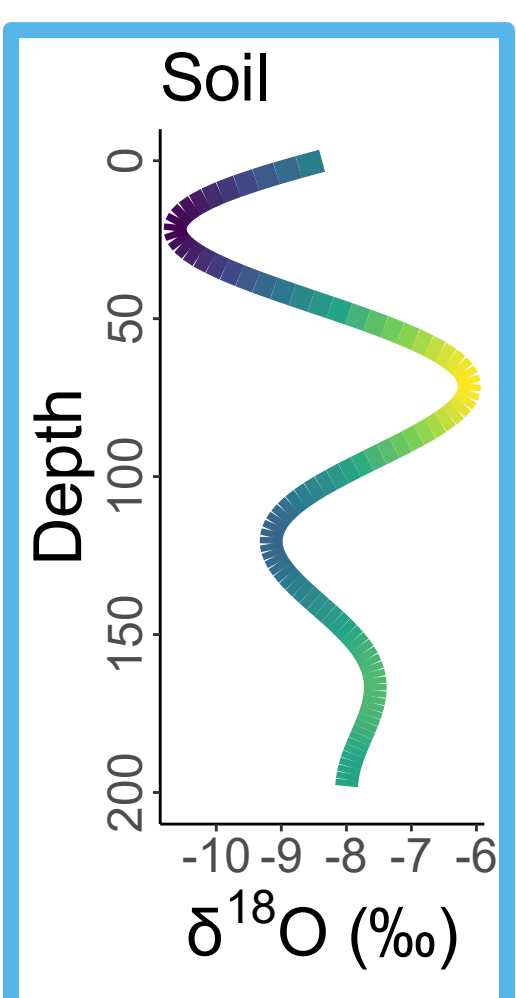
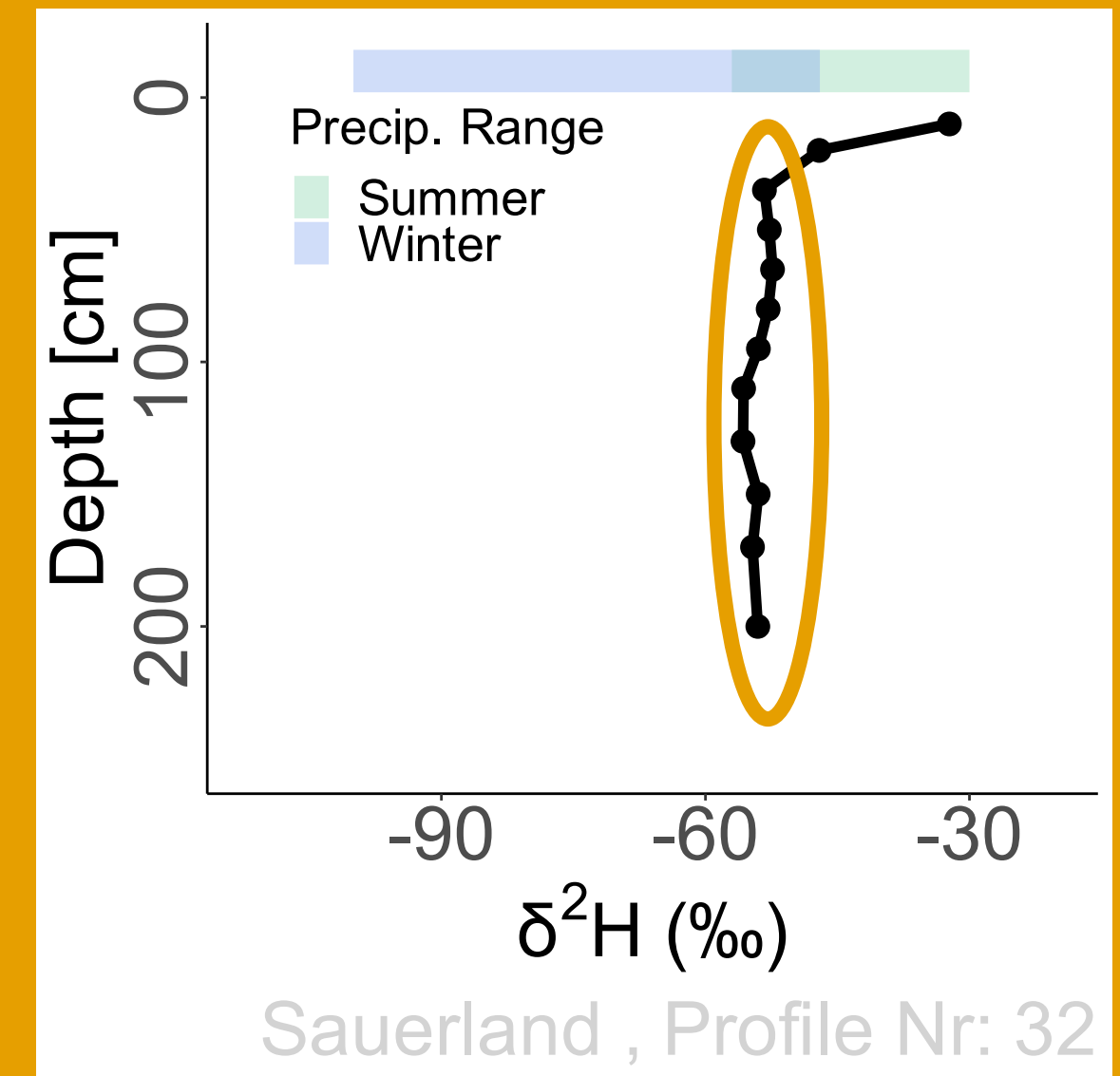
### Vertical flow



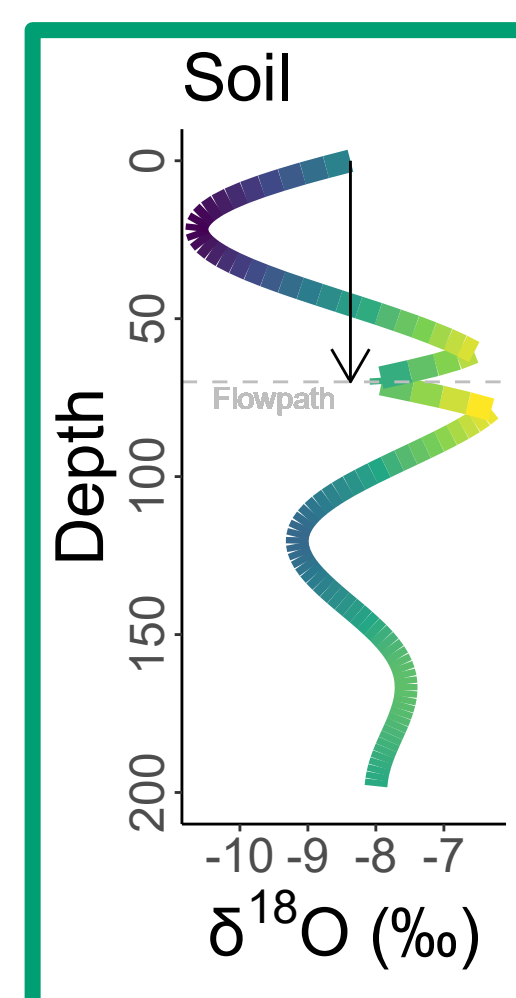
### Preferential flow



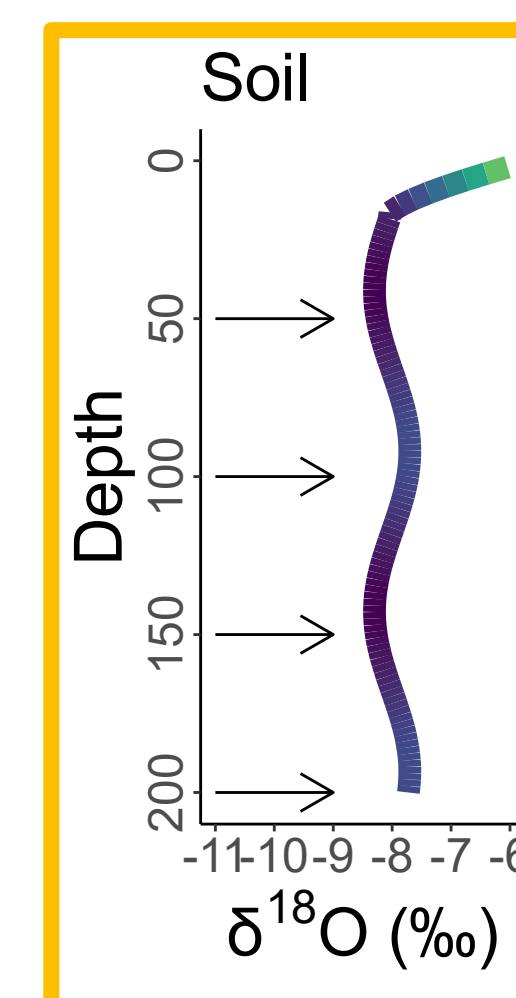
### Lateral flow



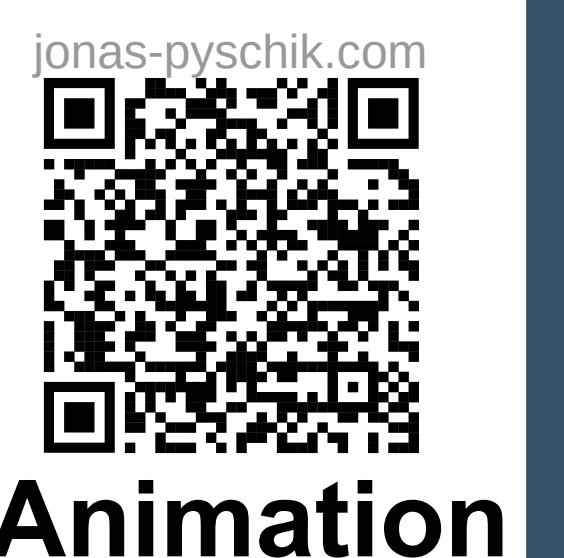
Seasonality is transferred into the soil with young event water near surface and older water further down.



Preferential flow-paths transport young event water down where it alters the isotopic signature.

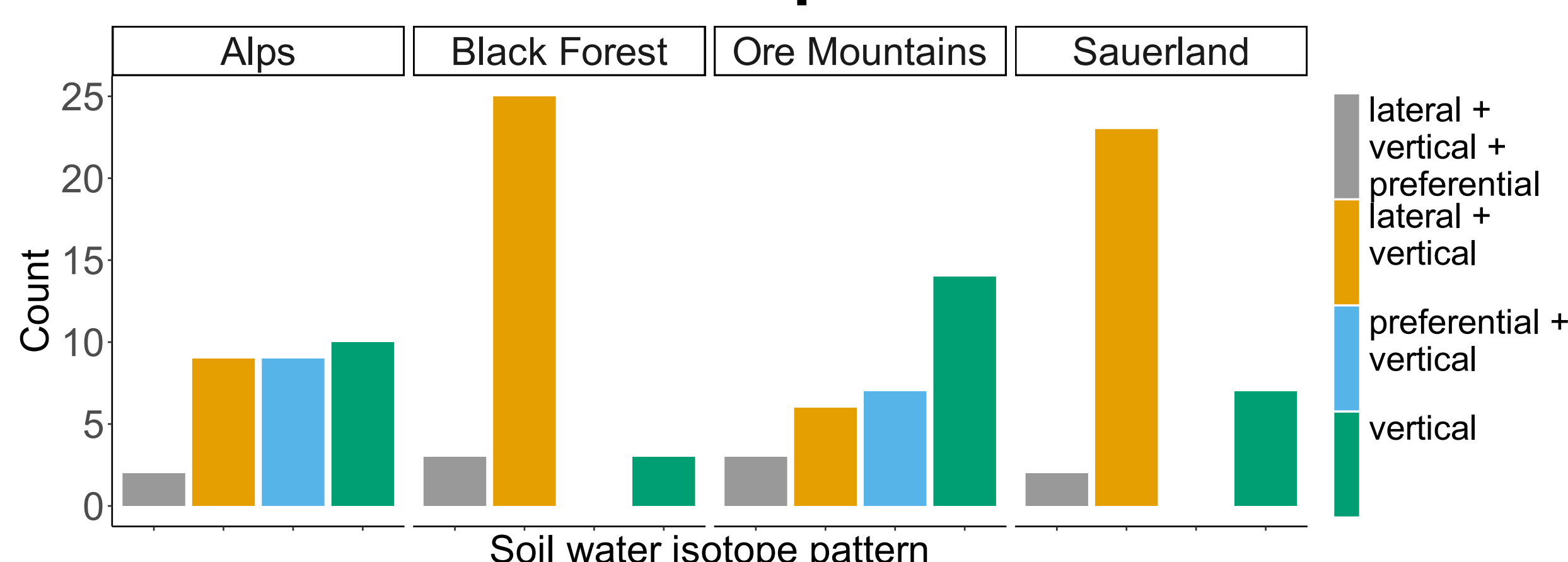


Lateral flowing water of different transit times, thus different ages dampen the isotope profile.



Graphs produced by the authors with data by [1]

## Pattern Occurrence Comparison



## Conclusion

- All 3 processes are visible in soil-water isotope profiles
- Not all processes are visible in each catchment
- Analysis will be enhanced by comparison with WSOC and eDNA