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Isotopic signals across the forest water cycle

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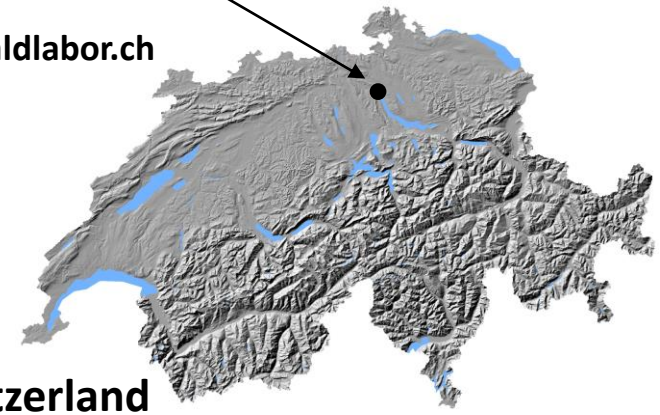

Switzerland

- 0.3 km^2 catchment
- beech & spruce mixed forest
- hillslope with small creek at the bottom

Isotope sampling in…

- precipitation (incl. throughfall & stemflow)
- Bulk, mobile soil (10, 20, 40, 80cm depth) & deep mobile water (1 to 7m depth)
- beech & spruce (and young spruce) xylem
- groundwater & streamflow

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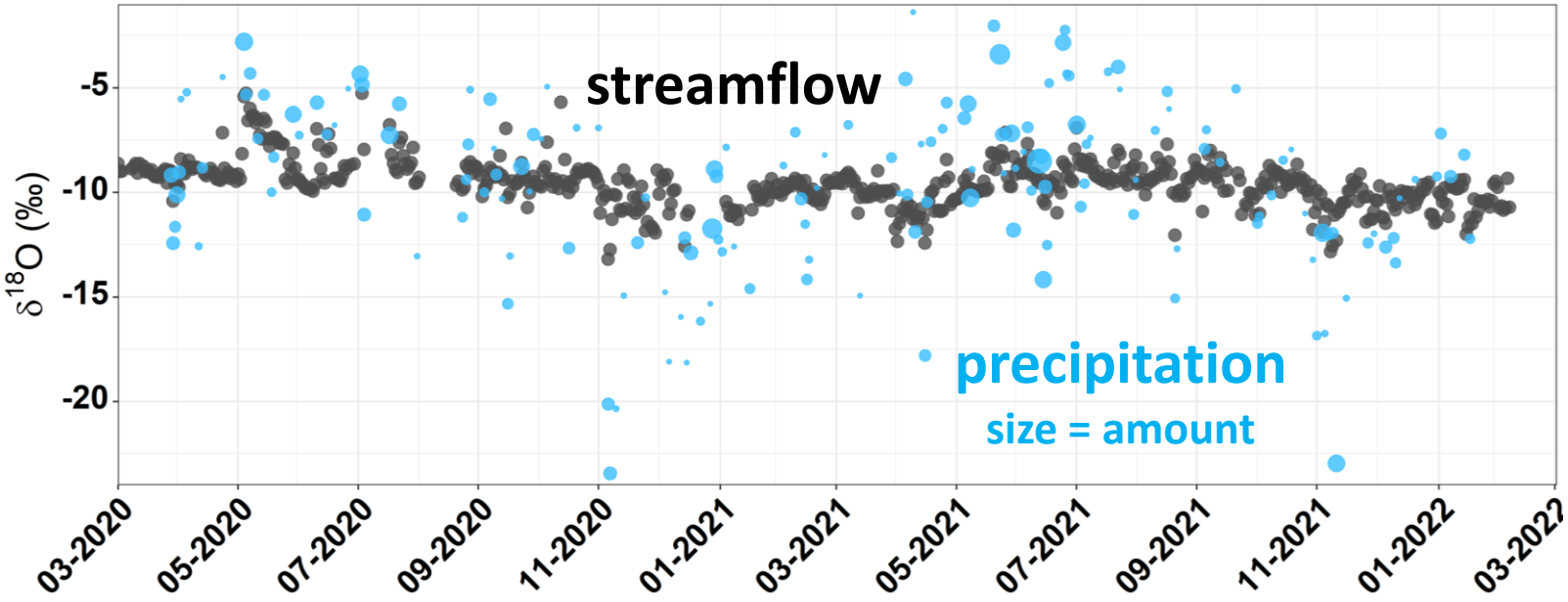
Seasonal isotope signals are damped from precipitation to streamflow

2 years of precipitation and streamflow

04-2020 to 04-2022



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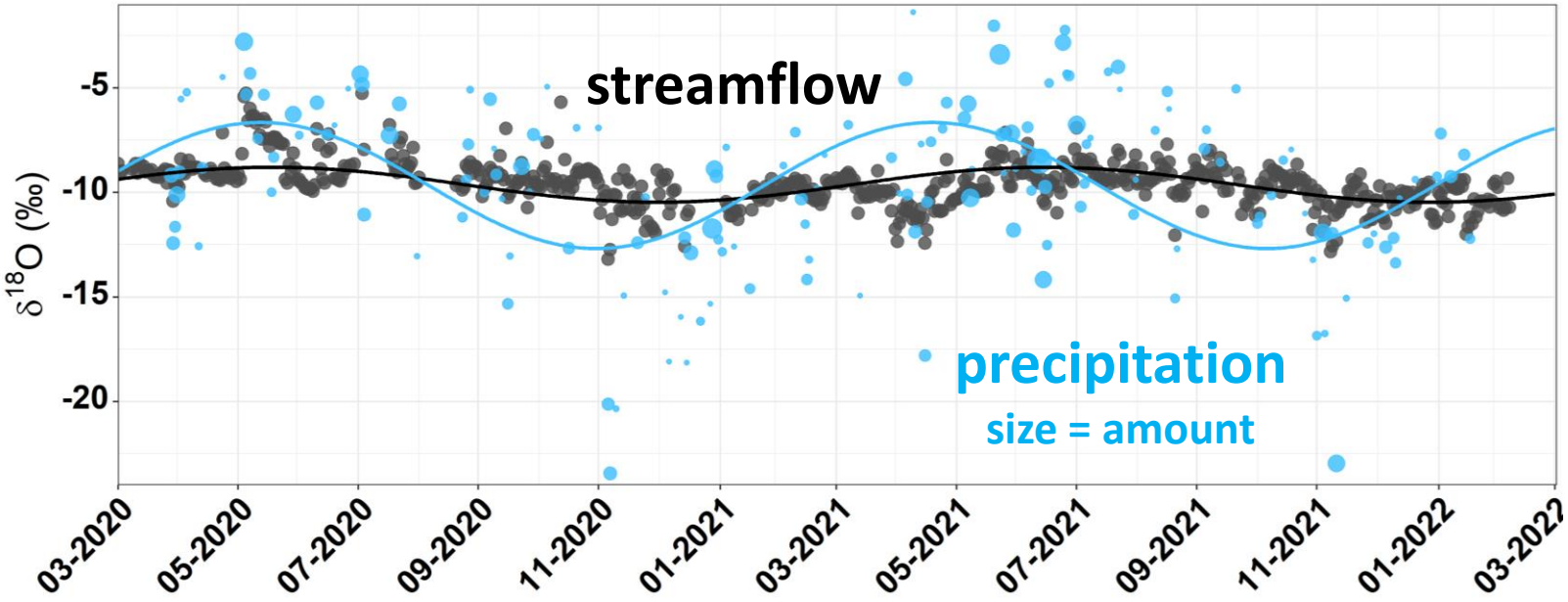

non-linear regression fit

sinusoidal function

Amplitude: 0.8

Amplitude: 3.0

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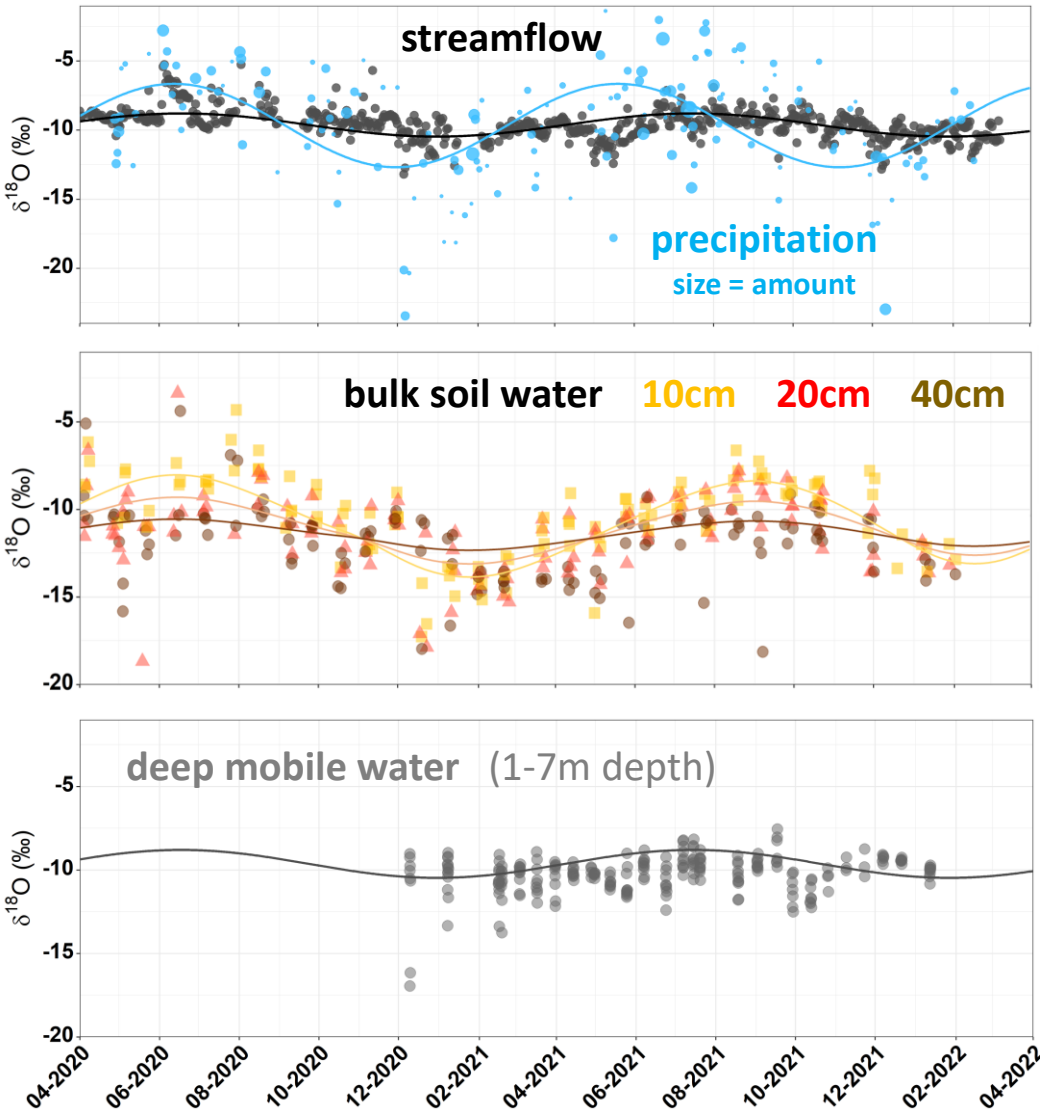

Amplitude: 0.8

Amplitude: 3.0

Amplitude: 2.6

Amplitude: 2.0

Amplitude: 1.3

Amplitude: 0.9

Seasonal isotope signals

(and young water fractions)

are damped from precipitation

to streamflow

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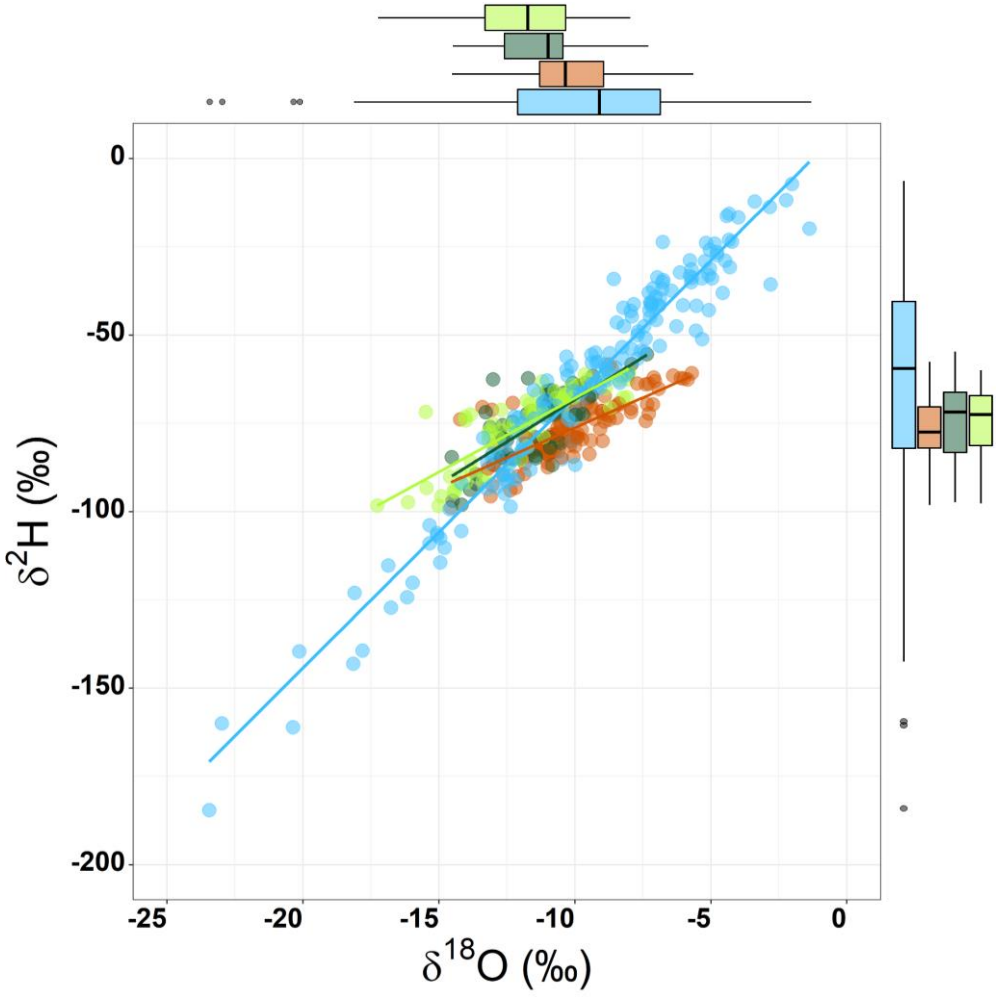
Spruce and beech species access slightly different water pools



2 years of precipitation, soil & xylem water data

04-2020 to 04-2022

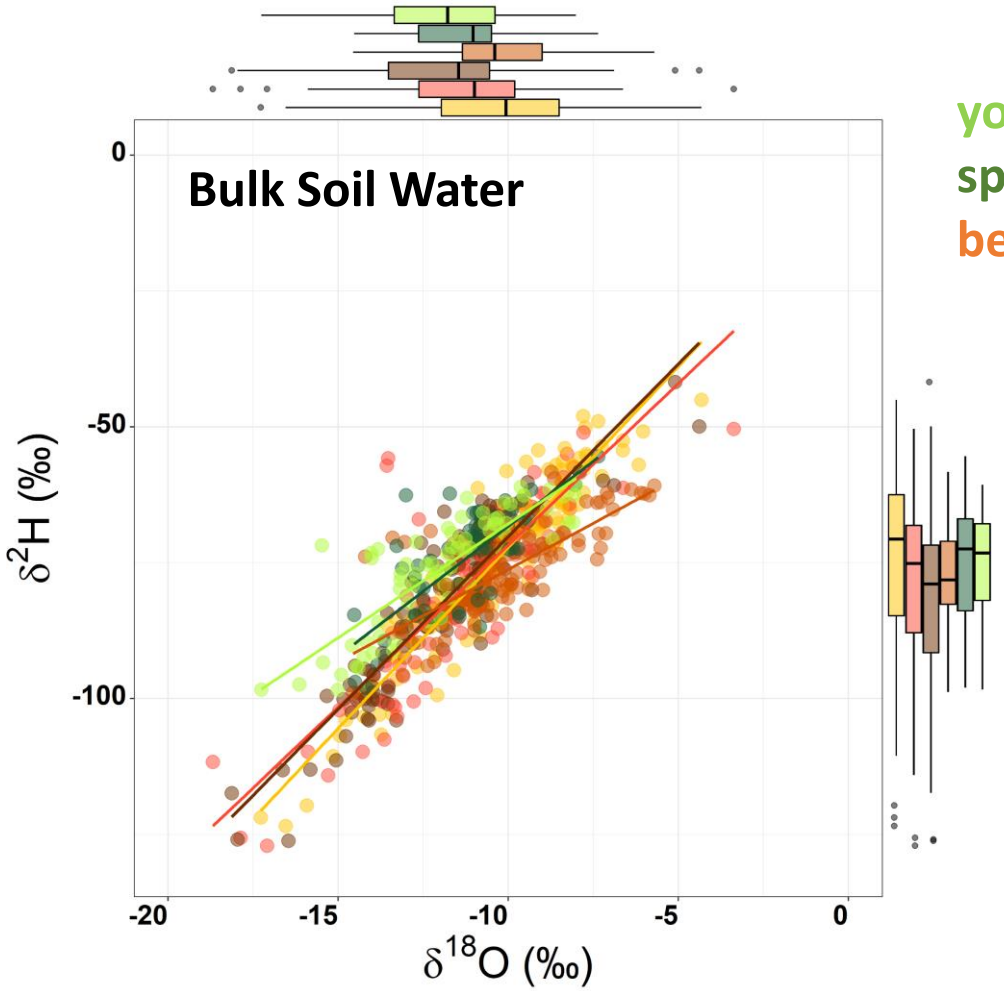
young spruce xylem

spruce xylem

beech xylem

precipitation

Spruce and beech species access slightly different water pools



young spruce xylem
spruce xylem
beech xylem

10cm
20cm
40cm

bulk soil water isotope ratios

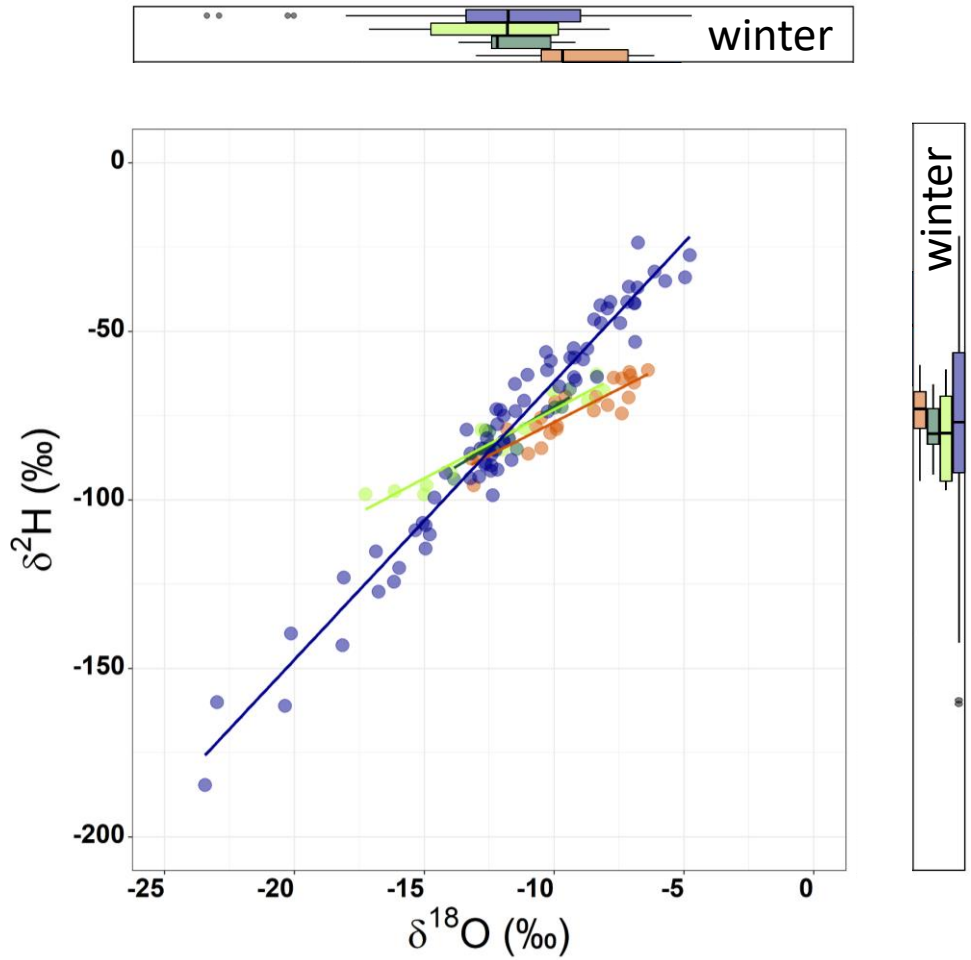
decreased with depth

- fractionation effects evaporation
- more recent precipitation

Beech use deeper water sources

than **spruce**

In winter, both spruce and beech store winter precipitation



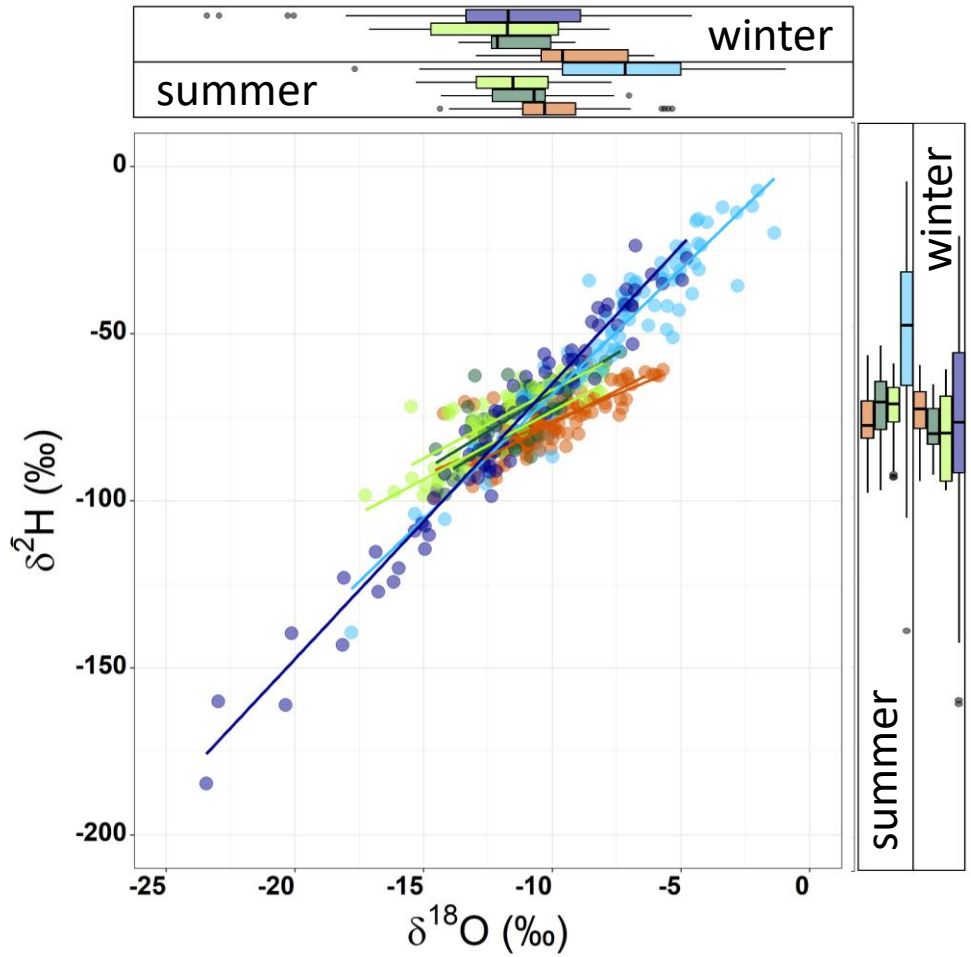
2 years of precipitation and xylem data

04-2020 to 04-2022

winter precipitation

young spruce xylem
spruce xylem
beech xylem

Spruce and beech species transpire winter precipitation



in **BOTH** summer & winter,

xylem water carries the isotopic

signature of **winter precipitation**

summer precipitation
winter precipitation

young spruce xylem
spruce xylem
beech xylem

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Take home messages

- Isotopic signatures get **damped with depth** in the subsurface
- Beech & spruce preferably access **bulk soil waters** of **different depths**
- Xylem waters contain a **winter signature** during both winter & summer

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