1/2025

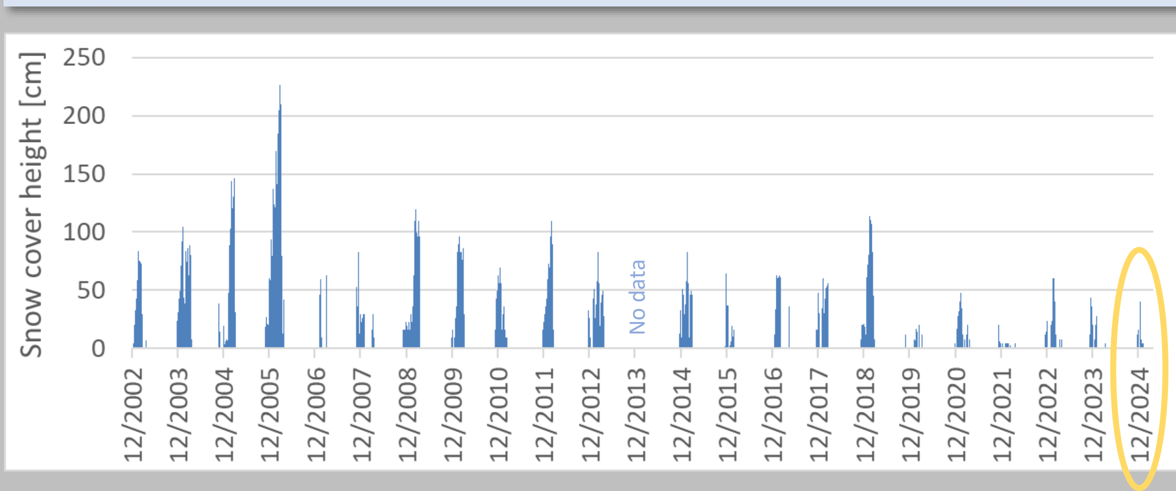
YEAR IN A FOREST

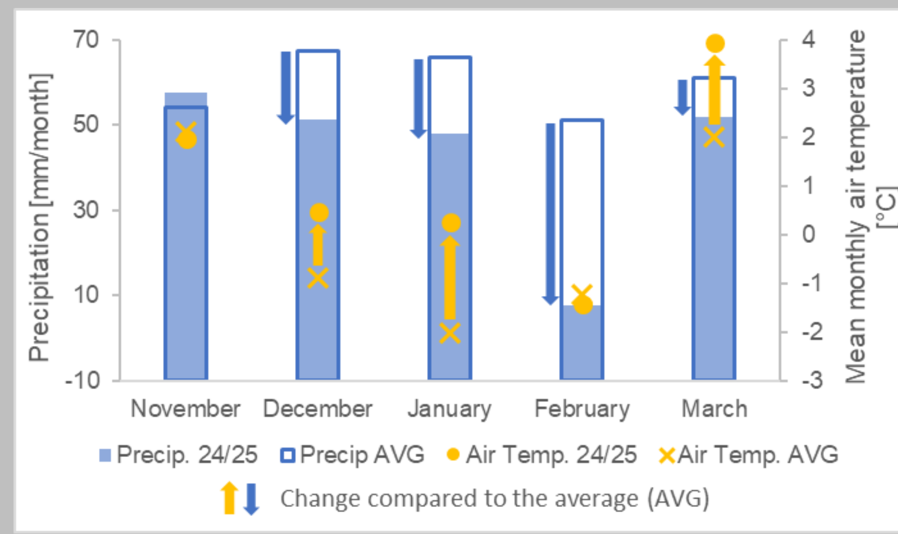
The cold season: November–March

Meteorological conditions

- Total deficit of rain of 83 mm over Nov-Mar compared to average (AVG: 2002–2024)
- Precipitation mostly in a liquid form
- Significantly higher mean air temperature in Jan (by 2.25°C) and March (by 1.95°C)
- Mean air temperature below 0°C recorded only in February (-1.4°C)

Data from our experimental catchment Liz (800–1000 m a.s.l.), detailed monitoring since 2002





Snow conditions

- Decreasing mean depth and duration of snow cover
- At open area, snow cover lasted only from 9 Dec till 22 Jan
- In forest, little snow detected and it melted away quickly

→ Not possible to analyse difference in beach and spruce forests

The role of snow cover

- Insulates the surface and thus reduces the depth to which the soil freezes
- The light color causes a significant portion of solar radiation (>70%) to be reflected back to the atmosphere and therefore it is not absorbed by the surface
- It affects when and in what amount water enters the soil and streams
- The water released during snowmelt significantly recharges groundwater reserves

The impacts of water shortages in one period can be transferred to the following ones. So what proportion of winter/summer water will we observe in beech and spruce this summer?

How to tell apart water from snow and from summer rain?

Thanks to the isotopic composition of water molecules!

- The isotopic composition tells us about the processes that water has undergone
- ‘Lighter’ molecules (containing atoms with fewer particles in the nucleus) evaporate more easily compared to ‘heavy’ molecules
- Precipitation falling to the ground is therefore isotopically lighter compared to surface water, in which the proportion of ‘heavy’ molecules is higher
- At lower temperatures, less energy is available → in winter, even smaller proportion of ‘heavy’ molecules evaporates

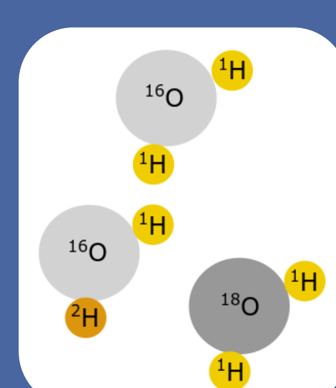
→ We can therefore recognize water originating from snow by the fact that it is ‘isotopically lighter’ than water from summer liquid precipitation

What are isotopes?

- Two atoms with the same number of protons but different number of neutrons are **different isotopes of the same element**
- A water molecule is made up of hydrogen and oxygen, but the isotopes of oxygen and hydrogen in the molecule can vary

Oxygen: ^{16}O (8 protons, 8 neutrons)
^{17}O (+1 neutron)
^{18}O (+2 neutrons)

Hydrogen: ^{1}H (1 proton)
^{2}H (D, Deuterium) (+1 neutron)



Occurrence: $H_2{}^{16}O$ (99.78%), $H_2{}^{18}O$ (0.2%), $H_2{}^{17}O$ (0.03%), $HD^{16}O$ (0.0149%)

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