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The Effect of Surface Sublimation on the Snow Isotope Signal

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Post-depositional processes affect the stable water isotope signal of surface snow between precipitation events. Combined vapor-snow exchange processes and isotope diffusion influence the top layer of snow as well as buried layers below. This implies, that ice core isotope climate proxy records can not be interpreted as a precipitation weighted temperature signal alone.

Here we present to what extend surface sublimation can explain in-situ observed changes of the stable water isotope signal in the snow.
We use direct observations of the isotopic composition of the sublimation flux together with surface snow samples taken in the North-East of the Greenland Ice Sheet accumulation zone throughout the summer months of 2019 to demonstrate sublimation impacts.
We show that, contrary to the understanding of effectless layer-by-layer removal of snow, sublimation involves fractionation and therefore influences the isotopic composition of the snow. Complementary measurements of humidity as well as isotope fluxes constrain the local vapor snow exchange and allow for the quantification of post-depositional influences while the snow is exposed to the atmosphere.
This improved process understanding of the formation of the climate signal found in snow is important for merging climate modeling and ice core proxies.