
Contribution ID: **175** Type: **Oral presentation**

# Summer snow surface water isotope variability driven by vapor-snow exchange

*Monday, 3 October 2022 14:20 (20 minutes)*

Observed variability in summer surface snow isotopic composition (∂18O, ∂D) cannot solely be explained by precipitation events. This variability, however, influences the overall summer isotope signal that is archived in ice cores. It is important to identify and quantify the impact of all signal formation processes contributing to the snow isotopic composition to ensure an optimal interpretation of ice core isotope records. Through a combination of laboratory experiments and in-situ observations from the Greenland Ice Sheet the evidence of isotopic fractionation during snow sublimation has been demonstrated. However, the impact of post-depositional processes influencing the surface snow isotope signal before it gets buried remains unquantified to-date. Here we show that the continuous exchange of humidity between the atmosphere and the snow surface through sublimation and deposition is a driver for the summer surface isotope variability. By comparing modeled against in-situ observed surface isotope variability, we demonstrate that fractionation-including vapor-snow exchange can explain 52% of the ∂D day-to-day variability and 35% of the variability observed in snow ∂18O. Further, we document substantial isotopic enrichment in the uppermost centimeters of snow induced by sublimation which suggests a vapor-exchange-induced warm-bias in the buried summer isotope signal. Our results lead to an improved process understanding and necessitate the implementation of fractionation during the sublimation process in isotope-enabled climate models.

**Primary author:** WAHL, Sonja (University of Bergen & CRYOS - EPFL, Lausanne)

**Co-authors:** STEEN-LARSEN, Hans Christian (University of Bergen); HUGHES, Abigail (Institute of Arctic and Alpine Research); ZUHR, Alexandra (Alfred-Wegener Institute Helmholtz-Center for Polar- and Marine Research); FABER, Anne-Katrine (Geophysical Institute University of Bergen and Bjerknes Centre for Climate Research, Bergen, Norway); DIETRICH, Laura (Geophysical Institute, University of Bergen); BEHRENS, Melanie (Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung, Bremerhaven, Germany); HÖRHOLD, Maria (Alfred-Wegener-Institute Helmholtz-Zentrum für Polar- und Meeresforschung)

**Presenter:** WAHL, Sonja (University of Bergen & CRYOS - EPFL, Lausanne)

**Track Classification:** Progress in proxy development and interpretation