# Quantifying the stable water isotope exchange between snow surface and lower atmosphere by direct flux measurements

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**Abstract**

Understanding surface processes in the polar areas are important for accurately simulating future climate. Measurements of the stable water isotope flux between the surface and the atmosphere offer the potential to constrain physical surface exchange processes. In addition, such observations allow for the evaluation of surface fluxes in the hydrological cycle of isotope-enabled climate models.

Here we present a record of stable water isotope surface fluxes measured in-situ in the accumulation zone of the Greenland Ice Sheet at the East Greenland Ice Core Project site. We measured isotope fluxes above the snow surface directly by combining high frequency eddy covariance measurements with low frequency isotope measurements from a cavity ring-down spectrometer (CRDS). A method was developed to correct for the high frequency loss of the CRDS by combining humidity measurements from both, the CRDS and eddy covariance instruments. Using this approach our measurements provide the first direct observations of water isotope fluxes in the polar areas.

We observed a clear diurnal cycle in the isotope fluxes and a net loss of stable water isotopes from the snow surface to the atmosphere over the course of the summer measurement campaign. The isotopic composition of the humidity flux shows a significant enrichment throughout the season. These observations open up for the possibility of quantifying the influence of isotopic exchange on the climate signal stored in the snow.