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How to sample precipitation/fresh snow on the plateaus of the ice sheets for isotopic analysis

Content

One standard climate parameter derived from ice cores is the stable water isotopic composition of the ice, formed at the ice sheet's surface. Whereas the isotopic composition of surface snow is relatively well known, the isotopic composition of the snow precipitation, as one input to the snow and ice isotopic composition of the ice sheet, is basically unknown. Simulations from isotope models are commonly calibrated against surface snow, the overall amount of precipitation is low and processes altering the isotopic composition of snow after a precipitation event are not yet well understood. One approach to determine the isotopic composition of precipitated snow is the direct sampling of fresh snow. However, often the sampling protocol in most Antarctic and Greenland research stations aim at collecting fresh snow once a day. This procedure exposes the snow to sublimation, which is not considered in the interpretation of the isotopic composition. We demonstrate that sublimation induced artefacts cannot be neglected and can introduce extreme scattering in the δ -excess, in particular during the summer. Relative humidity is usually below saturation so that during a large part of a day sublimation is possible. Series of fresh snow samples taken at Kohnen Station, the former EPICA-DML drill site, clearly demonstrate that snow not taken from the surface is highly susceptible to uncontrollable sublimation artefacts. These artefacts may explain some of the discrepancies discussed for the spatial/temporal isotope-temperature relationship.

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Track Classification: Progress in proxy development and interpretation