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Moisture sources and isotope signatures of snow and water vapour at the Norwegian mountain station Finse (1222m)

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Snow in Norway is an important resource for the hydro power industry. In a future climate, the amount and distribution of snowfall might change as a response to a changed atmospheric circulation. We utilize stable water isotopes and tracking of atmospheric water vapour to investigate the sources of the Norwegian snow pack. By analyzing the moisture origin in order to understand its transport pathways, variability and extremes, we gain the knowledge needed to manage future changes.

We identify the climatological winter mean moisture origin for the Norwegian mountain station Finse (1222m, 60.6N, 7.5E), using a Lagrangian moisture source diagnostic based on the FLEXPART model and ERA Interim reanalysis data from 1979 to 2018. Moisture sources in the North Atlantic and Norwegian Sea are characterised in terms of the source location, travel distance and environmental parameters as temperature and humidity at the moisture source, as well as the inter-annual variability of these properties.

Snow pit sampling was carried out at Finse during the season 2017-18 and has been measured for their stable water isotopic composition, expressed by main parameters dD, d18O and derived secondary parameter d-excess, which is related to evaporation conditions. These results establish a baseline for the isotopic measurements and their use for comparison with moisture origin analysis and provide a guide for continuing field campaigns and in site observations.

In addition, we present initial results from continuous water vapour stable isotope measurements, high-resolution snowfall sampling, and snow pit measurements from the 2018/2019 winter season to provide insight into how the moisture source information is converted from an atmospheric signal to a deposited record in the snow pack. This will allow direct comparison of in situ isotopic measurements with moisture tracking analysis on an snowfall event basis.