Title	**Cloud microphysical processes during ISLAS 2020 campaign in Ny-Ålesund**

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Arctic clouds are associated with a range of processes that contribute to uncertainty in the numerical weather prediction and climate models. In order to improve our understanding of cloud microphysical processes, the stable water isotopes can be utilized, since their composition in water vapour and precipitation reflects phase changes during cloud formation, within and below the clouds.

During the ISLAS campaign in spring 2020 in Ny-Ålesund and at the mainland of Norway , we conducted water vapour isotope measurements from evapouration to precipitation in cold-air outbreaks (CAOs) and warm air intrusions (WAIs). The thermodynamic conditions during four CAO and three WAI regimes were studied using ground-based measurements, Cloudnet and radiosonde profiles.

During the CAOs, local ice nucleation events and formation of shallow stratiform clouds were observed. The ice particles formed via vapour deposition on the ice nuclei, and additional riming was detected when supercooled droplets were present on the top of the ABL.

During the WAIs, the temperature and cloud top height increased, and a thin layer of cloud droplets was identified on the top of the supercooled droplets and ice clouds. In unstable stratification, the supercooled droplets were mixed with ice particles facilitating spontaneous riming within the cloud.

The isotopic composition of the equilibrium vapour from the precipitation samples showed strong correlation with the vapour measured at the Zeppelin station at 474 m a.s.l. Snow was more depleted in heavy isotopes than surface vapour, indicating that a large portion was formed aloft at colder temperatures. Irrespective of the regime defined based on the ground-based observations, the strongest discrepancy between the precipitation and vapour data was observed during the presence of clouds and specific humidity inversions above the ABL. Both features indicate the importance of considering contribution from different vapour sources during snow formation for interpretation of precipitation samples.