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Year-long observations of chemical properties of organic aerosols and cloud residuals at the Zeppelin Observatory, Svalbard

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The number of cloud seeds, e.g. cloud condensation nuclei (CCN) and ice nucleation particles (INP), in the pristine Arctic shows a large range throughout the year, thereby influencing the radiative properties of Arctic clouds. However, little is known about the chemical properties of CCN and INP in this region. This study aims to investigate the chemical properties of aerosol particles and trace gases that are of importance for cloud formation in the Arctic environment, with focus on the organic fraction.

Over the course of one full year (fall 2019 until fall 2020), we deployed a filter-inlet for gases and aerosols coupled to a chemical ionization high-resolution time-of-flight mass spectrometer (FIGAERO-CIMS) using iodide as reagent ion at the Zeppelin Observatory in Svalbard (480 m a.s.l.), as part of the Ny-Ålesund Aerosol Cloud Experiment (NASCENT). The FIGAERO-CIMS is able to measure organic trace gases and aerosol particles semi-simultaneously. The instrument was connected to an inlet switching between a counterflow virtual impactor (CVI) inlet and a total air inlet. This setup allows to study the differences in chemical composition of organic aerosol particles and trace gases at molecular level that are involved in Arctic cloud formation compared to ambient non-activated aerosol.

We observed organic signal above background in both gas and particle phase all year round. A comparison between the gas phase mass spectra of cloud-free and cloudy conditions shows lower signal for some organics inside the cloud, indicating that some trace gases are scavenged by cloud hydrometeors whilst others are not. In this presentation we will discuss the chemical characteristics of the gases exhibiting different behavior during clear sky and cloudy conditions, and the implications for partitioning of organic compounds between the gas, aerosol particle and cloud hydrometeor (droplet/ice) phase.