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In situ cloud and aerosol observations in the arctic region during the RadSnowExp campaign

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The high latitudes are likely to experience an increase in annual mean precipitation by the end of this century [1]. However, the difficulties in data collection and limited numbers of monitoring stations have resulted in significant knowledge gaps about these regions [2]. In the last decade, there has been an improvement in the characterization of cloud structures, microphysical properties and aerosol content at high-latitudes as a result of new research satellites such as CloudSat and Calipso and focused field studies using aircraft, ship and ground observations. While the details of the ice-nucleation mechanisms in Arctic clouds remain controversial, recent studies provide increasing evidence that aerosol population has an important role in these mechanisms [1].

The RadSnowExp is a multi-platform and multi-sensor study organized by the European Space Agency (ESA) and conducted by the National Research Council of Canada (NRC) and Environment and Climate Change Canada (ECCC), to address the pressing need for provision of precipitation measurements, locally and globally. In this study we investigated and documented spatial and temporal variability, intensity and types of precipitation with complementary in situ and remote sensing measurements in the arctic region in the vicinity of Iqaluit (~63N), Nunavut, Canada in November 2018, a month with the highest occurrence of frozen precipitation in this region. Our objectives included identification of remote sensing signatures, characterization of cloud microphysical properties and aerosol-cloud interactions, as well as, evaluation of the sensitivity of the instruments to particle size and morphology, evaluation of their spatial and temporal resolution and collection of data that can be used for future precipitation missions.

In this study, we used the NRC Convair-580 twin-engine aircraft with wing-mounted pylons equipped with an array of commonly used cloud probes; e.g. Cloud Droplet Probe (CDP), Precipitation Imaging Probe (PIP), Fast Cloud Droplet Probe (FCDP), 2D-S, Nevzorov and aerosol instruments such as Ultra High Sensitivity Aerosol Spectrometer (UHSAS), Condensation Particle Counter (CPC), Single Particle Soot Photometer (SP2), Cloud Condensation Nuclei Counter (CCNC). The flights took place above cloud top, below cloud base, and in clouds at altitudes up to 7 km, totalling 30 hours of collected data.

We present preliminary analysis of the multi-platform dataset of arctic thin and deep clouds. We report aerosol sizes and spatially resolved concentrations observed above and below clouds, and discuss their ability to act as CCN. Next, we present in situ single-particle data for cloud hydrometeor size distributions, ice crystal habits, and water content. These results are supplemented with the airborne lidar spatial characterization of the clouds. Last, we describe the overall microphysical picture for this set of flights and discuss the uncertainties of our measurements.

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[1] IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.
[2] Hanesiak et al.: Storm Studies in the Arctic: The meteorological field project. Bull. Amer. Meteor. Soc., 91. doi:10.1175/2009BAMS2693.1, 2010.