Cloud and Aerosol Measurements with the MASIN Twin Otter during ACCACIA Field Campaigns 2013

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ACCACIA

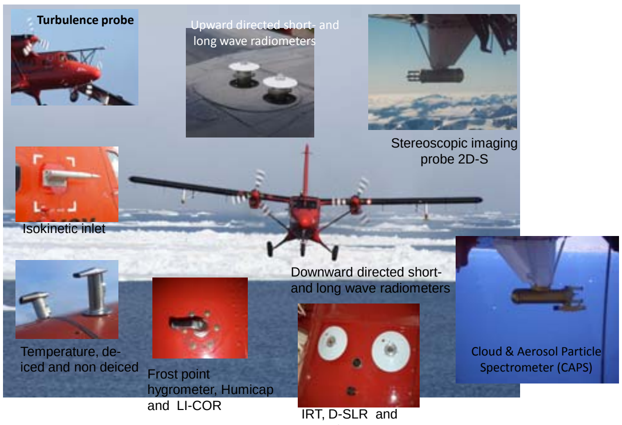
Aerosol-Cloud Coupling and Climate Interaction in the Arctic

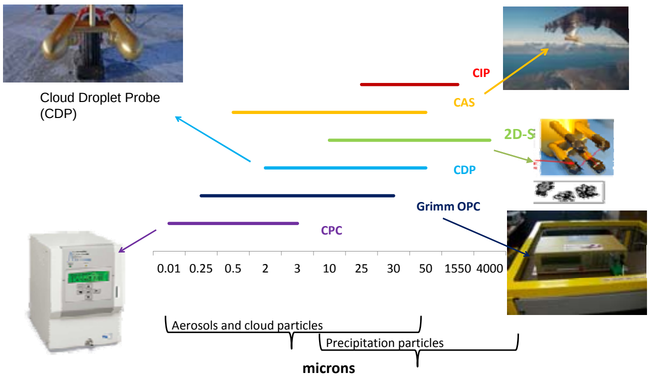
- *to understand the microphysical properties of Arctic clouds and their dependence on aerosol properties*
- *To determine the natural and anthropogenic sources of aerosol within the Arctic boundary layer*
- *To determine boundary layer structure and turbulent mixing properties*
- *To quantify the feedbacks between clouds, aerosol, sea ice and the wider climate system*

Why study clouds in the Arctic?

Clouds and their radiative properties play an important role in the Earth's climate system. In the polar regions the predominant cloud type, marine stratocumulus, is a mixed phase cloud. The clouds' properties are mainly determined by the availability, type and characteristics of the CCN and IN that the cloud particles form on.

Aircraft measurements are the best way to obtain data from these remote regions that can then be used to improve cloud and aerosol parameterisations in climate models.



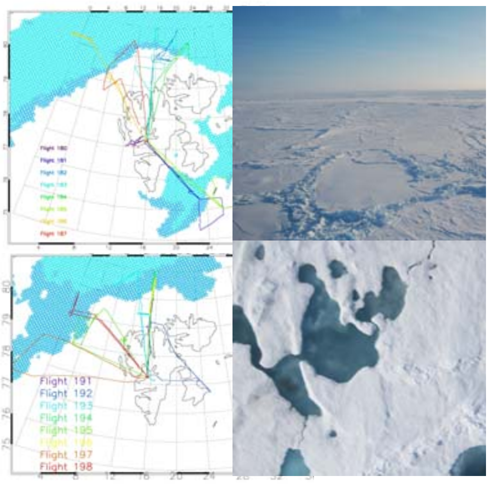


The aircraft's instrument suite for standard meteorological measurements, including turbulent and radiative fluxes, is complemented by various instruments capturing cloud and aerosol properties.

On both wings cloud probes were flown, one CAPS (Cloud, Aerosol and Precipitation Spectrometer) and one 2D-S (2D-Stereoscopic Cloud Imaging Probe) as well as a CDP (Cloud Droplet Probe) underneath the nose. An isokinetic inlet connected to a CPC (Condensation Particle Counter), a Grimm Optical Particle Counter, and a set of aerosol volatility experiments, as well as being used to draw filter samples for later analysis.

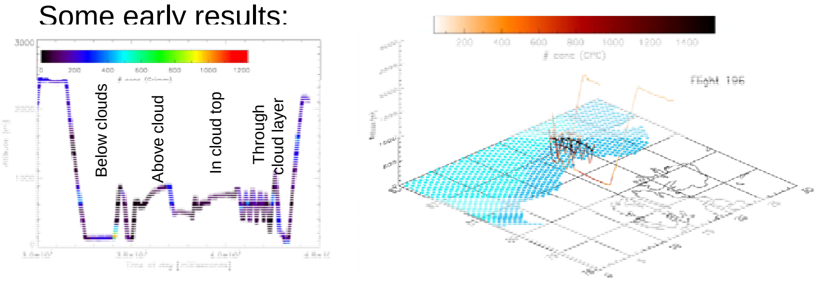
The field campaigns:

Two field campaigns of 3 weeks each took place in March /April and July/August 2013. During these campaigns the aircraft opertated out of Longyearbyen on Spitzbergen. Altogether ~83hours were flown during 17 flights. Of these flights 8 focussed on cloud measurements, 9 on the atmospheric boundary layer conditions. In spring conditions are characterised by maximum sea ice extent and atmospheric conditions that allow the long range transport of anthropogenic aerosol from industrialised regions in the mid latitudes into the Arctic. In late summer sea ice extent is at its minimum, and Arctic atmosphere is relatively isolated, thus increasing the importance of local aerosol sources.

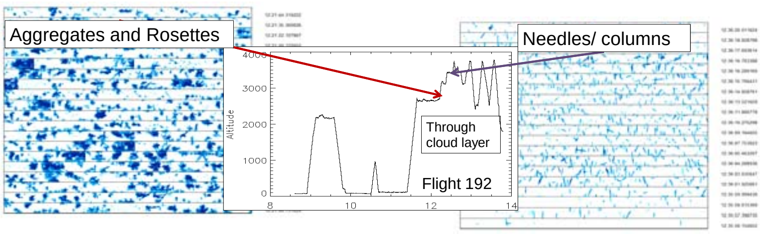


Flight patterns, sea ice extent and typical sea ice conditions during spring (top) and summer (bottom) 2013.

Some early results:



Particle concentration as measured with Grimm OPC and CPC during flight 196, shows high concentration of <250nm at low level over marginal sea ice zone (40-60% dark blue, 70-100% light blue).



These images from the Cloud Imaging Probe show how cloud particles differ within a cloud layer