The Arctic region is more sensitive to climate change than any other region of the Earth. Clouds and particularly low-level clouds related processes have a major impact on the Arctic surface energy budget. Observations suggest that boundary layer mixed-phase clouds (MPCs, mixture of liquid droplets and ice) are ubiquitous in the Arctic and persist for several days under a variety of meteorological conditions.

The Arctic Cloud Observation Using Cloudimager (ACLOUD) is designed to obtain a comprehensive data set to study physical microphysical in-situ measurements (Mioche et al., 2017). This work was primarily funded by EECLAT project (Expecting EarthCare, Learning from A-Train) supported by the French Centre National des Etudes Spatiales (CNES). We gratefully acknowledge the support from the Transregional Collaborative Research Center (TRR 216) “Arctic Cloud Observation Using Cloudimager (ACLOUD) in summer with a 10s average (~ 1 km resolution).

**Cloud Microphysical Properties of Summermte Arctic Stratocumulus during ACLOUD Campaign**

Comparison with Previous Results in the European Arctic

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**Scientific Background**

The vertical and horizontal variability of cloud properties such as cloud phase, particle size, total aerosol particles and trace gas concentration as well as energy fluxes in the atmospheric column.

**Processing and Sub Dataset**

- Discrimination of liquid and ice particle samples was based on jumps (Crosier et al., 2011) by threshold at 1.25% (surface must be larger than 16 pixels).
- Classification of surface based on average sea ice concentration measurements (Young et al., 2016).
- Above 90% is defined as “Sea Ice” (SI)
- Between 10 and 90% is the “Marginal Ice Zone” (MIZ)
- Lower than 10% is defined as “Open Water” (OW)
- Land correspond to NaN values.

**Cloud Vertical Profiles**

- Figures represent vertical profiles (expressed in normalized altitudes) of liquid droplet (fig. 1 and 2) and ice crystal (fig. 3) properties:
  - a) Extinction Coefficient
  - b) Number Concentration
  - c) Mass content
  - d) Effective Diameter
- The vertical profile curves correspond to:
  - Sea Ice > 90%
  - Over Marginal Ice Zone
  - Over Open Water > 10%
- Altitude normalized (Zn) to be [0 1] in the cloud liquid containing layer, [-1 0] in precipitating Ice and Zn = -1 at the surface layer.

**Discussion and outlook**

- Comparison of ACLOUD with our previous studies shows Spring / Summer differences.
- Liquid phase needs aerosol concentration to conclude difference in droplet concentration (Fig. 1).
- Few ice over open water (< 1L) during ACLOUD but ice phase over MIZ similar to spring cases with small ice crystals (Fig. 3).
- Differences induced by the surface overflown.
- Liquid phase (Fig. 2) show difference between air mass origin (fewer and larger droplets during Normal period) most likely due to aerosol concentration difference (Twoey effect) difference between surfaces may not be only explained by different aerosol source as droplet size is constant while UWC change could indicates change in droplet activation conditions (e.g. supersaturation) and MZB > Bi = OW BUT maximum of 2L1.
- ACCACIA campaign studies (Young et al., 2016 and Lloyd et al., 2015) have shown that:
  - Differences Spring / Summer
  - Ice being in a summer 'eyes in space' in spring
  - Differences with surfaces (measurements performed, top cloud temperature -20°C)
  - Ice properties constant, 0.5-1.5 L1
- Droplet concentration: MZB > Bi = OW
- Plans for clarifying misunderstandings:
  - Adding aerosol concentration (see S. Mertes presentation) and small ice crystals studies (see F. Waltz poster)
  - Future campaigns in the region:
    - AFLUX 2010 and MOSAIC 2020

**Acknowledgements and references**

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**Scientific Background**

The vertical and horizontal variability of cloud properties such as cloud phase, particle size, total aerosol particles and trace gas concentration as well as energy fluxes in the atmospheric column.