Characterization of cirrus clouds in the arctic depending on ambient conditions

G. Dekoutsidis[1], S. Groß[1], M. Wirth[1], C. Rolf[2], M. Krämer[2], A. Schäfler[1], F. Ewald[1]

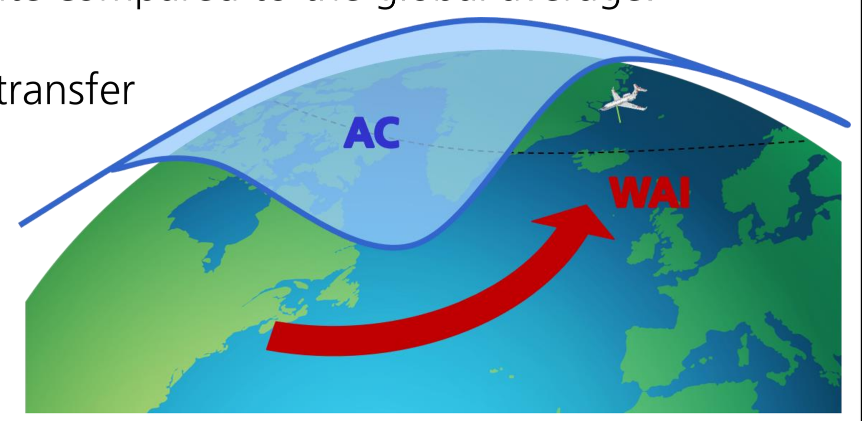
[1]Institut für Physik der Atmosphäre, Deutsches Zentrum für Luft- und Raumfahrt (DLR), Oberpfaffenhofen,82234 Wessling, Germany

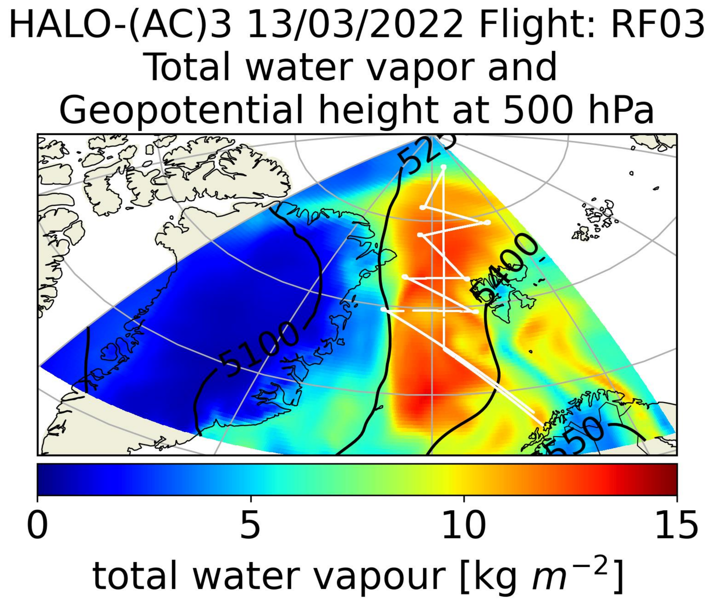
[2]Institute for Energy and Climate Research (IEK-7), Research Center Jülich, 52425 Jülich, Germany

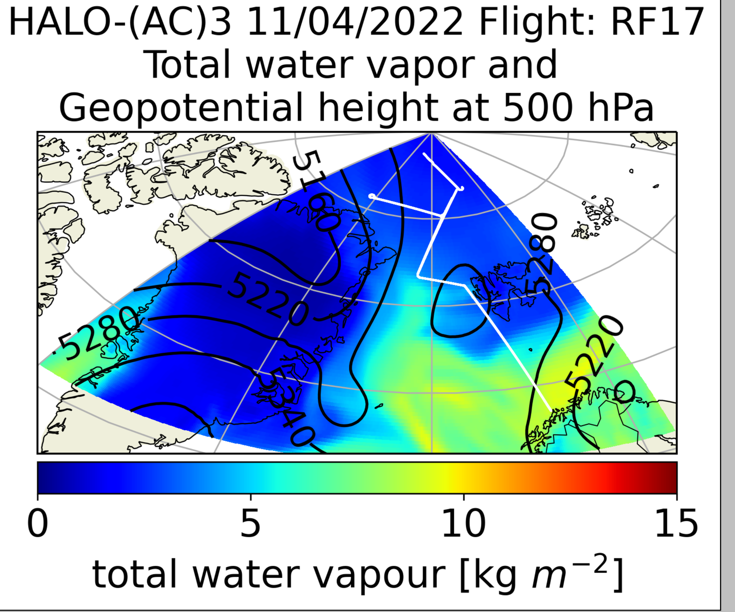
Contact: Georgios.Dekoutsidis@dlr.de

Motivation

- The arctic is warming with an accelerated rate compared to the global average: **Arctic Amplification** (AA) [1]
- **Warm Air Intrusions** (WAI) into the arctic transfer sensible heat, water vapor and aerosols contributing to AA [2]
- Two different cirrus types in the arctic:
  - under arctic conditions (**AC cirrus**)
  - under WAI conditions (**WAI cirrus**)







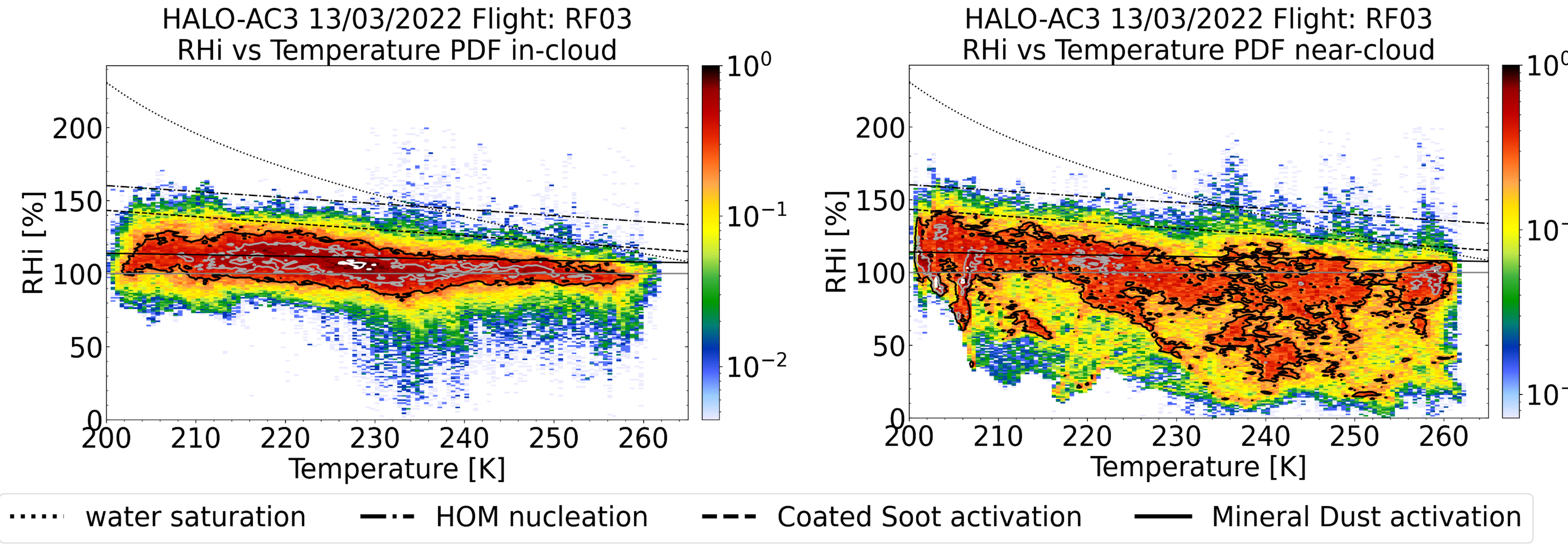
Data

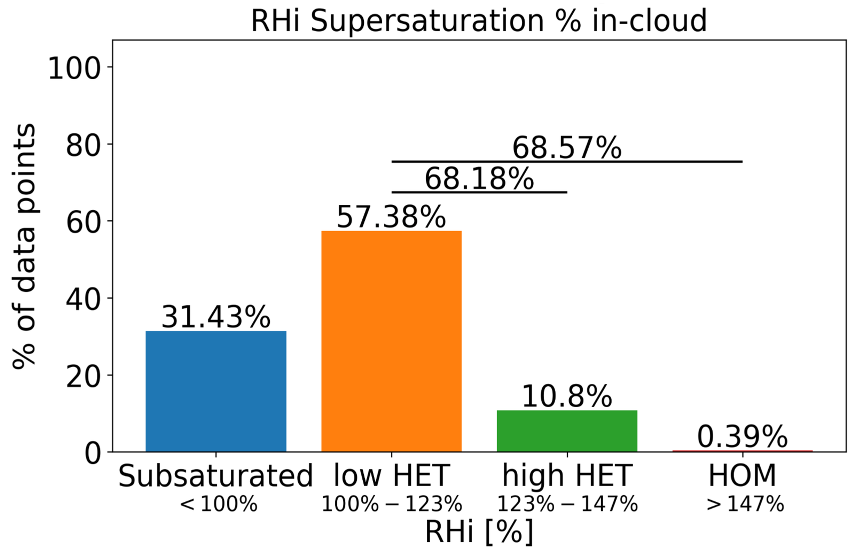
HALO-$(\mathcal{AC})^3$: Remote sensing field campaign in March and April 2022 over the arctic with the German research aircraft HALO [3]

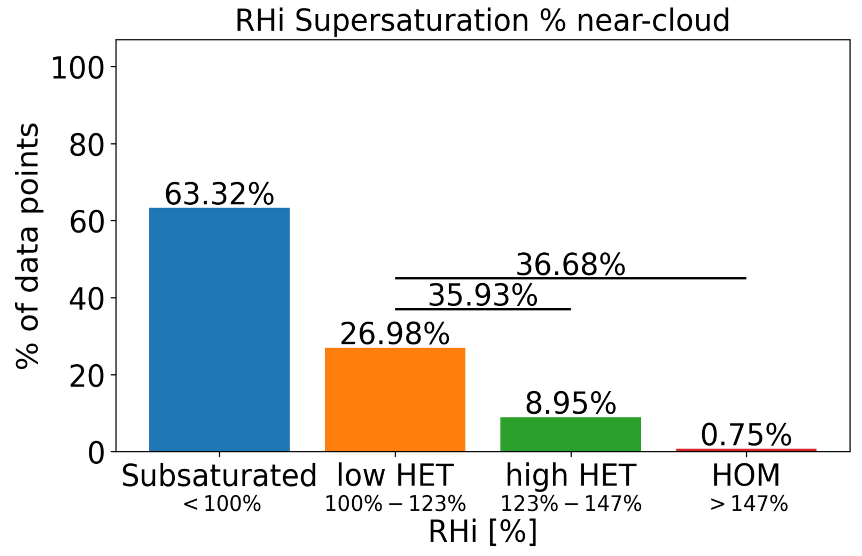
Tools

- WALES: HSRL and water vapor DIAL lidar system [4]
- HAMP: Cloud radar at 36 GHz and passive microwave radiometers [5]
- VarCloud: optimal estimate retrieval combining lidar and radar [6]
- LAGRANTO: Lagrangian analysis tool [7]
- CLaMS-Ice: combined Lagrangian model CLaMS with two-moment ice microphysics [8]

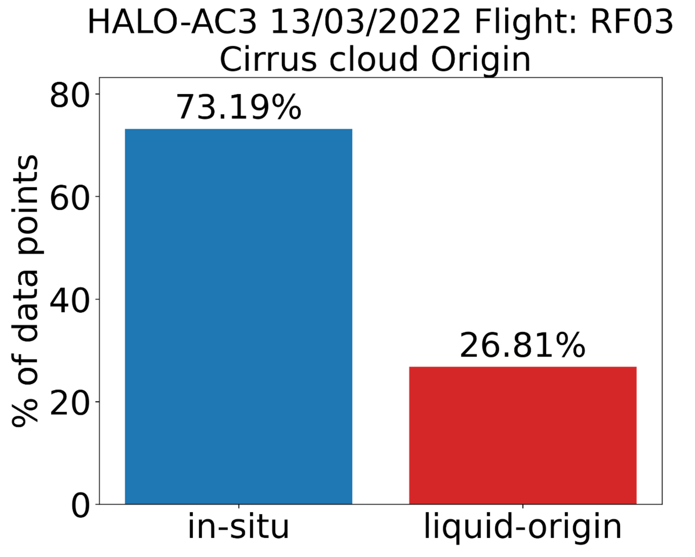
RF03: Conducted during a prevailing Warm Air Intrusion

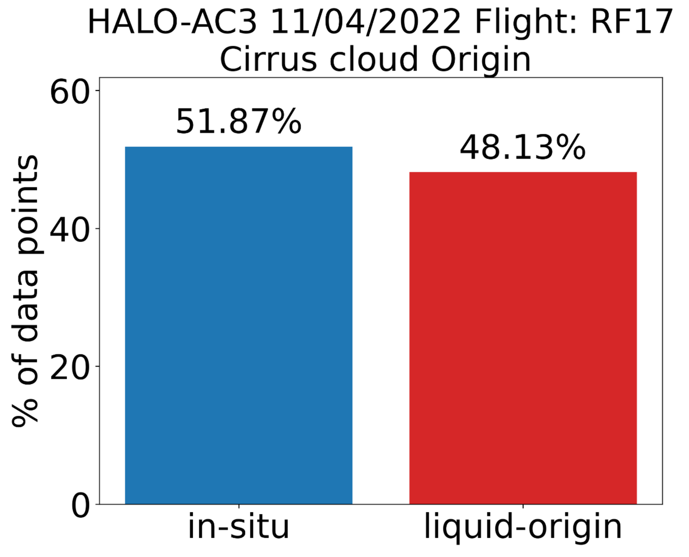




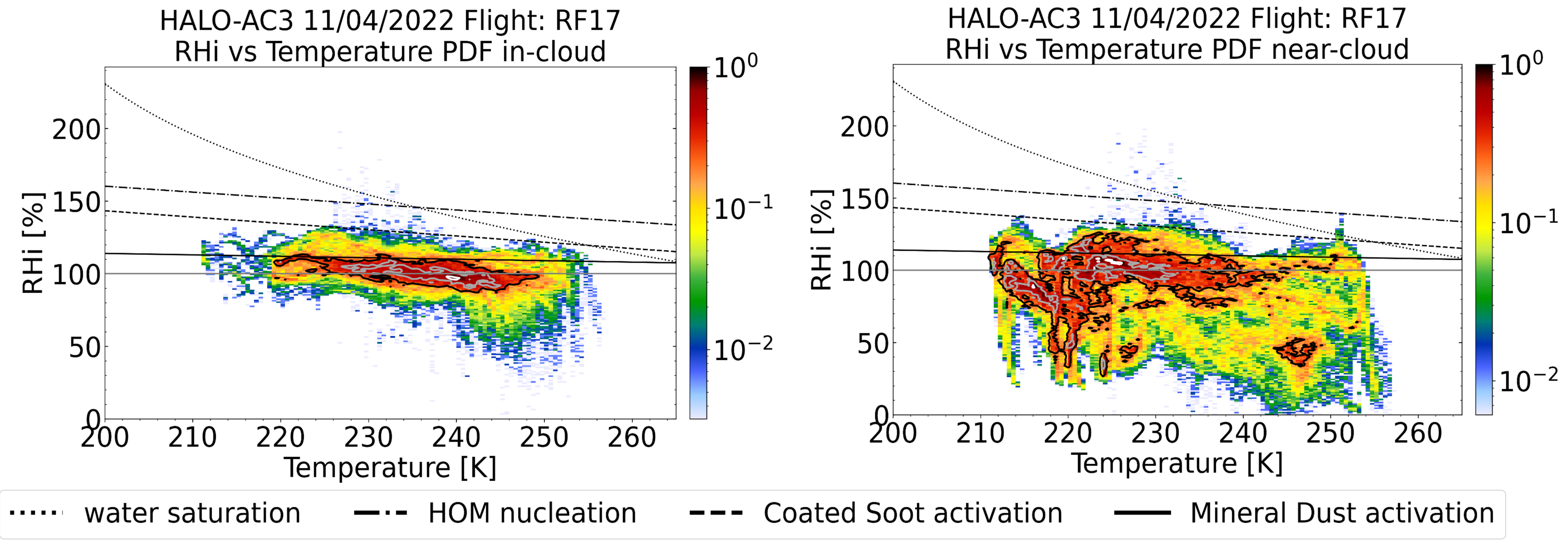


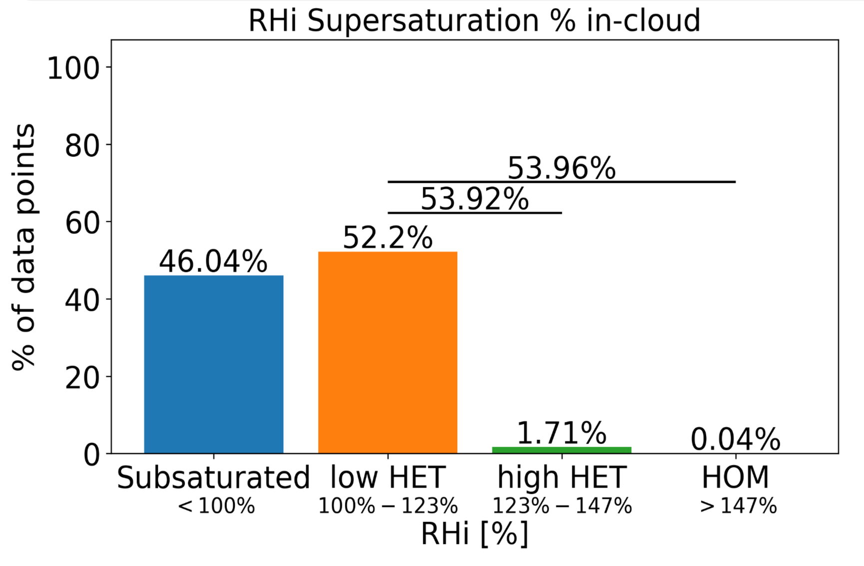
WAI Case (RF03)	**AC Case (RF17)**
Geometrically and optically thicker	**Lower depolarization** ratio
Rose higher and with **stronger updrafts**	Less frequently supersaturated especially for high RHi
Frequently with **high supersaturations**	Contains almost **no liquid water**
Formed predominantly **in-situ**	Similar amount of **in-situ and liquid-origin**
Higher ice crystal number concentration and smaller ice effective radius: Indicative of **homogeneous nucleation**	Smaller ice crystal number concentration and bigger ice effective radius: **Heterogeneous nucleation** more probable

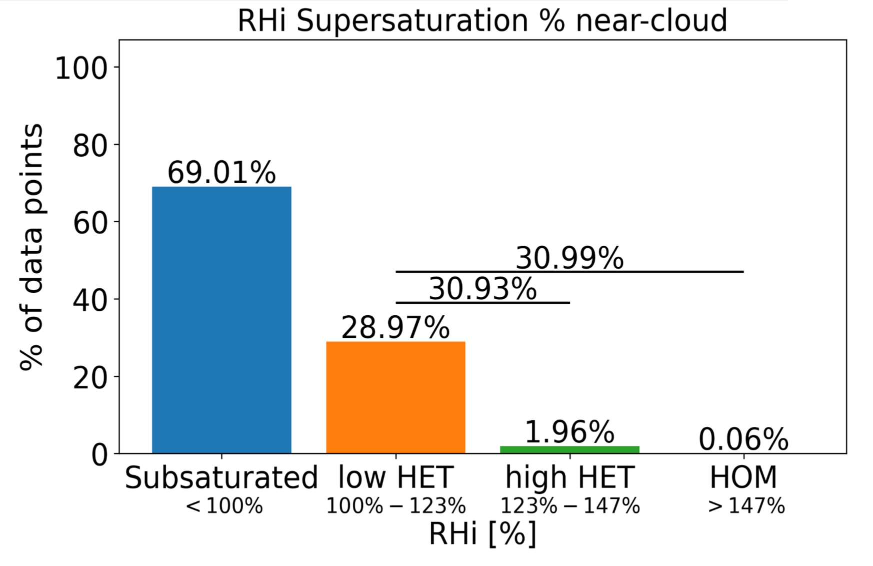




RF17: Conducted under undisturbed Arctic Conditions







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