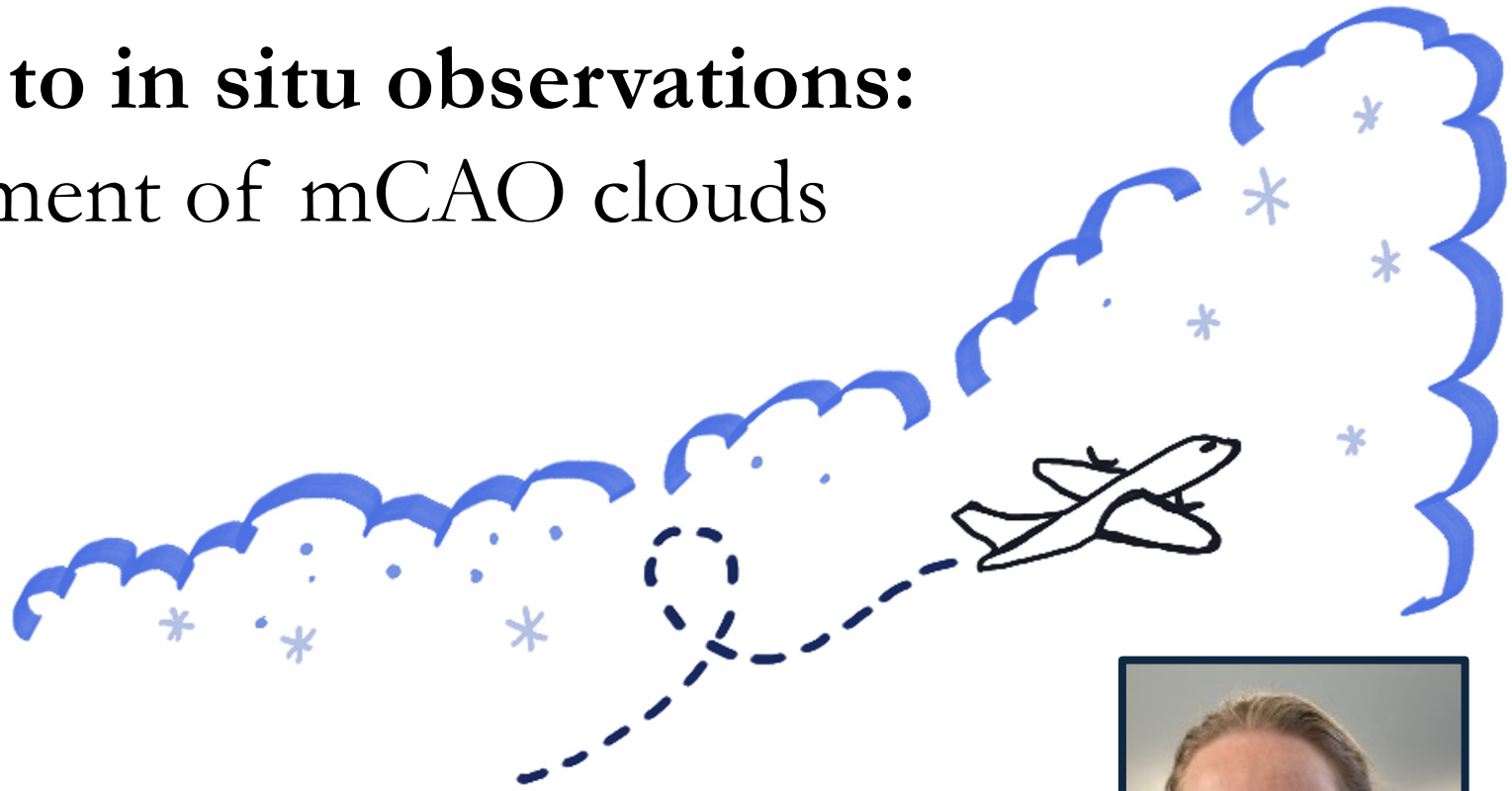
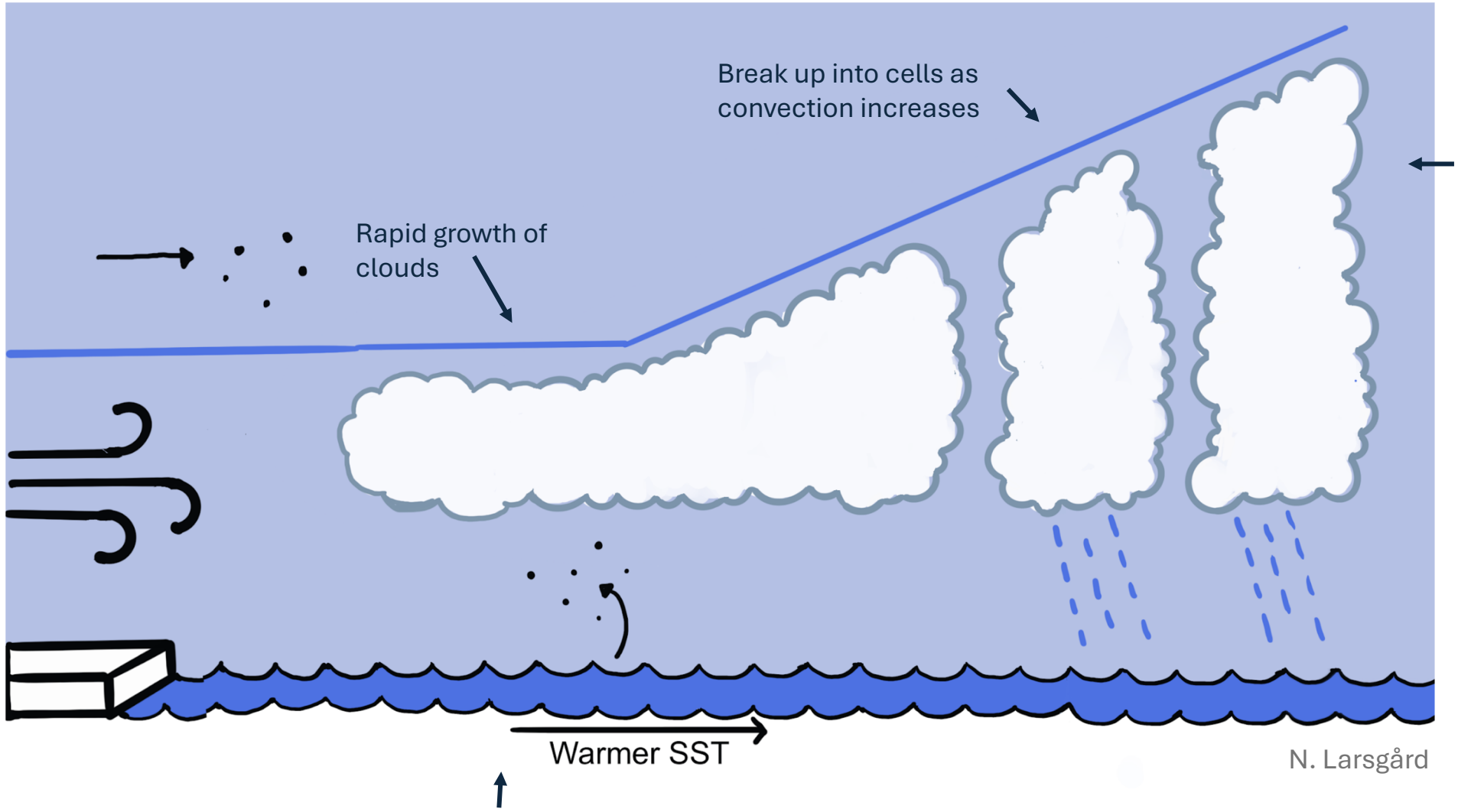
Composite approach to in situ observations:
Microphysical development of mCAO clouds



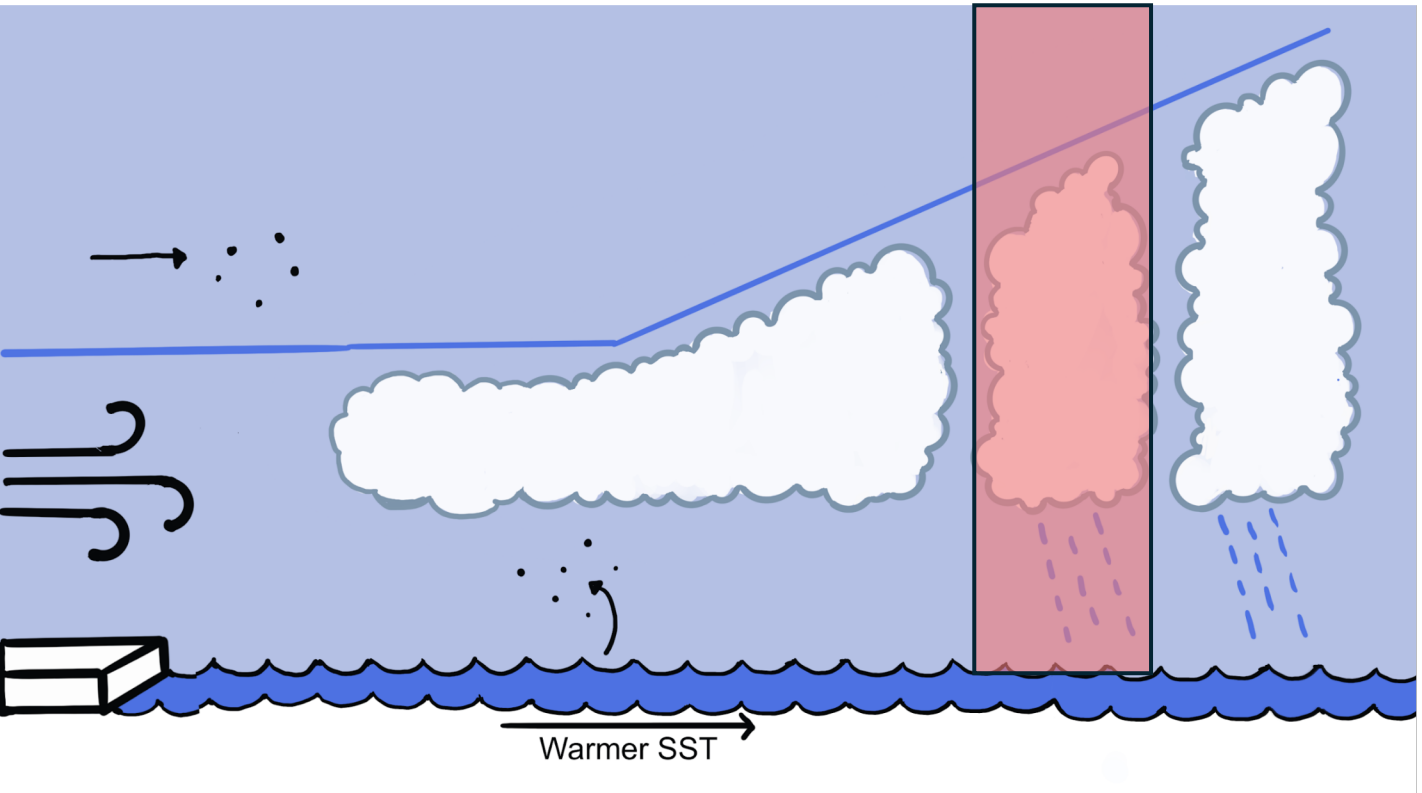
Tim Carlsen, Nina Larsgård, Filip von der Lippe,
Robert O. David, Trude Storelvmo, Harald Sodemann,
Alfons Schwarzenboek, and all of you

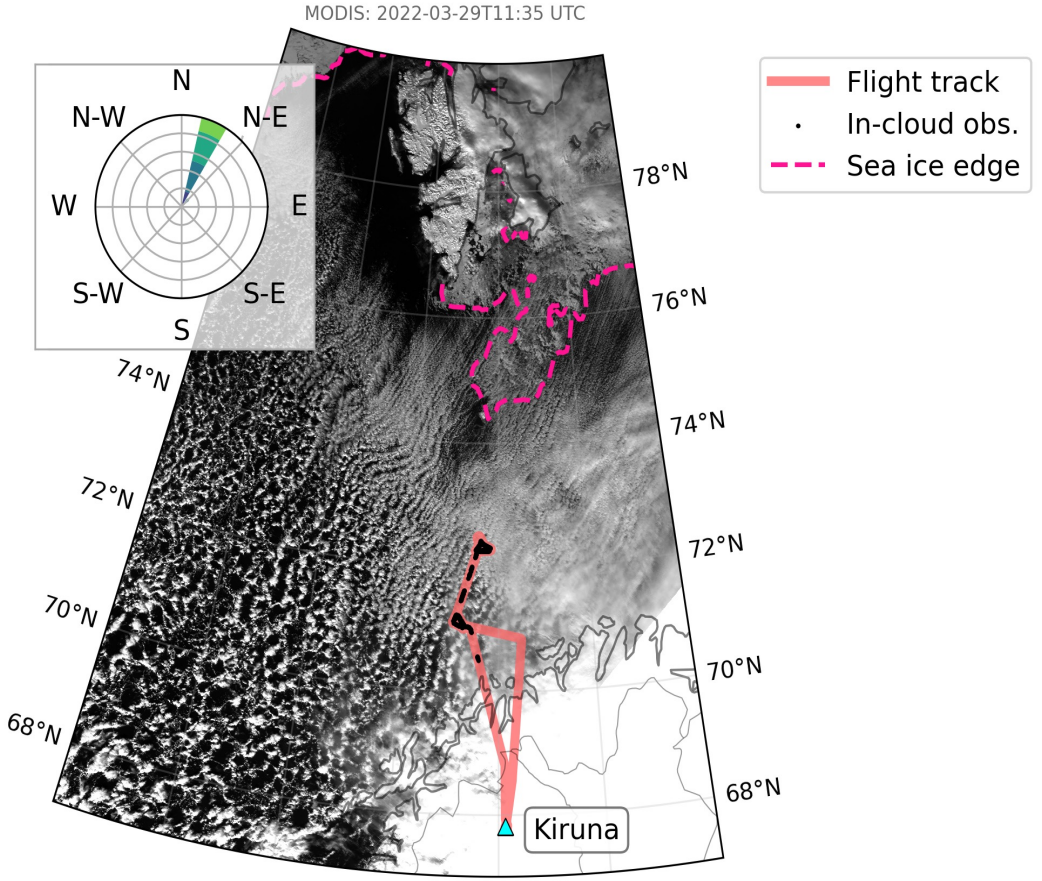
Marine Cold Air Outbreaks



N. Larsgård

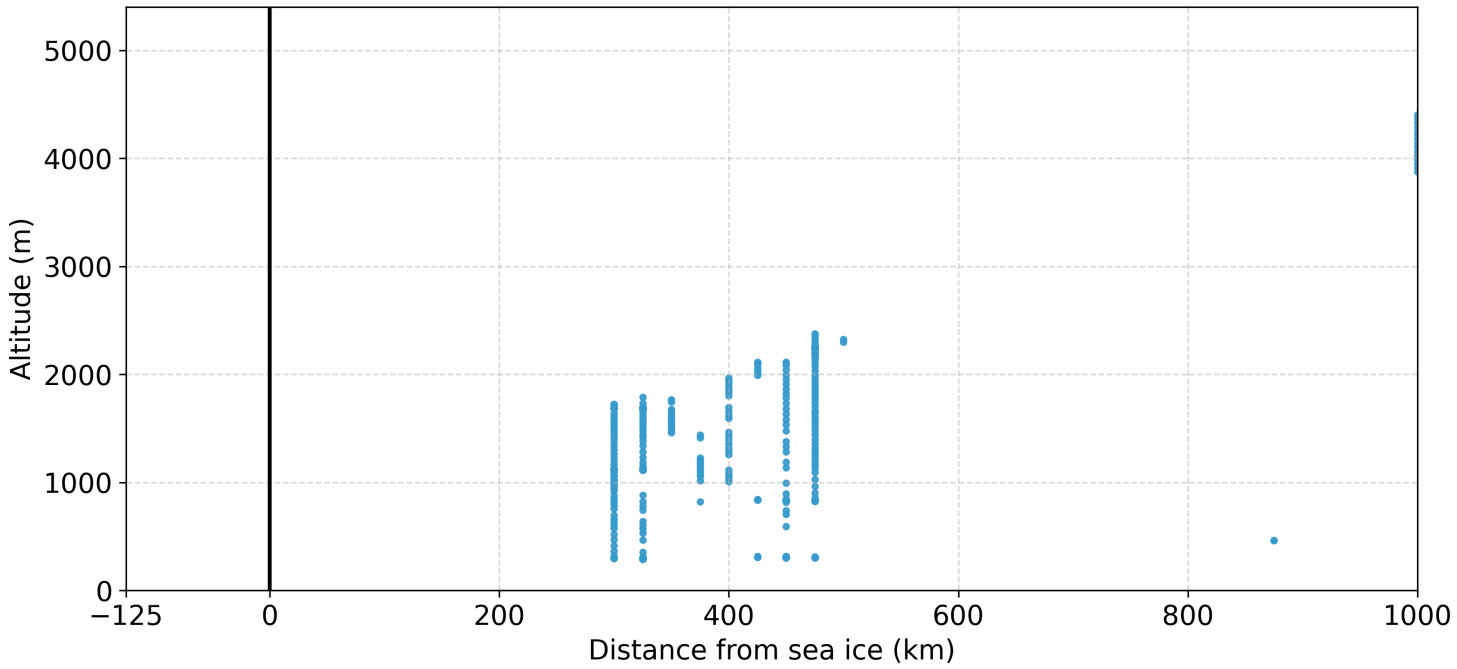
Composite approach

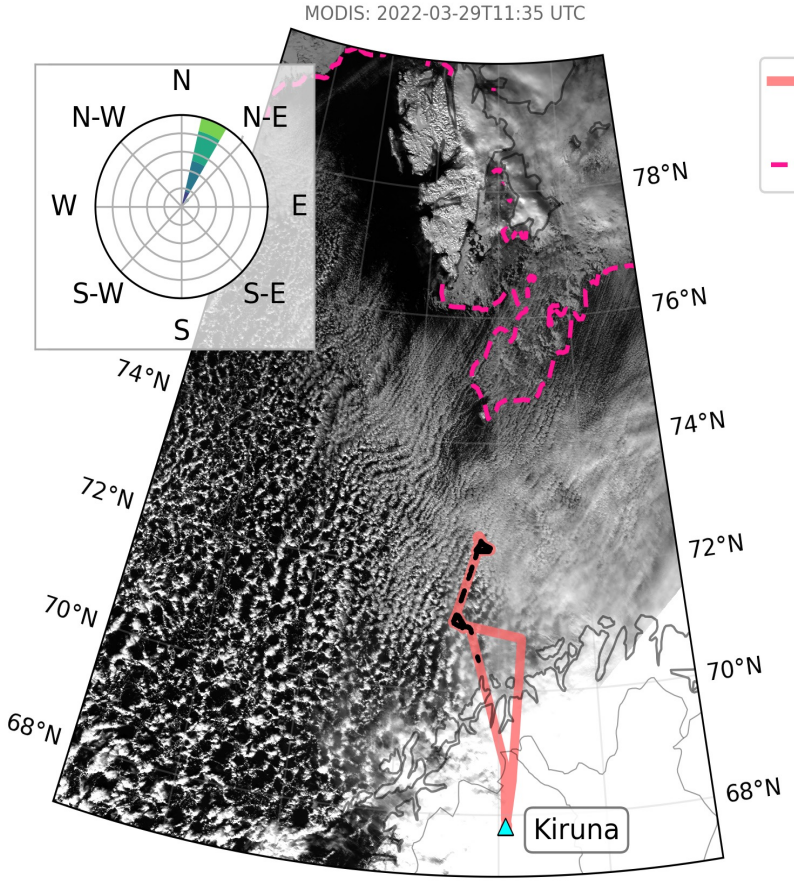




adapted from Larsgård et al. (2026, in review)

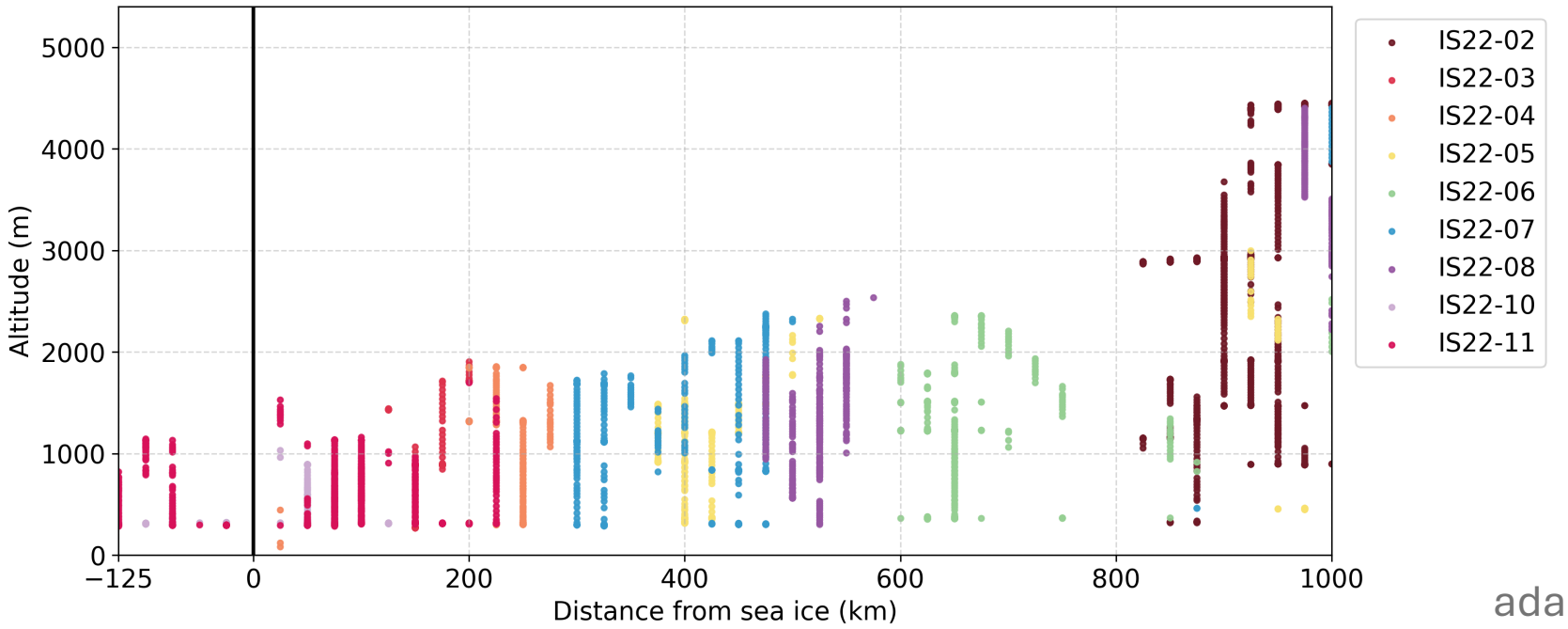
Composite approach

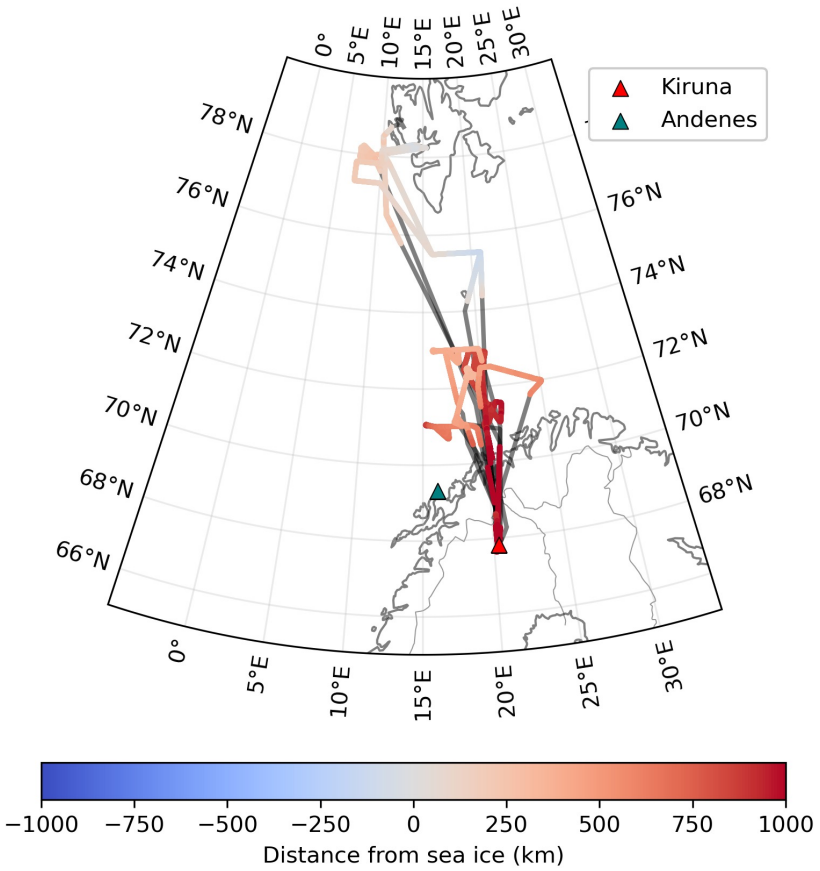




adapted from Larsgård et al. (2026, in review)

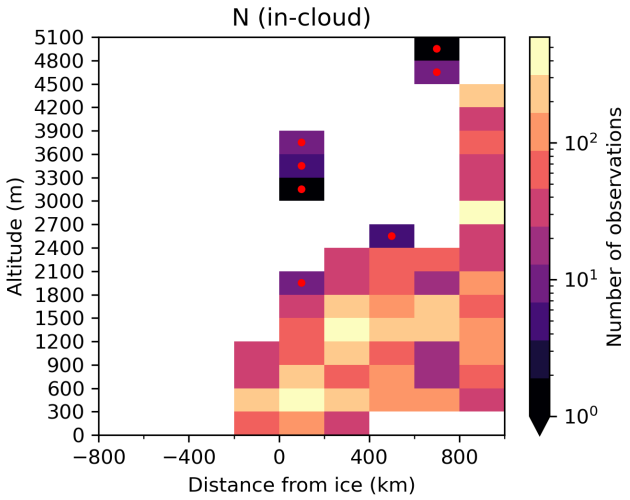
Composite approach





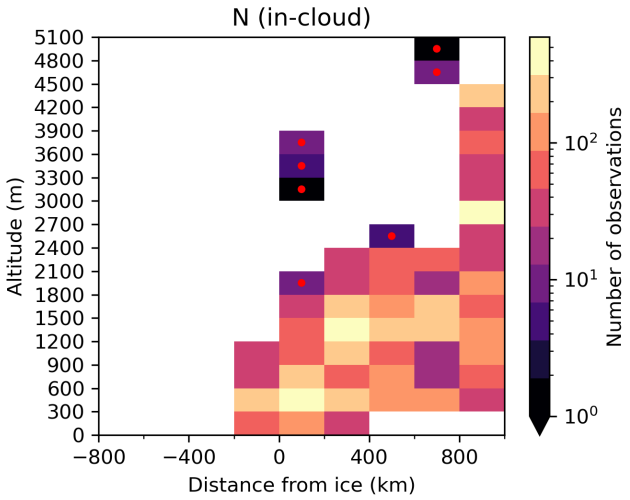
adapted from Larsgård et al. (2026, in review)

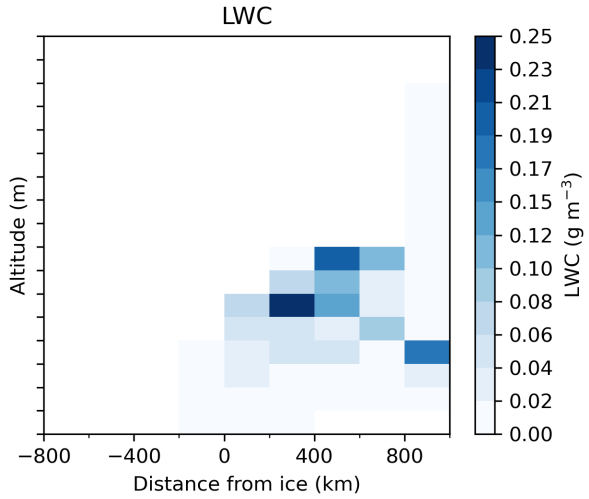
ISLAS 2022

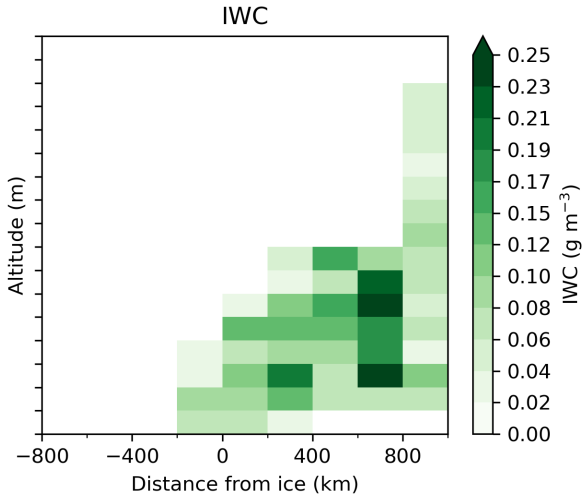


adapted from Larsgård et al. (2026, in review)

ISLAS 2022

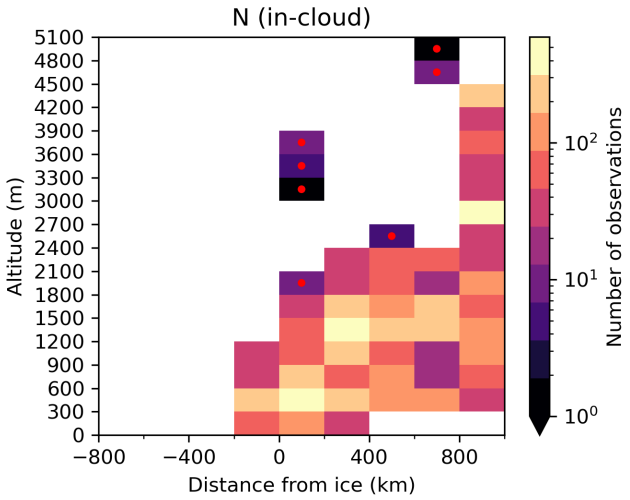


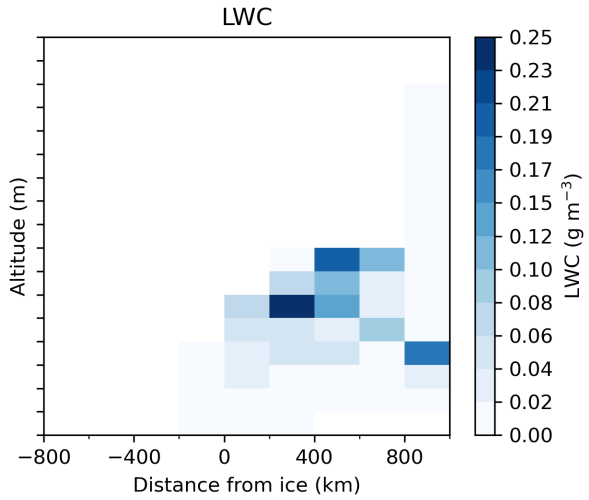


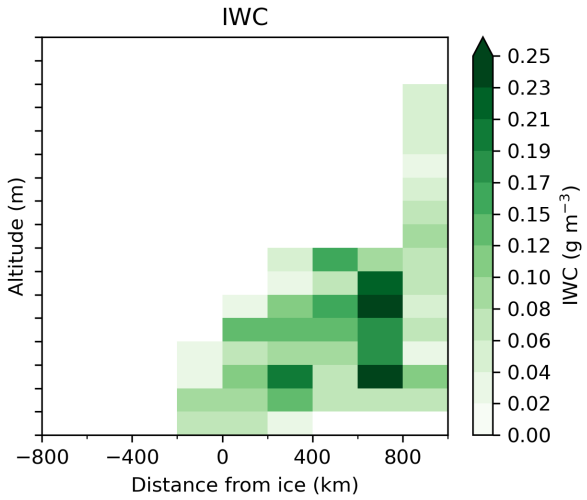


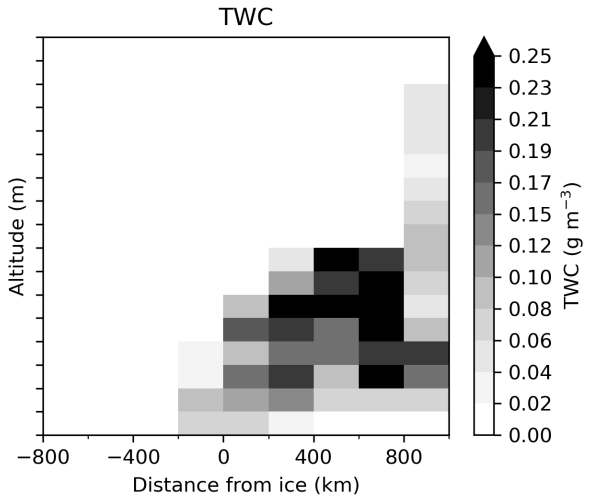
adapted from Larsgård et al. (2026, in review)

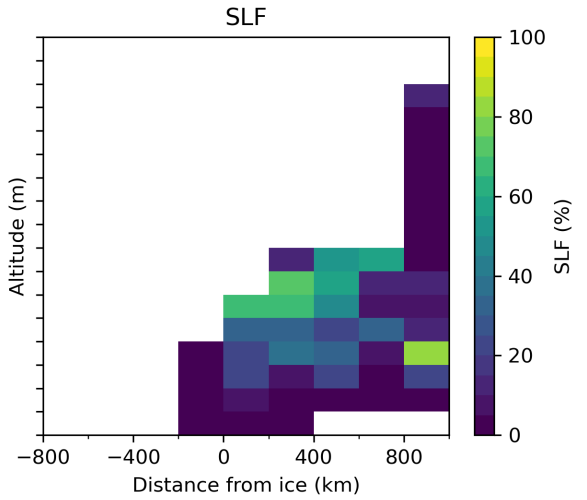
ISLAS 2022











adapted from Larsgård et al. (2026, in review)

Complementing campaigns

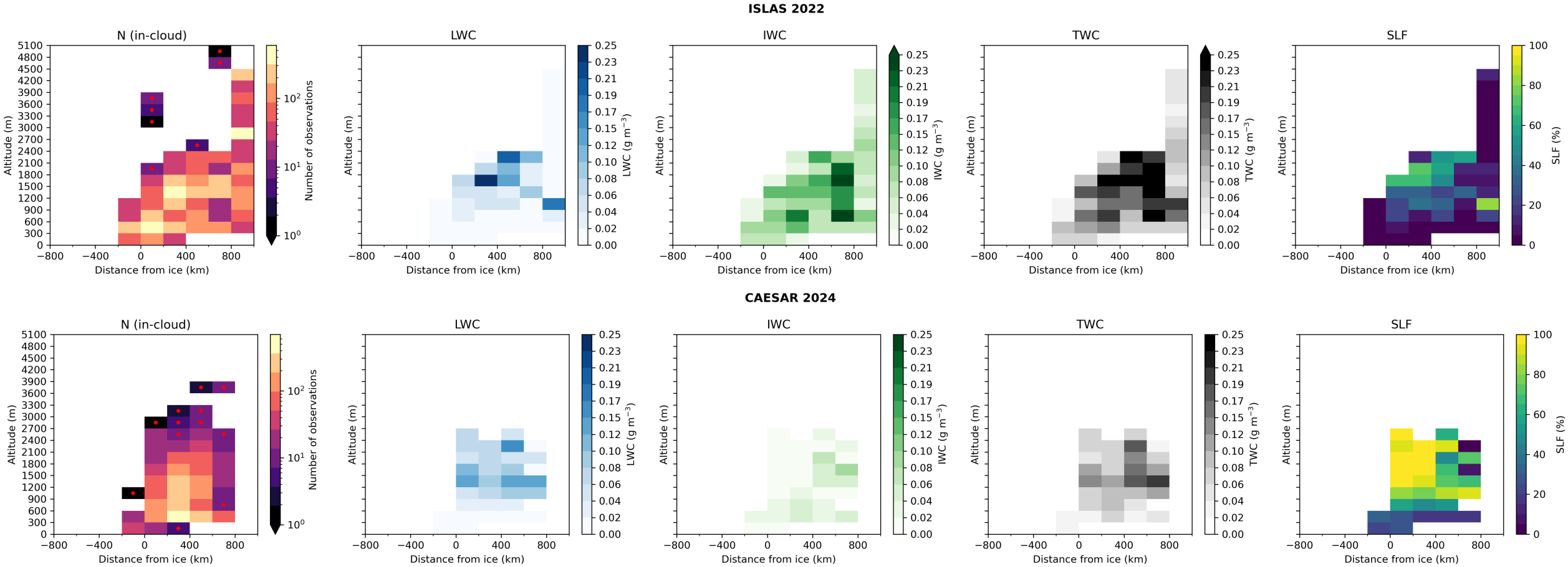
ISLAS2022	soon on PANGAEA
CAESAR	Rosky (2026), Value Added Product
ACAO	from CEDA: cloud-phy, v601, r1
HALO-AC3	Moser et al. (2023), Lüpkes et al. (2022), ac3airborne

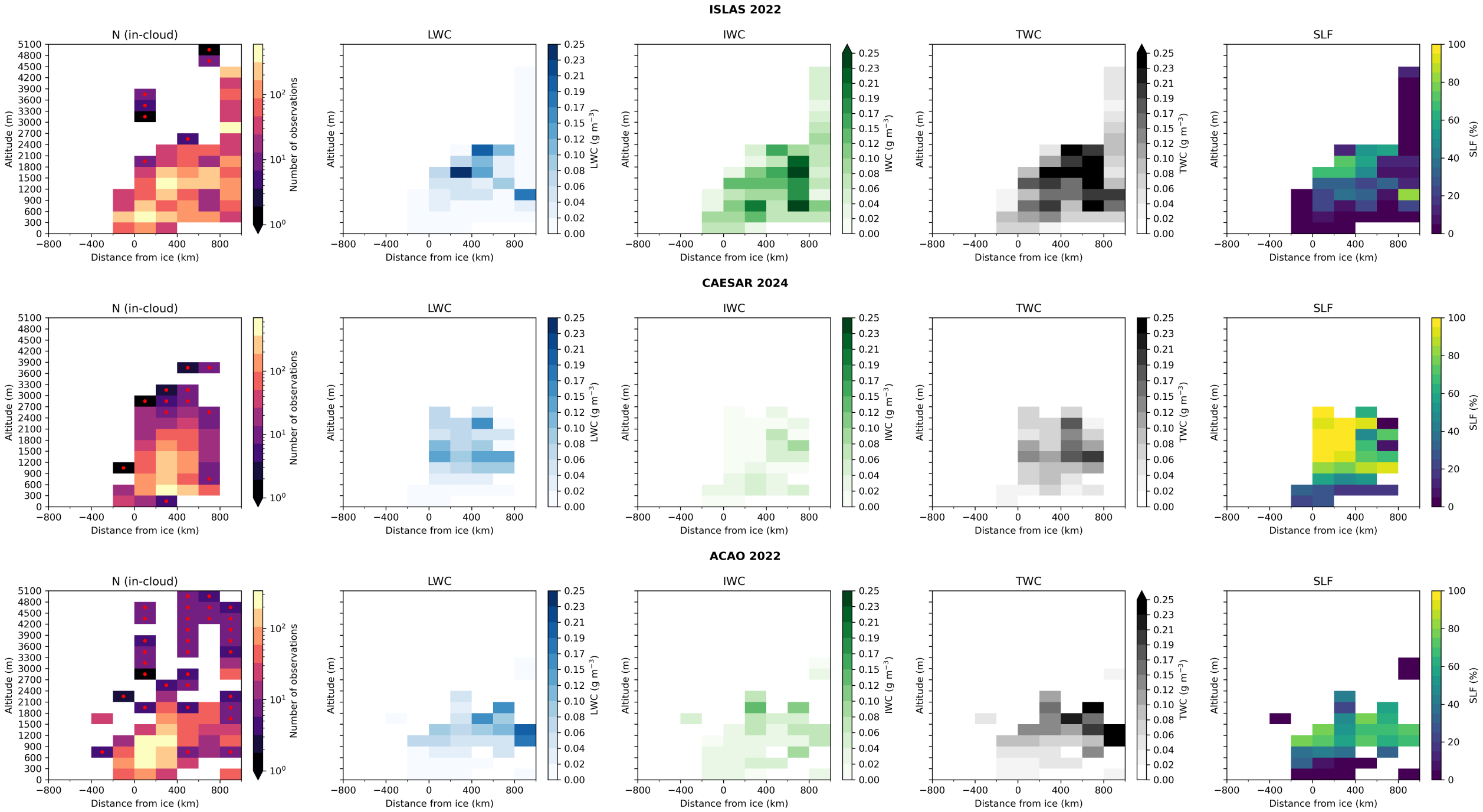
In-cloud: LWC > 0.01 g/m^3 | IWC > 0.01 g/m^3

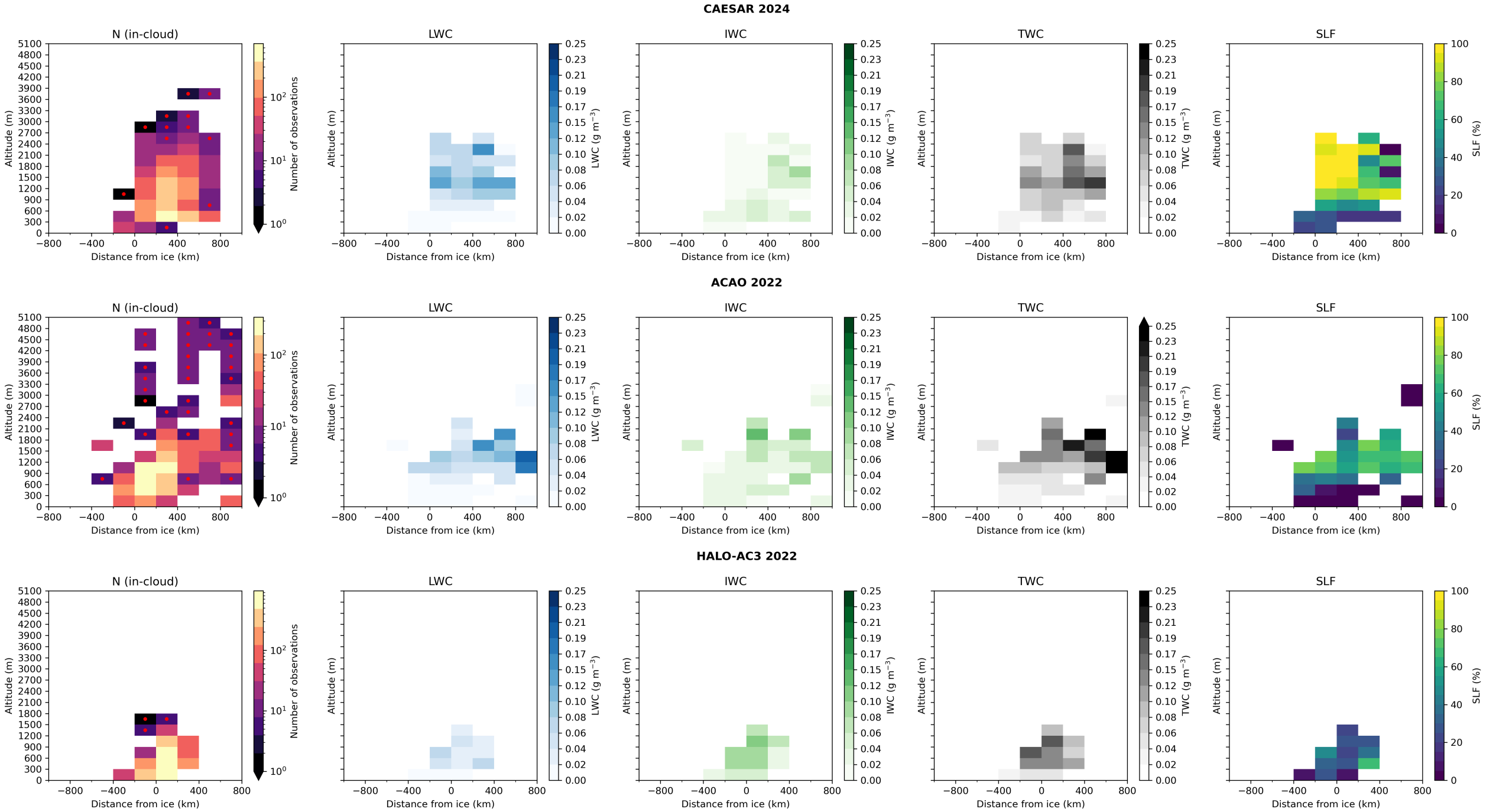
Temperature: -35°C < T < 0°C

Quickly: exclude non-mCAO flights

Complementing campaigns

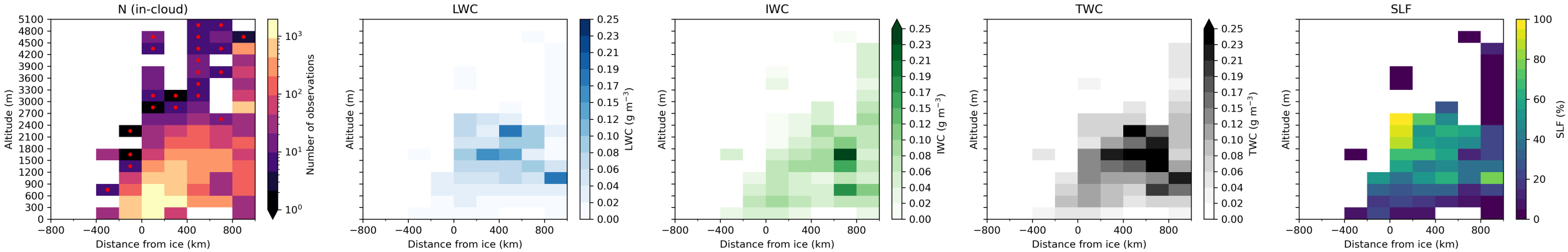



ISLAS 2022
CAESAR 2024
ACAO 2022
N (in-cloud)
LWC
IWC
TWC
SLF
Altitude (m)
Distance from ice (km)
Number of observations
LWC (g m^{-3})
IWC (g m^{-3})
TWC (g m^{-3})
SLF (%)

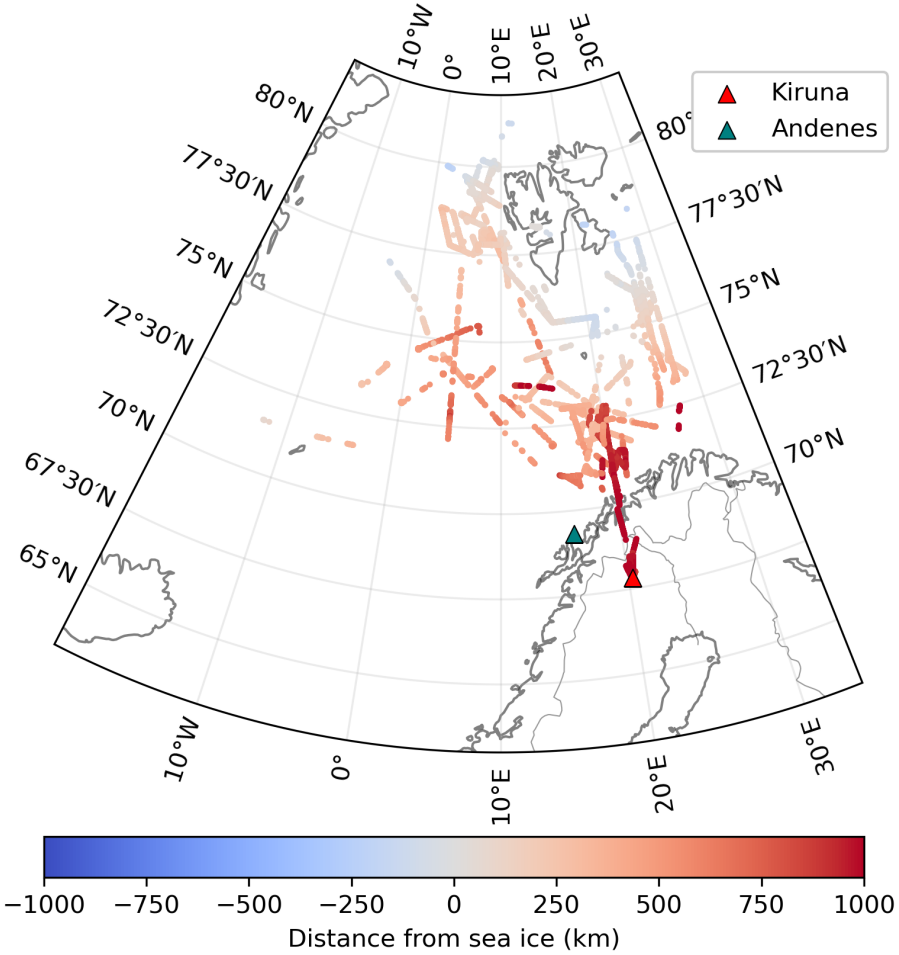

CAESAR 2024
ACAO 2022
HALO-AC3 2022
N (in-cloud)
LWC
IWC
TWC
SLF
Altitude (m)
Distance from ice (km)
Number of observations
LWC (g m^{-3})
IWC (g m^{-3})
TWC (g m^{-3})
SLF (%)

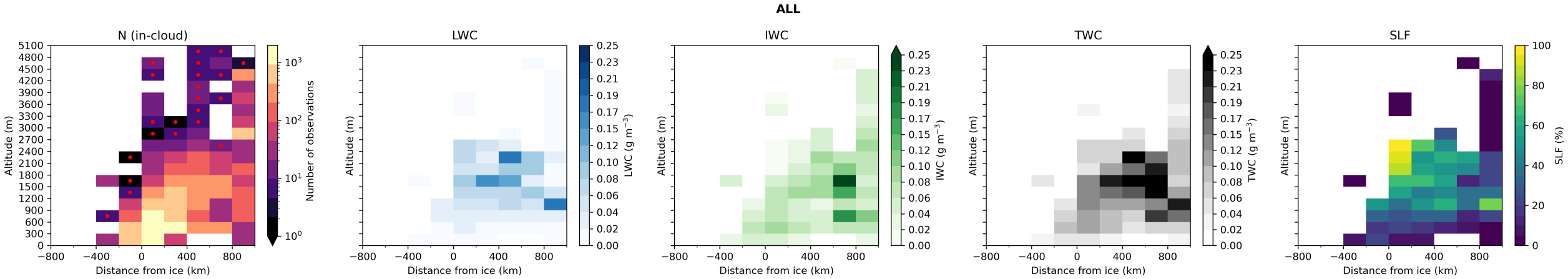
Complementing campaigns

CAESAR + ACAO + HALO-AC3 + ISLAS



Complementing campaigns



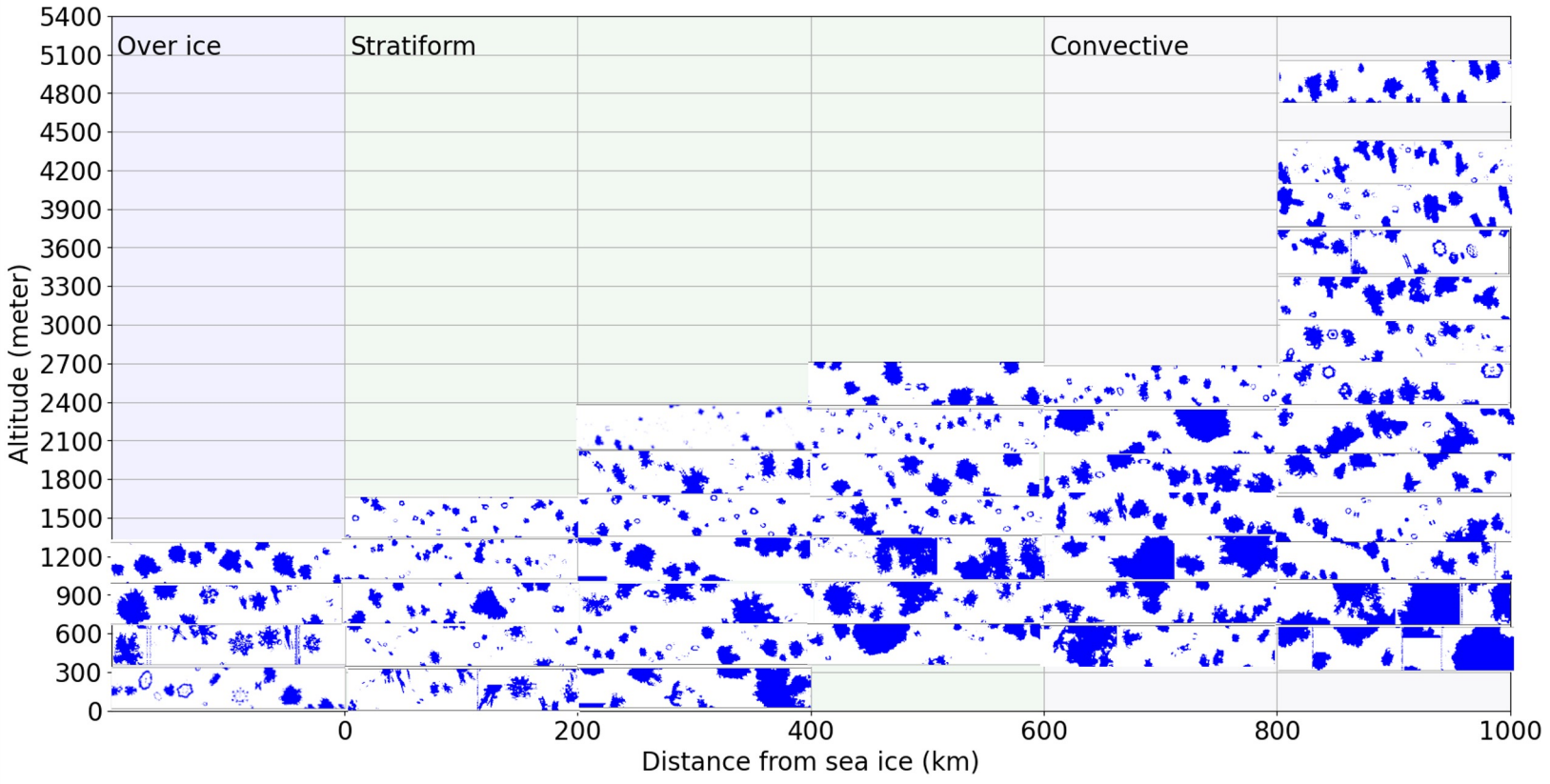


Potential and outlook

Look at composite with respect to distance from break-up (Rob's talk)

Extend from cloud water contents to precipitation (e.g. PIP, HVPS) etc.

… habit analysis: e.g. onset of graupel?



Larsgård et al. (2026, in review egusphere)

Potential and outlook

Look at composite with respect to distance from break-up (Rob's talk)

Extend from cloud water contents to precipitation (e.g. PIP, HVPS)
... habit analysis

Classify by mCAO index strength

Composites from model output for better statistics

M-Phase, MC2-ICEPACKS, ACLOUD,... (?)

There is more room for better filtering – I need your help