Aerosol-cloud interactions over the central Arctic Ocean

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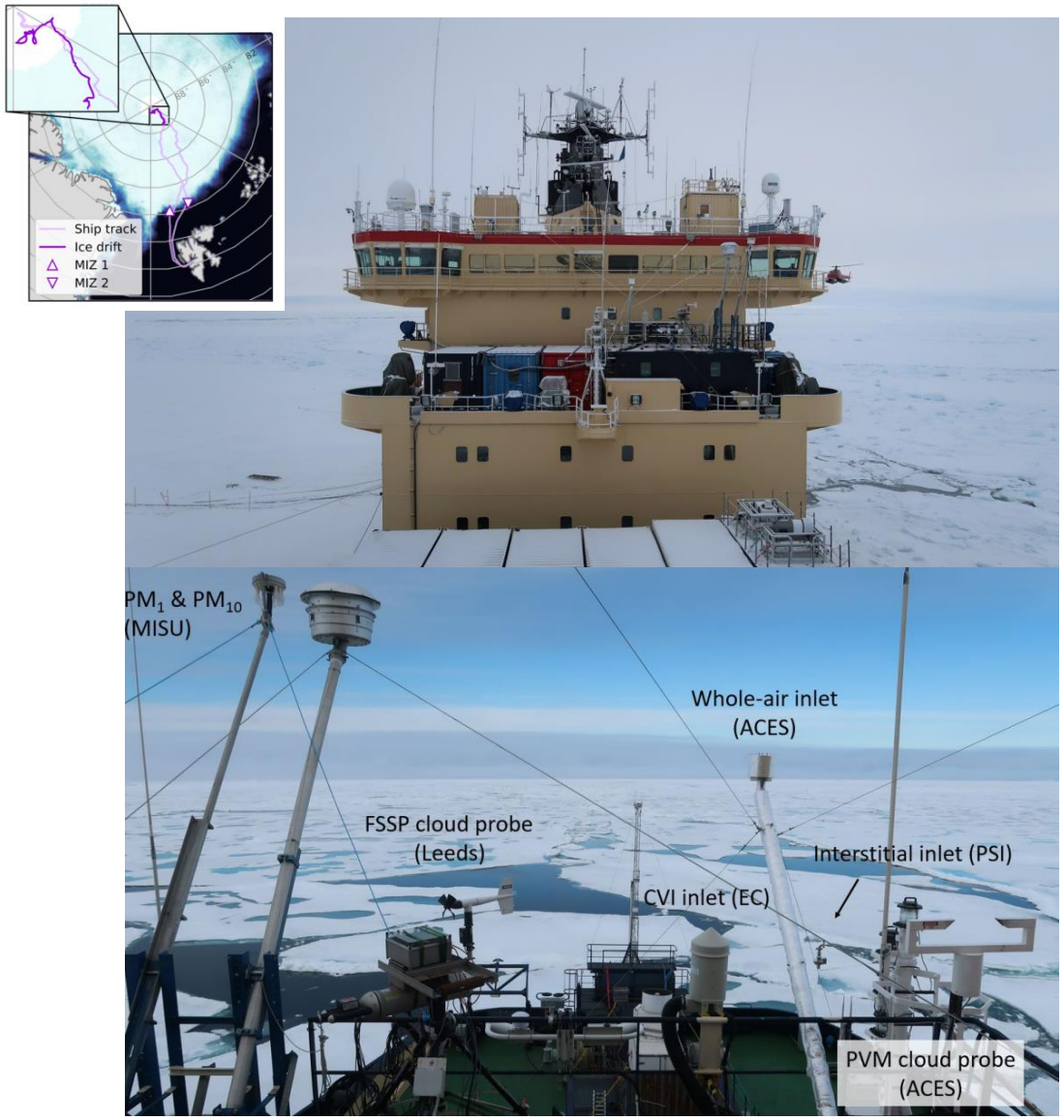
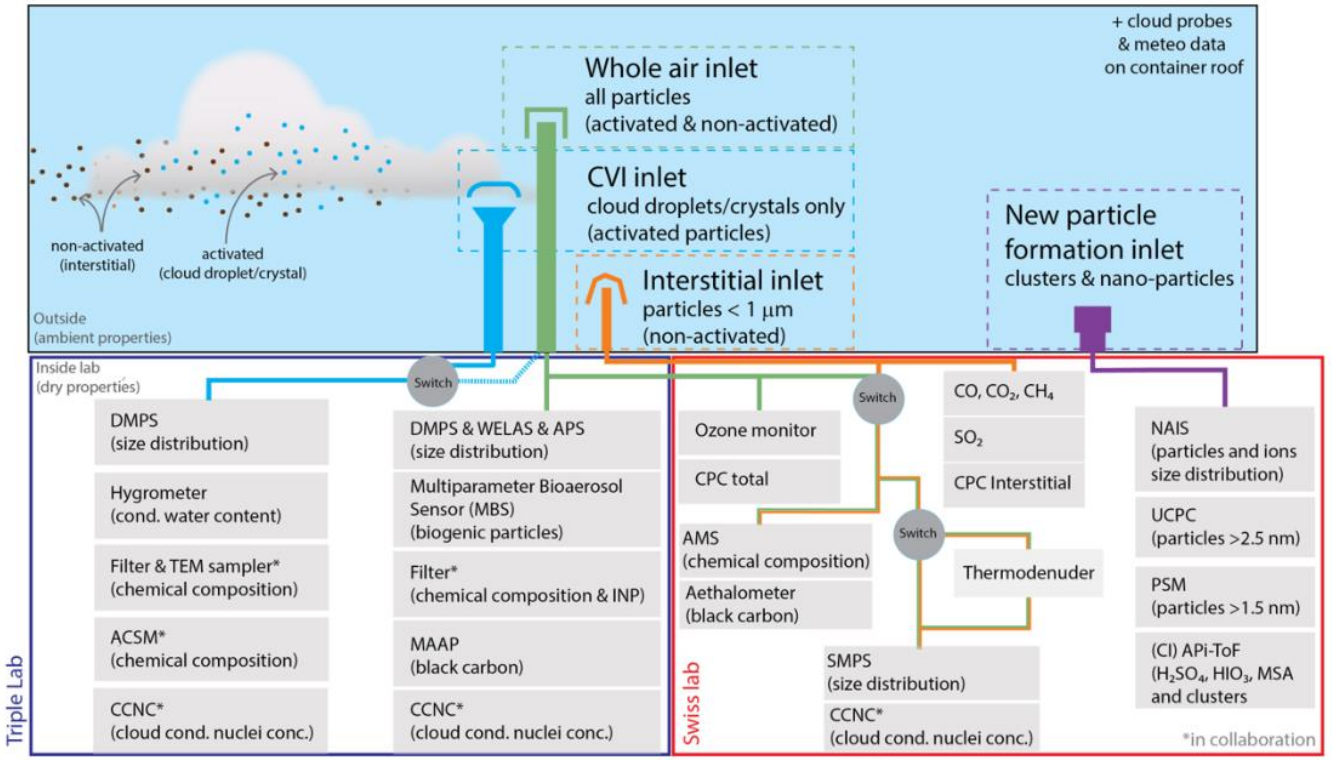
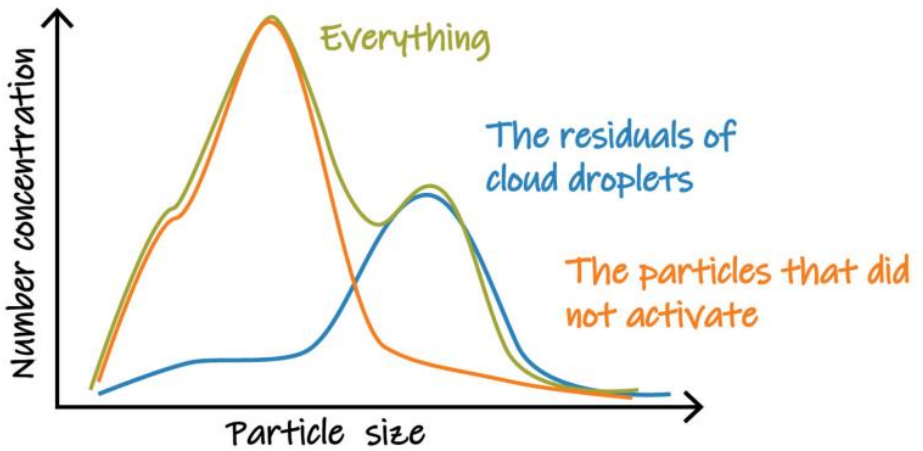
Arctic Ocean 2018 expedition



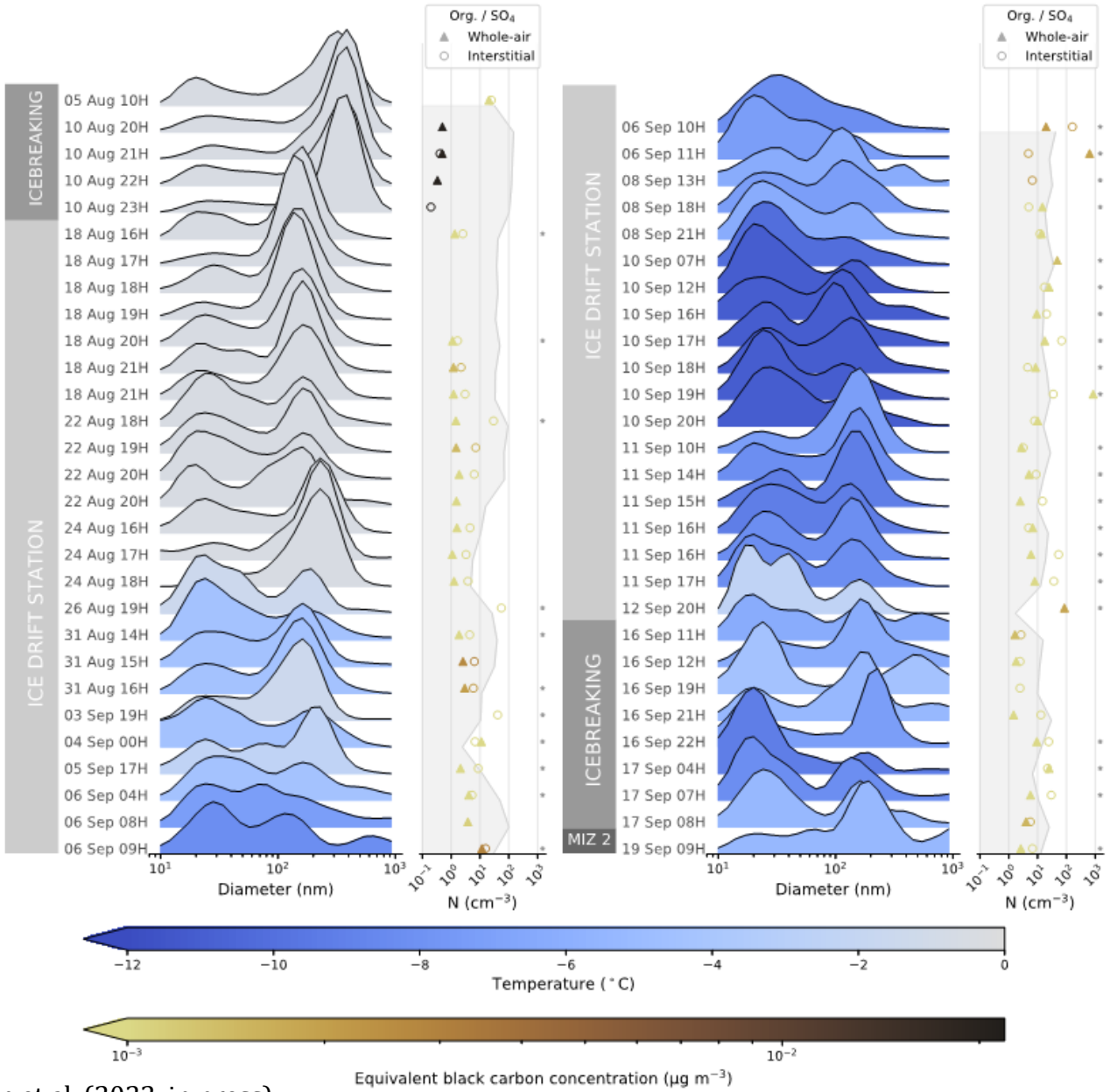
Aerosol-cloud sampling on 4th deck using a variety of inlets and aerosol in-situ instrumentation



Size distribution of dried particles



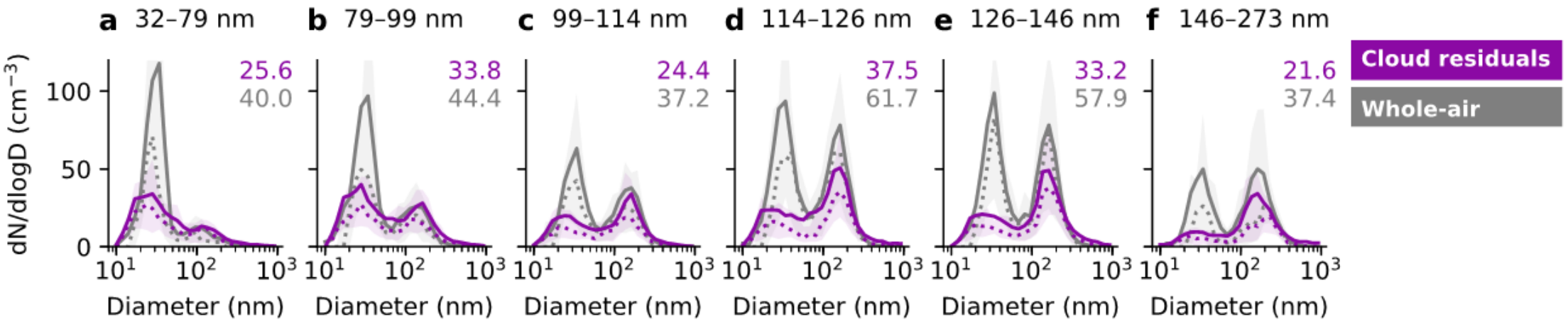
Overview of cloud droplet residual size distributions



- 25 cloud events (~50 hours of data)
- Focus on ice drift station close to North Pole
- Average cloud droplet residual number concentration ~20-30 cm^{-3}
- Large contribution of Aitken-mode particles (almost always present)
- Increase of Aitken-mode fraction after freeze-up of sea ice towards fall

Karlsson et al. (2022, in press)

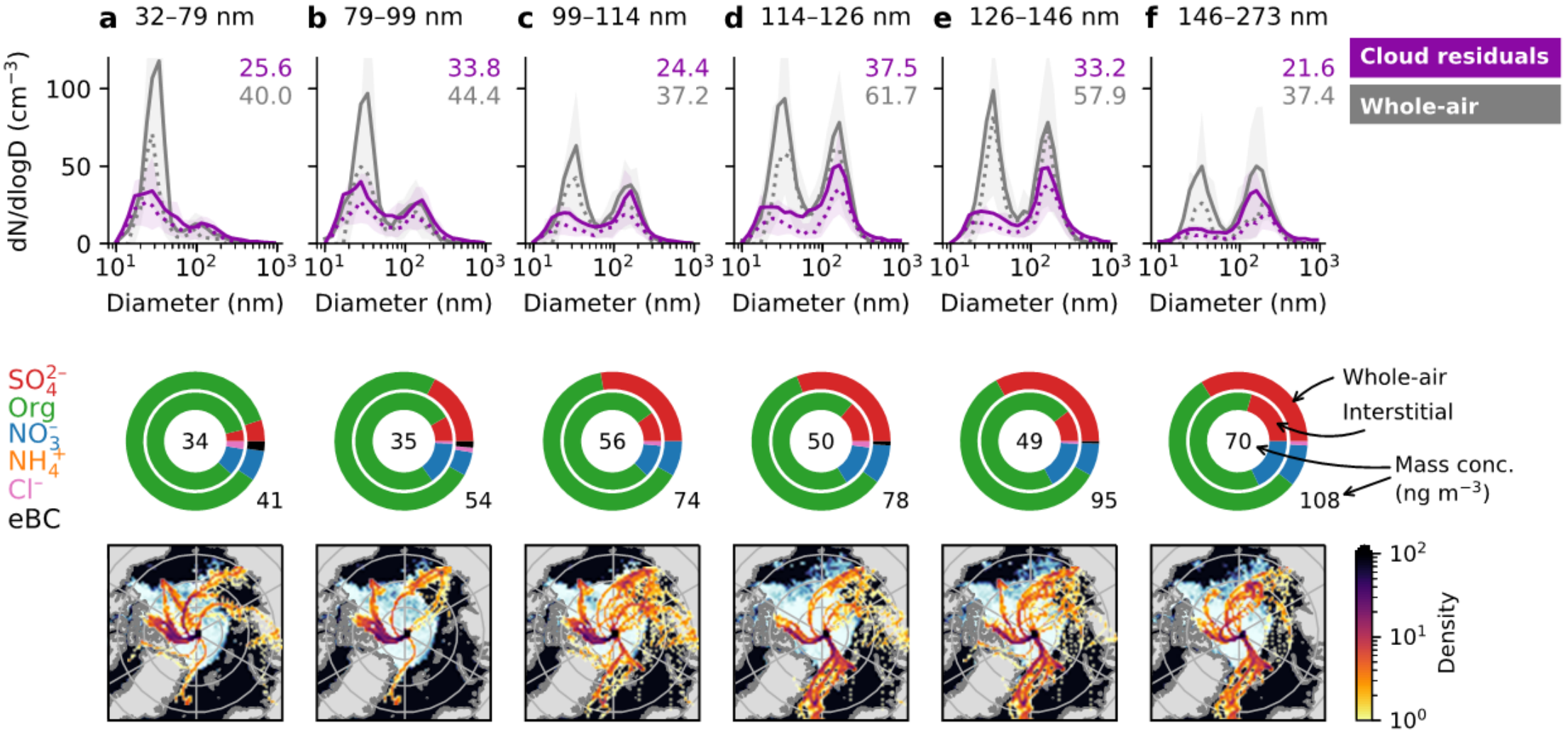
Cloud residual size distributions binned by number mean diameter



- Aitken-mode also present in whole-air (= interstitial and activated aerosol)
- Hoppel-minima almost unchanged (diameter ~ 67 nm) for both cloud residuals and whole-air ⇨ little addition of accumulation mode mass from aqueous phase chemistry

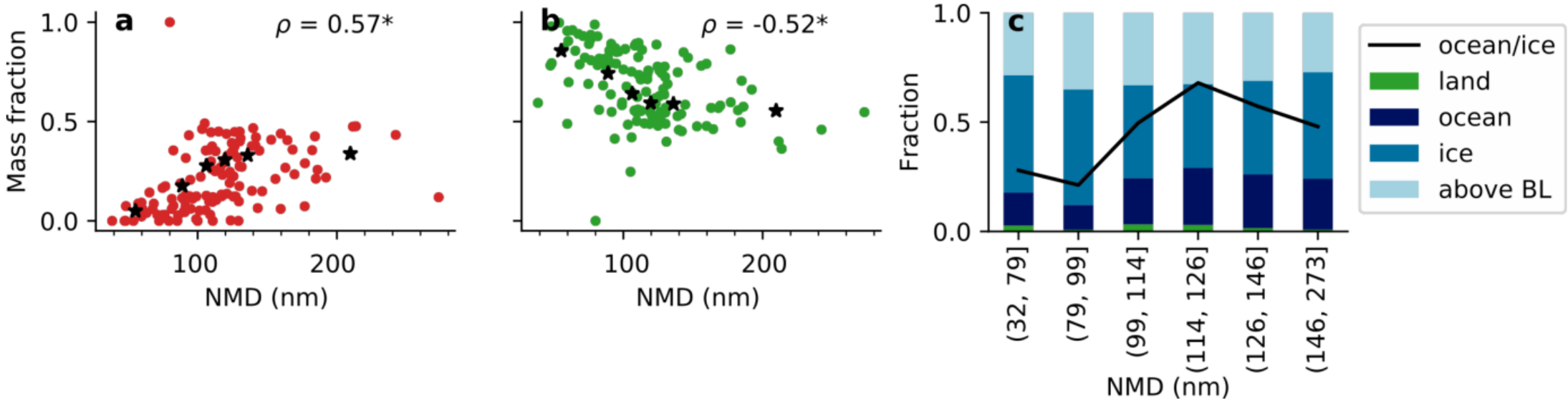
Karlsson et al. (2022, in press)

Cloud residual size distributions binned by number mean diameter



Karlsson et al. (2022, in press)

Cloud residual size distributions binned by number mean diameter



- Number mean diameters (NMD) of cloud residuals was larger for higher sulphate mass fractions (whole-air) and smaller for organic-dominated aerosol
- Smaller number mean diameters of cloud residuals were smaller when air travelled for longer periods over the pack ice

Karlsson et al. (2022, in press)

Conclusions

1. Cloud droplet residuals over the central Arctic Ocean are **strongly influences by Aitken-mode particles** (mode diameter ~30 nm) especially after transition to fall
2. **Residence time over the pack ice** and the **relative contribution of organics** both **increased** (↑) when average **cloud droplet residual particle size decreased** (↓)
3. Addition of aerosol mass due to **aqueous-phase chemistry was probably small** over the pack ice

⇨ More in Karlsson et al. (2022) "Physical and chemical properties of cloud droplet residuals and aerosol particles during the Arctic Ocean 2018 expedition" (in press in JGR)

Thank you for your attention!

Questions? ⇨ Contact: paul.zieger@aces.su.se

Photo: Lars Lehnert (SPRS)

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