

UAS Observations during the Soot Transport, Absorption, and Deposition Study (STADS)

Trish Quinn

NOAA PMEL

March 9, 2017

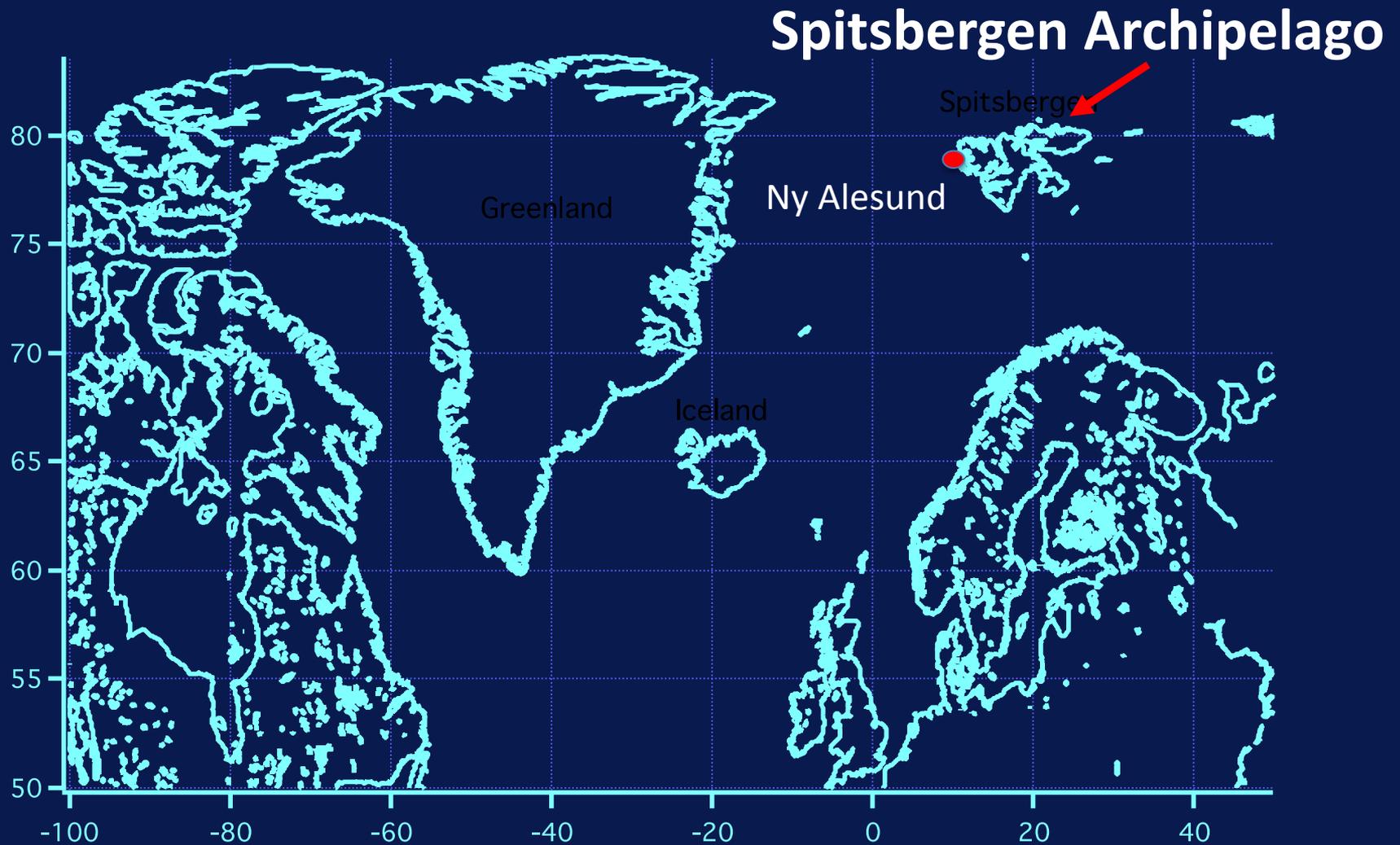


Mission Objective

Transition the NOAA UAS Aerosol Payload to Technology Readiness Level (TRL) 8 (System demonstration in an operational environment)

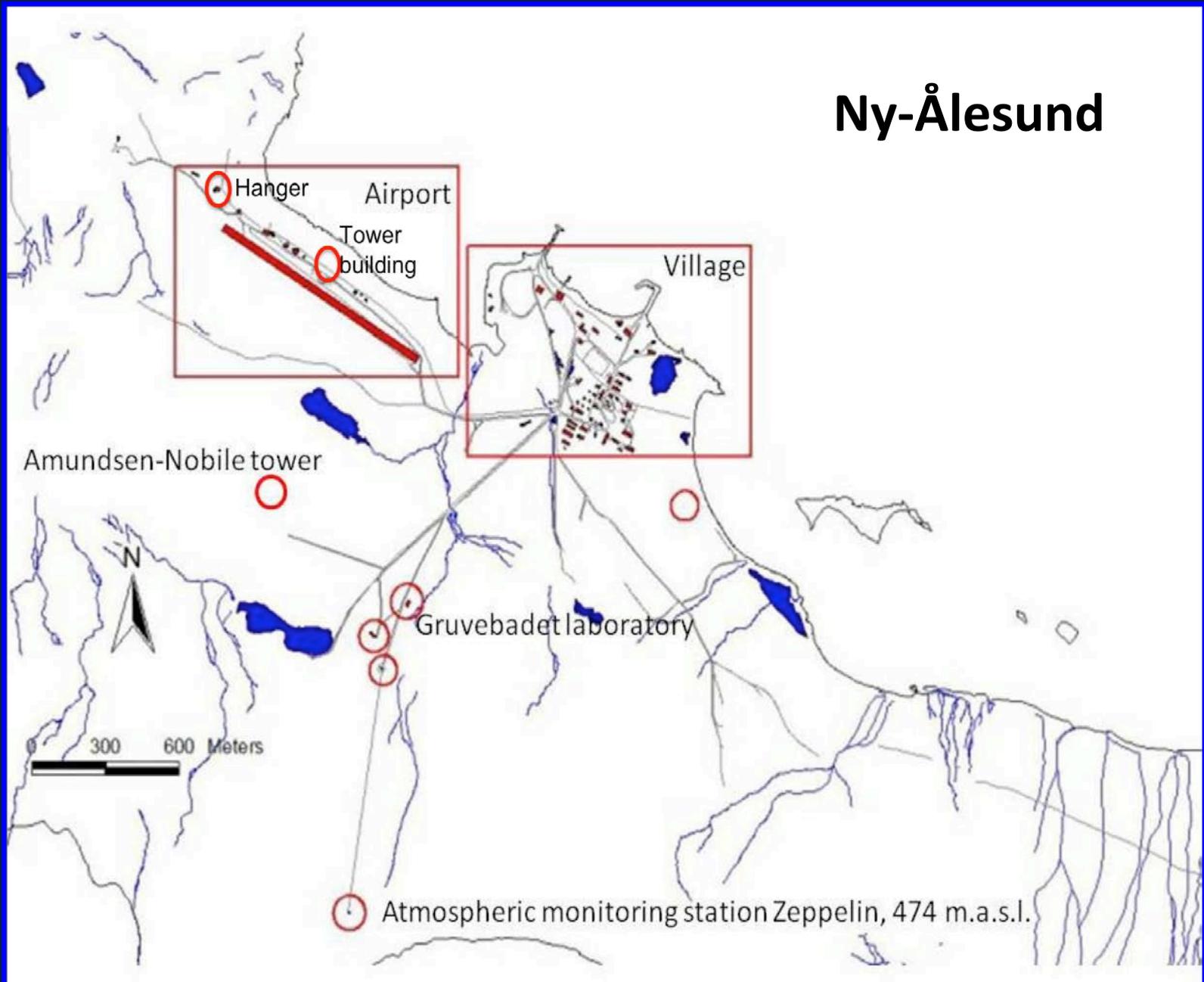


STADS Operational Area





Ny-Ålesund



NOAA UAS Aerosol Package



- Total particle number concentration
- Aerosol light absorption coefficient (proxy for black carbon)
- Aerosol number size distribution (calculated scattering and single scattering albedo) (POPS)
- Filter samples for post-flight chemical analysis
- T, P, RH, wind speed and direction

NOAA/PMEL & NOAA/ESRL/CSD

NOAA UAS Aerosol Package



- Radiant flux densities and aerosol optical depth (miniSASP)

NOAA/PMEL & NOAA/ESRL/CSD



Mission Dates

- April – May, 2011
 - 18 Flights
 - 38 Flight hours
 - 12 flights with the aerosol payload (PMEL instruments)
- April 2015
 - 26 Flights
 - 31.8 Flight hours
 - 2 flights were aircraft test flights
 - 9 flights with the aerosol payload (PMEL and ESRL instruments)
 - 15 flights with the Lamont Doherty camera payloads

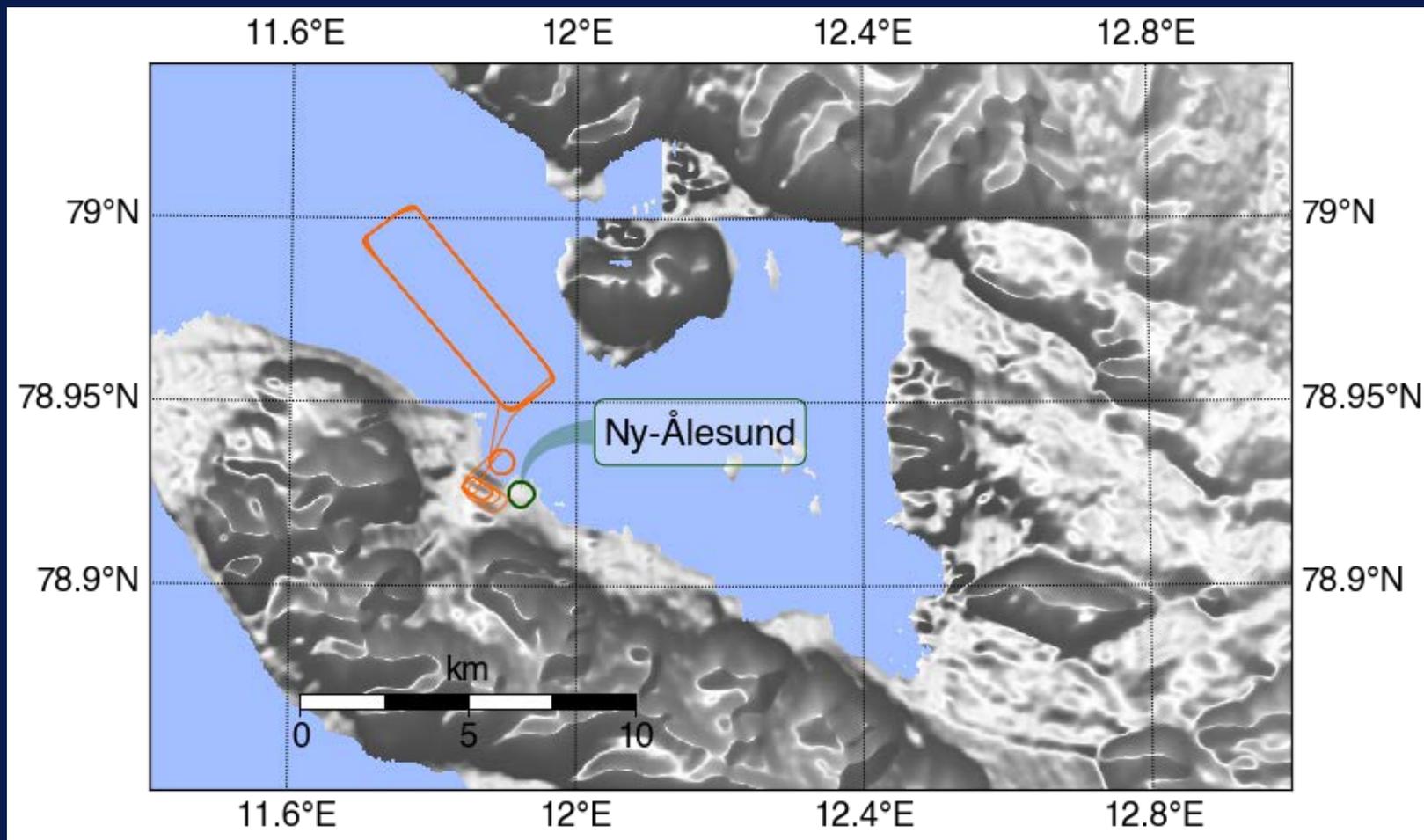


Take off from launcher

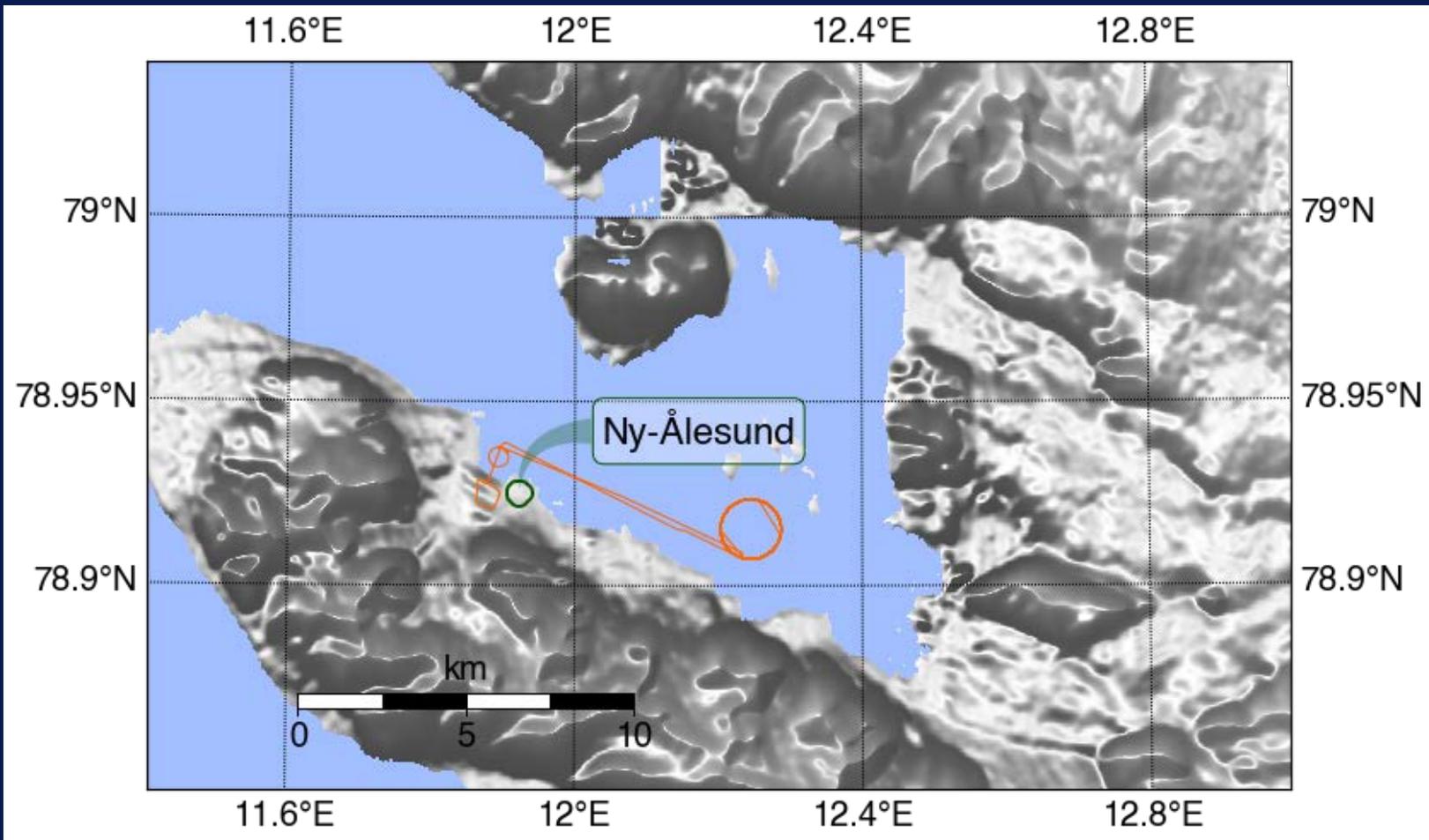


Autonomous landing
on runway

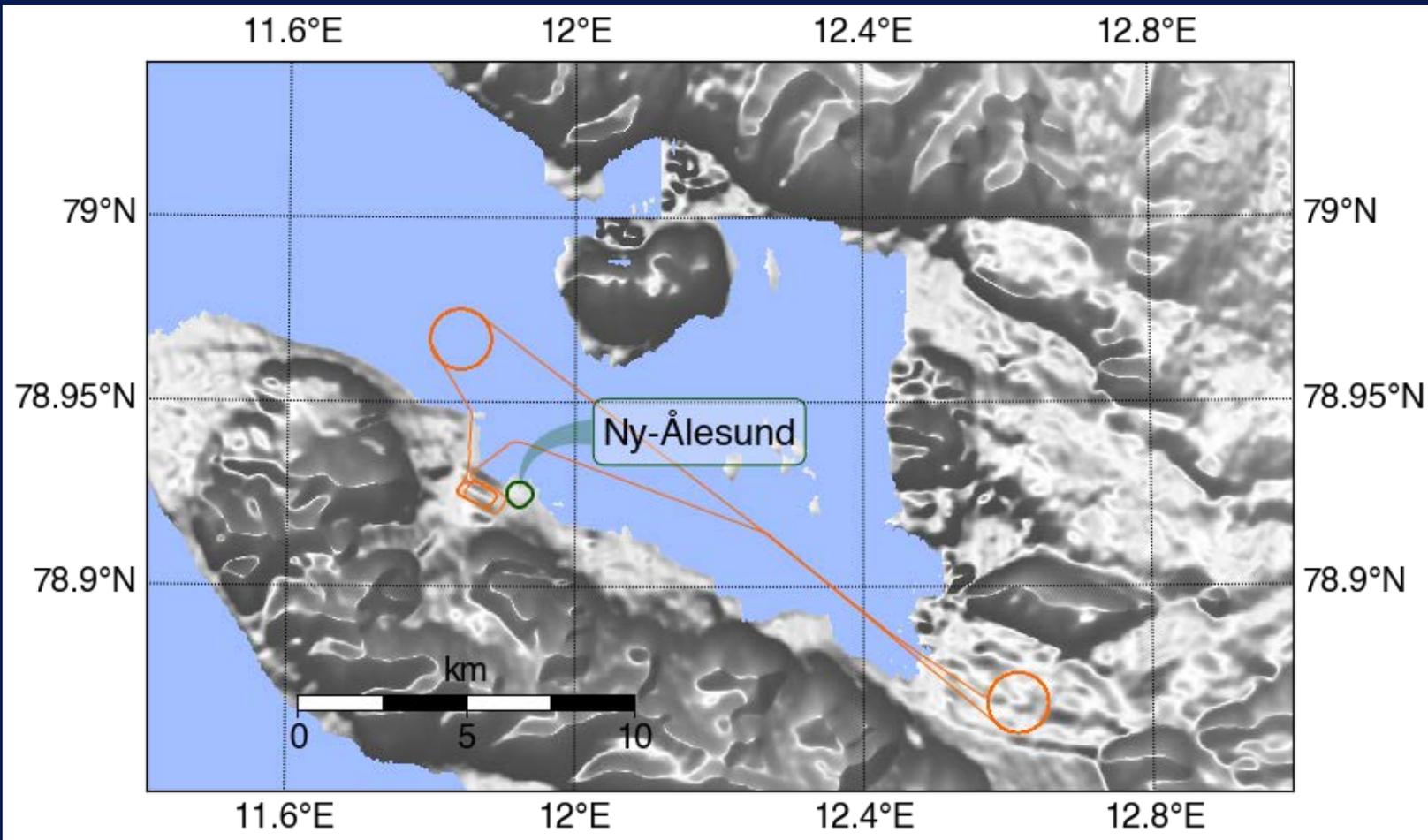
Western Fjord Race Track Flight Path



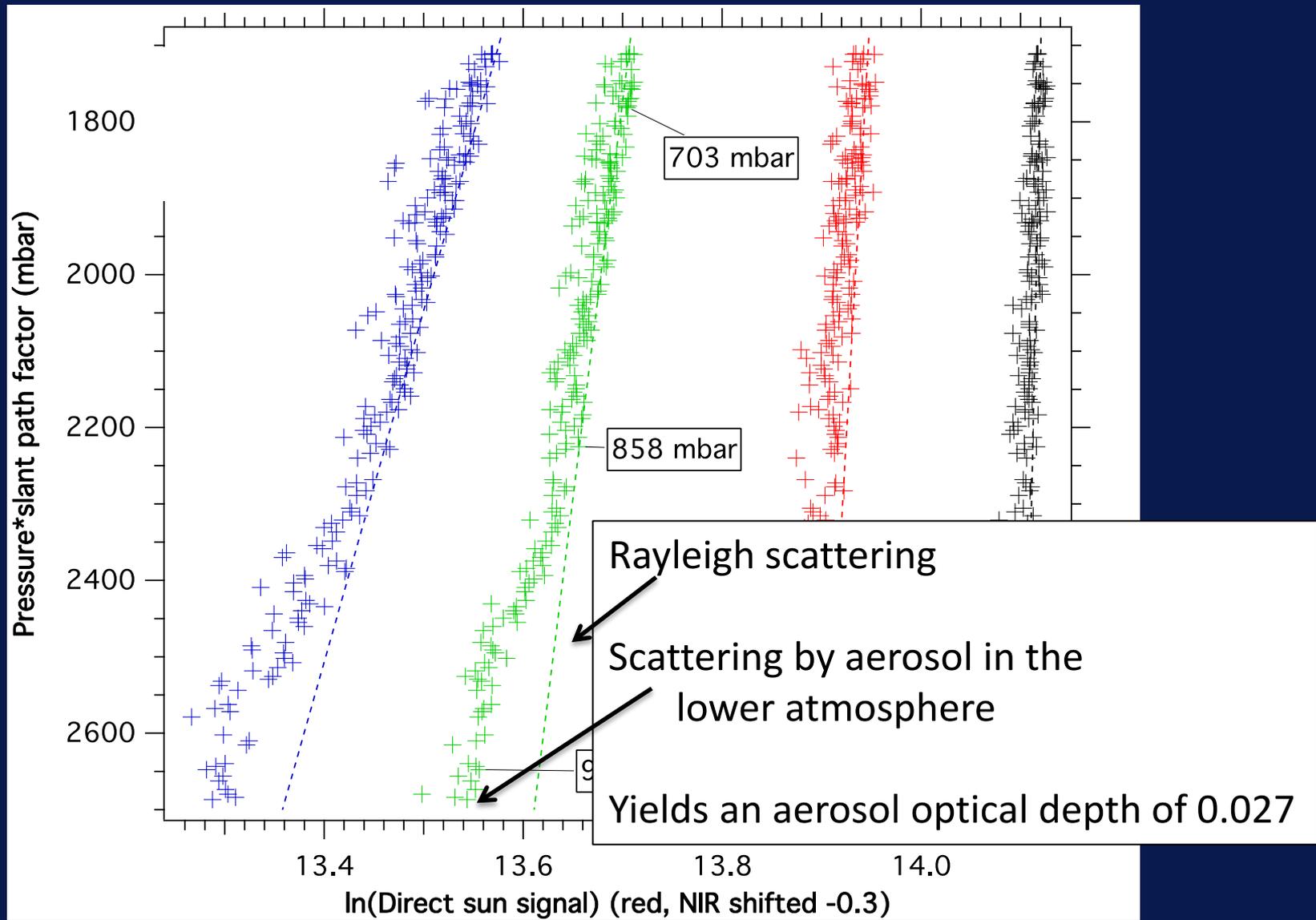
Eastern Fjord Spiral Flight Path



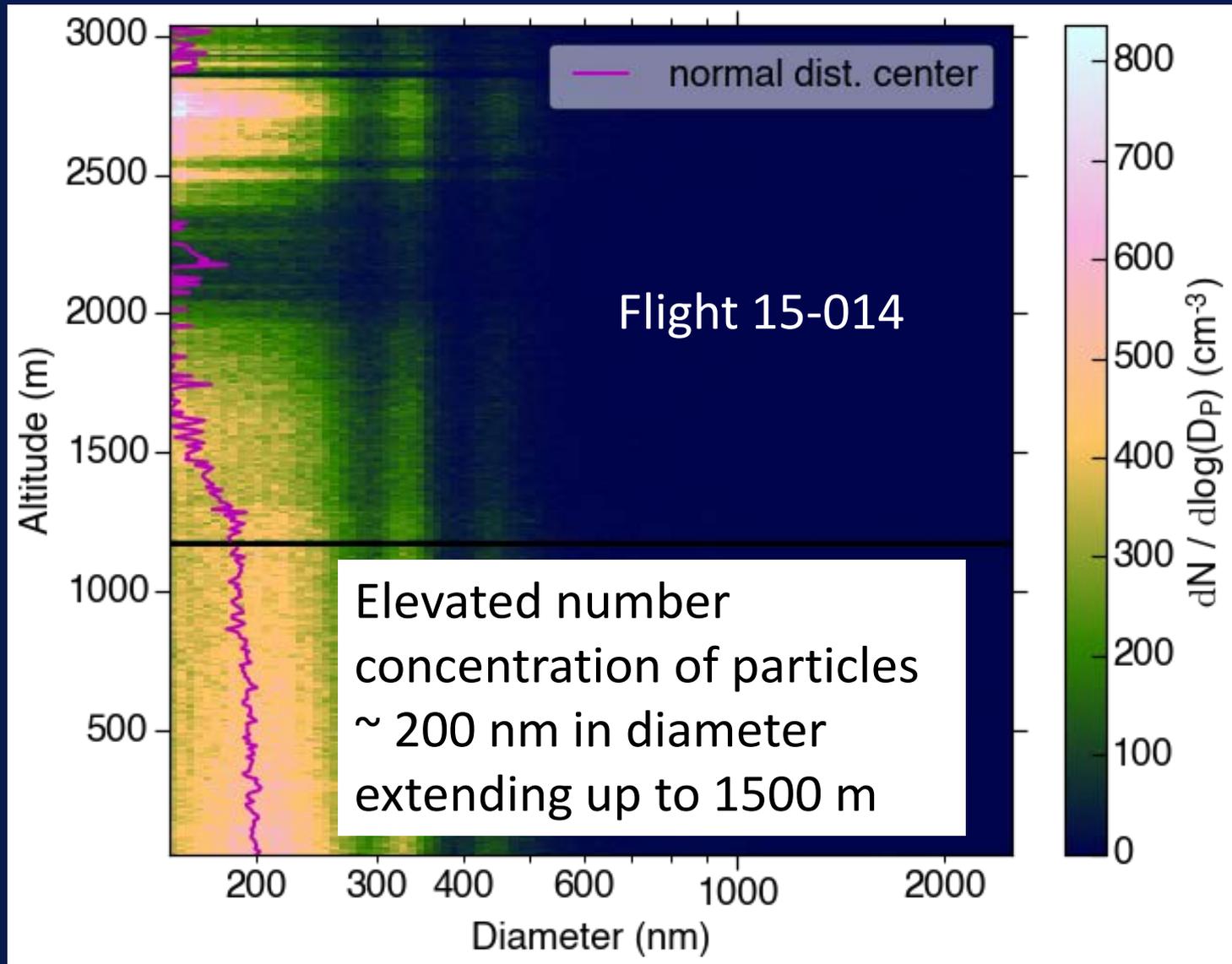
Fjord and Glacier Spiral Flight Path



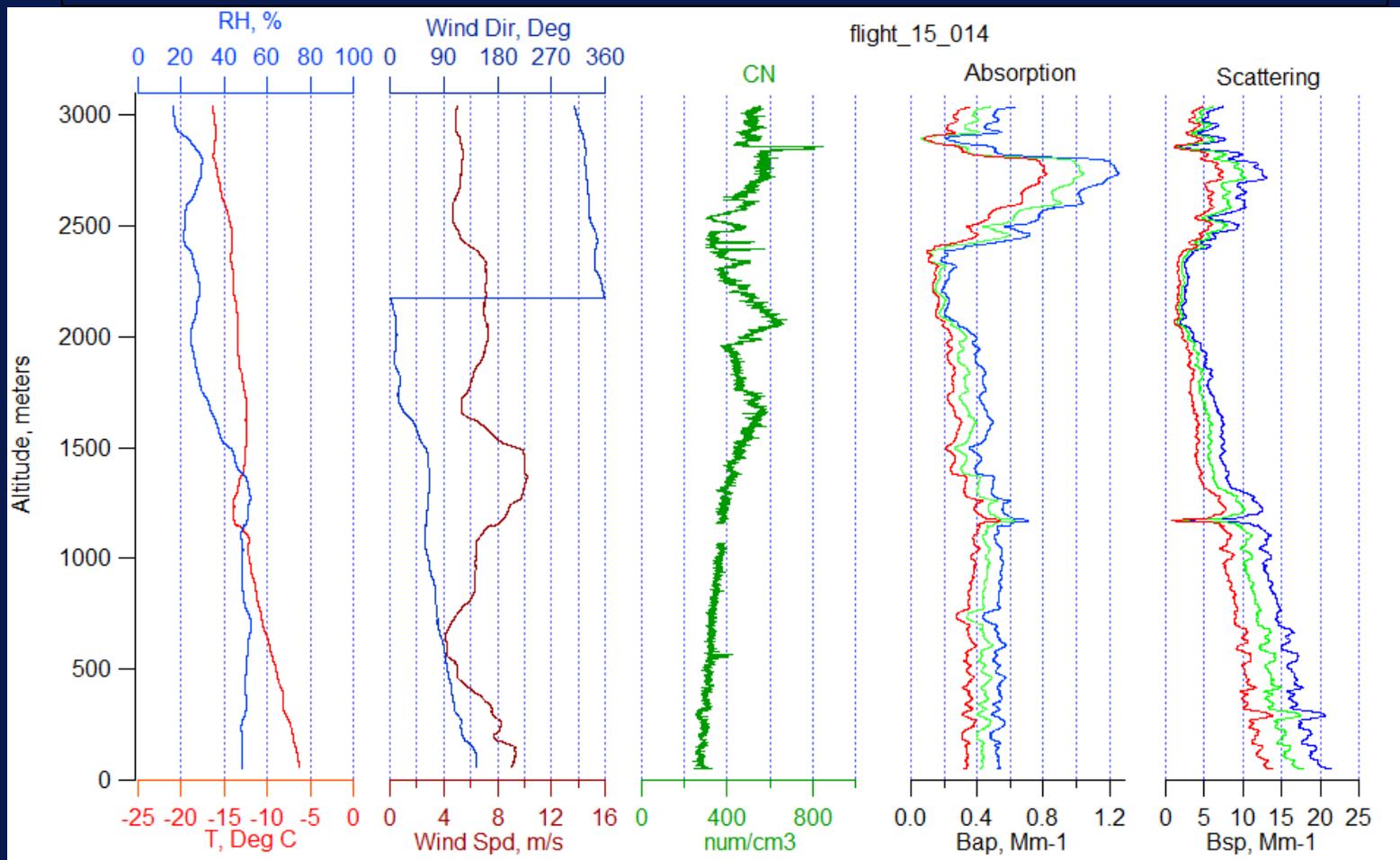
Mini-SASP data from Flight 15-014: Aerosol Optical Depth



POPS data from Flight 15-014: Particle number size distribution as a function of altitude

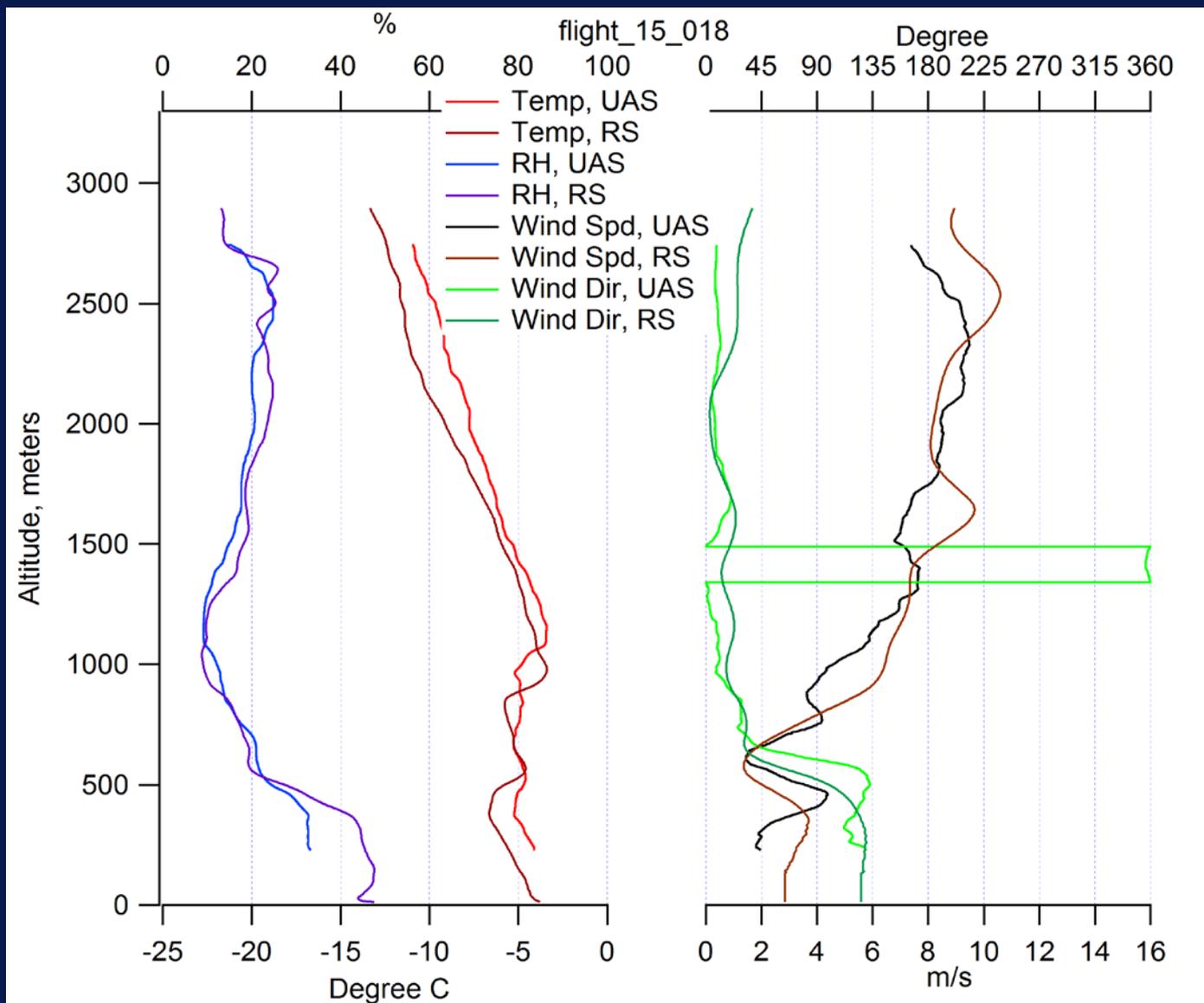


T, RH, total particle number concentration and light absorption for Flight 15-014



From POPS and miniSASP – more aerosol mass and scattering in the boundary layer
From the CPC and PSAP – layer aloft with small particles and black carbon

Comparison of UAS and Radiosonde Meteorological Measurements



Summary

- UASs can be used in the Arctic to obtain vertical profiles of aerosol properties to study aerosol transport, radiative effects, and deposition.
- At Ny-Alesund during April 2015 most of the aerosol mass and light scattering occurred in the boundary layer while the highest aerosol number concentrations and light absorption occurred in layers above the boundary layer. This atmospheric structure affects radiative effects and climate.
- Three papers have been published from the 2011 and 2015 missions.

Summary

- The aerosol payload, which was developed under a NOAA SBIR by Brechtel Manufacturing, is now commercially available from Brechtel.
- The DOE ARM program recently bought an aerosol payload for use in a developing UAS program.
- All 5 instruments in the PMEL/ESRL aerosol payload were shown to work in a harsh operational environment.
- The NOAA PMEL/ESRL-CSD aerosol payload has transitioned to TRL 8 (System demonstration in an operational environment).

Acknowledgements: NOAA UAS
Program and the Moore Foundation
for funding and our Norwegian hosts in
Ny Alesund for assistance and
hospitality.

Thank you for your attention.