

Chemical Composition of Individual Particles Collected Onboard G-1 Aircraft During The ACE-ENA Study

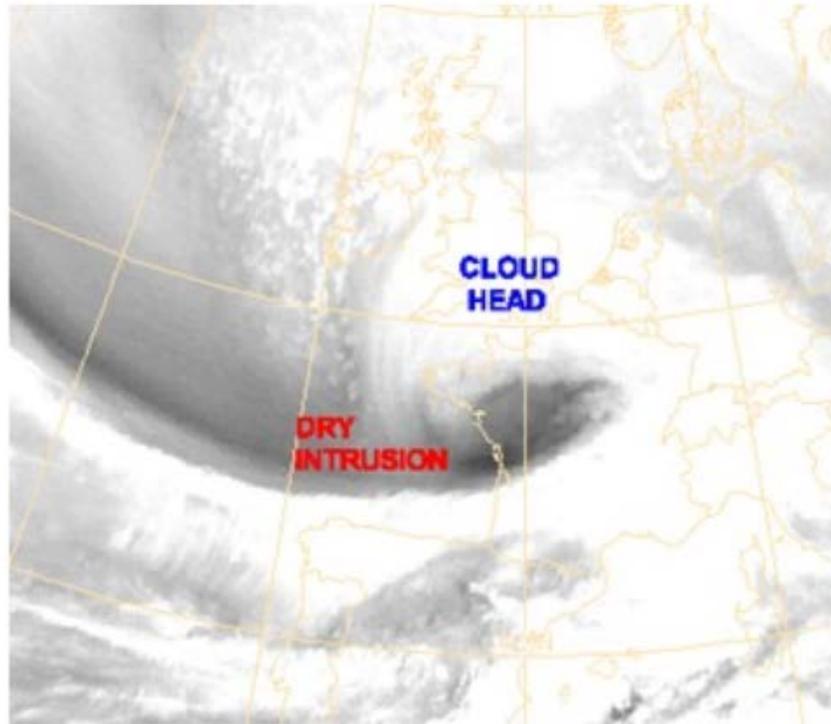
Daniel Veghte¹, Swarup China¹, Jay Tomlin,⁷ Daniel Bonanno², Joseph Charnawskas³, Ryan Moffet⁴, Mary K. Gilles⁵, Daniel Knopf³, Jian Wang⁶, Alexander Laskin⁷

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Sample collection: G-1 aircraft

- Particle Composition During Dry Intrusion Events ?



G-1 Research aircraft

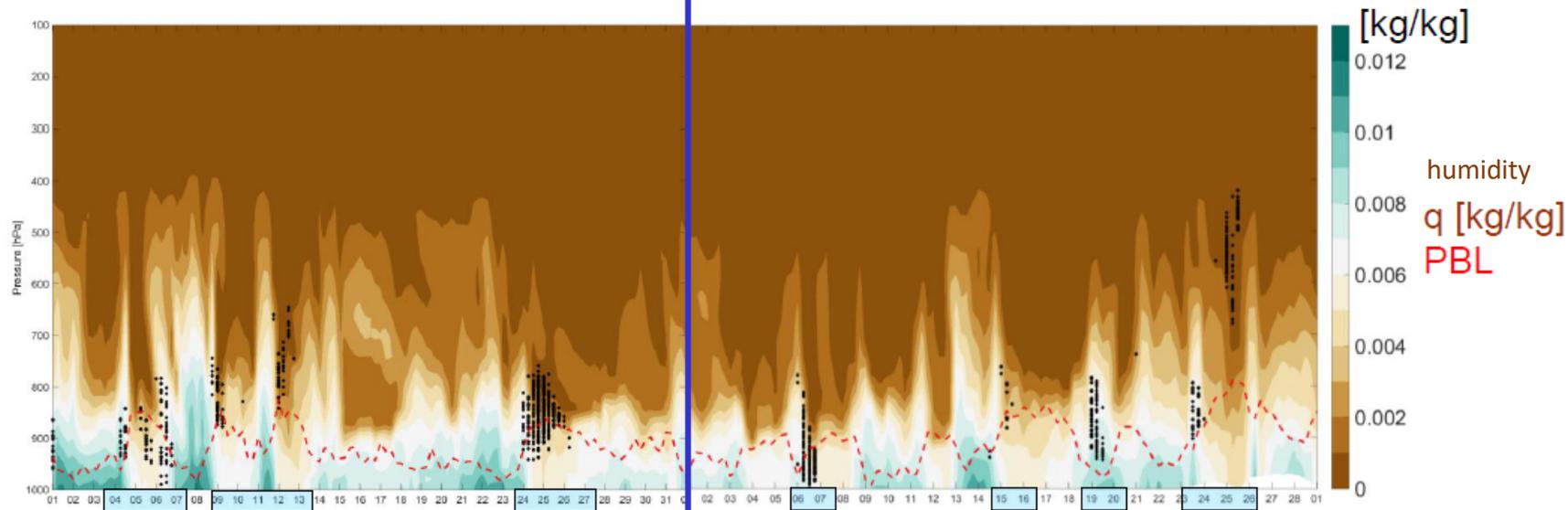
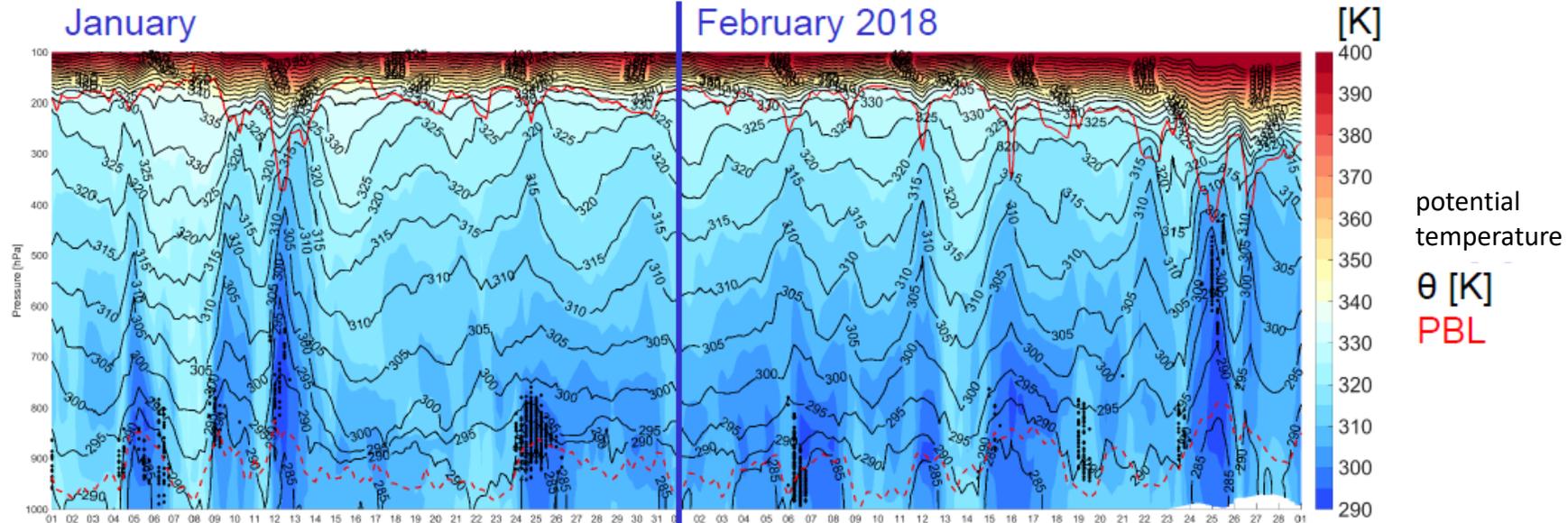


Time Resolved Aerosol Collector (TRAC)
Time per sample: 7 min

Dry intrusions events ACE-ENA IOP2

39N,28W
January

February 2018



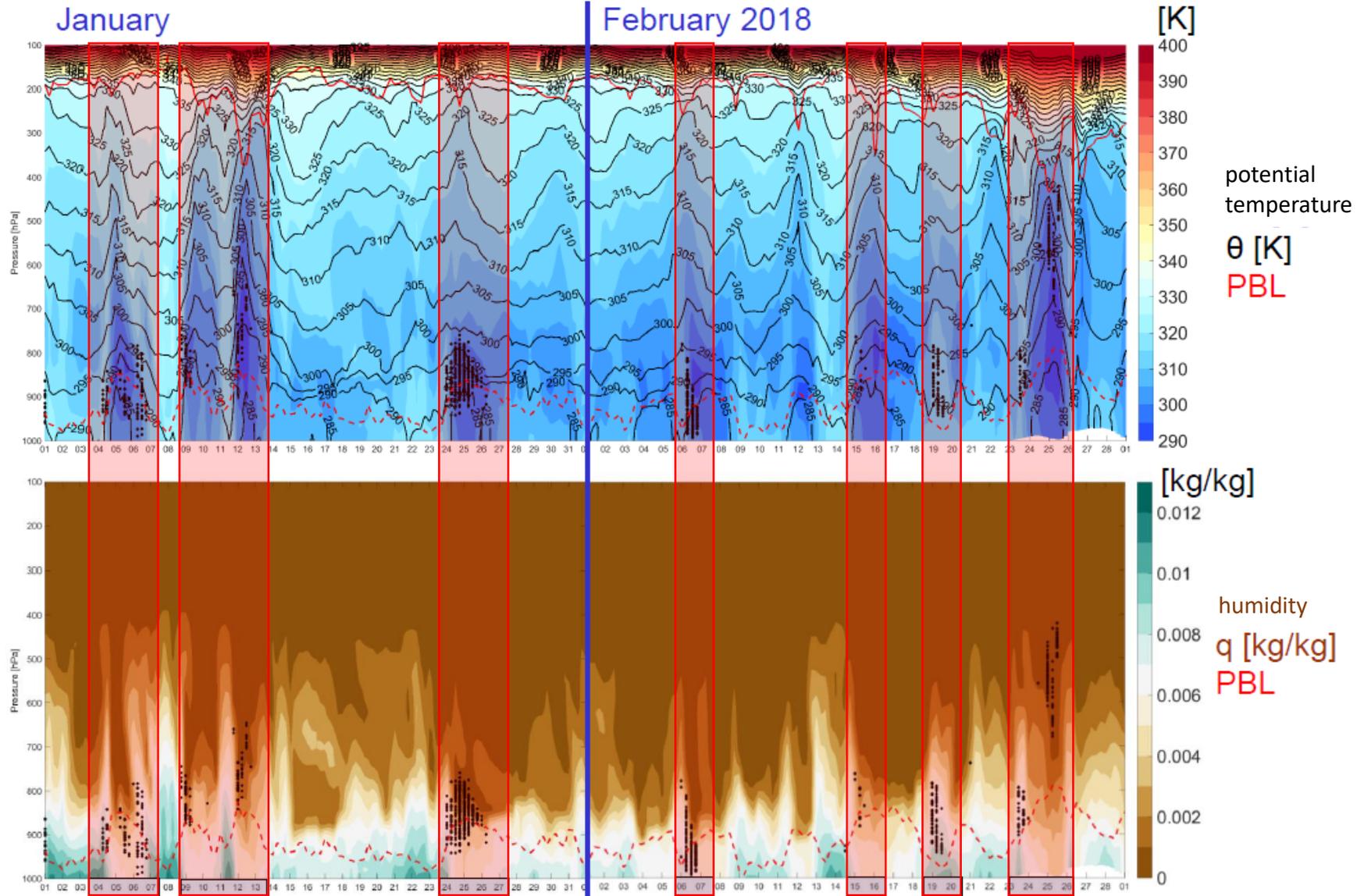
Shira Raveh-Rubin
Weizmann Institute of Science

- DI identified based on the vertically descended trajectories: >400 hPa in 48 h.
- **black dots** show DI trajectories arriving within a 3-degree radius from 39N, 28W

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Dry Intrusion Dates (IOP2)

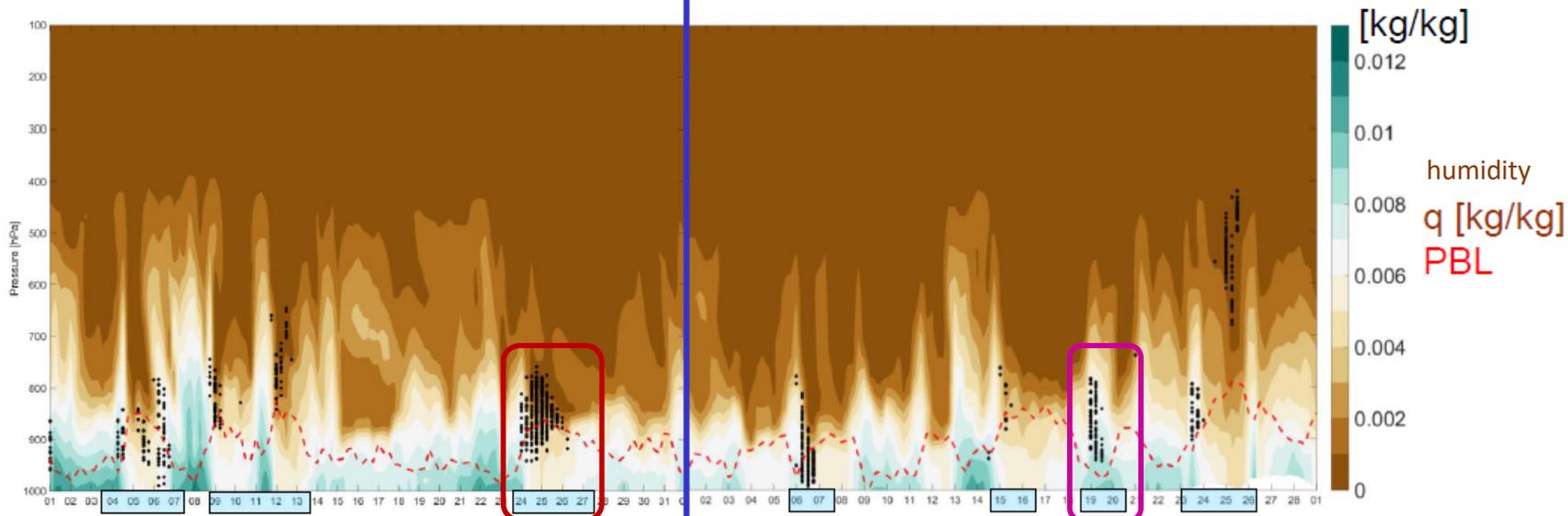
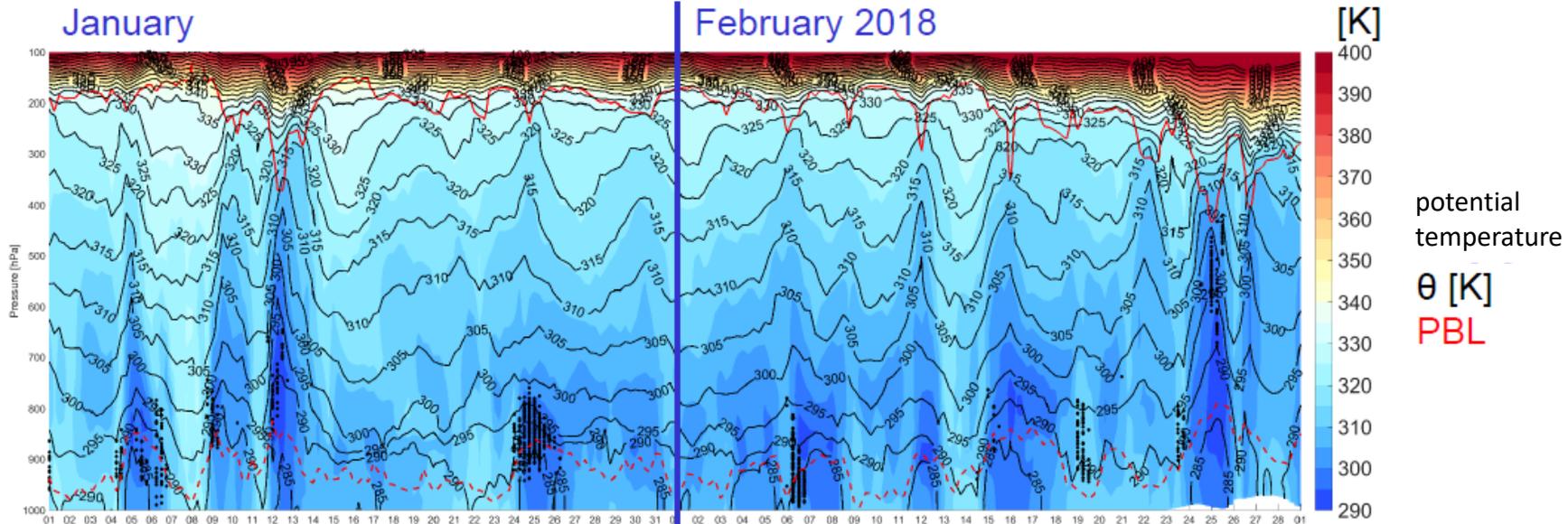
January 4th–7th, 9th–13th, 24th–27th

February 6th, 7th, 15th, 16th,
19th–20th, 23rd–26th

Dry intrusions events ACE-ENA IOP2

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January 4th-7th, 9th-13th, **24th-27th**

February 6th, 7th, 15th, 16th,
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* DIs at the PBL

DIs above the PBL

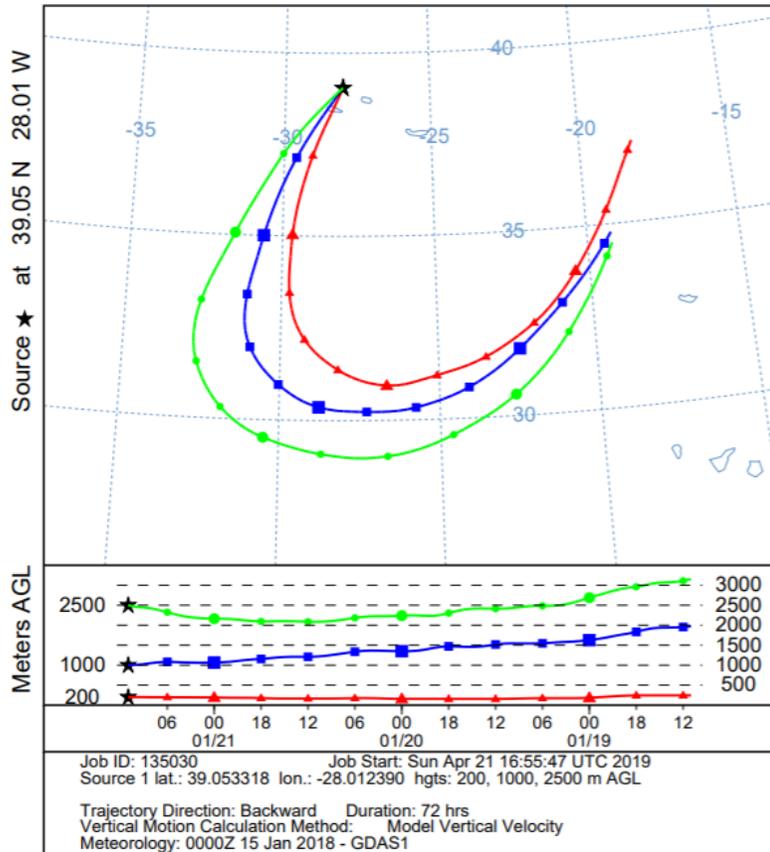
*

#

HYSPLIT: Backward trajectories

Pre Dry intrusion event*

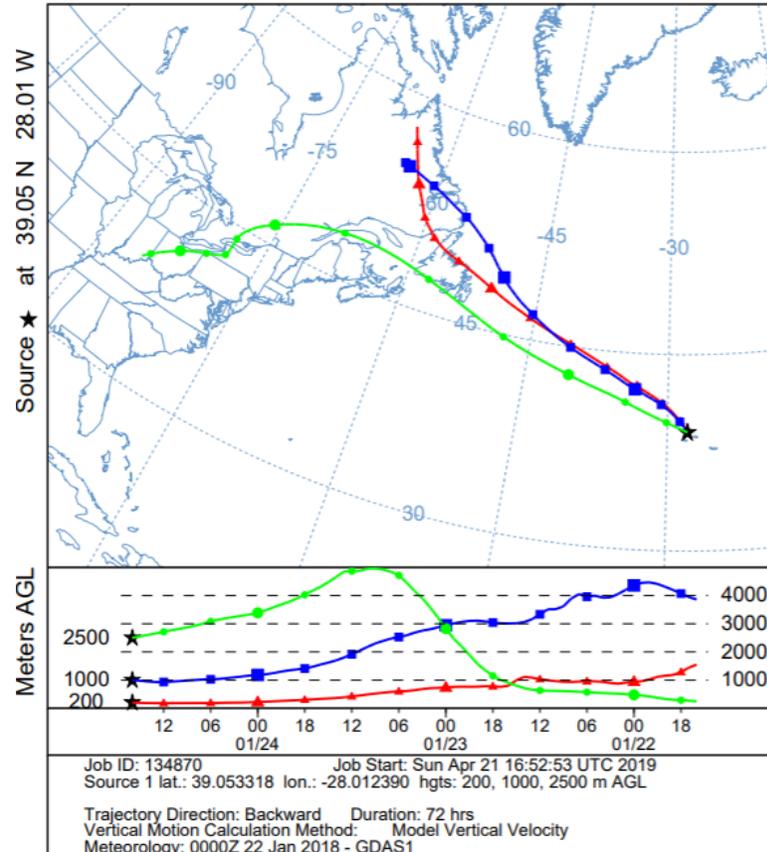
NOAA HYSPLIT MODEL
Backward trajectories ending at 1100 UTC 21 Jan 18
GDAS Meteorological Data



Dry intrusion event*

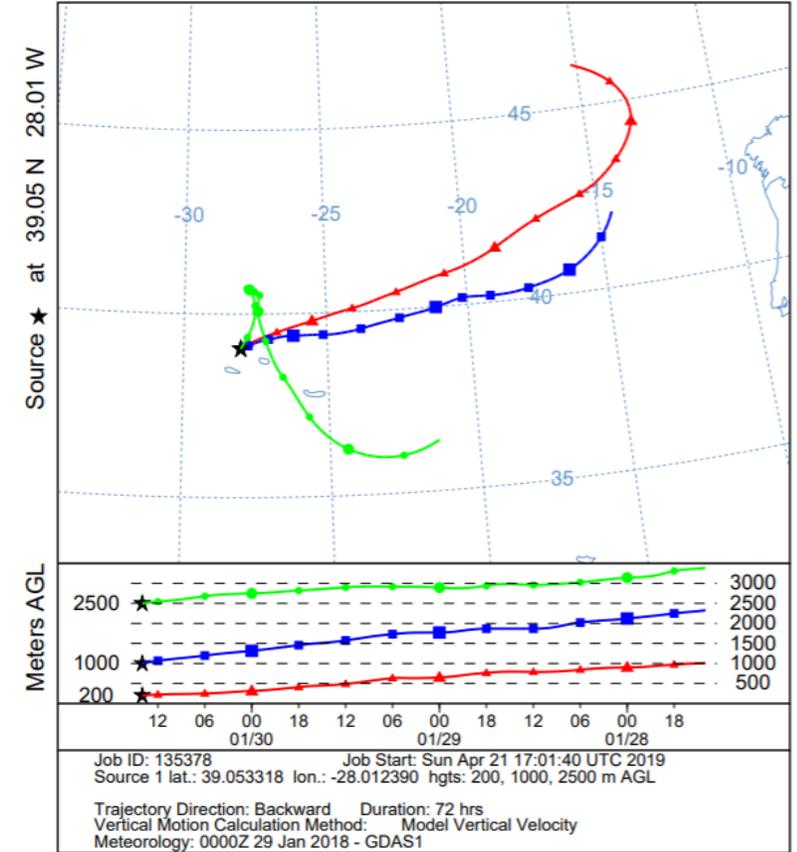
* DI at Jan 24th

NOAA HYSPLIT MODEL
Backward trajectories ending at 1600 UTC 24 Jan 18
GDAS Meteorological Data



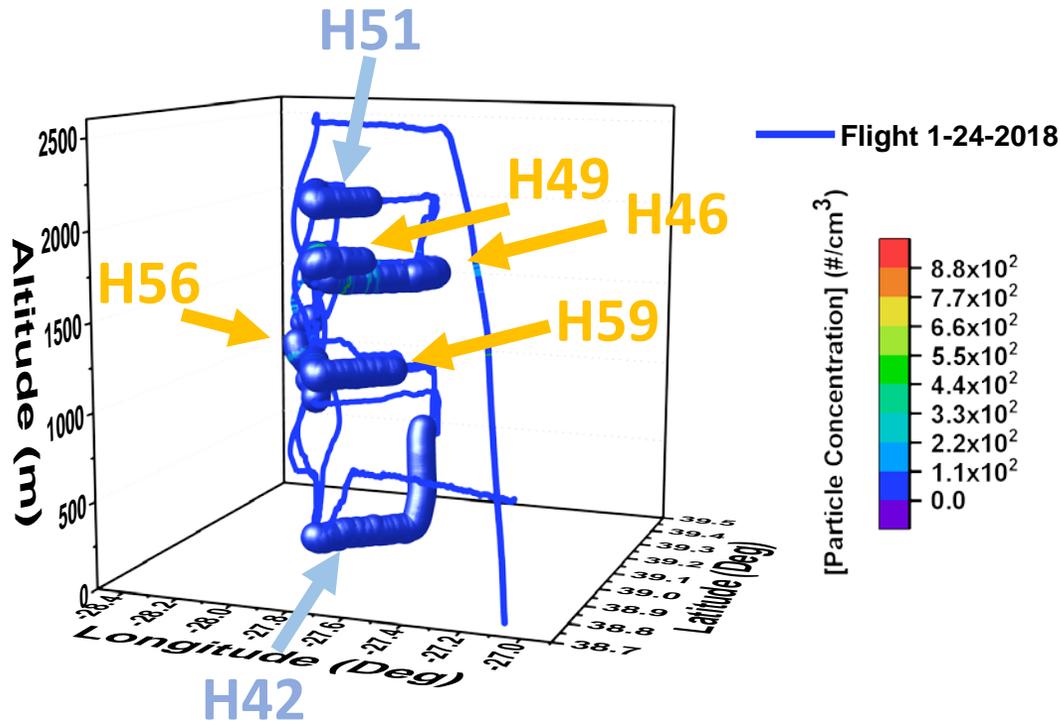
Post Dry intrusion event*

NOAA HYSPLIT MODEL
Backward trajectories ending at 1400 UTC 30 Jan 18
GDAS Meteorological Data



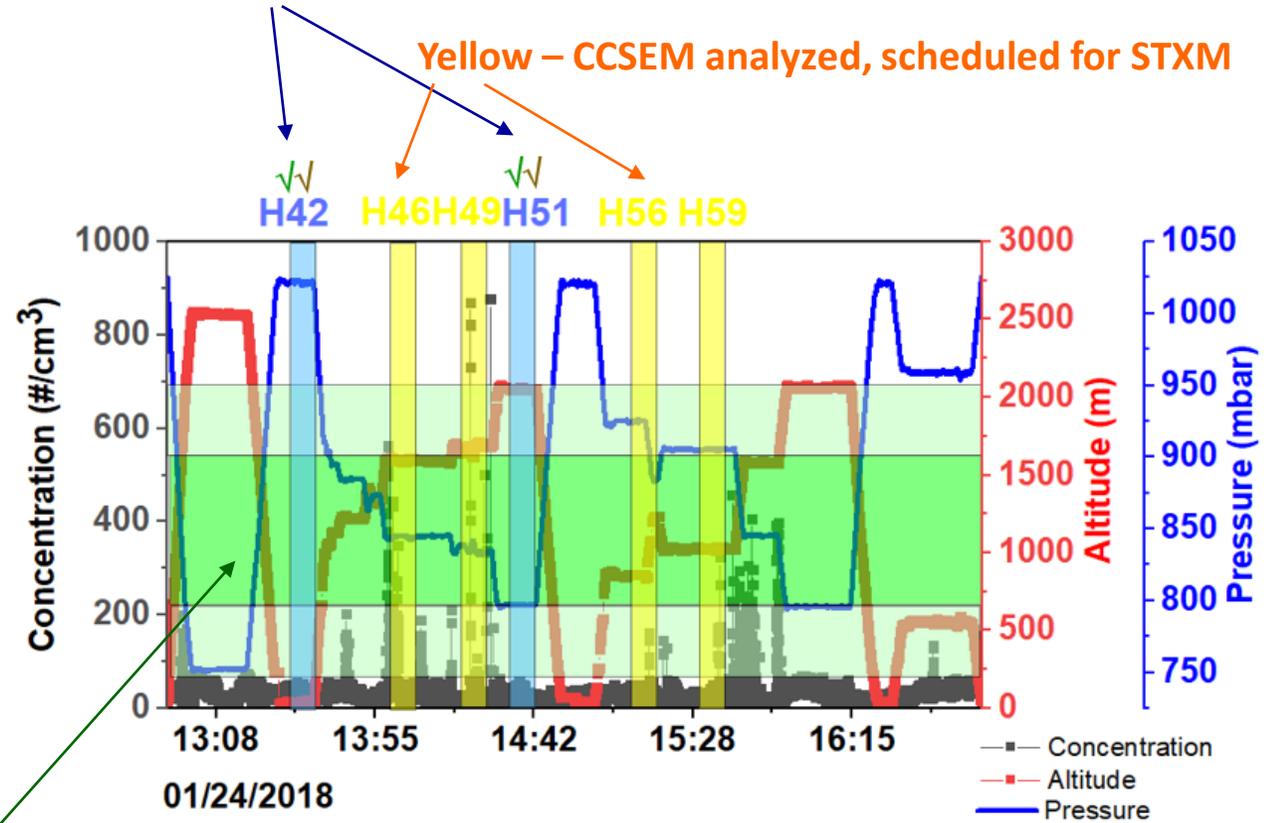
Selection of Samples for Particle Analysis

Jan 24th flight records (*DI episode)



Blue – Analyzed samples (CCSEM/EDX and STXM/NEXAFS)

Yellow – CCSEM analyzed, scheduled for STXM

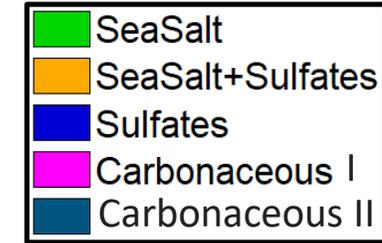
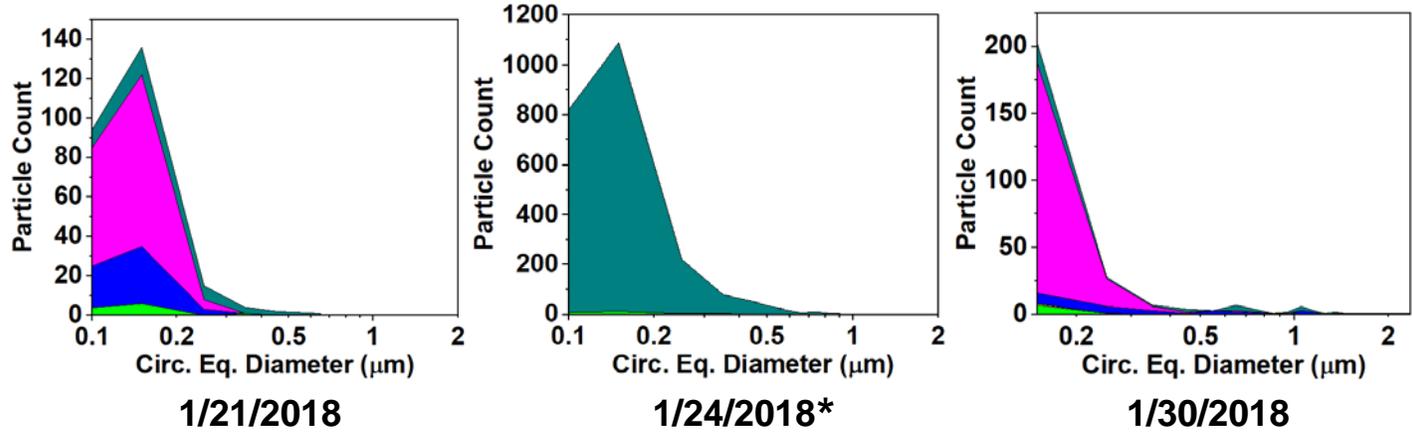


altitude range of DI parcel at the event date

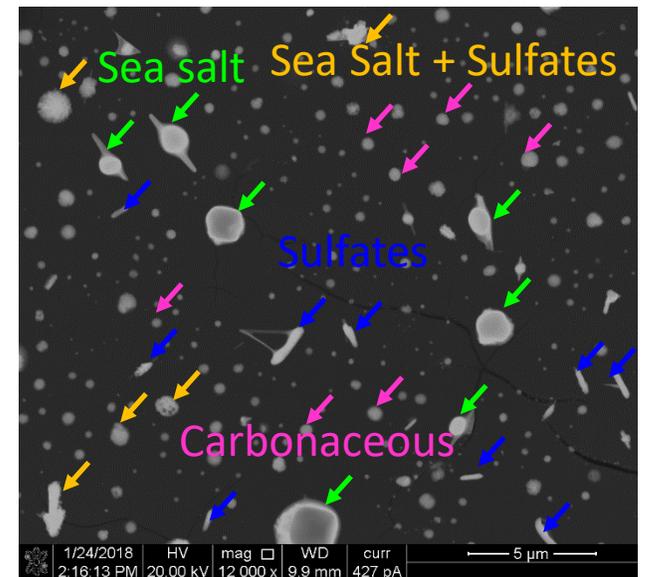
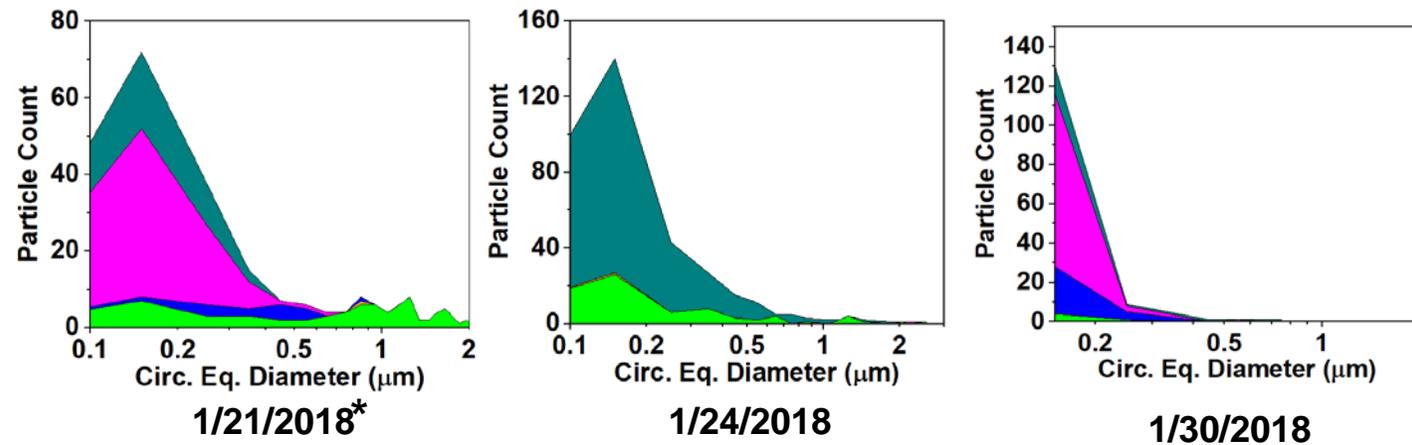
Particle Types Detected by CCSEM/EDX

* DI at Jan 24th

Free Troposphere



Boundary Layer

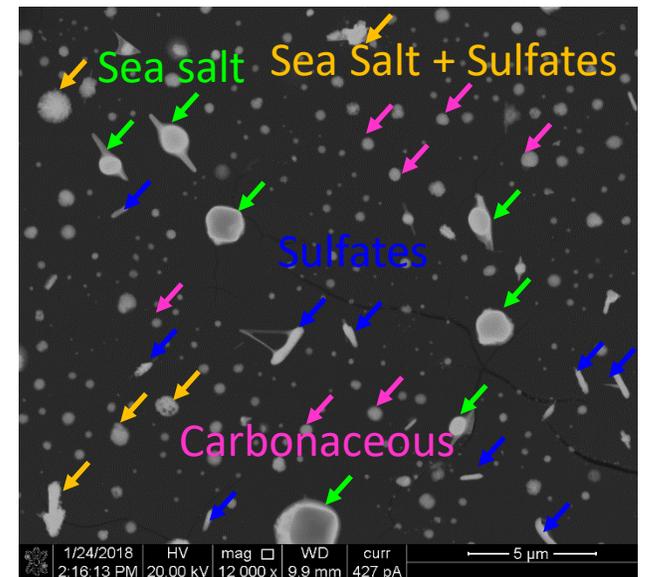
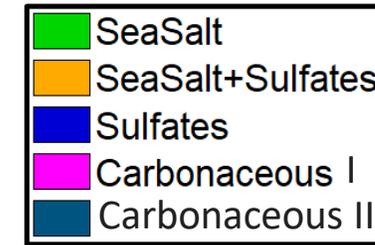
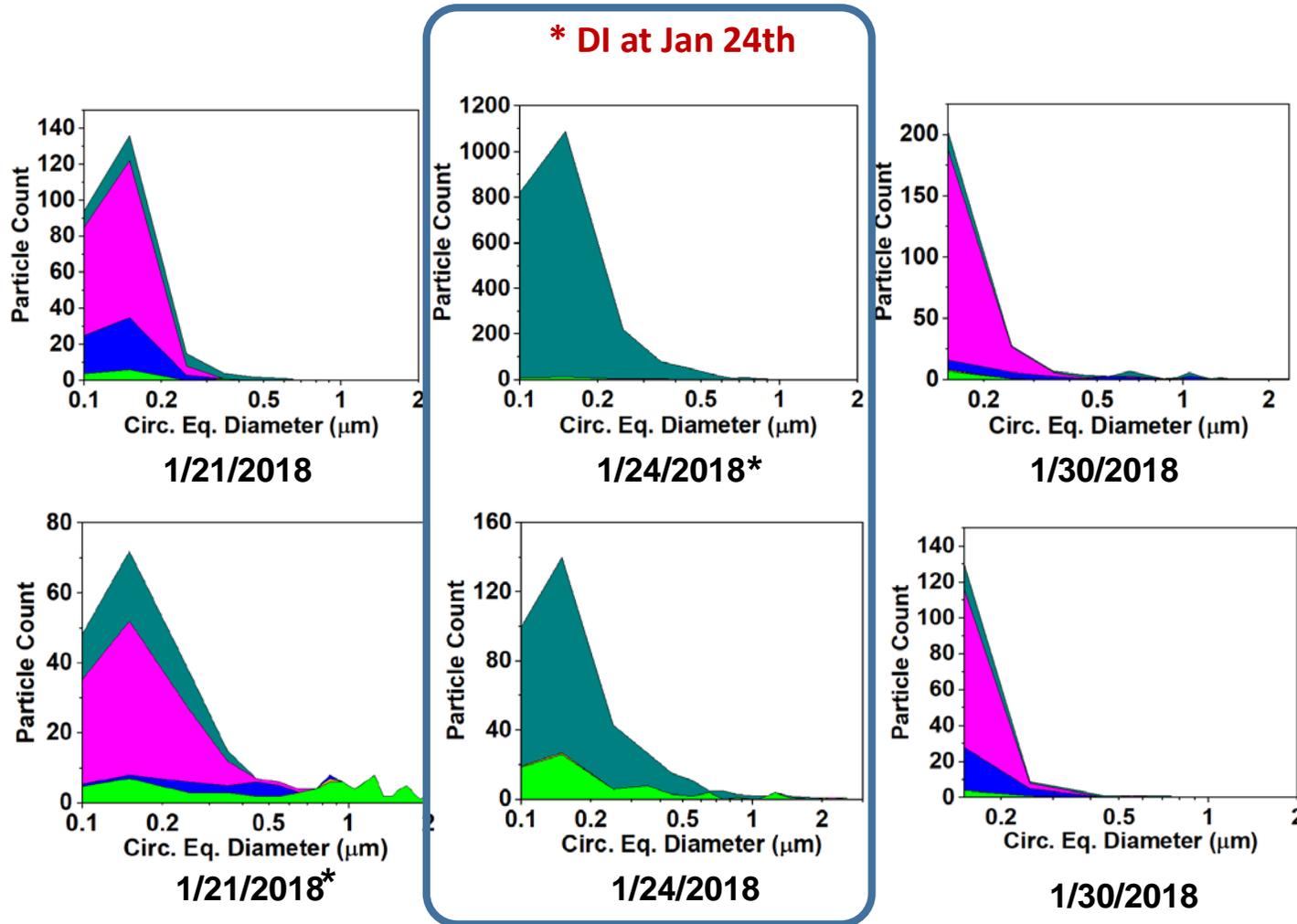


1/24/2018 HV mag WD curr
2:18:13 PM 20.00 kV 12 000 x 9.9 mm 427 pA

Particle Types Detected by CCSEM/EDX

- Large Fractions of Carbonaceous Particles during DI episode

Boundary Layer Free Troposphere



1/24/2018 HV mag □ WD curr
2:18:13 PM 20.00 kV 12 000 x 9.9 mm 427 pA

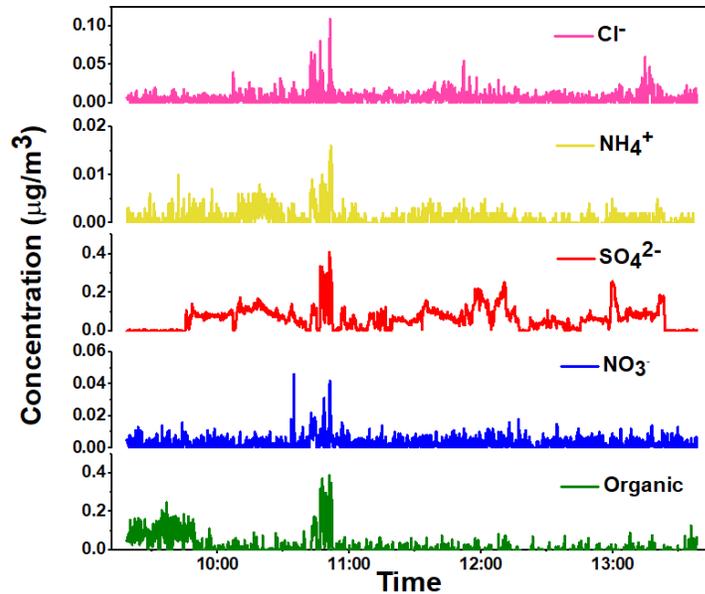
Particle Mass Loadings Detected by AMS

- Large Fractions of Carbonaceous Particles during DI episode
- factor of 2-3 lower mass loadings at DI episode

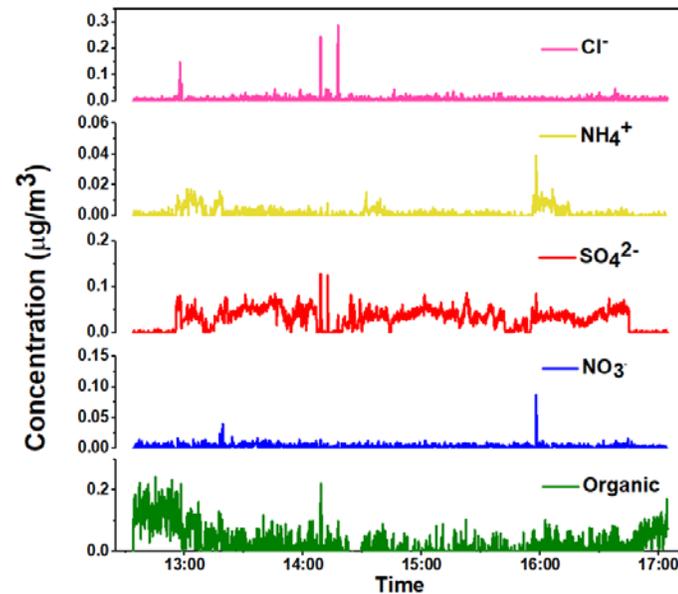
M. Zawadowicz, J. Shilling

PNNL

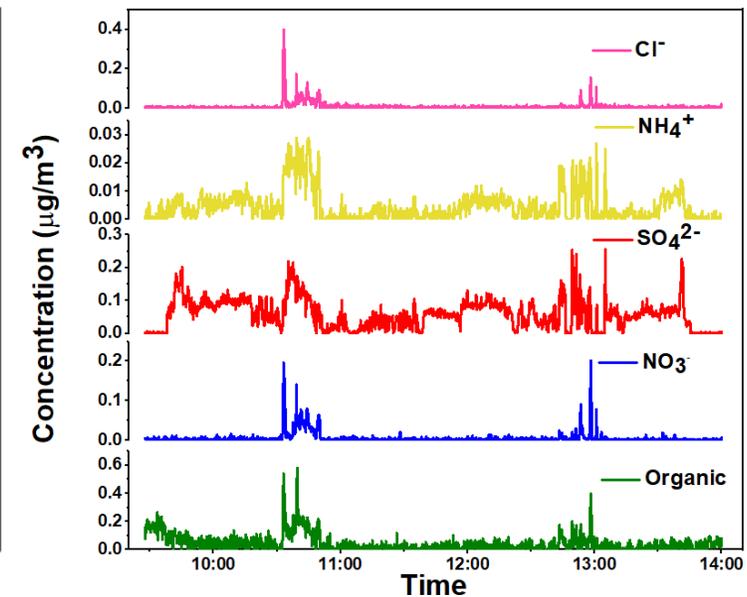
Jan 21st



* DI at Jan 24th



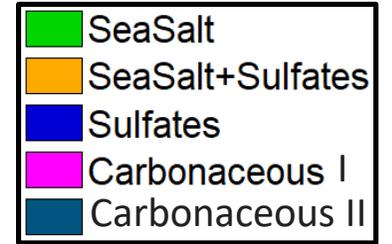
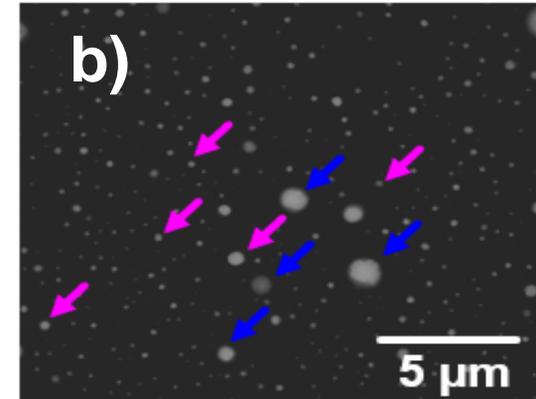
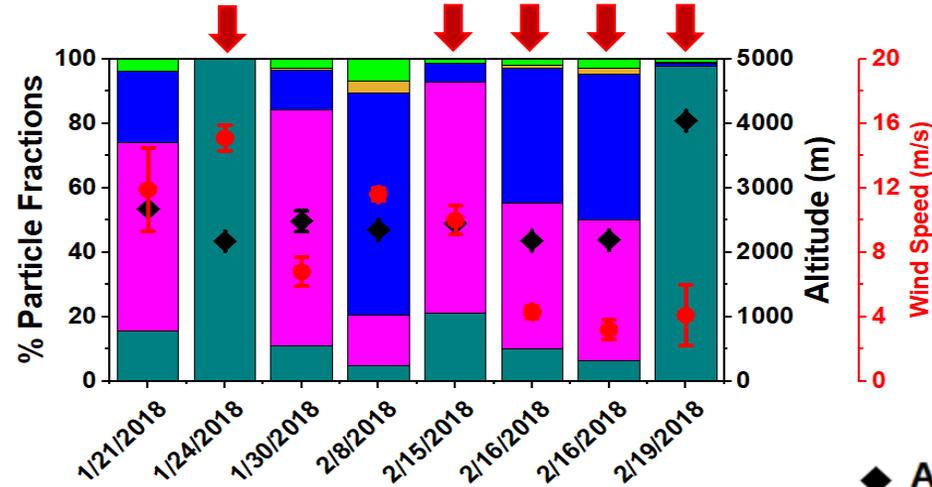
Jan 30th



Particle Types during other DI episodes

Free Troposphere

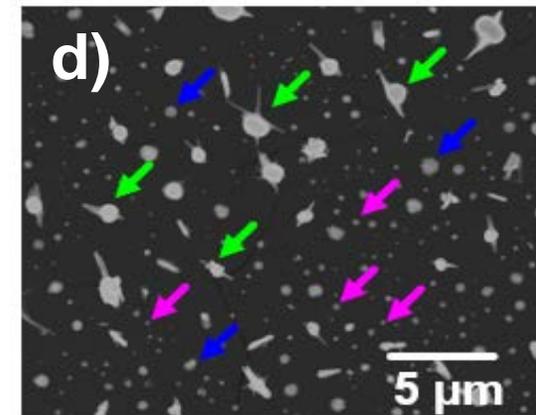
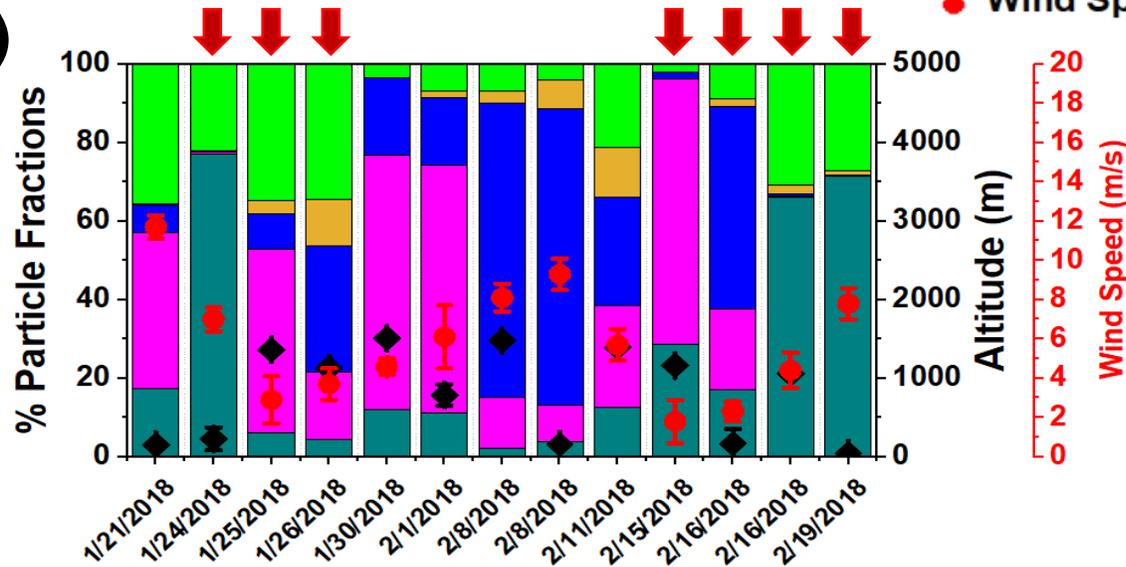
a)



◆ Altitude
● Wind Speed

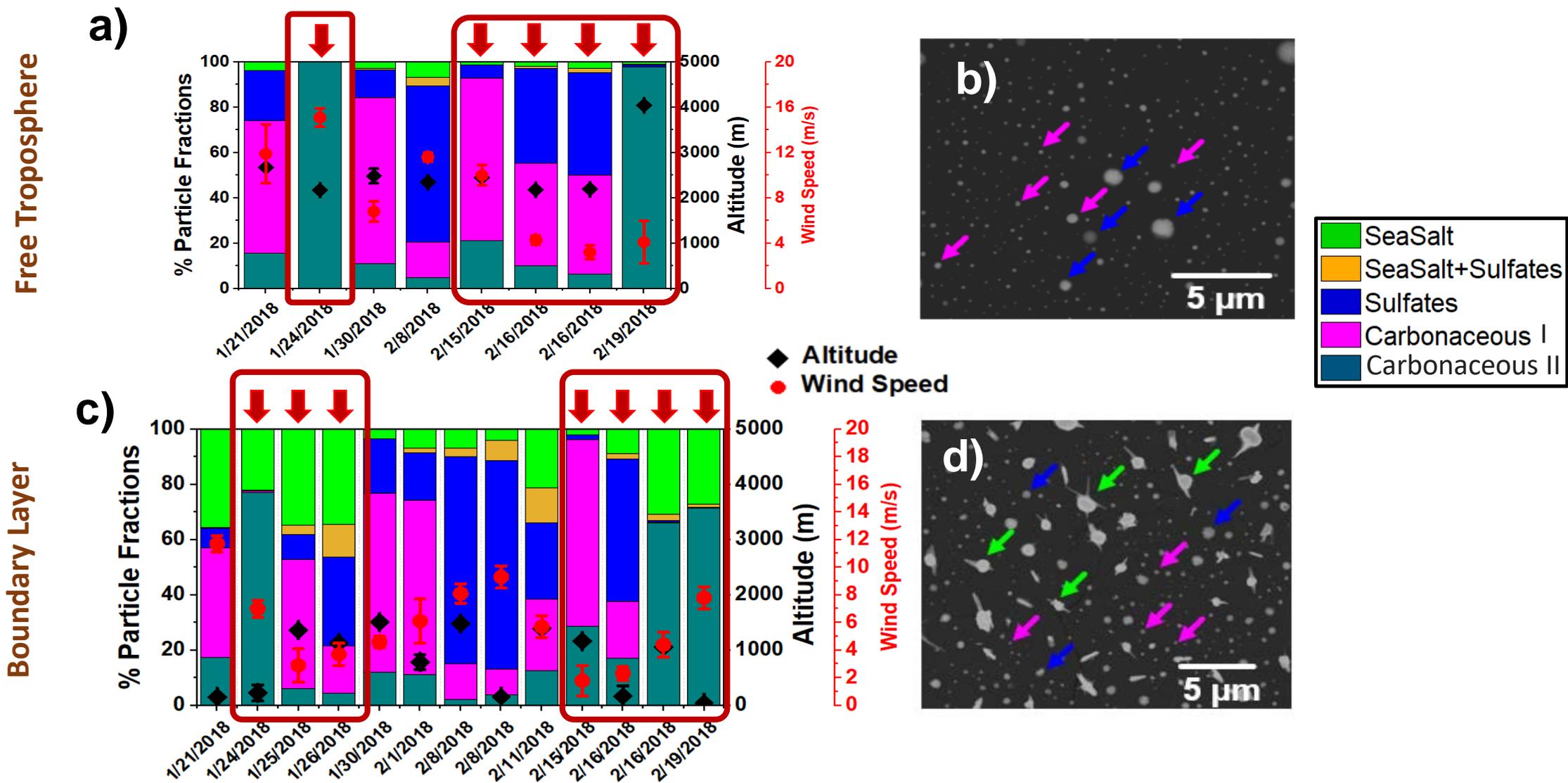
Boundary Layer

c)

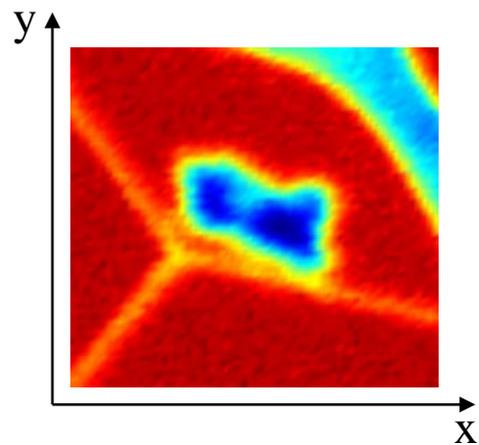
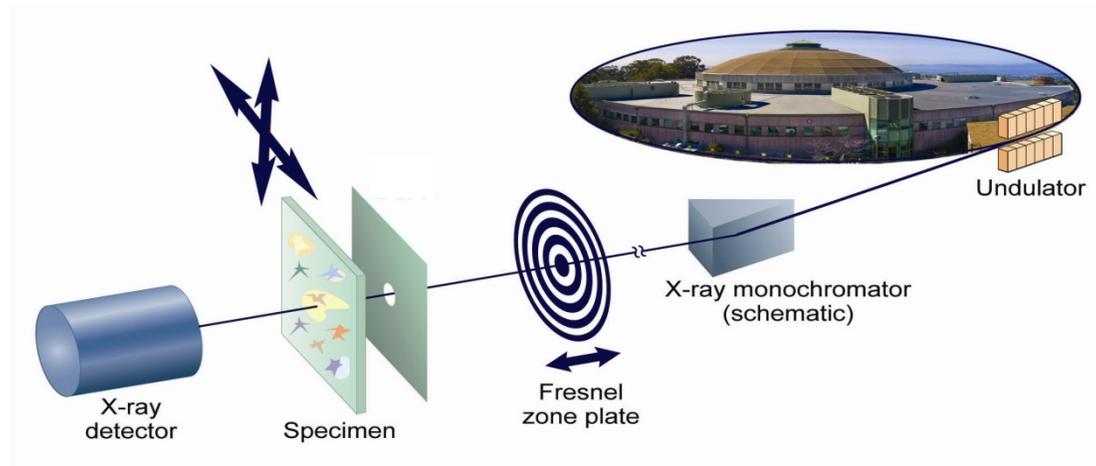


Particle Types during other DI episodes

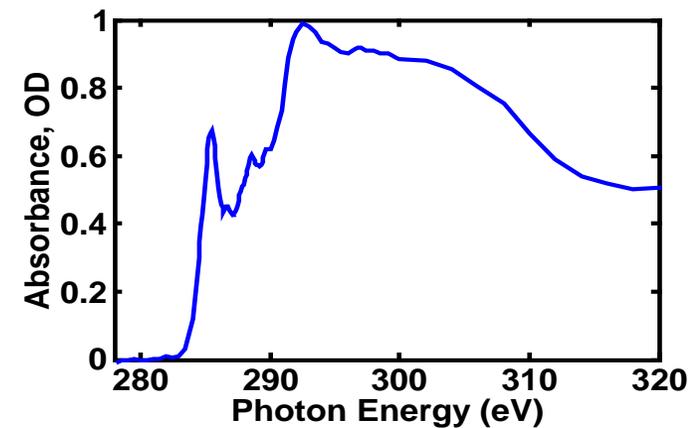
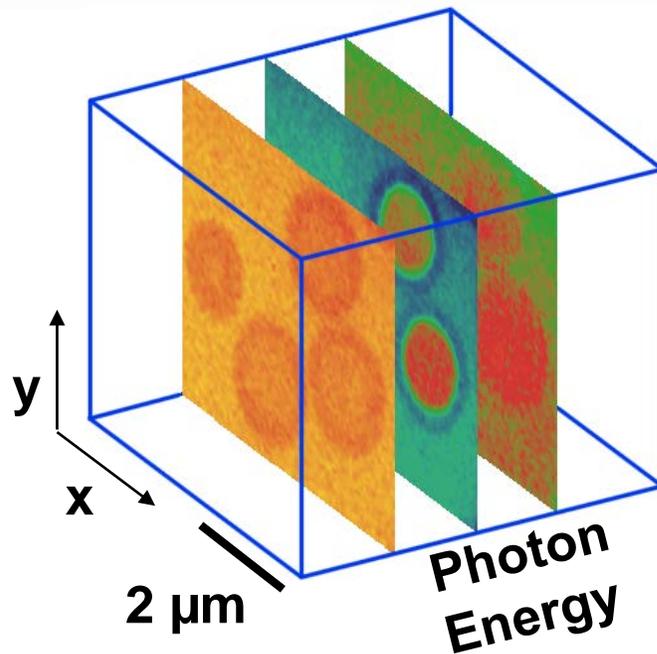
– Various fractions of Carbonaceous Particles at DI episode



Chemical Characterization of Carbon by STXM-NEXAFS



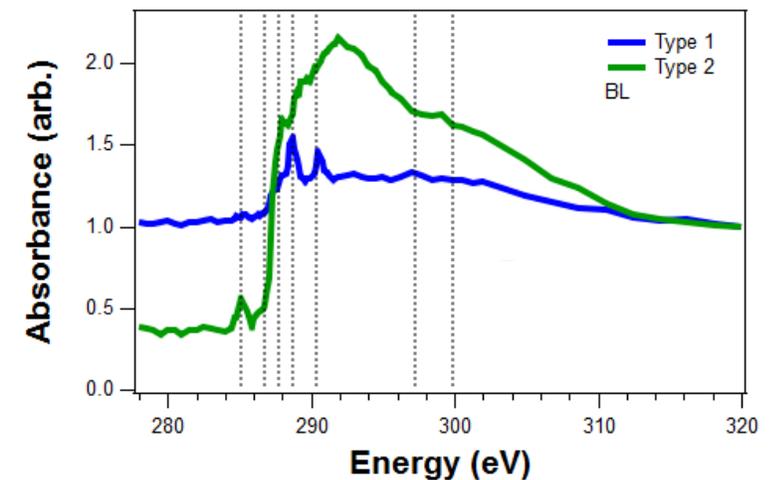
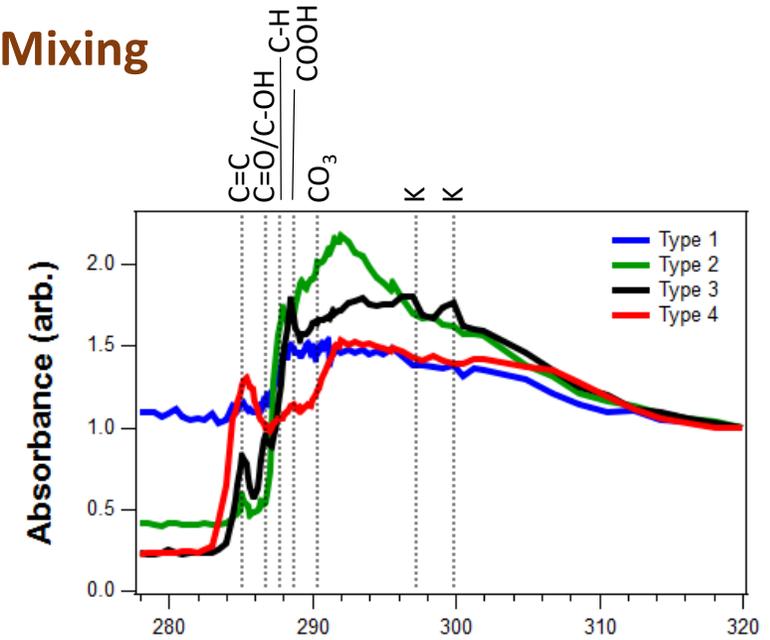
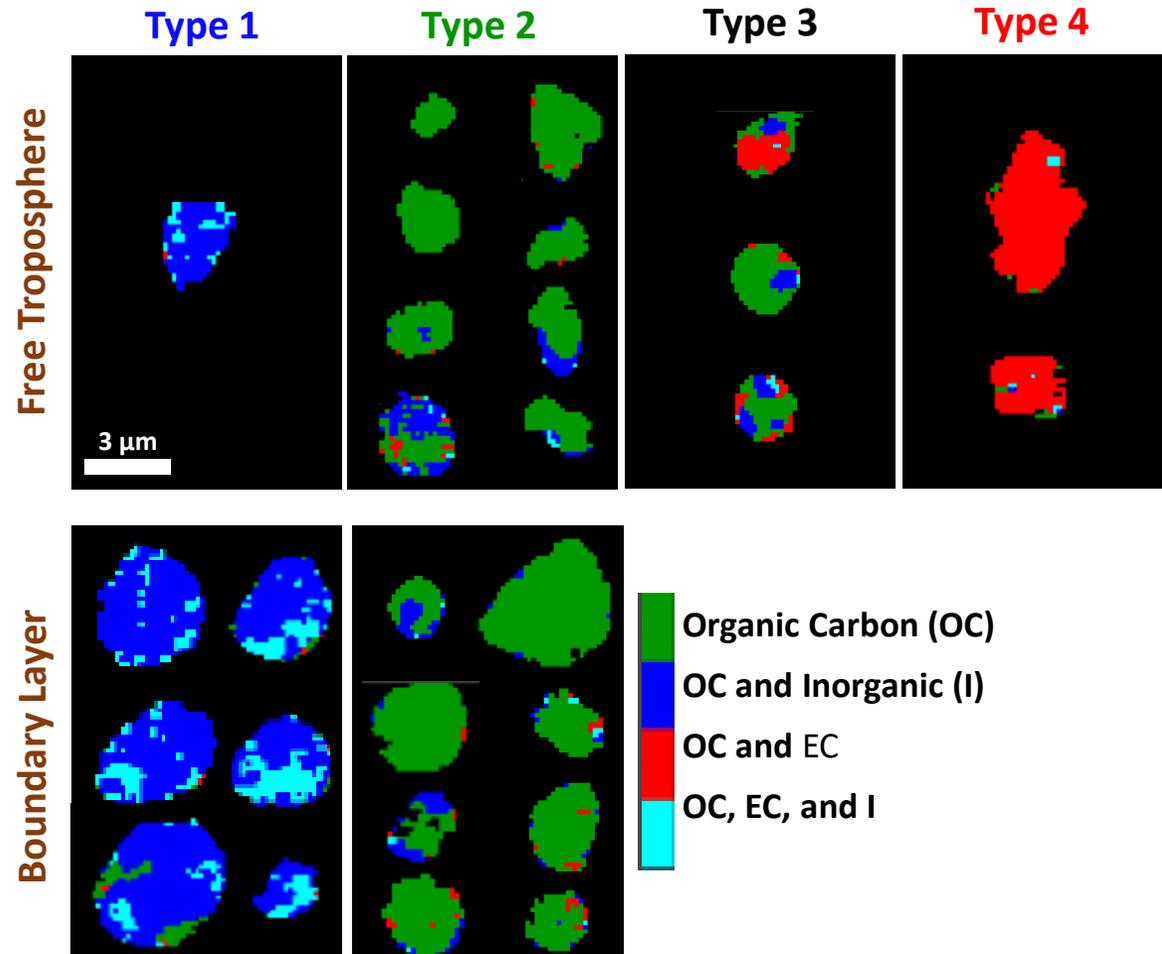
Scanning Transmission
X-ray Microscopy



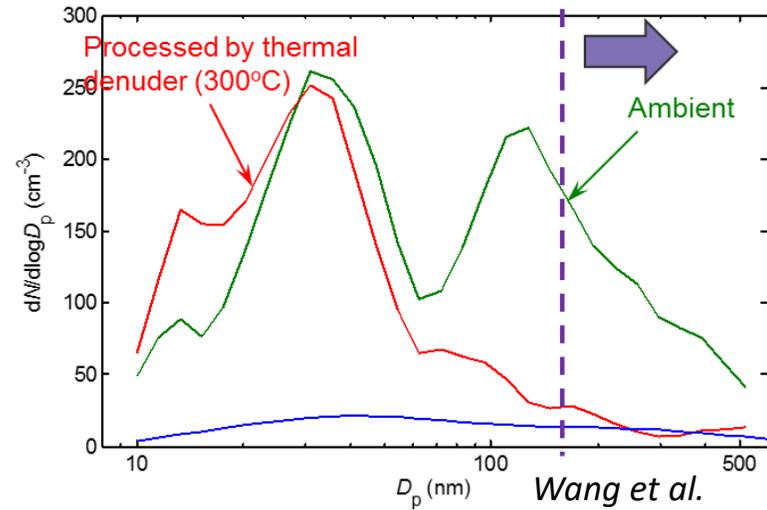
Near Edge X-ray Absorption
Fine Structure Spectroscopy

Chemical Characterization of Carbon by STXM-NEXAFS

- FT Particles show Large variance in Carbon Composition and Mixing



Particles Types differ in their volatilization upon heating



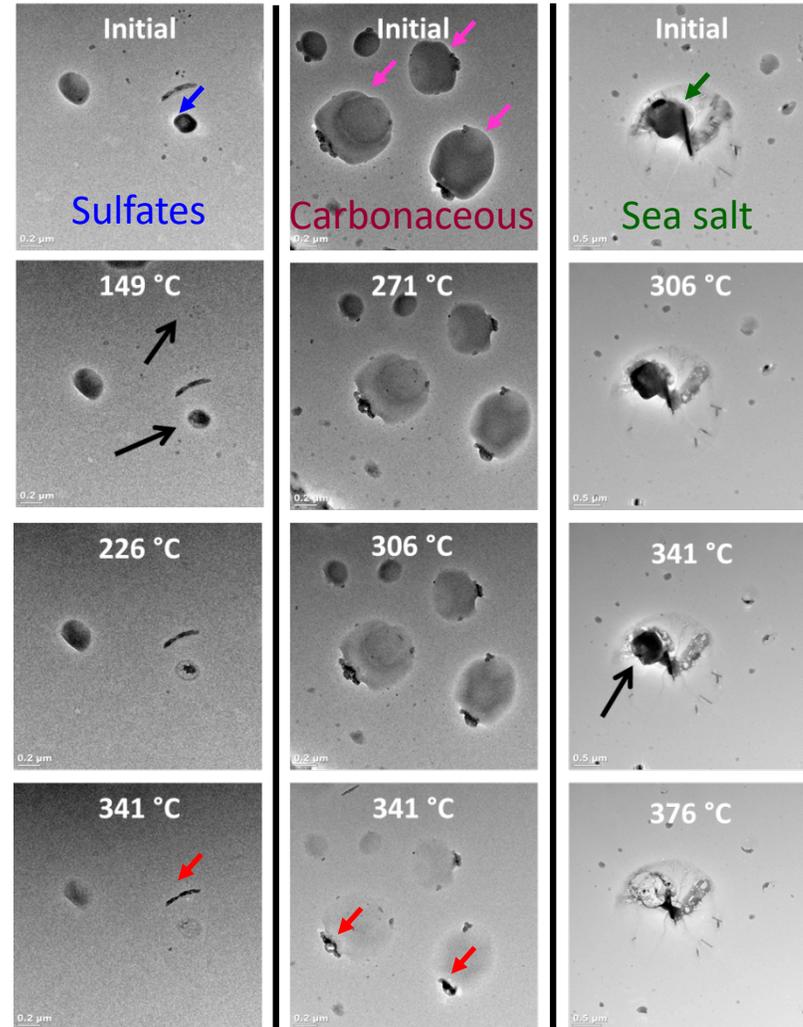
Heating response of individual particle type provides insight into thermal denuder data

Volatilization response of individually tracked particles

Sulfates ~200 °C

Organics ~300 °C

Sea-salt mixture ~350 °C

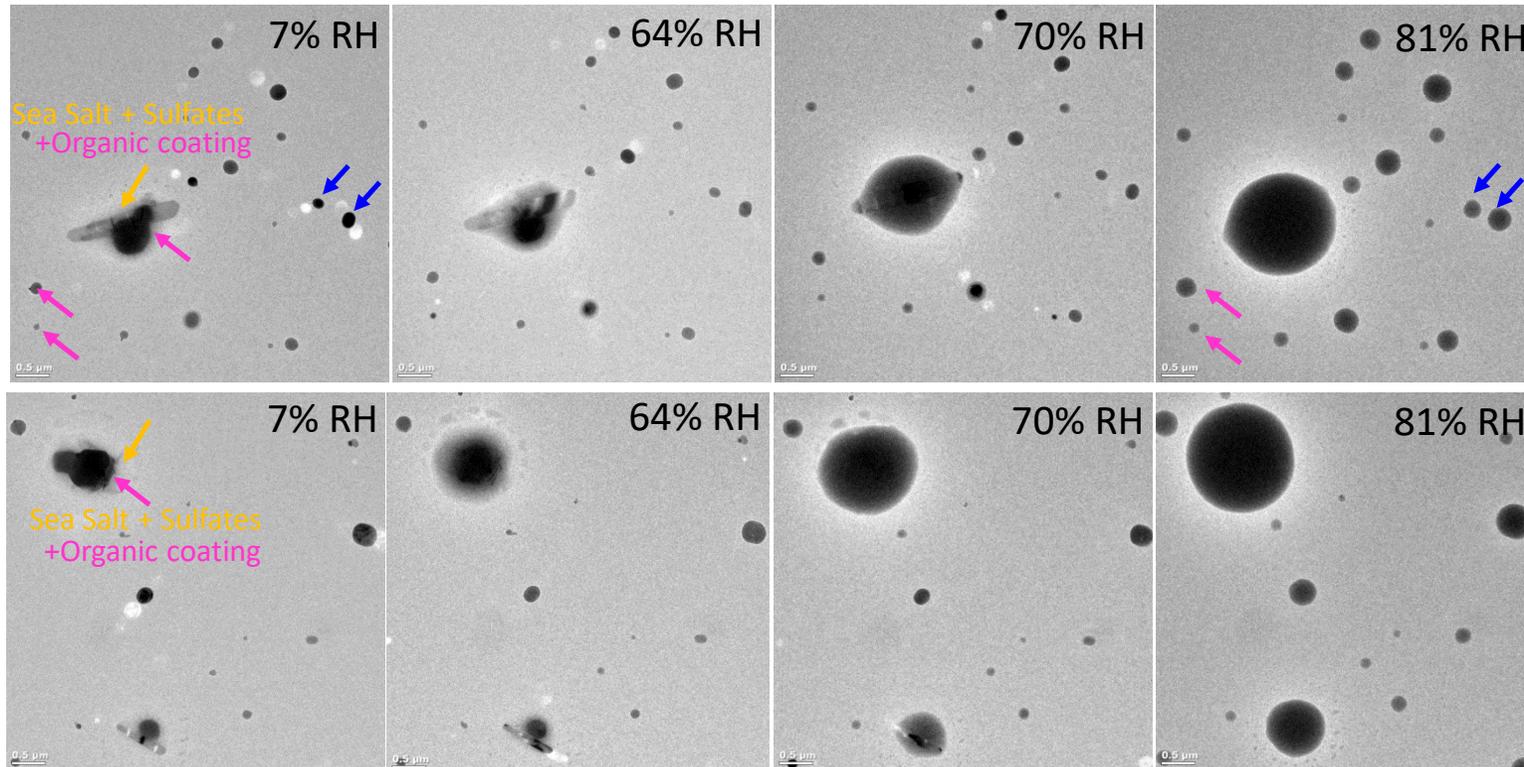


BC content is common in particles during DI episode

In-situ TEM heating experiment probes transformations in the size, morphology, and composition of individual particles

Particle hygroscopicity ESEM

- Extensive internal mixing: all particles contain organic hygroscopic components



Sea-salt particles often coated with organics

Smaller particles (sulfates and carbonaceous) uptake water as well)

Summary and conclusion

- Aerosol during DI contains large fractions of carbonations particles
- FT aerosol contains large variance in organic particle composition
- Minor contribution of sea-salt to boundary layer aerosol
- Results suggest that BL aerosol may be influenced by DI events

Veghte et al., In preparation

Acknowledgments



The AAF crew and scientist involved in the ACE-ENA campaign