The Dominance of Organic Aerosols During NEAQS 2002

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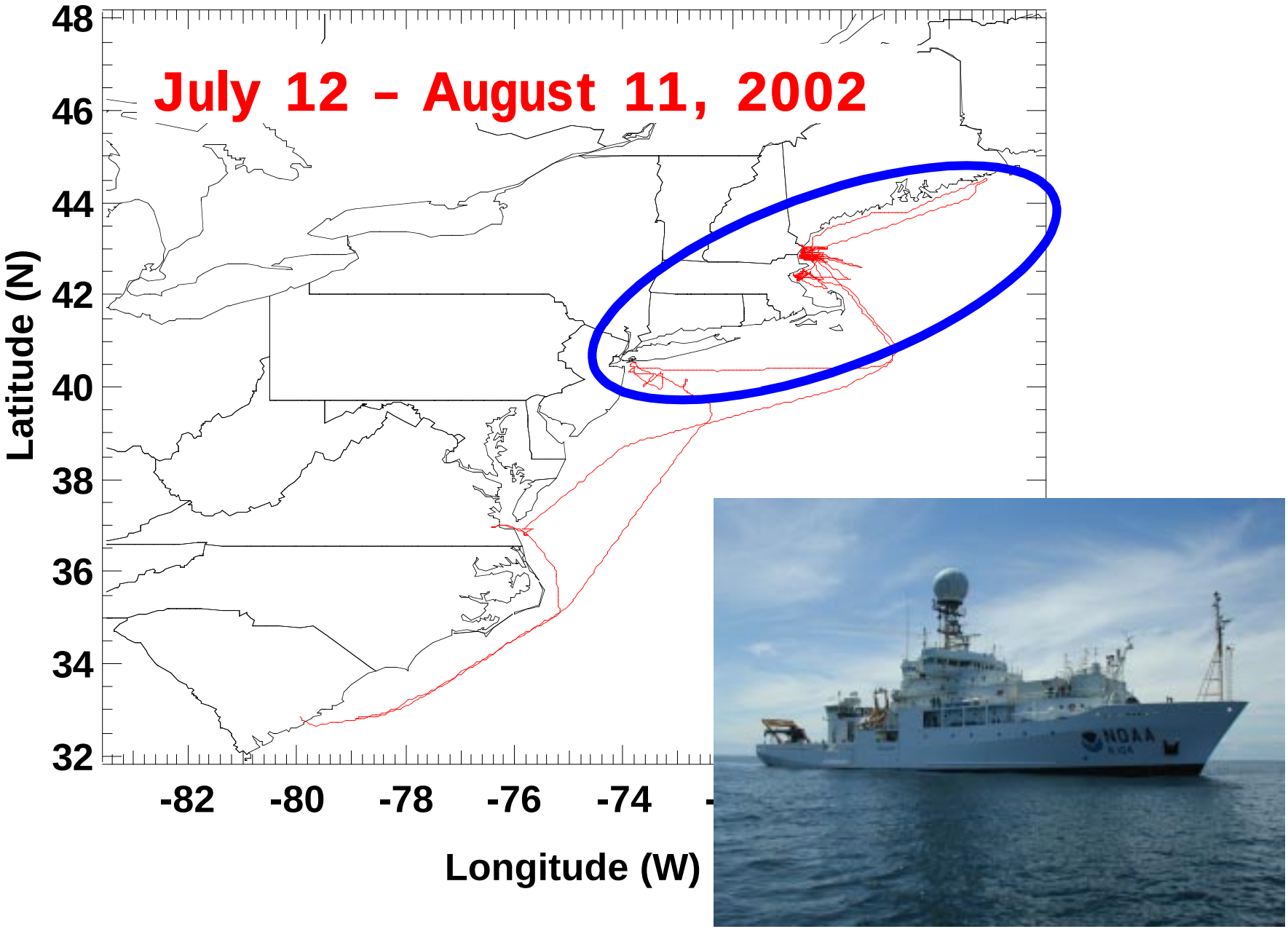
NOAA - PMEL & AL

Fall AGU Meeting - 2003


July 12 – August 11, 2002
Latitude (N)
48
46
44
42
40
38
36
34
32
-82
-80
-78
-76
-74
Longitude (W)
NOAA

Scientific Questions:

- **What were the primary aerosol species off the coast of New England during NEAQS 2002?**

- **What aerosol species dominated light scattering (haze)?**

Based on measurements conducted onboard *Ronald H. Brown of:*

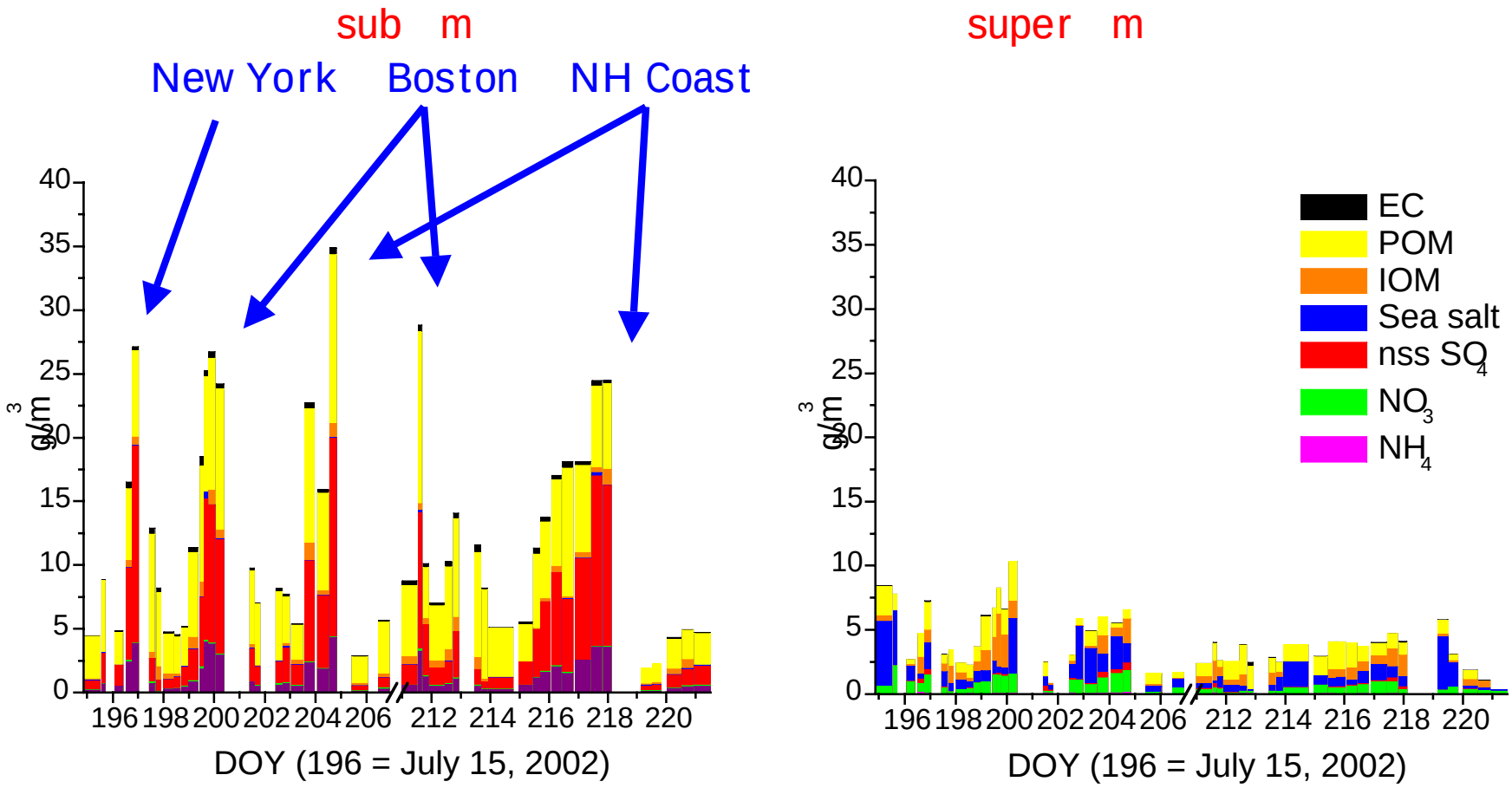
Aerosol chemistry:

- 2 & 7 stage Berner-type impactors – size segregated inorganic ions, OC, EC, total mass, trace elements (sub 10 m)
- PILS – inorganic ions (sub 1 m)
- AMS – Non-refractory sulfate, organics, ammonium, nitrate (sub 1 m)

Aerosol optics:

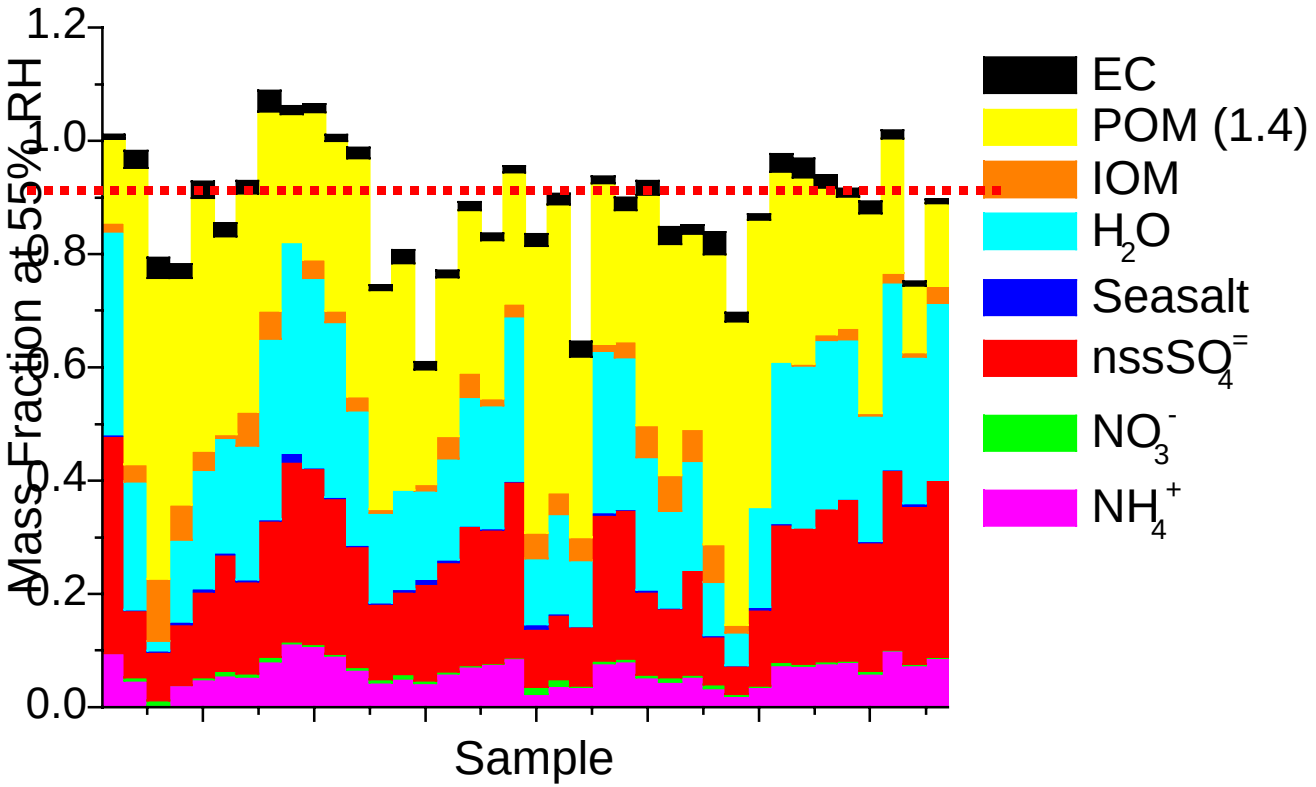
- Scattering (450, 550, 700 nm)

Aerosol concentrations (dry) reached 40 g/m^3 in the haze plumes



76±8 % of the dry aerosol mass was in the <1 m (55% RH) fraction

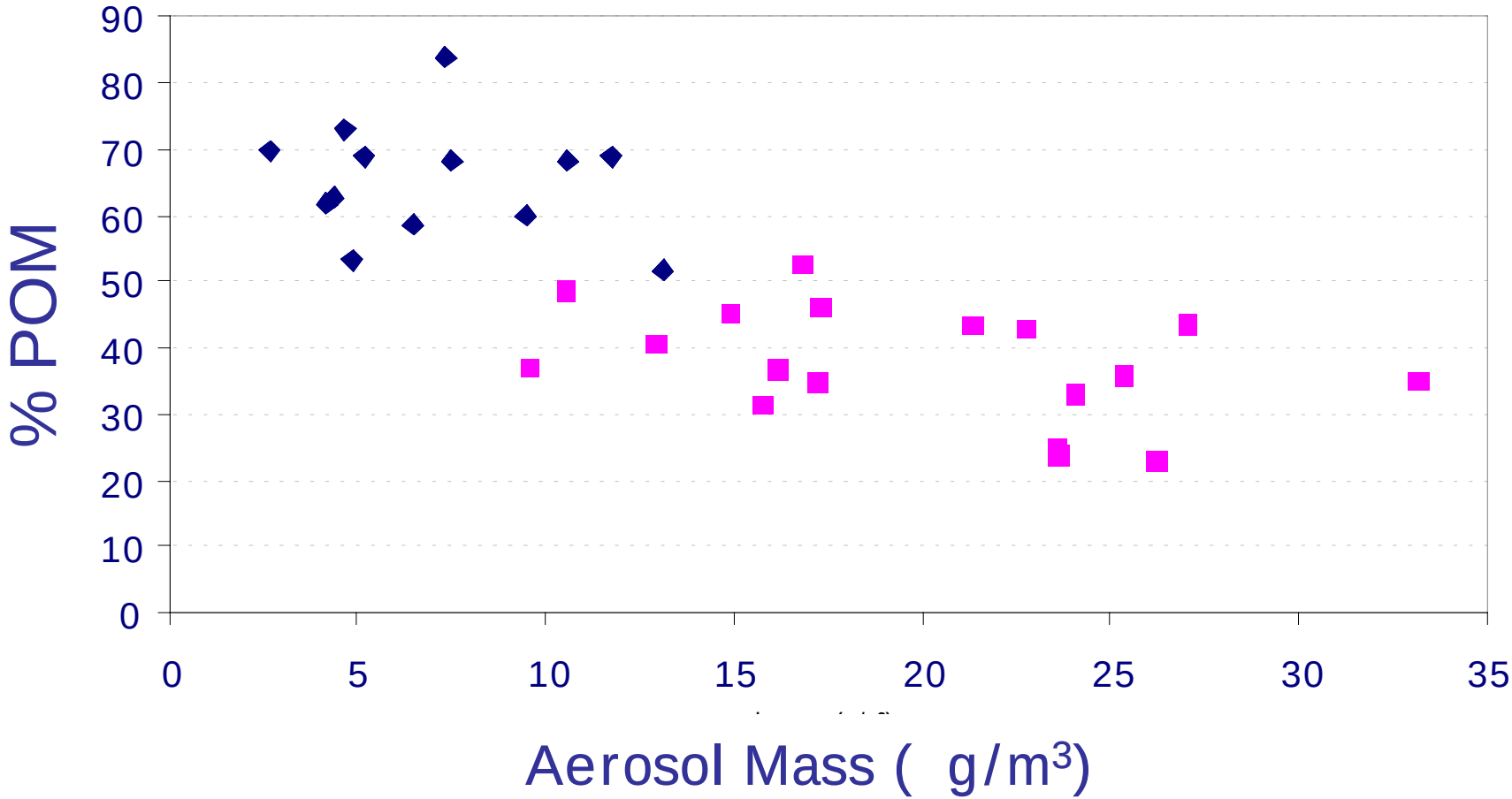
Measured components comprised 91±11% of the gravimetric sub- m mass (POM factor = 1.4)

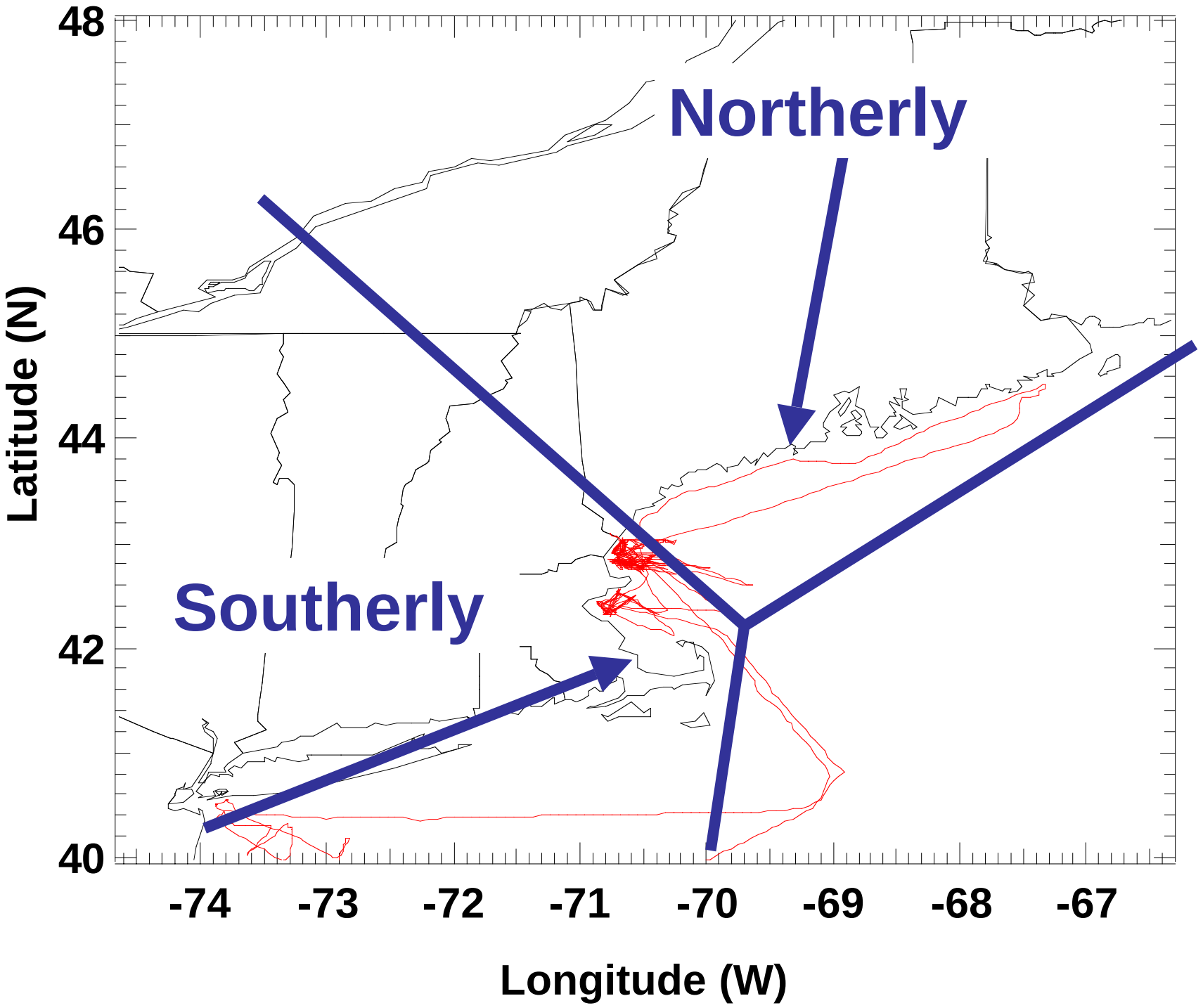


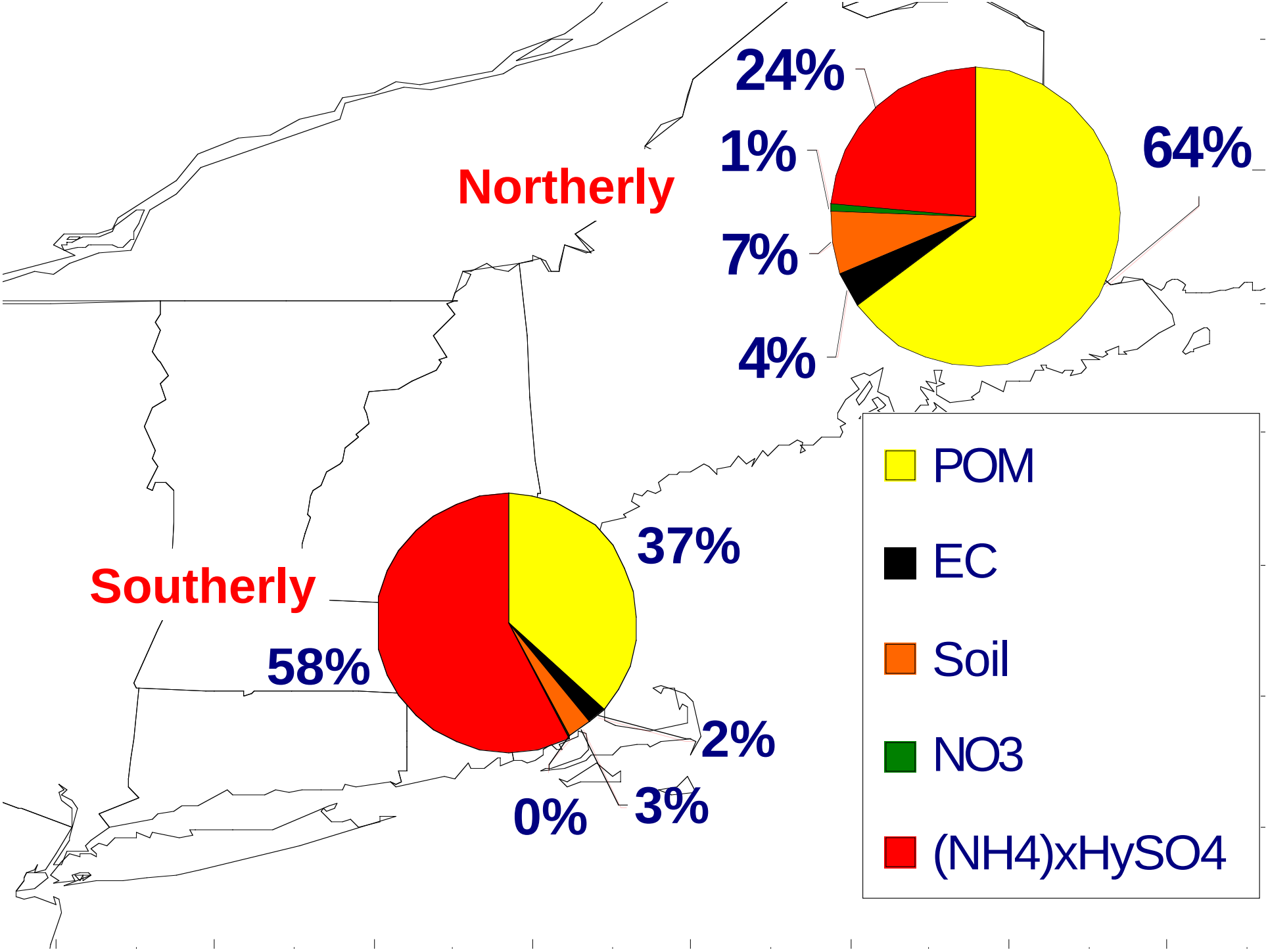
Organic species were a dominant aerosol component during all of NEAQS (49±16% of dry mass)

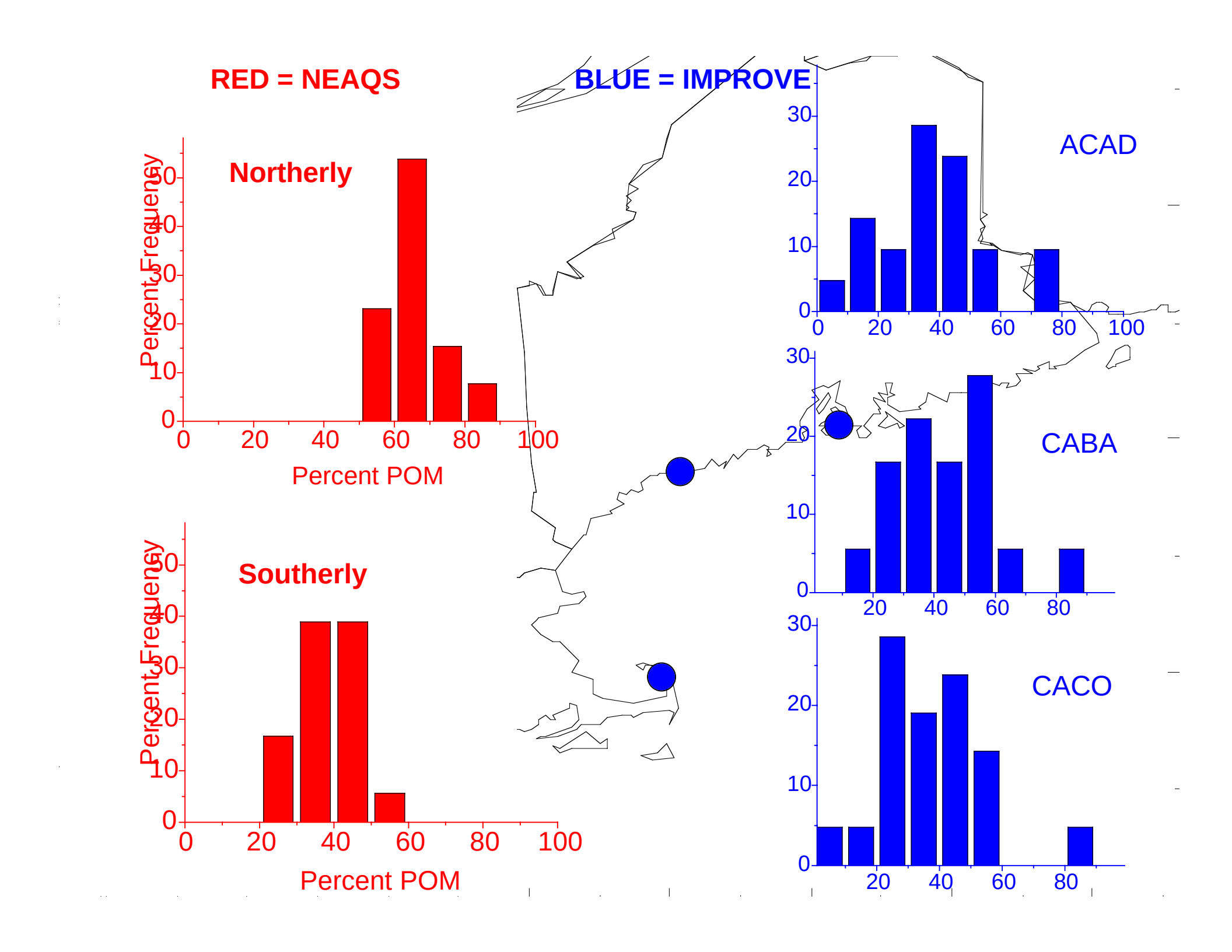
Quinn & Bates, GRL, 30(11), 2003

POM comprised 23-84% of the total aerosol dry mass

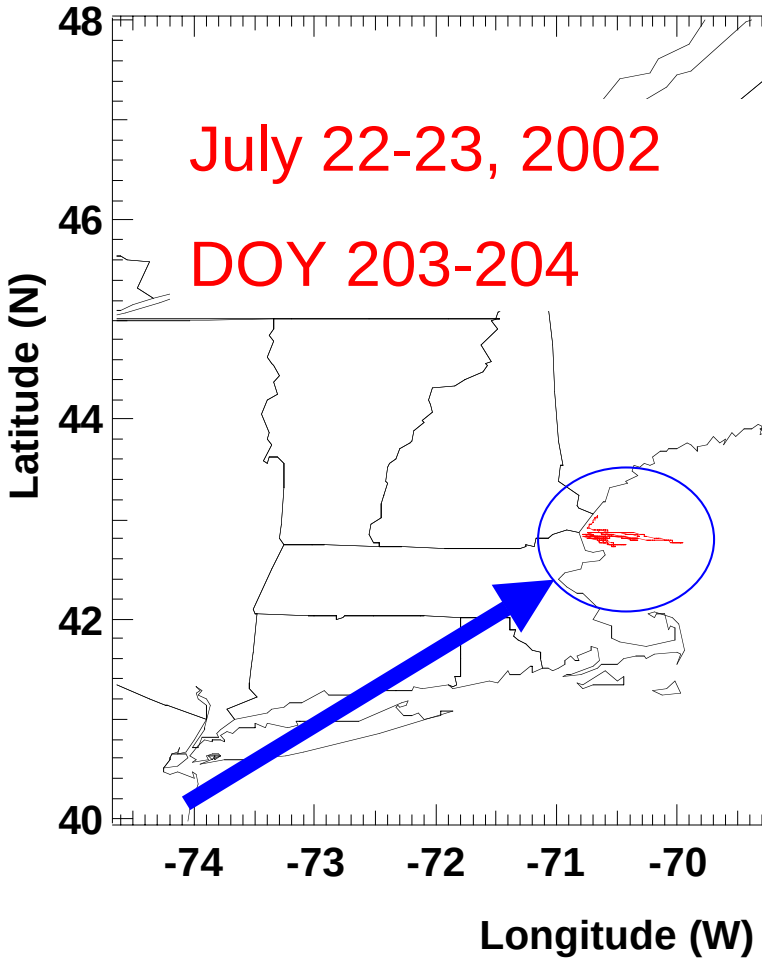


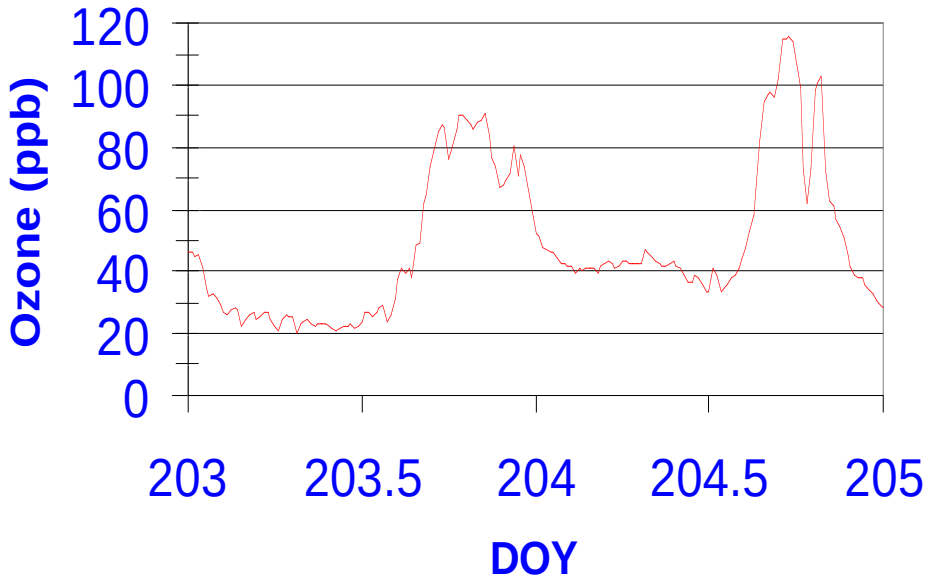

Northerly
Southerly
48
46
44
42
40
Latitude (N)
-74
-73
-72
-71
-70
-69
-68
-67
Longitude (W)


Northerly
24%
1%
7%
4%
64%
Southerly
37%
58%
2%
0%
3%
POM
EC
Soil
NO3
(NH4)xHySO4


RED = NEAQS
BLUE = IMPROVE
Northerly
Percent Frequency
Percent POM
Southerly
Percent Frequency
Percent POM
ACAD
CABA
CACO

What were the dominant aerosol species during the haze events?





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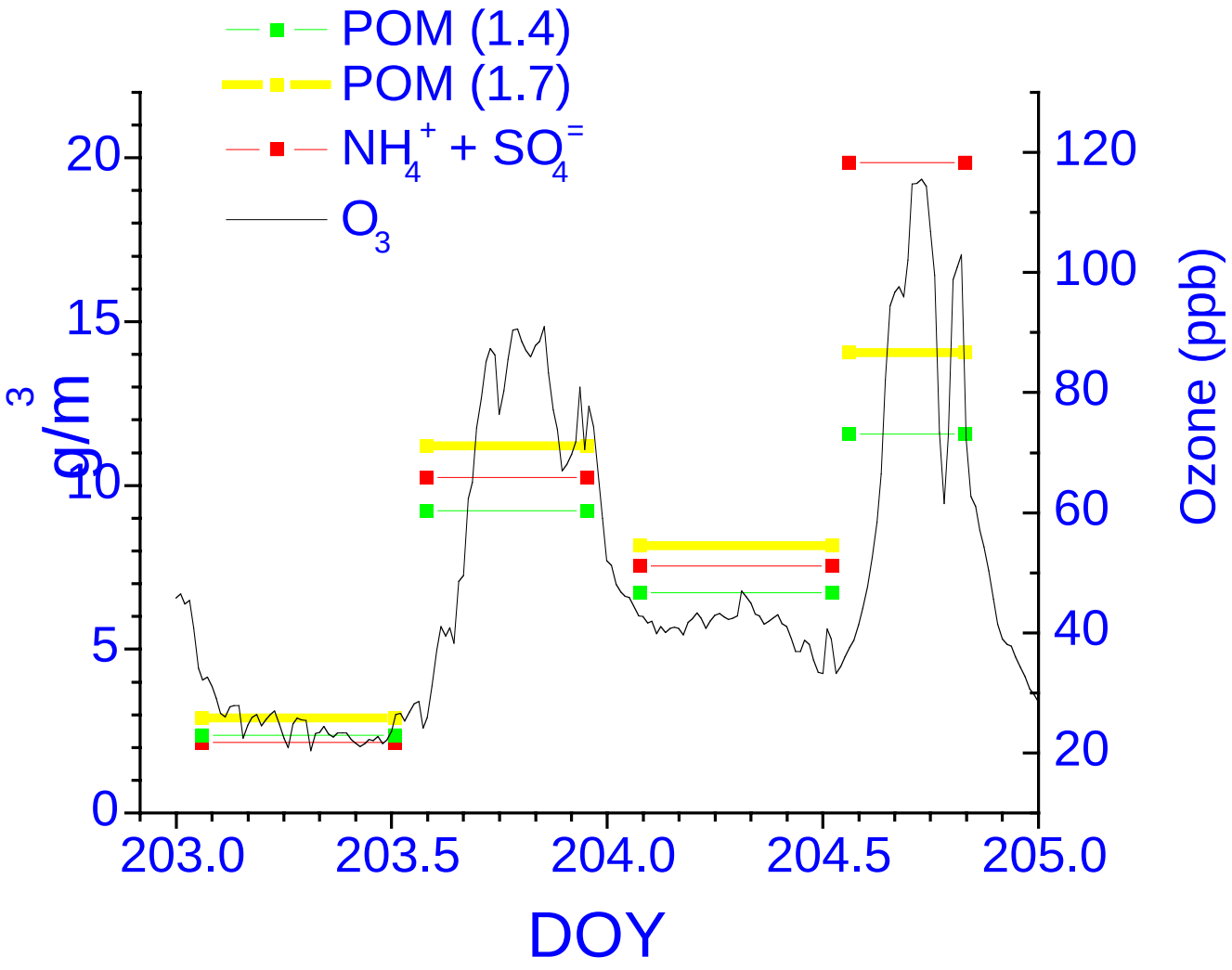

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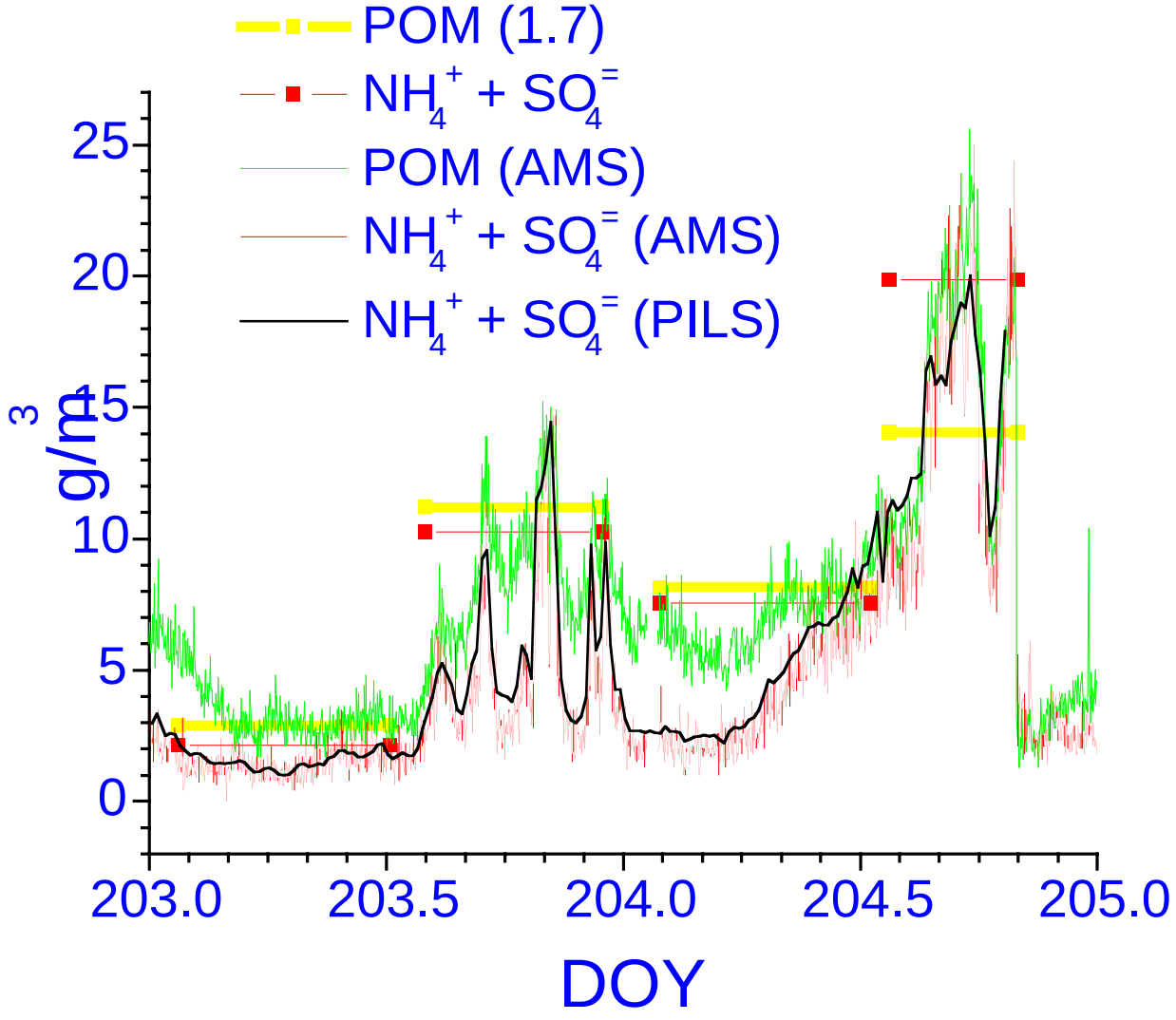

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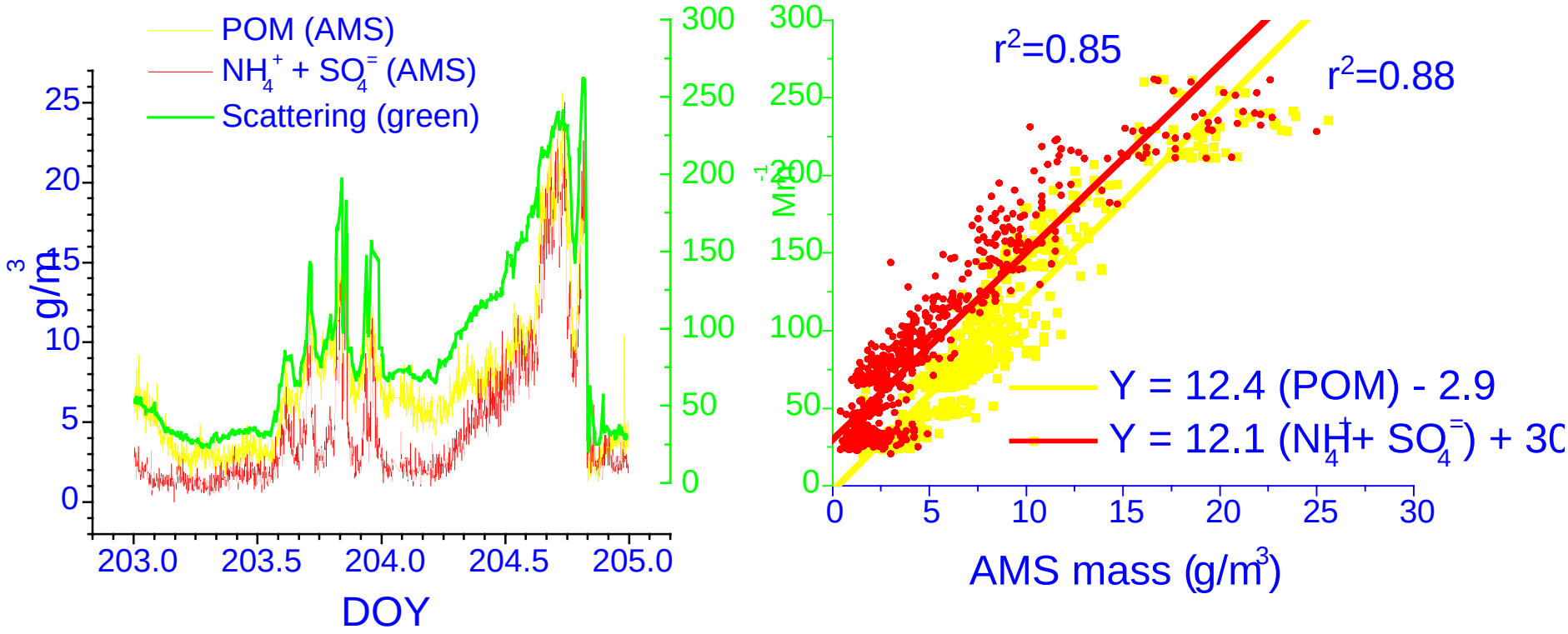

$Y = 4.8\ (NH_4^+ + SO_4^=) + 7.9\ (POM) + 6.5 \quad r^2 = 0.91$

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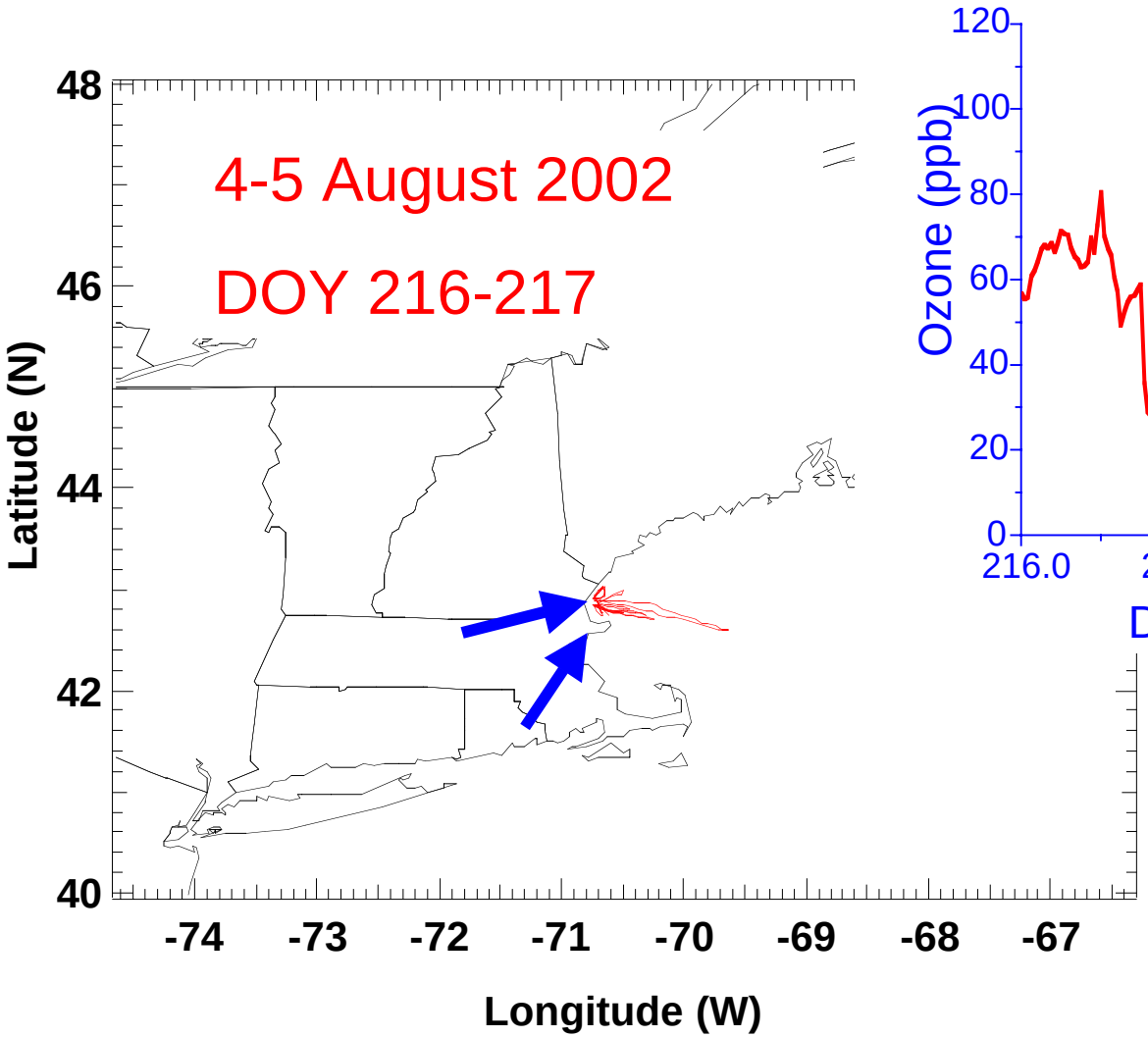

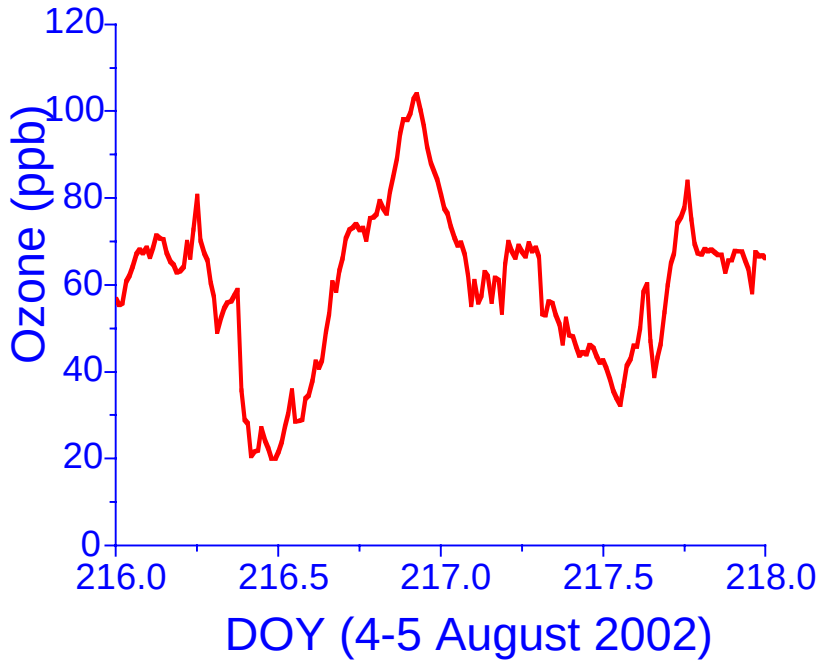

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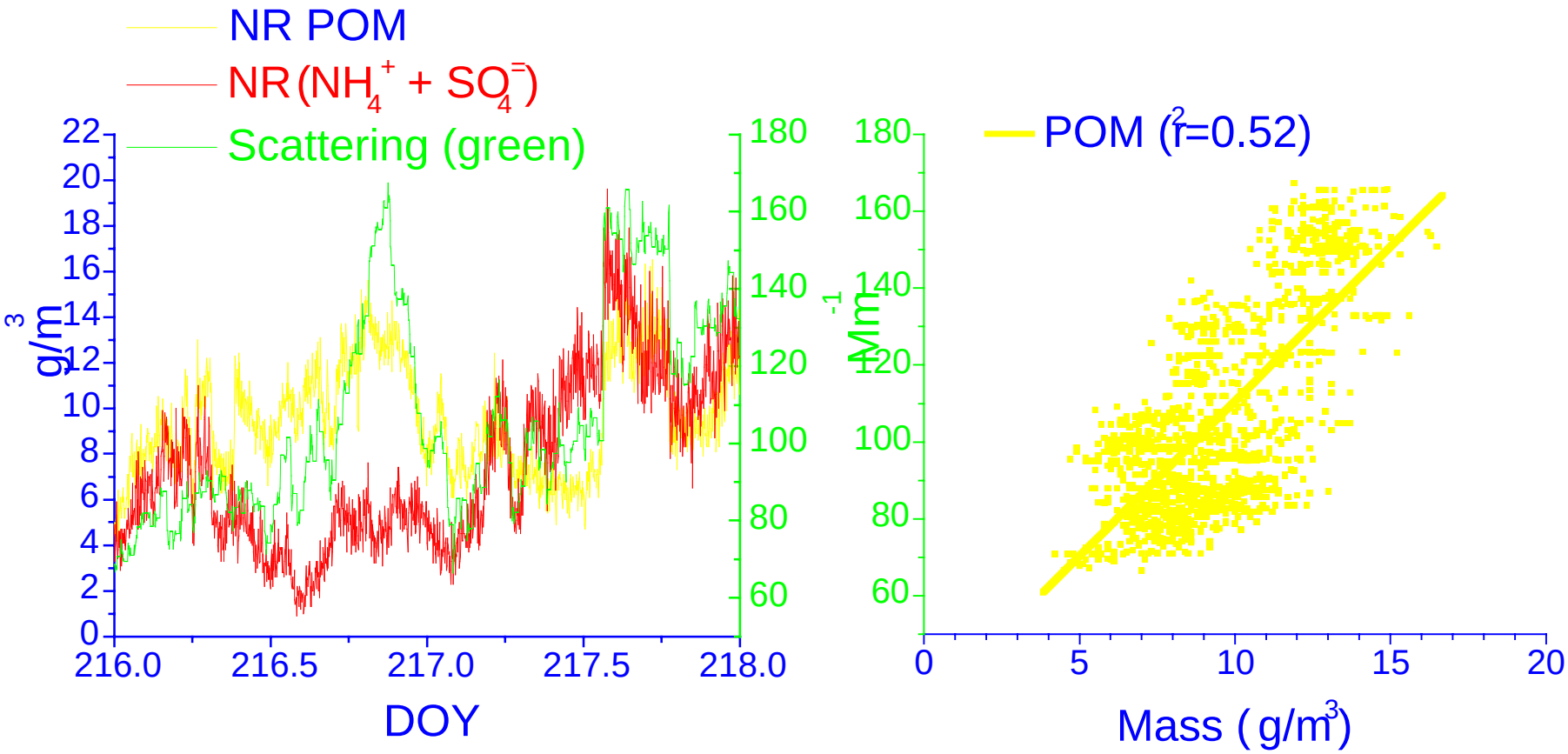

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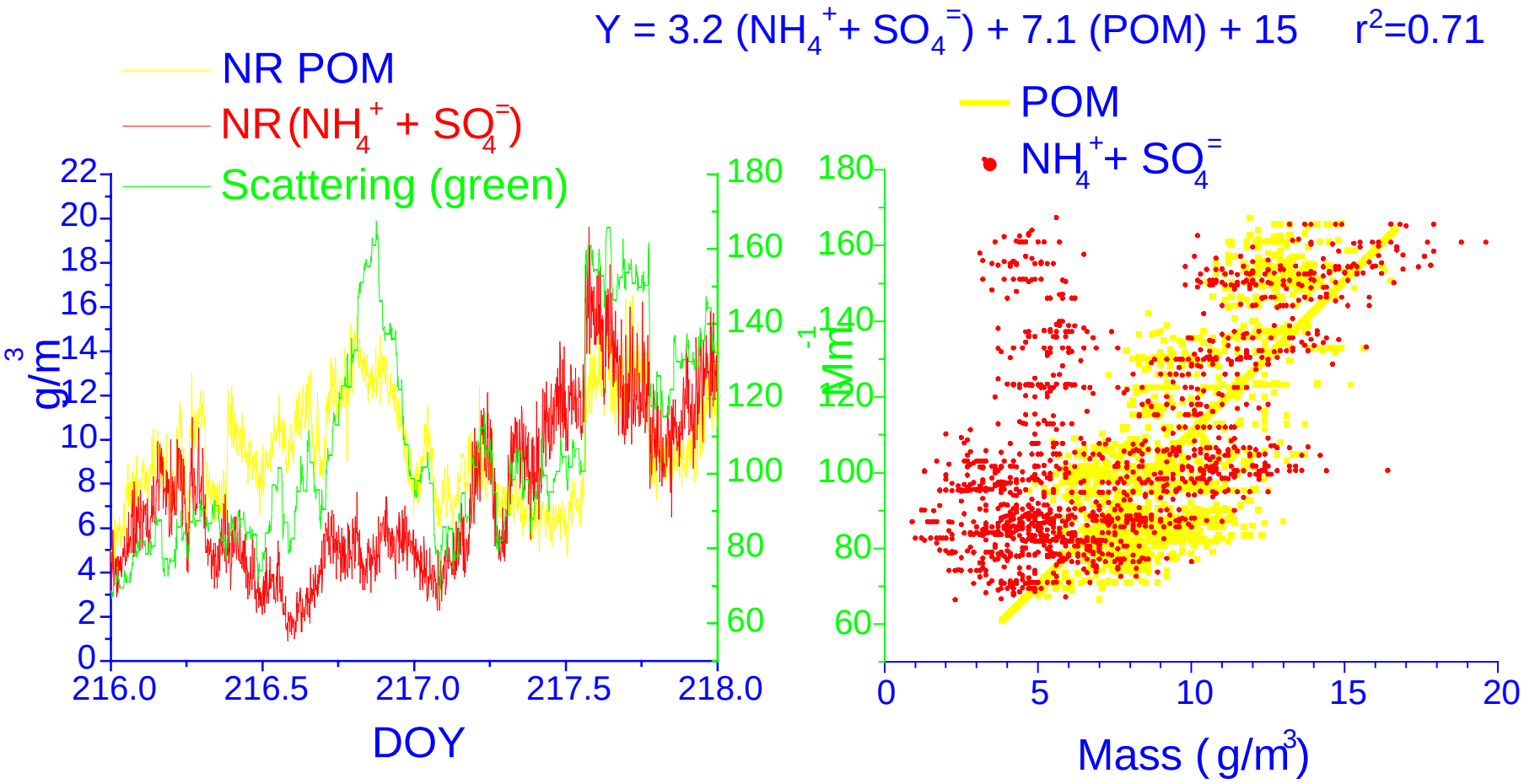


Organic species at times dominated aerosol light scattering

Conclusions

1. The aerosol mass concentration off the New England coast during NEAQS was dominated by accumulation mode organic and ammonium sulfate species.

POM / (NH_4^+ + $SO_4^=$)

POM/OC factor	1.4	1.7
Northerly flow	65% / 23%	70% / 21%
Southerly flow	37% / 56%	42% / 52%

NEAQS data are consistent with the coastal IMPROVE data

Conclusions

2. Both organic and ammonium + sulfate species contributed to the regional haze.
   - During the two major pollution episodes sampled during NEAQS, the POM mass fraction and the POM mass scattering efficiency were greater than that of ammonium + sulfate.

Acknowledgments

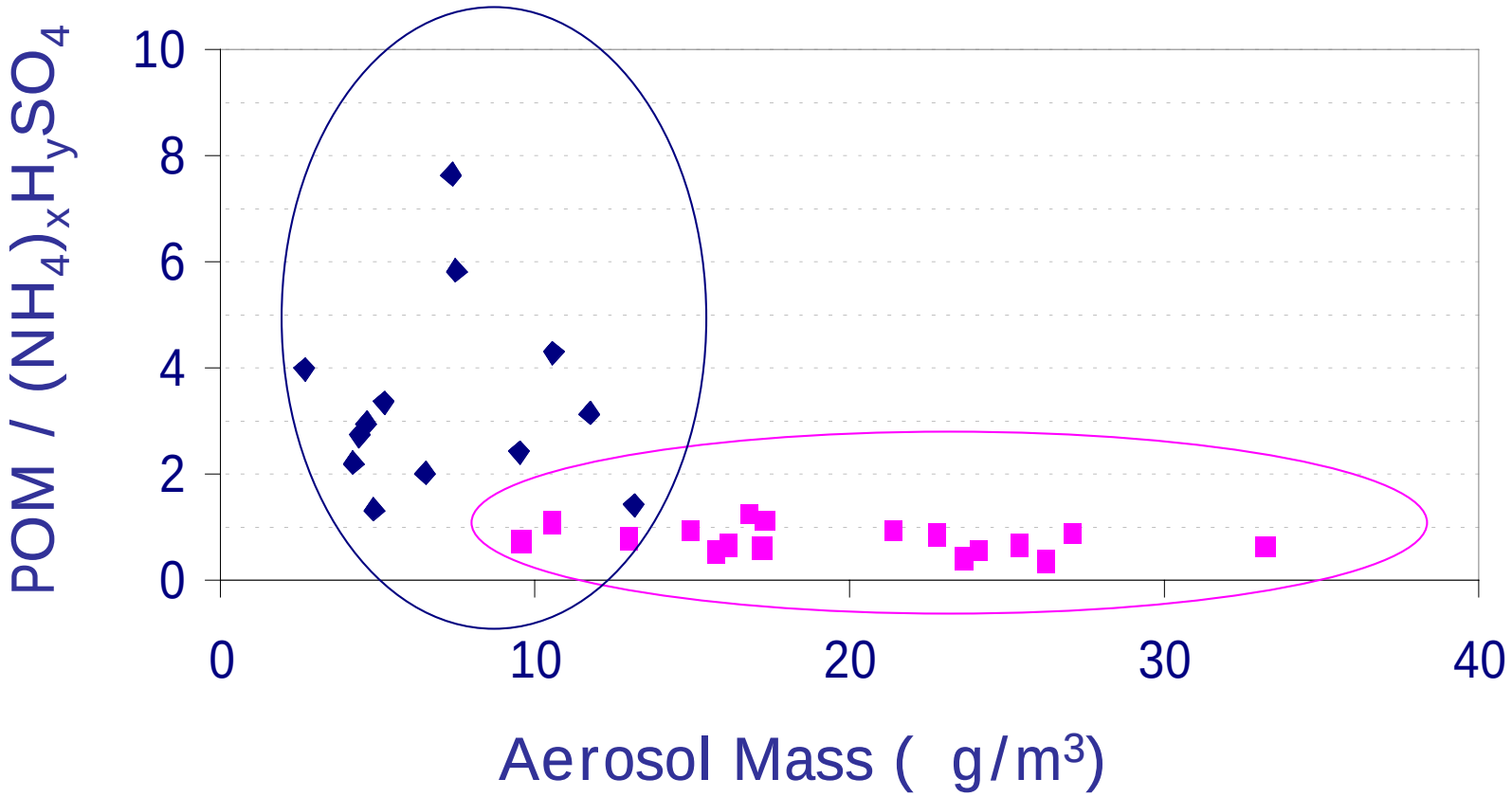
Jim Johnson, Derek Coffman, Theresa Miller, Drew Hamilton (NOAA-PMEL)

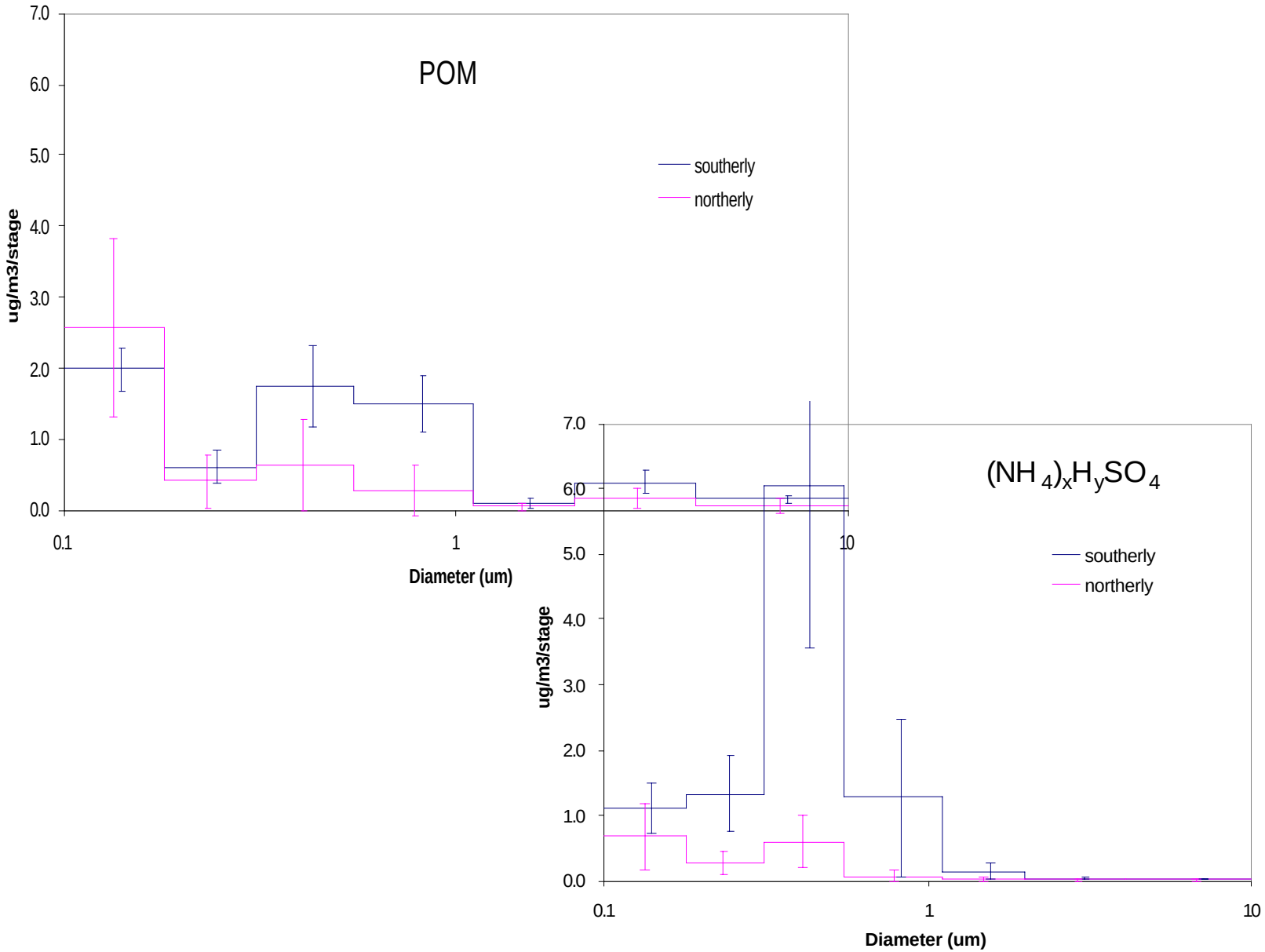
Wayne Angevine (NOAA-AL) – meteorological summaries

NOAA –Chemistry/Climate (Dan Albritton & Fred Fehsenfeld) and Air Quality (Jim Meagher) Programs

f the NOAA RV *Ronald H. Brown*

POM / $(NH_4)_xH_ySO_4$ Ratio




POM
ug/m3/stage
Diameter (um)
southerly
northerly
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.1
1
10
(NH 4)xHySO4
ug/m3/stage
Diameter (um)
southerly
northerly

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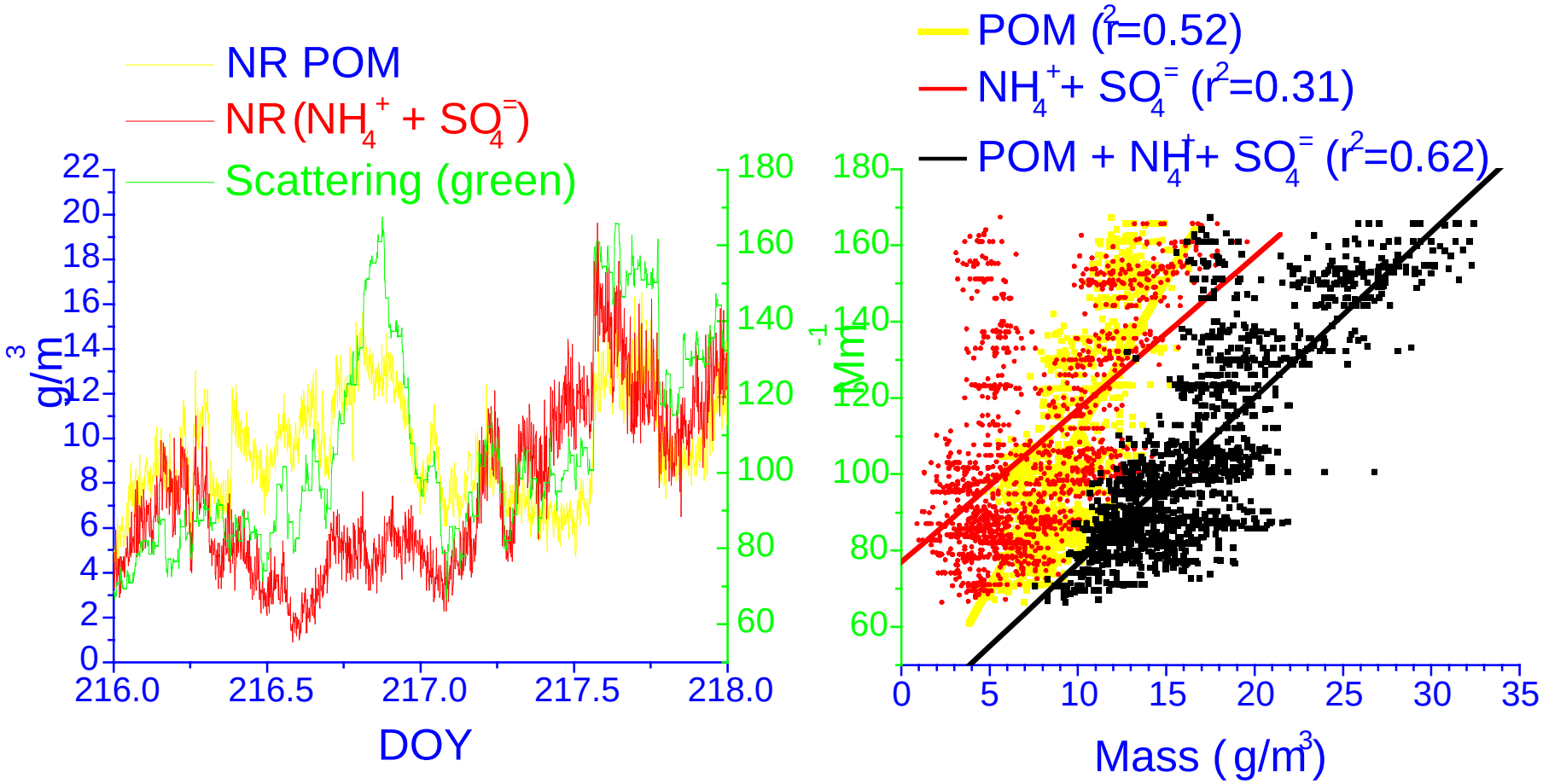

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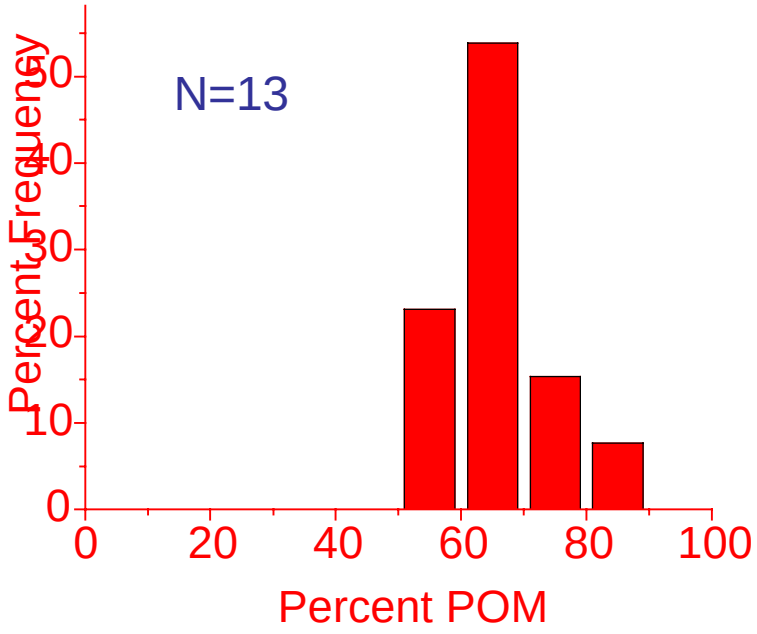
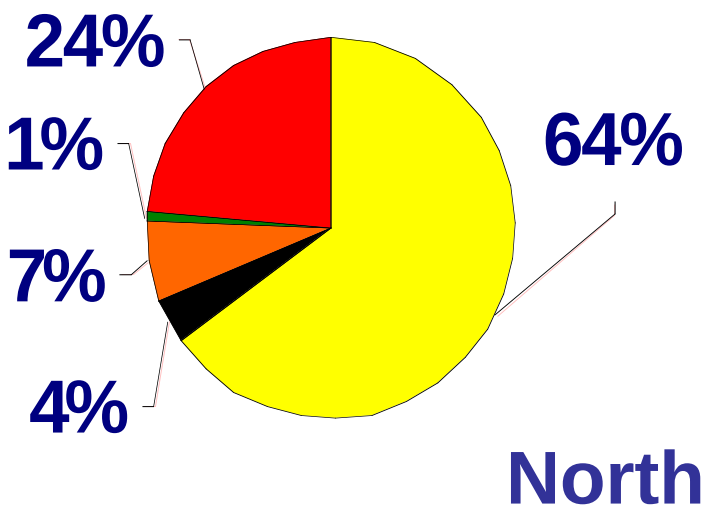
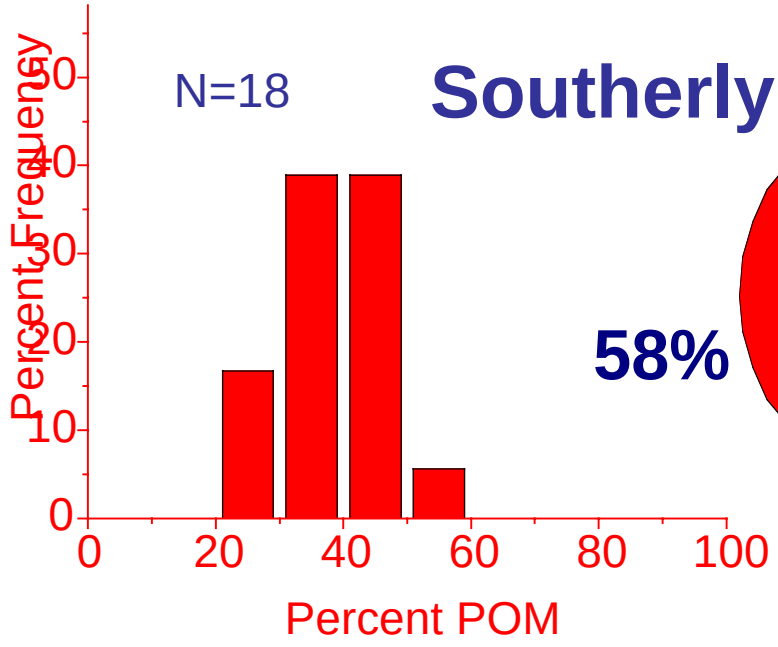




Northerly



Southerly