The Dominance of Organic Aerosols During NEAQS 2002

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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 μm (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.
RED = NEAQS
BLUE = IMPROVE

Northerly

Southerly
What were the dominant aerosol species during the haze events?

July 22-23, 2002
DOY 203-204

Latitude (N)
Longitude (W)

Ozone (ppb)
What were the dominant aerosol species during the haze events?

![Graph showing aerosol species and ozone levels over time.](image-url)
What were the dominant aerosol species during the haze events?

- POM (1.7)
- \(\text{NH}_4^+ + \text{SO}_4^{2-}\)
- POM (AMS)
- \(\text{NH}_4^+ + \text{SO}_4^{2-}\) (AMS)
- \(\text{NH}_4^+ + \text{SO}_4^{2-}\) (PILS)

[Graph showing the temporal variation of aerosol species concentrations.]
What were the dominant aerosol species during the haze events?

\[ Y = 4.8 \, (\text{NH}_4^+ + \text{SO}_4^{2-}) + 7.9 \, (\text{POM}) + 6.5 \quad r^2 = 0.91 \]
What were the dominant aerosol species during the haze events?

4-5 August 2002
DOY 216-217
What were the dominant aerosol species during the haze events?

- NR POM
- NR($\text{NH}_4^+ + \text{SO}_4^{2-}$)
- Scattering (green)

DOY

Mass ($\text{g/m}^3$)

POM ($r=0.52$)
What were the dominant aerosol species during the haze events?

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.

\[
\text{POM} / (\text{NH}_4^+ + \text{SO}_4^{2-})
\]

<table>
<thead>
<tr>
<th>POM/OC factor</th>
<th>1.4</th>
<th>1.7</th>
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</thead>
<tbody>
<tr>
<td>Northerly flow</td>
<td>65% / 23%</td>
<td>70% / 21%</td>
</tr>
<tr>
<td>Southerly flow</td>
<td>37% / 56%</td>
<td>42% / 52%</td>
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</tbody>
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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

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of the NOAA RV Ronald H. Brown
POM / (NH$_4$)$_x$H$_y$SO$_4$ Ratio

![Graph showing POM / (NH$_4$)$_x$H$_y$SO$_4$ Ratio vs Aerosol Mass (g/m$^3$).](image-url)
POM

\([\text{NH}_4]_x \text{H}_y \text{SO}_4\)

**Diagram**: A graph showing the concentration (in ug/m^3) of POM as a function of diameter (in um) for southerly and northerly directions.
What were the dominant aerosol species during the haze events?

Organic species at times dominated aerosol light scattering