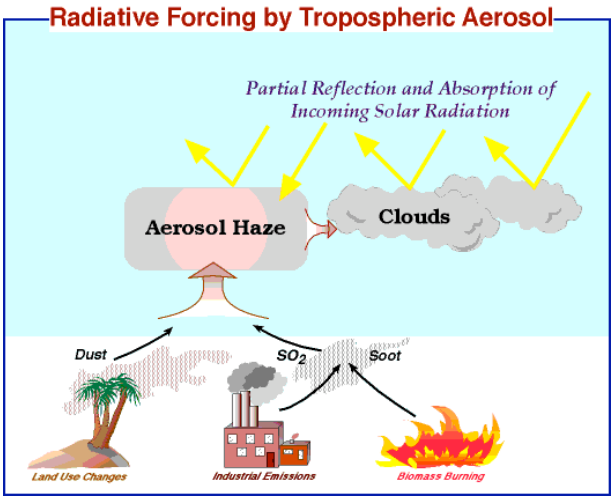
Particulate Organic Matter Affects Visibility and Aerosol Climate Forcing

How does aerosol composition control visibility and climate forcing and why do we care?

Aerosol particles downwind of continents are composed of a complex mixture of sulfates, nitrates, soot, dust, and organic compounds. The exact make-up of the aerosol depends on the active sources in the region (e.g., fossil fuel combustion, biomass burning, biogenic emissions, wind blown dust). If the aerosol is composed of compounds that take up water, such as ammonium sulfate salts, when the relative humidity increases, the particles will grow. This growth leads to increased scattering of incoming solar radiation, a larger climate impact, and reduced visibility. If the aerosol is composed of material less prone to water uptake, such as certain organic compounds, the impact on visibility and climate forcing as relative humidity increases may not be as large. To accurately calculate aerosol climate forcing and forecast visibility, models must realistically parameterize the scattering response of these complex aerosol mixtures due to changes in relative humidity.



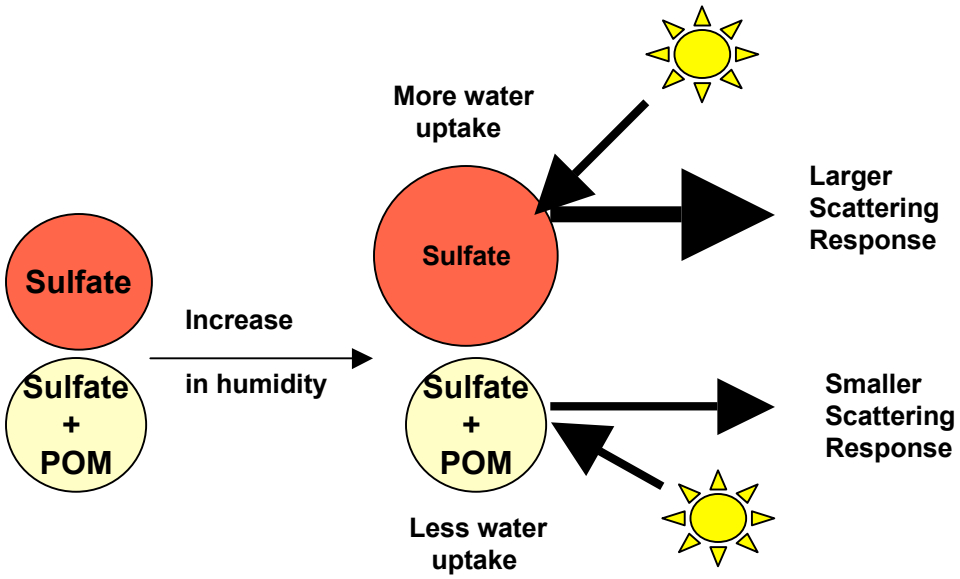
What did we do during ICARTT?

- Deployed instruments onboard the *NOAA R/V Ronald H. Brown* as it targeted pollution plumes and biogenic emissions downwind of the N.E. United States.
- Made detailed measurements of aerosol chemical composition AND measurements of how scattering by the aerosol changed when the relative humidity was increased and decreased.
- In the post-cruise data analysis, isolated the effect that organic compounds have on scattering by sulfate-organic pollution aerosol mixtures as relative humidity changes.

• We have compared ICARTT results with those from previous field campaigns that targeted emissions from the Indian subcontinent (INDOEX www.indoex.ucsd.edu) and Asia (ACE Asia http://saga.pmel.noaa.gov/aceasia/).

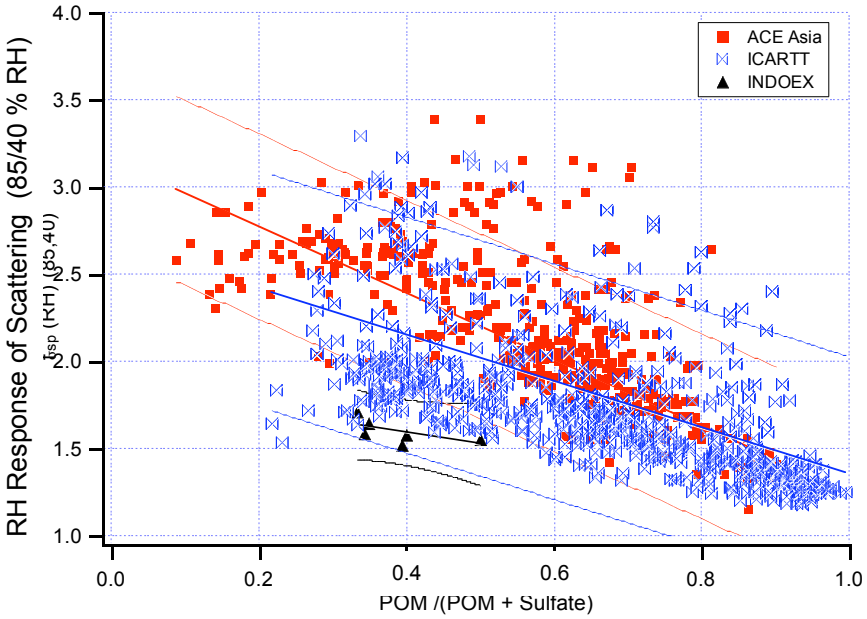
What did we learn?

1. As the fraction of the aerosol that is made up of particulate organic matter (POM) increases, the humidity dependence of light scattering decreases.



2. This same behavior was observed downwind of the N.E. United States (ICARTT), the Indian subcontinent (INDOEX), and Asia (ACE Asia).

3. These measurements yield a linear relationship between POM mass fraction and humidity response of scattering. The RH response of scattering is defined as the ratio of scattering at 85% RH to scattering at 40% RH.



What does it mean?

1. Field measurements Particulate organic matter reduces the uptake of water by soluble sulfate salts which results in a reduction of scattering at high relative humidity.
2. were used to develop a relationship between the POM content of the particles and light scattering by the particles. The relationship should help to improve the accuracy of climate and visibility models.

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The multi-agency ICARTT <http://www.al.noaa.gov/ICARTT/> was formed to study the sources, sinks, chemical transformations and transport of ozone, aerosols and their precursors to and over the North Atlantic Ocean. ICARTT Fact Sheets are designed to present important new science results and in non-technical language understandable by non-experts.