Linking Organic Aerosol Volatility and Cloud Condensation Nuclei Activity

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Motivation for Researching Aerosol

Direct Effect
Aerosol particles reflect and absorb solar and infrared radiation

Cloud Albedo Effect
Aerosols cool climate indirectly through the changes they cause in cloud properties
Organic Aerosol Volatility

Solar Radiation

Organic Aerosol (OA) in $\mu g \ m^{-3}$

Plots: Robinson et al., 2007
Aerosol-Cloud-Climate Interactions

Clean Environment (few Cloud Condensation Nuclei)

Polluted Environment (many Cloud Condensation Nuclei)

CCN

Higher Albedo

Lower Albedo
Organic Aerosol Complexities

- Semi-volatile Partitioning
- Organic Aerosol Burden
- Global Climate Models
- CCN
Measuring Volatility - Thermodenuder

- Heating Section
  - Heating Tape
  - Thermistor
  - Fiberglass Insulation

- Cooling Section
  - Activated Carbon
  - Wire Mesh

Distance

- Temperature
- Particle Size
- Volatilized Mass

Graph showing changes in temperature, particle size, and volatilized mass with distance.
Measuring Cloud Condensation Nuclei (CCN)

**Design**
- Cylindrical column
- Temperature gradient along the wall
- Wall saturated with H$_2$O

**Principle**
- H$_2$O diffuses faster than heat in air
- Creates a supersaturation at the centerline

Outlet: Droplets = CCN
Implications and Future Directions

- Use volatility basis set approach* to provide a picture of organic aerosol phase partitioning behavior into unique bins.

- Along with CCN properties, these basis sets will be measured across the globe to constrain inputs to global climate models.

- Reduce the uncertainty in global climate predictions.

- Better understand and define the impacts of personal and industrial activities on local and global environments.

*Donahue et al., 2006
Thank you!

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