

The Organic Aerosol Composition (OACOMP) Value Added Product for the ARM Archive

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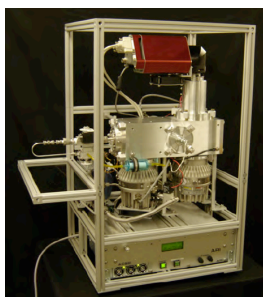
Objective

Organic matter (OM) frequently comprises a large fraction of the total aerosol burden, but regional and global models typically **underestimate OM mass** – contributing to uncertainties in aerosol radiative forcing. Improving the treatment of organics in models requires information on the magnitude of **primary and secondary components** of OM.

The objective of the new ARM Organic aerosol component (OACOMP) value-added product is to:

- Perform **multivariate statistical analysis of the organic aerosol data from aerosol mass spectrometers**
- Represent the **enormously complex atmospheric organic aerosol system as a lumped description of a limited number of components** that may be related to distinct sources and physicochemical properties

Aerosol Chemical Speciation Monitor (ACSM)



Measures real-time, non-refractory aerosol particle mass and chemical composition

- Organic matter (OM), sulfate (SO₄), nitrate (NO₃), ammonium (NH₄), chloride (Cl)

Long term, continuous data from 3 systems:

- The Southern Great Plains (SGP), Oklahoma
- Tropical Western Pacific in Darwin, Australia
- Mobile Aerosol Observing System (MAOS)

Possible to derive components of organic matter, such as:

- Hydrocarbon-like (HOA) ~ combustion POA
- Cooking related (COA) ~ cooking POA
- Biomass burning (BBOA)
- Low Volatility / More Oxygenated ~ aged SOA
- Semi-volatile / Less Oxygenated ~ fresher SOA

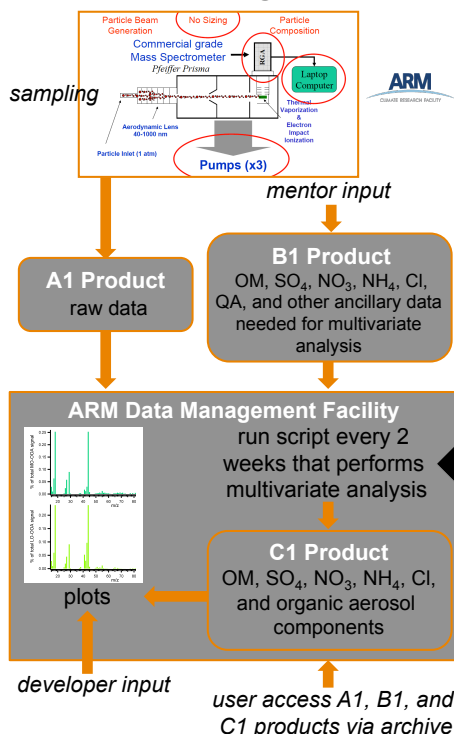
time resolution ~ 30 min

detection limits (µg m⁻³)

OM	0.3
SO ₄	0.4
NO ₃	0.2
NH ₄	0.5
Cl	0.2

ACSM shown to give similar results to HR-ToF-AMS and other means of measuring composition (Ng et al., AST, 2011)

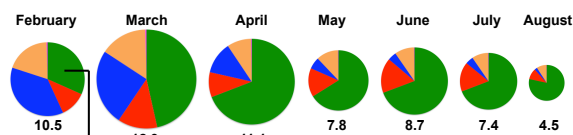
Data Processing Flow Chart



Current Results

Default Data from ACSM
Monthly Average PM1 Mass

OM
SO₄
NO₃
NH₄
Cl



organics become largest fraction during summer

Additional Information from OACOMP

- MO-OOA – more oxidized SOA, “aged”
- LO-OOA – less oxidized SOA, “fresher”
- BBOA – biomass burning



Pretreatment Steps Currently being Tested:

- Perform sanity checks on organic mass spectra error matrices, and species time series; remove or downweight bad data periods
- Treat spikes in organic mass spectral matrix
- Downweight signals scaled to m/z 44
- Apply minimum error
- Downweight weak m/z's in mass spectral matrix

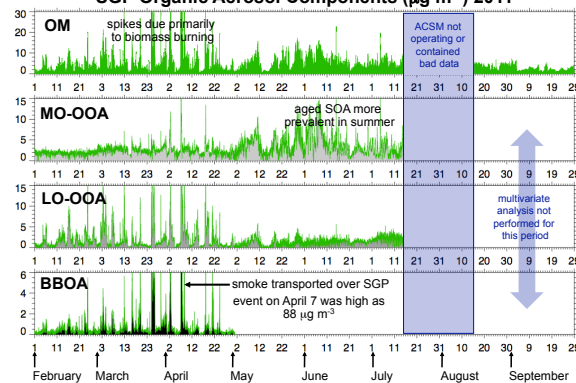
Other QA Steps May be Added

Timeline

- Update code, add data pretreatments based on evaluation
- Operational SGP product
- Assess feasibility of ingesting TWP site data when ACSM becomes on-line
- Update OACOMP QA and pretreatments

April
June
July
Oct

SGP Organic Aerosol Components (µg m⁻³) 2011



Note: Primary organic aerosol component associated with combustion (HOA) was very small (i.e. SGP site far from sources)