

Title: Characterizing OA Processes and Climate Relevant Properties via Advanced and Integrated Analyses of AMS Datasets from DOE Campaigns and ACRF Measurements

Objective: To improve understanding of atmospheric OA lifecycle processes and to generate data products that can be directly used to inform, improve, and evaluate regional and global models.

Climate Relevant SOA Property(s) Investigated: Size-resolved mass concentrations and chemical and physical properties of distinct OA factors.

Lead personnel: Qi Zhang (UC Davis), Jose-Luis Jimenez (CU Boulder)

Collaborators: Scientists and modelers at various institutes, including PNL and BNL

Summary of progress:

1. Perform systematic and advanced analyses of the HR-ToF-AMS data from CARES and ALC-IOP:
 - a. Characteristics, sources, processes, and climate relevant properties of OA under different atmospheric and aerosol regimes
 - b. Data products for informing and evaluating models.
2. Analyze long term aerosol chemistry data from ACSM deployed at ACRF sites:
 - a. Development of Organic Aerosol Component (OACOMP) VAP (available on ARM achieve)
 - b. Analysis of long term aerosol chemistry data and connection with other ARM observations
3. Integrate worldwide AMS field data
 - a. Further development of global AMS database (<https://sites.google.com/site/amsglobaldatabase/>)
 - b. More collaborations with modelers.

Challenges or needed resources/collaborators: Bridge the gap between field observations (open, uncontrolled system) and laboratory studies (closed, well-controlled system). More efforts are needed to maximize the values of ASB data

Global Aerosol Mass Spectrometry Database (Zhang et al. in preparation)

https://sites.google.com/site/amsglobaldatabase/

Aerosol Mass Spectrometry (AMS) Global Database

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Urban Urban Downwind Rural/Remote Aircraft



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Credits

This page was created and is maintained by the [Zhang Group](#) at UC-Davis in collaboration with the [Jimenez Group](#) at CU-Boulder, and has been supported through the U.S. Department of Energy (DoE) Atmospheric System Research (ASR) grants: DE-FG02-08ER64627, DE-SC0002191, DE-FG02-11ER65293 and DoE SBIR grant DE-SC0001673. If you use data from this database, please cite this web page and the paper(s) that reported the datasets you use.

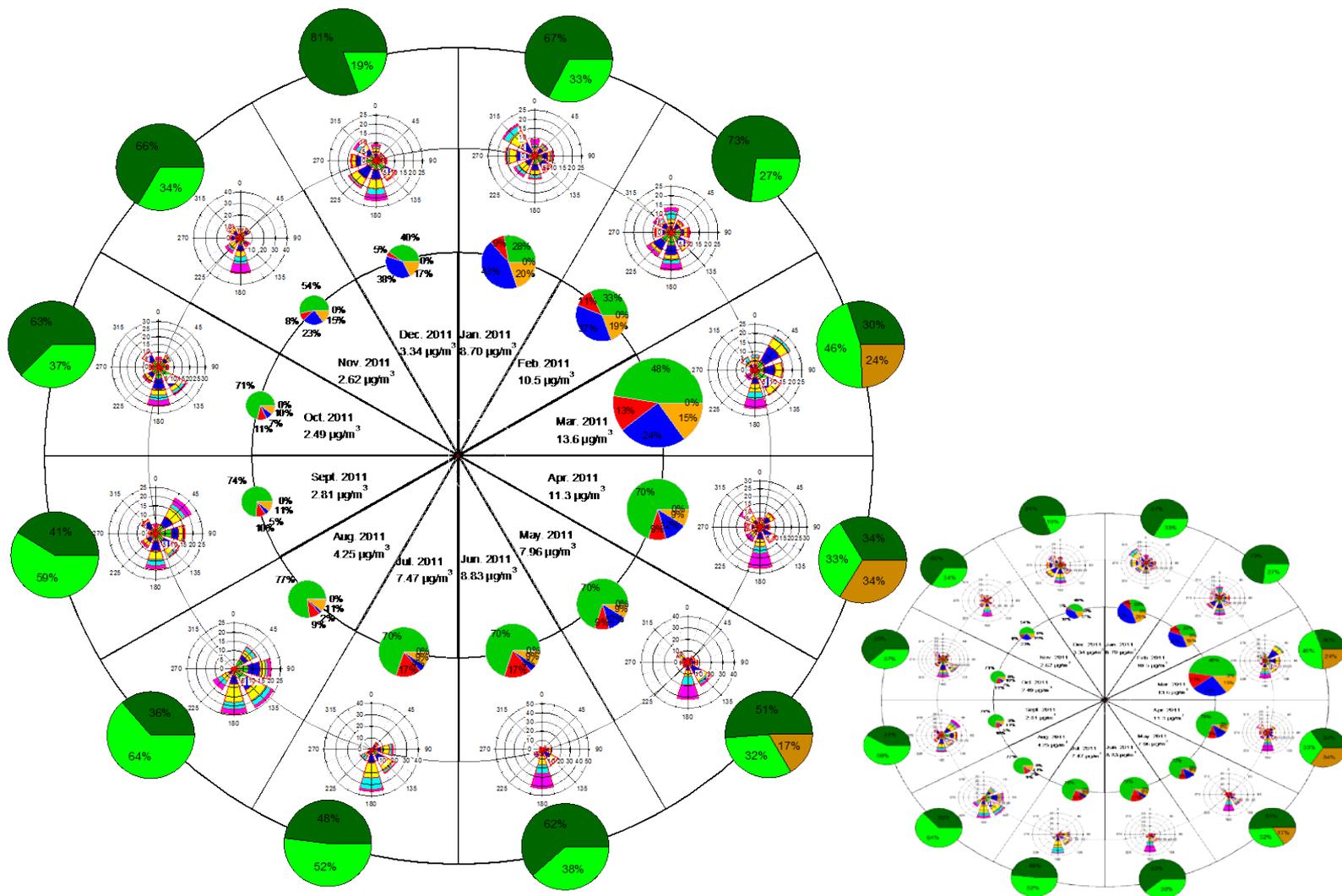
Contact Qi Zhang for questions and comments

SGP ACSM Data: Seasonal Variations in Aerosol Composition (Parworth et al. in preparation)

www.arm.gov/news/data/post/21989

July 23, 2013 [Data Announcements]

Evaluation Value-Added Product Estimates Organic Aerosol Components



Characterization of submicron particles influenced by mixed biogenic and anthropogenic emissions using high-resolution aerosol mass spectrometry: results from CARES

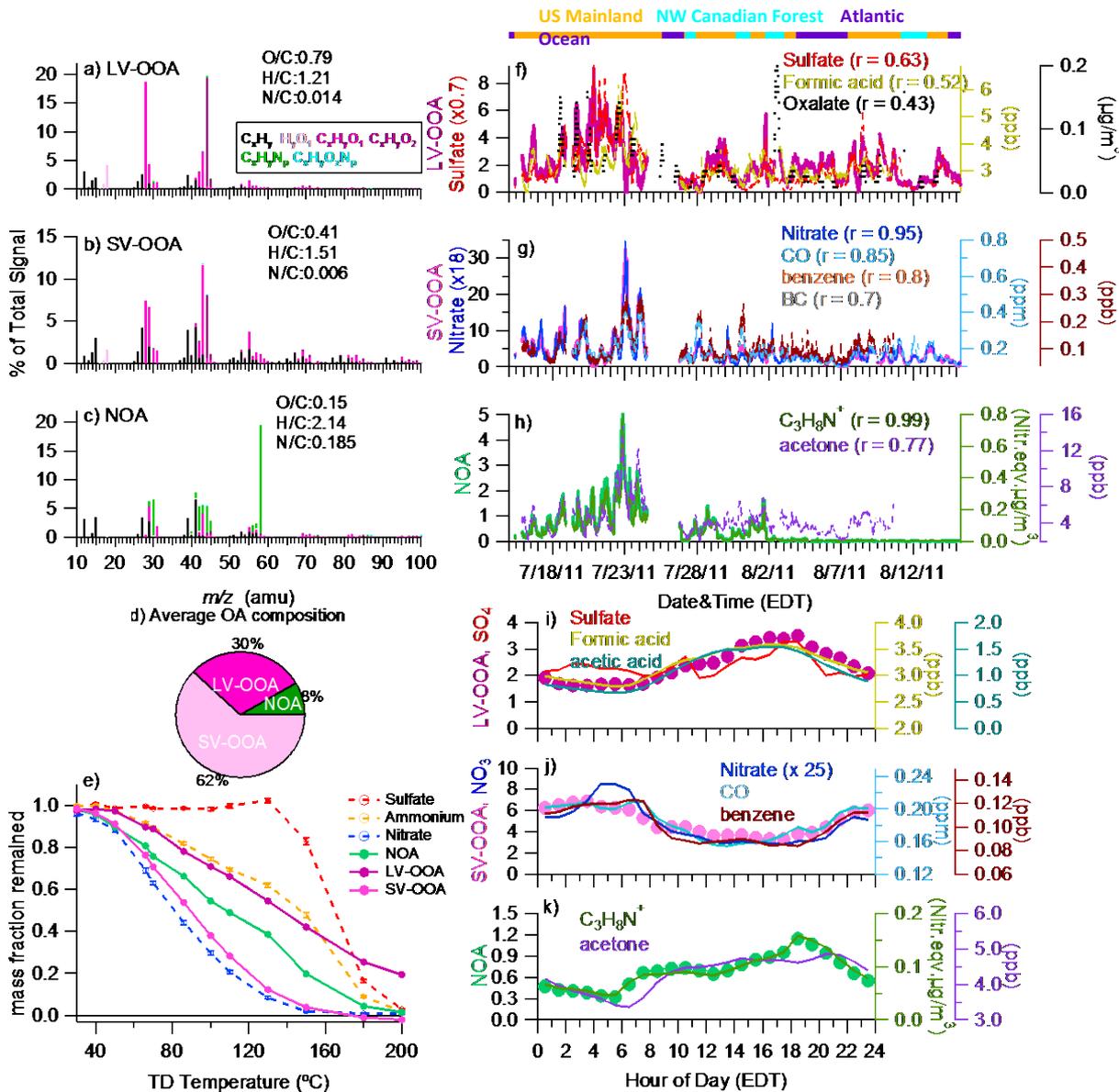
A. Setyan¹, Q. Zhang¹, M. Merkel², W. B. Knighton³, Y. Sun⁴, C. Song⁵, J. E. Shilling⁵, T. B. Onasch⁶, S. C. Herndon⁶, D. R. Worsnop⁶, J. D. Fast⁵, R. A. Zaveri⁵, L. K. Berg⁵, A. Wiedensohler², B. A. Flowers⁷, M. K. Dubey⁷, and R. Subramanian⁸

- Aerosol chemistry at Sierra foothills influenced by mixed A + B
 - **Organics** (80%) dominates aerosol composition
 - 3 major sources of organic aerosols:
 - Biogenic influenced SOA (40%) : O/C = 0.54
 - Urban transport, anthropogenic SOA (51%): O/C = 0.42
 - HOA (9%): local combustion POA
- Aerosols varied dynamically, due to influences from local, urban transport, and regional biogenic emissions.
- SOA production enhanced when anthropogenic air mass interacts with biogenic emissions. Corroborated by G-1 observations (Shilling et al., 2013).
- SOA formation rate appears to be influenced by A/B ratio. Need lab studies to understand the reaction mechanisms and need more field data to compare to models.

CARES: New particle growth in mixed biogenic and urban emissions (Setyan et al. in preparation)

- Regional NP events occurred almost daily at T0 & T1 during CARES (June, 2010).
- NPE were associated w/ SE winds bringing urban plumes from Sacramento to T1.
- Insights into chemistry of NP growth at T1 (based on HR-ToF-AMS):
 - Growth of new particles was driven primarily by “A”-SOA and, to a lesser extent, ammonium sulfate.
 - Ammonium species enhanced significantly during NPE → amines played a role.
- NP formation and growth are important processes in N. Cal., promoted by the interactions between biogenic emissions and urban plumes.
- Need to better understand the chemistry of NP formation and growth:
 - Field observations with instrumentation capable to measure particles < 10 nm and stable clusters (e.g., Nano-SMPS, APi-ToF, nano-CIMS...) and key gas phase species (e.g., amines).
 - Laboratory studies to assess how the interactions between biogenic and anthropogenic pollutants affect new particle formation and growth

ALC-IOP: PM₁ Sources and Processes at an Urban Downwind Location in NY (Zhou et al. in preparation)



- Aerosols at BNL, ~ 50 km downwind of NYC, are influenced by various emission sources and processes (urban, biogenic, BB, marine)
- OA dominated PM composition:
 - 62% was SV-OOA (less aged, strong association with urban emissions).
 - 30% was LV-OOA (highly oxidized, likely influenced by aq processes).
 - A nitrogen-enriched NOA (mainly composed of amino compounds).
- Photochemical processing of mixed biogenic emission and urban plumes strongly influence SOA formation and properties.

July 23, 2013 [Data Announcements]

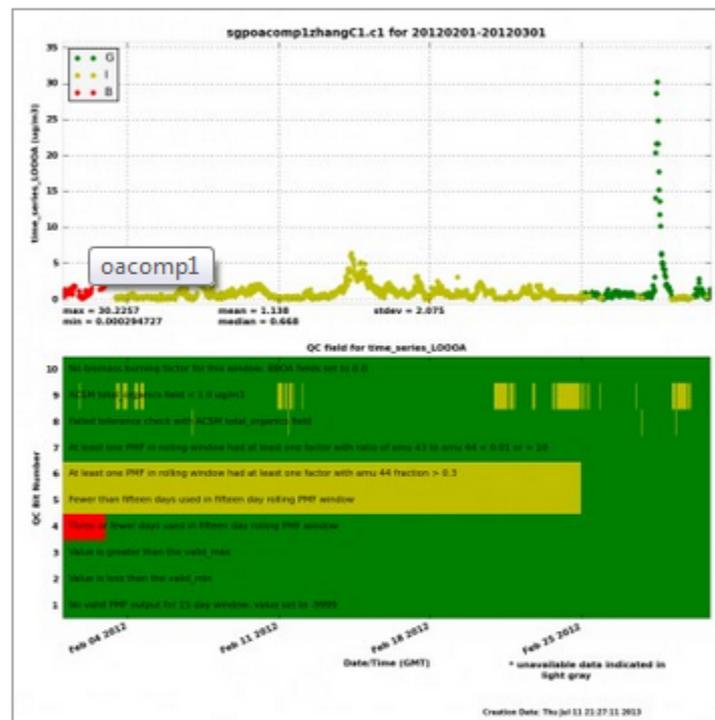
Evaluation Value-Added Product Estimates Organic Aerosol Components

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Organic aerosol (OA, i.e., the organic fraction of particles) accounts for 10–90% of the fine aerosol mass globally and is a key determinant of aerosol radiative forcing. But atmospheric OA is poorly characterized and its life cycle insufficiently represented in models. As a result, current models are unable to simulate OA concentrations and properties. This deficiency represents a large source of uncertainty in the quantification of aerosol direct and indirect effects and the prediction of future climate change.

The Organic Aerosol Component (OACOMP) value-added product (VAP) uses organic mass spectral matrix data collected by the [aerosol chemical speciation monitor \(ACSM\)](#) and multivariate analysis to obtain an estimate of the types of organic aerosols. Currently, time series of biomass burning organic aerosol (BBOA) and two types of secondary organic aerosol (SOA) (less-oxidated organic aerosol, LOOA, and more-oxidized organic aerosol, MOOA) are produced. These data are needed to assess the performance of aerosol models and determine whether the total organic aerosols are being simulated for the right reasons. For the convenience of users, OACOMP also includes the time series of total organic matter, sulfate, nitrate, ammonium, and chloride that is measured by the ACSM.

OACOMP is currently in evaluation mode, and any comments on the data set are welcome. The evaluation data are available for January 2011 through March 2012 from the Southern Great Plains (SGP) site. This VAP will run autonomously



Less-oxidized organic aerosol concentration and quality check flags for February 2012. Click to enlarge.

