

The ARM logo consists of the letters "ARM" in a bold, blue, sans-serif font. A thin blue arc is positioned below the letters, curving under them from the left to the right.

ARM

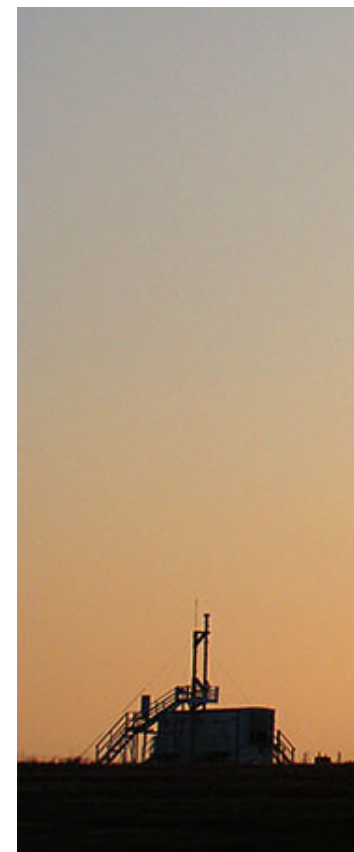
Aerosol Measurement Science Group 2019 Workshop & Community Input to the ARM Decadal Vision

Allison McComiskey
AMSG Co-chair
June 23, 2020

Aerosol Measurement Science Group

- ▶ ARM constituent group established in 2015
 - Tasked with “...providing enhanced coordination of ARM Climate Research Facility observations of aerosols and atmospheric trace gases with the needs of its Users.”
- ▶ 2017 Workshop
 - Identify an aerosol measurement strategy to align aerosol science questions with current ARM Facility instrumentation and observational capabilities
- ▶ 2018 Aerosol Measurement Plan:
 - Actionable items from 2017 workshop recommendations
- ▶ 2019 Workshop
 - Continue progress on technical issues defined in 2017 Workshop Report
 - Develop a science-oriented strategy to broaden the reach of ARM measurements

<https://www.arm.gov/about/constituent-groups/amsg>



2017 AMSG Workshop & Implementation Plan

- ▶ 2017 Workshop: Identify an aerosol measurement strategy to align aerosol science questions with current ARM Facility instrumentation and observational capabilities

- Particle size distribution
- System Configuration and Operation
- Optical Properties
- Aerosol Chemical Composition
- Documentation and Outreach
- Hygroscopic Activity and Cloud Droplet Activation
- Gas Phase Aerosol Chemistry

ARM Aerosol Measurement Plan
May 2018
(DOE/SC-ARM-TR-213)



2017 AMSG Workshop & Implementation Plan

- ▶ 2017 Workshop: Identify an aerosol measurement strategy to align aerosol science questions with current ARM Facility instrumentation and observational capabilities

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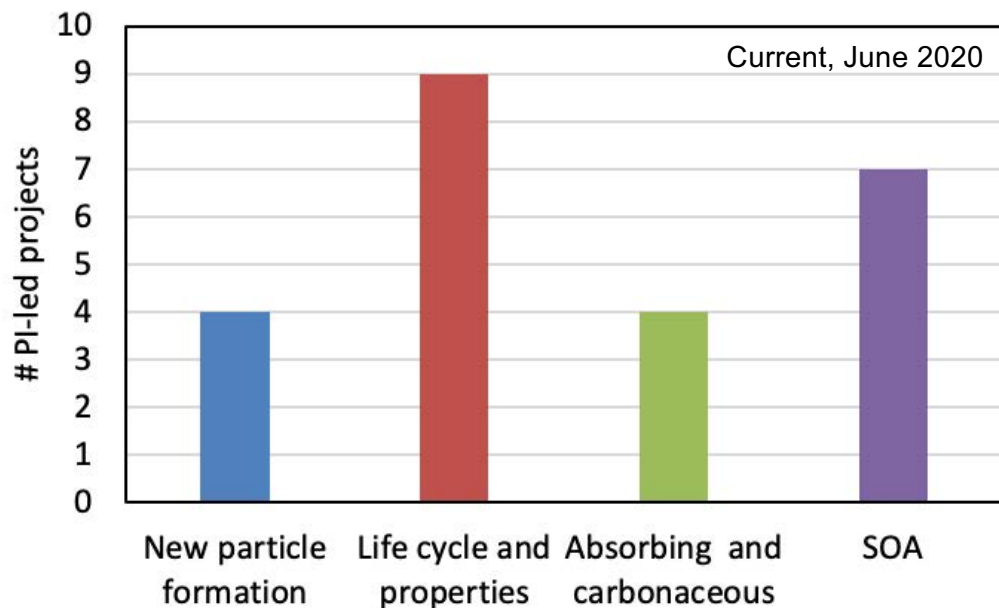
Shift from a technical to a science-oriented strategy



Context for the AMSG 2019 Workshop



Predominant Aerosol Processes Working Group research areas include:



- 1) new particle formation
- 2) effects of aerosol composition, mixing state, and physical properties on growth, aging, and removal processes
- 3) direct and indirect radiative effects of optically absorbing aerosols; and
- 4) understanding and predicting secondary organic aerosol concentrations and properties.

Context for the AMMSG 2019 Workshop



Aerosol Processes Working Group Survey

1. Which ARM aerosol data products are you using in your research?
2. If you are not using ARM data products in your research, why not?
3. Are there data products that you wish ARM could provide, but currently does not?



Results

- ▶ 43 mentions of the use of campaign data
 - 14 mentions of data use from fixed sites
- ▶ Prioritization of measurement classes:
 - Size distributions
 - Composition
 - Hygroscopicity/CCN concentrations
- ▶ > 1 mention, ranked
 - Wide range of aerosol sizes (distributions)
 - Composition beyond ACSM
 - Basic trace gases
 - Vertical profiles



**Decadal Vision
2020**

Toward a Science-Oriented Strategy

► Framing Questions:

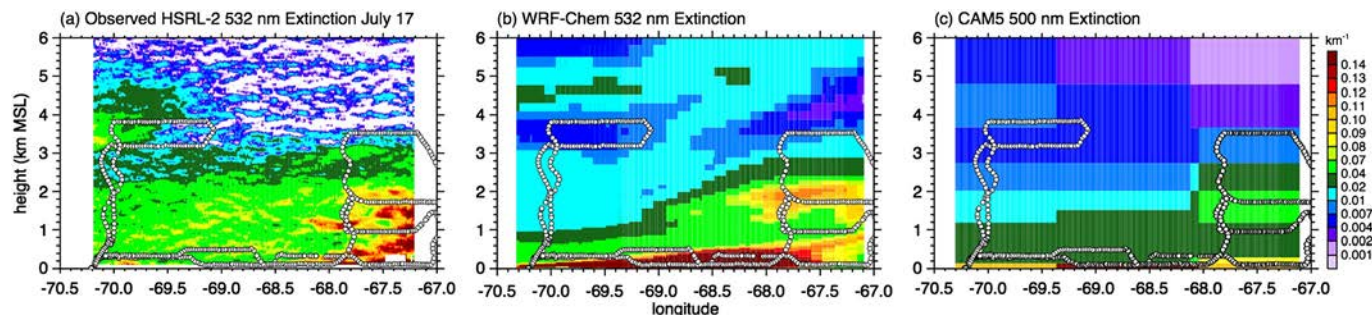
- Who are the audiences for ARM measurements? Are we appropriately serving these stakeholders and if not, how can we improve?
- Is there a community strategy (or strategies) for linking ARM data to the representation of aerosols in large-scale models?
- To what extent is the current ARM sampling strategy a limitation to stakeholders?
- Does there remain a core set of operational and calibration issues with measurements and data processing that are a limitation to stakeholders?
- Can a set of near- and longer-term goals can be devised for practical implementation of recommendations?

Workshop Sessions

- ▶ Interfacing with Models
- ▶ Sampling Strategies & Site-Specific Measurements
- ▶ Remote Sensing and Vertical Profiling
- ▶ Aerosol Properties and Instrumentation
- ▶ ARM Aerosol Calibration Protocols
- ▶ Aerosol Data Products

Cross-cutting Areas for Implementing a Science-Oriented Strategy

- ▶ Data Quality
- ▶ Measurements & Data Products
- ▶ Sampling Strategies
- ▶ Data Useability & Usership

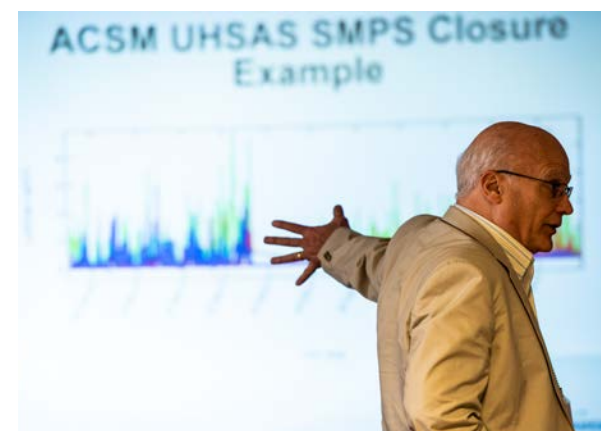


2019 Workshop Outcomes



Data Quality

- ▶ Shift mentor time from the field to the lab and to time spent analyzing data
- ▶ Develop established calibration protocols
 - publish aerosol instrument calibration and sampling protocols; follow international procedures where appropriate
 - more frequent participation in national and international instrument intercomparisons
 - invest in ARM internal instrument intercomparisons
- ▶ Develop and implement closure experiments to ensure internal consistency among measurements of aerosol properties
- ▶ Consider siting implications for local source contamination
- ▶ Invest in relationships with instrument vendors that include mentors, translators, and key users

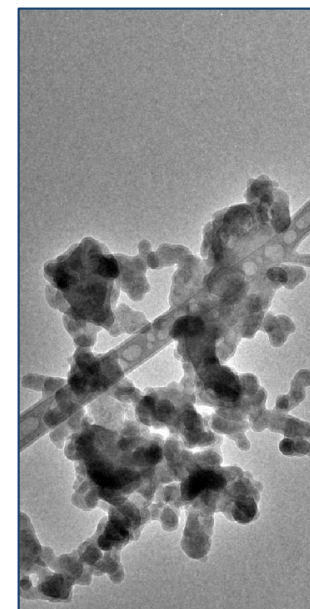


Tom Watson, EMSL-ARM Summer School 2019

2019 Workshop Outcomes

Measurements & Data Products

- ▶ Size & Number Concentration
 - unified/merged size distribution data stream reconciling different methods (reconcile SMPS and UHSAS)
- ▶ Composition
 - strategy for providing the appropriate components of composition at the right scales
 - size resolved chemical composition
- ▶ Hygroscopicity/Cloud Condensation Nuclei / Ice Nuclei
 - additional humidigraphs and HTDMA ambient scans where possible
 - implement CCN flow-scanning method
 - develop a Kappa product
 - increase frequency on IN measurements
- ▶ Absorption
 - use of remote sensing to constrain aerosol absorption
- ▶ Expand ARM's interface with external networks (e.g., AERONET, IMPROVE, EBAS, FAN)



2019 Workshop Outcomes

Sampling Strategies

- ▶ Shift to an IOP mode of operation
 - develop a 3-tier measurement strategy involving long-term observations, intensive periods, and guest instruments with consideration of needs for model improvement
 - consider seasonal IOP's at fixed site locations with a more comprehensive suite of measurements (more complex ARM and GUEST instruments)
- ▶ Develop new measurement strategies with consideration of needs for model improvement
 - enabling spatial (distributed networks) and vertical sampling (remote sensing/airborne platforms, esp. UAS)
 - better integrate remote sensing and in situ measurements
- ▶ Expanded GUEST instrument support
- ▶ Implement process to engage PIs regarding configuration of complex instruments
- ▶ Consider routine (bi-weekly?) flights between SGP and AMF3 SEUS site



Toward a Science-Oriented Strategy

Data Useability & Usership

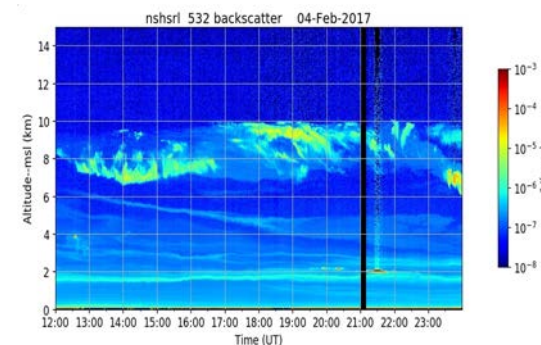
- ▶ Data bundling (with post processing masks) for ease of use with models
- ▶ Characterize measurement uncertainties
- ▶ Develop and implement operational closures among and between in situ and remote sensing observations
- ▶ Improve Translator-Mentor-User communication
 - joint ARM Aerosol Translator-Mentor annual meeting
 - mentor-user web conferences
 - e.g., Aerosol Modeling Translator
- ▶ Facilitate measurement science/technical peer-reviewed publications (additional to ARM reports)
- ▶ Improve instrument pages on the ARM web site and link to Data Discovery (incl. recommended data sets)
- ▶ Expand ARM presence in aerosol process community (e.g. AAAR meetings)
- ▶ Encourage PI data product submissions
- ▶ Continue ASR data products call

AMSG Looking Forward

- ▶ Public report to be published by end of summer
- ▶ Building 'Capability Needs Templates' according to priority science themes to track current and evolving community needs

Mini-workshops

- ▶ North Slope of Alaska aerosol measurements
 - Coordination with NOAA and their new Barrow Observatory
- ▶ Remote sensing and integration with in situ observations
 - Use of airborne platforms
- ▶ Modeling testbed
 - Data bundling
 - Uncertainty reporting



AMSG and 2019 Workshop Participants

AMSG Members

- Allison McComiskey, *AMSG Co-Chair*
- Stephen Springston, *AMSG Co-Chair, AOS Lead Mentor*
- Connor Flynn, *AMSG Co-Chair*
- Allison Aiken, *ARM Mobile Facility Aerosol Operations*
- Jerome Fast, *Modeling Representative*
- John Shilling, *ARM Aerosol Data Translator*
- Gannet Hallar, *Science Representative*
- Chongai Kuang, *Science Representative*
- Tim Onasch, *Science Representative*
- Arthur Sedlacek, *Science Representative*
- Nicole Riemer, *ASR APWG Co-Chair*
- Jim Smith, *ASR APWG Co-Chair*
- Mike Ritsche, *Southern Great Plains Observatory Manager*
- Fred Helsel, *North Slope of Alaska Site Operations*
- Adam Theisen, *ARM Instrument Operations Manager*
- Alyssa Sockol, *ARM Data Quality Office*
- Ranjeet Devarakonda, *ARM Archive*

Workshop Participants & Hosts

- Jim Mather, *ARM Technical Director*
- Susannah Burrows
- Gijs de Boer
- Don Collins
- Rich Ferrare
- Ann Fridlind
- Nicki Hickmon
- Petra Klein
- Po-Lun Ma
- Fan Mei
- Rich Moore
- Randy Peppler
- Jens Redemann
- Lynn Russell
- Joel Thornton
- Janek Uin
- Matt West
- Paquita Zuidema

