

Breakout Session Report

ARM/ASR Joint User Facility and PI Meeting June 21-24, 2021

Session Title: ARM Aerosol Measurement Activities and Plans

Session Conveners: Jim Mather

Session Date: Thursday, 24 June 2021

Session Time: 11:00-1:00 PM

Number of Attendees: ~75

Summary Authors: Jim Mather, Allison McComiskey, Qi Zhang, John Shilling, Gannet Hallar, and Tim Onasch

Main Discussion

This breakout included a series of presentations to communicate the status of activities focused on advancing ARM aerosol measurements and associated data products.

Jim Smith and Nicole Riemer kicked off the session with an update on the standards document being developed by ARM mentors and ASR scientists. A draft of the document is available here: <https://tinyurl.com/aerosol-standards>. It was noted in the discussion that ARM should work on being better connected to the American Association for Aerosol Research (AAAR) community, which also has an on-going effort on measurement standards.

Allison McComiskey provided an overview of the Aerosol Measurements and Science Group (AMSG) 2019 Workshop. This workshop focused on a number of topics to move the ARM Aerosol Observing System from a more technical to a science-oriented strategy and particular priorities were set to develop in the near future. Two of these priorities were selected for additional presentations at the end of the session to raise community awareness and solicit community feedback: aerosol measurements at the ARM North Slope of Alaska (NSA) observatory and a proposal for coordinated intensive operating periods.

Jim Mather provided an overview of development activities related to ARM aerosol measurements. This included an overview of actions to address recommendations from a 2017 AMSG workshop along with an overview of recently added instruments and plans for upcoming measurement additions. One of the recent advances was the porting of SP2 code to Python. This code has been made public by Bobby Jackson at <https://github.com/rcjackson/PySP2>. Another recent activity was the move to a new filter type for the particle soot absorption photometer (PSAP) and there was a request to keep the community in the loop regarding the characterization of this new filter.

The Aerosol Translator, John Shilling, gave a presentation updating the aerosol-related data products that are available. Priority for new products followed the recommendations from the AMSG and Aerosol working groups. Data from size distribution measurements instruments has been harmonized and a merged size distribution using ASP and SMPS data is being developed. A CCN kappa VAP is being developed and data is available for SGP. A CCN vertical profile VAP is also being developed. Aerosol optical depth for MCQ (MICRE) and NSA are being processed and an aerosol best estimate VAP combining AOD from multiple instruments is being developed. Finally, ACSM autonomous processing has been implemented. ACSM data were discussed more in a sub-breakout that followed.

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Four presentations were given to report various issues related to aerosol chemistry measurements using Aerodyne aerosol chemical speciation monitors (ACSM) deployed at ARM permanent sites. The topics include 1) the operation and calibrations of the ARM ACSMs, data processing procedures, and assessments of data quality (Maria Zawadowicz); 2) instrument developments such as ACSM with autonomus calibration and quality assurance capability or improved mass resolution (Phil Croteau); 3) analysis of multi-years' of ACSM data from SGP and efforts to develop organic aerosol value added products for better understanding aerosol sources and emission processes (Qi Zhang), and 4) application of long-term ACSM measurements for model evaluation (Jerome Fast).

The session concluded with presentations on pair of topics that emerged from the 2019 AMMSG workshop. The first presentation examined the status of ARM aerosol measurements at the NSA Utqiagvik site and opportunities to expand those measurements in coordination with the Barrow NOAA observatory (Jessie Creamean) and the second presentation focused on a proposal to introduce coordinated intensive operation periods at ARM sites as a means of both expanding aerosol measurement capabilities and focusing attention on data quality (Gannet Hallar and Tim Onasch).

Key Findings

The audience was very receptive and positive toward the proposed idea of a themed intensive operational strategy for aerosol measurements at the fixed ARM site. For example, Jose-Luis Jimenez from the University of Colorado stated "the structured IOP idea that was described is outstanding, and has the potential to solve what (in my opinion) has been for at least a decade a core problem in how to combine the ARM sites, the more complex instruments at those, and the intensives with research grade instruments." Jerome Fast from PNNL stated "... a structured IOP methodology is the only way to go to provide new data needed for advance aerosol research, particularly on SOA (Secondary Organic Aerosol)." Shantanu Jathar from CSU, "With my modeling hat on, I think high-quality data for a few weeks (perhaps a month) are better for manageable model-measurement comparisons with respect to learning about aerosol process/properties... I am thinking of the insight offered by similar exercises during CalNex, CARES, GoAmazon, etc. In general, it is very tedious to do longer model-measurement comparisons." No comments (either verbal or written) in opposition to the idea were received.

There was also a positive response to expanding aerosol measurements at Utqiagvik with specific calls for size distributions and filter measurements, including support for analysis of existing samples obtained by Patricia Quinn.

The audience showed a strong interest in ARM ACSM data products and asked a large number of questions about ACSM data processing, analysis, and usage.

Future Plans

The purpose for this session was to update the community on aerosol measurement and data processing activities following a period with limited communications during COVID. At this point, there are not concrete plans to address specific recommendations from the 2019 AMMSG workshop; however,

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given the positive response to the suggestions to pursue expanded measurements at Utqiagvik and the coordinated IOP framework, ARM will begin pursuing these ideas. ARM will next re-engage with the AMMSG to develop priorities and plans around issues raised in the 2019 workshop including these two topics. There is also a need for on-going community engagement. ARM is preparing to implement a mechanism to solicit input more broadly on priorities. Jim Mather is planning to host a webinar to kick-off that mechanism. Additionally ARM is exploring a forum for community discussion (currently being piloted by the LASSO modeling project) to solicit input and will make use of expanded meetings as appropriate and feasible. Follow-up meetings will be planned to discuss analyses of the ARM ACSM data in the context of understanding aerosol chemical climatology and lifecycle processes.

Action Items

In addition to the above plans for continued community engagement and development of implementation plans, there were several near term actions:

- Publish AMMSG workshop report (this is currently in the editing phase)
- Publish standards document (currently under review)
- Establish a mechanism to communicate progress on the characterization of the new PSAP filter