Breakout Session Report
ARM/ASR User and PI Meeting
March 16-20, 2015

Session Title: Secondary Organic Aerosol (SOA) Focus Group Breakout
Session Date: Thursday, March 19, 2015
Session Time: 1:30–3:30 p.m.
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Description

This session will include both presentations of the progresses during last year and discussions of future plans for key topics on secondary organic aerosol (SOA), including SOA growth mechanisms, effects of SOA viscosity/phase on SOA formation, and sulfate as a driver for SOA formation.

Main Discussion

The session was comprised of two parts. The first hour was dedicated to principal investigator presentations highlighting recent achievements. A measurement or observational finding was presented followed by a demonstration of how that finding was being used in models. Several examples of ASR experimental findings being incorporated in regional and global models were shown. Highlights include SOA volatility, phase and viscosity work being done by Martin, Zelenyuk, Shrivastava, and Zaveri, who identified SOA volatility/phase/viscosity as a key parameters required for accurately modeling its formation, growth, and atmospheric evolution. These studies generally show that SOA is significantly more viscous and less volatile than assumed in traditional modeling approaches. These findings have been incorporated into several modeling studies and have implications for growth of nano-particles to cloud condensation nuclei (CCN) active sizes. Jimenez and Thornton presented new details on isoprene oxidation chemistry and how these mechanisms impact model SOA predictions. Alvarado presented work on modeling SOA formation from wildfires. Lambe presented work comparing SOA formation and properties from SOA produced in the PAM chamber to larger simulation chambers. Several of these process level details are missing in global climate models and have large potential implications on radiative climate forcing of SOA.

The second hour of the session was designated for discussion. First, the group decided that we would move toward becoming an official focus group. A committee to write an SOA focus group white paper has been organized and volunteers were solicited. The writing committee will prepare a white paper and then circulate it to the entire SOA group for comment. The paper will be organized around three topics that were agreed upon by the entire SOA group at a previous DOE meeting; 1) SOA phase/viscosity, 2) SOA growth mechanisms, and 3) sulfate as a trigger or driver for SOA formation. There was a short discussion about whether these topics were still of interest to the group and the group affirmed they were. There was some discussion about whether the three topics were perhaps too broad. This concern was balanced by the desire to not exclude interested principal investigators. It was noted that ASR-funded researchers have made significant advances in addressing phase/viscosity and particle growth mechanisms with somewhat less momentum around the sulfate topic.

A substantial portion of the discussion revolved around the question of how the SOA focus group could take advantage of the ARM megasite reorganization. There was considerable enthusiasm for continued use of the ARM Aerial Facility G-1 to target SOA formation and the group agreed that it was a valuable resource. The group felt that the most appropriate megasite for an SOA-focused study would be the ARM

Southern Great Plains (SGP) site; however, there was disagreement about the utility of such a study. Some in the group felt that SGP was not ideal for studying SOA formation due to lack of volatile organic carbon (VOC) emissions in the area, relatively low formation of SOA, and the dominance of inorganic species. Some suggested a deployment of an ARM Mobile Facility to either the southeastern United States or to the Amazon for a longer period of time. Others felt that a rural site, such as SGP, would be useful for understanding the SOA formation because SGP is representative of large regions of the country and may be a reasonable representative for SOA formation in many rural agricultural areas.

In any case, the group agreed that additional instrumentation, particularly at SGP, would make the site more amenable to understanding SOA formation. The group widely agreed that an Scanning mobility particle sizer (SMPS) should be added to SGP for use in calibrating the Aerosol Chemical Speciation Monitor (ACSM) more regularly and for measuring size distributions and aerosol volume loading. The current ACSM calibration schedule appears to be insufficient. The group also agreed that VOC measurements will be key to understanding SOA formation. Without measurements of SOA precursors, it is difficult to understand SOA formation and aging. There was a split about whether Proton Transfer Reaction Mass Spectrometer (PTR-MS) or canister sampling followed by offline analysis would be best. It was generally agreed that PTR-MS would be preferable if the instrument could be operated continuously and rigorously calibrated; however, this mode of instrument operation is somewhat at odds with the ARM paradigm. Canister sampling could potentially quantify more VOCs at the expense of time resolution. Generally, the group agreed that several canister samples per day would need to be collected to be of use. After the discussion, the canister sampling was costed ($200/sample for analysis) and appears to be too expensive at the necessary time resolution (minimum 3 hours) to be feasible.

Final items of discussion included a brief discussion of the potential construction of a chamber at DOE's Environmental Molecular Sciences Laboratory that could be used to study SOA formation from plants. Comments were generally positive. Alvarado felt that as a modeler more clarification about what the aerosol mass spectrometer (AMS) derived positive matrix factorization (PMF) organic aerosol (OA) factors represented would help. There was a short discussion about whether focus on traditional SOA VOC precursors missed some potential important SOA precursors.

Needs

The group strongly recommends that an SMPS be added to the instrumentation at ARM megasites. The SMPS(s) would serve two purposes. First, it would be used to calibrate aerosol instrumentation. The group felt that more frequent calibrations would greatly improve the quality of the data from instrumentation, particularly the ACSM. The ACSM is a key instrument for SOA studies and the group agreed that, with more frequent calibrations, the data could be used to assess long term trends in SOA loading at SGP. Second, the SMPS would provide information on size distribution and aerosol loading.

The group also felt that VOC measurements are necessary to measure SOA precursors at the megasites. There was a discussion about whether PTR-MS or canister sampling followed by offline analysis would be more appropriate (see notes above). However, costing of the canister sampling suggests it is unreasonably expensive. This issue remains open.

Future Plans

A committee to prepare an SOA white paper was formed and plans are in place to advance the SOA group toward official focus group status. The initial committee will prepare the white paper and then circulate it to the wider group for comment.

Action Items

- Prepare and SOA white paper
- Solicit the SOA focus group for comments
- Submit the white paper to formalize SOA focus group status
- Cost the analysis of canister sampling of VOCs (done and noted above).