

Session Title: AMF3 Southeast United States Deployment
Session Conveners: Chongai Kuang, Scott Giangrande, Shawn Serbin, Joe Hardesty, Nicki Hickmon, Jim Mather
Session Date: Thursday, June 25th, 2020
Session Time: 2:00 pm – 4:00 pm, EDT
Number of Attendees: 211 (unique viewers)
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Main Discussion

A summary of our breakout session discussion results is presented here, organized by topical category (Aerosol, Convection, Land-Atmosphere-Interactions, General), with each category further sub-organized into the sections of (when applicable): science drivers and considerations, measurements and instruments for consideration, sampling considerations, siting and deployment considerations, and outreach to local partners/agencies/measurement networks.

Aerosol

Science drivers and considerations:

Science discussion focused primarily on biogenic VOCs (volatile organic compounds) and secondary organic aerosol (SOA) in the SEUS. Participants made sure to bring to attention that monoterpene (MT) contributions were dominant as compared to isoprene (ISO) for SOA as observed during SOAS (Southern Oxidant and Aerosol Study). Also, the relative MT/ISO contributions to SOA vary seasonally and spatially across land-surface with respect to both vegetation and anthropogenic pollutants (SO_2 and NO_x). Measuring changes in NO_x /oxidants are critical to understanding aerosol-cloud-VOC emissions feedback, and feedbacks with soil moisture are different between MT and ISO.

Measurements/instruments for consideration:

Participants emphasized the need for measurements of: the complete aerosol size distribution (1 nm up to 30 microns); aerosol molecular/chemical composition and morphology via filters, PILS (particle into liquid sampler), and MOUDI (micro orifice uniform deposition impactor); aerosol optical closure via vertical profiling and integration with surface aerosol optical column sensors; aerosol hygroscopicity under super-saturated conditions via size-resolved CCN (cloud condensation nuclei) spectrometer; and surface fluxes and concentrations of total and speciated VOCs via GC-MS (gas chromatography mass spectrometry). Several questions and concerns were raised regarding the suitability of the PTR-MS (proton-transfer mass spectrometry) for long-term measurement of VOCs due to challenges associated with operational complexity.

Sampling considerations:

Participants mentioned that, typically, the largest uncertainties in regional BVOC (biogenic) emissions are how they are distributed spatially, and how they are changing over time (from years to decades). “Snapshots” of VOC flux distributions measured from aircraft were mentioned as useful in addition to long term surface measurements, providing a mapping of emissions to ecosystems and land cover. There was general interest in having aircraft campaigns at regular intervals and/or during a single period such as an IOP.

Outreach to local partners/agencies/measurement networks:

Participants mentioned the long-term aerosol measurement system (AOS-like) located in Boone, NC associated with Appalachian State University as a potential network partner, and emphasized leveraging campaign data from SOAS and data from the SEARCH/IMPROVE measurement networks.

Convection

Science drivers and considerations:

There was a question (no follow-up discussion was possible) regarding if stratiform processes / QLCS / precipitation (that may dominate during a significant fraction of the year) would be studied in order to fully leverage observational data.

Measurements/instruments for consideration:

Participants mentioned the desire for stereo photogrammetry that would be helpful for shallow cloud, shallow convective studies. ARM leadership responded that scientific justification will need to be provided for inclusion of that capability. Questions were raised regarding availability of scanning cloud and precipitation radars, which are critical to deliver on several convective microphysics and dynamics science questions. The site science team (SST) responded that we initially anticipate that the ARM CSAPR2 and SACR (X-Ka variant preferable) would be available at some points during this deployment, and that for certain retrievals (kinematic), ARM radar assets would be enhanced by proximity to other agency radars (e.g., NEXRAD).

Sampling considerations:

There was extensive discussion regarding the sampling of the local storm environments, which is critical to convective intensity, aerosol processing, and convective transport. In particular, participants were discussing sounding availabilities and frequencies, and whether better spatial coverage, better temporal coverage, or combinations of both should be prioritized (including IOP options). Arguments in favor of greater temporal coverage articulated that there is little observational evidence currently as to how rapidly local storm environments change and their impacts on convective updrafts. Participants agreed on the need to develop a plan to achieve both spatial and temporal enhancements, including mention of recent ASR work based on RELAMPAGO-CACTI that addressed needed spatial and temporal observational scales.

Outreach to local partners/agencies/measurement networks:

Potential integration and coordination with the proposed PERiLS/CAVEAT-Q measurement campaigns starting after 2022 was mentioned.

Land-Atmosphere Interactions

Science drivers and considerations:

The summary of science challenges and opportunities presented by Greg Starr was well-received and fully supported. Participants also suggested the importance of considering differentiating between broad vegetation types in the SEUS, such as needle leaf vs. deciduous forests, since these different types will affect the nature of biogenic SOA precursors. The SST responded in agreement, and is actively working on capturing the main “end-members” in the region. There was stated need and interest in: land-model products for coupled modeling at cloud/LES scales, modeling studies needed to address spatial heterogeneity and to use models as the means to capture overall regional responses as informed by observations at the model limited sampling locations, as well as 2-way interactive land-atmosphere coupled simulations.

Measurements/instruments for consideration:

Participants mentioned a desire to include ECOR (eddy correlation flux measurement) systems as part of the phase 1 (initial) deployment for surface flux measurements, and to have measurements of canopy height, soil, and root depth at multiple locations.

Sampling considerations:

Several participants mentioned the need for a measurement network targeting surface fluxes and turbulence, which would provide the spatial coverage necessary to study secondary circulation induced by land surface heterogeneity. Furthermore, measurement networks would provide regional-scale fluxes rather than single site local surface fluxes.

Siting and deployment considerations:

Participants asked if there was interest in siting in coastal regions characterized by additional complexity such as oceanic aerosol and different land types in addition to agriculture/forest/urban land types characteristic of interior regions in the SEUS. The SST was also asked to consider disturbance events associated with extreme weather (hurricanes and tornadoes) in terms of their impacts on siting, and disturbance events associated with land-use (logging) in terms of their impacts on vegetation heterogeneity, age, and structure.

Outreach to local partners/agencies/measurement networks:

A small science team/working group was proposed for coordinating LAI science/measurements/instrumentation/deployment with other agency partners. Coordination with agency flux towers (TES, Ameriflux, and NEON) would be critical for up-scaling to TCCON (Total Carbon Column Observing Network) to address spatial heterogeneities.

General

Siting and deployment considerations:

Participants suggested that the area in North Alabama should be seriously considered for siting due to: good land cover contrast, presence of biogenic emissions from Bankhead National Forest, good sites for radars, and instrumental support/proximity from local agencies and the University of Alabama, Huntsville. There was also a stated preference of co-locating the AMF3 with existing measurement sites/networks to provide additional measurements and to leverage long-term measurement records. Due to the nature of the phased installation of the AMF3, it was suggested that the SST consider prioritizing instruments that are most critical for science drivers.

Outreach to local partners/agencies/measurement networks:

Participants expressed interest to coordinate deployment with solar energy research facilities, and also to communicate/coordinate with the SERDP program with respect to fire management/biomass burning in the SEUS.