☒ **Talk**   ☐ **Poster**

In-situ and off-line characterization of vertical profiles of supermicron bioaerosols in forest and coastal-urban environments

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Understanding the vertical distribution of bioaerosols is crucial for advancing knowledge in public health, climate science, and ecology. These airborne particles of biological origin, including bacteria, fungi, viruses, pollen, and spores, play significant roles in disease transmission, cloud formation, and biogeochemical cycling. While bioaerosol composition and abundance have been extensively studied at ground level, their vertical distribution remains poorly characterized across geographic regions and meteorological conditions.

Supermicron bioaerosols such as pollen are particularly challenging to observe in real-time using inlet-based instruments. To address this, we deployed a unique combination of in-situ sensors on the Atmospheric Radiation Measurement (ARM) Tethered Balloon System (TBS) platform. The payload included the Wideband Integrated Bioaerosol Sensor (WIBS), an optical particle counter (OPC), and the Cloud Droplet Measurement System (CDMS), paired with particle collection for off-line chemical, microscopy, and ice nucleation analyses.

We present results from TBS vertical profiles during three summertime intensive operational periods (IOPs) at the DOE ARM Bankhead National Forest (BNF) site in Alabama and one IOP at the DOE ARM Coast-Urban-Rural Atmospheric Gradient Experiment (CoURAGE) campaign in Baltimore, MD. Off-line analyses, including CCSEM-EDX and high-resolution mass spectrometry, were conducted at the Environmental Molecular Sciences Laboratory (EMSL). Off-line measurements of ice nucleation propensity were conducted at Colorado State University.

We hope to discuss potential collaborations in off-line analysis with NSLS-II, where synchrotron-based methods such as X-ray fluorescence microscopy, X-ray absorption spectroscopy, and nano-tomography could be applied to our collected samples. These approaches would provide new insights into the chemical speciation, trace element content, and nanoscale morphology of individual bioaerosols, complementing ARM's in-situ and EMSL's off-line analyses. By linking structural and chemical information with atmospheric measurements, such collaborations would enable a more comprehensive understanding of bioaerosol sources, transformations, and climate impacts, while fostering cross-disciplinary connections between atmospheric and photon science communities.