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Evolution of Biomass Burning Aerosols in the Near Field

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Biomass burning is a significant source of aerosols that can perturb Earth's climate through the direct (both scattering and absorption), indirect (cloud formation and precipitation), and semi-direct (cloud dissipation) radiative effects. Despite much effort, quantities important to determining radiative forcing for these events still remain highly uncertain due to the inherent difficultly of conducting the required measurements and instrumentation limitations. Further adding to this uncertainty is that few field campaigns have been conducted in the northern temperate latitudes in spite of biomass burning producing about one-third of the PM2.5 in the US.

During the summer and early fall of 2013, the Atmospheric Radiation Measurement (ARM) program of the U. S. Department of Energy (DOE) sponsored an aircraft-based field campaign to study the near-field evolution of particulate emissions from biomass burning. Key scientific objectives for the Biomass Burning Observation Project (BBOP) are to 1) quantify the downwind time evolution of microphysical, morphological, chemical, hygroscopic, and optical properties of aerosols generated by biomass burning, 2) use the time sequences of observations to constrain processes and parameterizations in a Lagrangian model of aerosol evolution, and 3) incorporate time evolution information into a single-column radiative transfer model for determining forcing per unit carbon burned.

Discussion will be on the near-field evolution of particle mixing state and morphology, chemical composition, and microphysical processes that determine aerosol size distribution and single scattering albedo (SSA) of light absorbing aerosols. In cases studied, increases in the coating thickness of refractive black carbon (rBC) particles, organic aerosol/rBC ratio, scattering/CO ratio, and aerosol size distributions have been observed. Results are based on wildfires sampled in the US northwest and on controlled agricultural burns in the south-central Mississippi valley will be given.