2.026 Laboratory studies on the aging of biomass burning emissions: chemical evolution and secondary organic aerosol formation.

Early Career Scientist

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Abstract:

Biomass burning emissions represent a major source of fine particulate matter to the atmosphere, and this source will likely become increasingly important in the future due to changes in the Earth's climate. Understanding the effects that fire emissions have on air quality and climate requires understanding the composition of the particles emitted, since their composition is directly related to important properties such as absorptivity, toxicity, and cloud condensation nuclei activity. However, the composition of biomass burning particles in the atmosphere is dynamic, as the particles are subject to the condensation of low-volatility vapors, reaction with oxidants such as the hydroxyl radical (OH), and evaporation during transport. Previous studies have shown significant variability with respect to the net effect of aging on the amount of biomass burning organic aerosol (OA), with some studies showing a decrease in OA with age and other studies showing significant increases. Here, we present a series of laboratory chamber experiments on the OH-initiated aging of biomass burning aerosol performed at the Fire Sciences Laboratory in Missoula, MT as part of the Fire Influences on Regional and Global Environments Experiment (FIREX) campaign. We measure the evolution of biomass burning aerosol produced from a variety of fuels, monitored with a high-resolution time-of-flight aerosol

mass spectrometer (Aerodyne HR-ToF-AMS) and a proton-transfer reaction time-of-flight mass spectrometer (NOAA PTR-ToF-MS). Typical equivalent atmospheric aging times in the chamber range from 2 – 10 days of OH exposure, over which the mass and carbon oxidation state of the particles increase. OA production varies significantly from experiment to experiment, but we observe a strong correlation between the concentration of relatively high molecular weight gas phase compounds (C_5 and above) measured by the PTR-ToF-MS in the chamber before oxidation and the absolute amount of OA formed after aging.