First results from a large, multi-platform study of trace gas and particle emissions from biomass burning

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We report preliminary results from a large, multi-component study focused on North American biomass burning that measured both initial emissions and post-emission processing. Vegetation types burned were from the relatively less-studied temperate region of the US and included chaparral, oak savanna, and mixed conifer forest from the southwestern US, and pine understory from the southeastern US. These vegetation types are commonly managed with prescribed burning. In a laboratory component, vegetation samples collected from the southeastern and southwestern US were burned under “realistic” conditions at the USDA Forest Service’s Fire Sciences Laboratory in Missoula, MT. The smoke emissions were measured with a comprehensive suite of state-of-the-art trace gas and particle instruments. The University of Montana open-path Fourier transform infrared (FTIR) system measured many trace gases and additional instruments (some deployed in smoke for the first time) allowed measurements of over 150 additional non-methane organic compounds (NMOC). A subsequent field campaign featured ground-based sampling of smoldering emissions in North Carolina with FTIR and airborne measurements of initial emissions and plume aging in California, Arizona, and North Carolina on a Twin Otter aircraft outfitted with airborne FTIR, aerosol mass spectrometer (AMS), single particle soot photometer (SP2), nephelometry, and whole-air sampling from November 2009 - March 2010. The laboratory fire studies revealed large initial emissions of HONO and high molecular weight gas-phase NMOC. Airborne FTIR confirmed the laboratory observations of large emissions of HONO (HONO/NOx ~ 0.1) and heavy NMOC from the field fires and documented fast formation of PAN, organic acids, ozone, and rapid loss of several precursors. Changes in aerosol properties and composition with aging were also observed in our California airborne measurements.

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