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# Physical properties of black carbon aerosol emitted by a series of laboratory biomass fires

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Black carbon aerosols have major impacts on the transfer of radiation in the atmosphere and affect climate and air quality on regional and global scales. Globally averaged, biomass burning represents roughly 40% of the total BC emissions to the atmosphere. The amount and physical properties of BC emitted by fires is highly uncertain as is our knowledge regarding the processing/transformation of BC once emitted to the atmosphere. To address these areas, we measured emissions of black carbon (BC) aerosol emitted by a series of controlled laboratory-scale burns involving a range of biomass fuels commonly consumed during prescribed and wildfires in North America. Black carbon aerosol physical properties including size distribution and mixing state were determined using a Droplet Measurement Technologies single particle soot photometer (SP2). The SP2 uses a laser induced incandescence technique to determine the mass of individual BC particles. Unlike filter-based methods previously used to quantify BC emitted from fires, the SP2 does not suffer from artefacts related to the presence of non-BC material co-sampled with BC particles. The SP2 also allows for simultaneous measurement of light scattered by BC particles to diagnose the presence of non-BC material associated with the BC particles (i.e., coatings). We also compare the BC physical property measurements to simultaneous light absorption and scattering measurements made by a DMT photoacoustic spectrometer at multiple wavelengths (405, 532, and 870 nm). Both BC physical and optical properties are linked to fuel properties and combustion conditions. The SP2 and photoacoustic spectrometer sampled downstream of a thermal denuder and three-stage dilution system throughout the study to examine the volatility of aerosol emitted by the fires. This allowed for the examination of the role of non-BC material on aerosol optical properties and BC coatings as measured by the SP2 and has implications for BC atmospheric aging processes.