Chemical composition of wildland and agricultural biomass burning particles measured downwind during BBOP study

T.B.Onasch[1], J. Shilling[2], E. Fortner[1], M. Pekour[2], D. Chand[2], S. Collier[4], Q. Zhang[4], L. Kleinman[3], A. Sedlacek[3], A. Freedman[1], D. Worsnop[1]

[1]Aerodyne Research, Inc. Billerica, MA, 01821 USA
[2]Pacific Northwest National Laboratory, Richland, Washington, 99354 USA
[3]Brookhaven National Laboratory, Upton, New York, 11973 USA
[4]University of California Davis, Davis, CA 95616 USA
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Presenting author email: onasch@aerodyne.com

The Biomass Burning Observation Project (BBOP) measured plumes from wildland fires in the Pacific Northwest and prescribed agricultural burns in the Central Southeastern USA from the DOE Gulfstream-1 (G-1) aircraft platform over a four month period in 2013. The objective of BBOP was to measure the changes in biomass burning plumes in the first few hours after emissions.

The chemical composition of the emitted particulate emissions were characterized using an Aerodyne Soot Particle Aerosol Mass Spectrometer (SP-AMS) (Onasch et al., 2012). The SP-AMS was operated with both laser and resistively heated tungsten vaporizers, alternatively turning the laser vaporizer on and off. With the laser vaporizer off, the instrument operated as a standard HR-AMS. With the laser vaporizer on, the SP-AMS was also sensitive to the refractory black carbon content, in addition to the non-refractory components, and will be presented within the context of technique-specific collection efficiencies. Optical measurements (extinction, scattering, and absorption) were made over a range of 355 to 700 nm. Here we focus on the single scattering albedo (SSA) derived from extinction measurements made at 630 nm with the Aerodyne CAPS PM_{ex} monitor and a TSI 3-λ nephelometer operating at 700 nm.

The mass loadings, chemical composition, and optical properties of the biomass burning particles were characterized during downwind transport for multiple fire locations, fuel types, and modified combustion efficiencies (MCE). Specific attention is focused on characterizing the level of oxidation (i.e., O:C, H:C, and OM:OC), anhydrosugar, and aromatic content and investigating the governing atmospheric processes (i.e., dilution and/or secondary aerosol formation). Addition information on the mass of black carbon, the OM/BC ratio, and the R_{BC} (coat-to-core) ratio will be examined, with a focus on correlating with the simultaneous optical measurements.

The particulate extinction measured as a function of the flight pattern during sampling of the Colockum Tarps fire in central Washington during late July 2013 is shown in Figure 1. Figure 2 shows changes in particulate organic mass to carbon monoxide ratio and the oganic chemical composition measured downwind. The average Org/CO ratios were relatively constant with distance down wind, whereas the O:C increased and the f_{60} ratio decreased.

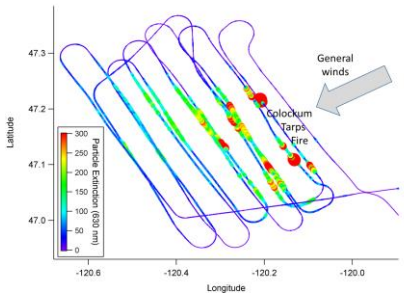

Figure 1. Particulate extinction measured downwind of the Colockum Tarps fire 30 July 2013.

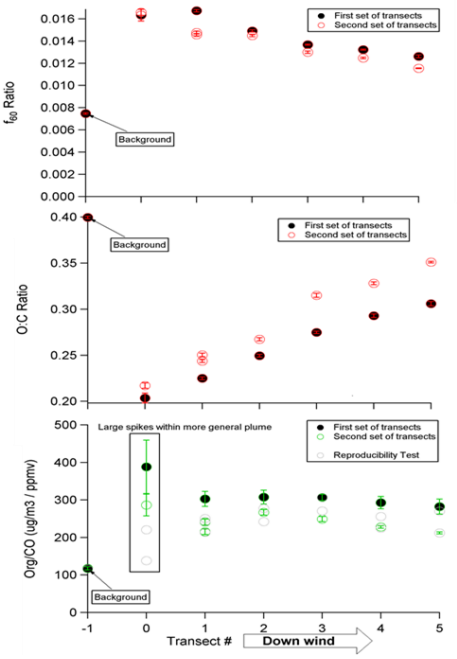

Figure 2. Particulate organic mass and chemical composition measured downwind.

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Onasch, T.B., Trimborn, A., Fortner, E.C., Jayne, J.T., Kok, G.L., Williams, L.R., Davidovits, P. and Worsnop, D.R., Soot Particle Aerosol Mass Spectrometer: Development, Validation, and Initial Application, (2012) *Aerosol Sci. Technol.*, **46**(7), 804–817.