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Organic composition of carbonaceous aerosols in an aged prescribed fire plume

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Abstract. Aged smoke from a prescribed fire (dominated by conifers) impacted Atlanta, GA on 28 February 2007 and dramatically increased hourly ambient concentrations of $PM_{2.5}$ and organic carbon (OC) up to 140 and 72 μg m^{-3}, respectively. It was estimated that over 1 million residents were exposed to the smoky air lasting from the late afternoon to midnight. To better understand the processes impacting the aging of fire plumes, a detailed chemical speciation of carbonaceous aerosols was conducted by gas chromatography/mass spectrometry (GC/MS) analysis. Ambient concentrations of many organic species (levoglucosan, resin acids, retene, *n*-alkanes and *n*-alkanoic acids) associated with wood burning emission were significantly elevated on the event day. Levoglucosan increased by a factor of 10, while hopanes, steranes, cholesterol and major polycyclic aromatic hydrocarbons (PAHs) did not show obvious increases. Strong odd over even carbon number predominance was found for *n*-alkanes versus even over odd predominance for *n*-alkanoic acids. Alteration of resin acids during transport from burning sites to monitors is suggested by the observations. Our study also suggests that large quantities of biogenic volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) were released both as products of combustion and unburned vegetation heated by the fire. Higher leaf temperature can stimulate biogenic VOC and SVOC emissions, which enhanced formation of secondary organic aerosols (SOA) in the atmosphere. This is supported by elevated ambient concentrations of secondary organic tracers (dicarboxylic acids, 2-methyltetrols, pinonic acid and pinic acid). An approximate source profile was built for the aged fire plume to help better understand evolution of wood smoke emission and for use in source impact assessment.

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