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In situ aerosol optics in Reno, NV, USA during and after the summer 2008 California wildfires and the influence of absorbing and non-absorbing organic coatings on spectral light absorption

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Abstract. Hundreds of wildfires in Northern California were sparked by lightning during the summer of 2008, resulting in downwind smoke for the months of June and July. Comparisons are reported for aerosol optics measurements in Reno, Nevada made during the very smoky month of July and the relatively clean month of August. Photoacoustic instruments equipped with integrating nephelometers were used to measure aerosol light scattering and absorption coefficients at wavelengths of 405 nm and 870 nm, revealing a strong variation of aerosol light absorption with wavelength. Insight on fuels burned is gleaned from comparison of Ångström exponents of absorption (AEA) versus single scattering albedo (SSA) of the ambient measurements with laboratory biomass smoke measurements for many fuels. Measurements during the month of August, which were largely unaffected by fire smoke, exhibit surprisingly low AEA for aerosol light absorption when the SSA is highest, again likely as a consequence of the underappreciated wavelength dependence of aerosol light absorption by particles coated with non-absorbing organic and inorganic matter. Coated sphere calculations were used to show that AEA as large as 1.6 are possible for wood smoke even with non-absorbing organic coatings on black carbon cores, suggesting care be exercised when diagnosing AEA.

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