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The impact of biogenic carbon sources on aerosol absorption in Mexico City

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Abstract. In order to determine the wavelength dependence of fine (<1 micron) atmospheric aerosol absorption in the Mexico City area, the absorption Ångstrom exponents (AAEs) were calculated from hourly averages of aerosol absorption measured at seven wavelengths (370, 450, 520, 590, 660, 880, and 950 nm) with an aethalometer during two field campaigns, the Mexico City Metropolitan Area study in April 2003 (MCMA 2003) and the Megacity Initiative: Local and Global Research Observations in March 2006 (MILAGRO). These results were compared to AAEs determined in the laboratory from 850–280 nm (350 points) on 12-h fine aerosol samples collected at the same sites. The aerosol AAEs varied from 0.76 to 1.5 in 2003 and from 0.63 to 1.4 in 2006. The AAE values determined in the afternoon were consistently higher than the corresponding morning values, suggesting the photochemical aging of the aerosols leading to the formation of more highly UV absorbing organic aerosol species in the afternoon.

The AAE values were compared to stable and radiocarbon isotopic measurements of the 12-h aerosol samples to determine the sources of the aerosol carbon. The fraction of modern carbon (fM) in the aerosol samples, as determined fromC analysis, showed that an average of 70% of the carbonaceous aerosols in Mexico City were from modern biomass sources during both field campaigns. The $^{13}C/^{12}C$ ratios of the aerosol carbon illustrate the significant impact of Yucatan forest fires (C-3 plants) in 2003 and local grass fires (C-4 plants) in 2006. A direct comparison of the fM values, stable carbon isotope ratios, and aerosol AAEs suggested that the wavelength dependence of the aerosol absorption was controlled by the biogenically derived aerosol components.

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