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Measurements of aerosol absorption and scattering in the Mexico City Metropolitan Area during the MILAGRO field campaign: a comparison of results from the T0 and T1 sites

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Abstract. In March 2006, a multiagency field campaign was undertaken in Mexico City called the Megacities Initiative: Local and Global Research Observations (MILAGRO). Two of the five field components of the MILAGRO study focused a major part of their efforts on atmospheric particulate emissions from the Mexico City basin and their effects on radiative balance as a function of time, location and processing conditions. As part of these two MILAGRO components, measurements of aerosol optical properties were obtained at a site located in the northern part of Mexico City (T0) and also at a site located 29 km northwest (T1) to estimate the regional effects of aerosol emissions from the basin.

Measurements of aerosol absorption and scattering for fine mode aerosols were obtained at both sites. Aerosol absorption at 550 nm was similar at both sites, ranging from 7–107 Mm^{-1} at T0 and from 3–147 Mm^{-1} at T1. Aerosol scattering measured at 550 nm at T0 ranged from 16–344 Mm^{-1} while the aerosol scattering values at T1 were much lower than at T0 ranging from 2–136 Mm^{-1}. Aerosol single scattering albedos (SSAs) were calculated at 550 nm for the fine mode aerosols at both sites using these data. The SSAs at T0 ranged from 0.47–0.92 while SSAs at T1 ranged from 0.35–0.86. The presence of these highly absorbing fine aerosols in the lower atmosphere of the Mexico City area will result in a positive climate forcing and a local warming of the boundary layer in the region.

Broadband UVB intensity was found to be higher at site T0, with an average of 64 $\mu W/cm^2$ at solar noon, than at site T1, which had an average of 54 $\mu W/cm^2$ at solar noon. Comparisons of clear-sky modeled UVB intensities with the simultaneous UVB measurements obtained at sites T0 and T1 for cloudless days indicate a larger diffuse radiation field at site T0 than at site T1. The determination of aerosol Ångstrom scattering coefficients at T0 suggests that this is due to the predominance of aerosols

in the size range of 0.3 micron, which leads to scattering of UVB radiation peaked in the forward direction and to an enhanced UVB radiation observed at ground level. This enhancement of the UVB diffuse radiation field would explain the enhanced photochemistry observed in the Mexico City area despite the reduction in UVB anticipated from light absorbing species.

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