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Applications of lagrangian dispersion modeling to the analysis of changes in the specific absorption of elemental carbon

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Abstract. We use a Lagrangian dispersion model driven by a mesoscale model with four-dimensional data assimilation to simulate the dispersion of elemental carbon (EC) over a region encompassing Mexico City and its surroundings. The region was the study domain for the 2006 MAX-MEX experiment, which was a component of the MILAGRO campaign. The results are used to identify periods when biomass burning was likely to have had a significant impact on the concentrations of elemental carbon at two sites, T1 and T2, downwind of the city, and when emissions from the Mexico City Metropolitan Area (MCMA) were likely to have been more important. They are also used to estimate the median ages of EC affecting the specific absorption of light, α_{ABS}, at 870 nm as well as to identify periods when the urban plume from the MCMA was likely to have been advected over T1 and T2. Median EC ages at T1 and T2 are substantially larger during the day than at night. Values of α_{ABS} at T1, the nearer of the two sites to Mexico City, were smaller at night and increased rapidly after mid-morning, peaking in the mid-afternoon. The behavior is attributed to the coating of aerosols with substances such as sulfate or organic carbon during daylight hours, but such coating appears to be limited or absent at night. Evidence for this is provided by scanning electron microscopy images of aerosols collected at the sampling sites. During daylight hours the values of α_{ABS} did not increase with aerosol age for median ages in the range of 1–4 h. There is some evidence for absorption increasing as aerosols were advected from T1 to T2 but the statistical significance of that result is not strong.

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