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Estimation of a "radiatively correct" black carbon specific absorption during the Mexico City Metropolitan Area (MCMA) 2003 field campaign

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Abstract. During the Mexico City Metropolitan Area (MCMA) field campaign of 2003, measurements of the shortwave radiation field allowed the inference of the black carbon (BC) specific absorption, a_{λ} , defined as the monochromatic absorption cross section per unit mass (with units of m^2/g). The averaged values of a_{λ} derived from the method here are either 8.9 m^2/g or 8.2 m^2/g at 500 nm, depending upon the physical and optical parameters assumed for BC. These results are reasonably consistent with those of Schuster et al. (2005), 9.5 m^2/g , and Baumgartner et al. (2002), 7.0 m^2/g , both measured at 550 nm. The a_{λ} values reported in this paper should only be considered effective, "radiatively correct" values because when used in radiative transfer calculations the calculated irradiances match the measured irradiances at 500 nm. The specific absorption so defined can assume a wide range of values, depending upon: (1) the assumptions made prior to the retrieval (e.g., shell/core aerosol configuration), and (2) values chosen for BC density and refractive index. The range of possible values is large, corresponding to a "worst case" uncertainty of about $\pm 70\%$, assuming that all errors are additive and of the same sign so that no error cancellation occurs.

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