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Spectral absorption properties of atmospheric aerosols

R. W. Bergstrom¹, P. Pilewskie², P. B. Russell³, J. Redemann⁴, T. C. Bond⁵, P. K. Quinn⁶, and B. Sierau⁷ ¹Bay Area Environmental Research Institute, Sonoma, CA, USA ²Laboratory for Atmospheric and Space Physics, Department of Atmospheric and Oceanic Sciences, University of Colorado, Boulder, CO, USA ³NASA Ames Research Center. Moffett Field, CA, USA ⁴Bay Area Environmental Research Institute, Ventura, CA, USA ⁵University of Illinois, Champaign-Urbana, IL, USA ⁶Pacific Marine Environmental Laboratory, National Oceanic and Atmospheric Administration, Seattle, Washington, USA ⁷Institute for Atmospheric and Climate Science, ETH Zurich, Zurich, Switzerland Abstract. We have determined the solar spectral absorption optical depth of atmospheric aerosols for specific case studies during several field programs (three cases have been reported previously; two are new results). We combined airborne measurements of the solar net radiant flux density and the aerosol optical depth with a detailed radiative transfer model for all but one of the cases. The field programs (SAFARI 2000, ACE Asia, PRIDE, TARFOX, INTEX-A) contained aerosols representing the major absorbing aerosol types: pollution, biomass burning, desert dust and mixtures. In all cases the spectral absorption optical depth decreases with wavelength and can be approximated with a power-law wavelength dependence (Absorption Angstrom Exponent or AAE). We compare our results with other recent spectral absorption measurements and attempt to briefly summarize the state of knowledge of aerosol absorption spectra in the atmosphere. We discuss the limitations in using the AAE for calculating the solar absorption. We also discuss the resulting spectral

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single scattering albedo for these cases.

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