

## Absorption of Mineral Dust: Comparison between Measurement and Effective Media Theories

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Mineral dust particles are irregularly formed particles containing a heterogeneous internal mixture of silicates, clay minerals, iron oxides and many other components. There are indications that dark mineral phases, e.g. iron oxides like hematite, increase the absorption of mineral dust towards the UV-wavelengths. Because of the mineralogical complexity of the particle system it is difficult to determine the complex refractive index of mineral dust.

For our laboratory study we used two soil samples from the field campaigns SAMUM and AMMA. The optical properties of these two dusts were determined experimentally during the “Mineral Dust Campaign 2008” at the AIDA facility at the Institute of Meteorology and Climate Research of Forschungszentrum Karlsruhe, Germany. Detailed description of the instruments are given in Schnaiter et al., 2005 and Linke et al., 2006.

Particles of the size fraction  $< 20 \mu\text{m}$  or  $20 - 75 \mu\text{m}$  were dispersed into the  $3.7 \text{ m}^3$  big aerosol chamber, reaching initial particle concentrations of approximately  $10^3 - 10^4 \text{ cm}^{-3}$  and median particle diameters of approximately  $300 \text{ nm}$ . During three to four hours the particle concentration decreased by one order of magnitude. Table 1 shows an extract of the optical quantities measured at the aerosol chamber.

Instrument	Optical Quantity	Wavelength [nm]
Extinction Spectrometer LOPES	extinction coefficient	200 – 1000 $\Delta\lambda = 2.5 \text{ nm}$
Integrating Nephelometer	scattering coefficient	450, 550, 700
Photoacoustic Spectrometer MuWaPAS	absorption coefficient	266, 355, 532, 1064
deduced	singles scattering albedo angström exponents	450, 550, 700

Table 1. Some optical quantities measured at the aerosol chamber and their corresponding wavelengths.

With data from the laboratory study we tried to estimate an effective complex refractive index for the two dust aerosols. For simplification of the complex system we assumed the dust consisting of only two minerals. Illite representing a component that causes only scattering in the considered wavelength range and hematite causing absorption. The optical constants of illite and hematite were mixed following the Bruggeman and volume mean effective medium approximations. With the obtained set of effective optical constants we performed Mie calculations. The received spectral absorption behaviour was compared to measured absorption cross sections. The poster shows that employing the Bruggeman and volume mean effective medium approximations results in slightly different hematite contents.

Schnaiter et al., *Measurement of Wavelength-Resolved Light Absorption by Aerosols Utilizing a UV-VIS Extinction Cell*, *Aerosol Science and Technology*, 39, 249, 2005

Linke, C. et al., *Optical Properties and Mineralogical Composition of Different Saharan Mineral Dust Samples: A Laboratory Study*, *Atmospheric Chemistry and Physics Discussions*, 6, 3315, 2006