Spectral absorption of mineral dust: Results of the Mineral Dust Campaign 2008 at the AIDA facility, Forschungszentrum Karlsruhe

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Mineral dust aerosols contribute significantly to the total atmospheric aerosol load. Dust transported over long distances affect the earth's radiative budget by absorption and scattering light in the near ultraviolet, visible and infrared spectral ranges. Optical properties of mineral dust may vary with particle size and mineralogical composition.

The Mineral Dust Campaign 2008 (cf. accompanying contributions to EAC2009), held at the NAUA chamber (IMK, Karlsruhe), was conducted to determine optical and physical properties of re-suspended dust. One of the goals of the experiment was to determine absorption coefficients of different dusts, especially the wavelength dependence in the ultraviolet and the visible spectral range. Several types of systems to measure the absorption coefficient were available. These are filter-based absorption photometers (PSAP, MAAP, and SOAP) and a photoacoustic absorption spectrometer (PAS).

An overview of the systems and methods used in the workshop is given in Table 1. Details on the measurement principles and data evaluation methods can be found in the references. The combined use of these instruments offers a great wavelength range.

Table 1. Systems used for measuring the absorption coefficient of mineral dust. [1]German Aerospace Center (DLR), [2]Leibniz Institute for Tropospheric Research (IfT), [3] Institute for Meteorology and Climate Research (IMK)

Photometer	Wavelengths [nm]	References
PSAP[1]	467, 530, 660	Virkkula et al., 2005
MAAP[1]	637	Petzold et al., 2005
SOAP[2]	300 to 960	Mueller et al., 2009
PAS[3]	266, 355, 532, 1064	Linke et al., 2006

Mineral dust of several sources was investigated. An example of the spectral absorption coefficients ($\sigma_{abs}(\lambda)$) of two different dust samples, collected in Burkina Faso and Morocco, is shown in Figure 1. Both types of dust show a similar dependence on the wavelength. The Ångström absorption exponent, which is a measure of the steepness of the wavelength dependent absorption, is defined by

$$\alpha = -\frac{\ln(\sigma_{abs}(\lambda_1)/\sigma_{abs}(\lambda_2))}{\ln(\lambda_1/\lambda_2)} \ .$$

The Ångström absorption exponent (at wavelengths λ_1=530nm and λ_2=637nm) are 4.35 and 6.41 for the Morocco and Burkina Faso samples, respectively. Measurements of the optical properties of mineral dust in Morocco during the field campaign SAMUM-1 revealed, that the Ångström absorption exponent is between 4.07 and 4.73 for high dust concentrations (Schladitz, 2009).

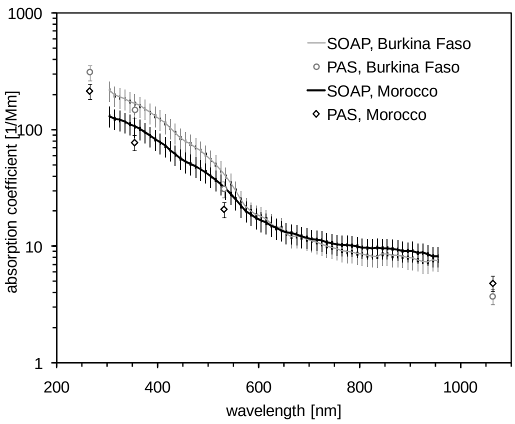

Figure 1. Spectral absorption coefficient of two dust samples measured with SOAP and PAS.

Measurements of spectral absorption and extinction coefficients and the particle number size distribution will be used to estimate effective refractive indices. Derived refractive indices will be related to the mineralogical particle composition.

Virkkula, A., et al. (2005). *Aerosol Sci. Technol.* **39**, 68-83.

Linke, C. et al. (2006). *Atmos. Chem. Phys.* **6**, 3315-3323.

Müller T., et al. (2009). *Tellus* **61B** (1), 79-95.

Petzold et al. (2005). *Aerosol Science & Technology*, **39**, 40-51.

Schladitz, et al. (2009). *Tellus* **61B (**1), 64-78