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Spectral absorption coefficients of mineral dust measured at Cape Verde

C. Meusinger, A. Wiedensohler and Th. Müller

Leibniz Institute for Tropospheric Research, Leipzig, Germany

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Absorption measurements are essential in aerosol science, as they are important for estimating the earth's radiative budget. An Optical Spectral Absorption Photometer (SOAP) was newly developed at the Leibniz Institute for Tropospheric Research in Leipzig (Müller et al. 2009). This instrument allows in-situ determination of different kinds of absorbers, e.g. mineral dust and soot. A SOAP installed at Cape Verde worked in several campaigns so far, embedded in the project SOPRAN (Surface Ocean Processes in the Anthropocene). Here, dust transported from the mainland of Africa (Saharan desert) is of special interest, being expected to fertilize marine flora and fauna. Using the SOAP dust concentrations will be determined.

Simultaneous, filter-based measurements of transmission and reflection over a wavelength range from 350nm to 960nm are performed using a deuterium lamp as source and two spectrometers as detectors. An additional reference channel is optionally available, measuring without any loading. Filters are changed manually at least once a day or if transmission is less than 50%. The aerosol flow is regulated by a flow controller to a constant rate of 1.5 l/min and the sample spot area has a diameter of 6.1 mm on the filter.

SOAP was calibrated using highly absorbing (soot) and strongly scattering (ammonium sulphate) particles. The corresponding reference instruments for optical depths in scattering and absorption were Nephelometer and MAAP, respectively. According to a two-stream radiative transfer model (Arnott, et al., 2005), absorption was calculated from the measured data, providing the basis for further discussions.

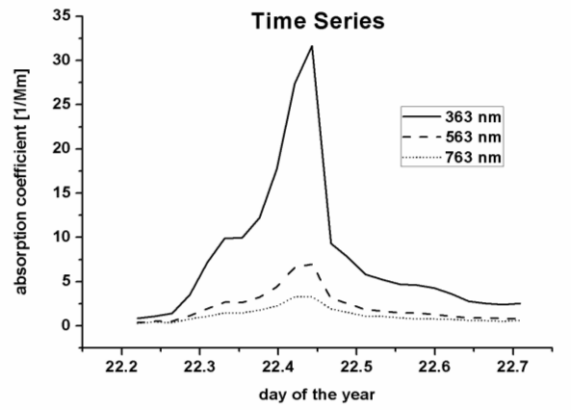

Figure 1. Time series of absorption coefficients of several wavelengths during a dust event

At Cape Verde islands, the SOAP was localized near the shore on São Vicente. The use of an inlet installed on a tower of 30 m height ensured a minor part of sea spray in the measured aerosol compared to an inlet near the ground. Absorption coefficients during a dust event in January 2009 are shown in figures 1 and 2.

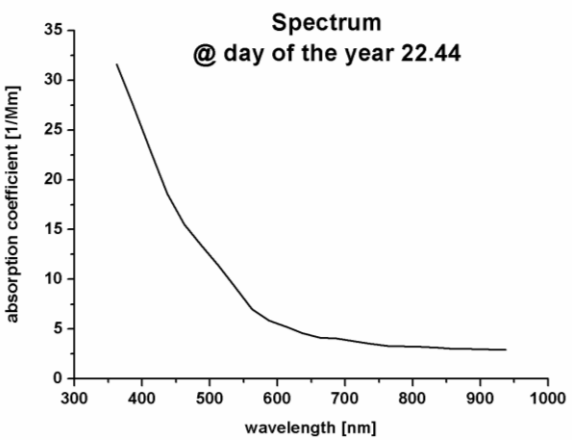

Figure 2. Spectrum of absorption coefficient of a dust event (same as figure 1)

Figure 1 exemplifies a significant change of the absorption coefficient (factor >30 at 350nm) in relatively short time (half a day). Whereas data in figure 2 shows typical spectral absorption of dust as they were found in other campaigns before, e.g. Morocco (Müller et al., 2009). For a more detailed explanation, future experiments in the lab are planned to determine specific spectra of the most commonly found compounds of mineral dust.

Arnott, P.W. et al. (2005). Towards Aerosol Light-Absorption Measurements with a 7-Wavelength Aethalometer: Evaluation with a Photoacoustic Instrument and 3-Wavelength Nephelometer. *Aerosol Sci. Technol.*, **39**, 17-29.

Müller, T., et al. (2009). Spectral absorption coefficients and imaginary parts of refractive indices of Saharan dust during SAMUM-1, *Tellus*, **61B** (1), 79-95.