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Retrieval of Aerosol Profiles using Multi-Axis Differential Optical Absorption Spectroscopy (MAX-DOAS)

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Multi Axis Differential Absorption Spectroscopy (MAX-DOAS) is a well established measurement technique to derive atmospheric trace gas profiles. Using MAX-DOAS measurements of trace gases with a known vertical profile, like the oxygen-dimer O_4, it is possible to retrieve information on atmospheric aerosols. Based on the optimal estimation method, we have developed an algorithm which fits simultaneously measured O_4 optical densities and relative intensities at several wavelengths and elevation angles to values simulated by a radiative transfer model. Retrieval parameters are aerosol extinction profile and optical properties such as single scattering albedo, phase function and Angström exponent.

In 2008 and 2009 several intercomparison campaigns with established aerosol measurement techniques took place in Cabauw/Netherlands, Melpitz/Germany, Ispra/Italy and Leipzig/Germany, where simultaneous DOAS, lidar, Sun photometer and Nephelometer measurements were performed.

Here we present results of the intercomparisons for cloud free conditions. The correlation of the aerosol optical thickness retrieved by the DOAS technique and the Sun photometer shows coefficients of determination from 0.96 to 0.98 and slopes from 0.94 to 1.07. The vertical structure of the DOAS retrieved aerosol extinction profiles compare favourably with the structures seen by the backscatter lidar. However, the vertical spatial development of the boundary layer is reproduced with a lower resolution by the DOAS technique. Strategies for the near real-time retrieval of trace gas profiles, aerosol profiles and optical properties will be discussed as well.