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Retrieval of Aerosol Profiles using Multi Axis Differential 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 at several wavelengths and elevation angles to values simulated by a radiative transfer model. Retrieval parameters are aerosol extinction profile and optical properties like single scattering albedo, phase function and Angström exponent. In the scope of a joint research activity of the EU funded project EUSAAR (European Supersites for Atmospheric Aerosol Research) we have developed a new kind of DOAS instrument, which uses three miniature spectrometers to cover the near-ultraviolet to visible wavelength range (290–790nm), enabling to capture all absorption bands of the oxygen-dimer O_4. Additionally, it is possible to point to any direction in the sky with a 2D telescope unit which is connected to the spectrometers via fiber optics.
In May 2008, an intercomparison campaign with established aerosol measurement techniques took place in Cabauw/Netherlands, where simultaneous DOAS, LIDAR, Sun photometer and Nephelometer measurements were performed. We present first results of selected days from this period. The optical properties of aerosols retrieved by the DOAS measurement technique show very promising qualitative agreement with the established measurement techniques demonstrating the progress towards our goal of establishing the MAX-DOAS technique for retrieving optical properties of atmospheric aerosols. Quantitative comparison is ongoing.