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Aerosol Optical Parameters and Vertical Profile from Satellite Data: Combining SCIAMACHY Measurements of Reflectance and of Absorption by O_2 and O_2-O_2

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Aerosols cause a substantial amount of radiative forcing, but quantifying the amount of radiative forcing caused by aerosols is difficult: determining aerosol concentrations in the atmosphere and, especially, characterizing their (optical) properties, has proven to be quite a challenge.

A good way to monitor aerosol characteristics on a global scale is to apply satellite remote sensing. Most satellite aerosol retrieval algorithms are based on aerosol-induced changes in earth reflectance, which are usually subtle and have a smooth wavelength dependence. To simplify the under-defined problem, such algorithms need to assume certain aerosol models, where optical parameters such as single scattering albedo, asymmetry parameter and size parameter (or Angstrom exponent) are defined.

We combine measurements of the sun-normalized radiance and of absorption features, as well as Monte Carlo radiative transfer modeling (RTM). From the measured radiance we can obtain aerosol optical parameters (optical thickness, single scattering albedo, asymmetry parameter, Angstrom exponent); the absorption by atmospheric gases with known concentrations (O_2 and O_2-O_2) can provide us with the height profile of the aerosol layer.

For the measurements we make use of the large, continuous spectral range of the SCIAMACHY instrument (214-1773 nm). Modeling is performed with the RTM Tracy-II and its successor McArtim.

A complication to aerosol retrieval is the presence of clouds, which can be easily mistaken for aerosols and vice versa. We therefore studied the influence of clouds on aerosol retrieval for several representative cases (ocean, desert, highlands, and urban environments).

Results from SCIAMACHY measurements and calculations using our RTM will be presented.