Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union

Atmos. Chem. Phys., 4, 231-254, 2004
www.atmos-chem-phys.net/4/231/2004/

Multi axis differential optical absorption spectroscopy (MAX-DOAS)

G. Hönninger[1,*], C. von Friedeburg[1], and U. Platt[1]
[1]Institut für Umweltphysik, Universität Heidelberg, Heidelberg, Germany
[*]now at: Meteorological Service of Canada, Toronto, Canadanals.ne

Abstract. Multi Axis Differential Optical Absorption Spectroscopy (MAX-DOAS) in the atmosphere is a novel measurement technique that represents a significant advance on the well-established zenith scattered sunlight DOAS instruments which are mainly sensitive to stratospheric absorbers. MAX-DOAS utilizes scattered sunlight received from multiple viewing directions. The spatial distribution of various trace gases close to the instrument can be derived by combining several viewing directions. Ground based MAX-DOAS is highly sensitive to absorbers in the lowest few kilometres of the atmosphere and vertical profile information can be retrieved by combining the measurements with Radiative Transfer Model (RTM) calculations. The potential of the technique for a wide variety of studies of tropospheric trace species and its (few) limitations are discussed. A Monte Carlo RTM is applied to calculate Airmass Factors (AMF) for the various viewing geometries of MAX-DOAS. Airmass Factors can be used to quantify the light path length within the absorber layers. The airmass factor dependencies on the viewing direction and the influence of several parameters (trace gas profile, ground albedo, aerosol profile and type, solar zenith and azimuth angles) are investigated. In addition we give a brief description of the instrumental MAX-DOAS systems realised and deployed so far. The results of the RTM studies are compared to several examples of recent MAX-DOAS field experiments and an outlook for future possible applications is given.

Final Revised Paper (PDF, 1424 KB) Discussion Paper (ACPD)

Citation: Hönninger, G., von Friedeburg, C., and Platt, U.: Multi axis differential optical absorption spectroscopy (MAX-DOAS), Atmos. Chem. Phys., 4, 231-254, 2004. Bibtex EndNote Reference Manager