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MAX-DOAS measurements of atmospheric trace gases in Ny-Ålesund - Radiative transfer studies and their application

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Abstract. A new approach to derive tropospheric concentrations of some atmospheric trace gases from ground-based UV/vis measurements is described. The instrument, referred to as the MAX-DOAS, is based on the well-known UV/vis instruments, which use the sunlight scattered in the zenith sky as the light source and the method of Differential Optical Absorption Spectroscopy (DOAS) to derive column amounts of absorbers like ozone and nitrogen dioxide. Substantial enhancements have been applied to this standard setup to use different lines of sight near to the horizon as additional light sources (MAX - multi axis). Results from measurements at Ny-Ålesund (79° N, 12° E) are presented and interpreted with the full-spherical radiative transfer model SCIATRAN. In particular, measurements of the oxygen dimer O₄ which has a known column and vertical distribution in the atmosphere are used to evaluate the sensitivity of the retrieval to parameters such as multiple scattering, solar azimuth, surface albedo and refraction in the atmosphere and also to validate the radiative transfer model. As a first application, measurements of NO₂ emissions from a ship lying in Ny-Ålesund harbour are presented. The results of this study demonstrate the feasibility of long term UV/vis multi axis measurement that can be used to derive not only column amounts of different trace gases but also some information on the vertical location of these absorbers.

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