



Improving satellite retrievals of large tropospheric NO₂ columns

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Satellite observations of tropospheric NO₂ amounts are based on application of the Differential Optical Absorption Spectroscopy (DOAS) method to space-borne nadir measurements of the backscattered solar radiation. In the DOAS method, the effects of absorption and radiative transfer are usually treated separately to facilitate rapid data analysis. In most cases, this approximation is valid and only small uncertainties are introduced.

During the dramatic pollution episode in China in January 2013, tropospheric NO₂ retrievals on GOME-2 data suffered from significantly increased residuals leading to rejection of the retrievals as having poor quality. Closer inspection of the fits revealed systematic residuals which could be explained by the wavelength dependence of the air mass factor (AMF) for absorbers located close to the surface. At the large NO₂ columns present during the event, this effect becomes significant. In addition, the spectral signature of the temperature dependence of the NO₂ absorption cross-section could be detected.

In this study, GOME-2 data for high NO₂ situations are evaluated systematically for usually neglected effects such as the AMF and temperature dependence. Using semi-empirical approaches, solutions are proposed to improve the quality of retrievals under these conditions. In addition, the potential for retrieving useful information from the magnitude of these effects is evaluated and it is shown, that some qualitative deductions on the vertical position of the NO₂ absorption can be made under favourable conditions.