Geophysical Research Abstracts
Vol. 18, EGU2016-15033, 2016
EGU General Assembly 2016

Trace gas retrieval for limb DOAS under changing atmospheric conditions: The X-gas scaling method vs optimal estimation

Tilman Hueneke (1), Katja Grossmann (2), Matthias Knecht (1), Rasmus Raecke (1), Jochen Stutz (2), Bodo Werner (1), and Klaus Pfeilsticker (1)

(1) Institut für Umweltphysik, Universität Heidelberg, Heidelberg, Germany (tilman.hueneke@iup.uni-heidelberg.de), (2) Department of Atmospheric and Oceanic Sciences, University of California Los Angeles, Los Angeles, USA

Changing atmospheric conditions during DOAS measurements from fast moving aircraft platforms pose a challenge for trace gas retrievals. Traditional inversion techniques to retrieve trace gas concentrations from limb scattered UV/vis spectroscopy, like optimal estimation, require a-priori information on Mie extinction (e.g., aerosol concentration and cloud cover) and albedo, which determine the atmospheric radiative transfer. In contrast to satellite applications, cloud filters can not be applied because they would strongly reduce the usable amount of expensively gathered measurement data. In contrast to ground-based MAX-DOAS applications, an aerosol retrieval based on O4 is not able to constrain the radiative transfer in air-borne applications due to the rapidly decreasing amount of O4 with altitude. Furthermore, the assumption of a constant cloud cover is not valid for fast moving aircrafts, thus requiring 2D or even 3D treatment of the radiative transfer. Therefore, traditional techniques are not applicable for most of the data gathered by fast moving aircraft platforms.

In order to circumvent these limitations, we have been developing the so-called X-gas scaling method. By utilising a proxy gas X (e.g. O_3, O4, ...), whose concentration is either a priori known or simultaneously in-situ measured as well as remotely measured, an effective absorption length for the target gas is inferred.

In this presentation, we discuss the strengths and weaknesses of the novel approach along with some sample cases. A particular strength of the X-gas scaling method is its insensitivity towards the aerosol abundance and cloud cover as well as wavelength dependent effects, whereas its sensitivity towards the profiles of both gases requires a priori information on their shapes.