

We thank you the reviewers for the careful reading of the manuscript and the positive comments and suggestions.

Response to reviewers comments are in italics.

Reviewer 1.

General comments:

The Gil et al.'s paper presents interesting results and is reasonably well written. The scientific quality of the paper has been improved by adding a Section on the Optimal Estimation Method. However, a lot of questions remain unanswered regarding this method: On which criteria did you decide not to include aerosols in the OEM retrieval? Did you perform sensitivity tests on this?

We have used the OEM technique to estimate the vertical distribution of the transported NO₂ cloud for a single case. In this particular day (2013, 128 day number), the mean Aerosol Optical Depth above the station at 500 nm was lower than 0.02 which in practice implies a pure Rayleigh atmosphere. We have noticed, however, that there was no comment in the text to this very low AOD conditions, therefore we have added it in OEM section.

What is the impact of the a-priori profile on your retrieved profiles, especially on the vertical extension of the NO₂ layer?

We noticed a mistake in the text (section 4). The a priori NO₂ profiles used in the paper were not obtained from the standard atmosphere, but from hourly profiles provided by a photochemical box model (Denis et al., 2005) derived from the SLIMCAT 3-D chemical transport model (Chipperfield, 2006) for the location and day. This profile is the best estimation that can be used for his purpose. Changes of plus/minus 20% in the a priori result in mean changes of 15 % in the results.

The section 4 of the manuscript has been rewritten to include this information.

A brief description on the main sources of uncertainty of the OEM is still missing. All these points should be discussed in the revised manuscript.

The section 4 of the manuscript has been revised and extended to include the requested points.

Specific comments:

Page 14479, lines 15-29: The Thalman and Volkamer (2013) O₄ cross-sections are used in the test on the impact of the temperature dependence of the O₄ cross-sections. Since this cross-sections data set is now considered by the DOAS community as the reference O₄ cross-sections, what would be the impact of using them on the MGA approach results instead of Hermans et al. (1999)?

Following the reviewer's comment we have computed the optical paths obtained by using the Thalman&Volkamer and compared them with the Hermans ones. Results show differences of only 0.5 ± 0.6 % (larger in Hermans) which has a negligible influence on the obtained results.

Page 14482, line 9: a references should be added for the Gaussian correlation functions.

The following references have been included in the text:

Barret, B., De Maziere, M. D., and Demoulin, P.: Retrieval and characterization of ozone profiles from solar infrared spectra at the Jungfraujoch, J. Geophys. Res. 107(D24), 4788, doi:10.1029/2001JD001298, 2002.

Friess, U., Monks, P. S., Remedios, J. J., Rozanov, A., Sinreich, R., Wagner, T., and Platt, U.: MAX-DOAS O4 measurements: A new technique to derive information on atmospheric aerosols: 2. Modeling studies, J. Geophys. Res., 111, D14203, doi:10.1029/2005JD006618, 2006.

Why did you choose a correlation length of 300 m?. What is the impact of this correlation length on the vertical extension of the NO₂ profiles presented in Fig. 3 ?

*After several tests on the retrieval, gamma value has been chosen to be 300 m, corresponding to the value (between 0.1 and 1 km) that maximizes the DFS (trace of **A**), for the overall retrieval as well as for the altitudes closer to the station (2.3-2.6 km)."*

Technical corrections:

Page 14478, line 5: 'specie' -> 'species'. *We think the singular is appropriate since the formulae refers to a only one tracer at a time*

Page 14500, Fig. 4: The y-axis legends in the three plots should be identical, e.g. 'NO₂ concentration (pptv)'. *Corrected*

Page 14485, line 1: You should refer to Sect. 4 instead of Rodgers et al. (2000). *Rodgers reference has been removed from this place.*