

Rozanov et al

BrO vertical distributions from SCIAMACHY limb measurements: comparison of algorithms and retrieval results

The manuscript introduces three different algorithms for retrieving BrO from SCIAMACHY limb measurements. The main characteristics of the algorithms are discussed. The main systematic error sources are estimated applying sensitivity analysis to simulated measurements. The performance of the algorithms is compared with three different types of balloon borne measurements. The manuscript is well written rather easy to read and contains a lot of information on limb measurement retrievals. The topic of the manuscript is very relevant within the scope of AMT.

Scientific Significance: good

Scientific Quality: good

Presentation quality: good

Main comments:

- 1) The treatment of the measurement error is not properly discussed. The concept of posterior error is used but it is not defined how it is estimated. I suggest that the error propagation (how the measurement error and modeling errors are propagated through the inversion steps and how the 'theoretical precision' is computed) is added.
- 2) I suggest that a statistical comparison of the BrO retrieval of the three different algorithms is included. This could be done e.g. by using data from one orbit or something like that. It would be important to see if there are some systematic differences in the algorithms (eg. latitude or altitude dependent).
- 3) I would like to see some discussion how the BrO retrieval algorithms compare with the NO₂ and O₃ retrieval algorithms that are applied to SCIAMACHY data: similarities and main differences. This could be used to motivate the manuscript.

Minor comments:

- 4) P 5082 – L 20: Whereas.... – the sentence is unclear and too long.
- 5) P 5083-L 15. Adding a figure of the measurement geometry would be useful.
- 6) P 5086 – L 1. There are also other techniques besides DOAS and global fit. Among the OSIRIS teams also so called Flittner algorithm (Flittner et al , O₃ profiles retrieved from limb scatter measurements: Theory, Geophys.

Res. Lett., 27, 2601–2604, 1999) and a so called Modified Onion Peeling algorithm (Tukiainen et al, Description and validation of a limb scatter retrieval method for Odin/OSIRIS. Journal of Geophysical Research, 113(D04308), 2007) are successfully used.

- 7) Eq (5): linearization. It would be good to add some discussion about the noise here. Can the noise be linearized also without disturbing its 'normality' distribution. The algorithms seem to assume normally distributed noise. This should be commented.
- 8) Eq(8): The difference btw F and F^{hat} is not clear (not clear if similar to y^{hat} which refers to normalized spectra)
- 9) Eq(11) – please, explain notation $\{ \}$ here.
- 10) P5091 – L19. The sentence is not clear: In conclusion, ...
- 11) Eq(18). Should it be I_0 (not \mathcal{I}_0)?
- 12) Eq(29) and P5101 –L 3. Covariance matrix S_{ϵ} . In my understanding the dimension here should be the dimension of c , ie, altitudes and not wavelengths. What does it mean spectrally uncorrelated in this context?
- 13) Eq (3), need to clarify p_k and s_m here.
- 14) P 5103-L 23 ill-posed. If this concept is used it is important to clarify what is meant here: no unique solution exists? The sentence is not clear.
- 15) P 5103 – 24: stochastic constraint – should it be statistical constraint?
- 16) P 5105 - L 7: What is the reason for using correlation length 1.5 km?
- 17) P 5108 – L24: Optimal regularization parameter λ_a . It is unclear to me if it is assumed that there exists a optimal λ_a that would satisfy the needed regularization at all altitudes taking into account that the BrO concentrations change a lot depending on the altitude. (also in Bremen algorithm it varies depending on the altitude).
- 18) P 5130 – L 1: It might be good to add that the influence was negligible among those radiative transfer models that were studied.
- 19) Figs 7 and 8 – they give rather similar message. Are both needed?
- 20) Section 8.3 The comparison with the TRIPLE method seems to be rather poor. Has the measurements been compared with other ground based instruments – has there been observed a bias?