

Interactive comment on “BrO vertical distributions from SCIAMACHY limb measurements: comparison of algorithms and retrieval results” by A. Rozanov et al.

Anonymous Referee #1

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BrO vertical distributions from SCIAMACHY limb measurements: comparisons of algorithm and retrieval results

The authors have written a very comprehensive report that documents three separate retrieval processes used to infer vertical profiles of bromine monoxide from limb scatter measurements made by SCIAMACHY onboard ENVISAT. They have detailed the techniques, they have discussed the different sensitivities these techniques have to algorithm assumptions including the radiative transfer model and they have compared results from the three techniques with balloon based measurements of BrO. Although

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this paper appears not to conform to the general rule for AMT that “contributions should be short but self-contained” I feel it is still worthy of publication in AMT. It is a very thorough treatment of a subject matter that is appropriate for AMT and for this reason I suggest an exception to the general rule. However, I would like to see the things mentioned below addressed before the paper is published.

Requested Revisions

This paper really struggled with a lack of focus. I found it interesting and somewhat informative but I was never able to capture the main point of the paper. Was it written to compare the algorithms for BrO retrieval from SCIAMACHY, was it written to document the retrievals of BrO from SCIAMACHY, was it written to validate the retrievals of BrO from SCIAMACHY through comparison with balloon based measurements, was it written to tell the reader of all the systematic errors associated with the retrieval of BrO from SCIAMACHY, was it written to tell the reader about the expected precision associated with the retrieval of BrO from SCIAMACHY, was it I think this paper was written to do all these things and I think it was actually fairly successful. However, I really could have used more guidance as I read the paper and perhaps a little less detail.

Here are some suggestions for the authors. If other reviewers also pick up on these things I think they should be addressed in a revised version of the manuscript.

1) The paper is very long and contains a lot of detail but other than being thorough it does not provide much guidance with respect to which of the three SCIAMACHY BrO products I should choose if I were interested in BrO science. I am hesitant to ask for the addition of another section but I would find it extremely useful if the retrieved results from each of the three algorithms were directly compared with each other, not just with results from DOAS, SAOZ or TRIPLE. Perhaps this comparison could be done using zonally and/or monthly averaged climatologies. I leave it up to the authors to decide the exact mechanism for comparison but I would appreciate some guidance

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when choosing one of the SCIAMACHY BrO products over the others.

2) If the authors are interested in shortening the paper to make it more concise it is probably only necessary to compare with one of the three balloon based instruments. The TRIPLE comparisons can definitely be excluded as in the author's own words "Comparisons with TRIPLE do not provide any consistent picture".

3) Also, if the authors are interested in shortening the paper to make it more concise a lot more of the detail can be put into the appendices. I found it extremely useful but it took away from what I thought, or perhaps I hoped, was the main goal of the paper. That being an evaluation of the results from the three products.

Specific Comments

There is something about the fact that "The smoothness coefficients are chosen empirically. . ." that I am not comfortable with. Could the authors provide me with more detail on this process? It doesn't necessarily have to go into the paper, as it is already too long. However, I would like to see something that make me believe this is an acceptable idea.

On page 5115 the impact of the a priori is discussed where terms like "negligible" and "significantly different" are used. I would really like to see this discussion expanded as I believe this topic to be extremely important. This is where systematic biases are introduced within the retrieval process and I would like to know their impact on the study of atmospheric BrO. In many applications or uses of the data the random noise may average out but a systematic bias introduced by a dependence on the a priori may be misinterpreted with undesirable result. Could the authors put these systematic biases in context with the accuracy required for BrO science? Also, could the authors recommend the data product they feel has the least amount of bias for all possible measurement conditions?

On page 5116 it is not clear to me how the BrO optical depth is calculated. Could the

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authors please clarify this?

The discussion about aerosol loading in section 7.3 needs to be expanded to discuss the impact of the systematic bias that may be imposed upon the data products by an improper treatment of aerosol. Which retrieval process better treats the aerosols and are the biases that are introduced too large to allow for useful science with the BrO data sets?

Typos and Grammar

The words “a” or “the” are either misused or missing on many pages. Here is the list I found. The format is (page numbers; followed by all line numbers on that page).

(5082; 25 and 26), (5086; 12, 13, 15 and 21), (5090; 17), (5092; 17), (5094; 11), (5095; 7), (5110; 27), (5111; 11), (5112; 11, 12, 27), (5114; 5), (5115; 3, 4, 5), (5117; 27), (5118; 13, 25), (5119; 2, 11, 23), (5120; 21) and (5121; 2, 7)

Sentences that contain bad English that require rewriting (overall not that many): “Being ...” starting on page 5084, line 2. “Thus ... “ starting on page 5092, line 11. “The obtained ...” starting on page 5095, line 16. “The effect ...” starting on page 5095, line 2. “In the tropical ...” starting on page 5113 line 7. “The SCIATRAN ...” starting on page 5116, line 4. “This yields ...” starting on page 5117, line 23.” To do this, ...” starting on page 5121, line 7.

Other minor corrections

The first sentence in Section 3.2 indicates there are only two ways that are commonly used to retrieve constituent profiles from limb scattered sunlight. This is not true. Ozone and aerosol are commonly retrieved with SCIAMACHY and OSIRIS data and I believe that none of these retrieval processes use either a global fit or DOAS.

Are there commas missing in equation 6 that should be there to separate the elements of the vector?

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In the first sentence of Section 3.2.2 I don't believe you mean "their dependence upon the retrieval".

Line 21 on page 5089 the word "of" should be "in".

Line 6 on page 590 should contain "by rewriting all of the terms".

On page 5092 and elsewhere the term "fitted out" is used. This isn't a good choice of words.

On line 19 page 5092 the phrase "results in only incomplete cancelling" needs to be reconstructed.

On page 5092 line 25 is the choice of the word "convoluted" correct or should it be "convolved"?

In line 20 on page 5093 it is the "shape of the tilt spectrum. . ." that is considered to be independent.

In line 19 on page 5094 "fitted then" should go to "then fit".

On page 5095 and elsewhere the words "can not" must be replaced by the word "cannot".

Line 7 on page 5098 should start with "It".

The sentence that starts in line 9 on page 5098 should start with "These".

In line 11 on page 5112 the phrase should read "the bulk of the information originates"

In line 22 on page 5117 I'm pretty certain the authors don't mean an SNR of 1.5×10^{-3} .

Final Remarks

The scientific content of the paper is good and the presentation, although long, is also good. I would be happy to look at it again once the comments above are addressed.

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