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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Carbon monoxide, methane and carbon dioxide columns retrieved from SCIAMACHY by WFM-DOAS: year 2003 initial data set" *by* M. Buchwitz et al.

M. Buchwitz et al.

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Authors answer to the interactive comment of B. van Diedenhofen on paper Buchwitz et al., Carbon monoxide, methane, and carbon dioxide columns retrieved from SCIAMACHY by WFM-DOAS: Year 2003 initial data set, Atmos. Chem. Phys. Discuss., 5, 1943–1971, 2005

Answers to "General":

First of all we would like to thank Bastian van Diedenhofen and Ilse Aben for the

comments on our paper. Each comment will be carefully considered for the revised version of the paper. Below we give answers to each of the comments made by the referees.

Concerning the reservations due to Diedenhofen and Houweling papers:

We cannot follow the arguments given here concerning ”serious reservations”: It is not new for us that "care must be taken" because of the different sensitivities w.r.t. aerosols and albedo. In fact we have quantified these errors and the results have been published in Buchwitz et al., Atmospheric methane and carbon dioxide from SCIAMACHY satellite data: Initial comparison with chemistry and transport models, Atmos. Chem. Phys., 5, 941-962, 2005, and earlier in a more comprehensive form in Buchwitz, M. and Burrows, J. P.: Retrieval of CH_4, CO, and CO_2 total column amounts from SCIAMACHY near150;infrared nadir spectra: Retrieval algorithm and first results, in Remote Sensing of Clouds and the Atmosphere VIII, edited by Schäfer, K. P., Comèron, A., Carleer, M. R., and Picard, R. H., vol. 5235 of Proceedings of SPIE, 375–388, 2004. A reference to this paper is given in our paper. Our analysis is not as detailed as the analysis provided in Houweling et al. but the results are consistent and, therefore, not a surprise for us. In fact because of this we now normalize methane with CO_2 and not with O_2 (following the approach of Frankenberg et al., Science, 2005) because O_2 is quite far away in wavelength and therefore the sensitivities are quite different. All this is clearly explained in our paper. For CO_2 we have to divide by O_2 because there is basically no other choice (at least we have not yet identified a better general approach to do this although we have some ideas to improve a number of details) as there is no alternative even better mixed (long-lived) reference gas with absorption lines nearby. We will show in the revised version of the paper that normalizing with model surface pressure will not help. Because of our analysis we are well aware that all this is challenging and we do not claim that we already now have

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found the global optimum solution. But we are confident that after much more work we will be able to provide a retrieval algorithm which is less sensitive to aerosols and albedo than our currently existing initial approach.

The Diedenhofen and Houweling papers will be cited in the revised version of our paper.

Answers to "Main comments":

Our statement with "similar radiative transfer" implies everything the radiative transfer depends on, including surface albedo. In general, also the albedo gets the more similar the smaller the spectral difference between the two intervals is (we have included "in general" - here and in the paper - because this is (obviously) not true under all conditions, e.g., because of absorption features). We will modify this a bit in the revised version of the paper to avoid misunderstandings.

We will add an outlook on our new XCH_4 data product retrieved only from channel 6 to ensure better cancellation of errors (including albedo, aerosol, and instrument related errors). Our new approach is similar to the one used by Frankenberg et al. and this will be mentioned in the revised version of the paper.

We will also report on our investigations to make clear that the normalization of CO_2 really improves our XCH_4.

page 1956:

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The sentence with the correlation coefficient of 0.9 will be modified along the lines suggested.

We will show that for XCO_2 the normalization by O_2 is in fact better than the normalization by surface pressure. In this sense it is not true that “errors are introduced”. Although the cancellation of errors is not perfect (see above) it helps.

page 1957:

The scaling factor issue will be addressed more clearly in the revised version of the paper.

Concerning the O_2 overestimation: We will add a discussion of this taking into account the findings of Diedenhoven et al.

If Houweling et al. do not have to apply a scaling factor for their CO_2 retrievals than this is good news. We are confident that after a thorough investigation of this (spectroscopy, slit function, calibration issues, etc.) we will also be able to get rid of this factor (as we have recently achieved for our CO product). This will be one of our major priorities for our future work. At present, however, we focus on variability, which is much more important for the detection of sources and sinks.

Answers to "Minor comments":

page 1949:

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The paper will be cited.

page 1957:

We think a "few percent" is pretty much equivalent to about 5%.

page 1960:

We still think a "few percent" is pretty much equivalent to about 5%.

section 3:

The details about the look-up are given in: Buchwitz et al., Atmospheric methane and carbon dioxide from SCIAMACHY satellite data: Initial comparison with chemistry and transport models, Atmos. Chem. Phys., 5, 941-962, 2005. More details (esp. concerning the aerosol scenario) are given in: Buchwitz, M. and Burrows, J. P.: Retrieval of CH_4, CO, and CO_2 total column amounts from SCIAMACHY near150;infrared nadir spectra: Retrieval algorithm and first results, in Remote Sensing of Clouds and the Atmosphere VIII, edited by Schäfer, K. P., Comèron, A., Carleer, M. R., and Picard, R. H., vol. 5235 of Proceedings of SPIE, 375–388, 2004. We will consider adding more details in the revised version of the paper and/or adding the reference to the Buchwitz and Burrows, 2004, paper including the link to the PDF file.

table 1:

The comments related to table 1 will be considered.

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figures 2–6:

The revised version of the paper will be substantially longer including a number of additional important figures. This includes a quantitative comparison for CO_2. Concerning CO and XCH_4: The paper gives quite a number of quantitative details concerning the comparison. Quantitative details concerning the comparisons are already given in Buchwitz et al., ACP, 2004, and Buchwitz et al., ACP, 2005. Furthermore, the revised version will contain an outlook section which will contain an overview about our latest, significantly improved, CO and XCH_4 data products including quantitative details concerning the comparison with the reference data. For all these reasons we hesitate to implement the recommened changes.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 1943, 2005.