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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Atmospheric methane and carbon dioxide from SCIAMACHY satellite data: initial comparison with chemistry and transport models" *by* M. Buchwitz et al.

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Authors answer to the interactive comment of anonymous referee number 5 on manuscript Buchwitz et al., Atmos. Chem. Phys. Discuss., 4, 7217, 2004 (manuscript number: acpd-2004-0135).

General:

First of all we would like to thank the referee for the constructive comments on our manuscript. Each comment will be considered as good as we can for the revised

version of the paper. Below we give answers to each of the comments made by the referee.

Answers to "Scientific issues":

A priori information (p.7227/l.25):

It is true that our retrieval results depend on a priori information. Our retrieval depends on the selected linearisation point (i.e., on the assumed atmospheric state) which has been used for the radiative transfer computations of the top-of-atmosphere radiance and its derivatives. This is not in contradiction to what has been written in the manuscript. In the manuscript we have written that "It is important to point out that no a priori information is used to constrain the retrieved columns. ... a priori information on the atmosphere is only used to get a reasonable linearisation point for the unconstrained linear least-squares WFM-DOAS fit." The point we want to make is that the retrieved columns are not forced to lie in (or close to) a predefined interval (defined by, e.g., an a priori column and its a priori uncertainty as would be the case for a typical "Optimal estimation" (profile) retrieval method). In order to clarify this we will add in the revised version of the paper that the retrieved columns are not independent of priori assumptions as the results dependent on the choice of the linearisation point.

Averaging kernel (p.7228/l.14):

It is right that the averaging kernel (AK) is not a scalar but a vector. In the manuscript we have used the following equation to define AK: $AK(z) \equiv (V^{rp} - V^{tu})/(V^{tp} - V^{tu})$. Here z denotes the altitude of the perturbation (at perturbation altitude z) and for a finite set of altitudes z_i the averaging kernel becomes a vector (with elements AK_i =

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$AK(z_i)$). We will use a better notation for the revised version of the paper to make this clear.

The referee is right in stating that the numerator in the equation given above should not be $(V^{rp} - V^{tu})$ but $(V^{rp} - V^{ru})$ as the averaging kernel is the derivative of retrieved columns. We will take this into account for the revised version of the paper. This, however, does not influence the corresponding results shown in the paper (e.g., Figures 2 and 3). The reason for this is that our retrieval is self consistent (as it should be), i.e., numerically V^{ru} is equal to V^{tu}, i.e., our retrieval method gives the right answer for an unperturbed profile (this has already been mentioned in the manuscript).

Smoothing error (p.7229/l.6):

First of all a clarification: Our algorithm is not the operational algorithm for SCIAMACHY. WFM-DOAS is a scientific algorithm which is independent of the operational algorithm for SCIAMACHY which is under development. We will add this information for the revised version of the paper.

It is right that the values for the smoothing error given in the paper are for an optimal estimation profile retrieval algorithm (this is mentioned in the manuscript) and that the smoothing error is expected to be somewhat larger for WFM-DOAS. An optimal estimation profile retrieval algorithm has more degrees of freedom and therefore it is possible to achieve averaging kernels that are closer to unity than the WFM-DOAS averaging kernels. This has influence on the magnitude of the smoothing error which gets larger the more the averaging kernel deviates from unity.

Table for CO_2 (p.7237/l.28):

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For the revised version of the paper we will follow the suggestion of the referee and add table also for CO_2.

CO_2 variability (Sec.9.2):

The referee is right. The variation of the retrieved CO2 is in general larger than the variation of the CO2 model field. This finding is not restricted to southern Africa. As suggested by the referee we will discuss this more explicitly in the revised version of the paper, e.g., by taking into account an error analysis performed with simulated measurements, first results from a recently performed comparison with ground based CO2 column measurements, and the current status of the validation of the model.

Answers to "Stylistic issues":

For the revised version of the paper we will use a revised selection of figures. Figures which are not absolutely necessary for the main part of the paper will be removed or shown in a separate Appendix, if appropriate.

The typo on p. 7241/l. 16 will be corrected.

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