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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.

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General comments

The paper by Buchwitz et al. extends the analysis of previous papers dealing with the retrieval of CO, CH_4 and CO_2 (by the authors) from case studies to a more comprehensive, although still qualitative, study of the year 2003 SCIAMACHY data set. In addition, major improvements for the retrieval of atmospheric methane are presented. Since retrieval of greenhouse gases from space is a very important topic for the sci-

entific community, this paper should be published in ACP. If proven to be real, the detection of uptake of CO_2 by the biosphere would be exciting. However, the authors should strengthen (with more scientific evidence) this interpretation and respond to the specific comments given below.

Specific comments

Abstract: The conclusion that the CO_2 variations are indeed due to uptake from the land biosphere should be more convincing in the discussion of the CO_2 retrievals (see specific section).

page 1946, line 8 Although this is also in my interest, you should cite the following paper that has been published in the meantime: C. Frankenberg, J.F. Meirink, M. van Weele, U. Platt, and T. Wagner. Assessing methane emissions from global space-borne observations. Science, 2005.

page 1947, lines 4-7 You mention the *spatial resolution* twice but explain it only in the second instance. Giving the description in the first sentence would be less confusing.

page 1949, line 5 In the meantime, a paper on ice and slit function issues has been published and should be cited: The impact of SCIAMACHY near-infrared instrument calibration on CH4 and CO total columns Gloudemans, A. M. S. , Schrijver, H., Kleipool, Q., van den Broek, M. M. P., Straume, A. G., Lichtenberg, G., van Hees, R. M., Aben, I. and Meirink, J. F. Atmospheric Chemistry and Physics Discussions, Vol. 5, pp 1733-1770, 18-3-2005

page 1951, lines 10-14 You state that the agreement between SCIA and MOPITT is good and that both sensors show the same typical range in total CO columns. I would not focus on one plot and then say that the agreement is good. Especially in August, the SCIAMACHY retrieval exhibits very high columns in the Sahara (in contrast

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to MOPITT), a region where the retrieval is supposed to be good due to the high S/N ratio. Either you change "good" to "reasonable" or you mention more explicitly that this only holds for September (e.g.: The best agreement between MOPITT and SCIA is found in September, where ...).

Further, you apply a scaling factor to the SCIAMACHY data. Thus, both sensors show the same range of columns not independently but due to the fact that you scale your columns to match the MOPITT range.

page 1952, lines 24-25 You state that the modulation of methane due to sources is only of the order of one percent. This value seems far too low to me and is not consistent with your findings later in the manuscript (with variations up to 6%).

page 1954, lines 28-29 Please cite the Frankenberg et al. (Science, 2005) paper that elaborates the findings presented at the ENVISAT Symposium. The same paper should be cited when referring to the enhanced methane abundances in Asia and Africa since Frankenberg et al. found the same and discussed it intensively.

page 1955, lines 14-18 Here you mention that the scaling with CO_2 works better than with O_2. You assume that CO_2 shows only small variations but later in the discussion of the CO_2 retrievals you find quite large variations in CO_2, up to 4 times higher than expected. If your scaling with CO_2 now works for methane retrievals but your CO_2 retrieval (scaled by O_2) shows artificially high variations, I would conclude that there is a problem with the scaling by O_2. This should be investigated in more detail (see comments later in the CO_2 Section).

Section 7 As already mentioned, I am wondering how much of the variability of your CO_2 retrievals origins from the retrieved CO_2 column or from the O_2 column. Is the scaling factor of 1.27 due to an underestimation of the CO_2 column or an overestimation of the O_2 column (i.e. are your maximum CO_2 columns at low surface elevation about 8e21 molec/cm2 or not)? Given your cloud filter (only cloud free pixels), it would be interesting to see plots of CO_2 and O_2 only scaled by surface pressure and not by a

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proxy for the light path. In cloud free conditions, the uncertainties in the light path can be expected to be in the same range (or even lower) as your variations in the CO2 abundances. Perhaps scaling with surface pressure alone helps to check whether the scaling factor as well as the too high variability is due to the CO_2 or the O_2 column retrieval. As further remark: the latest HITRAN database (www.hitran.com) provides updates of the CO_2 line parameters in the applied fitting window and might help to improve the retrievals.

Although the spatial patterns of the CO_2 reductions in SCIA and TM3 model (for July in the northern hemisphere) look very similar, the comparison in other regions is far worse. For instance over central Africa, SCIA seems to observe persistently too low CO_2 perhaps induced by clouds. Can you be sure that the low columns in the northern hemisphere in July are not due to a measurement bias (e.g. a SZA, albedo or cloud dependence). Due to the large discrepancies in other regions and since the magnitude of your variations in the SCIA retrieval is far too high, I would not conclude that SCIAMACHY observes the uptake of CO_2 by the biosphere. It might be seen as an indication (as you also mention) but is certainly not yet proven and requires further investigations. Either you provide more evidence that these measurements are not due to an retrieval bias or you should reformulate your sentence in the abstract (which suggests that the retrieved low columns are really due to CO_2 uptake by the biosphere).

page 1959, line 13 "... MOPITT is mostly within 30%." How did you get this number?

page 1960, line 2 "show agreement with model simulations within a few percent". Did you find any statistical correlation between model and measurement? Otherwise, the retrieval would show the same agreement to a constant value of 370ppm.

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technical corrections

page 1945, line 7 O'Brian should be O'Brien

page 1949, line 17 one bracket too much: ...by red line)

page 1950, line 18 "columns" instead of "column"

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