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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "The impact of SCIAMACHY near-infrared instrument calibration on $CH_4$ and CO total columns" *by* A. M. S. Gloudemans et al.

**A. M. S. Gloudemans et al.**

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The authors would like to thank the referee for his constructive comments on our manuscript. The general comment that it remains somewhat unclear whether the target accuracies of 1-2% for $CH_4$ and 10-20% for CO will be met is justified. The present study cannot answer this question yet, but a future paper dealing with the detailed error sources and giving a global error budget is foreseen in the near future. The referees' specific comments are addressed below in order of appearance.

Answers to specific comments:

**Page 1738, line 11:** This sentence will be changed into: "...leads to $CH_4$ total columns that are too high..."

**Page 1740, line 9:** The US standard temperature profile has been used. The error in the retrieved $CH_4$ total column due to an inadequate temperature profile of 2% is indeed a mean value of this error. Recently retrievals using temperature profiles from ECMWF have been performed showing that using the US standard temperature profile can introduce errors of $<$10% in the retrieved total column, but most ground pixels have errors well within 5% for $CH_4$. For most ground pixels the retrieved CO total column is off by $<0.35\times10^{18}$ molec/cm$^2$.

Since the retrievals with and without ice correction and retrievals with and without correction for the orbital variation are done with the same temperature profile, these errors do not affect the results on the instrument calibration issues presented in this paper. This has been checked by performing a set of retrievals using the ECMWF profiles and comparing the effect of ice layer and the variation of the dark signal over the orbit with those presented in the manuscript. It was found that the conclusions do not change when using the more realistic ECMWF temperature profiles instead of the US standard profile.

The referee is correct that these errors are significant when comparing the retrieved $CH_4$ total columns with the TM3 model calculations. However, ground pixels with the largest errors are mostly isolated cases: no large geographical areas are found with a systematic large error due to the wrong temperature profile. Thus, the effect of a wrong temperature profile on large scale structures, such as the North-South gradient for $CH_4$ will be smaller than the values stated above. For example, the $CH_4$ latitudinal averages as shown in Fig. 4 are found to change by a few percent at most, which is indeed still significant for $CH_4$. Thus, taking into account a more realistic temperature profile, such as those from the ECMWF, is indeed very important, especially for $CH_4$, but it does not affect the conclusions of the manuscript. For CO, the effect of a wrong temperature



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profile is comparable to or less than the current precision of the CO retrievals and using ECMWF temperature profiles instead does not lead to significant improvements when comparing SCIAMACHY results with MOPITT measurements. However, also for CO a more correct temperature profile than the current US standard profile should be taken into account in future retrievals. This is currently done by using ECMWF temperature profiles. A few lines will be added to the discussion stressing these points.

**Page 1740, line 24:** Given unsolved issues at the time of writing, such as for example the (incorrect) temperature profile used in the retrievals (see previous point) a quantitative agreement is not feasible for the data set presented in this manuscript. Meanwhile, the retrievals have improved on several aspects and a quantitative comparison will be performed in a future paper.

**Page 1741, line 23:** Meanwhile this paper has appeared on the ACP Discussion site, so we think that referring to the Dils et al. paper is now justified.

**Figure 3 versus Figure 5:** The referee is correct that there are large differences between the $CH_4$ and CO data set especially over oceans. The error threshold on the CO total column may indeed be somewhat loose, but using stricter criteria may result in a loss of (still useful) information and may present an over-optimistic picture of the current CO retrievals. We are still experimenting with what is the best error threshold for CO, but in this paper we prefer not to be too strict in our error filtering.

**Page 1743-1745:** The word 'good' will be substituted by 'reasonably good'.

**Figures 4 and 6:** In September only very few points are located South of 40S, much fewer than in November and therefore these have not been taken into account in Figs 4 and 6. This is probably due to the much higher solar zenith angle leading to much lower signal-to-noise ratios and the presence of ice/snow in September may also play a role, since the cloud filter used in this paper cannot discriminate between clouds and snow/ice. Regarding the MOPITT data: that is a good question which cannot be answered yet. The authors think that both points play a role, but only a more detailed



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comparison between SCIAMACHY and MOPITT data can solve this question.

**Figure 7 and related text (pages 1745 - 1746):** The authors want to point out that although Fig. 7b seems to indicate that CO is not affected by the broadening of the slit function, Fig 7c clearly shows that it is affected if one presents the data in a different way. For $CH_4$ there is no real need to do this, since Fig. 7a already clearly shows the effect of the broadening of the slit function. We prefer not to add the $CH_4$ relative differences to Fig 7c, since this may be misleading. For example, a relative effect of 5% for $CH_4$ is a much more serious effect than a 10% relative difference for CO. The authors will read the pages mentioned again and try to clarify the above mentioned points.

**Page 1735 lines4-6:** The first sentence will be changed into: Global measurements of $CH_4$ and CO have also been performed by the MOPITT instrument. The authors wanted to point out that $CH_4$ is measured, but that the retrievals have been unsuccessful, so that no $CH_4$ total columns are available from MOPITT.

**Page 1759:** This has been corrected.

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Interactive comment on Atmos. Chem. Phys. Discuss., 5, 1733, 2005.