

***Interactive comment on “The impact of  
SCIAMACHY near-infrared instrument calibration  
on CH<sub>4</sub> and CO total columns” by  
A. M. S. Gloudemans et al.***

**C. Frankenberg (Referee)**

cfranken@iup.uni-heidelberg.de

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### General comments

The paper by Gloudemans et al. deals with a very important topic, namely the effect of the instrument calibration of SCIAMACHY on the quality of retrievals of atmospheric methane and carbon monoxide. Although there are already first papers about the retrieval of these trace gases, it is the first that examines systematically and in detail the effects of instrumental issues. There is no question about the necessity for such a

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study especially with respect to the importance of precise measurements of methane and CO. It is not only of interest for the SCIAMACHY community itself but could also have potential impacts for other satellite missions since not only possible instrumental problems but also their solutions are presented.

The paper gives a good overview over the most important calibration issues and subsequently describes the effects on the retrieval in detail. It is very informative and comprehensive and gives some first nice examples of retrieved methane and CO column amounts. Thus, I recommend publication in ACP after the authors have clarified some specific aspects, especially the treatment of the slit function that remained unclear in certain aspects (see "Specific comments").

## Specific comments

**Abstract:** Since not all readers are familiar with SCIAMACHY, it would be nice to have a short explanation already in the abstract (one sentence is more than enough)

**Page 1737, line 11** You state that the ice layer can be roughly 400  $\mu\text{m}$  thick. How did you obtain this thickness?

**Page 1738, line 13** You mention that the dark signal's deviations from the measured ones varies over the month although you mentioned earlier that you use daily dark current measurements that should already show the effect of the ice layer on the dark current.

**Page 1739, line 22** You say that the broadening of the slit function resembles an additional background signal. How did you get to this conclusion? Do you assume the background signal to be constant or relative to the actual signal itself? Assuming that photons scattered in the ice layer are distributed over a wide range of detector pixels, the additional background signal should also vary with the total amount of measured

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photons itself. Do you account for this? If not, a dependence on albedo is introduced that could be very crucial and should be further analysed.

Do you simply apply the offset and no changes in the shape of the slit function itself? Which underlying type of slit function is used? I would assume that especially the change in the wings of the slit function could be of importance. Further, you mention that you derive the background signal by using measurements over the Sahara. Do you do this on a daily basis? How does the background signal behaves in time? Using a smooth time dependence of the background signal (e.g. fitting a polynomial) could help to discriminate between changes in the background signal and actual changes in methane over the Sahara (see first reviewer remarks). These questions should be addressed.

**Page 1740, line 5** Please explain what a "SRON patched level 1 file" is. Most readers won't know it.

**Page 1740, line 24** Some new papers on NIR retrievals appeared in the meantime. Please also cite Buchwitz et al. (Carbon monoxide, methane and carbon dioxide columns retrieved from SCIAMACHY by WFM-DOAS: year 2003 initial data set, ACPD, 2005) and Frankenberg et al (Science, 2005).

**Page 1742, line 16** You say: "polluted areas in ...". This implies that your measurement is right and the model is wrong since it doesn't see enhancements in "polluted" areas. What do you mean by polluted (esp. with respect to methane since it is not a classical product of industrial pollution)? I would omit "polluted" to be more objective.

**Page 1742, line 24** "are clearly identified by the lack of SCIAMACHY data": It sounds as if SCIAMACHY doesn't deliver data over clouds. It might be better to say: "SCIAMACHY retrievals classified as cloud free"

**Page 1748, line 9-12** What happens to the applied additional background signal if the total signal is low as in this case? Does it depend on the total signal?

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**Page 1749, line 17-20** You state that a dead pixel would hamper the retrievals only if it is in the range of an absorption line of the species of interest. This is not in-line with your findings later where you see changes in CO columns when a dead pixel (not close to CO lines) is not masked out.

**Page 1751, line 24** I agree that bad pixels with high noise can sometimes lead to reasonable fits. However, considering the entire orbit this pixel should show up in the residuals although some fits might seem ok. Thus, I would assume that the fit residual should in principle also be a good method of detecting bad pixels (taking several fits into account). Could you comment on that?

**Section "Effect on retrieval windows"** You should at least mention the overlapping strong water absorptions and its possible strong implications. Are there substantial differences in water absorptions between the different windows?

Further: Is there a reason why you didn't choose a fitting window without water lines for the methane retrieval?

**Discussions (page 1754, line 27)** You mention that the dead/bad pixel mask has a random effect on the retrieval whereas Fig. 10 seems to indicate quite systematic biases.

**Conclusions** If you actually can't detect dead/bad pixels only looking at residuals (using an entire orbit), you can leave the statement: "However, a dead pixel mask based on fit residual only is insufficient". Otherwise, please change this formulation.

## technical corrections

As far as I can judge it, there are no technical corrections needed.

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