Atmos. Chem. Phys. Discuss., 8, S3614–S3618, 2008
www.atmos-chem-phys-discuss.net/8/S3614/2008/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Error analysis for CO and CH_4 total column retrievals fromSCIAMACHY 2.3 μm spectra" *by* A. M. S. Gloudemans et al.

A. M. S. Gloudemans et al.

Received and published: 11 June 2008

We would like to thank the referee for his/her useful comments on our paper. We agree with the referee's point of view that it would be better to start the paper with summarizing the most important SCIAMACHY instrument calibration problems which have been discussed in previous papers. We have therefore restructured the paper accordingly, now starting with mentioning the largest problems with the SCIAMACHY 2.3 micron spectra, i.e. the ice layer, the variation of the dark signal within an orbit, and the increasing number of damaged detector pixels. After correction for these problems, the instrument-noise error is the dominant error source in the retrieval of CO and CH_4 from SCIAMACHY's 2.3 micron spectra, which is then discussed in detail as described in Section 4.2 of the Discussion paper (which has become section 3.1 of the revised version of the paper), followed by a discussion of the minor calibration

problems (Section 4.3 of the Discussion paper; now Section 3.2). The analysis presented in Section 3 of the Discussion paper are now included in the revised paper as Section 4. In this way, the largest error sources of the SCIAMACHY 2.3 micron spectra are mentioned first, so that the reader will get a good feeling for the magnitude and importance of the different error sources. Section 4.1 of the Discussion paper on the H_2O columns has become section 4.2 of the revised version with the new section heading 'Temperature and water vapor'. This section 4.2 of the revised version now starts with the first paragraph of section 3.2 of the Discussion paper which described the influence of the temperature and water vapor profiles on the retrievals. We felt that the discussion on the water columns and water and temperature profiles in relation with ECMWF data should be done in one section and since this is not an instrumental issue we put it in section 4 of the revised version.

Minor comments:

Page 5185, Line 20: Where are the accuracy figures for the CO and CH4 columns taken from? It would be sensible to insert a reference.

We have included a reference for these numbers.

P5187, L23: Add (in brackets) the spectral resolution of the synthetic and SCIAMACHY spectra.

We have included these numbers.

P5194, L4: Does the application of the averaging kernel actually 'eliminates errors' or

ACPD
8, S3614–S3618, 2008

simply minimizes them?

When the total column averaging kernel is applied to the data set with which the SCIAMACHY data are compared the error due to a true vertical profile that deviates from the a priori profile used in the SCIAMACHY retrievals is eliminated. We have rephrased the sentence somewhat in the revised version of the paper.

P5195, L16: What is the uncertainty in the ECMWF pressure fields? Are errors in the total columns created by highly variable surface pressure over mountain regions really negligible?

The uncertainty in the ECMWF pressure fields is typically on the order of a few hPa which has a negligible effect on the retrieved total columns. The variation of surface pressure over mountain regions is a different issue. The large foot print of the SCIAMACHY 2.3μm measurements only allows to retrieve an average column within the satellite foot print. However, the surface elevation of the ECMWF data interpolated onto the SCIAMACHY foot print is compared with the mean surface elevation of the foot print calculated from high-spatial resolution data bases such as the NOAA 5'x5' Terrainbase elevation data base and the retrieval algorithm corrects the ECMWF data for differences between these two data sets. Thus the retrieved SCIAMACHY CO and CH_4 columns are representative for the average columns within the SCIAMACHY foot print.

P5206, L9: Correct spelling of 'noise errros'

Thanks for noting this. We have corrected it.

ACPD

8, S3614–S3618, 2008

P5206, L10-14: What percentage of SCIAMACHY measurements have instrument noise errors greater than 1.5E18 molce/cm2? Adding a map of the noise distribution would be useful.

Only about 10% of the CO data with cloud-cover less than 0.2 has noise errors greater than 1.5e18 molec/cm2 (de Laat et al. 2007). We have added this number to section 4.1 of the revised version. We have also added a map of the noise distribution of the CO errors similar to that published by de Laat et al. (2006, 2007), but for a slightly different time period, i.e. 2004 instead of September 2003 - August 2004.

P5211, L20: The authors write 'sufficient precision for application to satellite data' what do they mean by this statement?

For SCIA the dominant errors come from the instrumental issues in particular the instrument-noise error. The errors due to assumptions in the retrieval algorithm such as fixed atmospheric profiles, neglecting scattering etc. are much smaller and are well within the requirements for the retrieval of CO and CH_4 total columns. Since the above statement is indeed rather vague we have removed it from the conclusions. Instead we have added the above clarification.

Figure 2: The x-axis in the top panel, which shows the CO averaging kernel, could be expanded (e.g. from 0.6 to 1.4).

The x-axes in both panels have been expanded. Figure 2 has become Figure 10 in the revised version.

ACPD
8, S3614–S3618, 2008

Figure 9: How much of the difference between July and November could be due to seasonal variations in albedo?

This has become Figure 3 in the revised version. Since the difference is plotted as a function of albedo the differences between July and November are not caused by seasonal variations in albedo. However, seasonal variations in solar zenith angle could play a role. This effect is however small. For consistency we have now plotted data for September 2003 and September 2004 so that in this comparison seasonal differences do not play a role.

Annemieke Gloudemans
Ilse Aben
Hans Schrijver
Otto Hasekamp

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 5183, 2008.