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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.

Anonymous Referee #1

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A review of the paper in open discussion "Error analysis for CO and CH4 total column retrievals from SCIAMACHY 2.3 μm spectra" by A. M. S. Gloudemans, H. Schrijver, O. P. Hasekamp, and I. Aben

A large number of publications based on spectra recorded by the SCIAMACHY grating spectrometer does not necessarily mean that all methodical problems have been solved. The paper under discussion partially fills this gap. The authors punctually consider sources of errors point by point and finally come to the general conclusion that their retrieval algorithm "is able to retrieve CO and CH4 total columns with sufficient precision for application to satellite data" (they probably mean "SCIA data"). Fortunately, the paper itself is not restricted by this very global and, maybe, too optimistic statement.

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Interactive Discussion
Discussion Paper

I recommend to a reader to start reading this paper with Figure 7. A real SCIA spectrum illustrates a degree of difficulties that any researcher trying to retrieve CO and/or CH4 information from these spectra has to overcome. The spectral interval for fitting is relatively short, almost half of detector pixels are not working or neglected, moreover "good" pixels mostly correspond to low absorption of the gases of interest. Water vapor occurs a lucky species in this respect and it is well determined (see Figure 8). There are problems with calibration, problems with the instrumental function, an ice layer forming on the detector, and so on.

Such error analysis is really necessary. It would be especially useful for those who are not familiar with details and problems of retrieval techniques, but uses the published CO and CH4 total columns quantitatively, compares them with models, and come to important geophysical conclusions. Probably a more general paper(s) treating advantages and disadvantages of thermal (4 - 12 um) and near-inftrared (1.2 - 3 um) sateliite techniques is necessary for making a decision about further development of satellite monitoring. So far, I do not see that predicted high sensitivity of SCIA to the boundary layer gives it a significant advantage over the results obtained by thermal sensors (MOPITT, AIRS, TES and others). On the contrary, MOPITT demonstrates a good sensitivity to the boundary layer for continental areas in summer time. AIRS is doing a good job for the free troposphere everywhere, and in tropics CO total columns are very close to the MOPITT data. High resiolution of TES also allows it to see deeply into the boundary layer. Therefore, the question of which spectral interval is better is stll open.

Specifically about this paper, stylistically it is poorly written and should be re-organized. As I already mentioned, Figure 7 should be the first. In general, the instrumental problems should be discussed first. E.g., I can not understand a consideration of spectra with noise $>$ 1.5 E18 for CO (and corresponding noise for CH4). This means S/N $<$ 1, that makes further analysis senseless. The noise of SCIA should be demonstrated on a map or by any other means. The shape of vertical sensitivity function, is it flat or not, is a secondary issue, if other issues are more important. Otherwise, a reader may be

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disoriented, especially if he would not be able to reach the end.

I understand that the goal of this paper might be proving an ability of SCIA to supply realistic results for some favorite conditions and its inability (or larger errors) for some unfavorable conditions. These conditions should be specified; it would give a clue for a reader in its assessing and using the published results. In this respect, aerosol influence should be considered in more detail (e.g., error for Sahara dust, for African biomass burning, Chinese emission, Siberian biomass burning, etc.). The usefulness of such paper would be much higher.

A need for general re-writing the paper makes a list of small typos and obscure spots unnecessary.

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