Atmos. Chem. Phys. Discuss., 3, S1991–S1994, 2003
www.atmos-chem-phys.org/acpd/3/S1991/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "First retrieval of global water vapour column amounts from SCIAMACHY measurements" *by* S. Noël et al.

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Received and published: 24 November 2003

1. General comments

I am delighted to see that a paper on water vapor is one of the first to emerge from the scientific dust settling around SCIAMACHY post-launch activities. However I think that the authors can do more to give it the justice it deserves. Although Noël *et al.* present considerable evidence to show that their retrievals are doing a fair job of fitting the spectra and generating columns, albeit with an *ad hoc* global correction factor required in one case, I believe they could do much to improve the overall presentation of their arguments, assumptions and conclusions.

Ideally, it is my view that papers on a new instrument should await at least some of

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the results of the validation campaign which will take place for SCIAMACHY data (and, in fact, all ENVISAT data). Such collaborative work would provide the scientific readership of this journal and the community at large a much-needed source of properly-understood water vapor data indeed! However, I see no reason why the results presented here should have to wait that long in practice, providing that comments of the type mentioned here are taken properly into account.

2. Specifics

There are a number of issues I would like to see addressed in the mansucript. I have phrased these in terms of questions I asked myself as I read through it.

1. What are the calibration assumptions? The authors do not make clear that the input data has been taken from what is still an unfinished piece of calibration work, namely SCIAMACHY level 1 calibration. In other words, their input data is still in the preliminary stages of being understood. For example, they claim (lines 8-11) that they do not need to take into account potential sources of radiometric calibration error because the results appear adequate (bar a poorly-understood correction factor). I find this logic somewhat circular although understandable given that the instrument is still in the throes of in-flight calibration. However, the authors have additionally neglected to mention issues like the difference between the irradiance and radiance spectra they use (the former is taken from a specially-calibrated data set in early January and distributed by private communication while the latter were taken from a late January orbit and presumably calibrated by the authors) and the polarization sensitivity of the detectors in the spectral regions involved. In general, it appears that their choice of spectra has taken none of the highly intensive calibration of the last six months into account. In fact, it is not at all clear from the paper what their calibration assumptions are.

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2. What is the added value of presenting two different methods on this particular data set given its limitations and the fact that no real validation has been attempted? Even though the methods are not really new, the input data certainly is. That water vapor has the potential to be retrieved from a satellite instrument such as SCIAMACHY is certainly an interesting statement, because it shows that parts of the instrument are close to nominal in spite of outstanding calibration issues. However, as similar retrievals could be done for GOME using AMC-DOAS perhaps the virtue of presenting two methods is one of comparing the quality of the SCIAMACHY results with those from GOME? I think the authors have not really made the connection either between the two methods or the two instruments properly, and in failing to do so have also neglected to take into account the approaches used and the results of some of the most recent GOME water vapor retrieval work in the field, for example, Wagner *et al.*, (*ACP*, **3**, 651-663, 2003).

3. Do the results shown here add to our scientific knowledge of the atmosphere, or show enhanced potential to do so? On the whole, I would say that the preliminary comparison with ECMWF and SSM/I shows no major breakthrough in water vapor retrievals has been achieved. Pearson correlation coefficients are, if anything, slightly lower than those obtained, for example, by Lang *et al.* in an earlier publication on water vapor columns retrieved from GOME (*ACP*, **3**, 145-160, 2003) which has also not been cited by the authors.

4. Should one object to the inclusion of *ad hoc* scaling factors such as the 10% required by WFM-DOAS? No, in general, I think not. Largely because retrievals are always prone to systematic errors, which can be easily corrected for if the correction were proven to be justified, for example, by more forward modelling or validation with an extensive ground network such as is planned for SCIAMACHY. However it is also not clear from the manuscript whether the algorithms work well over all types of surfaces (although this is strongly hinted at throughout the manuscript). For example, in the section on WFM-DOAS it is stated that WFM-

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DOAS underestimates the column by 10% over oceans and that therefore a scaling factor is included. Does one conclude from this that WFM-DOAS is dependent on surface type? In addition, is the 10% factor always used over oceans regardless of the presence of clouds? Reading the last line in section 3.2 it is difficult to be certain if all WFM-DOAS water columns have been corrected with 10% or only the ocean pixels.

5. What confidence can we have in the retrieved columns? Basically, I view the error analysis as somewhat incomplete and would like to see a proper error estimation for each retrieval, rather than mean scatter values from linear correlations compared against the same from SSM/I and ECMWF. While the latter are interesting, an absolute confidence limit from the retrieval algorithm would be much more worthwhile for validation purposes and I would suggest that the authors consider including such a confidence limit in their calculations.

Finally, although “visible" is a commonly-used spectroscopic term, I think that “near-visible" (line 11) is not in common parlance. Perhaps "near-infrared" would be more appropriate here?

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