

Interactive comment on “Validation of SCIAMACHY AMC-DOAS water vapour columns” by S. Noël et al.

S. Noël et al.

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Answer to general comments:

The main criticism of the referee seems to be that no direct comparisons with radio sonde data are performed (which is true). However, the referee concludes from this that no "validation" is performed but only an "additional verification".

We disagree with this opinion. From our understanding, a "validation" of a data set is a comparison with independent data which have themselves been validated. A comparison with radio sonde data is only one possibility. Although radio sonde data in general provide very accurate results, they are very much restricted in both temporal and spatial coverage. Using radio sonde data to validate global data derived from LEO satellite

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measurements of a highly variable species like water vapour is therefore very difficult because of the different scales.

Because of this problem, we decided to compare the SCIAMACHY water vapour results with other global data sets, namely SSM/I measurements over ocean and global ECMWF results. Both data sets are completely independent from the SCIAMACHY data and have been successfully validated (including comparisons with radio sonde data). However, it is recognised (and mentioned in the paper) that the ECMWF data are partly based on SSM/I data, which makes them not completely independent from each other. The temporal and spatial coverage of both SSM/I and ECMWF data is quite similar to the SCIAMACHY measurements. We therefore think these data are well suited for the validation of SCIAMACHY water vapour columns.

The referee states that Figures 1 and 2 show a global offset which has already been noted in an earlier publication. This is true, but this previous publication was based on a very restricted data set. The new result shown in Figures 1 and 2 is that this offset seems to be nearly independent of time. Although this does not explain the bias, this is an important new finding on which further investigations about the reasons for this systematic discrepancies can be based. As the referee mentions, it is important to look further into the spatial regions where these differences occur. First results of these activities (namely comparing monthly means) are already presented in the paper (Figs. 3 to 5). Note that these figures are expected to be larger (and thus better readable) in the ACP version of the paper.

Another point of criticism by the referee is that no reference is given to the SCIAMACHY validation campaigns. It is true that within the context of SCIAMACHY validation comparisons between SCIAMACHY water vapour data and other sources (including radio sonde data!) have been performed, leading in fact for AMC-DOAS data to similar results as presented in the current paper. However, as far as we know these results have only been presented at project meetings and conferences; they have not been published up to now. This is why we did not refer to them.

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Answer to specifics:

1. *Page 1927 Line 22. Sentence beginning "Unfortunately, NIR sensors can not see through clouds..." The same is true for VIS sensors like SCIAMACHY. What point are the authors trying to make?*

This sentence should point out the difference to MW instruments, not VIS sensors. We will clarify this in the revised version of the paper.

The new sentence will read: "Unfortunately, in contrast to MW sensors, NIR sensors can not see through clouds..."

2. *Page 1930 Line 10. Two sentences beginning "As a consequence, the AMC-DOAS...". The AMC-DOAS results are presented as completely independent of any ad hoc adjustments (eg. scaling factors). This is to be lauded. However the comparison with radiosonde measurements is exactly what is missing from this work in order to do a proper validation.*

What is meant here is that the AMC-DOAS results do not rely on calibration factors derived from comparisons with radio sonde data, as e.g. SSM/I. It does especially not mean that radio sonde data can not be used for validation. This will be clarified in the revised version of the paper.

The new sentences will read: "As a consequence, the AMC-DOAS results do not rely on any other measurement data, e.g. calibration factors derived from comparisons with ground based radio sonde measurements as it is the case for e.g. SSM/I data. The retrieved water vapour columns therefore provide an completely independent data set."

With respect to scaling factors it shall be mentioned at this point that the referenced Noël et al. (2004b) paper will not be published. We will take this into account for the revised version and especially replace this reference.

3. *Page 1931 Line 20. It is not clear why the ECMWF data used for the comparison*

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was chosen to be the coarsest spatial resolution of ECMWF data available ($1.5^\circ \times 1.5^\circ$). Much higher spatial resolutions are available and should have been used in order to minimize the errors introduced by regriding onto the SCIAMACHY grid.

Unfortunately, we have only access to the $1.5^\circ \times 1.5^\circ$ ECMWF data. A finer grid would be indeed preferred for the comparison, but for the more qualitative results of this study the error due to regriding is of minor importance as it should only (slightly) affect the scatter of the data, not the large-scale offsets. Since we are not looking at individual grid points, this should be not relevant for the results.

4. *Page 1933 Line 3. Sentence starting "Note that no direct comparisons...". This statement is simply not true. A comparison with ECMWF over sea is not the same as a direct comparison with SSM/I because ECMWF has assimilated the data, not simply incorporated it. ECMWF has also assimilated the radiosonde data over land but that does not mean we should not use the latter data to do a proper validation. In fact, a comparison between radiosonde data and ECMWF data at some eighty radiosonde sites around the world (which I have carried out with colleagues) reveals disturbing differences between the two sources. For example, the variability of ECMWF data is much lower (possibly by as much as a factor of two in dynamic range) than the radiosonde data which indicates that ECMWF represents a very smoothed version of the true water vapor data field.*

It is not surprising that radio sonde data show larger variations than the ECMWF model data because radio sondes provide very localised data. It is also true that the ECMWF data over ocean are not identical with the SSM/I data. However, we have compared SSM/I and ECMWF data (over ocean) for the year 2003 and came to the conclusion that the overall agreement is quite good (although the scatter of data is high). So, even if individual data points may differ quite much, the large scale structures are not affected, and this is what we are looking at here.

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Nevertheless, we agree that the mentioned sentence may be misleading and will remove it in the revised version of the paper.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 1925, 2005.

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