

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

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### **1. General comments**

In this work, Noël *et al.* provide the first detailed evaluation of a year of SCIAMACHY water vapour columns. They make a good case for the development of such a data set (in summary, that the combined GOME, SCIAMACHY and GOME-2 data set could span several decades). The comparison is conducted against SSM/I data (ie. derived from another set of satellite measurements) and ECMWF data (which is a data assimilation scheme that uses SSM/I and radiosonde data as inputs but nevertheless adjusts

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the water vapor field to obtain physical self-consistency). Therefore neither of the comparison datasets are really appropriate to providing independent confirmation of the SCIAMACHY dataset which is the very essence of validation.

This work builds on the authors' original publication on the subject (ACP, 4, 111, 2004.) Figures 1 and 2 are used to claim some consistent bias in the SCIAMACHY data depending on which of ECMWF or SSM/I SCIA is compared against. However every point on this graph represents a *global* average for an entire month or day. The figures therefore show little more than an offset which was already noted in their earlier ACP article. Also, no further attempt is made to find the reason for this bias offset. Plotting time series for the offset at specific locations or regions of the globe would have been far more useful or, at the very least, for sea and land areas, in order to discern, for example, problems with surface albedo affecting the SCIA algorithm performance. The remaining figures are very hard to read, although they are a step in the right direction. For example the fact that SCIA finds more water vapor over the Sahara than ECMWF reports is consistent with findings for GOME and indicates that the SCIA dataset is potentially a useful logical continuation of the GOME data.

I think it important that papers on results from a new instrument should incorporate at least some of the results of the accompanying validation campaign (which has taken place for SCIAMACHY data and, in fact, all ENVISAT data). Sadly, there has been no mention of this work anywhere in the manuscript.

In short, I think this paper highlights an exciting new water vapor dataset which could potentially contribute to the development of long time series water vapor climatology. However the paper itself falls somewhat short of the right approach and analysis to realize this potential. Therefore I strongly recommend that the authors either change the first word in the title and the spirit of the paper from "Validation" to something like "Additional Verification" or they consider changing the content to include a proper validation against the only available means of absolute ground truth assessment: radiosonde data.

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## 2. 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?
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.
3. Page 1931 Line 20. It is not clear why the ECMWF data used for the comparison 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 regridding onto the SCIAMACHY grid.
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.

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