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Atmospheric Measurement Techniques Discussions

Interactive comment on "UTLS water vapour from SCIAMACHY limb measurements V3.01 (2002–2012)" *by* K. Weigel et al.

Anonymous Referee #2

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Overview:

The paper describes the performance of the SCIAMACHY V3.01 water vapour retrievals from limb scattering observations in the upper troposphere and lower stratosphere (UTLS) region. The setup of the water vapour retrievals and modifications with respect to earlier data versions is described. The authors present detailed end-to-end tests showing the sensitivity and limitations of the retrieval scheme. Especially the influence of aerosol on the retrieval results is considered and discussed, providing the basis for analysis of the comparisons to other instruments. Nearly ten years of operation provide a large number of collocations with other insruments, balloone borne in situ and satellite borne remote sensing instruments. Comparsions of the SCIAMACHY UTLS water vapour with different instruments provide a good overview

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on the quality of the data together with possible limitations. The timeseries analysis of the comparisons provides valuable insights in the temporal changes in instrument performance and dependence of the sensitivity on the atmospheric state.

The article is important for all, who will use these datasets in order to correctly apply the data and interpret results based on these data. The article covers and describes all important aspects required. I recommend this article for publication after some minor revisions.

General comments:

It was a pleasure to read this article. It is well written and all aspects that are required to understand the methods and procedures are described in a clear and concise way.

Specific Comments:

Page 7960:
In the decription of the averaging kernels and the assessed vertical resolution I see an inconsistency between different definitions of vertical resolution. Taking the FWHM of the rows of the averaging kernel, one gets the values described here, with the best vertical resolution at altitudes where the tangent point of the observation is. Here the resolution is in the range of the vertical field of view, indicating that most of the signal at these altitudes rally originates from the measurements at these altitudes.

However, the vertical resolution is also determined by the vertical spacing with 3.3 km between the tangent altitudes.Looking at the sensor response, which is around 1 for all altitudes in the selected vertical range this means that all altitudes contribute to the signals. In my understanding the vertical resolution can only be as good as the spacing of the measurements if the field of view is smaller than the vertical spacing of

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the measurements.

This explanation could be improved. Especially as the origins of the measured signal and smoothing are discussed later (see my comment further down).

Page 7980, Line 3-5:
I cannot follow the explanation on the annual cycle. In my understanding, either the SCIAMACHY datasets catch the annual cycle while the others do not or vice versa, while the annual cycle in the differences is much weaker for polar latitudes. Rewording probably makes this point clearer. In line 9/10, the explanations are getting clearer.

Page 7984 Line 24-25:
I think this sentence could be improved by rewording. It is not completely clear what you mean by the fact that measurements at higher altitudes are a "mixture of measurements at about 18.3 and 21.6 km altitudes." Even the with sentence before, about SNR at 24.9 km, is not clear to me. The influence on what part of the profile is smaller?

Page 7986 Line 14:
The statement concerning the increase in water vapour in the tropical lower stratosphere is very strong. By stating that "... it is real", it seems that this is a common result, found and supported by other sources. In that case you have to support this by an independent reference to other studies. Otherwise, I propose to weaken the statement by writing e.g. " ... the measurements discussed here indicate (suggest) that this increase in water vapour is real."

Minor/Technical Comments:

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Page 7956, Line 3:
Check placing of comma.
"... minimum in water vapour mixing ratios, the hygropause, is located (see.e.g...."

Page 7956, Line 4:
"Therefore, it is challenging... " Why is it challenging? Because the low temperatures and low mixing ratios lead to signals close to the detection limits for most observation techniques?

Page 7957, Line 1:
Check placing of comma.
"... European satellite Envisat, provided ... "

Page 7964, Line 5:
Are the errors "higher" in the sense of altitude of appearence? Or larger in the sense of magnitude. In case of the second alternative, I propose to use "larger" errors.

Page 7967 Line 22:
"... profile is taken into account." (remove comma)

Page 7969 Line 5-6:
Looking at figure 7, the region without data due to the SAA appears to be rather between 90 W and 5 E (not 5 W and 90 E).

Page 7974 L 4-6:
Here the filter criterion is unclear. Are measurements with AVK less than 0.03 in the

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diagonal used (which would not make sense)? Or are these neglected? Also it would be good to mention what visibility flag 0 means. Additionally, it would be good to mention that the MIPAS data are the reduced resolution after 2005 (you mention it on p7980 l 25/26, but it would help here, too, as the reader is not necessarily familar with the version numbering) It would be good to make clear which data are used. The filter requirement used for ACE-FTS is similarly unclear.

Page 7979:
The paragraph discussing comparisons with other satellite data is very dense, containing a lot of information. I suggest to split this paragraph into several paragraphs. E.g. split up by instruments or latitude bands, for better readability.

Page 7985, Line 6:
".. because they does not show..." : shouldn't this be plural and thus "do"?

Figure 16:
I suggest to see over the layout for Figure 16. The overlapping y-labels should be removed.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 7953, 2015.