Atmos. Meas. Tech. Discuss., 6, C256–C259, 2013
www.atmos-meas-tech-discuss.net/6/C256/2013/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Validation of two independent retrievals of SCIAMACHY water vapour columns using radiosonde data" *by* A. du Piesanie et al.

R. Lang (Referee)

ruediger.lang@eumetsat.int

Received and published: 12 March 2013

The detailed evaluation of truly independent water vapour climatologies from satellite observations is an important prerequisite towards the establishment of a global, long-term 3D data-set of water vapour available for the evaluation of climate models and the studying of climate feedback related to the hydrological cycle. The work presented here provides important insights in the usage of two existing, and potentially valuable, data-sets from SCIAMACHY using AMC-DOAS (here SCIAMACHY-ESA WVC) with vis/NIR data, and SCHIAMACHY-IMLM using SWIR data. The establishment of such a future 3D data-set is challenging with respect to the complex nature of the water

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

vapour profile, being highly variable in time, not well mixed, and decreasing by three orders of magnitude until the tropopause, i.e. with a significantly larger scaling height than oxygen. The paper by du Piesanie et al. is generally well written and presented. It provides an evaluation of the two retrieval techniques for total column water vapour (WVC) by comparing to in-situ radiosonde data over a period of one year (AMC-DOAS) and two individual years (IMLM).

General comment: While the paper presents a detailed analysis of the individual sets it is short in detailing and evaluating the pros and cons of both retrievals with respect to each other. For the latter task only one day for comparison and a very brief analysis is provided in Section 5. Given the fact that a detailed evaluation of the AMC-DOAS algorithm has already been provided in Mieruch et. al. along the same lines of reasoning (evaluating the biases due to the AMF CF approach) and using similar measures, and considering that there are currently a large amount of water vapour retrievals available (which in itself is not a bad thing), I believe the paper should put more attention the description of the advantages and disadvantages of both data-sets, by taking into account their underlying fundamental limitations due to observation geometry, surface type, presence of clouds, cloud height, etc, and with respect to the fundamental limitations of their specific energy region. Since no single retrieval of water vapour, profile and columns, can cover all aspects concerning the much needed 3D monitoring of the WV field, the remaining task lies in an evaluation of the potential synergies between data-sets, in order to arrive at such a 3D global data-set. So I propose to expand more on these synergies for the given sets both in the introduction and, if possible, by reducing or focusing the section on the AMC-DOAS evaluation to those aspects, which are relevant with respect to such potential synergies (and otherwise refer to the paper by Mieruch et al.), while expanding the section on the comparison between the two sets.

Specific comments: 1) In the evaluation of biases and standard deviations from AMC-DOAS there is one conceptual issue which I am not sure I have fully understood. From my point of view the AMC-DOAS formulation, as presented in Eq. 1, introduces two

AMTD
6, C256–C259, 2013

systematic biases in the case of an atmospheric light-path, which is different from the pure geometrical (the introduction of biases of some sort in this case is of course true for basically all remote sensing retrievals): One is from the assumption that a scaling of the observed WV along the path, and after the geometrical AMF c has been applied, to a "true" total vertical water vapour column, which is based on a scaling of the oxygen profile. This bias can be evaluated quite well, as done in Figure 6, based on climatological profile (-differences) of both O2 and WV with respect to RT calculations. The other bias is however introduced by the difference between these climatological WV profiles (neglecting the small error in O2 w.r.t. its true profile) and the real WV profile below the fraction of the pixel which is shielded by a cloud at a certain height. The latter can be quite different from the assumed climatalogical one, as to why the above mentioned 3D knowledge of it is so much needed. It occurs to me that the observed differences to validation sources (here radiosonde data), as presented in Fig. 4 and 5, and with respect to the impact of cloud shielding, are always referred to the former error not to the latter. Can it be that the latter error (the difference between the climatological assumption of the WV profile to the real shielded profile), is indeed negligible in comparison to the O2/WV profile-difference error in the scaling? And can this be shown somehow (or has this been shown somewhere)? To this respect it might be beneficial to look at the partial columns from AMC-DOAS with respect to radiosonde data, as has been done for IMLM, and which at the same time may help the discussion on synergies, as suggested in my general comment.

2) In the comparison section 4 (p. 678) it would be helpful if Table 2 would state explicitly which retrieval settings are making use of which type of cloud retrieval (FRESCO+ or other).

3) I don't quite understand the conclusion of Section 4 (p.678, l. 22f). Table 2 shows that the mean bias will increase when including some cloudy scenes (as expected). So, either one has to increase the acceptance/accuracy limit for a total column product, which is fine, as long as one defines what this limit should be. Or one derives a partial

AMTD
6, C256–C259, 2013

water-vapour column data-set which is evaluated with respect to partial columns from radiosonde profiles, which however is something different than a total-column data-set. I think one should not mix them both and then call it an extension.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 665, 2013.