Atmos. Meas. Tech. Discuss., 6, C1978–C1981, 2013
www.atmos-meas-tech-discuss.net/6/C1978/2013/

Atmospheric Measurement Techniques Discussions

Interactive comment on "A feasibility study for the retrieval of the total column precipitable water vapor from satellite observations in the blue spectral range" *by* T. Wagner et al.

T. Wagner et al.

thomas.wagner@mpic.de

Received and published: 11 August 2013

Reply to anonymous Referee #2

The authors demonstrated the feasibility to retrieve water vapor from satellite observations in the blue spectral region. They tested blue retrievals of SCDs of water vapor from both GOME-2 and OMI data. Unlike OMI data, GOME-2 data contain both blue and red spectral ranges for water vapor retrievals. They performed both red and blue retrievals from GOME-2 data to allow direct comparison and discuss of the red/blue retrieval differences. They also showed the GOME-2/OMI blue retrievals differences

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

for both values and retrieval uncertainties. To discuss the differences among different datasets of water vapor SCDs, the authors performed representative (e.g., in surface albedo) RTM calculations of AMFs over both clear and cloudy conditions and carefully explained those differences. Although the retrieval uncertainties from the blue retrievals are significantly larger than those in red retrievals, the authors illustrated several advantages of blue retrievals. This paper is suitable for publication on AMT. It is well written and organized. Although the blue retrievals of using 430-450 nm especially the fitting window might not be as optimized as the red retrievals, it is adequate for the feasibility study. Overall, I would recommend it to be published on ATM after the following minor comments are addressed.

Author Reply: First of all we want to thank the reviewer for the positive assessment of our work! We agree that the fitting window is not yet very optimised. In the revised version of our manuscript we investigated the uncertainties of the spectral retrieval in more detail and added the results of sensitivity studies varying several parameters of the spectral retrieval. In summary, varying the settings of the spectral retrieval can lead to small systematic biases (between -1.29 $\times$ 1022 and 1.24 $\times$ 1022). To date it is not possible to identify the optimum settings for the spectral retrieval. This should be subject to futures validation studies after H2O VCDs have been calculated from the retrieved H2O SCDs. We added the results of the sensitivity studies at the end of section 2.

Specific comments

1. P3644, L5, change “is systematically” to “are systematically”

Author Reply: Corrected

2. P3647, L5 and in Fig. 1, for H2O cross section, what pressure is used as the cross sections depend on both temperature and pressure? Please specify it.

Author Reply: We added the information on the pressure (1013hPa) to section 2 (the

AMTD
6, C1978–C1981, 2013

information on temperature (290K) was already given in the AMTD paper).

3. In Fig. 2, it seems to me that the black lines are the fitted optical depths for the specific species plus fitting residuals. If that is the case, please make it clear. I think that it does not mean the same as “respective features in the measured spectra”

Author Reply: We changed the text to: The red lines indicate the reference spectra scaled to the retrieved optical depths plus residual in the measured spectra (black).

4. P3651, first paragraph, according to the calculated AMFs in Figure 4 and Table 1, the AMF is significantly larger in the blue over the ocean, and is significantly larger in the red over land. But from Figure 6, blue retrievals are significantly larger than red retrievals over the ocean, but read retrievals are comparable or slightly larger than blue retrievals over the land. Why is that? Could be due to some positive systematic biases from the blue?

Author Reply: We can not rule out a systematic bias of the blue retrieval (see above). However, in principle the findings presented in Fig. 6 are basically consistent with the expectations from the RTM: - the SCDs in the blue are systematically larger over ocean - over land, the situation is more complex, because the surface albedo in the red spectral range shows a rather high variability. In addition, high clouds and high mountains lead to small H2O VCDs which make relative differences less obvious.

Also note that in Figs. 10 and 12 the general effects of the different AMF become more clear.

5. P3652, last paragraph of section 4.1, it might be better to move/merge this paragraph to P3651, L16-17, which discusses the reasons for possible differences.

Author Reply: In our opinion, the reasons given in this paragraph explains the specific differences shown in Fig. 8 (top), which are caused by the sampling of different air masses at lower latitudes. These specific differences are not caused by instrumental properties or RTM effects of the different spectral ranges. Thus we think it would be

AMTD
6, C1978–C1981, 2013

better to keep this paragraph at the end of section 4.1. (in section 4.2 more general reasons for systematic differences are discussed.)

6. P3652, L14-15, should it be June 1 and June as it is inconsistent with Figure 9?

Author Reply: Many thanks for this hint! We changed July to June.

7. P3653, L5-7, the consistency between ocean and land using blue is considered as the first advantage, but not quantitative estimate is provided about the magnitude of inconsistency from red retrievals. It would be very useful to provide an estimate about this.

Author Reply: We added a new table (3) with the uncertainties of AMFs in both spectral ranges for different surface types. These results are discussed at the end of section 3, where a new paragraph is added: 'Finally, we investigated the uncertainties of the AMF calculations for both spectral ranges for different surface albedos and cloud fractions. In table 3, the uncertainties of the respective AMF are shown, which are caused by variations of the surface albedo by 1% (absolute uncertainty). Especially over ocean, the uncertainties in the blue spectral range are much smaller than in the red spectral range. Over land, the uncertainties are similar, except over deserts, where the uncertainties in the red spectral range are smaller.'

At the beginning of section 3, a general statement about the interpretation of the AMF is added: 'Here it should be noted that a) a higher AMF indicates a higher sensitivity of the measurement, and b) that higher AMF lead to smaller uncertainties of the H2O VCDs calculated from the retrieved H2O SCDs (see also discussion at the end of this section and table 3).'

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 3643, 2013.