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Atmospheric Measurement Techniques Discussions

Interactive comment on "Total column water vapor retrieval for GOME-2 visible blue observations" *by* Ka Lok Chan et al.

Anonymous Referee #2

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The paper titled 'Total column water vapor retrieval for GOME-2 visible blue observations' by Chan et al. presents a new method to retrieve total column water vapor (TCWV) from GOME-2 spectra in the blue wavelength band. Slant column water vapor is retrieved using the DOAS spectral fitting technique, and subsequently converted to vertical column using Air Mass Factor (AMF). A dynamic search approach is used to find suitable a priori profile for the AMF calculation. The new algorithm is then applied to retrieve TCWV from GOME-2A and GOME-2B observations. TCWV results from GOME-2A and GOME-2B are also validated against GOME-2 measurements in the red band, sun-photometer and radiosonde measurements. The comparisons show that new blue band retrieval in general shows good agreement with other data sets, and proofed the reliability of the new algorithm. In general, this manuscript presents

an interesting results. However, there are still some concerns need to be addressed before publication in AMT.

1)The author introduced the source of a priori water vapor vertical profile in section 3.1.4, which is the statistical result of ERA reanalyzing data for 10 years. In section 2.6, it explained the horizontal and time resolution of ERA data but did not explain the vertical resolution. The vertical resolution and the number of layers should be clearly explained here, because the layer of a priori profile is used to calculate the AMF.

2)The third line on page 13 of the author indicates that "using a priori profile from model is not optimal for our water vapor retrieval", but the ECMWF ERA data used by the author is also the result of numerical simulation. Here the author only needs to emphasize that the a priori profile used is statistical data, which can reduce the model error.

3)The author wrote in the third line on page 16 that the profile below cloud is taken from the a priori profile. The water vapor below cloud is close to the atmospheric boundary layer, where the water vapor concentration is high and the change is large, so this approximation will produce a large error. In addition, should the thickness of the cloud layer also be considered?

4)The authors mentioned the level 1B issue appears at wavelength larger than 460 nm, and that is why they avoided including longer wavelength in the spectral analysis. However, we still see a jump of TCWV in 2015 when switching the level 1B data version. The authors should explain why this is still happening even they did not use wavelength longer than 460 nm in their analysis.

5) The details of the spectral fitting settings are scattered in the text which is quite difficult for the audience to follow. I would suggest the authors to summarize this information in a table.

6) The comparison of TCWV to the retrieval in the red band shows a positive bias over

vegetations, e.g., South America and Central Africa, which the authors claim that this is related to the uncertainty of the surface albedo data set. The authors also mentioned that they are trying to improve the albedo database to by using new surface albedo retrieval. It would be nice to show some preliminary results (if available) to show the new method can potentially reduce this bias.

7) Page 23, line 15-16: When the authors compare big data sets (sample size > 10k), even a small bias is significant, so I think there is no need and uncommon to mention the P value.

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