Atmos. Meas. Tech. Discuss., 6, C4146–C4151, 2014
www.atmos-meas-tech-discuss.net/6/C4146/2014/

Atmospheric Measurement Techniques Discussions
Open Access

AMTD

6, C4146–C4151, 2014

Interactive Comment

Interactive comment on "Retrieval of characteristic parameters for water vapour transmittance in the development of ground based sun-sky radiometric measurements of columnar water vapour" *by* M. Campanelli et al.

M. Campanelli et al.

m.campanelli@isac.cnr.it

Received and published: 28 January 2014

GENERAL ANSWER TO BOTH REVIEWERS:

After the comments received by both the Reviewers, we realized that to validate our work, GPS estimation of columnar water vapor was necessary. Fortunately we were able to find GPS measurements for two sites close to Chiba University (respectively 10 and 19 km far from the site used in this paper), and the entire paper was substantially changed in the following points:

1. We recognized that both the reviewers misunderstood the presented methodology with the Surface Humidity Method, and it was surely our fault. Therefore we changed the mail Sections of the paper as follows: 1. Introduction. 2. Equipment. 3. Methodology. 3.1Preliminary check of dataset. 4 Parameters estimation. 5. Water vapor estimation. 6 . Discussion. 7 Conclusions.

2. GPS water vapor data (W) were used as an independent dataset, needed for applying the proposed methodology, in addition to the Surface Humidity Method already described in the previous version. This allowed us also to validate: i) the proposed methodology, based on the hypothesis that calibration parameters characterizing the atmospheric transmittance (a, b) are dependent on vertical profiles of pressure, temperature and moisture occurring at each site of measurement; ii) the SHM that is a cheap procedure, easy to implement for retrieving the needed independent W dataset using measurements of surface temperature, pressure and relative humidity, when other measurements are not available.

3. Thanks to GPS measurements we discovered that Microwave radiometer estimation of water vapor was affected by a bias. Therefore we corrected it, and the validation of water vapor from sun-sky radiometer was largely improved.

4. The behaviour of a and b parameters as function of W was validate by the analysis of the available radiosonde measurements, by introducing two indices to describe the W vertical distribution and having different sensitivity to the shape of the distribution. The improvement in the retrieval of W from sun-sky radiometer when such dependence of a and b on W is introduced, was also presented.

5. Old Figure 7 was removed. Infact it was previously used to provide an explanation of why some points of W, retrieved from SHM, underestimated the measurements from RDS. With the introduction of GPS dataset we noticed that the problem was conversely due to an overestimation by RDS measurements, identified also in the comparison against GPS measurements.

Answer to reviewer #2

"The paper describes a new method based on surface pressure and relative humidity to initiate the estimation of the water vapour column from sun-sky radiometer measurements at 940 nm. Water vapour column estimates with the new method are compared with near-simultaneous microwave radiometer and radiosonde measurements. The methods and results presented are incremental improvements of earlier works by the same authors and provide documentation and validation of the water vapour procedure to be released as part of the ESR.pack software. While the paper validates the method for one site over a year, validation for other sites and climatologies are still needed. Especially since the accuracy of the method is highly dependent on the shape of the water vapour profile."

In the new version of the paper GPS measurements independent datataset needed for the application was also considered for the application of the present methodology, in addition to the SHM, providing an important clarification and validation of our the results.

"Before publication the points below should be addressed.

Page 8075, line 24: Please specify at which wavelengths the instrument measures."

Done.

"Page 8080, line 13: May you please justify why the “standard deviation appears to be the best estimate”?"

Because the distribution of the 80 pairs (a,b) is Gaussian, and therefore characterized by mean values (and) and their standard deviation. Therefore the uncertainty associated to and , once verified the coincidence with , is also the uncertainty associated to the entire procedure. We changed the sentence as follow : “Given that, the standard deviation (that is the uncertainty associated to the above mean values) appears to be the best estimate of standard error to associate to each of the actual optimal values

AMTD

6, C4146–C4151, 2014

Interactive Comment

a_opt , b_opt and therefore the best estimate of the uncertainty associated to the entire procedure. This evaluation is an improvement respect to the estimation obtained using a simple propagation error formula."

"Page 8081, line 11: It is stated that "... e0 is calculated . . . according to Lowtran code formula". Neither the Kneizys et al. reference nor the LOWTRAN code is easily available. And in the case LOWTRAN is available it is a waste of time to search for that single line with the wanted code snippet. Hence, please provide the equation(s) or a more detailed reference. "

The formula has been provided in the text.

"Page 8085, line 22: A radiative transfer code is mentioned to be written by one of the authors. This information is of little relevance and may be omitted. However, information should be included about:

What does the radiative transfer code calculate?"

The code calculate the atmospheric transmittance

"How does it include/treat absorption by water vapour? Line-by-line? If parameterizations then please justify the parameterization."

It uses correlated-k distribution method with band width 10 nm. The data base of correlated-k distribution was calculated based on HITRAN data base using line-by-line code.

"Is the geometry plane-parallel or spherical? If plane-parallel, how accurate is it for m = 8 compared to spherical geometry?"

The code takes into account the curvature of the earth and the refraction of solar path.

"Does the radiative transfer code include aerosols and cirrus clouds?"

No, it does not include aerosol and cirrus cloud. It just calculates transmittance of

AMTD

6, C4146–C4151, 2014

Interactive Comment

radiatively active gases.

"How does this code compare with other radiative transfer codes? If it is not a line-by-line code: has it been validated against line-by-line codes?"

Actually there is no comparison with other radiative transfer codes, neather with a line-by-line codes

"Was there a problem with existing codes that necessitated the need to develop yet another radiative transfer code?"

The code used in this paper uses the correlated k-distribution method, that is a good approximation for our study. The choice of this code was related to the fact that also the Meteorological research Institute of Japan is developing a technique for calculating water vapour from PREDE sun-sky radiometer, so that it was correct comparing their results (not yet published) with our results.

All the above considerations were added in the text.

"Pages 8090-8091. On lines 20-22, page 8090, the water vapour from the Microwave Radiometer (MWR) is indicated to be poor for law water vapour content. Then, on lines 28 (page 8090), 1-2 (page 8090) it is emphasized that water vapour dependent a and b parameters improved the agreement with MWR measurements especially for low water vapour content. Thus such an improvement in agreement mean anything as long as the MWR measurements may not be fully reliable at low water vapour content?"

Right. We solved this problem by introducing GPS measurements for validating the results from our methodology. Thanks to the comparison against GPS, we also found that MWR was affected by an unknown bias, that we corrected before using these measurements for validation.

"Page 8092, lines 9-12. Please check the title of the Campanelli 2010 reference. Should it start with “Summertime”?"

AMTD

6, C4146–C4151, 2014

Interactive Comment

Corrected.

"Page 8098: Caption Fig. 2. Why is a fixed value for b used and not one you have derived? Please justify the use of b from Halthore et al. Same comment applies to caption of Fig. 4, page 8100."

This choice was done because at this point of the paper we have not yet calculated a,b pairs, so that in order to show the efficiency of the method we chose the value suggested by the literature.

"Page 8102, Caption Figs. 5 and 6. Please add reference to table 2 so it is clear where the values of a, b and V0 come from. For example, for Fig. 5, change “each class.” To “each class, see table 2.”"

Done

"Generally the language throughout the manuscript would benefit from a careful read by a native English speaker. That would potentially clarify expressions such as “with the intent of the reprocessing data once the calibration table is available” (Page 8089,line 13)."

We are sorry for our English mistakes, and we did the best to improve it, also in the sentence suggested by the reviewer. But we know that it could be still largely improved.

Please also note the supplement to this comment:
http://www.atmos-meas-tech-discuss.net/6/C4146/2014/amtd-6-C4146-2014-supplement.pdf

---

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 8071, 2013.