Atmos. Meas. Tech. Discuss., 3, C2648–C2652, 2011
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Atmospheric Measurement Techniques Discussions

Interactive comment on "Analysis of the application of the optical method to the measurements of the water vapor content in the atmosphere – Part 1: Basic concepts – the measurements of the water vapor content in the atmosphere with the optical method" *by* V. D. Galkin et al.

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Received and published: 7 February 2011

Dear Referee #1! Thanks for your important and useful comments. Unfortunately, we do not know why you did not receive our answers concerning your initial review comments. In any case now we try to answer your present comments.

1) Of course we are aware of today's investigations carried out by different other devices and methods. In order to emphasize our engagement into other methods for observing IWV we suggest to add the following paragraph to the final version of the article at line 20 on page 5718 (before the Discussion):

"Ground-based GPS-receivers deliver continuously data for climate and NWP (Numerical Weather Prediction) applications. In order to ensure the high quality of this products reference data for Integrated Water Vapor (IWV) from independent instruments are required for quality control and accuracy estimation. To meet the general needs for high-quality water vapor information the WCRP/Global Water Vapor Project (GVaP) was initiated, which includes the establishment of reference observation stations. The Deutscher Wetterdienst is setting up the Meteorologisches Observatorium Lindenberg as validation site. Also, since 2008 this observatory is the first GRUAN (GCOS Reference Upper-Air Network) network station and also hosts the GRUAN lead centre (Seidel et al, 2009; Immler et al., 2010). Lindenberg performs continuous monitoring and validation of IWV using GPS, radiosondes, microwave profiler and 2-channel radiometers since more than 15 years (see for example Güldner, J., 2001). The results of the determination of the water vapor column contents (IWV) made by the optical method and their intercomparison with those obtained with the use of other techniques will be discussed in more detail in a separate publication (Analysis of the application of the optical method to the measurements of the water vapor content in the atmosphere – Part 2: Intercomparison with data obtained by other devices and techniques).

Also we will add some articles in References:

Campmany, E., Bech, J., Rodríguez-Marcos, J., Sola, Y., and Lorente, J.: A comparison of total percipitable water measurements from radiosonde and sunphotometers, Atmos. Res., 97, 385-392, 2010.

Güldner, J.: Validation of Integrated Water Vapor Using Independent Measurement Techniques, Phys. Chem. Earth (A), Vol. 26, Is. 6-8, 427-431, 2001

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Immler, F. J., Dykema, J., Gardiner, T., Whiteman, D. N., Thorne, P. W., and Vömel H.,: Reference Quality Upper-Air Measurements: guidance for developing GRUAN data products, Atmos. Meas. Tech., 3, 1217-1231, 2010.

Morys, M., Mims III, F.M., Hagerup, S., Anderson, S.E., Baker, A., Kia, J., Walkup, T.: Design, calibration, and performance of MICROTOPS II handheld ozone monitor and Sun photometer. J. Geophys. Res. 106 (D13), 14,573–14,582, 2001.

Rollin E. M., An introduction to the use of Sun-photometry for the atmospheric correction of airborne sensor data. Activities of the NERC EPFS in support of the NERC ARSF, ARSF Annual Meeting, Keyworth, Nottingham, UK (2000) 22 pp..

Schneider, M., Romero, P. M., Hase, F., Blumenstock, T., Cuevas, E., and Ramos, R.: Continuous quality assessment of atmospheric water vapour measurement techniques: FTIR, Cimel, MFRSR, GPS, and Vaisala RS92, Atmos. Meas. Tech., 3, 323–338, 2010

Seidel, D. J., Berger, F. H., Diamond, H. J., Dykema, J., Goodrich, D., Immler, F., Murray, W., Peterson, T., Sisterson, D., Sommer, M., Thorne, P., Vömel, H., and Wang, J.: Reference Upper-Air Observations for Climate: Rationale, Progress, and Plans, B. Am. Meteorol. Soc., 90, 361369, doi:10.1175/2008BAMS2540.1, 2009.

2) Fig. 6 represents of our long-time data set. The details of intercomparisons will be given in our next article (see point 1).

3) We agree with you and follow your recommendation to shorten the title in the final version to: “Analysis of the application of the optical method to the measurements of the water vapor content in the atmosphere – Part 1: Basic concepts of the measurement technique”.

4) In order to explain the terms “uncertainty” and others we will add the little “Glossary” as “Appendix A” to final text of the article. Also, we will correct the final text according this glossary.

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5) This problem will be discussed in our next article too (see point 1).

We will correct Fig. 1c in final version of the article.

6) We agree that it should be the best, if all researchers use SI units only. But for non-system physical value “Precipitable Water” the situation is not so simple. From American Meteorological Society “Glossary of Meteorology” one can have the following definition:

"Precipitable Water - (or Precipitable Water Vapor) - The total atmospheric water vapor contained in a vertical column of unit cross-sectional area extending between any two specified levels, commonly expressed in terms of the height to which that water substance would stand if completely condensed and collected in a vessel of the same unit cross section."

For this physically the same term the lot of abbreviations is used by different authors using GPS, MW-radiometers, radiosondes (RS), or sun photometry: PW, PWV, TPW (Total Precipitable Water), IWV (Integrated Water Vapor) and some more. In a quantitative sense, most authors use units “cm” or “mm” for PW until today. The National Oceanic and Atmospheric Administration (NOAA) uses for PW the unit “in.” (Inches) in its NCDC Radiosonde Database of North America. Only some authors (for example at University of Bern) use SI unit “kg/m2”for PW. At Meteorologisches Observatorium Lindenberg the abbreviation “cmppw” (cm pre precipitable water) had been used as unit for column precipitable water PW (or integrated water vapor, IWV) during long time (Leiterer et al., 1998). In Lindenberg’s PW-database (including data obtained by radiosondes, MW-radiometers, GPS, and sun and star photometers) this unit is used also. And at Pulkovo Observatory for laboratory measurements of integrated water vapor content along the line of sight this same unit was used too. Therefore we keep this non-system unit in presented article too.

7) Axis numbering of figures will be larger in final version of the article.

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Thanks again, and best regards. Victor Novikov, corresponding author.

Interactive comment on Atmos. Meas. Tech. Discuss., 3, 5705, 2010.

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