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Atmospheric Measurement Techniques Discussions

Interactive comment on "Quality assessment of Izaña's upper-air water vapour measurement techniques: FTIR, Cimel, MFRSR, GPS, and Vaisala RS92" *by* M. Schneider et al.

Anonymous Referee #1

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General

The article is well written and structured.

A cross-comparison of different sensors is necessary to establish a record of quality for the measurements. As outlined in the publication the methods have different advantages and limitations. The advantages of the instruments and methods can be exploited to give the full picture about water vapor in the troposphere.

There are, however, gaps in the article which make a revision of parts of the article necessary. After clarifying the issues raised below the study should be published.

After starting off with a general introduction into the need of long term measurements of water vapor and the need of inter-comparison between sensors the authors proceed with a overview over the water vapor instrumentation of the Izaña observatory in section 2.

Section 3 contains an overall cross comparison of total water vapor measurements of the different sensors. Section 4 discusses the measurements of profiles and compares measurements by RS92 radiosondes and FTIR, the only two instruments from this study which are able to derive vertical profile information.

The study continues with an estimation of the clear sky bias of the FTIR, CIMEL and MFRSR instruments in section 5 and finishes with conclusions in section 6.

The authors discuss the strong need of comparisons of measurements of different sensors and the establishment of long time stability. Although other studies have been cited, the results obtained elsewhere are not mentioned in this study. In order to establish a record of quality checks, the results found in this study should be related to other results.

The work does not exploit the possibilities of the large number of different sensors, see the specific points below. For a quality assessment a detailed discussion of all the failures or contradictions in the results presented would be expected. This contradiction between the title and the abstract on one side and the contents of the publication should be resolved in a final version.

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Specific

Section 3.3

The two other instruments measuring direct or indirect solar light, the CIMEL and the MFRSR, are cross-compared with the FTIR instrument.

The standard deviation when the CIMEL and the MFRSR are compared to each other is much larger than the standard deviation of the comparison of each instrument to the FTIR. This results is used to bolster the argument that the FTIR data are more precise than the measurements of both instruments, the CIMEL and the MFRSR. The authors did not, however, make sure, that all three instruments measure under the same conditions. On several occasion the authors mention the strong dependency of the MFRSR and CIMEL data set on the effectiveness of the cloud screening algorithm. It would be interesting if the comparison would be better if only measurements are used for which the sky was clear. This could be done if only CIMEL and MFRSR measurements are compared when also a FTIR measurement exists. It would also be worth investigating, if the strong uncertainty of the CIMEL-MFRSR difference shows any SZA dependence.

The conclusion that the FTIR measurements are of lower scatter than the CIMEL and the MFRSR is therefore too strong when based on the presented comparison.

Section 5 and table 2

The authors write, that the dry bias for the MFRSR data is not significant. The reason for this judgement is not made clear. Why is the CIMEL dry bias considerably smaller than the FTIR dry bias?

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Section 4, line 25 to the end of the page:

The authors maintain that the standard deviation of the sonde profiles is about 20 % and therefore the standard deviation of the comparison between FTIR and sonde is caused by the sonde alone.

The radiosondes measure every few meters and I would expect the standard deviation be given for these measurements. The AVK-function for the 8 km value of the FTIR shows that the retrieved VMR value has a FWHM of several km. It is therefore a weighted mean over this altitude range. The standard deviation on the sonde profiles should reduce considerably if this would be taken into account.

It should therefore be clarified if and how the standard deviation of the sonde measurements has been made comparable to the FTIR altitude resolution.

Technical corrections:

page 1629, line 19: replace absorption by absorbs

page 1634, line 17: replace provide by provides

page 1636, line 11: replace reliably by reliable

Table 1: An expression like (25.4 +/- 12.7)% means commonly that the error on the value 25.4 % is 12.7 %. As I understand the text, it is meant that the mean value of all differences of the measurements is 25.4 % but the standard deviation on the differences measurements leading to this mean value is 12.7 %. The notation and text should be made consistent.

Table2 and section 5: Dry bias and clear sky bias are used parallel in this chapter. Although the terms are correctly introduced and used, it would be more convenient to stick to the term clear sky bias which is what is investigated.

Interactive comment on Atmos. Meas. Tech. Discuss., 2, 1625, 2009.

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