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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Integrated water vapor above Ny Ålesund, Spitsbergen: a multisensor intercomparison" *by* M. Palm et al.

M. Palm et al.

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The authors thank the reviewer for the constructive and helpful discussion of the publication, especially for the careful review of typographic errors and technical details.

Q) Differences between the subtypes of the radio sondes.

A) For a discussion refer to the comment # S11400.

Q) The reviewer asks for a description of the use of LINEFIT

A) For a description of the LINEFIT code and its use in order to adjust a FTIR spectrometer we refer to the publication of Hase et al. (1999). The instrument is adjusted by optimizing the instrumental lineshape which is calculated using the LINEFIT software with very well defined measured spectra (here: HBr at a known pressure). A

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description of this rather technical procedure is clearly not in the scope of this paper.

Q) Why stop data from the microwave 2004?

A) The RAM spectrometer stopped working in autumn 2003 after a major hardware failure. Brief failures were numerous before, due to the failure of minor parts of the instrument. After 2003 major parts of the instrument had to be replaced. The major changes ask for a new verification of the usage for the measurements presented here, which is due to be performed.

We would like to stress that no measurements have been excluded from the investigation because they did not fit to the intended conclusion.

Q) Why differs the matching criterion for AMSU-B.

A) Lines 2 and 3 state how a measurement above Ny Ålesund was created, line 22-24 state the criterion for the inclusion into the comparison. The criterion includes a spatial requirement, i.e. a circle of 50 km diameter. The pixels which are included in the retrieval should not deviate to much in order to exclude measurements which show signs of strongly varying IWV within the ground pixel.

Q) Typical noise figures for each instrument?

A) The error figures given in the products of SCIAMACHY are calculated from the spectral residuum of the fit and are smaller than 10%. For the AMSU-B instrument the rms-error is about 10 %. For a more detailed discussion of the errors of the satellite instruments, we refer to Noël et al. (2004) and Melsheimer and Heygster (2008) for the SCIAMACHY and the AMSU-B instrument, respectively. The IWV of the RAM instrument have a noise figure of about 20% and the IWV derived from the FTIR about 5 %, both due to measurement noise. A major outcome of this publication is the quantification of noise when values derived from different instruments using retrievals which exploit different principles are compared.

ACPD

8, S11582–S11586, 2009

Q) Caption of table 1 appropriate?

A) The hints given in this questions will be considered in the revised version.

Q) How are the errors calculated?

A) The errors for m and b are calculated using the error propagation, i.e. the error of a variable m is $\sigma_m = \sqrt{(\sum_{i=1}^{n}(\frac{\partial m}{\partial x_i}\sigma_i))^2}$ if the variable m depends on several variables $x_i, i = 1 \ldots n$ which have a corresponding error σ_i.

Q) Correlation coefficients?

A) **Values for the correlation corresponding to table 1:**

Comparison	Correlation coefficient
Sonde-FTS_Lun	0.73
Sonde-FTS_Sol	0.99
Sonde-SCIA	0.86
Sonde-AMSU	0.86
Sonde-RAM	0.95

Values for the correlation corresponding to table 2:

Comparison	Correlation coefficient
FTIR SCIA	0.992
FTIR AMSU-B	0.929

Values for the correlation corresponding to table 3:

Comparison	Correlation coefficient
Sonde SCIA	0.982
Sonde AMSU-B	0.945

ACPD

8, S11582–S11586, 2009

Interactive Comment

The high correlation is not very surprising because all instruments follow the course of the IWV (as measured by the sondes) and are also able to reproduce single events. We feel that the correlation coefficients do not contribute to the results of publication for several reasons:

- The correlation coefficient provides information if the variables show the same behavior, an offset or scaling error will not lead to a different correlation coefficient.
- The number of matched pairs will differ according to the comparison.
- An instrument measuring during spring will have a better correlation coefficient because the absolute change of IWV is much higher than e.g. in winter.

The latter two points will have the effect, that the correlation depends strongly on the details of the comparison conducted.

Q) Correspondence of slope to error?

A) The error is determined in a statistical way as the scatter around the fitted line $mx+b$. The slope itself has no connection to the slope. The deviation of the slope from 1 is due to a systematic error of either the sonde or the remote sensing instrument. We have not attempted to quantify this systematic error.

The assumption is here, that the measurements of the sonde or the FTIR are the 'truth'. This is of course not true, but the section 3.2 does show, that the measurements of the sonde and of the FTIR differ by a scaling factor.

Q) Why the two step process?

A) As stated in the publication, there is an apparent contradiction between the comparison of the IWV derived from the SCIAMACHY instrument to the sondes and to

ACPD

8, S11582–S11586, 2009

the FTIR measurements. This discrepancy can be resolved using the two step process, which excludes measurements which passed the cloud filter of the SCIAMACHY measurements but not the "clear sky criterion" of the FTIR measurements.

The technical remarks will be considered for the revised version of the paper.

References

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Noël, S., Buchwitz, M., and Burrows, J. P.: First retrieval of global water vapour column amounts from SCIAMACHY measurements, Atmos. Chem. Phys., 4, 111–125, 2004.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 21171, 2008.