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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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We thank the reviewer for the constructive and helpful comments on the publication.

Beside error corrections which have been suggested by the reviewer, the revised version will include clarifications on the issues answered below.

Q) The main message

A) We feel that there is a misunderstanding between the intended message of the publication and the perception of the reviewer. The aim of the publications is by no means to investigate long-term time series of IVW over Spitsbergen but to compare different methods for remote sensing. As has been stated in the publication a dense time series for all conditions will not be available from remote sensing instruments, due to technical restrictions.

The message of this publication is that a combination of different sensors is necessary in order to get a dense and long-term series of IWV. The publication shows, that this is possible using different techniques but also lines out some of the restrictions for doing so. This includes an estimation of the errors which can be expected by using different remote sensing techniques.

The analysis of the extended time series is refered to a future publication.

Q) Why are other instruments not included?

A) The inclusion of the GPS occultation and LIDAR data will be considered in the revised version of the publication.

The 22 GHz radiometer has never been commenced to operation for technical reasons. The spectra recorded by the 22 GHz spectrometer show artifacts which are not understood. A thorough investigation of this instrument is under way but it is unlikely, that the spectra recorded so far are good for retrieval of tropospheric water vapor.

Beside this technical reasons the water vapor radiometer is mainly intended and designed for measuring stratospheric and mesospheric water. The measurement of tropospheric water vapor is not intended using this instrument.

Q) Differences in the radio sondes?

A) Between different sub-types of sondes has not been discriminated because publications (e.g. Miloshevich et al., 2006) show that problems for in-situ humidity measurements occur for weather conditions, i.e. thick clouds, precipitation, ice clouds, when neither of the remote sensing instruments measure. The results of the publication support this notion.

A test using the findings of Treffeisen et al. (2007) shows that the corrections have very little impact on the IWV (smaller than 0.1 %).

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A split of the sondes would not change the results in section 3.2.

For more details on this problem please see the answer on the short comment to this publication (S11400).

Q) Spectroscopic errors in the FTIR measurements.

A) It has been stated that it is LIKELY and not certain that spectroscopic error causes the deviation of the FTIR measurements. It is likely, because it has been shown (e.g. Boone, 2007), that water vapor in the infrared exhibits a different line-shape (speed dependent Voigt line shape) rather than the commonly used Voigt line shape.

Q) Derivation of IWV from microwave measurements

A) The opacity of the atmosphere is an obligatory part of the retrieval of the ozone VMR profile because it yields information of how the ozone emission is attenuated while traveling through the place of its origin to the instrument. The estimation of the opacity is performed by fitting the MPM93 (Liebe, 1993) continuum model to the spectrum together with the ozone radiation and instrumental artifacts. This model is part of the radiative transfer model ARTS which is used in the analysis.

The radiative transfer model MWMOD has been used by Wohltmann (2002) to establish the relationship between the opacity measured and the sonde measurements at the same time using a linear regression. We refer to the work of Wohltmann (2002). It was also not the intention of this work to refine the IWV retrievals from the measurements of the microwave sensor.

Q) Error analysis?

A) As stated in the publication (section 2.4), a thorough error analysis has not been performed because the information on errors of the input for the retrieval of the IWV information is non existent or sparse. We think it more meaningful to derive statistical

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errors from the comparison of different sensors.

A detailed error analysis for the satellite instruments are performed in the respective publications (Noël et al., 2004; Melsheimer and Heygster, 2008) for the SCIAMACHY and the AMSU-B instrument, respectively.

References

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