Atmos. Chem. Phys. Discuss., 8, S10689–S10691, 2009
www.atmos-chem-phys-discuss.net/8/S10689/2009/


Atmospheric Chemistry and Physics Discussions



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

**Anonymous Referee #2**

Received and published: 23 January 2009

General comment: The paper describes the use of four remote sensing techniques to retrieve the column density of water vapor at Ny Alesund, Spitsbergen. Two of the techniques are ground based, microwave radiometry and FTIR spectroscopy. The other two are satellite sensors, SCIAMACHY and AMSU-B. The data set extends over a period from 1997 until 2007. However only during summer 2003 data are available from all four sensors.

The retrieved integrated water vapor content (IWV), the column density, is compared to the column density obtained from co-located radio sounding profiles. Over the period of interest three different sonde types have been used from Vaisala, RS80, 90 and 92. The IWV from the radio sondes is then used as a standard against which the other data are compared.

It has to be noted that the FTIR measurements are performed only during clear atmospheric conditions and thus have an inherent nice-weather bias. The microwave data stem from a microwave radiometer that originally is used to monitor ozone and not water vapor. However the retrieved atmospheric opacity incorporates information about the water vapor content.

The main findings are that all instruments reproduce the annual cycle of IWV but with a rather high variance and that correlation of the individual remote sensing techniques with the balloon sonde is good. The remote sensing techniques all show a dry bias with respect to the sondes.

The main message of the paper ought to be that a combination of the different ground based techniques would allow to cover all seasons and ranges of IWV at the arctic location of Spitsbergen. However based on the presented material this conclusion can not really be drawn. The weakness of the paper actually is that though on first sight it looks as a lot of data are available this is not true. Only very few days have been covered by all sensors.

The reader would expect that from a data set extending over almost ten years something could be learnt about IWV variability or even trends but this definitely is not the case.

In addition it is not clear why other instruments providing IWV at Spitsbergen have not be included in the study such as lidar, the water vapor microwave radiometer at 22 GHz or data from GOME. May be also data from GPS would be available.

Specific comments: - radio sondes Sondes of different types are used but later on in the investigation there is no discrimination between the different types. The correlation plots in Figure 3 are thus misleading and actually should be split for the three cases.

- FTIR FTIR measurements are performed only during clear weather conditions, a fact that is clearly noted. It is stated that the dry bias of FTIR is caused by a spectroscopic



**ACPD**

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error (p. 21182, line 6). There is no justification or explanation given why this should be the case.

- Microwave radiometry The explanations given about how IWV can be retrieved from the measurements of the ozone spectra is not adequate. Unfortunately no reference is given to the theory the authors use to retrieve IWV from the ozone spectra. The few equations they give are not clear. Several questions arise: How is the opacity determined and at what frequency? How affects the mean tropospheric temperature the retrieved IWV, what values are assumed? How is the absorption coefficient of water vapor determined? What is the effect of clouds? What is K? This part of the paper needs a major revision.

- Errors: It is not quite clear why no proper error analysis is performed. The explanation on p. 21178, l. 5 is not clear and needs clarification.

p. 21175, equation (1) Replace CH2O by IWV, no need for a new term

p. 21195 Figure caption: Comparison of four (not three)

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