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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A multi-instrument comparison of integrated water vapour measurements at a high latitude site" *by* S. A. Buehler et al.

Anonymous Referee #1

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This paper is well written and carefully assesses the capability of different techniques to determine the column amount of water vapour (IWV) at a high latitude site. While several papers have been published so far about inter-comparisons of IWV, this paper addresses material that to my knowledge has not been covered in detail and that is of relevance and definitely merits publication: the assessment of a representativeness error in data sets obtained by instruments at different locations, the correction of altitude from where instruments are operated relative to a reference and finally how the measurements obtained at Kiruna fit in the overall picture.

As the paper is clearly and carefully written and as the figures are well presented

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and of relevant information content I recommend to accept the paper with some minor corrections.

- p. 21016, l 17: and the the repr. . .

- p. 21017, l 5: Table 6 gives a summary. . . actually it is Table 2

- p. 21019: paragraph starting at l 10 gives the wrong impression that radiosondes measure water vapour up to 20-40km. I suggest that it is stated that conventional sondes measure water vapour reliably up to approx. 8km. But as almost all H2O is below 5km . . ..

- p. 21020: paragraph about microwave data: This paragraph explains that IWV has been retrieved from measured spectra of ozone as a byproduct of the tropospheric correction. This in principle is possible with limitations as the authors are explaining. The "normal" way to retrieve IWV, and indeed also the column amount of liquid water, is by using a so called dual channel radiometer with frequencies around 20 and 30 GHz. There exist several of theses instruments and they are not susceptible to the cloud problem.

In order to prevent that the wrong impression is drawn from this paper that microwave radiometers in general suffer from the cloud problem please add two or three sentences and make reference to the dual channel approach. Make clear that the cloud problem arises in your configuration.

The reference to Raffalski et al., 2002 is to conference proceedings that probably are not easy to obtain. Please give another reference to a paper or give a link to where this Proc. can be downloaded from.

It is difficult to assess how IWV is retrieved in detail as the reference to Palm et al. does not really help as only and empirical equation is given there. I guess that the opacity is determined and that an effective temperature of the troposphere has to be used. This effective temperature can be quite variable, particularly at high latitudes. If this is not

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taken into consideration in detail this might affect the retrieval of IWV in addition to the cloud effect. May be the authors would like to investigate this effect in the future.

- p. 21030, l 24: Please state what NICAM stands for.

- p. 21034, l 12: Please indicate what spectral information is used, HITRAN?

- p. 21034 just a suggestion: I could imagine that if you further restrict the selection of microwave data by not using data obtained in case of strong temperature inversions, the comparison would be improved.

- p. 21035. I suggest to move para 4.5 after para 4.1 as it refers to Figure 6 top right. Otherwise the para about ERA comes after the reader has gone through Figures 6-8.

- p. 21049, Table 2 I suggest to add an additional column with information about "bias" or "restrictions" such as GPS -> snow cover of radome FTIR -> clear sky microwaves -> no clouds AMSU -> IWV< 8mm

- p. 21059, Figure 5 The equation stands there without being an equation ;-) Say that it is sigmaˆ2=0.0131|d|+0.79

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 21013, 2012.