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Atmospheric Measurement Techniques Discussions

Interactive comment on "ARIS-Campaign: intercomparison of three ground based 22 GHz radiometers for middle atmospheric water vapor at the Zugspitze in winter 2009" *by* C. Straub et al.

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Dear Referee, thank you for carefully reading our paper and for your comments and suggestions. They will help to improve the article. To answer your comments we will always print your comment first and then our answer to it.

1; 3.1 Measurement noise Page 3370 line 19 'by the simulated Gaussian noise of a total power spectrum with the same value for Tsky' I think this needs to be explained by a sentence or two

We changed this to:
The experimental values for a, shown as circles, are obtained by dividing the measurement noise of the one day integrated spectra, acquired between 2 April 2009 and 22 April 2009, by σ_{TP} (Eq. 5 with a=1), with an estimated value for $T_{sys,sky}$. and the caption of figure 2 accordingly to:
Sensitivity factor a calculated by Gaussian error propagation on the calibration equations (lines) and from measurements compared to the uncertainty of a total power measurement σ_{TP}, with an estimated value for $T_{sys,sky}$.
As Referee # 2 correctly pointed out that this is what we are doing.

2; Figure 2 (connected to part 3.1) I think you should comment on the systematic errors in a in cWASPAM3 and Mira5
We added the following to section 3.1. where we comment on Fig. 2:
There is a slight positive offset in a determined from the measurements compared to the value calculated by Gaussian error propagation which is most likely due to an underestimation of the receiver temperatures. Increasing the estimated receiver temperature by 4 K for cWASPAM3 and by 15 K for MIRA5 explains the offset (not shown). These values seem realistic for an uncertainty in the receiver temperature as it is a parameter which is very difficult to determine exactly, e.g. for MIRA 5 the receiver temperature varies between 135 and 151 K for the three different spectrometers (including the RPG-FFT added after the ARIS campaign).

3; 4 Retrieval Why not mention that AoA is the same as measurement response?
Done.

4; Figure 5 (connected to part 4) Why not have a scale for AoA at the top of the figures?
Done.

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5; 5 Intercomparison of profiles I think you should discuss possible reasons for the dry bias of Mira5. Is it perhaps a wet bias of the other two instruments?
There have been difficulties in the non linear retrieval of MIRA 5. Somehow the AVK calculated for this retrieval do not seem to represent the sensitivity of the retrieved profile very well. However, after long discussions among the Co/Authors of this paper and with external people we decided to use this retrieval for this paper even though there were difficulties as the retrieved profiles seem to look reasonable except for that dry bias. We added the following to the section intercomparison of profiles: *The leftmost panel reveals that MIRA 5 has a dry bias of approximately 0.5 ppm (8%) below 0.1 hPa with respect to the three other instruments, which is larger than one standard deviation. EOS/MLS is validated and no significant bias is known at the altitudes of interest. Therefore we assume that the dry bias of MIRA 5 is real. The non linear retrieval of MIRA 5 seems to be less sensitive to the atmospheric state (higher contribution from the apriori profile) than indicated by the AVK. As the apriori vmr is significantly lower than the profiles over the Zugspitze this can lead to a dry bias.*

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 3359, 2011.