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Atmospheric Measurement Techniques Discussions

Interactive comment on "Retrieval of tropospheric water vapour by using spectra of a 22 GHz radiometer" *by* R. Bleisch et al.

R. Bleisch et al.

rene.bleisch@iap.unibe.ch

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General replies

Our paper deals about a new approach to retrieve water vapour profiles using spectra of 1 GHz around the 22 GHz line and we want to show the potential of our approach to retrieve the water vapour profile. Therefore we consider comparisons and extended evaluations of IPW/IWV as being outside of the scope of this paper. We already made some comparisons of integrated water vapour content (IWV) calculated from the retrieval with IWV derived from GPS wet delay and calculated from MIAWARA opacity using the Deuber-formula. This revealed a tendency of underestimation of the IWV by the retrieval, most likely due to the low altitude resolution, making it impossible to

resolve large water vapour gradients in lower troposphere. This can have a significant influence on IWV and minimizes the significancy of such comparisons.

According to the recommendation of referee 2, in a revised version of the paper the discussion about information content is moved before the comparisons. Chapters 4 and 5 are merged and the sections are rearranged in the order: 4.1, 5.1, 5.2, 4.2, 5.3. (Consequently, also the order of figures will be changed).

The averaging kernels and the tests performed in section 5.2 clearly reveal that our retrieval approach delivers information about the verical distribution of water vapour with a gain of information compared to the use of just surface level humidity and opacity. To show this better, Fig. 15 of the paper will be updated (attached figure 1), showing also H_2O from Payerne soundings. Further a new figure and its discussion will be added (attached figure 3) showing the correlation between retrieval and sounding resp. model and sounding. The correlations are nearly identical up to 4 km, whereas above the correlation between model and sounding decrease rapidly in contrast to the correlation between retrieval and sounding.

Specific replies

An additional important point to make here is that obtaining tropospheric water vapor from the spectral method certainly requires a good spectral measurement with minimal instrumental baseline components. This is a much more difficult than the standard method tipping curve measurement. Instead of the current first 3 figures, it would therefore be much more useful to show the spectrum from MIAWARA, and ideally a model-measurement residual.

Attached figure 2 shows a typical example of an averaged total power spectrum compared with forward model calculation. The residuals indicate no significant

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instrumental baseline. The figure will be added in the revised version.

The author should look at Nedoluha et al. J. Geophys. Res., 116, D02309, doi:10.1029/2010JD014728, which contains some discussion of the sensitivity of this measurement technique to tropospheric water vapor for a similar instrument, and shows some spectral plots.

The mentioned paper from Nedoluha et al. is known to us. It deals about the sensitivity of the retrieval of stratospheric and mesospheric water vapour to changes in tropospheric water vapour. Among others, they state that the pressure broadening of the troposperic emissions is too intense to be able to retrieve tropospheric profiles. This statement is obviously true for the bandwidth they are using (500 MHz around the center of the line). Using the doubled bandwidth of 1 GHz (as MIAWARA) allows us nevertheless to get profile informations with a coarse vertical resolution.

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 1427, 2011.

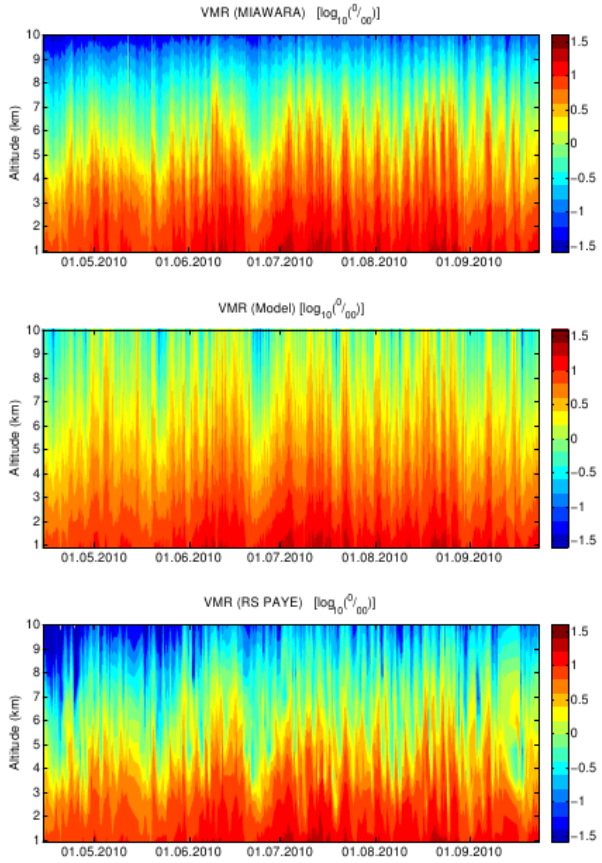

Fig. 1. Adapted version of Fig.15: H2O vmr from Payerne soundings is plotted additionaly

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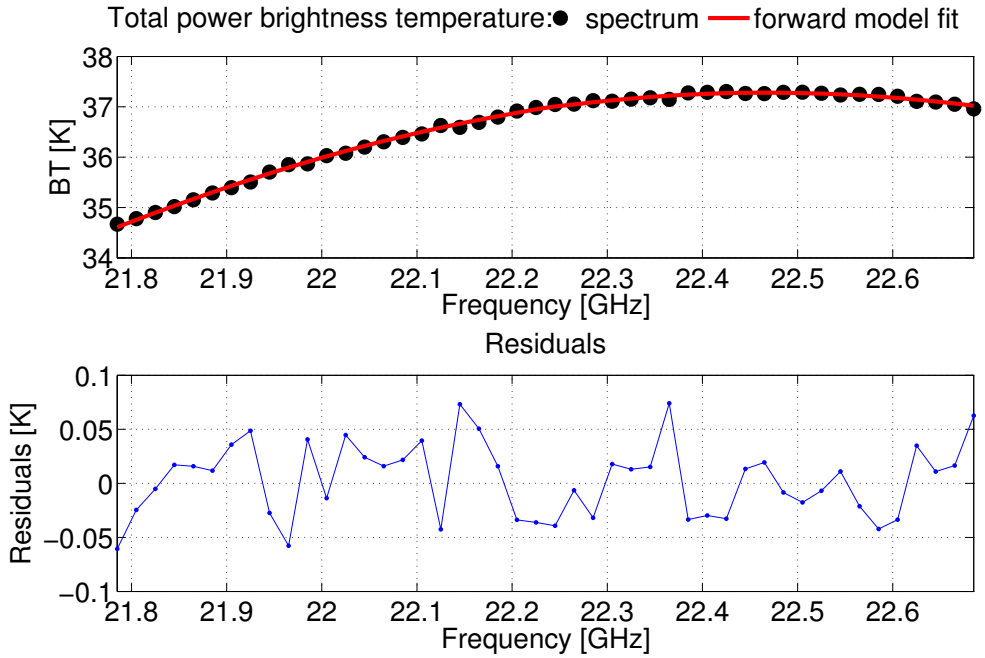

Fig. 2. New figure: Total power brightness temperature spectrum of MIAWARA (2h average) compared with the forward model calculation (top plot) and residuals (bottom plot)

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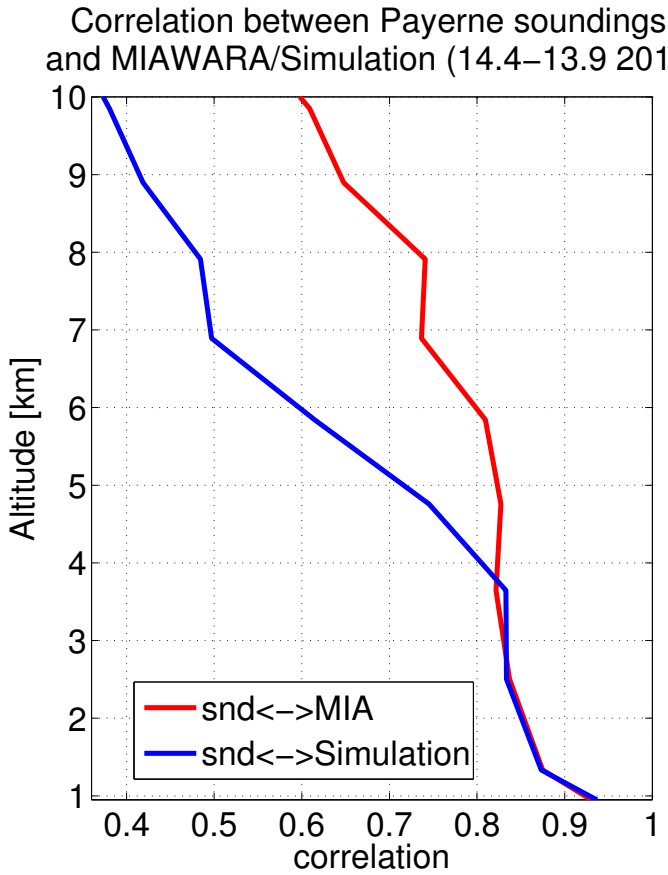

Fig. 3. New figure: Correlation between H2O vmr retrieved from MIAWARA/modelled using the surface value from Zimmerwald meteo station and MIAWARA-opacity against Payerne radiosoundings.

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