Review for „**Determination of low-level temperature profiles from microwave radiometer observations during rain**" submitted to *Atmospheric Measurement Techniques* by Foth et al.

General comments:

The manuscript analyses the performance of temperature profile observations by microwave radiometers during rain. This is a relevant topic as more and more of these instruments are operated continuously, and rainy profiles were usually discarded in the past.

I would, however, like to see a more general recommendation on how and under which circumstances these observations can be used. In the discussion, it needs to be clearly stated which channel/angle combination should be used during operation, and which uncertainties are considered to be acceptable, depending on height above ground and rain rate.

Concerning the radiative transfer calculations, I would strongly recommend using the updated Rosenkranz gas absorption model from 2022/2023, as this version significantly improves the radiative transfer results in the lower V-band.

Specific comments:

Lines 29ff: Please provide a more precise statement about which "high frequencies" become opaque? The center V-band frequencies (around 58 GHz) are already opaque without rain.

Lines 46ff: This motivation can be formulated better, such as: "The method presented here can be applied to standard measurement modes and does not require any changes in measurement setup".

Lines 63ff: HATPRO doesn't measure voltages, the detectors convert the antenna signal into voltages. A calibration is necessary to convert the voltages into brightness temperatures (but not "the voltages are then calibrated to brightness temperatures")

Line 69: Add: "during rain"

Section 2.2.: Why did you base your retrieval training on old RS80 radiosondes? These sondes are known to have a dry bias, and therefore might also bias your retrieval. I would strongly recommend using state-of-the-art sondes (Vaisala RS41) which have been used in Lindenberg for quite some time already.

Section 2.4: It seems you did not use all hourly data from 2000 to 2019 for the retrieval development. That would roughly make 20*365*24=175200 time steps, while you used 58195 profiles. How did you select the data? Are the data evenly distributed over the years and seasons?

Section 3, lines 117ff: Please explain better how spectral retrievals work: Individual channels are highly dependent on each other and can thus be used to retrieve the whole spectrum. Did you apply the spectral consistency check only for zenith observations or for all elevation angles? Please comment on that!

Fig. 3: The y-axis range until +/-60 K makes it difficult to see differences between the channels, especially around 0. I would recommend limiting the range to +/-20 K. By the way, I don't think that 10 K bias for some channels in the no-rain case (3a) is satisfactory, whereas in 3b for low

elevation angles, the agreement is much better. Do you have an explanation for this? For a bias in the input model data, I would expect that the difference changes with elevation angle.

Fig.3, continued: Furthermore, I couldn't find a clear explanation of the results in 3c, concerning the different fractions of rain used. Can you discuss that a bit more? Don't you consider the solid lines for 51.26 and 52.28 GHz (yellow, blue) for low elevation angles as significant deviations? Concerning the figure style: I cannot really distinguish the different lines in 3c neither.

Page 8, lines 191ff: This paragraph is a bit confusing, try to make your statements more clearly.

Figure 4: Please provide a somewhat larger plot! (same for Fig. 7)

Section 4.3: Did you classify the rainy cases using rain rates from the model or from observations?

Figure 8: I would strongly recommend to add a comparative figure (putting the red lines from a,c,e,g and b,d,f,h respectively into one figure). Like this, the additional uncertainties depending on the rain rate can be seen much more clearly. What about the performance of *7v9ϕ* ? I would be interested to see this combination in comparison here as well.