

Interactive comment on “Assessing the potential of passive microwave radiometers for continuous temperature profile retrieval using a three year data set from Payerne” by U. Löhnert and O. Maier

Anonymous Referee #3

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Summary and general comments.

This paper shows the strength and weakness of a Microwave Radiometer for atmospheric temperature profiling over a significant long period of time. The authors want to address very important points: Long term stability and random error using collocated radiosonde; where do systematic differences come from and how can they be removed; how do MWR perform during extreme conditions; what are the data_quality control measures needed in order to maintain the described performance. The study uses the measurements of a HATPRO (humidity and temperature profiling) system op-

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erated at the aerological station of Payerne (MeteoSwiss) and the measurement of the operational radiosonde launched at the site in the time period August 2006 -December 2009. This represents a particularly large data set.

In short, the authors compare the measured brightness temperature (T_b) with the simulated one from the collocated radiosonde in clear sky (they use monochromatic centre frequency, pencil beam, simulation). The authors suggest that water deposit during some of the LN2 calibrations is responsible for some of the jumps in the offset. They look at different possible source of offset: shift of the centre frequency, band pass, beam width effect versus respectively centre frequency, pencil beam simulation. They compute the mean offset for each period in between calibration, recalibrate the brightness temperature. Retrieved the profile from the bias corrected brightness temperature and compare the obtained profile to the same radiosonde for the clear sky case. The retrieved profile in average are unbiased and very accurate in the 1st km. They apply the same bias correction for all sky cases, the results are of similar accuracy, just slightly worse in term of bias and rms. When they classify between day and night, compensating bias show up. In frontal situation the accuracy is better than in the all sky inter comparison.

From this data set the authors have shown that this radiometer is very stable over very long period of time (year) which is a very important point and have produced some part of the error characterisation of the retrieved profile. What is missing to my point of view is the vertical correlation of the error and some comments on the operational feasibility of such calibration method. So with a better characterisation of the error, (see comments), I think this paper is worse to be published, because it shows that at least the radiometer (for the V band) considered in this study is stable over long period of time. It shows to the community that LN2 calibrations are not so easy to perform, can introduce significant bias and need to be checked. Work still needs to be done to get reliable calibration.

Specific Comments

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1) With such a data set and method, the brightness temperatures are extremely well calibrated to the data set and the type of retrieval used. Effects due to radiative model, centre frequency shift, band pass beam width effect are fully absorbed in the calibration and are completely coherent with the statistical method which use the centre frequency, pencil beam approximation and a larger data set of radiosondes from Payerne. Because this radiometer is very stable this calibration will remain valid outside of the data set. In the clear sky condition comparison, it would be interesting to know what is the standard deviation of the bias computed for the period used for figure 5 for each of brightness temperature, this will show some how the link between the noise on T_b and the accuracy of a profile, for a perfectly well calibrated radiometer.

2) For these results to be reproducible we need a perfectly well calibrated radiometer. What the authors should address is how many radiosondes are required to calibrate the radiometer. The radiometer is quite stable but on the lower channel one can see some time evolution in the bias. Would the calibration done using the data in April May 2008 gives equivalent results on the retrieved profile that the data used in June July 2008. Is this calibration method something that can be reasonably done if the radiometer is not located at a radiosonde site. Or could the same quality of calibration be obtained using NWP model profile.

It would be interesting to see if some of the offset are not brightness dependant in particular in the lowest channel.

If the first 50 m of the radiosonde measurements are faulty because of lack of ventilation around the sensor, it might be better to bottom the 50 m of the radiosonde by nearby tower measurement, this might decrease the random error seen in the brightness inter comparison for the highest channel and reduce the rms in the retrieved profile if compared using this bottom profile.

3) For assimilation purpose, when the retrieved profile are assimilated rather than the brightness temperature, it is very important to compute the error correlation of the re-

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rieved profile. The authors should show the error correlation of the retrieve profile. They could also give a profile with a variable resolution which reflects the real resolution. It could be also useful to check if the noise at each altitude is Gaussian. This wide data set gives a good opportunity to evaluate this.

4) On the retrieval aspect, the authors make us think that the compensating bias in the day and night plots, are due to the use of radiosonde at 0 and 12h only. It is not fully clear to me, if this come from the fact that the data set used to compute the retrieval coefficient is not well distributed, or if the method will show no bias in average only on data set who shows the same distribution of profile that the training data set. Could the authors clarify this point. The addition of surface temperature indeed improve the first few hundred metre, but the compensating bias still exist aloft.

5) On the significant weather event, the error is lower than for the general inter comparison. The authors mention that this might be due to the lack of elevated inversion in the profile for which radiometers have indeed low skill. Could the authors show some examples of profile (retrieved profile and associated radiosonde) and how do they compare with the average climatology shifted using the surface temperature. Are the conditions really extreme?

6) The data availability is quite high, the cross check by eye is not an option for operational radiometer as mentioned by the authors. The authors quote a 12 % rejection of data, it would be nice to know how much of this % come from the “by eye” check. The authors mention that the new generation of HATPRO will reject automatically this data, but this would have to be evaluated.

Typo

In the text it is mentioned STDEV, but in all the inter comparison plots we can see RMS, could you precise what are the number.

Line 85 ,one and , should be removed

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Line 584 ,592 TB org, should be TB orig

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