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Interactive Comment

Interactive comment on "Biases caused by the instrument bandwidth and beam width on simulated brightness temperature measurements from scanning microwave radiometers" *by* V. Meunier et al.

Anonymous Referee #1

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Comments to: AMTD-5-8085-2012 "Biases caused by the instrument bandwidth and beamwidth on simulated brightness temperature measurements from scanning microwave radiometers".

The manuscript presents simulations of brightness temperatures for various radiometer designs and evaluates the differences between simulated brightness temperatures that include some of the receiver characteristics (such as the beamwidth and the bandwidth) and propagation effects (such as the earth curvature and the refractivity) and simulations that do not include such effects. The manuscript is generally well written and figures and captions are well readable.

Technical comments:

The simulations and results are interesting, however the largest differences result from mostly unrealistic values of the radiometric specifications/operations. Radiometers with larger beamwidth (> 6 degrees) can't be expected to scan low elevation angles because of the risk of spurious intrusions in the field of view. Therefore only radiometers with narrow beamwidth should be considered for operations at low elevation angles. In addition radars have very narrow beamwidth making the interpretation of coincident measurements difficult unless the characteristics of the instruments are reasonably close. If we consider ground-based radiometers whose beamwidth allows scanning at low elevations (FBHW<3.5 degrees) and that could be used in conjunction with radar operations the differences in the simulations are of the order of fractions of degrees.

Among the instruments listed in Table 1 the ASMUWARA has the largest beamwidth. However, with a 10-degree beamwidth, the ASMUWARA wasn't probably designed for scanning at low elevation angles. Usually radiometers with large beamwidth employ algorithms that correct for the beam approximation (E.g. [1], [2]). But even with corrections the interpretation of the data in relation to the radar narrow beamwidth would be difficult.

The beamwidth of V-band channels is generally less than 2.5 degree in all currently available ground-based radiometers. Based on Fig. 13 the effect would then be in the noise level at all elevation angles. So the 8 K overestimation mentioned in the summary refers to a channel at 50 GHz with a 10 degree beamwidth. I don't think any of the radiometers currently built meets that specification.

Similarly the 11 K bias mentioned in the summary for the W-band channels corresponds to a radiometer with 10-degree beamwidth. This is unrealistic in the W-band. Actually most of the W-band receivers have beamwidth of less than 2 degrees, which

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again would not cause a large effect based on Fig. 13.

In my opinion the study would be more valuable if, to summarize the simulation exercise, the authors could determine a set of requirements (for example frequencies, desired noise level, optimal bandwidth/integration time, beamwidth and lowest scanning elevation) necessary to achieve a meaningful synchronized coordination of operations between a radiometer and a radar, then work out the uncertainties and biases and then come up with a possible optimal design.

For example the choice of narrow non-overlapping bandwidth in most profiling radiometers is due to the fact that they sample high-resolution channels on the shoulder of the absorption line to obtain a vertical profile. For a radar-radiometer coordinated operations if profiling is necessary then one can't enlarge the bandwidth arbitrarily. If profiling is not necessary then there could be a set of optimal frequencies that allow the optimization of the design (i.e. larger bandwidth, choice of appropriate beamwidth, noise optimization, etc.).

References [1] E. Motte, P. Ricaud, B. Gabard, M. Niclas, F. Gagneron, "A 22-GHz Mobile Microwave Radiometer (MobRa) for the Study of Middle Atmospheric Water Vapor", IEEE Trans. Geosci. Remote Sens., vol. 46, no. 10, 2008.

[2] L Martin, M. Schneebeli, C. Mätzler, "ASMUWARA, a ground-based radiometer system for tropospheric monitoring", Meteor. Zeitsch., Vol. 15, No. 1, 11-17, 2006.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 8085, 2012.