Review AMT-2021-9:

Improving thermodynamic profile retrievals from microwave radiometers by including Radio Acoustic Sounding System (RASS) Observations

ANSWERS to REFEREE

We wish to thank you very much for the additional re-reading our manuscript and for offering two comments towards its improvement. We believe these notes are useful. We hope that these changes will make our manuscript clearer and more transparent. Please, find below our answers in red.

Minor corrections:

Line 330:

- Please, make explicit the number used for LWP uncertainty into the following sentence, as "large" is only relative: "LWP is arbitrarily assigned in Xa, with large values chosen for its uncertainty in Sa, so that it does not impact (constrain) the retrieval"

We included additional sentence: "**Presently, the assumed uncertainty in LWP in the prior is assigned to 200 g/m^2 in TROPoe configuration file**".

Fig. 1A:

- Please, add the retrieval performances from non-BC MWRzo/MWRz to Figure 1A. As is, the manuscript gives no evidence that TROPoe BC provides better retrievals than original non-BC Tb. Actually, Fig.1A suggests that TROPoe BC provides no better retrievals than NN (based on non-BC Tb), specially in the boundary layer. If the TROPoe BC does not improve performances significantly with respect to non-BC MWRzo/MWRz, that should be clearly stated. In such a case, I'd suggest mentioning alternative BC sources to be considered, e.g. based on NWP profiles (as used in https://doi.org/10.5194/amt-13-6593-2020 and references therein).

We made two additional sets of TROPoe retrievals for zenith and zenith-oblique scans without any bias-correction and included those two new statistics profiles in Fig. 1A (below) and included the text:

"**The PRs without any Tb bias-correction (dashed lines in Fig. 1A) clearly indicate that the BC is useful and needed, showing very noticeable degradation in all three statistical measures above 3 km, and larger RMSE and bias in 0.5-1.5 km AGL compared to TROPoe BC method**".
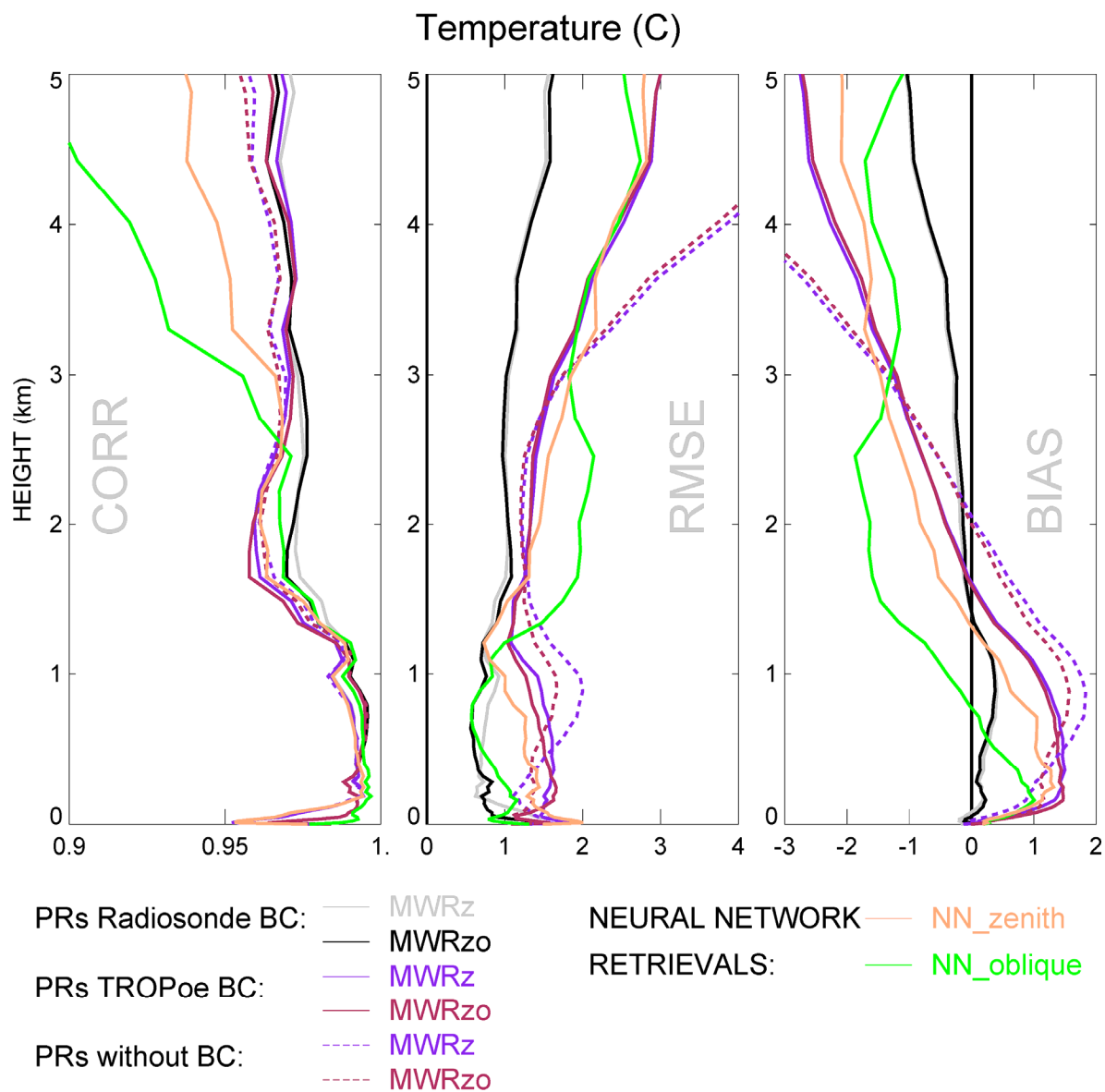
Temperature (C)

Fig. 1A. Pearson correlation, RMSE, and mean bias for temperature profiles for MWRz in grey (and purple) and MWRzo in black (and maroon) when the radiosonde BC (and the TROPoe BC) method is applied. **TROPoe temperature retrievals without any bias-correction are shown for MWRz in dashed purple and for MWRzo in dashed maroon.** Included in this figure are the NN temperature profiles, from the zenith scan (in beige), and from the averaged oblique scans (in green).