Submitted on 07 Sep 2022
Anonymous referee #3

General comments:
There are a few points that need to be taken into account before the manuscript can be published.

The authors would like to thank the reviewer for the time and effort to review this manuscript and is very much appreciated. Please find the responses to each comment below.

Detailed comments:
-In plots 3,6,8,10, the values of MBE (and others) in the layers close to ground can't be clearly distinguished. You should think of another way to present the data, maybe by removing some height layers? In addition, the differentiation between $p>0.05$ and $p<0.05$ is not very useful here. For sake of simplicity, you could just use the same color and don't differentiate whether the bias is significant or not.

Response: For clarity of error profiles at the lower heights, Fig. 3 is replotted up to 1 km and Figs. 6, 8 and 10 are replotted up to 2 km only and are submitted in the Supplement file (Fig. S1 – S4).

- Lines 206-208: As you are using only off-zenith observations, the larger biases for temperature profiles compared to other studies may also arise from the fact that you didn't use zenith observations. See e.g. Cimini et al. 2011 or Cimini et al., 2015, who show that zenith retrievals might provide smaller biases. This should be mentioned in the discussion.

Response: For limited period, we compared the MWR retrievals between off-zenith and zenith retrievals and we found out that off-zenith retrievals are clearly better during precipitation days, consistent with Xu et al., 2014, while those retrievals are somewhat comparable to zenith retrievals during non-precipitation days. As a result, we decided to use off-zenith retrievals in this study. But we agree that there could be comparatively lower biases for zenith retrievals during non-precipitation days. This note is added to the line 207-208.

- Lines 415-422: This part needs to be rephrased, I think there is still some old text in the new version.

Response: The suggested part is rephrased in line 418-422.

- Line 691: You mentioned the newly Acal method by Radiometrics which will improve the calibration. Can you just give some information on the principle that is used for this calibration method, if it doesn't involve liquid nitrogen? Is it still an absolute calibration that is independent of external data sources? This should be shortly mentioned in the discussion.

Response: Automatic calibration (Acal) continuously evaluate and calibrate the instrument and reduces the biases in the brightness temperature compared to biannual liquid nitrogen calibration. Acal does not require access to internet and/or other data sets otherwise not embedded in the software. We do not have further information from the Radiometrics about Acal as of now as they are planning to release details very soon in about a couple of months. To answer your questions, as a courtesy Radiometrics provided us the information about Acal to share as below:

> *"ACal utilizes an ensemble of independent, exploitable, physically constrained atmospheric relations that - when imposed simultaneously - provide a verifiably accurate framework by which the near-entirety (> 3 sigma) of the site-specific brightness temperature joint probability distributions can be fully characterized such that measured quantities can be statistically compared to expected quantities for the purposes of establishing and correcting calibration drift".*

As mentioned in the manuscript, we have been testing Acal results extensively at multiple sites, and we are excited about the results that significantly reduces cold biases in the MWR retrievals.