EGUsphere, referee comment RC2
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Comment on egusphere-2022-757

Xavier Calbet (Referee)

Referee comment on "Evaluation of tropospheric water vapour and temperature profiles retrieved from MetOp-A by the Infrared and Microwave Sounding scheme" by Tim Trent et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-757-RC2, 2022

This paper describes the validation of the RAL IMS water vapor and temperature profiles retrieved from infrared hyperspectral and microwave sounders. This is useful if this dataset is to be used as a CDR for climate applications. The paper is well written and well structured. I therefore deserves publishing.

Some minor comments the authors may wish to consider:

1. Page 3 line 63. Section 2.Data. The retrievals are not only IASI based, so you might want to add something like "and microwave sounder data".

2. Page 4. line 99. You might want to add something like "This is justified by the finding that WV inhomgeneities within the FOV do cause a significant modification in the results of the radiative transfer modeling (https://amt.copernicus.org/articles/11/6409/2018/, https://cimss.ssec.wisc.edu/itwg/itsc/itsc23/presentations/oral.2.01.calbet.pdf).

3. I would be interested in seeing the results of the bias corrections. If the inhomogeneity correction hypothesis is true, the biggest contribution to this bias will come from inhomegeneities in WV within the FOV. So this could be a way to measure them. They potentially can be correlated with turbulence.

4. I do not completely understand what DOFS is. And along with it Fig. 3. Also in Fig. 3 you say you plot DOFS but in the scale you show "% of profiles per bin". Please explain this better for people not familiar with DOFS. One or two sentences should be enough.

5. Please explain which radiosondes are used in GRUAN. There is a relatively big difference in WV between RS92 and RS41, being the latter much more precise.

6. Page 10. line 133. I believe for x_(z) you mean "layer mean profile" and not "weighted layers". This is confusing since in the next couple of sentences the term "layer mean profile" is used. Please correct or explain better.

7. Please note that RS92 sondes do not measure very well with low WV. This usually happens above tropopause. This is probably why the biases are much bigger at higher altitudes. You might want to repeat the statistics using only levels below tropopause. Or, equivalently, with small GRUAN uncertainties. This will most likely reduce the biases at high altitudes. Something to consider.

8. Page 10. line 206. Change "i) the dataset is being validated" with "i) the dataset being validated".

9. Please explain in the text what MAD is when it first appears.

10. Fig 5. and 6. If you use a smaller collocation window than 3 hrs and 100 km, the MAD will certainly disminish. Something to consider as en exercise.

11. Fig. 8. Why is there less cases with higher cloud fractions? Can you give an explanation or hypothesis?

12. GRUAN WV measurements are bias corrected with, mainly, an estimation of the incident radiation from the Sun. This is critical for RS92 sondes. Not so much for RS41. Are ARSA sondes also bias corrected in WV?

13. Are ARSA sondes RS92? Are they corrected from WV biases are they are in GRUAN (taking into account radiation)? Please explain in the paper. This would explain the day night bias difference in ARSA.

14. I would separate discussions and conclusions section. The section is too long woth too many comments for a conclusion.

15. I would recommend to draw conclusions from night time sondes only. Since we know

day time sondes have biases. Especially if they are RS92 sondes and even more if they are not bias corrected in ARSA. Your conclusions on bias trends might vary.

Congratulations to the authors for this nice paper!