Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC1
https://doi.org/10.5194/amt-2022-12-RC1, 2022

Comment on amt-2022-12

Anonymous Referee #1

Referee comment on "Passive ground-based remote sensing of radiation fog" by Heather Guy et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2022-12-RC1, 2022

Overall evaluation

A very relevant, interesting and well written paper perfectly in the scope of AMT. I recommend for publication after the following comments have been adressed:

General comments

- Here we only look at cases were we know fog develops. How many false alarms for fog onset to expect? Can you please comment on this?
- The commercial MWR have a surface temperature sensor incorporated. With this cheap addtion, the retrieval can be constrained at the lowermost levels. Excluding these is scientifically possible, however, it does distort reality if we consider the instrument as a whole (MWR plus meteo station). Please account for this in your manuscript, not just in the appendix. You have done all of this in appendix B, and I found it relevant enough to include Fig B1 and B2 to the main manuscript in place of Fig 5 and 7.

Specific comments

- l. 35: on clear evenings with light winds -> on clear evenings with no or light winds (otherwise one might think that wind is needed)
- l. 54: The DIAL by Vaisala claims to have a lowest usable range gate at 50 m (see e.g. Mariani et al. 2021). Anyway, I agree that in the end this does not change a big deal for the usability for fog.
- l. 66: I don't like the +/- here as the direction of the sign of the change has opposite influence on the melting potential.
- l. 68: It is an over-simplification to reduce MWR to K- and V-band. What about "... that measure downwelling radiation. Commercial sensors for temperature and water vapour

profiling typically operate 14-35 spectral channels at 22-31 GHz and 51-58 GHz.
- l. 77: "Despite the promise of MWRs to improve fog forecasts". Please re-word the beginning of this sentence. I judge that the above-cited references (Martinet, ...) demonstrated that the improvement is more than just a "promise" that might not be fulfilled.
- l. 104: your study only assess the situation of supercooled radiation fog. Would you expect your results to also be representative for fog>0°C? Why (not)? Please elaborate in the manuscript. Ok, see you mention it is not guaranteed to be representative in Sect. 4, but maybe you want to give an indication here already.
- l. 173: here you study only cases without cloud. Please comment on what effect clouds above fog would have on AERI observations.
- l. 249: I undertand that you are limited to max altitude 10m by the height of the tower. However, this comparison is most probably artificially penalising MWR which, with its lower vertical resolution, might perform better when comparing to 20 or 50 m. And having a somwhat thicker layer might also make sense from a physics point of view. Please comment on this.
- l. 317: "This suggests that most of the information ... comes from the prior" -> It would be interesting to see the measurement response (i.e. the sum of the averaging kernels). This would allow us to judge how much info comes from the prior rather than just guessing.
Fig. 8: Please specify the extent of the central box in the legend
Appendix B: Can you also show the corresponding figure for the 0-10m lapse rate with and without surface temperature. I would suggest to use this instead of Fig. 6
- l. 388: ... Results of Appendix B... --> you probably wanted to add a reference to Appendix B
- l. 427: "AERI contain more information about the temperature near the surface than the MWR measurements". you might add something like "what indicates the importance of including surface observations to the retrieval if available from the MWR's weather station"