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Comment on amt-2022-85

Anonymous Referee #2

Referee comment on "Evaluation of the New York State Mesonet Profiler Network data" by
Bhupal Shrestha et al., Atmos. Meas. Tech. Discuss.,
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Review of Evaluation of the New York State Mesonet Profiler Network Data

By Shrestha, Brotzge, and Wang (AMT-2022-85)

General:

This study presents an evaluation of part of the New York State Mesonet, with several stations providing microwave radiometer profiles of thermodynamic quantities and profiles of winds from a Doppler lidar. Multiple years of data are considered, and three sites located near radiosonde launch sites are evaluated by comparison to those soundings. Errors in thermodynamic quantities are large (and differ between clear-sky, cloudy, and precipitation conditions), and to resolve these errors a linear regression method is developed and applied to the MWR data. A brief case study is presented, that of a thunderstorm that would not have been characterized with the radiosonde network. Finally, some profile-related thermodynamic parameters are derived from the MWR and evaluated, but an opportunity was missed to evaluate important stability-related metrics like the Richardson number that would be available from conventional radiosonde datasets.

A manuscript like this, presenting a new, publicly-available dataset, could be of interest to the AMT readership. The main novelty is the correction applied to the MWR, but insufficient detail on that correction is provided for a reader to understand the steps involved or how to implement a similar correction on a different dataset. I would recommend that the authors present this correction in more detail, and that the section on derived parameters be expanded to include the Richardson number and perhaps the boundary-layer height as well. The figures should be improved as discussed in my comments below.

Major:

- The section on the "Correction to MWR biases" requires more detail. As lines 464-6 are written, it is not clear if the correction is derived separately for cloudy, clear, and precipitation days. Not enough information is given for a reader to attempt to replicate this correction. Are the profiles in Figure 11 taken from the 25% of the dataset used for testing, or from the 75% training? (I would presume the "testing" portion, but it is never explicitly stated.) Is this correction something that could be applied to other datasets in other locations? If so, what steps should a researcher take?
- Some profile-related thermodynamic parameters are derived from the MWR profiles and briefly evaluated in section 4.6. Because both winds and thermodynamics are available from the RS, why not combine the MWR and the DL datasets to calculate stability metrics like the bulk Richardson number (Ri)? That would be a very useful test of the utility of the network. An important opportunity was missed here. The Ri could have been incorporated into the discussion of the thunderstorm case study as well. Similarly, the planetary boundary layer (PBL) height is easily calculated from the DL dataset, and that could have been compared to sounding-based estimates as well. Or, if the radiosonde dataset is not adequate for calculating the PBL height, pointing out the utility of the new mesonet capabilities could be a nice addition to the paper.

Minor:

- Line 133: can you comment on how often the lidar can actually retrieve wind estimates

from 7000m? We see later that almost no data is available above 3km, so that should be noted here.

- Figure 2 would be more intuitive with height on the y-axis. The colors are difficult to distinguish (especially for red-green colorblind readers) so please consider using different linestyles.
- Lines 200-205: how sensitive is the agreement between the radiosondes and the doppler lidar to the averaging time selected?
- Near line 210: please explicitly state which RS sites were used to train the neural nets for each of the MWR sites
- Line 252: better to provide a textbook reference than a link that disappear over time.
- Fig 3, 6: again, please don't rely on red-green differences. Use colors that are more easily distinguishable or also use linestyle differences
- Why doesn't Fig 4 also include Stony Brook?
- Line 347: explicitly point out the elevated inversion layer near 1 km in Fig7a, near 2.5km in Fig7b, etc.
- Line 459-460: write these statements out explicitly instead of using the confusing parenthetical formulation.
- Figure 12 relies on the rainbow color table although extensive literature is available showing that it is suboptimal (Light and Bartlein, 2004; Stoelzle and Stein, 2021)

References

Light, A. and Bartlein, P. J.: The end of the rainbow? Color schemes for improved data graphics, *Eos Trans. AGU*, 85, 385–391, <https://doi.org/10.1029/2004EO400002>, 2004.

Stoelzle, M. and Stein, L.: Rainbow color map distorts and misleads research in hydrology – guidance for better visualizations and science communication, *Hydrology and Earth Systems Sciences*, 25, 4549–4565, <https://doi.org/10.5194/hess-25-4549-2021>, 2021.