

Referee comment on *The first decadal-scale ground-based microwave radiometer dataset in China: Brightness temperature and thermodynamic profiles from Xianghe (2013–2022)*, by Gong et al.

19 April 2026

1 General comments

The dataset contains around 10 years of ground-based microwave radiometer (MWR) observations at Xianghe Integrated Observatory in China. It consists of calibrated zenith brightness temperatures (TBs) in the K- and V-band channels, integrated water vapor (IWV), liquid water path (LWP) and a set of associated flags with a one minute resolution. It also contains retrieved temperature and relative humidity profiles with a 10 minutes resolution computed using two different retrieval methods.

The associated manuscript describes the methodology used to construct the dataset. It details the quality control applied to the data, the retrieval processes and shows a validation of the data quality. It finally shows some case studies that exemplify how the data can be used. For the validation of their dataset, the authors compared the measured TB against radiative transfer simulation from model data and used radiosonde data to validate their retrieved temperature and humidity profiles. The authors also show some comparisons of their retrieved profiles against the manufacturer products.

In general, such high temporal resolution and long-term ground-based MWR observations are valuable and can provide interesting insights on the atmospheric boundary layer and its evolution. As exemplified by the authors, these measurements can be used in a variety of atmospheric studies (e.g. air quality, atmospheric trends, ...) and they can serve as validation data, e.g. for numerical weather predictions (NWP). The provided dataset is relatively easy to use but it does lack some documentation and some of the variables are not well defined in the manuscript nor in the data repository. The dataset and associated manuscript fits the scope of ESSD and my recommendation would be to accept it for publication after addressing the specific comments below.

2 Specific comments

2.1 Dataset

- The dataset is lacking some documentation, especially in explaining what is contained in the different files. Some of the variables are explained in the manuscript but some are undefined (e.g. cflag, IRT1 vs IRT2, ...). Also the units are generally missing from the dataset and should be specified for all the variables. Although most are obvious, some are not, e.g. datetime (is this UTC or LT ?) or the altitude (I guess m.a.g.l. but this should be specified somewhere). Proper variable naming is missing in the *2013-2022final_merged_RH.csv*
- To address these points, the provided dataset would highly benefit from an additional README file.
- The origin of some quantities is unclear, e.g. LWP and IWV as they could in principle be retrieved (from either methods) or directly taken from the manufacturers retrieved values.

- The temperature and RH profiles should be flagged to identify which profile were retrieved from OEM or from the DNN method in the dataset. Also, the fact that the dataset is composed of merged profiles from two retrieval methods based on weather conditions should be clearly stated in the data repository.
- Uncertainty estimates should be provided in the dataset.
- Adding the meteorological parameters measured by the AWS could also be beneficial for a potential user of this dataset.
- Also, is there a reason why the vertical grid is irregularly spaced ? This could be specified somewhere in the manuscript, e.g. when giving more details on the retrieval methods.
- Although I don't think it's required from ESSD, sharing the retrieval code(s) could be a great asset and of interest for the MWR community.

2.2 Manuscript

2.2.1 Measurement site

Please add a short description of the measurement sites in Section 2. Especially the type of environment where it's located and the distance to the other measurement (RS, which is only mentioned in 1.266, or PM2.5).

2.2.2 Retrieval methods

- In general, the authors could add a bit more details on the retrieval methods used to compute the thermodynamic profiles. For the OE retrieval, you should state which quantities were retrieved and add more information on the retrieval setup (e.g. noise covariance matrix) and maybe state the altitude range where the retrievals can actually be trusted and what vertical resolution can be expected. The uncertainty derived from the OE could be added as well as this, together with the vertical resolution will greatly impact any analysis conducted with this dataset.
- It is unclear to me whether scanning observations were performed during the 10 year. I think it is a key information to provide in the manuscript (and also whether they were used in the retrieval) and if so, it should be either added to the dataset or specified that only the zenith observations are shared.
- The origin of the IWV and LWP values should be clearly indicated in the manuscript and dataset as this could be taken either from the manufacturer or from the retrievals.
- Did you perform any kind of quality check on the retrieved profiles ?
- The justification on why this merged retrievals approach was chosen should be more detailed as this remains quite vague for the reader, e.g. in Section 3.3.

2.2.3 Comparisons of thermodynamic profiles

- It is an interesting approach to construct a the profile dataset out of 2 different retrieval methods but it would be interesting to compare how these 2 methods compare to each other. In fact, this comparison would allow the reader to judge whether the DNN is actually performing better under cloudy scene and provide some justification for the merged retrievals approach.
- I disagree with the 2 last sentences of Section 3 (line 353 to 356). We lack information on the manufacturer retrieval and it's likely that they are also using some kind of Neural Network approach. So the difference could be explained by the training dataset used as much as in the method. Also, the reader can not appreciate the last sentences as no comparisons are shown between the OE and the DNN approach, especially not under different sky conditions. The same can be said of the (2) of the Conclusions (1.492).

3 Technical correction

In addition to the point mentioned above, the followings minor points could further improved the quality of the manuscript:

- 1.28-29: change "MWR's self-developed products" by something more meaningful, e.g. "manufacturer's retrieval". Similarly, the term "LV2" should be replaced by something more meaningful (e.g. manufacturer, RPG, ...) throughout the manuscript.
- 1.33: SBI acronym should be defined in the line above.
- 1.48: here you could also add a reference to Thomas et al. 2025
- 1.96: Specify which version of the HATPRO was used.
- 1.126: maybe replace "electromagnetic" with "radio-frequency" ?
- 1.135: can you maybe add a sentence justifying the "singular value check" ? Were there a lot of data removed with this check and was this due e.g. to a specific issue, e.g. the radome wettening ? Also maybe I'd rename this check as an "Outlier detection" step.
- Table 1: IRT threshold for the cloud checks should be specified and justified.
- Table 1: for nflag=3, the checking conditions should probably be n1=1 OR n1=2 no ?
- 1.200: probably the word "accuracy" and "efficiency" should be exchanged ?
- 1.211: can you give more details on how the dataset was matched ?
- Figure 2: the colormap used in this figure does not comply to the journal guidelines, please consider changing it.
- Figure 3: the colormap design is somehow misleading as the zero bias is not centered in the colorbar.
- 1.305: for the reference truth, why is ERA5 mentioned here ? This is not used further for the profile validation (only for TB simulation) or did I miss it ?
- 1.339: although the temperature bias is small, it does look like it exist from Fig. 6.
- Figure 6: could be worth to state in the legend that the profiles shown here are now from the DNN retrievals, whereas Figure 5 showed the OE-retrieved profiles.
- 1.373-374 and Table 4: how do you define the "available" sample here ? Does this refers to the good quality, unflagged data ? Also do I understand correctly that the percentage refers to proportion of available data out of the total sample. Could have been interesting to have the proportion of available data out of the full year instead, the numbers would have been lower but the information equally valuable.
- Figure 7: the red and pink colors are not so easy to distinguish on this figure.

References

Guillaume Thomas, Pauline Martinet, Pierre Brousseau, Philippe Chambon, Jean-François Georgis, Maxime Hervo, Thierry Huet, Ulrich Löhnert, Emiliano Orlandi, and Vinciane Unger. Assimilation of ground-based microwave radiometer temperature observations into a convective-scale nwp model for fog forecast improvement. *Quarterly Journal of the Royal Meteorological Society*, 151(766):e4893, 2025.