

Response to Reviewers

We would like to sincerely thank the reviewers for their professional comments and helpful suggestions. We believe they help us to improve the manuscript significantly and provide many useful ideas to our work. We have revised the manuscript according to the reviewer's comments and answered the reviewer's question point by point below.

Reviewer comments are in italic blue and our responses in black, the manuscript changes are in red.

Reviewer 1

Reply to comments

- *l. 213: "... to close the reference data.". I think this part of the sentence is incorrect and suggest to remove it.*

Reply: Thanks, revised.

Reviewer 2

Reply to comments

General comments:

- 1. It is good to see the collocation database has broader coverage in fig.4, even though the samples in most areas are still limited. As for the retrievals of thin ice clouds in the testing experiments, I still feel uncomfortable about the NN results. Figure 11 and the first plot of fig. 13 suggest that the capabilities of IWP retrievals using MWHS measurements are around 1 kg m⁻², and the retrieved IWP below this threshold will be significantly biased even when we have idealized prior knowledge. Both conclusions are not in agreement with previous studies.*

Reply: Thanks for your comment. I think the conclusions are consistent in general, the main inconsistency is due to the cloud filtering network, and the performance of microwave channels is limited. The IWP threshold of 1 kg m⁻² is also caused by cloud filtering, it is not obvious in Fig. 9 (IWP retrieval without cloud filtering).

Further research will be focused on this issue.

- 2. I think it is fine to publish this manuscript to present the latest algorithm development with FY MWHS measurements for potential ice cloud products in the future. Considering that the collocation database in this study only contains one-year data and the number of cloudy samples is relatively small (<1e5), I suggest that the authors should keep improving the database in the future research since it is one of the most critical elements in the NN algorithm.*

Reply: Thanks for your suggestion. The collocation database is quite important in NN retrieval and the result is limited due to the one-year samples. More years of collocation data will be included in the future study.

Technical issues:

- 3. l. 43, 52: Instruments like AMSU and GMI are referenced without introducing what they mean.*

Reply: Thanks for your comment. These instruments such as AMSU are referenced since they have similar channels to FY-3B/MWHS (but these sensors are without polarization channels) and have been used to measure IWP. This introduction has been added. GMI is referenced to demonstrate that the polarization differences are associated with ice clouds and this is described in the same paragraph (l. 53-57).

4. l. 86: Descriptions like “subsequent” and “in the end” need to be more specific.

Reply: Thanks for your comment. The descriptions have been revised as:

“The IWP retrieval results and analysis are discussed in the Sect. 4.1 and Sect. 4.2. The network application on tropical cyclones and the global mean map are shown in Sect. 4.3, with conclusions in Sect. 5.”

5. l. 139, 154, 166, 169: number needs to be written in the right format. For example, 1207731 should be 1 207 731.

Reply: Thanks, revised.

6. Fig. 2: the colorbar of panel(b) needs to be added.

Reply: Thanks, revised.

7. l. 197: Fig. 6 should be Figure 6

Reply: Thanks, revised.

8. l. 239-242: This figure does not fit the context here and it should be moved to section 4.3.2.

Reply: Thanks, revised.

9. Fig. 9: Channels for the y-axis need to be indicated.

Reply: Thanks, revised.

10. l. 321: use $g\ m^{-2}$ instead to make the unit consistent.

Reply: Thanks, revised.

11. l. 332, 334, fig.12: change channels like 183-7 to 183 ± 7 for consistency with fig. 4.

Reply: Thanks, revised.