

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2022-753

Anonymous Referee #2

Referee comment on "Convective organization and 3D structure of tropical cloud systems deduced from synergistic A-Train observations and machine learning" by Claudia J. Stubenrauch et al., Atmos. Chem. Phys. Discuss.,
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Review of "Convective Organization and 3D Structure of Tropical Cloud Systems deduced from Synergistic A-Train Observations and Machine Learning" by C. Stubenrauch et al. (Submitted to ACP)

Summary and Recommendation:

This study aims to study convective organization and dynamics of upper tropospheric clouds over the global tropics using satellite datasets and ERA reanalysis products. The authors apply novel machine learning method to merge these datasets in order to fill in the gap in these dataset to obtain a fully-connected understanding of tropical convective systems. Overall, I commend the authors for writing such a comprehensive manuscript and I really liked the scientific analyses presented here. I specifically liked the authors efforts to connect dots between convection, cloud systems, and organization using multiple metrics so as to provide a better idea of tropical convection. However, I think that manuscript needs some restructuring as currently it looks like a lot of ingredients are mixed together but it didnt result in an edible dish. I got lost and a bit confused in section 3 as the authors jump between multiple thoughts and I couldnt connect the dots well. Therefore, I recommend **major revision** to the manuscript.

Comments:

1) First, some figures are highly pixelated (Figures 3, 7, 10, 11) and therefore I recommend providing high resloution version of all the figures.

2) I was wondering that whether the authors performed any tests regarding the variables of interest? For e.g., did the authors test other atmospheric state variables to predict the cloud properties? If not, can the authors comment on how they came up with these input/output variables. It would also be useful if the authors can comment on relative importance of each input variables, if possible. This will aid the readers to choose which variables are more important and significant for cloud properties and rain classification.

3) I suggest adding a schematic of the designed ANN as it would be easier to visualize the connected network and their hidden layers.

4) Previous studies (de Szoeke et al. 2017, Garg et al., 2020) have shown that cold pools have a strong relationship with tropical convection and specially with precipitation and convective areas. I highly recommend connecting these results with global tropical oceanic cold pool properties shown in these studies as it will help the authors connect dots between clouds, precipitation and convection over the global tropics.

5) Line 390: Correct "MSCs" to "MCSs".

6) I suggest correcting TB to T_B throughout the manuscript.

7) I recommend summarizing the conclusions section in some take-away points so that it better concludes and summarize your major points. Currently the conclusions section is also not linked at all.

8) In the Code/Data availability, the authors have provided links to the relevant datasets but I am just wondering if the authors intend to provide open source code of their ANN as well?