

Atmos. Chem. Phys. Discuss., referee comment RC2
<https://doi.org/10.5194/acp-2021-154-RC2>, 2021
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Comment on acp-2021-154

Anonymous Referee #1

Referee comment on "Impacts of tropical cyclones on the thermodynamic conditions in the tropical tropopause layer observed by A-Train satellites" by Jing Feng and Yi Huang, Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-154-RC2>, 2021

General: The authors have chosen a topic, modification of the thermodynamic structure of the tropopause by organized convective systems, that is both timely and interesting. This is an important topic because an accurate understanding of diabatic convective processes at the tropopause in the tropics and subtropics could impact the modeling of climate response to increased convection caused by rising surface temperatures. The analysis uses retrievals of temperature and water vapor profiles from AIRS, combined with a Radar-Lidar estimation of cloud ice water content to address an old and on-going debate about whether overshooting convective plumes can hydrate the lowermost stratosphere. It is refreshing that the authors have provided an alternative to the very coarse-resolution MLS water vapor profiles to address this question, with the strong benefit of having a co-located retrieved temperature profile. The cyclone-centered coordinates are a welcome way to organize the observations. I am recommending that this paper be accepted with some minor changes that are listed in the attached document. In addition, vertical resolution around the tropopause for each data set/retrieval needs to be stated explicitly, some references ought to be consulted and updated to reflect the most current thinking and the development/uncertainty of satellite algorithms, for DARDAR-cloud and for the brightness temperatures. Uncertainties and potential sampling biases need to be discussed. Are the retrievals representative? How many AIRS-DARDAR combined profiles did not converge (I am only finding the number that did converge). What do the authors think about diurnal changes? Are these relevant to their results? The choice of 16 km as a threshold for "overshoots" seems arbitrary and creates awkwardness for the interpretation because it often includes the cold point. Many tropical cyclones extend much higher than this at their cores, sometimes to 18 km. I'm not recommending that the authors redo the analysis, but acknowledgement that "overshoots" may instead be "cloud tops" ought to be included. Presentation of the new AIRS retrieval technique adds information and shows good promise, and it would be good to also see the authors present and understand the limitations of this technique.

Please also note the supplement to this comment:

<https://acp.copernicus.org/preprints/acp-2021-154/acp-2021-154-RC2-supplement.pdf>