Response to Review Comment 2, acp-2021-154

This is a very thorough study of a relevant topic, with a number of interesting results. The analysis is careful and detailed, and the manuscript is well organized and well written. For these reasons I recommend publication with minor comments.

Thank you for your positive comments on this manuscript. Following your suggestions, we rewrote the abstract and greatly expanded the Section 2 to briefly describe the synergistic retrieval and A-Train instruments used in this study.

Here are those minor comments:

The use of CIWV to represent water vapor amount above a certain layer is non-standard and thus a bit confusing. 'Column integrated' implies total in the entire column; a web search shows many examples of this usage: https://www.google.com/search?client=firefox-b-1-d&q=column+integrated+water+vapor. One suggestion is to use "Layer Integrated Water Vapor", whose meaning should be immediately apparent.

Done. Thank you for pointing it out.

A few more details on the analysis are needed in the Abstract. Please explicitly mention the A-Train instruments used and what quantities are examined. Also, please expand briefly on the synergistic retrieval. What specific instruments does it use? A sentence or two should suffice. Also, how are cooling rates estimated. Again, a sentence or two will suffice.

Following this suggestion, we rewrote the abstract and added necessary descriptions to instruments and methods.

Finally, change 'convections' to 'convection'.

Done.

Line 118. Please state which two (or more?) AIRS L1B frequencies are used to estimate brightness temperature.

Done.

Include the OT, NOT, etc. definitions in figure 2 caption. Otherwise, terms for quantities in the figure cannot be fully understood without knowing where in the text the figure is discussed.

We have re-order the figures and corresponding texts so that the schematic plot and the definition show up earlier.

Line 339. Change 'cools' to 'cool'.

Rephrased.

Line 463. Change "under overcast cloud conditions" to "for overcast cloud conditions" or something similar. Please don't use "under" because it implies beneath the clouds.

Done.