

Point to point responses, ACP-2021-154

Page 4, lines 95-100:

This isn't stated correctly. The Lidar does not measure particle concentrations, and can observe below the highest clouds if they are thin. The Radar doesn't measure clouds with small particle sizes in a profile (so it doesn't always provide the full profile).

Suggest you state this instead:

The lidar signals are sensitive to cloud particles at all sizes but are quickly attenuated in thick clouds. The radar is not sensitive to clouds with effective particle sizes smaller than 40-50 microns, but can observe thick clouds and precipitation in storm cores.

Thank you. This statement is better and more precise; we have added it to the manuscript.

Page 4, around line 118

It's good to mention that you are using DARDAR v2.1.; this version of DARDAR uses CALIPSO Version 3 and CloudSat R04, both of which have been replaced by newer, more accurate versions of the data. I think that it is good to mention which versions of the Radar and Lidar are being used in this study (and it is easy to add this information here).

Done. Thank you for pointing out that DARDAR v2.1 use the updated version of CALIPSO.

Page 6, end of page (last sentence)

This is a good place to mention that any diurnal variability that may be occurring is not being addressed in this study. It's OK not to address it, but it's important to acknowledge it.

Done.

Abstract/Introduction/Section 3.1

This information is important and needs to be stated BEFORE the term overshoot is ever used. It needs to be in the abstract as well.

Your reply to my review states, "We chose 16 km as a threshold because the averaged LZRH is located at 15.7 km and the 380 K potential temperature is located at 15.9 km, at the selected region (northern part of the west pacific)."

This is good and important information, where is this stated explicitly and how are we to interpret "overshoot" before we are given this info?

Conclusion: Did you add this to the paper?

This information appears at the beginning of Section 3.1, at L170 and L179 , before the definition of 'DCC-OT' to clarify how we select 'overshooting' clouds in this study. It might not be necessary to move it to the first appearance of 'overshoot(ing)' in the Introduction because this wording is more generalized in the introduction, and we later specified it in Section 3.

“However, there might not be sufficient samplings in every radius bin. As a result, the composite constructed with retrieved values as a function of radial distances may not be representative of the geographical pattern associated with tropical cyclone events.”

Yes, this information was updated to the manuscript. Please check L284.

That is important to know when interpreting the results. Here is one more important thing to state in the paper:

“3475 FOVs meet the criterion of 1) cold scenes 2) CloudSat footprints within 6.5 km from the center of FOV. 2735 converges. 740 FOVs do not converge. A typical situation for these rejected FOVs is that the radiance residual at the initial time step is too large (i.e., > 20K). It happens when cloud amount among a FOV is not uniform so that there is a large difference in cloud states between CloudSat (1.4 x 1.8 km) and AIRS footprint (13.5 x 13.5 km). It may also happen when the optical depth of the topmost cloud layer is less than 1 (in CI and MIX category). We assume that spectral optical properties with respect to cloud ice mass are uniform through vertical layers of an atmospheric column; this assumption fails when the topmost cloud layer does not effectively attenuate infrared radiation.”

It is critical to acknowledge that 20% of your retrievals won't close, and that this is selectively when the topmost cloud layer is optically thin.

Yes, thanks for pointing it out. It was discussed in L272. Sorry that we did not include the exact line numbers where our revisions were made in the previous reply.