

Responses to Comments

We sincerely thank Editor Dr. Xu, and two anonymous reviewers for the constructive and thoughtful comments.

Comments are in *blue italic lettering*, responses in black.

Reviewer 2 Comments

Line ~110 – The results presented here depend to some extent on the details of the particles that were assumed to make up the liquid and ice clouds, and how supercooled water was handled. To make the results more reproducible, I would encourage the authors to make their PSD assumptions explicit. Because the profiles are artificially simple, the authors should also add a caveat to the conclusions. It may be that changes in PSD properties or the inclusion of super-cooled water in the cloud may be another reason to perform 2D tomography but that has not been demonstrated.

The PSD for liquid clouds has been added along with the PSD for ice clouds, as shown in Lines 122-123 in the track-changes document. The particle habit assumption for both ice and liquid particles are also described in Lines 121-122. Additionally, in the conclusion section, the limitations of this study in terms of simplified experiment setup and atmospheric conditions have been discussed, as shown in Lines 411-413,

Line ~140 – the suggestion is that T_b are computed for each CloudSat profile at multiple angles needs a little more explanation. Because slant path computations cut through multiple horizontally adjacent profiles, this leads to uneven layering of the slant path profiles. Exactly how the authors handled this was not clear from the description.

Line ~150 – If T_b s are constructed from single profiles but simply for different view angles, then the vertical correlations are assumed in the prior data. Some discussion here about how this is ultimately handled in the retrieval would be appropriate here.

Both comments concern the prior database and are addressed together. The current database is built by applying multiple angles to the same vertical profile from the CloudSat product. Addressing the actual slanting angle is very important, but this task has not been done yet. This simplification reduces the variability of cloud parameters in the prior database and affects the correlation between clouds at different layers. The establishment of a more sophisticated prior database will be done next. The limitation of the current prior database has been described in Lines 154-158 in the track-changes document.

Line 220 – Simply averaging the same voxels retrieved from each view angle in the 1-D scheme seems to artificially simplistic. Given that the authors have the goodness of fit from the OE, should this not be a weighted average?

Thanks for the insightful suggestions. The current averaging method assumes that each TB observation from different angles contributes equally to the final results. As you suggested, the contributions can be weighted based on factors such as the retrieval uncertainty in the covariance matrix and how well the

simulations reproduce the TB observation indicated by χ^2 . More description of the weighted averaging method has been added in Lines 237-239 in the track-changes document.