Atmospheric
Chemistry
and Physics
Discussions

Interactive comment on "Study of cloud droplet number concentration using the A-Train satellites" *by* S. Zeng et al.

Anonymous Referee #1

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General Comments:

This work compares estimates of cloud droplet number concentration (CDNC) from two different algorithms and A-Train data streams. The presentation is a bit sloppy with some details unmentioned, assumptions unaddressed, and poor grammar. In general, I'm left with the impression that CDNC estimation is sensitive to the effective radius input but effective radius itself varies quite a bit depending on retrieval methodology. This is a fairly minor result as a number of papers have highlighted this effective radius problem lately. I want to know why there are differences and how might they be reconciled. I recommend major revisions to correct some of the presentation flaws.

Specific Comments:

line 2, pg 29036: superfluous 'it'

Line 6, pg 29036: define MODIS. Same for CALIOP and CALIPSO later in the paragraph. Also POLDER/PARASOL in the next paragraph.

Line 16, pg 29036: is delta the cloud layer integrated or layer mean quantity?

Line 16, pg 29036: Does the term layer refer to the cloud layer or the cloud top. effective radius is heavily weighted towards the first unit or two of optical depth. Is there an inconsistency here. Or is the retrieval of cloud top CDNC with the inference that CDNC is relatively constant with height in the cloud. If so there is an assumption about cloud vertical structure here too and the authors should discuss. There is also a horizontal (footprint size) inconsistency in the observations that requires some explanation.

Equations 1 and 2: There are multiple combinations of re that could be used in these equations. You should be more explicit about where the re information is coming from.

Line 21, pg 29036: 'the' needed

Line 19, pg 29039: cloud height may come from CALIOP but pressure certainly does not.

Line 4, pg 29040: 3-D photon transport doesn't seem to explain all the difference. I think you are using this term incorrectly to describe both true 3D effects and spatial heterogeneity effects. Also what about drizzle (nakajima et al. 2010)?

Line 20, pg 29040: grammar

Figure 1: Is the data filtering identical? It should be otherwise this would not be an appropriate comparison. There should also be some discussion of the sampling biases which are implicit in the data filtering. Should these values even be compared to models given the number of pixels thrown out of the analysis?

Line 24, pg 29041: slops -> slopes. Error in figure also.

Line 12, pg 29042: underline -> underlying

Figure 3: What fraction of the difference is due to the difference in effective radius from POLDER vs MODIS versus the use of equation 1 and 2. To test can't you compute a CDNC using equation 2 but with POLDER re as input and compare this to the CALIOP estimate. The differences shown in figure 3 suggest about a 25% difference which is about what I would expect the effective radius differences to be. So does effective radius explain everything?

Line 12, pg 29042: 'unit' -> unity

Line 24, pg 29004 I think that it is too simple to just call this a drizzling effect because re > 15 micron. Just present the result as it is without over interpretation.

Section 4.2: I think that you are interchanging 3D and heterogeneity as one in the same thing when in fact they are not.

Line 25, pg 29047: grammar

Line 18, pg 29048 grammar