

Interactive comment on “An evaluation of clouds and radiation in a Large-Scale Atmospheric Model using a Cloud Vertical Structure classification” by Dongmin Lee et al.

Anonymous Referee #1

Received and published: 30 October 2019

Disclaimer: This is my first review of a GMD manuscript. In addition, my background is in atmospheric observations rather than numerical modelling. These circumstances might be reflected in my comments.

Lee et al. describe a method to assess the representation of clouds and their radiative effects in a global model based on A-Train observations and sub-column generators. At least the latter is not within my field of expertise and I had quite some difficulties in understanding how these sub-column generators work. However, I'd leave the assessment of the model-related methodology to an expert reviewer. In terms of presentation, there are a couple of items below that might make it easier for the reader to follow the

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reasoning of the authors. Finally, the use of jargon and abbreviations quite affect the readability of the text.

Detailed comments:

It has not been clear to me from reading the abstract what this paper is about, particularly in terms of quantitative findings.

page 4, line 12/13: Cloudsat and CALIPSO have collected a much longer time series. Wouldn't it be better to base the analysis on 10+ years of observations?

page 5, lines 4-6: To me the fact that the model produces more than the generally observed four cloud layers sounds like there might be an issue with properly representing clouds in the model. Please comment.

page 5, line 10 - page 7. line 3: I'll leave commenting on this part to modelling experts. Suffice to say that I don't understand from this text how the two sub-column generators work.

page 7, line 21: not sure maritime continent is used correctly here, but I might have mixed up plots

page 9, line 16: If I understand correctly, this is a comparison of the findings of the two sub-column generators. What is your benchmark for stating that one method produces underestimates?

page 10, lines 1-4: This statement should be moved to the figure caption. Also, state at the start of the discussion what kind of averaging has been applied.

page 11, discussion of Figure 5: Do I understand correctly that Figure 4 refers to values for all instances at which the respective cloud types are present while Figure 5 presents those numbers normalised by the occurrence rate of the respective cloud types? This information is somewhat hard to extract from the text (but might be due to use of jargon). Also, what is meant with grid-mean? I have really no idea what global

grid-mean is supposed to be.

page 12: I understand that f and r are expressions for parameters that have been used earlier in the manuscript. Why not introduce them at the first instance they are being used? It would be much less confusing if you would be consistent with the naming parameters throughout the text!

Please make use of the sub-figure labelling (a, b, c, etc.) in the discussion of the findings. This would make it much easier for the reader to follow your argument.

page 13, lines 23-28: This is a somewhat disappointing conclusion. What's the contribution of this study apart from anything's possible?

page 20, line 19: please update reference.

Figure 1: I took notice of the dotted lines in the figure only after trying to make sense of the combination of classes from your description myself. The purpose of those lines is not stated anywhere. Please add: dotted lines show which cloud classes have been combined for this study.

Figures 2 and 3: I would suggest to revise these figures in a more intuitive way. For instance, you could have columns with high clouds on top and low clouds at the bottom. Also have all cases in Figure 2a in one column, then the plots of Figure 2b next to it in another column, and then the findings of Figure 3 in a third column. However, Figure 3 seems pointless to me as it presents the differences between the two sub-column generators. It would be better to present the difference to the observations for each sub-column generator, i.e. as an individual column added to Figure 2. I would also prefer to see plots from -180 to $+180$ degree. Finally, please elaborate on the global mean values. Shouldn't they add up to 100%. They don't right now.

Figures 4 to 6: Please add a line at zero. See also my comments regarding the discussion on page 11. In Figure 6, you should at a statement to the caption regarding the meaning of the grey bars.

Figures 7 to 9: I'd suggest to refer to the two lines as observations and model.

Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2019-216>, 2019.

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