Geoscientific

Model Development

Discussions

GMDD

Interactive

comment

Interactive comment on "A simulator for the CLARA-A2 cloud climate data record and its application to assess EC-Earth polar cloudiness" *by* Salomon Eliasson et al.

Salomon Eliasson et al.

salomon.eliasson@smhi.se

Received and published: 18 September 2019

article color

Dear referee#1,

Thank you for taking the time to review our manuscript. We are especially happy that you agree that the core objective of the paper is clear and highly relevant for the community. Thank you also for the suggested minor revisions and following is a point by point response to each question/suggestion:

Printer-friendly version

Discussion paper

Line 7, "compared to the simulators in CFMIP". It should probably read "comparable to the simulators in CFMIP". It took me a few more lines until I understood what the usual approach was. Please clarify.

I have now reworded this sentence to "The first method, comparable to the simulators in COSP, relies on a single τ_c- threshold applied globally to delineate cloudy and cloud-free conditions."

Line 15, "Method three ...": Isn't this sentence just rewording the statement of the sentence before?

I agree. I removed this sentence

Line 23, "the simulated cloud mask of CLARA-A2": Please add "based on EC-Earth" for clarity.

OK

Line 30: In the abstract I'm missing the information how the location-illumination dependent POD is found/ how the method is calibrated. Please add this information.

I have now added this sentence earlier on: "The gridded POD values are from the CLARA-A2 validation study by Karlsson and Håkansson (2018)"

Line 104, "five pixels from the first scan line and none from the next two scan lines are

used to create the GAC measurement.": Please explain why, with another sentence.

OK. I added this sentence to clarify the situation: "Saving the data on a GAC pixel resolution was a compromise to drastically reduce the data, a necessity due to limited bandwidth."

Line 105: Here you cite Figure 1 OF Karlsson and Hakansson 2018 and not Figure 1 IN THIS manuscript, right? Maybe "(Fig. 1 in Karlsson and Hakansson, 2018) " might be clearer.

Yes, I understand how this was confusing. Fixed

Line 140: The same again. Better write "(Fig. 9 in ...".

Fixed

Line 127 and 141: The use of the acronym "SNO" seems unnecessary. You just mention it twice and, at least for me, it's not a very common acronym and thus not easy to read.

I have remove them

Line 150: Can you please comment on the lowest tau detected by CALIOP and its impact on a comparison with the model clouds.

I added for reference that the optical depth sensitivity for CALIOP is about τ_c=0.01 according to Winker et. al., 2009. The climate models have no lower limit besides numerical precision, i.e., much lower than CALIOP's lower limit. I also added a sentence about this in the paper to be clear

Line 157: Why "IR" instead of a wavelength? Are they different? Then please give a wavelength range. Line 165 and again in line 327, "198307–201506" Please change the date format to something more readable: E.g. "July, 1983 – June 2015"

I have included 11 micron and updated the date format

Line 167, Section 3: On the first half page, I would expect a general layout of the simulator method. As I understood, the CLARA-A2 simulator is first presented in this manuscript and this will be the main reference for later use of it. You state that apart from cloud detection, cloud top height, tau_c, re, WP are produced by the simulator. The remaining section lays its focus on cloud detection only. Can you please extend the explanation a bit for the other parameters and how they are averaged? Starting from overlap assumption, subcolumns, and optical properties, the next step for a full simulator would be a radiative transfer forward step? Do you use this step to simulated satellite measured reflectivities? This could be the lookup table you mention, but it stays unclear. Where do you get r_e from? It can not be correctly derived by just averaging model columns (or subcolumns) vertically and horizontally in a simple way? Please extend description.

OK, understood. I will expand this section to explain in much more detail how these other variables are simulated

Fig. 2 and Fig. 3, 4 and Tab.2 are all results from earlier publications, aren't they (or at least based on them). This could be made more clear.

Yes, the underlying results that are base for these figures and table where created for the Karlsson et.al., 2017 paper. I can add this information in the captions of the figures and see that it is clear in the text.

Line 272: It's only these last 6 lines of the section 3.1.3 which are not part of the summary based on Karlsson and Hakansson 2018, right? Think about pushing these lines into the next section as they clearly belong to the new retrieval simulator. They are somewhat hidden here.

I see your point, that this paragraph seems out of place. I think it may fit better at the beginning of this subsection before we go into detail about the τ_c intervals, illumination etc.

Line 323, "simulated ISCCP-H". Please give a reference again.

I changed the order of the sentences so that I can reference ISCCP-H again as well as the ISCCP simulator

Line 327, "All three datasets ...": You just show two, don't you?

By three datasets, I am referring to CLARA-A2, ISCCP-H, and EC Earth. For clarity I will write 2 satellite datasets and the climate model

Line 327, hardly readable date format, as before

Fixed

Line 331, "underpredicts cloudiness . . . by 20% to 30%": Can not be judged from the absolute images shown. Think about showing it in a similar way as in Fig 6

It's a good point. I can swap out the simulated datasets showing absolute cloudiness to showing absolute difference compared to the observation

Lines 335-341: This is basically all repetition, I think. Could be shortened in my opinion. Typos/Language:

It appears to me that especially lines 333-335 more or else repeat what is said in the information from lines 331-333. I removed the second duplicate and moved the sentence about ISCCP-H underestimating cloudiness to the earlier paragraph, and now I think it reads much better. Otherwise, to me, I think the latter information from lines 336-341 is necessary to explain why the ISCCP simulator produces more clouds in the Arctic summer that the CLARA simulator as seen in Fig. 7

Lines 94/95: Should read "trends are inverstigated", "Summary and conclusion are given".

Fixed

Line 366: "is run" → "run is"

C6

Fixed