

## ***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.***

### **Anonymous Referee #1**

Received and published: 6 September 2019

Review of “A simulator for the CLARA-A2 cloud climate data record and its application to assess EC-Earth polar cloudiness”, by Salomon Eliasson et al.

The manuscript presents a nice discussion of the impact of different techniques to compare climate model and satellite datasets with respect to cloudiness. They demonstrate that it is important to account for the illumination and surface characteristics dependent sensitivity of passive satellite methods to detect clouds which form the basis for several long-term climate records. The impact of simplifications commonly used in literature when comparing climate models and CDR is presented. This core objective of the paper – highly relevant for the community – is very well met and I suggest publication

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after minor revision.

Material and results from earlier work are used quite extensively. Some examples of impact are somewhat repetitive, but overall this does not hamper readability and thus there is no need for shortening.

I basically only have one suggestion for improvement of the manuscript. The key content of the paper is the CLARA-A2 simulator. The whole description focuses on cloud detection. Other parameters as cloud top height,  $\tau_c$ ,  $r_e$  or WP are mentioned, but techniques are not described. If this is supposed to be the main reference for the CLARA-A2 simulator method, this should be extended. See my specific comment below.

Specific points:

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.

Line 15, “Method three ...”: Isn’t this sentence just rewording the statement of the sentence before?

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

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.

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.

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.

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

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.

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

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"

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.

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.

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

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are somewhat hidden here.

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

Line 327, “All three datasets ...”: You just show two, don’t you?

Line 327, hardly readable date format, as before

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.

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

Typos/Language:

Lines 94/95: Should read “trends are investigated”, “Summary and conclusion are given”.

Line 366: “is run” → “run is”

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Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2019-174>, 2019.

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