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Atmospheric
Measurement
Techniques
Discussions

Interactive comment on "On the optimal method for evaluating cloud products from passive satellite imagery using CALIPSO-CALIOP data: example investigating the CM SAF CLARA-A1 dataset" *by* K.-G. Karlsson and E. Johansson

Anonymous Referee #1

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General comments

The paper adresses the evaluation of the CM SAF CLARA-A1 data set using CALIOP measurements and the authors give guidance for evaluation of cloud products from passive sensors in general. This is a relevant scientific question that fits well to the scope of AMT. The comments about the missing clouds in the CALIOP products and the recipe how to construct a more consistent merged 1km – 5km CALIOP cloud data set can be used in other studies, too. In total the discussion of the different quality measurements (POD, FAR both for clear and cloudy, the HR and the Kuiper skill score)

is a bit on the lengthy side considering that the authors finally chose the derivation of the sum of (POD+FAR) with respect to optical depth as most relevant quantity. The arbitrary choise of a threshold of 1% for this quantity cloud be more motivated to my opinion. On the other hand the discussion of the cloud detection bias in dependence of the latitude, surface type, and illumination conditions gives important indications when the situation is challenging for remote sensing and/or where the CLARA-A1 algorithms might be improved in the future. This is interesting for both remote sensing scientist and potential user of the data set. I recommend to publish the paper with minor revisions.

Specific comments

I would recommend to be more quantitative in the abstract: Page 1094, line 9: "Some misclassifications" and Page 1094, line 11: "Substantial fraction"

Page 1098, line 14ff. Is there a reference for the cloud top retrieval and the histogram technique?

Page 1103, line 10: You chose a threshold CFC'>50%. Maybe you could make a comment on how the results depend on the choice of this threshold, e.g. do we get comparable results when using 30% or 70%?

On page 1103, line 26 you write: "This cloudy 5km FOV will now be removed which maybe could be questioned." But in Step 2 you mention only, that you add clouds in the 5km product. Please clarify, weather you also remove clouds with a CFC'<50% or not.

To my opinion, the naming convention of the False Alarm Rate makes the paper difficult to understand. FAR_cloudy refers to the conditions where AVHRR is cloudy and CALIOP is not. So the index describes the AVHRR result and not the reference dataset. I would have done it the other way around. This convention makes the paper difficult to read, e.g.: Page 1112, line 10ff: The reader might be confused by the expression: "FAR quantity for clear condition". Looking at figure 8, the property FAR_cloudy decreases

with decreasing optical depth. I would suggest to use: FAR_(CALIOP=cloudy)=c/(a+c) FAR_(CALIOP=clear)=b/(b+d) and to use "FAR_(CALIOP=clear/cloudy)“ everywhere in the text of section 4 instead of "FAR quantity for cloudy/clear condition“.

Page 1112, line 24. In the end the author uses the derivation of the FAR and POD with respect to the optical depth. All the figures used in the paper always show the FAR and POD of clouds with an optical depth larger than a certain threshold. To my opinion, figures showing the derivation d(FAR)/d(optical depth) and d(POD)/d(optical depth) instead of FAR or POD for cloud thicker than a threshold in figures 4 to 13 would have made the discussion of the results easier.

Page 1112, line 24. The threshold of 1% seems to be rather arbitrarily chosen. The author should comment on how sensitive the result is to the threshold, e.g. by reporting the how the value of cloud detection limit of 0.35 changes if one chose 0.5% or 2%.

Page 1113, line 25ff: The authors wrote that the cloud optical threshold for day and night is 0.3, but during twilight it is 0.45 and that this implies, that cloud detection is especially challenging during twilight. According to this the most easy solution "to fix“ the complex solar illumination conditions of twilight would be to ignore the solar channels. Then conditions should be comparable to those of the night. What optical threshold do the authors expect, when using the nighttime algorithm instead of the twilight algorithm during twilight? Assumed that the threshold becomes smaller, using less information (no solar channels) for the retrieval, is the threshold a meaningful measure for the complexity of the retrieval problem or does it also reflect deficiencies of the retrieval algorithm?

Page 1116, line 3: repeat the threshold in the text: taking into account the cloud detection limit "of 0.35“.

Page 1116, line 3: I would suggest to mention here, that not only the bias is reduced, but also the RMS is reduced by approx. factor of 2, when using the cloud detection threshold of 0.35.

Page 1118, line 2: "Both deficiencies are well understood...“ Please add references.
Page 1118, line 12: "well known problem“ Please add references.

Technical corrections

I would add in the headings of Table 3: Mean error (%) of cloud detection ...

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 1093, 2013.