Atmos. Meas. Tech. Discuss., 6, C4123–C4131, 2014
www.atmos-meas-tech-discuss.net/6/C4123/2014/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Validation of CM SAF cloud fractions: can cloud cover be reliably derived by satellite data at Hannover, Germany and Lauder, New Zealand? – a comment" *by* A. Werkmeister et al.

A. Walther (Referee)

andi.walther@ssec.wisc.edu

Received and published: 27 January 2014

General comments:

This article deals with validation of cloud fraction product of CM-SAF by ground-based data sets. The topic meets the aim and scopes of the journal. This task is important for the cloud observation community and the users of cloud products. The general structure of the paper is good.

However, I have general concerns about the approach introduced here. The ground-based and the satellite observations' spatial coverage are very different with a 15 times greater coverage for satellite data. Therefore, the HSI cloud fraction and the satellite CFC value are two different measures. The use for a cloud mask performance evaluation is limited. This approach assumes a high correlation of cloud field texture between the small area and the larger area. This may be true only for certain weather situations and cloud pattern, but not in general.

Additionally, a validation period of only three months is far too short and not adequate.

The article exhibits many inaccuracies. The description of the data, methods and results is often incomplete, confusing and not precise. Text and figures are sometimes inconsistent.

My recommendation is reconsidering after major revisions. This may include a longer validation period.

Specific comments:

11149 l18: Please introduce the terms INT, DM, MM before using it.

Section 2.1.1: It would be interesting to know the spatial horizontal coverage of HSI (and SYNOP) depending on cloud base height. I found in a talk (http://www.solaripedia.com/files/1129) an approximation of 15km_2 for a similar instrument.

Section 2.1.4:

The SEVIRI cloud data make a long journey from the actual radiance measurement to the CFC product analyzed here. The reader may be interested to know how the individual steps were conducted from the actual measurement size (the point-spread function) over the EUMETSAT SEVIRI grid (3712x3712) to the 5925 x 5928 sinusoidal grid. Is it always a transition of a pure binary mask (1/0) or is there sub-pixel cloud fraction involved? How is the pixel selection done (nearest neighbor?).

AMTD

6, C4123–C4131, 2014

Section 2.1.1

Please add a reference for the improved cloud cover algorithm developed by the Hannover institute?

Are the HSI data public available?

Section 2.2:

11156 l.18: What does spatial averaging of the cloud situation mean here?

Chapter 3:

11156 l8: No need to cite Hartung for these very simple definitions.

11157/ l10-15: The POD and FAC definitions in your equations seem to be in contrast to common definitions in the literature. The POD is usually defined as the number of results that a certain event occurs (could be the classification “cloudy”) in truth data (or observations) and at the same time detected by the retrieval or forecast data. This is also explained in Reuter et al. (2009). But, your equations 5 and 6 seem to include also the correctly classified non-events (cloud-free) pixels. Literature refers here to "proportion correct“ to the amount of correct classification of both categories. I see the same problem with the false alarm rate in equation (6). Please consider revising these definitions for clarity.

Chapter 4.1.1

11157 l19-21: This sentence " ..showed the highest number of occurrences when both SEVIRI and HSI have a CFC of zero octal or eight ..“ does not correspond to Figure1: I see that only 10 events have a 0/0 octal classification.

Fig.1 shows a very surprising result. SEVIRI data set is representative for a 15x15 km area this is 15 times bigger than the assumed HSI coverage. Only 10 scenes out of approx. 1000 are cloud-free. But if and only the HSI area is cloud-free,the much larger SEVIRI is also totally cloud-free. There is not one case where HSI has zero octas and

AMTD
6, C4123–C4131, 2014

SEVIRI has a few clouds! As mentioned above to interpret these results it would be valuable to specify and discuss the spatial coverage of the HSI instrument, which may be different for cloudy and cloud-free scenes due to geometrical effects.

The FAC and POD values confuse me. Lets look to the numbers. From Fig.1 I estimate that HSI detects about 370 events as fully clouded with 328 correctly classified by SEVIRI. Using these numbers the POD would be 88%. On the other hand SEVIRI detects about 600 events as 8/8 octaves (all red colored bars in Fig.1). About 328 out of those are 8/8 also for HSI. This would mean a "POD“ of 54%. Using your equations literally I come to a POD of 42 percent considering all 950 pixels. For my calculations I used the numbers from Figure1 of the article and put them in a kind of a scatter-plot (see image Fig.1 of the review).

Did you consider parallax effects? They may be considerable for high clouds, because the sensor zenith angle is relatively high for Hannover. Please clarify this in the text.

Section 4.1.2: p.11158 line19-22: Which AVHRR sensors did you use? Do you use a threshold for sensor zenith angle? You analyzed Daily mean (DM) comparisons. Do you use here all HSI observations for a day or only the values at AVHRR overpass times?

P.11159, l.9: SEVIRI resolution over Hannover is about 5 km. The 3km is for the sub-satellite point.

P11159 l28: According the caption Figure 3 is only for Hannover and not for Lauder. What is correct, text or the figures caption? Do you mean Fig.5? Then you should change the order of Figures. (Would become fig.4). Actually the following text does not match to both figures (“point out a high number of accordance when both AVHRR and HIS state a CFC of eight octas(100%)”). I can’t see this in Fig.3 or 5. Did you forget to provide one image?

CLARA-A1 is only computed till 2009. What is the observation period of HSI in Lauder?

AMTD

6, C4123–C4131, 2014

Is there any chance to extend the period?

Section 4.2: The results you describe here seem to be far off any expectations. An average absolute difference of 4.1 octas looks like a random dice experiment. Would be interesting to see the Fig.1 (or a scatter plot as above) for the SYNOP results. Does these results corresponds to Reuter (2009)? I saw much better results there. You should discuss the differences of your results to this paper.

P11161l1: "When the observer estimates a CFC to zero octas... SEVIRI estimates mostly between six an eight octas.." Really? How often did an observer set the cloud cover to zero in this three months period? Did you check the SEVIRI pixel (3712x3712) or the 3km sinusoidal data from which you computed the CFC instead of the cloud fraction?

Section 4.3.1:

You wrote that cloud contamination factor (CCF) is a product provided by CM-SAF. (p.11162 -l.2-3 "each pixel provides information..") Is this in the 3kmx3km sinusoidal grid or in the 15km2 x 15km2 grid? You set then the CCF to 75 - 100% . How do you know this factor. Just because the results fit better?

Section 4.3.2:

The entire section is very confusing and needs revisions.

examples:

"... that the correlation is high enough to state a correlation ..." You describe standard deviation and correlation, as they would be totally independent. It is clear that if the standard deviation is low also the correlation tend to be high. "For these days.." : Is this a DM or an INST comparison? "," .. a cloud pixel contamination occurs..", and other sentences:

Which data set did you use for these results? Are these the 950 pixels from the SEVIRI

AMTD

6, C4123–C4131, 2014

Hannover/HIS comparison?

Section 5.2: p.11166 l. 1-2): What is the cloud coefficient function you wish to introduce according to the measurement? How can this be defined?

“Is not accurate enough for days with a Std higher than 10% “: This sentence tells me that if something is not accurate then it is not accurate. There is a lot of “ days” in this part of the paper, and no “occurrences” anymore. (“ these days consists of CFCs between zero and seven octas” - The entire day?). Please be more precise.

“ Although instantaneous measurements are not as reliable as ground-based measurements . . .”: Guess you mean satellite-based measurements are not as reliable. I would disagree. Both just retrieve cloud cover on a different scale. The satellite may be the better instrument to estimate a cloud cover for large areas, even there were more sky imagers available.

Conclusion:

Many details of the HSI (the 5% solar filter) and SYNOP data set belong to the data and instruments description part of the paper.

Tables: In Table 2 you use in the caption the term MAD and in the table header "Bias“ obviously as identical terms. However, the bias is not the mean absolute difference.

see equations in Fig.2 of this review

The bias can also be below 0. MAD as you have defined it is the absolute difference average.

Technical comments:

11147 line 1: "a greenhouse gas and warm..“ Missed "gas“

P.111151, l27: remove "(see Sect. 2)“

Fig.5: Correct your x-axis (remove "day of month“, and probably add 1s as "1 Nov“, "1

AMTD

6, C4123–C4131, 2014

Dec“ , "1 Jan“., add a "%“ to the Standard deviation.

Figure 5 appears in the text before Figure 4.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 11145, 2013.

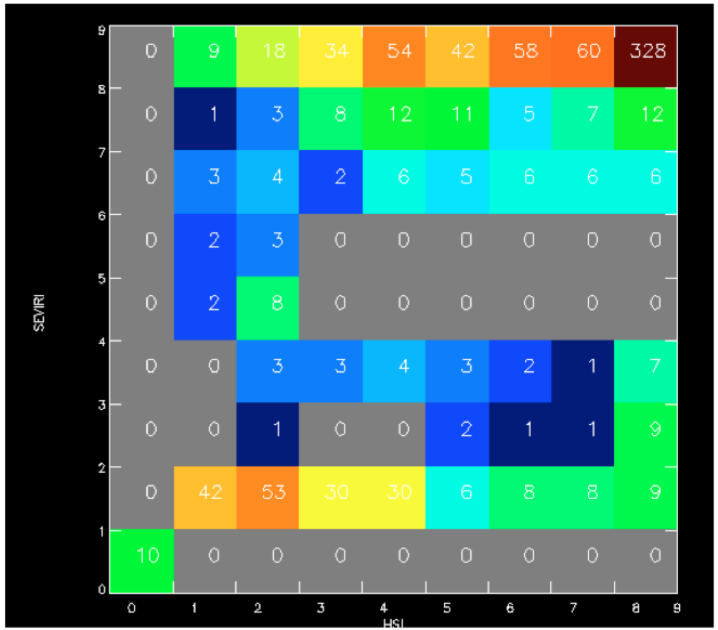

Figure 1: My (approximate) translation of Figure1 into a scatter plot with numbers.

Fig. 1.

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

$$bias_{xy} = \frac{1}{n}\sum_{i=1}^{n}(x_i - y_i) \qquad MAD = \frac{1}{n}\sum_{i=1}^{n}|x_i - y_i|$$

Fig. 2.

AMTD

6, C4123–C4131, 2014