**Atmospheric
Chemistry
and Physics
Discussions**

Interactive
Comment

Interactive comment on "Total and partial cloud amount detection during summermonths 2005 at Westerland (Sylt, Germany)" *by* N. H. Schade et al.

N. H. Schade et al.

Received and published: 2 October 2008

We would like to thank referee 2 for the very fruitful comments which will help to improve and highlight our work.

In particular, we want to answer the specific comments:

1) (Entire document): You should mention the size of the data set used (how many observations, what time frame, frequence of observations). Did you filter the data in any way? How? Why?

The size of the used dataset is mentioned in chapter 3, p 13486, but we include it in the measurements chapter as well. All cases, were the camera's TCAs could not be

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

calculated properly, e.g. when "blooming" occurred (a surplus of charge is delivered by a pixel to its neighbors and leads to a whitening of a larger area of the picture, see Schade et al, 2007) or at sunset/sundown, when the bluish stain of the pictures avoids correct cloud amount calculations, were excluded from the analysis. This information has been added to the manuscript.

2) The abstract should have more focus, including motivation and aim of the study.

We added a short part to the abstract. See introduction chapter for a more detailed description of motivation and aim.

3) Abstract: your definition of "Total cloud amount" is circular.

We rewrote this part to make it more understandable.

4) Abstract/intro: Why do you assume human observations to represent the truth more ccurately than the instruments? I know this is a common approach, but still a brief remark to this end would be useful.

We trust cloud cover from human observations more, because the characterization of the cloudy sky follows, despite the complex appearance of clouds, a well defined scheme (e.g. WMO, 1975: Manual on the observation of clouds and other meteors. WMO Publ. 407, WMO, 155 pp..). Automatic systems, on the other hand, often run into problems when the cloud pattern become too complex. Obviously, the human brain is better suited for complex pattern recognition than any measurement device,

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

up to this time.

5) p 13480: sky imager limited to daytime: what about IR imagers?

Good point! Indeed we are planning to purchase a IR device. Unfortunately, costs for the optics are rather high at the moment. To avoid misunderstandings, we have specifically denoted our sky imager as "visible sky imager" in the manuscript.

6) 13481: Ruffieux at al., 2005 is a summary paper. Is there a more specific reference?

We included the following reference: Morland, J. and Mätzler, C.: Spatial interpolation of GPS integrated water vapour measurements made in the Swiss Alps, Meteorol. Appl., 14, 15–26, 2007.

7) While APCADA and sky camera are described, observations and their reliability are not mentioned.

The DWD observers are specially trained for synoptical observations and should therefore be more reliable than any untrained observer. Nevertheless, observations are only estimates. Unfortunately the DWD does not directly say anything about the quality control of the synoptical observations, but admits that errors can occur. Therefore the cloud amounts were compared within +/- 1 (+/- 2) octa classes, to ensure best possible comparability, since a difference of +/- 1 can easily occur even between two observers.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

8) "Because of the availability of pyrgeometer data during this campaign..." This sounds like this study is a casual by-product. Is there any specific motivation for undertaking the research outlined in this paper?

As mentioned in the previous sentence, the main motivation of our work was the detection of cloud induced enhancement of solar radiation. In this context, the present manuscript can be regarded as a by-product, indeed. Still we believe, that this 'by-product' is worth to communicate to a larger communitiy.

9) What are the advantages/disadvantages of this location and time?

Advantages are the high sun, broken clouds due to land-sea wind, little continental aerosol, and that people at coastal areas expose themselves to the sun, e.g. for sunbaths (see Schade et al., 2007). This has been added to the manuscript.

10) 13482: You use two different translations of DWD in short sequence. Please check dwd.de for the official translation and use that one only.

We use "National Meteorological Service" now.

11) "Given this small distance it is assumed that cloud observations..." what about situations with very low clouds?

Sorry, we don't see how "very low clouds" should affect the synchronicity of cloud appearence at both sites. In general, with 1 km distance both sites "see" almost the very same sky, even for fast moving low clouds.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

12) 13483: Please justify your use of 0.75 as the threshold value.

The threshold value of 0.75 was taken after manual inspection of several cloud images for different situations in 2004 and appears to be robust. It was chosen to minimize misinterpretation without supressing the detection of cloudy pixels too much (see also Schade et al., 2007).

13) Wouldn't it be a good option to leave out the marginal pixels instead?

That's exactly what we did.

14) Your use of 0.016 and 0.981 for 0/8 octa seems a bit strange. After all, octa is a defined fraction (1/8). Did you use an independent data set in your visual inspection?

We were hoping that these details could be looked up in Schade et al. 2007 by the interested reader. The main reason for these "strange" numbers is the fact that the cloud-octa scheme gives 1 octa if only a small cloud is detectable, and 7 octa when a bit of blue sky is seen in the otherwise overcast sky. Schade et al. (2007) chose those values to best fit the observations. This has been added to the manuscript.

15) 13484: Why do equations 3 and 4 have to be fitted to observations?

As described by Dürr and Philipona (2004) the emissivity of a clear sky follows a diurnal and annual course, which depends on the specifics of the measurement

site (continental/maritime climate, latitude, etc). Since measurements were made in summer, only the diurnal course has to be taken into consideration. To find its maximum and minimum values a day- and nightime fit for observed clear skies has to be performed seperately. This has been added to the manuscript.

16) Why do you use 0.48 as your first guess?

0.48 was chosen as first guess following the procedure described by Dürr and Philipona, as it was expected not to be far away from the finally derived values (0.446, night and 0.425, day).

17) What is the meaning of k_{amp}?

k_{amp} is the difference between the daytime(nighttime) value of k and the mean value, i.e. the amplitude of the dirunal course.

18) 13485: Figure 1 does show an upper limit of 0.951 for the clear cases. However, I would not use this as a threshold. As I understand it, theory would suggest a threshold of 1 - is that correct?

It is correct, that the threshold should be 1 in theory. Since all observed clear sky cases are below 0.951, we chose this value. We changed the whole APCADA chapter in our revised manuscript regarding the comments of reviewer 1 and skipped the detailed discussion on most equations since the procedures are described in detail by Dürr and Philipona (2004)

19) What do you mean by $k_{day(night)}$?

$k_{day(night)}$ *means, that this value is based on whether it's a day- or nighttime measurement.*

20) Why is LDR variability greatest in the range from 4-5 octa?

We are not sure, what the reviewer is referring to. As shown in Figure 3, the standard deviation of LDR is largest for 2-4 octa.

21) 13487: "...reflect the observations in 72 (58) $\%$ of all cases ..." I think the figures should probably be 58 (72). Why would a higher tolerance result in a worse fit?

Yes, this has been a typo. We have corrected it, thank you.

22) 13489: overall bias is reduced to -0.28 octa. Isn't that still a lot?

An error of -0.28 octa is a significant improvement compared to an error of -1.01 octa.

23) 13490: How could APCADA be improved to properly attribute medium-level altocumulus situations? These are of significant importance in marine locations.

We are afraid that the original APCADA scheme cannot be improved for this cloud type. The short wave downwelling irradiance is a promising piece of information

Interactive
Comment

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

in this regard as it exhibits a strong variability for this cloud type including large enhancements compared to clear sky radiation (Schade et al. 2007). Therefore, a day-time APCADA algorithm that accounts for both longwave and shortwave irradiance may be quite suitable for this cloud type. This suggestion for improvement has been added to the conclusions.

24) 13491: Here you say that the TCA study was performed only to correct for user errors. What is the significance of this section in the context of this study?

That was one point of our study. Another point was to establish the APCADA scheme for a coastal mid-latitude site for longterm observations of cloud cover.

Technical Corrections:

We changed past perfect tenses into simple past as proposed, we also corrected the use of hyphens, apostrophes.

Concerning the specific comments:

1) Throughout document: consider using "clear" instead of "cloud-free"

We used the term "cloud-free" in accordance to the Dürr and Philipona (2004) paper. We would like to keep it as it points to the Cloud-Free Index as well and therefore the reader should easily be able connect these terms.

2) Throughout document: consider using "local time" instead of "MESZ"

We use "local time" instead of "MESZ" now.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

3) Title: I suggest using "summer" instead of "summer months"

We will use "summer" instead of "summer month".

4) 13481: "for the interpretation OF the surface radiation budget"

Thanks for the spell-checking: We included "of".

5) "information" not "informations"; change throughout paper

We changed "informations" into "information".

6) "Alpine" not "Apline"

We changed "Apline" into "Alpine".

7) "...Partial Cloud Amount Detection Algorithm (APCADA) for estimating..."

We changed the sentence as proposed.

8) "focusing on cloud-induced excess solar..."

We changed as proposed.

9) 13482: "cloudy by its red/blue ratio"

We changed as proposed.

10) "is simply taken from the ratio of the cloudy to all pixel"; change to: "is simply taken as the fraction of cloudy pixels".

We changed the sentence as proposed.

11) 13483: "threshold FOR labeling"

We changed as proposed.

12) "...might have affected the measurements"

We corrected the spelling.

13) 13484: After introducing an acronym (e.g. APCADA), the same can be used without the long form.

We changed as proposed.

14) Equation 1: the denominator should probably be $\epsilon_{AC}\sigma T_L^4$ I guess.

Yes, it was a typo.

15) After equation 2 change sentence order: " ϵ_{AC} **the emissivity of a cloud-free sky, as described in ..."**

We changed the sentence order as proposed.

16) 13485: "STD" obviously stands for standard deviation. Please say so.

We included "standard deviation".

17) 13486: Table 1, not 4.

Of course, it is Table 1.

18) 13487: "underestimates ... -1.01 octa"; double negative!

We removed the double negative expression.

19) "aerosol scattering" instead of "scattering at aerosols"

We changed "scattering at aerosols" into "aerosol scattering".

20) 13489: "In other words ..." sentence confusing and redundant. Please remove.

We removed the sentence.

21) "Since the lower 15..." change to "Since the lowermost $15\circ$ of solar eleva-tion..."

We changed "Since the lower 15 ..." into "Since the lowermost $15\circ$ ..."

22) Reference list: Berk et al. and Buck are not cited in the manuscript.

We inlcuded both citations in the APCADA section.

23) Ohmura et al.: some special characters missing in names. Please list all authors instead of "et al."

We listed all authors now.

24) Sutter et al.: some special characters missing in names.

We inserted the special characters.

25) Fig 1: "summer days"

We changed "summerdays" into "summer days.

26) Fig 3: "Standard deviation of LDR and cloud-free index ..."

We changed the order.

27) Fig 6 + 10: change scaling to make more legible

We changed the scaling for Fig 6 + 10.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 13479, 2008.