We thank anonymous referee #1 for reviewing the manuscript and providing corrections and suggestions. Following are our point-by-point replies with the referee comments in italic. Page and line numbers refer to the marked-up revised manuscript, to be provided as a final response.

General comments

The paper is well written and has an overall clear structure and figures. The topic is interesting and fits well to the aims and scopes of AMT. The authors identified two cloud features, bow and glory in the diurnal cycle of the cloud optical thickness and effective radius of stratocumulus clouds, which caused irregularities and could lead to misinterpretation by the user. The use of the two SEVIRI instruments onboard the Meteosat-8 and -10, which give the stereo perspective, is a great possibility to study these phenomena.

The sensitivity study focused only on the width of the droplet size distribution, which is important parameter and normally fixed for the cloud retrievals. The paper is valuable for people involved in cloud properties determination from image like SEVIRI measurements. The authors suggested two effective variance of the size distribution based on the sensitivity study. The whole study based only on two case studies. It is not shown that these two days are represented for a maritime and continual stratocumulus diurnal cycle, which should be included to make the results useful. Further the authors should discuss if this feature can be flagged for the user and include a suggestion how this cloud specific parameter could be used in standard retrievals as it mention in the abstract, but not discussed later.

It is true that in our study we did not examine the level of representativeness of the selected cases for typical conditions in the corresponding marine and continental clouds. In the revised manuscript we comment on similarities and differences in the diurnal evolution of the marine case with the study by Seethala et al. (2018), which evaluated the typical diurnal cycle of marine Sc clouds over the south Atlantic. Our case appears typical for the diurnal evolution of τ in this region, and less typical for r_e. However, in order to perform this analysis a near overcast cloud deck during a whole day relatively close to the equinox was needed, which is not easy to find.

The cloud bow and cloud glory features are related to retrievals falling outside the LUT, and these are already flagged, as we clarify in the revised manuscript (page 18, lines 3-5). Hence the users can already use this information to minimize their effects.

In principle the approach the authors present in their paper is very valuable and have great potential to understand cloud glory and cloud bow effects on the diurnal cycle of the cloud properties retrieved from satellite measurements. It is interesting and suitable for publication in AMT. However, I suggest the following revisions:

Abstract

Future climate data record is not mention or discussed in the paper at all, should be add in the discussion summary part.

The relevant part of Sect. 4 (last paragraph) was expanded with reference to the CLAAS-3 and CLARA-A3 plans to update the v_e value used, based on the findings of the present study. We also added more details on plans to attempt a retrieval of v_e based on the information available in the glory time slot.

Introduction

p. 3, line 4:

"Another issue in cloud optical properties retrieval, which relates to the cloud glory effects …" The citation from Mayer et al (2015) should come here already to motivate the sensitivity to ve. ("While under most retrieval circumstances the sensitivity of τ and re to ve is low, this is not the case for special illumination geometries, as was shown e.g. in Mayer et al. (2015) for the cloud glory conditions.")

This sentence was moved based on the referee's suggestion (page 3, lines 10-11).

p. 3, line 24.

This is inconsistent to the abstract the authors mentioned: " .. over different underlying surfaces (ocean/land) .." and here "..over the southeast Atlantic and one characteristic day"

We clarified this part by mentioning both the studied regions (page 3, lines 29-30).

p.3 line 26-28.

Should be move to the summary: " While … properties."

This sentence was moved to the beginning of Section 4.

Data and Methodology

p.6 line 4-7. "It relies on … illumination conditions." This have not to repeat again. I would suggest to shorten this part. (see p.2 line 22-27.)

The same piece of information was indeed repeated. We have shortened this part (page 6, lines 17-19).

p. 8 line 2. Why only two days? Please discuss.

Cloud glory and bow, and the ensuing irregularities in the retrievals, occur in specific time slots depending on the region. In order to combine both features in the analysis, we needed to narrow our selection of days to cases close to an equinox, when cloud glory features manifest. Hence, their study was necessarily limited to small areas and specific days. We have added this information in page 3, lines 26-29 of the revised manuscript. Irregularities due to cloud bow and glory conditions in the diurnal evolution of clouds will occur no matter how that diurnal cycle exactly looks. Hence, the diurnal evolution in the selected day(s) does not have to be representative of the specific cloud types and regions. In cases with variable cloudiness during the day, the impact of the cloud bow and glory features on the cloud property diurnal cycle may be blurred. Therefore, we searched for near-ideal cases in terms of cloud cover in a sufficiently large region during the full day.

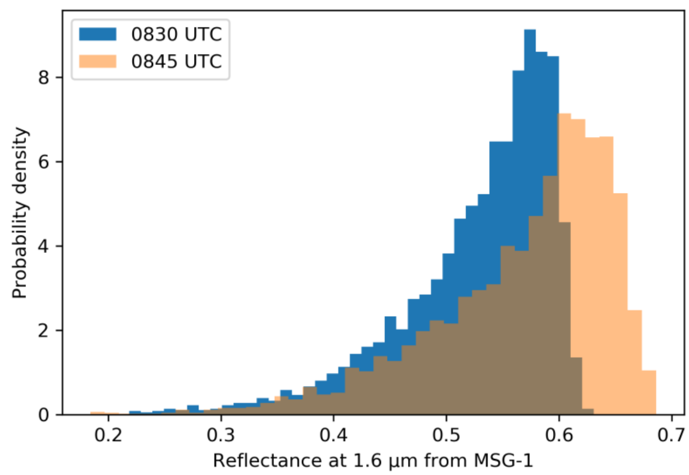
It would be useful to have RGB images for the two days and two satellite on a time slot.

Compared to similar studies (e.g. Cho et al. (2015)), the areas under study are rather small (2°×2° based on the revised analysis) and covered to a large extent (more than 80%) by clouds. Hence we think that an RGB image would not add useful information, also considering that the analysis was mainly based on spatial averages.

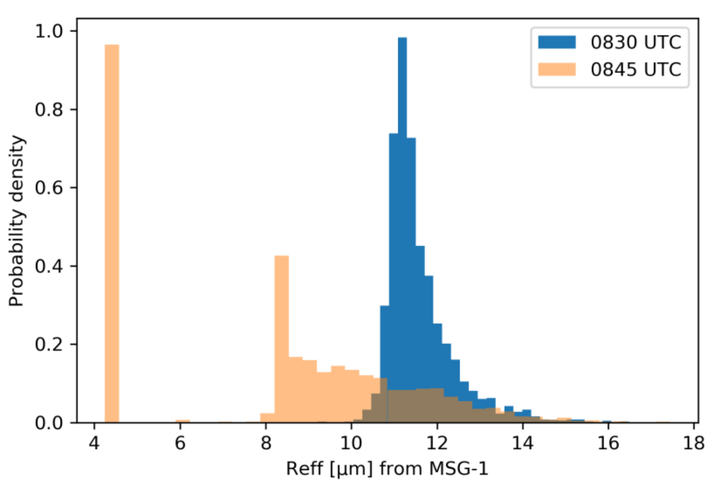
Results

For the spatially averaged reflectances it would be interesting to see the variation (max and min cloud glory and cloud bow effects) and the propagation to the CPP algorithm.

Cloud bow and glory conditions lead to a momentary increase in reflectances in both the visible and the SWIR channels. This is depicted in Figs. 4c and 4e for the spatial averages, but it is true overall on a pixel basis. The histogram below shows an example of changes in reflectance at 1.6 µm from MSG-1, on 7/3/2017 over the southeastern Atlantic region, from 08:30 UTC, which is a "normal" time slot, to 08:45 UTC, which is affected by glory (see also Fig. 4e).



Propagation of this temporary "jump" to the CPP output is not straightforward to visualize, since the LUT, from which the output is retrieved, also changes shape through time. These changes ideally will compensate for the "jumps" in reflectances and lead to a diurnally smooth output. In practice, twists and folds in the LUTs (see e.g. Fig. 5a) lead pixels with extreme reflectance values to fall outside the LUT. These pixels are flagged, but retrievals are still performed, giving extreme output values. The retrieved r_e values corresponding to the histograms above are shown below.



Obviously in this case the glory causes many pixels to lie above the LUT, leading to an unnatural peak in low r_e values. These extreme retrievals lead to jumps when included in the spatial averages (see also Fig. 4f). A user should of course avoid using these flagged pixels. In our study, however, the aim is to analyze these cases and their effects, so their inclusion in the analysis was self-evident.

Figure 4: The dotted and dashed line are hard to distinguish. For example, dotted dashed line and dotted line, should be better.

We have added letters next to each vertical line, denoting either cloud bow (b) or glory (g).

p. 14, line 13. Expression "more natural output" , please rephrase.

This expression was rephrased (page 18, lines 2-3).

p. 15, line 8. "this does not necessarily mean that the actual droplet size distribution is so narrow." Should be discussed how this could be verified in the conclusion.

The purpose of this sentence was to state that the smoothness of the diurnal curve around the glory is not directly linked to the retrieval failures depicted in Fig. 9. However, this is not directly supported by the analysis, and it was removed from the revised version.

Discussion and Summary
The authors should more discuss if this feature can be flagged for the user and include a suggestion how this cloud specific parameter could be used in standard retrievals as it mention in the abstract.

The irregularities in cloud bow and cloud glory can already be avoided to some extent by the user, since they are associated with pixels falling outside the retrieval LUT, and these pixels are flagged (see also Fig. 9 and relevant discussion). Based on our findings, an updated value of v_e will also be used in future retrievals of CLAAS and CLARA. This information was included in the last paragraph of the revised Sect. 4.

p. 19, line 12. How often do these irregularities happen?

Based on the way scattering angles change during a day, cloud bow irregularities will manifest twice per day in any region. Irregularities associated with cloud glory require high values of scattering angles. Due to the position of both satellites along the equator, these conditions are met in days close to the two equinoxes. This information was added in the revision (page 24, lines 16-18 and page 25, line 1).

Should be critical discussed that the finding depends on the optical thickness of the cloud and the cloud types.

The effect of τ on the cloud bow irregularities was already discussed in Sect. 3.4 (page 21, line 27 and page 22, lines 1-2). On the other hand, cloud glory irregularities on τ appear in both low and high τ cases.

Typo
p.4 line 9: Data and Methodology

Corrected.