Review of

Daytime low-level clouds in West Africa – occurrence, associated drivers and shortwave radiation attenuation

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This paper presents the analysis of the daytime low level clouds (LLC) over West Africa using ERA5 dataset for the period 2006-2015 to investigate their occurrence frequency, seasonal and diurnal cycles, as well as the associated atmospheric conditions for the two contrasting regions, i.e. Sahelian and Guinean region. Based on the cloud fraction, three classes were formed (no LLC, LLC class-1, and LLC class-2) and the results indicate that during the summer months LLC class-1 has the peak occurrence frequency in the Sahel, while LLC class-2 is dominant in the Gulf of Guinean. Finally, this study also addressed the attenuation of the shortwave downwelling radiation due to the LLC and found that during the summer months it is on average between 44 % and 49 % for the Sahel and Guinean region.

Considering the importance of the LLC for the regional climate of West Africa and the general lack of studies addressing these clouds, I find the topic of this study to be relevant and suitable for publication in ESD. This study provides new results which in my opinion will be useful, especially considering the ongoing and future solar energy project. However, before this manuscript can be accepted for the publication, it should be carefully revised, since there are some shortcomings in the analysis and the presentation of the results needs to be more clear. My comments and suggestions are listed below.

Major comments:

1. I do not understand why authors extract reanalysis data of a higher resolution of 0.25o to a very coarse 1o resolution. What do you mean by “directly extracted” (Pg. 3, line 87)? Although the focus is on the analysis of large scale conditions, it is well known that some mesoscale processes are responsible for the formation and maintenance of LLC. Have you performed some sort of validation test to make sure that the conditions are properly presented with the data of coarser resolution? Additionally, sensible and latent heat flux analyzed here are not large scale phenomena.

2. In my view, the analysis of the atmospheric conditions should be presented more consistently and more clearly.

   The definition of the “horizontal moisture flux advection” is not correct (Pg. 5, line 141). Namely, eq. (1) presents the average moisture flux and not the advection of the moisture! Therefore, the presentation and discussion of the results regarding the advection of the moisture need to be carefully revised. If Figs. 5 and 6. show the quantity calculated according to the eq. (1), then they do not show moisture advection. The large majority of the paper discusses the role of moisture advection, however, this quantity is not calculated.

On Pg. 6 Equation (2) is inconsistent with the text on lines 160-161: shouldn't the equation read as: CREswt=SWt-SWcs(t)?

3. Due to the definition of the LLC used in this study, i.e. all clouds with cloud base below 2 km, different cloud types are considered as LLC. This causes some confusion in understanding atmospheric forcing related to different LLC classes in the two regions. For example, the dominant LLC class-2 during the JAS period in the Guinean region is most likely related to the stratiform clouds and shallow cumulus, while the LLC class-2 peak in the same season most likely corresponds to deep convective clouds (as it corresponds to rain events). These different cloud types have different forcings and the authors need to make a more clear distinction between these throughout the manuscript. This is especially confusing in the Abstract.

   The authors should refer to the recent finding from the DACCIWA regarding the physical processes responsible for the formation and maintenance of the LLC over the Gulf of Guinea during the WAM season.

4. In the recent DACCIWA papers (ACP special issue available at https://www.atmos-chem-phys.net/special_issue914.html), the advection of the cold maritime air mass, related to the low level jet and the SW monsoon flow, is found to be the key process responsible for the LLC formation and not the advection of moist air. On the other hand, the advection of the relatively moist air could be important for the LLC formation in the Sahel. However, the authors do not assess the role of temperature advection. What is the reason for this?

Minor comments:

- Pg. 2, line 59-60: This statement is not correct. In the Guinean region the LLC form during the night and persist long into the morning and early afternoon hours, therefore have a direct impact on the surface solar irradiance. Please see the study of Lohou et al. (2020) and Zouzoua et al. (2020) regarding this.
- Pg. 7, lines 198-200: Here it would be better to refer to recent DACCIWA publications which show that the advection of cold air, and not the advection of moist air, is the key process responsible for the formation of LLC in the Guinean region during the monsoon season.
- Pg. 8, line 234-236: The reference here should be Adler et al. (2019) not (2019b). Additionally, all the studies referenced here find that the advection of cold air is the major factor in leading to saturation, not moist air! The authors should carefully revise the paper when discussing the processes leading to the formation of LLC in the two regions and when referring to previous studies to avoid making mistakes like these. Namely, based on the DACCIWA observational data it became clear that the advection of cold maritime air is the dominant process for the LLC formation in the Gulf of Guinea, while the advection of moist air into the Sahelian region is the most dominant process for LLC formation.
- Pg. 8, line 242: It should be Saharan Heat Low.

- Pg . 8, line 243: What is the role of the cold air advection?
- Pg. 8, line 245: Consider here replacing “moist air” with cold air.
- Pg. 9, line 287: How can water vapor be cooled by moist air advection?
- Pg. 10, line 304 and 312: Which region are you referring to? Is it entire West Africa?
- Pg. 10, line 310: Figs. 10 and 11 also show the downwelling shortwave radiation attenuation for no LLC class.
- Pg. 11, line 329-330: The sentence “In Sahel, the mean attenuation during the occurrence of LLC Class-1 events is 16.3% *though* areas around the southern coast of WA can experience higher losses.” should be rephrased since it is not clear what is the connection between the attenuation in the Sahel and the southern coast of WA.