Response to the co-editor comments (ACP-2018-775)

"Nocturnal low-level clouds in the atmospheric boundary layer over southern West Africa: an observation-based analysis of conditions and processes"
by Bianca Adler et al.

January 3, 2019

We thank the co-editor, Susan van den Heever, for her comments. We addressed all comments and provided a second revised version of the manuscript, where the new changes are highlighted in blue. Changes from the first revision are still highlighted in red.

1. *Referee 2 raised a question about IOP 10 in terms of the differences on this day when compared with others. I understand the authors arguments however, it would be useful to state something more specific to this effect including that this day was different and that these interesting differences form the basis of an upcoming manuscript.*

   Response: We added an explanation that IOP 10 was within the vortex period during which a drier air mass was present and mention that the differences between nights with and without clouds are the topic of another upcoming publication.

   No LLC existed at Savè during IOP 10. This IOP was within the vortex period during which a drier air mass was present in the investigation area (Kalthoff et al., 2018). A detailed analysis of the differences between nights with and without LLC is the topic of another upcoming publication.

2. *Referee 2 also asked about why the LCLs were calculated using surface conditions as opposed to using the radiosondes. This is a good question, particularly given that the fact that the radiosondes are released on a frequent basis, a point emphasized by the authors in the introduction as a strength of the field campaign, and as one of the reasons for fact for the extension of the Babic study. Can the authors please (a) include in the manuscript the reason for using the surface-based approach; and (b) comment on how the surface-based calculations of the LCL differ from those obtained using the radiosondes at the times that these are available.*

   Response: We are not sure that we fully understand this comment. In our study, we use the LCL to investigate the relationship between the LLC and surface processes following

the work done by Zhu et al. (2001). The LCL is only based on and defined by near-surface data (Romps, 2017). The LCL is defined as the level at which a parcel of moist air which is lifted dry-adiabatically would become saturated. On a thermodynamic diagram it is the point of intersection of the dry adiabat and constant mixing ratio line that pass through the temperature and mixing ratio of the parcel to be lifted. We calculate the LCL for a parcel lifted from the surface after the well-known approximation of Espy LCL $= 125(T - T_d)$ (e.g. given in Romps (2017)) using the continuous near-surface measurements of temperature and humidity. Information on the temperature and humidity profiles are not necessary to calculate the LCL which is why we do not use the radiosoundings for this. If we calculated the LCL from radiosoundings, we would only use the lowest measurement level of the soundings, which are basically the same as the near-surface values measured at 2 m at the tower. From the radiosoundings we could estimate the cloud base height (CBH) as the level where RH exceeds a certain threshold. This method is e.g. used in the overview paper by Kalthoff et al. (2018). As continuous information on CBH are available from the ceilometer, it is not necessary to use CBH from radiosondes in this study. We added the information that we use the approximation after Espy to calculate the LCL.

"We calculate the LCL from air temperature, T, and dew point temperature, T_d, measurements at 2 m a.g.l. with the equation after Espy LCL$= 125(T - T_d)$ (e.g. Romps, 2017), and compare it to the observed CBH. "

3. *Referees 1 and 2 both commented on the quality of the figures. I still have some concerns in this regard. More specifically:*

   a) *Figure 3 is a beautiful figure and will be most useful to readers interested in this topic. It is clear that the authors have attempted to improve this figure from the first version. However, there are still a number of issues. Firstly, the times on the abscissa have been cut off by virtue of the placement of each of the panels. Secondly, the fonts on both the left and right ordinate axes (labels and titles) are really too small to read. I tested this both with a printout and an on-screen version. Please consider ways in which to improve this. You might, for example, use just one height label on the left, applying it across panels, and one time label at the bottom (or top) and applying it across all columns.*

   Response: We increased the font size of the axis and colorbar bar labels as well as the indication of the IOPs. We removed the tick labels for the panels in the right column, which allows us to enlarge the individual panels. We are aware of the fact that the font size in this figure is borderline small, but we hope that in the revised version the labels are now readable.

   b) *Figure 6 has also been improved. The authors argue against making Save a solid marker, however, I think it would be clearer if it were and I dont think that it makes a difference to the cloud fields. Furthermore, the lat and lon fonts should be increased, and the times could be slightly larger too. Finally, please make a clear separation between your legend and panels. Alternatively consider using a single, much larger legend for the figure.*

Response: We follow the editor's suggestions and use a solid marker to indicate the location of Savè. We also increased the fonts of the labels, the times and the colorbar legend and increased the spacing between the panels and the colorbar to make a clear separation.

c) *Figure 7. None of the referees commented on figure 7, however, the label axes, as well as the legend labels are again too small on this figure. Please enlarge these fonts.*

Response: We enlarged the font size of the legend and axis labels.

References

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Zhu, P., Albrecht, B., and Gottschalck, J.: Formation and development of nocturnal boundary layer clouds over the southern Great Plains, J. Atmos. Sci., 58, 1409–1426, 2001.