

## ***Interactive comment on “Low Level Cloud and Dynamical Features within the Southern West African Monsoon” by Cheikh Dione et al.***

### **Anonymous Referee #3**

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Review of “Low-level cloud and dynamical features within the southern West African monsoon” by Cheikh Dione et al.

### Review summary

The authors describe the occurrence statistics of the nocturnal low-level jet, the maritime inflow, and stratus deck during a 40-day observation period of the DACCIIWA campaign at Savè, Benin. The jet and inflow are identified from UHF wind profiler measurements and radiometer-derived temperature profiles. The stratus deck is identified using IR “RGB” measurements. The authors identified the dynamical features on 20-25 days out of 40 (when there was no appreciable precipitation or density current) and the stratus deck on most of those days. Comparing the onset and breakup, the stratus deck was found to initiate approximately 3 hours after the onset of the maritime

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inflow, while the breakup of the jet was found to occur around sunrise and the breakup of the stratus after sunrise.

The manuscript is generally well-written with a clear structure. The figures present some nice and valuable results, although the figures are sometimes too busy to easily interpret. Some of the statistical findings are reported using vague or incorrect terminology. Overall, the scientific concerns are minor and this paper could be accepted after minor revisions.

## Major comments

### 1. Conclusion / novelty

The authors lean a lot on the work presented in Adler et al. (2018) and Babic et al. (2018). When reading the conclusions, the emphasis appears to be on the findings of those two papers, e.g. the list starting at line 31, page 15. Instead, the authors should highlight in their conclusion how their Figure 12 synthesizes their results. For instance, one could identify three key periods, e.g. 1800-0000, 0000-0700, and 0700-1200 (more or less as done in lines 10-24, page 14). This Figure 12 provides a broader context for the case-study type and process analysis done in the previous studies. The main point here is that from the conclusions, it is unclear what the novelty is of this particular paper (although the introduction does provide this in line 13-19 on page 4).

### 2. Busy figures

The amount of information condensed into single figure panels is impressive, but it makes it very difficult to interpret some of these. One might imagine using these figures in a presentation and certain features will be difficult to highlight. Specific issues are:

Figure 2. The grey squares are difficult to see. How important are these for this figure? The rainy conditions could be presented in separate panels, although that would shrink Figure 2. Alternatively, the authors could present the rainfall information in a separate Figure using the same day-hour axes. If the information is not crucial to the paper, it

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could be provided as a supplementary figure. As it stands, the information is getting lost.

Figure 4. The three markers are difficult to discern in this figure. A solution could be to (1) remove the wind barbs to a separate figure and (2) replace the open markers with slightly larger, filled, black markers of different shapes. As a separate point, the barbs are not intuitive to interpret, as they are shown against a height axis. If the barbs were placed in a separate panel, the authors could also colour code them or use a filled contour plot to emphasize different cardinal or intercardinal directions.

Figure 10. Although the figure is visually fun, it is difficult to read. The preceding analysis means that the colours are no longer necessary. Without the colours, it would be much easier to interpret the relationship between the onset and breakup of the jets and clouds.

#### Minor comments

Page 3, line 4. Please mention the source of “dew point temperature” used in this paper.

Page 3, line 18. Please rephrase or clarify in the text what is meant by “convective turbulence”.

Page 3, line 20. What are “inertial oscillations”?

Page 3, line 23. What does “it” refer to? The NLLJ?

Page 5, line 6. Please give the exact limits of the profiler data, rather than “roughly 150 m”.

Page 5, line 14. “above and below” this phrasing does not make sense. It suggests that the bias is both 0.5 and 2.0 K between 1000m and 2000m.

Page 5, line 15. “funding” should be “finding”.

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Page 5, line 19-24. Given that the UHF data are block-averaged to 15 minutes, and given that it is interpreted alongside the sensible heat flux. Shouldn't the latter also be block-averaged to 15 minutes? Please specify the averaging performed on these data.

Page 5, line 30. "manufactured" should be "manufacturer"

Page 6, line 7. "most of the time" and "complementary scans". Please be specific. Did the radar perform a volume scan every 30 minutes? How long did the volume scan take, e.g. 5 minutes? Does that mean that you have five 5-minute estimates of cloud-top height per 30-minute period?

Page 6, line 14-22. This analysis seems really nice and original. Is it designed in this study? Perhaps the authors could emphasize this more. If not, please provide references.

Page 6, line 29. Should "height" be "top" (of the monsoon flow).

Page 6, line 33. "depth" should be "layer".

Page 7, line 29. The monsoon depth is less than 1500m in the middle of the night.

Page 7, line 31-33. The authors use a reference from 2010 to describe the status of the monsoon in their 2016. Please consider rephrasing this sentence.

Page 8, line 18. It is important here to note the temporal resolution of surface sensible heat flux, if it is different to the other measurements (see previous comment for page 5).

Page 8, line 29. How is the 302 K potential temperature measured? Is it based on the radiometer profiler? Please specify.

Page 9, line 15-16. "affected" should be "applied".

Page 9, line 18-20. Please enlighten the reader to what range of thresholds are appropriate for r-ws and r-T, and which values were chosen for the subsequent analysis.

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Page 10, line 1-2. “the wind maximum increases” – it is the “height” of the wind maximum that increases. Please rephrase.

Page 10, line 14. “if the same scenario appears every day” – surely, the authors mean that it is difficult to determine criteria if “different” scenarios appear each day? (i.e. the opposite)

Page 10, itemized points. These conclusions cannot be drawn based on Figure 5. An increase in wind speed is not observed “at all times”. It “may” be observed at any time, but certainly not at all times for all days. Similarly, cooling “may” occur between 1700 and 0000 UTC, but it certainly does not occur throughout that period for all cases.  $FLF_{mean}=1$  does not occur “during the entire night” for all cases. If any of these statements were true, then we should see that the temporal occurrence equals the total number of days for a prolonged period of time in figure 5.

Page 11, line 3. “most probable” this means the time with the highest occurrence. Instead, the authors appear to refer to the median.

Page 11, line 5-6. “exhibited a nearly symmetric distribution centered at 1800 UTC.” This distribution does not appear symmetric: it has a long tail towards later times. Also, it has a maximum at 1730 UTC.

Page 11, line 11. “clearly linked” – what is the reason for this statement? Visual inspection of the scatter plot? The authors should include a correlation value and its significance here.

Page 11, line 16. The “most frequent” onset seems to be at 1745 UTC, not 1900.

Page 11, line 22. “to reach 700” – this looks like 500 in Figure 8.

Page 11 line 23. “most likely” this again appears to be the “median”, which is a different measure.

Page 11, line 31. Is there a reference for this “precious dataset”?

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Page 12, line 14. “are said to occur” – please provide a reference.

Page 12, line 14. Should the G and B also be average values?

Page 12, line 33. “when they are large enough” – the clouds? Please specify.

Page 13, line 20. This section should be “LLC lifetime statistics”. “Macrophysical characteristics” suggests a description of the thickness and liquid water path of these clouds.

Page 14, line 7. “LLC always form” this is not true. There are days where the NLLJ forms, but no LLC are observed. Perhaps: “on the days that LLC form, they appear more than 3 hours. . .”

Page 14, line 14-16. It appears as if the authors combined different days to produce their Figure 12. It would be a more reliable result if the authors could ensure that their sample is consistent across the three statistics, i.e. only select those days that have both a NLLJ and a cloud deck.

Page 14, line 23. “after sunrise or later” – either say “after sunrise” or be specific about “later”, e.g. “after sunrise or up to X hours later”.

Page 15, line 18. “the most frequent occurrence is at 1800 UTC” – this is true for the FLF-mean measure, but not the others. Is it really “most frequent” that is the useful statistic here? Why not report the median?

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-1149>, 2018.

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