## Response to reviewer 2

*In this response letter, we repeat the reviewer's questions and answer them one by one. Our response is marked in blue letters.*

This paper is important and presents original work on a feature that has not received much attention. I was originally going to rate this as "minor revision". However, I realized that the length and complexity is such that very few would read it. I am extremely interested in this topic, but would dread, as a researcher, having to go through this article. The word count must be close to 15,000, roughly twice that accepted by most journals. It indicates 26 figures, yet most have numerous panels. In most cases those panels are quite independent of each other, so that 40 figures is a more realistic number. I am indicating major revision because I feel it is imperative that the authors break this into two articles. That is actually not that difficult or time-consuming to do. It will guarantee that the work receives more attention.

Based on this comment, I have stopped the review around Figure 5.

=> Thank you for your valuable comments. We appreciated your comments. Following your suggestion, we now separate the paper into two parts. The part 1 of the revised manuscript will be focused on the climatology part.

I do hope the authors will consider what is suggested above, as it is important work and should eventually be published. Also, the authors might want to look at the extensive work on the fogs and stratus done by Cermac and colleagues and cite some of that literature.

=> Thank you for your suggestion. We will go over the Cermak et al. papers and will cite them in the revised manuscript where appropriate.

**INDIVIDUAL COMMENTS**

The abstract is too long and includes too many details that really belong in the text. This is particularly the case in describing the anomalous characteristics for the three months considered.

=>. We will reduce the abstract for the revised manuscript. Reviewer 1 however requests more information be included on the cloud and aerosol anomalies within the abstract, so we do expect to keep information pertinent to the anomalies in the abstract.

Good overview of the background literature. Variables considered and data sets to derive them are clearly described.

=> Thank you for your comments.

A major concern is their use of ERA-5 because its representation of the AEJ-S is questionable. The core tends to be over the ocean in the various diagrams, with little extension over the land in most cases. The only paper that focuses directly on the AEJ-S is Kuete et al. (2020) in Climate Dynamics (see also Jackson et al. 2009). Of the three reanalyses Kuete et al. examined, only ERA-Interim shows a pattern similar to that in this paper. The others show a core further land-ward and extensive development over the land. The greater development over land is consistent with the idea that the temperature gradient between the rain forest to the north and the dry season in the savanna to the south is the cause of the jet. I would suggest that the authors start by showing the jet in at least two additional reanalyses, in order to recognize that there are differences. MERRA and JRA 55 would be good choices. They should also speculate on how the use of ERA-5, with the core over the ocean, would affect their results.

=> Thank you for pointing this out. To comply with the reviewer's comments, we investigated the location of AEJ-S in the other reanalysis data such as MERRA2, JRA 55, and NCEP/NCAR for climatology and deployment month, using monthly mean data. The climatology is based on 2000-2018 for all reanalyses data. They have different spatial resolutions: ERA-5 has 0.25 deg x 0.25 deg, MERRA 2 has 0.625 deg x 0.5 deg, JRA55, and NCEP/NCAR reanalysis has 2.5 deg x 2.5 deg resolution, respectively.

All three reanalyses, ERA5, MERRA2, and JRA55 data, show similar features in terms of location and strength of AEJ-S, with the weakest magnitude shown within the most coarsely resolved reanalysis, namely the JRA55 (see Fig. R1). Perhaps, for this reason, the AEJ-S in August 2017 is almost the same as the climatological mean in JRA55 (with the core value slightly weaker). However, the local enhancement of the upper-level wind is evident within all three reanalyses mentioned above.

One small difference in ERA5 and other reanalyses is that the core of AEJ-S is slightly displaced to the coast in the higher resolution data such as ERA5 and MERRA2 in September and October, as the reviewer mentioned. We investigated this a bit more and found that this might be related to the variability of the AEJ-S core altitude at the jet entrance region and exit region represented in the monthly mean data in ERA5. The preliminary analysis showed that the core of AEJ-S using the monthly mean data in ERA5 tends to occur around 3.5 km (slightly lower than 600 hPa) at the jet entrance region over land, while it gets up to about 4 km (about the same as 600 hPa) at the jet exit region over the ocean, especially in October.

We also checked the zonal wind isotach at 650 hPa level and found that the core is located over land, especially in the climatological mean. When we looked at the 6-hourly wind data at 600 hPa, AEJ-S is certainly originated from the land in ERA 5 (not shown). Therefore, while the actual position in the monthly mean data may need to be interpreted with caution in different resolutions of data and different reanalysis products, we think the position of the AEJ-S in ERA5, MERRA2, and JRA55 is still reasonable.

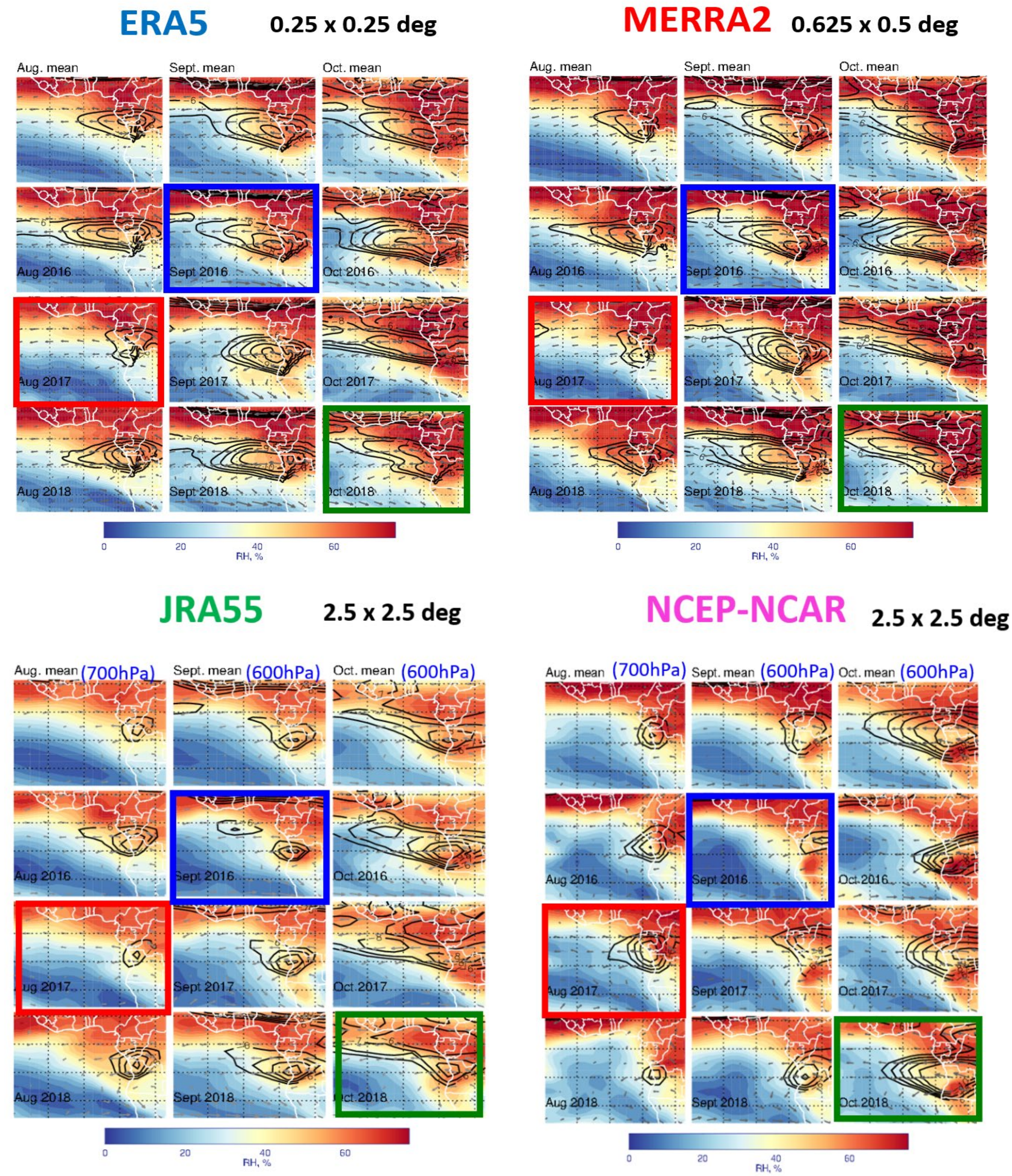
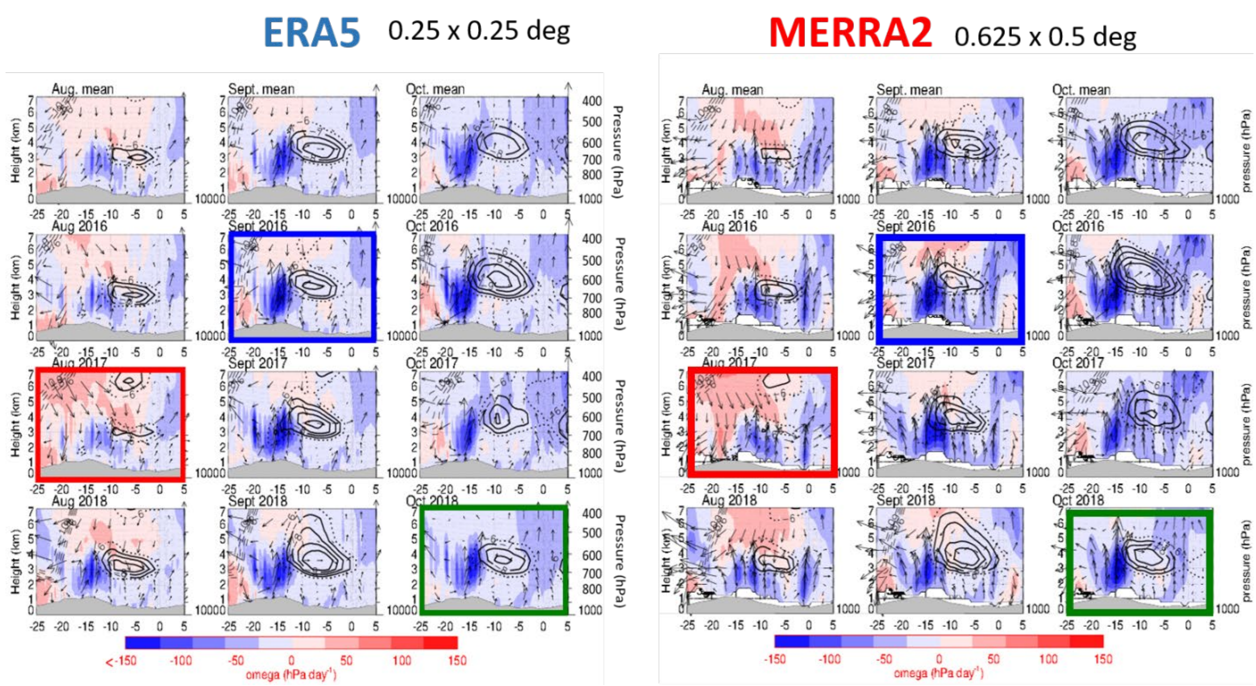



*Figure R1. Map of zonal wind (black contours, from -10 m s$^{-1}$ to -6 m s$^{-1}$ with 1 m s$^{-1}$ interval), RH (shading, %), and horizontal wind vector at 700 hPa for August and at 600 hPa for September and October for ($1^{st}$ row) the climatological mean (2000–2018) and ($2^{nd}$ – $4^{th}$ rows) the August, September, and October in 2016-2018. The color boxes (red, blue, and green) indicate the month of ORACLES deployment. The plots are made using ERA5, MERRA2, JRA55, and NCEP/NCAR (from top left to bottom right) reanalyses data, respectively.*

To examine the effect of the coarse resolution, we compared NCEP/NCAR data with JRA55 because both data have 2.5 deg x 2.5 deg resolution, shown in Figs. R1 and R2. Interestingly, although NCEP/NCAR data also show some AEJ-S features, the NCEP/NCAR looks most different from the other three reanalyses data in many aspects during August-October. There is neither strong subsidence over 12-18E, 10-25S nor enhanced upper-level wind over 5-10S in NCEP/NCAR but, rather, these features are displaced much further to the north (0-5S) for many months in 2016-2018. One large difference between NCEP-NCAR and the other three reanalyses is that the subsidence is very weak. Related to this, AEJ-S in August 2017 from NCEP is slightly stronger than the climatological mean. Kuete et al. (2020) also showed that the location and magnitude of AEJ-S in NCEP2 differ from ERA-Interim, MERRA2.

Not only the magnitude of AEJ-S but also the position of AEJ-S, especially its vertical location, is different in NCEP/NCAR. This may be another reason (besides subsidence) why August 2017 has a slightly stronger AEJ-S in NCEP-NCAR compared to the other reanalyses. Furthermore, a very strong updraft around 0-5N over land is also found for NCEP-NCAR in general compared to the other three reanalysis data, which are not observed in the other reanalyses such as ERA-interim, ERA-5, MERRA2, and JRA-55.

In short, the weaker AEJ-S in August 2017 is most pronouncedly shown in ERA5, MERRA2, and weakly in JRA55 as well, but not shown in NCEP/NCAR. Other large-scale subsidence features and local upper-level wind enhancements over the 5-10S region are all shown in all ERA5, MERRA2, and JRA-55.



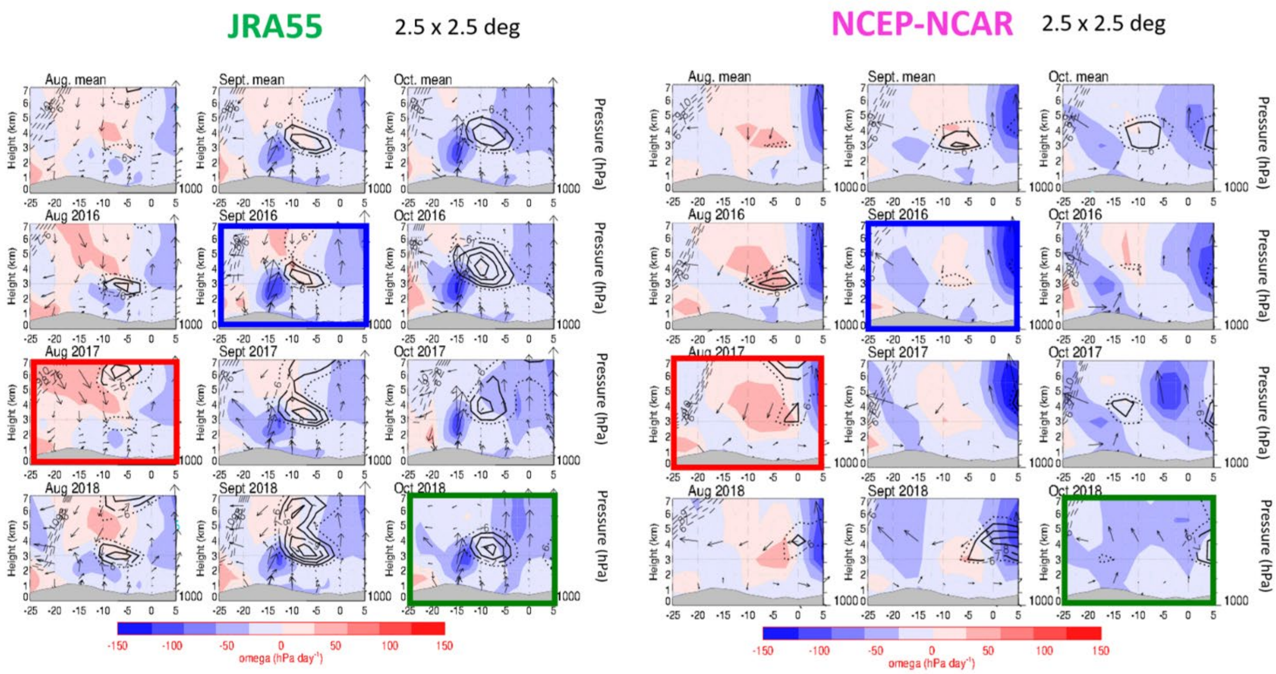



*Figure R2. Latitudinal cross-section of vertical motion (omega (ω), shading, hPa day$^{-1}$) averaged over the jet entrance region (12–18° E) overlaid by wind vector (meridional wind vs vertical wind; the vertical wind (ω, hPa day$^{-1}$) is multiplied by -1 to represent the ascent as a positive value). Zonal wind (black contour, m s$^{-1}$) is overlaid for the (1$^{st}$ row) climatological mean and (2$^{nd}$ – 4$^{th}$ rows) August-October in 2016-2018. The gray-filled area represents the inland topography. The plots are made using ERA5, MERRA2, JRA55, and NCEP/NCAR (from top left to bottom right), respectively. The color boxes (red, blue, and green) indicate the month of ORACLES deployment.*

**A general issue:** the authors discuss altitude both in terms of pressure level and height. However, their figures only give height, but call it pressure altitude (not a commonly used term). Putting the associated pressure level somewhere (e.g., once at the far right of the figure) would really help the reader.

=> We will follow your suggestion in the revised manuscript.

**More specific points:**

Line72 and 73 I looked at both papers cited and do not see the links suggested here. This statement should be removed. Lamb and Peppler do not even consider the same season evaluated in this article.

=> "SSTs along the Benguela coast are strongly linked to rainfall variability in the Sahel (Lamb and Peppler, 1992) and western equatorial Africa (Balas et al., 2007)."

The first author apologizes for the misinterpretation of the Lamb and Peppler (1992) paper. Although there is no mention of SST in the Benguela region in the paper, the figures in the paper cover this region, and the region also seems to be included in the tropical Atlantic regions and associated with sub-Saharan rainy season variability. However, it is less clearly stated, and this paper focuses on sub-Saharan West Africa, it is less relevant to the regions we are interested in. In addition, there is no reason to believe the two forms of variation are linked other than through a different, unmentioned, common driver. Thus, this reference will be removed as will be the Balas et al. (2007) reference.

Figs. 1 b and c are too busy, so hard to interpret.

=> The Figure 1b and 1c in the previous manuscript presents the multiple fields of the climatological mean values, such as RH, zonal wind, thickness (layer mean temperature). Our intention for this figure is just to provide the overall climatological characteristics in the SE Atlantic. We will make it simple in the revised manuscript.
Lines 220-225 That feature cannot possibly be part of the Tropical Easterly Jet because it is clearly a relatively local feature. The TEJ commences over the central Indian Ocean and then extends over Africa. Also, the Wu et al. (2009) reference is not appropriate here. That paper concerns the AEJ-North only. The TEJ is well known and several papers describe is directly, starting with papers in the 1960s or 1970s. A more recent paper on the TEJ is Nicholson and Klotter (2021), which I think appeared in the International Journal of Climatology.

Also in that section, I wonder if the pattern described could instead be a

"moist tongue" near the level of the AEJ-S. Sometimes cross-circulations are associated with jet streams. This could be determined by looking at the meridional wind.

=> Thank you for your suggestion. We found upper-level wind development in August 2017 interesting and tried to find clues within previous studies that examined similar features. We now realize we misinterpreted a connection between the TEJ and AEJ-N and will remove this discussion on TEJ.

Fig. 3. The caption indicates a box is shown at the top left of (a) giving the area over which precipitation is averaged. I cannot see this box. However, the coordinates are given, so the box is not really necessary, but the caption must be changed.

=> Sorry for the missing box region. We will not include the precipitation histogram in part 1 of the revised manuscript, the magenta dashed box will not be displayed.

Please note that in determining the impact on rainfall, this was not the best region to choose. The jet appears to be characterized by a "jet streak" circulation, with rainfall enhanced in the right entrance quadrant and left exit quadrant (Jackson et al. 2009). By averaging more or less over the entire region of the jet, the impact on rainfall is probably lower than if the right entrance quadrant were used. I am not suggesting that the authors change anything. This comment is only for their own reference. But they might examine this and see if results are enhanced.

=> Thank you for the valuable comment. We compute the anomaly field at the given grid point instead of averaging over the large box region to minimize the possible misinterpretation of the results. With this approach, the precipitation histogram in the previous version has been deleted. As you pointed out, most of the precipitation occurs over land and the right entrance quadrant.

Fig. 5. What is -1*omega?

=> The omega is the vertical pressure velocity (unit in hPa day$^{-1}$). The negative omega represents the ascent motion, and the positive omega represents the descent motion. The vertical velocity in isentropic coordinate (omega, ω) is associated with vertical velocity in isobaric coordinate (w) by ω= -

ρgw, where ρ is a density, and g is gravity. To make the visual support, we multiply -1 by omega (since ρ is invariant in the low-troposphere and g is constant) so that we can simply refer to upward-pointing arrows as the “ascent” and downward pointing arrows as the “descent”. Thus, -1*omega means the “multiplying -1 by omega”. -1*a negative omega implies descent, -1*a positive omega implies ascent.

## Reference


Jackson, B., Nicholson, S. E., Klotter, D.: Mesoscale Convective Systems over Western Equatorial Africa and Their Relationship to Large-Scale Circulation, Mon. Wea. Rev, 137, 1272-1294, doi: 10.1175/2008MWR2525.1, 2009.

Kuete, G., Mba, W. P., and Washington, R.: African Easterly Jet South: Control, maintenance mechanisms and link with Southern subtropical waves, Climate Dynamics, 54, 1539-1552, doi: 10.1007/s00382-019-05072-w, 2020.