

The transport history of African biomass burning aerosols arriving in the remote Southeast Atlantic marine boundary layer and their impacts on cloud properties, by Wu et al.

General comments:

Wu et al. presented a study investigating the impacts of African biomass burning aerosols (BBAs) on liquid clouds over the southeast Atlantic region. This study combines both airborne observations on aerosol properties and cloud micro-physic properties and numerical simulations for air mass sources and properties. It reveals that the presence of BBAs can increase the observed cloud droplet number but decrease cloud droplet size. In addition, this study evaluates the BBA-cloud interaction activities under both free troposphere and marine boundary layer conditions. Overall, the revised manuscript is improved compared with the original submission. If comments below can be addressed, we would like to suggest acceptance for publishing in ACP.

Major comments:

1. In addition to presenting NAME simulations for three cases (Figure S2) as representatives for three periods in Figure 2, the authors should provide one simulation result for each flight observation (e.g., releasing air parcels at the middle time of each flight). This will make the paper stronger. One would worry about whether the three cases presented in Figure S2 are the best cases. For example, one would wonder if one of the flight observations during period 2 with similar fractions of air mass from African continent to those of case 2 in Figure S2 also shows similar air mass back trajectories. In addition, rationales for selecting case 2 are not clearly provided in discussions on Figure 2. For example, it should be directly noted that it is a reference case as clean MBL for comparing with BBA polluted case 1 and 3.
2. This study focuses on the impacts of BBAs from Africa on SAE clouds. It is stated that ‘the presence of BB-pollution was defined using thresholds of carbon monoxide above 83 ppb and black carbon above $0.1\mu\text{g m}^{-3}$ ’ (Line 223-225 in Section 3). However, Figure 2 and Figure S2 present results about all air masses from African continent which may include all kinds of continental pollutions. To clearly indicate the presence and influence of BBAs, the abundance of carbon monoxide and black carbon as a function of time should also be provided in Figure 2 or in the supplement material.
3. Relevant text statements for introducing each figure and table in the Supplementary document should be provided.

Minor comments:

1. In the caption of Figure 8 and Figure S2, it should be clarified that Figure 8 is based on the output of 3D air parcel footprints whereas Figure S2 is based on the method introduced in the second paragraph in section 2.2.
2. Line 47: to reduce the **relative** humidity
3. Better to also provide the flight numbers for flights with mainly limited cloud samplings that are not included in this study
4. Line 128-129 (and Line 133): PCASP is missing here for Passive Cavity Aerosol Spectrometer Probes
5. Line 145-146: the general size range of BBAs observed in this region should be provided here (or refer to the literature)
6. Line 161: Why 0.01 g m^{-3} is used as the threshold LWC? Any rationale or reference?
7. Line 201: what is BL? Only MBL was defined before this.
8. Line 236: isn't case 1 at the middle of period 1?
9. Figure 2: why do not choose case 2 and case 3 at a point where flight observations are available?
10. Line 248-249: it might be too arbitrarily to use three cases to conclude the pollution source of the whole campaign. It is necessary to provide back trajectory results for each flight observation. Same as major comment 1.
11. Line 276-278: please refer to Figure 3a. Also, please check through the manuscript to make sure relevant figures/tables are correctly and properly referred in the discussion. Some of in-text references are missing, which makes it a bit hassle to follow the flow.
12. Line 300: Also provide **the value of the CCN activation fractions of these highly aged African BB aerosols**
13. Line 304: A sentence for clear definition of clean MBL is missing in the manuscript. It should be already introduced in Section 1 or Section 2
14. Line 305: 'The aerosols in the clean MBL were smaller', is the number or size of aerosols small?
15. Line 312-316: based on the results, the two individual statements seem right. However, it is awkward when putting them together
16. Figure 3: provide legend in each panel. A missing legend makes it not convenient to read it
17. Line 406: ambiguous statement. Enhanced Nd value or larger Nd distribution range?
18. Line 406-407: Figure 5a shows what kind of effects? It should be clearly stated out what the figure/result show but not only say 'affect'
19. Figure 8: indicate the atmospheric condition and case number in the legend for each panel
20. Line 609-611: the continuous increasing of CTH cannot explain why there is a decrease in Re at -24 hours. Further details/results should be provided to explain this?