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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol influences on low-level clouds in the West African monsoon" *by* Jonathan W. Taylor et al.

Anonymous Referee #1

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The authors use measurements from multiple aircraft to construct a large dataset of cloud properties. The authors show differences in these cloud properties based on location, and provide explanations for their differences based on pollution tracers and the understanding of the local dynamics and meteorological phenomenon. The authors conclude that significant increases in population in south west Africa and resulting enhanced pollution will not greatly affect cloud properties in the region, because a considerable fraction of aerosol particles are high concentrations of biomass burning smoke transported from the southern hemisphere. I have some concerns about the evidence being used to make this claim. I think the use of SMPS measurements would make a stronger case than OPC measurements alone. Furthermore, it is understandable that mixing state can be difficult to determine, but the expected hygroscopicities of

different particles are very different and simply assuming an internal mixture weakens the argument (aged biomass, fresh emissions, sea salt).

Major concerns:

A considerable amount of the introduction is attributed to explaining the effect of the low level jet on the inland clouds. While it is necessary for the reader to understand the role of the LLJ, I suggest limiting the explanation some since it is not the focus of the results. I would suggest performing a few parcel model simulations to identify how sensitive the simulation results are to mixing state, even if they are speculative. Proving to the reader that this (arguably bad) assumption cannot account for major changes in CDNC would be helpful to your results. Section 3.4 analysis with CDNC and Reff seems a little pointless, and possibly misleading. It's nice and simple to group up all your data, show the statistics and interpret them, but you're mixing together very different cases. You pointed out the fact that your profiles often contain multiple layers of clouds. And you pointed out that offshore measurements of CDNC are only for a day or so, but you still make plenty of comparisons despite this and I don't see the point. These offshore cloud measurements are certainly not enough to suggest they are representative of the regions offshore clouds and they are distracting from your real results/objectives.

Did you have a CPC? Figure 6 would benefit from such measurements. They include particles that are too small to be CCN, but N250 certainly misses a lot of CCN. CPC measurements would also provide some insight on the pollution levels.

Beginning of Page 14: Often the majority of the accumulation mode particles (and CCN) are smaller than 250 nm so based on the OPC data alone it's not entirely convincing that the offshore particles account for the majority of the accumulation mode. I understand there are limitations in the SMPS data, but for an analysis where you are averaging all concentration measurements over the land, it should not be a problem. Furthermore, I believe the next paragraph, where you compare CDNC between off-

shore and inland clouds to counter this conclusion with the inland CDNC often being more than double the offshore CDNC. Though again, there aren't quite enough offshore clouds measured, but stating that inland clouds have 85-175% more droplets makes your argument less convincing. It's likely the different dynamics on and offshore may play a role here, so comparing the concentration of particles below cloud (from a CPC and SMPS) would be more useful.

Generally aerosol size distributions should not be averaged together unless they look similar (similar peak locations). Can you add all the distributions averaged in Figure 8 with light lines? It would also give the reader a good picture of the distribution variability.

Page 18 first paragraph: The argument on entrainment is a bit week. Sure you had a lot of layered clouds, but clouds with greater than 1 g mˆ-3 of LWC were often likely convective, and therefore, higher updraft velocities. At the very least I would include standard deviations for these CDNCs and the number of cases.

Minor points:

Page 8 line 15 change 'an' to 'and'.

Page 13 "This is"

Page 15 line 19. Do you mean scanning time?

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