The research describes in-situ measurements and analysis from the ACTIVATE project over the Western North Atlantic Ocean. Investigation of low level cloud layers and measurements of Cloud Condensation Nuclei (CCN) concentrations below cloud base were compared with droplet number concentrations (CNDC) from just above cloud base. They present this in the context of the vertical wind speed (w) and use a method to relate the updraft velocity to the CDNC just above cloud base.

They found a significant range of CCN concentrations that spanned different seasons. One of the key aspects of the paper split the measured CCN into Low Polluted (LP), Medium Polluted (MP) and High Polluted (HP) groups. The authors found all occurred in the winter while summer was found to be split between LP and HP.

The contributions to the CCN population from the aerosol composition was presented, with the conclusion that Sea Salt Aerosol, although present in significant quantities throughout, was not the driver of the changes in aerosol groups, but rather always present as a background of deliquesced aerosol likely based on the boundary layer windspeeds. During elevated aerosol periods the strongest association was with Organic Aerosol (OA).

They found that the relationship between CCN and CDNC was due to the interplay between the dynamics and availability of CCN for the formation of cloud droplets. For example in the HP cases CDNC was sensitive to the full range of w, where as in more pristine LP cases the CDNC was CCN limited and therefore didn't change as significantly with increasing w values.

I found the paper to be well presented with excellent figures that highlighted the key aspects of the study. I recommend publication with minor corrections –

We thank the reviewer for the insightful summary and the positive evaluation of the manuscript.

Minor comments

Section title and numbering missing immediately after the abstract. (should be 1. Introduction?)

We thank the reviewer for catching the missing first part of the Introduction. It seems that one page of the first part of the Introduction with section title and numbering is missing in the preprint version.

L99 *"The FCDP with its fast 100 electronics, small pinhole feature for coincidence reduction and applicable filtering techniques can be classified among the lower end of both propagated uncertainties in size and NC. "*
Has this been demonstrated or is it just an estimation?

We thank the reviewer for finding this ambiguity and have changed the text as follows: *"The FCDP with its fast electronics, small pinhole feature for coincidence reduction and applicable* *filtering techniques <u>is estimated to be</u> among the lower end of both propagated uncertainties in size and N_C. "*

L104 It's stated the effective pixel size for the 2D-S is 11.4 µm. Lawson et al. (2006) describes this differently. The effective pixel width used as standard is 10 µm. Please confirm whether your effective size range is different or whether this needs correcting.

The effective pixel size of the 2D-S was calibrated with a spinning disc experiment in the laboratory before the ACTIVATE deployment. For clarification we have changed the text to: "*It measures single particles in a size range of 5.7 - 1465 µm with a <u>calibrated</u> effective pixel size of 11.4 µm for each photodiode channel.*"

L211 I'm not suggesting this should be changed but I've always found the terminology of 'polluted' to be a little misleading. What exactly *is* polluted? Or is it just the same as 'elevated' aerosol.

We use 'polluted' for regions with high aerosol loading and in particular for cloud condensation nuclei concentrations above 372 /ccm derived from the statistical distribution of the measurement conditions in contrast to clean conditions with lower CCN concentrations. We think it is appropriate to stick with the wording 'polluted' even though the source of the elevated aerosol and CCN loading is not directly known.

Figure 4. What type of fit are the lines to the histograms?

We thank the reviewer for addressing the missing fit method. We use the seaborn python package kernel density estimation for this plot which utilizes a gaussian kernel without discrete bins but in relation to the underlying 30-micron binned histogram. We added the reference:

Waskom, M. L., (2021). seaborn: statistical data visualization. Journal of Open Source Software, 6(60), 3021, https://doi.org/10.21105/joss.03021,

and added the following text to Figure 4 caption: "*The line fit represents a kernel density estimation of the python seaborn package (Waskom, 2021).*"

Figure 6. a) should maybe refer to a-b)

We thank the reviewer for this suggestion and have changed the Figure 6 caption to a-b) and c-d). In addition, we have deleted the last sentence of the caption as it became unnecessary.

General Comment: it would be nice to see some FCDP, 2DS size distributions comparisons. The image plot 3b is fine though otherwise.

We than the reviewer for this thoughtful comment and understand that this would be viable information. Therefore, we added the mean particle size distribution of only in cloud seconds of the ACB leg for the FCDP, 2D-S and the combination of both in a separate plot below and changed the last sentence of the caption into: "*b) Histogram showing the color-coded log-normalized number concentrations per bin on a 1-second basis of the 2D-S/FCDP combination with the diameter given in* *the ordinate and the derived mean particle size distribution of in cloud seconds during the ACB leg below."*

APPENDIX: N_{gt85} definition missing.

We have added the N_{gt85} definition to the A1 List of symbols and abbreviations.