Lenhardt et al. investigate the effects of above-cloud and below-cloud CCN concentrations on cloud-top properties, primarily using remote sensing measurements obtained during the ORACLES campaign. The datasets used in this study, along with the co-location methodology (Figure 2), are clearly described and well justified. The calculation of ACI metrics is also comprehensively presented. The manuscript is well written and easy to follow. Uncertainty quantification is clearly described for both the physical properties and the regression slopes. I have a few minor comments that aim to further improve the manuscript. I recommend it for publication after these comments are addressed.

Minor comments:

1. Lines 63-65: The limitations also include 3D scattering, which enhances near cloud reflectance and is maximum for sunlit edges of clouds (Varnai and Marshak 2009, 2011). Active lidar observations are not affected by such 3D effects.

T. Vrnai and A. Marshak, "MODIS observations of enhanced clear sky reflectance near clouds", *Geophys. Res. Lett.*, vol. 36, pp. L06807, Mar. 2009.

T. Varnai and A. Marshak, "Global CALIPSO Observations of Aerosol Changes Near Clouds," in *IEEE Geoscience and Remote Sensing Letters*, vol. 8, no. 1, pp. 19-23, Jan. 2011, doi: 10.1109/LGRS.2010.2049982.

2. Lines 99-103: Do all airborne measurements used in this study correspond to clouds influenced by smoke plumes? If so, please explicitly state this in the research questions.

Also in line 102, change “Nccn concentration” to “Nccn”

3. Equation 1: it would be more convenient for readers to use 10^{-6} than e^{-06}

4. Figure 1: Do the authors consider only those flight snippets that contain clouds when estimating the autocorrelation? If not, I recommend restricting the analysis to such segments, since the conclusion that CCN concentrations do not vary significantly over horizontal distances of 5 km is used to support the representativeness of cloud-adjacent regions in depicting below-cloud concentrations.

5. Line 300: MERRA 2 data citation needs correction:

Global Modeling and Assimilation Office (GMAO) (2015), MERRA-2 inst3_3d_asm_Np: 3d,3-Hourly,Instantaneous,Pressure-Level,Assimilation,Assimilated Meteorological Fields V5.12.4, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: [*Data Access Date*], 10.5067/QBZ6MG944HW0

6. Equations 7 and 8: I suggest also stating the physical meaning of these ACI metrics. For instance, dlnNd/dlnNccn represents the fractional change in cloud droplet number

concentration in response to a fractional change in CCN concentration. It may also be noted that these quantities are fundamental components of radiative forcing calculations.

7. Is it possible that above-cloud and below-cloud CCN concentrations are correlated? If so, could the observed correlation between above-cloud CCN concentrations and cloud properties be biased by this co-variability?

8. I am surprised by the low ACI$_{\mathrm{CDNC}}$ value of 0.053 estimated from below-cloud CCN and cloud-top N$_{\mathrm{d}}$. This implies that for every 100% increase in below-cloud CCN, Nd increases by only 5%. If I understand the methodology correctly, below-cloud CCN is approximated using CCN concentrations adjacent to clouds, which is what satellite-based studies assume in ACI studies. However, this sensitivity is considerably lower than values reported from satellite observations, including those based on active lidar, which typically range between 0.3 and 0.4 (e.g., Zheng et al., 2025; Li et al., 2025; Choudhury et al., 2026). The authors should comment on this discrepancy. In addition, the strong meteorological dependence of ACI metrics reported by Zheng et al. (2025) is not evident in Figure B1 in the Appendix for below-cloud CCN and cloud-top Nd.

One possible explanation is that the presence of an aerosol plume above the cloud, which may actively serve as a CCN reservoir for the cloud-top or boundary, as also shown by Gupta et al. (2021), makes the cloud-top Nd less related to below-cloud CCN. This could be also discussed in Line 475.

Zheng, X., Feng, Y., Painemal, D., Zhang, M., Xie, S., Li, Z., Jacob, R., and Lusch, B.: Regime-based aerosol–cloud interactions from CALIPSO-MODIS and the Energy Exascale Earth System Model version 2 (E3SMv2) over the Eastern North Atlantic, Atmos. Chem. Phys., 25, 17473–17499, https://doi.org/10.5194/acp-25-17473-2025, 2025.

Li, Z., Painemal, D., Feng, Y., and Zheng, X.: Progress in the quantification of aerosol-cloud interactions estimated from the CALIPSO-CloudSat-Aqua/MODIS record, EGUsphere [preprint], https://doi.org/10.5194/egusphere-2025-4769, 2025.

Choudhury, G., Goren, T., & Tesche, M. (2026). Satellite observations show negligible impact of mineral dust on cloud droplet number. Geophysical Research Letters, 53, e2025GL120234. https://doi.org/10.1029/2025GL120234

9. As a general comment, I recommend using an alternative binning approach in Figures 4, 5, 7, 8, and 10. Instead of fixed Nccn bins, consider dividing the dataset into a specified number of equally populated bins based on Nccn, and then estimating the median Y value within each bin. This approach can improve the visual representation of the relationship between X and Y. Additionally, using a logarithmic scale for the X-axis may further improve these figures.