The paper is a fascinating study exploring the potential of radar with ultra-fine sampling volume to increase the possibility of detecting tiny drizzle drops in small concentrations in a cloud chamber. Practical experiments also support the analytical analysis. The study has relevant implications for gathering knowledge on aerosol-cloud interaction and microphysical processes leading to warm rain formation, and for this, I recommend its publication. My only primary concern is that most graphics are color-blind people unfriendly. I suggest that the authors re-elaborate them after exploiting tools to check their plots, which can also be found at https://hiweller.rbind.io/post/using-the-dichromat-package-to-check-if-your-plot-is-colorblind-friendly/

Response: We want to thank the reviewer for the positive feedback on this study and for providing valuable suggestions. We have modified the color scheme to make the figures to be more colorblind-friendly.

Moreover, I collected some minor comments, corrections of typos, and mere curiosity questions, which I list here:

Under which hypothesis do you assume the same distribution used for cloud droplets is also valid for drizzle? I understood that you used eq 6 to describe the N(D) of the drizzle drops in 9, and I would like to understand more about this choice.

Response: We want to thank the reviewer's comments. In Sec. 4, the main focus is to demonstrate the trade-off scenario that the probability of particle occurrence in a radar volume decreases significantly as the volume decreases. In this regard, a theoretically derived DSD (i.e. Eq. 6), which is required in Eq.9, is qualitatively adequate to illustrate this effect. However, we agree with the reviewer that Eq. 6 might not represent the experimental probability of occurrence for drizzle particles. To achieve a more realistic droplet size distribution, we apply the ClusColl model to illustrate the caveat of application of Eq. 6 for drizzle occurrence estimation (shown in Fig. 6).

L 237: Is it possible to also include, as a reference, dots representing typical in real situ observed relations of LWC/N in Figure 2, as you did for the ones observed in the cloud chamber? It would show how representative the cloud chamber of what happens in reality is—for example, one or two cases of warm maritime and continental clouds from literature studies.

Response: We thank the reviewer for the suggestion. As the focus of this manuscript is on drizzle detection in a cloud chamber, we decided not to link drizzle detection in real cloud observations because this additional information would be distracting and is not directly related to the research topic. Instead, we add the following statement in the manuscript to emphasize the difference between cloud in a chamber and cloud in the atmosphere:

"…It should be noted that LWC_c and N_c in a convection cloud chamber have a stronger correlation compared with those in atmospheric clouds (Shaw et al., 2023)"

Fig 3: I think that adding a grey grid on the background of the plots would help the reader to follow your arguments.

Response: The corrections have been made.

L 264: Where is the 70-micron case?

Response: The corrections have been made.

L 240: … probability of “detecting, " not detection.

Response: Corrections have been made.

L 481: Do you think the high inhomogeneous variability in the cloud droplet distributions is happening only in the cloud chamber, or is it a property that can also hold for real clouds? Here, and in general, in the whole paper, it would be great to have a more evident connection to the cloud observations in the environment, maybe highlighting how these studies in the cloud chamber can support them and also discussing possible limitations and differences between what occurs in the cloud chamber and what happens when taking observations outside.

Response: We want to thank the reviewer for the comments. In-situ observations have shown that droplet size distribution can also vary in real clouds, especially near the transition region between cloudy and clear air (Beals et al., 2015). Thus, when detecting drizzle drops in real clouds using small radar sampling volume (if possible), we also need to consider the impact of “background-noise” fluctuation on drizzle detection. However, drizzle detection in atmospheric clouds would encounter more complicated challenges compared with the detection in a cloud chamber, due to the complexity of microphysics and dynamics in real clouds. A more detailed and comprehensive assessment of the application of high-resolution radar for drizzle detection in real clouds will be conducted in our future study.

Reference:

Beals, M. A., Fugal, J. P., Shaw, R. A., Lu, J., Spuler, S. M., and Stith, J. L.: Holographic measurements of inhomogeneous cloud mixing at the centimeter scale, Science, 350, 87-90, 2015.

Shaw, R. A., Thomas, S., Prabhakaran, P., Cantrell, W., Ovchinnikov, M., and Yang, F.: Fast and slow microphysics regimes in a minimalist model of cloudy Rayleigh-B\'enard convection, Physical Review Research, 5, 043018, 10.1103/PhysRevResearch.5.043018, 2023.