This is an interesting paper that explores the use of very high-resolution radar to characterize drizzle drops in a large cloud chamber. The authors find that identification of single drop backscatter against the background cloud droplets is very challenging and at best requires multiple hours to expect observation of a single droplet. While the authors remain optimistic that such a radar can be used for this purpose, its seems that this optimism is a bit premature since the shortest time for detection (order of hours) relies on a droplet concentration theory that, while plausible and published, is perhaps a theory that cannot yet be relied upon to be mature.

I can find no technical issues with the paper and I think it could be published as is. However, I do think the authors should consider a more realistic assessment of the challenges of this methodology being successful. For instance I question whether a 3-hour observational interval between detecting drizzle drops is reasonable? Can the cloud chamber remain in steady state for this long? What exactly can be learned by sensing the presence of a single drizzle drop every several hours? Is drizzle actually produced for the liquid water contents that seem most suitable for generating the SNR needed for detection (much less than 1 g/m3)?

Response:

We appreciate the reviewer's acknowledgement on our work, and we agree that a more realistic assessment is necessary for the drizzle detection method. However, the main focus of this study is to propose the concept of detecting single particle using high-resolution radar in cloud chamber. We have demonstrated this concept using theoretical model and real-chamber observation. A full assessment of the proposed method, while is necessary, is not decided to be added in the manuscript as this work is beyond the scope of this study.

For instance, to answer the questions mentioned by the reviewer. A more realistic cloud chamber simulation should be conducted in combination with a full consideration of the radar capability. To be more specific, the spatial and temporal information of the drizzle particles in the cloud chamber should be known, the associated radar sampling strategy, range resolution and the Signal to Noise Ratio (SNR) should be considered. That is to say, the 3-hour observational-internal discussed in the manuscript is just an example showing the significantly reduced observational time after considering the collision-coalescence process. This example does not provide specific guidance or quantitatively estimation on the drizzle detection time in real cloud chamber. Depending on the chamber environment, radar scanning strategy, SNR, and the size of particle to be detected, the detection time would vary signifyingly. A more realistic and comprehensive assessment of the proposed drizzle detection approach will be conducted in our future study.

Minor issues:

The manuscript should be proofed for grammar.

Response: Thanks for the comments. We have carefully proofread the manuscript, addressing grammar, spelling, and punctuation errors in the revised version.

Line 56: Is there documentation of this inability to explain drizzle growth by "traditinally-defined condensation growth processes"? It seems that a single 1996 paper is insufficient to establish this statement which is the motivation for using the cloud chamber to study the process

Response: More related references have been added in the revised manuscript to support the statement.

Line 65: What effects?

Response: We have modified this sentence in the revised manuscript:

Line 65: "…One main barrier that hinder our ability to investigate the drizzle initiation process is the lack of observations with sufficient sensitivity and spatiotemporal resolution to detect the early growth of drizzle particles…"

Figue 2: Color scheme is not friendly to color-blind readers.

Response: The color scheme has been modified to be more colorblind-friendly.

Line 235: The likelihood of getting 40 micron drizzle drops in an 0.2 g/m3 LWC cloud seems very unlikely.

Response: We want to thank the reviewer's comments. In Zhu et al. (2022), we have demonstrated that drizzle-size particles are ubiquitous in nature and can be generated in clouds with Liquid Water Path(LWP) lower than 50 g m^{-2}. Thus, we tend to consider that the formation of 40-micron particle in cloud chamber with 0.2 gm^3 LWC is plausible.

Reference:

Zhu, Z., Kollias, P., Luke, E., and Yang, F.: New insights on the prevalence of drizzle in marine stratocumulus clouds based on a machine learning algorithm applied to radar Doppler spectra, Atmospheric Chemistry and Physics, 22, 7405-7416, 2022.