This manuscript addresses a key challenge in dual-frequency radar retrievals of raindrop size distributions (DSD) — the dual-solution ambiguity in the DFR-Dm relationship. The authors propose a novel solution by incorporating Ka/W-band DFR as an additional constraint, combined with T-matrix scattering simulations. The research is well-structured, the experimental design is sound, and the validation using ground-based disdrometer data is rigorous. The proposed method demonstrates clear improvements, particularly for weak echo regions. Overall, The manuscript is well suited for Atmospheric Measurement Techniques and will be valuable to the community. Accordingly, I recommend this manuscript for publication; however, you may consider the minor comments as follows:

1. *The manuscript's central assumption is the availability of W-band (93.75 GHz) data. However, W-band radar suffers from extreme attenuation in rainfall, potentially losing signal within hundreds of meters during moderate to heavy rain. It appears from Section 3.6 that Z_W was simulated using T-matrix calculations based on measured DSDs, rather than being directly observed. If true, this manuscript presents a proof-of-concept simulation study rather than a retrieval algorithm ready for operational radar data. The authors must clarify this point explicitly in the abstract, introduction, and conclusions. A more accurate framing would be "simulation-based retrieval framework" rather than simply "retrieval method."*

Response: We sincerely thank the reviewer for this critical and constructive comment. We fully agree with the reviewer's assessment that the W-band reflectivities used in this study were obtained through T-matrix scattering simulations based on measured DSDs, rather than from actual W-band radar observations. Consequently, this study is indeed a proof-of-concept investigation rather than an operational retrieval algorithm ready for direct application to real three-frequency radar data.

To address this concern, we have made comprehensive revisions throughout the revised manuscript to explicitly clarify the proof-of-concept nature of this work and the simulation-based origin of the W-band data. The specific modifications are as follows:

The original title was "An Improved Method for Raindrop Size Distribution Retrieval Using Combined Dual-frequency Radar DFR." In the revised manuscript, the title has been changed to "The Proof-of-Concept for Raindrop Size Distribution Retrieval Using Combined Dual-frequency Radar DFR." The explicit inclusion of "Proof-of-Concept" accurately reflects the nature of this study from the outset.

In the revised abstract, we have explicitly stated that "W-band reflectivities obtained through scattering simulations based on measured raindrop size distributions, combined with the DFR(Ka, W) constraint, effectively mitigate the DFR(X, Ka)-Dm dual-solution ambiguity." Furthermore, the abstract conclusion now clearly states: "This proof-of-concept study provides a reference framework for future three-frequency radar DSD retrieval." These revisions ensure that readers immediately understand the simulation-based and conceptual nature of the work.

A new subsection has been added to the Discussion and Limitations section to explicitly acknowledge this limitation. The text states: "It is important to explicitly acknowledge that this study does not include W-band radar observations. The W-band reflectivities used herein were obtained entirely through T-matrix scattering simulations based on measured DSDs. Therefore, the DFR(Ka, W) constraint should currently be regarded as a theoretical assessment of its potential to mitigate DFR-Dm ambiguity, rather than a fully operational retrieval constraint that has been validated with real three-frequency radar data. The practical implementation of this approach would require a three-frequency radar system with X/Ka/W bands, and the actual performance may be affected by W-band radar calibration accuracy, atmospheric attenuation at W-band, and signal-to-noise ratio limitations. This study provides a proof-of-concept demonstration that motivates the development of future three-frequency radar systems for operational DSD retrieval."

The conclusions have been thoroughly revised to emphasize the proof-of-concept nature. The opening now states: "This study presents a proof-of-concept DSD retrieval framework that explores the potential of combining X/Ka-band radar observations with simulated DFR(Ka, W) constraints to mitigate the DFR(X, Ka)-Dm ambiguity problem." A new paragraph explicitly emphasizes: "It is important to emphasize the W-band reflectivities were obtained through scattering simulations rather than actual radar observations, and the evaluation is based on a limited sample from a single observational site. The practical applicability of the Ka-W constraint for operational three-frequency radar systems requires further validation with real W-band observations and more extensive datasets covering diverse precipitation regimes."

In the retrieval framework description, we have added explicit clarification that "Blue boxes denote the results from scattering simulations, and green boxes represent those derived from radar observation data." This visual distinction in the flowchart (Figure 1) helps readers immediately identify which components are simulation-based and which are observation-based.

2. *When DFR(X,Ka) ≤ 0, the algorithm switches to DFR(Ka,W). However, Table 6 shows that 12.5% of data points still fall within the ambiguous zone of DFR(Ka,W) (i.e., DFR(Ka,W) ≤ 0). The authors do not specify how these remaining ambiguous cases are handled. Are they discarded? Assigned a default Dm value? Or constrained by another relationship (e.g., Z_Ka-LWC)? The authors should provide a complete decision tree or flow chart (as an enhancement to Figure 1) that explicitly states*

the retrieval strategy for all possible combinations of DFR(X,Ka) and DFR(Ka,W). Additionally, the retrieval performance for these "doubly ambiguous" cases should be highlighted in Figure 17.

Response: We sincerely thank the reviewer for raising this important point regarding the handling of the remaining 12.5% of data points that fall within the ambiguous zone of DFR(Ka,W).

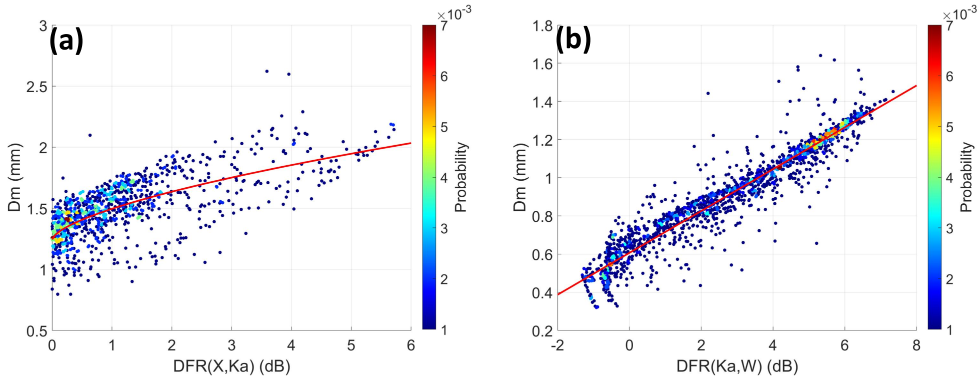

Figure 13. DFR-Dm fitting curve [a: DFR(X, Ka)>0, b: DFR(Ka, W) when DFR(X, Ka)≤0]

In the revised manuscript (Section 4.1), we present the combined retrieval formula (Eq. 19) as follows:

$$D_m = \begin{cases} 0.251DFR(X,Ka)^{0.6391} + 1.2445 & DFR(X,Ka) > 0 \\ 0.11DFR(Ka,W) + 0.6064 & DFR(X,Ka) \le 0 \end{cases}$$

This formulation implicitly applies the DFR(Ka,W)-Dm relationship whenever DFR(X,Ka) ⩽ 0, regardless of whether DFR(Ka,W) is positive or negative. We note that Section 4.1 of the revised manuscript includes the following statement: "***Specifically, the DFR(Ka, W)-Dm accurately retrieves larger Dm values when DFR(Ka, W) is less than 0, with retrieval errors remaining only for raindrops smaller than 0.5 mm (Fig. 13b). Furthermore, as indicated in Fig. 14, rain rates do not exceed 0.6 mm h^{-1} when Dm is below 0.5 mm. Therefore, the retrieval error associated with DFR(Ka, W) in this range is almost negligible***."

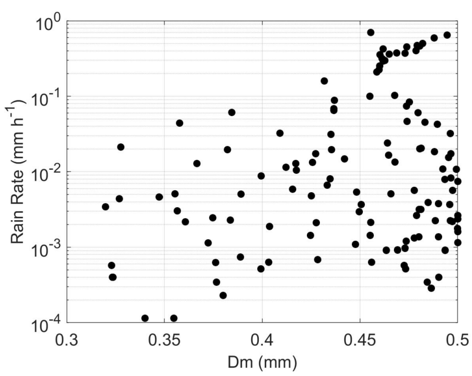

Figure 14. Scatterplots of rain rate versus Dm when Dm is below 0.5 mm based on measrued DSDs

3. *In Section 3.1 (Instruments), the authors provide detailed specifications for the X/Ka-band radar and the 2DVD disdrometer. However, there is no mention of any W-band radar or the source of W-band reflectivity data. This is a critical omission for understanding the experimental setup. Please add a clear statement at the end of Section 3.1 or at the beginning of Section 3.3: "W-band reflectivities used in this study are simulated using the T-matrix method based on measured DSDs."*

Response: We sincerely thank the reviewer for this important observation. Since Section 3.1 provides a detailed description of the X/Ka dual-frequency radar and the 2DVD disdrometer without introducing retrieval methods, we have not added a statement regarding the source of W-band reflectivity within this section. Nevertheless, we have emphasized this point in the abstract, conclusions and Section 5.1.

Abstract: "..., This study demonstrates that W-band reflectivities obtained through scattering simulations based on measured raindrop size distributions, combined with the DFR(Ka, W) constraint, effectively mitigate the DFR(X, Ka)-Dm dual-solution ambiguity. ...".

Conclusions: "..., It is important to emphasize the W-band reflectivities were obtained through scattering simulations rather than actual radar observations,... ".

5.1 Practical Applicability of Ka-W Constraints

It is important to explicitly acknowledge that this study does not include W-band radar observations. The W-band reflectivities used herein were obtained entirely through T-matrix scattering simulations based on measured DSDs. Therefore, the DFR(Ka, W) constraint should currently be regarded as a theoretical assessment of its potential to mitigate DFR-Dm ambiguity, rather than a fully operational retrieval constraint that has been validated with real three-frequency radar data. The practical implementation of this approach would require a three-frequency radar system with X/Ka/W bands, and the actual performance may be affected by W-band radar calibration accuracy, atmospheric attenuation at W-band, and signal-to-noise ratio limitations. This study provides a proof-of-concept demonstration that motivates the development of future three-frequency radar systems for operational DSD retrieval.

4. *Figure 6 shows dense scatterplots for Z_X-DFR(X,Ka) and Z_Ka-DFR(Ka,W). The 6th-order polynomial fitting curves are barely visible despite being provided in equation form. Please increase the line width or color contrast of the fitting curves. Also, add a note in the caption stating "The black curve represents the 6th-order polynomial fit."*

Response: Thank you for your suggestion. Corresponding revisions have been made.

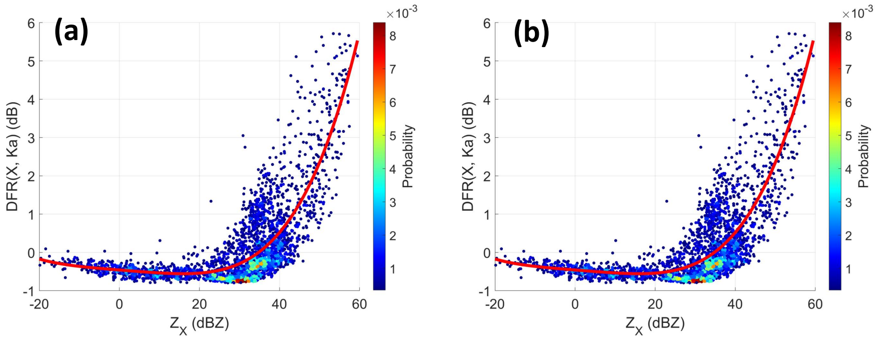

Figure 6. Scatterplots of the X-band reflectivity (Z_X) and X/Ka dual-frequency ratio [DFR(X, Ka)]; the Ka-band reflectivity (Z_{Ka}), and Ka/W dual-frequency ratio [DFR(Ka, W)]. The red curve represents the polynomial fit.

5. *Several sentences could be clarified for better readability. For example, on Page 12, the sentence "...the corrected reflectivities were validated against those derived from ground-based raindrop size distributions measurements" — the word "those" is ambiguous. It should read "...validated against the theoretical reflectivity values derived from ground-based DSD measurements." Similarly, on Page 17, "This characteristic underpins the interpretation..." would be more accurate as "This characteristic guides the choice of retrieval algorithms..."*

Response: Thanks for your valuable comment. Corresponding revisions have been made.

"The corrected reflectivities were validated against the theoretical reflectivity values derived from ground-based raindrop size distributions measurements. "

In response to comments from other reviewers, the section concerning axis ratio has been removed, including the sentence "This characteristic underpins the interpretation...".

6. *In Table 1, the unit for Antenna Gain is listed as "dB". While this is common, the formal unit should be "dBi" (decibels relative to isotropic). Please consider this correction.*

Response: Thank you for the correction, it has been revised in the revised manuscript.