

This manuscript addresses the DFR-Dm dual-solution ambiguity in dual-frequency radar DSD retrievals by incorporating Ka/W-band DFR as an additional constraint. The method is well-designed and shows clear improvements, particularly for weak echoes. The following three key issues should be addressed prior to publication.

1. Clarify that W-band data are simulated, not observed

The manuscript's central innovation relies on Ka/W-band DFR, but it appears from Section 3.6 that W-band reflectivities are simulated using T-matrix calculations based on measured DSDs, rather than directly observed. Given that W-band radar suffers from extreme attenuation in rainfall, this distinction is critical. The authors must explicitly state in the abstract, introduction, and Section 3.1 that this is a simulation-based retrieval framework, and add a clear statement: "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 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, 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.

2. Specify handling of remaining ambiguous cases ($DFR(Ka, W) \leq 0$)

Table 6 shows that 12.5% of data points still fall within the ambiguous zone of $DFR(Ka, W)$ (i.e., $DFR(Ka, W) \leq 0$). The authors do not specify how these "doubly ambiguous" cases are handled (discarded? default value? constrained by Z_{Ka} -LWC?). Please provide a complete decision tree or flow chart (as an enhancement to Figure 1) and evaluate the retrieval performance for these cases.

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 $DFR(Ka, W)$.

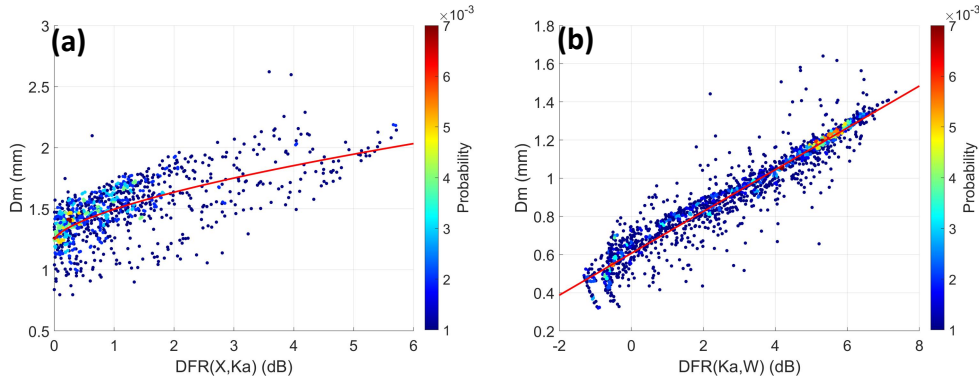


Figure 13. DFR-Dm fitting curve [a: $DFR(X, Ka) > 0$, b: $DFR(Ka, W)$ when $DFR(X, Ka) \leq 0$]

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

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

This formulation implicitly applies the $DFR(Ka, W)$ - D_m relationship whenever $DFR(X, Ka) \leq 0$, 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 $DFR(Ka, W)$ - D_m accurately retrieves larger D_m 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 D_m is below 0.5 mm. Therefore, the retrieval error associated with $DFR(Ka, W)$ in this range is almost negligible.**"

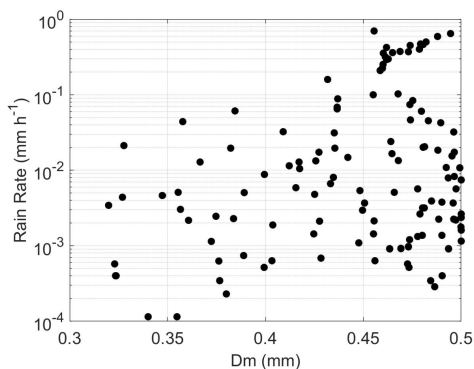


Figure 14. Scatterplots of rain rate versus D_m when D_m is below 0.5 mm based on measured DSDs

3. Quantitative assessment of the inversion errors caused by temperature variations

Provide quantitative error analysis (e.g., D_m bias) for 0°C , 10°C , and 30°C , not just state that errors are small.

Response: We have added error analysis at different temperature. Thanks for your suggestion.

“To evaluate the impact of temperature on raindrop size distribution retrieval, we take $\text{DFR}(K_a, W)$ as an example to simulate the retrieved relationship between $\text{DFR}(K_a, W)$ and D_m for raindrops at different temperatures (Fig. 2a). As shown in Fig. 2b, the RMSE of D_m retrieval is minimized at 20°C . Therefore, the $\text{DFR}-D_m$ retrieval model was established with 20°C adopted as the reference temperature.”

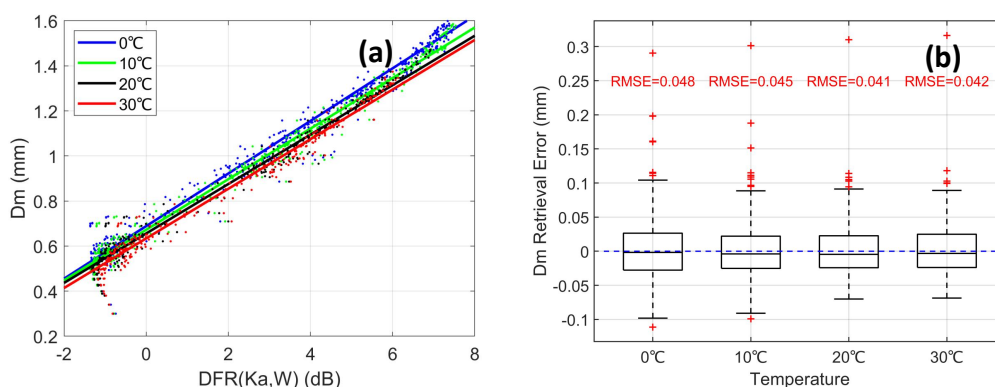


Figure 2. Fitting curves(a) and D_m retrieval error(b) of $\text{DFR}(K_a, W)-D_m$ at different temperatures (blue: 0°C ; green: 10°C ; black: 20°C ; red: 30°C).