

# ***Interactive comment on “Retrieval of Lower-Order Moments of the Drop Size Distribution using CSU-CHILL X-band Polarimetric Radar: A Case Study” by Viswanathan Bringi et al.***

**Anonymous Referee #1**

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This manuscript opens a chance to retrieve the lower-order moments with dual-pol radar measurement. The accuracy in retrieval is remarkable and there are some rooms for microphysical interpretation of retrieved moments/parameters. The review recommends to accept this manuscript with a minor revision. See the below comments.

We believe the measured Z is relatively accurate and the moment(s) close to measurements should be retrieved most accurately. However, the results show the accuracy in M6 is not better than others. This should be elaborated more.

The reviewer recommends further studies as separate papers to explore microphysical evolution of precipitation systems after applying this retrieval technique.

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More comments are below:

Line 6: → 0th moment of DSD, M0

Line 19~20: the radar-retrieved characteristic diameter with M0.. More specific.

Line 52~63: any moment  $M_k$  can be expressed as power laws of  $M_i$ ,  $M_j$ , and the  $k$ -th moment of  $h(x)$  → any moment  $M_k$  can be expressed as power laws of  $M_i$ ,  $M_j$ , in which the coefficient is and the  $k$ -th moment of  $h(x)$  and the two exponents are pre-determined by  $i$  and  $j$ .

lines 91~94: Multi-step –minimize the parameterization errors???

Line 150: Schönhuber et al. (2008) → (Schönhuber et al. 2008)

Line 162~169: Please further describe “drizzle mode”, “shoulder” and “precipitation mode”

Fig 1: It is interesting to find two peaks at  $D=1.3\text{mm}$  and  $D=2.2\text{mm}$ . Any comments in terms of the equilibrium DSD?

Fig. 2: It is worthwhile to show the same image from the X-POL.

Fig. 6: Any better way to show the pixel-to-pixel data? Currently, they are quite confusing.

Lines 281~283: Any explanation why ZDR is so different at  $\sim 2045\text{UTC}$ ?

Lines 320~321: The authors need to elaborate this.

Line 338:  $D'M \rightarrow D'm$

Lines 347~349: multi-step procedure: how does this minimize the overall errors? Please add more explanation.

Lines 407~409: It is not intuitive.  $M_6$  is the closest moment that we can measure with the radar but the estimation accuracy is worse than other moments. Why? Further

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detail explanation is required.

Lines 412~520: Same as the above comment. M3(least IQR) and M5 (unbiased) is the most accurate. It is understandable for M3. Why does the M5 have the least bias, not M6?

Fig. 11 and 12: What is the red line around 500?

Lines 452~454: Z was around 30~35dBZ in this later period. What will be the main reason of the dominant break-up process in such a moderate intensity?

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