AMT Review of “Evaluation of the reflectivity calibration of W-band radars based on observations in rain” by A. Myagkov, S. Kneifel and T. Rose.

General comments

This article proposes a self-consistency methodology to assess the calibration of the W-band radar. That is the main focus of the paper. For mm-wavelengths, this methodology increases in complexity compared to cm-wavelengths because of Mie scattering effects and attenuation. Next another calibration evaluation technique, which uses disdrometer data, is discussed. This technique is improved by taking into account possible evaporation in the path range bin – disdrometer location. Comparing both methods, consistency is found in radar constant offsets of two W-band radars.

For readers interested in the topic of calibration of W-band radars, this article is very valuable. Further it is very well referenced. Therefore, I recommend this article for publication. In the section “Specific comments”, I have some questions to the authors and some corrections for improving the paper.

Specific comments

1) The spectral polarimetric measurements are acquired at the elevation 30 deg. Why this choice? Is it an optimum elevation angle for the proposed self-consistency method?

2) In page 7, the ratios (1)-(2) and the specific attenuation (3) are parameterized as a function of the backscattering differential phase, δ, and, δ and the measured equivalent reflectivity factor Z_0, respectively. Can you discuss the choice of the function *f* for the parameterization? And for the number of coefficients (a_i, b_i, c_i) where *i* varies from 1 to 10, or 1 to 17. What is/ are the criterium/ criteria to select these numbers?

3) Equations corrections

Replace $S_{jk}\left(D_i\right)$ by $F_{jk}\left(D_i\right)$ in equations (A4), (B3) and (B4)

$$A_i = 8.686\times10^3\left(\frac{2\pi}{k}\mathrm{Im}\left[F_{hh}\left(D_i\right)\right]\right) \quad \text{(A4)}$$

$$A_{DP} = 8.686\times10^3\frac{2\pi}{k}\sum_{i=1}^{n}\mathrm{Im}\left[F_{hh}\left(D_i\right)-F_{vv}\left(D_i\right)\right]N_i \quad \text{(B3)}$$

$$K_{DP} = 10^3\frac{180}{\pi}\frac{2\pi}{k}\sum_{i=1}^{n}\mathrm{Re}\left[F_{hh}\left(D_i\right)-F_{vv}\left(D_i\right)\right]N_i \quad \text{(B4)}$$

In equation (B4), add 10^3 to express K_{DP} in ° km^{-1}.

In (B2), S_{hh} is complex conjugate instead of S_{vv}.

$$\delta = \frac{180}{\pi} \arg\left[\sum_{i=1}^{n} N_i S_{hh}^{*}(D_i) S_{vv}(D_i) \right] \quad \text{(B2)}$$

4) Do the authors use the estimated radar calibration constant, C_Z, to correct the equivalent reflectivity factor values of the radar 2?

5) Page13, lines 10 and 21: For the calculation of Z_0 (equivalently Z_d) using the disdrometer DSDs, I don't understand the use of Table A1, which is related to the other method, self-consistency. I may miss the point here.

6) For comparing disdrometer and radar reflectivity factor measurements, the trade-off radar range is 250 m. What is the expected underestimation of Z_m related to the FMCW measurement mode at this range? Is this significant for the radar calibration constant?

7) What is the argument for the rain rate upper limit 20 mm h^{-1}?

8) Be consistent with the terminology for the radar observables in the whole paper.

I would avoid the term "shift" for Φ_{DP} , K_{DP} and δ.

Instead of Φ_{DP} differential phase shift, just term it as "differential phase". Example: line 10 in page 19.

Instead of K_{DP} specific differential phase shift, just term it as "specific differential phase". Example: line 9 in page 15.

Instead of δ backscattering phase shift, term it as "backscattering differential phase". Examples: line 3 in page 7, line 8 in page 15.

9) Page 10, lines 26-28: Taking into account that signal-to-noise ratio in rain within the first kilometer typically exceeds 30 dB, and the copolar correlation coefficient in rain approaches 1, variability in the polarimetric variables are low…….

10) Page 11, line 15: discussion related to Fig. 8, … Around 21 UTC positive and negative values in both Z_{DR} and Φ_{DP} are visible…….I don't see this. Add in Fig. 8 a zoomed window in the area of interest.

11) Page 12, line10: …………. (3) the median K_{DP} must be lower than -0.3°km^{-1}, and (4) the median A_{DP} is lower than -0.06 dB km^{-1}. How are found these threshold values?

12) About Table A1.

Mention the units of N_i, V_i, v_i and S_i.

$|K|^2$ is the dielectric factor of water at a certain temperature. How is defined $|K_0|^2 = 0.74$ (water? which temperature?)

Typo in the Table: Parsivel

13) What is the meaning of the bending of the curve Z_{EVP}-Z_{NOEVP} versus Z_{EVP} at values of Z_{EVP} near 20 dBZ in Figure 15?

Technical corrections

1) Page 4, line 10: …The calibration methods and their comparison are shown in **Secs. 3-4**.

2) Page 8, line 3: …….and $c_{1\text{-}\mathbf{17}}$ are given ………

3) Replace Φ by Φ_{DP} in the whole text (line 12 in page 8, lines 11, 13, 23, 31 in page 11)

4) Page 10, line 23: …Size distributions with *A* less than 3 dB km^{-1} were excluded from the analysis ……. Is it not 0.3 dB km^{-1} instead of 3 dB km^{-1}?

5) Page 11, line 11: …The melting layer can be depicted at **the height** 2.5 km by enhanced values of ….

6) Page 13, line 27, ….to LPM, **Parsivel**, and radar 1 …….

7) Page 14, line 1: …The blue dots were calculated according to Sec. 4**.1**, while ….

8) Page 14, line 21: …As it was mentioned in Sec. **4.5**, the ….

9) Page 15, line 6: …. spectral polarimetry obtained **from** a W-Band radar….

10) Page 15, line 11: …based on realistical **assumptions** of errors …………………

11) Page 18, line 13: ……the application of such evaporation correction…….

12) Page 18, lines 23-24: …one-way differential attenuation A_{DP} [dB km^{-1}], and specific differential phase K_{DP} [° km^{-1}]…

13) Figure 5 caption: replace (d), (e), (f), (g) and (h) by (1), (2), (3), (4) and (5) to be consistent with Figure 5c.