Comparison of D_0 and R from KPOL and PR: Version 6 vs. Version 7

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1. INTRODUCTION

- The KPOL radar located on Kwajalein Atoll of the Marshall Islands is the only operational dual-polarized S-band radar covering precipitation over the 'open' ocean, and hence ideal for comparing radar-derived D_0 and rain rate with those from the TRMM-PR 2A25 algorithm.
- Recently, Wolff et al. (2010) established quality control procedures for the KPOL radar enabling accurate reflectivity and Z_{dr} calibration, which in turn enables the estimation of the median volume diameter (D_0) and R for meaningful comparisons with R from 2A25 and, more importantly D_0 as diagnosed by Kozu et al.(2009).
- In this poster we consider two TRMM overpass events over the KPOL coverage area and compare the KPOL-based retrievals of D_0 and R with PR-2A25 estimates from version 6 and version 7.
- The goal is to see if the D_0 is adjusted in the right direction (for a given R) by version 7 and to see if the rain rates are in better agreement with KPOL-derived rain rates, primarily for moderate-to-heavy rates where the α-adjustment procedure is invoked by the 2A25 algorithm.

2. KPOL Data

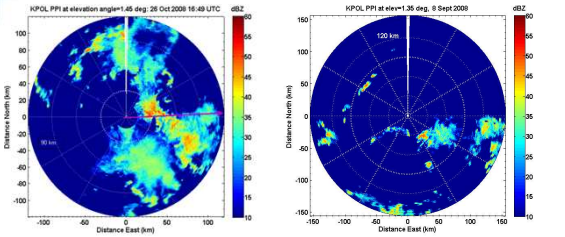

Fig. 1: PPI of reflectivity from (left) 26 Oct 2008 and (right) from 8 Sept 2008: both close in time to the TRMM overpass.

3. TRMM overpass events of 26 Oct and 08 Sept 2008

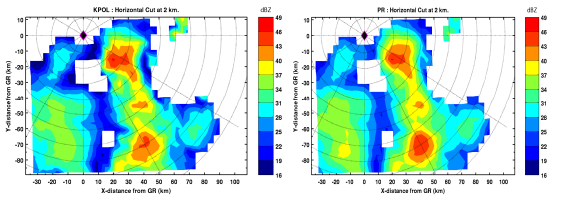

Fig. 2: CAPPI of reflectivity from KPOL at 2 km altitude (left panel) and from ZC from 2A25 (right panel). Both KPOL and PR data have been interpolated to common Cartesian grid with grid spacing of 4X4X0.5 km and aligned using the methodology of Bolen and Chandrasekar (2003). Event on 26 Oct 2008.

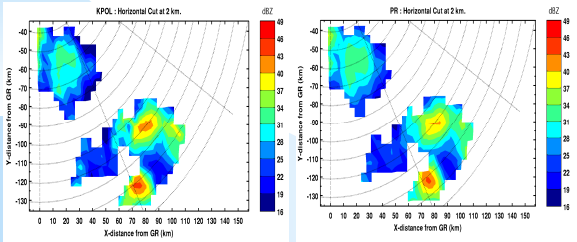

Fig. 3: As in Fig. 2 except for event on 08 Sept 2008.

4. Comparing ZC, D_0 and ε_f between Versions 6 and 7

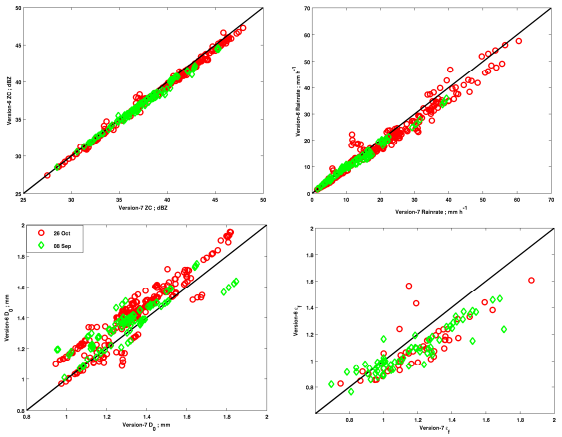

Fig. 4: Scatter plot of convective rain pixels from the 2 events comparing Version 6 along the Y-axis and Version 7 along the X-axis. Top left compares ZC (attenuation-corrected reflectivity) and similarly for R (top right), D_0 (bottom left) from Kozu et al. 2009) , and ε_f .

In Version 7 the ZC is slightly increased for ZC>35 dBZ while the R has increased more significantly, especially at higher rain rates. There is a corresponding decrease in D_0, andincrease in ε_f . This implies that the coefficient "a" in the $Z=aR^b$ relation has been adjusted to a lower value relative to its initial value (in agreement with Kozu et al. 2009). Note that D_0 here is derived from (R, ε_f) according to Appendix of Kozu et al. 2009.

5. Comparing D_0, R from the two versions with KPOL ground radar for 26 Oct case

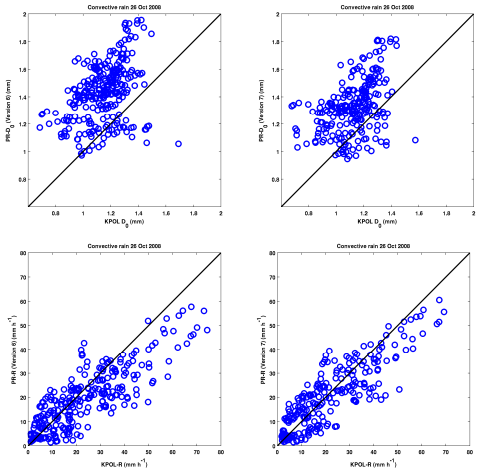

Fig. 5: Scatter plot of version 6 vs KPOL (left 2 panels) and version 7 vs KPOL (right 2 panels). One can see that D_0 and R from version 7 are adjusted closer to KPOL than Version 6 (though there is still overestimate in D_0 and resulting underestimate of R assuming KPOL is "ground truth")

6. D_0 vs R with overlay of constant ε_f

Another way of comparing the data from the 2 versions against KPOL is to do a scatter plot of D_0 vs R with overlay of constant ε_f for the 2 events as shown in Fig. 6 for the 26 October event and Fig. 7 from the 08 Sept event.

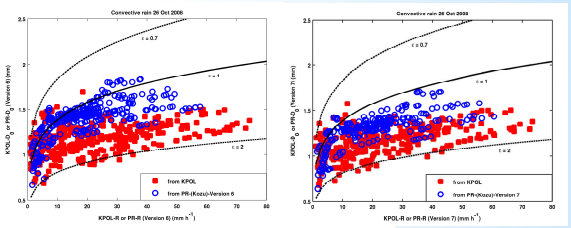

Fig. 6: Scatter plot of D_0 versus R from Version 6 (left panel) and Version 7 (right panel). Curves of constant ε_f are also shown. Event from 26 Oct 2008.

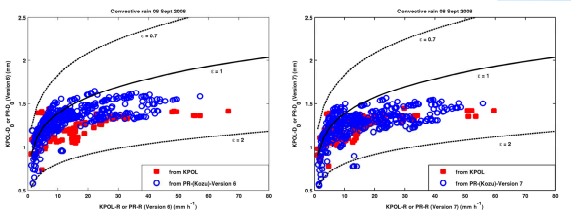

Fig. 6: As in Fig. 7 except for event of 08 Sept 2008

From Figs.6-7, one can note that Version 7 data fall along a higher value of ε_f as compared with Version 6 and closer to the KPOL data. The higher ε_f in Version 7 might occur because of the different vertical profile of the phase state model (no wet ice at -20C and colder temper-atures) or because of including NUBF correction which was not done in Version 6.

7. Preliminary conclusions

- We have compared D_0 from Versions 6 and 7 of 2A25 (using Kozu et al 2009) and show that the D_0 values from Version 7 are systematically larger than from Version 6.
- From the D_0 versus R scatter plot for both events we show that Version 7 adjusts D_0 in the "right" direction relative to KPOL and somewhat better than Version 6 (much better for 8 Sept than for 26 Oct case).
- Regarding comparisons for R from Version 6 to Version 7: Version 7 gives higher R, especially for R>20 mm/h. This is related to higher ε_f values obtained from the α- adjustment procedure. Using Kozu et al. 2009, this in turn is consistent with lower values of D_0 from Version 7 or lower values of the coefficient "a" in the $Z=aR^b$ relation.
- In general, it appears from this limited study that Version 7 derived values of D_0 and R are in better agreement with KPOL retrievals as compared with Version 6. This is a consequence of higher derived values of ε_f from Version 7 which may be due (among other factors) to a significant change in the vertical phase state model or including the NUBF correction.