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# *Interactive comment on* "Determination of Ice Water Content (IWC) in tropical convective clouds from X-band dual-polarization airborne radar" *by* Cuong M. Nguyen et al.

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This is a very important study demonstrating a potential of a polarimetric radar for accurate estimation of ice water content in clouds by using a unique experimental setup combining X-band polarimetric radar measurements and in situ microphysical observations on the same airborne platform. It is shown in a number of flights that the polarimetric method grossly outperforms existing IWC-Z relations and that the combination of KDP and ZDR yields better accuracy of the IWC estimate than a use of sole KDP. I am particularly pleased to find out that empirically derived relations IWC(KDP) and IWC(KDP,ZDR) are very close to the theoretical relations derived by Ryzhkov et

al. (1998, 2018). I found that the multipliers a1 and a2 in the empirical formulas (12) and (13) (shown in Table 1) are within 6% of the theoretical ones which is remarkable. I think that this should probably be mentioned in the paper. There are several technical deficiencies in the manuscript which have to be addressed before the paper can be recommended for publication. (1) I was confused by the definitions of IWCmeas and IWCmod. It took me awhile to realize that IWCmod = (1-ZDR-1)IWCmeas. This is very weird and, I am sure, will confuse other readers as well. I would recommend simply using (1-ZDR-1)IWC instead of IWCmod in the text and labels in Figs. 5 and 12. (2) I may hypothesize that increasing negative bias in the radar IWC retrieval shown in Fig. 14 could be related to the minimal ZDR threshold of 0.6 dB. I would recommend to decrease the ZDR threshold in the IWC(KDP,ZDR) relation below 0.6 dB and see what happens. Adding large aggregates may disproportionally increase KDP and IWC. At the same time, ZDR decreases and may fall below 0.6 dB. Using values of ZDR lower than 0.6 dB will provide some "boost" for the IWC(KDP,ZDR) estimate. (3) Number concentration n in Eq (2) is not defined in the text. (4) In Eq (5), Kp2 is not equal to 0.177. It has to be the one for water. (5) Page 4. Cross sections $\sigma$hh,vv are not used in Eqs (1) – (6). (6) Page 5. The approximation (1-ZDR-1) IWC $\approx$ KDP is not correct and is not consistent with the value a2 = 0.135 shown in Table 1. (7) The reference to Korolev et al. (2018) can not be found in the reference list. (8) Page 8. Both $\Phi$DP and $\Psi$DP may exhibit discontinuities due to phase wrapping. (9) Page 9. Two equations IWC(Z) are very different and both differ much from the popular Hogan et al. IWC(Z) equation. Please clarify and comment. (10) English usage has to be improved, e.g., data are plural, not single, etc. References Ryzhkov, A., P. Bukovcic, A. Murphy, P. Zhang, and G. McFarquhar, 2018: Ice microphysical retrievals using polarimetric radar data. 10th European Conference on Radar in Meteorology and Hydrology, 1 – 6 July, The Netherlands, # 40. Available online at: projects.knmi.nl/erad2018/ERAD2018_extended_abstract_040.pdf.