

Interactive comment on “Observational operators for dual polarimetric radars in variational data assimilation systems” by Takuya Kawabata et al.

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General Comments This paper presented two forward operators for dual-pol radar data assimilation and compared their effect on analysis. The operators were developed for WRF VAR and NHM-4DVAR. The former system has been widely used by the community and the latter has been used operationally by JMA for a number of years. This is the first paper, to my knowledge, that has compared the two types operators - converting model variables to observation variables and converting observational variables to model variables. The work is significant and approach is appropriate. The subject is clearly presented and the result is convincing. The presentation of the modeled operators can be easily followed and they should be able to be reproduced either by following the paper or collaborate with the authors. Below lists my specific comments that the

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authors may want to clarify.

Specific Comments 1. Page 2, line 9: "The objective of our study was thus to improve QPE and ..." How can you improve QPE by assimilating the dual-pol data with the developed operators? 2. Page 2, line 16: "...our study is their first implementation in variational assimilation systems". Note that Li and Mecikalski (2010) implemented an dual-pol operator in WRF Var similar to your KD. 3. Page 4, line 18: Change "the fitting" to "a statistical fitting". 4. Page 8, section 4.2 and Figure 2: What DA system did you use to produce the results in Figure 2? If you developed the operators for the two systems, it should be natural to show the analyses from both systems, right? Page 8, line 16: These errors are quite large. Have you tried to use smaller errors? Page 9, line 8: "...reasonable results with both the FIT and KD operators". This statement is not accurate. The result from KD is reasonable and clearly better than that from FIT for Zh. The result of Zdr from FIT has some characteristics of the observed Zdr but not that from KD. The Kdp from both FIT and KD differ quite significantly from the observation. Can you speculate why the Kdp is so poorly represented? From the Eq (19), Qr and Kdp have a quite simple relationship but why Zh is rather reasonable but not Kdp?

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