Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2018-43-AC2, 2018

Geoscientific Model Development Discussions
Open Access
EGU

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

Takuya Kawabata et al.

tkawabat@mri-jma.go.jp

Received and published: 23 May 2018

Dear Dr. Juanzhen Sun,

The authors deeply appreciate you for your useful comments. Our sincere responses are shown as follows and will be presented in the final form of our manuscript.

Sincerely, Takuya Kawabata on behalf of the authors

[Comment] 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?

[Response] As shown in Bauer et al. (2015), high resolution DA systems with rapid

Printer-friendly version

Discussion paper

update cycle is able to produce rainfall distributions comparable to actual observations. We added the following words at P2L9.

", which was discussed in Bauer et al. (2015) in the context of a data assimilation with high resolution and rapid update cycle,"

[Comment] 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.

[Response] We removed the expression regarding KD and modify the sentence to "Although this emulator (Jung et al., 2008a, 2008b) has been used previously as observational operators in ensemble Kalman filter data assimilation systems, to our knowledge, our study is their first implementation in variational assimilation systems." (P2L15-16)

[Comment] 3. Page 4, line 18: Change "the fitting" to "a statistical fitting".

[Response] Thank you for your suggestion. We changed it like as it.

[Comment] 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?

[Response] We used NHM-4DVAR for Fig. 2. Figures by WRF DA were added as Figure 3 and explanations were displayed in the 3rd paragraph of Section 4.2

[Comment] Page 8, line 16: These errors are quite large. Have you tried to use smaller errors?

[Response] The values of the observational errors were determined after statistical investigations (Kawabata et al. 2018) but they were adopted conservatively (larger than the statistics). (P8L21-22)) The sensitivity of the errors will be examined over scientific explores.

[Comment] 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.

[Response] Since this statement is from the comparison with the first guess field (FG), which catches no rain it is clear that the results are better than FG. However, since we agree with you that ZDR from both methods are poor, we will add “except for ZDR” at the end of the sentence (P9L28).

[Comment] 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?

[Response] Since ZDR of our results are much poorer than KDP, we assumed that you were confused between ZDR and KDP. We are doubting some points to be modified in our method, for instance, axis ratio, quality control, and initial conditions, but no investigation has been done yet. This is one of future issues (P9L32-P10L2).

[Comment] From the Eq (19), Qr and Kdp have a quite simple relationship but why Zh is rather reasonable but not Kdp?

[Response] In KD, we can see quite small values of KDP (Fig. 2f), but good agreement with OBS in its horizontal distribution, while Zh looks better than KDP as Dr. Sun pointed out. However, since some of erroneous convections are seen in Zh, it is difficult to determine which one is truly better. We added the following sentence to P9L3.

“In KD, we can see quite small values of KDP (Fig. 2f), but good agreement with OBS in its horizontal distribution, while Zh looks better than KDP”

Interactive comment on Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2018-43, 2018.