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Discussions

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Interactive comment on "Do surface lateral flows matter for data assimilation of soil moisture observations into hyperresolution land models?" *by* Yohei Sawada

Anonymous Referee #2

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The author investigated the data assimilation with a 3-D hyperresolutin land model named as ParFlow using ETKF on the various scenarios. Although I think that this manuscript is well written, I have some comments for publication.

Major comments

1. Ll. 316-321. Each ensemble member has different saturated hydraulic conductivity and rainfall rate using random numbers from lognormal distribution with mean = 0 and standard deviation = 0.15. Why does the author choose them? Does the author confirm their sensitivities? Please address the reason simply.

2. L. 365: RMSE is calculated by using all members, not an ensemble mean. Usually,

I think the RSME is calculated by difference between an ensemble mean and truth. Although I guess the author's RMSE is better for the author's experiments, please explain why the author use all members for RMSE.

3. Ll. 461, 665-666: In my understanding, the ensemble Kalman filters (EnKFs) do not assume the Gaussian PDF and linearity. The EnKFs derive an optimal value under the Gaussian PDF and linearity. This does not mean assuming the Gaussian PDF and linearity.

4. L. 616: "there are large errors in the area around 500<=x, y <=1500" I have trouble with this sentence. I cannot confirm the large errors in Fig. 9.

5. Ll. 688-699: Assimilating just one observation improves the analysis errors in whole domain despite the nonlinear equations. This means that the model has long-range spatial correlations. Therefore, I guess the ETKF works well without the localization. Also, the author mentioned that the localization scale depends on the model parameter. In order to confirm those, the author should investigate the spatial correlations.

6. Figure 8: In the OF configuration of Fig. 8 (a) and the noOF and OF configurations of Fig. 8 (b), the DA_obs1 and DA_obs9 experiments have almost the same RMSE although the DA_obs9 experiments have 9 times observation information. Why?

7. Figure S4: A green line looks like to splits into a single outlier and the others. If so, I think this is ensemble clustering (EC, Anderson 2010, Amezcua et al. 2012). The EC is frequently generated by ensemble square loot filters included the ETKF and may be related to the non-Gaussian PDF. Therefore, please refer to the EC in section 4.

Minor comments

1. Equation numbers are confused. For instance, Eq. 4 is written on the lines 141 and 148. Please correct the all equation numbers.

References

Anderson, J. L.: A non-Gaussian ensemble filter update for data assimilation, Mon. Wea. Rev., 138, 4186-4198, 2010.

Amezcua, J., Ide, K., Bishop, C. H., and Kalnay, E.: Ensemble clustering in deterministic ensemble Kalman filters, Tellus, 64A, 1-12, 2012.

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