Nonlin. Processes Geophys. Discuss.,
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Nonlinear Processes in Geophysics
Discussions
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Interactive comment on "Application of ensemble transform data assimilation methods for parameter estimation in nonlinear problems" *by* Sangeetika Ruchi and Svetlana Dubinkina

Anonymous Referee #1

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[Comments to the Authors]

This manuscript aims to compare performance of ensemble transform Kalman smoother (ETKS) and ensemble transform particle smoother (ETPS) in nonlinear parameter estimation problem. The authors conducted observing system simulation experiments and obtained reasonable results. The scope discussed in this manuscript suits well to Nonlinear Processes in Geophysics. I do not have any major concerns for the experiments presented in the manuscript. However, some discussions and descriptions are difficult to follow due to insufficient explanation. Here I list the concerns, which would be beneficial to improve the manuscript further.

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Discussion paper

[General Comments]

1. Scientific Significance: The authors addressed that they applied the ETPS for estimating a large number of uncertain parameters (P2L34). It can be a good motivation; however I could not understand the scientific significance that can be achieved by applying the ETPS and ETKS for the large-dimensional problem. Please address this point clearly in abstract and conclusion.

2. Lack of explanations: I could not follow several logics of the manuscript, therefore, my major comments includes many "whys" and "reasons". Most of the issues should be solved by adding sufficient explanations.

3. Results (Figures): Some figures were discussed insufficiently. It is better to remove figure(s) if they are not needed.

4. Methods: The author compared the ETKS and ETPS. I am wondering the difference between the ETPS used in this study and a nonlinear ensemble transform filter by Tödter and Ahrens (2015). Also, it is better to compare the localization methodology with local particle filters (Penny and Miyoshi 2016; Poterjoy 2016). Please add more discussion on difference from existing methods.

Penny, S. G. and T. Miyoshi, 2016: A local particle filter for high-dimensional geophysical systems. Nonlin. Processes Geophys., 23, 391-405.

Poterjoy, J. (2016). A localized particle filter for high-dimensional nonlinear systems. Monthly Weather Review, 144(1), 59-76.

Tödter, J., and B. Ahrens, 2015: A second-order exact ensemble square root filter for nonlinear data assimilation. Mon. Wea. Rev., 143, 1347–1367.

[Major Comments]

1. P1L13: Please add reason(s) why ETPS is very sensitive w.r.t. the initial ensemble.

2. P1L15: Please add reason(s) why the localization deteriorated the posterior estima-

tion

3. P7L15: Isn't it possible to apply the localization between variables?

4. P8L1: I could not understand the sentence "$\sim$ is made such that y_obs=48". Please rephrase this sentence.

5. P10L14: Please explain more about reason(s).

6. P11L5: Why? Does it relate to the resampling issue discussed later?

7. Fig.4, Fig. 8 (b) and (c), : I did not understand why this figure is needed because they were not discussed.

8. P15L5, perturbation of ensemble member: In generic PF, the resampling (or inflation) method is very important to avoid the particle convergence. Could you explain why you did not need to consider this issue?

9. Fig. 8 (b): I was confused why the ETKS outperforms the ETPS if RMSE is used for the metric.

10. Fig. 10: It is helpful to add RMSEs on the figure.

11. Table 1: Could you discuss why the optimal radius for the ETKS is larger than that of the ETPS?

12. P16L15: Please discuss why the localization degrades the posterior estimation

13. Conclusion: It would be helpful to add findings and limitation further in this section.

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