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Nonlinear Processes in Geophysics
Discussions

Interactive comment on "Accelerating assimilation development for new observing systems using EFSO" *by* Guo-Yuan Lien et al.

Anonymous Referee #1

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This research investigated an efficient methodology to accelerate the development for appropriate data selection strategies for new observing systems using the Ensemble Forecast Sensitivity to Observations (EFSO). The EFSO diagnostics are used to design potential data selection rules for data selection. The usefulness of this method is demonstrated with the assimilation of satellite precipitation data in a low resolution global model. It is shown that the EFSO based method can efficiently aid data selection that significantly improve the assimilation and forecasting results. The manuscript is well written and easy to follow. I suggest to accept it for publication after some revisions.

Comments 1. The key for EFSO is to evaluate gradient of error reduction to observations (Eq. 4 and 6). Could you please justify why an ensemble of 32 members can

provide reasonable/accurate estimation of the gradient to precipitation? Precipitation processes are highly nonlinear, which may cause difficulties when adjoint method is used to calculate the gradient as mentioned in this manuscript and many published articles. Do you think the EFSO can deal well with this nonlinear issue? 2. It is good to see precipitation assimilation can improve the forecasts up to 5 days. But overall, RMSEs in wind and temperature are reduced about 3-5 % up to 5 days. Do you think this result can be reproduced at operational centers, e.g. NCEP, if the satellite precipitation was assimilated? 3. Experimental design. Rather than a year run using a low resolution model (T62) with an ensemble of 32 members, results from a seasonal run of high resolution model and more ensemble members that are close to operational configurations might be more convinced.

Other comments: 1. Page 2, lines 15-24. Though adjoint-based FSO method faces some difficulties, for specific applications, it is still can give a good evaluation compared to OSE. Here is an example: Zhang, X.-Y., H. Wang, X.-Y. Huang, F. Gao, and N. A. Jacobs, 2015: Using adjoint-based forecast sensitivity method to evaluate TAMDAR data impacts on regional forecasts. Adv. Meteor., 2015, 427616, doi:https://doi.org/10.1155/2015/427616. 2. Page 9, lines 18-19 Though there are some difficulties, adjoint models have been used in the operational data assimilation systems at ECMWF and UK Met office, which produce world-best global weather forecasts. EnKF has its merits but also has its limitations. The key for EFSO is to evaluate gradient of error reduction to observations (Eq. 4). Do you think an ensemble of 32 members can provide a good estimation of the gradient?

3. Figure 4. Can we assume precipitation obs over open waters have same quality? If Yes, however, the percentages of useful data from Pacific tropical region are much different. The explanation is reasonable and acceptable. Just wonder it might be good to mention that suggest to mention that rejected data, does not always mean they are bad data.

4. Figure 6. It is good to see precipitation assimilation can improve the forecasts up to

5 days. But overall, RMSEs in wind and temperature are improved about 3-5 % up to 5 days. Do you think the impact is overestimated?

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