Nonlinear Processes in Geophysics Discussions

Nonlin. Processes Geophys. Discuss., referee comment RC1
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Comment on npg-2022-10

Anonymous Referee #1

Referee comment on "Using a hybrid optimal interpolation–ensemble Kalman filter for the Canadian Precipitation Analysis" by Dikraa Khedhaouiria et al., Nonlin. Processes Geophys. Discuss., https://doi.org/10.5194/npg-2022-10-RC1, 2022

Highlights

The paper presents an extension of the classical 'static' data assimilation to incorporate ensemble forcast and by such allowing to releveive some restricting constraints on the shape of the covariance matrix of the errors terms in the classical DA approach.This approac is interesting, and make use nicely of some recent developments in DA.

General comments

The paper is rather easy to read and is well structured, altough I got quite lost in all the acrynonims, maybe a list of them could be appreciated. As I am not directly an expert of the domain, I do not know what are the models, so it took me some time to figure out what how it is constructed. It may worth introduciong the whole model in section 2 (analysis and observations models).

In Eq 6, the authors use the approach of Hamil and Snyder to estimate the varianc eof the background errors, but it seems that they do not do the same for the hydrid approch (Eq 10), I may be wrong, or may the authors comment on that ?

Concerning the results I am a bit surprised that the performance curve un beta (figure 2-c) goes up between .3 and .4, is a sampling artifact ? Maybe the authors should add some comment on this fact or provide some estimation of the variability of the NRMSE. IN the same objective of better understanding the gain linked to the assimilation of the data in the model, would it be possible to compute the metrics (FBI-I, ETS, POD and FAR) when \beta=1 ?

In the metrics, the authors point out the values that are not significatively different, maybe they could also plot the variability (errors bars, or boxplots ?)

Specific issues

- Eq 1, the model coul be presented first, so that we know what \hat{P}^b corresponds to. In particular, it could be usefull to have the size of the matricies
- Eq 5 the prime notation is introduced a bit too early I guess, and P^α_{OI} (L96) is not yet defined. Similarly, A_{:,j} (eq 6) is not defined.
- L155: I understand that SYNOP is a netwrok of stations, but the term is not introduced earlier.
- L174: 'progressively' if quite unprecise, if the authors think it is worth mentioning, I think it should be precised;
- L187: 'in the transformed space', does it refer to the box-cox transformed data ?
- L201: what are the 'robustness reasons' ?
- Eq 16: the sum in the denominator are between 1 and N_y ?
- L374: the "two different interpretations" should be precised, they are not clear (at least to me)