

Interactive comment on “Chaotic dynamics and the role of covariance inflation for reduced rank Kalman filters with model error” by Colin Grudzien et al.

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The following comments are a "hot take" from a quick reading of the manuscript, and do not have the quality of a full review.

From my perspective as an EnKF practitioner, the paper is highly interesting. It derives explicit formulae for "upwelled model error", a source of error whose existence I only vaguely suspected. It also demonstrates how inflation is a workable remedy to counteract this phenomenon.

C1

Suggested modifications:

Sometimes "correcting [some of the] BLVs" is used. It should rather be "correcting the uncertainty along the BLVs", right?

Both Prop 1 and Def 3 seem to refer to the exact same set of equations. This is somewhat confusing.

P11 L26 uses "doesn't" which is a no-no

P12 L25. "The dynamical upwelling of model error differs from the sampling errors induced by nonlinear dynamics in perfect models, treated in the modified EKF-AUS-NL (Palatella and Trevisan, 2015) and in the finite size ensemble Kalman filter, (EnKF-N) (Bocquet, 2011; Bocquet et al., 2015)." I'd say EKF-AUS-NL is concerned with the **truncation** error, while the EnKF-N is (mainly) concerned with **sampling error**

P13 L21-22. Insert something like the following sentence: "A survey of the causes for inflation in the EnKF (model error, sampling error, intrinsic bias, localization, non-Gaussianity, and upwelling) is given by [1]."

P21 L7: "the reduced rank" → "a low-rank"

Discussion could be slightly less scattered. Repetition is good, but sometimes I'm wondering if I have already read this point, or if it's a new one.

P14 L11: ensemble based → ensemble-based P14 L19: simulates → emulates

P14 L24: hypothesized → found evidence that

P19 L7: Just to help lazy readers like me: could you state whether the inflation (through K) affects the mean **and cov** updates, or just the mean.

P20 L2-3: change to: multiplicative inflation will also **need to** compensate for the **truncation** error as described by Palatella and Trevisan (2015),

C2

P20 L6: samples → "sample points" or "members" or "particles"

Refs:

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{  
[1]  
@article{raanes2018adaptive,  
  title={Adaptive covariance inflation in the ensemble Kalman filter  
  author={Raanes, Patrick N and Bocquet, Marc and Carrassi, Alberto}  
  journal={arXiv preprint arXiv:1801.08474},  
  year={2018}  
}
```

Interactive comment on Nonlin. Processes Geophys. Discuss., <https://doi.org/10.5194/npg-2018-4>, 2018.