Answers to referees and editor : npg-2018-5 &6, 2018

Mohamed Jardak & Olivier Talagrand

1 To referee I:

We thank the referee for his suggestions for future research, concerning in particular the numerical cost of EnsVAR.

2 To referee II:

1. The referee has spotted an inconsistency in our paper, for which we thank him. We have made the correction. Our 'day' is equal to 0.24 time unit in Equation (12) (instead of 0.2 in the paper by Lorenz). We do not think the difference is critical.

2. As requested by the referee, we have explicitly mentioned the Random-Then-Optimize (RTO) algorithm in our Introduction (it was already mentioned in our Conclusion).

3. The other comments of the referee bear on what he considers are limitations of our work and of our conclusions. We basically agree with him, and we had already mentioned that our conclusions are limited to the conditions of our experiments. The referee mentions deterministic versions EnKF as an alternative to the stochastic version we have used. We now include the use of deterministic EnKF among the various possibilities for future works. The referee stresses that our EnsVAR is not cycled, and seems to consider that, because of the ensuing numerical cost, it could not be used in practical situations. That may the case, and cycling is already discussed in our papers, in particular in the perspective of future works. In the other hand, we do not understand some of the remarks made by the referee on this aspect of cycling. He writes for instance I think this is totally acceptable for the Bayesian estimator, but not for the deterministic estimator (where this designates our approach). We do not understand why the referee makes here a difference between the two estimators. In our logic, assimilation is intrinsically a problem in Bayesian estimation, and a deterministic estimator can only be a by-product (e.g., an expectation) of a Bayesian estimator. In any case, the fact that our EnsVAR is not cycled is stressed in two places in our Part I, and discussed again in the Conclusion of Part II. We do not think it is necessary to add more on this aspect.

3   To the editor:

The Editor has specifically asked us to consider two points. One is the question of the time unit we use. We think this has now been clarified. Our 'day' is equal to 0.24 time unit in Equation (12) (see point 1 in our response to Referee 2). As for the other point, the editor writes I am also concerned about the lack of a clear assertion that your experiments do not include any cycling. Well, the fact that our experiments do not include any cycling was clearly asserted in the latest version of Part I of our papers (ll. 223-225 and 387-388) and discussed again in the Conclusion of Part II (ll. 344-355). See also point 3 of our responses above to Referee 2.

4   Reference:

Lorenz, E. N.:, Predictability: A problem partly solved. In: Proc. Seminar on Predictability, Vol. 1. ECMWF: Reading, Berkshire, UK, pp. 1–18, 1996.