

Dear Giovanni,

I think your paper is now acceptable, provided you make a number of final corrections. Here is what, as Editor, I consider as necessary.

1. Figure 6 is not clear. Please state precisely what the *mean surface zonal velocity trajectories* are. And what are the units on the vertical axes ?

2. Figures 7, 10, 11 and 13. The time axis goes well beyond the length of the Data Assimilation Window (10 days I think, and 30 days at most). This means that DBFN, 4Dvar (and, I presume, ONDG) have been cycled over successive assimilation windows. How was the cycling done ?

3. L. 427, ... *it is impossible to store the entire covariance matrix*. The problem is not storing the matrix  $B$ .

In most numerical applications involving matrix computations, it is not necessary to store matrices. It is sufficient to have codes which perform matrix x vector multiplications. For instance, in Eq. (13) for incremental 4Dvar, I do not think you ever stored the matrix  $M_{0,l}$ . I presume you computed the vector  $M_{0,l}\delta x_0$  by integrating the tangent linear system.

The problem is defining the matrix  $B$  in the first place. I suggest you remove the sentence (ll. 426-427) *Since the state space ... covariance matrix*, and write instead *In order to define the matrix  $B$ , Derber and Bouttier ... have proposed to decompose it as the product of simply defined matrices*.

4. Eq. (12) as it stands implies that the operator  $\mathcal{M}_{0,l}$  is part of  $\mathcal{H}_l$ . It is not. A correct equation would be

$$\mathcal{H}_l \mathcal{M}_{0,l} (x^b + \delta x_0) \approx \mathcal{H}_l \mathcal{M}_{0,l} (x^b) + \mathbf{H}_l \mathcal{M}_{0,l} \delta x_0$$

5. Ll. 532-533. *Iterations compensate for the lack of a priori information on the model errors ...* That cannot be. Numerical computations cannot create information that is not there in the first place. This point was already raised by Reviewer 1 in his/her review of your previous version. From what I understand from your response to his/her comment, what you mean would be properly expressed by saying *Iterations use the information contained in the observations and in the model equations to reduce the uncertainty on the initial state*.

6. L. 389. Is ONDG defined by the only condition that  $\gamma = 1$  ? If yes, I suggest you introduce ONDG when you introduce  $\gamma$  (ll. 368-373). If not, please say more about what ONDG exactly is.

7. The same notation  $\mathcal{F}$  is used inconsistently in Eqs (1) and (2). It denotes the complete model operator in the former equation, and the reversible part of the operator in the latter.

8. L. 509. ... *root mean square* ~~d~~ ...

9. L. 255. Centre (British spelling)

I thank you for having submitted your paper to *Nonlinear Processes in Geophysics*, and hope you will be able to rapidly send the final version.