

Dear Prof. Mandel,

You must have seen the reports of the two referees of your paper. You must also have received a message from Copernicus Publications asking you to send your own response to the referees' reports by 2 September next. That same message must also mention the possibility of your submitting a new version of the paper after you have responded to the referees.

I as Editor encourage you (if you have not already done so) to start preparing without delay a new version of your paper. And, in order to save time, I want to send you now my comments on the referees' reports, as well as my suggestions and requests for the new version.

The two referees are qualified experts on assimilation of observations, and especially on Kalman filters and smoothers. Referee 1, who has let his name known, is E. Cosme from Grenoble University.

Both referees consider your paper contains material that deserves publication, but both also consider that it requires major revisions. Referee 1 has comments on both the general presentation of the method you use, and on your numerical results. Concerning the method, he questions in particular the use of the word 'variational' for qualifying it (his comments 2.2 and 2.3). Concerning your results, he asks for comparison with other assimilation algorithms (his comment 1.1). He also considers that it is insufficient to use only the value of the objective function as diagnostic for the quality of the assimilation performed with the QG model (his comment 1.3). Concerning this last point, you know the 'true' field at all gridpoints and timesteps, and there is fundamentally a circular argument in evaluating the accuracy of the reconstructed fields by their fit to the observations that have been used in the assimilation.

Referee 2 strongly stresses that you have not in his/her opinion given proper credit to recent works on ensemble Kalman filtering and smoothing (main comments 1 to 3). He/she also asks for a more detailed description of your implementation of algorithm 3 (main comment 5) and, as Referee 1, says he/she is not convinced by your numerical results concerning the QG model (main comment 6).

I as Editor also have a few comments. I mention two at this stage.

1. You refer to Algorithms 3 and 4 (statement of Theorem 1, Section 4) without having described what they are, nor even mentioning the Tables in which the corresponding equations are given. These algorithms must be described in the text before they are discussed.

2. The setting of the QG experiments (independently of their validation) should be described in more detail. For instance, the sentence *The vertical correlation function value was taken as 0.2* (subsection 6.3.2, about three lines before end of penultimate paragraph) does not make much sense (in which unit is the value 0.2 expressed?). And how do you 'non-dimensionalise' the parameter  $\beta$  (2 lines after Eq. 26; it is somewhat inconsistent to keep a dimensional Coriolis parameter  $f_0$ , and then to non-dimensionalise its spatial derivative)?

Please revise your paper according to the comments and suggestions of the two referees, as well as to mine. Concerning the referees' requests, that may require additional diagnostics or even numerical experiments. As requested by Copernicus Publications, give a point-by-point answer to all these comments and suggestions (including mine). Should you disagree with one particular comment, or decide not to follow one particular suggestion, please state precisely your reasons for that. As far as I am concerned, your response can be submitted in the open discussion, or in a letter attached to your revised version.

Both referees have stated they would be willing to review your paper again, and I will send your revised version to both of them.

I thank you for having submitted your paper to *Nonlinear Processes in Geophysics*, and look forward to receiving a new version.

Olivier Talagrand  
Editor, *Nonlinear Processes in Geophysics*