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Nonlinear Processes in Geophysics
Discussions
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Interactive comment on "Ensemble Kalman filter for the reconstruction of the Earth's mantle circulation" *by* Marie Bocher et al.

Marie Bocher et al.

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We thank the anonymous reviewer for his/her review of our paper. We hope that the answers provided here, as well as the modifications proposed in the paper will be satisfactory. Please find below the list of comments, each associated with our answer and details on the associated modifications of the manuscript

1. The discussion of the error plots was at times confusing. In some places you simply refer to errors, when you could mean the difference between the true state and the assimilation, or sometimes the innovation (equation 36 for example, which isn't really a forecast error). Please be clear about what error you mean each time you use this term.

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⇒ **We changed the notations for innovations to a system which is hopefully more straightforward. We also changed the name of variables based on the innovation vector that were refered to as "errors".**

2. I was surprised by how little the errors dropped in Figure 1, until later in the results and discussion it became apparent that only small regions have most of the errors (like the plumes, ridge or subduction). It would be really helpful to plot the average error over these regions rather than the entire domain (where the temperature field is fairly constant for long periods). I think this would give a clearer picture of the errors between the various experiments.
   ⇒ **We found a compromise between this suggestion and the major comment number 8 of reviewer 1. We changed all the plots to represent the RMS error and plot on each figure the RMS error that we would obtain if the estimate was the "climatological" average 1D profile.**

3. It would also be really useful to see how the velocity field responds to the assimilation, because this is the part of the state directly related to the surface velocity. I realize that it is not a prognostic variable, but it is an important part of the state.
   ⇒**Overall, the surface velocities are very well corrected during analyses, due to their direct link with observations. We plotted on figure 1 the evolution of errors on Velocities.**

4. Please define the vector **1** in equation 18.
   ⇒ **The text has been modified.**

5. The text is pretty carefully edited for writing and typos. I just found a couple of things: line 12 , change explicitely to explicitly (though this suggests that you didn't run a spell check, so there might be more). And page 13, line 3, the word "embarassingly" is probably not appropriate.
   ⇒ **The text has been modified.**

6. Please clarify what you mean by state space localization, page 10, line 16.
   ⇒**We mean that the localization has to be done on the forecast error covariance matrix. Text modified.**

7. Some of the figures need larger fonts on the captions, particularly Figure 6. And if possible, use the Greek symbol for pi.
   ⇒**The text has been modified.**

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