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Nonlinear Processes
in Geophysics
Discussions

Interactive comment on "Optimal Transport for Variational Data Assimilation" *by* Nelson Feyeux et al.

Nelson Feyeux et al.

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A revised version of the paper has been added as a supplement

Reply to the Editor

We would like to thank the editor for his review of our paper and for giving us the opportunity to improve our paper.
We copied your commentary in italics below, we reply in normal font.

Both referees have recommended acceptance of the paper subject to minor revisions. As Editor I suggest that the authors (if they have not already done so) start writing a revised version of their paper, taking into account the comments of the referees. They

may of course also submit to the interactive discussion any response they may have to the referees' comments.

I make in addition the following comments.

1. Concerning Figure 3 (top right) and the fact that the two inner products lead to distinct 'minima' of the cost function (13) (see major comment 4 of Referee 1 and specific remark 58 of Referee 2), I note that the steepest gradient algorithm is known to be very inefficient. The 'failure' of the L2 gradient may be therefore due as much to the choice of the descent algorithm as to the choice of the inner product. As suggested by Referee 1, replacing the steepest descent algorithm by another algorithm, such as a conjugate gradient one, might be useful.

A comparison of the steepest descent algorithm (DG2) with a conjugate gradient algorithm has been shown in the Figure 3. This conjugate gradient is faster but not as quick as (DG#). A note has been added in the third paragraph of 4.1.

2. As noted by Referee 2, the English of the paper needs significant improvement. The Referee makes quite a few suggestions, and, once a paper has been accepted for publication, Nonlinear Processes in Geophysics provides free copy-editing, intended primarily at correcting the English if necessary. It would however be preferable that the authors have their paper checked by a native English speaker.

Ok.

Other comments.

3. It does not seem to be said, in either one of the numerical applications, what the dimension of the discretized control space is. And it does not seem to be said what Ω is subsection 4.2 (Non-linear example).

Ok, dimension added in the introduction of Section 4. Ω is the same for both experiments, described at the beginning of Section 4. We added a sentence at the beginning of 4.2 to refer the reader to 4 for the experimental framework details.

4. Eq. (6). Most readers of NPG will not be familiar with the Wasserstein metric. It might be useful to explain the significance of the indices 2 in W2 (or to remove them since they are not useful for the paper anyway).

Ok, we removed them.

5. I understand Eq. (9) defines $T_\rho P$ as the set of potentials Φ that verify the conditions on the right-hand side of the equation. Say it clearly (see also specific remark 41 of Referee 2).

Ok. We clarified the definition, as the tangent space is actually the set of η, such that there exists Φ such that (...).

6. P. 8, l. 21, symbols = 0 missing (see l. 12 higher up).

Ok.

7. Figure 4, end of caption ... at the output of the model → ... at the end of the assimilation window.

Ok.