Second Round of Responses to Reviewer Comments for:

Automatic adjoint-based inversion schemes for geodynamics: Reconstructing the evolution of Earth's mantle in space and time

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We again thank the reviewers, Georg Reuber, Nicolas Coltice for reading our reponses to their reviews. We also thanks to the editorial team for excellent handling of the review process. Below is our response to the reminaing comment from Nicolas marked with "Response - [#] ".

Responses to Reviewer 3: (Nicolas Coltice)

N. C.–C1: *From my assessment, the authors have answered the questions and proposed appropriate modifications. There are two exceptions, being minor revisions, that I suggest the authors do: - replace Fig.4 and Fig.9 that do not prove their point by Fig.1 in the answer to the review that prove their point. This Fig.1 shows the consistency of their approach without a doubt and should be now within the manuscript. Little text to go with them is needed. - Fig.10 shows peculiar optimisation curves, with changes of states. Theses increase in cost function while optimizing have to be discussed within the text, which is not the case yet. With both these changes, the manuscript is good to go as far as I am concerned. It shows great progress in building consistent reconstruction of mantle circulation.*

Response – 1: We sincerely thank Nicolas for his detailed and insightful feedback, which has significantly strengthened our manuscript. In response to the comments:

1. We have replaced Figures 4 and 9 with Figure 1 from our responses, as suggested. The new figures effectively illustrates the consistency of our approach, reinforcing the main points of our discussion.

2. We have revised the optimisation curves in Figure 10. The noted issues were due to incorrect sorting of output file names as a result of change in a sorting function, which has now been rectified.