Geoscientific
Model Development
Discussions

Interactive comment on "ECCO version 4: an integrated framework for non-linear inverse modeling and global ocean state estimation" *by* G. Forget et al.

Anonymous Referee #1

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General Comments: This paper presents methodology for the ECCO v4 reanalysis with specific attention paid to changes in the current version. It also tries to address the controllability of the system, which is a very interesting and important question.

Since ECCO is a well-established reanalysis product that the authors rightly point out has been used in many scientific studies, the refinement of the product is very relevant to GMD. The paper presents advances that are extremely suitable for addressing questions within the scope of EGU. The controllability analysis in this paper is novel and potentially useful in addressing scientific questions as well as improving future state estimation projects. As the authors documented, this iteration of ECCO has enough modifications and improvements from the previous version to be considered a sub-

stantial advance in modeling science. Furthermore, since ECCO v4 will undoubtedly be used in future studies, it is important for this documentation to be published.

The new changes to ECCO are well documented and changes are clearly outlined. The system is obviously very large and complex, so there is excellent direction to references if the readers want to learn more about different aspects. In this way, what is new and what is previously done is clearly stated and documented. I believe that the description is complete enough that others can use the freely available code that the authors describe and reproduce the author's results. Tools are also provided to apply the framework to other applications.

The paper is well written and largely free of errors. The title is appropriate and it is clearly stated which model version is being described. The abstract is sufficient in summarizing the contents of the paper. Furthermore, the appendices are thorough and appropriate for this type of paper. I have a few minor suggestions for clarifications and a few typos that I will list below, but I think this is a very good paper that is very appropriate for this journal and should be published with only technical corrections.

Specific Comments:

Page 3679, line 25 – It would be nice to have a little more elaboration on why it is tempting to attribute global mean sensitivity to discrete choices to omission of hydrology modeling over other explanations.

Page 3688, Line 28/Figure 10 – Fig. 10 shows misfits in ECCO v4 that are lower than other ECCO versions and other products. For the broad misfits that are still present, are there thoughts on how these can be addressed in future versions?

Minor corrections:

Page 3681, Line 1 – commas around "for example"

Page 3686, Line 10 – Add the appendix number

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