

Final Response Letter Template (EGU/Copernicus)

Title: Author Response to Referee Comment(s) on egusphere-2025-3810

Date: 28 January, 2026

Authors: Gennady A. Chepurin, James A. Carton, Luyu Sun, and Stephen G. Penny

Manuscript Title: SODA4: a mesoscale ocean/sea ice reanalysis 1980-2024

Dear Riccardo Farneti and Reviewers,

We would like to thank the reviewers for their constructive comments and suggestions, which have helped improve the manuscript. Below, we provide a point-by-point response to all comments.

Comment 1:

The manuscript presents and describes SODA4, one of only a few eddy permitting ocean reanalyses available to the community. The presentation of the system and the results are quite clear, and the split between what is presented in the main manuscript and in the supplemental material is appropriate. The evaluation metrics shown make the fidelity of SODA 4 quite clear. With the exception of the few minor issues, mostly suggestions for expanded description of the system or of the results, I recommend that the manuscript be published with minor revisions.

Many thanks for your help and guidance.

Minor Issues:

Comment 2: Line 66 - Please explain what orphan points are

Response: [rephrased for clarity](#)

Comment 3: Lines 73-78 - Please articulate a little more how the decision was made to switch and when. The text in Section 3.1 suggests that the instabilities occurred at stream boundaries - if this is the case please state that, if not, please at least speculate about the source of the instabilities.

Response: [We have added some discussion regarding the switches in advection schemes.](#)

Comment 4: Section 2.2 - Please add some discussion about the impact of the coarser resolution of the forcing

Response: [The calculation of surface fluxes and flux corrections has been expanded.](#)

Comment 5: Line 128 - please say what L3 means

Response: [A definition has been added](#)

Comment 6: Line 159 - Fig 6 seems to show large increments in the WBC areas as well, not only between +/-5 degrees. Please address this as well in the text.

Response: Discussion of bias in WBC areas and the deep Southern Ocean is added (L165-169).

Comment 7: Lines 174-179 - Please add some discussion about the streams - for example, why three years of overlap, what was examined to determine that three years were adequate, and what are the regions where the spinup was not complete in three years, and what are the consequences for the fidelity of the simulated ocean in those regions?

Response: Great questions. To the first: we have added a parenthetical remark (L.186): *“the overlap was extended as long as possible based on our available computer allocation”*. To the second of how long the ocean will take to come into equilibrium with the data assimilation system we need to respond that we don’t really know. More discussion is in the response to comment 8.

Comment 8: The text in Section 3.1 mentions the streams but does not address the questions I raised.

Response: We have added a comment (L193) “The issue of how much overlap is needed remains open”. As noted above, we think this deserves its own study. We did some very early work: Carton (1987) DOI10.1175/1520-0485(1987)017<0751:HPATGC>2.0.CO;2.

Comment 9: Lines 223-225: The correspondence in all the basins as stated is well noted. The exception is the Arctic in the last few years of the comparison, where EN4 shows a stronger warming than SODA4. Please comment on this.

Response: A sentence has been added (L229-31): “Note that observational coverage is limited in the Arctic (Supplemental Materials Fig. S7, upper row), particularly in the marginal seas in recent years. EN4.2.2 suffers more from this deficiency than SODA4 since its mapping algorithm fills data voids with a combination of persistence and monthly climatology”.

Comment 10: Line 232: Again in the Arctic at 0-300m, SODA4 seems to show less interannual variability than EN4. The discussion on lines 216-220 seems to suggest that EN4 should be expected to have less geographic variability - is this the expected behavior for temporal variability? If so, why does EN4 have more temporal variability than SODA4 in the Arctic near-surface salinity? Please comment.

Response: This issue is at least partly addressed by the response to the previous comment. We try to emphasize that the Arctic is a region where data assimilation is absolutely necessary because of the limited observational coverage.

Comment 11: Line 234: Is the implication of the "limited representative salinity observational coverage" that the salinity in EN4 and SODA4 rely on the background field? Does this explain why the variations in SODA4 salinity at depth are larger than EN4 variations? Please comment.

Response: The sentence (L228-229) has been modified to include our suggested explanation that the nonphysical changes observed in salinity 300-1000m in both SODA4 and EN4.2.2 are consequences of extremely sparse observational sampling.

Minutae:

Comment 12: Line 74 - Syntax - the word "with" should be replaced by a comma.

Response: We've modified the sentence to read, "We switched among a third order Adams-Bashforth scheme using a third order upwind biased scheme ..." (L74)

Comment 13: Lines 103-104 - should be "three/six hourly averaged"

Response: We don't think this text should change. Perhaps there is some confusion. The radiative fluxes are specified at 3hr intervals while other terms such as surface winds are specified at 6hr intervals.

Comment 14: Line 130 - in situ should be italicized'

Response: This change made throughout the text.

Comment 15: Section 2.4 - in-sentence equations and symbols are offset from the text - please correct this

Response: Done

Comment 16: Line 174 - typo - "was" not "has"

Response: Done.