

Referee #1:

I thank the Authors for all the corrections they have made in the new version of their manuscript, which improved it quite significantly. In my last comment, I would like to emphasise again that the impact of position errors should not be neglected in data assimilation results. This is an important issue to further improve data assimilation systems, especially as we move towards higher and higher resolution systems.

We thank the reviewer for reviewing again the manuscript. We have added the discussion of the importance of position errors for developing EnKF-based ocean data assimilation systems to the last paragraph in Section 4.

Referee #2:

Thank you for the additional revision of the manuscript. Now, your changes resolved my previously raised issues. Thank you also for adding the 1.5Terr experiment and changing the colormaps of the figures, they are now much more pleasant to look. I have still some smaller remarks, but beside this, the manuscript looks good:

We thank the reviewer for carefully reviewing the manuscript again. We have modified it following the reviewer's comments.

#1) Line 128: "assimilate the following observations" can be ambiguous, what is following referring to?. I supposed following the spin-up period, but remains unclear.

We have modified the first sentence in the second paragraph in subsection 2.2.

#2) Line 138: why do you use for the localisation length-scale "LS" instead of the commonly used calligraphic l ? Additionally, please use for the units in this line the non-mathematical font as used in Line 139.

In the third paragraph in subsection 2.2, we have used L for the localization scale instead of LS following Houtekamer and Zhang (2016) and have modified the fonts of the units.

#3) Line 140f: please switch the position of salinity and SSH, as you speak afterwards about the salinity. This would improve the flow of reading.

Following the reviewer's comment, we have modified it in the third paragraph in subsection 2.2.

#4) Line 170: I don't understand why the system conserves the temperature and salinity budget. With your increment from the EnKF you add/subtract temperature and salinity, so you don't conserve the budget?

Because of the effects of the covariance, temporally averaged nonlinear terms (ex. advection term) cannot be accurately calculated if temporally averaged single variables consisting of them (ex. temperature, salinity, and velocities) are used. This system accumulates each term in the temperature and salinity budget equations at each model timestep and each grid and then outputs the daily-mean values to close the budget. To

specify this, we have modified the last sentence in subsection 2.3.

#5) Line 240: “highest ... around” there is a preposition missing.

We have inserted “at” between “the highest” and “around “35%–40%” in the second sentence in the first paragraph in subsection 3.2.

#6) Figure 4: Posit(i)ve, the i is missing in the legend.

We have modified the legend in Fig. 4.

#7) Figure 5: There are white areas in (a)-(c), which indicate either missing values or ratios below your minimum colormap value. Please, either adapt the limit by extending the colormap or mention the white areas in the caption.

We have added the explanation of white areas to the caption of Fig. 5.

#8) Figure 5 & 6: you use the same colormap for panel d and e, although they present different quantities. Could you please choose another map for one of them, otherwise the reader might be confused.

We have modified the color pallets in Figs. 5e and 6e.

#9) Figure 7 (b): The unit in the bias is missing. If the bias of the SSS is dimensionless, then please use “Bias (1)”. Otherwise, the reader could be misled and think that you simply made a copy and paste error from panel (a), since you use exactly the same colormap and limits.

To clarify that Fig. 7a and 7b shows the different variables, we have modified the color pallet in Fig. 7b.

#10) In your equations, you write out “increment”. For an informed reader, it is clear that you mean the increment of this variable, but it remains nevertheless ambiguous, if it means only the increment of the specific variables or the increment of all variables. Consequently, I would suggest using the common delta formulation, e.g. ΔT for the increment in the temperature.

To clarify which variable is used for the increment terms, we have replaced (*increment*) with (*T increment*) and (*S increment*) in the temperature and salinity budget equations [Eqs. (4), (5)], respectively, as well as the related equations [Eqs. (13), (14), and (B1)] and have modified the related descriptions.

#11) You quite often refer to not-shown figures. Although the figures might not give too much new information, you partially base your arguments on them. Thus, I would prefer to see them in the Appendix.

By providing the four sentences including “(figure not shown)” with additional sufficient explanation and information, we have removed “(figure not shown)”.