

Response letter to the referee #1

Presented is an improved version of the internal solitary wave model. The efforts of the improvements have been made through several aspects: inclusion of background currents, horizontally inhomogeneous stratifications, and many others. The results are very encouraging. This paper documents these achievements towards a better internal solitary wave model. The graphs are impressively beautiful. I would recommend it be accepted for publication after some clarifications and minor revision.

Response:

We would like to thank the referee for the careful reading and valuable comments. In the revision, we have carefully considered them, and the necessary changes are provided to address them. Below, we provided point-by-point responses in blue to your comments.

Specific comments:

The title gives readers an impression that this is a forecast model. However, it has not been implemented as a forecast model yet. The numerical experiments reported in this paper are hindcast modeling. I would suggest to remove the keyword “forecasting”.

Response: We sincerely appreciate the referee’s insightful suggestion. In accordance with this recommendation, we have systematically replaced the abbreviation “ISWFM” (Internal Solitary Wave Forecasting Model) with “ISWNM” (Internal Solitary Wave Numerical Model) throughout the manuscript. This revision ensures consistency with the technical scope of our model, which emphasizes numerical simulation capabilities rather than operational forecasting. All relevant figures and texts have been updated to reflect this terminology adjustment.

L17, “ISWFM-NSCS v2.0” can be replaced with “the new version”.

Response: “ISWFM-NSCS v2.0” has now been replaced with “ISWNM-NSCS v2.0”.

L20, “in ISWFM-NSCS v2.0” can be removed.

Response: “in ISWFM-NSCS v2.0” is now removed.

L21, “presented” should be changed to “used”.

Response: We now replace “presented” with “used”.

L68, “by comparing with numbers of” can be changed to “through”.

Response: We now replace “by comparing with numbers of” with “through”.

L79, “by” should be changed to “by using” or “from”, and “a” should be “the”.

Response: We now replace “by a” with “by using the”.

L87, “well” should be changed to “good”.

Response: We now replace “well” with “good”.

L138-139, it would be good to provide some examples, e.g., Liu et al. (2000, 2008).

Response: We fully concur with the referee’s suggestion regarding the importance of exemplifying the interactions between ocean circulations and internal solitary waves. In revised manuscript, we have now integrated two pivotal studies by Liu et al. (2000, 2008) here.

Figure 5, the model name “MITgcm” should be changed to “ISWFM-NSCS v2.0” for a more specific case.

Response: We agree that the headings should be more specific and now replace “MITgcm” with “ISWFM-NSCS” in Figure 5.

L145-148, it is mentioned that background currents are added and that velocity data are also extracted from the HYCOM. However, it is not clear whether the HYCOM velocity data are used as the background currents. If so, please clearly state it in this paragraph. If not, then provide more information on what data are used for specifying the background currents or temperature and salinity fields in the ISWFM-NSCS v2.0. (This information is found later in the manuscript, L320-321. But it would be better to state that earlier in this paragraph).

Response: We sincerely agree that the information about how to extract HYCOM velocity and associated temperature and salinity fields as the initial and boundary conditions should be clarified in section 2.3. To demonstrate the source of background currents and hydrographic fields in the ISWFM-NSCS v2.0, we have now explicitly stated in the revised manuscript as follows:

“The background zonal and meridional velocity fields, associated with the corresponding temperature and salinity fields, are directly derived from the global HYCOM re-analysis dataset (<https://www.hycom.org/>, last access: 12 July 2024). These three-dimensional datasets are linearly

interpolated onto the model grid to initialize the baseline dynamic conditions, while the time-varying velocity fields from the HYCOM dataset are imposed as lateral boundary forcing across all four domain edges, thereby continuously driving the internal circulation patterns through dynamic coupling.”