

Response to reviewer comments

We sincerely thank the editor, Riccardo Farneti, and the anonymous reviewer for their efforts to thoroughly review our revisions to the original manuscript. We detail here responses to the final outstanding comments and indicate changes made to the manuscript. The reviewers' comments have been listed in order below in italic text, followed by our responses in normal text, and new manuscript text in blue.

Reviewer 1

Reviewer 1: *The authors have addressed all previously raised points, and the manuscript has improved considerably. I have one additional minor consideration that requires clarification before I can recommend acceptance.*

Reply: Thank you for these encouraging remarks in support of this manuscript.

Reviewer 1: *Mixed-layer depth definition and comparison with observations*
The discrepancy between model and observational MLD arises not only from the different threshold criteria but also from differences in the reference depth used in each calculation. The new observational MLD product (de Boyer Montégut et al., 2023) defines MLD relative to 10 m, whereas the model computes MLD relative to the depth of the first model layer. This distinction can have substantial implications for the comparison. As noted by Treguier et al. (2023), “a difference of less than 10 m in the reference depth can lead to more than 40 m difference in the MLD climatology.” I suggest that the authors explicitly discuss this additional source of discrepancy in the text around line 311.

Reply: We have added this information to the manuscript as follows: Further, a discrepancy of more than 40 m (Treguier et al., 2023) in estimated MLD may exist due to the different reference depths used in the observational product (10 m) and in the model (surface grid cell).

Typos

Reviewer 1: *Line 256 – add a space before “along.”*

Reply: Fixed (at line 245).

Reviewer 1: *Figure 5 – add a period after “Figure 6.”*

Reply: Fixed.

Reviewer 1: *Lines 631–632 – remove the second occurrence of “can serve as,” as it appears twice.*

Reply: Removed.