

Response to reviewers

We thank Carine van der Boog and one anonymous reviewer for their very helpful recommended improvements to this manuscript. We will incorporate all the reviewers recommendations in our revised manuscript.

Response to comments

The main point raised by both reviewers is our use of suboptimal salinity data for the classification of thermohaline staircases. In the revised version of the manuscript, we will better explain how our algorithm uses salinity and temperature profiles by adding additional sentences in Section 2.2 . As Reviewer 2 noted, our classifier uses temperature profiles to identify potential thermohaline staircases. Temperature and salinity profiles are used to distinguish between thermohaline staircases and other structures such as thermal intrusions. As part of the revision, we will include in Section 2.2 a quantitative analysis on the effect of using both temperature and salinity profiles for the initial step of identifying thermohaline staircases, as performed by Carine van der Boog et al. (2021), vs using only temperature profiles for this step.

Following Reviewer 2's recommendation, we make the following changes:

- Clarify our use of Mediterranean vs North Atlantic data in text and figures.
- Add more geographic detail to our analysis, particularly in the Section 2.1
- Explicitly state our use of units
- Add more discussion on the effect that varying vertical bin size has on the classification of thermohaline staircases in Section 4.2.
- Using calendar dates as well as yeardays to help orient readers in Section 2.1
- Increase the connections between text and figures in Section 3
- Discuss more of the previous studies within this domain that has been undertaken in the Mediterranean

Annotated manuscript

In their annotated manuscript Reviewer 2 echoed many of the points raised by Reviewer 1, and also made a number of useful recommendations to improve the manuscript. These recommendations included suggestions to standardise language, quote more specific numbers where available, highlight more salient areas of figures and make better use of colour. We will work these helpful recommendations into the revised manuscript.

The reviewers brought several recent papers to our attention that we had not discussed in the original submission. We will include discussion of the following papers in our revised manuscript:

van der Boog et al. 2021 Double-diffusive mixing makes a small contribution to the global ocean circulation <https://doi.org/10.1038/s43247-021-00113-x>

Shibley et al. 2017 Spatial variability of the Arctic Ocean's double-diffusive staircase <https://doi.org/10.1002/2016JC012419>

Durante et al., 2021 Mixing in the Tyrrhenian Interior Due to Thermohaline Staircases <https://doi.org/10.3389/fmars.2021.672437>

Ferron et al. 2021 Contribution of Thermohaline Staircases to Deep Water Mass Modifications in the Western Mediterranean Sea From Microstructure Observations <https://doi.org/10.3389/fmars.2021.664509>

Meccia et al. 2016 Decadal variability of the Turner Angle in the Mediterranean Sea and its implications for double diffusion <https://doi.org/10.1016/j.dsr.2016.04.001>

Community review

This manuscript has not received any community reviews from non-nominated reviewers. However, Frederic Merceur of IFREMER contacted us via email to request a more complete acknowledgment of Argo data used in this study. We have added his suggested citation to the acknowledgements section of the revised manuscript.