nature portfolio

# Peer Review File

# Equatorial Atlantic mid-depth warming indicates Atlantic Meridional Overturning Circulation slowdown

Corresponding Author: Professor Shang-Ping Xie

**This manuscript has been previously reviewed at another Nature Portfolio journal. This document only contains reviewer comments and rebuttal letters for versions considered at Communications Earth & Environment.**

**This file contains all editorial decision letters in order by version, followed by all author rebuttals in order by version.**

**Attachments originally included by the reviewers as part of their assessment can be found at the end of this file.**

Version 0:

Decision Letter:

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Dear Professor Xie,

Thank you for transferring your manuscript titled "Equatorial Atlantic mid-depth warming indicates Atlantic Meridional Overturning Circulation slowdown" from another Nature Portfolio journal, together with the peer review reports. We have now carefully evaluated the manuscript and your responses to the reviewer comments, and we are delighted to say that we are happy, in principle, to publish a suitably edited version in Communications Earth & Environment.

We therefore invite you to revise your paper one last time to edit your manuscript to comply with our format requirements and to maximise the accessibility and therefore the impact of your work.

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Best regards,

Heike Langenberg, PhD
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**Reviewer #1**

I would like to thank the authors for addressing my original comments and suggestions.

I only have a few additional comments that the authors might want to consider:
L. 89-91: This sentence sounds as if the AMOC slowdown would occur only in the BUOY-NA simulation, which is not the case.

In Supplementary Fig. 1b, why not show the AMOC timeseries for all experiments shown in panel a?

L. 86-96 discuss the BUOY and BUOY-NA simulations and in a second step the SSS-NA simulation is discussed in L. 107-119. I would suggest to have a more integrated discussion of the three simulations and consequently also include the SSS-NA in Fig. 1e and possibly substitute the not very informative panel d with SSS-NA results.

**Reviewer #2**

I have a concern on the originality of the manuscript. The similar, but very close research paper by the same group is published recently.

Ren,Q.,Li,Y.,Hu,S.,Xie,S.-P.,Lyu,Y., & Wang, F. (2025). Heat storage pattern linked to the Atlantic Meridional Overturning Circulation slowdown. Geophysical Research Letters, 52, e2025GL116801. https://doi.org/10.1029/2025GL116801

**Reviewer #3**

I would like to thank the authors for their careful consideration of my suggestions and detailed response to my comments. I can see that the manuscript has been significantly improved from the previous version. The attribution of the mid-depth equatorial Atlantic warming to the propagation of Kelvin waves triggered by an AMOC weakening is more grounded and the possible sources of uncertainties/limitations of study a clearer mentioned. I only have some minor, but critical, comments listed below that I would strongly recommend the authors to address before publication.

1. Regarding my previous comment 3.i, I suggest the authors to include the 'Methods' section the degree of global warming (4.57ºC) their forcing corresponds to. I think this important for reproducibility of their results.

2. Regarding my comment 3.ii, I also suggest the authors to include a discussion in the Methods to clearly states that their SSS-NA forcing corresponds to changes in precipitation/runoff and to the AMOC salt-advection feedback (given abrupt4xCO2 simulations also show strong AMOC weakening). Thus showing a broader region of reduced SSS in the NA.

3. L. 28 and L. 326 – "late 20th century" can be quite vague, and I don't the results suggest that. The results show that, in fact, the warming trend in T1000-2000 started in the early- or mid-1960's (Fig. 4d,e and Supplementary Fig. 9), as stated in the previous sentence (L. 26). Please, be consistent about timing suggestions throughout the manuscript. Noting that in 338 the authors use the trend from 1960-2020 to estimate

the relationship and in L. 342 the authors use the year 1950 as a reference of the AMOC weakening.

4. L. 36 – Please be consistent about level of global warming the manuscript is referring to (i.e., in the abstract the authors mention 1.5ºC), while also indicating the approximate year the mentioned level was reached.

5. L. 79 – A short description of what the 'all-forcing' run is would improve readability.

6. L. 255 – Fig. 3c -> Fig.4c.

7. L. 306-308 – I suggest merging the sentences "WOA shows …" and "The ToE of …" around the single value ToE. The former suggests a ToE in 1995-2005 while the later more precisely defines it in 2000, which can be confusing.