Anonymous Referee #3, 08 Jan 2026

General comment:

In my opinion the submitted manuscript "Two decades of pHT measurements along the GO-SHIP A25 section" is excellent and I suggest should be accepted after minor revisions.

Measurements of any parameter to high accuracy and precision over a long timescale are challenging especially where no certified reference material is available. Further confounding the challenge is the evolving consensus in best practice. The attractive simplicity of spectrophotometric seawater pH measurements has been long established, however the various improvements and refinements potentially thwart production of a consistent high quality long-term data set.

This paper summarises the fundamentals and the issues with dye impurity well then proceeds to discuss various replication and quality assurance protocols used to eventually ascribe a justifiable offset with uncertainty between pHT data calculated from absorbances determined with unpurified and purified dye stocks. It is difficult to imagine anything further that could have been done ensure the data quality.

We would like to thank Anonymous Referee #3 for the thoughtful review, the positive assessment of our manuscript, and for recognizing the challenges of producing high-quality long-term spectrophotometric seawater pH measurements, particularly in the absence of certified reference materials and given the evolution of best practices over time. All comments have been carefully considered, as detailed in the responses below. Anonymous Referee #3's evaluation is reproduced in black, *the author's responses appear in green and italics, the original manuscript text appears in black and italics, and the changes introduced in the manuscript are shown in blue and italics.*

Comments:

C1: There are a lot of acronyms used and not all are explained on their first use**.**

Thank you for pointing this out. We have provided the acronym meanings for GO-SHIP (line 14), OVIDE-BOCATS (line 14) and CLIVAR (in line 97).

C2: Line 163 CB'13 should be CB'93

Corrected, thank you.

C3: Line 192 expansion of DB'17.

This is explained previously in line 93 as follows: " (…) and correct them accordingly (Douglas & Byrne, 2017; hereafterDB'17; (…) ". However, if the Referee considers it appropriate, we could expand on this in the line 192.

C4: Line 193 language could be improved

Thank you, agree. We have corrected the line as follows: "This approach allows ~~to compute the~~ R to be corrected for the contribution of impurities ~~contribution~~ at $_{434}A$ (i.e., $_{434}A_{imp}$), and consequently (…) ".

C5: Line 337 orange squares in Fig. 3

Thank you, corrected.

C6: Line 410 Font sizes, point colour makes chart difficult to when printed.

Thank you for noting this. We have increased the font sizes and adjusted the point colors to prevent them from appearing faint when printed.

C7: Line 447 Colours faint when printed. Could authors comment on why the σ on the purified dye differences (0.0014) seems notably smaller than the unpurified dye (0.0024) for Tris but not modified seawater (both 0.0017).

Thank you for pointing this out. We have updated the color map to improve contrast and visibility when printed, including black-and-white reproduction.

Regarding the difference in σ, given the mean reproducibility of our measurements (~0.0015 pH_T units), we agree that the σ obtained with the unpurified dye is slightly higher than expected. We explored the data, and a couple of measurements with the unpurified dye exhibit a positive bias together with a slight temperature bias.

C8: Line 591 upper-right insert.

Corrected, thank you.

C9: Couldn't see the dataset due to restricted access in Zenodo

We sincerely regret that you were unable to access the dataset. At the time of manuscript submission, and following the options provided by ESSD, we chose to keep the dataset in a permanent repository (Zenodo, with DOI) under embargo until publication. In parallel, we created a temporary public repository containing the identical dataset for reviewers to use during the review process. This temporary link is: https://saco.csic.es/s/kKqDXFYGKsKbaXj. According to ESSD procedures, this link should have been sent upon acceptance of the referees. We apologize for the oversight and any inconvenience it may have caused.