

Third review of EGU sphere-2024-3436

REV#2

Effect of double diffusion processes in the deep ocean on the distribution and dynamics of particulate and dissolved matter: a case study in Tyrrhenian Sea by *Durrieu de Madron et al.*

The authors have responded well to the reviewers' suggestions, and I believe the overall structure and readability of the paper, including the figures, are now excellent. The addition of stratification and stability parameters is useful, and classifying stations with and without staircases is an effective choice. There is a notable improvement in Figure 8.

Significant progress has been made in the statistical analysis, as wisely recommended by Reviewer #1. Despite this, I would still like to make a few comments:

Paragraph 2.3: The methods of threshold-based detection of stations could be expanded. It's clear how you selected the WStairs stations, which are six, but it's less clear why stations 4, 5, 6, 17, and 18 are excluded from the NoStair category. Why don't they fit your classification criteria? Splitting stations into two groups smooths out local variability, but it also assumes that the groups are comparable within each category. Heterogeneities within groups could affect the slopes and the significance, that's why you are not using all the 16 stations? This should be clarified.

Line 422: There's a misalignment issue in Figure 5 with the numbers in the subplot.

Figure 9: When you mention shifted AOU profiles, do you mean both graphs start at 700 m, even though the linear regression for AOU begins at 1000 m? If so, the last two lines of the caption may be more confusing than helpful, as the graph is self-explanatory. Additionally, depth is plotted on the y-axis in all other figures and plots, including those for individual stations... except in this one. If this does not affect the readability of the plot from a statistical perspective, you might consider flipping the axis.

Line 612: You define WStairs and NoStair in 2.3, and paragraph 3.2.2 is about the positioning and persistence of the main staircases.

Line 614: If I am not mistaken, Aiken et al., 1991 refers to a book. Could you specify the exact location of this reference within your manuscript?

Line 610- 625: While the slopes are very close in value, you report a p-value indicating that the difference is statistically significant. But, given the small magnitude of these differences

and the brief description of your statistical approach, this section could benefit from a more detailed explanation to clarify the reasoning behind the significance and its implications. For instance, you could include some details about the statistical approach in the Methods section (Paragraph 2.3), which would help keep the discussion section more concise and focused without losing information