

## Report #2

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Submitted on 26 May 2025  
Anonymous referee #4

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The authors characterize Poleward undercurrent eddies (PUDDIES), a subsurface eddy in the South-East Pacific Ocean, and how their biogeochemistry evolves. A particular focus is put on the dissolved oxygen as these eddies are hypothesized to influence the oxygen minimum zone in the region. To do this, they use a 9-year output of a coupled physical-biogeochemical model (ROMS+BioEBUS), configured at a horizontal resolution of 1/12 degree and a temporal resolution of 3 days. They found that PUDDIES have hypoxic cores in the open ocean, compared to suboxic cores close to the coast, and this is due to ventilation during their propagation. Ventilation occurred through lateral and vertical advection, and vertical mixing supply O<sub>2</sub> to a lesser degree.

I have only seen the revised version of this manuscript and found the topic to be of interest, with the manuscript well written and clearly defined methods and choices (after revision from 1st review process). Indeed, complex biogeochemical models are computationally expensive, but are important to better resolve processes such as mixing processes which can influence the SMS dynamics.

We appreciate the time you took to read and review our work, as well as your helpful comments to improve the manuscript.

Specific comments:

- The comments raised by Reviewer 2 about the structure of the methods, as well as the methods themselves have been appropriately addressed by the authors.
- Figure 2 is really small with many subplots, hence making it really hard to read. I recommend extending it vertically, and reducing the space between the plots. Changing the colorbar to something else than jet will also be helpful.

Following your suggestion, Figure 2 was improved for better clarity of content, and the color map was changed to a more suitable range.

- Line 374: relative to instead of “concerning”

The sentence was modified as follows: “....and estimated anomalies of the profiles relative to the general mean profile of the corresponding box”.

- Line 380: I’m not sure of the word ‘evidence’ here. Consider changing it.

The line was modified as follows: “However,  $\text{NO}_3^-$  and  $\text{N}_2\text{O}$  exhibit maximum levels in the central region”

- Line 532: the case that  $\langle \text{AOU}' \rangle$  is greater than....  $\langle \Delta \text{NO}_3 \rangle$  is greater. Please check these lines.

The paragraph was reviewed and the arguments are correct, therefore it was not modified.

- Line 619: Consider changing “it finishes completely mixed” to “which becomes completely mixed”

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