

Thanks for the suggestions and the rapid response.

We corrected the minor typos and here we address the rest of questions.

Page 9 line 26:

We realize that the description of jets is confusing, and changed it to the following:

“This complex equatorial system is formed by the eastward Northern and Southern Equatorial Countercurrents (NECCs and SECCs) and Northern and Southern Subsurface Countercurrents (NSCCs and SSCCs, also known as Tsuchiya jets in the Pacific; Tsuchiya, 1981) - shown as currents at 6°N-8°N and 6°S-8°S in the last panel of Fig. 4 -, the westward northern and main branches of the South Equatorial Current (SEC(N) and SEC) - on both sides of the EUC in Fig. 4 -, and deeper currents as described in detail for example in Stramma et al. (2010b).

In observations, the Northern and Southern Equatorial and Subsurface Countercurrents (ECCs and SCCs) determine the separation between the well-ventilated tropics and the low-latitude OMZs (Fig. 1a).”

Page 15 lines 20-23: CESM1-BGC denitrification and nitrogen conservation.

We propose to update the sentence to this:

“Additionally, the CESM1-BGC model adjusts the nitrate consumed during denitrification to lower values to avoid running out of nitrate (Lindsay et al., 2014), such that the same amount of nitrate supports a larger POC remineralization. This fixes nitrate concentrations and decreases the transfer of POC to deeper waters, which might partially solve the expansion of OMZ.”

About the conservation of nitrate:

Nitrate is not locally conserved, but globally it is at steady state (conserved), since fixation adjusts to match denitrification at longer time scales. Basically, by fixing denitrification (too large in this model and most models) they also fix fixation and maintain both processes at realistic rates.

This is the detailed answer that Keith Lindsay gave us:

“Total N is not preserved by the model. NO₃ is destroyed during denitrification. This N is a net loss to the system. Similarly, N fixation introduces new N to the system. We do not have a direct coupling between N fixation and denitrification. However, denitrification leads to NO₃ depleted waters. When they reach the surface, they form environments that are loosely more favorable to N fixers, which increases N fixation. So there are emergent feedbacks between denitrification and N fixation on timescales longer than the ventilation timescales of the OMZs (where denitrification occurs).”

We think that it is not necessary to add a line on nitrate conservation on the main text, but we could add one if the editor finds it adequate.

Figure1: strange orange lines.

We removed these lines from panels b) and c) for clarity. Those lines were due to low O₂ concentrations around Papua New Guinea in this model MRI-ESM1. Since we focus on the eastern part of the Pacific, it looks cleaner without these lines.