We thank the reviewer for their constructive and helpful review of our paper as well as for the many great ideas to improve our research.

Following, we reply to each issue individually, and explain the changes we will make to the revised manuscript to meet the reviewer's criticism. Reviewer comments are written in bold italics, our answers are kept in plain font.

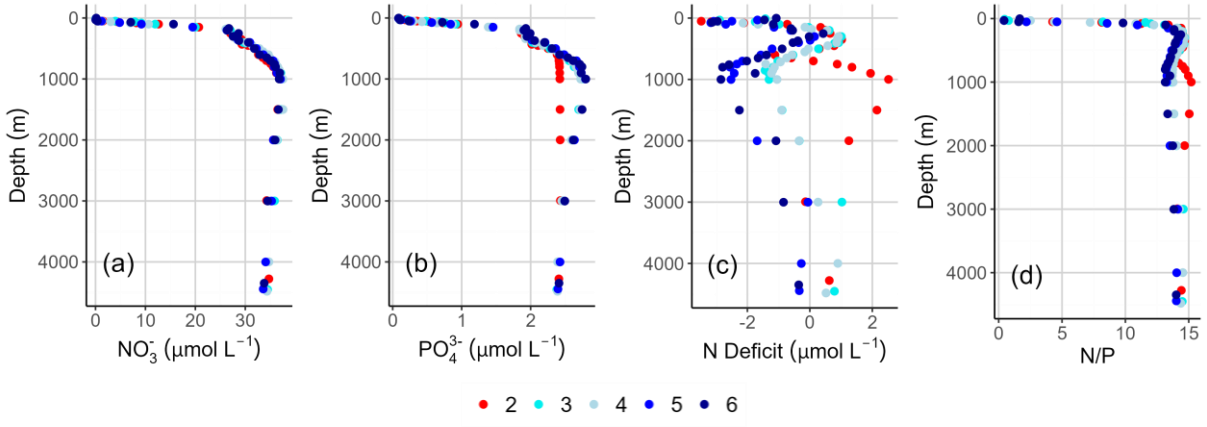
Schulz et al. present a comprehensive data set of hydrography and nitrate and nitrite (concentrations and isotopes) for a single transect spanning the Equatorial Indian Ocean into the central Bay of Bengal (BoB). The hydrography data are then used to define the water masses and their vertical and regional distributions. The nitrate/nitrite data are used to investigate the potential for loss of fixed nitrogen in the BoB.

The main conclusions are that the two regions are essentially separate with little mixing, the general circulation controls the distribution of N and N isotopes at depths greater than 300m, and that the N isotopes indicate loss of fixed N via anammox somewhere in the depth interval of approximately 100 – 300 m. Overall the data support these conclusions and the idea that some fixed N loss does occur in the BoB, even though it is not absolutely anoxic.

Specific queries:

L170: The aberrant data are from the first, most southern, station. Is there any logistical/practical reason that they might be diNerent? Problem with the sampling? It is indeed striking how diNerent those data are, since everything else is quite consistent with water mass identity and an abrupt hydrological boundary seems unlikely.

To investigate further, we closely examined the nitrate and phosphate profiles at Station 2 and compared them with those from subsequent stations (see following figure). It becomes evident that the differing N deficit values at Station 2 primarily result from variations in measured phosphate concentrations. Specifically, phosphate levels between 500 and 3000 meters were significantly lower at Station 2 compared to the other stations. In contrast, the nitrate profiles at Station 2 are largely consistent with the depth profiles observed at the other locations.



As the reviewer points out, we also find a hydrological boundary to be an unlikely explanation, particularly given the tight sampling grid near the equator, which should capture any abrupt transitions. Our water mass analysis shows no significant shifts in water mass distributions between Stations 2 and 3. Moreover, the observed changes in phosphate occur in deeper water layers, where site-specific biological turnover is less likely to cause such distinct deviations. At this point, we currently do not have a satisfactory explanation for the observed deviations at station 2.

While human error can never be entirely ruled out, we consider measurements errors to be unlikely. All measurements were conducted with rigorous quality control procedures, including the use of standards and documentation of any anomalies.

Despite these uncertainties, we have chosen to retain the data from station 2, as (1) we do not have evidence of measurement error, and (2) unexplained patterns may still reflect real and meaningful oceanographic phenomena. As we will include the phosphate concentrations in our revised manuscript, as also suggested by the reviewer, we will add a brief discussion addressing the points outlined above.

Section 3.1. I find myself wanting to see depth profiles of PO4 concentration. PO4 concentration is essential for the Ndef calculation so it would be good to see how variable it is. Why not include it in the profile data shown in Figure 3? We are given the value for the average (N/P)deep but not the actual PO4 distributions. I think those data would be appropriate to include in a paper that presents such a comprehensive basic data set.

We will add phosphorus data either to figure 3 in our revised manuscript or upload supplementary material showing the concentration profiles.

Figure 3. This is an unusual aspect ratio for depth profiles. I would much rather see the more usual elongated Z axis and narrower X axis. That way, it would be much easier to compare the depths of important features, especially if several of the profiles were lined up horizontally.

Thanks for this suggestion, we will try the suggested ratio and alignment of plots in figure 3 in a revised version of our manuscript, especially with adding additional plots for ammonium and phosphorus.

Section 3.4. What exactly is being correlated here? The text says the isotope data were not correlated with the water mass variables. With at 2 or 3 water mass variables and 2 isotope variables for each region, there are at least 4 possible correlations but the text lists two for each region. So we can't tell exactly what correlation analysis is being reported. More importantly, it would be very useful to see the plots of d15N and d18O against those water mass variables (especially sigma-t, with labels for water mass identity). That would make it possible for the reader to see how the strength of the correlations varies with depth interval – which is described in the text but would be much more compelling if we could see the plots.

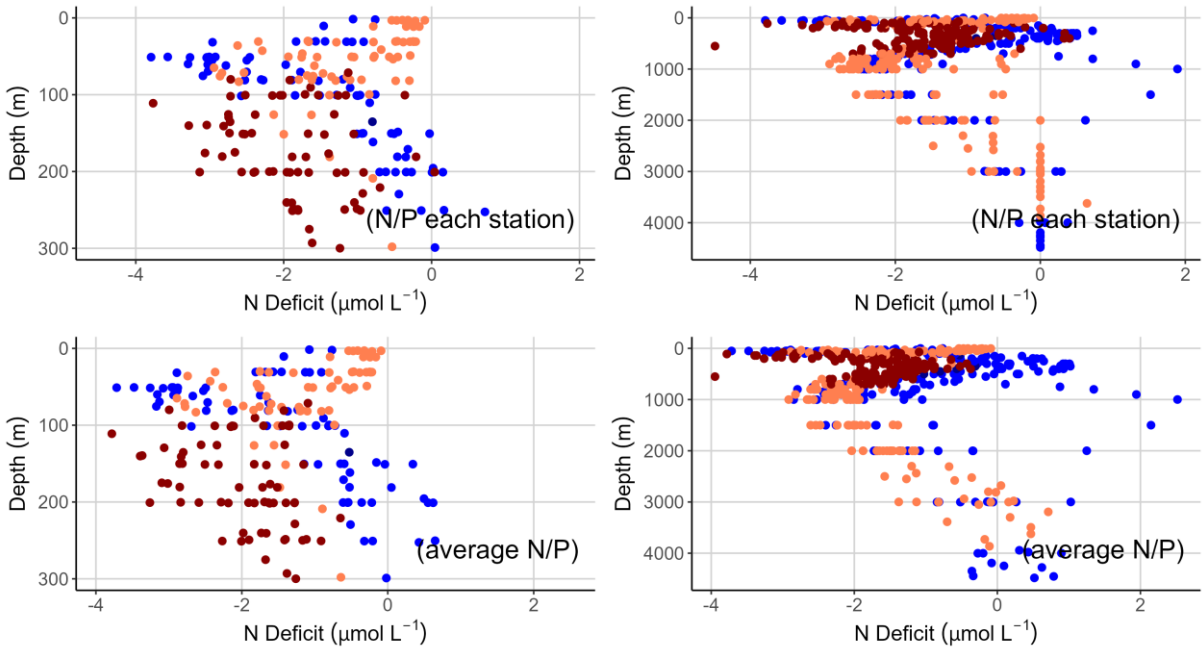
We correlated each $\delta^{15}N\text{-}NO_3^-$ and $\delta^{18}O\text{-}NO_3^-$ with salinity, potential temperature, and oxygen. Additionally, we performed multiple regression analysis of both isotopes using the following combinations: 1) salinity and potential temperature and 2) salinity, potential temperature and oxygen. To maintain focus on nitrogen turnover processes and avoid overextending the manuscript, we chose not to include extensive data in the main text, as the results were not particularly surprising. However, we will revise the methods section accordingly and include relevant figures or tables in the supplementary material of the revised manuscript.

L300: It looks to me like there is a significant Ndef deeper than 100m in the EEIO in Fig 3. Is Ndef defined as Ndef less than zero? There are many blue points deeper than 100m in both 3.i and 3.j.

Indeed, we defined the N deficit as less than 0. We agree with the reviewer that there are EEIO samples showing a N deficit below 100 m, and we acknowledge that our statement in L300 is misleading.

The observed N deficit in water layers >300 m is not a result of biological in-situ consumption but rather reflects the transport of a nitrogen-deficient signal within the water mass. However, the data also shows N deficits within the EEIO in the upper 300 m, albeit significantly less pronounced than in the BoB. Importantly, there is a strong reduction in the N deficit in the EEIO compared to the strong surface deficit driven by phytoplankton uptake.

The observed N deficit down to ~150 m likely reflects a NO_3^- source due to coupled remineralisation and nitrification processes counterbalancing the N deficit. Furthermore, we recognize a potential bias in our N deficit calculation. We used the ratio of average ratio between NO_x^- to PO_4^{3-} in the deepest water samples of each station (L118-121). Applying this deep-water ratio to shallower samples may overestimate the N deficit in the upper water column. We recalculated the nitrogen deficit using station-specific deep-water N/P ratios. However, this adjustment did not significantly alter the observed pattern (see figure). We acknowledge that uncertainties remain due to the inherent assumptions of the method, especially considering that deep-water masses may differ from those in the upper layers, potentially affecting the N/P ratio.



We will rephrase the sentence in L300, expand the discussion to include the vertical distribution in the EEIO and address the possible bias of the N deficit calculation in the revised version of our manuscript.

L311: I understand that the 1:1 relationship between d15N and d18O in Figure 6.a indicates NO3 assimilation in the surface water. The correlation is made using only surface samples. Since the color coding in the figure is by nitrate, not depth, it's not entirely obvious which points in the figure were included in the correlation. AND, the tail of that distribution, the portion NOT included in the correlation, also tells a story. Changing d15N with no change in d18O indicates nitrification (with partial nitrate assimilation) (Fawcett et al. 2015), which the authors address later without referring to these data. I suggest discussing this feature more completely and including two regression lines in Figure 6.a. One for the surface points and one for the deep points. Something like this

Thanks for this suggestion. We will revise the figure accordingly and incorporate a discussion of the data related to the figure, as well as the study of Fawcett et al. (2015), in the section 4.2.2 of nitrification later in the text.

Minor comments:

L42: Bristol et al. (2017) is not an appropriate citation for the calculation of the volume of OMZs. Bristol et al. (2017) simply cited Codispoti et al. 2001 and that's what these authors should do. Or upgrade their citation to DeVries et al. 2012, who refined the estimate to about 30% (rather than 20 – 40%).

Thanks for this recommendation, we will adapt the citation and estimated OMZ volume in our revised version.

L123: Please clarify what you mean by drying filters for two nights. Does that mean 48 hr?

Yes, we will clarify the drying time of our filters in the revised manuscript.

L165: please specify that the ammonium concentration data are not shown. The reader might look for them, expecting to see them in a supplemental figure since they are mentioned here.

We will add plots showing the ammonium concentrations to figure 3 in the revised manuscript.

Figure 4, Section 3.3. There appears to be an interesting feature in panels a and b, looks like maybe an eddy? Stations 18 - 27 where the is a feature defined by anomalously high O2? Worth a mention?

Along the 88°E section, we indeed crossed an anticyclonic mode-water eddy between 12° and 13°N (stations 18, 27; Fig. 4), which shows the typical uplift of the isopycnals in the seasonal thermocline above 150 m and a deepening of the main thermocline below 150 m (McGillicuddy Jr. et al., 2007). The mode-water eddy is associated with a thick lens of anomalous high-oxygen water in the core of the eddy (Fig. 4b, d), but, however, does not show any effect on our nitrate stable isotope signatures. For this reason, and to maintain the focus of our manuscript, we chose not to elaborate on the eddy in our manuscript.

L229: "Further, other studies"

We will add the "other".

L230: "The ASHSW spreads eastward…"

We will correct our sentence in the revised manuscript.

L235: "…the BOB is attributed…"

We will change "being" to "is".

L320: …deposition that is reflected in low…."

Thanks, we will made the suggestion change.

L365: "…we conclude that the main diNerences…"

We will change "claim" to "conclude".

L380: "Anammox bacteria are known…"

We will add "bacteria".

Figure 7. This is a nice summary figure. I don't see any purple points/nitrite data, although nitrite is included in the caption.

Thanks for spotting that mistake. In a previous version of the figure, we included the nitrite data. However, we have decided to omit nitrite from the figure to improve clarity and readability. Apparently, we forgot to adapt the figure caption, which we will do in the revised version of our manuscript.