Author responds

1 Review comment (RC1) – 25.05.2025

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 made 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. 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. We included the phosphate concentrations in our revised manuscript, as also suggested by the reviewer, we also added a brief discussion addressing the points outlined above.

Lines	**Change**
L201	In Fig. 3, we have incorporated phosphate (Fig. 3b, l) concentrations.
L171-173	Added short description of measured phosphate concentrations in results section 3.1: "Phosphate concentration followed a similar pattern, with lowest values in surface waters and increased a maximum of 2.9 µmol L^{-1} also observed 900 m (station 28). In bottom waters, phosphate levels declined slightly to an average of 2.5 ± 0.1 µmol L^{-1} (Fig. 3b, l)."
L182-185	Added: "This anomaly seems to be primarily driven by unusually low phosphate concentrations between 500 and 3000 m at station 2 (Fig. 3b), while nitrate profiles remain largely consistent with those at adjacent stations (Fig. 3a). Although hydrological boundaries and biological turnover are unlikely explanations, and no clear evidence for measurement error was found, the cause of this deviation remains unclear."

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 added phosphate concentrations to Fig. 3. Please note that the figure was further revised in response to later comments from Reviewer #1 and #2.

Lines	**Change**
L201	In Fig. 3, we have incorporated ammonium (Fig. 3e, o), phosphate (Fig. 3b, l) and silicate concentrations (Fig. 3c, m).
L171-174	Added short description of measured ammonium, phosphate and silicate concentrations in results section 3.1: "Phosphate concentration followed a similar pattern, with lowest values in surface waters and increased a maximum of 2.9 µmol L^{-1} also observed 900 m (station 28). In bottom waters, phosphate levels declined slightly to an average of 2.5 ± 0.1 µmol L^{-1} (Fig. 3b, l). Silicate concentrations increased with depth, starting from low surface values and reaching average bottom water concentrations of 133.7 ± 20.6 µmol L^{-1} (Fig. 3c, m)"
L176	Added: "up to 0.4 µmol L^{-1} (Fig. e,o)"

	References to Figure 3 have been adjusted throughout the manuscript.

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.

We adapted the ratio of Fig. 3 according to the suggestion of the reviewer. Please note that the figure was further revised in response to other comments from Reviewer #1 and #2.

Lines	**Change**
L201	We adapted the ratio of Fig. 3 according to the suggestion of the reviewer.
L201	In Fig. 3, we have incorporated ammonium (Fig. 3e, o), phosphate (Fig. 3b, l) and silicate concentrations (Fig. 3c, m).
L171-174	Added short description of measured ammonium, phosphate and silicate concentrations in results section 3.1: "Phosphate concentration followed a similar pattern, with lowest values in surface waters and increased a maximum of 2.9 µmol L^{-1} also observed 900 m (station 28). In bottom waters, phosphate levels declined slightly to an average of 2.5 ± 0.1 µmol L^{-1} (Fig. 3b, l). Silicate concentrations increased with depth, starting from low surface values and reaching average bottom water concentrations of 133.7 ± 20.6 µmol L^{-1} (Fig. 3c, m)"
L176	Added: "up to 0.4 µmol L^{-1} (Fig. e,o)"
	References to Figure 3 have been adjusted throughout the manuscript.

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.

Lines	**Change**
L283-284	Changed: "We examined the relationship of nitrate isotopes with tracers of water masses such as salinity and potential temperature" To

	"We examined the relationship of nitrate isotopes with salinity, potential temperature, and multiple regressions analysis of both isotopes using salinity and potential temperature (see supplementary material)."
L283-296	We recalculated the correlations and corrected the values. We always added "best fit with …" to indicate which pairing was used for the presented values in the main text
	We added supplementary material showing the correlations.

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 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 rephrased the sentence in L300, expanded the discussion to include the vertical distribution in the EEIO and addressed the possible bias of the N deficit calculation in the revised version of our manuscript.

Lines	**Change**
L317-325	Changed "…while in the EEIO the N_{def} disappears below ~100 m. The isotopic variations with depth suggest changes in nitrate cycling with depths, while the regional decoupling between $\delta^{15}N\text{-}NO_3^-$ and $\delta^{18}O\text{-}NO_3^-$ shows regional differences in nitrate cycling in the EEIO and BoB." To "…while in the EEIO the N_{def} is markedly reduced below ~100 m. Although some EEIO samples do show N_{def} at depths >100 m, these are significantly less pronounced than in the BoB and likely reflect a NO_3^- source due to coupled remineralisation and nitrification processes counterbalancing the N_{def}. We also acknowledge a potential bias in our N_{def} calculation (equation 1) based on deep-water samples at

	each station. Applying this deep-water ratio to shallower layers may overestimate the N_{def} in the upper water column, especially if the N/P ratio varies with depth due to biological or physical processes. Taken together, the vertical and regional patterns in nitrate isotopes and N_{def} suggest distinct nitrate cycling in the BoB and EEIO. The isotopic variations with depth suggest changes in nitrate cycling with depths, while the regional decoupling between δ^{15}N-NO_3^- and δ^{18}O-NO_3^- shows regional differences in nitrate cycling in the EEIO and BoB.”

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

We revised Fig. 6 by adding a regression line for the surface water samples. However, we chose not to include a second regression line for the deeper samples, as the relationship was not as clear as suggested in the reviewer's sketch and did not provide additional insight. Nevertheless, we referred to Fawcett et al. (2015) in the section 4.2.2 of our revised manuscript to support our observation of nitrification below 100 m.

Lines	**Change**
L349	Revised Fig. 6
L362-368	Added: “Our data (Fig. 6a) is consistent with findings from the Sargasso Sea, where Fawcett et al. (2015) observed changes in δ^{18}O-NO_3^- without corresponding shifts in δ^{15}N-NO_3^-, indicating nitrification alongside partial nitrate assimilation. The decoupling occurs because nitrification produces nitrate with a relatively high δ^{18}O values, while its δ^{15}N remains like that of organic nitrogen remineralized. At the same time, nitrate assimilation removes lower δ^{18}O, causing the δ^{18}O of the remaining nitrate to increase more than δ^{15}N. Additionally, ammonium in the euphotic zone is more likely oxidized than assimilated due to a large isotope effect during ammonium oxidation. This introduces low δ^{15}N-NO_3^-, further reducing δ^{15}N relative to δ^{18}O (Fawcett et al., 2015).“

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%).

Lines	Change
L42	Changed “(Bristow et al., 2017)” to “(DeVries et al., 2012)”

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

Lines	Change
L128	Changed “two nights” to “48 hours”

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 added ammonium concentrations to Fig. 3. Please note that the figure was further revised in response to previous comments from Reviewer #1.

Lines	Change
L201	In Fig. 3, we have incorporated ammonium (Fig. 3e, o), phosphate (Fig. 3b, l) and silicate concentrations (Fig. 3c, m).
L201	Added short description of measured ammonium, phosphate and silicate concentrations in results section 3.1: “Phosphate concentration followed a similar pattern, with lowest values in surface waters and increased a maximum of 2.9 µmol L^{-1} also observed 900 m (station 28). In bottom waters, phosphate levels declined slightly to an average of 2.5 ± 0.1 µmol L^{-1} (Fig. 3b, l). Silicate concentrations increased with depth, starting from low surface values and reaching average bottom water concentrations of 133.7 ± 20.6 µmol L^{-1} (Fig. 3c, m)”
L171-174	Added: “up to 0.4 µmol L^{-1} (Fig. e,o)”
	References to Figure 3 have been adjusted throughout the 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 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"

Lines	Change
L244	Changed "Further, studies…" to "Further, other studies…"

L230: "The ASHSW spreads eastward…"

Lines	Change
L254	Changed "The ASHSW is spreading…" to "The ASHSW spreads…"

L235: "…the BOB is attributed…"

Lines	Change
L251	Changed "being" to "is"

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

Lines	Change
L343	Changed "…deposition that reflects…" to "…deposition that is reflected…"

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

Lines	Change
L399	Changed "claim" to "conclude"

L380: "Anammox bacteria are known…"

Lines	Change
L413	Changed "Anammox are known…" to "Anammox bacteria are known"

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

Lines	Change
L431	Removed "nitrite in purple"

2 Review comment (RC2) – 13.06.2025

We thank the reviewer for their constructive and helpful comments and suggestions about our paper. Following, we reply to each issue individually, and explain the changes we made to the revised manuscript to meet the reviewer's criticism. Reviewer comments are written in bold italics; our answers are kept in plain font.

General comments:

The manuscript looks at the nitrogen cycling in the Bay of Bengal as well as East Equatorial Indian Ocean. The methodologies are detailed, the data well presented and the discussion follows a logical pathway.

Motivation:

The authors make a good case of why the Bay of Bengal OMZ is important to study. It is not clear, however, why they chose EEIO. Please include a section about why you study this region.

Lines	**Change**
L67-70	Added: "The East Equatorial Indian Ocean (EEIO) remains largely understudied compared to other major ocean bodies (Ummenhofer and Hood, 2024). Including the EEIO and BoB in our study allows us to compare nitrogen turnover across contrasting oxygen regimes and to assess regional differences in nitrate transformation pathways."

Specific comments:

L21: "Below". Do the authors mean "subsurface waters"?

Lines	**Change**
L21	Changed: "Below" to "In subsurface waters"

L27: Please change to "unavailable for most organisms"

Lines	**Change**
L27	Changed: "microorganism" to "organism"

L31: Denitrification may also be autotrophic. Please restructure this sentence.

Lines	**Change**
L31	Changed: "Denitrification is the stepwise heterotrophic dissimilatory process that reduces nitrate…" to "Denitrification is a stepwise dissimilatory process, which can either be heterotrophic or autotrophic, that reduces nitrate…"

L41: Define "low oxygen" and "anoxic"

In L43-45 we elaborate on the oxygen limits of anammox and denitrification. We rephrased this section. Please note that we adapted the estimated nitrogen loss from OMZs and reference as a response to a comment of reviewer #1.

Lines	**Change**
L43-45	Changed: "Nitrogen loss only occur under low oxygen or anoxic conditions. Despite covering only 1 % of the global ocean, oxygen minimum zones (OMZ, with oxygen concentrations <20 µM) account for about 20-40 % of fixed nitrogen loss (Bristow et al., 2017)." to "Nitrogen loss processes are inhibited by the presence of oxygen, which is why oxygen minimum zones (OMZ, with oxygen concentrations <20 µM) account for about 30 % of fixed nitrogen loss, despite only covering 1 % of the global ocean (DeVries et al., 2012)."

L43&44: Add references for "…oxygen concentrations upto 20µM" and "…concentrations of 6µM"

Lines	**Change**
L43-45	Changed: "Anammox has in some cases been observed to tolerate oxygen concentrations up to 20 µM and denitrification up to oxygen concentrations of 6 µM. However, in OMZ waters, the rates of both processes increase only at oxygen concentrations <1 µM." to "Anammox has in some cases been observed to tolerate oxygen concentrations up to 20 µM (Kalvelage et al., 2011) and denitrification up to oxygen concentrations of 6 µM (Bristow et al., 2016)."

L59: "dual": please mention N and O in parentheses.

Lines	**Change**
L60	Added: "… nitrate dual isotopes (nitrogen and oxygen) …"

L87: "large amount of freshwater input": a number would be helpful

Lines	**Change**
L91	Added: "… from this rivers ($1.6 \cdot 10^{12}$ m^3 yr^{-1}; Sarma et al., 2016) causes…"

Figure 2: I would recommend adding BoB and EEIO in the figures too.

Lines	Change
L96	Changed Figure 2 by adding labels for BoB and EEIO

L124: How was particulate nitrogen measures? Did the authors scrape material from the filter paper or pellets or any other way?

Lines	Change
L129-132	Added: "For the measurements of particulate nitrogen a laboratory hole puncher was used to extract defined pieces from the filter (punch area: 20.43 mm^2). These were measured…"

L133-134 : The international standards are reported for NO3- and not Nox. I suggest writing NO3- . Same goes for the samples: since the authors have ensured nitrite removal.

Lines	Change
L139-151	Changed "NO_x" to "NO_3^-"

L165: Where is the figure for ammonium concentrations?

We added ammonium concentrations to Fig. 3. Please note that the figure was further revised in response to comments from Reviewer #1.

Lines	Change
L201	In Fig. 3, we have incorporated ammonium (Fig. 3e, o), phosphate (Fig. 3b, l) and silicate concentrations (Fig. 3c, m).
L201	Added short description of measured ammonium, phosphate and silicate concentrations in results section 3.1: "Phosphate concentration followed a similar pattern, with lowest values in surface waters and increased a maximum of 2.9 µmol L^{-1} also observed 900 m (station 28). In bottom waters, phosphate levels declined slightly to an average of 2.5 ± 0.1 µmol L^{-1} (Fig. 3b, l). Silicate concentrations increased with depth, starting from low surface values and reaching average bottom water concentrations of 133.7 ± 20.6 µmol L^{-1} (Fig. 3c, m)"
L171-174	Added: "up to 0.4 µmol L^{-1} (Fig. e,o)"
	References to Figure 3 have been adjusted throughout the manuscript.

L177: "heaviest isotope signature….upto 13.9‰ " yet Fig 3e shows δ15N>20‰

Lines	**Change**
L191	Changed "…values up to 13.9 ‰ for $\delta^{15}N$-NO_3^- and 17.0 ‰ for $\delta^{18}O$-NO_3^-…" to "…values up to 20.7 ‰ for $\delta^{15}N$-NO_3^- and 17.2 ‰ for $\delta^{18}O$-NO_3^-…"

Figure 3: Please keep the labels identical for all . (a)-(j) are on the bottom right while (k)-(n) on bottom left.

Lines	**Change**
L201	We aligned all labels uniformly to the bottom right corner.

L201: It is not clear what is a "strong oxygen minimum zone"?

Lines	**Change**
L216-217	Changed "North of 5°N a strong oxygen minimum zone…" to "North of 5°N an oxygen minimum zone…"

L340: Is the calculation of $\delta^{15}N$ of nitrite shown?

We calculated $\delta^{15}N$-NO_2^- using the following formula, which is also shown in L163.

$$\delta^{15}NO_2^- = \frac{\delta^{15}NO_x^- \times c(NO_x^-) - \delta^{15}NO_3^- \times c(NO_3^-)}{c(NO_2^-)}$$

We decided not to present the calculated values in detail in the manuscript, because due to low nitrite concentrations in the water column, the calculation is prone to errors, which we also elaborated in the manuscript (L370-372) and only discuss the general trend of the data.

L367: I would like to see the authors discuss a few more Indian Ocean studies. For e.g. how distinct is it to the Arabian Sea OMZ?

We appreciate the reviewer's suggestion to broaden the discussion by incorporating more studies from the Indian Ocean. While a comprehensive comparison is beyond the scope of our current manuscript, we agree that including additional references from the Arabian Sea OMZ will enhance the context and depth of our current discussion. Accordingly, we revised L401 to incorporate findings from Martin and Casciotti (2017), who, in line with Gaye et al. (2013), reported deviations of Δ(15, 18) indicative of coexistence of coupled anaerobic and aerobic nitrogen transformation processes. We also included a short paragraph highlighting the differences of nitrate isotopic enrichment in the Arabian Sea OMZ (Gaye et al., 2013; Martin and Casciotti, 2017; Naqvi et al., 1998) and Bay of Bengal OMZ in the beginning of section 4.2.3.

Lines	Change
L384-391	Changed “Generally, water column nitrate removal should be accompanied by an isotopic enrichment of nitrate (Gaye et al., 2013; Martin and Casciotti, 2017; Naqvi et al., 1998) Indeed, in the BoB, samples with persistent N_{def} and low oxygen concentrations were accompanied by a small, but notable enrichment of both $\delta^{15}N\text{-}NO_3^-$ and $\delta^{18}O\text{-}NO_3^-$ (Fig. 6b, c). This enrichment can be indicative of nitrate removal and clearly differs from nitrate dual isotope signatures in the oxic water column in the BoB and EEIO (Fig 3e, g). Within the OMZ, ...” to “Generally, water column nitrate removal should be accompanied by an isotopic enrichment of nitrate. In the adjacent OMZ of the Arbian Sea, such removal processes result in substantial enrichment of nitrate stable isotopes, with values reaching up to 30 ‰ for both $\delta^{15}N\text{-}NO_3^-$ and $\delta^{18}O\text{-}NO_3^-$ (Gaye et al., 2013; Martin and Casciotti, 2017; Naqvi et al., 1998). Although the isotopic enrichment observed in the BoB is less pronounced, we still detect a significant signal: samples characterized by persistent N_{def} and low oxygen concentrations were accompanied by a small, but notable enrichment of both $\delta^{15}N\text{-}NO_3^-$ and $\delta^{18}O\text{-}NO_3^-$ (Fig. 6b, c). This enrichment clearly differs from nitrate dual isotope signatures in the oxic water column in the BoB and EEIO (Fig 3e, g), providing strong evidence that nitrogen removal processes are indeed active in the BoB. Within the OMZ of the BoB, …”
L401	“(Gaye et al., 2013)” to “(Gaye et al., 2013; Martin and Casciotti, 2017)”

Technical corrections:

L98: onboard R/V Sonne

Lines	Change
L103	“on board” to “onboard”

L124: Dried filters were used “to”

Lines	Change
L129	Added “to”: “Dried filters were used to….”

L127-132: The authors use the past tense in some sentences and the present tense. I believe the past tense is more appropriate.

Lines	Change
L137	"is" to "was"
L138	"is" to "was"

References

Bristow, L. A., Dalsgaard, T., Tiano, L., Mills, D. B., Bertagnolli, A. D., Wright, J. J., Hallam, S. J., Ulloa, O., Canfield, D. E., Revsbech, N. P., and Thamdrup, B.: Ammonium and nitrite oxidation at nanomolar oxygen concentrations in oxygen minimum zone waters, Proc. Natl. Acad. Sci., 113, 10601–10606, https://doi.org/10.1073/pnas.1600359113, 2016.

Bristow, L. A., Callbeck, C. M., Larsen, M., Altabet, M. A., Dekaezemacker, J., Forth, M., Gauns, M., Glud, R. N., Kuypers, M. M. M., Lavik, G., Milucka, J., Naqvi, S. W. A., Pratihary, A., Revsbech, N. P., Thamdrup, B., Treusch, A. H., and Canfield, D. E.: N2 production rates limited by nitrite availability in the Bay of Bengal oxygen minimum zone, Nat. Geosci., 10, 24–29, https://doi.org/10.1038/ngeo2847, 2017.

DeVries, T., Deutsch, C., Primeau, F., Chang, B., and Devol, A.: Global rates of water-column denitrification derived from nitrogen gas measurements, Nat. Geosci., 5, 547–550, https://doi.org/10.1038/ngeo1515, 2012.

Fawcett, S. E., Ward, B. B., Lomas, M. W., and Sigman, D. M.: Vertical decoupling of nitrate assimilation and nitrification in the Sargasso Sea, Deep Sea Res. Part Oceanogr. Res. Pap., 103, 64–72, https://doi.org/10.1016/j.dsr.2015.05.004, 2015.

Gaye, B., Nagel, B., Dähnke, K., Rixen, T., and Emeis, K.-C.: Evidence of parallel denitrification and nitrite oxidation in the ODZ of the Arabian Sea from paired stable isotopes of nitrate and nitrite, Glob. Biogeochem. Cycles, 27, 1059–1071, https://doi.org/10.1002/2011GB004115, 2013.

Kalvelage, T., Jensen, M. M., Contreras, S., Revsbech, N. P., Lam, P., Günter, M., LaRoche, J., Lavik, G., and Kuypers, M. M. M.: Oxygen sensitivity of anammox and coupled N-cycle processes in oxygen minimum zones, PloS One, 6, e29299, https://doi.org/10.1371/journal.pone.0029299, 2011.

Martin, T. S. and Casciotti, K. L.: Paired N and O isotopic analysis of nitrate and nitrite in the Arabian Sea oxygen deficient zone, Deep Sea Res. Part Oceanogr. Res. Pap., 121, 121–131, https://doi.org/10.1016/j.dsr.2017.01.002, 2017.

McGillicuddy, D. J., Anderson, L. A., Bates, N. R., Bibby, T., Buesseler, K. O., Carlson, C. A., Davis, C. S., Ewart, C., Falkowski, P. G., Goldthwait, S. A., Hansell, D. A., Jenkins, W. J., Johnson, R., Kosnyrev, V. K., Ledwell, J. R., Li, Q. P., Siegel, D. A., and Steinberg, D. K.: Eddy/wind interactions stimulate extraordinary mid-ocean plankton blooms, Science, 316, 1021–1026, https://doi.org/10.1126/science.1136256, 2007.

Naqvi, S. W. A., Yoshinari, T., Brandes, J. A., Devol, A. H., Jayakumar, D. A., Narvekar, P. V., Altabet, M. A., and Codispoti, L. A.: Nitrogen isotopic studies in the suboxic Arabian Sea, Proc. Indian Acad. Sci. - Earth Planet. Sci., 107, 367–378, https://doi.org/10.1007/BF02841603, 1998.

Sarma, V. V. S. S., Rao, G. D., Viswanadham, R., Sherin, C. K., Salisbury, J., Omand, M. M., Mahadevan, A., Murty, V. S. N., Shroyer, E. L., Baumgartner, M., and Stafford, K. M.: Effects of Freshwater Stratification on Nutrients, Dissolved Oxygen, and Phytoplankton in the Bay of Bengal, Oceanography, 29, 222–231, 2016.

Ummenhofer, C. C. and Hood, R. R. (Eds.): The Indian Ocean and its Role in the Global Climate System, 1st ed., Elsevier, 2024.