

Interactive comment on “Nitrogen budgets following a Lagrangian strategy in the Western Tropical South Pacific Ocean: the prominent role of N₂ fixation (OUTPACE cruise)” by Mathieu Caffin et al.

Anonymous Referee #4

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Summary Statement

Caffin et al. constructed a nitrogen budget for three stations in the western tropical Pacific Ocean by quantifying N₂ fixation, NO₃ diffusion, atmospheric deposition, and PN export. Overall, the study seems to be well-conducted, arguments are supported by data, and the paper is well-cited. There are some relatively minor issues, mostly with the presentation, as described below. The manuscript requires a thorough editing to correct awkward word choices, punctuation errors, and confusing text. The main point I found that was missing from the paper was a definition of the system being studied.

C1

When the authors attempted to describe the system and site selection choices, the text was confusing and too vague, so this area of the paper could be improved. Some additional details are also missing from the methods and should be included. The conclusions section fell a bit flat and could be bolstered by putting the study findings into a better context relative to filling information and data gaps and describing the overall importance of the study results for our understanding of the global ocean. None of these issues represent serious barriers to publication, in my view, and only minor revisions are needed.

Specific Comments

Abstract — Overall, I found the Abstract was confusing. There is no clear direction, and the text jumps around from topic to topic without any clear context for the study or results. The concluding sentences do not place the study findings into any sort of importance relative to information and data gaps that we have for the WTSP (or other areas of the oligotrophic ocean). Why is the disequilibrium and apparent N accumulation important to describe?

P1, Lines 21-22 — Confusing sentence. Rewrite for clarity.

P1, Lines 24-25 — Is there more information on these locations, other than just DCM, that could be presented to give the reader a better idea of what these sampling locations are like?

Introduction

P3, Lines 1-8 — The authors need to define the “system” they are talking about. What are the boundaries of the “system”? Are sediments included? What does “. . .with an adequate time frame under contrasting diazotroph communities’ composition” mean? Does “the same water mass” mean that horizontal water movement is not present/considered? Are there processes occurring within (or beyond) the boundaries of this “system” that could confound the approach?

C2

P3, Lines 9-16 — The authors should provide more information on the trophic gradient and how 'oligotrophic' and 'ultra-oligotrophic' are defined. What are the physical factors causing the gradient?

P3, Lines 17-19 — The points of focus are great, but were there hypotheses to be tested? Why was it important to focus the study on these three points? What information/data gaps were being filled by conducting the study?

Methods

P3, Line 27 - P4, Line 14 — There are not enough details on the 3 criteria for site selection. What were the parameters of "local minima of surface current intensity" used to determine if conditions were suitable? How much surface current was considered acceptable? Were deeper currents considered? How was trophic status defined? In terms of chlorophyll or something else? If so, what were the thresholds used for oligotrophic, ultra-oligotrophic, etc.?

P5, Line 3 — Was the chlorophyll fluorescence sensor calibrated to simultaneous samples analyzed for chlorophyll using more conventional extraction techniques?

P5, Lines 4-7 — Were nutrient samples analyzed immediately, or filtered and stored for analysis later (if so, provide details on procedures used), or not filtered at all...? Why wasn't ammonium included in the nutrient measurements?

P5, Lines 9-17 — It is unclear where the "associated N uptake" part of this section is evaluated. More details are needed describing sample handling and analyses for the PP incubations.

P5, Lines 19-22 — More details are needed on the aerosols sampling, especially since the reference given for the method is only a submitted paper. Is there a reason why ammonia was not included in the atmospheric deposition measurements?

P5, Line 29 – P6, Line 3 — Very confusing sentence. Rewrite for clarity.

C3

P6, Lines 7-10 — How were dissolved gas samples transferred from the bottles to Exetainers? Kana et al. (1994) does not cover $^{15}\text{N}_2$ measurements/analyses using MIMS. Is there another citation for the $^{15}\text{N}_2$ analyses using MIMS?

P7, Lines 1-3 — perhaps add "and" before daily? Something is missing in this sentence.

P7, Lines 12-15 — Define "swimmers". PP was previously defined as primary production, so also using it for particulate phosphorus is confusing.

Results & Discussion

P9, Lines 24-27 — What was the integration depth used for these rates? It is odd to see areal rates reported for a depth-integration that apparently does not include sediments.

P9, Line 30 — Is there really a strong contrast between LD A and the other two stations given the very large variability around the mean at LD A (24.4 ± 24.4)?

P11, Line 11 — Perhaps the authors should use LD-A, LD-B, and LD-C to denote their stations, instead of LD A, LD B, and LD C. There have been a few cases like here (LDA) where the site abbreviations have not been consistent.

P12, Lines 3-23 — I found this narrative confusing. Perhaps the authors could streamline this text to focus it on the most important points?

P13, Line 13 — (and elsewhere) primary production or particulate phosphorus?

P13, Lines 15-16 — correct these scientific notations for gene copies

P13, Lines 20-21 — Why use the areal rates here instead of the volumetric rates?

P13, Line 32 – P14, Line 2 — Awkward sentence. Rewrite for clarity.

P14, Lines 7-14 — Confusing text. Rewrite for clarity.

P14, Line 22 — What is "PCD"?

C4

P16, Lines 12-26 — The conclusion section is a little flat. The authors could do a better job of placing their study into a better context in terms of the global N budget and C export in the oceans.

Table 1 — Are these Kz values supposed to be in scientific notation? Are the units for the nitracline correct?

Technical Corrections

P1, Line 24 — add “respectively” after “LD B”

P1, Line 28 — add a comma after “LD C”

P1, Line 31 — PC and PP not defined (or PN earlier)

P1, Line 34 — change “there” to “their”

P2, Line 5 — add comma after “ammonia”

P2, Line 7 — “before” is an awkward word choice

P2, Lines 7-11 — Long, run on sentence. Rewrite for clarity.

P2, Line 21 — add comma after “. . . et al., 2008”

P2, Line 24 — add comma after “large”

P2, Line 25 — add comma after “phytoplankton”

P2, Line 29 — add comma after “ocean”

P3, Line 9 — “harbouring” is an awkward word choice

P3, Lines 10-15 — Long, run on sentence. Rewrite for clarity.

P3, Line 17 — add comma after “study”

P4, Line 22 — “every day”

C5

P7, Line 13 — “weighed”

P9, Line 13 — add “from” after “ranged”

P10, Line 32 — “2.67 x 10⁴”

P11, Line 2 — change “from” to “for”

The paper requires a thorough editing for grammar, word choice, and punctuation.

Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2017-468>, 2017.

C6