

Interactive comment on “N₂ fixation in eddies of the eastern tropical South Pacific Ocean” by C. R. Löscher et al.

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We thank referee #2 for recommending our manuscript for publication in Biogeoscience. The comments and thoughts provided by referee greatly helped to improve this paper, we addressed the suggestions as described in the following, changes in the text are highlighted in the main text.

Material and Methods

RC 1: Page 18952, line 26 the authors state “The filtrations were stopped after one hour since high particle load in surface waters often lead to a clogging of the filters.” Please provide detail on how much volume has passed the filter by then (Table in Suppl). Likewise, how do the authors consider the error introduced by stopping the

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filtration abruptly e.g. considering the sedimentation of particles on the filter. Why did the authors not adjust the filtration volume accordingly, and why did they choose one hour? Did they filter the rest onto a second filter and measure both?

AC 1: The filtration volumes were already reported as a range in the methods part (p.18952, l. 23 in the Discussion paper). The filtration was performed in a stepwise manner. After rotating the bottles, 0.5 L was filtered. Afterwards, if filters were not clogged, bottles were again rotated and additional 0.2-0.5 L were filtered and so on. Therefore, an error from sedimentation cannot occur. One hour was not actively chosen but was the average filtration time before filters clogged. The rest of the incubation water was used for chlorophyll filtration and DNA/RNA filtration.

RC 2: Page 18950, line 11: How was the age of the eddy determined?

AC 2: The age has been estimated by Stramma et al. 2013 based on satellite monitoring of sea level height anomalies. This information, as well as the reference, was added to this sentence.

RC 3: Page 18951, line 2: Does P* also stimulate heterotrophic N₂ fixation?

AC 3: This could indeed happen; therefore the term ‘autotrophic’ has been removed.

RC 4: Page 18951, Line 8, also line 18: Do the authors mean N₂/Ar?

AC 4: Yes, this has been changed.

RC 5: Page 18952, Line 10-12: Please add the exact initial enrichments for each bottle, e.g. in a table or give a range.

AC 5: We included the range of 15N₂ enrichment as a range (2.4 ± 0.144 atom%, p. 18952, line 4 of the Discussion paper)

RC 6: Page 18952, Line 25: Replace “-“ by “âĶij”.

AC 6: The ‘-‘ refers to the negative pressure resulting from vacuum filtration and is thus

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correct.

Results and Discussion

RC 7: Figure 3- What sustained C-fixation in A1 below 200 m and was there any light available at that depth?

AC 7: Light was unavailable at this depth and enhanced C fixation may rather be due to so-called 'dark carbon fixation' as previously shown to be important in this region (Schunck et al., 2013), and e.g. the Cariaco basin (Taylor et al., 2001) or lake environments with enhanced N-loss and N₂ fixation activity (Camacho et al., 2001). A sentence stating that dark C fixation is likely the reason for enhanced C fixation at deeper depths has been added to the manuscript.

RC 8: Page 18957, Line 5: There are already quantifications so the authors are not the first who provide quantitative N₂ fixation rates. Please correct.

AC 8: To our knowledge, this is the first study presenting N₂ fixation measurements from that region using the method developed by Mohr et al., 2010. Other studies cited here, used the bubble addition method that underestimates rate measurements. The quantification was therefore biased and not fully quantitative.

RC 9: Page 18967: Fig. 1. SSHA is not an acronym for Aviso sea level anomaly- please correct.

AC 9: We agree and modified to 'Aviso satellite-derived altimeter sea surface height anomaly data (SSHA)'.

RC 10: Page 18969, Fig. 3: Please enlarge numbers and legends- it's hard to read.

AC 10: We modified the figure as suggested.

RC 11: Page 18972, Fig. 6. Please delete repetition of between "N₂ fixation and O₂ and N₂ fixation and O₂"

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AC 11: We modified the sentence to 'N₂ fixation and O₂ and N₂ fixation and temperature'.

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