

## ***Interactive comment on “Distribution and rates of nitrogen fixation in the western tropical South Pacific Ocean constrained by nitrogen isotope budgets” by Angela N. Knapp et al.***

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Response to Reviewers We thank the reviewers for their constructive feedback. Based on their suggestions, the following changes have been made:

We have included a figure illustrating the location of the field work (Fig. 1a), as well as included additional data to provide more context for the results. The additional data include a section plot showing the  $\text{NO}_3\text{-}+\text{NO}_2\text{-}$   $\delta^{15}\text{N}$  at additional stations across the transect (Fig. 1b), as well as the fluorescence trace on the figure of the  $\delta^{15}\text{N}$  budgets to indicate the range in depth and magnitude of productivity within the euphotic zone (Fig. 1c).

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Additional changes in response to specific comments are described below in italics.

Review #1: The manuscript by Angela Knapp and colleagues describes rates of nitrogen fixation via the analysis of nitrogen isotopes. This is a topic that Angela knows very well and has published multiple times on previous occasions. It is therefore not surprising that the manuscript is well-written with a good knowledge of the relevant literature. I recommend the manuscript for publication with just a few minor comments.

Specific comments 1. This work seems to suggest there is an offset of N isotope analysis from to in situ  $^{15}\text{N}$  incubations which might be resolved or understood with time, rather than just analytical differences leading to variable results. Is this the case or am I just optimistic?

The reviewer is correct that recent work shows an offset between  $\text{N}_2$  fixation rates estimated by  $^{15}\text{N}_2$  bottle uptake experiments and  $\delta^{15}\text{N}$  budgets. A discussion of potential causes for this offset can be found in Knapp et al., 2016, PNAS. Some factors specific to the OUTPACE study that potentially contributed to the lower  $\text{N}_2$  fixation rates estimated by  $\delta^{15}\text{N}$  budgets than those estimated by  $^{15}\text{N}_2$  bottle uptake experiments are addressed in the text briefly, and include potential decoupling during a large *Trichodesmium* spp. bloom at LD B, as well as the fate of that newly fixed N, which is further discussed in de Verniel et al., 2018, as well as Caffin et al., 2018, both this issue.

2. Some of the geochemical description on Page 5 Lines 13-28 and Page 6 Lines 1-12 could go into the Methods section which could use the extra length

The text has been modified as suggested, and this text is now section 2.4 in the Methods.

3. Some broader context for the sediment traps might be helpful - where was the 150 m depth horizon with regards to the 1% light level or the DCM or the nutricline?

We appreciate the Reviewer's interest in a more complete representation of the biogeo-

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chemistry of the sediment trap stations. We have included the fluorescence trace in Fig. 1c, which can be compared with the NO<sub>3</sub>-+NO<sub>2</sub>- concentration and  $\delta^{15}\text{N}$  profiles, and have included more information in Figure 1 as described above.

4. I realize OUTPACE has multiple publications, but a map showing station locations would be useful to quickly orientate the reader without having to look it up.

We appreciate the feedback and have now included a map of the station locations (Fig. 1a).

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