

Interactive comment on “Significance of N₂ fixation in dissolved fractions of organic nitrogen” by U. Konno et al.

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Thank you very much for your comments on our manuscript. We would like to revise the manuscript in accordance with your suggestions.

Responses to your comments are as follows:

1) The primary aim of this study is to estimate the total N₂ fixation rate as discussed in text, and we focused on the N₂ fixation rates in filtrate fractions. The GF/F filter (mesh size: ~0.7 μm) is traditionally used for the determination of N₂ fixation rates in the field because it has a low blank for the determination of nitrogen-isotope compositions. However, it is difficult to determine the δ¹⁵N value of filtrate fractions in natural samples using the conventional EA-IRMS techniques. Therefore, thus far, no study

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has determined the N₂ fixation rates in the filtrate fractions in the field on natural bulk samples. Moreover, there has been not clear definition of the boundary between ‘particulate fraction’ and ‘dissolved fraction’ (Hansell and Carlson, 2002). In our MS, we define the terms ‘retentate fraction’ and ‘filtrate fraction’ as ‘impassable fraction’ and ‘passable fraction’ respectively, as using a GF/F filter. Thus we added the instruction of that definition (page 767, line 10 in the original MS). In accordance with this definition, picoplanktonic-sized diazotrophs (0.2 μm to 2 μm) may fix N₂ in filtrate fractions. Therefore, intracellular organic nitrogen is not the only source of filtrate 15N. Further, if N₂ fixation occurs during 15N₂ tracer incubation experiments, 15N must move into either retentate or filtrate and the total N₂ fixation rate should be the sum of the N₂ fixation rates in the retentate and filtrate fractions. Thus, we could estimate the total N₂ fixation rate in the field using natural bulk samples for the first time.

2) Time zero experiments: We have definitely conducted the time-zero experiments for all the incubation experiments. We calculated the N₂ fixation rates by comparing the initial and final $\delta^{15}\text{N}$ values. According to your calculations, the enrichment values range from 0.21 to 0.63 ‰ obtained from the data in Table 2 in our original MS. However, we estimate the initial to final $\delta^{15}\text{N}$ enrichment values of the filtrate fractions to range from ~ 0 to 10.7 ‰ because the actual initial 15N-N₂ enrichment is approximately 20% (~ 560000 ‰). We have also presented the maximum N₂ fixation rates in filtrate fractions for the samples whose increase in $\delta^{15}\text{N}$ values is less than the detection limit (2‰ (Stns. 19, 20 and 21 as listed in Table 2)).

3) Responses to comments on figures are as follows: Figure 1: We have calculated the combined retentate + filtrate enrichment as the mass-weighted average of the 15N enrichment of the retentate and filtrate fractions through incubation experiments. Figure 2: Thank you very much for your revision. We got the calculation factors backwards. We have now corrected Figure 2 as your suggestion.

We trust that the revisions made in response to your comments are satisfactory. Please find the pdf files of our revised manuscript attached. Thank you for your

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consideration.

Please also note the supplement to this comment:

<http://www.biogeosciences-discuss.net/7/C911/2010/bgd-7-C911-2010-supplement.pdf>

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