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Biogeosciences Discussions

Interactive comment on "Distribution of inorganic and organic nutrients in the South Pacific Ocean – evidence for long-term accumulation of organic matter in nitrogen-depleted waters" *by* P. Raimbault et al.

Anonymous Referee #1

Received and published: 29 October 2007

General comments South Pacific gyre is one of the worlds most unexplored ocean regions. It is highly oligotrophic, yet phosphorus rich relative to nitrate. Its role in supporting nitrogen fixation is unknown, although previous studies have speculated that it may support significant diazotroph communities. The authors present an extremely valuable dataset on the distribution of inorganic and organic nutrients, as well as indicators of autotrophic and total community biomass. The important outcomes of this manuscript is the accumulation of carbon-rich DOM in the south Pacific subtropical gyre in comparison to the upwelling regions found to the east and west of the gyre.

The authors speculate about the mechanisms that are holding the DOC in the upper water column and estimate a downward flux of DOC, and its importance with respect to total community production. However, there are many negative factors in this paper and in its present form, I would strongly recommend significant revisions (see below) before the manuscript is published.

Specific comments The authors spend a great deal of time, on a number of occasions, discussing and interpreting their observations as if the patterns observed had never been seen before (e.g. the fact that the deep chlorophyll maximum is not a biomass maximum). The authors need to state these findings and move on to the more interesting and new observations made in their study.

Although it is a valuable data set, it is a snap shot of the distribution of nutrients and biomass in the south Pacific gyre. The authors do not speculate how these distributions may vary seasonally, for example, in response to light, atmospheric influences.

My greatest concern in this manuscript, unfortunately, was the poor English. I had to read the manuscript extremely slowly in order to understand the information the authors were trying to deliver. I started to suggest how the English could be improved (see below), but this proved tedious and time-consuming and so I stopped making editorial comments about one third of the way through the manuscript. This was unfortunate, as it hampered by ability to assess the scientific content of the manuscript and quite frankly, was a distraction. I strongly recommend that the authors seek help in improving the English in this manuscript.

Abstract: I do not think the abstract accurately reflects the content of the manuscript. The abstract does not contain results from the DOC flux calculations found in the discussion, or any speculation regarding the source of accumulated DOC. These are important findings in this manuscript that need to be included in the abstract.

Technical corrections Page 3043 Line 22: remove word Then Line 24: rates of reported – or reported what? Organic nutrient production?

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Page 3044 Line 2: remove is in the sentence South Pacific Gyre, remains is one of the.. Line 6: change to clearest oceanic waters of the world – water needs to be plural. Line 26: The sentence beginning Twenty-four short term stations were studied each day. Do you mean one station per day? As it is written, it reads as though there were 24 stations per day!

Page 3045 Line 11: Change have been chose according the depth to have been chosen according to the depth. Methods: I would recommend changing flasks to bottles, which is a more conventional term. Line 19: by directly pumping with the Technicon Autoanalyzer. Please consider revising this sentence to using the Technicon Autoanalyzer.

Page 3046: Line 1: Replace at laboratory to in the laboratory The extraction time for chlorophyll is very short (20-30min). Were the samples manipulated in any way to encourage chlorophyll out of the cells (e.g. sonication or maceration?). Was there any sort of recovery tests done? Line 13: replace can not with cannot Line 14: Add an s to term Page 3048 15N/13C Analysis: the standards used in the determination of d15N-PN are extremely 15N enriched and far from the sample values (47 per mil and 245 per mil). This is concerning if these standards were used in anyway to calibrate or re-scale the d15N-PN of natural samples. Please state in this section what the precision and accuracy of the glycine standard that you used, which should be closer to the d15N of your natural samples. Also, you spelt glycin wrong (= glycine). Line 14: Replace the reference gas is N2 to the reference gas was N2.

Page 3049 Line 5: change coasts to coast Line 8: change sentence shallower to reach surface along the chilean coast to shallower to reach the surface along the Chilean coast Line 8: Change Salinity pattern (Fig. 2) generally followed this of temperature with a decreasing from west (37.75) to east to Salinity patterns generally followed temperature, decreasing from west to east

Page 3050 Line 5: change ranged to ranging Line 7/8: Regarding sentence in the

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South Pacific but we observed a strong nitrate gradient with concentration de-creasing from 1 to 0.05 μmoles l−1. The authors had stated that they observe a strong gradient but a gradient is a change in a concentration over some distance. Can the authors please include the depth range over which they observe this strong gradient. Also, strong is a relative term. What would a weak gradient be? Line 8: Change Phosphate concentrations in surface to Phosphate concentrations in the surface Please be careful when referring to the nitricline versus the nutricline. The first refers to nitrate only, the second to all nutrients. The authors interchange these words often throughout this section, which is confusing to the reader.

Line 11: by a very poor-nutrient water. Should this be nutrient-poor? Line 11: Surface nitrate concentration was always change to were always Line 13/14: The 0.01 μmoles l isoline became to be shallowed eastward from 108 degrees W and raised the surface at 96 degrees W, This is a poorly constructed sentence. Please revise. Line 19: nitrate out cropped the surface. Outcropped is one word. Should read at the surface. Line 21: Do the authors really mean superficial, or surface? Line 27: Nitrite was generally no detectable. Change to not detectable.

From this point onwards, I will not attempt to correct poorly constructed sentences and poor use of English language in this manuscript, which is distracting. I will focus on the scientific content but I strongly recommend that the authors seek advice from an colleague whose first language is English before this manuscript is published.

Page 3054 Line 29: Units need to be added to 6.5 (per mil). Page 3056 Line 7: re: DON concentrations were rather uniformly distributed in the photic layer and any subsurface maximum was observed. What does any mean? Was a subsurface DON maximum observed? Please change. Line 15: re: Isolines 0.1….. Please clarify what this refers to?

Pages 3056-3057. Regarding the discussion over which depth to integrate, Ze or 1.5Ze. I do not find this discussion useful whatsoever. The authors should decide

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on a depth (e.g. 150m) or horizon (e.g. MLD) to integrate to, defend their choice and make the necessary integrated comparisons over the region sampled. Giving a range of integrations is pointless in this paper and once again, distracts the reader from the scientific content.

Page 3061 Line 12: re: But pooling all the data, any correlation was found between magnitude of DCM and nutrient concentration. Again, what does any mean? Is there a correlation? Is there a table or figure to be referred to here?

It is well known that the deep chlorophyll maximum is not a biomass maximum but is associated with the expression of chlorophyll at low light. The authors spend a few sentences discussing this point as a new discover rather than referring to previous studies that have highlighted this finding. Such discussion increase the length of this manuscript unnecessarily.

Page 3062: Line 15-17: It is well known that DOM is created and accumulates in the surface ocean and decreases with depth. The authors state that this was a surprising result. I am not sure why it is surprising. Perhaps the structure of this sentence needs to be changed to better highlight the surprising result.

Line 20: re: The organic forms of nitrogen and phosphorus appeared much less diluted than the inorganic forms in the photic layer of the SPG. What do the authors mean by much less diluted. Again, it is well known that concentrations of dissolved organic nutrients are orders of magnitude higher than inorganic nutrients in oligotrophic regions. Again, not a surprising result.

Page 3064: Line 24: What is production sequestration? Do the authors mean loss of carbon fixed by primary producers? Please clarify.

Line 28: re: As horizontal advection can be neglected in the centre of the SPG…. This is not true. Ekman transport transfers dissolved organic matter horizontally (see papers by Abell et al., and Mahaffey et al).

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Page 3065: Line 18: What are the errors associated this estimate? Please calculate and add to the manuscript.

Figures and Tables: Figure 7. This figure is confusing. I would suggest having two panels (e.g. a and b) showing (a) gyre and (b) upwelling data separately. Also, some values are rather 15N-enriched, even in the gyre. There is not mention of the influence of trophic levels on the 15N content of PN and their potential enrichment. Were the samples pre-screened?

Interactive comment on Biogeosciences Discuss., 4, 3041, 2007.