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Biogeosciences Discussions

Interactive comment on "Regional and temporal variability of sinking organic matter in the subtropical northeast Atlantic Ocean: a biomarker diagnosis" *by* I. J. Alonso-González et al.

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Reviewer #2: âĂĺ

General comments:

Vertical flux of organic matter such as POC, PON, pigments and amino acids were determined in the Canary Current region. The authors discussed the source and freshness of sinking particle from the variation of organic composition. The discussion using the pigment composition of settling particles includes novel interpretation. Although this paper has a merit to publication, it needs some modifications and amendments as described below.

Comment: We appreciate the reviewer's comment about our work

âĂĺScientific comments:

The discussion largely depended on the regional and temporal difference in the composition and abundance of microorganisms, including phytoplankton and zooplankton population and abundance of bacteria, though a little observation has been carried out. Since this affects the reliability of discussion, more information concerning with microbial population in key stations should be necessary. Although physical condition of each station has been shown, chemical condition such as nutrient concentrations are not available. The nutrient concentration deeply concern with the composition of organic matter produced by phytoplankton as well as primary production rate. The presentation of nutrient concentration is useful to compare the biogeochemical processes in eddy and open ocean stations. The contribution of amino acid-carbon (AA-C) to POC is useful parameter to assess the freshness of sinking particulate matter as well as C/N ratio. I recommend calculating AA-C/POC, because the detail amino acid composition is available. Further, the calculation of AA-C/POC and AA-N/PON and the comparison with the values have reported are seems necessary to assess the reliability of these values.

Comment: We appreciate the comment about calculating the contribution of amino acids to the total POC flux (AA-C/POC). It also allowed us to detect a mistake in Table 4, where the amino acids fluxes within AE1 and FF2 were mixed. Unfortunately, we have neither nutrient data nor phytoplankton community structure data to include in the paper.

Action: We have calculated de AA-C/POC values and inserted them into Tables 5 and 6. We have also included prokaryote abundance information in a new table (Table 7).

Detailed comments: Introduction includes short review of the studies on the biogeochemistry in eddies and the clear statement of the object of the present study. Thus, this section is generally good.

Comment: We appreciate this comment.

p.11093, lines13-14: the length of the trap cylinder should be shown, because it is well known that the ratio of diameter/length concern with the correction efficiency of sinking particles.

Action: We have included the length (50 cm) of the trap cylinder (line 143).

p.11094, lines 2-6: the effect of DOC adsorption to determination of POC concentration, such as the contribution of DOC adsorption to POC measured as well as absolute value (0.3-1.6 umolC), is useful to readers asses the possible overestimation quantitatively.

Comment: DOC adsorption represented less than 3.5% of the POC signal (lines 162-167).

p.11096, lines 3-5: although the precision of determination of dissolved oxygen concentration has been stated, the precision in the GPP calculated at each depth is also important.

Comment: The calculated maximum standard error observed was (SE < 0.2).

p.11097, lines 5-7: it is better to sate clearly that the comparison of isotherm depth is the seasonal difference.

Comment: What we want to state here is that eddies affected both the seasonal and main thermoclines. In summer, the period when eddies were sampled, the main thermocline is found at 50-60m (Ratsimandresey et al. 2001), so the 18°C isotherm corresponds to the main thermocline.

p.11098, lines 4-5: mmol N m-2 d-1 instead of mmol C m-2 d-1.

Action: corrected

p.11099, lines14-15: the relation of the concentration of pheophorbide-a and grazing

activity of zooplankton is unclear. It should be stated clear with the reference.

Action: Agreed. We have clarified this sentence and the references stated (lines 291-293).

p.11100-11101: the authors compared the mole% of individual amino acids among stations, but the differences are not distinct. The statistical analysis is necessary to conclude the difference in AA composition.

Comment: The usual variability (dispersion, noise, etc..) of the marine systems and the short data set (n=2 for Far-field stations and n=3 for eddy stations) may hide the signal and a simple test as the t-test, z-test, etc.,. can not detect this difference. However, the principal components analysis (PCA) is a more “powerful” multivariate regression analysis that reduces a large number of variables to a few principal components. PCA is commonly used in the analysis of complex organic datasets where the signal is there but the inherent variability of the sample prevents that simple tests find significant differences (Dauwe and Middelburg, 1998; Goñi et al. 2000; Ingalls et al. 2006; Goutx et al. 2007).

p.11102, lines 17-19: the paper(s) showing the relation of the abundance of phaeophorbide-a and pyropheophorbide-a, and the grazing activity of mesozooplankton, should be sited here.

Action: We have added the corresponding references (line 396).

p.11103, lines 3-5: the comparison of AA-C/POC may direct information on the contribution of AA to POC.

Action: We have included this information (lines 402-406).

p.11103, lines 18-23: the study(ies) showing the relation of AA composition and the phytoplankton group or degradation state, should be sited.

Action: We have followed this suggestion. We have included a diagnostic table of

pigments and amino acids to clarify the biomarker interpretations. We have stated the reference to the Table 3 (lines 421).

p.11103, lines 26-28: the authors discussed that the effect of grazing by mesozooplankton is minimum both FF and eddy-field stations (p.11102, lines 27-29). The description here is inconsistent.

Comment: The reviewer is right. What we want to say is that "our amino acid and chloropigment compositional data indicate low impact of grazing by micro and mesozooplankton within eddy-field stations".

Action: We have modified the text (lines 426-427).

p.11104, lines 14-15: the composition of phytoplankton is key information to the discussion of this paper. More detail data is necessary instead of the short statement as "CE1 was relatively enriched in diatoms"

Comment: The phytoplankton community structure data will be published in a separate paper by another group of scientists. Thus we don't have the possibility of including the information here, except by referring as we have done as "pers.com"

p.11105-11106: it is difficult to explanation that total AA flux in CE1 was higher than that in AE1 by 3 times, though the PON fluxes were comparable. Considering that the pigment flux was higher in AE1 than CE1, I would doubt the reliability of AA data in CE1or AE1. Are the AA-C/POC or AA-N/PON values of the trap samples consistent with the previous studies?

Comment: The reviewer is right. Due to the detected mistake in Table 4, the total AA flux within CE1 is 2 times higher than that at AE1 station. We give a possible explanation to this in the text (lines 477-489). Since amino acids are compounds highly labile and AE1 presented a prokaryotic abundance (new Table 7) is reasonable to expect a high AA removal rate in this station (as observed in the low AA-C/POC, Table 4) and also a higher C/N ratio.

Action: We have modified the text (lines 469-481).

p.11106, lines19-20: is the enrichment of aspartic and glutamic acids in anticyclonic eddies statically significant?

Comment: As stated above, the usual variability (dispersion, noise, etc..) of the marine systems may hide the signal and a simple test as the t-test can not detect this difference. In summary, the signal is there (as observed in the PCA) but the inherent variability of the sample prevents that a simple test identifies significant differences.

p.11106, line 20-22: the reference(s) is(are) necessary concerning the enrichment of aspartic and glutamic acids in coccolithophorids.

Comment: We agree with the reviewer. We have included the references in text (lines 511-512).

p.11108, lines 9-29: these discussions largely depend on the "expected" structure of microbial community. Are there any "observational" results?

Action: We have incorporated the prokaryotic abundance (cells/ml) of the RODA I and II samples (Table 7). These new results reinforce the outputs from the PCA (lines 563-567).

Interactive comment on Biogeosciences Discuss., 6, 11089, 2009.