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Interactive comment on "Biogeochemical characteristics of suspended particulates at deep chlorophyll maximum layers in the East China Sea" *by* Qianqian Liu et al.

Anonymous Referee #2

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General overview

The manuscript of Liu et al. is focussed on characteristics of suspended particulate organic matter (SPOM) in the deep chlorophyll maximum (DCM) of the Eastern China Sea (ECS) during summer 2013. It is based on bulk descriptors of SPOM (C/N and POC/Chl a ratios as well as δ13C and δ15N). The mains findings are: 1) DCM SPOM mainly originates from in situ primary production, 2) terrestrial POM slightly or insignificantly contributes to DCM SPOM composition, and 3) the latter is contradictory to previous studies but illustrates the drastic decrease in the contribution of the terrestrial POM originating from the Yangtze River to the SPOM composition in the ECS. These

findings are sounded and clearly illustrated by the present data set.

The manuscript is well organized and usually well illustrated.

It is of broad audience for scientist who are interested in organic matter cycling and land-to-sea export. It is within the scope of BG.

However there are some issues in the present version of the manuscript that preclude the acceptance of the manuscript in its present version. These issues are:

- a lack of information in the methods

- many unneeded details and miscellaneous information that are not needed in the discussion, that rend the discussion too wordy and that dilute the main messages of the study. Authors should focus on what the data indicate, which is usually very clear.

- interpretations of δ15N data set that are not correct or at least very partial. This data set cannot be published within this manuscript without deeply reconsidering its interpretation and without additional data set regarding N-nutrient (at least nitrate and ammonium) concentrations.

There are also some inconsistencies and language errors that have to be corrected.

Thus, I recommend major revision.

Detailed comments

Section 3: lack of information and details needed

Conversion of fluorescence into chlorophyll a concentration: Since Chl a is a key parameter of the study and is used to calculate POC/Chl a ratio (which values are compared to reference values), it should be explained how in situ fluorescence was converted into Chl a concentration.

Section 3.1, line 9: indicate the range of depths of the samplings for SPM.

Section 3.1: indicate how the filters were rinsed right after the filtration

Section 3.2, line 28: detail how the filters were treated with HCl 1N

Section 3.2, line 30: indicate the diameter of the punches

Section 3.2, lines 30-31: it looks like δ15N and PN were analyzed on the decarbonated part of the filter. Why not on the un-decarbonated part of the filter? There is always chance to bias δ15N and PN using decarbonated material for these measurements (e.g. Lorrain et al (2003) and other references). Also, it looks like there was a very small part of the filters that were analysed for C and N elemental and isotopic composition. What quantities of C and N were analysed?

Influence of CDW at DCM depth in the ECS

It cannot be stated that the influence of CDW in the study site is nil or insignificant. The low salinity measured at some of the sites (Fig. 3) clearly indicates the influence of CDW. It is mainly the case in surface water but also the case at some of the DCM depths where water was sampled for SPM (stations DH1-1, DH2-1, DH2-2, DH3-1, CON02). This is also clear from Fig. 6b where five stations falls within the SMW square, SMW being clearly a water body composed of a mixing between KSSW and CDW.

It should better be written that the influence of CDW in the study site is low (see some of the 'minor points' below) or weak (as written in section 5.1, P8, line 34).

End of section 5.1 (P9, lines 1-9) and Fig. 7

Only the DCM depths (= the depths of interest for the present study) should be considered for delineate the polygons of Fig. 7. Was it the case? For similar reason, I think that the sentence "Interestingly...study area (Fig. 7)" should be deleted or reworded without citing Fig. 7 (but rather Fig. 3?) since it is quite confusing. Another option may be to not cite depth limitation of the water masses influences but only describe Fig. 7.

The last paragraph of section 5.1 is also quite confusing. Reword it as: "In summary, although the river runoff was huge, the influence of CDW plume in the southern part

of the ECS was insignificant during summer 2013, mainly because most of the CDW plume was transported to northeastward of the Yangtze estuary to the Korean coast (Isobe et al., 2004; Bai et al., 2014; Gao et al., 2014). This contrasts with summer 2003 when the plume front moved southward (Bai et al., 2014). Meanwhile, the intrusion of TWCW and KSSW was strong in the continental shelf of the East China Sea during summer 2013."

Section 5.2.1

I fully agree the main conclusions of this section and most of data interpretations (especially the first and last paragraphs).

However the second paragraph adds detailed discussion with literature comparison that is not needed (especially when dealing with zooplankton and Trichodesmium) for the present study. Authors should better goes directly to the conclusion (i.e. the last paragraph) without diluting the main conclusions with unneeded wording. Thus, the second paragraph should be deleted.

Section 5.2.2

As for the previous section, I fully agree the main conclusions and most of the data interpretation, but this section is too wordy and gives too many details (especially too many values from the literature). Authors should better focus on the main information and the main conclusions.

Thus, I suggest the following:

- P10, lines 26-34: one-two sentence(s) should be enough

- P11, lines 2-4: keep this sentence but rephrase the last line as "filtered particles (Chang et al., 2003; Hung et al., 2013)"

- P11, lines 8-10: do not report all these values

Regarding the high POC/Chl a ratio, did authors check if these high values were rather

due to very low Chla concentration or high POC concentration? If the former, these high values may be associated to high uncertainty on the Chl a estimation when values are low. If the latter (high POC concentration associated to Chl a concentration similar to surrounding stations), this may be effectively due to heterotrophic biomass.

Section 5.3: first three paragraphs

I fully agree the main conclusions and the data interpretations of the first three paragraph of this section.

I suggest authors to have a look at Lowe et al. (2014) and Miller et al (2013): these articles are of interest for the present section.

Page 12, Lines 18-26: two other processes may influence phytoplankton δ13C: temperature and degradation. This is discussed in Savoye et al. (2003) that authors cite in many occurences. Authors may have a look at biplots like δ13C vs temperature and versus POC/Chl a and C/N (considering these ratios may also indicate phytoplankton decay). They also may check the normalization of δ13C by temperature (as in Savoye et al., 2003) before plotting normalized δ13C versus POC, since temperature usually have (indirect) influence on phytoplankton δ13C.

Section 5.3: last three paragraphs

I do not think that the last three paragraph of the section are needed. The objective of the two paragraphs before the last (from "The nutrient N/P ratio" to "this mechanism is most likely") is to decipher whether POM sampled in the DCM came from in situ production or from surface production (cf. the fourth paragraph of the section). In fact, these two paragraphs lay on very putative argumentation and do not allow (and are not convincing in) deciphering between the two hypotheses. These hypotheses have already been discussed in sections 5.2.1 and 5.2.2 with sufficient argumentation for considering that POM mainly came from in situ production. To my point of view, these two paragraphs of section 5.3 are not needed in this section neither in the manuscript.

The last paragraph of the section is a tentative of inventory of POC in the DCM layer. The estimation is very rough, is associated to large uncertainty, and the calculation is not convincing. It is also completely disconnected from the rest of the section, which is focused on δ13C dynamics (see the title of the section). Again, this paragraph is not needed in this section neither in the manuscript. Thus, the last three paragraphs of the section should simply be deleted and the fourth paragraph of the section ("The range... DCM layers?") should be replaced with a brief conclusion of the first three paragraphs of the section.

Section 5.3 would better stand with the first three paragraphs and a conclusion without the unclear and unconvincing last three paragraphs.

Section 5.4

This section is the less clear and the less convincing of the manuscript. The main conclusion (POM δ15N distribution is primarily governed by the nutrient status and δ15N of nitrate) is mainly guess. One of the main issues of the section is the lack of nutrient data. This rend the data interpretation mainly guess-work. Another issue is that authors mainly take into account nitrate as a nutrient for phytoplankton. Ammonium appears only in the last paragraph. The other species of N-nutrient (N2, dissolved organic nitrogen as urea) are not mentioned. However, it is reported that "Kuroshio Water and TWCW induced Trichodesmium" (P10, line 7). Thus, PN δ15N values should also be discussed considering N2-fixers (diazotrophs). At last, many sentences are not clear. This gives the impression that authors do not fully have in mind what processes drives PN and phytoplankton δ15N.

Thus, this section should be deeply reworked including deep data re-interpretation. To me, such section dedicated to PN/phytoplankton δ15N cannot stand without data of nutrient concentration originating from the same cruise. If these data are not available, PN/phytoplankton δ15N cannot be discussed. If it would be the case, δ15N data should be removed from the manuscript.

Section 5.5

This section gives an important conclusion: the influence of terrestrial POM (mainly originating from the Yangtze River) has drastically decreased in the ECS. This section is mainly based on literature data and conclusions. These inputs from the literature are of interest, but the section should also compare data from the present study with previous data. Thus, this section should start with the comparison of POC/Chl a and C/N ratios, and δ13C values between the present study and previous studies. Then, the decrease of terrestrial POC fluxes and deposition can be cited (literature data). Last lines of the section: there are again unneeded details in these lines. Avoid describing the degradation index but directly give the conclusions of Wu et al (2007b).

English language

The language is usually quite understandable, but there are many errors or mistakes. Part of them is listed in the 'minor points' below. Nevertheless, the whole manuscript should be deeply checked for English language.

Inconsistencies

There are some inconsistencies between values that are cited in the text and values reported in the tables (see 'minor points' below). Please, check the consistency between all the values reported in the text and tables.

Abstract, Introduction and Summary and conclusions

Sections 'Abstract' and 'Summary and conclusions' should partly be re-written taking into account the above detailed comments.

The third objective that appear in section Introduction should be removed (see one of my comments dedicated to section 5.3 âĂŤ three last paragraphs âĂŤ above).

Minor points

- P1, Line 20: what do you mean with 'straddling'?

- P2, line 9 and in the whole manuscript: replace 'endmember' with 'end-member'

- P3, line 8: remove 'which in turn, the elemental and isotopic compositions of marine productivity' since it is not correct

- P5, line 1: depending what you want to say, add 'by' or 'to' between 'decreased' and '86%'

- P5, line 17: replace 'had' with 'have'

- Last sentence of section 3.1: place this sentence in section 3.2 since it is not sample collection. Rename section 3.2 as 'Determination of SPM concentration and analysis of POC, PN, δ13C and δ15N

- P5, line 30: replace 'with' with 'and placed in'

- Section 3.2, P5-6, sentence "organic carbon and nitrogen ... entering the IRMS": remove the sentence since such level of detail is not needed

- Section 3.2: remove the three last sentences ("Conventional...Sigman et al., 2009" since the first one is unneeded detail and the two last ones do not stand in a section dedicated to methods.

- P6, line 22: add 'usually' between 'profiles of Chl a' and 'show'.

- Section 4.1.3: since Fig. 3 illustrates at maximum the first 300m of the water column and since the sampling depth was within this depth interval, please do not describe deeper water, either the reading is quite disturbing. Thus, the temperature ranged between 30 and ca. 15°C.

- P7, line 16: replace 'increasing' with 'increases'; reword "with the high temperature (>30°C) spreads widely".

- P7, line 29: replace 'insignificant' with 'low'.

- P8, line 4: '4.4' or '4.5' as reported in table 1?

- P8, line 5: ‘17.7’ or ‘17.8’?

- P8, lines 7-8: please also indicate where the highest POC and PN concentration were located.

- P8, line 17: ‘8.0’ or ‘7.8’ as reported in Table 1?

- P8, lines 17-18: please also indicate where the highest δ13C values were located.

- P8, line 21: Fig. 10 is cited before Fig. 5. Check the numbering of the figures.

- P8, line 33: SMW is a water body that is composed of a mixture between two other water masses (CDW and KSSW; Fig. 6). So, do not consider SMW as a water mass and remove it from this list.

- P10, line 25: remove the word ‘moderate’ since this information is not useful here.

- P10, line 29: ‘48’ or ‘52’ as reported in Table 2?

- P11, line 28: replace ‘less’ with ‘low’; delete “and unrecognized content of terrestrial POM”.

- P12, 2: replace ‘to be’ with ‘would be’.

- P12, line 8: replace ‘more positive’ with ‘less negative’.

- P12, line 34: delete ‘As for species,’.

- P13, line 7: delete ‘that’.

- P13, line 8, 9 and 10: replace ‘larger’ with ‘higher’

- P13, lines 9 and 10: replace ‘size species’ with ‘phytoplankton’

- P15, line 33: replace ‘significantly less’ with ‘low’.

- P16, line 12: replace ‘proved’ with ‘illustrate’.

- Table 1: add POC/Chl a values in this table; indicate in the caption what means ‘SD’.

- Figure 1: indicate KSSW on the figure; be consistent with Fig. 6. Indicate on this figure the location of the stations that appear on Fig. 2 and 3 but were not sampled for SPM in the DCM.

- Figure 6: the two colours are not distinguishable. Choose other colours. Remove ‘from’ in the second line of the caption. Add ‘were’ after ‘matters’ in the third line of the caption.

- Figure 7: replace ‘black’ with ‘grey’ in the second line of the caption.

- Figure 8, first line of the caption: it is POC vs. PN and POC vs. Chl a.

Additional references

Lorrain A., N. Savoye, L. Chauvaud, Y-M. Paulet and N. Naulet, 2003. Decarbonation and preservation method for the analysis of organic C and N contents and stable isotope ratios of low-carbonated suspended particulate materiel. Analytica Chimica Acta, 491, 125-133.

Lowe, A. T., A. W. E. Galloway, J. S. Yeung, M. N. Dethier, and D. O. Duggins. 2014. Broad sampling and diverse biomarkers allow characterization of nearshore particulate organic matter. Oikos. 123: 1341–1354, doi:10.1111/oik.01392

Miller, R. J., H. M. Page, and M. A. Brzezinski. 2013. δ13C and δ15N of particulate organic matter in the Santa Barbara Channel: drivers and implications for trophic inference. Mar. Ecol. Prog. Ser. 474:53-66, doi:10.3354/meps10098

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