Response to Referee #3

General comments

1-The authors present interesting data on POC distribution, primary production and POC fluxes on one of the largest marginal seas in the world as the East China Sea. These kind of studies where PP and POC fluxes are coupled together provide a useful tool for a better understanding of C cycling in marginal seas. The effort of discriminate the resuspension contribution to the flux by mean of a simple two end member mixing model gives an idea of the relevance of this process to the measured fluxes however it
needs a further revision especially in the proper choose of the end members. The data presented refer only to the summer season and this is a limitation to the generalization of the results on POC fluxes and dynamics in this marginal sea.
Answer: We have revised our manuscript according to reviewer's comments.

2-The application of a simple two end member mixing model is highly dependent on the values assigned to the end members. The authors use as end member for resuspension
an average of OC concentration obtained from their work (but there is no mention to the sampling and analyses of bottom sediments in the methods) and from previous studies carried out in the same stations many years before without specifying the season.
Especially in shallow areas the dynamics of sediment settling and resuspension can be highly dependent on the seasonal and interannual changes (meteo-marine conditions,
phytoplankton blooms, zooplankton successions, etc.). This points should be better discussed.
Answer: The sampling of surface sediments and method of OC data in the sediments have been added in the revised manuscript. We also used OC contents in the sediments of the ECS to estimate the end members.

3-As there is a high variability in the concentration of organic carbon in bottom sediments
why the authors do not use the concentration for the same seasonal period (i.e. summer) for which they have all the other data? The use of data averaged on different years and seasonal periods could be misleading in choosing the proper end member.

Answer: We have used OC data in this study rather than the use of data averaged on different years and seasonal periods.

4-In the discussion it is not clearly addressed the role which could have bacterial degradation
of OM during the settling of OM in the different sub-areas of the East China Sea. Moreover why different deployment time of the drifting traps were chosen spanning from 3 to 8 hours? Could a significant bacterial degradation of settled organic matter occur in this time span as no preservatives were used inside the sediment traps?
Answer: Due to heavy fishing boat activities, we had to recover our sediment trap array in the study area. Smith et al. (1992) reported that particulate amino acids on sinking organic aggregates hydrolyzed by the attached bacteria had turnover times ranging from 0.2 to 1.6 days for a larvacean house, and 2.1 days for a diatom floc. In other words, the degradation rate of particulate amino acids on sinking organic aggregates can be expected to range from 3% to 21% per hour for larvacean houses and 2% per hour for diatom flocs. Hung et al. (2004) reported that the maximum bulk organic carbon leaching out into the dissolved fraction ranged from 0.8% to 1.3% per hour during a 1-day sediment trap deployment. Hung et al. (2010a) got even higher estimates averaging 50% in 2 days, or 2% per hour. So, our short-term deployment should be OK.

5-I think that in order to discriminate the contribution of resuspension versus marine produced matter the use of stable C isotopes and of major metals constituting the minerals of the fine fraction of seabottom sediments should be used to better check the validity of the estimates based on TSM and OC.
Answer: In order to validate the vertical mixing model, we also used other possible evidence, such as rare earth elements, e.g., Eu, to examine possible contributions of resuspended sediments on the POC flux (see below).

Rare earth element

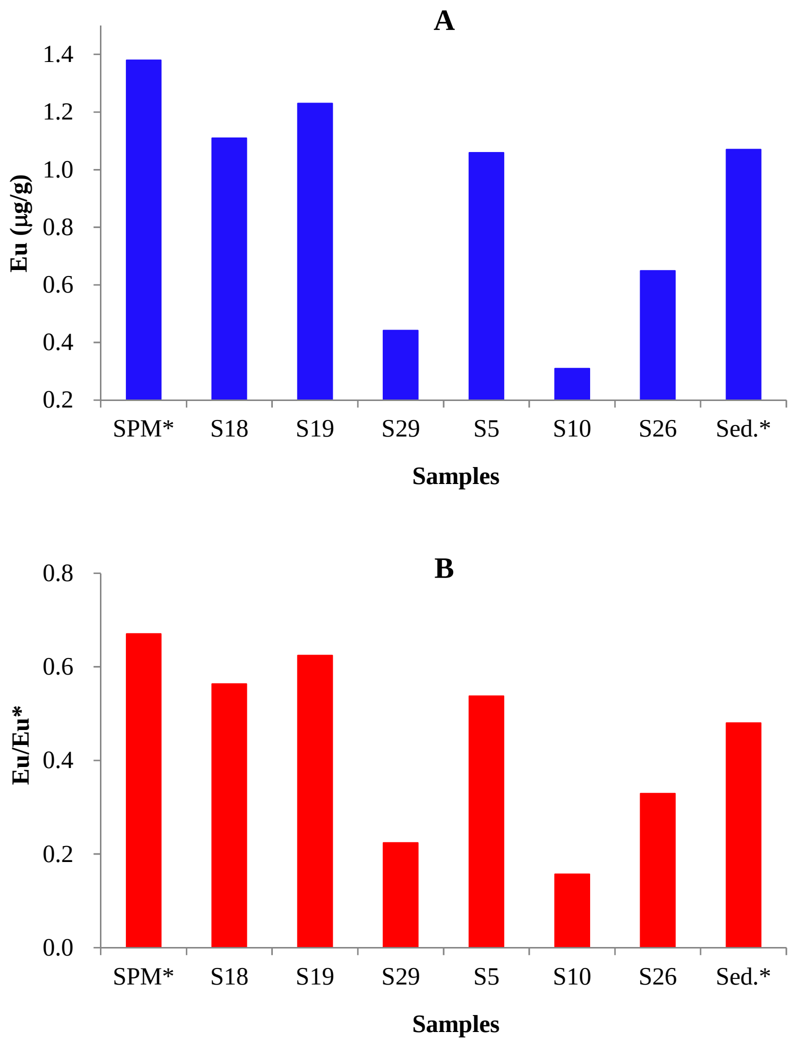
Some rare earth elements (REEs) such as light rate earth elements (LREES) have been used as proxies to evaluate sediment sources in numerous settings (Goldstein and Jacobsen, 1988; Sholkovitz et al., 1999; Li et al., 2013). Most LREES (see table below) in this study have difficulties with distinguishing suspended particles from sediments based on their levels, but Eu concentrations in particles seems to be a good tracer due to a remarkable difference between suspended particles and sediments. Therefore, we used the Eu anomaly (Eu/Eu*) (Eu*: was estimated by linear interpolation between Sm and Tb on the chondrite-normalized curve) to identify possible end-members (suspended particles and sediments) that contribute to sinking particles in this study. For example, the (Eu /Eu*) anomaly of the sediment and suspended off the Yangtze River (Changjiang) mouth (near station 19) were 0.48 and 0.67, respectively. The value of Eu/Eu* in the sinking particles at station 19 were 0.62. If a two end-member mixing model is used to estimate the contribution of suspended and sediment on sinking particles, the fractions of suspended particles and sediment will account for 74 % and 26% of sinking particles, respectively. The result suggests that R/T (0.26) is significantly lower than the estimated value (R/T =0.93) by using a TSM-OC mixing model. This approach may not truly reflect the resuspension value in this study because the Eu anomaly value should be from this study rather than from an estimated value determined 10 year ago (Yang et al., 2003). In addition, we should provide Eu values in both suspended particles and sediments, while the rare earth elements in this study were not available due to us using GF/F. Nonetheless, the fractions of REE are a good potential approach to evaluate possible contribution of suspended and resuspended particles in marginal seas with large river emptied.

Table 1 Concentrations of light rare earth elements in the sinking particles, sediment and suspended matter (SPM) in the East China Sea.

Station	La	Ce	Pr	Nd	Sm	Eu	Gd
	(μg g^{-1})	(μg g^{-1})	(μg g^{-1})	(μg g^{-1})	(μg g^{-1})	(μg g^{-1})	(μg g^{-1})
S18	40.87	72.44	6.77	35.18	5.37	1.11	5.61
S19	44.29	78.94	7.86	40.40	6.25	1.23	6.18
S28	4.17	4.86	0.24	0.46	ND	ND	ND
S29	17.92	31.27	2.85	14.44	1.63	0.44	1.47
S5	42.80	78.76	7.15	37.01	5.09	1.06	5.21
S10	11.04	21.99	1.84	9.84	1.20	0.31	0.98
S26	23.88	43.20	4.19	21.64	3.27	0.65	3.22
Sediment*	43.00	86.00	ND	44.00	6.00	0.89	ND
SPM*	44.00	85.00	ND	40.00	6.00	1.31	ND

*: the data of sediment and SPM were from the river mouth (near station 19) of the Yangtze River in Yang et al. (2002).

ND: no data.



6-Though a part of the East China Sea is under the influence of the river Changjiang overall in the paper it seems that the direct deposition of riverine POC is not properly considered as only resuspension and marine autochthonous organic carbon are discussed.

However the authors state (P. 4282, L.3-5) on the basis of previous results that up 50% of the OC can be of riverine origin. This aspect affect also the consideration of the authors for the high export ratio in the CDW (Changjiang Diluted Water) area. The authors explain that this could be due to a PP limitation by light intensity due to high turbidity or by nutrient limitation or by strong vertical mixing. It is very improbable that in turbid waters under riverine influence there is a nutrient limitation. Moreover the strong vertical mixing should be occurred during or just before the cruise and this should be demonstrated by thermohaline profiles and /or meteorological conditions (e.g. wind direction and intensity) during the sediment traps deployment and in previous days.

Answer: Distributions of salinity, Sigma-T (kg/m3) and NO3 in the inner shelf (Station 19, 19A and 29) were shown in Figure 6 suggesting that low PP in the inner shelf with riverine influence could be caused by high turbidity and water stratification rather than nutrient limitation.

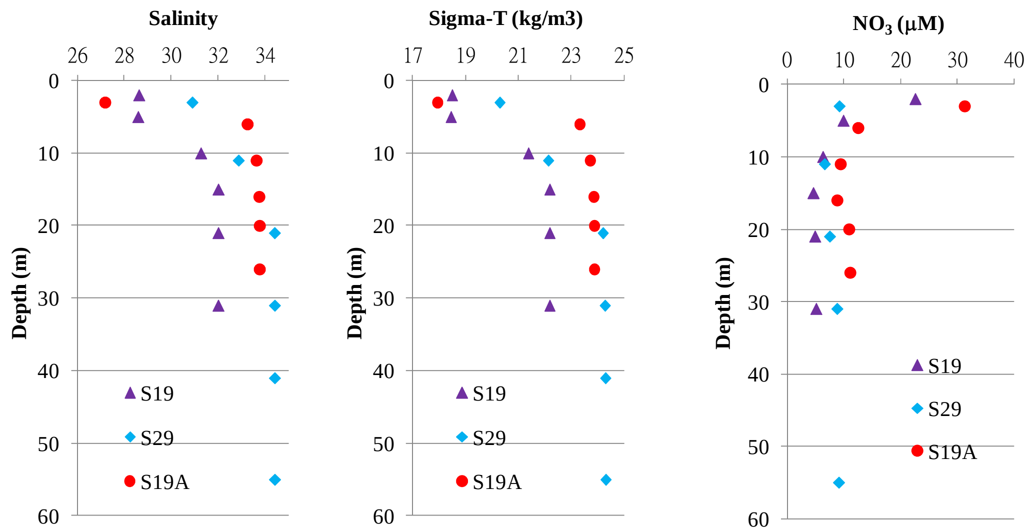


Fig. 6A Distributions of salinity, Sigma-T (kg/m3) and NO_3 in the inner shelf (Station 19, 19A and 29).

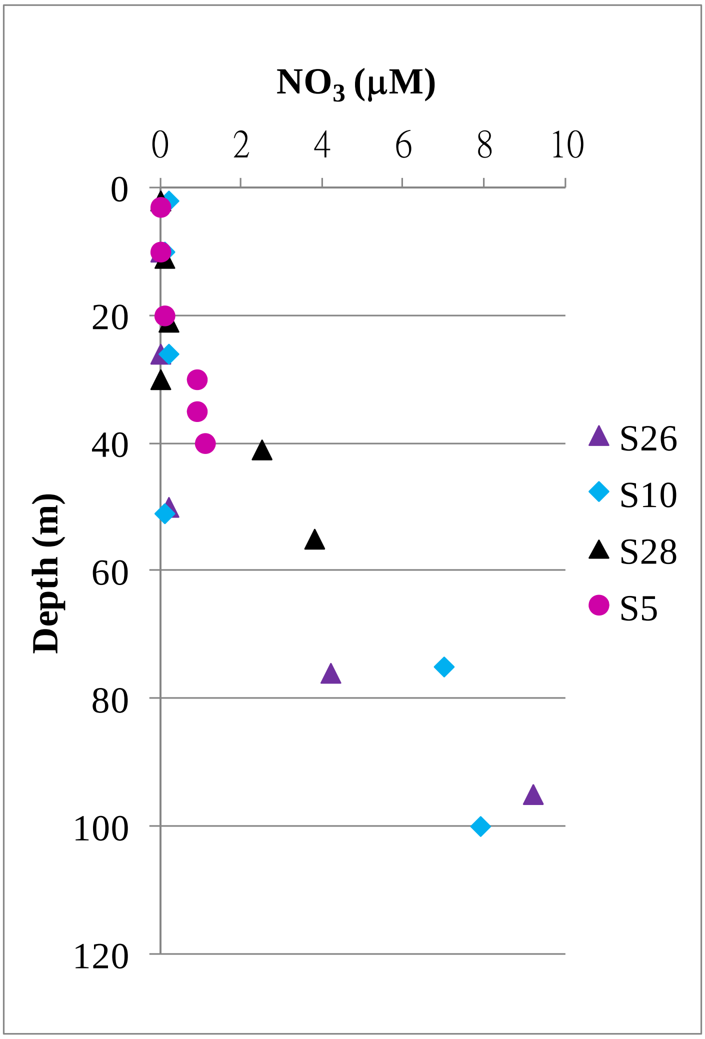
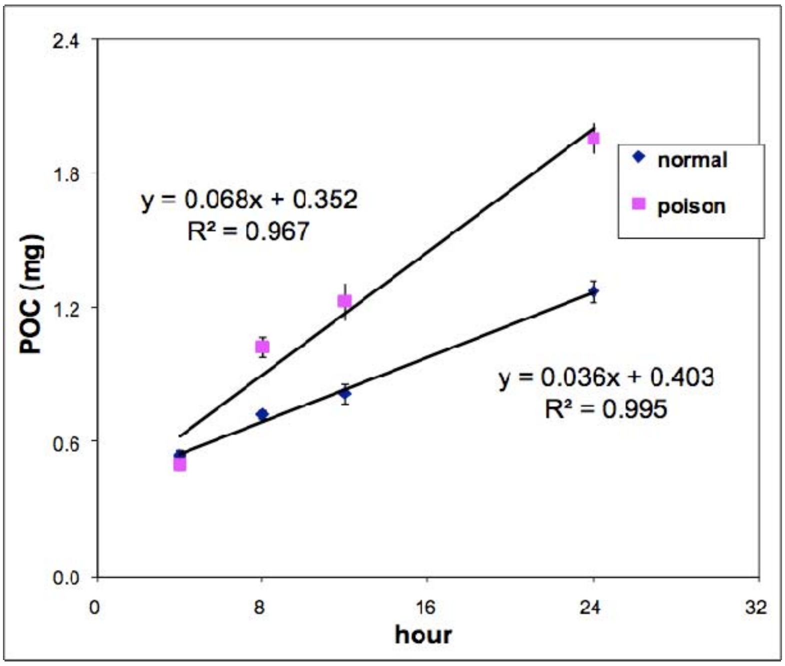
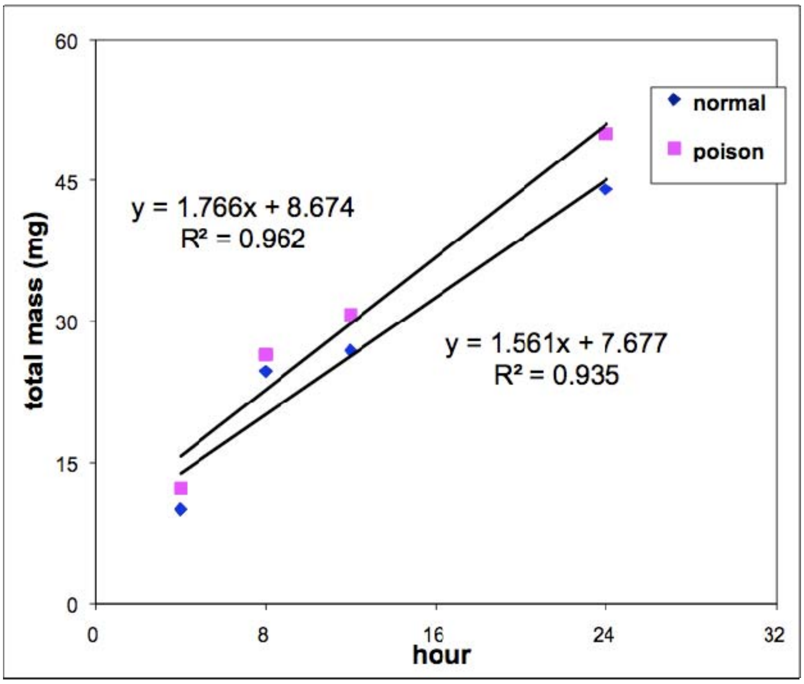


Fig. 6B Distributions of nitrate at stations S26, S10, S28 and S5.

7. The authors measured the fluxes during the daylight and assumed that no variation in the fluxes occurred during the night. This affirmation is not properly supported also by references as some include not only the night but also day time (P.4285 L.15) moreover they refer only to a particular season (not specified). This assumption could lead to an underestimation of the flux due to the vertical migration of zooplankton (and related fecal pellet flux) especially in deeper areas where the traps were deployed quite distant from the sea bottom.

Answer: As we mentioned in the text, some researchers said that POC fluxed had diel variation. But our data did not show a pronounced difference of POC and mass fluxes (see the figure below) between night-time and day-time. Detailed results of this experiment will be published elsewhere. In addition, content of sinking particles also contains other detritus, dead phytoplankton cells, aggregates etc. besides fecal pellets. Our floating trap is designed to collect vertical passive particles below or close to the depth of the euphotic zone so that we can not catch active particles such as deep fecal pellets, which is a difficult part to estimate in terms of its mass and POC content. It needs more studies in the future.





Normal: the trap tubing with filtered seawater only. Poison: the trap tubing with HgCl2 solution.

8. In the conclusions that Authors do not consider that in shallow areas under riverine influence with turbid waters there could be a limited primary production but a high

flux
of riverine and resuspended particulate matter this could imply that the higher POC flux with respect to primary production are not necessarily overestimated. I think that there is a need to better address this issue in the discussion.

Answer: We agree that in shallow areas under riverine influence with turbid waters there could be a limited primary production but a high flux of riverine and resuspended particulate matter; this could imply that the higher POC flux with respect to primary production is not necessarily overestimated. This part has been added to the revised manuscript.

Specific comments

In the title (P. 4271) it would be more correct to refer to summer.

Answer: OK.

In the Abstract (P.4272) the sentence L.15-19 is not clear: "in assessing reasonable quantitative estimate" of what?

Answer: Based on previous studies (Iseki et al., 2003; Hung et al., 1999, 2003; Liu et al., 2010; Guo et al., 2010), these researchers suggest that POC flux in the ECS could be overestimated due to resuspension. For example, Iseki et al. (2003) pointed out that organic carbon content in the ECS decreased with depth from the shallowest trap down to 20–30 m above the bottom, showing then constant, low values in the bottom layers (e.g., less than 2% Org. C contents), possibly due to resuspension. So, the sentence has been revised to "in assessing reasonable POC flux in the ECS"

In the Table 1 the depth of the euphotic zone is presented however in the "Sampling and analytical methods" section (P. 4274-4275) it is not reported how it was determined.

Answer: The depth of the euphotic depth (EZ) was defined as the depth of 1% surface light penetration (= 4.605/KPAR) where the KPAR is the mean downwelling attenuation coefficient.

No information on sediment sampling and analysis is presented in the "Sampling and analytical methods" section, though this data are reported in Table 2.

Answer: The procedure of POC measurement on surface sediment was listed in the revised ms.

The authors describe in the method the use of transmissometer (P.4274 L. 9) but they do not present nor discuss this data which could be useful in relationship with total suspended matter and POC.

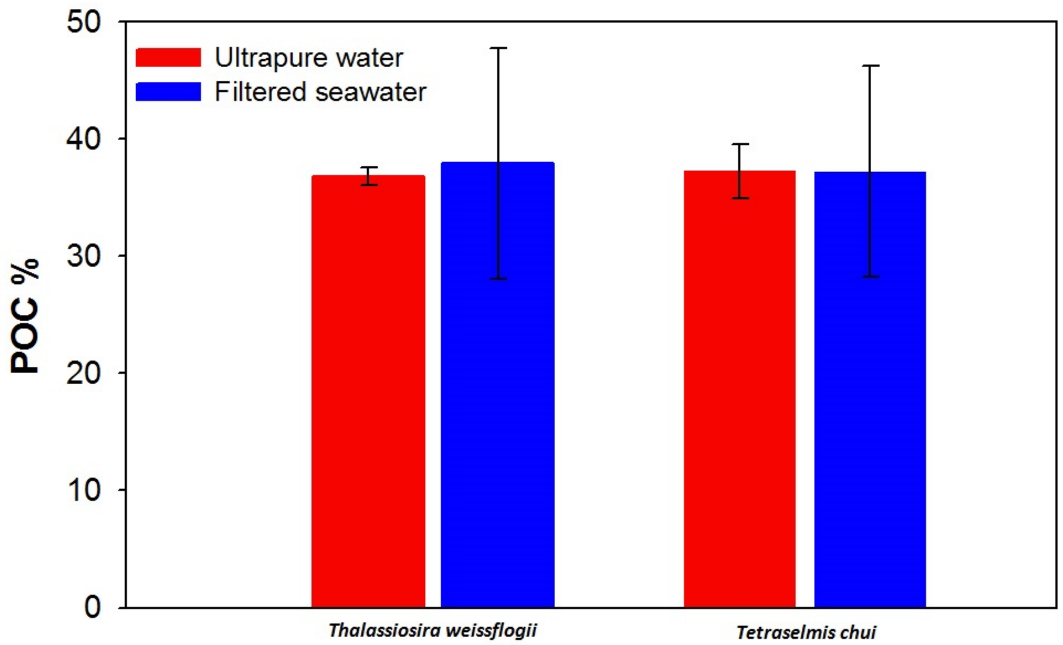
Answer: We have re-checked TSM data and found that some of our TSM data in outer shelf waters (e.g., stations 26 and 10) may contain some sea-salts. Because most of filters have been used up, we used a relationship between TSM and TM(%) (see figure below) to estimate modified TSM values in outer shelf water. As a result, the data of TSM values in outer shelf water were from the derived TM (%) values.

There are no details on the washing of the suspended matter in order to determine TSM (P. 4275, L. 4-8), nor on the method used with precision and accuracy of this measurement.

Answer: Sub-samples (0.5 _ 2 L for the inner and middle shelves
and 4 ~ 6 L for the outer shelf) for total suspended matter (TSM) were filtered through
pre-weight GF/F filters (after pre-combusted at 500 ^{o}C for 6 h) and then rinsed with about 20 ml of Milli-Q water. The analytical uncertainty (one sigma error) for TSM was 5–10% as estimated from duplicate measurements.

As washing could cause osmotic shock on the phytoplankton cells it could lead to an underestimation of POC concentrations. It would be useful if the authors could specify the details of HCl fuming (P. 4275, L.6) in order to remove carbonates as a not efficient removal could lead to an overestimation of POC concentrations and fluxes.

Answer: The POC concentrations on phytoplankton cells washing with Milli-Q (Ultrapure) water was comparable to POC values on phytoplankton cells washing with filtered seawater (see figures below). Briefly, carbonate carbon on the filter was fumed overnight by concentrated HCl in a vacuum desiccator and then dried at 50 ^{o}C in an oven.



The authors state that the ”at each sampling depth the PB-E curve was determined using a seawater –cooled incubator”(P. 4275, L. 18-25). Which where the temperature of incubation for primary productivity and which where the differences with respect to the real in situ temperatures? Could the temperature difference (incubation versus in situ) affect the estimate

of the primary productivity? In the methods section should be specified how were the PP data integrated on the water column.

Answer: Water samples (from three depths) for the PP measurements were prescreened through a 200-mm mesh and filled into acid-cleaned polycarbonate carboy. Each subsample was inoculated with 10 mCi NaH14CO3 before incubation. The PB-E curve at each sampling depth was constructed in a seawater-cooled incubator with artificial illumination (1000 W submersible halogen quartz lamp) and was incubated for 2 h. The circular seawater was from surface seawater (2-3 m). For example, the temperature from three depths (2, 25 and 50 m) was 27.7, 24.5 and 22.0 ^{o}C, respectively. The temperature difference between 2-m sample and 50-m sample was 5.7 oC. The main objective of PB-E curve incubation is to obtain physical response of phytoplankton. Physical response of phytoplankton is dependent on living history of phytoplankton. Therefore, physical response of phytoplankton is difficult to be changed within 2-hr incubation period due to temperature change. In addition, the 50-m sample was from the bottom of the euphotic zone and its contribution on the euphotic zone integrated PP is not important. The euphotic zone integrated primary production (IP) was calculated using a trapezoid rule.

In the discussion the comparison with the primary production derived by satellite data
easy to understand: 1) are the satellite data average for the whole year or for shorter period? 2) there are 3 fold higher than the summer fluxes reported by the authors and this important issue is not discussed.

Answer: the satellite derived data are shorter period (daily data). There are 3 fold higher than the summer PP (not fluxes) is caused by typhoon (also called hurricane) event. We have demonstrated them in the text.

Technical comments Units for the Chla concentrations are expressed sometimes as mg m-3 and sometime as ug L-1. It would be better to use uniform units throughout the text and as liter and not m3 are filtered as for POC and TSM the ug L-1 should be preferred.

Answer: OK. The concentration of Chl-a has been changed to ug L^{-1}.

P. 4276, L.4. Correct: “concentrationsin” and “July2007” P. 4275, L.22. Correct: “ThePB-E”

Answer: OK.

The reported data (P.4277, L.17) of Khodse et al. (2009) seem to be quite different from the Authors’ results when converted from mole g-1 to g g-1. When comparing the data with previous findings

Answer: We have found that the reported data of Khodse et al. (2009) seem to be much higher than previous data reported by many researchers. This could be due to very low chlorophyll values. So, we deleted the portion of Khodse et al. (2009) in the revised ms.

P. 4278, L. 5-9. the authors should consider the seasonal period (more interesting than the nationality of the researchers, which could be avoided).

Answer: OK, we have revised the seasonal variation of POC fluxes in the ECS, reported to Iseki et al. (2003). We also deleted the nationality of the researcher in the text.

P. 4278, L. 10-15. The same comments as above apply also for the comparison with previous PP data.

Answer: OK, we have compared our PP values with previous PP data (Gong et al., 2003) in the ECS in the revised version

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P.4281, L. 13 “phytoplankton cell abundant” should be substituted with “phytoplankton cell abundance”.

Answer: It has been revised accordingly.

P.4281, L.13-15 The sentence is unclear: what is the meaning of the specification between the parenthesis?

Answer: *Skeletonema costatum* (followed by *Synechococcus* spp.) means that Skeletonema costatum and Synechococcus spp. are dominant phytoplankton species. We have revised the sentences as follows: *Skeletonema costatum* and *Synechococcus spp.*, *Synechococcus* spp. and *Pseudosolenia calcar-avis*, and *Trichodesmium* spp and nanoflagellates are the main phytoplankton group contributing autotrophic carbon in the inner (75% of autotrophic carbon), middle (79% of autotrophic carbon) and outer (80% of autotrophic carbon) shelves, respectively.

P.4283 L.19. Correct: "organic phosphorous mineralization"

Answer: It is revised accordingly.

P.4284 L. 14. The authors introduce "Another possible transport pathway" but it is not clear which it the former pathway.

Answer: The former pathway is described on the first several sentences of same paragraph talking POC is directly exported in the outer shelf without staying on the surface sediments in the inner shelf.

P. 4284 L.21. Correct: "currentsflow"

Answer: It has been revised accordingly.

Figures Fig. 2 (P.4299).In the caption change "POC concentrations" with "POC concentration".

Answer: OK.

Fig. 4 (P.4301) Insert the statistical significance of the relationships presented.

Answer: The statistical significance of the relationships in Figure 4 has been presented in the revised version.

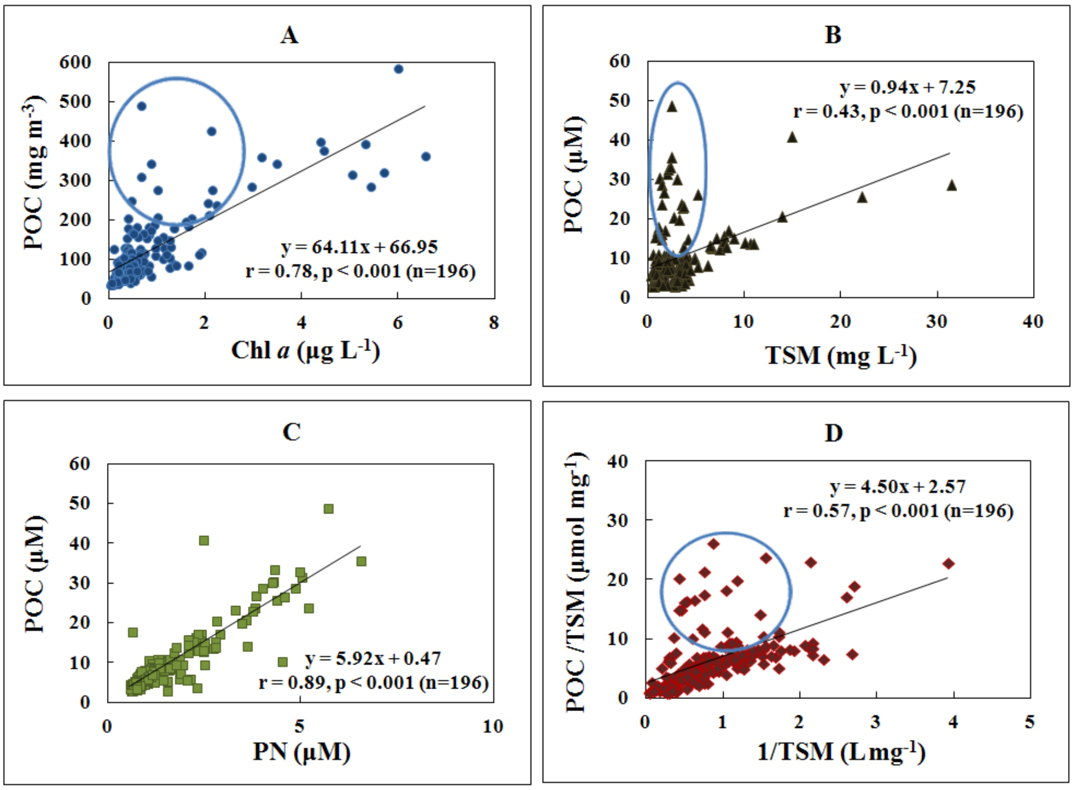
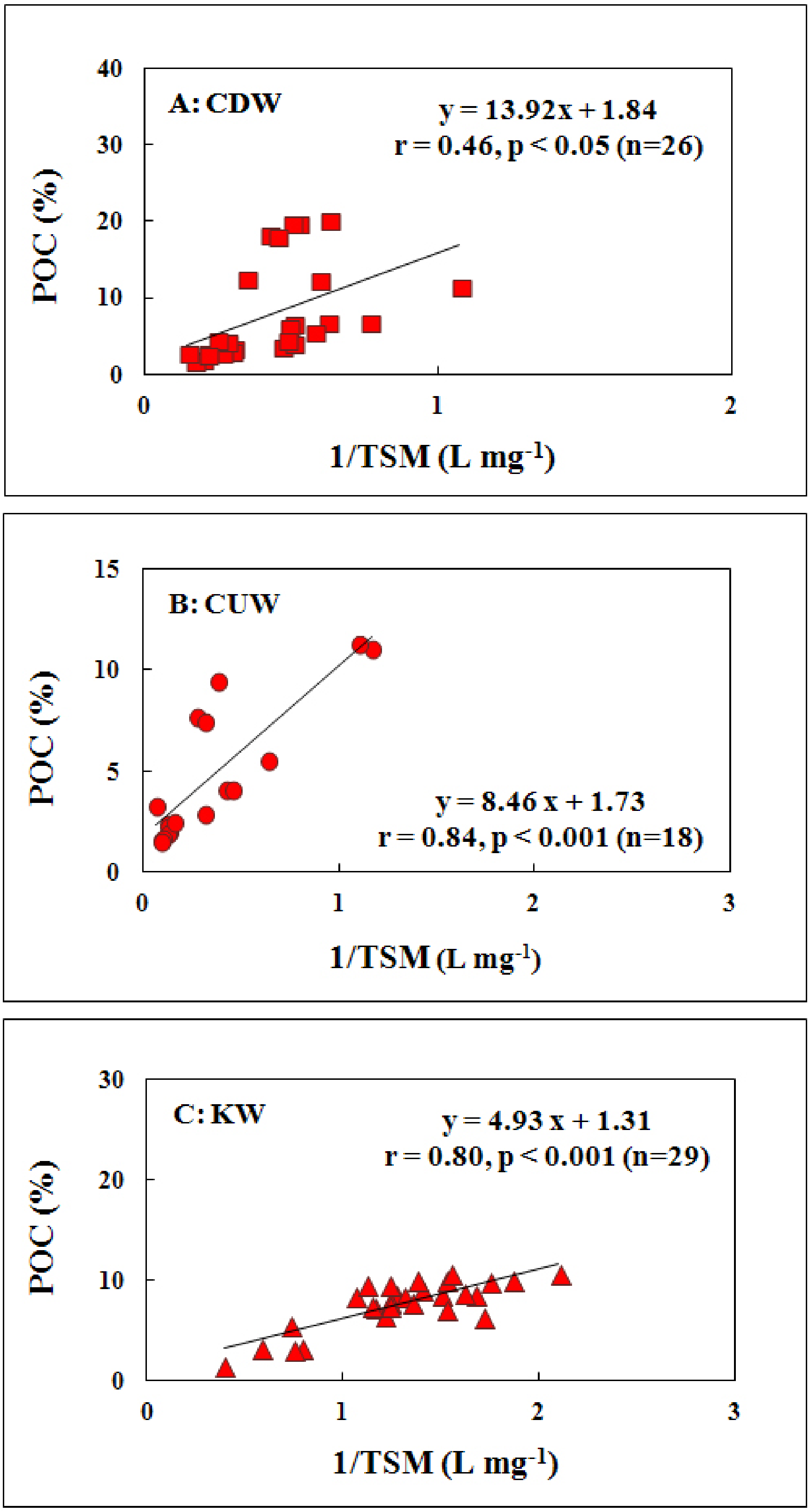


Fig. 5. (P. 4302). It is useless to use the symbol S in the X axes it would be better to use 1/TSM as in Fig. 4.

Answer: The symbol S has been changed to 1/TSM.



Tables Table 2 (P. 4294). For most stations the data presented in the ms are lower than previous data. How do the authors explain these differences?

Answer: We re-measured OC contents in the sinking particles again and found most OC contents were similar to previous data except for stations S10, S19 and S26. Lin et al. (2002) reported that organic carbon concentrations in surface sediments of the ECS ranged from 0.1 to 0.4% for the majority of the East China Sea continental shelf sediments (Lin et al., 2002; Other scientists reported that OC contents in the ECS ranged from 0.1~ 0.9 %, Sheu et al., 1995; Kao et al., 2003). OC contents less than 0.2% were found in the outer shelf area where approximately 90% of the sediments were composed of coarse-grained quartz and/or carbonate sand. Lower concentrations of OC found in the middle shelf and are possibly a combined result of limited fine-grained and large sediments (Lin et al., 2000). Basically, our values are slightly lower than previously reported data.

Table 2. Organic content (OC) in sediments in the ECS.

Water mass	Station	Cs[1]	Cs[2]	Cs[3]	Cs[4]
		(%)	(OC in surface sediment)		
CDW	S18	1.8	0.19%	0.67%	0.54±0.03%
CDW	S19	1.8	0.66%	0.19%	0.42±0.20%
SMW	S28	1.8	0.38%	0.29%	0.25±0.03%
CDW	S29	1.8	0.27%	0.28%	0.22±0.02%
CUW	S5	1.7	0.45%	0.88%	0.49±0.03%
KW	S10	1.3	0.29%	0.42%	0.24±0.06%
KW	S26	1.3	0.28%	0.23%	0.20±0.09%

C_s is the OC concentration of surface sediment (%).

1. model estimated values, 2.Sheu *et al.* (1995), 3. Kao et al. (2003).

4.this study (average±1std, n=4)

Table 3 (P. 4295)

No relationship is presented in figure 5 for SMW, why? However for SMW it is used the values of the slope obtained for CDW. This aspect should be explained in the text.

Answer: The T-S diagram of major water types in this study is shown below. SMW (Shelf Mixing Water) was composed of CDW (major) and YSW+TCWW (minor) so that we used the values of the slope obtained for CDW at Station 28.

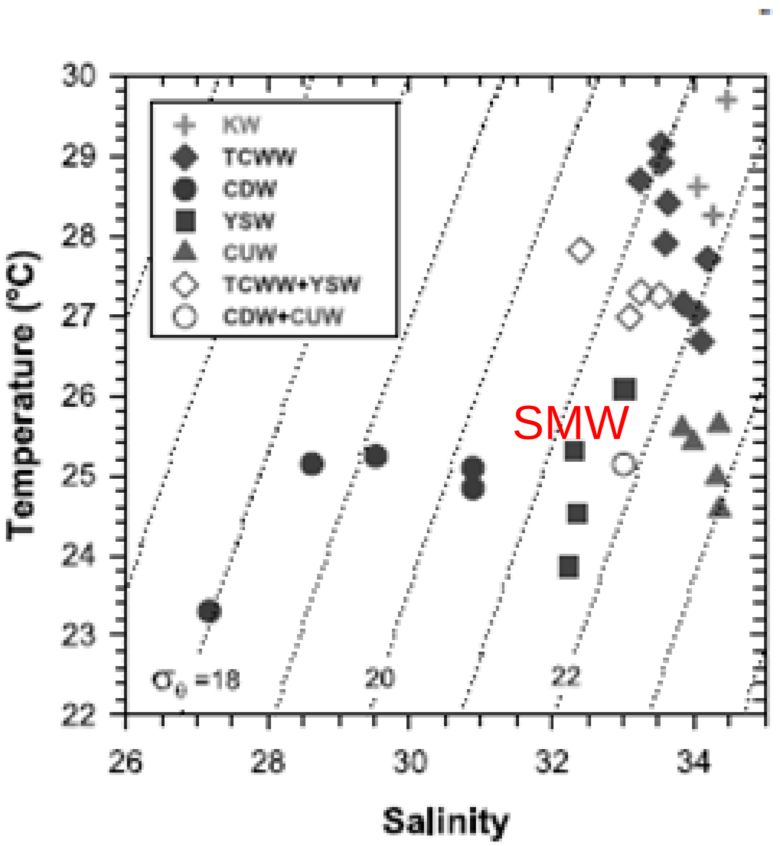


Figure 2. Temperature versus salinity plot for surface waters of the East China Sea in which seven distinct water types were identified. KW, Kuroshio Water; TCWW, Taiwan Current Warm Water; CDW, Changjiang Diluted Water; YSW, Yellow Sea Water; CUW, Coastal Upwelling Water; TCWW + YSW, mixed TCWW and YSW; CDW+CUW, mixed CDW and CUW.

Table 4 (P. 4290). The caption should contain the explanation of the symbol used : Ct, R and T.

Answer: OK.

Table 4. Detailed values of C_t, R/T, uncorrected POC flux (Uncorr. POC flux) and corrected POC flux (Corr. POC flux ± uncertainty) in the different areas of the ECS.

Water mass	Station	Ct	R/T	Uncorr. POC flux	Corr. POC flux
		(%)	(%)	(mgC m^{-2} d^{-1})	(mgC m^{-2} d^{-1})
CDW	S18	6.1	80	3900	785±438
CDW	S19	2.0	93	7300	486±275
SMW	S28	9.9	65	200	69±39
CDW	S29	11.2	60	750	297±168
CUW	S5	5.9	57	720	307±169
KW	S10	7.3	27	80	58±33
KW	S26	4.2	58	150	63±36

R represents the fraction of resuspended particles (mg L^{-1}, dry weight, dw) collected by a sediment trap.

T: total entrapped sinking particles (mg L^{-1}, dw) collected by a sediment trap.

C_t: organic fraction of observed sinking particles (%).

Note: the uncertainty of the calculated fluxes was based on the standard deviation of three C_0 values (C_0, C_0 (min), C_0 (max)).

Table 5 (P. 4297) In the caption correct: “ofcorrected”. In the title of one of the column “bottom” should be substituted by “Bottom depth”.

Answer: OK.

Table 5. Data of corrected POC flux (POC flux), primary production (PP) and e-ratio (POC flux/PP) in the ECS.

Water mass	Station	Bottom depth	EZ	Trap depth	POC flux	PP	e-ratio
		(m)	(m)	(m)	(mgC m^{-2} d^{-1})	(mgC m^{-2} d^{-1})	
CDW	S18	47	15	20	785±438	1897	0.41±0.23
CDW	S19	38	22	20	486±275	3045	0.16±0.09
SMW	S28	60	50	30	69±39	600	0.12±0.07
CDW	S29	57	26	20	297±168	3377	0.09±0.05
CUW	S5	51	36	20	307±169	337	0.91±0.50
KW	S10	154	90	120	58±33	1153	0.05±0.03
KW	S26	118	74	100	63±36	442	0.14±0.08