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Interactive comment on "The postmonsoon carbon biogeochemistry of estuaries under different levels of anthropogenic impacts" *by* Manab Kumar Dutta et al.

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Comment: Review of Dutta et al., The authors made measurements of organic and inorganic carbon parameters, along with isotopes and other ancillary measurements in an attempt to determine the sources and distribution of DIC, DOC, and POC in an estuary in the Hooghly-Sundarbans system (shortly written as C biogeochemistry by the authors). Although the ms falls within the scopes of BG and covers a good data range from various sites of the estuarine system but finally it ends up in a disappointment because of poor writing and hesitations of choosing a concrete aim. Unfortunately, the manuscript reads like a data dump, with incomplete descriptions of the methods, pre-

sentation of the data, and some speculation about processes but with major processes left out; nothing seems conclusive. The manuscript is still in quite a rough stage, as detailed with a non-exhaustive list of examples below, and does not seem ready for publication.

Response: We are thankful to the reviewer for his constructive criticism and comments. We are open to include his suggestions in the revised manuscript at suitable places and come back with a better version of the manuscript.

Specific comments:

Comment: The problem lies within the title. It seems the authors are in serous dilemma to show the data what actual basis: on C dynamics in polluted vs non-polluted system or only focus on mangroves and compare with sidechain Hooghly in a specific season or discuss on DIC mainly and less focus on DOC and POC or avoid already published articles on the same systems on same parameters on same season! (e.g. Samanta 2015, Ray 2018, 2015) Unfortunately nothing was clear due to poor writing and unclear intention.

Response: The main objective of the present study is to bring out contrast in different components of the carbon cycle of anthropogenically affected Hooghly estuary and mangrove-dominated estuaries of Sundarbans during postmonsoon. We have tried to focus on each component depending on the variabilities and scope of our data. We would respectfully disagree with the reviewer that we have tried to avoid the earlier works by Samanta et al., (2015) and Ray et al. (2015, 2018). We have cited their works and used the findings of these authors in our manuscript to interpret our data. We would also like to submit that whereas Samanta et al. (2015) is a nice study with comprehensive focus on only DIC in the Hooghly estuary; Ray et al. (2015, 2018) covers more number of parameters with limited spatial coverage (please see Figure 1 attached). In a vast mangrove ecosystem as Sundarbans, Ray et al. (2015, 2018) have covered just one location during both studies. We have tried our best to cover the Hooghly-Sundarbans system on wider scale with multiple parameters to comprehensively study C dynamics in this system. So far as writing is concerned, we believe that there is always a scope for improvement and we will be happy to incorporate the suggestions by the reviewer.

Other major comments

Comment: I would suggest authors to give details of the sampling stations e.g. how or what type of anthropogenic input is there in the Hooghly? From where it is more coming from (upstream?).

Response: We would include sentences to that effect in the revised version. For example, surface runoff at freshwater region, like waste water discharge from the City of Kolkata (St. H2) and jute industry (located in between Stns. H1 to H3) is a major source of anthropogenic inputs to the Hooghly. We would also include previously published nutrients concentration as an evidence for higher anthropogenic input in the Hooghly.

Comment: Its better to segment the study sites of Hooghly as upper/mid/lower stretch and Sundarbans as west/central and east. I anticipate the upper and mid stretches are human or industrial impacted compared to lower, so one of ideas in designing the story would be to explain variations of results within Hooghly first between e.g. H1-6 and H6-11 and then compare with S,T,M series. That would read the paper interesting otherwise its just mimicking the findings already shown by Samanta 2015, Ray 2018.

Response: During this postmonsoonal study, based on the present salinity range and gradient, it is difficult to divide the Hooghly estuary into upper/mid/lower stretch like other estuaries with sharp salinity gradient from fresh to marine zone. Although reviewer has suggested human and industrial influence along with lower estuarine region as a basis for such demarcation, we believe that such demarcation would be qualitative as no quantitative information are available to us to support such demarcation. Therefore, we are inclined to divide Hooghly estuary as freshwater zone (H1-H6) and mixing

zone (H6 – H11) based on our salinity data. For the Sundarbans, the spatial extent is not wide enough (less than 100 km2) to divide them into west, central and east zones. If we apply this criterion, we would be left with 3 data points from each region (upper/middle/lower), which is not enough for data analysis and further interpretation to understand the characteristics of individual estuaries (S, T and M). Therefore, in the revised manuscript, we wish to discuss first the freshwater and mixing region in the Hooghly estuary and then compare it with the Sundarbans. We hope that the reviewer will agree to our suggestion.

Comment: Authors argued on C- data limitation of previous reports but it is found that Samanata'15 covered even much higher sites from Hooghly than the present report (c.a 35 vs 13 surface water and 8 vs 8 ground water) and Ray '18 was also not far (>10 in S series vs 10 S,T,M). So this argument on data imitation does not hold true!

Response: We agree with the reviewer that DIC is extensively discussed by Samanta et al. (2015) for the Hooghly estuary with much better spatial and seasonal coverage compared to our study. The author have also reported δ13CPOC at some locations (n = 26). DIC and pCO2 for the Hooghly and Matla estuaries have also been reported by Akhand et al. (2016). The first report for the Hooghly-Sundarbans system with different components of C cycle with their isotopic compositions were reported by Ray et al. (2015). However, this study is limited by spatial coverage (3 stations from Hooghly and one from Sundarbans). Unless reviewer is referring to paper other than Ray et al. (2018) published in The Science of Total Environment, his argument about Ray et al. (2018) having large sampling locations (>10 in S series vs 10 S,T,M as pointed out by the reviewer) appears to be not correct. The map of the sampling location of Ray et al. (2018) is shown in Fig.1. In the light of the above, we would like to argue that the present study has much larger spatial coverage with multiple parameters and is better equipped to decipher the differences in C biogeochemistry of the contrasting systems such as Hooghly and the estuaries of Sundarbans.

Comment: Result section is only meant for results and it should be avoided to define data set and add citations in Results that fully present in the paper. It is proposed to move those parts of the Result section to discussion (LN 229-234, 248-49, 257-59, 267-71).

Response: Thanks for the suggestion. Agreed.

Comment: This is over-speculative to argue on contributions of pore water on the overlying DIC concentrations based on only one measurement (Tab 3, Lothian PW).

Response: We agree with the reviewer that it is not enough to quantify contribution of pore water on adjoining estuarine water DIC pool based on a single measurement in this large mangrove ecosystem (Sundarbans). We are sure reviewer will appreciate that it is a logistics challenge to perform sampling in the Sundarbans. To perform sampling, permission is needed from the forest department. Also, very few islands are open for scientific investigations and some of them are tiger infested. During the present sampling, we had planned to cover at least all littoral zones of the Lothian Island. However, we were not permitted by the forest security service as conditions were not conducive to carry out investigation at mid and upper littoral zones. Therefore, we had to restrict our measurement in lower littoral zone only. Our advective DIC flux across mangrove sediment-estuary interface can be considered as first-time baseline value. The same caveat we have put in the manuscript as well.

Comment: LN342- 345: This is unclear why ïĄĎDICM2 is shown as micromole instead of permil.

Response: As you can see from the formula, the units of numerator and denominator is (μM x ‰ and ‰ respectively. The ‰ǵets cancelled keeping ΔDICM2 unit as 'μM'.

Comment: Authors should better calculate the amount of DOC and POC added or subtracted from the system applying conservative mixing (same way they did for DIC) and explain in-depth details of their mixing pattern (same applies to DIC).

Response: Thanks to the reviewer for this suggestion. Using similarly calculated end

members values or taken from the same references as DIC, added or removed POC and DOC in the Hooghly were calculated for the revised manuscript. For Sundarbans, mangrove derived POC and DOC addition/removal was calculated using the same expressions as DIC. Additionally, very similar to DIC, a mixing plot between ΔPOC and $\Delta\delta$13CPOC was plotted to explore influencing processes. However, for DOC it was not possible to perform this analysis due to unavailability of δ13CDOC data during the present study. We have used interrelationships between various parameters to justify removal or addition. We will include the above information in the revised manuscript.

Based on the above, additions to the POC section may be as following: Estimated ΔPOC in the Hooghly indicated both net addition (n = 3) and removal (n = 3) of POC in the freshwater region (ΔPOC = – 95 to 101μM). The removal (n = 6) dominated over addition (n = 1) in the mixing region (ΔPOC = – 60 to 10μM). In an estuary, POC may be added through freshwater and surface runoff mediated inputs, phytoplankton productivity, and DOC flocculation. The removal of POC is likely due to settling at sub-tidal sediment, export to adjacent continental shelf region, modification via conversion to DOC and aerobic respiration in case of oxygenated estuary. The $\Delta\delta$13CPOC and ΔPOC were plotted (Figure 2 attached) that showed: [a] decrease in ΔPOC with increase in $\Delta\delta$13CPOC (RR) at four locations in the mixing region and one location in the freshwater region suggesting modification of POC via aerobic respiration, supporting our earlier argument. However, this process may not have great impact on estuarine pelagic metabolism as evident from the POC - pCO2 relationship (freshwater region: p = 0.29, mixing region: p = 0.50; Figure will be included in the revised version). [b] Decrease in both ΔPOC and $\Delta\delta$13CPOC (SD; n = 2 for mixing region vs. n = 2 for freshwater region) supports settling of POC to sub-tidal sediment. However, due to unstable estuarine condition this process may not be very effective despite high estuarine water residence time ($\sim$ 40 days during postmonsoon, Samanta et al., 2015). [c] Increase in ΔPOC with decrease in $\Delta\delta$13CPOC (SR, FR & PP; n = 2 for freshwater region) supports increase of POC via surface runoff or phytoplankton productivity. In the freshwater region, further evidence for surface runoff and primary productivity influenced POC addition was found based on spatial POC variability and δ13CDIC - POC relationship (freshwater region: r2 = 0.68, p = 0.05) [d] Increase in both ΔPOC and $\Delta\delta$13CPOC (n = 1 for mixing region vs. n = 1 for freshwater region) may be linked to DOC to POC conversion by flocculation (more details in DOC section). In freshwater region, direct signal for DOC - POC conversion was evident from the DOC study but not in the mixing zone. In the Sundarbans, negative and lower ΔPOCM2 (–209 to –28μM) compared to ΔPOCM1 (–35 to 327μM) suggested DIC like behaviour, i.e., evidence for simultaneous removal or modifications along with addition of mangrove derived POC. No evidence for in situ POC-DOC exchange was found based on POC - DOC relationship; however, signal for POC mineralization was evident in the Sundarbans from POC - pCO2 relationship (r2 = 0.37, p = 0.05, Figure will be included in the revised version). Similar to the Hooghly, despite having high water residence time in mangroves (Alongi et al., 2005, Singh et al., 2016), unstable estuarine condition may not favour significant settlement of POC at sub-tidal sediment. The export of POC from the Hooghly-Sundarbans system to the Bay of Bengal, without any in situ modification, is also a possibility, which has been estimated to be $\sim$ 0.02 - 0.07Tg and $\sim$ 0.58Tg annually for the Hooghly and Sundarbans, respectively (Ray et al. 2018). Please look later for explanation related to DOC.

Comment: LN349 Are the ground and pore water discharge not being considered as 'biogeochemical' process?

Response: We believe it is better to leave ground and pore water discharge from the realm of biogeochemical processes, as no biogeochemical processes are associated with them. It may be described as hydrological processes. We found "The driving forces of pore-water and groundwater flow in permeable coastal sediments: A review" published by Santos et al. (2012) in the Estuarine Coastal and Shelf Science a nice review work in this field.

Comment: Section 4.3. This part is weakly written and over-speculative without supporting any evidence e.g. the argument of DOC photo-oxidation or conversion of DOC

to POC as removal process. While it requires suitable ambient condition for DOC photo-oxidation such as high water residence time, stable environmental condition (not expected in mangroves), the same applies to adsorption/desorption of DOC-POC. Part of that exchange is mediated by charged complexes, repulsion - attraction interactions, and therefore subject to salinity effects. So, when river water rich in DOC first mixes with saline water, at least a portion of DOC is lost from solution (removed) and incorporated into POC (Fe-oxide colloids usually are extracted at the same time). Once the salinity exceeds 2 - 3, however, the effect of salinity on coagulation behaviour is largely complete. Another point is no detailed explanation on distribution pattern with salinity was given, authors should highlight the reasons of the mild upward gradient along Hooghly and steep downward trend along the Sundarban.

Response: We are thankful to the reviewer for insightful comment on the DOC study. We will try to include these points in the revised manuscript.

The section on DOC may be evolved as following in the revised version: "DOC - salinity relationship did not confirm significant influence of estuarine mixing on DOC at both Hooghly (freshwater: r2 = 0.33, p = 0.23; mixing region: r2 = 0.10, p = 0.50) and Sundarbans (r2 = 0.27, p = 0.10). Our observations showed similarity with other Indian estuaries (Bouillon et al., 2003) with opposite reports from elsewhere (Raymond and Bauer, 2001a, Abril et al., 2002). Although it is difficult to accurately decipher influencing processes on DOC without δ13CDOC, some insights may be obtained from estimated ΔDOC. The estimated ΔDOC in the Hooghly indicated both net addition (n = 3) and removal (n = 3) of DOC in the freshwater zone (ΔDOC = – 44 to 63μM); whereas, only net addition was evident throughout the mixing zone (ΔDOC = 18 to 420μM). In the Sundarbans, except lower Thakuran (St. T3, ΔDOC = – 20μM), net addition of DOC was estimated throughout (ΔDOC = 2 - 134μM). In an estuary, DOC can be added through in situ production (by benthic and pelagic primary producers), lysis of halophobic freshwater phytoplankton cells and POC dissolution. DOC can be removed through bacterial mineralization, flocculation as POC, and photo-oxidation

(Morris et al., 1978; Alvarez-Salgado et al., 1998; Bouillon et al., 2006). At the Hooghly - Sundarbans system, no evidence for freshwater phytoplankton (δ13C: – 33 to – 40‰ $Freitasetal., 2001)wasfoundfrom\delta$13CPOC, ruling out its potential effectiveness on DOC. Based on δ13CDIC and POC study (r2 = 0.68, p = 0.05), an indirect evidence for phytoplankton productivity was observed in the freshwater region of the Hooghly, but direct evaluation of its impact on DOC was not possible due to lack of data. Contradictory results exist regarding influence of phytoplankton productivity on DOC. Some studies did not find direct link between DOC and primary productivity (Boto and Wellington, 1988), whereas primary productivity mediated significant DOC formation ($\sim$ 8 - 40%) has been reported by others (Dittmar & Lara (2001a), Kristensen & Suraswadi (2002)). The DOC - pCO2 relationship suggested inefficient bacterial DOC mineralization in the Hooghly (freshwater zone: p = 0.69, mixing zone: p = 0.67). However, significant positive relationship between these two in the Sundarbans (r2 = 0.45, p = 0.02) indicated increase in aerobic bacterial activity with increasing DOC. In mangrove ecosystems, leaching of mangrove leaf litter as DOC is fast as $\sim$ 30% of mangrove leaf litter leaching as DOC is reported within initial 9 days of degradation (Camilleri and Ribi, 1986). In the Sundarbans, mangrove litter fall peaks during postmonsoon (Ray et al. 2011) and its subsequent significant leaching as DOC was evident during the present study from comparatively higher DOC compared to POC (DOC:POC = 0.50 – 3.39, mean: 1.79 $\pm$ 0.94%). Our interpretation corroborated with that reported by Ray et al. (2018) for the same system as well as Bouillon et al. (2003) for the Godavari estuary, South India. Despite having high water residence time in the Hooghly ($\sim$ 40 days during postmonsoon, Samanta et al., 2015) and in mangroves (Alongi et al., 2005, Singh et al., 2016), degree of DOC photo-oxidation may not be so potent due to unstable estuarine condition in the Hooghly-Sundarbans system (Richardson number < 0.14) with intensive vertical mixing with longitudinal dispersion coefficients of 784 m2 s$-$1 (Goutam et al., 2015, Sadhuram et al., 2005). The unstable condition may not favour DOC - POC interconversion as well but mediated by charged complexes and repulsion - attraction interactions, the interconversion partly depends upon variation in salinity. More

specifically, the interconversion is efficient when fresh (river) water mixes with seawater and the coagulation is mostly complete within salinity range 2 – 3. This appeared to be the case in the Hooghly where DOC and POC was negatively correlated (r2 = 0.86, p = 0.007) in the freshwater region, which was missing in the mixing region (p = 0.43) and in the Sundarbans (p = 0.84). Although estimated ΔDOC indicated mostly net DOC addition in the Hooghly-Sundarbans system, except leaf litter leaching in the Sundarbans, no significant evidence for the same was found. This suggested potential influence of exogenous (with respect to estuary) DOC sources to the estuary. Although there is no quantitative data available to justify this argument, DOC influx via surface water runoff is expected to be much higher in the freshwater region of the Hooghly due to presence of several jute industries and major cities including Kolkata (St. H2; population density: 22000 per km2, 7th highest in India), a hotspot for waste water disposal in this region. Relatively higher DOC level in the mixing zone compared to freshwater region suggested potential role of some other processes, possibly groundwater discharge. Contradictory results exist regarding contribution of groundwater discharge in the Hooghly. Based on dissolved Ca, groundwater contribution to the Hooghly estuary has been suggested by Samanta et al. (2015) at low salinity regime (S < 10, our salinity range); however, no signal for the same was found based on ‘Ra’ isotopic study by Somayajulu et al. (2002). Based on the present data, it is not possible to justify groundwater mediated DOC addition to the Sundarbans. Maher et al. (2013) estimated $\sim$89 - 92% of the total DOC export from mangrove driven by groundwater advection. To understand spatial variability of DOC chemistry in the Hooghly-Sundarbans system, a thorough investigation related to groundwater discharge and surface runoff mediated DOC flux is warranted.

Comment: Section 4.4 LN410 only freshwater runoff, no surface run off that adds POC too in upstream?

Response: We will include possibility of surface runoff mediated POC addition in the revised manuscript. The section may look like: In general, the salinity-SPM and salinity-

POC relationships (Figure will be included) were not significant, except freshwater region of the Hooghly, where a moderate negative correlation between POC and salinity was observed (r^2 = 0.62, p = 0.06). The inverse relationship may be linked to freshwater mediated POC influx with additional contribution from surface runoff from adjoining areas. In the freshwater zone, contribution from surface runoff was more evident as $\sim$ 61% and $\sim$ 43% higher POC at 'H3' and 'H4' were observed compared to the upstream location 'H2'. However, based on the present data, decoupling between freshwater and surface runoff mediated POC inputs was not possible.

Comment: LN440-446 this part is totally redundant as there was not an iota of signal of CH_4 from the observed d13 POC (13CH4 is 55-60 permil)

Response: We have removed the section from the revised manuscript.

Comment: Does the author have Chl-a or nutrient data (even from literature) to support higher marine input in POC in Sundarban and 13C values of mangrove leaf, and soil from Hooghly to denote higher terrigenous contribution to the POC pool? Authors are suggested to read carefully the works of Samanta'15 and Ray'18 and use their values to support some of the arguments.

Response: We are thankful to the reviewer for this suggestion. We have supported higher terrestrial contribution in the Hooghly based on previously reported nutrient and chlorophyll concentrations in this region compared to the Sundarbans. 13C values of mangrove leaf and soil from Sundarbans as reported by Ray et al. (2018) also included in the revised manuscript as an evidence to establish higher marine influence or modification of POC within the estuaries of Sundarbans. The addition regarding this in the section may look like as following: Our interpretation regarding higher terrestrial contribution in the Hooghly was also corroborated by previously reported relatively higher dissolved inorganic nutrients and Chl-a concentrations in the Hooghly (DIN: 14.72 $\pm$ 1.77 to 27.20 $\pm$ 2.05μM, DIP: 1.64 $\pm$ 0.23 to 2.11 $\pm$ 0.46μM, DSi: 77.75 $\pm$ 6.57 to 117.38 $\pm$ 11.54μM, Chl-a: 2.35 – 2.79 mgm-3) compared to the Sundarbans (DIN:

11.70 $\pm$ 7.65μM, DIP: 1.01 $\pm$ 0.52μM, DSi: 75.9 $\pm$ 36.9μM, Chl-a: 7.88 $\pm$ 1.90 mgm-3) based on seasonal and spatial investigations (Biswas et al., 2004, Mukhopadhyay et al., 2006, Dutta et al., 2015). In the Sundarbans, possibility of POC modification was evident as δ13CPOC during the present study was comparatively higher than previously reported values of δ13C of mangrove leaf (δ13C $\sim$ –28.4‰ and soil (δ13C $\sim$ –24.3‰ for the same system (Ray et al., 2015, 2018). Also, despite large sewage (δ13C $\sim$ –28.56 to –22.14 ‰ Andrews et al., 1998) discharge from Kolkata (St: H2) relatively higher δ13CPOC in the Hooghly also adds to the possibility of POC modification in Hooghly. Modification of POC within the estuaries of Indian sub-continent has also been reported by Sarma et al. (2014).

points of concerns

Comment: terminology > I counted 'biogeochemistry' was used over 25 times in the 16 pages ms! too much. Additionally, this is not clear to me what does it actually mean by C biogeochemistry?

Response: We will take care of it in the revised manuscript.

Comment: Is it C-components distributions in different phases (solid suspended and dissolved) under varying biogeochemical processes? If so please specify at least once

Response: Agreed. We will include it in the abstract of the revised manuscript.

Comment: > d13C values are not 'depleted' or 'enriched' (LN256, 428..). When referring to d13C values, they can be described as higher or lower when comparing different samples, or one could describe differences as e.g. a certain C pool is enriched or depleted in 13C versus another C pool or sample.

Response: Agreed. We will take care of it in the revised manuscript.

Comment: > r2 not R2

Response: We will change in the revised version.

Comment: Inconsistent use of [POC] in the discussion, if the bracket is used for POC then it should also appear for DIC and DOC

Response: Brackets will be removed for all cases in the revised manuscript.

Comment: unit Random use of units: DOC in mg/L, DIC in mM, POC in uM. These should be harmonized. Use DOC in uM for better compare with other studies

Response: To maintain uniformity we will change the units to 'μM' in the revised version.

Comment: Sampling Define sampling strategy neatly, Its written postmonsoon was chosen due to high litterfall, but there is no account of litter source identified for DOC or POC or any impact positive or negative on estuarine C biogeochemistry authors assumed. That is to be addressed in the discussion. Mention the H, S, T, M series in the text Mention general tidal nature while sampling (height, HT/LT, depth).

Response: The leaf litter fall is the main source of organic carbon in mangrove sediment, which peaks during postmonsson (Ray et al., 2011). It is expected that high litter fall might influence C components in the Sundarbans. The signal for influence of litter fall on DOC was evident from the DOC:POC ratio (as leaching) in the Sundarbans, but no direct signature for mangrove leaf litter on POC was found (modification is also a possibility, see POC section for more details). We are ready to include these points in the revised manuscript. Details on 'H, S, T and M' will be included in the revised manuscript. All samples were collected during the low tide phase as intertidal mangrove sediment - water interaction through groundwater discharge is maximum during low tide phase. Therefore, low tide is ideal sampling time to understand impact of mangroves on adjoining estuarine systems. To assess contrasting features between the Sundarbans and Hooghly, sampling was also conducted during low tide in the Hooghly estuary. We will include these points in the revised manuscript.

Methods

Comment: specify> pore size of filters used for DOC, SPM relative uncertainty in POC methods;

Response: Pre-combusted (500oC for 6 hours) Whatman GF/F (pore size: 0.7μm) was used for DOC filtration and SPM collection. Uncertainty for POC was < 10%. This information will be included in the revised manuscript.

Comment: technique of pore water collection; ground water (from tube pump?)

Response: We will add collection techniques for pore-water and groundwater in the revised manuscript on following lines: During low tide condition, pore-water from mangrove forest floor was collected from Lothian Island (one of the virgin island of Sundarbans) by digging a hole of $\sim$ 30 cm below the water table. After purging water at least twice in the bore, sample was collected from the bottom of the bore through syringe and transferred to the glass vial (Maher et al., 2013). Groundwater samples were collected from the nearby locations of the Hooghly-Sundarbans system via tube pump.

Figures

Comments: Again weak representation: font sizes of x, y axis digits (and titles) to be increased much (too much stress to eyes now!); use box to cover legends, its confusing with data points and legends, remove break in y axis in Fug 3e and 4a), black star coding was used both for sundarban and observed d13DIC and grey round coding was used for Hooghly and observed DIC, these symbols must be changed to give separate identity of them in all figs <overall IMPROVE CLARITY of ALL FIGURES>

Response: We will improve the figures as suggested.

Comment: Data use a consistent number of decimals (1) to report d13C data, and Salinity considering the analytical error on the measurements.

Response: Ok. We will take care of it in the revised manuscript and both salinity and δ13C data will be presented up to two decimals.

Minor comments

Comment: First sentence of abstract is redundant

Response: We will remove it from the revised manuscript.

Comment: LN65 Use current reference for the riverine export flux (works of Pete Raymond, Huang)

Response: We are thankful to the reviewer for suggestion. We will include Huang et al. (2012) in the revised manuscript at appropriate place.

Comment: Many references are out of place e.g. the comparison of present data with Khura (LN 231, 249 Miyajima paper) was unlikely as two environments are totally different even if compared authors should mention conservative data like S in Khura estuary for better comparison.

Response: We will present better comparison in the revised manuscript.

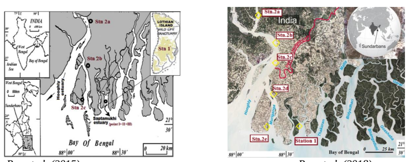
Comment: LN234: Pro-vide values of Samanta et al 2015

Response: We will provide postmonsoon DIC (1.70 – 2.25mM) and δ13CDIC (–11.4 to – 4.0‰ values of Hooghly estuary as reported by Samanta et al. (2015) in the revised manuscript.

Comment: Finally, I think it is necessary to stand back and consider how to best weave the entire story together in the discussion more efficiently and succinctly

Response: Thanks for the valuable suggestions.

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2018-310, 2018.



Ray et al. (2015) Ray et al. (2018)

Figure 1. Spatial coverage in the Hooghly-Sundarbans by Ray et al. (2015, 2018)

Fig. 1.

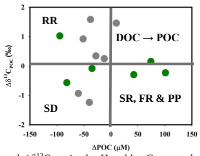


Fig 2 Plot between ΔPOC and $\Delta\delta^{13}C_{POC}$ in the Hooghly. Green and grey circles indicate location in the freshwater and mixing zones. SR: surface runoff; FR: freshwater runoff, PP: primary productivity; SD: Settling to sediments; RR: respiration.

Fig. 2.