Dear Prof. Gerhard Herndl

First, we very appreciate the useful comments from two anonymous reviewers and these comments are very meanful to improve the quality of this paper and our further study.

Our paper is a research paper about the stoichiometry of particulate organic carbon (POC) and particulate organic nitrogen (PON) based on expanded the global marine dataset and additional large number of inland water data. The first anonymous reviewer focuses on stoichiometry of POC and PON in the global ocean water and gave us a positive evaluation. However, the anonymous reviewer is much interesting in the review of POC, PON and carbon cycle (such as CO2 emission from inland water) in inland water and point out the data insufficient of POC and PON in inland water of our study. This is very useful and meaningful for our further study and gets an ambitious objective for global study of carbon cycle, mapped by reviewer.

Compared to the stoichiometry of POC and PON in inland water, the stoichiometry of POC and PON in the global ocean water is much stable. We also got some new findings different from previous studies based on the expanded the global marine dataset. In personal mind, we did not necessary to collect all the inland water data for the analyses of variation of POC/PON and inland water data worked as subsidiary in this study. The inland data of POC and PON includes 11875 samples in 253 lakes (small lakes in similar region were not listed separately in the supporting information). The analysis is validated if the representativeness of analyses dataset for the inland water can satisfy the variation range of such 'global synthesis'. Of course, the representativeness will be increased with much more data was utilized, and we should pay more attention to the complete collection of inland water data if we want to estimate the discharge flux to the ocean from rivers in further study.

Anonymous Referee #1

General Comments:

1) The authors have performed a review of variability in particulate organic carbon and nitrogen ratios in the world's oceans and inland waters. While the authors include a large amount of data for the ocean that is more or less globally representative, they consider 2 small temperate rivers and 7 different lakes, all located in the Northern hemisphere. There doesn't appear to have been any effort to incorporate data from the vast body of literature, rather data was only downloaded from websites with data readily available. For such a review to be meaningful, the authors need to spend considerable time mining the literature to collect a representative dataset. Not including large rivers in a global dataset is a massive oversight. Currently I do not see any value in this review considering the massive gaps in the data that was considered. The authors perhaps have a decent starting point with the assembled ocean datasets, but need to spend considerable time compiling the inland water data before any meaningful conclusions can be made. I have recommended some references to read through below to broaden perspectives on inland water bio-geochemical cycling that will perhaps inspire a more in depth analysis.

Response: We very appreciate the useful comments proposed by reviewer. We responded each comment carefully and did corresponding revision in the context of MS.

In fact, the purpose of this study is not review the variation of POC and PON in ocean and inland water. We compiled large of ocean (63208 samples) and inland (11875 samples, 253 lakes) data of POC and PON not only from online database but also previously studies. The

lake dataset listed in the supporting information includes many lake groups. The lake group contains many lakes, not just a single lake. We can open the online link if we are interested in it. These data were used to reexamine the variation pattern and relationship of POC and PON and also compared with previous study (Martiny et al., 2013a and 2013b). We also compared the relationship of POC and PON between ocean and inland water to help us much more comprehensive understanding the variation pattern of POC and PON, although the samples in the inland water is relatively small. Some new variation pattern of POC and PON was revealed via the expanded global marine data and some inland water data.

Martiny, A.C., Pham, C.T.A., Primeau, F.W., Vrugt, J.A., Moore, J.K., Levin, S.A., Lomas, M.W., 2013a. Strong latitudinal patterns in the elemental ratios of marine plankton and organic matter. Nature geoscience 6:279-283.

Martiny, A.C., Vrugt, J.A., Primeau, F.W., Lomas, M.W., 2013b. Regional variation in the particulate organic carbon to nitrogen ratio in the surface ocean. Global Biogeochem. Cycles, 27, 723–731.

Expert (reviewer) expect a thorough study and the summarization and analyses of the global dataset of POC and PON in ocean and inland water, and broaden the POC and PON to the CO_2 in global inland water, and also proposed to separate the inland water into lake and river. This is very useful and meaningful for our further study and gets an ambitious objective, mapped by reviewer.

In personal mind, we did not necessary to collect all the inland water data for the analyses of variation of POC/PON and worked as subsidiary in this study. The analysis is validated if the representativeness of analyses dataset for the inland water can satisfy the variation range of such 'global synthesis'. Of course, the representativeness will be increased with much more data was utilized, and we should pay more attention to the complete collection of inland water data if we want to estimate the discharge flux to the ocean from rivers in further study.

Actually, we got much larger dataset of inland water than present in this study. However, we can't confirm that the measurement method in each study is consistent with the data applied in our study, especially for the PON. Inorganic nitrogen was not able to be removed completely by acid treatment, i.e., the measured PON is not really the true PON in the water. The POC/PON ratio might be close to the POC/PON in the region with less suspended particles, e.g., oceans. However, the term (POC/PON) in inland waters might be highly affected by IN due to the high suspended particles (high IN). Consequently, we carefully use the collection data in the inland water.

Specific Comments:

2) Line 18: It would be perhaps more interesting to first list the difference between inland waters, oceans, and estuarine C/N averages, rather than just a global average..... this comment was made before realizing how sparse the inland water dataset is.

Response: Actually, we collect large data of POC and PON from different lakes. We have 11875 couples of POC and PON in the 253 lakes and 2 rivers. We listed the lake dataset in the supporting information, including 13 lakes' and 2 rivers' database.

We shown the variation of POC, PON and POC/PON in ocean and inland water separately primary due to facilitate comparison of our study to previous studies and reveal some new variation pattern of POC, PON and POC/PON in ocean. Meanwhile, the variation of POC, PON and POC/PON in ocean and coastal water has been studied in previous studies. The mean value of POC/PON in ocean is obviously lower than that in inland waters.

The difference of POC, PON and POC/PON in ocean and coastal water was more clearly and detailedly in the section 3.2 'variations in POC, PON and POC/PON with offshore distance'. The box chart for different data categories (Latitude-, depth-dependent and so on), included much more statistic information than simple mean value, were used to describe the distribution and variation of POC, PON and POC/PON.

3) Line 20: C/N variability in inland waters was attributed to "lake geomorphology, trophic state, and climate." This is a vast oversimplification, which is reflective on the manuscript in general. Rivers are not even mentioned, which are highly dynamic. For example, C/N ratios (either dissolved or particulate) can vary by several times over the course of a few hours in rivers/streams in response to rainfall. This concept is discussed in the following manuscript and the references therein and should be con-sidered for further discussion in the manuscript:

Ward, N.D., Keil, R.G., Richey, J.E. (2012) Temporal variation in river nutrient and dissolved lignin phenol concentrations and the impact of storm events on nutrient loading to Hood Canal, Washington, USA. Biogeochemistry. 111 (1-3), 629-645

The above comment was made prior to realizing the inland water dataset only included lakes and 2 rivers. Now this focus makes sense.....

Response: Yes, this description is an incomplete picture of impact factors to the variation of POC, PON and POC/PON in inland water. We knew that the POC, PON and POC/PON varied with many impact factors. Just as expert have said, the POC, PON and POC/PON can vary by several times due to the variation of streams in rivers, or the sediment resuspension in shallow lakes. However, this is not our issue in this paper. Spatial variation with depth, latitude, and offshore distance is prior in our study relative to the temporal variation. Sometimes, variation trend of POC, PON and POC/PON (such variation range) in spatial scale may similar to that in temporal scale. We recognize the temporal variation in river and ocean. The influencing factors to the variation of POC/PON are very complex (refer to the Response of comment 5). These impact factors were compacted in the abstract. We will show some detailed information in the corresponding context.

4) Line 30-35: There are much more recent syntheses of global inland water CO2 budgets that should be mentioned if this is going to be the focal point of the first paragraph. For example, see the following refs. Raymond et al. (2013) increased the outgassing component to 2.1 Pg C yr. Sawakuchi et al., (2017) noted, that a large fraction of the surface area of the world's inland waters aren't accounted for..... adding the complete surface area just of the Amazon River increases the global budget to 2.9 Pg C yr-1. This progression and factors that are still missing from global budgets were discussed in the review paper by Ward et al. (2017):

Raymond, P.A., Hartmann, J., Lauerwald, R., Sobek, S., McDonald, C., Hoover, M., et al. (2013). Global carbon dioxide emissions from inland waters. Nature. 503(7476), 355-359

Sawakuchi, H.O., Neu, V., Ward, N.D., Barros, M.L.C., Valerio, A.M., Gagne-Maynard, W., Cunha, A.C., Less, D.F., Diniz, J.E., Brito, D.C., Krusche, A.V., Richey, J.E. (2017) Carbon dioxide emissions along the lower Amazon River. Frontiers in Marine Science. 4 (76)

Ward, N.D., Bianchi, T.S., Medeiros, P.M., Seidel, M., Richey, J.E., Keil, R.G., Sawakuchi, H.O. (2017) Where carbon goes when water flows: Carbon cycling across the aquatic continuum. Frontiers in Marine Science. 4 (7)

Response: the estimation of global carbon cycle and budgets is constantly improved and perfected. Here, we want to express the important of aquatic system in the global carbon cycle.

We know the important of inland water CO_2 budget, the meaningful paper (Raymond et al., 2013)

also was cited in our MS. We lose sight of the latest progress in this aspect (Sawakuchi et al., 2017; Ward et al., 2017). We should add the recent syntheses of global inland water CO_2 budgets in the introduction. Thus, we revised this part according to the reviewer's comment.

These studies didn't tell us the input budget of carbon from terrestrial ecosystems and output budget of carbon to the oceanic ecosystems. We can't show the completely carbon cycle pattern among the terrestrial, inland and oceanic ecosystems in the introduction.

5) Line 50: See previous comment on Line 20. The factors controlling C/N in terrestrial environments and inland waters are grossly oversimplified. C/N in inland waters is not only a result of OM origin. Molecules are selectively leached from soils during mobilization into streams (or even the flow paths that come before this such as throughfall, stemflow, etc). Molecules are also selectively degraded and sorbed/desorbed during transport, influencing composition. The review paper mentioned above is a good place to start for honing the conceptualization and discussion of inland waters.

Response: the influencing factors to the variation of POC/PON are very complex.

Essential difference: difference accumulation rate of C and N for different plant.

The organic nitrogen presents in protein and nucleic acid of plant preferentially. Thus the organic nitrogen content in higher plants is lesser than it in lower plant (such as algae). Because of that the lignin and cellulose, which includes low organic nitrogen content, are the main component in the higher plants (Giresse, 1994). Recent study indicate that C/N ratios of higher plants can research to 30, even more than 30 (Müller, 1999). However, C/N ratios of lower plants only research to 10, commonly smaller than 10 (Tyson,1995; Kendall et al., 2001).

Environmental condition: microorganism degradation, photodegradation

The difference of mineralization rate between OC and ON also will change the ratio of carbon and nitrogen (POC/PON). The loss rates of OC and ON varied with the temperature, composition of organic matter, dynamic characteristics of water (Stief 2007; Gälman et al., 2008; Gudasz et al., 2010; Sobek et al., 2014; Cardoso et al., 2014).

We should discuss the influencing factors to the variation of POC/PON, at least should add many references for each impact factors, although they are work as supporting role in MS. We revised corresponding context in the paper.

6) Line 80: After reviewing the list of data used, it is not surprising to see the lack of inland water discussion. There is one river dataset listed as far as I can tellâ ˘A˘Tthe Ipswich and Parker rivers, 2 fairly small temperate rivers. The other inland water datasets are from 7 lakes. While the ocean dataset seems to be decently large, the attempt at a "global synthesis" of inland waters made here is non-existent. Where is the Amazon River, which makes up 20% of the freshwater flow to the ocean? How about the Congo River, the Ganges-Brahmaputra River, the Changjiang River, and all of the world's large rivers? Not to mention streams from different settings. I would recommend reading the following review from the 1980's that did a more comprehensive job than done here:

Meybeck, M. (1982). Carbon, nitrogen, and phosphorus transport by world rivers. Am. J. Sci. 282(4), 401-450

Response: in fact, our inland data includes 11875 couples of POC and PON and contains 253 lakes. The lake dataset listed in the supporting information includes many lake groups. The lake group contains many lakes, not just a single lake. We can open the online link if we are

interested in it. In my mind, we did not collect all the inland water data for the analyses of variation of POC/PON and worked as contrast in this study. The analysis is validated if the representativeness of analyses dataset for the inland water can satisfy the variation range of 'global synthesis'. Of course, the representativeness will be increased with much more data was utilized, and we should pay more attention to the collection of inland water data if we want to estimate the discharge flux to the ocean from rivers. We read the reference (Meybeck 1982, is a very good paper) recommended by expert (reviewer 2), the POC/PON in Prof. Meybeck study (range from 6.9 to 13) is covered by our data in this study.

We got much larger dataset of inland water than present in this study. However, we can't confirm that the measurement method in each study is consistent with the data applied in our study, especially for the PON. Inorganic nitrogen was not able to be removed completely by acid treatment, i.e., the measured PON is not really the true PON in the water. The POC/PON ratio might be close to the POC/PON in the region with less suspended particles, e.g., oceans. However, the term (POC/PON) in inland waters might be highly affected by IN due to the high suspended particles (high IN).

7) For this present study to be meaningful, the authors need to include the majority of robust datasets currently available in the literature. It appears the authors only used data that could be readily downloaded from websites, rather than making a true effort to mine the literature. They have ignored the entire body of inland water literature.

Response: We can't need to assemble all the inland water data for POC, PON and POC/PON, of course, more data is necessary for more representative analyses. We use the representative inland water data includes 11875 couples of POC and PON in 253 lakes and 2 rivers. The different types of eutrophic, turbid small, large, and shallow lakes are included in the dataset. Thus, we think that the dataset used in this study could represent the variation of POC, PON and POC/PON in inland water, and could help us to further reveal the relationship between POC and PON and deviations in POC/PON in ocean.