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Biogeosciences Discussions

Interactive comment on "Riverine carbon export in the arid-semiarid Wuding River catchment on the Chinese Loess Plateau" *by* Lishan Ran et al.

Anonymous Referee #1

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General comments:

Ran et al. reported new data on riverine carbon export in the arid-semiarid Wuding River watershed on the Chinese Loess Plateau. Considering that river systems in the East Asia, especially those in the arid-semiarid climates are under-represented in the global budget of riverine carbon fluxes, this study could provide valuable datasets. However, the paper can be improved further by explaining in detail how the errors were calculated in load estimates and CO2 evasion, offering detailed explanation in the methods (e.g. the river surface area), and providing discussion on the observed patterns with statistical significance testing results. Specific comments are below, which the authors may consider when revising the manuscript.

Specific comments:

Lines 48-: "substantial" is a relative term. Please provide a value or a range just like 1.8 Pg C year-1 in the previous sentence.

Lines 84-: "multi-annual" is an unspecific term. Please provide more information on how the mean of water discharge was calculated. For example, you can provide the period (e.g. 1980-2010?)

Also, year-1 as a time unit would be appropriate for annual discharge. Is it 11.2 * 10^8 m3 yr-1 (Ran et al., 2017)?

Lines 149-: Isn't the 14C half-life 5,730 years?

Lines 156-158: Detailed explanation is needed on the validity of the methods on how the riverine carbon exports were calculated considering that the major findings of this paper are the new estimates of the riverine carbon loads. Detailed explanation is needed on how river flow was measured. The method of load estimation appears to be too simple and with many assumptions, not specifying errors associated with each step. There are several methods for load estimation (e.g. Sickman, J.O. et al., 2007, Water Resources Research, Effects of urbanization on ...) you may try these and compare the results because load calculation is crucial to draw conclusions. One way to calculate daily load of stream ions is to use the LOADEST software developed by USGS if daily water discharge data are available. The software also provides confidence intervals.

Lines 160-: Do you mean the POC concentration not "content"? It appears the term, "content" is misused throughout the manuscript.

Lines 170-: How large is the river width? If it is near or lower than 90 meters, how can you estimate river surface areas using the DEM data of 90-m resolution? In other words, aren't you using too coarse data to estimate river water surface areas?

More detailed explanation is required on how the water surface area is calculated since this is a critical term for CO2 evasion estimates.

Lines 183-198: The method is better than nothing for sure. However, it appears the used references are relatively old (1995 and 2000). Do you have newer references on heterotrophic respiration than those? How the errors associated with the approach are calculated?

Lines 208-: Does the 'sediment' mean 'suspended sediment'? If so, please clarify it to prevent confusion.

Do you mean the POC concentration not "content"?

Lines 222- and throughout the manuscript: What is the "+/-"? Standard deviation? Or standard error?

Lines 225-: While [DOC] (3.3 mg/L) is larger than [POC] (0.61 mg/L), the DOC export is much lower (0.3*10ˆ10 g (yr-1?)) than POC export (3.7*10ˆ10 g (yr-1?)). Why is that so?

Lines 228-233: The river water discharge and carbon loads can be highly dependent on precipitation. Was the year of field campaign categorized as wet, dry, or normal year compared to the long term mean (e.g. 1980-2017 precipitation)?

Lines 258–261: As the authors mentioned, the precipitation is high during summer. Thus, this assumption of no significant seasonal fluctuations may not be valid. Can you provide a range of stream surface area and CO2 evasion depending on season?

Lines 300–: Is the decreasing trend of DOC (Fig. 2) statistically significant? It appears the error bars are large. If this is not statistically significant, the following argument is vague. The decrease of DOC can be microbial- or photo-degradation to CO2, sorption to particulate matter, and dilution from increased water discharge of low [DOC]. The following discussion is speculative and could be strengthened by checking each factor.

Line 325–336 (and lines 385–394, and Fig. 6): I am confused. Do you mean the POC concentration not "content"? Why the "content" has the unit of concentration, %, not just grams? I think heavy rain during summer could generate high POC content but

low POC concentration. Please clarify.

Line 351–368: The pCO2 is a function of pH and alkalinity. The pCO2 is high when the water pH is low. The ground water of the area has the pH of $>\sim$8. Then, the calculated pCO2 is very low which is well described in the line 211. Then, how CO2 evasion can be high when pCO2 is low? Please clarify.

Lines 400: Which part of the Figure S1 supports this sentence?

Lines 430-481: Very interesting findings.

Tables: : What is the "+/-"? Standard deviation? Or standard error?

Table 1: Please provide information on how many reservoirs were used to draw the table.

Figure captions need to provide more detailed description of the figures including explanation on legends.

Figure 1: It is hard to differentiate the colors of the stream order, especially with the background altitude colors. Please revise the figure so that each symbol can be seen clearly.

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