Biogeosciences Discuss., 11, C7282–C7287, 2014
www.biogeosciences-discuss.net/11/C7282/2014/

Biogeosciences
Discussions
Open Access

Interactive comment on "Spatial and temporal dynamics of CO_2 partial pressure in the Yellow River, China" *by* L. Ran et al.

Anonymous Referee #2

Received and published: 10 December 2014

Review of "Spatial and temporal dynamics of CO2 partial pressure in the Yellow River, China".

Summary: The manuscript entitled "Spatial and temporal dynamics of CO2 partial pressure in the Yellow River, China " by Dr. Ran and Co-authors investigates how dynamics of the partial pressure of CO2 (pCO2) varies along one of the world's large rivers, the yellow river in China. To reach this aim, long term time series are derived from modeling pCO2 based on pH/alkalinity.

The main contribution of the manuscript is that is it adds to the growing body of literature on the variation of pCO2 in large fluvial systems. Earlier work has shown that other major rivers such as the Amazon (Richey et al., 2002), northern humid rivers (Butman & Raymond, 2011) or boreal streams (Campeau et al., 2014, Wallin et al.,

2013) can overall greatly contribute to the evasion of pCO2 from streams and rivers to the atmosphere (Aufdenkampe et al., 2011, Raymond et al., 2013). However, the current manuscript focuses on the Yellow river, a large fluvial system that, according to my knowledge has up to date received little attention. Furthermore, this river has some specific properties such has for example the high sediment loads, as it drains loess plateaus that make it an interesting and exceptional study system.

The manuscript uses reasonable and commonly used methods and derives compelling results. Furthermore, it puts them into context and is overall well prepared. Thus, I consider the manuscript as a valuable contribution to the journal 'Biogeosciences' and suggest that the manuscript is accepted for publication after some minor revision work that I have listed in my comments below.

General comments:

Comment: There is no evaluation of the uncertainties that arises from modeling pCO2 based on pH and alkalinity. However, these uncertainties have been mentioned already in the early literature (see for example Cole & Caraco, 1998) and are one of the main reasons why pCO2 is today more commonly measured by other methods (GC or in situ sensors). Thus, I suggest that at least a few sentences discussing these uncertainties are added to the manuscript. This will help the reader to understand the limitations of the study. Adding such a discussion most often increases the overall credibility of the work.

Comment: The language and the structure of the manuscript are generally good. However, the discussion is not as good as the other parts of the manuscript yet. I suggest some changes here (see detailed comments below) to clarify and correct the language.

Minor comments and suggested changes:

Title: Good, but could be even more precise. Specifically I wonder about the term 'dynamics ', and if it could be replaced by 'variation'. Also the term 'long term' could be

added, as this is part of this story.

Abstract: Overall good. However, I would want the authors to state here explicitly that pCO2 was determined from Alkalinity and pH, that is, from other variables.

Last sentence: This is confusing as KCO2 was not measured or modelled. I would suggest to reword a bit more carefully to something like “large potential for CO2 evasion” instead. Introduction: Overall good and very well referenced.

The only thing I found was: P 14065, L12 ff, where there is a bit too much listed on what topics were researched in the past. As a reader this doesn’t help much, if not at least little hints are given of what was found by these studies. Alternatively this section can be reduced.

Materials and Methods: Reads well - nothing to add. Historical records of water chemistry:

P 14068, L09 I am not sure if political chaos is the right term here, as it sounds valuing to me. May be good to rephrase.

P14069, L7: Was the abbreviation introduced? I may have missed it, but check that they are all introduced correctly.

P14070, L5, remove ‘the’ before Henrys law

L17: may be better to write the pK = -lg K out in words, as this is easier to grasp.

L21: ‘indicative of natural processes’ needs more explanation. There are streams with pH 4-10, all based on natural processes. . .

Results: P 14072, L6-9 this section should maybe still go into the methods; these are not strictly results.

L10 how is the variation significant? Was this tested?

P14073, L10: Can a stream exhibit something? Suggest to reword.

Discussion: The discussion is overall not as strong as the other sections, even though well referenced. Make sure the main line of argumentation is not lost.

P14074, L22ff: reads nicely.

P14075, L9 not sure about the term ‘abnormal’, suggest rewording.

L15: this hypothesis can’t stand by itself like this. Is there any more support for this?

L25: not sure about the use of ‘since then’ here. Maybe ‘thereafter’?

P14076, L4: What is meant with lower organic matter composition? This remains unclear. Lower quality of organic matter? If so, please write that. Also, does any data support this? Here some more clarification is needed.

L16: Ice melt or snow melt? Seems strange to melt so much ice that fast. Or is it ice dams?

L18-22: Also here, is there any data or other study to support this? Iv’ seen this in other ecosystems, but those were closer to the arctic circle than this one. I have my doubts, that the ice cover could completely exclude the exchange with the atmosphere, as long as the river is still flowing. Even in boreal regions, this is not very common for streams.

L24: ‘more research. . .’ this statement is not needed here and should be removed.

P14077, L1: rephrase as ‘bitter tasting streams’ as this is what is meant. Also, this is a bit funny – I like it.

L3: ‘will not only result in’; L4: ‘but also the elevated’

L10-20: this read better.

L23: is alkalinity really ‘produced’?

L24: ‘human induced rainfall acidification’ seems a strange term. Suggest rewrite to: ”Significant decreases in pH in the middle. . . have been detected and are hypothesized

to result from acid rain that is likely caused by anthropogenically induced sulfur emissions to the atmosphere." or similar. Also, Figure 3 actually shows no indication for this happening, but rather the opposite.

P14079, L13 remove 'aggressive', as this is subjective.

L3-4: 'Riverine pCO2. . .' this sentence doesn not make any sense, as it is the gas transfer velocity that does that, but pCO2 can be a result of a myriad of different processes.

P14080, L9-11, this sentence also doesn't really make sense and needs language editing. If the uncertainties are so 'great', what does your study then add to this? Right now it doesn't make sense to me. What is meant by a 'diagnosis'? A robust estimate? Conclusions:

P14081, L11 replace resulted with resulting.

Tables:

1) ok.

2) how aboput replacing 'item' with 'variable'. Also you could add river kilometers to each of the stations named here, just as a rough reference (for example below the station name).

Figures:

Fig. 1-4) all ok.

Fig. 5) please give station names, or other indications of the locations as it is unclear where a,b and c are in Fig.1.

Fig. 6) it may be reasonable to refer to the discussion or the references given to indicate why a step function is used here. Without this additional knowledge it just looks like there is 'more scatter' at the highest values.

All following o.k.

Refs: Please check again, that all of them are there and formatted correctly. There seem to be a few missing(?).

References cited here:

Aufdenkampe AK, Mayorga E, Raymond PA et al. (2011) Riverine coupling of biogeochemical cycles between land, oceans, and atmosphere. Frontiers in Ecology and the Environment, 9, 53-60.

Butman D, Raymond PA (2011) Significant efflux of carbon dioxide from streams and rivers in the United States. Nature Geoscience, 4, 839-842.

Campeau A, Lapierre J-F, Vachon D, Del Giorgio PA (2014) Regional contribution of CO2 and CH4 fluxes from the fluvial network in a lowland boreal landscape of Québec. Global Biogeochemical Cycles, 28, 2013GB004685.

Cole JJ, Caraco NF (1998) Atmospheric exchange of carbon dioxide in a low-wind oligotrophic lake measured by the addition of SF6. LIMNOLOGY AND OCEANOGRAPHY, 43, 647-656.

Raymond PA, Hartmann J, Lauerwald R et al. (2013) Global carbon dioxide emissions from inland waters. Nature, 503, 355-359.

Richey JE, Melack JM, Aufdenkampe AK, Ballester VM, Hess LL (2002) Outgassing from Amazonian rivers and wetlands as a large tropical source of atmospheric CO2. Nature, 416, 617-620.

Wallin MB, Grabs T, Buffam I, Laudon H, Ågren A, Öquist MG, Bishop K (2013) Evasion of CO2from streams - The dominant component of the carbon export through the aquatic conduit in a boreal landscape. Global Change Biology, 19, 785-797.

Interactive comment on Biogeosciences Discuss., 11, 14063, 2014.