

Dear Dr Bouillon,

Many thanks for your comments on our manuscript. We have carefully incorporated these revisions into the manuscript based on your suggestions. Please see below detailed responses.

With best regards
Lishan Ran

Comments to the Author:

Dear Lishan,

Apologies for the delay in looking into your revised manuscript and author replies, I have been abroad for fieldwork and had little time and online access to handle this the past two weeks. Both reviewers were quite positive, and you've handled their suggestions and comments very adequately, the revised version represents an important improvement. I'm therefore pleased to accept your manuscript for publication in Biogeosciences, pending a few minor revisions, which you'll find below. I assume you can easily incorporate these, in case you have any questions, don't hesitate to contact me directly.

With best regards
Steven Bouillon

Non-public comments to the Author:

*The question by Referee#1 on the pH scale is not correctly addressed in the author replies – he/she is referring to the different existing pH scales (free, total, seawater, NBS, ..). Please look into this and mention it in the revised version.

“Thanks a lot for your clarification. The pH was measured on the NBS scale. We have mentioned this in the revised version. (Page 4).”

*The comparison between the output of CO2SYS and PHREEQ may be useful, but may not be the best validation. Please look into Hunt et al. (2011) and Abril et al. (2015), Technical Note: Large overestimation of pCO₂ calculated from pH and alkalinity in acidic, organic-rich freshwaters. Biogeosciences 12, 67–78.

“According to Hunt et al. (2011) and Abril et al. (2015), the calculated pCO₂ from alkalinity and pH may have overestimated the actual pCO₂. Greater overestimations of pCO₂ are mainly observed in acidic rivers with organic-rich waters and lower buffering capacity of carbonate system at low pH (Abril et al., 2005). However, it is expected that this method would not significantly overestimate the pCO₂ in the Yellow River, because the Yellow River basin is characterized by widespread carbonate minerals, thus high carbonate alkalinity, and low soil organic carbon content. For example, the DOC is only 2-5 mg/l (Ran et al., 2013. Journal of Hydrology, 498, 76-88). In addition, the river water is alkaline with the pH mostly larger than 7.7. We have added this reference into the manuscript. (Page 5).”

*Discussion, page 10, line 28 and further: please refer to Raymond et al. (2013) and Aufdenkampe et al. (2011) and check their average/median $p\text{CO}_2$ values for rivers globally. The range you cite from Li et al. (2012) appears low in comparison to the frequently cited global estimates of Raymond and Aufdenkampe.

“We have checked the median $p\text{CO}_2$ values of global rivers that range from 1300 to 4300 μatm (Aufdenkampe, et al., 2011). This has been revised this in the manuscript. Thanks. (Page 10).”