Interactive comment on “River inflow and retention time affecting spatial heterogeneity of chlorophyll and water–air CO₂ fluxes in a tropical hydropower reservoir” by F. S. Pacheco et al.

Anonymous Referee #1

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General Comments

The manuscript entitled ‘River inflow and retention time affecting spatial heterogeneity of chlorophyll and water-air CO₂ fluxes in a tropical hydropower reservoir’ by Pacheco et al. focused on the interaction of primary production of a tropical reservoir and the potential for CO₂ efflux. The strong correlation between chlorophyll and pCO₂ was quite compelling. This particular finding that this reservoir can act as a sink for CO₂ given its high production, in part due to anthropogenic nutrients and seasonal effects was interesting and contrasts with how we often think of reservoirs as sources of CO₂. The authors also discuss the pros and cons of measuring CO₂ fluxes either spatially or temporally. I follow the authors’ discussion line that reservoirs and lakes are heterogeneous in regards to potential CO₂ fluxes and this variability in CO₂ fluxes across a reservoir (and through time) in turn can make a BIG difference when budgeting C cycling for these systems. However, this discussion point needs more focus and needs to include why these systems vary spatially besides the seasonal shift of the inflow (see Maeck et al. 2013 ET & S – nice paper on ‘hot-spots’ of methane emission). Also, the research presented in this study is primarily focused on surface water. The driver behind why reservoirs are thought of as CO₂ sources is because of the high rates of sedimentation that can occur compared to natural lakes and rivers (not just the original organic matter when the reservoirs were new). The authors briefly discuss this concept, but I think more attention is needed here. I don’t think the sediments can be completely ignored.

Furthermore, regardless of which data set used to calculate CO₂ fluxes, the error around the CO₂ fluxes was quite high. I think caution is needed here in regards to the conclusions given the high variability of the estimates. In a statistical framework, the flux measurements do not significantly vary between the 2 methods or by season (Figure 4). The lack of significance weakens the authors’ argument of where and when samples taken determined whether this particular reservoir was a source or a sink for CO₂. I think this discussion point needs more clarity in light of the data presented here.

Reaeration calculation – The equation (equation 2) to convert from K600 to K is incorrect. This incorrect equation is very worrisome in regards to the CO₂ efflux calculations. Also if the lake is stratified, why not take that into account when calculating reaeration (k)? Please see my specific comments below in regards to estimation of k.

Grammar – verb tenses and articles need to be checked throughout the manuscript. I understand the perhaps English is not the authors’ first language, but I think another round of editing would be beneficial. See my specific comments below. I made indications of where I found grammatical errors, however I did not thoroughly check the entire manuscript, especially towards the end.
Specific Comments

8533, Line 6 – ‘...we investigate.’ – should be investigated

8533, line 16 – ‘...fluxes was.’ should be ‘fluxes were...’

8533, line 17 – ‘considering data.’ re-cast, sentence is awkward. The average calculated CO2 fluxes were x based on temporal data near the dam versus x using the spatial data collected throughout the reservoir.

8533, line 20 – ‘...change completely the role...’ perhaps re-cast. Be more specific – the take home message is that using temporal vs spatial data to calculate CO2 fluxes results in the reservoir acting as a sink or a source of CO2 (which can have implications towards regional and global C budgets).

8535, line 4 – change investigate to investigated
8535, line 5 – ‘old and stratified’ to ‘old, stratified’
8535, line 13 – change factor to factors
8535, line 14 – change conclusion to conclusions, also ‘regarding carbon cycle in reservoir’ - ‘regarding carbon cycling in Funil Reservoir’ or reservoirs or this reservoir.

8525, line 20 – m a.s.l. – I’m not familiar with these units.
8525, line 21 – Cwa? Koppen system? Please clarify.
8535, line 17 – LT? Time zone designation?
8538, line 15 – ‘...the samples was.’ should be ‘were’

8529, equation 2 - This equation is not correct. The correct equation to calculate $k_{CO2}$ from $k_{600}$ is: $k_{CO2} = k_{600}(Sc/600)^{-0.5}$

$k_{600}$ is the $k$ for a Schmidt number (Sc) of 600 at a given temperature (not necessarily at 20°C, as incorrectly stated in line 2 on the same page – please correct/clarify).
models.
8542, line 20 – ‘... and median of... Instead ‘of’ should be ‘was’.
8542, line 22 – re-cast to present the results in chronological order. January to July first, then July to September – it perhaps would be easier to follow.
8544, line 6 - ...water temperature were... should be ‘was’.
8544, line 18 – seasons are – should be seasons were comparable
8545, line 17 - ...associated to the high Chl... should be ...associated with high Chl...
8545, line 18 – pCO2 was negatively correlated with Chl... In an old.. or In old hydropower reservoirs...
8545, line 23 – perhaps this is better: in the transition and lacustrine zones of the Funil Reservoir...
8545, line 24 – in the riverine...
8546, line 4 – re-cast sentence, awkward, not concise. I would break this point into more than one sentence.
8546, line 9 – probably ‘measured’ or ‘observed’ would be more appropriate than ‘we found net uptake...’
8546, line 15 – mineralization – of what to what? Transformation? Please clarify. Also include a ‘the’ before carbon.
8546, line 18 – The outflow exported
8546, line 28 – observed
8547, line 1 – sentence beginning with ‘Therefore’ – recast, I am unsure what the authors are trying to convey.
8547, line 5 – insert a ‘the’ before transition zone and this not a full sentence – re-cast

(I think the authors meant ‘The position of the transition zone of the reservoir moves as a result of the season).
8547, line 7 – restricted
8547, line 8 – recast ‘Differently’, a bit awkward – perhaps ‘Contrarily’
8547, line 15 – insert ‘a’ before density gradient
8547, line 21 – replace ‘a’ with ‘the’ before lighter reservoir water
8547, line 26 – here Chlorophyll a is specifically mentioned. Throughout the manuscript, Chl was used, which I understand was a combination of several chlorophyll pigments. Please be consistent throughout.
8548, line 7 – perhaps recast. The conditions are not right when the surface water is dominated by riverine water. It isn’t until the conditions are more ‘lake’ – like that the conditions are optimal for phytoplankton to bloom.
8548, line 10 – sentence beginning with ...The results...’ Please re-cast sentence. Awkward and difficult to discern what the authors are attempting to convey. Also, the sentence following this particular sentence needs to be clarified. I am unsure what is meant by ‘The daily scale variation...’?
Also, quite a few articles are missing throughout the manuscript (I mention this here because in within this paragraph alone – several instances occur). I’ve attempted to correct some of these... but the entire manuscript should be checked. For example – the sentence beginning on line 19, 8548 – there are 4 articles missing: the transition zone, a result, the dry season, and the inflow.
8549, line 3 – reservoirs
8549, line 27+ – spatial heterogeneity discussion? Re-cast/clarify. There are quite a few areas within this entire paragraph that should be re-written. The writing is unclear and too colloquial.
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