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Biogeosciences Discussions

Interactive comment on "Regional-scale lateral carbon transport and CO_2 evasion in temperate stream catchments" *by* Katrin Magin et al.

Anonymous Referee #3

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General comments:

Katrin Magin and colleagues presented a synthesis of >200 catchments examining the relationships between lateral carbon export and CO2 emissions and terrestrial net primary production (NPP) in southwest Germany. Inland waters have recently been recognized as important components in the global carbon cycle. While widespread studies have been conducted worldwide, most of these studies are based on individual catchments and a synthesis involving multiple catchments remains lacking. This manuscript is well-organized and quite timely, and will provide insights into the understanding of catchment carbon cycle (or budget) at regional scales.

My first major concern after reading this manuscript is the carbon storage term which has not yet been considered when the authors evaluated catchment-scale carbon bud-

get. Caron burial associated with soil erosion and sediment deposition within catchments is a quite important component in carbon budget assessments (e.g., Smith et al., 2001). If the traditional sediment delivery ratio of 10% is assumed (Harden et al., 1999), 90% of the eroded POC from land may have been stored somewhere within the catchment and partly exposed to decomposition (thus evasion to the atmosphere). This missing term may affect the redistribution of carbon (downstream discharge vs. CO2 evasion) as well as the amount of total carbon input from land. Incorporating this term will thus refine the budget result.

My second concern is the estimation of CO2 evasion. What are the resulting k600 values? Are they comparable to those based on field direct measurements (e.g., floating chamber or eddy covariance)? Estimation of the total areal extent of water surface by means of the parameters derived from USA catchments is probably problematic (see my specific comment below). In addition, can the available dataset suggest any seasonal variability in CO2 evasion?

Specific comments:

Line 19: please clarify 'catchment-specific total export rate'. Is it the normalized carbon export by catchment area?

Line 29-30: the latest CO2 evasion from global rivers and streams is 0.65 Pg C/yr by Lauerwald et al., (2015).

Line 50: remove 'differ'.

Line 71: the reference 'Strahler, 1957' should move to line 56.

Line 77: remaining→retained

Line 81-83. What's the data quality and what kinds of standards for water sampling and processing were used? Estimating pCO2 from alkalinity and pH has been criticized for causing biases due to noncarbonate impacts (Abril et al., 2015). An uncertainty analysis should be provided here. I also suggest to provide the range of pH and alkalinity,

possibly into Table 1.

Line 95-97: how was the site-specific pCO2 interpolated to the upstream catchments? And which interpolation technique was used?

Line 102-103: These arbitrary parameters derived from American rivers may not necessarily be representative of German rivers. See Leopold and Maddock (1953).

Line 105: Is a resolution of 10m enough to estimate channel slope changes?

Line 125-126: Because the mean NPP for the period 2000-2013 is used here while the pCO2 data is for the period 1970-2011, it is better to explicitly indicate the distribution frequency of pCO2 data over the study period. For example, if the most of the pCO2 data were for the period 1970-1980, then using the NPP for 2000-2013 would be problematic.

Line 135: Based on the given definition, the 'drainage rate' term should be 'runoff depth' in a formal way.

Line 146: Please quantify 'only a small fraction'.

Line 158: For the total C input, how about the POC term and the carbon storage term? See my major comment.

Line 220-223: Are there peatlands within the studied catchments?

Line 229-230: Is the absence of the carbon yield and NPP correlation due to failure to measure pCO2 during flooding periods? The short-duration carbon export during flooding events usually accounts for disproportionately a large share of the annual total carbon export.

Line 238: please clarify the 'surface area'. The global surface area?

Line 244-247: Could it also be because of chemical weathering and groundwater inputs? Rock weathering in carbonate-dominated catchments can be a significant con-

tributor to DIC. I would suggest the authors to make a brief introduction about the lithology and mineralogy in the study area section (2.1).

Line 262: please summarize the study and make a short conclusion.

Figure 2. It seems the top 2(?) data points far away from the majority are outliers. Please check and make the regression again, if necessary.

Table 1. pH could also be tabulated here. Is there any trend in pH from SO1 to SO4?

References

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