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Biogeosciences
Discussions

Interactive comment on "Carbon dioxide dynamics in an agricultural headwater stream driven by hydrology and primary production" *by* Marcus B. Wallin et al.

Anonymous Referee #2

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Inland waters and specifically headwaters emit significant amounts of CO2 to the atmosphere; however, studies focusing in agricultural streams and including continuously measured in-situ CO2 from are rather rare. In this MS, the authors continuously monitored CO2 with cost-effective Co2 sensors during one year and explored the spatio-temporal variations of CO2 throughout the year as a function of hydrology and metabolism.

General comments The MS bg-2019-486 provides an interesting study about CO2 dynamics in one stream draining a catchment largely dominated by agriculture. An important finding is that stream intermittency can cause rapid pulses of CO2 even in

catchment with no pronounced dry and wet seasons. I think this is an important matter to better understand carbon emissions from streams at the global scale, in the context of climate change (change in hydrology). In line with this result, it could be useful to add somewhere in the discussion the spatial representativeness at the global scale of the stream studied here. In addition, it could be nice to add discussion/comparison of this agricultural stream with other agricultural streams worldwide, because the hydrology should be very different.To increase the readability, I suggest to better define some terms used in this study, particularly, open-water season, and the different periods, and also define better the time-intervals of these seasons throughout the text. Indeed, to my opinion, those terms are specific to boreal systems, and sometimes it is difficult to follow for a reader who is novice with boreal landscapes. A second important finding is the strong biologic control (aquatic primary production) of the CO2 dynamics during base flow that should decrease CO2 emissions during this period. Indeed, during base flow it is common to observed higher CO2 concentration in streams because deeper levels of groundwater are involved. Perhaps the authors could further developed this. Overall, I found the dataset very interesting; it is rare to have such continuous measurements for CO2 in streams. In addition, I found the paper well written. Perhaps the quality of some figures could be improved. Overall, I support publication of this manuscript and below are some more detailed comments.

Specific comments

Abstract L. 15-16: It would be nice for the reader adding the size of the catchment, the date of open-water season, and the time-step of CO2 measurements.

Introduction L.31-33: The authors can check this reference that suit with their study (Deirmendjian et al, 2019. Importance of the vegetation-groundwater-stream continuum to understand transformation of biogenic carbon in aquatic systems – a case study based on a pine maize comparison in a lowland sandy watershed), where the concentration of CO2 in agricultural and forested streams (and in groundwater) in a temperate catchment was compared. They found no differences between both streams

because degassing in agricultural streams was prevented. L. 43-45: Please clarify this sentence. You mean that different level of soils are exported in function of the change in hydrology? L-40-55: To my opinion, there is a lightly lack of spatial references in this paragraph. Indeed, I guess that agricultural streams in tropical or boreal areas are very different in terms of hydrology and carbon dynamics. Could you mention spatial references? L. 69: High-resolution: what is the time-step of measurements?

Methods L.78: What kind of cropland it is? This is important for the d13C-DIC L. 83: Lower end: how much lower? L. 85: Growing season: what is the time interval? L. 97: what was the concentration of gas standards? L.100: discharge rates lower than 0 L/s: so you mean when the stream was dry or when the stream was frozen? Or both? It is a bit confusing. L.101: Figure S1 L109: You wrote one measurements each minute but then a temporal resolution of 30. It is a bit confusing what is the meaning of temporal resolution here? L.120: What is the volume of the injections? L.129: Please specify that these streams were not located in your catchment and add the reference to the figure S2 L. 145: Please define better your four periods. What are the time intervals?

Results L.157: Please refer to figure 3 L.168-172: Please add corresponding pCO2 for reference, as you did L.166. To my opinion, I suggest to do that for the remainder of the text because pCO2 in ppmv is more “understandable” that CO2 in mg/L.

Discussion: L.225: I would not rush on conclusion about zero/limited tree cover along agricultural streams, at the global scale. I am agree considering your figure S2 that this is the case in your catchment. However, in temperate climate it is very common to observe riparian forest along agricultural streams.

Figures Figure 1: In the left part, I suggest to add a map of Europe rather than just Sweden. Please add a scale in the left part too. Figure 2: I suggest to separate the different periods (autumn, snowmelt, spring, dry period) with dotted lines, as you did in the next figure. Figure 4: It is not very intuitive what the time interval is for A, B, C and D. Figure 5: Same remark Figure 7: Perhaps add regression line with slope

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