

Biogeosciences Discuss., referee comment RC1
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Comment on bg-2022-62

Anonymous Referee #1

Referee comment on "Temporal patterns and potential drivers of CO₂ emission from dry sediments of a large river" by Matthias Koschorreck et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2022-62-RC1>, 2022

I have reviewed the manuscript entitled *Temporal patterns and potential drivers of CO₂ emission from dry sediments of a large river*. The authors perform several GHG measured with different techniques in the riparian area of a river, during different periods along a year. They complemented these measures with several other variables related to the sediment characteristics. Although I think the content of the study is novel and interesting and the topic is relevant for this journal, my major concern relates in the spatial scale of the study. It was performed in a specific reach of a large river, with very specific environmental characteristics. I think this limitation in the spatial scale should be acknowledged and taken in account while discussing the results.

General comments:

#1. In the introduction, the objective of the study was presented as the determination the origin of the CO₂ emitted by the dry sediment, saying that a possible source would be the seeping of ground water. When saying "seeping of ground water" the first thing that came to my mind was the presence of a ground water source (aquifer) in the catchment.

However, in this case, the term "seeping water" wanted to refer to the distance of the dry sediment to the flowing water in the river channel and to the saturated layer. I think this should be clear since the very beginning, to clearly understand the purpose of the different measures that were performed and the experimental design in general.

#2. The title of the study says "...CO₂ emission from dry sediments of a large river" but the spatial scale of the study was small, measures were not taken all along the river but in a specific reach. Taking in account the spatial scale of the study, I would change the title to make it a bit less pretentious.

#3. The aim of the study was to elucidate the origin of the CO₂ emissions. The response to this question was discussed taking together all different measured variables (section 4.1). However, the relationship of all the measured variables with the aim of the study was not totally clear for me while reading the methods and results section. Due to the high number of variables, I suggest adding a small explanation of their propose in the methods section. Moreover, finally not only the origin of the emitted CO₂ (ground water or respiration) was addressed, but also the drivers of the magnitude of the fluxes. I think that taking in account the extend of this other aspect, it should be also mentioned in the introduction and aim of the study.

Specific comments:

Introduction

L41: Large rivers with high-flow are also susceptible to seasonal dry (i.e., Albarine river catchment in sud-west France, where more than 80 km representing ~25 % of the catchment and including the most downstream part are intermittent)

L55: and what about long term dynamics?

L65: see my general comment #1 about the use of the term "water seeping water".

L75-77: related again to the general comment #1, make clear what you mean with "ground water" to clearly understand the aim of the study

Methods

L87: Could you specify the length of the reach? Maybe it's included in figure S1 but I was unable to download the supplementary material.

L96: I don't understand what do you mean with "the chambers measured hourly CO₂ fluxes". Did you measure 5 minutes intervals during a period of 1 hour?

L111: Why were these periods chosen? Looking at Figure 1, there were also other time-frames in which the water level was lower than in those selected periods

L152: The significance of the acronym "Bq" is not specified

L154: How/Where (flowing channel? ground water?) were these water samples taken?

L189: The significance of the acronym "g-dw" has not been specified

L207: For how long were the drying and the ignition?

L252-253: As the variability of the data shows a temporal pattern, it would be interesting to analyse the potential drivers of this changes.

L268: And what about precipitation? Why didn't you include it in the mixed model?

Figure 3. The way the hour is indicated in legend (0-20) seems a bit estrange

Results

Related to the general comment #3, at a first reading only the section 3.2.1 of the results seems directly related to the current aim of the study (source of the CO₂).

Discussion

The first point of the discussion (4.1) perfectly addresses the aim of the study and summarises all the results obtained. I really like the way it's written, very clear and direct.

In relationship with the general comment #2, along the discussion, the influence of different factors (dependence of temperature, sediment characteristics, thickness of the unsaturated layer...) in the CO₂ emissions were discussed. However, although performed in a big river, the spatial scale of the study was small. Those factors can substantially change along the river, from the headwaters (typically at higher altitude, with more forested and closer riparian areas) to downstream areas (wider reaches, less forested riparian areas, more exposed to solar radiation). I think this spatial scale (together with the already addressed temporal scale) should be at least mentioned in the discussion.

Typing errors:

L207: repeated words: loss after

L243: May