

Interactive comment on “Organic carbon mass accumulation rate regulates the flux of reduced substances from the sediments of deep lakes” by Thomas Steinsberger et al.

Anonymous Referee #1

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Steinsberger et al. investigate the flux of reduced substances (Fred) from sediments in five deep lakes of different trophic states. They found no indication that the trophic state of the lakes controls Fred. However, organic carbon mass accumulation rates together with the mean hypolimnion depth of the lakes relate to Fred and can potentially be used to estimate the influence of Fred to O₂ consumption in eutrophic deep lakes. The authors collected a big dataset from five deep lakes and calculate/estimate some factors that are relevant for assessing the hypolimnetic O₂ consumption and its driving factors.

The overall topic of the paper falls into the scope of Biogeosciences and it presents some novel and a solid dataset to assess the fluxes of reduced compounds from sed-

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iments and its role for hypolimnetic oxygen consumption. The overall presentation of the methods and results/discussion could be improved. The whole manuscript seems lengthy and quite descriptive at many places. I will elaborate on this in more specific comments below. I would recommend a publication but only after a rewriting of the aims/hypothesis and methods and a restructuring of the discussion to strengthen the main messages.

Major comments:

1) The aims of the paper could be reformulated to increase the curiosity of the reader. As it is now, the aims are: extend a dataset/assess constraints/discuss spatial variabilities and consequences. . . This is also reflected in the results/discussion section that is often hard to follow and difficult to say what the authors want to say/conclude here. The first two paragraphs in the “Results and Discussion” (page 5) are only data descriptions without any interpretations jumping from one lake to the other. I got easily lost in the details and did not get the major results and their interpretation, something that I would expect at the beginning of this section. I would suggest to reformulate the aims and maybe try to formulate a hypothesis (or hypotheses) or expectations from the data and analyses. With those newly formulated hypotheses the “Results and Discussion” section should be rewritten/-structured, focusing on the new hypotheses.

2) The “Materials and Methods” description has missing information:

How many cores were taken per day and depth? I am confused because the authors talk about a “set of cores” collected in Lake Zug (p. 3 line 2). Was there any replication or does this refer to the three cores taken for all analyses including reduced substances via capillary electrophoresis, methane and water/TOC content? In the introduction, the authors talk about 50 cores that they took (p. 2 line 21). When I count one core per date and depth for the five lakes (Table 1), I get to 57 cores, which means no replication. How reliable are those data without replication? And what happened to the 7 cores that do not match with the number stated and my calculations?

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It would also be nice to read somewhere how many times the reduced substances via capillary electrophoresis, methane and water/TOC content in each core were measured and to what depth. The distances of the holes are mentioned I could not figure out how deep the sediment was, only from looking at figure 1. From Figure 1, I can also see that it has different numbers (by counting dots) and sometimes different depths and that the distances between points change. This is not mentioned at all in the method description. I would like to see a photograph of the cores with the holes, maybe added to the supplement. That would make it much easier to picture such cores.

A short description about the literature search in the main text would be helpful. How did the authors search for those data and what did they extract and did they all use similar methods?

3) Assessment of uncertainty of data: The authors provide only limited information on the range of their data. I already asked the question if the authors replicate the sampling at one point on one sampling day and if not how reliable the data are. In figure 1, there are ranges of the data and you can see that especially at the deepest points, there are wide ranges. But in table 2, there is only one value. Did the authors calculate averages for the sampling times? Or are these data from only one sampling time? It is hard to assess the variability of the data at each sampling point without any knowledge of variation or uncertainty analysis. The authors do not test their results!

4) I miss some references throughout the text:

p. 2 line 5: "This relationship suggested a constant fraction of O₂ consumption from the sediments, which agreed with the few available estimations from direct of sediment porewater measurements of reduced compounds (ref.)." p. 3 line 17-21: a reference for the headspace technique? p. 4 line 26: "The lower TOC-MAR calculation depth of 10 cm was chosen to remain within the timeframe where steady state conditions can be assumed (ref.)." p. 7 line 17-19: "The areal accumulation of TOC per time is controlled by gross sedimentation (which is related to primary production), O₂ concentration in

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the lake bottom water, biological factors like grazing and bioturbation, and physical parameters such as sediment focusing (ref.)." Or is this results taken from the author's own data?

5) Why did the authors install the sediment traps at 15 m water depth? All sampling points of the cores are at deeper points and the sedimentation can change with deeper waters, especially because 15 m water depth is above the hypolimnion in most lakes. Does this influence the data and conclusions? Does it play a role and if yes, how? Please also consider discussing this in the main text.

Minor points: - P. 2 line 4: "...from direct sediment porewater..." Delete "of"! - P. 5 line 4: in the four lakes ... No capital letter! - P. 8 line 3: do you need to say "from the sediments were virtually zero"? Do the authors refer to both lakes that they mention before or only one here? - P. 10 line 3: "more commonly available than"

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