

BG-2022-143 RC2

General Comments

First, I would like to congratulate the authors on a very interesting manuscript. It provides insight into the biogeochemistry of the described estuary and attempts to quantify contributions of alkalinity from various sources.

I have a couple general comments about this manuscript. Firstly, I would like to suggest that the authors have the manuscript thoroughly proof-read before publication. I found several grammatical issues and a general lack of flow due to sentence/paragraph structure throughout the manuscript. In the section below I have identified some of these. This should be addressed for the reader's benefit.

Next, I have a general comment about the methods section. I think the authors should consider restructuring this section. First, a detailed description of the study site should be presented. I found that the authors did not go into enough detail when describing the estuary and it would really help "set the scene" for the reader if they bulked this up a bit. Sampling protocols should be removed from the study site section and have its own section that follows that describes the water sampling techniques as well as how each individual parameter was subsampled and preserved. The model/make of the CTD + O₂ probe on the FerryBox should also be provided. I noticed that the authors have grouped sampling/preservation techniques in with each analytical procedure. These should be removed and added to the new sampling section above to make the process of the study easier to follow sequentially. Try the following structure for the methods: Study Site -> Sampling -> Analytical Procedures...etc.

My final comment very similar to that of Reviewer 1. The processes described in this manuscript are based on estimations instead of field observation. On top of that, the dynamic nature of estuaries can lead to high variability both spatially and temporally which adds large uncertainties to estimations from models. Although the conclusions presented by the authors are compelling, they should add a note in the discussion or conclusions stating that these estimations may be serendipitous due to large levels of uncertainty.

AC: Dear reviewer, we gratefully appreciate your helpful comments. We have considered your comments and reworked the manuscript to improve it. You will find our answers below.

In accordance to your suggestion, we restructured the methods section and added a more detailed study site description as section (2.1). In there, we also included some sentences, which were previously in the Introduction and removed them there to prevent doubling. We also added the information of the O₂ optode. A more detailed description of the FerryBox is given in the reference (Petersen et al., 2011) which is given in the text. We also added a statement to uncertainties due to natural variabilities in the text. Also, a native speaker proof-read the manuscript.

We used field-observations of dissolved inventories that include the net metabolic generated amount of the parameters, rather than rate measurements. We rely on the strength of integrative capacities of our tracers (TA & DIC), which facilitate reliable estimations of metabolic processes. Such estimations should be seen as a powerful approach complementary to direct rate or process assessments.

We are aware that this natural system is variable and naturally influenced. The assessment of variability is out of scope of this work, but the further investigation of natural variability should be addressed in future research. We added a statement to uncertainties due to natural variability in the text.

Other Comments

L31: Add Gilbert et al. 2005 (<https://doi.org/10.4319/lo.2005.50.5.1654>) as a reference when describing oxygen deficits. It gives a 72-year record of oxygen depletion in the St. Lawrence Estuary.

AC: Done.

L34: Grammatical error – “It encompassing an area that begins” should read “It encompasses an area that begins”.

AC: Done.

L39-41: The following piece of writing does not flow well: “Eutrophication can cause large phytoplankton blooms both in rivers and in the coastal zone. Whose decay increases oxygen consumption....”. These few lines should be re-written to read something like the following “Eutrophication can generate phytoplankton blooms in both rivers and the coastal zone. This increased flux in organic matter can lead to higher rates of oxygen consumption which can drive hypoxia in stratified bodies of water such as estuaries and the coastal ocean”.

AC: We thank you for this comment. We have rearranged the sentence in accordance with your comment.

L41-42: When describing hypoxia in the coastal ocean you should add the following sources: Gilbert et al. 2005 (<https://doi.org/10.4319/lo.2005.50.5.1654>), Rabailas et al. 2001 (<https://doi.org/10.2134/jeq2001.302320x>), and Rabailas et al. 2002 (<https://doi.org/10.1146/annurev.ecolsys.33.010802.150513>).

AC: We have included the suggested references in the text.

L42-44: Again, there are some issues with flow here. Instead of describing the dredging then having a very short sentence with a statement that organic matter turnover exists, you should combine the sentences. Try something like: A hotspot of organic matter turnover exists upstream of the Port of Hamburg, where recently the sea floor has been dredged (increasing the depth from ~5 m to ~20 m) to increase accessibility for ships.”

AC: According to your comment, we have rearranged the sentences.

L57-60: I agree with Reviewer 1 on this section. The goals of this study should be separated for clarity. Also, the authors may want to consider removing the use of first person identifiers such as “We” or “I” in the manuscript and opt for a third person approach. For example changing “We want to answer the questions of....” to “This study aims to answer the questions of...”.

AC: We clarified the aims of the study by including a) and b). We changed the “This study aims to..” sentence in the Introduction like suggested, but we would like to stick to the first person approach in the major part of the manuscript.

L65: Grammatical error – “This study based on samples...” should read “This study is based on samples...”.

AC: Done.

L155-157: Please provide individual box volumes and fill times.

AC: Individual box volumes and fill times are provided in Table 1 for each box. To make this more clear, we referred to Table 1 in the text.