

Interactive comment on “The carbon budget of the Baltic Sea” by K. Kuliński and J. Pempkowiak

Anonymous Referee #1

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This ms provides a synthesis of C fluxes in the Baltic Sea. This paper arrives at different fluxes than those proposed by Thomas et al. Differences are discussed. Such box budgeting exercises are useful.

1. the authors should briefly mention the content of their recent papers Kulinski & Pempkowiak (2011) and Kulinski et al. (2011), so that reader can understand what is the originality of the present work and make sure there is no double publication.
2. While box models are a useful tool to understand the main players in carbon cycling, I'm not sure that the CO₂ exchange with the atmosphere as a closing term can be robust. A few percent error (5% ?) propagated on the all the bulk fluxes will lead to 100% error on the net flux. So I'm not sure that a box model approach can provide conclusive answers to the status as a source of a sink for atmospheric CO₂. On the other hand as mentioned by authors there seem to be a few publications on the Baltic

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that provide divergent air-sea CO₂ flux estimations.

3. In table 1, authors report TIC and TOC fluxes from rivers. I would be nice if the TOC fluxes could be broken down into POC and DOC fluxes. Although this is not necessary for the budget, such fluxes would be useful to others. Regarding TIC, it is unclear what it stands for. Is this the sum of DIC and PIC ? If so please break down the fluxes into the two components.

4. There is a term in the budget missing, regarding PIC. PIC is also buried in sediments. There are benthic calcifiers (invertebrates (bivalves, etc. . .), coralline algae, . . .) in the Baltic Sea that should contribute to this flux. Also there are some reports of suspended PIC as well (Bernard and van Grieken 1989). This term might be minor, but since the authors attempted to be as exhaustive as possible (even estimating dry deposition of CO₂) they should also attempt to provide a number on this.

5. It is unclear in which zone the organic carbon burial estimates were made. We can imagine a situation where the organic carbon from rivers and the diffusive organic carbon inputs are deposited and buried near-shore and that these deposition areas were missed in the budget. The carbon burial estimates probably apply to the more open areas of the Baltic and not the near-shore areas.

6. Page 4849 Line 8 : justify the choice of temperature (10°C)

7. Page 4849 Line 15 : If I understand this correctly, BOD should be a change of O₂ concentration per unit of time (mol / m³ / time). How was this converted into a flux that should be expressed as a quantity per surface and per unit of time (mol / m² / time) ?

8. It is a bit confusing to use a mix of units Gg/yr and Tg/yr.

References

Bernard P.C. and van Grieken (1989). Geochemistry of suspended matter from the Baltic Sea. 1. Results of individual particle characterisation by automated electron microprobe. *Marine Chem.* 26: 155-177.

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