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Comment on bg-2021-164

Anonymous Referee #2

Referee comment on "Nutrient transport and transformation in macrotidal estuaries of the French Atlantic coast: a modelling approach using C-GEM" by Xi Wei et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2021-164-RC2, 2021

Review of

Nutrient transport and transformation in macrotidal estuaries of the French Atlantic coast: a modelling approach using C-GEM

By Xi Wei et al.

In this manuscript Wei et al apply an existing model to 7 macrotidal estuaries along the French coast for the years 2014 – 2016 to simulate impacts of estuarine characteristics on riverine nutrient fluxes to the coastal Atlantic. The model used has been tested widely across different systems and modeled parameters compare well with observed values. The paper is well written, and the main conclusions that large estuaries have higher retention rates presumably due to higher residence times is clearly supported by the results.

In my view, two aspects need attention: 1) Riverine particulate (and organically bound) nutrient input and 2) impact of import particulate (organic)matter from the coastal Atlantic.

L85ff: Estuarine circulation is driving the accumulation of marine particulate matter and instrumental in the formation of the Turbidity Maximum (Burchard et al., 2018). How is this solved in a 1-D model? Import of marine organic matter can be an important source of nutrients in the estuary and how is this accounted for in your model set-up?

L129ff: The data used include inorganic nutrients. However, for a nutrient budget it is important to estimate total nutrient loads as many nutrients may be bound to organic matter (either dissolved or particulate and in case of P, Fe-bound PO4 may be important). Especially in case of riverine phytoplankton blooms, particulate loads may be significant. Living phytoplankton may only capture a small part of the total particulate nutrient load (e.g.Hillebrand et al., 2018) due to a substantial fraction of detritus. How do you account for this?

Furthermore, I suggest to use moles throughout the text.

Further smaller comments:

L 67-70: This sentence is difficult to understand (…despite mixing curves have (having?) been useful… Furthermore, I suggest to elaborate a bit on the limitation of using mixing curves. Wouldn't they have been useful to constraint he presented budgets?

L185ff: The Dordogne has exceptionally high SPM (>40 * other rivers). What is the reason and what is the impact of this on the model outcome of the Gironde?

L212ff: How would an import of SPM from the coastal Atlantic influence the parameters listed in Table 5? By which modelled processes is the SPM-max generated?

L240: Again, how is dealt with particulate/organically bound nutrients?

L273ff: Are the high Gironde values for SPM driven by the high Dordogne values? Is the SPM in the SPM max mainly riverine or marine?

L285ff: Desorption of PO4 is mentioned but from the model description I notice that this is not implemented in the present model. Please explain.

L289: I suggest to use moles instead of grams to indicate nutrient concentrations. Please note that phosphorus is misspelled as phosphorous at several instances throughout the text and in tables.

L361ff: If riverine TN is derived from DIN + N in phytoplankton, the TN load may be underestimated as riverine particulate matter may consist of phytoplankton detritus (see e.g. Hillebrand et al., 2018). Also DON and DOP are not accounted for. The potential underestimation of TN and TP loads should be discussed.

L 381ff: What drives the differences in TN/TP ratio?

L441: Unclear sentence: …often unavailable data sets (needed for?)

L507: which elimination process could be responsible (other than denitrification and sedimentation?)

L524: what is meant by diatom outburst under osmotic pressure?

Literature cited

Burchard et al. (2018) Sediment Trapping in Estuaries. Annual Review of Marine Science. Vol. 10:371-395

Hillebrand et al., (2018) Dynamics of total suspended matter and phytoplankton loads in the river Elbe Journal of Soils and Sediments (2018) 18:3104–3113