Biogeosciences Discussions

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Comment on bg-2021-59

Anonymous Referee #2

Referee comment on "Evolution of the long-term and estuary-scale phytoplankton patterns in the Scheldt estuary: the disappearance of net growth in the brackish region" by Dante M. L. Horemans et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2021-59-RC2, 2021

Overall Statements:

The manuscript "Evolution of the long-term and estuary-scale phytoplankton patterns in the Scheldt estuary: the disappearance of net growth in the brackish region" by Dante M. L. Horemans, Yoeri M. Dijkstra, Michèle Tackx, Patrick Meire, and Tom J. S. Cox describes the variations of Chl-a distribution in the Scheldt estuary within the time interval 2004 to 2018. The authors try to understand the high spring Chl-a concentrations in the brackish region during the years 2008-2014 which was not observed during other periods. In a first step they analyse observed data such as Chl-a concentration itself, zooplankton abundance, salinity, suspended matter concentration, and light climate related data. Except for some difficulties (see below) these investigations appear sound. In a second step the authors apply an over-simplified model which is not able to explain the phenomena observed within the data. Using parameter-variations they try to show that zooplankton grazing may be the important mechanism to reproduce the elevated spring Chl-a concentrations within the brackish region. The authors argue to use this simple model in order to have good performance. But this does not help as the model does not tackle the phytoplankton dynamics appropriately.

I suggest applying a more adequate model, which describes the investigated time interval in a transient manner and resolves different phytoplankton and zooplankton groups. Boundary conditions should be defined temporally variable. The excellent observation-derived data sets may be used for validation.

Based on these, my recommendation is reject.

Detailed remarks:

L 5: Define the brackish region according to salinity and position.

L 16 ff:

- Do you know similar studies for other rivers and estuaries? Gypens et al 2013 (http://dx.doi.org/10.1016/j.jmarsys.2012.10.006) studied the Scheldt estuary and came to more detailed and opposing results.
- Other parameters may play a role too (see McQuatters–Gollop and Vermaat (2011), doi:10.1016/j.seares.2010.12.004)
- Winter values of zooplankton may play a key role (Dudeck et al 2021, doi:10.1093/plankt/fbab011)

L20: The processes are governed by temperature variations .. salinity variations .. nutrient dynamics.

L59: Give the position of the gauge station.

L64: Silicate concentrations?

L76: Refer to English written peer reviewed articles only.

L77ff: Are the Chl-a measuring methods compatible? I know that in Rijkswaterstaat some efforts have been made to homogenize both approaches.

Figure 1: Indicate the brackish region and give km-positions for at least some of the stations.

L97: Are these methods compatible?

L109: Please introduce first the context of mu-max and alpha.

L116: Give the coordinates and resolution of the model area.

L131: ETM – please introduce this in full words.

L143: To define seaside concentration constant is questionable.

L159: The formula should have "minus alpha" not "alpha".

L161: The formula should have "+ kc" and "+kp".

L196: You mean surface concentrations?

L208ff: You often indicate the maximum as the mean plus standard deviation. This is not really the maximum.

L212: I do not understand the argument: " .., as the estuary is narrow and shallow in the upstream region."

L225: Can you really justify that SPM is in 2015 – 2018 (at 80 – 120 km) significantly larger than during the other periods, and KD is not significantly larger?

Figure 2 caption: b) is not shown

Figure 3 caption: It is not in the range km 60 – 90 but in the range km 60 – 80.

L227: You used the numbers of May?

L231: This is not always true: See March: The discharge is almost equal but not the salt

intrusion.

L242: Say increasing or decreasing development.

L261: from L252-L253 I've learned it is decreasing.

L261- L266: I do not understand this section.

L269: You see an accumulation at km 40-60. This is not your brackish region.

L334-L335: Highlight this by a figure and discuss it seriously.

L351: Salinity: This is in opposite to Fig. 5b: The intrusion of salt is largest in 2015 – 2018 for April and later.

L353: Have you studied the planktonic community?

L398: High SPM normally induce light inhibition for phytoplankton.

L432: This formula has 2 degrees of freedom. How do you find an optimum?

L436: The time-dependence of the parameters are questionable.

L451 ff: The method to calculate SPM for the early periods is very critical, as deep-water SPM structures are governed rather by benthic-pelagic interactions than by surface variations.

L458: Neglecting background and phytoplankton induced light extinction is very critical.

Figure C1. Please give units.