

The manuscript “Transformative processes in the Oder Lagoon as seen from a model perspective” presents and validates a new model setup for the Oder Lagoon in Northern Germany. Further it assesses the nutrient retention in the Lagoon and thus adds to our understanding of the supply of nutrients from the Oder River to the Baltic Sea. The role of coastal zones as nutrient filters is an important and often overlooked topic, and especially the large nutrient flow from the Oder is important for the eutrophication of the Baltic Sea.

I suggest accept after minor revisions

Major comments:

I suggest removing the part on resolution (section 3.4). While interesting, I find that the role of resolution does not quite fit with the general scope of the paper, and that the topic deserves further elaboration in a different study.

I suggest adding a figure/table on the seasonal variability of the different nutrient fractions (e.g. DIN, DON, PON) delivered to the Baltic Sea. From Figure 4, it looks like both DIN and DIP are very low in summer, suggesting a large seasonal variability in the fractions delivered to the Baltic. From a management point of view, the bioavailability of the nutrient supply is very important, especially if the bioavailability of the nutrients is very low during summer.

Discussion: Some thoughts about the relevance of the study for management of nutrients would be interesting. If targets are already reached, how were these targets defined, and did enough knowledge even exist regarding supply of nutrients from the Oder to the Baltic Sea? Are the targets too low if they were already reached?

Add section about nutrient cycling in the lagoon in the conclusion. The complete lack of this seems odd as it is the main focus of the manuscript.

Minor comments:

Title: I would suggest adding the word “nutrients”

L9: “Relative” nitrogen decreases

L25: What does “pollution” refer to

L47: Skogen et al., 2024 and 2021 have discussions on models versus observations.

L55: Also, it adds error to biogeochemical models of the Baltic Sea

L58: high”ly” resolved

L60: I would remove this

Figure 1a: A km-scale would improve understanding. Also the a thicker line at the coastlines would make the plot easier to see

L98: What was the spin-up time for water and sediment, how were the variables initialized. Do you have any knowledge on realistic sediment concentrations?

Figure 2 and 4: If the plots were made wider, the variability would be easier to see

L114: Is this due to lack of observations during peak times? Some discussion on the number of observations per year would be nice. It is very difficult to see from the plots how well the seasonal cycle is covered.

Figure 5: It took me a while to understand the difference between the figures. The title of b could be changed to something like “Mean duration of anoxic periods”

L198: What are the consequences of underestimation of DIP in summer, for productivity and the nitrogen cycle, including nutrient retention.

L249ff: To me the “,” and “.” In the numbering is confusing. European convention would be 1000 = 1.000,0 right? Not sure if the journal wants it differently, otherwise I would suggest not using comma to mark thousand.