Review of the manuscript by Mallissery et al., entitled "Temperature driven coastal processes and their far reaching effectson deep Baltic Sea biogeochemical dynamics"

Title
Please consider removing "far reaching" from the title. The wording is vague and open to interpretation (e.g., does the effect reaches outside the Baltic, how far is far?)

Abstract

Line 2:
The term "coastal filter" would benefit from clarification. It is often interpreted primarily as coastal nutrient retention, which may not fully reflect how the concept is applied in this study. Consider briefly explaining what is meant by the term in this context, or alternatively, focus more directly on the role and importance of the coastal zone and why it is critical for basin-scale biogeochemistry.

Line 4:
The model name MOM-ERGOM is introduced without explanation. Since abbreviations should generally be avoided in the abstract, consider writing out the full model name or rephrasing the sentence to avoid using the abbreviation.

Line 7:
Please spell out and briefly define the Q10 temperature coefficient rather than using only the symbol. A short clarification would improve accessibility for readers who may not be familiar with this parameter.

Line 12–14:
This appears to be a key finding and would benefit from clearer wording. I suggest rephrasing for precision and impact. For example:
"Our results suggest that, under a warming climate, enhanced temperature-driven remineralization in both sediments and the water column may substantially increase nutrient availability, with the potential to stimulate primary productivity."
Ensuring the causal link and magnitude of the effect are clearly expressed will strengthen this important conclusion.

Line 17–18:
The term "disproportionately" requires clarification. Disproportionate relative to what — the magnitude of the imposed temperature change, a linear expectation, or previous studies? Please specify the reference point.

More generally, I encourage the authors to carefully review their use of the term "sensitivity" throughout the manuscript. It is not always clear what "sensitive" refers to — sensitivity relative to which baseline, perturbation, or comparison? In some cases, "strong response" or "high impact" may be more appropriate if that is what is meant. A clearer and more consistent definition of "sensitivity" would improve interpretability. I have highlighted several instances, though likely not all.

Line 20:
The phrase "dynamics depend on the spatial scope of sediment recycling" is unclear and would

benefit from clarification. Please specify what is meant by "spatial scope" (e.g., coastal-only versus basin-wide enhancement).

Similarly, the phrase "when enhanced" should explicitly state what is being enhanced (e.g., temperature sensitivity, remineralization rates) to avoid ambiguity.

Line 23–24:
A comparison with empirically derived temperature dependencies from laboratory or in situ studies would strengthen the interpretation of the results. If sufficient observational constraints are not available, this limitation should be clearly acknowledged, and it should be stated explicitly that the temperature perturbations applied here are experimental and intended to explore system behavior rather than to represent directly validated future scenarios.

Introduction

Line 26-27:
Remove "(97%….)" and replace "It" by "and acts as".

Line 29:
Climate change is largely driven by human activities, and this should be reflected more clearly in the wording. Please rephrase accordingly.

In addition, the statement regarding eutrophication and hypoxia in the Baltic Sea would benefit from a broader and more balanced set of references. There are several important studies documenting these issues both prior to Almroth-Rosell (2016) and more recent contributions. Including a more comprehensive range of literature would strengthen the background section.

Line 30:
The phrase "Despite its smaller area" is not necessary in this context and can be removed without loss of clarity.

Lines 26–34:
This section could be substantially shortened or potentially removed. While briefly placing the study in a broader context can be valuable, the global ocean is not the primary focus of this manuscript. For example, carbon cycling is mentioned, yet it is not assessed in the study.

I suggest either:

1. Condensing this part to briefly frame the Baltic Sea within a broader context and then expanding the discussion section to explicitly link the study's findings to relevant global-scale processes,

   or

2. Removing the broader global framing altogether and focusing the introduction more directly and concisely on the Baltic Sea.

A clearer alignment between the introduction and the actual scope of the study would improve focus and coherence.

Line 39:

Please rephrase "It helps" by for e.g., "This process mitigates"

Line 51:
Please consider rephrasing "crudely neglected," as the expression carries a somewhat negative connotation. There are valid reasons why models simplify or omit certain coastal processes, most notably the limited availability of observational data needed for robust parameterization, as well as spatial resolution constraints and computational limitations. A more neutral formulation would be appropriate.

Line 55:
Please revise "such as as q10 temperature coefficient" to e.g.,:
"such as a temperature coefficient (commonly referred to as Q10)."

Additionally, it would be helpful to clarify whether this parameter is universally referred to as Q10 across models or whether this terminology is specific to your model formulation. Given that this parameter is central to the manuscript, it should be introduced thoroughly and clearly at first mention, including a brief explanation of its role and an appropriate reference describing its origin and theoretical basis.

Line 78:
The term "environmental conditions" is rather broad. Please specify which conditions are meant (e.g., sediment type, water depth, redox state, stratification, basin morphology, slope/steepness, etc.). Providing concrete examples would improve clarity. A stronger linkage between these environmental factors and the model results, supported by relevant references, would also strengthen the discussion section.

Line 88:
The explanatory information about q10 (currently given in brackets) should be moved to its first occurrence in the manuscript to ensure clarity and logical flow. Alternatively, avoid mentioning it briefly in Line 55 and instead provide a complete and well-structured introduction to the parameter at this point. In either case, ensure that the parameter is introduced clearly, consistently, and with appropriate referencing.

Line 107:
Replace all double "(…., (…..))" by "(…, ...)", this is the first one, but there are more along the text.

Line 134:
What does "partially" mean in this context? Please specify.

Line 138:
This is the first occurrence of CDOM in the manuscript. Please spell out the full term at first mention and retain the abbreviation thereafter for clarity.

Line 148:
This sentence could benefit from clarification. Does it mean that nutrients are assimilated by phytoplankton according to the Redfield ratio, but dissolved organic matter (DOM) is not? Please clarify to avoid ambiguity.

Line 153:
Please indicate that the equations relevant for this paper are described in Section 2.1.2. This will help guide readers to the detailed methodology.

Figure 1:
It is unclear why the figure shows Equation 1 rather than Equation 2, especially since Equation 2 is the one relevant for ERGOM in this study. Additionally, more context is needed regarding the use of these equations in other models. You refer to Equation 1 as the "classical q10 concept," but it is not clear where this classical formulation originates or how widely it is applied. Please clarify the rationale for using Equation 2 in ERGOM, explain how it differs from Equation 1, and provide context on how broadly accepted these formulations are in the modeling community. This will help readers understand the choice and significance of the equations.

Table 1:
Please consider merging Table 1 with Table 2 so that all information regarding the experiments is presented together, which would improve clarity and readability.

Additionally:

> 1) Table captions should be placed above the table, not below (this also applies to Table 2).

> 2) Consider replacing the column heading "Parameter" with "Process" and updating the text accordingly. In reality, processes such as remineralization and nitrification represent dynamic biogeochemical processes rather than simple model parameters, so this terminology would more accurately reflect their nature. In addition, q10 itself is also a parameter so it becomes confusing at times to identify which parameter is referred to in the text.

> 3) Change "Value" to "q10 Value" for clarity, if tables are merged.

Table 2:
1) Remove the brackets around the reference Neuman et al., 2022. This formatting issue appears throughout the text whenever a reference follows "in."

2) I suggest renaming the experiments to make the processes more immediately clear (this is optional, but would improve readability). For example: E1_detsed, E2_detwater, E3_DOCsed, E4_waternit (instead of just E1–E4). Similarly, C1–C4 could be renamed accordingly. This would make it easier for readers to follow which processes are being referred to when reading the Results and Discussion sections, without having to constantly refer back to the table.

3) Please clarify whether nitrification is also included in the sediments. Are E3 and C4 only applied in the water column? This should be explicitly stated to avoid ambiguity.

4) The choice of a 10% enhancement should be better justified in the text. You mention that the potential range could be as high as 50%, so it would be helpful to explain why 10% was selected— was this based on observations, literature, or is it an arbitrary value chosen for exploratory purposes?

Line 221:
It is unclear when, where, or by whom it was established that sensitivity analyses "typically involve two model simulations." I would argue that two simulations are the minimum for a basic sensitivity analysis, but in practice, the number of simulations depends on the question being tested and may

often be higher. Please either rephrase this statement or provide a supporting reference or justification for the choice of two simulations.

Line 222:

The example of water column nitrate concentration at a selected station is confusing, as this does not appear to be part of the sensitivity test described. Consider clarifying why this example is included or removing it to avoid misleading the reader.

Lines 223–224:

The sentence beginning with "For a model…" up to the equation is currently unclear. It is not obvious whether you are calculating a change in sensitivity, a percentage change, or something else.

> 1) The notation "i.e., ΔP" after parameter P is confusing, particularly because the equation defines S (sensitivity), not ΔP.

> 2) The definitions of S (sensitivity) and ΔP appear too late (line 226), making this section difficult to follow.

> 3) Symbols should only be used if they are clearly defined; otherwise, describing variables in words will improve readability.

> 4) Prior to Equation 3, you define V, but Equation 3 uses Ve and Vo, whose descriptions appear only later. All variables, their definitions, and what is being calculated should be introduced before presenting the equation.

> 5) It is also important to clarify whether V represents only a state variable (e.g., in concentration) or if it could also be a process rate, as this affects interpretation.

A clearer, stepwise explanation of what is being calculated and how each variable relates to the sensitivity metric is essential to ensure readers can follow the Results and Discussion sections.

Equation 3:

Please clarify whether this equation has a reference or is commonly recognized as a standard sensitivity metric. To me, based on the equation it self, it appears more like a calculation of bias or percentage difference rather than a sensitivity measure. If it is being called "sensitivity," explain why, and provide context or reference so that readers can interpret it appropriately. Sensitivity can be estimated in different ways, so providing an explanation of the chosen method would improve the robustness of the analysis.

Line 226:

Please clarify what you mean by "parameter." In reality, processes such as nitrification and remineralization are biogeochemical **processes**, not simple parameters, which makes the current notation of $\Delta P=0.1\times P$ somewhat confusing. It appears that the 0.1 represents your chosen 10% increase, but this could in principle take any value between 0 and 1. P corresponds to the temperature-dependent biogeochemical processes in your model (as listed in Table 2). Make sure this link between ΔP, P, and the 10% perturbation is clearly stated so that readers can interpret your calculations correctly.

Lines 225–231:

The relationship between ΔP and S (sensitivity) is not clearly explained. For example:
> 1) Why does an S of 3% correspond to $\Delta P=0.1\times P$?

2) What is the connection between V and P? Or are you referring to differences between experiments or different formulations?

Please clarify these relationships and rephrase the paragraph to explicitly define:

1) What is being varied (ΔP, P, or a specific process),

2) How this variation produces the sensitivity metric S.

3) The relevance of different S values across formulations, and

4) The meaning of "in our example", specify which example you are referring to.

Additionally, please clarify why the use of Celcius or Kelvin matters in this sensitivity analysis. As currently written, lines 225–231 are difficult to interpret and their relevance is unclear.

Line 233:
Please remove "The same holds for a measure …" and instead explicitly describe the goal of this calculation for the coastal zone. If you refer to "a third model run," please clarify which experiment or set of runs this corresponds to, as Table 2 shows multiple coastal simulations. Be precise so readers can reproduce or understand the analysis.

Line 234:
Please define what you mean by the "coastal zone," as there are multiple definitions for the Baltic Sea coastal areas. Include a reference for the one you consider in this study and add it also in the caption of Figure 2.

Avoid statements such as "we suspect," which are speculative. Instead, clearly explain the assumptions behind why you expect certain processes in coastal waters to differ from open waters. Reference the relevant literature (some of which is already in your introduction) and justify why these assumptions are applied to all shaded areas in your figures.

Finally, the repeated use of "parameter" is confusing. Consider using "process" or another term that better represents the real-world biogeochemical processes rather than model-specific terminology. Consistent and accurate wording will improve clarity throughout the manuscript.

Line 240:
Is P always the default (original) parameter? This is not clear and needs to be define well before this line. Maybe by adding this clarification "default parameter by Neuman et al…" where first mentioning P and ΔP (lines 225-230) and use same symbols or names in Table 2 (baseline = P, 10% = 0.1 x P). Also, "we may assume" does not mean much, did you or did you not assume that the default P was correct for open waters? Is P the same as the baseline? Please rephrase by for example: "In this set of experiments, we assume that the default parametrization in Neurmann et al,... i.e. the baseline, is representative of open waters, while for the coastal zone a … is closer to reality". Also, refer to Table 2 to better explain your set of experiments, instead of using "this model run".

Line 243:
Add a reference for the linear range.

Lines 245–259:

If this represents a genuinely new methodological development (or at least its first application in this type of study), this should be clearly highlighted. If the approach has been used previously, please provide appropriate references. In either case, ensure that relevant sources are cited and that proper credit is given for the conceptual or statistical foundations of the method, even if they originate from well-established statistical frameworks.

Line 247:

Please remove "may typically." The statement would benefit from clearer and more explicit reasoning. For example, instead of "is smaller than one; in the coastal…," consider rephrasing along the lines of:
"we assume that this ratio is smaller than one because the parameter is only modified in the coastal region, which represents a limited fraction of the total basin area."

Additionally, the transition toward Equation 5 could be smoother. Please explain more clearly why the ratio Sc/S alone is insufficient and why normalization by area is required. This will help justify the introduction of Equation 5 and improve the logical flow of the argument.

Lines 244–245:
Please replace "the first" with a clearer and more neutral formulation, such as:
"is an objective measure that allows comparison between…"
You may also add that it "enables assessment of the relative impact of …" to better articulate its purpose.

Line 252:

Why write "We assume that V is measured outside the coastal zone"? Is it measured outside o not? V comes from your model, you should know where is V extracted from your results. Can you refer to your map to explain this or simply remove this sentence?

Line 254-255:

Please rephrase to be more specific on what is meant, for example, when using "system". Is it the entire system, including both coastal and open waters? And for clarity "in the parameter everywhere in the same way". Do you mean that if S=0 the implemented changes in coastal waters affect only coastal waters, and if S=1 the entire system including open waters are affected by the coastal processes?

Line 255-256:

"So, ignoring a deviation of this parameter…" unclear what is meant with this sentence. Which deviation and which parameter? And the coastal area is anyway small compared to the open ocean so why the if? Please rephrase.

Line 256:

Replace "we should make the effort…, since" by "that the process in the coastal zone requires further constraint, since ...". Also what errors? They are not errors per say, parametrisation may not capture all, but I would not call them errors. Please also rephrase the end of the sentence.

Line 259:
Please replace "below zero" by "negative".

Lines 258-260:
I do not fully understand the distinction between an Scr value greater than 1 and one that is substantially negative. Don't both cases indicate a need for further constraints on the processes, since they both reflect differences between coastal and open-ocean conditions? How are the strict thresholds defined, and on what basis? Additionally, how can we be confident that these values are not ecologically significant—can this be supported with references?

Line 264:
"five targeted biogeochemical variables" could be replaced by "five key biogeochemical variables"

Line 265:
Please replace "we assume" with "we analyze" or a similar phrasing, since in a model the source of your variables are known. This is the foundation of your analysis, so it should not be presented as an assumption; otherwise, the validity of the method could be called into question.

Results

General comment
While the results are interesting and innovative, providing valuable insights into basin-scale nutrient dynamics, the result section could benefit from a better structuring. The figures are rich and informative but relatively complex, so it would be helpful to first provide the reader with an overview or "roadmap" before diving into the details. The results span multiple basins, nutrients, and experiments, and the current presentation can feel a bit fragmented. Structuring the results more clearly—for example, by briefly outlining how they will be described and the rationale for the order (e.g., starting with NH_4 if it shows the most variation across basins and experiments)—would greatly enhance readability.

Additionally, providing more precise references to figures, experiments, and specific basins throughout the text will help guide the reader and make it easier to follow the narrative. Overall, a clearer structure and more explicit connections between text and figures would strengthen the presentation of your results.

Specific comments

Line 272:
Missing ")" after Figure 3

Line 273:
A tracer is not the same as a nutrient, phytoplankton or oxygen and before you were referring to these as variables. Please be more specific on the wording and also avoid the term "tracers" when referring to biogeochemical variables through out the manuscript.

Line 274:
Is "base" the same as "baseline"? If so, please be consistent with the wording. Also, why specify that they are not converted to inventories? Why not simply say "expressed in concentrations" or similar? Now the reader wonders why inventories would be necessary, without any further explanation.

Line 276:
Please remove ")" after values.

Lines 277:
The reader may find it difficult to follow which experiment is being discussed, as the names in Table 2 do not match those used in the figures. It would be helpful to update the figure labels to correspond directly to Table 2 for consistency.

Regarding the reference to "30–45%" in the text, these values are not immediately evident in Figure 3, and lower values (e.g., <10% for NH_4 in Arkona and Bornholm for E1 and E2) are also present. Please be more specific and clarify where these numbers can be found in the figure (e.g, in which experiment).

Additionally, it may be more effective to start by highlighting which basins show the strongest positive sensitivity. Additionally, indicate whether these percentages correspond to actual increases in NH_4 concentrations or simply relative changes, and ensure this is clearly explained in the Methods section. Providing this clarity will make it much easier for readers to interpret the results accurately.

Line 278:
The statement "is evident in E4" is not clear. Is evident where? In all basins? Please rephrase
"A strong negative sensitivity of NH4 is evident in E4, which is a response to basin wide enhanced nitrification"
by for example,
"E4 shows the strongest negative sensitivity in all basins."

In addition, the last part of the sentence should be better explained as it is not obvious. Why would enhance nitrification increase the negative sensitivity?

Line 281-284:
This is interesting, but it is hard to follow if the meaning of these % is not better explained.

Figure 3: In the caption, because this was not very clear from the methods "Percentage sensitivity" remains a vague wording. Make sure it is better explained and maybe think of renaming it to something more meaningful. Some additional points for this figure:

1) Please replace "(q10 sed rec, …)" by the actual names of the experiments used in Table 2 and in the figure it self as well.

2) Please rephrase "10% increase in biogeochemical parameters" as it is misleading, it is a 10% increase in the temperature sensitivity of the biogeochemical parameters.

3) What does "negative sensitivity" means? What does "increased target variable values" mean? Please clarify. Comments also valid for **Figure 4 and 5**.

Lines 286-287:

Is this in general or in specific experiments? Please specify.

Line 290:

Remove "Case" in "(i.e. Case-E2)"

Line 292:

Missing space in "...Bornholm).T"

Line 303:

Please replace "key ecosystem variables" by "the five key ecosystem variables" as they are the same as the ones described before.

Line 304:

The text does not specify what is meant by "strong" or "weak" sensitivity. For example, is a value of ~2% considered weak? The figures for PO_4 shows values close to 2%. Please clarify your criteria and indicate whether this classification applies across all cases and basins.

Line 305:

Replace "targeted" by "the five key" here and throughout the manuscript.

Line 308-310:

The areas should not be specified in results, but where coastal areas are defined. This statement should come before, not here.

Line 331:

Please consider rephrasing or removing the last sentence. Alternatively, make it more specific. For example, do you mean that an Scr=0 indicates that the enhanced coastal processes do not create a significant bias in the five analyzed key variables for these specific basins? Additionally, the phrase "spatial differences" may be misleading, as your analysis compares coastal versus open-ocean conditions rather than a continuous gradient.

Line 335:

For clarity, add the scenario(s) that you are referring to here in parenthesis. Also, please rephrase to ". This highlights a significant ...."

Line 336:

The figures show only the overall effect of all coastal areas. It would be helpful to discuss which specific coastal regions might drive the responses—are basins mainly influenced by nearby coasts or by multiple regions? Even if this cannot be fully quantified with the current results, a brief

discussion would add valuable context. Would it be possible to show nutrient transport or current patterns from your model results to support this discussion?

Line 344:
The phrasing "respond opposite" is unclear. Does it mean that phytoplankton and PO4 decrease while NO3 increase? Can you explain this better? How can this be?

Line 350:
Please add the scenario that is referred to in parenthesis for clarity. Also what do you mean by "basin wide", the open ocean, specific basin or entire Baltic Sea? Please specify and make sure this is clear through out the text.

Line 350-351:
This statement is important and may explain why different models struggle to capture the Bothnian bay nutrient dynamics. It should come back in discussions with references and comparison to other models.

Section 3.4:

General comments
The presentation of the results would benefit from reordering to match the sequence of the figures, or alternatively, the figures could be rearranged to follow the order of the text. Additionally, the text should provide more explicit references to the specific experiment(s) being discussed to guide the reader and improve clarity. While I have highlighted some examples below, but careful attention should be paid to this throughout the entire Results section.

Specific comments

Figure 6: In caption, remove "Entire". In figure, experiment names should be the same as those in Table 2 (E1, E2...etc). Also valid for **figures 7, 8, 9 and 10.**

Line 363:
Keep figure order as mentioned in the text (7e is mentioned before 6, it should then be 6).

Line 369:
I would describe everything related to NO3 before mentioning primary productivity and this sentence is confusing, is it for all experiments or only for coastal ones. Also, if mentioning figure 10 before 8 and 9, Figure 10 should be 8. Please, be more specific when describing the results and improve the structure following the correct order of the figures to improve readability of the text.

Line 372:
Please convert all your units to something more conventional. HELCOM uses for example, μmol L-1 for nutrients, μg L-1 for chlorophyll and mg L-1 for oxygen (although it would be likely better

to use µmol L-1 for oxygen). Your units are difficult to compare with other studies are they really mol x meters per kg? These are odd units for concentrations.

Figure 8: In caption, Are the units of PO4 in P?
Figure 9: In caption, it says nitrate but should be oxygen. Please correct
Figure 10: Are the units correct in the caption?

Discussion

General comment

As noted previously, this section would benefit from further development. The Discussion has strong potential but currently reads more like an extension of the Results. To fully realize its value, it should provide concrete and robust interpretations of the interesting results presented, clearly highlighting their contribution to scientific knowledge and how they compare with previous studies —both modeling and field-based. Some of the content currently included could be integrated into the Results section, and a few statements would benefit from greater specificity.
I have added some targeted comments as guidance, but the section would likely benefit from a thorough rewrite. In particular, emphasizing comparisons with other models and observational studies, and discussing how these findings can inform the modeling community and improve understanding of Baltic Sea biogeochemistry, would significantly strengthen the manuscript. With these additions, the Discussion could fully showcase the relevance and impact of your work for the scientific community.

In addition, I recommend including the following citations (though not limited to these) in the Discussion, as they represent some of the most recent modeling studies for the Baltic Sea, to provide context and allow for meaningful comparisons.

Lignell et al 2025: https://doi.org/10.1016/j.jmarsys.2025.104049
Muller-Karulis et al., 2024: https://doi.org/10.1016/j.jenvman.2024.122478
Ruvalcaba Baroni et al., 2024: https://doi.org/10.5194/bg-21-2087-2024
Neumann et al., 2025: https://doi.org/10.5194/egusphere-2024-3734
Samlas et al., 2025: https://doi.org/10.1016/j.marpolbul.2025.117975
See also copernicus products and how these could benefit from your study would also be useful:
https://data.marine.copernicus.eu/product/BALTICSEA_ANALYSISFORECAST_BGC_003_007/description?utm_source=chatgpt.com

Specific comments

Line 407:
This sentence is too general, maybe remove and start first by cases where NH4 has decreased followed by cases where NH4 has increased, or give more information regarding why this is relevant.

Line 411:

This is based on your results, why add a citation here? Are you comparing results? In that case be more specific.

Line 412:
For all cases?

Line 419:
This is too generic if referring to denitrifying bacteria. Either mention the correct name of such bacteria or mention the process alone.

Line 421: Add references for this mechanism.

Line 422:
This is the consequence of the "chosen" parametrisation in your model, it is not really a result "supporting" a process, since the parametrization is based on what we know about how the process works. The sentence should be rephrased as it is misleading.

Line 426:
Similar comment as above, here "support" may not be the correct wording.

Line 441:
Why not plot denitrification maps in the same way as Figure 8-10? This will show what you are writing here, giving a tangible proof (instead o using "may"). Also valid for **line 449**.

Line 451:
Understanding the statement "stronger stratification and anoxia conditions" is not straight forward, please explain how stratification can lead to such results and how anoxia, if no big changes are seen in oxygen concentrations in such area, influence this. Please also add a reference.

Line 457:
Which one is more realistic between E1 and E2 and between C1 and C2? Can you add discussion on this and base it on literature?

Lines 459-462:
I think the relevance of experiment E3 and C3 should be more detailed and highlighted, maybe in this paragraph, otherwise I fail to see its importance. For example, is increased DOC remineralization due to temperature more realistic than that of detritus in sediments? In other words, would DOC be easier to remineralised than all detritus particles (some of which may take longer time to decomposed). Why is this experiment important? Why did you choose it? Of course the motivation for this experiments should not come up in the discussions, but introduction or methods.

Figure 11:
Nice figure, but why is the little blue and yellow fishes up side down? Are they dead? Also, the arrows and pools are a bit messy, as they do not follow a scale in sizes. Please make the arrows and

pools indicating the same thing (e.g., "smaller" or "larger") the same size and shape. It will make the figure more readable.

Line 478:
But to me this scenario seems more likely, or? Please explain more on how realistic each scenario is and based on literature.

Line 492:
Is the increase in phytoplankton large or significant in E1, E2 and C1, C2? This is not necessary the same. Maybe for this plot, plotting percentages will be better. How does it compare to the real world? Primary productivity is an important topic in the Baltic Sea, which depend on all the other variables analysed here, so more focus on phytoplankton should be given.

Line 478-492:
Somewhere in this paragraph (or elsewhere in the discussion), it should be mentioned that even if not analysed specifically in these experiments, oxygen is less soluble at high temperatures, and will thus, likely further affect most of your results (explain in which way).

Line 499:
"Here", where? Entire Baltic Sea, its coastal waters in this experiment, in this study, ...?

Lines 503-404:
I have a problem the way it is described. The coastal process do not change because you normalise it with the area. Their impact on the basin remains the same. It may become more visible. Is that what you mean? Please rephrase and explain better. Also, has these been done before, can you refer to similar work (maybe in other basins and not necessarily through modelling). The entire paragraph lacks references and comparison to previous work.

Lines 511-512:
" Here, it would not make much ...specifically". Why? Do you mean that the focus is on the impact that coastal zone exerts in the deep basins and not in the coast it self? This sentence is not very clear. Please rephrase it to for example:
"Because our focus is on the impact of the coastal processes on deep basins, we do not assess …"

Line 512-513:
"It rather ...substantially." Please be more specific. Also, when referring to the "system", is it the entire Baltic Sea or coastal waters? Please specify (here and through the text).

Line 514:
Remind the reader what parameter P is for this sentence to be more understandable. You are describing several parameters at the same time, it gets confusing and difficult to follow.

Line 515-516:
How come? where does this come from? Add reference. The sentence "So, ignoring a deviation…" is not clear. Please be more specific.

Line 517:
Please replace "we have" by "the coastal sensitivity is high." and explain what is actually meant by coastal sensitivity. Do you mean that the coast is more prone to nutrient recycling (but then you are making it more sensitive due higher temperature dependency?) or do you mean that the coast will have more impact to the open waters? This is not clear. Also the word "differs" is confusing in this context. Differs from what? from the open ocean? Please specify and give some more input on why a smaller or larger values is relevant.

Line 518:
If I understand correctly, you get one single parameter value for the entire coastal area for each experiment (C1, C2, C3, C4), correct? Do you calculate also one for the open ocean? Or how do you compare to coastal impact? Or are you referring to Scr factor? Please, be more specific.

Line 519:
Is this only valid for your model then? Add more comparisons to other models. Also, I would not call them "errors", these are choices hopefully based on best information available at the time of parametrization.

Line 522:
Please better define what is meant by "parameter", otherwise it is difficult to follow your descriptions.

Line 523:
"we should try to understand the mechanisms why this happens". Yes, why not do it here then? This is the correct place to start a discussion on this.

Line 526:
"These should not be interpreted quantitatively". Why not? Please explain, not obvious in this context.

Lines 514-526:
I think this entire paragraph is an important part of the discussions, but it is too vague, not clear enough or specific enough. More than mentioning "parameter", it should be more clear what they actually mean and possible consequences for general modelling. It is not clear whether this affects only their model or all models. Model tuning/calibration is very model specific. How this can be useful to other models. This is when validation of results should come in and comparison to other studies.

Line 539 and Line 542:
Please add "(figure 5, e.g., top-left panel)" and add "(Figure 5, bottom-right panel)", respectively.

Line 540:
Why sediments more than water column? Negative versus positive Scr shows different responses but not necessarily best results, or?

Line 548:
This is too vague, you should find more specific information in the literature. Why is this basin so different?

Figure 12:
Nice figure, but needs to be put further into context of what has been published before and what is actually new.

Lines 552-556:
Is this supported by published evidence? How robust is this? If no comparison is made with previous findings, it is difficult to judge the likelihood of this mechanisms.

Lines 552-567:
This entire paragraph contains no citation and most of what is described here is not new. Please refer to the corresponding papers describing these mechanisms and highlight what is actually a new in this manuscript.

Summary and Conclusions

General comments
The section will need to be rephrased according to new discussion section, but some problems in this sections can be already notified so that they are not reproduced later on.

Line 580:
This is not clearly mentioned/highlighted in the discussions, if mentioned here, it should be better highlighted.

Line 584:
Accumulation where? Not clear, rephrase the sentence.

Line 594:
Please add the cause, e.g., "due to enhanced remineralization…"

Line 594 and 597:
Care must be taken with the use of significant or disproportionately, if no statistics or comparisons are given.

Line 600:
Is "coastal sensitivity" a name you chose for the method? Why call it sensitivity? The term sensitivity does not say much about what you are trying to estimate. In my understanding, this method represents the relative coastal impact. It should be clarified in methods and introduction, but here it becomes more obvious that the term can mean different things, if not well defined.

Lines 601-603:

"Using this metric…". This sentence needs to be more specific, for example: " that nitrate in (which basin? all?) is consistently impacted by coastal sediment recycling. This suggests that basin wide enhancement of (what? water column, sediment recycling, DOC recycling, nitrification?) ..."

Line 602:
This is a very important part of your work and needs to be absolutely clear. As currently written, the sentence in the Conclusion is open to interpretation, which should be avoided, since readers may not refer back to earlier sections to fully understand its meaning.

Line 604:
The "2-4 times greater" is not highlighted properly in discussions.

Lines 613-614:
Interesting finding and likely very important, but evidence from other studies is lacking. Evidence from previous studies (the Baltic Sea being a widely if not the most studied basin), must exist and will supports this in the real world. Please add references to studies on e.g., sediments in coastal waters by Slomp, Gustafsson, Jilbert, Cartensen and many others. Some of them are referred in the introduction, but none in the discussions and therefore, your conclusions, although relevant, are not very robust as presented at the moment.