

## ***Interactive comment on “Uncertainties in projections of the Baltic Sea ecosystem driven by an ensemble of global climate models” by Sofia Saraiva et al.***

### **Anonymous Referee #1**

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This article attempted to explore the uncertainties of biogeochemistry component, such as primary production, nitrogen fixation, and hypoxia area by using numerical experiments within Baltic Sea region. These uncertainties then discussed by various numerical scenarios among the change of nutrient loads, global model deficiencies and future greenhouse gas scenarios.

Although the context looks well fit the ESD journal, the writing skills of authors made a hard time to me to read through the entire paper. In such case, I would like to suggest giving the rejection or requesting the major revisions in the way of the writing first.

Here are some examples I would like to give.

C1

â&acircledil The abstract mentioned a jargon “transient simulations”, which also exist within the introduction section; however, the authors didn’t declare/define what it is.

â&acircledil Line 22 on page 2 addressed “By approximately 18 years ago” to begin the sentence, but the sentence or the sentences nearby did not mentioned the reference year of “18 years ago”. As a reader, it is hard to capture what the period of “18 years ago” is meaning? Is it the 18 year ago of 2018, 2017, 2006 or what?

â&acircledil The authors keep using “GCM” or “GCMs”, but didn’t mentioned/defined what GCMs are. For example, line 25 on page 2, “The first scenario simulations were based on only one GCM and one greenhouse gas emission scenario, .... to future climates utilizing mini-ensembles consisting of two GCMs and two emission scenarios .... even used three GCMs and three emission scenarios.”

This is hard to understand what “GCMs” and what “scenarios” the previous studies worked. It is also difficult to realize the thoughts of authors why they want to mention those of previous works, even though reader can “guess” the authors want to address the uncertainties issue from the usage of GCMs use.

â&acircledil The name of section “Methods” should use “data and methodologies” instead, because you are only just saying what methods you will use but also the data you apply.

â&acircledil Again, it is confused by the abbreviations authors used. For example, line 17 on page 4 saying “The Baltic Sea model was forced by (1) atmospheric surface fields from a regional coupled atmosphere-ocean climate model (RCM) driven by lateral boundary conditions from GCMs and by (2) runoff and (3) nutrient loads from a regional hydrological model also forced by regionalized atmospheric data from the same GCMs. The RCM is RCA4-NEMO applied to the EURO-CORDEX domain with an interactively coupled Baltic Sea and North Sea.”

Is it necessary to give the abbreviation “RCM” to use in the sentence? Is it possible

C2

to just use RCA4-NEMO to instead? What is RAC4-NEMA? What is EURO-CORDEX domain? If RCA4-NEMO is coupled model, why you only briefly explain the RCA4 but no description for the ocean component? Also, the description is too shallow to understand what it is.

â€” There is no connection between sentences and sentences. For example, in the line 21 on page 4, “RAC4 has a 0.22-degree spherical rotated latitude/longitude grid with 40 vertical levels. The hydrological model is E-HYPE, a process-based multi model applied for Europe. The runoff from each river was corrected by a factor . . . . .”

From these few sentences, it is understood that there is an atmospheric component called RCA4, but there is no clue saying that the E-HYPE is the ocean component of the coupled model.

â€” Line 24 on page 4. “The runoff from each river was corrected by a factor that corresponds to the ratio . . . This approach has been previously applied for regional climate simulations of the Baltic Sea.”

Authors did not explain it clearly why they want to use this ratio to correct the river runoff. In addition, the sentence I addressed above didn't have the connection with the sentence below “here, improved versions of the regional and global climate models and the results of scenario simulations from the latest IPCC assessment report were used.” It is hard to understand the authors want to speak out again.

â€” Line 30 on page 4. “RCP 4.5 and 8.5 are medium and high-end scenarios, respectively.” As a reader, it is no sense to know what are RCP4.5 and RCP8.5, what those scenarios look like. This is the duties of authors to declare their words clearly rather than the readers guess the authors' thoughts.

â€” Line 1 on page 5. “The selection of these GCMs follows the approach presented by Wilcke and Barring (2016)”. Again, what is the “approach” you are saying it. You need to explain it.

C3

â€” Line 4 on page 5. “The four driving GCMs of this study were selected from the distinct clusters identified y Wilcke and Barring (2016).” Is this redundant sentence comparing with line 1 on page 5?

â€” Line 5 on page 5. What is “necessary/unnecessary lateral boundary data”? Meanwhile it is little bit confused about the selected GCMs came from. It is “Wilcke and Barring” or “SMHI”.

â€” Line 7 to Line 11 on page 5. 1. High quality reanalysis dataset EUR04M. What is the definition of “high quality”? Is ERA40 low quality reanalysis? Than why do not compare with ERA-Interim or other ECMWF products? Or what do not you to compare with satellite observed winds? 2. Where is the correct factor 1.6 coming from? Why is 1.6? Why is not 2.0, 3.0, or 4.0? You didn't mention it.

â€” Line 12 to Line 18 on page 5. 1. You were mentioned the wind correction of RCA4-NEMO output, and then jump to an example. Normally, this example should be the example of your wind correction; however, you are addressing the “air temperature” and “total runoff” as examples. It is hard to see the connection between the sentences. 2. Meanwhile, what air temperature you are using? On the surface layer? On the 850mb, or on 200mb? 3. Since the previous description did not clearly describe the RCP 4.5 and RCP 8.5, it is hard for readers to understand what “present” and “future” climates in your figures. 4. When you use legend for your figures, you want to keep consistency between your figures and legends. You are using line with square in the legend, then should use line with square in the plots. 5. You are addressing the annual men for both air temperature and runoff. But you can only see the runoff annual mean plots existed, but no for air temperature. Where is it? Why do not you to show it?

â€” Subsection of nutrient load scenarios. 1. It is understood that there is three nutrient loads scenarios are applied in your study, but it is hard to understand why you want to pick up this three scenarios. It is better to describe the purposes and differences between each nutrient scenario clearly. 2. Line 34 on page 5 and Line 1 on page 6.

C4

“are multiplied by a factor that summarizes the impact of a worst case socio-economic development on current nutrient loads. The main assumptions and description of this impact factor can be found in (Zandersen et al., in prep).”

Here is the thing. You didn't explain why you want to multiple a factor. You didn't explain how did you obtain this factor. You didn't address the assumptions and description of this impact factor but addressing a non-published article. How does the reader know what/why/how you are doing this? 3. Line 3 on page 6. “as well. In all three scenarios, nutrient loads . . .” The sentence and the previous sentence are not talking about the exactly the same thing. It is necessary to give a line break here.

After read through the entire method section, It is difficult to understand that the authors are running regional coupled model – RCA4-NEMO or running the Baltic Sea model or running the four GCMs (MPI-ESM-LR, EC-EARTH, IPSL-CM5a-MR, and HadGEM2-ES) to conduct their research.

Please revise your writing for the reviewer. Good luck.

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