

Answers to reviewer no. 1 (Dr. Boris Chubarenko) in red

Thank you very much for the thorough review and good comments. We will follow your suggestions and will revise the manuscript accordingly

General comments

The paper is very informative and well structured. It is written in clear language and wishes to explain the main aspects and details to a reader sincerely.

The paper clear overviews the results of several profoundly advanced (at its time) attempts to develop the climate projections for the Baltic Sea. These attempts were made during BACC (2008), BACC II (2015). BEAR (this study), ECOSUPPORT, BalticApp and CLEAMSEA projects. All of them are mentioned in the text everywhere. It would be good to present the general overview scheme to help the reader quickly understand the differences between these initiatives and projects without reading the whole text.

A general overview is provided by Table 1. We will add a sentence at the end of the introduction section clarifying that an overview and summary is provided by Table 1.

The paper emphasizes a significant step of CLEMASEAS - including a new driver, the global sea-level rise. It appeared (according to the Conclusions) that this third driver causes “a more or less complete compensation for the projected increasing river runoff” that changes previously concluded the future drop of the average salinity. It would be better to clarify whether it is the same for all used scenarios of the global sea-level rise (0.9, 1.26 or 2.34 m water depth rise) or the extreme only?

We will better explain that we refer to the ensemble mean of the entire ensemble instead of individual simulations.

For such complicated issues as climate projections for the Baltic Sea, I would expect a more extended summary that includes final statements for all analyzed variables. Or at least the reference to the appropriate section of the text.

We will add the reference to the appropriate section.

My opinion is that the idea that NAO well controls the interannual variability of the climate variables in the Baltic Sea has outlived its usefulness. Figure 25 clearly illustrates that correlation is so low that the discussion of this relationship is on the verge of physical meaning (no technically reliable instrument will not work with such characteristic correlation). The idea to find the good simple predictor for the Baltic Sea climate variability is attractable, but unfortunately, it seems, it is not realizable.

We agree completely. This was the motivation to add Figure 25. Thank you.

It is remarkable, and I personally very much support the message of the paper that “BSAP would lead to a significant improvement” of the state of the Baltic Sea. And, more generally, human activity in the Baltic Sea catchment and the sea has a more substantial influence than the natural influence of global climate change. In this regard, it is not clear why the previously formulated (probably in ECOSUPPORT) strong sound statement “that climate change will worsen the situation in the Baltic if people do nothing” is not included in the number of conclusions.

Good suggestion. We will add a corresponding sentence to the conclusion.

Specific comments

The statement (lines 796-797) needs more clarification as it is not well understood. Maybe via the words that the existed natural negative south-north gradient will be partly compensated.

We will rephrase the sentence accordingly, see:

With increasing warming, SST trends in the northern Baltic Sea would get larger relative to SST trends in the southern Baltic Sea. As in present climate mean SSTs considerably decline from south to north, this gradient will be weaker in future compared to present climate. The latter might be caused by the ice-albedo feedback.

The sentence (lines 832-835) is too long. Better to split into several more simple sentences to more clearly present the idea.

We will split the sentence into three:

These low-frequency changes in correlation were projected to continue. Furthermore, systematic changes in the influence of the large-scale atmospheric circulation on regional climate and on the NAO itself could not be detected. However, a northward shift in the mean summer position of the westerlies at the end of the twenty-first century compared to the twentieth century was reported earlier (Gröger et al., 2019).

The list of abbreviations would be helpful.

We will add a list of abbreviations.

If possible (in addition to Table 1 and Table3), the table with the list and the main characteristics of RCM (RCSM) and Baltic Sea ecosystem models would be handy to understand the progress.

We will add such a table.

Technical corrections

Lines 774-776: It seems that the word ‘model is absent after ‘physical-biochemical’.

Correct. It should be “state-of-the-art physical-biogeochemical models”

Figure 25: Please, insert the legend explanations in the figure caption.

We will revise Figure 25 and the figure caption accordingly.

Table 3: Please, introduce the column titles to link with the Table caption (via numbers, for example). The acronym of scenarios (BSAP, REF and BAU) have to be explained in the caption.

We will add column titles and explain the acronyms.

Table 4: Please, introduce the sign '+' (as in the other tables) to indicate the positive changes. There is enough space in the table to have explicit column titles; for example, December-January-February (DJF), not only DJF.

We will add the sign. As the abbreviations for the seasons are explained in the figure caption we will add the corresponding season, i.e. winter, spring, ...

Table 6 and 7: the last row 'BAU/WORST': Why is only one number given for these two scenarios? Better explain in the caption.

Good point. For clarity, we will add another row to make clear that both scenarios BAU and WORST are different. BAU was only used in ECOSUPPORT while WORST was only applied in BalticAPP.