

Interactive comment on “Looking beyond stratification: a model-based analysis of the biological drivers of oxygen depletion in the North Sea” by F. Große et al.

Anonymous Referee #1

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General comments

The manuscript by Grosse et al describes a very thorough modeling study focusing on the oxygen dynamics of the North Sea using the ecosystem model HAMSOM-ECOHAM5. The model is validated extensively, both temporally and spatially, on basis of various data sources. Then it is applied to understand and characterize the oxygen dynamics of the North Sea.

Oxygen concentrations are notoriously difficult to simulate, since they depend both on hydrodynamic and biological processes. In addition, simulations results are typi-

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cally difficult to validate since oxygen measurements are sporadic. This manuscript therefore provides a good step forward and may even set a new standard in oxygen modelling. The authors have clearly put a lot of effort in testing the performance of the ecosystem model. The results are shown and described in a detailed manner. This provides a lot of insight, but on the other hand makes the manuscript quite lengthy and gives it a technical nature. This, in combination with the fact that the overall story line is not always clear, makes it quite challenging to read through from beginning to end. My feeling is that if the study would be framed somewhat differently, it could become much stronger.

Specific comments

In the introduction, various issues and ‘gaps’ are indicated, however this does not lead to a clear research question. Instead, three more or less intermediate steps are mentioned (1. To validate the model, 2. To characterize several subregions of the NS in terms of oxygen, 3. To understand which processes/compartments are dominant in causing oxygen minima). I think the paper could be made much more ‘lean and mean’ by setting it up on basis of a clear research question. This question can be either technically based (“can models fill the gap between data requirement and data availability?”) or more content based (“how important is eutrophication with respect to causing oxygen minima?”. The second (type of) question(s) seem more obvious, since they are already (more or less implicitly) included in the paper. In contrast, the first type of questions would require an elaborate discussion on statistical properties (confidence, accuracy, and precision of both models and data) which are not part of the current manuscript. Once the research question is clearly defined, the text should be filtered and only those sections that directly or indirectly support the answering of this question should remain. This would make the paper much more concise and therefore increase its readability.

An additional way to make the paper more readable, would be to put part of the information (e.g. the extended validation results) into an (electronic?) appendix.

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Furthermore, I would personally prefer the results and discussion sections to be split up into two separate parts. I understand this is not always easy. However it will allow for a more objective description of the results on the one hand, and a more interesting discussion on the other hand. Also, it would be easier for the readers to find their way around the paper. Similarly, several parts in the chapter on results and discussion even contain methodological information (e.g. the equations in sections 3.2.3, and the definition of the 4 subdomains in section 3.4). I would recommend to take these parts out as well and put them in the methodological section. Probably, if the paper would be centered around one clear question, this issue of mixing methods/results/discussion would be resolved quite easily.

Technical issues

From a technical perspective, I was wondering about the choice of the 4 subregions. It is unclear from the current text what the choice for these 4x4 subregions was based on, and whether they are representative at all for their larger subregion. Actually, reading about this made me also wonder why the authors did not approach it the other way around: i.e. by starting from characterizing all (individual or partially aggregated) gridcells and then divide them into several distinct subregions on basis of these characteristics (e.g. by means of multivariate statistics). Such a subdivision would be more objective and could be very useful in terms of setting subregion-specific thresholds in the context of the MSFSD.

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