

Interactive comment on “Impact of global change on coastal hypoxia” by L. Meire et al.

Anonymous Referee #1

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General comments

This is a very good paper that presents a carefully performed modeling study on the effects of climate change and changes in nitrogen nutrient loading on oxygen concentrations in coastal North Sea over the next 100 years. The study uses a one-dimensional (k-epsilon) hydrodynamic model to drive an NPZD-type pelagic model coupled to a benthic geochemistry model. Informatively, the paper separates the effects of different factors that affect O₂ concentrations: temperature effect on oxygen solubility, temperature effect on organism metabolic rates, stratification strength, and nutrient (N) inputs. The model is reasonably well calibrated and predictions of climate models are used as inputs for the future sea-surface boundary conditions. The model formulations appear correct. The paper is well organized and written. I recommend that the paper be accepted with relatively minor revisions, but hope that the authors can address the issues listed below.

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Specific comments

1. The effect of temperature on organism metabolisms and the rates of microbially catalyzed geochemical reactions is represented by a $Q_{10} = 2$ factor. It is not clear whether this factor represents a typical increase in reaction rates observed over some short periods of time, or whether it would be expected to hold over the centurial time frame when the long term adaptation of microbial communities is taken into account. Could the authors discuss this?

2. The reaction list for the sediment model does not include anammox, which now emerges as a potentially significant pathway of nitrogen removal. How would including anammox affect the nitrogen balance and the conclusions of the paper?

3. The 1D hydrodynamic model cannot account for the lateral transfer of oxygen-depleted water masses. The text does mention that currents in the study area are weak, however it is a non-quantitative statement and it is not clear that over the long term such currents would not affect the oxygen levels at Oyster Grounds. This perhaps warrants a brief discussion.

Technical comments

4. The upper and lower panels in Figure 5 have different time scales, yet their placement urges the reader to compare them directly. For example, the peak in Chl around 100 days appears correlated to the decline in oxygen, which appears immediately below but actually happens later in time. I suggest rescaling the upper panel or positioning the two panels side by side.

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