

Interactive comment on “Response of Export Production and Dissolved Oxygen Concentrations to pCO₂ and Temperature Stabilization Scenarios” by T. Beaty et al.

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General comments Thank you for your comments and suggestions. I agree that ventilation is an important variable for determining changes in OMZs (see also our respective response to reviewer #1). Though we aimed at focusing on the temperature and CO₂ effects on the ocean oxygen distribution, we will add a respective experiment on ocean circulation changes (see also our response to reviewer #1). We focus on changes in the biological pump and how these changes affect ocean interior oxygen and OMZs. We will provide a better separation of the solubility and biological productivity effects with an additional reduced biology experiment. The model does overestimate productivity at the equator due to nutrient trapping (see Najjar et al., 1992, GBC). Productivity

C1

is temperature dependent; however, remineralization is dependent on a fixed Redfield ratio and oxygen consumption (ie POC concentration). A plot of PO₄ will be added for clarification in the revision.

Specific comments 1. We will revisit the text to make sure figures are referenced correctly.

2. Section 4.1 and 4.2 will be merged and comparisons to observed data added to the supplementary data.

3. This sentence will be corrected to state that the bottom boundary of the OMZ does not deepen.

4. Changes in the OMZ distribution will be added to the supplementary data. Figure 4 illustrates the changes to the dissolved oxygen profile through the core of the OMZ for each simulation as well as observed data. Illustrating the profile this way allows the reader to evaluate the depth of the oxycline. Unfortunately, this same detail can not be accomplish with the plotting program that accompanies HAMOCC.

5. An introduction to the atmospheric oxygen simulation will be added to page 6 line 13.

6. All experiments including the reduced biology scenario are run from a near-steady state condition and integrated for 30,000 yrs. CO₂ and O₂ at actively exchanged between the ocean and the atmosphere.

7. This statement will be clarified. Strong upwelling in the tropical Pacific Ocean could transport high-nutrient and oxygen depleted water masses to the surface; however, in the model these waters are at equilibrium with the atmospheric and therefore the effect of the upwelling on DO concentrations is diminished in the model.

8. The model assumes a constant Redfield ratio following Maier-Reimer, 1993, GBC. However, potential changes in the Redfield ratio due to ecosystem dynamics could result in changes in POC and thus the OMZ (e.g. as resulting in a mesocosm experiment,

C2

see Riebesell et al., 2007, Nature). We will discuss these effects in the revised version.

9. Variables and units will be added to the color bar.

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