

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

T. Beaty et al.

tbeaty@newmexicoconsortium.org

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General assessment; we appreciate the referee's comments and suggestions. We agree with the referee that consideration of changes in ventilation is also of importance for the distribution of dissolved oxygen and the distribution of OMZs in the oceans. However, we originally did not aim to consider circulation changes and to focus on temperature induced changes only. The reason for this was that oxygen and radiocarbon are not very well correlated in the ocean water column and circulation changes may mask the temperature effect. We will, however, include an experiment on the effect of a change in ocean circulation in our revision. HAMOCC is a biogeochemical model designed to long integration with low computational cost to allow adjustment with sedi-

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ment geochemistry in the timescale of 100,000 yrs. In contrast, comprehensive Earth System Models can run only in a order of several 1,000 yrs. This study focuses on the long-term trend of the oxygen minimum zone by the changes in the biological and solubility pump in response to global temperature on a longer time sales. Interactive changes between ocean circulation and carbon cycle on the millennial time scale with a similar model has been published elsewhere (e.g. in Mikolajewic et al. 2007, Climate Dynamics, or Winguth et al., 2005 JGR). However, for the revision we will add an additional sensitivity experiment where the ocean circulation is shutdown, as an extreme scenario. This will provide insight into the maximum effect of potential circulation changes on dissolved oxygen distribution. .

Page 1 line 18; Yes, we will clarify this sentence to include the distribution of CO₂ dissolution. Page 2 lines 2 and 3; We will change the units to $\mu\text{mol kg}^{-1}$. Page 2 line 3; Sentence will be corrected accordingly. Page 2 line 18; We will add a plot and section on DOC; however, since we are focused on changes in POC it was not added to the submission. Page 2 lines 23-26; This is an offline model and flow fields are an input into the model. Therefore we focus on changes in productivity and solubility in this study. Page 4 lines 26-28; We will add changes in TOC which includes both dissolved and particular carbon and discuss these changes in a separate section. Page 5 lines 16-19; To clarify the sensitivity study, we applied a global uniform temperature change in the ocean in each simulation. Page 6 lines 7-9; see major comments. Global mean temperature anomalies have been applied. Pages 8-12 All Supplementary figures requested could be added. Page 12 lines 16-18; The sentence should be corrected to state that "Dissolved oxygen $\hat{\Delta}$ 17 increases to $>300 \mu\text{mol L}^{-1}$ in the deep-sea and $>200 \mu\text{mol L}^{-1}$ in the intermediate water masses". $\hat{\Delta}$ Page 12 lines 29-30; the purpose of this study is to analyse the strength of the following two OMZ controls: changes in the solubility and biological pump. Page 13 first paragraph. A figure for total organic carbon can be added to the supplementary data as well as adding to information to the text.

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Table 1; sCO₂ will be defined within the table Figure 2 and 3; units will be added Figure 5; DO with units will be added as well as the map of the transect Figure 7; We will correct the caption to read sea water temperature at 450 meters in the 8 X CO₂ simulation Figure 8; units will be corrected to m³

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