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Interactive comment on “Oxygen and indicators of stress for marine life in multi-model global warming projections” by V. Cocco et al.

Anonymous Referee #1

Received and published: 11 January 2013

This manuscript presents predictions of the current (1990–1999) and future (2090–2099) state of the mesopelagic layer (100–600 m) of the World Ocean based on simulations performed with seven Earth System Models. The worst greenhouse gas emission IPCC scenario (SRES A2) was tested.

The effort to coordinate this multi-model simulation experiment, compare the outputs, and produce consensus predictions for the end of the 21st century is commendable. Furthermore, the manuscript covers the lack of joint predictions of the expected decline of O₂ and increase of CO₂, both affecting negatively the respiration of aerobic organisms. I find the manuscript very appropriate for a journal as Biogeosciences and have only a few minor comments and corrections detailed below.

Page 10787, Lines 8–9. Please, state clearly in the abstract what you mean by “upper

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ocean". It would be much better to define it as the upper mesopelagic layer (100–600 m).

Page 10788, Line 29. Please, define “surface ocean” (0-100 m?) and “thermocline” (100– 600 m).

Page 10790, Lines 27–29. I cannot see why a larger C/N ratio of the sinking organic matter leads to an enhancement of O₂ consumption at depth. To my understanding, a larger C/N ratio means a larger proportion of carbohydrates, with a respiration ratio (-O₂/C) of 1.0, which is lower than the respiration quotient of 1.4, characteristic of a material of Redfield's composition. Therefore, a higher C/N ratio would lead to lower oxygen consumption at depth.

Page 10791, 1st paragraph. Maybe you could also comment on the positive effect of increased CO₂ levels on the dark incorporation of CO₂ by prokaryotic organisms inhabiting the dark ocean.

Page 10794, Line 11. Replace “calcite cycle” by “calcium carbonate cycle”

Page 10795, Line 13. I'm not familiarized with the Taylor diagrams and would acknowledge a brief introductory explanation of them. I think it would be useful for most readers of the ms.

Page 10798, Line 27. Please, check the units of the delta fO₂ plot in Figure 4.

Page 10801, Line 17. Maybe you refer to “Fig. 6” rather than “Fig. 8”.

Page 10803, Line 3. Please, replace “Fig. 11a” by “Fig. 11”.

Page 10803, Lines 9–12. On one hand, Why did you use a C:P ratio of 117 rather than the standard Redfield's ratio of 106? On another hand, the marine biological cycle consists not only of organic carbon but also of CaCO₃. Depending on the effect of increasing CO₂ levels on the dissolution of CaCO₃, considering only the degradation of organic matter could be an oversimplification.

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Page 10803, Line 13. Figure 13 is cited before Figure 12.

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