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Geoscientific Model Development Discussions

Interactive comment on "Biogeochemical protocols and diagnostics for the CMIP6 Ocean Model Intercomparison Project (OMIP)" *by* James C. Orr et al.

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Response to Short Comment by C. Senior, representing the CMIP Panel

We thank the CMIP Panel represented by Catherine Senior for their comments that will surely improve our manuscript and make it more compatible with other contributions to the special issue in GMD on CMIP6. Their comments are repeated below in gray, while our responses are provided in black.

Dear OMIP BGC authors,

The CMIP Panel is undertaking a review of the CMIP6 GMD special issue papers to ensure a level of consistency in answering the key questions that were outlined in our request to submit a paper to all co-chairs of CMIP6-Endorsed MIPs. These questions are outlined in the overview paper (Eyring et al, GMD, 2016) and the relevant section is summarised below:

Each of the 21 CMIP6-Endorsed MIPs is described in a separate invited contribution to this Special Issue. These contributions will detail the goal of the MIP and the major scientific gaps the MIP is addressing, and will specify what is new compared to CMIP5 and previous CMIP phases. The contributions will include a description of the experimental design and scientific justification of each of the experiments for Tier 1 (and possibly beyond), and will link the experiments and analysis to the DECK and CMIP6 historical simulations. They will additionally include an analysis plan to fully justify the resources used to produce the various requested variables, and if the analysis plan is to compare model results to observations, the contribution will highlight possible model diagnostics and performance metrics specifying whether the comparison entails any particular requirement for the simulations or outputs (e.g. the use of observational simulators). In addition, possible observations and reanalysis products for model evaluation are discussed and the MIPs are encouraged to help facilitate their use by contributing them to the obs4MIPs/ana4MIPs archives at the ESGF (see Section 3.3). In some MIPs additional forcings beyond those used in the DECK and CMIP6 historical simulations are required, and these are described in the respective contribution as well.

We very much welcome the OMIP BGC contribution and the hugely valuable detailing of the desired formulations for gas exchange and carbonate chemistry, diagnostic tracers and their initialisation that you currently cover in section 2. This is nicely consistent with the leadership that the other OMIP paper (Griffies et al) is also providing on the physical ocean diagnostics and together these will provide an important protocol for

CMIP6.

Thank you.

However we would like to suggest that for consistency with the other papers in the GMD special issue, you consider moving much of section 2 to an appendix rather than in the main body of the paper. A similar suggestion was made on the Griffies at al paper for documentation of diagnostics. Some parts of section 2 such as detailing the tier 1 experiments, their length and initialisation should remain in the main paper and perhaps this section can be re-organised around these including the justification of these runs. I think much of this is already in the paper but could be better structured.

The question of moving some of information on protocols to an appendix will be considered. However, we fear that a reorganization that would break apart the protocols into two major sections (one being an appendix), separated by other sections, would force readers to need to repeatedly move back and forth between sections, degrading flow. However during the revision process, we will more fully consider this option.

Additionally, we would like to see some more detail on some of the issues raised above, notably;

a. More discussion on the science goals of the OMIP BGC in CMIP6 and what science gaps it is attempting to fill to be outlined in the introduction. You mention that OMIP BGC is focussed on the CMIP6 question on 'understanding systematic biases' but give no detail on what OMIP BGC is hoping to achieve that is new.

In the revised manuscript we will include more detail on the OMIP-BGC science goals as well as the gaps to be addressed. We will then further address how OMIP-BGC aims to assess fundamental concerns about systematic biases.

b. All MIPs have been asked to demonstrate connectivity to the DECK experiments and the CMIP6 historical simulations as one of the 10 endorsement criteria (see Table 1 in Eyring et al., 2016). Please document this for OMIP BGC.

The connectivity to the CMIP6 historical and DECK experiments will be made clearer in the revised manuscript.

c. You have not provided an analysis plan for the science community engaged in OMIP BGC. How are you going to use the experiments and diagnostics? Are you committing to analyse all the data that you are requesting (or can you point to other MIPs that will do so)?

The OMIP-BGC effort aims to provide a central forum to promote discussion, facilitate analysis, and prompt wide participation of the ocean biogeochemical modeling community in the related analysis effort. In this sense then, speaking for the community, the goal is indeed to analyze all of the model output requested. An analysis plan will be included in the revised manuscript. Other MIPs under the CMIP6 umbrella such as C4MIP will certainly take on some analysis of ocean output for which OMIP has provided diagnostics.

d. You describe observations of e.g. CFC-11, CFC-12, SF6 etc in the introduction that might be used for evaluation of the models. Are/Could any new observations be made easily available to the modelling community (e.g. through Obs4MIPs?)

Discrete and gridded observations of CFC-11, CFC-12, and SF_6 will be used extensively to evaluate the OMIP models. Whether we have the right, as a modeling community, to submit new observations through Obs4MIPs is an open question that we have not adequately considered. Certainly existing observations that are already available publicly could also be added through Obs4MIPS, assuming approval can be obtained from the data providers. It is an aim of OMIP-BGC to facilitate access to the relevant observational data that is used for model evaluation, as done previously during the Ocean Carbon Cycle Model Intercomparison Project.

We hope you agree that some level of consistency across the MIP papers in this special issue is valuable and that the above suggestions can be accommodated in your paper.

Consistency across the contributions to the CMIP6 special issue in GMD is important, and we will do our part to help.

Other comments:

- For the diagnostic section (3 and tables 4-14), what is the link to the CMIP6 data request? Perhaps you need to clarify where is the definitive documentation of what is actually being output from the models (e.g. via a link to the actual data request) and to reference the GMD paper by Martin Jukes?

In the revised document, we will cite the GMD paper by Jukes and provide links to the CMIP6 data request, while assuring consistency with revisions to the Tables.

Other comments: With many thanks for your ongoing efforts in the CMIP6 process.

The CMIP Panel

Your comments are much appreciated.

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