

Interactive comment on “Drivers and uncertainties of future global marine primary production in marine ecosystem models” by C. Laufkötter et al.

C. Laufkötter et al.

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We greatly appreciate the constructive and helpful comments and criticisms by reviewer #1. We incorporated almost all suggestions into the revised version of the manuscript. A detailed reply to each point follows below:

Reviewer Comment: This manuscript examines between-model differences in ocean NPP in nine CMIP-5 coupled carbon climate models for the IPCC high emission scenario RCP8.5. To be included in the study models had to have at least 2 phytoplankton and 1 zooplankton Plankton Functional Types (PFTs). Most previous publications emphasize the multi-model mean outcomes and do not explicitly examine the differences between models and their causes.

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While the objective is highly worthwhile and the results are for the most part informative, the current version of the paper is too long and repetitive, and the key results are difficult to pull out from the mass of detail. Reading the paper is made difficult because in some cases the numbers in the discussion do not match the numbers in the tables or figures, and some tables are discussed in a different order to how they are numbered. Unfortunately only 2 ecosystem models are coupled to the same physical model, making it difficult to separate out effects caused by physical processes from those caused by ecosystem/biological processes.

Author Response: The revised version of the manuscript is shortened significantly. We have also made sure that the numbers in the Tables/Figures match the description in the text and adjusted the numbering of the Tables.

Specific comments Reviewer #1

Reviewer Comment: Tables 7 and 8 are referred to before Table 6, and the discussion of Table 8 precedes that of Table 7. They should all be renumbered accordingly. In addition the numbers quoted in the text often do not agree with those in Tables 7 and 8.

Author Response: Done

Reviewer Comment: The idea of ‘Bottom-up vs top-down’ processes was carefully presented on p. 3746- 47, but discussions of Figs. 9 and 12 are confusing and do not discriminate between ‘Bottom-up’ (growth rates) and

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'top-down' (changes in phytoplankton biomass). I think there is too much info on these 2 figures.

Author Response: We have changed the structure of the manuscript such that the discrimination between top-down and bottom-up control becomes more obvious. We use Figs 9 and 12 to show the differences in responses of diatoms and nanophytoplankton for which the level of detail of the plots is required.

Reviewer Comment: Eqn (6) on p.3753 is confusing. The authors do not clearly define the numerator term 'P-dependence'

Author Response: Done, P-dependence describes the dependence of the grazing on prey density.

Reviewer Comment: Sections 6.1 and 6.2 – In an effort to make the paper more concise and have less unnecessary detail, I think references to results from 'older' (i.e. pre-2010) papers should be minimized. Key points on the current work seem to be getting lost in the details of other references.

Author Response: Done

Reviewer Comment: Sections 7, 8 and 9 seem to repeat certain findings. It would make the paper more readable if these sections were reduced substantially. I think 8 and 9 could be combined into a single section on Conclusions.

Author Response: Done

Reviewer Comment: The analysis here is made more difficult because most of the biogeochemical models are coupled to different climate models. Yet the paper by Kwiatkowski et al. (2014) is only referred to as “. . . a more solid

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comparison between differences . . .". It seems to me that a summary of their main findings, relative to this paper, would be a valuable addition.

Author Response: The Kwiatkowski et al. (2014) paper describes the design of a project (IMarNet) which aims to examine the differences in biogeochemical responses of several ecosystem models coupled to one physical model, but they do not present results yet. We have changed the sentence in our manuscript to make this more clear. The sentence reads now: "A more ambitious program is currently undertaken, where a larger group of ecosystem models are being coupled to the same circulation model (the iMarNet project, Kwiatkowski et al., 2014). The outcome of this project will help to better separate the ecosystem model uncertainty from the uncertainty introduced by different physical models."

Interactive comment on Biogeosciences Discuss., 12, 3731, 2015.

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