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

Anonymous Referee #2

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General comments This study investigates the effects of climate change on ecosystem dynamics and biogeochemical fluxes in several CMIP5 models. The main focus is to illuminate the between-model-differences and underlying mechanisms.

While this is a very important and interesting study, it is difficult for the reader to pull out the key findings from the current manuscript, as well as differences to previous studies. As I see it, major findings of this study are the role of temperature dependence of the different ecosystem processes, the balance between them (if different temperature curves are applied within the same model), and the particular role of zooplankton grazing in controlling NPP and biogeochemical fluxes.

I think the paper could be shortened quite a bit, as (a) a lot of the information is very repetitive, and (b) the highlight should be put on the key findings mentioned above, and

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not the general findings that have already been discussed in previous studies.

Overall, some arguments are very repetitive, and appear 4 or 5 times throughout the text, e.g. regional patterns of the NPP response and associated mechanisms. This could be condensed quite a bit. Maybe it would be worthwhile to restructure the paper. In general, some of the structuring seems rather odd, i.e. some methods are described in the results section or discussion (e.g. calculation of correlations with observations, Taylor decomposition of NPP). The paper has 9 sections and I would prefer a classic separation (intro, methods, results, discussion and conclusion). I think this would also help to avoid being too repetitive, as well as highlighting the key findings of this study.

And the key findings are indeed important! It is interesting too show how much influence the choice of temperature sensitivity has, as well as its specific application for zooplankton grazing. In this regard, it would be nice to have a more extended discussion about the scientific basis for this... What are the used parameterizations based on? Are they justified? And how much do we know about this topic at all? Will temperature dependence really matter in a physiological way, or will organisms just follow their preferred temperature or evolutionary adapt? I would be happy to read an extended discussion on this, as this seems to be the main finding of the whole study!

Some specific comments: I will keep this short for now, and save specific comments for a revised, and shortened version of this paper. Just some notes on the tables and captions:

Table 2: Recom has 3 nutrients, not 4 Also the caption should be extended to explain the stoichiometry... probably R means Redfield and V means variable, but this should be mentioned somewhere.

Table 3: to what temperature does the Q10 refer? By definition, the Q10 gives the change of a biological rate when temperature increases by 10%. However, all models use exponential functions for temperature dependence, so the Q10 will change depending on the temperature range considered (imagine Q10 between 0 and 10°C

compared to Q10 between 20 and 30 °C).

Table 5: Usually, the relationship between prey concentration and grazing rate is described by Holling...

Table 6: more detailed caption needed. What does NPP in % stand for? Satellite data?

Table 7 and 8: I think the given numbers are unitless (correlation coefficient), so the units in brackets should be deleted

Table A7: zooplankton have no number for growth rate

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