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Interactive comment on "Constraining parameters in state-of-the-art marine pelagic ecosystem models – is it actually feasible with typical observations of standing stocks?" *by* U. Löptien and H. Dietze

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We thank A.W. Omta for his time, effort and encouraging comments. Overall A.W. Omta finds that our manuscript provides valuable new insights and that it is well-written. Following his advice we will extend the discussion part and include his suggestions into the revised manuscript.

Major comments:

- A.W. Omta: In my view, the manuscript at hand by Loeptien & Dietze is well-written

and provides valuable new insights. Since I am suggesting only textual changes, I recommend publication after minor revisions. In my opinion, the key insight is that many parameters in marine ecosystem models are very difficult to constrain due to strong correlations between the different parameters. For example, a too high phytoplankton maximum growth rate can be 'compensated' by a too high half saturation constant and/or a too high mortality. The authors summarize this in a clear fashion in the Discussion section. However, I believe that this important finding also deserves to be emphasized in the Abstract as well as in the Summary and conclusions section.

-A: We agree and will revise the discussion section as well as abstract, summary and conclusions accordingly.

Specific comments: - A.W. Omta: 1) I am missing a clear strategy to better constrain the plankton growth parameters (or MM constants, as the authors call them). Should we rely on laboratory measurements of growth rates and half saturation constants? Or are those too ill-constrained as well? Should the focus be on measuring primary production rates? And if so, which method do the authors consider the most appropriate?

-A: These are interesting questions and we are still struggling to find comprehensive answers (and this is also why these must remain beyond the scope of this paper). At this point we can not be more specific and we fear that answering these questions satisfactorily is not possible at present state of knowledge (e.g. due to the poorly known noise/error amplitude and structure).

The scope of this paper is to illustrate that field measurements of standing-stocks are generally not sufficient to constrain model parameters of state-of-the-art ecosystem models. Because laboratory experiments allow for controlled variations of e.g. nutrients and photosynthetically active radiation they are certainly of benefit. In line, our results do highlight the value of rate measurements. However, we are at this stage hard pressed to decide which combination of laboratory experiments and rate mea-

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surements might be sufficient to ensure reliable projections.

- A.W. Omta: 2) An interesting finding is that it is much more difficult to constrain parameter values, if correlated 'reddish' noise is applied than if uncorrelated white noise is used. Do the authors have an idea why this is the case? The authors suggest a relation with the finding by Friedrichs (2001) that systematic biases are more detrimental than white noise (p.250, l.9-11). How are these findings related, given that a constant bias is not the same as correlated noise?

-A: We will clarify the relation between reddish noise and systematic biases in the revised manuscript (or delete the respective reference). Our line of thinking is: most of white noise-variance is related to timescales, which are not captured by typical ecosystem models (e.g. because the processes explicitly resolved by the model are not fast enough). During the optimization procedure this part of the variance is irrelevant as there is no detectable relation between cost and parameter choice and this part of the model-data misfit remains more or less equal for differing parameter choices. Reddish noise differs in so far as there is more variance associated to timescales that are captured by the model and thus an optimization procedure is more prone to sense a relation between cost and parameter choice. Systematic biases can be regarded as very low frequent nose which acts on scales much longer than the runtime of the model. We find (in twin experiments) a similar effect as for reddish noise because in both cases the parameter values can be adjusted such that an optimal fit to the perturbed data yields a lower cost than the genuine truth.

Technical corrections

- A.W. Omta: "an AR(3)-processes (Et,t=1,...,n) by" -> "an AR(3)-process (Et,t=1,...,n)" (p.239, l.22) "estimation way more than" -> "estimation much more strongly than" (p.250, l.9/10) "rates systematical biases" -> "rates systematic biases" (p.250, l.10/11)

-A: Thanks! We will include all three suggestions into the revised manuscript.

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