

# ***Interactive comment on “Zooplankton mortality effects on the plankton community of the Northern Humboldt Current System: Sensitivity of a regional biogeochemical model” by Mariana Hill Cruz et al.***

## **Anonymous Referee #3**

Received and published: 22 January 2021

### General Comments

The manuscript describes the responses of the plankton ecosystem in the Eastern Tropical South Pacific to different scenarios of small pelagic fish abundance using a coupled physical-biogeochemical model in a regional configuration. Changes in fish predation are simulated by changing mortality rate of zooplankton compartments in the biogeochemical model. This simple method provides an insight of the ecosystem's response to fluctuations in small pelagic fish biomass.

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The manuscript addresses relevant scientific questions within the scope of the journal.

The study is based on a previous work (Getzlaff and Oschlies, 2017) carried out on a global scale, using a different model.

The overall presentation is well structured and clear.

The results are discussed in an appropriate and balanced way.

Substantial conclusions are reached but need to be confirmed with an end-to-end model.

The title clearly reflects the contents of the paper.

The abstract provide a concise and complete summary.

The amount and quality of supplementary material is appropriate.

This study has 2 weaknesses:

1/ the evaluation of the plankton compartments is poor. There is little data and the comparison is not convincing. However, the difficulty of comparing model and observations is well discussed. Are there no more in the area?

2/ this study would have deserved some prior improvements: DVM implementation and a tuning of the model. However these two points are mentioned as weaknesses in the discussion.

Specific comments

The reference study of Getzlaff and Oschlies (2017) is based on a simulation that has been running for 300 years. It shows that the Tropics are really long to reach a balance and that the difference between an experiment (high, low scenario) and the reference can changes sign between the first decades of simulation and the rest (Getzlaff and Oschlies, 2017; see Figures 2, 3). So what is the strategy justifying a 30 year climatological simulation ? What are the reasons for this choice? Does the model

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reach a state of equilibrium ? Please provide a figure with the time evolution of the main biomasses and fluxes, as in Getzlaff and Oschlies (2017)

I wonder about the relevance of these results in an end-to-end ecosystem. In the high scenario, the flow of energy and matter return immediately to the detritus pool and feed the microbial loop instead of being transferred to higher trophic levels and take longer time to return to the microbial loop. Won't this difference affect the conclusions of this study? This point deserves to be discussed.

A paragraph is missing in the Introduction to describe plankton groups in the study area : the spatial distribution, the succession from the coast to the open ocean... It is disseminated throughout the paper, but it would be clearer to have it in the Introduction.

This manuscript is based on the Getzlaff and Oschlies (2017) study. This latter should be described in Section 2.4 or the first time you discuss it in the discussion section. I mean: specify the area of the study, a different model, the method, the scenario, a 300 year simulation. We learn the main elements of this study but too late in the text.

L42: please indicate that this calculation is valid excluding any non-linearity.

Section 2.3: please modify the title to “Zooplankton comparison” or “zooplankton evaluation”, because we can't say it is a validation.

Section 2.3: The model is compared to data between February 10 to March 3, 2013. Which model data are used for the comparison ? an annual mean for the last year of simulation ? a monthly average ? a daily average ? Please specify.

Figure 2: the comparison is not really convincing. Why not show the comparison in log transform as in Appendix C ? This would be justified, as biomasses often have a log distribution.

L199: what is the width of this box? Because Figure 2 shows that the zoo maximum is not to the coast but offshore (~ 50 km offshore). Is this maximum included in the box ?

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Figure 3: please add “in the reference scenario” at the end of the legend.

L209: “coastal upwelling” section: do you mean the white line or the coastal blue box in Figure 1 ? if it is the latter, please change to “coastal upwelling region”.

L244-250: Is the spatial pattern of modelled plankton realistic? Is this distribution found in observations, described in literature? Is plankton succession from the coast towards the open ocean typical of EBUS ?

L255: why are deep large detritus increased in the A\_low scenario ?

Section 3 and Figure 4: I wonder what the description of the deep zone (100-1000m) provides because the analysis focuses on the surface layer. I would remove that part. This would simplify Figure 4 and remove the questions about the strong differences in phyto and zoo found at depth, even if this is explained in the text. I think it would simplify the message.

Figure 5: please specify that 12°S section refers to the white line in Figure 1.

L339-340: The mortality rates estimated for linear assumption are lower than the 0.19 d-1 estimated by Kiørboe (2002) at 25°C, but there are close to the 0.062 d-1 estimated at 5°C in the same study. Why compare to the first estimate and not the second? What is the temperature in the region ?

L340: “This indicates that the model may not include all potential sources of variability.” This sentence should be changed. Of course the model does not take into account all kinds of variability, this must be mentioned, but variability difference between the model and the data cannot be summarized by this sentence. Several other reasons should be mentioned: 1/ In-situ observations represent a snapshot of the ocean while the model outputs are an average (daily, ... not specified in the text). 2/ there is a crucial lack of data to make a robust assessment. 3/ The sampling methods do not allow for a representative sampling. 4/ The scenario uses a climatological simulation, without taking into account inter-annual variability.

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L407-408: Are these numbers for the coastal upwelling area or the full domain ?

L408-409: The sentence should be rephrased. It suggests that there are several compartments of zooplankton in their study, whereas there is only one, so obviously “the response depends only on one zooplankton size class”. In fact, since this manuscript is based on the Getzlaff and Oschlies (2017) study, this latter should be described before being discussed.

L409-412: are these numbers for the global ocean or for your specific area ?

L407-412: model with 1 plankton compartment = mild changes. Model with 2 compartments = more pronounced changes. What would be expected with 3 plankton compartments ? Can we think that the more plankton compartments there are in the biogeochemical model, the greater the change in plankton biomass ?

L428-429: I do not understand this sentence. Figure 5 shows a maximum at the coast and not at the transition from coast to open ocean.

Table 1: explain in the legend why “Global” and “Full” are put together, same for “Tropics” and “Oligotrophic”, “Southern ocean” and “Coastal Upwelling”

L445-447: I am sorry, I do not find the same numbers. Could you detail them please ?

L 494: I do not understand. Figure 4 shows that grazing on Zs is not affected

L 497: ENSO seems to be the main factor but is not discussed.

Technical corrections

L41: the units “Mt” has not been defined above, please define it or use the full name.

L119: correct “dissolved”

L129-130: correct the exudation symbol

L272: please remove “top” when you refer to Figure 5

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L273: please remove “top” when you refer to Figure 5

Figure 6: please check units

L337: please change “ZL” to “ZL”

L339: “estimated ”instead of “estimate”

Appendices: Please place text together with figures for each Appendix.

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Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2020-417>, 2020.

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