

**Second Review of « CITRATE 1.0: Phytoplankton continuous trait-distribution model with one dimensional physical transport applied to the Northwest Pacific » by Bingzhang Chen and S. Lan Smith.**

I have read with interest the revised version of the manuscript by Bingzhang Chen and S. Lan Smith as well as their answers to the editor and the three referees' comments. The manuscript has been substantially improved. Indeed, the authors have extensively reworked some parts of the study which adds a significant value to the manuscript in terms of both methodological implications of their work and scientific outcome. In particular, new simulations have been conducted with a modified version of the model equations, including e.g. a second zooplankton variable corresponding to the mesozooplankton with grazing preferences scaled with prey size.

As suggested, and importantly, the method that has been conducted in this study, namely using the observations at two distinct stations to set up a single set of parameters values that can later be used as an initial estimate for new simulations (e.g. 3D simulations), has been clarified in the new version of the manuscript. Moreover, some efforts have also been made to validate the model and the previously obtained unique set of parameters using an independent station (ALOHA) with only limited success in reproducing the observed biogeochemical features in this region (underestimation of Chl, NPP and PON). Some suggestions have been proposed to improve the optimization of the parameters for 3D GCM's simulations (Transport Matrix Technique).

The results section 3.4 has also been further developed with a detailed description of the relative weight of the different factors and their relationship in driving the simulated size variance (i.e diversity) and its variability over time at the two stations. Finally, the discussion section (4.1) has been deeply improved and better structured which contributes to a better connection between this work and more general concepts with regards to ecological mechanisms explaining plankton diversity (exclusive competition, evolutionary processes (trait diffusion) and physical transport, see section 4.1.1).

Overall, convincing and detailed arguments have been given by the authors on every points requested by the referees. Therefore, I recommend this revised manuscript for publication in GMD. Hereafter, I give a few remaining minor suggestions to improve the clarity of the manuscript.

P4 L.13-19 : *'The trait variance, treated as a tracer in the model, serves as a measure of trait diversity; although it cannot be simply equated to species richness, it can be converted to other diversity metrics such as the continuous entropy (Quintana et al., 2008). The diversity of functional traits is arguably a better diversity index than species richness relating to ecosystem functioning (Loreau et al., 2001). Thus, the continuous trait-based model has the advantage that the factors controlling diversity can be directly quantified ...'*

Due to the inclusion of new sentences, text organization results in poor transitioning. I would suggest restructuring as follows:

*'The trait variance, treated as a tracer in the model, serves as a measure of trait diversity. **Thus, the continuous trait-based model has the advantage that the factors controlling diversity can be directly quantified ... . Although the size variance cannot be simply equated to species richness, it can be converted to other diversity metrics such as the continuous entropy (Quintana et al., 2008). Moreover, the diversity of functional traits is arguably a better diversity index than species richness relating to ecosystem functioning (Loreau et al., 2001).'***

P.5 L26-P.6 L4: Section 2: This added overview paragraph at the beginning of the model description section is very useful. However, the use of the term 'CITRATE 1.0' (P.4, L.26) is sometimes confusing as the reader might not know whether the authors are talking about the name of the model (which should be the correct use for CITRATE 1.0) or the method conducted in this study. Moreover, it would also be useful to mention here that the method that has been used aims at calibrating the model parameters to be applied for different oceanic regions. I would suggest something like:

*The aim of the present study is to design and implement a continuous trait-based model (CITRATE 1.0) at two representative stations in the North Pacific. The overall goal of this model is not only to simulate the phytoplankton size diversity but also to faithfully reproduce the seasonal and vertical dynamics of other important quantities such as nutrients Chl a, and productivity in for later investigations of the roles of phytoplankton diversity in biogeochemical cycles in different oceanic regions (using 3D regional/global simulations). Therefore, the two contrasted stations were used to provide a single set of parameters values by fitting the model results to observations before the obtained model was validated in another independent station (ALOHA). Hence, CITRATE 1.0 consists of the following key features:*

P. 21 L. 6-10: For consistency reasons, this part on the comparison of estimated growth rate with literature values should be moved P. 20 L. 21 together with the paragraph on the test of sensitivity of the growth rate.