

Dear Paul,

Thanks for your comments. In response, I think we have addressed the general concerns of Reviewer 2 (although perhaps not so well in the response). I respond to the reviewers general comments below, with their comments in bold.

I am missing a critical discussion concerning ecosystem complexity versus simplifications in GENIE and possible problems related to light attenuation, export production (no prognostic variable for POC) and the neglect of physical transport of the ecosystem variables.

critical discussion concerning ecosystem complexity versus simplifications in GENIE

While this comment is quite vague, and I think we have allocated a reasonable amount of text to the issue of complexity. In particular, there is a fairly long section of the Introduction that tackles the issue of Eco-BGC model complexity and our motivation for developing a physically simple yet ecologically complex model. This is also noted in the abstract “The increased capabilities of EcoGENIE in this regard will enable future exploration of the ecological community on much longer timescales than have previously been examined in global ocean ecosystem models and particularly for past climates and global biogeochemical cycles”.

The complexity issue is certainly an important scientific question, and hopefully one that EcoGENIE can make a contribution too. However, we feel that this is beyond the scope of the paper, as is already noted in the Discussion “The aim of this paper is to provide a detailed description of the new ecological component. It is clear from Figure 19 that the switch from the parameterised biological pump to the explicit ecological model has led to a deterioration in the overall ability of cGENIE to reproduce the global distributions of important biogeochemical tracers. This is an acceptable outcome, as our goal here is simply to provide a full description of the new model. Given that the original model was calibrated to the observations in question (Ridgwell et al., 2007a), that process will need to be repeated for the new model before any sort of objective comparison can be made”.

possible problems related to light attenuation

This is addressed under the specific comments. Specifically, the reviewer was not correct that C:Chl will not be relevant in the model, because they vary horizontally.

export production (no prognostic variable for POC)

The POC equations were addressed in response to Erik Buitenhuis’ comments, with our response being to change the equations. We also comment instant export term in the introduction “In the case of the nutrient-limitation models, the lack of an explicit biomass term results in export fluxes changing instantaneously in response to changing limiting factors. In the real world, by contrast, sufficient biomass must first exist, such as in a bloom condition, in order to achieve maximal export. This has 85 consequences for the how the seasonality of organic matter export is represented”. To examine this further would require additional model development experiments.

the neglect of physical transport of the ecosystem variables

This is also addressed in the Discussion: “In the initial implementation of ECOGEM described and evaluated here, the explicit plankton community is held entirely within the ECOGEM module and is not subject to physical transport (e.g. advection and diffusion) by

the ocean circulation model (although dissolved tracers such as nutrients still are). As a first approximation, this approach appears to be acceptable, as long as the rate of transport between the very large grid cells in cGENIE is slow in relation to the net growth rates of the plankton community. On-line advection of ecosystem state variables will be implemented and its consequences explored in a future version of EcoGENIE. ”

I hope you will agree that, for the scope of the paper, we have already sufficiently addressed the main concerns.

With regard to the code availability section, I have written a tutorial for the model, which I will upload. Please let me know if this is suitable (possibly in slightly modified form).

Best regards,

Ben Ward