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Earth System Dynamics
Discussions

Interactive comment on "Climate change in a conceptual atmosphere–plankton model" *by* György Károlyi et al.

Anonymous Referee #1

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This work presents an analysis of the feedbacks between atmosphere and ocean life with simplified mathematical models and detailed mathematical analysis. The questions and science considered in the paper are of broad relevance to researchers across many slices of the life sciences.

Overall, the study is very good and offers broadly applicable insights relevant to the Earth Sciences. However, the paper does not sufficiently put the Earth Science relevant findings and broader implications front and center for ESD and its audience. The findings are there, but the paper (and especially the introduction and conclusion) would benefit from expansion in this direction. Overall, I suggest re-arranging the material to highlight broader relevance.

Major Comments:

1. As mentioned, a greater focus on the broader Earth science issues and relevance is needed for an ESD paper. This can likely be accomplished through changes to the introduction and discussion/conclusions. Questions I wish the paper had addressed are along the lines of: what do these findings mean for more complex, process-based Earth System Models? I wanted more than Lines 355-356, and I think more could be said.

1a. Section 3 is a good example of how the paper is heavily focused on the details of the math. There's good scientific insight there: Lines 179-181 "The relation indicates that in the case of a positive enrichment parameter α the phytoplankton dynamics weakens the climate change, weakens the trend from D0 to D in the temperature contrast, as expected. Quite surprisingly, however, the effect is rather weak since α Âů β is quadratically small." Is there a way to make that point up front in this section, with fewer references to equations, and to move even more of the equations to the SI? Adjustments along these lines throughout would be beneficial to appeal to a broader audience of researchers.

2. One easy change would be to include a table of variable and parameter notations, the quantities each notation represents, and any assumed values or boundaries imposed on the variables/parameters (such as alpha). This could be included in the SI, but is important to include, given the number of variables, parameters, and values being considered.

3. Similarly, any kind of figure/model schematic illustrating the setup and feedbacks (and their notations where possible) would be beneficial in the main text Section 2.

Specific comments:

1. Lines 42-57: some of this text would be better suited in a methods section than the introduction.

2. Line 60: What is the relevance to this work that the ensemble approach has been

used in other adjacent but distinct studies that presumably consider different models of different variables?

3. Figure 8 : Could you add a colorbar rather than (or in addition to) writing it out in the caption?

4. Section 4: overall I like this section very much but please make explicit mention that angled brackets always correspond to ensemble average, for every variable, early in the section.

5. Please consider making code and possibly some archive of the ensembles you run available to support open-access, reproducible science.

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