

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

**Anonymous Referee #2**

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Review of “Climate change in a conceptual atmosphere–plankton model” by Károlyi et al. for ESDD

This manuscript describes a conceptual modelling study of how phytoplankton respond to changes in temperature, atmospheric CO<sub>2</sub>, and ocean mixing. In this study the authors attempt to use a relatively simple model that contains many assumptions to simulate phytoplankton growth as a function of changes in anthropogenic forcing. While I am not opposed to simple conceptual models that focus on key processes or dynamics, I feel that the conceptual model presented here makes many assumptions that are not well justified. In addition, many relevant dynamics seem to be left out, e.g., other bottom-up controls on phytoplankton growth such as light and nutrients like N, P, and Fe, as well as top-down controls like grazing and mortality. While, it may be possible

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that global phytoplankton-climate dynamics and responses to forcing can be explained without such factors (although I doubt it), in order for me to have confidence in their model I would need to see better evidence that justifies the model simplifications and model parameterizations. Many other conceptual studies of phytoplankton use laboratory studies or observations to justify their model structure and parameterizations, surely this can be done here as well. In addition, and perhaps more importantly, for me to have confidence in the model there needs to be some validation, i.e., comparisons to actual data. I know that the goal is to simulate climate change and obviously one cannot validate future projections. However, it should still be possible to come up with a clever way to validate the model (or key underlying equations) using observations. There is also no real attempt to contrast the results of this study with other phytoplankton focused climate studies that have used ocean-only or Earth system models (e.g., see citations listed below). Without satisfactory justification and validation of the model and the results this is just a mathematical exercise that while interesting, leaves the reader wondering if it has meaning. Therefore, I must recommend that the manuscript be rejected.

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