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Interactive comment on “A mathematical modelling of bloom of the coccolithophore *Emiliana huxleyi* in a mesocosm experiment” by P. Joassin et al.

Anonymous Referee #2

Received and published: 26 March 2008

Comments Joassin et al. : .

The incorporation of calcification and its sensitivity to increased atmospheric CO₂, is a challenge to present biogeochemical modeling. The mesocosm experiment described, with its bloom dominated by *Ehux* and its intensive and broad sampling program, is an excellent opportunity to test models of this.

As all models, this one contains a set of choices of what to include and what not to include, choices that obviously will influence what the model can be expected to reproduce/predict. This model contains a relatively elaborate description of *Ehux* C:N:P stoichiometry, including calcification and TEP production. There is also a description

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of viral lysis and there is a bacterial population that consumes organic material and releases/consumes mineral nutrients depending on stoichiometry of the organic substrates relative to bacterial requirements. What is not included is any description of micro- or meso-zooplankton grazers.

I think these choices are defensible for this particular experiment, but one should be very aware that they leave some important aspects untested. Among these is the balance between nutrient competition and predatory loss of Ehux relative to other phytoplankters in general, and relative to other flagellates in the same size class in particular. With no grazing control on bacterial biomass, the model probably has no steady state with mineral nutrient limited bacterial growth rate. This probably gives an internal feedback loop where Ehux production of labile DOC increases stimulates bacterial competition for mineral nutrients. Whether this is realistic or not is not discussed.

What is not clear to me is whether the model picks up effects of the CO₂-treatments. There is only one simulation presented, the one for present-day CO₂. While one may claim that the model picks up main features of the bloom dynamics, it seems that no claim is made for the model's ability to predict effects of changing CO₂.

The work contains a relatively elaborate parameter fitting procedure, and the result is that simulations fit quite well with observations. As far as I could understand, the whole dataset (all treatments?) is used for fitting, i.e. there is no validation part of this work.

If this work is published, it is likely to be used as a module, more or less uncritically used to incorporate Ehux into larger plankton models. My main worry with this is not the model itself, but more the discussion in this ms which tends to focus on whether the data fits the observations of this particular experiment, more than on the shortcomings and limitations if this model is coupled into more complete models. I would strongly recommend inclusion of at least some of these caveats in the discussion.

Minor: English language in the title does not seem perfect

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5, S220–S222, 2008

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