

Interactive comment on “Implementation and assessment of a carbonate system model (Eco3M-CarbOxv1.1) in a highly-dynamic Mediterranean coastal site (Bay of Marseille, France)” by Katixa Lajaunie-Salla et al.

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Lajaunie-Salla and coworkers present an extension of an existing food-web model with a carbonate chemistry balance. They subsequently use this model to look at the carbonate dynamics in the Bay of Marseille, and use sensitivity test to find under what circumstances the the coastal waters of the BoM could be a source or sink for CO₂. Overall I found this an interesting study, even though its focus is very local. Depending on the flexibility, this model could likely also be used on different coastal sites. I do have a few issues with the manuscript in its current state that I feel need to be resolved

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before it can be published. First and foremost, I had troubles to understand the model set-up. Given that this is a model development journal, the model should be clearly articulated in the main text, and this is not the case. Secondly, I am not convinced by the authors discussion of the disagreement between model and data. Because they are using the model to look at dynamics in carbonate chemistry, they should either be able to reproduce the data in a better way, or at the very least discuss in more detail why there is a disagreement, and why that is not a problem.

I do however think these issues can be dealt with in a revised version, and find the study itself valuable.

Comments:

1. Model Description: I do not think the model development or set-up has been well described in the text. All equations and parameters are to be found in a number of tables of the appendix, and the readers are expected to either know the plankton model used, or go to other papers to find it. This might be fine if it was an established model and in a different journal, but I do not think it is good for GMD. The reasoning behind model set-up and parametrisation is not explaining in the text, so it is difficult to understand why the model was set-up as it was. After reading the methods I still had a number of basic questions; (i) what are the dimensions of the model (1 box, 3D, ...)? (ii) It is stated at L153 that the variables were initialized at winter conditions and forced with measured temperature etc. Does it not require a spin-up for the circulation – that is, presuming it has circulation? (iii) Why do you choose two three-day periods of wind speed? Why 7 m s⁻¹? What are the boundary conditions? How does the BoM connect to the rest of the Mediterranean? ...

Furthermore, there seem to be a number of inconsistencies between tables and between tables and text, for example; (i) In Table A3 you use 'POM' for the bacterial grazing term, but that does not show up in your state variable list (it is likely detritus, but then it should be called that, otherwise it causes confusion), (ii) (O/N)nit in Table

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A2 -> (O/C)nit in Table A5, (O/N)uptNO₃ in Table A2 -> (O/C)uptNO₃ in Table A5 . . .

It is stated at L138 there is closure term, but I did not find where the grazing term closes the balance?

2. Model-data agreement: You discuss the model-data comparison in section 3.1, but seem to brush over some of the misfits quite easily. For example, the alkalinity in Fig.3 – you say the model results are within the range of the data, but they are only barely within the range, and most of the data plots above the model values. At L208 you say that the model shows the same trends for pH and pCO₂, but you have a consistent offset in the first half of your pCO₂ graph? And the trends seem to be inverse in the first half (blue dots going up and orange down) and last part (orange up and blue down) of the graph. Same for the pH (which is what you would expect as they are coupled) I would think that if you want to use the model to investigate carbonate dynamics under future climate change scenarios, you would want to be able to reproduce (or explain) what happens with the alkalinity and pH? Those model-data comparison does not give much confidence to the model (or parametrization) if you specifically want to address carbonate related questions.

3. General readability: In general, the text reads a bit awkward, and seems to have a strong French influence (I mean no offense, but that is just the way it felt when I was reading it). In particular oddly placed articles, and plural forms where it should be singular. The manuscript could probably benefit from proofreading by a native speaker. Then again, I might be wrong as I am also not a native speaker, and this is merely a suggestion.

Minor comments:

L29: 'strong atmospheric CO₂' -> do you mean high concentrations?

L41: are you considering the biological pump to be a physical process?

L47: 'organic matters' -> organic matter

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L143: just 'dataset' suffices

L149: Why did you not plot the temporal trend versus the datapoints?

L236: Why is the flux not expressed in a mol per unit area value?

L248: There is not really a decrease of seawater pCO₂, it just becomes much more variable

L282: 'farer' -> further ?

L304: how can it affect the Spring bloom before the nutrients are supplied?

L359: It sounds contradictory to say the 1.5°C rise affects the carbonate system little, but at L350 that the system is mostly driven by temperature variations

L363: double set of citations

Figures: give the legend in the figure panels instead of in the caption

Fig. 6: what are those weird spikes in the air-sea gas exchange curve?

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