Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2019-250-RC2, 2020

Geoscientific Model Development Discussions
Open Access

Interactive comment on "Simulating stable carbon isotopes in the ocean component of the FAMOUS General Circulation Model with MOSES1 (XOAVI)" *by* Jennifer E. Dentith et al.

Anonymous Referee #2

Received and published: 13 February 2020

General comments

This paper presents the inclusion of stable carbon isotopes, i.e. 13C, in the FAMOUS model. The authors have evaluated the effect of fractionation by air-sea gas exchange, biology and ocean circulation, and have tested different fractionation parameterisations for biology. This is a very useful development of the model that will be very valuable for paleo studies. This work is well presented and the reasoning is easy to follow. It has already demonstrated its usefulness by showing that the discrepancy between model results and data is likely to be due to biases in the simulated climate as well as the biogeochemical model.

Printer-friendly version

Discussion paper

My main concern is that this model should not be used as it is for paleo studies but should be re-tuned, especially the biogeochemical module, as there are very large disagreements between simulated d13C and data. This is highlighted by the authors and re-tuning the model is clearly out of the scope of this study, but it might nonetheless be interesting to have a few additional sensitivity simulations to evaluate how much the results could be improved if the biogeochemical model was slightly modified, for example with a modified remineralisation, which could potentially help reduce the model-data disagreements.

Specific comments

Abstract

p.1 l. 7: do you mean "carbon isotopic ratios" instead of isotopic ratios?

Introduction

p.2 l.2. The first sentence is almost the same as the first sentence from the abstract: maybe change it?

p.2. l.2-10. This is not entirely true for 14C as it also depends on radioactive decay: maybe you could say right at the beginning (after giving the percentages) that C14 is not studied here and only keep 12C and 13C in this part.

p2. l.9. You could give the complete definition of d13C mode explicitely as this is entirely on d13C inclusion it is worth reminding clearly the definition (d13C=...).

p.3 l. 5-8. You should also include the LOVECLIM model. What about Genie?

p.3 l.19. There is an arrow that should be deleted between "studying" and "complex" .

p5. Line 16. Sea ice does not change salinity: this is out of the scope of the study but probably needs to be modified in the model...

P5. Line 27-28. This seems at odds with what is said later. From what I understand from this paper both the physical model AND the biogeochemical model are responsible for carbon isotopes mismatch between simulation results and data and disentangling between the two is not done here.

Results and discussion

p. 10 l. 15 / Figure 4. I would start with standard results before looking at the sensitivity experiments to be able to compare these sensitivity experiments with the standard one. So, on Figure 4 I would add the standard simulated d13C first as (a) and then the other 3 sensitivity simulations as b-d, which would also be more coherent with having the 4 simulations on Figure 5.

p.10 line 19. Is this a simulation that you actually did to verify this or just discussion? Please specify.

p.11 line 8. Could you quickly remind the reader what this simulation is (to avoid looking for it earlier in the text)?

p.14 l.18. Could you test your hypothesis for the cause of the model-data mismatch due to the export ratio and remineralisation rate vs biases in ocean circulation by running additional sensitivity experiments? Testing the ocean circulation is probably more difficult, but modifying the export ratio and/or remineralisation to evaluate if this could have a large contribution to the mismatch is probably easier.

Interactive comment on Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2019-250, 2020.