

***Interactive comment on “Coupling of a sediment diagenesis model (MEDUSA) and an Earth system model (CESM1.2): a contribution toward enhanced marine biogeochemical modelling and long-term climate simulations” by Takasumi Kurahashi-Nakamura et al.***

**Anonymous Referee #2**

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General comments

I like the paper. It has a clear objective and is nicely written. I support publishing it, but just have a few suggestions how it could still be improved.

Specific comments

Page 1 Line 16: I consider this sentence as a bit unclear or vague. Please state more

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explicitly which models might show a bias, and which results of those models might therefore be less reliable than previously thought.

Page 2 Line 24-25: "Up to the present, no fully-coupled comprehensive climate model has been coupled with a sediment diagenesis model for longer time-scale applications (e.g., the glacial-interglacial variations)." -> Has this approach been used on shorter (e.g. centennial) time scales? Can you give examples, and how does your approach differ from them?

Page 5 Line 24-31: Can you show a figure, possibly in the online supplement, that proves that your time step was sufficiently small and your integration period sufficiently long to show something like a convergence of the sediment-water fluxes in the end (for all but the 14C of course)?

Page 7 Line 3-4: "which would lead to the overestimate of biological production" -> "which would lead to an overestimation of biological production"?

Page 9 Line 15-17: "Otherwise, one would need to translate records obtained from sediments into corresponding variables of the ocean model, which would introduce an additional source of uncertainty to the model–data comparison." -> You have an opposite translation by the MEDUSA model: ocean model variables are translated to sediment records. Why is this less uncertain than the other way around?

Table 1: Would it make sense to add a third column for the values in the EXORG run?

Figure 1: Why are the state variables only listed for the MEDUSA model and not for the BEC model? Probably the list of processes might be too long, but at least the state variables would give an indication of the model complexity for those not familiar with BEC.

Figure 6: Having this figure separate from Fig. 5 and using changed color scales makes the comparison very hard. And the improved behaviour of the model using the coupling is the main point of your manuscript. If you think the subfigures become too

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small if you put all three weight fractions for EXORG, EXCPL and OBS into one figure, you might consider one figure for each weight fraction but then containing EXORG, EXCPL and OBS?

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Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2019-231>, 2019.