

Review of the second revised version of

“Southern Ocean controls of the vertical marine $\delta^{13}\text{C}$ gradient – a modelling study”

submitted for publication to *Biogeosciences*
by A. Morée and co-authors

I have gone through the authors' responses to the my comments from the second review. All in all, the responses appear to be satisfactory. The required additional information (weathering fluxes etc.) have been provided. The $\delta^{13}\text{C}$ of the weathering flux at -11‰ (from $+14\text{‰}$) is still somewhat peculiar: as mentioned in my previous review, the total sedimentary carbon subject to weathering has an average $\delta^{13}\text{C}$ of -5‰ , wherein the most abundant source are carbonate rocks with a $\delta^{13}\text{C}$ of around 1.8‰ . Perhaps the amount of organically derived weathering DIC is larger than in reality (this would be the case the shelf carbonate sink is not considered). At least -11‰ can be more easily explained than $+14\text{‰}$. The model apparently included some errors that have now been corrected, making the results more plausible now.

I regret that the authors still have not changed their mind about the duration of the perturbation experiments.

I am, however, truly disappointed about the fact that even this second major (!) revision is not devoid of its share of confusion.

The previous version included in its Supplement Figures S3 and S4:

- Fig. S3 represented the surface ocean Δp_{CO_2} for the control run;
- Fig. S4 represented the specific air-to-sea exchange flux of CO_2 for the control run, the Fast gas and the Slow gas experiments.

These two figures presented several deficiencies:

1. inconsistent colour scales
2. physically incompatible results

According to the “Author's response”, the incompatibility between the results (deficiency (2)) was due to a plotting error during the production of Fig. S3. Regarding deficiency (1), we read on the 12th page of the authors' response (page numbers in the authors' response would have been the reviewers best friend ...) that “We corrected this in the new Fig. S4 so that both figures now have the first positive interval in green.” Unfortunately

- the revised Supplement contains only one figure with these informations (which other one could possibly be the second of “both” having the “first positive interval in green”?);
- this is the new Fig. S4, which represents the surface ocean Δp_{CO_2} for the control run (formerly shown on the former Fig. S3) and the Fast gas and the Slow gas experiments.

So, the new Fig. S4 actually includes the old Fig. S3 as its left panel and has equivalent panels added for the two perturbation experiments. The old Fig. S4 has been discarded. At least the old Fig. S4 (specific CO₂ exchange rates) and the new Fig. S4 (Δp_{CO_2}) are compatible (at first sight), but to check this, one has to compare graphs carrying different information in different revisions of the Supplement.

None of these comments is meant to be a showstopper and I am ready to give green light for the publication. I leave it to the editor to decide on whether the inconsistency between the figures in the Supplement and the Author's response needs correction or not.