

Interactive comment on “Variable C/P composition of organic production and its effect on ocean carbon storage in glacial model simulations” by Malin Ödalen et al.

Anonymous Referee #1

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Ödalen et al., study the impact of a variable C/P on ocean carbon storage during glacial times. The variable C/P is combined with other mechanisms possibly leading to a glacial atmospheric CO₂ decrease, such as halved winds, a deepening of the remineralization depth, and increased iron fertilization. To my knowledge this is the first systematic study of the impact of variable C/P. This is well-written and interesting manuscript. I thus recommend publication in Biogeosciences, provided the comments below are taken into account.

Introduction: It might be good to add a sentence detailing the evidence for lower terrestrial carbon storage during glacial times (p2, L.1).

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Section 2.3.1: It would be good to precise whether the wind changes impact the air-sea gas exchange of CO₂.

Methods and section 3.2.1: If I understand correctly global salinity is not increased during glacial times. If correct, it might be good to clearly state it as well as its impact on solubility changes.

Section 3.2.3: p10, L. 29: Please quantify magnitude and direction of “small” p11, L.3-4: This is an interesting result that should be emphasized. p10, L. 31-32: This sentence is unclear p11, L. 11: Shouldn’t iron fertilization lead to an increase in Prem (instead of P*)? p11, L. 16: It is unclear what you mean here with “radionuclide proxy data”

Section 4.2: - Please consider amending the title of that section - I would suggest to add all the results of experiment 121 here and thus all the finishing sentences of the diverse paragraph (ex: p10, L. 31-32).

Figure 5: I’m confused as to what is shown here. I think mistakes have been made in the plots or legends as it does not make any sense. How can both HOL and LGM can be shown for CTR? How can both HOL and LGM can be shown for GLcomb? It is really not obvious LGM Pacific is HOL Pac-0.32 permil (h compared to f). Similarly how do you go from Hol Pac to LGM Pac in CTR (g compared to e)? g looks much more like an Atlantic section than a Pacific one. How can d be LGM Atl and f) Hol Pac? d) might be Pacific.

Figure 9: With a fixed Redfield ratio ACrem should increase with Prem. I am confused as to why ACrem increases with P* here.

Table 2: I find the format of this table not ideal and wonder if it would make sense to split the RED and GAM results. Also, it might not be necessary to show the AMOC strength for both experiments. The AABW transport in the Atlantic is extremely low (where did you take it?).

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Minor points and typos: Section 2.3.3, L. 17: Missing table number P6, L. 22: “retrieved” P7, L. 14: missing reference P8: Sverdrup is usually noted “Sv” P11, L. 10: remove one “the”

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