

Line-by-line comments on the manuscript '*GEOCLIM7, an Earth System Model for multi-million years evolution of the geochemical cycles and climate*' by Maffre et al.

I found several typos throughout – see an (incomplete?) list below. Please check carefully. Plus, the list below contains some minor comments/suggestions that require attention.

L.82. 'It was one of our objective...' Unclear structure – rephrase

L.107. 'u-inside' → 'inside'

L. 127. 'surface' → 'deep (depth >1000 m)' ?

L. 130-131. 'latitude <60°S' & latitude >60°S (or latitude <-60°N)

Figure 1: Add number to each box to reflect the definitions on previous page

L. 160. 'recifal' → reefal?

L. 161. 'force' → 'forced'

L. 193. Should  $15/8F_{sulw}$  be  $xF_{sulw}$  as in Eq.1 and 12?

L. 215. Add reference to origin of this equation

L. 223. Are  $F_{adv}$  and  $F_{sink}$  missing in Eq.15? They are described on L.224-225

L. 243. '...isotopic ratio THAN the surrounding...'

L. 266-270. Eq.21-22. Just checking, no isotopic fractionation associated with dissolution and remineralization?

L. 276-280. Is there an upper limit to the dependence of primary productivity on P flux/inventory? E.g. in environments where the P inventory is extremely high, is there still a dependence on P input flux?

L. 297. 'dissolved' → dissolve

L. 351. 'similarly than' → 'similar to'

L. 369. '...sinking TO THE seafloor are lost from THE oceanic...'

L. 404. '...all other cations than...' → '...all cations other than...'

L. 417-420. Check subscripts. Should  $A \rightarrow (i)$  and  $(i) \rightarrow A$  be swapped in the text on L.417 and in the equations on L.419-420?

L. 435. '... same timestep AS in...'. Also, might be worth mentioning the time stepping here or earlier instead of waiting until Section 3.

L. 441-442. Unclear sentence, please re-write

L.443. '... elements that have UNDERGONE...'

L. 451. '...material lost FROM the oceanic...'

L. 455. 'exceed' → 'exceeds'

- L. 467. Define  $k_{sed}$
- L.480. ‘... threshold when THE sedimentation flux reachES the...’
- L. 492. Explain ‘ $k$ ’ in the subscript.  $i$  and  $j$  are adjacent boxes, what is ‘ $k$ ’?
- L. 549. Degree of ‘anoxia’ (DOA)?
- L. 564. ‘...same geographic grid AS the GCM...’
- L. 587. ‘... the slope WAS calculated [...] and/or PALEONTOLOGICAL data taken from the literature but in GEOCLIM7, a new method is added (see Section 3.4.1)’
- L. 617. ‘abondance’ → ‘abundance’
- L. 698. So the terrestrial Corg export is independent of terrestrial productivity?
- L. 724. What interpolation method is used for the climate fields? Add reference.
- Table 4 caption. Include meaning of abbreviations and explain that where one value is given, it applies to all lithologies (is that correct?)
- L. 744. ‘...time interval AS the ...’
- L. 745. Since you provide a complete overview of GEOCLIM, can you also add information about the model run/computation time along with the info about time stepping?
- L.756. ‘...geographic resolution AS the...’
- L.775. by ‘cutting depth’, do you mean ‘cut-off depth’? If so, please correct here and throughout the rest of the manuscript.
- L. 788. ‘...Lij sums up the lengths...’
- L. 859. ‘Finally, THERE are...’
- L. 865-866. Reference the origin of these equations.
- L. 879-880. ‘This needS to be manually [...] this guess ignores all [...] hydrographic networkS that...’
- L. 906. ‘Another’ → ‘Other’
- L. 907. Define  $n_x$  and  $n_y$ .
- L. 910. ‘...categories AS for slope...’
- L. 933. In addition to silicate weathering, and volcanic/anthropogenic CO<sub>2</sub> outgassing, does fossil Corg weathering not contribute to the CO<sub>2</sub> fluxes to the atmosphere?
- Figure 3. Clarify if ‘paleo-geology’ refers to the lithology or to the geological categories? Make sure to include both in Fig.3
- Figure 4. Can you add the modern mean profiles of these basins so readers can visually compare GEOCLIM pre-industrial output to the modern?
- L. 996. ‘...vertical profiles AS another...’

L. 1020. Why not include tuning of  $\delta^{13}\text{C}$ ? The equations are listed in Section 2.2.3 so it leaves the reader wondering how these are resolved.

L. 1110. Has this acceleration technique been published or tested before to yield accurate results? If so, please cite reference. If not, include a comparison between an accelerated and non-accelerated run to demonstrate the accuracy of final results.

L.1120. Use 'approximately' or '~', not both.

L. 1127. Checking Laugie et al. (Fig.5), it seems like panel H yields the best match with Laugie et al. (2021)?

Figure 8 caption. '...projections AS IN Fig. 5 ....'

L. 1136. '...goal of this paper IS to present...'

L. 1139. '...presented here start from a steady state achieved in a similar manner as explained in section 4.4...'

L. 1164. '... time ranges AS in...'

L. 1169. '...surface O<sub>2</sub> variations (~8 mmol/m<sup>3</sup>) are much smaller than the deep variations (~XX mmol/m<sup>3</sup>).'

Figure 11. It is difficult to interpret the results in this figure because the reader has to switch between the caption and the subpanels to figure out the variables that are plotted. Can you add the variable names to each subpanel to improve legibility? Plus, both the influx and outflux of an Arctic box are plotted as positive values. It would be more intuitive to plot influxes as 'positive' and outflux as 'negative' to reflex the result of the 'net' flux.

L. 1183. Evacuate → 'eliminate' or 'confirm'? This entire paragraph (L.1180-1205) needs some re-writing to present a clearer explanation, it is difficult to follow in the current state, partially because Fig.11 is not immediately intuitive. Perhaps a schematic of the proposed mechanism that drives Arctic [O<sub>2</sub>] changes can help, showing changing P fluxes in and out the Arctic boxes.

L. 1214. (des)oxygenation → (de)oxygenation

L.1225. '...not be the same AS in PISCES...'

L. 1227. 'totally inexistent' → nonexistent