

Interactive comment on “Ocean carbon inventory under warmer climate - the case of the LIG” by Augustin Kessler et al.

V. Brovkin (Referee)

victor.brovkin@mpimet.mpg.de

Received and published: 24 August 2018

Kessler et al. presented analysis of two time-slice experiments for the Marine Isotope Stage 5, comparing warm periods of 125 ka and onset of glaciation at 115 ka using Nor-ESM. The paper is focused on changes in DIC components in the ocean, and provide a novel way to separate DIC into components associated with different physical and biological mechanisms. I found it quite useful for understanding of biogeochemistry changes in paleo simulations. An obvious caveat is that the simulations are not transient, but this is a usual limitation of state-of-the art ESMs. The paper is well written, and main findings are well described in the manuscript. I have few comments/suggestions aimed at more detailed understanding of the method and model results.

[Printer-friendly version](#)

[Discussion paper](#)



Method:

- Are DIC changes due to changes in SSTs (solubility) included into $\Delta\text{DIC}^{\text{sat}}$, $\Delta\text{DIC}^{\text{dis}}$, or both? Please discuss this, as SST changes are essential for differences between cold and warm states.
- My understanding is that the biological pump changes are caused by changes in the physical circulation. If it is so, could it be briefly mentioned?
- Differences in atmospheric CO_2 and total alkalinity between two simulations are minor (p. 4), but ocean DIC changes are minor too ($< 1\%$ of ocean DIC content). DIC effect of changes in these boundary conditions (pCO_2 , TALK) needs to be discussed.
- Please provide differences in weathering/sedimentation between two simulations, as they are essential for carbonate chemistry.

Results:

- One of the interesting findings is that the ocean circulation, in particular formation of deep waters in the Southern ocean, is very sensitive to the orbital forcing changes via SH sea ice changes. Please provide 2-D plots for extent of summer/winter sea ice in the Southern Ocean. Plots of meridional overturning in Atlantic might be insightful too.
- Figure 4. What is the threshold in PO separating the SSW from NSW (dashed lines)? Is it the same value for both plots? If total phosphate inventory is different in two simulations, should PO be corrected for it?
- Figure 9. A relevance of this figure to the study is unclear.

Interactive comment on Clim. Past Discuss., <https://doi.org/10.5194/cp-2018-77>, 2018.

[Printer-friendly version](#)[Discussion paper](#)