This manuscript by Cornuault and co-authors uses carbonate accumulation rates to (1) evaluate long-term changes in pelagic carbonate production since the Middle Miocene, and in particular during four major past warm intervals: the MIS 5, the MIS 9; the PWP and the MCO; (2) characterize the orbital-scale variability and (3) determine whether orbital periodicity forcing carbonate production changed from the Middle Miocene to present. To do that, the authors first compiled existing CaCO3 % from all the Leg 154 sites in the Ceara Rise (equatorial Atlantic Ocean) since the Miocene. Next, they revised the age models of these sites to calculate sedimentation rates and carbonate accumulation rates. Moreover, they generated new $\delta^{18}O$, $\delta^{13}C$ and carbonate content data from Site 927 (Leg 154) for the four selected time intervals and developed updated age models for each time interval to calculate carbonate accumulation rates.

The results show a general increase in sedimentation rates since the late Miocene, but the carbonate accumulation rates did not show a similar clear trend. Additionally, the authors observed that the highest carbonate accumulation rates occurred during the Pliocene. Furthermore, they demonstrate that variations in carbonate accumulation prior to the Quaternary cycles follow obliquity and eccentricity and suggest that this reflect changes in the export flux of pelagic biogenic carbonate. The authors thus propose that the overall carbonate production responded to local changes in light, temperature and nutrients delivered by upwelling, which followed long orbital cycles and long-term shifts in climate and/or ocean chemistry. Finally, they suggest that the observed changes were sufficiently large that could have played a role in the regulation of the carbon cycle and global climate evolution during the Miocene warm climates into the Quaternary icehouse.

The manuscript adds to a growing body of knowledge surrounding the controlling factors regulating the global carbon cycle and global climate evolution. The conclusions are therefore significant. The selection of the four warm time intervals is appropriate, as they represent key warm periods of the late Cenozoic, selected by the international scientific community. The methods are appropriate for the work.

I generally agree with the interpretations, however, as part of my review I have some points the authors should consider/address during revision that I don't think will result in significant changes to the conclusions. In particular, there needs to more evidence to indicate that changes in carbonate AR are not affected by dissolution, especially for Site 927. There also needs to be more discussion on the link between the carbonate production and the driving mechanisms (e.g., light, temperature, nutrients-upwelling processes).

I also have some other minor recommendations and corrections listed below.

With some moderate to major revision this manuscript will represent an important contribution for publication in Biogeosciences.

<u>Main Review Points:</u>

1. a) I found the first part of the discussion section "carbonate preservation" rather weak. Although this does not mean that I necessarily disagree with author's arguments, but as this section is very important for the next parts of the paper, I recommend to provide more evidence indicating that the observed changes are (not) driven by dissolution. A series of Scanning Electron Microscope (SEM) images for instance could be helpful, or/and comparison with other available data (e.g., biogenic siliceous productivity) (maybe add a figure in supplementary material).

   b) Moreover, the authors infer in several places in the text that Leg 154 sites remain either above or below lysocline based on their modern depths. Given that depth is a crucial parameter for dissolution/preservation, I recommend to provide information on the paleodepths of the sites, especially for Site 927 for all studied time intervals.

2. a) The authors propose that changes in light, temperature and nutrients driven by upwelling, forced the observed changes in the export of flux of pelagic biogenic carbonate. These could be plausible mechanisms, but I would like to see a more detailed discussion on this. The authors could use available published data (e.g., SST; Herbert et al., 2016) to back up their hypothesis. Additionally, in Lines 22-23, they state "These results imply that the pelagic carbonate production in the tropical ocean, buffered from large temperature changes, varied…." Are there available data that shows that?

b) I also recommend to include a final figure (conceptual model) summarizing the main conclusions: changes in carbonate AR for the different time intervals, orbital variability, as well as potential mechanisms (e.g., light, temperature and nutrients).

3. In line 239, you state that "the $CaCO_3$ AR, on the contrary, does not show any obvious temporal trend (Fig. 4), *indicating that the increase in SR is compensated by decreased carbonate content in the sediment*". Maybe I'm confused, but when I'm looking for example Site 927 in Figs 3 and 4, I see that increased SR coincide with increased carbonate content between 16 and 3 Ma. Could you explain this better?

4. I'm missing a section in the result part for the new $\delta^{18}O$, $\delta^{13}C$ data generated from this study. Moreover, these data can provide additional information that can help the part of discussion.

5. I recommend to add a section of modern hydrography of the region.

Minor comments:

Lines 20-21: "…, but that each interval was characterized by large orbital-scale variability" Although I understand what you mean, reword if possible.

Lines 23-24: "…on orbital time scales similarly or even more than on longer time scales". Rephrase.

Line 71: "plankton had no opportunity to responds to the climate cycles by migration" Add a reference.

Line 80: "… to assess the spatial coherence of long ~~terms~~

Line 111: "…is also characterized as wetter" wetter compared to today? clarify

Line 130: "This aseismic ridge rises several km above…" Give depth

Line 273: "… and times of *fastest* sea-level change..." What do you mean by fastest sea level change?

Line 506: "a *largely similar* overall trend…" I cannot see that - reword this part.

Lines 507-508 you state "*Clearly*, the overall of carbonate accumulation at the Ceara Rise supports the existence of a late Miocene carbonate maximum also under tropical conditions". However, in lines 15-16 you note that there is "a systematic increase in sedimentation rates since the late Miocene, but carbonate accumulation rate does not show a clear trend", which is what your data show. Therefore, these lines in the discussion need rewording.

Lines 515: "… The two shallow sites consistently…." Add sites in a parenthesis to remind them to the reader.

Figures

Figure 1: Add scale for bathymetry

Figure 3: This is a nice figure. 3b: I recommend to add also a small key-scale showing the values of the colors.