

Second round revisions for “Late Cenozoic Sea Surface Temperature evolution of the South Atlantic Ocean”

We thank the reviewer for their positive and constructive feedback. We respond to the individual comments in purple below and have made the appropriate edits to the manuscript.

The revised manuscript is well structured and clear. The language is fluent but not precise at some places. For instance, in the abstract “little additional cooling during the Late Miocene” is not consistent with “3–5°C SST decrease at Site U1536 between the MMCT (~14 Ma) and the latest Miocene (~6.4–5.2 Ma)” at Line 390-391. Please look at the specific comments below.

We have rephrased the line in the abstract to “relatively moderate cooling”. Cooling is small compared to mid latitudes which cooled by 10°C.

In addition, the authors did not explain why Site U1536 experienced reduced cooling during the late Miocene compared with the other sites from the Southern Ocean. The authors just concluded “Due to the already relatively cold conditions in the southwestern South Atlantic in the Middle Miocene, it experienced little further cooling during the Late Miocene”. It seems that the authors assume that SST at this site cannot have additional cooling at a cold baseline. Why?

Since the lower end of the temperatures after the MMCT at Site U1536 were ~5-7°C, we argue that there is a limited amount these already cold temperature could cool compared to the warmer subtropics (around 24°C at MMCT). We have added some more information to make it more clear in line 405. There is no Site U1536 record between ~14.2-8.4 Ma (reflector-c) where we suggest a prolonged time interval of slow sedimentation rates or non-deposition or erosion cause the gap. Temperatures could've been colder and variable in this time, and sea ice might have been present, but without the record we can't speculate any further.

Specific comments:

Line 24-25: “the regional similarity in SSTs” is confusing since you did not mention it earlier. Add some info about similar SSTs between Site 696 and 511 before this sentence?

We have changed the sentence accordingly.

Line 65: delete “occurred that”.

We have changed the sentence accordingly.

Line 68: “during this time” is confusing. Please specify “this time”.

We changed “this time” to “since the late Eocene”.

Line 221-222: change “refer to the proxy results as such in the reminder of this work” to “refer to the proxy results as SSTs in the reminder of this work”.

We have changed the sentence accordingly.

Line 225-227: In your supplementary information, Fig. S3 shows that BAYSPAR-derived SSTs are higher than the SSTs derived from Kim et al. (2010) and O'Brien et al. (2017). Please check if the markers used for different calibrations in Fig. S3 are correct or not.

Yes the colors were changed between the two calibrations. This has now been corrected.

Line 224: Kim et al. (2010) generated two calibrations from GDGTs to SST. Does this study use GDGT index-1 or GDGT index-2?

We used index-2. I've included this in the text.

Line 225: I don't think the calibration from O'Brien et al. (2017) designed for warm Cretaceous climates is appropriate for this study. O'Brien et al. (2017) excludes all data for which satellite-derived mean annual SSTs are < 15 °C, probably including the regions where your study sites are located.

We argue to still keep this calibration in as a reference. Although the calibration is not specifically made for Oligocene-Miocene conditions, doesn't mean it is wrong at lower temperatures. It is very close in absolute temperature to the linear calibration from Kim et al., 2010.

Line 265-297: This paragraph is too long. Please consider breaking it into two paragraphs.

We split this paragraph into two.

Line 272: Please cite the most recent review paper for Cenozoic CO₂, Rae et al. (2021)

<https://doi.org/10.1146/annurev-earth-082420-063026>

We've added this reference.

Line 272: Hoenisch, 2021 is not in your list of references. Please check if you put all the cited references in the reference list.

This ref has been added. We will go through and check.

Line 453: please specify "SST gradient". Latitudinal SST gradient or gradient between Site 511 and 696?

We also mean Site 1090. I now added "latitudinal" before SST gradient.

Line 457: delete "already".

We have deleted this word.