Point-by-point response

We thank both reviewers for their constructive comments which we address briefly in this response.

Reviewer 2:

1) Add details on which samples were drilled in previous studies and which ones for this study…some fine tuning of wording around use of growth banding or high-resolution oxygen isotopes profiles

Answer:

For information, current methods states: "We resampled the Ifaty-4 core at annual resolution for Sr/Ca, except for multidecadal periods subsampled previously at bimonthly resolution (Zinke et al., 2004) following the established and precise age model of the high-resolution $\delta^{18}O$ sampling from austral summer to summer in any given annual cycle. Cores Ifaty-1 and Tular-3 were sampled at annual resolution along the major growth axis following the density pattern from summer to summer in any given annual cycle, established from X-ray-radiograph-positive prints. "

We will clarify the use of previous and new data in a Supplementary Table.

2) Simplify description of Monte Carlo approach for seawater oxygen isotope reconstructions…clarify if Monte Carlo approach was also used for 1881-1661 section.

Answer:

See our comment to Rev. 1.

The Monte Carlo approach was used for all data including the 1881 to 1661 section, as described in methods.

3) Why was average Sr/Ca-SST slope used? Why HadISST for $\delta^{18}O_{seawater}$ reconstruction and not ERSST?

Answer:

We did not use the average proxy-SST slopes alone, the Monte Carlo approach applies slope errors randomly. It reads: "Monte Carlo parameters are calculated by adding random values on the proxy-SST slopes, Sr/Ca, and $\delta^{18}O$ (random values are normally distributed numbers in the 1 σ range of slope errors and analytical errors, respectively)." Thus, we fully take into account uncertainties in slope estimates reported in the literature.

HadISST was used to cross-check the $\delta^{18}O_{seawater}$ reconstruction based on Sr/Ca-SST with a different SST dataset then ERSST5. By doing so, we assessed if results would improve by using reconstructed SST from observations at 1x1 degree spatial resolution instead of Sr/Ca-SST for a longer period of time. We have done the $\delta^{18}O_{seawater}$ reconstruction with ERSST5 as well, see Figure 2 of this response. We observe close agreement in long-term changes for the majority of the past 140 years (see Figure 2 of this response).

4) Improve discussion of model results in comparison to coral-based reconstructions.

Answer: See response to reviewer 1 above.

Minor comments:

Line 17: Might be helpful to define the acronyms for sea-surface temperature and salinity as they're used later in the abstract.

Answer: Done.

Line 22: please indicate the full time period of comparison (1958-1995?)

Answer: Done.

Line 38: both "inter-ocean" and "interocean" appear in the manuscript. Use one or the other for consistency.

Answer: inter-ocean now used consistently

Line 42: possible formatting issue on one of the references?

Answer: Corrected.

Line 78: This is the first mention of $\delta^{18}O$. It might be "spelling out" what the $\delta^{18}O$ notation stands for.

Answer: Changed to "…Measurements of the $\delta^{18}O$ in seawater (hereafter $\delta^{18}O_{seawater}$),…"

Line 170: One occurrence of "for SST" can be removed.

Answer: Corrected.

Line 160: The -0.22 per mil/deg C relationship pre-dates Thompson et al., 2011. Please use the appropriate reference here.

Answer: Added: Lough, 2004.

Lines 202-205: Interestingly the $\delta^{18}O$-SST variability appears to be more consistent with ERSST than Sr/Ca-SST (which has some very large spikes that aren't observed in temperature). Any thoughts on why this is the case?

Answer:
Up to 1890, $\delta^{18}O$-SST apparently agrees better with ERSST than Sr/Ca-SST. Pre-1890, $\delta^{18}O$-SST deviates from ERSST more than Sr/Ca-SST. Between 1942 to 1995, both proxies perform equally well. Between 1854 and 1910, Sr/Ca-SST outperforms $\delta^{18}O$-SST, most probably due to greater impacts of $\delta^{18}O_{seawater}$ variations (already suggested by Zinke et al., 2004). Especially between 1910 and 1940, Sr/Ca-SST shows higher magnitude variability for the most recent period. We suggest that Sr/Ca-SST may better reflect local SST variations at the reef site and between reefs which at times may be higher than recorded by the dual proxy $\delta^{18}O$ (influenced by SST and d18Osw) or the coarse gridded ERSST.
As stated in the manuscript, we also expect the annual mean $\delta^{18}O$-SST record to perform better for parts of the 20th century and pre-1890 because 1 core (Ifaty-4) has been previously sampled and measured at higher resolution (monthly 1920-1995; bimonthly 1919-1661) while Sr/Ca is

largely based on annual mean samples for all cores. Thus, annual sampling leads to overall larger uncertainties in reconstructed Sr/Ca-SST for individual years than higher resolution sampling. These uncertainties are propagated by our Monte Carlo approach.

Line 205: Are these trends? If so, please include the term "trend" in the sentence. Also, both numbers are consistent which is nice!

Answer: "trend" now included in sentence

Figure 1: I'd recommend using a different light color to represent the errors in panels a-c (maybe gray) so that the median of each reconstruction is more visible. This is more of an issue with the panel A where the shades of red are very close to each other.

Answer: We have changed the median line in panel a. See comment to Rev. 1.

Line 240+: the use of both NST and SST is confusing. Using NST alone for this presentation is fine. Same goes for NSS/SSS.

Answer: NST is the correct description of model data. We have now clarified in methods why we use NST instead of SST for the model data.

Line 330: This sentence might be missing a few words?

Answer: Unclear what the reviewer refers to.

Line 395: This sentence might be too strong and casts a lot of doubt the observations in the rest of the paragraph, especially given the evidence from the literature presented in the next paragraph that supports more ENSO activity in the 16th century.

Answer: We have referred to studies that show enhanced interannual ENSO-band variability in the 17th century and at the turn to the 18th century, not the 16th century. It's unclear what the reviewer refers to here.

Line 400: Cobb 2003 is a more appropriate reference

Answer: Cobb, 2003 added

Line 402: Is this the same coral used in this study? If so, using it to support the results is somewhat circular. If it's a different core, it might be worth mentioning so others don't make the same assumption.

Answer: We now make it clear that it is related to the previous study.