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Dr. Julien Emile-Geay
Editor of *Cliame of the Past*

Kiel, 18.12.2025

Response to reviewer comments for the manuscript titled 'The Northwest Pacific corals unravel the NPGO/Victoria Mode-related temperature back to the 19th century' by Ito et al., https://doi.org/10.21203/rs.3.rs-3861020/v3

Dear Editor,

We thank you and the two anonymous reviewers for the constructive comments and suggestions that have helped us significantly improve our manuscript. Major changes in the revised version will be:

1. We will provide additional analyses and clearer explanations regarding the appropriateness of the filtering approaches applied to each dataset, following the recommendations from both reviewers.
2. We will include analyses using the winter coral data and the Victoria Mode Dipole Index (Wen et al., 2024) for comparison to extend discussions, as suggested by both reviewers.
3. We will replace the HadCRUT5 dataset with the ERSST dataset for all comparison analyses, following Reviewer #2's suggestion.
4. We will revise the definition of seasons (3-month averaging), which helps address potential age model uncertainties at the seasonal scale, also following Reviewer #2's suggestion.
5. We will add additional supporting materials - figures, tables, descriptive text, and statistical tests - to reinforce the robustness of our results and interpretations.

We have confirmed that these revisions do not alter the primary objectives of our study; instead, they strengthen the manuscript, particularly the structure of the results, discussion, and conclusions.

Below are our detailed responses to the reviewer's suggestions (in red).

Thank you very much for your consideration.

Sincerely yours,
Dr. Saori Ito (as a representative of authors)

RC1: 'Comment on egusphere-2025-4054', Anonymous Referee #1, 28 Oct 2025

Summary

Ito et al. present a highly novel coral record of Sr/Ca that monitors North Pacific Gyre Oscillation/Victoria Mode temperature variability from 1798 to 2014. The authors identify an important scientific question: the NPGO/VM has a tight and intensifying connection with the central Pacific in future simulations with strong greenhouse gas forcing, but how has this relationship changed over the common era? This record provides insight during an important gap in instrumental and coral observations and will be of interest to the paleoceanographic and coral communities. This record documents a variable relationship with instrumental observations from the central equatorial Pacific at 8-30 year timescales (sometimes the correlation between these two regions reverses sign, sometimes is significant, sometimes not). The manuscript is well structured and does a great job of acknowledging other paleo-derived reconstructions of NPGO variability, but could benefit from streamlining the central message of this analysis.

We sincerely appreciate your time for reviewing our manuscript and your insightful comments. We will revise our manuscript in accordance with your suggestions.

Major Comments

1. The introduction attempts to differentiate between reconstructions of NPGO and Victoria Mode variability (~line 65-70) and states that this coral record will be the first record of Victoria Mode variability. However, the rest of the analysis compares the Kikai Island record and instrumental SSTs to the NPGO index by DiLorenzo et al. 2008. If the authors want to make the case that their record is the first of Victoria Mode variability (not NPGO), they should compare their record to the Victoria Mode. At the least, they could describe how the timeseries of the NPGO and VM indices differ. Ding et al. 2014 show that the NPGO and VM are different at decadal timescales (which would certainly apply when using the 8-30 year bandpass filter), writing "The NPGO exhibits a significant (at the 90% level) spectral peak around 10 years that is absent from the VM; instead, the VM tends to have higher power at interannual time scales, with a peak at periods of 3-4 years (but not significant at the 90% level). "

Major1. Thank you for the insightful comments. In addition to the North Pacific Gyre Oscillation (NPGO), we will place an emphasis on the Victoria Mode (VM). Specifically, in the revised manuscript, we will (1) describe the characteristics of the NPGO and VM separately (e.g., showing Figure R1-1), and then (2) directly compare our coral record with both the NPGO and VM using the NPGO Index (Di Lorenzo et al., 2008) and the Victoria Mode Dipole Index (VMDI; Wen et al., 2024).

Although their definitions differ (the NPGO represents the second-leading mode of sea surface height anomalies (SSHa), whereas the VM represents the second-leading mode of sea surface temperature anomalies (SSTa)), it is well established that the two modes are synchronised. For example, Di Lorenzo et al. (2008) demonstrated the alignment between the NPGO and VM (see their Figure 4c). As noted in your comment, Ding et al. (2015) examined the spectral characteristics of these modes. They found a significant spectral peak around 10 years for the NPGO at the 90% significance level, whereas they did not identify a dominant frequency of the VM at the 90% level. In the previous NPGO studies, an 8-year low-pass filter has been commonly applied for time series analysis (Di Lorenzo et al., 2010; Ding et al., 2015; Nurhati et al., 2011). Although the number of previous VM studies is fewer than the NPGO studies, Wen et al. (2024), who applied an 11-year low-pass filter, confirmed a robust correspondence between the conventional empirical orthogonal function-based VM index (Bond et al., 2003) and their newly proposed VMDI.

To verify the efficiency of our filtering approach, we will additionally conduct spectral analysis (preliminary results are shown in Figure R1-1). For the NPGO (the NPGO Index), it exhibits significant frequencies at 9.8, 6.8-6.9, and 3.6 years at the 95% confidence level (CL), with and without 30-year high-pass filtering (Figures R1-1a and R1-1c). For the VM (the VMDI dataset) without filtering, we do not detect any significant time frequency at the 95% CL (Figure R1-1b). In contrast, with 30-year high-pass filtering, we detect significant frequencies at 12.4 and 10.6 years at the 95% CL (Figure R1-1d). This result suggests that the 30-year high-pass filter effectively removes long-term trends/frequencies, such as global warming or external forcing. Based on the previous studies (Di Lorenzo et al., 2010; Ding et al., 2015; Nurhati et al., 2011; Wen et al., 2024) and our additional spectral results (Figure R1-1), we will employ an 8-year low-pass filter and/or an 8-30-year bandpass filter for the NPGO analysis, and a 10-year low-pass filter and/or a 10-30-year bandpass filter for the VM analysis. These filters are appropriate for capturing the characteristics of both VM and NPGO.

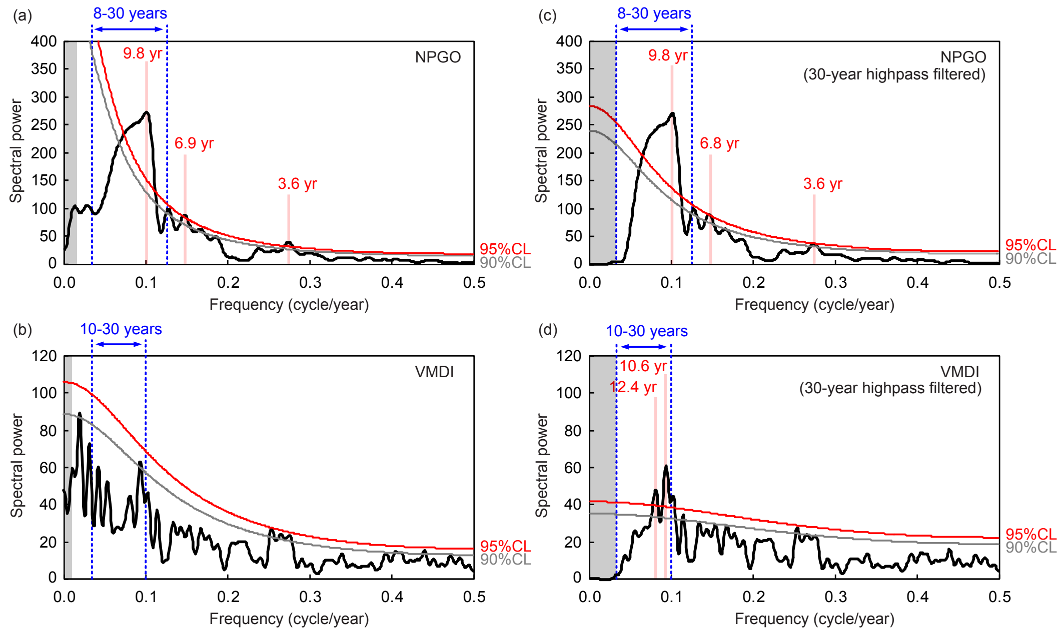

Figure R1-1. Spectral power analysis for the NPGO Index and the VMDI.
(a) Annual mean dataset of the NPGO Index (Di Lorenzo et al., 2008) for the period 1950-2014. (b) Annual mean dataset of Victoria Mode Dipole Index (VMDI, Wen et al., 2024, calculated using ERSST5, Huang et al., 2017) for the period 1900-2014. (c)(d) Same as (a) and (b), respectively, but for the dataset, which was 30-year high-pass filtered. The detected significant frequencies at the 95% confidence level (95% CL) are denoted with years (yr). Indetectable frequencies are shaded in grey. The spectral power analysis was computed using Past software (v. 4.0.3; Hammer et al., 2001). The time frequency between the blue dashed lines with a note (year) indicates the range of the pass filter that is employed in this study. Notes: The results are preliminarily shown in this reply document, and conclusive results can be found in a revised manuscript.

2. The authors should clarify some of the assumptions that they make in their interpretation of the Kikai Sr/Ca index over the instrumental era.

Firstly, the authors focus on 8-30 year bandpass filtered summer Sr/Ca measurements to derive their Kikai-ST_coral record. This relationship has the highest agreement with annual instrumental data in the late 20th century, but I am concerned that this filtering may prevent capturing meaningful signals about the Victoria mode. For example, winter time SST variability is often noisier than summer SST variability at higher latitudes– the VM even shows high variance in late winter and early spring SSTs (Ding et al. 2014). Eliminating winter observations and bandpass filtering for 8-30 years may be smoothing out potentially important signals.

Major2-1. Thank you for the comments. Regarding the significance of time frequencies and the selection of pass filters, please refer to our response Major1. We have confirmed the validity of the filtering approach used in this study (an 8-year low-pass filter and an 8-30-year band-pass filter). In the revised manuscript, we will include a detailed explanation of the significant time frequencies identified in our analysis and clarify how these results support our choice of pass filters (see Figure R1-1).

With respect to the winter coral Sr/Ca record, we will provide additional results using the winter dataset to broaden the interpretation of the Kikai-coral Sr/Ca record. Our preliminary findings are shown in Figure

R1-2 (see also Table R1-1, referenced in our response Major2-2). It is noted that we used the ERSST5 sea surface temperature (SST, Huang et al. 2017) instead of the HadCRUT5 surface temperature (ST, Morice et al., 2021) following Reviewer #2's suggestion (see *Specific Comment 4* and our response *S4-1*). By this revision, we will replace the abbreviations "Kikai-ST_{coral}", "Kikai-$ST_{HadCRUT5}$", and "CP-$ST_{HadCRUT5}$" with "Kikai-SST_{coral}", "Kikai-SST_{ERSST5}", and "CP-SST_{ERSST5}", which means temperature records from our Kikai-coral Sr/Ca dataset, the ERSST5 dataset for the grid covering Kikai Island, and the ERSST5 dataset for the Central Pacific, respectively. This revision has also been applied in this response document.

We obtained markedly different relationships between Summer Kikai-SST_{coral} and Winter Kikai-SST_{coral} when compared with instrumental temperature datasets (Figure R1-2) (all datasets were computed as 3-month averages following Reviewer #2's suggestion; see their *Specific Comment 5* and our response *S5*). As discussed in Discussion section 4.1, Kikai-coral Sr/Ca_{winter} may be affected by growth biases at the seasonal scale (i.e., season-dependent growth-related bias). This bias likely influences the winter temperature record derived from winter Sr/Ca values (i.e., Winter Kikai-SST_{coral}). Although potential winter bias remains a concern, we will expand our discussion of winter variability in the revised manuscript. In addition, we tested comparisons using winter-to-spring averages; however, these did not yield significant relationships between Kikai-SST_{coral} and either instrumental temperature records or climate indices. For these reasons, we focus on the comparison between summer or winter coral records and annual means of instrumental temperature records and indices in this study.

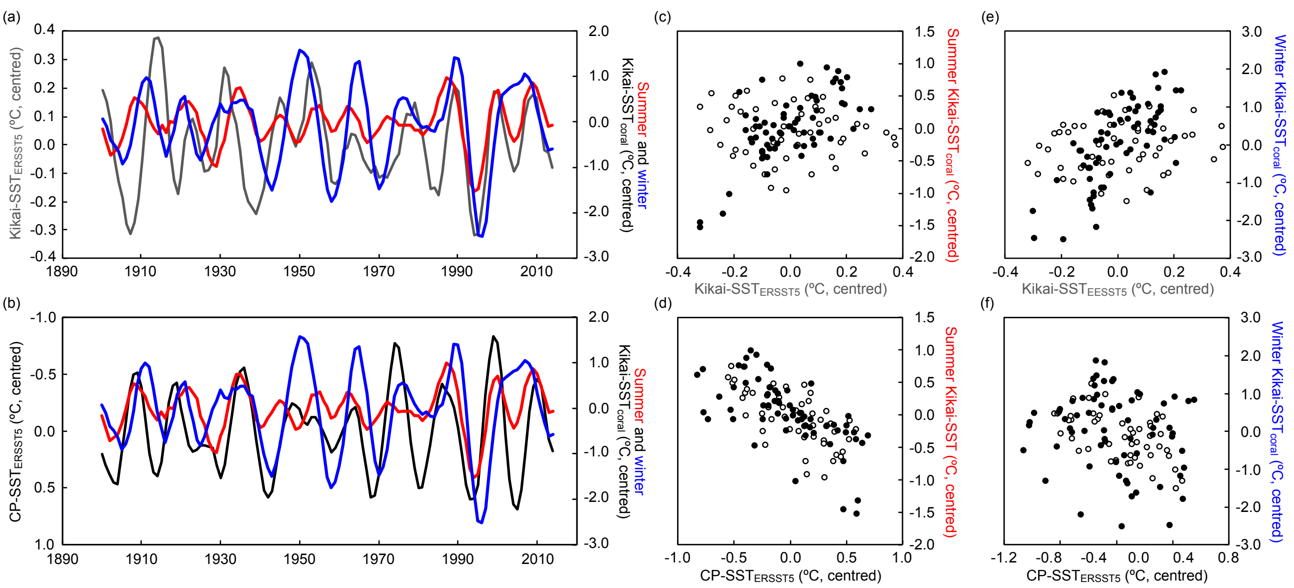

Figure R1-2. Time series comparisons of Kikai-SST_{coral} and instrumental temperature records for the period 1900-2014 CE. Comparison of (a) Summer Kikai-SST_{coral} (red line), Winter Kikai-SST_{coral} (blue line), and annual mean Kikai-SST_{ERSST5} (grey line, Huang et al., 2017, for the grid covering Kikai Island), (b) Summer Kikai-SST_{coral} (red line), Winter Kikai-SST_{coral} (blue line), and annual mean CP-SST_{ERSST5} (black line, Huang et al., 2017, for the grid covering the Central Pacific, 5° S-5° N, 160° E-150° W). An 8-30-year bandpass filter was applied to all time series. (c)(d)(e)(f) Scatter plots corresponding to (a) and (b), among Summer Kikai-SST_{coral}, Winter Kikai-SST_{coral}, annual Kikai-SST_{ERSST5}, and annual mean CP-SST_{ERSST5} datasets. Open-circle plots are data for the period 1900-1949 CE. Closed-circle plots are for the period 1950-2014 CE. Notes: The results are preliminarily shown in this reply document, and conclusive results can be found in a revised manuscript.

Secondly, the authors demonstrate that their 8-30 year bandpass filtered summer Sr/Ca Kikai-ST record has stronger coherence with 8-30 year bandpass filtered SST (all months) observations from the central equatorial Pacific than the Kikai region (Figure 3). Why might this record not represent local conditions as well? Additionally, in Figure A8, the authors compare the Kikai summer Sr/Ca record with Palmyra Sr/Ca record and find a much weaker relationship. This is surprising given that Nurhati et al. 2011 published a strong agreement between Palmyra Sr/Ca and the NPGO index. Why might the relationship between Kikai-ST_coral have a stronger correlation with uncertain instrumental SST observations than another coral Sr/Ca record?

Major2-2. Thank you for the comments. As a preliminary note, the temperature product used in our study will be changed, and the correlation coefficients (*r* values) between our coral record and instrumental datasets will be updated accordingly. This revision follows Reviewer #2's suggestions (see their *Specific Comments 4* and *5*, and our responses *S4-1* and *S5*).

Our preliminary comparison results are summarised in Table R1-1. For the period 1950-2014 CE (Table R1-1a), our coral record shows significant correlations at the 95% CL with local SST (Kikai-SST_{ERSST5}) and SST variability in the Central Pacific (CP-SST_{ERSST5}), except for the comparison between Winter Kikai-SST_{coral} and CP-SST_{ERSST5}. These results indicate that our coral record robustly reflects local temperature variability connected to the Central Pacific region. For the longer period 1900-2014 CE (Table R1-1b), only Summer Kikai-SST_{coral} shows a significant correlation with CP-SST_{ERSST5} at the 95% CL. These results imply the possibilities of (1) season-dependent growth-related bias on winter coral data (i.e., Winter Kikai-SST coral, see also our response Major 2-1) and (2) insufficient quality of instrumental SST record for the grid covering Kikai Island (i.e., Kikai-SST_{ERSST5}) prior to 1949 CE. Under appropriate statistical practice, correlation strength should not be evaluated solely through *r* values when population variances differ among datasets. Importantly, Summer Kikai-SST_{coral} shows a significant correlation with Palmyra-SST_{coral} (Nurhati et al., 2011) at the 95% CL (Table R1-1c). Given that Palmyra-SST_{coral} exhibits high coherence with the NPGO, this significant relationship supports our interpretation that our coral record has the potential to reconstruct NPGO/VM variability.

Table R1-1. Correlation among Kikai-SST$_{coral}$, instrumental temperature record (ERSST5) around Kikai Island and in the Central Pacific, and Palmyra-SST$_{coral}$.

The dataset of Kikai-SST$_{coral}$ was converted from Kikai-coral Sr/Ca (i.e., temperature proxy record). The Kikai-SST$_{ERSST5}$ dataset was derived from ERSST5 (Huang et al., 2017) for the grid covering Kikai Island. The CP-SST$_{ERSST5}$ dataset was derived from ERSST5 (Huang et al., 2017) for the grid covering the Central Pacific, 5° S-5° N, 160° E-150° W. An 8-30-year bandpass filter was applied to all time series prior to calculating correlations. The statistical significance of correlation coefficients, i.e., confidence levels (CL), was tested using the method described by Di Lorenzo et al. (2009) and Di Lorenzo et al. (2010), which accounts for the reduction in effective sample size (N_{eff}) due to filtering. Notes: The results are preliminarily shown in this reply document for discussion in *Climate of the Past*, and conclusive results can be found in a revised manuscript.

(a) Comparison of seasonal coral record (this study) and annual mean instrumental temperature record, 1950-2014

Pair of correlation analysis	Period	*r*	significance	$N_{eff.}$
Summer Kikai-SST$_{coral}$ versus Kikai-SST$_{ERSST5}$	1950-2014	0.69	95%CL	7.66
Summer Kikai-SST$_{coral}$ versus CP-SST$_{ERSST5}$	1950-2014	-0.66	99%CL	6.71
Winter Kikai-SST$_{coral}$ versus Kikai-SST$_{ERSST5}$	1950-2014	0.68	95%CL	8.53
Winter Kikai-SST$_{coral}$ versus CP-SST$_{ERSST5}$	1950-2014	-0.18	*n.s.*	6.02

(b) Comparison of seasonal coral record (this study) and annual mean instrumental temperature record, 1900-2014

Pair of correlation analysis	Period	*r*	significance	$N_{eff.}$
Summer Kikai-SST$_{coral}$ versus Kikai-SST$_{ERSST5}$	1900-2014	0.34	*n.s.*	15.86
Summer Kikai-SST$_{coral}$ versus CP-SST$_{ERSST5}$	1900-2014	-0.65	95%CL	9.80
Winter Kikai-SST$_{coral}$ versus Kikai-SST$_{ERSST5}$	1900-2014	0.41	*n.s.*	19.40
Winter Kikai-SST$_{coral}$ versus CP-SST$_{ERSST5}$	1900-2014	-0.28	*n.s.*	10.96

(c) Comparison of seasonal coral record (this study) and annual mean Palmyra-SST$_{coral}$ (Nurhati et al. 2011)

Pair of correlation analysis	Period	*r*	significance	$N_{eff.}$
Summer Kikai-SST$_{coral}$ versus Palmyra-SST$_{coral}$	1950-1997	-0.69	95%CL	5.74
Summer Kikai-SST$_{coral}$ versus Palmyra-SST$_{coral}$	1887-1997	-0.56	95%CL	12.73
Winter Kikai-SST$_{coral}$ versus Palmyra-SST$_{coral}$	1950-1997	-0.09	*n.s.*	6.05
Winter Kikai-SST$_{coral}$ versus Palmyra-SST$_{coral}$	1887-1997	-0.16	*n.s.*	11.91

Thirdly, the authors describe that the NPGO annual index lags the Kikai-ST_coral record by 1 year. Ceballos et al. 2009 describe that the NPGO can lead KOE variability by 2-3 years, but what processes might cause SSTs in the Northwestern Pacific to lead NPGO variability by a year? COuld this unusual lead-lag relationship be partially caused by the authors focus on summer Sr/Ca values?

Major2-3. Thank you for the comments. Following Reviewer #2's suggestion (see their *Specific Comment 5* and our response *S5*), we will revise the seasonal definition for our analyses, using 3-month averages for each summer and winter value. Based on our preliminary results, Summer Kikai-SST$_{coral}$ shows a significant correlation with the NPGO Index **without any lag** (r = 0.63, N_{eff} = 11.99, 8-year low-pass filtered). According to Di Lorenzo et al. (2013) and Ceballos et al. (2009), the Kuroshio-Oyashio Extension (KOE) variability is likely a consequent output in the NPGO mode-centred "Pacific climate dynamics and teleconnections" (Di Lorenzo et al., 2013, their Figure 1). In our study, we do not discuss the consequent output associated with the NPGO mode to maintain our study focus throughout the manuscript, which is the NPGO-related temperature variations propagated from the Central Pacific to the Northwest Pacific via the "ocean–atmosphere bridge" (Discussion section 4.2).

3. I was also curious about the authors interpretation of the Kikai Sr/Ca index prior to the instrumental era (e.g. Figure 6). From 1798-1920, the reconstructed NPGO index is virtually always in a negative phase. Would the analysis be better served by detrending their coral record? Physically, it does not seem realistic for the NPGO/VM to be in a centuries long negative phase.

Major3. Thank you for the comments. In our manuscript, the coral-based NPGO/VM variability is presented as an 8-year low-passed record, following previous NPGO studies (e.g., Di Lorenzo et al., 2010; Ding et al., 2015; Nurhati et al., 2011). While the number of NPGO studies focusing on the period that the NPGO Index does not cover (prior to 1949 CE) remains limited, there is still room to discuss multi-decadal features of the NPGO mode. Because our study provides the first reconstruction of NPGO/VM variability from the Northwest Pacific, and because detrending may suppress potential decadal-scale NPGO signals, we chose not to apply a detrending procedure in this study.

Following Reviewer #2's suggestion, we will revise the seasonal definition for our analyses (see their *Specific Comment 5* and our response *S5*). This revision will update Figure 6. Our preliminary results are shown in Figure R1-3, and we will revise the text description accordingly. From 1798 to 1920 CE, the reconstructed NPGO/VM variability alternates between negative and positive phases. The negative phases exhibit a greater magnitude than the positive phases. In particular, a pronounced negative phase is observed from the 1860s to the early 1900s. As described in Lines 370-373, this feature may represent a regional characteristic specific to the Northwest Pacific.

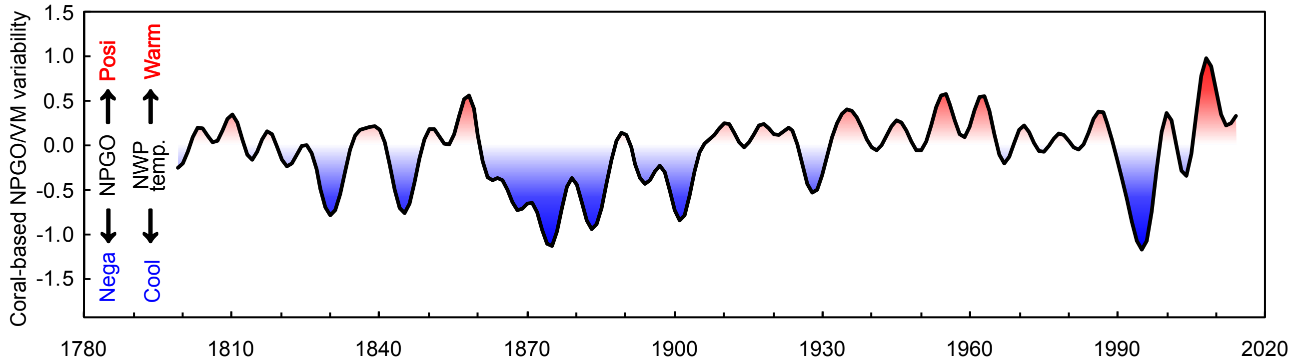

Figure R1-3. Reconstructed NPGO/VM variability extending back to the 1800s.
Coral-based NPGO/VM variability calculated using the Kikai-coral Sr/Ca_{summer} dataset. The reconstruction equation is shown in Eq. 1 in the manuscript. An 8-year low-pass filter was applied to the datasets before calculation. Blue-coloured portions indicate negative phases of NPGO (< 0)/cool-temperature, while red-coloured portions indicate positive phases of NPGO (> 0)/warm-temperature. Notes: This figure is an update for Figure 6 in the manuscript. The results are preliminarily shown in this reply document, and conclusive results can be found in a revised manuscript.

4. In the abstract and introduction, the authors mention set up the reader to think about how the relationship between the central equatorial Pacific and NPGO/VM changed over the 19th and 20th centuries as context for the projected changes over the 21st centuries. The authors don't focus on this as much as implied earlier on– the authors show a plot of 8-30year bandpass filtered CP SST observations with their 8-30year Sr/Ca record over the instrumental era. Given the uncertainties in SSTs in the early 20th century, wouldn't it make more sense to use the Nurhati et al. 2011 record? The authors could also loop in the Sanchez et al. 2016 Clarion record into this analysis. Is Figure 7 (the running correlation plot) substantially different if using all months from the Kikai Sr/Ca record? In addition, the authors are uniquely well suited to comment on how Kikai Sr/Ca variability changes during other periods of substantial volcanic or aerosol forcing for additional impact, if they want. The response of the climate system to the Mystery and Tambora eruptions is of interest to many in the paleoclimate and paleoceanographic communities.

Major4. Thank you for your helpful suggestions. We will revise the manuscript to ensure that the objectives and focus are clearly maintained throughout. We have already shown comparisons of our coral record with the instrumental temperature record in the Central Pacific (1900-2014 CE; Figure 3) and with Nurhati et al. (2011) (1887-1997 CE; Figure A8). In addition, we will present comparison results with Sanchez et al. (2016) (1820-1997 CE).

The quality of the temperature product depends on the grid and period (Chan and Huybers, 2021). The quality of Kikai-SST_{ERSST5} prior to 1949 CE may have been insufficient, as evidenced by the poor correlation with our coral record (Table R1-1). While we have confirmed significant relationships between Summer Kikai-SST_{coral} and the annual mean CP-SST_{ERSST5} at the 95% CL, both periods 1900-2014 and 1950-2014 (Table R1-1). Therefore, we do not find any insufficiency in the quality of the CP-SST_{ERSST5} dataset. As Figure 7 (revised) will represent a comparison between the CP-SST_{ERSST5} dataset (of sufficient quality) and our coral record, there will be no concern related to the quality of the datasets. Nonetheless, following your suggestion, we will include additional results using data from Nurhati et al. (2011) and Sanchez et al. (2016) in Figure 7. These extended analyses will cover a longer period (1820-2014 CE) compared to the previous period (1900-2014 CE).

In response to your question regarding Figure 7, we provide supplementary results for annual mean values calculated from all monthly data (Figure R1-4). Although the individual correlation coefficients (*r* values) differ slightly from those in Figure 7, the main conclusions are still supported: (1) a significant historical correlation persists from the early 20th century until 2014, except for the period from the 1970s to the 1990s; and (2) the degree of correlation observed between the 1930s and 1940s is nearly equivalent to that of recent decades (see also Lines 399-406).

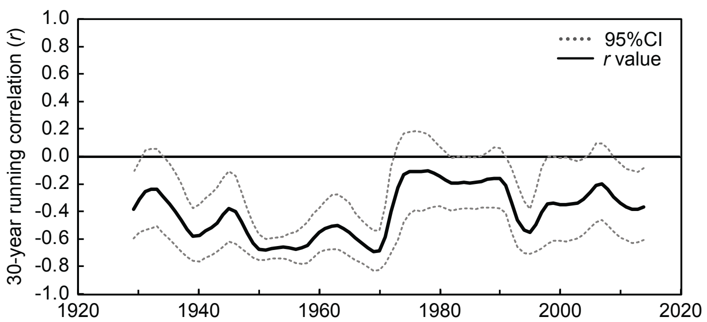

Figure R1-4. 30-year running correlation between CP-$ST_{HadCRUT5}$ and coral-based NPGO/VM variability (calculated using annual mean values).
The solid line represents the 30-year running correlation coefficient (*r*), and the dashed lines indicate the 95% confidence interval (CI). An 8-year low-pass filter was applied to both time series of CP-$ST_{HadCRUT5}$ and coral-based NPGO/VM variability (calculated using Kikai-$Sr/Ca_{annual\ mean}$) prior to calculating the correlation. Notes: The results are shown only in this reply document.

We also appreciate your suggestion regarding volcanic forcing as a potential impact, and we will mention this possibility in the revised manuscript. According to previous studies (e.g., Brönnimann et al., 2019), major volcanic eruptions occurred between the 1800s and 1830s (late phase of the Little Ice Age), including the 1808/1809 CE "Mystery" eruption, the 1815 CE Tambora eruption, the 1822 CE Galunggung eruption, the 1831 CE Zavaritskii caldera eruption (Hutchison et al., 2024), and the 1835 CE Cosigüina eruption. These eruptions caused sustained cooling for several years following each event. Both our coral Sr/Ca record and our coral-based NPGO/VM variability (see Figure R1-3) show a modest cooling phase between the late 1820s and the early 1830s, coinciding with this period of frequent eruptions. While we cannot entirely rule out volcanic forcing as a contributor to this cooling, its overall influence appears to be limited. Furthermore, we observe a transition from a warm phase to a pronounced cooling phase in the 1860s, which occurred well after the late phase of the Little Ice Age and after the major eruptions that significantly affected the climate. Therefore, the substantial cooling observed at our study site during the mid-19th century is unlikely to be attributable to volcanic forcing during the early-mid 19th century.

Minor Comments

- I suggest replacing instances of "ST" with "SST" for sea surface temperature. This abbreviation is more conventionally used and will decrease reader confusion

Minor1. We appreciate your comments; however, we respectfully decline this suggestion. In the original manuscript, we used "ST" and "SST" as abbreviations for "surface temperature (i.e., land-surface air temperature and sea surface temperature)" and "sea surface temperature," respectively. These abbreviations are properly defined in Introduction section (Lines 34 and 50).

It should be noted that, following Reviewer #2's suggestion (see their *Specific Comment 4*), we will use the ERSST5 (SST) dataset instead of the HadCRUT5 (ST) dataset. In any case, we will ensure consistent use of these abbreviations in the revised manuscript.

- Figure 1 has a handful of typos:

– Figure 1 B,C,E, the word "annual" is misspelled

Minor2. We will correct the typos. Thank you for pointing them out.

— How does 1B differ from 1C? The heading is exactly the same?

Minor3. The difference between Figures 1B and 1C is the time periods of the datasets used. The figure heading are not identical: Figure 1B is labeled "... 19**50**-2014 CE," whereas Figure 1C is labeled "... 19**00**-2014 CE." These differences are noted both in the figure captions and in the figure headings.

–The authors should indicate that they limit the analysis to the year 2014 to heighten similarity with their Sr/Ca record or use the latest available data through 2025. The authors should consider using the most recent decades– it would double the available years for their SSH analysis.

Minor4. We appreciate and accept your suggestion to use datasets through 2014 CE to facilitate comparison with their Sr/Ca record. Following this suggestion, we have tested a comparison using the latest available data for the SSH analysis (through 2021). We confirmed that the NPGO pattern is consistent in both periods, 1993-2014 CE and 1993-2021 CE.

- The authors analysis would be clearer if they also provided raw correlation coefficients between coral Sr/Ca and local SST. Instead their focus is on only using summer months, then using an 8-30 year bandpass filter. It would be nice if there was a supplementary table or something to see how this seasonal focus influences the interpretation of this record. Would the relationship with local SST also be improved if examining seasonal correlations?

Minor5. Thank you for the comments. In the revision, we will provide additional results using the winter dataset to broaden the interpretation of the Kikai-coral Sr/Ca record (please see also our response Major2-1). We conducted season comparisons as a basic data analysis; however, we did not obtain consistent, statistically significant results. This may be due to season-dependent growth-related biases in the coral Sr/Ca record (Discussion section 4.1) and/or the insufficient quality of the instrumental temperature records (Lines 311-313; for the grid covering Kikai Island). On the other hand, we found a significant relationship between our coral record (both summer and winter data) and the annual mean instrumental temperature dataset (see Table 1-1, presented in our response Major2-2). We will also show correlation coefficients between our coral Sr/Ca record and the SST product for the grid covering our study site, before presenting the comparison using 8-30-year band-pass filtered datasets.

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