Replication and reproducibility in (paleo)climate science

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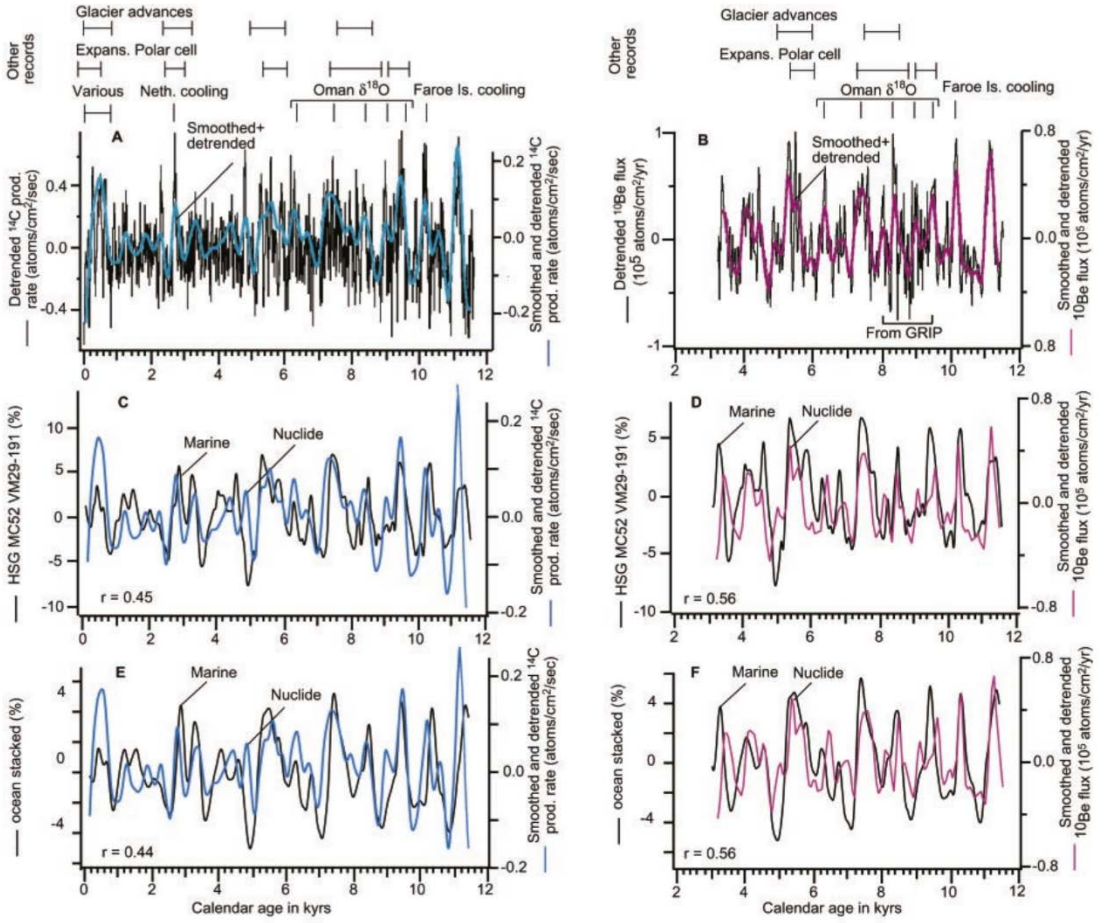
1. Reproducibility: c. 2001



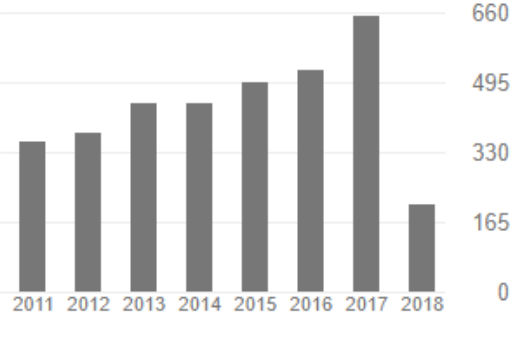
Persistent Solar Influence on North Atlantic Climate During the Holocene

Gerard Bond,[1]* Bernd Kromer,[2] Juerg Beer,[3] Raimund Muscheler,[3] Michael N. Evans,[4] William Showers,[5] Sharon Hoffmann,[1] Rusty Lotti-Bond,[1] Irka Hajdas,[6] Georges Bonani[6]

7 DECEMBER 2001 VOL 294 SCIENCE www.sciencemag.org

Bond et al (2001)

CITED BY	YEAR
2628	2001
416	1999



1. Reproducibility: c. 2016

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Global and Regional 500 Year Temperature Reconstructions

Originator:

Abram, N.J.; McGregor, H.V.; Tierney, J.E.; Evans, M.N.; McKay, N.P.; Kaufman, D.S.; Thirumalai, K.

Citation Information:

Nerilie J. Abram, Helen V. McGregor, Jessica E. Tierney, Michael N. Evans, Nicholas P. McKay, Darrell S. Kaufman, Kaustubh Thirumalai, Belen Martrat, Hugues Goosse, Steven J. Phipps, Eric J. Steig, K. Halimeda Kilbourne, Casey P. Saenger, Jens Zinke, Guillaume Leduc, Jason A. Addison, P. Graham Mortyn, Marit-Solveig Seidenkrantz, Marie-Alexandrine Sicre, Kandasamy Selvaraj, Helena L. Filipsson, Raphael Neukom, Joelle Gergis, Mark A.J. Curran, Lucien von Gunten. 2016. Early onset of industrial-era warming across the oceans and continents. Nature, 536(7617), 411-418. doi: 10.1038/nature19082

NOAA Study Page:

https://www.ncdc.noaa.gov/paleo/study/20083

JSON Metadata:

https://www.ncdc.noaa.gov/paleo-search/study/search.json?xmlId=17895

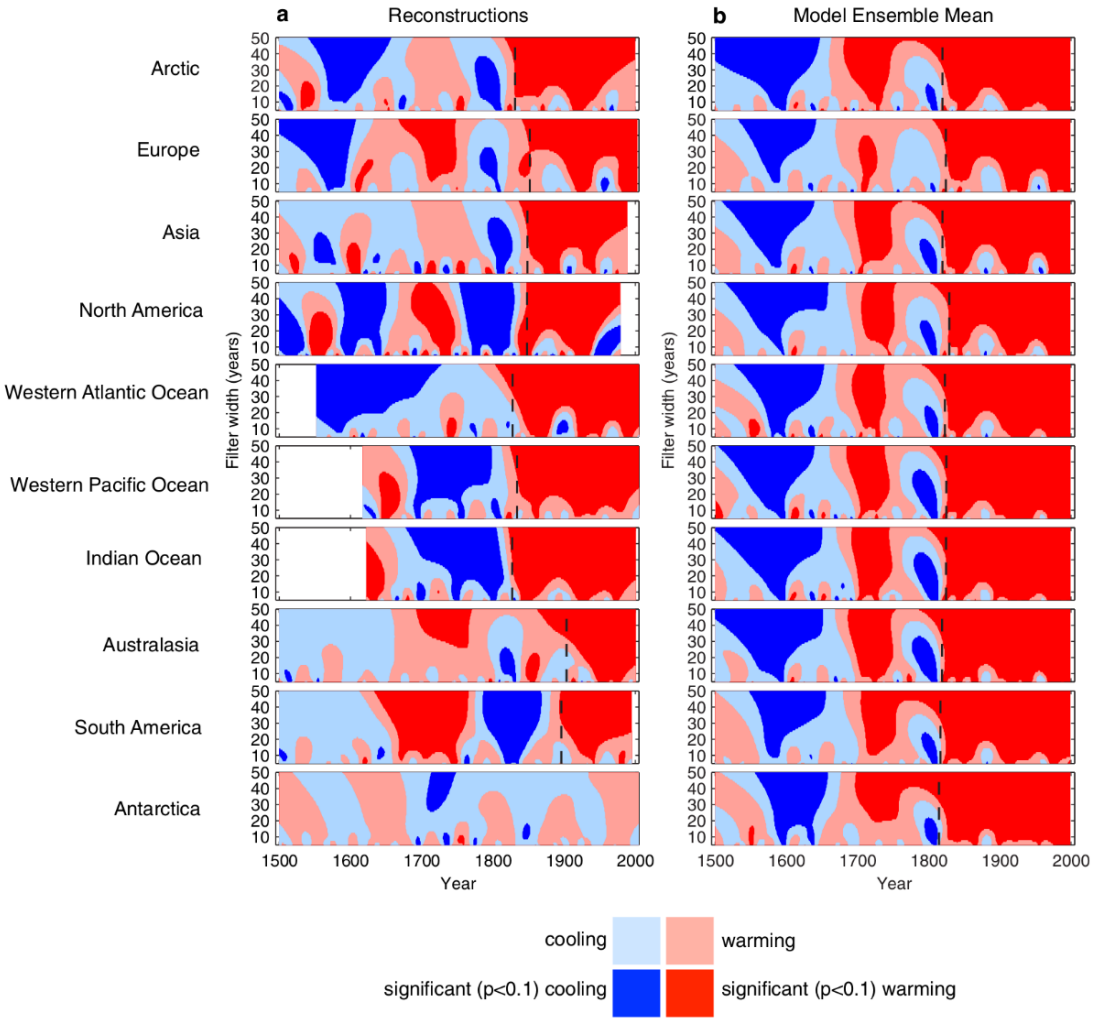
DIF Metadata:

http://www1.ncdc.noaa.gov/pub/data/metadata/published/paleo/dif/xml/noaa-recon-20083.xml

Download Data:

Show Data File Variables

Abram et al. 2016 Code	Compressed ZIP File containing Abram et al. 2016 Code
Abram et al. 2016 Data	Compressed ZIP File containing Abram et al. 2016 Input Data



Abram et al. (2016)

2. Replication: within site

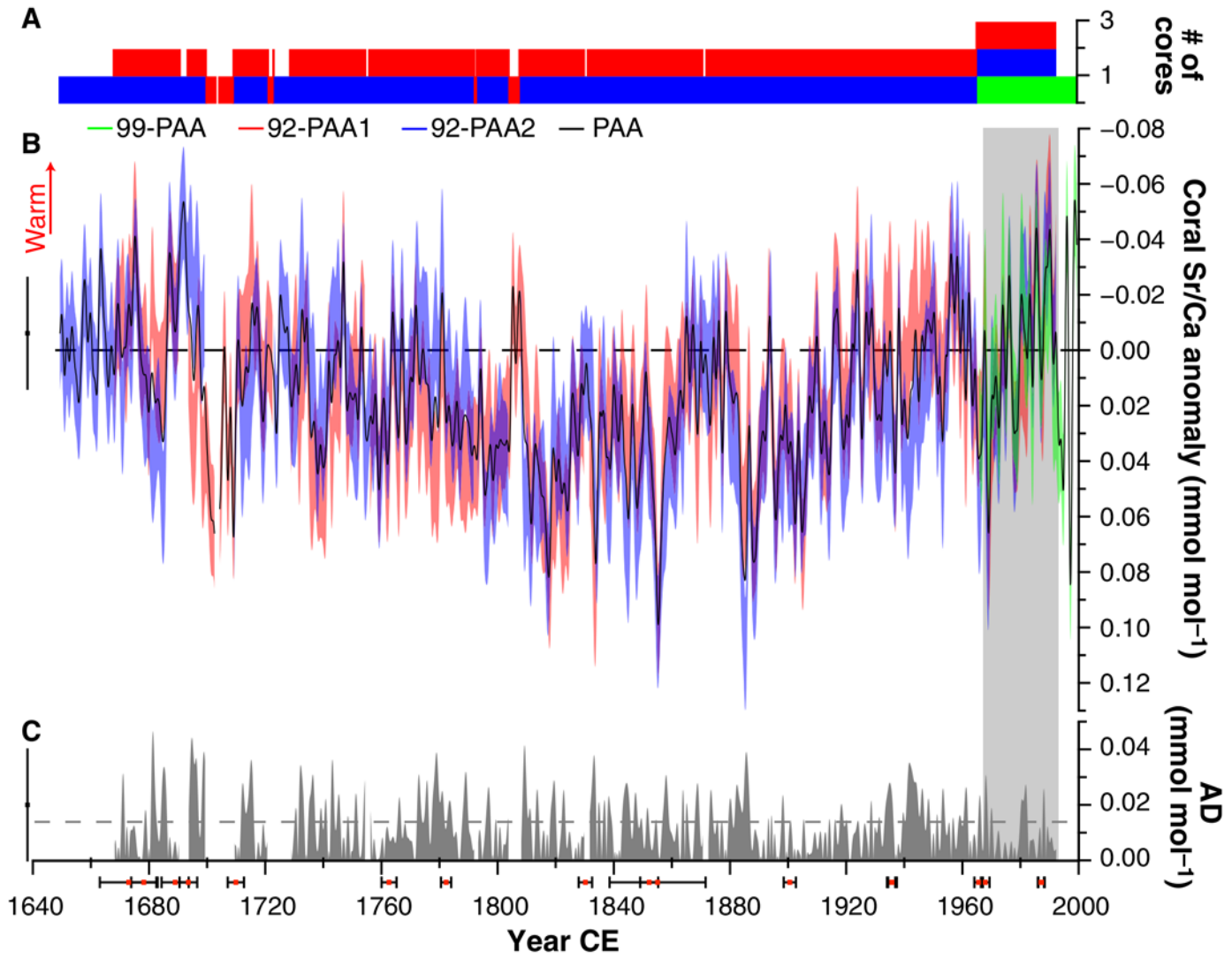


Fig. 4. Interannual coral Sr/Ca reproducibility. (a) Number of cores sampled for each month. (b) Monthly coral Sr/Ca anomalies smoothed with a 24-month LPFIR filter (90% pass = 40 months) (Bloomfield, 2000) to minimize subannual dating uncertainties. Shaded areas and error bars represent analytical precision (2σ). PAA is the average of 99-PAA, 92-PAA1, and 92-PAA2. Anomalies calculated with respect to the interval from 1967 to 1992 CE (vertical gray box), the common interval for the coral cores with IRD SST. Correlation between these time series is significant ($r = 0.65$; $n = 3496$, and $p < 0.001$). (c) Absolute differences (AD; Eq. (1)) determined between 92-PAA1 and 92-PAA2 (b) for any single month with gray dashed line denoting the mean (0.013 ± 0.009 mmol mol^{-1}, 1σ). Red boxes indicate ^{230}Th dates ± 1σ analytical precision (Table 5).

DeLong et al (2013)

2. Replication: within site

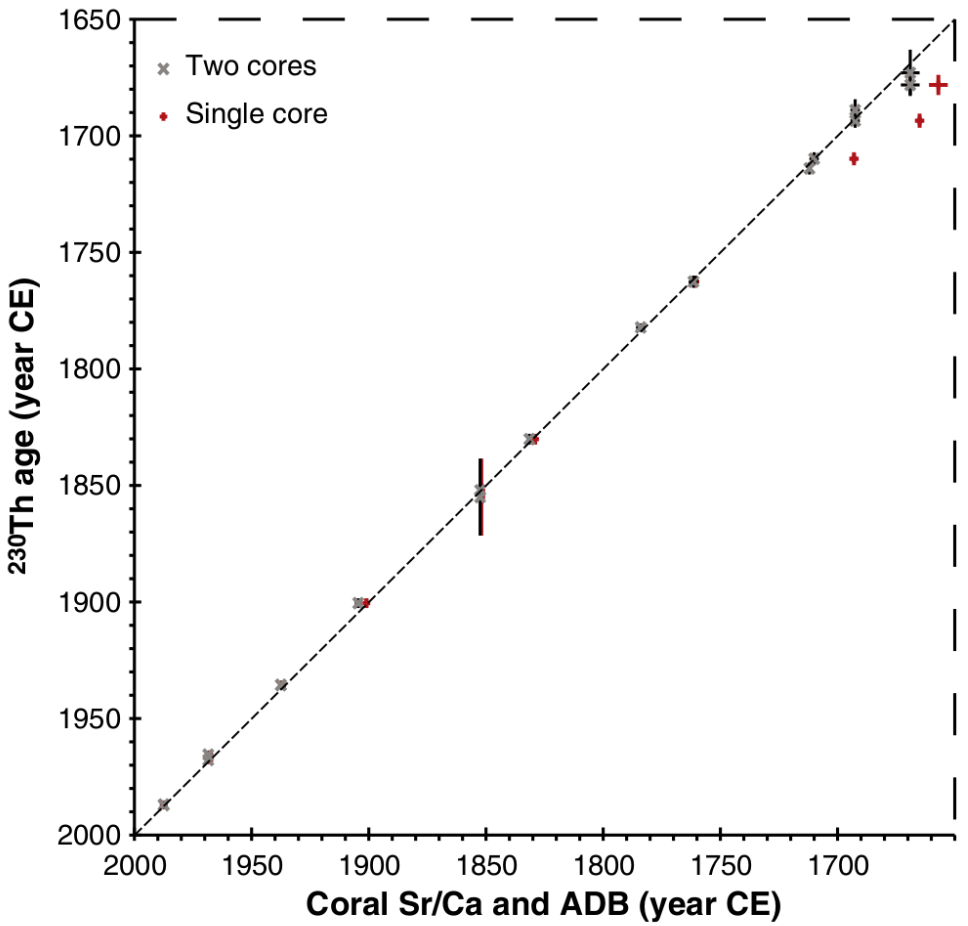
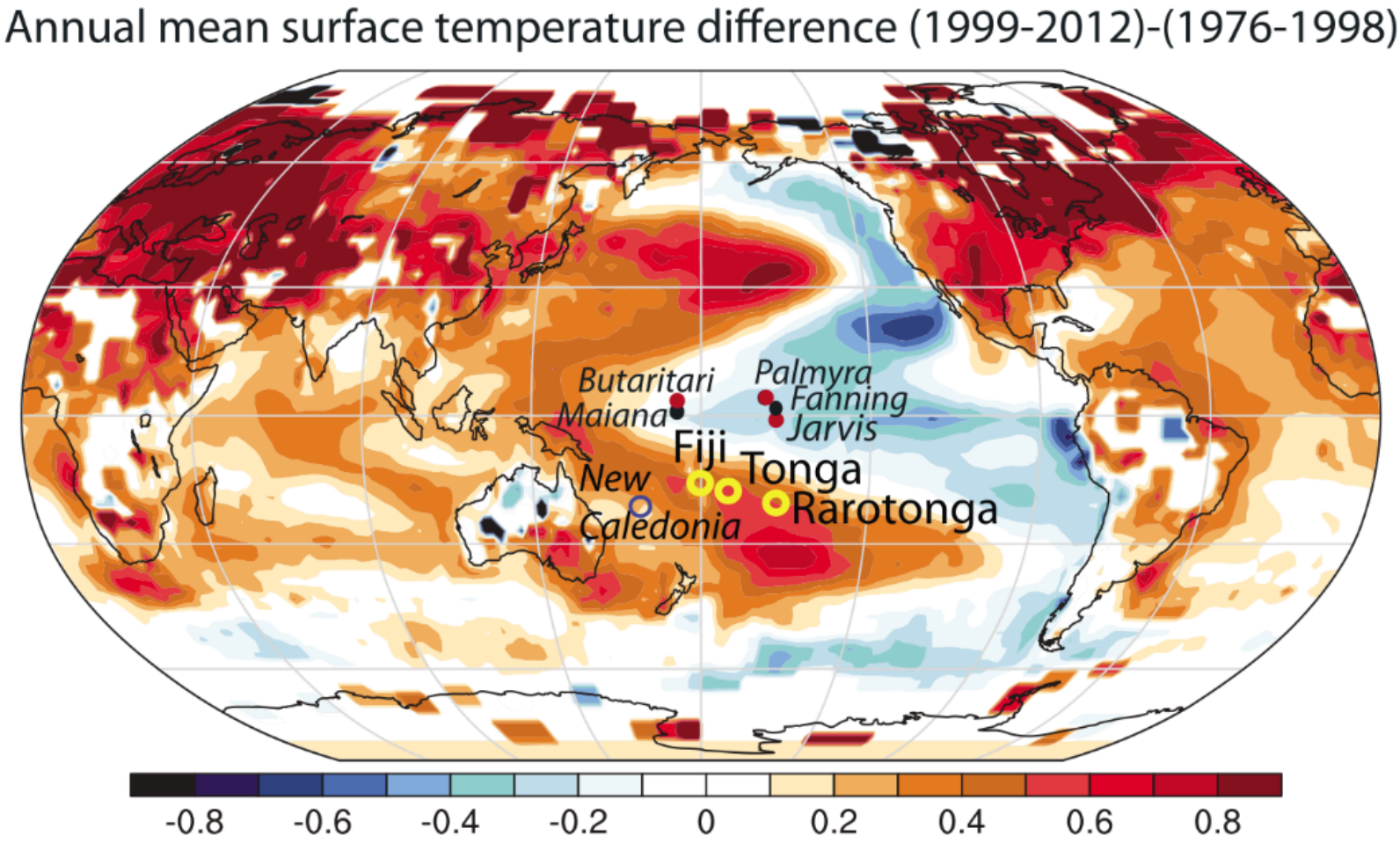


Fig. 9. Comparison of sclerochronology dates with ^{230}Th dates. Sclerochronology determined by cross-dating coral Sr/Ca variations from two cores (92-PAA1 and 92-PAA2) and counting annual density bands (ADB). Samples for ^{230}Th dating were extracted from the core 92-PAA1 (Fig. 1 and Table 5). Error bars for ^{230}Th dates represent analytical precision (2σ). Error bars for sclerochronology method were determined by examining ^{230}Th sample area in X-radiographs (e.g., sample contains ~1 ± 0.5 year; Fig. 1). For the single core dates (red), the sclerochronology date of the ^{230}Th samples is from the chronology determined by the previous study (Quinn et al., 1998).

DeLong et al (2013)

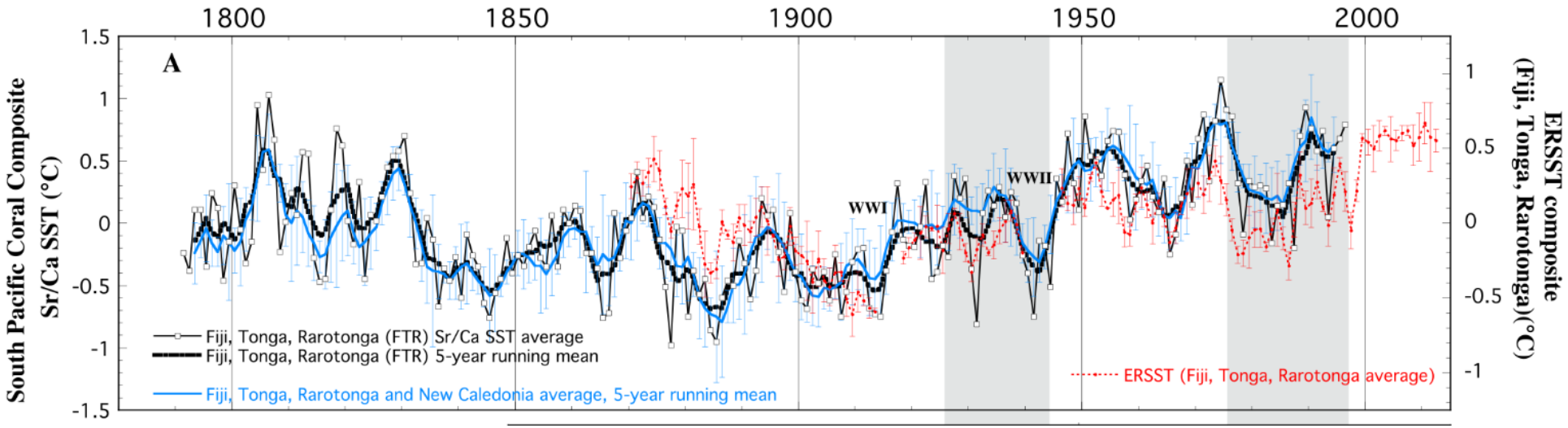
2. Replication: across sites



Linsley et al (2015)

Figure 1. Mean annual surface temperature differences between the periods from 1999 to 2012 and 1976 to 1998 in °C. In the Pacific the spatial pattern strongly resembles the negative phase of the Pacific Decadal Oscillation (PDO) [*Trenberth and Fasullo*, 2013]. Our study sites at Fiji, Tonga, and Rarotonga (FTR) are indicated as is New Caledonia, Maiana, Jarvis, Fanning, and Palmyra (see text). Figure modified from *Trenberth and Fasullo* [2013].

2. Replication: across sites



Linsley et al (2015)

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and positively correlate with South Pacific OHC (0–700 m). FTR SST is also inversely correlated with decadal changes in equatorial Pacific SST as measured by coral Sr/Ca. Collectively, these results support the fluctuating trade wind-shallow meridional overturning cell mechanism for decadal modulation of Pacific SSTs and OHC.

Citing Literature

Supporting Information

Filename	Description
grl52730-sup-0001-DataSetS1.xlsapplication/unknown, 421 KB	Data Set S1
grl52730-sup-0002-Supplementary.pdfPDF document, 1 MB	Text S1 and Figures S1–S5

Metrics

Citations: 9

Am score 74

Details

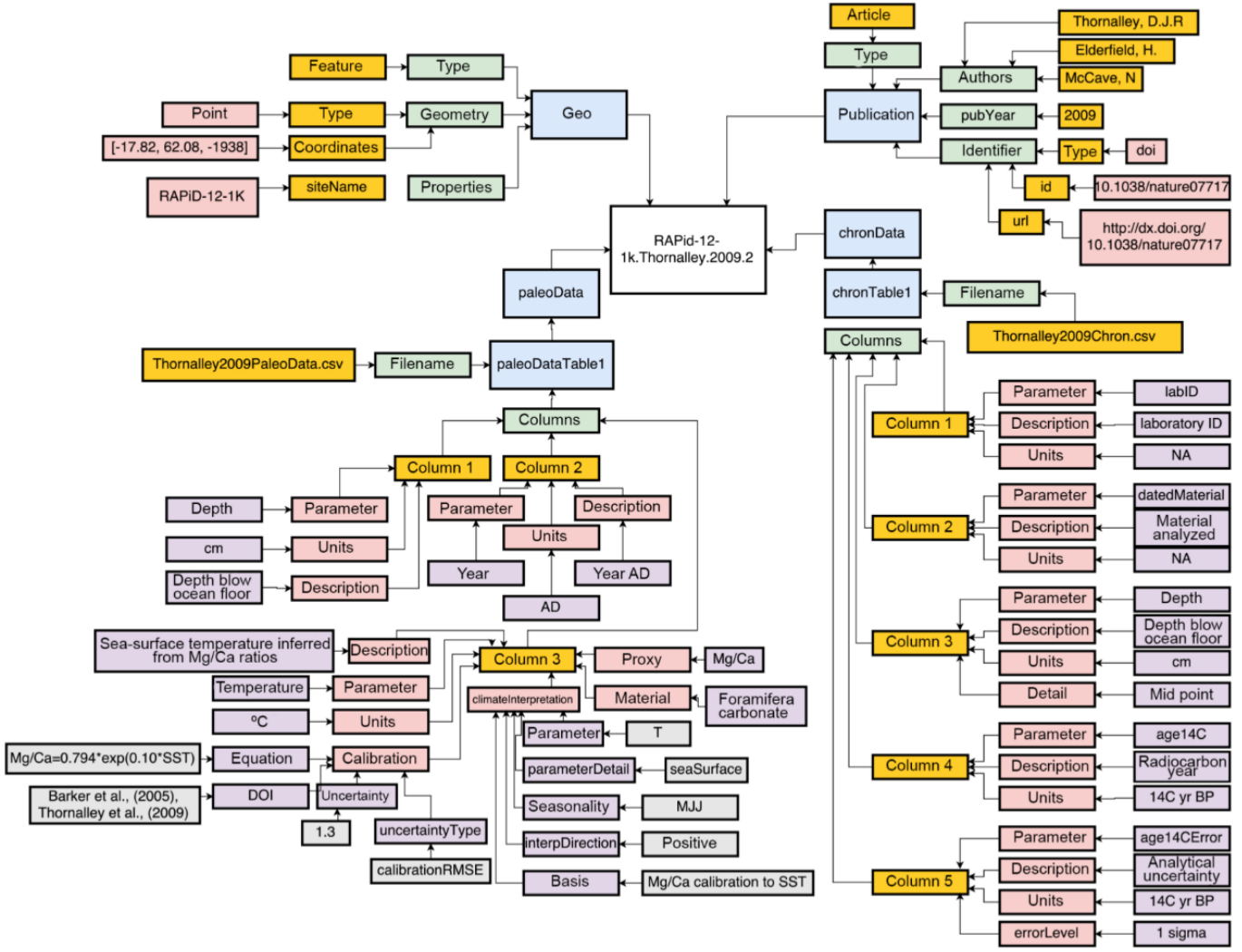
Keywords

coral Sr/Ca SST PDO ocean heat decadal climate change

3. New approaches to reproducibility and replication: publicly archived digitized data, metadata, code

Georeferencing

Observations/ data modeling



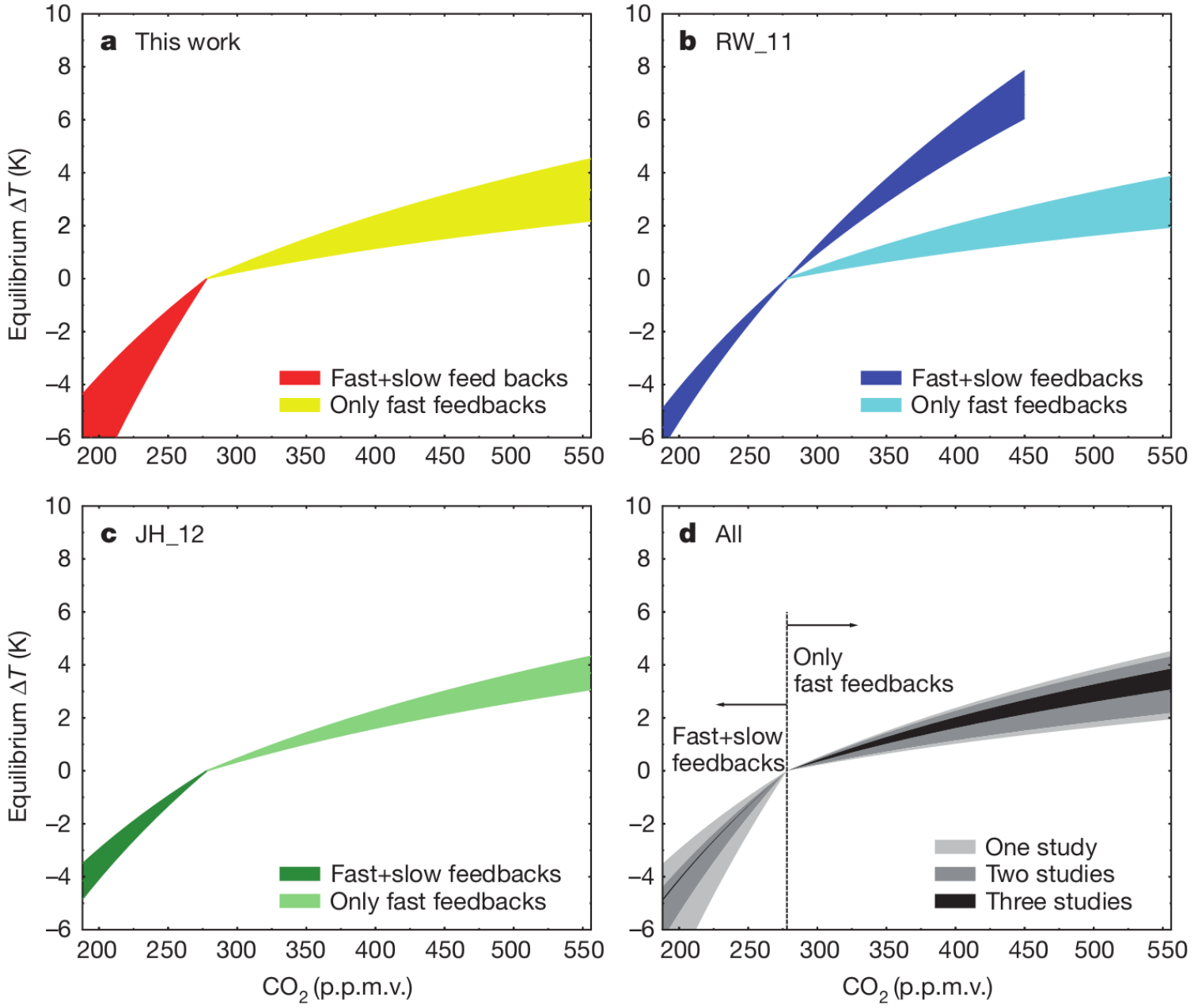
Publication

Chronology/ data modeling

McKay and Emile-Geay (2016); *Emile-Geay et al (2017)*

- Neotoma Paleoecology database
- Linked Earth
- Github: LiPD, PRYSM, …

3. Replicating and extending climate science research: equilibrium climate sensitivity



Palaeosens Project Members (2012)

Summary: Replication and reproducibility in (paleo)climate science

1. Paleoclimate science has progressed in reproducibility and replication over the past two decades by publicly archiving data, metadata and analysis codes.
2. Observational replication within and across sites is improving our estimation of amplitude and chronological uncertainties.
3. Replication of equilibrium climate sensitivity estimates is an important test of climate projection-based estimates, because paleoclimate data may reflect climate system processes operating over long timescales.

Summary: Replication and reproducibility in (paleo)climate science: Haiku version

Standards, access, ‘net
Data, metadata, code
Accelerates work.