Supplementary table

Name	Ref.	Proxy	Conversion	Duration	$\triangle t$	lon	lat
1. Clim. Anl. Cent.	[1]	instrum.	N/A	33	1/12	global	—
2. Clim. Res. Unit	[2]	instrum.	N/A	135	1/12	global	—
3. Rarotonga Coral	[3]	Sr/Ca	$-4°$/(mmol/mol)	270	1/12	-160	-21
4. W167-79 Sed.	[4]	$\delta^{18}O$	$4°$/mil	5210	21	-83	24
5. ODP658 Sed.	[5]	foram asmb.	—	14700	109	-18	20
6. PL07-39 Sed.	[6]	Mg/Ca	—	24500	134	-65	11
7. OCE205-103 Sed.	[7]	$\delta^{18}O$	$4°$/mil	51600	273	-79	27
8. EW9209-1 Sed.	[8]	$\delta^{18}O$	$4°$/mil	190000	632	-43	5
9. TR163-19 Sed.	[9]	Mg/Ca	—	360000	1740	-90	2
10. ODP6777 Sed.	[10]	$\delta^{18}O$	$4°$/mil	771000	1840	-43	6
11. ODP846 Sed.	[11]	alkenones	—	1830000	2000	-90	3
12. ODP927 Sed.	[12]	$\delta^{18}O$	$4°$/mil	772000	2200	-43	6
13. ODP806 Sed.	[9]	Mg/Ca	—	46600	2440	159	2
14. NCEP	[13]	instrum.	N/A	55	1/12	—	—
15. Clim. Res. Unit	[14]	instrum.	N/A	135	1/12	—	—
16. Cent. England	[15]	instrum.	N/A	345	1/12	0	60
17. Donard Lake	[16]	varve thick.	—	1240	1	-61	67
18. Taylor Ice	[17]	$\delta^{18}O$	$1.5°C$/mil	209000	65	158	-77
19. GISP2 Ice	[18]	$\delta^{18}O$	$1.85°C$/mil	111000	79	-39	73
20. Byrd Ice	[19]	$\delta^{18}O$	$1.5°C$/mil	79800	109	-120	-80
21. Vostok Ice	[20]	δD	—	423000	128	107	-78
22. Dome C Ice	[21]	δD	$0.2°C$/mil	740000	910	124	-75

Table S1: Instrumental, tropical sea surface temperature proxies, and high-latitude surface air temperature proxies used to estimate temperature variability. Each group is ordered according to sampling resolution. From left to right are the record designation, a primary reference, observation method, the conversion used for temperature, duration in years, mean sampling interval in years, longitude in °E, and latitude in °N. Temperature conversions listed as "—" are nonlinear and are provided by the cited reference. Conversion for GISP2 is from [22] and for Taylor and Byrd from [23]. The marine $\delta^{18}O_{\text{calcite}}$ conversion is from [24]. Rarotonga temperature conversion is determined by adjusting the level of the background spectra to that of average tropical pacific instrumental records from [1]. Fig S2 shows the spectral estimate associated with individual records.

Supplementary figures and legends

The NCEP reanalysis of surface air temperatures has the advantage of being global, but relies upon a spectral model, introducing concerns regarding the accuracy of the surface temperature spectra. Thus, a complimentary analysis is conducted (see Fig S1) using the CRU compilation of instrumental surface air temperature records [14]. The CRU compilation is not globally resolved, but has the advantage of containing records extending back as far as 1870. NCEP, proxy, and CRU results all agree with one another. Fig S2 shows the spectral estimates for individual proxy and instrumental records used in generating Fig 2.

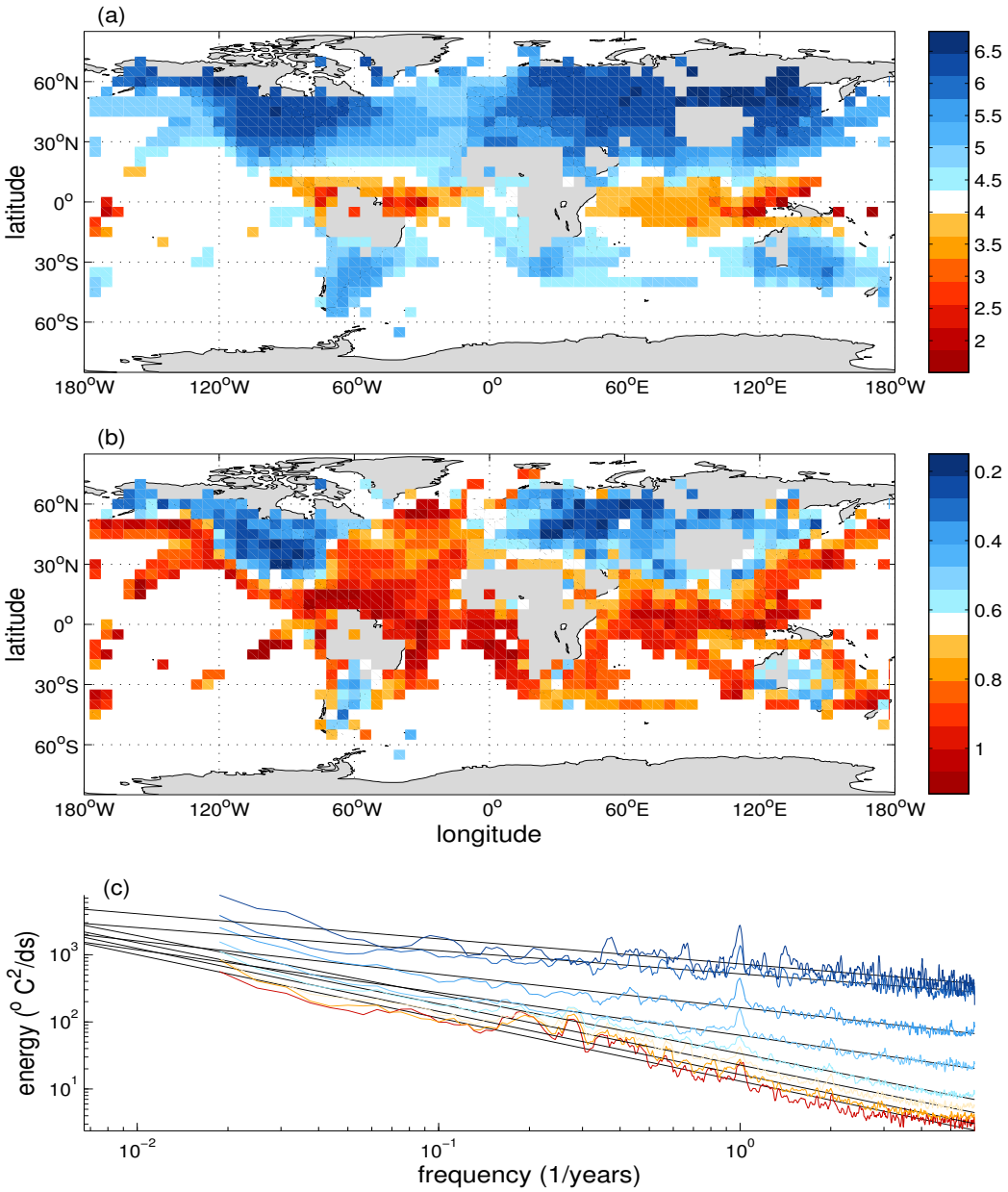

Figure S1: Temperature scaling at instrumental periods from the CRU compilation of instrumental surface air temperature records. **(a)** Map of the energy at the annual cycle in log-base-ten $^{\circ}C^2$/ds. **(b)** β computed between 1 month and 100 years after removing the energy associated with the annual cycle and its higher harmonics. Note that the scaling indicated by the colorbar is inverted. **(c)** Spectra binned according to annual period energy and averaged. In this case, the annual cycle and its higher harmonics are removed prior to averaging, unlike in fig 1. Black lines indicate power-law fits to the continuum. The axes are logarithmic and the shading corresponds to the colorbar in panel a. The β and average magnitude of the continuum both scale with the annual variability and are in agreement with the NCEP results.

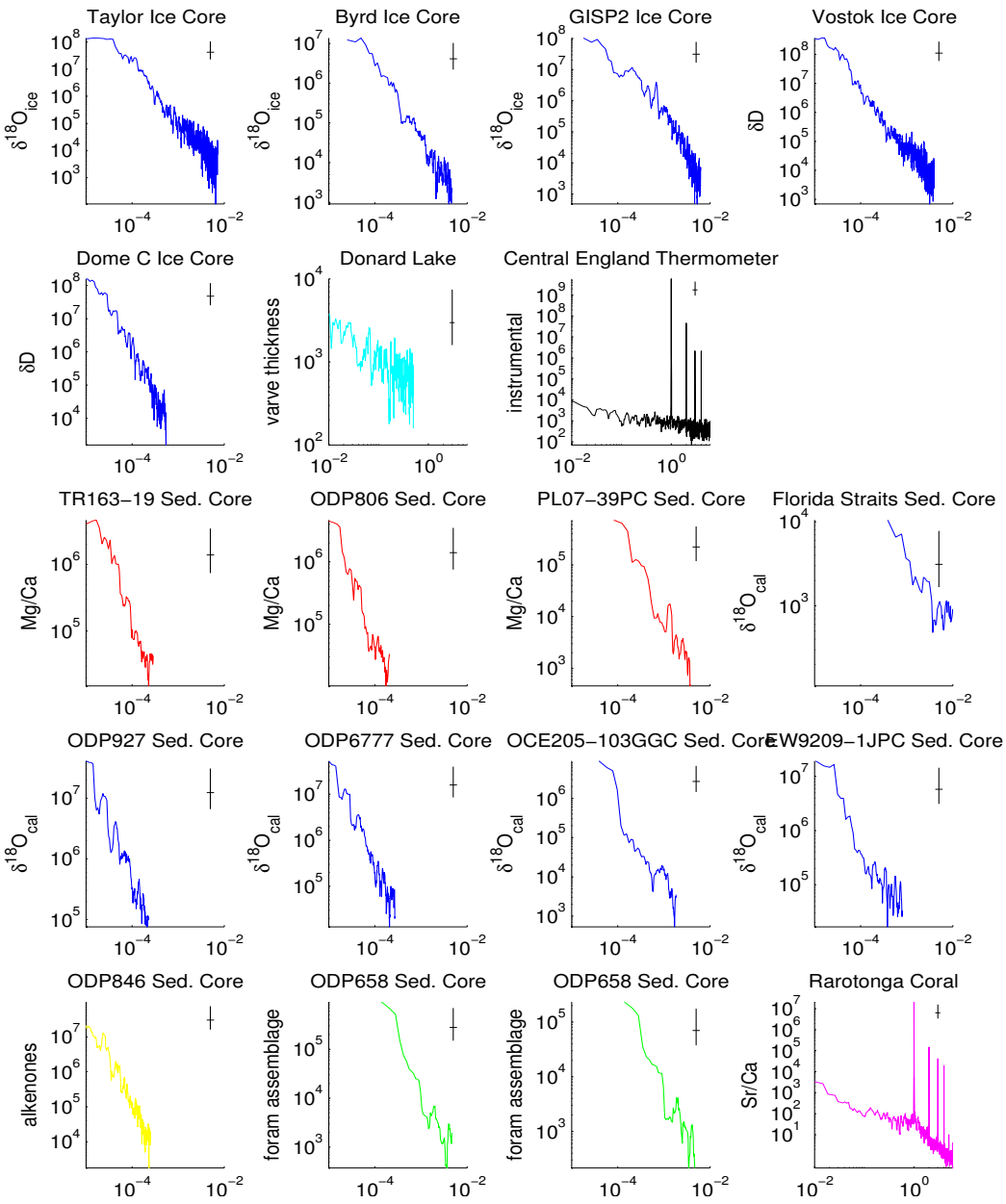

Figure S2: Spectral energy estimates for individual proxy and instrumental temperature records. The first seven panels are for high-latitude land temperatures and the last twelve are for tropical sea-surface temperatures. The title gives the name of each record and the y-axis indicates the data type. The y-axis is in units of $^{\circ}C^2$/ds and the x-axis is in units of cycles/year. Axes are logarithmic. Daggers in the upper right hand portion of each plot indicate the approximate 95% confidence level, where the horizontal dash indicates the level of the background continuum. Fig 2 shows these spectra plotted together after averaging according to data type. Data types are grouped by color.

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