Disentangling the evidence of Milankovitch forcing from tree-ring and sedimentary records

Supplemental online material

Content

Supplementary Table 1. Tree-ring sites. Site names, their northern latitudes and eastern longitudes, altitude (in metres, above modern sea level), and the number (N) of tree-ring dated series used in this study for minimum blue channel light intensity measurements per each site.

Site	Lat	Long	Alt	N
Hangasjärvi	66.75	28.73	264	949
Juomusjärvi	69.26	27.40	199	137
Hattulompolo	68.64	23.61	386	137
Selkäjärvet	69.53	28.08	208	67
Ailigas	69.91	27.07	71	62
Namates	69.30	27.47	210	42
Kompsiotievanlammit	68.50	22.50	358	18
Tsehajaaurads	69.40	27.66	197	8
Pieni Vuotkimlompolo	69.38	27.72	202	6
Vuotkimlompolo	69.39	27.72	205	5
Pousujärven suo	68.85	21.17	450	3
Loassamlompolo kapea	68.38	27.72	207	3

Supplementary Table 2. Sedimentary proxy records. Characterisation of the data by their number specific to this study (N), the region (A&Y = Alaska and Yukon, CI & G = Canadian Islands and Greenland, FENN = Fennoscandia, MCAN = Mainland Canada, NA & I = North Atlantic and Iceland, RA = Russian Arctic), site abbreviation, proxy type (Pr; CH = chironomids, DT = diatoms, DC = dinocysts, FM = foraminifera, OT = other, and PO = pollen), site latitude and longitude, the reconstructed temperature variable (Var; AIR = air temperature, NST = near surface temperature, SST = sea surface temperature, LST = lake surface temperature) as well as the seasonality of the proxy signal (S; J = July, A = August, MJJA = May through August, S = summer, W = warmest) according to Sundqvist et al. (2014), the temperature change (Slope) and its standard error (SE) and the number of data points (n) between 140 cal BP and 7440 cal BP.

N	Region	Site abbreviation	Pr	Lat	Long	Var	S	Slope	SE	n
1	A & Y	P1B3	DC	73.68	-162.66	SST	S	-8.91E-05	4.27E-05	62
2	A & Y	ranger	PO	67.15	-153.65	AIR	W	-5.83E-05	6.81E-05	22
3	A & Y	rainbow	CH	60.72	-150.80	AIR	J	-8.31E-05	2.82E-05	24
4	A & Y	screaminglynx	CH	66.07	-145.40	AIR	J	2.06E-06	2.21E-05	127
5	A & Y	moose	CH	61.37	-143.60	AIR	J	-1.17E-04	1.80E-05	121
6	A & Y	honeymoon	PO	64.63	-138.40	AIR	W	-8.23E-05	1.09E-04	44
7	A & Y	lily	PO	59.20	-135.40	AIR	W	-8.02E-05	6.12E-05	20
8	A & Y	candelabra	PO	61.68	-130.65	AIR	W	-6.09E-05	1.25E-04	37
9	A & Y	hail	PO	60.03	-129.02	AIR	W	9.60E-04	1.72E-04	36
10	A & Y	andy	PO	64.65	-128.08	AIR	W	-5.54E-04	1.57E-04	34
11	A & Y	bells	PO	65.02	-127.48	AIR	W	-4.80E-04	1.49E-04	34
12	A & Y	meleze	PO	65.22	-126.12	AIR	W	-2.34E-04	1.60E-04	35
13	CI & G	LS009	DC	74.19	-81.20	SST	S	-3.02E-04	1.43E-04	28
14	CI & G	HU91	DC	77.27	-74.33	SST	S	-5.28E-04	1.14E-04	41
15	CI & G	iglutalik	PO	66.14	-66.08	AIR	J	-3.77E-05	1.63E-05	51
16	CI & G	jake	PO	63.67	-65.15	AIR	J	2.58E-05	1.08E-04	25
17	CI & G	akvaqiak	PO	66.78	-63.95	AIR	J	-1.58E-04	4.24E-05	29
18	CI & G	HU84	DC	58.37	-57.51	SST	S	-6.76E-04	3.26E-04	33
19	CI & G	north	CH	69.24	-50.03	AIR	J	-2.15E-04	7.51E-05	21
20	CI & G	HU90	DC	58.21	-48.37	SST	S	-2.27E-04	1.02E-04	36
21	CI & G	MD99-2227	DC	58.21	-48.37	SST	S	-2.49E-05	1.10E-04	62
22	CI & G	qipisargo	PO	61.00	-47.75	AIR	J	-5.84E-04	6.60E-05	30
23	FENN	oykjamyrtjorn	PO	59.82	6.00	AIR	J	-1.49E-04	3.29E-05	49
24	FENN	oykjamyrtjorn	CH	59.82	6.00	AIR	J	-7.31E-05	3.09E-05	32
25	FENN	holebudalen	CH	59.83	6.98	LST	J	-2.90E-04	4.14E-05	32
26	FENN	holebudalen	PO	59.83	6.98	AIR	J	-2.73E-04	2.54E-05	55
27	FENN	trettetjorn	PO	60.72	7.00	AIR	J	-5.07E-04	5.88E-05	39
28	FENN	isbenttjonn	PO	59.77	7.43	AIR	J	-2.35E-04	2.58E-05	47
29	FENN	flotatjonn	PO	59.67	7.55	AIR	J	-1.94E-04	2.37E-05	33
30	FENN	grostjorn	PO	58.53	7.73	AIR	J	-7.63E-05	2.78E-05	44
31	FENN	dalene	PO	58.25	8.00	AIR	J	-1.02E-04	3.38E-05	42
32	FENN	brurskardstjorni	CH	61.42	8.67	AIR	J	-2.94E-04	3.72E-05	39

33	FENN	tiavatnet	PO	63.05	9.42	AIR	J	-2.93E-04	2.09E-05	65
34	FENN	svartvatnet	PO	63.35	9.55	AIR	J	-2.22E-04	2.32E-05	38
35	FENN	ratasjoen	CH	62.27	9.83	AIR	J	-1.09E-04	4.47E-05	44
36	FENN	kinnshaugen	PO	62.02	10.37	AIR	J	-1.45E-04	2.42E-05	39
37	FENN	haugtjern	PO	60.83	10.88	AIR	J	-1.65E-04	2.31E-05	55
38	FENN	spaime	CH	63.12	12.32	AIR	J	-9.92E-05	4.40E-05	45
39	FENN	svanavatnet	PO	66.44	14.05	AIR	J	-3.57E-04	2.93E-05	54
40	FENN	liltlvatn	PO	68.52	14.87	AIR	J	-7.56E-05	1.77E-05	31
41	FENN	gilltjarnen	CH	60.08	15.83	AIR	J	1.85E-04	4.52E-05	37
42	FENN	myrvatn	PO	68.65	16.38	AIR	J	-1.56E-04	2.41E-05	34
43	FENN	austerkjosen	PO	68.53	17.27	AIR	J	-1.90E-04	3.67E-05	23
44	FENN	gammelheimvatnet	PO	68.47	17.75	AIR	J	-1.75E-04	2.12E-05	54
45	FENN	bjornfjelltjorn	PO	68.43	18.07	AIR	J	-2.20E-04	2.40E-05	41
46	FENN	sjuuodjijaure	DT	67.37	18.07	AIR	J	-2.42E-04	1.82E-05	41
47	FENN	sjuuodjijaure	PO	67.37	18.07	AIR	J	-1.27E-04	3.53E-05	42
48	FENN	sjuuodjijaure	CH	67.37	18.07	AIR	J	-1.16E-04	2.14E-05	41
49	FENN	tibetanus	PO	68.33	18.70	AIR	J	-3.54E-04	5.87E-05	32
50	FENN	njulla	DT	68.37	18.70	AIR	J	-1.56E-04	3.85E-05	36
51	FENN	njulla	CH	68.37	18.70	AIR	J	-1.46E-04	3.10E-05	36
52	FENN	njakajaure	DT	68.33	18.78	AIR	J	-2.19E-04	3.91E-05	35
53	FENN	vuoskkujavri	DT	68.33	19.10	AIR	J	-2.67E-04	3.32E-05	35
54	FENN	vuoskkujavri	PO	68.33	19.10	AIR	J	-1.92E-04	3.73E-05	42
55	FENN	vuoskkujavri	CH	68.33	19.10	AIR	J	-1.19E-04	3.49E-05	42
56	FENN	lake850	CH	68.37	19.12	AIR	J	-5.80E-05	1.95E-05	91
57	FENN	lake850	DT	68.37	19.12	AIR	J	1.39E-05	2.29E-05	47
58	FENN	dalmutladdo	PO	69.17	20.72	AIR	J	-2.41E-04	3.62E-05	50
59	FENN	toskaljavri	PO	69.20	21.47	AIR	J	-1.68E-04	1.52E-05	116
60	FENN	toskaljavri	CH	69.20	21.47	AIR	J	-8.32E-05	1.36E-05	77
61	FENN	tsuolbmajavri	DT	68.41	22.05	AIR	J	-1.76E-05	9.55E-06	108
62	FENN	tsuolbmajavri	CH	68.41	22.05	AIR	J	6.96E-06	2.37E-05	108
63	FENN	tsuolbmajavri	PO	68.41	22.05	AIR	J	-1.09E-04	1.53E-05	109
64	FENN	gunnarsfjorden	PO	71.04	28.17	AIR	W	-6.68E-04	5.93E-05	80
65	FENN	chuna	PO	67.95	32.48	AIR	J	-1.12E-04	3.38E-05	29
66	FENN	KP2	PO	68.80	35.32	AIR	J	-7.30E-05	1.66E-05	47
67	FENN	yarnyshnoe	PO	69.07	36.07	AIR	J	-1.39E-04	6.76E-05	27
68	FENN	berkut	CH	66.35	36.67	AIR	J	-7.70E-05	4.27E-05	30
69	MCAN	KR02	PO	71.34	-113.78	AIR	J	-8.34E-05	1.23E-05	43
70	MCAN	2005-804	DC	68.99	-106.57	SST	S	-1.11E-04	9.52E-05	39
71	MCAN	s53s52	OT	59.89	-104.21	AIR	J	-2.04E-04	1.68E-04	32
72	MCAN	ennadai	PO	61.17	-100.92	AIR	W	-1.44E-04	3.07E-04	31
73	MCAN	JR01	PO	69.90	-95.07	AIR	J	-8.47E-05	8.65E-05	49
74	MCAN	LR01	PO	58.58	-75.25	AIR	W	-2.81E-04	7.50E-05	19
75	MCAN	k2	CH	58.73	-65.93	AIR	J	1.25E-04	6.70E-05	95
76	NA & I	LO09	DT	58.94	-30.41	SST	A	-6.97E-05	2.34E-05	202
77	NA & I	JM96-1207	DC	68.10	-29.35	SST	S	-1.25E-04	6.71E-05	62
78	NA & I	ODP-684	OT	61.00	-25.00	NST	S	-4.30E-05	6.27E-05	63

79	NA & I	B997-321	OT	66.53	-21.50	NST	J	-5.33E-05	7.54E-05	33
80	NA & I	MD99-2269	DT	66.85	-20.85	SST	A	-1.04E-04	2.08E-05	198
81	NA & I	Troll28-03	FM	60.87	3.73	NST	S	-4.21E-06	9.61E-06	44
82	NA & I	MD95-2011	FM	66.97	7.64	NST	A	-4.25E-04	2.23E-05	271
83	NA & I	GIK23258	FM	75.00	14.00	NST	S	2.84E-04	4.88E-05	114
84	NA & I	JM01-1199	FM	71.99	14.36	NST	S	1.01E-04	6.14E-05	47
85	RA	PL-96	DC	71.74	42.61	SST	S	1.18E-04	6.62E-05	52
86	RA	kharinei	PO	67.36	62.75	AIT	MJJA	-3.74E-04	4.83E-05	75
87	RA	kharinei	CH	67.36	62.75	AIR	J	-7.67E-05	3.50E-05	26
88	RA	lyadhej-To	CH	68.25	65.79	AIR	J	-1.60E-04	3.95E-05	32

Supplementary Table 3. Trend characterisation. Linear trends calculated for sedimentary proxy data across the circumpolar Arctic sites (Fig. 1a) between 140 cal BP and 7440 cal BP characterised by the number of temperature records (n), the median of the slopes, the lower and upper 95% confidence intervals of the median (for plotted values, see Fig. 4) and the statistical significance (p-value) for the one-sample Wilcoxon (W) signed rank test for comparing the median of a set of slopes against the slope of -1.28×10^{-04} (obtained for our tree-ring temperature reconstruction).

	n	Median	Lower CI	Upper CI	W (p-value)
All	88	-1.26E-04	-1.49E-04	-9.28E-05	0.31698
Fennoscandian	46	-1.52E-04	-1.89E-04	-1.13E-04	0.03810
Non-Fennoscandian	42	-8.69E-05	-1.01E-04	-2.24E-05	0.71966
Pollen	68	-1.52E-04	-1.95E-04	-1.13E-04	0.06611
Chironomids	20	-9.12E-05	-1.07E-04	-6.42E-05	0.09731
Fennoscandian pollen	27	-1.75E-04	-2.04E-04	-1.28E-04	0.00074
Fennoscandian chronomids	13	-9.92E-05	-1.25E-04	-7.92E-05	0.19092