



NICOLAUS COPERNICUS
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Faculty of Earth Sciences
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Before Modern Weather Stations: The Moravian Brethren's 18th-Century Climate Records from Labrador/Nunatsiavut and Southwestern Greenland

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<https://morclim.umk.pl/>



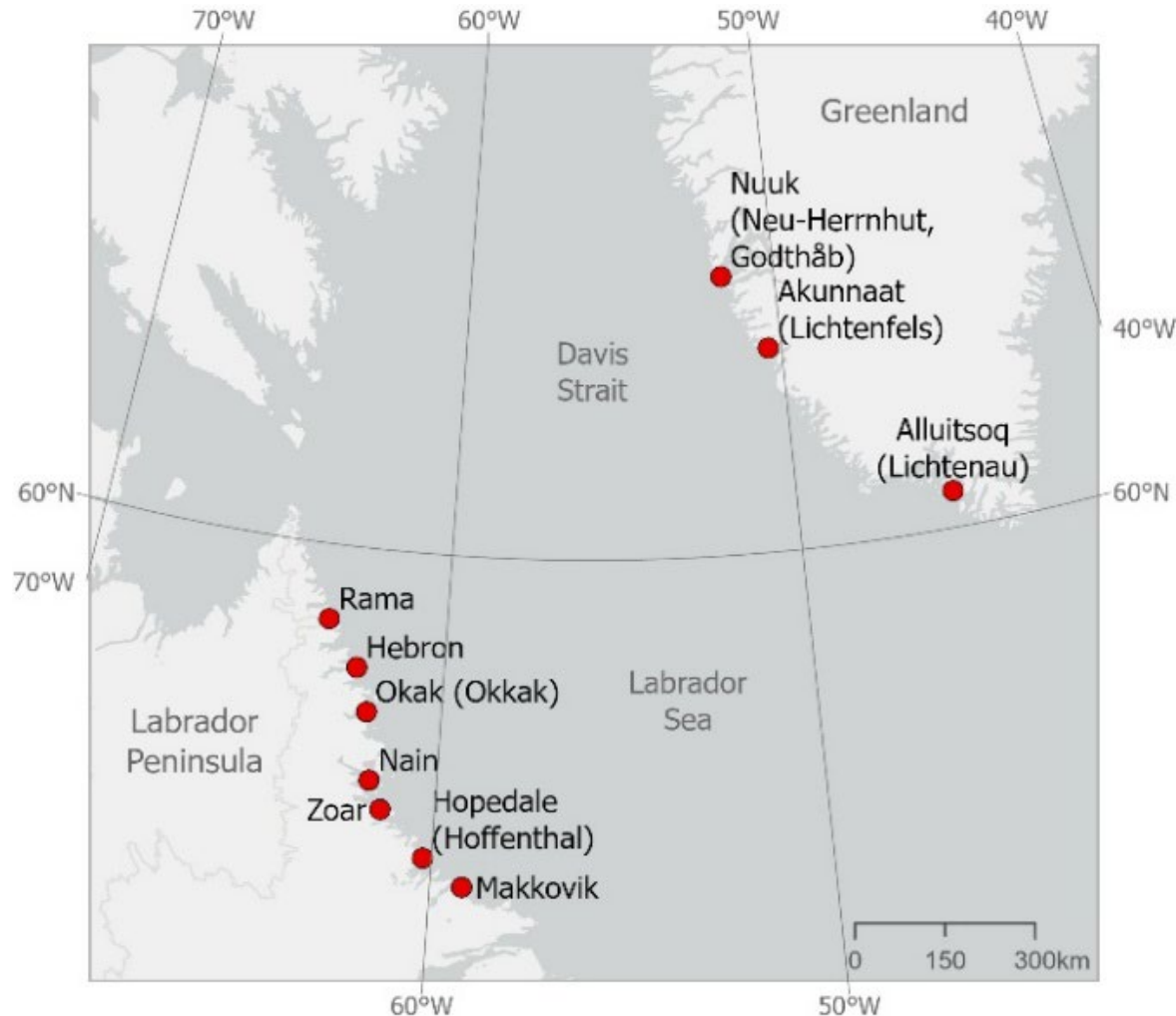
Why data recovery?

1914/15 in the Arctic, 20CRv3 reanalysis



Philip Brohan on Vimeo

Location of historical Moravian Brethren missions where meteorological measurements were carried out





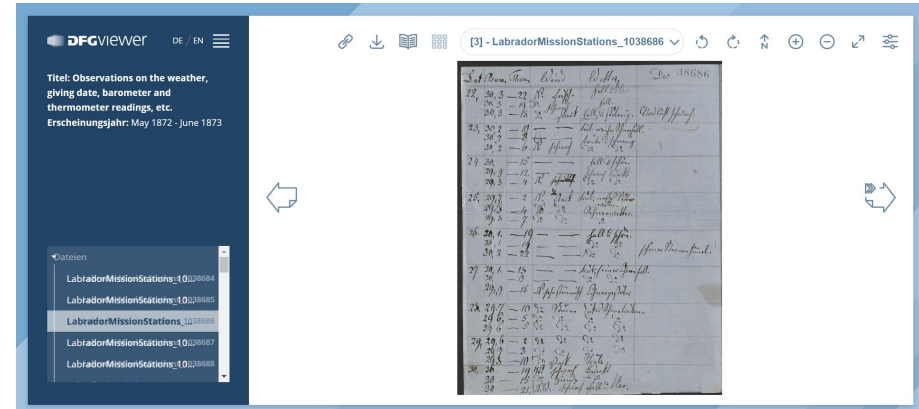
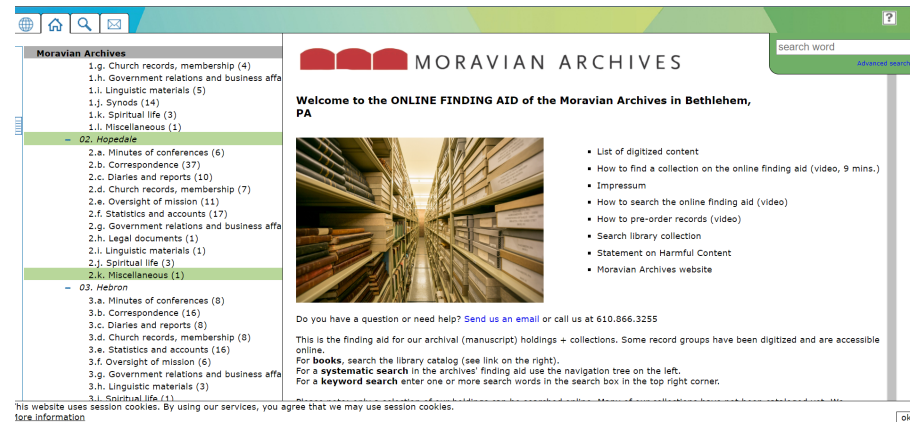
Outline

- 1. Preliminary archival research**
- 2. Digitisation process**
- 3. QC and unit conversion**
- 4. Repository for Open Data (RepOD),
Nicolaus Copernicus University Centre for
Climate Change Research**

On-line sources

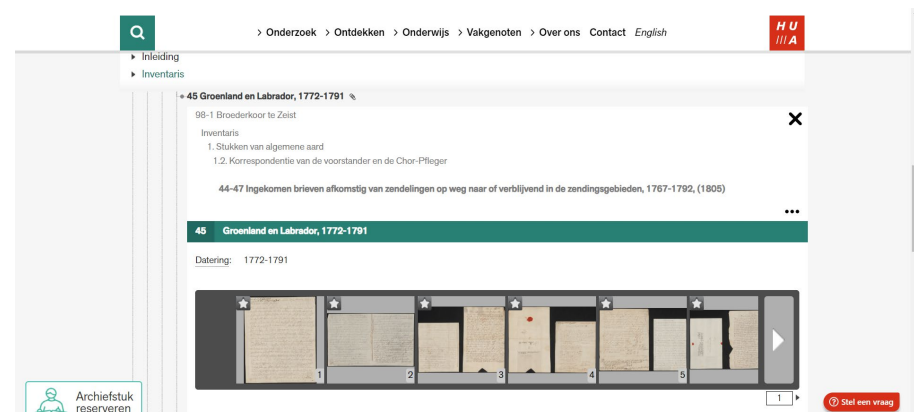
Moravian Archives in Bethlehem

Hopedale, May 1872 – June 1873



The Unity Archives Moravian Archives Herrnhut

Het Utrechts Archief The Utrecht Archives





Research work

Preliminary archival research

- United States, Bethlehem, 17-22.03.2024: **The Moravian Archives**
- Netherlands, Utrecht, 21-26.05.2023:
 - **The Utrecht Archives** (Het Utrechts Archief)
 - **Utrecht University Library, Department of Special Collections** (Bijzondere Collecties van de Universiteitsbibliotheek Utrecht)
- Germany, Munich and Offenbach, 10-17.05.2023:
 - **Germany's National Meteorological Service** (Deutscher Wetterdienst), Offenbach
 - **Technical University of Munich** (Technische Universität München)
- Germany, Hamburg, 15-22.04.2023:
 - **Federal Maritime and Hydrographic Agency** (Bundesamt für Seeschifffahrt und Hydrographie)
 - **University of Hamburg** (Universität Hamburg)
- Denmark, Copenhagen, 2-10.11.2022:
 - **Library and Archive of the Arctic Institute** (Arktisk Institut)
 - **Royal Danish Library** (Det Kgl. Bibliotek)
 - **The National Archive** (Rigsarkivet)
- Germany, Herrnhut, 04-10.09.2022: **The Unity Archives – Moravian Archives Herrnhut**
- Great Britain, London, 06-18.06.2022:
 - **Library and Archives at the Royal Society**
 - **Moravian Church House, Muswell Hill**

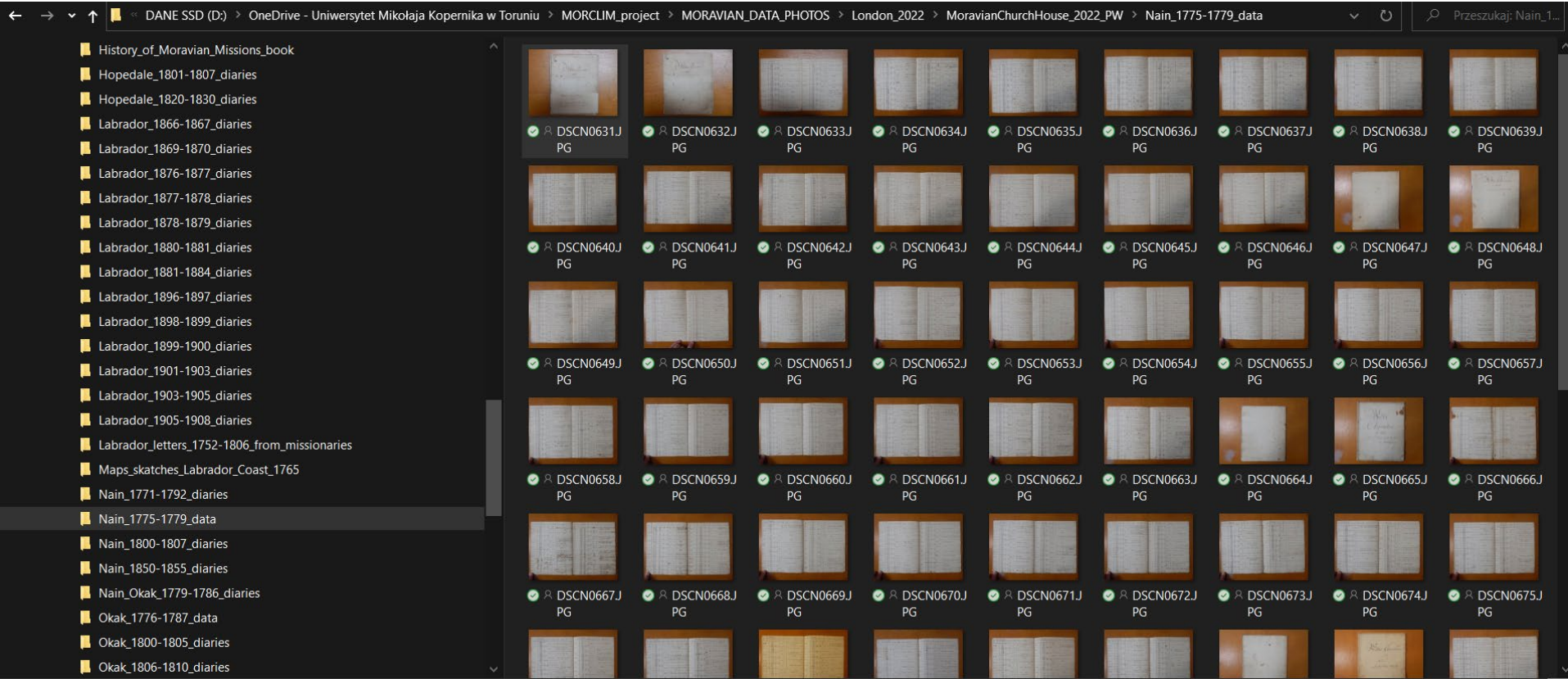


Preliminary archival research





Thousands of photos





Nain 1775-1779

Wetter-Observation

in Nain

vom 1 Dec. 1775 bis 25. Sept. 1776.

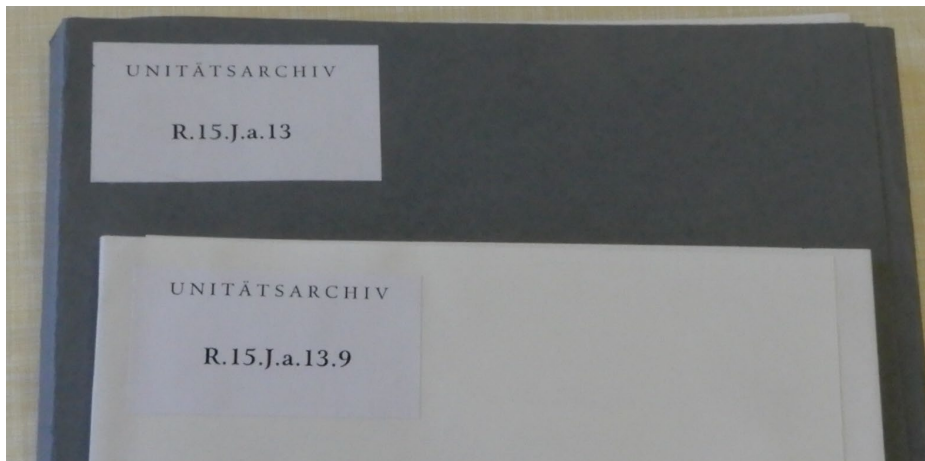
*Wetterbeobachtung
in Nain*

*von Anfang December 1775
bis Ende October - 1779*

Tag	Wind	Thermometer Linde. Portia	Barometer	Wind	Wölk.	Wetter in Dec. 1775	Tag	Wind	Thermometer Linde. Portia	Barometer	Wind	Wölk.	Wetter in Dec. 1776
3. 23	8	19 11.	27.	10			8. 2	8	20 12.	27.	6 1/2		
	12	22 13.						12	24 17.				
	4	21 12.						4	18 10				
	8	20 12.	27.	10 1/2				8	15 7.	27.	8.		
	8	19 11.	27.	9 1/2				8	11 3	27.	9 1/2		
	12	21 14.						12	10 2				
	4	18 10.						4	8 0				
	8	20 12.	27.	8 1/2				8	1 8	27.	10.		
	8	20 19	27.	9				8	12 22	27.	11.		
	12	28 21.						12	12 22				
	4	26 19						4	13 20				
	8	27 19.	27.	8.				8	14 24	27.	11 1/2		
	8	18 10	27.	7 1/2				8	15 25	27.	11 1/2		
	12	24 17						12	8 17				
	4	25 17.						4	10 20				
	8	25 18.	27.	6 1/2				8	12 22	28.			
	8	0 9	27.	9 1/2				8	11 21.	27.	9 1/2		
	12	0 0						12	3 6				
	4	2 10.						4	4 5				
	8	3 12	27.	11.				8	2 7	27.	6 1/2		
	8	0 3	27.	10 1/2				8	3 6	27.	7.		
	12	10 2						12	7 2				
	4	10 2						4	4 5				
	8	11 2	27.	7 1/2				8	3 6	27.	10.		
	8	5 0	27.	5				8	7 10	28.	1/2		
	12	8 0						12	2 7				
	4	0 9						4	2 7				
	8	0 9	27.	7 1/2				8	4 5	28.	1/2		
	8	3 19.	27.	10.				8	20 12	27.	11.		
	12	0 8						12	23 15.				
	4	0 11						4	24 16				
	8	3 12	27.	10 1/2				8	27 20	27.	4		
	8	5 3	27.	7 1/2				8	26 19	28	1 1/2		
	12	10 2						12	28 21				
	4	13 5						4	29 15				
	8	13 5						8	21 10	28	5 1/2		

18th-century data were digitised first

Neu Herrnhut 1767-1768



R.15.J.a.13 *Observationes in Grönlandia 1767.*
Auf 62 Grad 9 Minuten Breite und 52 Grad 20 Minuten Länge.

Tag	Baro. meter Fahrenheit	Thermo. meter Fahrenheit	Wind	Wind Miles	Wetter in Septemb. Monat 1767.
Donst. 1 ^{te}	8 2	40 26	N.	0	Wolken, Vögel, Fische.
Mitt. 2 ^{te}	8 2	39 31	N.	2	Fallw. - Föhn.
Donst. 3 ^{te}	8 2	22 25	N.W.	3	Fallw. - Föhn.
Freit. 4 ^{te}	8 2	40 25	N.	3	Wolken, Vögel, Fische.
Sonab. 5 ^{te}	8 2	38 22	N.O.	2	Linsolb. - Föhn.
Sonst. 6 ^{te}	8 2	40 25	N.O.	3	Linsolb. - Föhn.
Mont. 7 ^{te}	8 2	40 25	N.O.	2	Linsolb. - Föhn.
Donst. 8 ^{te}	8 2	37 22	S.W.	1	Linsolb. - Föhn.
Mitt. 9 ^{te}	8 2	40 25	N.O.	3	Linsolb. - Föhn.
Donst. 10 ^{te}	8 2	40 22	N.O.	2	Linsolb. - Föhn.
Freit. 11 ^{te}	8 2	38 26	N.O.	1	Wolken, Vögel, Fische, Regen, Schnee, Hagel, etc.
Sonab. 12 ^{te}	8 2	36 22	N.O.	2	Vögel, Fische.
Sonst. 13 ^{te}	8 2	31 25	N.	2	Linsolb. - Föhn.
Mont. 14 ^{te}	8 2	32 25	N.O.	1	Linsolb. - Föhn, Vögel, Fische.

R.15.J.a.13.9

Neu Herrnhut 1767-1768, Godthaab 1784-1792

QC and unit conversion

Okkak 10.1776-08.1787

wind speed conversion
from historical scale to ms⁻¹

Transcribed data

Converted data

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA
1	wg	MorawianChHouse		Okkak 10.1776-08.1787						Calculated																
2	rok	miesiac	dzień	godzina	ter.London	kier.wiatru	sila wiatru			Year	Month	Day	Hour	T (°C)	W_Dir	W_Speed										
3	1776	10	16	8	25	NW	3			1776	10	16	8	-3.9	NW	10.75										
4				12	26	NW	3			1776	10	16	12	-3.3	NW	10.75										
5				16	24	NW	3			1776	10	16	16	-4.4	NW	10.75										
6				20	18	NW	3			1776	10	16	20	-7.8	NW	10.75										
7			17	8	24	NW	2			1776	10	17	8	-4.4	NW	5.45										
8				12	30	NW	2			1776	10	17	12	-1.1	NW	5.45										
9				16	28	NW	2			1776	10	17	16	-2.2	NW	5.45										
10				20	18	NW	2			1776	10	17	20	-7.8	NW	5.45										
11			18	8	26	SW	1			1776	10	18	8	-3.3	SW	1.55										
12				12	33	SW	1			1776	10	18	12	0.6	SW	1.55										
13				16	26	SW	1			1776	10	18	16	-3.3	SW	1.55										
14				20	26	SW	1			1776	10	18	20	-3.3	SW	1.55										
15			19	8	40	E	0.5			1776	10	19	8	4.4	E	0.25										
16				12	39	E	0.5			1776	10	19	12	3.9	E	0.25										
17				16	36	E	0.5			1776	10	19	16	2.2	E	0.25										
18				20	33	E	0.5			1776	10	19	20	0.6	E	0.25										
19			20	8	39	SW	1			1776	10	20	8	3.9	SW	1.55										
20				12	44	SW	1																			
21				16	39	SW	1																			
22				20	38	SW	1																			
23			21	8	39	E	0.5																			

W_Dir ->	0 = lack of data		W_Speed	0	0.1
	99 = wind variable			0.25	0.18
				0.5	0.25
				1	1.55
				1.25	2.45
				1.5	3.35
				2	5.45
				2.5	7.95
				3	10.75
				3.5	13.85
				4	17.15
				4.5	20.75
				5	24.45
				5.5	28.45
				6	32.65

New wind speed classes were defined for each series and assigned appropriate values:

Wind speed conversion

Historical Scale	Beaufort Scale	Range [m·s ⁻¹]	Mean Value [m·s ⁻¹]
0-1	0-1	0.0-1.5	0.45
2	2-3	1.6-5.4	3.40
3	4-5	5.5-10.7	8.00
4	6-7	10.8-17.1	13.90
5	8-9	17.2-24.4	20.75
6	10-12	24.5-max	30.50

Neu-Herrnhut 1767-1768			Godthaab 1784-1792		
Historical Scale	Beaufort Scale	Mean Value [m·s ⁻¹]	Historical Scale	Beaufort Scale	Mean Value [m·s ⁻¹]
1	0-1	0.45	0	0	0.0
2	2-3	3.40	1	1-3	2.4
3	4-5	8.00	2	4-6	9.3
4	6-7	13.90	3	7-9	18.9
5	8-9	20.75	4	10-12	30.5
6	10-12	30.50	-	-	-

Chmist et al. 2025

QC and unit conversion

Transcribed data
Atmospheric pressure

Hoffenthal 1782-1786

Converted data
P(hPa)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA
1	Hoffenthal 1782-1786																	Calculated									
2																											
3	rok	miesia	dzien	godzin	term. Lond	ter. Berl	baromet	baromet	kier. wia	sila wia								Year	Month	Day	Hour	T (°C)	P (hPa)	W Dir	W_Speed		
3507				20	-5		29	7.5	NW	1								1786	2	22	20	-20	1069.26	W	1.55		
3508			23	8	-14		29	7.75	NW	1								1786	2	23	8	-25	1070.01	W	1.55		
3509				12	-7		29	7.75	NW	1								1786	2	23	12	-21	1070.01	W	1.55		
3510				16	-6		29	7.75	NW	1								1786	2	23	16	-21	1070.01	W	1.55		
3511				20	-8		29	7.25	NW	2								1786	2	23	20	-22	1068.5	W	5.45		
3512			24	8	-6		29	6.75	W	1								1786	2	24	8	-21	1067	W	1.55		
3513				12	3		29	6.75	W	1								1786	2	24	12	-16	1067	W	1.55		
3514				16	3		29	6.75	W	1								1786	2	24	16	-16	1067	W	1.55		
3515				20	-3		29	6.5	W	1								1786	2	24	20	-19	1066.25	W	1.55		
3516			25	8	-10		29	6.5	W	1								1786	2	25	8	-23	1066.25	W	1.55		
3517				12	-2		29	6.5	W	1								1786	2	25	12	-18	1066.25	W	1.55		
3518				16	-4		29	7.5	W	1								1786	2	25	16	-20	1069.26	W	1.55		
3519				20	-10		29	7.75	W	1								1786	2	25	20	-23	1070.01	W	1.55		
3520			26	8	-19		30	0										1786	2	26	8	-28	1082.79	0			
3521				12	-6		30	0.5										1786	2	26	12	-21	1084.3	0			
3522				16	-4		30	0										1786	2	26	16	-20	1082.79	0			
3523				20	-10		30	0.25										1786	2	26	20	-23	1083.54	0			
3524			27	8	-10		30	0.25										1786	2	27	8	-23	1083.54	0			
3525				12	9		30	0.25	NW	1								1786	2	27	12	-12	1083.54	W	1.55		
3526				16	6		30	0.25										1786	2	27	16	-14	1083.54	0			
3527				20	4		30	0.5										1786	2	27	20	-15	1084.3	0			
3528			28	8	7		30	1.25	N	1								1786	2	28	8	-13	1086.55	N	1.55		
3529				12	21		30	1	E	1								1786	2	28	12	-6	1085.8	E	1.55		
3530				16	18		30	0.5	N	1								1786	2	28	16	-7	1084.3	N	1.55		
3531				20	21		29	9.5	N	1								1786	2	28	20	-6	1075.27	N	1.55		
3532	1786	III	1	8	29		29	7.25	E	2								1786	3	1	8	-1	1068.5	E	5.45		
3533				12	35		29	6.25	E	2								1786	3	1	12	1	1065.5	E	5.45		
3534				16	35		29	6.25	E	2								1786	3	1	16	1	1065.5	E	5.45		
3535				20	35		29	6.25	E	2								1786	3	1	20	1	1065.5	E	5.45		
3536			2	8	35		29	8	E	2								1786	3	2	8	1	1070.76	E	5.45		
3537				12	37		29	8.75	SE	2								1786	3	2	12	2	1073.02	SE	5.45		
3538				16	36		29	9.75	SE	2								1786	3	2	16	2	1076.02	SE	5.45		
3539				20	35		30	0.5	SE	2								1786	3	2	20	1	1084.3	SE	5.45		
3540			3	8	34		30	3.5	SE	1								1786	3	3	8	1	1093.32	SE	1.55		
3541				12	36		30	3.75	SE	1								1786	3	3	12	2	1094.07	SE	1.55		
3542				16	34		30	4.25	SE	1								1786	3	3	16	1	1095.57	SE	1.55		
3543				20	33		30	4.5										1786	3	3	20	0	1096.33	0			
3544			4	8	30		30	5	SE	1								1786	3	4	8	-1	1097.83	SE	1.55		

Inch of Hg ???

Errors: 1065 – 1097 hPa ???

QC and unit conversion

Transcribed data

Hoffenthal 1782-1786

Converted data

Atmospheric pressure

P(hPa)

Hoffenthal 1782-1786																			
rok	miesiąc	dzień	godzina	term. Lond	barometr	barometr	kier. wiat	siła wiat	Year	Month	Day	Hour	T (°C)	cal Frn P (hPa)	cal Ang	cal Prus	W Dir	W_Spec	
			12						1784	8	31	12					99		
			16						1784	8	31	16					99		
			20						1784	8	31	20					99		
1785	9	1	8	55	29	6.5	NW	3	1785	9	1	8	12.7	1066.249	1001.584	1031.374	NW	10.75	
			12	64	29	6.5	NW	3	1785	9	1	12	17.7	1066.249	1001.584	1031.374	NW	10.75	
			16	68	29	6.75	NW	3	1785	9	1	16	20.0	1067	1002.336	1032.126	NW	10.75	
			20	60	29	6.75	W	2	1785	9	1	20	15.5	1067	1002.336	1032.126	W	5.45	
		2	8	60	29	6.5	SW	2	1785	9	2	8	15.5	1066.249	1001.584	1031.374	SW	5.45	
			12	67	29	5.75	W	2	1785	9	2	12	19.4	1063.993	999.328	1029.118	W	5.45	
			16	66	29	5	W	3	1785	9	2	16	18.8	1061.737	997.0722	1026.862	W	10.75	
			20	65	29	4.75	W	3	1785	9	2	20	18.3	1060.985	996.3203	1026.111	W	10.75	
		3	8	45	29	5.5	NW	2	1785	9	3	8	7.2	1063.241	998.5761	1028.366	NW	5.45	
			12	48	29	6.25	NW	3	1785	9	3	12	8.8	1065.497	1000.832	1030.622	NW	10.75	
			16	48	29	6.5	NW	3	1785	9	3	16	8.8	1066.249	1001.584	1031.374	NW	10.75	
			20	43	29	7	NW	1	1785	9	3	20	6.1	1067.752	1003.088	1032.878	NW	1.55	
		4	8	45	29	7.5	NW	3	1785	9	4	8	7.2	1069.256	1004.592	1034.382	NW	10.75	
			12	48	29	7.5	E	2	1785	9	4	12	8.8	1069.256	1004.592	1034.382	E	5.45	
			16	45	29	7.5	E	2	1785	9	4	16	7.2	1069.256	1004.592	1034.382	E	5.45	
			20	45	29	7	E	2	1785	9	4	20	7.2	1067.752	1003.088	1032.878	E	5.45	
		5	8	48	29	6	SE	1	1785	9	5	8	8.8	1064.745	1000.08	1029.87	SE	1.55	
			12	51	29	4.5	SE	1	1785	9	5	12	10.5	1060.233	995.5684	1025.359	SE	1.55	
			16	49	29	4	N	1	1785	9	5	16	9.4	1058.729	994.0645	1023.855	N	1.55	
			20	43	29	4	N	2	1785	9	5	20	6.1	1058.729	994.0645	1023.855	N	5.45	
		6	8	39	29	5.5	N	4	1785	9	6	8	3.8	1063.241	998.5761	1028.366	N	17.15	
			12	39	29	6.5	N	3	1785	9	6	12	3.8	1066.249	1001.584	1031.374	N	10.75	
			16	40	29	7.5	N	3	1785	9	6	16	4.4	1069.256	1004.592	1034.382	N	10.75	
			20	31	29	7.75	N	2	1785	9	6	20	-0.5	1070.008	1005.344	1035.134	N	5.45	
		7	0	44	29	7.75	NW	2	1785	9	7	0	6.6	1070.008	1005.344	1035.134	NW	5.45	

In Europe the measurement called "pied du roi" was used



“Pied du roi” is a historical French unit of length.

Meaning

English: “the king’s foot”

What it was

The **pied du roi** was a unit used in **France before the metric system**.

- 1 pied du roi $\approx$ 32.48 cm

- 1 pied du roi $\approx$ 12.79 inches

It was slightly **longer than the English foot**.

TITLE OF PROJECT/DATA SET:

Understanding Climate-Driven Phenological Change - Observations, Adaptations and Cultural Implications in Northeastern Siberia and Labrador/Nunatsiavut (PHENARC)

Authors:

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2. G.R. Demarée: Royal Meteorological Institute, Ringlaan 3, 1180 Brussels, Belgium. Phone: +32 2373 0540. Email: gdemaree@oma.be

Data Calculations: The barometric measurements were converted in the following way:

In Europe the measurement called “pied du roi” was much used. 1 *pied du roi* = 32.48 cm; 1 *pied du roi* also = 12 “pouces”. 1 *pouce* = 27.07 mm ; 1 *pouce* also = 12 “lignes” ; 1 *ligne* = 2.256 mm. (NB - sometimes the decimal system is used for the *lignes* (lines) depending on the instrument.) Thus, the measurement of the barometer at Nain in August 1777: The observation of 28,3 is converted thus: $28 \times 27.07 \text{ mm} + 3 \times 2.256 \text{ mm} = 757.96 \text{ mm} + 6.768 \text{ mm} = 764.728 \text{ mm Hg}$ (in modern units). Then mmHg is converted into mbar: $1 \text{ mm Hg} = 1,333224 \text{ hPa or mbar}$ ($764.728 \text{ mm Hg} = 1019.55 \text{ hPa or mbar}$ ($1 \text{ hPa} = 1 \text{ mbar}$)). The temperature measurements were calculated by converting the Fahrenheit scale used in the observations to the Celsius scale. These calculations were undertaken by Gaston Demarée.



19th and 20th-century data

Overseas stations Canada

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



Climate Data from the Overseas Stations of the Deutsche Seewarte (German Marine Observatory) in Canada

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Last updated:
30 May 2022



Overseas stations Canada

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Figure 2: Geographical positions of the 20 stations of the Deutsche Seewarte in Canada (Source: DWD).

Table 1 gives a list of all 20, now fully digitised stations in Canada, including the position data and observation periods. Detailed information about the elements observed and the daily observation hours can be found in the Annex to this document in Table A1.

Table 1: Name, internal station identifier, country, geographic co-ordinates, altitude of station and periods of reporting of the 20 stations of the Deutsche Seewarte in Canada. Further information about the observed weather elements can be found in Table A1 in the Annex.

No.	Station	Station identifier	Country	Latitude	Longitude	Altitude in m	Time period
1.	Fort Simpson	CAN00010	Canada	61°51'45" N	121°21'05" W	91	1849–1851
2.	Rama	CAN00100	Canada	58°53' N	63°15' W	3	1872–1890
3.	Hebron	CAN00200	Canada	58°12' N	62°38' W	15	1841–1918
4.	Okak	CAN00210	Canada	57°33'00" N	61°57'53" W	64	1883–1889
5.	York Factory	CAN00220	Canada	57°00' N	92°26' W	17	1875–1878
6.	Nain	CAN00300	Canada	56°33' N	61°41' W	11	1841–1843 1877–1913 1926–1939
7.	Zoar	CAN00400	Canada	56°07' N	61°22' W	10	1870–1871 1882–1894
8.	Hoffenthal	CAN00500	Canada	55°27' N	60°13' W	8	1867–1874 1882–1898
9.	Makkovik	CAN00600	Canada	55°07' N	56°07' W	5	1932–1933
10.	Moose Factory	CAN00700	Canada	51°16'00" N	80°36'58" W	7	1855 1858–1859 1878–1880
11.	Spences Bridge	CAN00800	Canada	50°25'25" N	121°20'42" W	780	1872–1881





19th and 20th-century data

Meteorologisk Aarbog for 1874.

Udgivet af
det danske meteorologiske Institut.

Annuaire météorologique pour l'année 1874.

Publié par
l'Institut météorologique Danois.



Kjøbenhavn.

Trykt hos J. B. Schultz. — Autograft af C. Forsslow & Co.

1875.

GODTHAAB.

MARTS.

1874.

Dag	Thermometer.				Celsius.			Føgtighedsges.			Damptryk.			Barometer.			Vindens Retning og Styrke.			Skydekke.			Ned.	An.		
	5.	1.	9.	Midd.	Max.	Min.	5.	1.	9.	5.	1.	9.	5.	1.	9.	5.	1.	9.	5.	1.	9.	bør.			max.	
1	-11.5	-13.8	-13.8	-13.0									741.3	745.1	738.0	5SE	4	2	10	10	10			*		
2	-13.8	-11.9	-12.5	-12.7									737.4	743.9	750.4	4	4	3	10	10	10			*		
3	-12.5	-10.6	-7.5	-10.8									57.8	52.6	50.5	4W	1	5	1	10	10			*		
4	-12.5	-5.0	-3.8	-7.1									59.8	53.3	43.8	5SE	1	5SE	5	10	10			*		
5	-13.1	-11.3	-14.0	-12.8									56.3	58.9	65.2	4NE	3	4NE	2	10	10			*		
6	-16.4	-16.3	-18.0	-17.1																						
7	-15.4	-11.3	-11.0	-12.4									71.0	78.9	82.5	4	2	1	10	5	2	13.7		W		
8	-4.3	-0.4	-1.1	-1.8									81.7	78.5	74.5	4	3	4	3	5	2	0		*		
9	-1.5	0.5	-0.9	-0.6									74.3	73.1	71.2	5SE	3	5	2	5	10	10		*		
10	-1.3	1.2	-1.0	-0.4									69.9	68.8	68.1	5	3	5	4	10	10			*		
11	-3.8	0.4	-2.0	-1.8									68.0	67.4	66.0	5	3	2	5	1	10	10			*	
12	-3.0	0.4	-1.5	-1.8									64.4	64.5	62.4	0	0	0	0	0	0	10	10		*	
13	-1.3	2.7	0.0	0.5									58.1	54.0	49.8	4NE	2	4NE	2	3	5	2	0		W	
14	-0.0	0.0	-6.5	-2.5									48.0	47.4	46.2	4NE	2	5	2	0	2	10	10		*	
15	-8.0	-6.0	-7.8	-7.3									48.3	51.5	55.3	5W	2	5W	2	4NE	2	10	10		*	
16	-8.5	-5.5	-8.4	-7.5									54.5	52.2	50.8	4NE	2	4NE	3	4NE	2	8	8	2	6.7	W
17	-5.0	-3.8	-7.6	-5.5									51.2	51.1	50.7	4NE	2	4NE	2	1	0	2	10		*	
18	-10.3	-8.6	-4.0	-7.6									44.2	50.7	55.4	5	2	5	3	4	10	10			*	
19	-1.3	-0.5	-8.6	-3.5									57.4	55.0	43.0	1	5W	3	5SE	4	10	10			*	
20	-10.3	-7.4	-12.5	-10.8									36.6	35.9	41.2	5	5	3	4NE	2	10	10			*	
21	-13.4	-11.8	-13.3	-12.4									41.4	42.0	39.6	4NE	2	4NE	2	4NE	3	10	10		16.0	*
22	-15.1	-13.8	-15.3	-14.7									32.5	26.6	24.1	4NE	4	4NE	4	4NE	4	10	10			
23	-14.6	-12.5	-13.8	-13.1									25.1	31.9	40.1	4NE	2	4NE	2	4NE	1	8	5	10		*
24	-12.6	-10.0	-9.0	-10.5									44.0	46.8	47.6	0	5W	2	4NE	2	10	10		7.6	W	
25	-11.3	-1.3	-6.3	-5.4									46.0	37.0	26.1	4NE	2	4NE	3	4NE	3	0	8	10		*
26	-3.4	-0.5	-5.0	-3.0									37.2	26.0	32.4	0	4NE	4	0	2	8	0			W	
27	-5.0	-3.9	-6.0	-5.0									32.8	35.4	39.3	0	4NE	1	4NE	2	2	10	10			
28	-6.6	-6.5	-7.5	-6.9									39.8	40.4	40.1	4NE	1	4NE	2	4NE	2	10	10			*
29	-8.1	-8.5	-9.4	-8.7									38.9	35.1	32.5	4NE	1	4NE	2	4NE	2	10	10			*
30	-10.4	-7.4	-10.5	-9.6									34.3	40.6	42.8	4NE	1	4NE	3	4NE	3	10	10			*
31	-10.3	-8.1	-15.0	-11.1									43.6	44.1	47.0	4NE	1	4NE	3	4NE	3	10	10			*
													47.5	48.0	48.7	4NE	3	4NE	3	0	5	8	8	3.9		*
Midd.	-8.6	-6.2	-8.2	-7.7									749.5	749.0	749.3	2.0	2.4	2.3	8.0	8.3	7.9	47.9			3.9	

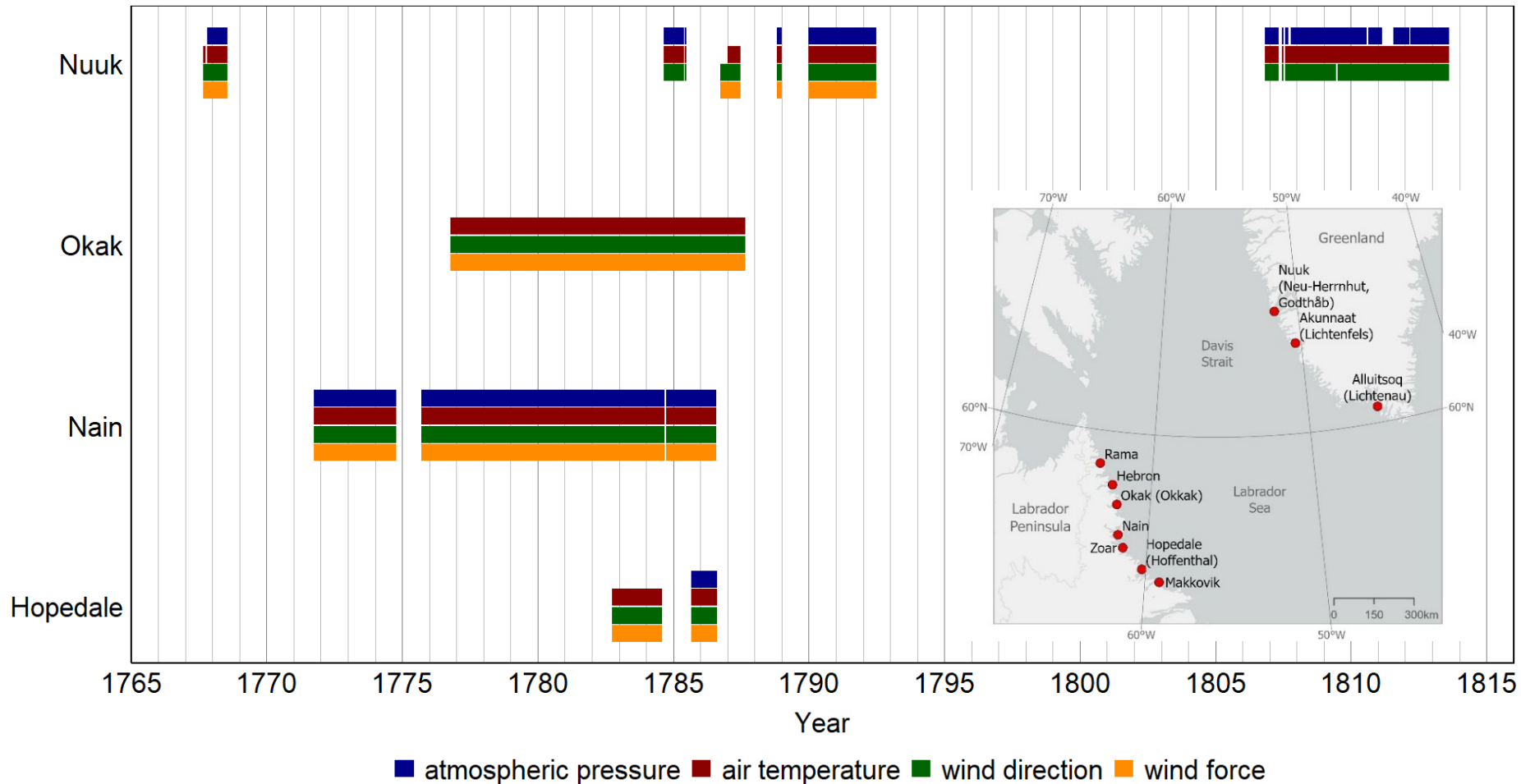
APRIL.

APRIL.																										
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2	-7.5	-5.5	-4.4	-5.5									39.7	40.9	42.7	4NE	3	4NE	1	4NE	1	8	10	8		*
3	-6.3	-3.8	-7.0	-5.7									44.3	44.4	45.4	4	0	0	0	0	10	10	10		*	
4	-8.3	-4.0	-6.1	-6.1									45.6	45.6	45.9	4	4NE	1	4NE	1	10	8	8		0.6	W
5	-7.5	-1.3	-6.8	-5.5									45.0	45.6	43.5	4NE	2	0	1	4NE	2	10	8			*
6	-2.5	4.4	-3.5	-0.5									37.3	37.6	43.4	4	3	0	4	1	2	8	10			W
7	-6.3	-7.9	-9.3	-7.8									47.0	49.3	52.0	4NE	2	4NE	3	4NE	2	10	10			*
8	-8.3	-4.4	-11.9	-8.2									50.9	48.8	47.3	4NE	2	4NE	1	0	10	10	2			*
9	-8.8	-8.9	-13.6	-10.4									49.6	51.1	47.2	4NE	3	4NE	3	4NE	3	10	8			*
10	-10.4	-11.6	-13.3	-11.8									44.2	46.0	46.7	4NE	3	4NE	3	4NE	3	10	10			*
11	-13.5	-10.0	-11.6	-11.7									43.3	41.3	41.4	0	5	2	0	10	10	10			*	
12	-13.1	-9.5	-7.5	-10.7									39.4	37.0	43.8	0	5	4	5	4	10	10	10			*
13	-7.3	-3.8	-8.0	-7.0									46.5	47.2	44.3	5	3	5	2	5SE	2	10	8	10	3.7	*
14	-8.3	-6.8	-10.8	-8.6									42.3	43.1	46.2	5	3	5	1	0	10	10	8	6.2	*	
15	-9.0	-4.4	-14.3	-9.2									52.4	59.4	63.2	4NE	2	4NE	1	0	8	10	2	2.0	W	
16	-10.0	-6.0	-4.4	-7.0									41.8	57.5	53.1	4	2	4	4	3	0	2	0		W	
17	-8.4	-0.1	-3.8	-4.1									51.3	48.7	46.5	0	4	2	4	2	0	0	0		*	
18	-2.5	1.5	-3.5	-1.2									42.2	40.0	39.9	4NE	2	4NE	1	4NE	1	2	2	5		*
19	-3.0	5.6	-3.5	0.3									39.8	42.1	44.6	0	0	0	0	0	0	0	0		*	
20	-6.0	1.6	-2.4	-2.3									45.7	47.1	48.4	0	5	1	5	2	2	10	10		*	
21	-2.5	0.5	-3.5	-2.2									49.9	52.3	53.2	5	3	5W	1	5	2	10	10		*	
22	-6.0	2.2	-3.0	-2.3									57.3	59.1	59.3	0	0	0	0	0	0	0	0		*	
23	-3.2	-0.5	-2.9	-2.2									58.5	57.6	56.7	4NE	2	4NE	3	4NE	2	8	0		1.8	*
24	-9.3	1.5	-2.3	-3.4									56.2	54.7	53.9	0	4	1	4	2	0	5	2		*	
25	-2.6	1.2	-1.8	-1.1									50.8	52.7	52.8	4NE	1	4NE	2	4NE	2	3	5	8		*
26	-1.6	3.0	2.0	1.1									52.0	54.0	58.9	4NE	2	4NE	2	4NE	2	1	5	8		*
27	0.3	3.3	0.8	1.5									58.5	56.8	53.8	4NE	1	4NE	2	4NE	2	3	5	2		*
28	3.1	5.8	5.0	4.6									66.40	63.3	61.4	4NE	1	4NE	2	4NE	2	1	8	8		*
29	5.6	4.4	-0.5	3.3									50.1	44.8	43.8	4NE	2	4NE	2	4NE	2	1	8	8		*
30	-0.5	3.6	0.5	1.2									50.1	54.5	57.8	5	2	4NE	1	4NE	1	2	8	8		*
31													59.0	59.3	57.9	4NE	2	4NE	1	4NE	1	5	0	0		*
Midd.	-6.0	-1.8	-5.4	-4.4									748.6	748.9	749.3	1.7	1.5	1.4	66	67	60	143			*	



Synthesis

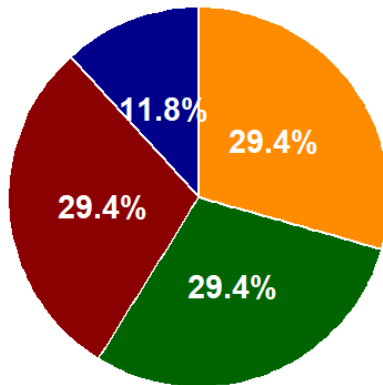
Data time coverage in the 18th and beginning of the 19th centuries



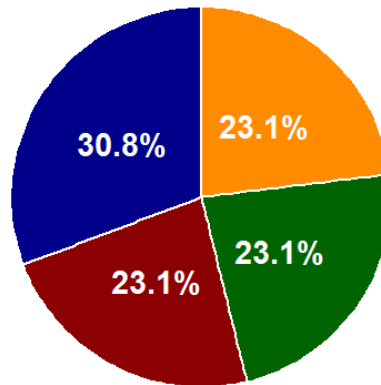


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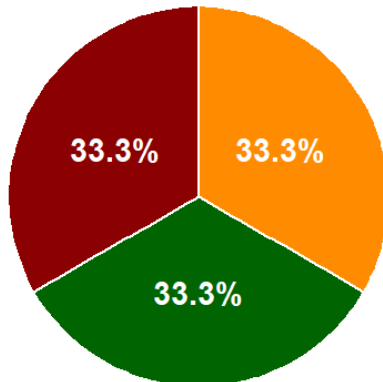
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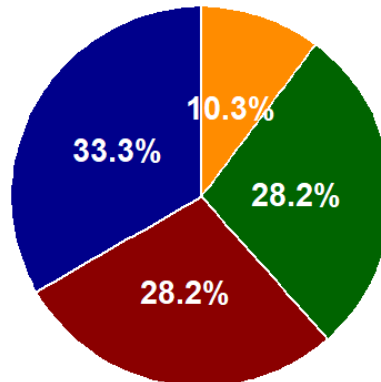
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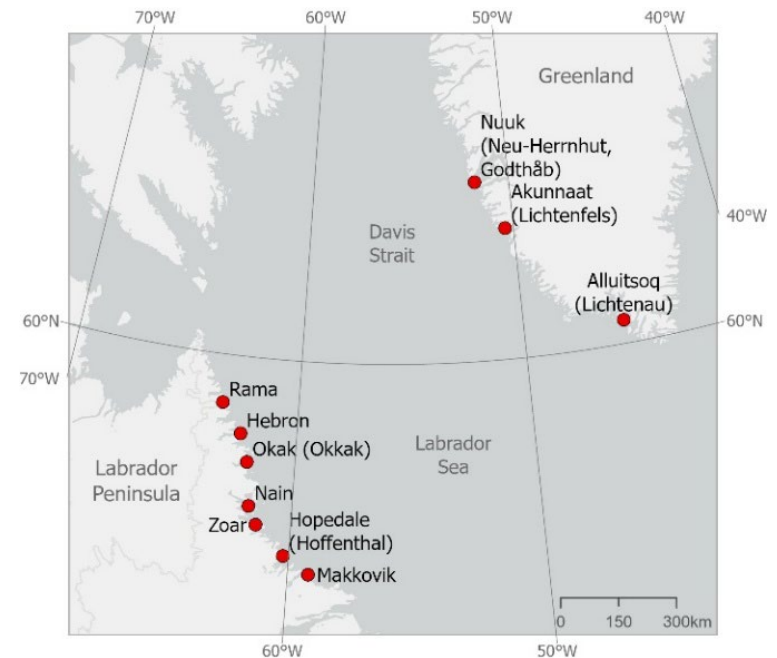
Okak



Nuuk



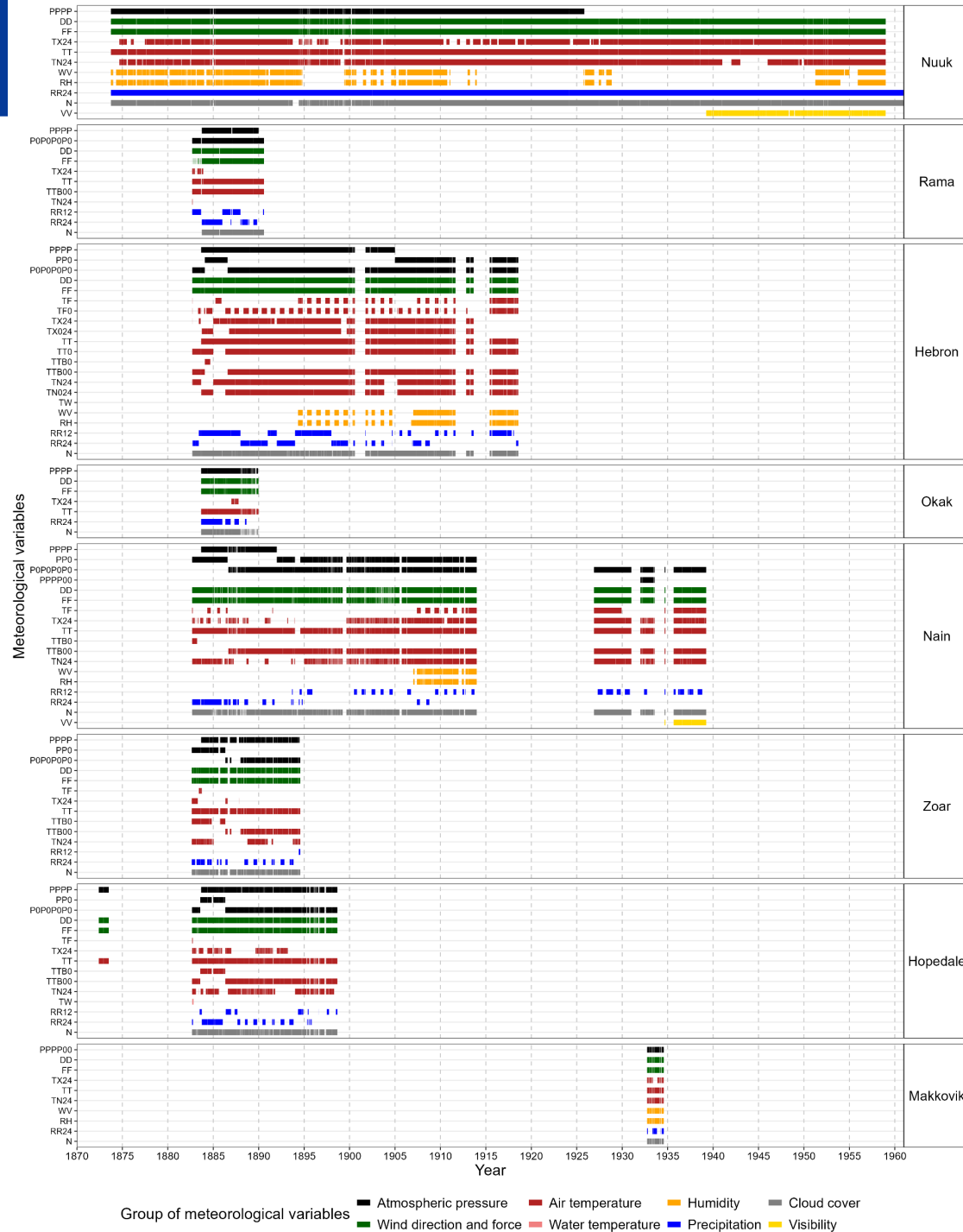
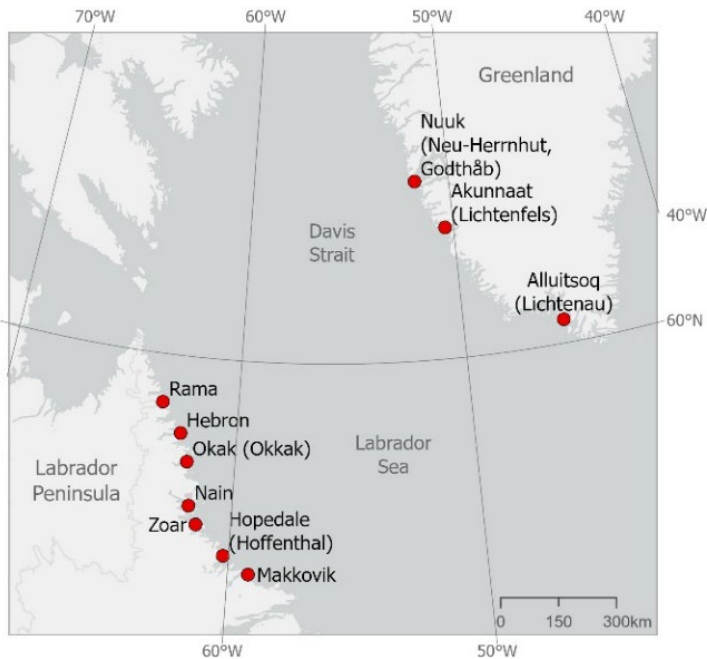
1767-1813



- atmospheric pressure
- air temperature
- wind direction
- wind force

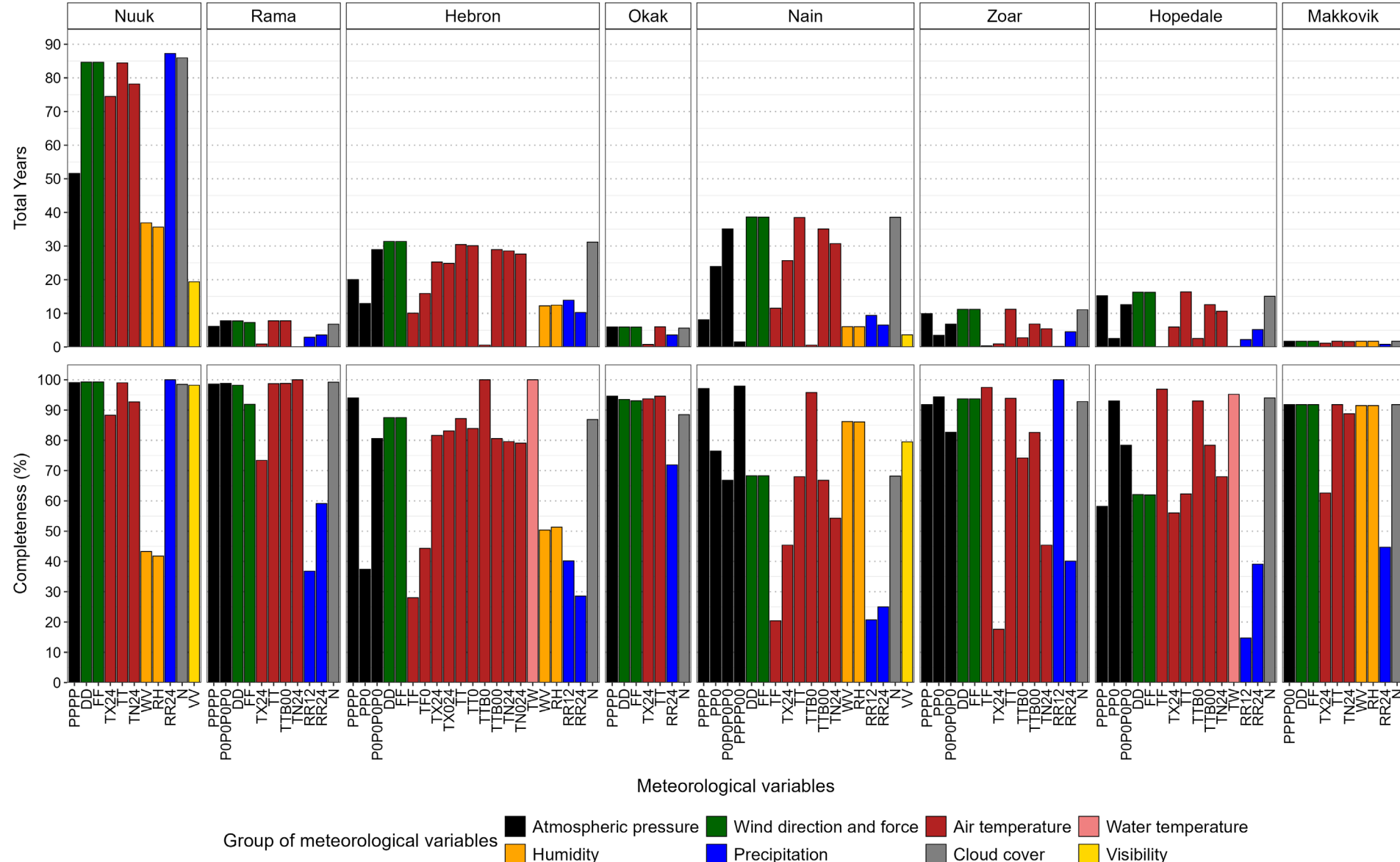
Synthesis

1872-1960



Synthesis

1872-1960





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Keyword Term



Subdaily records of atmospheric pressure, wind speed and direction, and air temperature in Labrador in the second half of the 18th century

Nov 27, 2025

Singh, Garima; Chmist, Konrad; Przybylak, Rajmund; Araźny, Andrzej; Wyszyński, Przemysław, 2025, "Subdaily records of atmospheric pressure, wind speed and direction, and air temperature in Labrador in the second half of the 18th century", <https://doi.org/10.18150/PODXZQ>, RepOD, V1



Subdaily records of atmospheric pressure, wind speed and direction, and air temperature in southwest Greenland during the latter half of the 18th century.

Oct 13, 2025

Chmist, Konrad; Singh, Garima; Araźny, Andrzej; Przybylak, Rajmund; Wyszyński, Przemysław, 2025, "Subdaily records of atmospheric pressure, wind speed and direction, and air temperature in southwest Greenland during the latter half of the 18th century.", <https://doi.org/10.18150/XGCONO>, RepOD, V1



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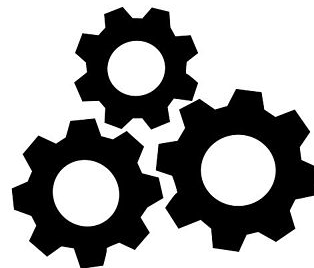
F indable



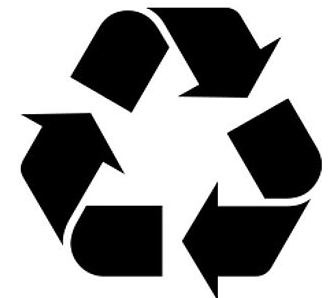
A ccessible



I nteroperable



R eusable





Clim. Past, 20, 1451–1470, 2024
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Air temperature changes in SW Greenland in the second half of the 18th century

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Abstract. The thermal conditions of south-western Greenland in the second half of the 18th century were estimated using two unique series of meteorological observations. The first series (Neu-Hermbut, 1 September 1767 to 22 July 1768, hereinafter 1767–1768) is the oldest long-term series of instrumental measurements of air temperature available for Greenland. The second (Godthaab, September 1784 to June 1792) contains the most significant and reliable data for Greenland for the study period. The quality-controlled and corrected data were used to calculate daily, monthly, seasonal and yearly means. The daily means were further used to calculate day-to-day temperature variability (DDTV), thermal seasons, growing degree days (GDDs), the air thawing index (ATI), positive degree days (PDDs) and air freezing index (AFI) degree days.

Air temperature in Godthaab (now Nuuk) was, on average, warmer than the present day (1991–2020) in 1767–1768 and colder in 1784–1792. Compared to the early 20th-century Arctic warming (ETCAW) period, the data for the two sub-periods show that the late 18th century was as warm or even warmer. Except winter 1767/1768, winters and springs in the study period were longer, while summers and autumns were shorter than at present. The analysed climate indices usually did not exceed the maximum and minimum values from 1991–2020. Mean daily air temperature in the studied historical periods rarely exceeded ± 2.5 SD (standard deviation) of the long-term mean calculated for the contemporary period. Air temperature distribution was usually close to normal, in both historical and contemporary periods.

1 Introduction

As we know, the Arctic plays a critical and leading role in the climate change we are now observing. The changes in climate and environment are greatest here (IPCC, 2021). To precisely estimate the scale of influence of human activity on the Arctic climate, the range of natural climate changes should first be estimated. According to existing knowledge, little anthropogenic influence has been noted in the Arctic before the mid-20th century. For this period, regular instrumental meteorological observations are very sparse, short and incomplete, especially before the 1920s (Przybylak, 2000, 2002a, 2016; van Wijngaarden, 2015; Brönnimann et al., 2019). For a longer perspective, all available early instrumental observations should be collected and used. These were made mainly during numerous exploratory and scientific expeditions to the Arctic. We have gathered and processed these kinds of data in our previous works (Przybylak, 2000; Przybylak and Vizi, 2005; Przybylak et al., 2010, 2016, 2021, 2022; Nordli et al., 2014, 2020; Przybylak and Wyszynski, 2017). In those works, we focused on climate analysis for a time span including the 19th century and the first half of the 20th century.

The cited papers, however, did not analyse meteorological observations made in Greenland by the Moravian missionaries beginning in the second half of the 18th century. According to our knowledge, only in a small number of recently published papers (Vinter et al., 2006; Demaree et al., 2020; Demaree and Ogilvie, 2021) have limited analyses of some series of instrumental observations covering the 18th century been performed for the study area. In the first paper, monthly means from Nuuk from the period 1784–1792 were used. Ac-

Thermal conditions on the coast of Labrador during the late 18th century

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Abstract. In this article, we present research results on the air temperature changes on the Labrador coast at the end of the 18th century (1771–1787). This important climatic variable was studied on the basis of valuable instrumental meteorological observations made by Moravian missionaries. The data were taken from meteorological registers available in three major archives: the Moravian Archives in Hermbut (Germany) and the Moravian Archives at Maxwell Hill and the Archives of the Royal Society, both located in London (UK). The series of meteorological observations we used in the paper are the oldest and longest long-term meteorological observations available not only for Labrador, but for anywhere in the entire Arctic. Moravian missionaries measured not only air temperature (analysed here) but also atmospheric pressure and wind (force and directions) two, three, or even four times a day. These unique data allow us to better understand the climate variability and trends in the region during the study's historical period. We have analysed sub-daily air temperature readings from three sites: Okak (1776–1787), Nain (1771–1786), and Hopedale (1782–1786). The data were converted into more reliable present-day units and have undergone rigorous quality control. Original mean daily air temperature data calculated using different numbers of measurements per day were corrected to the “real” mean daily values. The corrected values were subsequently used for statistical analysis. The historical temperatures documented during our specified study period along the Labrador coast were compared with those experienced today. The analysis shows a significant warming from historical to present times. Historical data from Nain, Okak, and Hopedale, representing different periods, were, on average, about 0.5 to 2.3 °C colder than in the modern period of 1990 to 2020, es-

pecially in winter and autumn. Most monthly mean air temperatures in historical times lie within 2 standard deviations of the modern mean. The frequency of temperature occurrence in 1 d intervals suggests a shift towards more stable and less extreme temperature distributions in contemporary times, implying substantial changes in climate patterns over time in this region. The continentality of the Labrador climate and the year-to-year variability in mean monthly temperatures were greater in historical times than at present.

1 Introduction

Investigating historical climate changes, especially for the last millennium, is crucial for understanding past climate systems and, as a result, for constructing more reliable scenarios of future climate. Reconstructing the features of the climate in the last millennium, including the range of its natural changes, is particularly important for the Arctic, where recently observed changes in climate and environment have been greater (Walsh et al., 2011; Jeffries et al., 2013; IPCC, 2021). Improved knowledge about the range and rate of climate fluctuations in the last millennium in the Arctic, in particular prior to the start of regular instrumental observations covering much of the area (mid-20th century; see Przybylak, 2000, 2016; Przybylak et al., 2024), can help in estimating the magnitude of anthropogenic influences on Arctic and global climate. Therefore, there is an urgent need to collect and analyse any meteorological data for this period for every area of the world, particularly the Arctic.

In this paper, we present the results of our investigation of thermal conditions on the coast of Labrador (Canada) in

Changes in bioclimatic conditions on the coast of the Labrador Peninsula in the second half of the 18th century

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Abstract

The article presents the bioclimate of the north-eastern part of the Labrador Peninsula estimated based on meteorological observations from three measuring stations: Nain, Okak and Hopedale. The meteorological measurements were taken by members of the Moravian Church conducting religious missions in the area. Two-time slots were designated: from September 1776 to August 1786, for which data exist for Nain and Okak stations; from September 1782 to August 1786 (with a year-long gap from September 1784 to August 1785), for which data exist for all three stations (Nain, Okak and Hopedale). The following indices were used: Wind Chill Temperature (WCT), Wind Chill Index (WCI) and Insulation Predicted (Icpl). The results were compared with the bioclimatic conditions in Nain from the contemporary period (1991–2000). It was found that, in the first of the specified time intervals (lasting 10 years), bioclimatic conditions were less bearable for humans in Nain than in Okak (for Nain and Okak the index values were as follows: WCT -0.8 °C and -0.4 °C, WCI 874.1 W m⁻² and 802.2 W m⁻², Icpl equal 1.7 clo). In the second time period (only 3 years), the most difficult conditions prevailed at the Okak station while the most favourable were recorded at Hopedale (for Nain, Okak and Hopedale the index values were as follows: WCT -1.0 °C, -1.4 °C and 0.5 °C, WCI 881.6 W m⁻², 838.4 W m⁻² and 819.6 W m⁻², Icpl 1.7 clo, 1.8 clo and 1.7 clo). At each station, conditions for humans were more favourable during the historical periods than in the contemporary period (WCT -2.7 °C, WCI 987.9 W m⁻², Icpl 1.9 clo). The most important role in this matter was played by wind speed, which was higher in 1991–2000 than in the second half of the 18th century.

Keywords. Labrador · Historical bioclimatology · Moravian Brethren · Air temperature · Wind speed · Bioclimatology indexes

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► EndNote

Newly discovered series of meteorological measurements in SW Greenland (Nuuk) in the period 1806–13

Rajmund Przybylak, Andrzej Arazyński, Przemysław Wyszynski ✉, Garima Singh ✉, and Konrad Chmist

Short summary

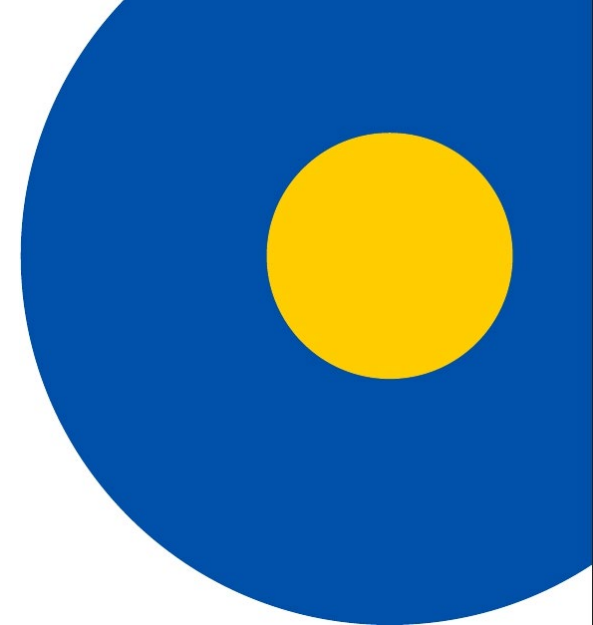
This study presents and analyses a newly discovered unique series of meteorological measurements



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Thank you!

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