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Air Temperature Conditions in SW Greenland in the Period 1806–1813

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In this paper, we present preliminary research findings on the thermal conditions of south-western Greenland (based on data from Godthåb [now Nuuk]) for the period from 1 November 1806 to 16 August 1813 (Fig. 1). As part of the ongoing NCN research project titled "Reconstructions of climatic and bioclimatic conditions in Greenland and Labrador/Nunatsiavut ca. 1770 to 1939 from Moravian Missionary observations (MORCLIM)", we discovered a handwritten manuscript (MA/154) in the archives of the Royal Society in London containing previously unknown meteorological measurements from Godthåb for the aforementioned period (Fig. 2). The meteorological observations were carried out by the German mineralogist Dr. Charles Lewis Giesecke (born Johann Georg Metzler [1761–1833]) (Fig. 3), or at least this is what the title page of the manuscript and the Royal Society catalogue describing the source suggests. However, given the numerous biographical accounts of his stay in Greenland (e.g., Monaghan 1993; Jørgensen 1996; Wyse Jackson 1996; Whittaker 2001), there is some doubt as to whether he conducted the meteorological observations alone. During that time, he undertook numerous research expeditions along the south-western coast of Greenland, from Upernavik in the north to Cape Farewell in the south. The purpose of these expeditions was geological research, particularly the collection of minerals. Someone must have been assisting him with the meteorological measurements, given that, over the six-year period (August 1807 – July 1813), there exists an almost complete series of observations taken three times a day (morning, midday, and evening). It is possible that the Moravian missionaries present in the area, who had extensive experience in conducting meteorological observations (Przybylak et al. 2024), were involved. Another possibility is that Giesecke conducted all his geological research during the first year of his stay in Greenland (as he had originally planned), and that, unable to return to Denmark due to the outbreak and continuation of the Napoleonic Wars (Whittaker 2001), he

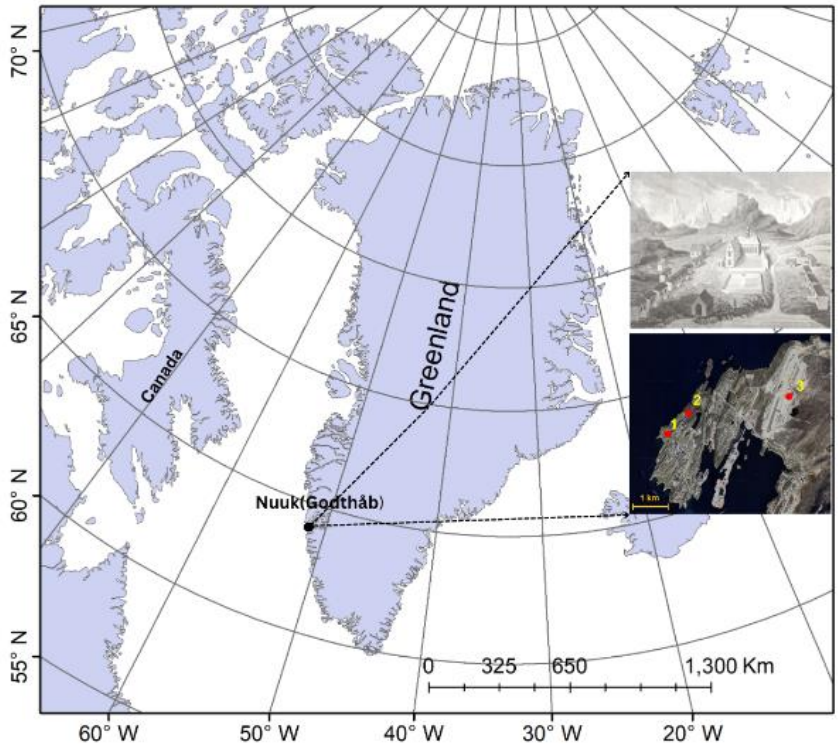

Fig. 1. Study area and location of historical and contemporary sites of meteorological measurements. Explanation: 1 – historical site Godthåb (1806–1813), 2 – 4250 Nuuk (1991–2020), 3 – 4254 Mittarfik Nuuk (2001–2020). Upper photo source: Neu-Herrnhut (Crantz 1820). Map data for location of sites: © Google Earth; images © 2023 Maxar Technologies, © 2023 Airbus, and © 2023 Asiaq.

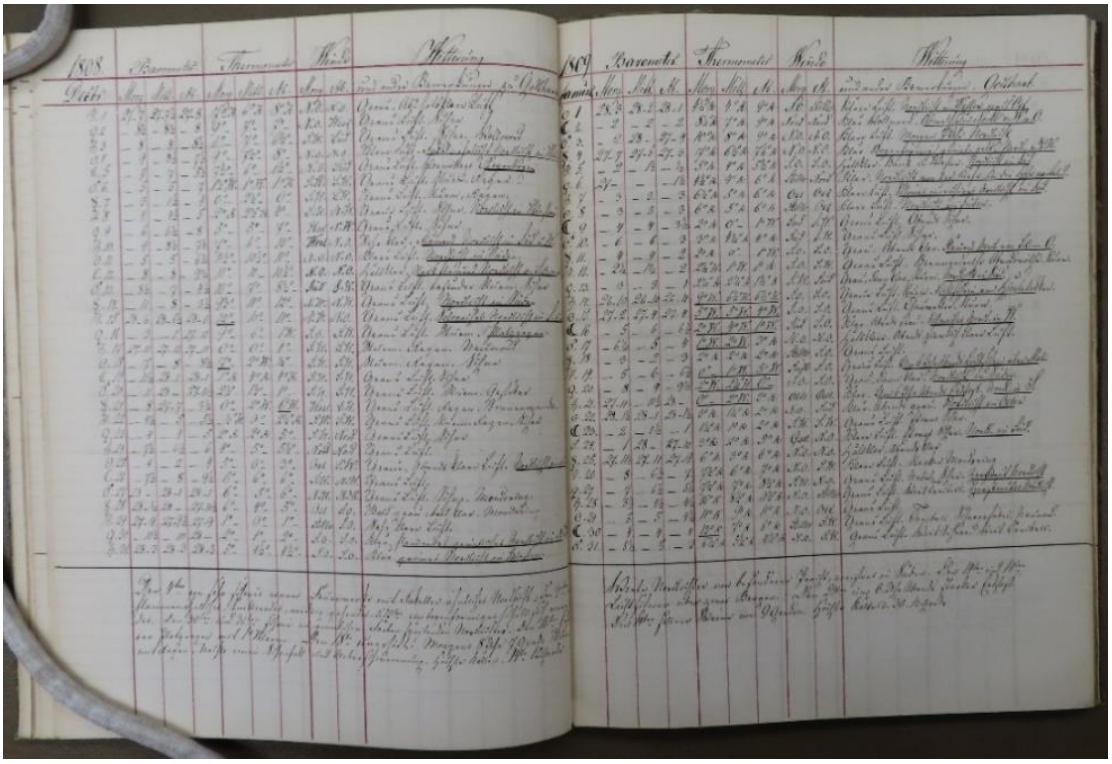

Fig. 2. Examples of manuscript presenting meteorological observations in Godthåb (1 November 1806 – 16 August 1813) (data presented in the manuscript: 1 December 1808 to 31 January 1809). Source: Archives in the Royal Society in London, MA/154.

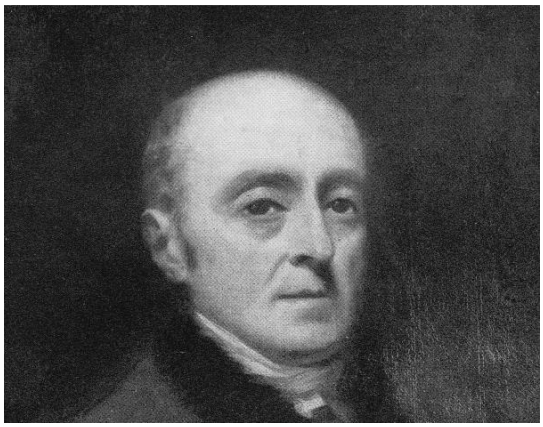

Fig. 3. Portrait of Sir Charles Lewis Giesecke (1761–1833), by the Scottish painter Raeburn (after Whittaker 2001).

decided to begin systematic meteorological observations starting in August 1807. He arrived in Greenland on 31 May 1806, and began meteorological observations only on 1 November 1806, which continued regularly until April 1807. From then until August, the observations were intermittent and irregular. It is therefore likely that he carried out his geological research during the periods of June–October 1806 and then May–July 1807.

As Fig. 2 shows, Giesecke conducted measurements and observations of the following meteorological elements: atmospheric pressure (morning and evening), air temperature (morning, midday, and evening), and wind direction (morning and evening). In addition, in the meteorological register, he briefly described the weather conditions for each day. At the end of each month, he also included a short summary of the weather conditions (at the bottom of the table of meteorological data). Unfortunately, the register does not provide information about the units used for the measurements, nor does it include details about the thermometer's exposure. It is assumed that the thermometer was placed on the north-facing wall outside the building where Giesecke lived. However, in the Arctic, where there is polar day during summer months, such placement does not fully eliminate the influence of solar radiation unless the thermometer is properly shielded.

In the article, we present the thermal conditions prevailing during that time. The unit used for air temperature measurements (°C) was determined by comparing the recorded values with parallel temperature observations conducted in another location in Godthåb during the years 1811–1812 (Vinther et al. 2006). The exact times of temperature measurements are unknown. Nevertheless, we calculated daily mean temperatures using a weighted average: $(T_{morning} + T_{midday} + 2 \times T_{evening}) / 4$. The obtained results were compared both with earlier temperature observations from the years 1784–1792 (Przybylak et al. 2024) and with later records, including modern observations from the period 1991–2020.

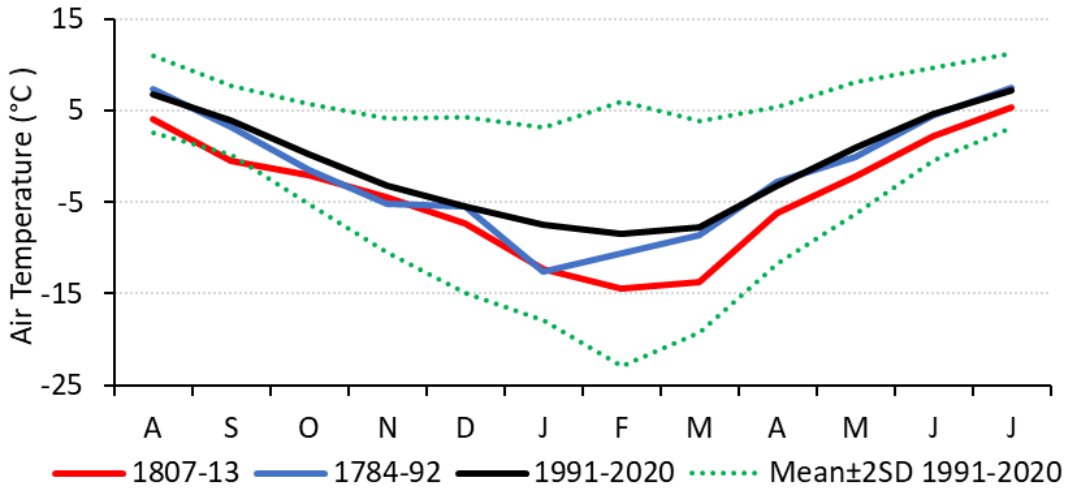

Fig. 4. Annual cycles of air temperature in the historical periods (1784–1792 and 1807–1813) and at present (1991–2020). Data for 1784–1792 taken from Przybylak et al. (2024).

Due to the irregularity of meteorological observations between 1 November 1806 and 31 July 1807, we present here an analysis for the period of regular observations, i.e. August 1807 – July 1813 (6 full years). The average annual temperature reached –4.0 °C, the coldest year was 1811 (–7.3 °C), and the warmest was 1809 (–1.8 °C). In the annual cycle, the coldest temperature occurred in February (–14.4 °C) and the warmest in July (5.3 °C) (Fig. 4). In the daily cycle, the highest average annual temperature was noted at midday (–2.1 °C) and the lowest in the evening (–5.1 °C). For all sub-daily measurement times, the warmest month was July, while the coldest was February (midday and morning) or March (evening). The highest temperature was observed on 16 July 1810 (18.5 °C), while the lowest was on 21–24 February 1812 (–36.5 °C). The temperature in the historical period was on average 3 °C colder than today (1991–2020). In the warmest month (July) in both comparative periods, this difference reached 1.7 °C, whereas in the coldest (February) it was 6.1 °C (Fig. 4). This was the greatest difference of all months.

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