

## Reply to the Reviewer comments

I would like to thank the Reviewer for the valuable comments, which helped enhance the form and substance of this paper. The majority of the suggestions have been implemented in the manuscript. My reply to the comments and my explanations are listed below.

### Reply to GENERAL COMMENTS

#### Reviewer: 2

The manuscript presents an interesting contribution that is clearly relevant to the readership of “Climate of the Past”. The topic is well aligned with the journal’s scope, and the study has the potential to provide valuable insights into historical climate variability. For these reasons, I would like to see this work eventually published in “Climate of the Past”. However, in its current form, the manuscript has several substantial shortcomings that preclude publication at this stage. These issues relate to (1) the insufficient description of the historical sources used, (2) the lack of essential metadata on the instruments and their installation, (3) an overly superficial discussion of the data-conversion methodologies, and (4) significant problems concerning style, clarity, and overall presentation. I elaborate on these points below.

#### *Response:*

*Thank you very much for your recognition of the article’s merits. We hope we have satisfactorily clarified and expanded on the issues that raised doubts.*

### Reply to DETAILED COMMENTS

#### 1. Description of Historical Sources

The information provided on the historical documentary materials is insufficient. The manuscript must include a complete and precise description of all primary sources, explicitly indicating whether they are printed or manuscript documents. Moreover, the exact archival locations (including repository names, call numbers, and shelf marks) must be stated. This level of detail is crucial both for reproducibility and to avoid duplication with previous research already conducted on the same materials. Without full transparency regarding the provenance and nature of the sources, it is difficult for readers to evaluate the robustness of the dataset.

#### *Response:*

*Thank you for this comment. As suggested, I have changed the paragraph at lines 87-95. Below is the corrected text.*

”The climatic conditions in SW Greenland were characterised using data from handwritten diaries containing records of meteorological measurements taken during the historical period. These materials were prepared by the Moravian missionaries, who were conducting missions at that time, including in Arctic areas. The aforementioned materials are kept in European archives: 1) Moravian Archives in Herrnhut (Germany), catalogue number MH R.15 J.a.13.9; 2) Det Kgl. Bibliotek in Copenhagen (Denmark), manuscript title *Astronomiske og meteorologisk Jagttagelser, anstillede i Godthaab i Grønland 1782–1792*. The records present two periods: 1) September 1767 – July 1768; 2) September 1784 – June 1792. This second period consisted of four shorter series: September 1784 – June 1785, October 1786 – June 1787, November – December 1788, January 1790 – June 1792 (hereinafter, all series are often referred to collectively as those of the “historical period”).”

## **2. Instrumentation and Installation Details**

**A clear understanding of the measurement setup is essential for interpreting the results presented in this study. Unfortunately, the manuscript provides insufficient information on the type of instruments used and the conditions under which the observations were taken. Details such as the model of the instruments, their exposure, installation height, and any known calibration procedures are necessary to assess data quality. For example, the 5.9 hPa offset reported between the historical and modern barometric measurements could plausibly arise from an unaccounted-for error in the historical barometer’s installation height. Similarly, the methodology used to derive the wind-force index is only briefly mentioned, yet it may be crucial for validating the resulting series and their comparability with modern observations. A substantial expansion of this section is needed.**

*Response:*

*Thank you for this comment. As suggested, I have expanded the necessary information by adding lines 98-105:*

“The meteorological observations conducted by the Moravian brothers in Nuuk in 1767/68 were based on meteorological instruments (a thermometer and a barometer) provided by Christian Gottlieb Kratzenstein (1723–95), Rector of the University of Copenhagen (Borm et al., 2021). Unfortunately, no information on the methods of these observations (e.g., location, exposition)

has been found. The measurements in 1782–92 used instruments provided by the Palatine Meteorological Society. The Society prepared instructions for conducting meteorological observations, which were also included in the publication *Societas Meteorologica Palatina: Ephemerides Societatis Meteorologicae Palatinae 1781 (1783)*.”

*Unfortunately, we do not have precise descriptions of the meteorological instruments that were used to conduct measurements at that time. The information was restricted to the device type, i.e. thermometer, barometer.*

*For atmospheric pressure measurements, corrections to altitude, latitude and air temperature were applied as described in lines 116-128.*

*Comments regarding wind speed are commented upon in the next point.*

### **3. Methodologies of Data Conversion**

**The procedures used to convert historical scales and units into modern equivalents are described only superficially. This topic warrants much more detail, including references to the relevant literature and established best practices. I strongly recommend that the authors incorporate additional citations to guide readers and to justify their methodological choices. Examples of particularly relevant sources include:**

**A more explicit and transparent description of conversion procedures, unit transformations, corrections, and assumptions is necessary to ensure scientific soundness and reproducibility.**

*Response:*

*Thank you for this comment. As suggested, I expanded upon the topic of unit conversion and transformation methods. Accordingly, I have revised the entire subsection 2.3. Methods:*

*„This work uses data on air temperature, atmospheric pressure, wind direction and wind force from Nuuk (Greenland) from 1767/68 and 1784–92. They were quality controlled and then converted to modern units.*

*As mentioned earlier, we did not have information on the calibration required for the thermometers. Therefore, we decided to simply convert the historical thermometer’s units to modern units. For the first stage of the historical period (1767/68), temperature was converted from °F to °C, whereas for the second period (1784–92) it was converted from °R to °C. For atmospheric pressure, measurements were taken using barometers with a scale in Paris inches and Paris lines. One Paris inch is 27.07 mm long and corresponds to 12 Paris lines of 2.256 mm*

(Lamb, 1986). The results were converted to mmHg and then to hPa. Corrections were applied to the resulting data, enabling comparison between historical and contemporary data. A normal gravity correction ( $P_{\phi\text{corr}}$ ) (i.e., pressure reduction consistent with gravity values observed at an altitude of 0 m above sea level and a latitude of  $\phi=45^\circ\text{N}$ ) was applied, and the pressure was converted to sea-level altitude (SLP) using the formulas provided in Cappelen (2009). For more details, see Przybylak et al. (2013).

Temperature and pressure records taken from a barometer equipped with a thermometer are also available for Nuuk for the period from November 1788 to June 1792. These measurements allowed the correction of atmospheric pressure to a temperature value of 0 °C. For this purpose, the Kämtz formula provided in Können et al. (2003) was applied. For more details, see Przybylak et al. (2013). The obtained correction values averaged for individual months (Table S1) were used to correct the remaining atmospheric pressure data at Nuuk.

Wind speed and direction measurements were used to analyse anemological conditions in Nuuk. Wind direction did not require conversion because it was recorded using wind rose directions. The greatest challenge in meteorological observations was measuring wind force, which was recorded using numerical scales. The sources do not provide information on which speed corresponds to a given scale value, but they do describe the conditions around the stations that should occur for each wind category. These historical categories were then compared with descriptions of conditions for each Beaufort scale category (García-Herrera et al., 2003). This allowed for the conversion of wind force from numerical scales of 1–6 and 0–4 to  $\text{m}\cdot\text{s}^{-1}$ . The obtained results provide information about wind speed at a height of 10 m above ground level. In the contemporary period, “calm” was defined as wind speeds below  $0.3 \text{ m}\cdot\text{s}^{-1}$ .

Based on available data, an analysis of atmospheric pressure values and anemological conditions was conducted for the historical period (1767/68; 1784–92) and the contemporary period (1991–2020). For atmospheric pressure, the course of daily and monthly mean and extreme values were examined. Furthermore, the monthly frequency and day-to-day variation of individual atmospheric pressure events were presented for each year and for the entire periods (historical and contemporary). Day-to-day changes in atmospheric pressure can be bothersome. Depending on the intensity of the changes, they can be felt as weak ( $\leq 4.0 \text{ hPa}$ ), moderate (4.1–8.0 hPa), strong (8.1–12.0 hPa) or very strong ( $> 12.0 \text{ hPa}$ ).

Wind speeds (as with atmospheric pressure) were examined in terms of daily and monthly averages and extreme values. Observed wind directions were compared against contemporary measurements, with the analyses covering individual months, entire seasons and multi-year periods. The article also presents how observed wind direction correlates with air temperature and with atmospheric pressure.”

This also involved adding two items to the literature between lines 562-563 and 577-578, respectively:

*"García-Herrera, R., Prieto, L., Gallego, D., Hernández, E., Gimeno, L., Können, G.P., Koek, F.B., Wheeler, D.A., Wilkinson, C., Prieto, M.R., Báez, C., and Woodruff, S.: CLIWOC multilingual meteorological dictionary, EU contract EVK2-CT-2000-00090, 2003."*

*"Lamb, H.H.: Ancient units used by the pioneers of meteorological measurements, Weather, 41, 230–233, 1986."*

#### **4. Style and Editing**

**In several parts, the manuscript reads more like a collection of notes than a cohesive scientific article. Explanations are often too brief, and many sentences (particularly in figure captions and other descriptive sections) are excessively short or even lack verbs. The text needs a thorough stylistic revision to ensure clarity, coherence, and consistency. The manuscript should be self-contained, well structured, and homogeneous in tone and format. At present, significant work is required to meet the editorial standards expected by "Climate of the Past".**

*Response:*

*Thank you for your general comment regarding the readability of the manuscript. We have had the article re-examined by a professional language editor and have made various changes to make the article more self-contained and explicit, to remove ambiguities and to improve the consistency in tone. However, the article was prepared following the recommended structure and conventions regarding the organisation of the sections, the presentation of results. Similarly, the narrative style and tone were consciously chosen to ensure conciseness and precision, though occasional lapses did indeed occur that have now been addressed.*

*The decision to caption figures using short sentences in places and non-sentential notation forms and extended noun phrases was a deliberate and conventional approach that describes the content clearly and without excessive repetition. We believe that the explanations provided are thus sufficient to understand the presented results.*

*If you have any further comments on specific phrases or sentences, we are open to introducing stylistic corrections to improve the clarity of the message.*

## **Recommendations**

**In summary, while the study has promising scientific value and fits well within the journal's scope, it requires major revisions before it can be considered for publication. Substantial improvements in the documentation of sources, description of instruments and metadata, methodological transparency, and overall writing quality are necessary. I therefore recommend major revisions.**

### *Response:*

*We appreciate the Reviewer's positive assessment of the potential scientific value of the study and for confirming that the subject of the work fits within the scope of Climate of the Past. We also appreciate the detailed highlighting of areas requiring clarification and improvement.*

*In response to the recommendation for thorough revisions, we have made significant changes to the manuscript. In particular, the documentation of data sources, the description of measurement instruments and related metadata have been expanded and clarified. The methodology has been described more transparently and in greater detail to enable assessment of the procedures used and improve the reproducibility of the analyses.*

*We hope that the above responses fully address the comments made and that the revised manuscript meets the editorial standards required for further consideration for publication in Climate of the Past.*

Thank you once again for all the remarks and comments

On behalf of the authors,

Konrad Chmist