Program and Abstracts

52nd International Arctic Workshop 2024

NSF INSTAAR University of Colorado Boulder EGCS Earth, Geographic, and Climate Sciences

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Cover photo:

Coastal Nunivak Island, City of Mekoryuk, overlooking the Bering Sea.

Photo: Julie Brigham-Grette, Sept. 2023.

PROGRAM AND ABSTRACTS

52nd ANNUAL INTERNATIONAL ARCTIC WORKSHOP

March 13th – 16th, 2024

DEPT. OF EARTH, GEOGRAPHIC, AND CLIMATE SCIENCES

WCRP CLIMATE AND CRYOSPHERE PROJECT

SCHOOL OF EARTH AND SUSTAINABILITY

CLIMATE SYSTEM RESEARCH CENTER

University of Massachusetts, Amherst

Organizing Committee:

Julie Brigham-Grette

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Catherine Britt

Raymond Bradley

Introduction

Overview and history

The 52nd Annual International Arctic Workshop will be in person 13-16 March, 2024 at the University of Massachusetts Amherst Campus Conference Center. The meeting is traditionally hosted by the Institute of Arctic and Alpine Research (INSTAAR). This workshop has grown out of a series of informal annual meetings started by John T. Andrews in 1970, and sponsored by INSTAAR and other academic institutions worldwide.

Theme

"The Legacy of Arctic Change: Looking Back but Thinking Forward" The polar regions are undergoing rapid change, perhaps a transformation that can only be informed from our understanding of the climate system based on studies of the past, contemporary observations, and modeling of the future.

Website

https://umass.irisregistration.com/Site/Arctic

Program

The workshop takes place on 2.5 succeeding days, mostly from 9am to 6pm Eastern Standard Time. Time slots are 15 min, allowing for 12 min talks and a few minutes of questions and transitions. Posters should be up all day March 14 and 15 in the Campus Center Auditorium. Each is numbered and grouped. Two-hour poster sessions will be held with odd numbers on Thursday and even numbers on Friday. Lunches are served in the same room as the posters.

NSF

The National Science Foundation's Division of Polar Programs has a long tradition of being a supporter of the Arctic Workshop. *Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.*

BIOCLIMATE CONDITIONS IN SW GREENLAND AND EASTERN COAST OF LABRADOR DURING THE INTERNATIONAL POLAR YEARS (1882/83, 1932/33, 1957/58, 2007/08 AND 2032/33)

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International Polar Years (IPY) are an organised series of international scientific and research expeditions that have aimed to collect information about the Earth's polar regions. The first such expedition took place in 1882/83 and the second in 1932/33. The International Geophysical Year took place in 1957/58, and the fourth Polar Year took place in 2007/08. This last was extended by several months due to the particular importance given to research to explain the variability and changes taking place in polar regions. The fifth International Polar Year is planned for 2032/33. One of the main goals of IPYs has been and will be to determine the current state of the environment of polar regions by assessing the spatial and temporal variability of its physical, biological and social elements. The research has demonstrated the key importance of polar regions in shaping weather and climate at lower latitudes.

The aim of this study is to present changes in bioclimatic conditions over the last 140 years using data collected during IPYs in south-west Greenland and the eastern coast of Labrador (Fig. 1). Results were compared with contemporary conditions from the period 1991–2020. The meteorological data used for the study were taken from the Godthaab station (now Nuuk) in Greenland (Fig. 2) and from the Nain station in Labrador for 1882/83, 1932/33, 2007/08 and 1957/58. In Labrador for the last listed year the data were taken from Hopedale due to a lack of data from Nain. The Nain and Hopedale stations are relatively close to each other and correlate closely in terms of climatic conditions. However, to investigate biometeorological conditions for the future IPY 2032/33, we employed two General Circulation Models (MRI-ESM2-0 and UKESM1-0-LL) under two climate change scenarios, SSP1-2.6 (highest mitigation scenario) and SSP5-8.5 (highest greenhouse gas emission scenario).

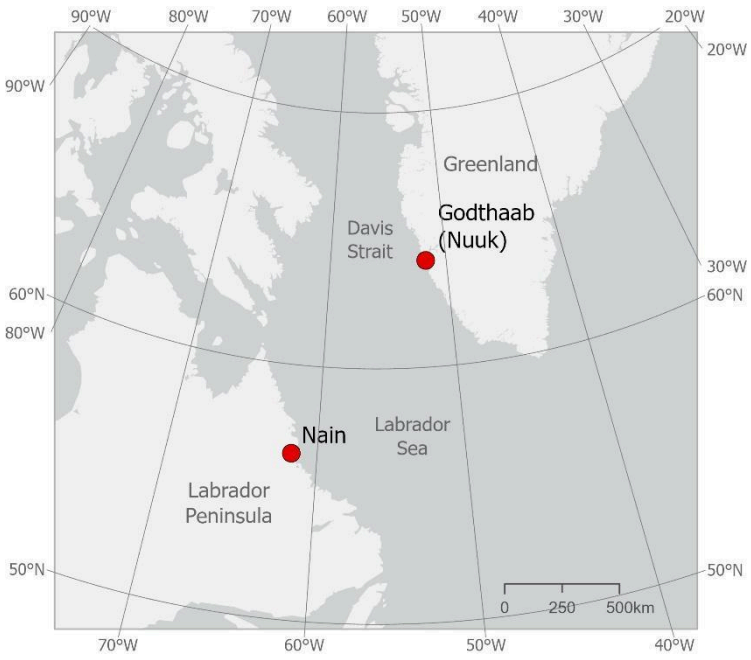

Fig. 1. Location of research area

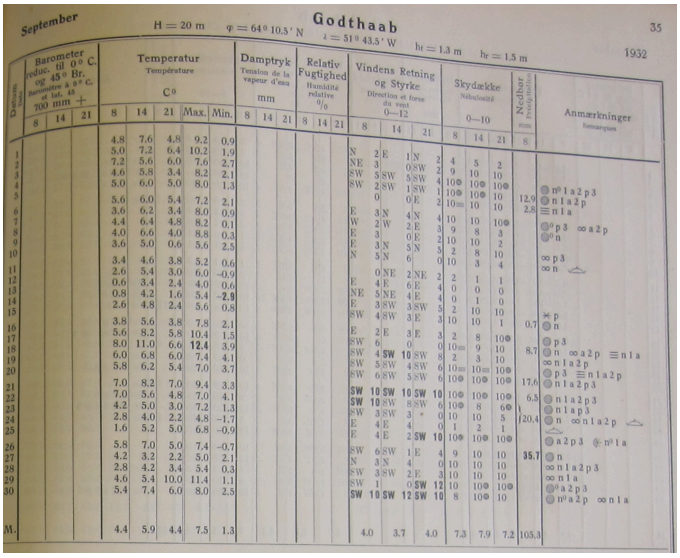

Fig. 2. Example of source data from the Danish *Meteorological Yearbooks* for Godthaab station

The study analysed two biometeorological indicators: Wind chill temperature (WCT) and predicted clothing insulation (Iclp). These indicators were calculated using the BioKlima 2.6 program (www.igipz.pan.pl/geoekoklimat/blaz/BioKlima.htm). The calculations employed data from measurements taken in the afternoon (mainly 1–2 pm LT). The wind chill temperature was used to examine apparent cold and to assess the risk of frostbite to the human body in SW Greenland and on the eastern coast of Labrador. A

weather hazard scale is used that is based on the WCT value. The following apparent cold ratings can be assigned to WCT values: slight (0÷-10 °C), moderate (-10.1÷-25 °C), significant (-25.1÷-45 °C), severe (-45.1÷-60 °C) and very severe (<-60 °C). The predicted clothing insulation index was developed for thermophysiological tests of outdoor working conditions. It was calculated assuming a metabolism of 135 Wm^{-2} for a person moving outdoors at 4 km h^{-1}. Then, the expected insulation value of clothing (in clo) was determined for given meteorological conditions. Iclp values are assigned the following assessment of thermal conditions: very warm (<0.30 clo), warm (0.31–0.80 clo), neutral (0.81–1.20 clo), cool (1.21–2 .00 clo), cold (2.01–3.00 clo), very cold (3.01–4.00 clo), Arctic (>4.00 clo).

In the modern period (1991–2020), the average annual value of predicted insulation of clothing was 1.9 clo in both Nuuk and Nain. In Nuuk, during the 1932/33, 1957/58 and 2007/2008 IPYs, ~0.1÷0,2 clo less was needed to maintain the comfort of a warm person than today, whereas 0.1 clo more was needed during the IPY of 1882/83. Conditions were similar to these at the Nain station during the four IPYs. In the Nuuk and Nain stations, it is recommended that people in motion (~4 km/h) use clothing with thermal insulation of ~1.0–1.5 clo in summer up to over 3.0 clo in the winter months. However, in the planned IPY in 2032/33, the expected insulation of clothing will be similar to today.

At the turn of the 21st century, wind chill temperatures were comparable in Nuuk and Nain (-2.0 and -2.1 °C, respectively). In the modern period and in the four IPYs (1882/83, 1932/33, 1957/58, 2007/08), there has generally been no risk of frostbite in the study area from May to September. However, the most unfavourable conditions for humans occur, of course, in winter. Then, there is a risk of hypothermia for anyone outside for long periods without adequate protection. For a few days a year at both stations, a high and significant risk of frostbite has been recorded. On such days, it is possible for a person to suffer frostbite on uncovered face and hands after 5–30 minutes. The results of global climate models indicate that, in the planned 2032/33 IPY, WCT values will be similar to or slightly lower (less favourable) than those recorded today. This will probably be the result of higher wind speeds, despite the ongoing warming in the analysed area.

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