Foreword

The Boreal Institute for Northern Studies is pleased to provide the *Climate of Arctic Canada in Maps*, for we are confident that it will be of meaningful assistance to the many researchers and others of Canada's North. The Institute believes the publication to be a significant contribution to the scientific community and to the people of the North, providing valuable information not previously available.

The Institute is grateful to Roy J. Fletcher, who made the information available for publication. Dr. Fletcher is eminently well qualified to provide the meteorological and climatological data. He was the first graduate from the University of Alberta in the Department of Geography, obtaining a Bachelor of Arts Degree. He obtained his graduate degree from the University of Minnesota and later his PhD from Clark University in Massachusetts. During this period, Roy Fletcher maintained as his primary area of interest Canada's vast northland from the Alaskan border to the eastern tip of Newfoundland and the Arctic Islands to the North. Dr. Fletcher is a native Albertan, born in Red Deer, and is now an associate professor at The University of Lethbridge, Alberta. He teaches in the specialties of Climatology and Canadian Northlands.

The Institute acknowledges with gratitude the valuable contribution to the publication by G. Stanley Young, who worked closely with Dr. Fletcher, providing advice and the cartographic drafting to produce the finished maps. Mr. Young has been with the Geography Department of the University of Lethbridge as a cartographer since 1970. He attended university at Calgary and Eugene, Oregon. His most recent published works are the numerous illustrations within the book, *The Landscapes of Southern Alberta* (December 1975).

The Boreal Institute for Northern Studies, The University of Alberta, is pleased to be associated with this publication.

R.S. Jamieson
Acting Director of the
Boreal Institute for Northern Studies

Introduction

On the following pages we have attempted to present a series of maps exhibiting numerous facets of the climate of the Canadian Arctic. The region is defined here to be that area of ET climate type according to the Köppen classification, tundra natural vegetation, and continuous permanently frozen ground. Except for the extreme southern fringes of the region (the southern Hudson Bay and Labrador tundra coastal zones), all three aspects of "arctic" environment are present simultaneously.

Although we have not attempted to produce a fully comprehensive climate atlas, several aspects are treated in detail. Thus, there are maps dealing with "transportation climate" as well as precipitation and temperature.

The data source for the great majority of the maps was the *Monthly Record* published monthly (about one year following observations) by the Atmospheric Environment Service, Department of Environment, Downsview, Ontario (prior to 1972: Meteorological Branch, Department of Transport, Toronto). Several of the maps near the end of the collection were produced using data from the *General Summaries of Hourly Weather Observations in Canada* published annually for 1952 to 1961 inclusively. All maps without a footnote reference to source utilized data from the *Monthly Record*.

Before the end of the Second World War there were relatively few weather stations in the Canadian Arctic. The rather rapid improvement in the region's spatial pattern of stations began in the late 1940s and their numbers increased substantially with the completion of the Distant Early Warning radar line in the mid-1950s (see map titled "Length and Period of Station Meteorological Data"). It is believed that there are now a sufficient number of years of meteorological data for enough stations to produce valid statistical mean values of most climatological parameters. Certainly, a longer record of observations would be desirable for more accurate mean precipitation values and there are several rather large areas of the arctic that have never had a weather station.

There is great temporal variability in precipitation within most of the Canadian Arctic largely as a result of the small amounts that fall. There is also great spatial variation in this phenomenon, especially in the mountainous areas of the east. Nearby weather stations on opposite sides of narrow water bodies or at different elevations on the windward side may have very different amounts of rain and snow. Great place-to-place variation in wind speed and in visibility is also found in these areas. For example, the old Resolution Island weather station on the south end of the island experienced much weaker winds and many fewer days of poor visibility than its present location only 20 miles north but 1,081 feet higher. Anywhere, even in areas of low topographic relief, local variations in wind direction in relation to
nearby open water or ice-covered ocean may help create considerable place-to-place variation in precipitation amount. On the other hand some aspects of precipitation, such as seasonal distribution, exhibit much less spatial variation.

The maps on the following pages recognize the problems mentioned above and therefore utilize point quantity symbols at stations to illustrate a particular aspect of precipitation climate. The proportional circles and other cartographic “point” symbols portray accurately the value of the particular climatic parameter displayed for that station at instrument height but not for other locations or heights. For example, the maps of temperature and number of frost-free days (days without below-freezing temperatures are correct for a shaded location about five feet above ground level. Temperatures close to the ground such as within a grass or moss cover could be quite different from those within the meteorological station’s Stevenson Screen. When studying many of the maps it is important to recognize that the data do provide valid climatic information for the individual stations but not for other, even nearby, settlements or uninhabited areas.

Isolines such as isobars (pressure), isoyets (precipitation), and isotherms (temperature) have been placed on many maps to show approximate spatial quantity and trend. However, their locations are often of doubtful accuracy especially in the case of most maps of precipitation phenomena, and therefore they are shown as dashed lines. Thus the dashed isolines represent only an estimated best-fit location and should be considered as “visual” guides only.

The importance of transportation in the economic and other types of “development” in the Arctic is well recognized. Therefore we have included numerous maps showing meteorological parameters of concern to safe and efficient aircraft and ship operation. In this respect the significance to transportation of a factor such as visibility is evident but even wind direction influences land and water runway orientation, harbour and off shore sea ice conditions, as well as amounts and types of precipitation and fog (therefore visibility).

Acknowledgments

We wish to gratefully acknowledge the assistance provided by Scott Polar Research Institute of Cambridge, England, and The University of Lethbridge’s Research Committee, Geography Department, and Mr. Boon of Production Services.
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Meteorological Stations in Northern Canada
with data published in the Monthly Record

Meteorological Stations:

- Operating in 1973
  - major (usually synoptic, some are rawinsonde)
  - minor

- Not operating in 1973, some abandoned many years ago
  - major
  - minor

- Research stations (referred for several years, not published in Monthly Record)

Length and Period of Station Meteorological Data
1948 to 1972

- 25 years (1948-1972)
- 15-24 years, earlier in period
- 15-24 years, later in period
- 9-14 years, earlier in period
- 9-14 years, later in period
Frost-Free Days*
Mean Annual
1948 to 1972

*Isolated extreme values are numbered.

Mean Annual Precipitation*
1948 to 1972

*In inches

Locations of isohyets (lines of equal precipitation) were determined from weather station data and are accurate for them but may be incorrect for intervening areas. In mountainous areas of little precipitation such as the eastern portion of Arctic Canada, the place-to-place variability of precipitation is often great.
Mean Annual Snowfall*
1948 to 1972

*Locations of isohyets (lines of equal precipitation) were determined from weather station data and are accurate for them but may be incorrect for intervening areas. In mountainous areas of little precipitation such as the eastern portion of Arctic Canada, the place-to-place variability of precipitation is often great.

Mean Annual Number of Days with Measurable Precipitation*
1948 to 1972

*At least .01 inch.

Inches
- 25 or less
- 26 - 50
- 51 - 75
- 76 - 100
- Greater than 100, values shown

Mean Annual Snowfall
1948 to 1972

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- 76 - 100
- Greater than 100, values shown

Mean Annual Snowfall
1948 to 1972

*Locations of isohyets (lines of equal precipitation) were determined from weather station data and are accurate for them but may be incorrect for intervening areas. In mountainous areas of little precipitation such as the eastern portion of Arctic Canada, the place-to-place variability of precipitation is often great.

Mean Annual Number of Days with Measurable Precipitation*
1948 to 1972

*At least .01 inch.
Mean Snowfall
December, January, February
1948 to 1972

Locations of isohyets (lines of equal precipitation) were determined from
weather station data and are accurate for them but may be incorrect for
intervening areas. In mountainous areas of little precipitation such as the eastern
portion of Arctic Canada the place-to-place variability of precipitation
is often great.

Inches
- 1 = 2.5
- 5.1 = 10.0
- 10.1 = 15.0
- 15.1 = 25.0
- Greater than 25. values shown

Mean Snowfall
March, April, May
1948 to 1972

Locations of isohyets (lines of equal precipitation) were determined from
weather station data and are accurate for them but may be incorrect for
intervening areas. In mountainous areas of little precipitation such as the eastern
portion of Arctic Canada the place-to-place variability of precipitation
is often great.

Inches
- 1 = 2.5
- 5.1 = 10.0
- 10.1 = 15.0
- 15.1 = 25.0
- Greater than 25. values shown
Mean Snowfall*
June, July, August
1948 to 1972

Locations of isohyets (lines of equal precipitation) were determined from weather station data and are accurate for them but may be incorrect for intervening areas. In mountainous areas of little precipitation such as the eastern portion of Arctic Canada the place-to-place variability of precipitation is often great.

*Also see map of autumn precipitation.

Mean Snowfall*
September, October, November
1948 to 1972

Locations of isohyets (lines of equal precipitation) were determined from weather station data and are accurate for them but may be incorrect for intervening areas. In mountainous areas of little precipitation such as the eastern portion of Arctic Canada the place-to-place variability of precipitation is often great.

* Also see map of autumn precipitation.
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Mean Precipitation*
June, July, August
1948 to 1972

*In inches, mostly of rain.

Mean Precipitation*
September, October, November
1948 to 1972

*In inches of rain and snow.

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WETTEST MONTH

Absolute Maximum Monthly Precipitation*
1948 to 1972

*In inches

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Absolute Maximum Monthly Snowfall*
1948 to 1972

*In inches

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PRECIPITATION DAYS
Mean Number of Days with Measurable Precipitation
1948 to 1972

January

Locations of isohyets (lines of equal precipitation) were determined from weather station data and are accurate for them but may be incorrect for intervening areas. In mountainous areas of little precipitation such as the eastern portion of Arctic Canada the plate-to-plate variability of precipitation is often great.

○ Greater than 13, values shown

April

Locations of isohyets (lines of equal precipitation) were determined from weather station data and are accurate for them but may be incorrect for intervening areas. In mountainous areas of little precipitation such as the eastern portion of Arctic Canada the plate-to-plate variability of precipitation is often great.

○ Greater than 13, values shown
PRECIPITATION DAYS
Mean Number of Days with Measurable Precipitation*
1948 to 1972

July

Locations of isohyets (lines of equal precipitation) were determined from weather station data and are accurate for them but may be incorrect for intervening areas. In mountainous areas of little precipitation such as the eastern portion of Arctic Canada, the place-to-place variability of precipitation is often great.

*At least .01 inch.

Greater than 13, values shown

PRECEITATION DAYS
Mean Number of Days with Measurable Precipitation*
1948 to 1972

October

Locations of isohyets (lines of equal precipitation) were determined from weather station data and are accurate for them but may be incorrect for intervening areas. In mountainous areas of little precipitation such as the eastern portion of Arctic Canada, the place-to-place variability of precipitation is often great.

*At least .01 inch.

Greater than 13, values shown
DRIEST MONTHS
Months Without Measurable Precipitation*
Percentage of all December, January and February Months
1948 to 1972
*Less than .01 inch.

DRIEST MONTHS
Maximum Number of Consecutive Months
without Measurable Precipitation*
1948 to 1972
*There may have been more than one occurrence of these "strings" of dry months.
WETTEST DAYS
Mean of Maximum Precipitation* in 24 Hours
1948 to 1972

January

Locations of isohyets (lines of equal precipitation) were determined from weather station data and are accurate for most areas. However, they may be inaccurate for some intervening areas. In mountainous areas of little precipitation such as the eastern portion of Arctic Canada, the place-to-place variability of precipitation is often great.

*In inches

70 inches and greater, values shown

WETTEST DAYS
Mean of Maximum Precipitation* in 24 Hours
1948 to 1972

April

Locations of isohyets (lines of equal precipitation) were determined from weather station data and are accurate for most areas. However, they may be inaccurate for some intervening areas. In mountainous areas of little precipitation such as the eastern portion of Arctic Canada, the place-to-place variability of precipitation is often great.

*In inches

70 inches and greater, values shown
WETTEST DAYS

Mean of Maximum Precipitation* in 24 Hours
1948 to 1972

July

Locations of isohyets (lines of equal precipitation) were determined from weather station data and are accurate for them but may be incorrect for intervening areas. In mountainous areas of little precipitation such as the eastern portion of Arctic Canada, the place-to-place variability of precipitation is often great.

October

Locations of isohyets (lines of equal precipitation) were determined from weather station data and are accurate for them but may be incorrect for intervening areas. In mountainous areas of little precipitation such as the eastern portion of Arctic Canada, the place-to-place variability of precipitation is often great.

70 inches and greater, values shown
STRONG WINDS
Absolute Maximum Reported Hourly Wind Speed*
1948 to 1972

*One minute average wind speed usually observed at one-hour intervals.

Miles per hour
- 45 - 54
- 55 - 64
- 65 - 74
- 75 - 89
- 90 and Greater, values shown

STRONG WINDS*
Mean Annual Percentage of Observations
1948 to 1972

*39 miles per hour and faster.

Less than 1%
1 - 5%
4 - 10%
11 - 20%
Greater than 21%, values shown
STRONG WINDS*
Mean Percentage of Observations
1948 to 1972

July

*39 miles per hour and faster.

Greater than 21% values shown

STRONG WINDS*
Mean Percentage of Observations
1948 to 1972

October

*39 miles per hour and faster.

Greater than 21% values shown
**STRONG WINDS**

Mean of Maximum Reported Hourly Wind Speed*
1948 to 1972

January

*One minute average wind speed usually observed at one-hour intervals.

Miles per hour:
- 20 - 24.9
- 25 - 29.9
- 30 - 34.9
- 35 - 39.9
- 40 and Greater, values shown

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**STRONG WINDS**

Mean of Maximum Reported Hourly Wind Speed*
1948 to 1972

April

*One minute average wind speed usually observed at one-hour intervals.

Miles per hour:
- 20 - 24.9
- 25 - 29.9
- 30 - 34.9
- 35 - 39.9
- 40 and Greater, values shown
ICE FOG
Percentage of Hours with Ice Fog with ½ Mile or Less Visibility
Mean Values: December, January, February 1952 - 1961

BLOWING SNOW
Mean Yearly Percentage of Hours with Blowing Snow 1952 - 1961
Mean Yearly Values: 
Mean Winter Values:
WIND
Dominant Wind Direction During Periods of Lowest Visibility and Ceiling (less than ½ Mile, 300 Feet)
Summer and Winter
1952 - 1961

- - June, July, August
- December, January, February
\(\bigcirc\) Calm

No Arrow: no direction is sufficiently dominant during the respective season.