### ANNUAL DATASETS

Greenness

Neighborhood

Air Quality

Weather

**♀** Climate Metrics

**| ♥** Water Balance Metrics

| **Q** Local Climate Zone

| **♀** Land

**Temperature** 

Surface

# **MONTHLY DATASETS**

Air Quality

### **CLIMATE METRICS (WTHNRC\_A\_YY)**



#### DATASET DESCRIPTION

Each annual file contains 35 metrics calculated by CANUE staff using base data provided by the Canadian Forest Service of Natural Resources Canada. The base data consist of interpolated daily maximum temperature, minimum temperature and total precipitation for all unique DMTI Spatial Inc. postal code locations in use at any time between 1983 and 2015. These were generated using thin-plate smoothing splines, as implemented in the ANUSPLIN climate modeling software. The earliest applications of thin-plate smoothing splines were described by Wahba and Wendelberger (1980) and Hutchinson and Bischof (1983), but the methodology has been further developed into an operational climate mapping tool at the ANU over the last 20 years. ANUSPLIN has become one of the leading technologies in the development of climate models and maps, and has been applied in North America and many regions around the world. ANUSPLIN is essentially a multidimensional "nonparametric" surface fitting method that has been found particularly well suited to the interpolation of various climate parameters, including daily maximum and minimum temperature, precipitation, and solar radiation. Equations for calculating the included metrics, based on daily minimum and maximum temperature, and total precipitation were developed by Pei-Ling Wang and Dr. Johannes Feddema at the University of Victoria, Geography Department, and implemented by CANUE staff Mahdi Shooshtari.

Keywords: annual climate parameters - precipitation - rain - snow - temperature - heat - interpolated surface

Place Keywords: Canada - national

#### **GEOSPATIAL REFERENCE**

65.14N,-141.02W



(https://www.mapbox.com/)
© Mapbox (https://www.mapbox.com/about/maps/) © OpenStreetMap (https://www.openstreetmap.org/about/)

41.68N, -52.62W

Coordinate System: GCS\_WGS84 - Geometry Type: POINT Units: Geometry Data Source: DMTI Spatial

EPSG: 4326 Decimal Degree Inc. (postal codes)

### **QUALITY ASSESSMENT**

#### **QA/QC Procedures:**

CANUE did not assess the quality of the base data. Users should review the supporting documentation and any recommended citations.

### **Geographic Coordinate Positional Accuracy:**

These metrics are linked to the corresponding annual postal codes files for mapping and analysis purposes. Refer to the postal code metadata file in Supporting Documentation for more information.

**Vertical Positional Accuracy:** N/A

**Attribute Accuracy:** N/A

Data Validity: NoData = -9999 (for numeric fields) - NoData=null (for category fields) - Data insufficient to calculate value = -1111

**Associated Files:** N/A

#### **Data Comment:**

Elevations were assigned to postal code locations by NRCAN CFS staff. Where coastal locations were not assigned an elevation, a default of 10 m above sea level was assigned.

### **DATA SOURCE**

#### **Data Sources:**

Daily Interpolated precipitation and temperature, DMTI Spatial Inc. postal codes. See supporting documentation.

**Spatial Resolution:** Postal code locations

**Data Preparation Date:** 2017-10-01

**Beginning Date: 1983** 

**End Date:** 2015

Sampling Frequency of Data: Annual

#### Years Available:

1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

#### **MAINTENANCE**

**Description:** N/A

**File Type:** Comma separated values(.csv)

File Size: Between 170 MB to 260 MB

**Number of Data Files: 33** 

#### DATA USE CONDITIONS

#### The Data User is REQUIRED:

(i) to acknowledge data sources listed under Acknowledgement(s)

(ii) cite the publication(s) listed under Recommended Citation(s) as the providers and source of these data when using them in support of research, analysis, operations, policy decision or any other undertaking including publication

(iii) complete and sign the CANUE Data Use and Sharing Agreement (available at http://canue.ca/data/), in which the name and signature of the researcher/analyst who takes responsibility for ensuring all conditions are met.

### **Data Sharing Restrictions:**

These data files are provided solely for the purposes stated in the CANUE Data Sharing and Use Agreement and should not be re-distributed for any reason. These data also contain proprietary postal code data and may only be used for the project named in the CANUE Data Sharing and Use Agreement. Data can be shared only within a project team for the exclusive purposes of teaching, academic research and publishing, and/or planning of educational services in accordance to DMTI End User Agreement associated with the Spatial Mapping Academic Research Tools (SMART) Program.

#### Include the following references in any publications resulting from the use of these data:

[1] Customized spatial climate data files prepared for the CanadianUrban Environmental Health Research Consortium by the Canadian Forest Service of Natural Resources Canada, October 2017.

[2] CanMap Postal Code Suite v2015.3. [computer file] Markham: DMTI Spatial Inc., 2015.

#### Include the following acknowledgements:

1. Weather-related indicators were developed bu Dr. Johannes Feddema, Pei-Ling Wang, and Mahdi Shooshtari for CANUE, based on custom data from Natural Resources Canada. These indicators were indexed to DMTI Spatial Inc. postal codes and provided by CANUE (Canadian Urban Environmental Health Research Consortium).

#### SUPPORT DOCUMENTATION

NRCAN customized data document	http://canue.ca/wp- content/uploads/2017/10/NRCAN-BAMS- Customized-climate-data.pdf
Wahba, G., 1990: Spline Models for Observational Data.	
-	
Hutchinson, M. F., 1991: The application of thin plate	
smoothing splines to continent-wide data similation.	
Data assimilation systems: Papers presented at the Second	
BMRC Modelling Workshop, J. D. Jasper, Ed., Bureau of	
Meteorology Research Centre Research Rep. 27, 104–113.	
Documentation in preparation from PLWang/Mshooshtari.	
Contact info@canue.ca for more information.	
Postal Code metadata	https://canue.ca/wp-
	content/uploads/2019/09/CANUE-Browser-
	Metadata-PostalCodes.pdf
	Wahba, G., 1990: Spline Models for Observational Data. CBMS-NSF Regional Conference Series in Applied Mathematics, Vol. 59, Society for Industrial and Applied Mathematics, 169 pp. Hutchinson, M. F., 1991: The application of thin plate smoothing splines to continent-wide data similation. Data assimilation systems: Papers presented at the Second BMRC Modelling Workshop, J. D. Jasper, Ed., Bureau of Meteorology Research Centre Research Rep. 27, 104–113. Documentation in preparation from PLWang/Mshooshtari. Contact info@canue.ca for more information.

### **VARIABLES**

<b>♥</b> WTHNRCYY_01 - Annual Highest Temperature	<b>♥</b> WTHNRCYY_02 - Annual Lowest Temperature
(celsius)	(celsius)
Annual highest temperature (celsius)	Annual lowest temperature (celsius)
Map Browser (map.php?	Map Browser (map.php?
cat=4&grp=25&vrb=195&yyy=1983)	cat=4&grp=25&vrb=196&yyy=1983)
<b>♥</b> WTHNRCYY_03 - Annual Average Temperature	<b>♥</b> WTHNRCYY_04 - Annual Average of Daily Maximum
(celsius)	Temperature (celsius)

Annual average temperature (celsius)

**❷ Map Browser** (map.php?

cat=4&grp=25&vrb=197&yyy=1983)

### **♥** WTHNRCYY\_05 - Annual Average of Daily Minimum Temperature (celsius)

Annual average of daily minimum temperature (celsius)

**ᢙ Map Browser** (map.php?

cat=4&grp=25&vrb=199&yyy=1983)

### **♥** WTHNRCYY\_07 - Annual Total Precipitation as Rain (mm)

Annual total precipitation as rain (precipitation on all days with minimum temperature > = 0) (millimeters)

**ᢙ Map Browser** (map.php?

cat=4&grp=25&vrb=201&yyy=1983)

#### **♥** WTHNRCYY\_9 - Annual Number of Days with Rain

Annual number of days with rain (precipitation on all days with minimum temperature > = 0)

**ᢙ Map Browser** (map.php?

cat=4&grp=25&vrb=203&yyy=1983)

### **♥** WTHNRCYY\_11 - Annual Average Length of Rain Events (days)

Annual average length of rain events (days)

**ᢙ Map Browser** (map.php?

cat=4&grp=25&vrb=205&yyy=1983)

### **♥** WTHNRCYY\_13 - Annual Number of Snow Events

Annual number of snow events (consecutive days with snow, including single day events)

**♦ Map Browser** (map.php?

cat=4&grp=25&vrb=207&yyy=1983)

## **♥** WTHNRCYY\_15 - Annual Average Amount of Snow per Event (mm)

Annual average amount of snow per event (millimeters)

**ᢙ Map Browser** (map.php?

cat=4&grp=25&vrb=209&yyy=1983)

Annual average of daily maximum temperature (celsius)

**❷ Map Browser** (map.php?

cat=4&grp=25&vrb=198&yyy=1983)

### **♥** WTHNRCYY\_06 - Annual Average of Difference Between Maximum and Minimum Temperatures (celsius)

Annual average of difference between maximum and minimum temperatures (celsius)

**❷ Map Browser** (map.php?

cat=4&grp=25&vrb=200&yyy=1983)

### **♥** WTHNRCYY\_08 - Annual Number of Rain Events

Annual number of rain events (consecutive days with rain, including single day events)

**ᢙ Map Browser** (map.php?

cat=4&grp=25&vrb=202&yyy=1983)

### **♥** WTHNRCYY\_10 - Annual Average Amount of Rain per Event (mm)

Annual average amount of rain per event (millimeters)

**ᢙ Map Browser** (map.php?

cat=4&grp=25&vrb=204&yyy=1983)

# **♥** WTHNRCYY\_12 - Annual Total Precipitation as Snow (mm)

Annual total precipitation as snow (precipitation on all days with minimum temperature < 0) (millimeters)

**❷ Map Browser** (map.php?

cat=4&grp=25&vrb=206&yyy=1983)

### **♥** WTHNRCYY\_14 - Annual Number of Days with Snow

Annual number of days with snow (precipitation on all days with minimum temperature < 0)

**❷ Map Browser** (map.php?

cat=4&grp=25&vrb=208&yyy=1983)

### **♥** WTHNRCYY\_16 - Annual Average Length of Snow Events (days)

## **♥** WTHNRCYY\_17 - Annual Number of Heat Event Starts Based on Maximum Temperature

Annual number of heat event starts based on maximum temperature (where there are three or more consecutive days with maximum daily temperature > 95th percentile of daily normal maximum temperatures; normal distribution based on daily maximum temperatures 1985-2015)

**♦ Map Browser** (map.php? cat=4&grp=25&vrb=211&yyy=1983)

### **♥** WTHNRCYY\_19 - Annual Average Length of Heat Events Based on Maximum Temperature

Annual average length of heat events based on maximum temperature (where there are three or more consecutive days with maximum daily temperature > 95th percentile of daily normal maximum temperatures; normal distribution based on daily maximum temperatures 1985-2015)

### **♥** WTHNRCYY\_21 - Annual Number of Days in Cool Events Based on Maximum Temperature

Annual number of days in cool events based on maximum temperature (where there are three or more consecutive days with maximum daily temperature <5th percentile of daily normal maximum temperatures; normal distribution based on daily maximum temperatures 1985-2015)

**♦ Map Browser** (map.php? cat=4&grp=25&vrb=215&yyy=1983)

# **♥** WTHNRCYY\_23 - Annual Number of Heat Event Starts Based on Minimum Temperature

Annual number of heat event starts based on minimum temperature (where there are three or more

Annual average length of snow events (days)

# **♥** WTHNRCYY\_18 - Annual Number of Days in Heat Events Based on Maximum Temperature

Annual number of days in heat events based on maximum temperature (where there are three or more consecutive days with maximum daily temperature > 95th percentile of daily normal maximum temperatures; normal distribution based on daily maximum temperatures 1985-2015)

## **♥** WTHNRCYY\_20 - Annual Number of Cool Event Starts Based on Maximum Temperature

Annual number of cool event starts based on maximum temperature (where there are three or more consecutive days with maximum daily temperature <5th percentile of daily normal maximum temperatures; normal distribution based on daily maximum temperatures 1985-2015)

# **♥** WTHNRCYY\_22 - Annual Average Length of Cool Events Based on Maximum Temperature

Annual average length of cool events based on maximum temperature (where there are three or more consecutive days with maximum daily temperature <5th percentile of daily normal maximum temperatures; normal distribution based on daily maximum temperatures 1985-2015)

**Variable** WTHNRCYY\_24 - Annual Number of Days in Heat

consecutive days with minimum daily temperature > 95th percentile of daily normal minimum temperatures; normal distribution based on daily minimum temperatures 1985-2015)

### **♥** WTHNRCYY\_25 - Annual Average Length of Heat Events Based on Minimum Temperature

Annual average length of heat events based on minimum temperature (where there are three or more consecutive days with minimum daily temperature > 95th percentile of daily normal minimum temperatures; normal distribution based on daily minimum temperatures 1985-2015)

**♦ Map Browser** (map.php? cat=4&grp=25&vrb=219&yyy=1983)

## **♥** WTHNRCYY\_27 - Annual Number of Days in Cool Events Based on Minimum Temperature

Annual number of days in cool events based on minimum temperature (where there are three or more consecutive days with minimum daily temperature <5th percentile of daily normal minimum temperatures; normal distribution based on daily minimum temperatures 1985-2015)

**♦ Map Browser** (map.php? cat=4&grp=25&vrb=221&yyy=1983)

# **♥** WTHNRCYY\_29 - Annual Number of Heat Event Starts Based on Average Temperature

Annual number of heat event starts based on average temperature (where there are three or more consecutive days with average daily temperature > 95th percentile of daily normal average temperatures; normal distribution based on daily average temperatures 1985-2015)

#### **Events Based on Minimum Temperature**

Annual number of days in heat events based on minimum temperature (where there are three or more consecutive days with minimum daily temperature > 95th percentile of daily normal minimum temperatures; normal distribution based on daily minimum temperatures 1985-2015)

## **♥** WTHNRCYY\_26 - Annual Number of Cool Event Starts Based on Minimum Temperature

Annual number of cool event starts based on minimum temperature (where there are three or more consecutive days with minimum daily temperature <5th percentile of daily normal minimum temperatures; normal distribution based on daily minimum temperatures 1985-2015)

**⊘** Map Browser (map.php? cat=4&grp=25&vrb=220&yyy=1983)

## **♥** WTHNRCYY\_28 - Annual Average Length of Cool Events Based on Minimum Temperature

Annual average length of cool events based on minimum temperature (where there are three or more consecutive days with minimum daily temperature <5th percentile of daily normal minimum temperatures; normal distribution based on daily minimum temperatures 1985-2015)

**♦ Map Browser** (map.php? cat=4&grp=25&vrb=222&yyy=1983)

## **♥** WTHNRCYY\_30 - Annual Number of Days in Heat Events Based on Average Temperature

Annual number of days in heat events based on average temperature (where there are three or more consecutive days with average daily temperature > 95th

**⊘** Map Browser (map.php? cat=4&grp=25&vrb=223&yyy=1983)

## **♥** WTHNRCYY\_31 - Annual Average Length of Heat Events Based on Average Temperature

Annual average length of heat events based on average temperature (where there are three or more consecutive days with average daily temperature > 95th percentile of daily normal average temperatures; normal distribution based on daily average temperatures 1985-2015)

**♦ Map Browser** (map.php? cat=4&grp=25&vrb=225&yyy=1983)

## **♥** WTHNRCYY\_33 - Annual Number of Days in Cool Events Based on Average Temperature

Annual number of days in cool events based on average temperature (where there are three or more consecutive days with average daily temperature <5th percentile of daily normal average temperatures; normal distribution based on daily average temperatures 1985-2015)

**♦ Map Browser** (map.php? cat=4&grp=25&vrb=227&yyy=1983)

**♥ WTHNRCYY\_35 - Annual Number of Frost Free Days** Annual number of frost free days (min temp > 0) (days)

 percentile of daily normal average temperatures; normal distribution based on daily average temperatures 1985-2015)

# **♥** WTHNRCYY\_32 - Annual Number of Cool Event Starts Based on Average Temperature

Annual number of cool event starts based on average temperature (where there are three or more consecutive days with average daily temperature <5th percentile of daily normal average temperatures; normal distribution based on daily average temperatures 1985-2015)

## **♥** WTHNRCYY\_34 - Annual Average Length of Cool Events Based on Average Temperature

Annual average length of cool events based on average temperature (where there are three or more consecutive days with average daily temperature <5th percentile of daily normal average temperatures; normal distribution based on daily average temperatures 1985-2015)

#### SUPPORT CONTACT

Data Set Support Contact: info@canue.ca (mailto:info@canue.ca)

#### **Affiliated Organization:**

CANUE (Canadian Urban Environmental Health Research Consortium)
Dalla Lana School of Public Health, University of Toronto

**WebSite:** https://www.canue.ca (1. Weather-related indicators were developed bu Dr. Johannes Feddema, Pei-Ling Wang, and Mahdi Shooshtari for CANUE, based on custom data from Natural Resources Canada. These indicators were indexed to DMTI Spatial Inc. postal codes and provided by CANUE (Canadian Urban Environmental Health Research Consortium).)

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