

# **Climate Observations and Data Analysis**

**Dr. Adam Fenech**  
**University of Prince Edward Island**

**April 16, 2012**



# Climate Observations and Data Analysis



1. Acquiring Climate Observational Data
2. Quality Controlling Climate Data
3. Analyzing Climate Data

# Glossary

- Tmax = maximum temperature
  - Tmin = minimum temperature
  - Tmean = mean temperature
  - Ptotal = Total Precipitation
- 
- DJF = Winter
  - MAM = Spring
  - JJA = Summer
  - SON = Autumn

# 1. Acquiring Climate Observational Data

1. Canada's National Climate Data and Information (NCDI) Archive
2. US National Climatic Data Center (NCDC)
3. NCEP Reanalysis
4. homogenized data sets
5. selecting a climate station
6. downloading data

# Acquiring Climate Observational Data

- Connections
- \$

# 1. Canada's National Climate Data and Information (NCDI) Archive

[www.climate.weatheroffice.ec.gc.ca/climateData/canada\\_e.html](http://www.climate.weatheroffice.ec.gc.ca/climateData/canada_e.html)

The screenshot shows the homepage of the National Climate Data and Information Archive. At the top, there are logos for Environment Canada and the Government of Canada. The main header features a red maple leaf and the text "National Climate Data and Information Archive" with the URL "www.climate.weatheroffice.ec.gc.ca". Below the header is a navigation bar with links for "Français", "Home", "Contact Us", "Help", "Search", and "canada.gc.ca". A sidebar on the left lists various services and resources. The main content area includes a search form with a "Province" dropdown set to "ALBERTA", a "Go" button, and a "Customized Search" button. To the right of the search form are "Search options" for "Month" (Feb), "Day" (8), "Year" (2009), and "Interval" (Hourly). Below the search form is a map of Canada with red dots indicating climate data stations. At the bottom, there is a "Date Modified" timestamp and links for "Top of Page" and "Important Notices".

Environment Canada / Environnement Canada

Canada

## National Climate Data and Information Archive

www.climate.weatheroffice.ec.gc.ca

[Français](#) | [Home](#) | [Contact Us](#) | [Help](#) | [Search](#) | [canada.gc.ca](#)

[Home](#) » Climate Data Online

- Products & Services
- Climate Data Online
- Climate Normals & Averages
- Canadian Daily Climate Data (CDDC)
- Contacts
- Frequently Asked Questions
- Links
- Water Data
- Proactive Disclosure

Province:

Search options:

- Month:
- Day:
- Year:
- Interval:

Map locations: Whitehorse, Yellowknife, Iqaluit, Prince George, Edmonton, St. John's, Vancouver, Calgary, Saskatoon, Regina, Winnipeg, Thunder Bay, Montréal, Ottawa, Québec, Charlottetown, Fredericton, Toronto.

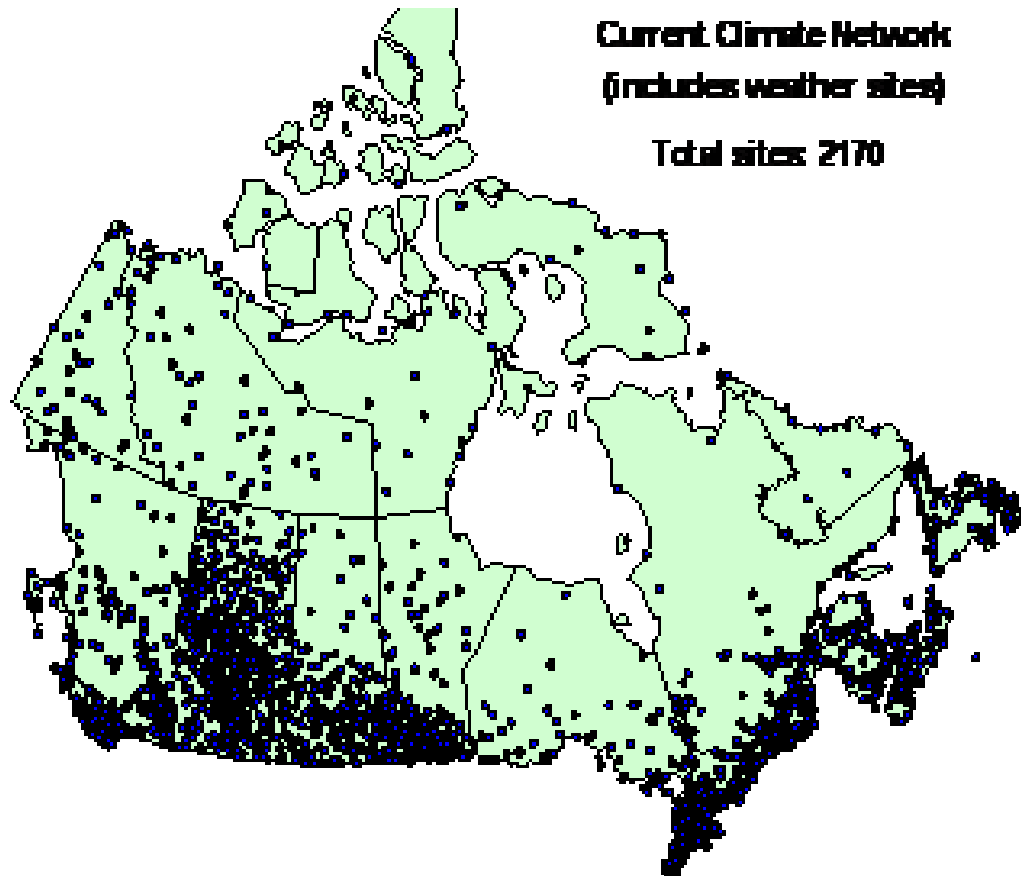
Date Modified: 2008-10-09

[Top of Page](#) | [Important Notices](#)

# Climate Data available at NCDI

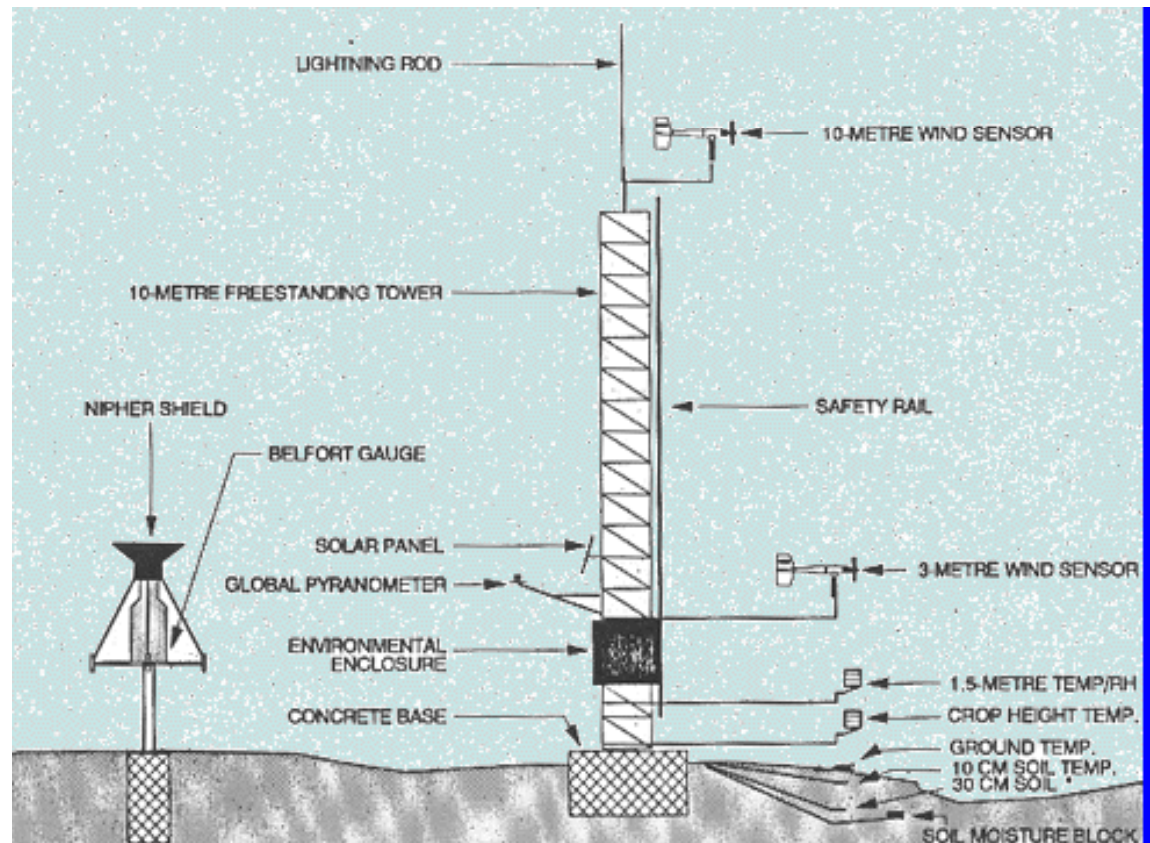
Hourly	Daily	Monthly	Almanac
Temperature	Maximum Temperature	Mean Maximum Temperature	Average Maximum Temperature
Dew Point Temperature	Minimum Temperature	Mean Temperature	Frequency of Precipitation
Relative Humidity	Mean Temperature	Mean Minimum Temperature	Frequency of Precipitation
Wind Direction	Heating Degree Days	Extreme Maximum Temperature	Highest Temperature
Wind Speed	Cooling Degree Days	Extreme Minimum Temperature	Lowest Temperature
Visibility	Total Rainfall	Total Rainfall	Greatest Precipitation
Station Pressure	Total Snowfall	Total Snowfall	Greatest Rainfall
Humidex	Total Precipitation	Total Precipitation	Greatest Snowfall
Wind Chill	Snow on Ground	Snow on Ground on Last Day	Most Snow on Ground
Weather	Direction of Maximum Gust	Direction of Maximum Gust	
	Speed of Maximum Gust	Speed of Maximum Gust	

# Climate Stations Reporting (as of March 2008)





# Automated Weather Stations



# Volunteer Observers



Roy Westland - Devon, Alberta since 1915

Yukon farmer Hugh Bradley receiving 50 years certificate



# Canada's National Climate Data and Information (NCDI) Archive

What is available?

- more than 7 billion observations
- collected across Canada
- over the past 150 years

What is needed?

- observations of Tmax and Tmin as well as Ptotal should be available on a daily basis, with a record length of at least thirty years of data

## 2. US National Climatic Data Center

<http://www7.ncdc.noaa.gov/CDO/cdo>

The screenshot shows the NOAA National Climatic Data Center (NCDC) website. At the top, there are logos for NOAA Satellite and Information Service (NESDIS) and the National Climatic Data Center (U.S. Department of Commerce). Below the logos is a navigation breadcrumb: [DOC](#) > [NOAA](#) > [NESDIS](#) > [NCDC](#). To the right of the breadcrumb is a search bar with the text "Keyword(s), City, Station Name" and a "Search NCDC" button. Below the search bar are links for [Land-Based Data](#), [NNDC CDO](#), [Product Search](#), and [Help](#). The main heading is "NNDC CLIMATE DATA ONLINE". Underneath, there are two columns of links. The left column, titled "Sample Output:", includes [ASCII Space Delimited](#), [Printable Web Form](#), [Hourly Summary](#), [Inventory](#), [Map Analysis](#), and [Info / Help](#). The right column, titled "Search Options:", includes [Country](#), [Geographic Region](#), [Data Set/Product](#), [Station Name](#), and [Map Services](#). At the bottom of the page, there are links for [Privacy Policy](#), the [USA.gov](#) logo, and [Disclaimer](#). The URL <http://www7.ncdc.noaa.gov/CDO/cdo> is displayed at the very bottom.

# Climate data available from about 200 countries

NOAA Satellite and Information Service  
National Environmental Satellite, Data, and Information Service (NESDIS)

National Climatic Data Center  
U.S. Department of Commerce

[DOC](#) > [NOAA](#) > [NESDIS](#) > [NCDC](#)

Keyword(s), City, Station Name

[Land-Based Data](#) / [NNDC CDO](#) / [Product Search](#) / [Help](#)

## NNDC CLIMATE DATA ONLINE

### Climate Data Online

**Country Options**

- Afghanistan
- Albania
- Algeria
- American Samoa
- Andorra
- Angola

**Sample Output:**  
[ASCII Space Delimited](#)  
[Printable Web Form](#)  
[Hourly Summary](#)  
[Inventory](#)  
[Map Analysis](#)  
[Info / Help](#)

[Privacy Policy](#) [Disclaimer](#)

<http://www7.ncdc.noaa.gov/CDO/country>

# Climate Data available at NCDC

Mean temperature (.1 Fahrenheit)

Mean dew point (.1 Fahrenheit)

Mean sea level pressure (.1 mb)

Mean station pressure (.1 mb)

Mean visibility (.1 miles)

Mean wind speed (.1 knots)

Maximum sustained wind speed (.1 knots)

Maximum wind gust (.1 knots)

Maximum temperature (.1 Fahrenheit)

Minimum temperature (.1 Fahrenheit)

Precipitation amount (.01 inches)

Snow depth (.1 inches)

Indicator for occurrence of: Fog Rain or Drizzle, Snow or Ice Pellets,  
Hail, Thunder, Tornado/Funnel Cloud

# OVER 9000 STATIONS WORLDWIDE

- based on data exchanged under the World Meteorological Organization (WMO) World Weather Watch Program according to WMO Resolution 40 (Cg-XII)



World Meteorological Organization  
Working together in weather, climate and water

## 3. NCEP Reanalysis

<http://www.esrl.noaa.gov/psd/data/gridded/data.ncep.reanalysis.html>

- When no climate data (observations) are available for your area of interest, one can try reanalyzed data
- NCEP/NCAR Reanalysis 1 project uses a state-of-the-art analysis/forecast system to perform data assimilation using past data from 1948 to the present
- joint project between the National Centers for Environmental Prediction (NCEP) and the National Center for Atmospheric Research (NCAR)
- available as 4 times daily format and as daily averages
- E. Kalnay *et al.*, 1996. The NCEP/NCAR 40-Year Reanalysis Project. *Bulletin of the American Meteorological Society*



# Issues Using NCEP Reanalysis

- Data available as GRIB files  
(WMO format for gridded data used by operational meteorological centers for storage and the exchange of gridded fields as typically 1/3 smaller)
- Need to download and read in Fortran, C or Basic computer language

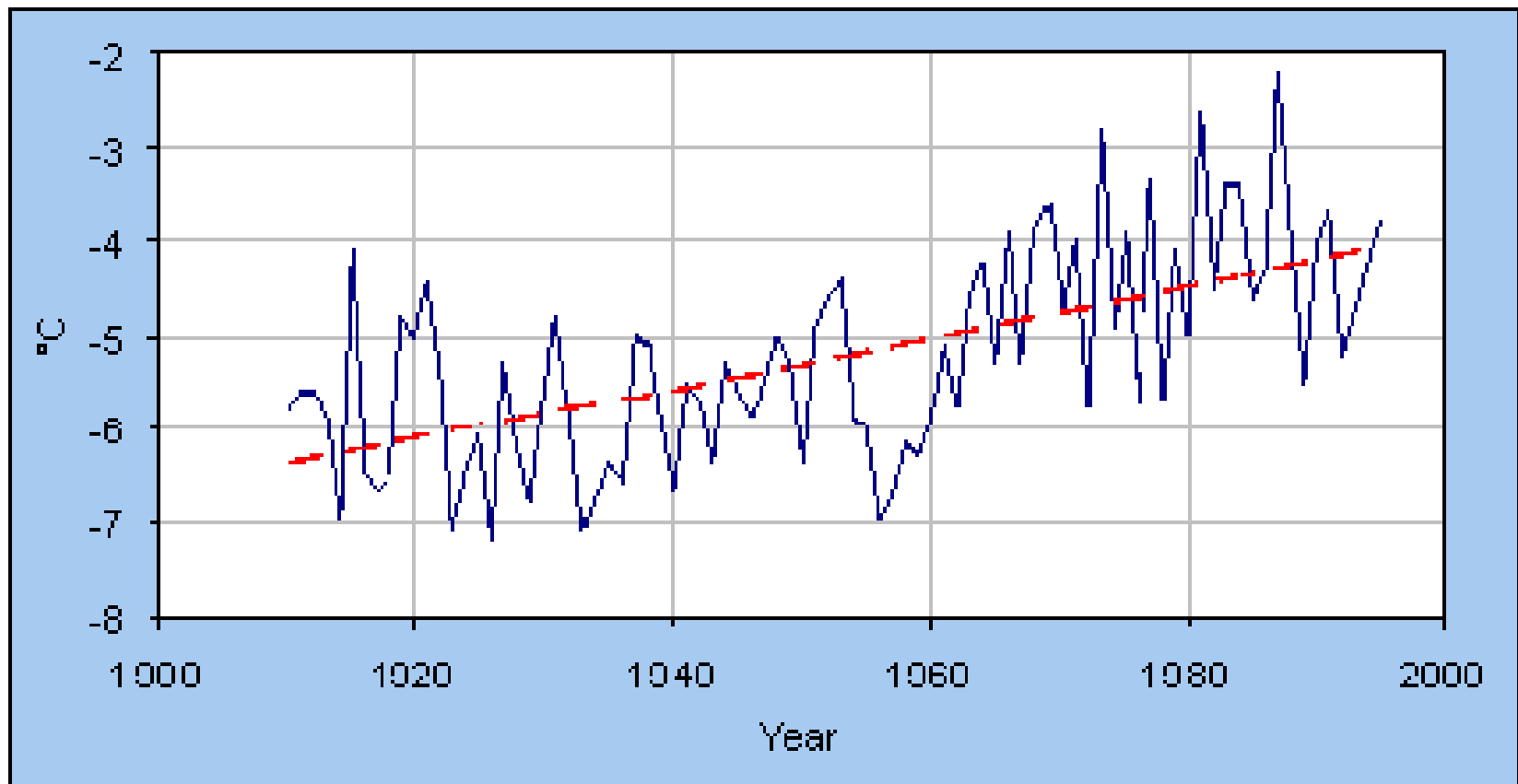
## 4. Homogenization of Data

- data should be free of variation not caused by the atmosphere
- 2 examples (Zhang, 2004)
- station is moved from a hill top location to the valley floor 300 meters lower in elevation, analysis of its temperature data will likely show an abrupt warming at the time of the station relocation.
- a station located in the garden of a competent and conscientious observer for 50 years, and suppose a tree was planted west of the garden at the time the observation station was established. The instruments are maintained in good condition and the observer accurately records the temperature in the garden. The tree slowly grows up and shades the observing site during the late afternoon when the daily maximum temperature is observed.

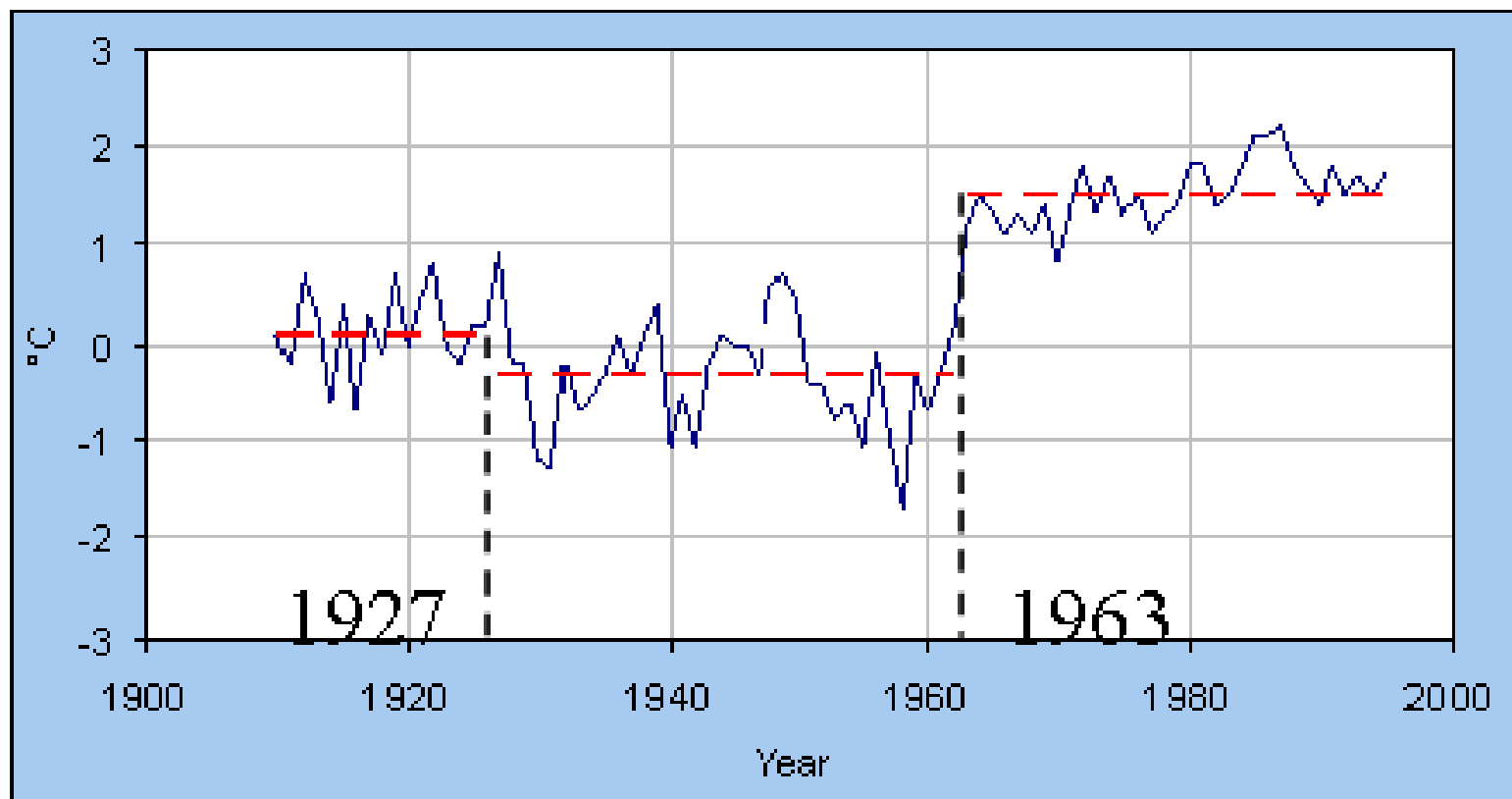
# Example of Data Homogenization Amos, Quebec, Canada



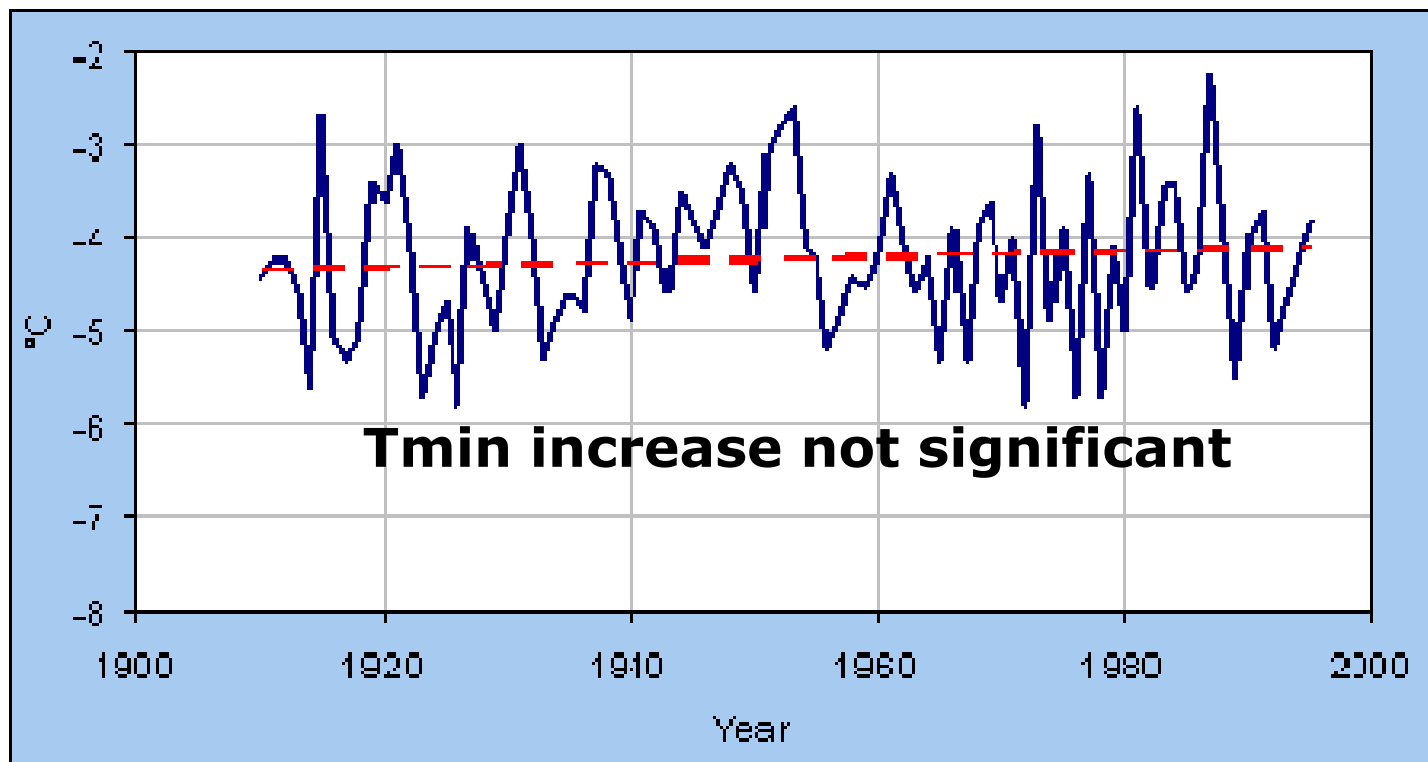
# Original Analysis – increase 2.8°C in Tmin



# 2°C Tmean Jump in 1963 due to relocation

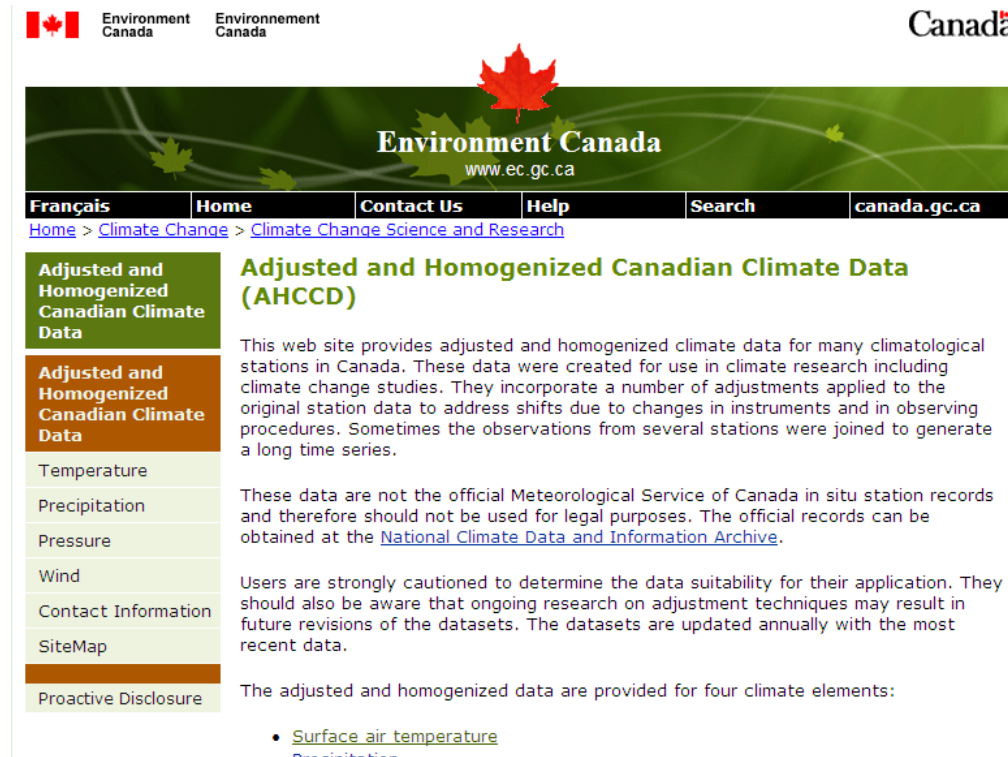


# data homogenization removes the artificial jump



# Adjusted Historical Canadian Climate Data

<http://ec.gc.ca/dccha-ahccd/>



The screenshot shows the Environment Canada website interface. At the top left, there are logos for Environment Canada in English and French, and the Canadian flag. At the top right is the word "Canada" with a small flag. Below this is a green banner with a red maple leaf and the text "Environment Canada www.ec.gc.ca". A navigation bar contains links for "Français", "Home", "Contact Us", "Help", "Search", and "canada.gc.ca". Below the navigation bar is a breadcrumb trail: "Home > Climate Change > Climate Change Science and Research". The main content area is divided into a left sidebar and a main column. The sidebar has a green header "Adjusted and Homogenized Canadian Climate Data" and a list of menu items: "Adjusted and Homogenized Canadian Climate Data", "Temperature", "Precipitation", "Pressure", "Wind", "Contact Information", "SiteMap", and "Proactive Disclosure". The main column has a green header "Adjusted and Homogenized Canadian Climate Data (AHCCD)". Below the header is a paragraph: "This web site provides adjusted and homogenized climate data for many climatological stations in Canada. These data were created for use in climate research including climate change studies. They incorporate a number of adjustments applied to the original station data to address shifts due to changes in instruments and in observing procedures. Sometimes the observations from several stations were joined to generate a long time series." Below this is another paragraph: "These data are not the official Meteorological Service of Canada in situ station records and therefore should not be used for legal purposes. The official records can be obtained at the [National Climate Data and Information Archive](#)." Below that is a paragraph: "Users are strongly cautioned to determine the data suitability for their application. They should also be aware that ongoing research on adjustment techniques may result in future revisions of the datasets. The datasets are updated annually with the most recent data." At the bottom of the main column is a paragraph: "The adjusted and homogenized data are provided for four climate elements:" followed by a bulleted list: "• [Surface air temperature](#)" and "• [Precipitation](#)".

# Issues Using Homogenized Data Set

- **Limited Number of Stations (>200)**
- **Limited variables**
  1. Surface air temperature
  2. Precipitation
  3. Surface pressure
  4. Surface wind speed



## 5. Selecting a Climate Station Using NCDI

Province:

**Search options:**

Month:	Feb	<input type="button" value="v"/>
Day:	8	<input type="button" value="v"/>
Year:	2009	<input type="button" value="v"/>
Interval:	Hourly	<input type="button" value="v"/>

Search by province

# By Province or Station Name

To determine data availability for a custom location and date, please complete and submit one of the following searches:

**Search by Province:**

Province:

for years from:  to

or a specific date:

Display  results per page.

OR

**Search by Station Name:**

Name:

contains  begins with

for years from:  to

or a specific date:

Display  results per page.

# Or by Proximity

OR

## Search by Proximity:

kilometres away from:

a city,

a National Park,

location coordinates:

latitude:  °  ' North

longitude:  °  ' West

for years from:  to

or a specific date:

Display  results per page.

# By City (limited)

OR

**Search by Proximity:**

25 kilometres away from:

a city,  a National Park,  location,  for year,  or a specific day

Select City

- Select City
- Brampton
- Burnaby
- Calgary
- Charlottetown
- Edmonton
- Fredericton
- Halifax
- Hamilton
- Iqaluit
- Kitchener
- Laval
- London
- Markham
- Mississauga
- Montréal
- Ottawa
- Québec
- Regina
- Saskatoon
- St. John's
- Surrey
- Toronto
- Vancouver
- Vaughan
- Victoria
- Whitehorse
- Windsor
- Winnipeg
- Yellowknife

ark

' North

' West

to 2009

ary 8 2009

results per page.

05-04-06

[Top of Page](#) [Important Notices](#)

# By National Park

The screenshot shows a web browser window with the title "Internet Explorer". The page content includes a search interface for "Canada's National Parks". The search bar has a "Search" button and a "Favorites" icon. Below the search bar, there are radio buttons for "or a specific date" and "or a specific date". A "Display" button is visible. The "Search by Proximity" section has a dropdown menu set to "25" and "kilometres". There are radio buttons for "a city, [Select City]", "a National Park, [Select Park]", and "location coordinates:". A dropdown menu is open, listing the following national parks: Aulavik National Park, Auyuittuq National Park, Banff National Park, Cape Breton Highlands National Park, Elk Island National Park, Fathom Five National Marine Park, Forillon National Park, Fundy National Park, Georgian Bay Islands National Park, Glacier National Park, Grasslands National Park, Gros Morne National Park, Gwaii Haanas National Park, Ivvavik National Park, Jasper National Park, Kejimikujik National Park, Kluane National Park, Kootenay National Park, Kouchibouguac National Park, La Mauricie National Park, Mingan Archipelago National Park, Mount Revelstoke National Park, Nahanni National Park, Pacific Rim National Park, Point Pelee National Park, Prince Albert National Park, Prince Edward Island National Park, Pukaskwa National Park, and Quttinipaaq National Park.

# Or by Co-ordinates

OR

## Search by Proximity:

25 kilometres away from:

a city,

a National Park,

location coordinates:

latitude:  °  ' North

longitude:  °  ' West

for years from:  to

or a specific date:

Display  results per page.

# Within 25, 50, 100 or 200 kms

OR

**Search by Proximity:**

kilometres away from:

a National Park,

location coordinates:

latitude:  °  ' North

longitude:  °  ' West

for years from:  to

or a specific date:

Display  results per page.

## Selecting a climate station

- Length of record (30 years of data)
- Continuous records
- Up to present
  
- Proximity to impact study



# Example – Searching climate stations within 25 kms of Windsor, ON

## Station Results

7 locations match your customized search. Confirm the [Data Interval](#) and Date for one of the locations listed and click GO to display the data.

Station	Prov	Data Interval	Day	Month	Year	
AMHERSTBURG	ONT	Daily	3	Feb	2009	Go
ESSEX	ONT	Daily	30	Nov	1968	Go
WINDSOR A	ONT	Hourly	8	Feb	2009	Go
WINDSOR FORD PLANT	ONT	Daily	30	Nov	1993	Go
WINDSOR RIVERSIDE	ONT	Daily	6	Feb	2009	Go
WINDSOR SOUTH	ONT	Daily	31	Mar	1955	Go
WINDSOR UNIVERSITY	ONT	Daily	29	Feb	1980	Go

1

Another Location

# Click on year to determine length of record

Proactive Disclosure

## Station Results

7 locations match your customized search. Confirm the [Data Interval](#) and Date for one of the locations listed and click GO to display the data.

Station	Prov	Data Interval	Day	Month	Year	
AMHERSTBURG	ONT	Daily	3	Feb	2009	Go
ESSEX	ONT	Daily	30	Nov	1988	Go
WINDSOR A	ONT	Hourly	8	Feb	1989	Go
WINDSOR FORD PLANT	ONT	Daily	30	Nov	1990	Go
WINDSOR RIVERSIDE	ONT	Daily	6	Feb	1991	Go
WINDSOR SOUTH	ONT	Daily	31	Mar	1992	Go
WINDSOR UNIVERSITY	ONT	Daily	29	Feb	1993	Go
					1994	Go
					1995	Go
					1996	Go
					1997	Go
					1998	Go
					1999	
					2000	
					2001	
					2002	
					2003	
					2004	
					2005	
					2006	
					2007	
					2008	
					2009	

1

Date Modified: 2004-05-13

[Top of Page](#)

Another Location

[Important Notices](#)



## Example

- 2 possible sites given criteria
  - **Windsor A** (1953 to 2011)
  - **Windsor Riverside** (1866 to 2011)

# Location and Elevation Similar

## WINDSOR A ONTARIO

**Latitude:** 42° 16.800' N **Longitude:** 82° 57.600' W **Elevation:** 189.60 m

**Climate ID:** 6139525 **WMO ID:** 71538 **TC ID:** YQG

[Previous Month](#)

February 2009

Daily Data Report for February 2009									
Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm
01†	4.4	-0.5	2.0	16.0	0.0	0.0	0.0	0.0	17
02†	0.8	-6.4	-2.8	20.8	0.0	0.0	T	T	13
03†	-2.2	-10.6	-6.4	24.4	0.0	0.0	0.8	0.6	10
04†	-9.6	-15.9	-12.8	30.8	0.0	0.0	T	T	10
05†	-7.8	-18.5	-13.2	31.2	0.0	0.0	0.0	0.0	10
06†	0.4	-11.5	-5.6	23.6	0.0	0.0	0.0	0.0	10

[Notes on Data Quality:](#)

## WINDSOR RIVERSIDE ONTARIO

**Latitude:** 42° 19.800' N **Longitude:** 82° 55.800' W **Elevation:** 188.40 m

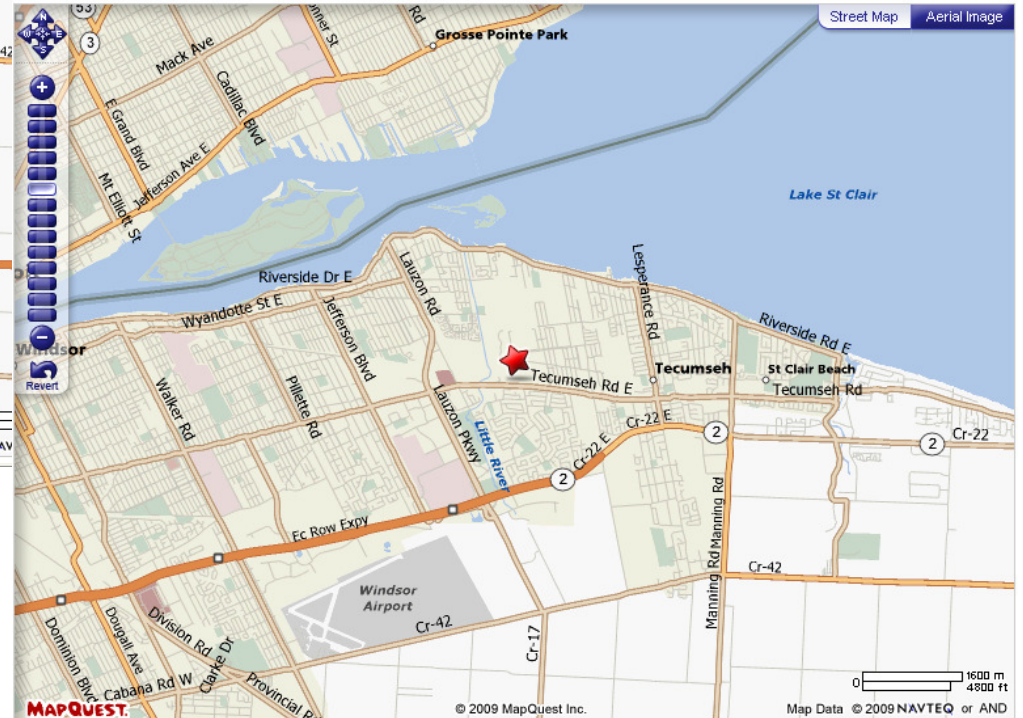
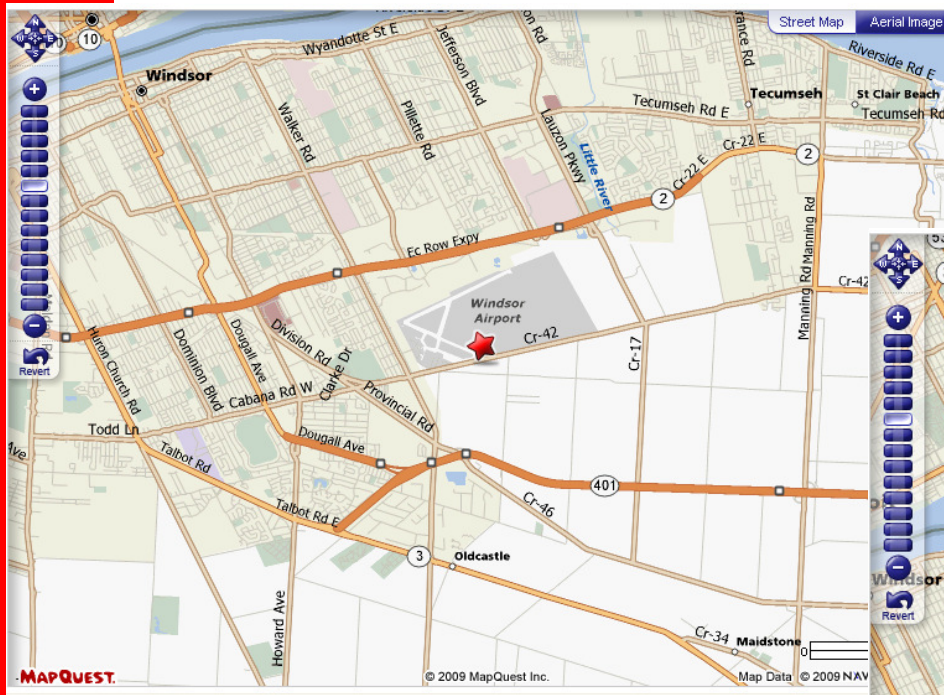
**Climate ID:** 6139520 **WMO ID:** **TC ID:**

[Previous Month](#)

February 2009

Daily Data Report for February 2009											
Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days °C	Cool Deg Days °C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01†	7.5	-7.0	0.3	17.7	0.0	0.0	0.0	0.0	28		
02†	4.0	-7.0	-1.5	19.5	0.0	0.0	0.2	0.2	26		
03†	-0.5	-10.5	-5.5	23.5	0.0	0.0	0.8	0.8	27		
04†	-8.5	-14.0	-11.3	29.3	0.0	0.0	0.0	0.0	28		
05†	-7.0	-19.0	-13.0	31.0	0.0	0.0	0.0	0.0	27		
06†	6.0	-11.0	-2.5	20.5	0.0	0.0	0.0	0.0	27		

# Locations mapped



## Quick Data Check to Help Select Site

- **Windsor Riverside** missing data 1935 to 1995
- **Windsor A** data appears okay

## 6. Downloading Data using NCDI

<a href="#">U/†</a>	8.4	0.4	4.4	13.6	0.0	0.0	0.0	0.0	9	21	50
<a href="#">08†</a>	6.0	-1.6	2.2	15.8	0.0	0.0	0.0	0.0	1	30	37
<b>Sum</b>				<b>176.2*</b>	<b>0.0*</b>	<b>0.0*</b>	<b>0.8*</b>	<b>0.6*</b>			
<b>Avg</b>	<b>0.1*</b>	<b>-8.1*</b>	<b>-4*</b>								
<b>Xtrm</b>	<b>8.4*</b>	<b>-18.5*</b>								<b>21*</b>	<b>50*</b>

[Previous Month](#)

February  2009

Legend	Navigation Options
[empty] = No data available	<a href="#">Canada Map</a>
M = Missing	<a href="#">Ontario Map</a>
E = Estimated	<a href="#">Customized Search</a>
A = Accumulated	<a href="#">Nearby Stations with Data</a>
C = Precipitation occurred, amount uncertain	<a href="#">1971-2000 Climate Normals</a>
L = Precipitation may or may not have occurred	<a href="#">Customizable Chart</a>
F = Accumulated and estimated	Bulk Data (2009) <a href="#">[CSV]</a> <a href="#">[XML]</a>
N = Temperature missing but known to be > 0	
Y = Temperature missing but known to be < 0	
S = More than one occurrence	
T = Trace	
* = The value displayed is based on incomplete data	
† = Data for this day has undergone only preliminary quality checking	

- Bulk Data download CSV (comma delimited)
- For daily data, 1 year per download

# Save to Folder

02†	0.8	-6.4	-2.8	20.8	0.0	0.0	T	T	13		<31
03†	-2.2	-10.6	-6.4	24.4	0.0	0.0	0.8	0.6	10	33	48
04†	-9.6	-15.9	-12.8	30.8	0.0	0.0	T	T	10	14	41
05†	-7.8	-18.5	-13.2	31.2	0.0	0.0	0.0	0.0	10	20	35
06†	0.4	-11.5	-5.6	23.6	0.0	0.0	0.0	0.0	10		<31
07†									9	21	50
08†									1	30	37
Sun											
Avg											
Xtrm										21*	50*

File Download

Do you want to open or save this file?

Name: eng-daily-01012009-12312009.csv  
 Type: Microsoft Office Excel Comma Separated Values File  
 From: www.climate.weatheroffice.ec.gc.ca

Open Save Cancel

While files from the Internet can be useful, some files can potentially harm your computer. If you do not trust the source, do not open or save this file. [What's the risk?](#)

Customizable Chart  
 Bulk Data (2009) [\[CSV\]](#) [\[XML\]](#)

Options  
 Data  
 Normals

Legend:  
 N = Temperature missing but known to be > 0  
 Y = Temperature missing but known to be < 0  
 S = More than one occurrence  
 T = Trace  
 \* = The value displayed is based on incomplete data  
 † = Data for this day has undergone only preliminary quality checking



# Save to Folder

**Save As**

Save in: My Documents

- My Recent Documents
- Desktop
- My Documents
- My Computer
- My Network

- AIRD
- Bluetooth Exchange Folder
- CCBR
- Events
- Fenech
- IMAP
- Memory Stick
- My Data Sources
- My Music
- My Pictures
- My Videos
- Neat Stuff
- Personal
- PhD
- RAICC
- Security

File name: eng-daily-01012009-12312009.csv

Save as type: Microsoft Office Excel Comma Separated Value

Save Cancel

Legend:

- N = Temperature missing but known to be > 0
- Y = Temperature missing but known to be < 0
- S = More than one occurrence
- T = Trace
- \* = The value displayed is based on incomplete data
- † = Data for this day has undergone only preliminary quality checking

Bulk Data (2009) [CSV] [XML]

# Save to Folder

The screenshot shows a web browser window with a 'Save As' dialog box open. The dialog box has a blue title bar and contains a 'Download complete' notification. The notification text reads: 'Download Complete', 'Saved: ...aily-01012009-12312009.csv from ...imate.weatheroffice.ec.gc.ca', 'Downloaded: 37.6 KB in 1 sec', 'Download to: C:\...\eng-daily-01012009-12312009.csv', and 'Transfer rate: 37.6 KB/Sec'. There is an unchecked checkbox for 'Close this dialog box when download completes'. At the bottom of the dialog, there are buttons for 'Open', 'Open Folder', and 'Close'. Below the dialog, the file name 'eng-daily-01012009-12312009.csv' and the save type 'Microsoft Office Excel Comma Separated Value' are visible. In the background, a table of data is partially visible, with a legend at the bottom.

Legend:

- N = Temperature missing but known to be > 0
- Y = Temperature missing but known to be < 0
- S = More than one occurrence
- T = Trace
- \* = The value displayed is based on incomplete data
- † = Data for this day has undergone only preliminary quality checking

# Downloading Data using NCDC

The screenshot shows the NOAA National Climatic Data Center (NCDC) website. At the top, there are logos for NOAA Satellite and Information Service (NESDIS) and the National Climatic Data Center (U.S. Department of Commerce). Below the logos is a navigation bar with the breadcrumb trail: [DOC](#) > [NOAA](#) > [NESDIS](#) > [NCDC](#). To the right of the breadcrumb trail is a search box labeled "Keyword(s), City, Station Name" with a "Search NCDC" button. Below the search box are links for [Land-Based Data](#), [NNDC CDO](#), [Product Search](#), and [Help](#). The main heading is "NNDC CLIMATE DATA ONLINE". Underneath, there are two columns of links. The left column, titled "Climate Data Online", includes links for "Sample Output:", "IMPORTANT: Changes", "ASCII Space Delimited", "Printable Web Form", "Hourly Summary", "Inventory", "Map Analysis", and "Info / Help". The right column, titled "Search Options:", includes links for "Country", "Geographic Region", "Data Set/Product", "Station Name", and "Map Services". A black bullet point with the text "Select Country" is positioned to the right of the "Country" link.

NOAA Satellite and Information Service  
National Environmental Satellite, Data, and Information Service (NESDIS)

National Climatic Data Center  
U.S. Department of Commerce

[DOC](#) > [NOAA](#) > [NESDIS](#) > [NCDC](#)

Keyword(s), City, Station Name

[Land-Based Data](#) / [NNDC CDO](#) / [Product Search](#) / [Help](#)

## NNDC CLIMATE DATA ONLINE

### Climate Data Online

Sample Output:  
[IMPORTANT: Changes](#)  
[ASCII Space Delimited](#)  
[Printable Web Form](#)  
[Hourly Summary](#)  
[Inventory](#)  
[Map Analysis](#)  
  
[Info / Help](#)

Search Options:  
[Country](#) • **Select Country**  
[Geographic Region](#)  
[Data Set/Product](#)  
[Station Name](#)  
[Map Services](#)

# Downloading Data using NCDC

The screenshot shows the NOAA National Climatic Data Center (NCDC) website. At the top, there are logos for NOAA Satellite and Information Service (NESDIS) and the National Climatic Data Center (U.S. Department of Commerce). Below the logos is a navigation bar with the breadcrumb trail: [DOC](#) > [NOAA](#) > [NESDIS](#) > [NCDC](#). To the right of the breadcrumb trail is a search box labeled "Keyword(s), City, Station Name" with a "Search NCDC" button. Below the search box are navigation links: [Land-Based Data](#) / [NNDC CDO](#) / [Product Search](#) / [Help](#). The main heading is "NNDC CLIMATE DATA ONLINE". Underneath, there are two columns. The left column is titled "Climate Data Online" and contains several links: "Sample Output:", "IMPORTANT: [Changes](#)", "[ASCII Space Delimited](#)", "[Printable Web Form](#)", "[Hourly Summary](#)", "[Inventory](#)", "[Map Analysis](#)", and "[Info / Help](#)". The right column is titled "Country Options" and features a dropdown menu with the following options: Canada, Canary Islands, Canton Island, Cape Verde, Caroline Islands, and Cayman Islands. A bullet point next to the dropdown menu says "• Select Country". Below the dropdown menu is an "Access Data/Products" button.

NOAA Satellite and Information Service  
National Environmental Satellite, Data, and Information Service (NESDIS)

National Climatic Data Center  
U.S. Department of Commerce

[DOC](#) > [NOAA](#) > [NESDIS](#) > [NCDC](#)    Keyword(s), City, Station Name    Search NCDC

[Land-Based Data](#) / [NNDC CDO](#) / [Product Search](#) / [Help](#)

## NNDC CLIMATE DATA ONLINE

**Climate Data Online**

Sample Output:  
[IMPORTANT: Changes](#)  
[ASCII Space Delimited](#)  
[Printable Web Form](#)  
[Hourly Summary](#)  
[Inventory](#)  
[Map Analysis](#)

[Info / Help](#)

**Country Options**

- Canada
- Canary Islands
- Canton Island
- Cape Verde
- Caroline Islands
- Cayman Islands

• Select Country

Access Data/Products

# Downloading Data using NCDC

The screenshot shows the NOAA National Climatic Data Center (NCDC) website. At the top, there are logos for NOAA Satellite and Information Service and the National Climatic Data Center. Below the logos is a navigation bar with the breadcrumb path: [DOC](#) > [NOAA](#) > [NESDIS](#) > [NCDC](#). To the right of the breadcrumb is a search box labeled "Keyword(s), City, Station Name" with a "Search NCDC" button. Below the search box are links for [Land-Based Data](#), [NNDC CDO](#), [Product Search](#), and [Help](#). The main heading is "NNDC CLIMATE DATA ONLINE". Underneath, there are two columns of content. The left column, titled "Climate Data Online", lists "Sample Output:" followed by links for [IMPORTANT: Changes ASCII Space Delimited](#), [Printable Web Form](#), [Hourly Summary](#), [Inventory](#), [Map Analysis](#), and [Info / Help](#). The right column, titled "DataSet/Product Options", contains a list of data products: "Surface Data, Daily (Over 19,000 U.S. some non-US sites)", "Surface Data, Global Summary of the Day \*", "Surface Data, Hourly Global (Over 10,000 worldwide sites)", "Surface Data, Monthly Global (Over 3,100 worldwide sites)", and "Surface Data, Monthly Global (Over 900 worldwide sites; GSN) \*". Below this list is an "Access Data/Products" button. At the bottom right of the screenshot, there is a bullet point: "• Select Global Summary of the Day".

NOAA Satellite and Information Service  
National Environmental Satellite, Data, and Information Service (NESDIS)

National Climatic Data Center  
U.S. Department of Commerce

[DOC](#) > [NOAA](#) > [NESDIS](#) > [NCDC](#)

[Land-Based Data](#) / [NNDC CDO](#) / [Product Search](#) / [Help](#)

## NNDC CLIMATE DATA ONLINE

**Climate Data Online**

Sample Output:  
[IMPORTANT: Changes ASCII Space Delimited](#)  
[Printable Web Form](#)  
[Hourly Summary](#)  
[Inventory](#)  
[Map Analysis](#)  
  
[Info / Help](#)

**DataSet/Product Options**

- Surface Data, Daily (Over 19,000 U.S. some non-US sites)
- Surface Data, Global Summary of the Day \***
- Surface Data, Hourly Global (Over 10,000 worldwide sites)
- Surface Data, Monthly Global (Over 3,100 worldwide sites)
- Surface Data, Monthly Global (Over 900 worldwide sites; GSN) \*

\* Free Product

- Select Global Summary of the Day

# Downloading Data using NCDC

NOAA Satellite and Information Service  
National Environmental Satellite, Data, and Information Service (NESDIS)

National Climatic Data Center  
U.S. Department of Commerce

DOC > NOAA > NESDIS > NCDC

Keyword(s), City, Station Name

[Land-Based Data](#) / [NNDCCDO](#) / [Product Search](#) / [Help](#)

## NNDCC CLIMATE DATA ONLINE

### Global Summary of the Day (GSOD)

Retrieve data for:

Worldwide


Geographic Region

Country Canada

Station Range (IDs):  to

<input type="checkbox"/>	<a href="#">Data format documentation</a>
<input type="checkbox"/>	<a href="#">Station List</a>
<input type="checkbox"/>	<a href="#">FTP Access</a>
<input type="checkbox"/>	<a href="#">Comma Delimited data sample</a>
<input type="checkbox"/>	<a href="#">Space Delimited data sample</a>
<input type="checkbox"/>	<a href="#">Graph sample</a>

Data and pricing (if applicable) details at the [CDO Help Page](#)

[Privacy Policy](#)  [Disclaimer](#)

<http://www7.ncdc.noaa.gov/CDO/cdoselect.cmd>  
Downloaded Fri Jul 15 12:20:55 EDT 2011  
Production Version  
If you have questions or comments, please contact our [support team](#).

• Select Continue

# Downloading Data using NCDC

NOAA Satellite and Information Service  
National Environmental Satellite, Data, and Information Service (NESDIS)

National Climatic Data Center  
U.S. Department of Commerce

DOC > NOAA > NESDIS > NCDC

Keyword(s), City, Station Name  Search NCDC

[Land-Based Data](#) / [NNDC CDO](#) / [Product Search](#) / [Help](#)

## Global Summary of the Day (GSOD)

**Retrieve data for:**

- Selected CANADA stations - Note: may be slow to load station list on next page

[Privacy Policy](#) [USA.gov](#) [Disclaimer](#)

<http://www7.ncdc.noaa.gov/CDO/cdogetsubquery.cmd>  
Downloaded Fri Jul 15 12:22:30 EDT 2011  
Production Version  
If you have questions or comments, please contact our [support team](#).

- Select Continue again

# Downloading Data using NCDC

NOAA Satellite and Information Service  
National Environmental Satellite, Data, and Information Service (NESDIS)

National Climatic Data Center  
U.S. Department of Commerce

DOC > NOAA > NESDIS > NCDC

Keyword(s), City, Station Name Search NCDC

[Land-Based Data](#) / [NNDC CDO](#) / [Product Search](#) / [Help](#)

## Global Summary of the Day (GSOD)

Selected CANADA stations - Note: may be slow to load station list on next page

Select Stations:

WILLIAMS LAKE ARPT.....	71104099999	07/1944	to	07/2011
WILLIAMS LAKE ARPT.....	74104099999	01/1961	to	06/1977
WILLOW CREEK 1.....	71252099999	04/1994	to	07/2011
WIMBORBE AGCM.....	71904099999	07/1977	to	07/2011
WINDSOR AIRPORT.....	72538099999	01/1973	to	06/1977
WINDSOR.....	71538099999	07/1977	to	06/2011
WINNEPEG.....	71852799999	06/1989	to	09/1989
WINNEPEG ARPT CS.....	71849099999	09/2001	to	07/2011
WINNEPEG INTL AIRPOR.....	71852099999	01/1957	to	06/2011
WINNEPEG INTL ARPT.....	72852099999	01/1973	to	06/1977
WINNEPEG THE FORKS.....	71579099999	09/2001	to	07/2011

[Order by Station ID](#) - [Order by Station Name](#)

### Selecting Multiple Stations

1. To select one station, just click on it.
2. To select multiple sequential stations, click on the first station, scroll down to the last station, hold the Shift key down and click on the last station.
3. To select multiple non-sequential stations, click on the first station, then hold the Control key down while clicking on additional stations. To deselect a station, hold the Control key down while clicking on that station.

[Privacy Policy](#) [Disclaimer](#)

<http://www7.ncdc.noaa.gov/CDO/cdosubqueryrouter.cmd>  
Downloaded Fri Jul 15 12:23:33 EDT 2011  
Production Version  
If you have questions or comments, please contact our [support team](#).

- Select Station



# Downloading Data using NCDC

NOAA Satellite and Information Service  
National Environmental Satellite, Data, and Information Service (NESDIS)

National Climatic Data Center  
U.S. Department of Commerce

DOC > NOAA > NESDIS > NCDC

Keyword(s), City, Station Name

Search NCDC

[Land-Based Data](#) / [NNDC CDO](#) / [Product Search](#) / [Help](#)

**Global Summary of the Day (gsod)**

**Select Date Restrictions:**

Use Date Range <== OR ==>  Use Selected Dates \*

	Year	Month	Day	Year	Month	Day
From	1977	06	01	1977	01	01
To	2011	06	01	1978	02	02
				1979	03	03
				1980	04	04
				1981	05	05
				1982	06	06
				1983	07	07
				1984	08	08
				1985	09	09
				1986	10	10

Tabular Data Output  Graphical Output

Select Output Format:  
Comma Delimited

Select Output Media:  
FTP

Continue Previous Page Clear Selections

**\* Date List Notes:**  
Uses all combinations of selected year(s), month(s) and day(s). For example, selecting years of (1993, 1995), months of (03,04), days of (01, 15) will result in Year/Month/Day date selections of (1993/03/01, 1993/03/15, 1993/04/01, 1993/04/15, 1995/03/01, 1995/03/15, 1995/04/01, 1995/04/15).  
[Return to Date List](#)

- Select Date Restrictions, Output Format

# Downloading Data using NCDC

The screenshot displays the NOAA National Climatic Data Center (NCDC) website interface. At the top, there are logos for NOAA Satellite and Information Service (NESDIS) and the National Climatic Data Center (U.S. Department of Commerce). A navigation bar includes the breadcrumb path: [DOC](#) > [NOAA](#) > [NESDIS](#) > [NCDC](#). A search box contains the text "Keyword(s), City, Station Name" and a "Search NCDC" button. Below the search bar, there are links for [Land-Based Data](#), [NNDC CDO](#), [Product Search](#), and [Help](#). The main heading is "NNDC CLIMATE DATA ONLINE" in blue, followed by "Climate Data Online, Data Output" in red. A specific data file is listed as [CDO8052895040007.txt](#). Below this, there are two buttons: "Data format documentation" and "Station List". At the bottom, there are links for [Privacy Policy](#), [USA.gov](#), and [Disclaimer](#). The footer contains the URL <http://www7.ncdc.noaa.gov/CDO/cdodata.cmd>, the date "Downloaded Fri Jul 15 12:26:55 EDT 2011", the text "Production Version", and a note: "If you have questions or comments, please contact our [support team](#)."

- Returns as an Output file

# Downloading Data using NCDC

http://www1.ncdc.noaa.gov/pub/orders/CD08052895040007.txt - Windows Internet Explorer

http://www1.ncdc.noaa.gov/pub/orders/CD08052895040007.txt

STN	WBAN	YEARMODA	TEMP	DENP	SLP	STP	VISIB	WDSRP	MKSFD	GUST	MAX	MIN	PRCP	SBNP	FRSMTT
715380	99999	19770701	71.1,24	58.2,24	1006.2,24	984.0,24	12.0,24	17.1,24	23.9	35.9	80.6*	57.2	0.390	999.9	110010
715380	99999	19770702	70.3,24	49.7,24	1016.8,24	994.3,24	14.1,24	11.5,24	21.0	29.9	80.6	55.4	0.120	999.9	000000
715380	99999	19770703	70.4,23	55.6,23	1019.6,23	997.1,23	12.8,23	8.8,23	15.9	22.9	80.6	55.4	0.000	999.9	000000
715380	99999	19770704	78.5,20	68.4,20	1016.1,20	993.9,20	6.3,20	9.9,20	14.0	999.9	84.2	71.6	0.001	999.9	000000
715380	99999	19770705	79.9,22	73.1,22	1015.6,22	993.4,22	6.1,22	10.3,22	17.9	26.8	91.4*	71.6	0.080	999.9	110010
715380	99999	19770706	85.7,19	71.8,19	1011.2,19	989.1,19	9.1,19	11.6,19	18.8	23.8	96.8*	71.6	0.001	999.9	000000
715380	99999	19770707	83.5,22	72.6,22	1005.9,22	986.5,22	8.2,22	8.4,22	32.0	22.0	96.8	53.9	99.99	999.9	110020
715380	99999	19770708	74.1,22	67.2,22	1012.5,22	980.3,22	7.2,22	7.1,22	11.8	999.9	91.4	66.2	0.250	999.9	100000
715380	99999	19770709	72.3,23	63.5,23	1017.5,23	995.3,23	9.3,23	9.9,23	19.8	28.9	82.4	66.2	0.430	999.9	110010
715380	99999	19770710	68.1,24	58.3,24	1022.7,24	1000.1,24	14.9,24	8.3,24	12.8	999.9	78.8	59.0	0.001	999.9	000000
715380	99999	19770711	69.5,23	61.3,23	1018.3,23	995.8,23	10.7,23	5.1,23	8.0	999.9	78.8	59.0	99.99	999.9	010000
715380	99999	19770712	74.1,22	70.8,22	1013.1,22	990.9,22	2.7,22	6.4,22	15.9	999.9	82.4*	60.8	0.200	999.9	110000
715380	99999	19770713	77.1,24	64.2,24	1016.6,24	994.3,24	11.8,24	9.2,24	14.0	999.9	86.0*	68.0	0.160	999.9	000000
715380	99999	19770714	76.9,24	63.1,24	1021.4,24	999.0,24	11.9,24	5.4,24	11.8	999.9	87.8*	60.8	0.000	999.9	100000
715380	99999	19770715	83.3,23	71.2,23	1019.5,23	997.1,23	6.7,23	8.1,23	12.8	999.9	95.0	60.8	0.001	999.9	100000
715380	99999	19770716	79.2,24	69.5,24	1019.9,24	997.4,24	8.4,24	7.6,24	15.9	21.0	96.8	71.6	0.350	999.9	010010
715380	99999	19770717	75.0,22	70.0,22	1017.1,22	994.8,22	6.0,22	5.8,22	9.9	999.9	87.8*	69.8	0.001	999.9	100000
715380	99999	19770718	78.5,24	69.7,24	1017.6,24	995.3,24	9.0,24	6.4,24	26.8	36.9	89.6	69.8	99.99	999.9	110010
715380	99999	19770719	79.5,23	71.3,23	1015.2,23	993.1,23	5.0,23	10.9,23	19.8	26.8	93.2*	68.0	0.940	999.9	110010
715380	99999	19770720	85.8,23	73.5,23	1015.2,23	993.1,23	5.4,23	8.5,23	11.8	999.9	95.0*	69.8	0.160	999.9	000000
715380	99999	19770721	81.8,24	70.3,24	1015.6,24	989.6,24	6.9,24	8.5,24	15.0	999.9	95.0	75.2	0.000	999.9	000000
715380	99999	19770722	70.9,22	53.7,22	1022.1,22	999.7,22	14.9,22	11.5,22	15.0	17.9	84.2	60.8	0.001	999.9	000000
715380	99999	19770723	69.5,23	55.5,23	1022.9,23	1000.3,23	14.9,23	6.1,23	12.8	999.9	78.8	57.2	0.001	999.9	000000
715380	99999	19770724	71.6,24	60.4,24	1018.2,24	992.8,24	12.6,24	7.7,24	11.8	999.9	82.4*	57.2	0.001	999.9	000000
715380	99999	19770725	73.5,24	64.6,24	1009.3,24	997.1,24	6.9,24	8.5,24	15.9	16.9	82.4	62.6	0.210	999.9	110010
715380	99999	19770726	65.3,23	49.2,23	1020.3,23	997.8,23	14.9,23	6.3,23	10.9	999.9	78.8	55.4*	0.590	999.9	000000
715380	99999	19770727	65.2,24	49.4,24	1023.0,24	1000.4,24	14.9,24	6.0,24	9.9	999.9	73.4	55.4	0.000	999.9	000000
715380	99999	19770728	66.8,24	53.1,24	1020.3,24	997.7,24	13.3,24	6.0,24	9.9	999.9	77.0	55.4	0.001	999.9	000000
715380	99999	19770729	70.4,23	60.7,23	1014.5,23	992.2,23	4.7,23	4.5,23	9.9	999.9	82.4	57.2	99.99	999.9	110010
715380	99999	19770730	70.8,23	63.9,23	1013.5,23	991.2,23	4.1,23	3.8,23	7.0	999.9	82.4	60.8	0.010	999.9	110010
715380	99999	19770731	74.4,24	45.1,24	1000.1,24	984.0,24	7.6,24	9.8,24	14.0	24.0	86.0	42.6	0.000	999.9	100000
715380	99999	19770801	71.9,24	56.8,24	1011.9,24	989.7,24	14.4,24	8.3,24	22.9	35.9	86.0	62.6	0.350	999.9	010010
715380	99999	19770802	70.0,22	53.8,22	1015.8,22	993.5,22	13.4,22	8.2,22	15.9	22.0	80.6	57.2	0.001	999.9	000000
715380	99999	19770803	71.1,23	62.4,23	1014.6,23	992.3,23	7.9,23	6.5,23	19.8	26.8	82.4*	57.2	0.020	999.9	110010
715380	99999	19770804	73.9,24	63.5,24	1015.4,24	993.2,24	7.3,24	8.0,24	12.8	17.9	86.0*	60.8	0.390	999.9	100010
715380	99999	19770805	77.2,24	67.4,24	1015.9,24	993.7,24	6.7,24	10.9,24	15.0	16.9	86.0	64.4	0.470	999.9	110010
715380	99999	19770806	74.4,24	69.7,24	1015.9,24	993.7,24	4.1,24	6.5,24	10.9	999.9	78.8	69.8	0.120	999.9	110000
715380	99999	19770807	73.6,23	63.2,23	1017.7,23	991.5,23	3.4,23	12.6,23	12.6	12.6	90.6*	59.0	0.000	999.9	110000
715380	99999	19770808	75.2,23	69.0,23	1012.5,23	990.4,23	7.9,23	9.4,23	15.0	999.9	82.4	69.8	0.020	999.9	110000
715380	99999	19770809	72.0,23	61.0,23	1015.6,23	993.4,23	14.1,23	7.0,23	9.9	999.9	82.4	62.6	0.040	999.9	000000
715380	99999	19770810	73.6,23	68.6,23	1011.8,23	989.5,23	8.5,23	9.8,23	15.9	999.9	80.6*	62.6	0.000	999.9	110010
715380	99999	19770811	72.6,24	66.9,24	1015.6,24	993.4,24	6.0,24	7.4,24	14.0	17.9	80.6	64.4	0.550	999.9	110010
715380	99999	19770812	64.7,24	56.4,24	1018.0,24	995.5,24	12.0,24	6.4,24	10.9	999.9	80.6	55.4	0.550	999.9	110000
715380	99999	19770813	67.2,21	59.9,21	1014.1,21	991.7,21	9.0,21	7.5,21	14.0	999.9	77.0*	55.4	0.080	999.9	000000
715380	99999	19770814	71.8,23	63.9,23	1013.1,23	990.9,23	8.9,23	7.6,23	11.8	999.9	77.0	55.4	0.000	999.9	100000
715380	99999	19770815	67.8,24	55.0,24	1021.0,24	996.4,24	14.9,24	5.1,24	9.9	999.9	77.0	59.0	0.001	999.9	000000
715380	99999	19770816	73.4,23	63.7,23	1015.4,23	993.0,23	8.6,23	8.2,23	21.0	32.0	90.6*	59.0	0.000	999.9	010000
715380	99999	19770817	70.6,23	58.1,23	1012.2,23	989.9,23	12.4,23	11.8,23	16.9	22.0	80.6	60.8	0.240	999.9	000000
715380	99999	19770818	62.2,23	45.8,23	1018.1,23	995.4,23	14.9,23	9.0,23	16.9	999.9	77.0	51.8	0.000	999.9	000000
715380	99999	19770819	62.8,23	47.0,23	1017.6,23	994.9,23	14.4,23	5.9,23	12.8	999.9	71.4*	51.8	0.001	999.9	000000
715380	99999	19770820	60.0,24	47.8,24	1018.9,24	996.2,24	14.9,24	5.6,24	8.0	999.9	73.4	46.4	0.001	999.9	000000
715380	99999	19770821	64.4,23	58.5,23	1012.4,23	989.6,23	8.2,23	8.4,23	9.9	999.9	69.8	46.4	0.420	999.9	110000
715380	99999	19770822	64.6,23	56.8,23	1009.7,23	987.4,23	9.1,23	7.2,23	10.9	999.9	73.4*	55.4	0.200	999.9	110000

- Opened as a file to be cut and paste into a spreadsheet



## 2. Quality Controlling Observational Data



1. organizing and viewing data
2. data checks (range, visual, missing data)
3. data summaries (monthly, annual)

# 1. Organizing and Viewing Data



Open ***Charlottetown A Climate*** file





# Calculate Minimum (=min(range))

The screenshot shows a Microsoft Excel spreadsheet with the following data:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
7279	9-Dec-98	9	-0.8	4.1	0										
7280	10-Dec-98	7.8	-1.1	3.4	0										
7281	11-Dec-98	8.3	-1.1	3.6	0										
7282	12-Dec-98	8.1	-1.7	3.2	0										
7283	13-Dec-98	9.1	-2.5	3.3	0										
7284	14-Dec-98	6.1	-2.5	1.8	0										
7285	15-Dec-98	11.3	-0.1	5.6	0										
7286	16-Dec-98	4.8	-0.6	2.1	7.2										
7287	17-Dec-98	2.6	-2.9	-0.2	0										
7288	18-Dec-98	6.4	-4.6	0.9	0										
7289	19-Dec-98	7.6	-0.7	3.5	5.8										
7290	20-Dec-98	4.3	-1.5	1.4	0.4										
7291	21-Dec-98	6.6	-3.6	1.5	10										
7292	22-Dec-98	-3.6	-11.3	-7.5	0										
7293	23-Dec-98	-5.7	-12.1	-8.9	0										
7294	24-Dec-98	-2.4	-9.8	-6.1	0										
7295	25-Dec-98	-1.3	-8.7	-5	0										
7296	26-Dec-98	1.1	-8.7	-3.8	0										
7297	27-Dec-98	4	-8.7	-2.4	0										
7298	28-Dec-98	4.8	-4.9	-0.1	0										
7299	29-Dec-98	3	-11.2	-4.1	2.8										
7300	30-Dec-98	-6.8	-12.3	-9.6	0										
7301	31-Dec-98	-6.3	-9.1	-7.7	1.6										
7302															
7303		40.2													
7304		=min(b2:b7301)													
7305															
7306															
7307															
7308															
7309															
7310															
7311															

The formula bar shows the formula `=min(b2:b7301)` entered in cell B7304. The spreadsheet title is "Microsoft Excel - Windsor 1979 to 2008.csv". The status bar at the bottom shows "1979 to 1998 / 1999 to 2008 /" and the system tray shows the time as 5:55 PM.







# View Data

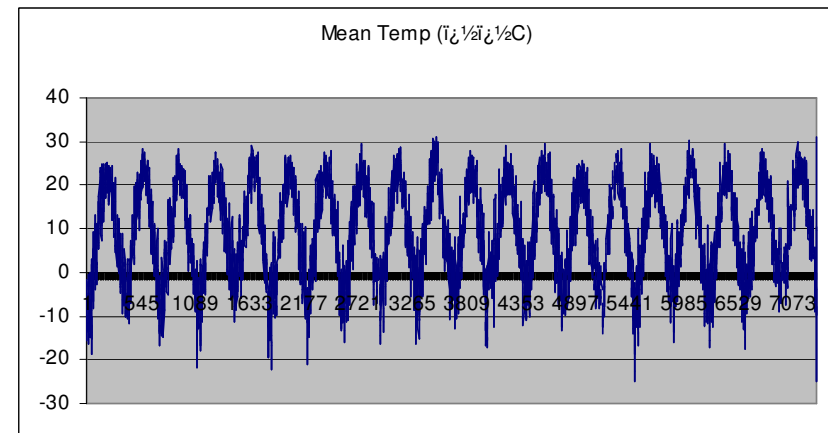
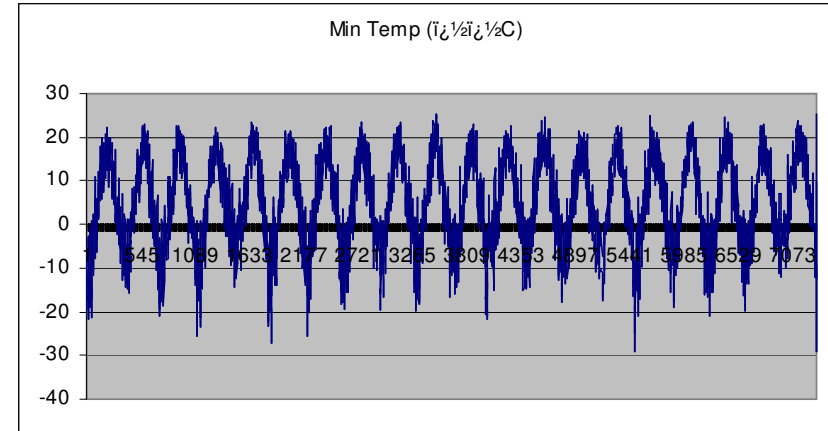
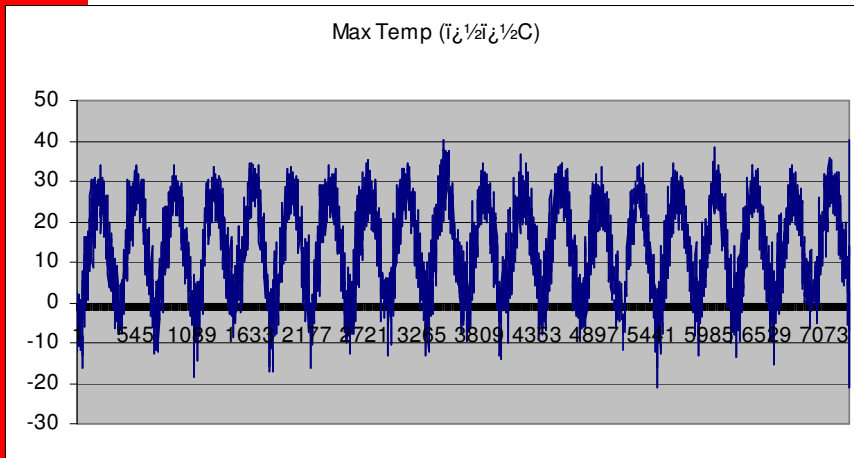
- **Select column**
- **Select Chart Wizard Icon**
- **Select Line Chart**
- **Select Chart sub-type**

The screenshot displays a Microsoft Excel spreadsheet with the following data:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Date/Time	Max Temp	Min Temp	Mean Tem	Total Precip	(mm)									
2	1-Jan-79	2.4	-5.3	-1.5	6.6										
3	2-Jan-79	-4.9	-19.2	-12.1	0.2										
4	3-Jan-79	-12	-19.4	-15.7	0										
5	4-Jan-79	-9.7	-14.1	-11.9	0										
6	5-Jan-79	-9.6	-13.3	-11.5	1										
7	6-Jan-79	-9	-15.4	-12.2	0										
8	7-Jan-79	-6.7	-12.5	-9.6	0										
9	8-Jan-79	-7.9	-16.4	-12.2	0										
10	9-Jan-79	-9.7	-17.4	-13.6	0										
11	10-Jan-79	-9.2	-15.1	-12.2	0										
12	11-Jan-79	-9.7	-17.7	-13.7	0										
13	12-Jan-79	-5.2	-13.2	-9.2	0										
14	13-Jan-79	0.7	-5.7	-2.5	16.8										
15	14-Jan-79	0.4	-15.9	-7.8	2.6										
16	15-Jan-79	-10.9	-21.6	-16.3	1.8										
17	16-Jan-79	-7	-13.9	-10.5	0										
18	17-Jan-79	1.1	-10.7	-4.8	5.6										
19	18-Jan-79	-6	-15.5	-10.8	0										
20	19-Jan-79	-3.4	-15.8	-9.6	0.2										
21	20-Jan-79	0.3	-4	-1.9	3.6										
22	21-Jan-79	-1.4	-3.2	-2.3	0.8										
23	22-Jan-79	0.3	-6.1	-2.9	0										
24	23-Jan-79	-0.5	-7.2	-3.9	0										
25	24-Jan-79	2.2	-2.7	-0.3	1.6										
26	25-Jan-79	-1.2	-4.7	-3	3										
27	26-Jan-79	0.6	-3.4	-1.4	0										
28	27-Jan-79	0.6	-2	-0.7	0										
29	28-Jan-79	0.8	-0.8	0	0.2										
30	29-Jan-79	-0.8	-2.2	-1.5	0										
31	30-Jan-79	-1.6	-4.5	-3.1	0										
32	31-Jan-79	-3.6	-9.1	-6.4	2										
33	1-Feb-79	-5	-10.4	-7.7	0										

The Chart Wizard dialog box is open, showing the 'Standard Types' tab. The 'Line' chart type is selected, and the 'Line' sub-type is chosen. The dialog box includes a preview of the selected chart and a 'Press and Hold to View Sample' button.

# View Data for Tmax, Tmin, Tmean



# Missing Data

- Count empty cells  
(=countblank(range))
- 3 and 5 rule
- If 3 consecutive days data missing in month, then cannot use that month's data
- If 5 days of data missing in month, then cannot use that month's data

Microsoft Excel - Windsor 1979 to 2008.csv

count: if cell empty

SUM	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	7283	13-Dec-98	9.1	-2.5	3.3	0									
	7284	14-Dec-98	6.1	-2.5	1.8	0									
	7285	15-Dec-98	11.3	-0.1	5.6	0									
	7286	16-Dec-98	4.8	-0.6	2.1	7.2									
	7287	17-Dec-98	2.6	-2.9	-0.2	0									
	7288	18-Dec-98	6.4	-4.6	0.9	0									
	7289	19-Dec-98	7.6	-0.7	3.5	5.8									
	7290	20-Dec-98	4.3	-1.5	1.4	0.4									
	7291	21-Dec-98	6.6	-3.6	1.5	10									
	7292	22-Dec-98	-3.6	-11.3	-7.5	0									
	7293	23-Dec-98	-5.7	-12.1	-8.9	0									
	7294	24-Dec-98	-2.4	-9.8	-6.1	0									
	7295	25-Dec-98	-1.3	-8.7	-5	0									
	7296	26-Dec-98	1.1	-8.7	-3.8	0									
	7297	27-Dec-98	4	-8.7	-2.4	0									
	7298	28-Dec-98	4.8	-4.9	-0.1	0									
	7299	29-Dec-98	3	-11.2	-4.1	2.8									
	7300	30-Dec-98	-6.8	-12.3	-9.6	0									
	7301	31-Dec-98	-6.3	-9.1	-7.7	1.6									
	7302														
	7303	Max	40.2	25.3	31	89									
	7304	Min	-20.9	-29.1	-25	0									
	7305	Mean	14.08034	5.02472	9.567441	2.572515									
	7306	StDev	11.36711	9.926756	10.52908	6.44172									
	7307														
	7308	Empty	=countblank(b2:b7301)												
	7309														
	7310														
	7311														
	7312														
	7313														
	7314														
	7315														

1979 to 1998 | 1999 to 2008

start Quality Co... Getting Ob... Windsor 1... C:\Docume... Agenda v2... EN 6:18 PM

## 3. Data Summaries



Go get the  
“Monthly, Seasonal, Annual Template”

# Copy columns F to T

The screenshot shows a Microsoft Excel spreadsheet titled "Monthly, Seasonal, Annual Template.xls". The spreadsheet contains a table with the following structure:

	D	E	F	G	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	Tmean	Ptotal	Monthly	Tmax	Tmin	Tmean	Ptotal	Seasonal	Tmax	Tmin	Tmean	Ptotal	Annual	Tmax	Tmin	Tmean	Ptotal
2	Jan-81		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Winter 1981					1981	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
3	Feb-81		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Spring 1981	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1982	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
4	Mar-81		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Summer 1981	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1983	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
5	Apr-81		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Autumn 1981	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1984	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
6	May-81		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Winter 1982	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1985	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
7	Jun-81		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Spring 1982	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1986	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
8	Jul-81		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Summer 1982	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1987	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
9	Aug-81		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Autumn 1982	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1988	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
10	Sep-81		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Winter 1983	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1989	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
11	Oct-81		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Spring 1983	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1990	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
12	Nov-81		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Summer 1983	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1991	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
13	Dec-81		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Autumn 1983	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1992	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
14	Jan-82		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Winter 1984	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1993	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
15	Feb-82		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Spring 1984	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1994	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
16	Mar-82		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Summer 1984	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1995	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
17	Apr-82		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Autumn 1984	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1996	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
18	May-82		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Winter 1985	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1997	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
19	Jun-82		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Spring 1985	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1998	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
20	Jul-82		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Summer 1985	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	1999	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
21	Aug-82		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Autumn 1985	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	2000	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
22	Sep-82		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Winter 1986	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					
23	Oct-82		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Spring 1986	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					
24	Nov-82		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Summer 1986	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					
25	Dec-82		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Autumn 1986	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					
26	Jan-83		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Winter 1987	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					
27	Feb-83		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Spring 1987	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					
28	Mar-83		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Summer 1987	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					
29	Apr-83		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Autumn 1987	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					
30	May-83		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Winter 1988	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					
31	Jun-83		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Spring 1988	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					
32	Jul-83		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Summer 1988	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					
33	Aug-83		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Autumn 1988	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					
34	Sep-83		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Winter 1989	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					
35	Oct-83		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Spring 1989	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					
36	Nov-83		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Summer 1989	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					
37	Dec-83		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Autumn 1989	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					
38	Jan-84		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Winter 1990	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					
39	Feb-84		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Spring 1990	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					
40	Mar-84		#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Summer 1990	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!					

# Paste into 30-year climate worksheet at cell F1

Microsoft Excel - Windsor 1979 to 2008.xls

File Edit View Insert Format Tools Data Window Help

Type a question for help Close

F1

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Date/Time	Max Temp	Min Temp	Mean Tem	Total Precip	(mm)									
2	1-Jan-79	2.4	-5.3	-1.5	6.6										
3	2-Jan-79	-4.9	-19.2	-12.1	0.2										
4	3-Jan-79	-12	-19.4	-15.7	0										
5	4-Jan-79	-9.7	-14.1	-11.9	0										
6	5-Jan-79	-9.6	-13.3	-11.5	1										
7	6-Jan-79	-9	-15.4	-12.2	0										
8	7-Jan-79	-6.7	-12.5	-9.6	0										
9	8-Jan-79	-7.9	-16.4	-12.2	0										
10	9-Jan-79	-9.7	-17.4	-13.6	0										
11	10-Jan-79	-9.2	-15.1	-12.2	0										
12	11-Jan-79	-9.7	-17.7	-13.7	0										
13	12-Jan-79	-5.2	-13.2	-9.2	0										
14	13-Jan-79	0.7	-5.7	-2.5	16.8										
15	14-Jan-79	0.4	-15.9	-7.8	2.6										
16	15-Jan-79	-10.9	-21.6	-16.3	1.8										
17	16-Jan-79	-7	-13.9	-10.5	0										
18	17-Jan-79	1.1	-10.7	-4.8	5.6										
19	18-Jan-79	-6	-15.5	-10.8	0										
20	19-Jan-79	-3.4	-15.8	-9.6	0.2										
21	20-Jan-79	0.3	-4	-1.9	3.6										
22	21-Jan-79	-1.4	-3.2	-2.3	0.8										
23	22-Jan-79	0.3	-6.1	-2.9	0										
24	23-Jan-79	-0.5	-7.2	-3.9	0										
25	24-Jan-79	2.2	-2.7	-0.3	1.6										
26	25-Jan-79	-1.2	-4.7	-3	3										
27	26-Jan-79	0.6	-3.4	-1.4	0										
28	27-Jan-79	0.6	-2	-0.7	0										
29	1-Jan-79	0.8	-0.8	0	0.2										
30	29-Jan-79	-0.8	-2.2	-1.5	0										
31	1-Jan-79	-1.6	-4.5	-3.1	0										
32	1-Jan-79	-3.6	-9.1	-6.4	2										
33	1-Feb-79	-5	-10.4	-7.7	0										

Comparison Tmean / Future Scenarios Tmean / All Years / Seasons / 1979 to 1998 / 19

Draw AutoShapes

Ready

start C:\Do... Agend... Scenar... Chapt... Scenar... Winds... EN 7:42 PM



# Select columns to view and chart

The screenshot displays a Microsoft Excel spreadsheet titled "Windsor 1979 to 2008.xls". The spreadsheet contains data for various years from 1979 to 1988, with columns for Tmin, Tmean, Ptotal, Tmax, and Tr. A "Chart Wizard - Step 1 of 4 - Chart Type" dialog box is open, showing the "Line" chart type selected. The dialog box includes a "Sample" preview area showing a line chart with three data series: Tmax (blue), Tmin (magenta), and Tmean (yellow). The preview chart shows the trend of these variables over time, with Tmax generally being the highest and Tmin the lowest. The dialog box also includes a description: "Line. Displays trend over time or categories." and buttons for "Cancel", "< Back", "Next >", and "Finish".

Year	Tmin	Tmean	Ptotal	Tmax	Tr
1979	-10.58	-7.26	1.48	0.75	12.56
1980	-12.17	-8.64	0.58	-0.12	12.54
1981	-1.02	2.92	2.62	-2.03	13.49
1982	2.35	6.75	4.50	3.20	13.60
1983	8.51	13.73	3.22	-0.84	12.18
1984	13.68	19.37	2.19	0.42	10.78
1985	16.61	21.58	3.10	-1.07	16.01
1986	15.30	20.27	1.51	1.28	14.63
1987	11.75	17.61	1.57	0.81	15.50
1988	6.31	10.44	1.77	1.77	14.43

## 3. Analyzing Climate Data

1. Annual, Seasonal and Monthly Climate Data
2. Climate indices
3. International/IPCC/national climate indices
4. Calculating climate indices

# 1. Annual, Seasonal and Monthly Climate Data

Microsoft Excel - FABR Climate (Hartington IHD).xlsx [Read-Only]

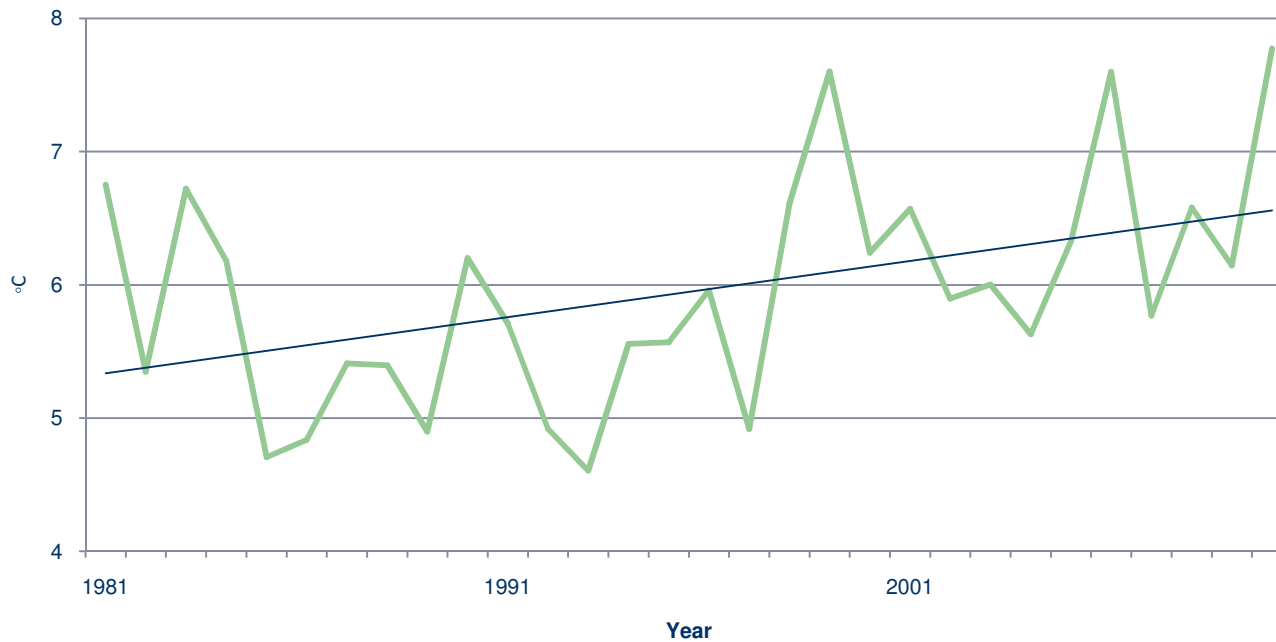
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Annual	Tmax	Tmin	Tmean	Ptotal									
2	1968	11.05815	1.330208	6.203562	2.637078									
3	1969	11.03047	1.771288	6.412414	2.382841									
4	1970													
5	1971	11.24864	1.352985	6.307802	2.353792									
6	1972	10.12271	0.818428	5.477882	3.161413									
7	1973	12.30995	2.706695	7.519597	2.532369									
8	1974	11.05073	1.344053	6.207476	2.391572									
9	1975	12.38899	2.309593	7.356519	2.480684									
10	1976	10.90677	0.573141	5.748124	2.578135									
11	1977	11.89424	1.718141	6.816021	2.466635									
12	1978	11.06785	0.652789	5.867682	2.246853									
13	1979	11.24097	1.6822	6.472356	2.925545									
14	1980	10.95403	0.87876	5.92236	2.679395									
15	1981	11.43222	2.042905	6.746334	2.946271									
16	1982	11.48333	1.420088	6.459198	2.724983									
17	1983	12.27498	2.450678	7.371228	2.897364									
18	1984	11.6426	2.018247	6.839643	2.764345									
19	1985	11.15579	1.473278	6.320919	2.827706									
20	1986	11.42704	2.047302	6.745842	3.068098									
21	1987	12.71052	2.825438	7.775913	2.557743									
22	1988	12.40065	1.976614	7.193915	2.2906									
23	1989	11.38122	0.576165	5.985545	2.369928									
24	1990	12.7603	2.762692	7.767076	2.936829									
25	1991	13.05509	2.536562	7.801707	2.386015									
26	1992	10.80501	0.869055	5.84257	2.930944									
27	1993	11.24346	0.996576	6.124504	2.740145									
28	1994	11.51315	0.615019	6.070002	2.402055									
29	1995	11.85842	1.231189	6.55097	2.6407									
30	1996	11.15294	1.520027	6.344552	3.035397									

In Annual Summaries

\*indicate missing data with highlites

# Annual Mean Temperature

Annual Mean Temperature  
Charlottetown, Prince Edward Island  
1981 to 2010

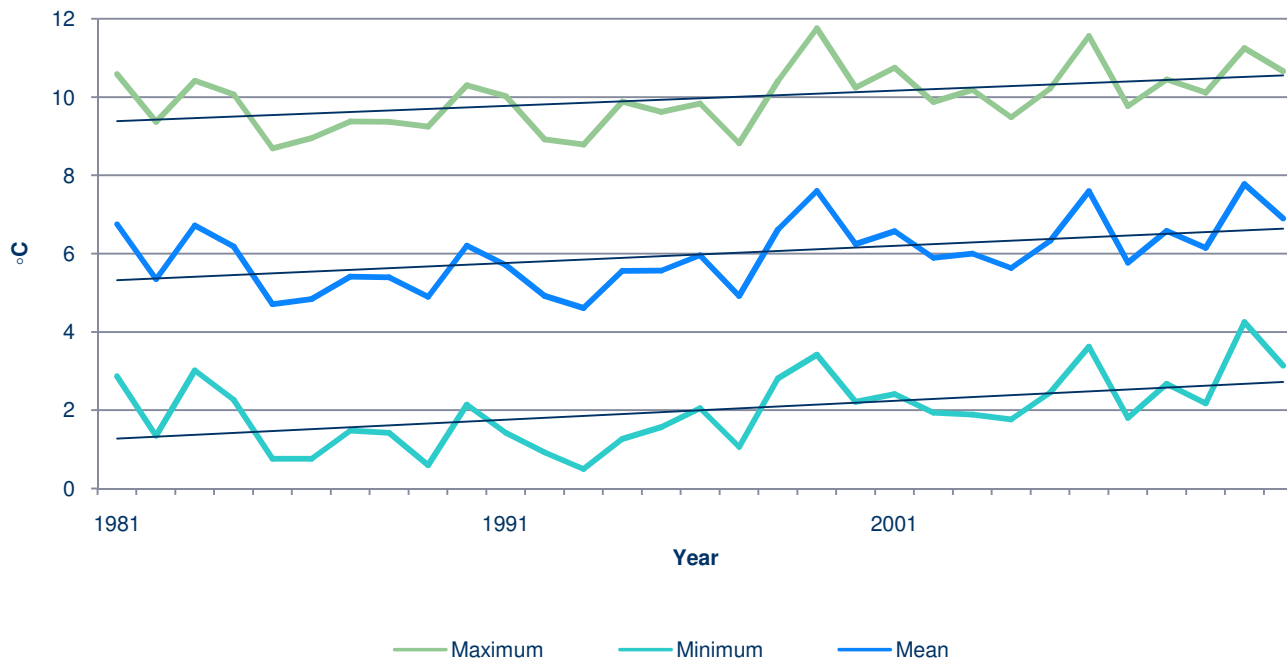


Graph  
Tmean  
with linear  
trend line

\*remember  
means can  
hide large  
changes

# Determine driver of Tmean changes

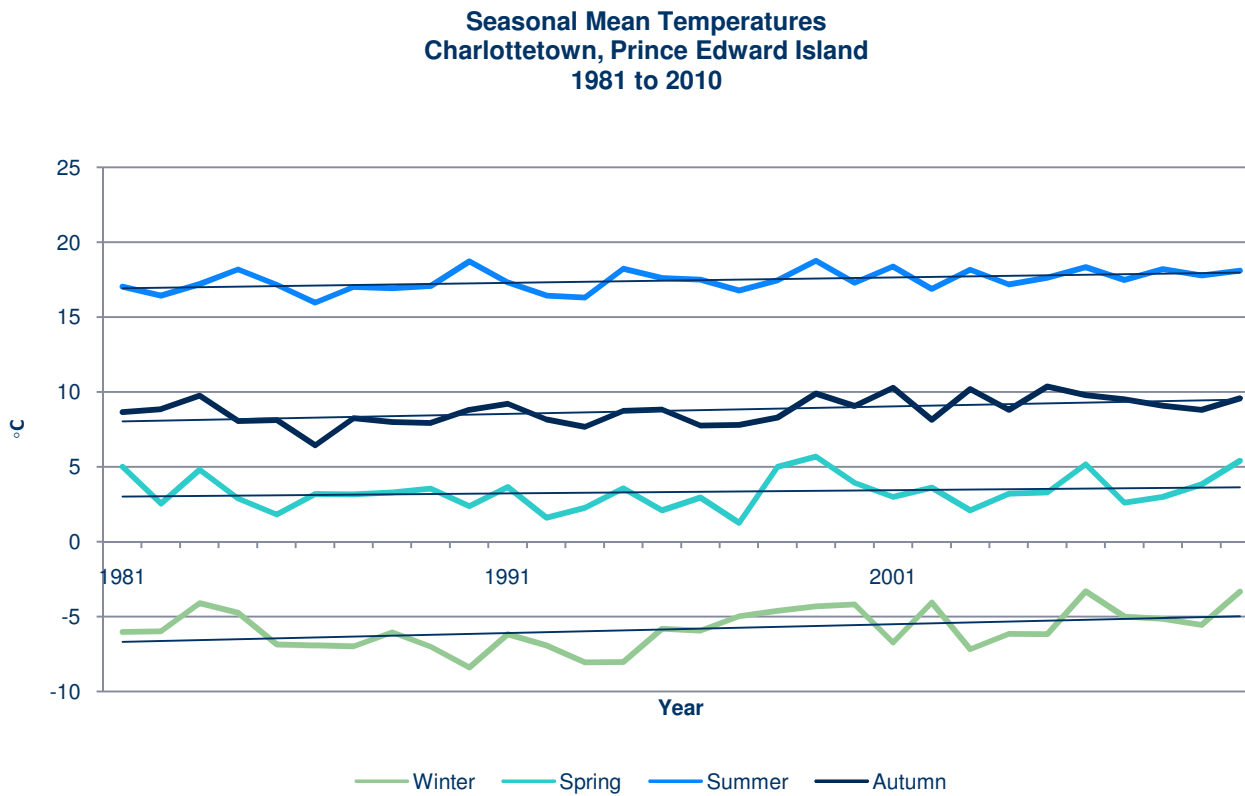
Annual Temperatures  
Charlottetown, Prince Edward Island  
1981 to 2010



Graph  
Tmean,  
Tmax  
and  
Tmin

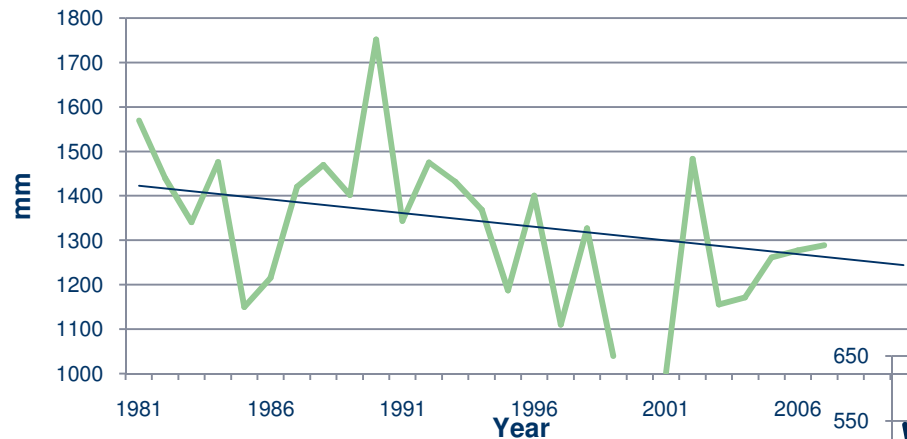
# Determine Seasonal Driver

Graph seasonal data to determine driver

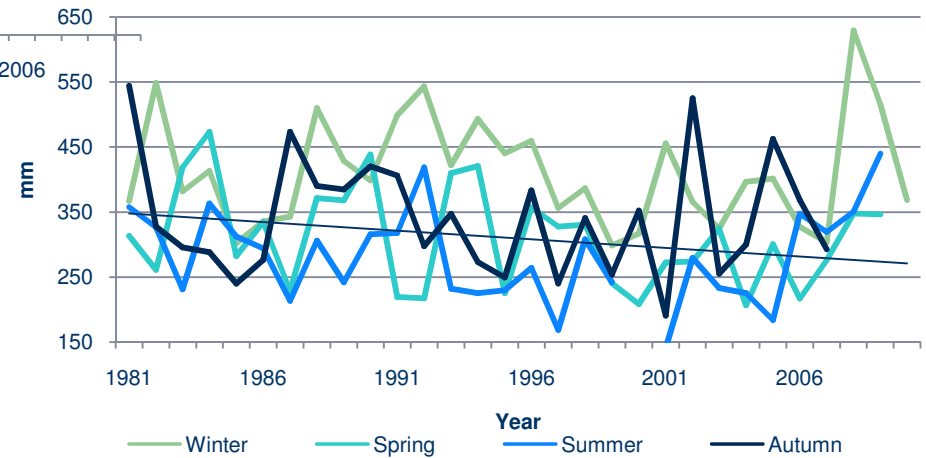


# Do same with Ptotal

**Annual Total Precipitation  
Charlottetown, Prince Edward Island  
1981 to 2010**



**Seasonal Total Precipitation  
Charlottetown, Prince Edward Island  
1981 to 2010**



## 2. Climate Indices

Ott, W. 1978. Environmental Indices: Theory and Practice

*Indices are used to summarize and present a complex set of multivariate (several variables at the same time) changes so that the results can be easily understood and used in policy decisions made by non-specialists in the field.*



# Over 400 Climate Indices

**ClimDex. 2001. ClimDex Version 3.1: User's Guide.**

[cccma.seos.uvic.ca/ETCCDMI/ClimDex/climdex-v1-3-users-guide.pdf](http://cccma.seos.uvic.ca/ETCCDMI/ClimDex/climdex-v1-3-users-guide.pdf)

**Frich, P., L. V. Alexander, P. Della-Manta, B. Gleason, M. Haylock, A. M. G. Klein Tank and T. Peterson. 2002. Observed coherent changes in climatic extremes during the second half of the twentieth century. *Clim. Res.*, 19:193-212.**

**European Climate Assessment. 2008. European Climate Assessment and Dataset. [eca.knmi.nl/](http://eca.knmi.nl/)**

**Klein Tank, A.M.G., J.B. Wijngaard, G.P. Können, R. Böhm, G. Demarée, A. Gocheva, M. Mileta, S. Pashiardis, L. Hejkrlik, C. Kern-Hansen, R. Heino, P. Bessemoulin, G. Müller-Westermeier, M. Tzanakou, S. Szalai, T. Pálsdóttir, D. Fitzgerald, S. Rubin, M. Capaldo, M. Maugeri, A. Leitass, A. Bukantis, R. Aberfeld, A.F.V. van Engelen, E. Forland, M. Miletus, F. Coelho, C. Mares, V. Razuvaev, E. Nieplova, T. Cegnar, J. Antonio López, B. Dahlström, A. Moberg, W. Kirchhofer, A. Ceylan, O. Pachaliuk, L.V. Alexander, and P. Petrovic, 2002. Daily dataset of 20th-century surface air temperature and precipitation series for the European Climate Assessment. *Int. J. Climatol.*, 22, 1441-1453.**

**Kiktev, D., D. Sexton, L. Alexander and C. Folland. 2003. Comparison of modelled and observed trends in indicators of daily climate extremes. *J. Clim.*, 16, 3560-71.**

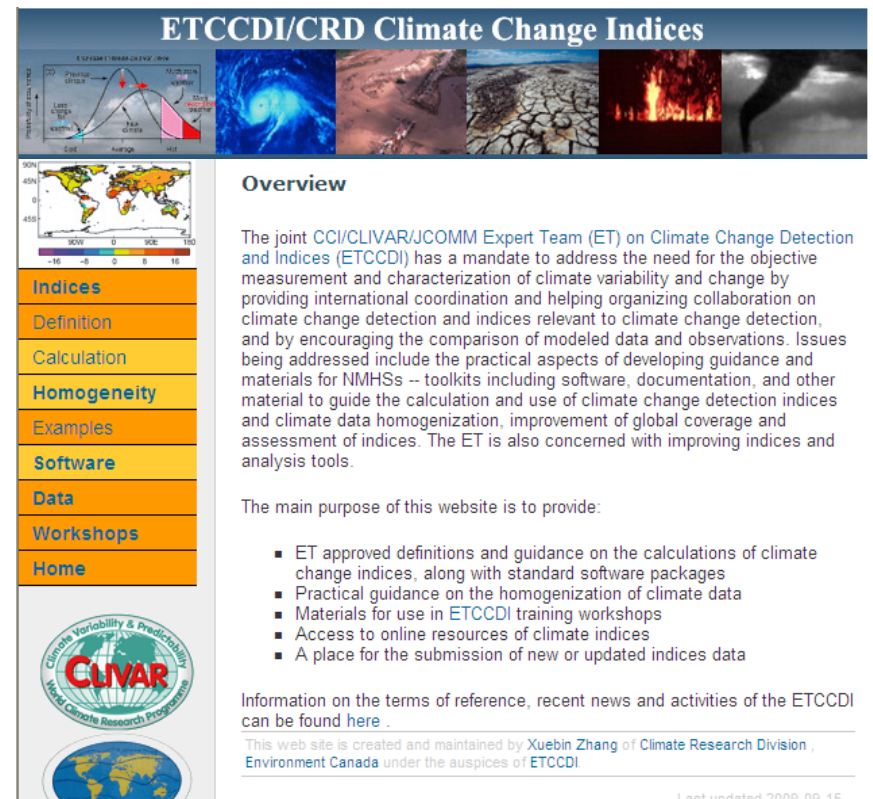
**Stardex. 2008. Statistical and Regional dynamical Downscaling of Extremes for European regions. [www.cru.uea.ac.uk/projects/stardex](http://www.cru.uea.ac.uk/projects/stardex)**

**Bonsal, B.R., X. Zhang, L.A. Vincent and W.D. Hogg. 2001. Characteristics of daily and extreme temperatures over Canada. *Journal of Climate* 14 :1959-1976.**

**Klein Tank, A.M.G. and G.P. Können, 2003. Trends in indices of daily temperature and precipitation extremes in Europe, 1946-99. *J. Climate*, 16, 3665-3680.**

# 3. International/IPCC/National Climate Indices

- International - WMO CCI/CLIVAR/JCOMM
- Xuebin Zhang Environment Canada
- Uses free statistical package “R”
- Does QC, homogeneity testing and creates 27 indices
- [cccma.seos.uvic.ca/ETCCDMI/](http://cccma.seos.uvic.ca/ETCCDMI/)



### ETCCDI/CRD Climate Change Indices

**Overview**

The joint CCI/CLIVAR/JCOMM Expert Team (ET) on Climate Change Detection and Indices (ETCCDI) has a mandate to address the need for the objective measurement and characterization of climate variability and change by providing international coordination and helping organizing collaboration on climate change detection and indices relevant to climate change detection, and by encouraging the comparison of modeled data and observations. Issues being addressed include the practical aspects of developing guidance and materials for NMHSs -- toolkits including software, documentation, and other material to guide the calculation and use of climate change detection indices and climate data homogenization, improvement of global coverage and assessment of indices. The ET is also concerned with improving indices and analysis tools.

The main purpose of this website is to provide:

- ET approved definitions and guidance on the calculations of climate change indices, along with standard software packages
- Practical guidance on the homogenization of climate data
- Materials for use in ETCCDI training workshops
- Access to online resources of climate indices
- A place for the submission of new or updated indices data

Information on the terms of reference, recent news and activities of the ETCCDI can be found [here](#).

This web site is created and maintained by Xuebin Zhang of Climate Research Division, Environment Canada under the auspices of ETCCDI.

Last updated 2009-09-15

# Intergovernmental Panel on Climate Change (IPCC)

## Extremes indices

The following ten "extremes indices" are described in Frich, P, Alexander LV, Della-Marta P, Gleason B, Haylock M, Klein Tank AMG, Peterson T, 2002: Observed coherent changes in climate extremes during the second half of the twentieth century, *Climate Research 19*: 193-212. Frich et al. describe these as "derived data in the form of annual indicator time series" and present them (as derived from observations) as a function of longitude, latitude, and year. See <http://www.cru.uea.ac.uk/cru/projects/stardex> for sample computer code and documentation.

**Table A4: Extremes indices (longitude, latitude, time:year) from Frich et al. (their Table 1).**

	output variable name	units	notes
1	fd	days	Total number of frost days (days with absolute minimum temperature < 0 deg C)
2	etr	K	Intra-annual extreme temperature range: difference between the highest temperature of any given calendar year ( $T_h$ ) and the lowest temperature of the same calendar year ( $T_l$ )
3	gsl	days	Growing season length: period between when $T_{day} > 5$ deg C for > 5 d and $T_{day} < 5$ deg C for > 5 d
4	hwdi	days	Heat wave duration index: maximum period > 5 consecutive days with $T_{max} > 5$ deg C above the 1961-1990 daily $T_{max}$ normal
5	tn90	%	Fraction (expressed as a percentage) of time $T_{min} > 90$ th percentile of daily minimum temperature, where percentiles are for the 1961-1990 base period.
6	r10	days	No. of days with precipitation greater than or equal to 10 mm d <sup>-1</sup>
7	cdd	days	Maximum number of consecutive dry days ( $R_{day} < 1$ mm)
8	r5d	kg m <sup>-2</sup>	Maximum 5 d precipitation total
9	sdi	kg m <sup>-2</sup> s <sup>-1</sup>	Simple daily intensity index: annual total / number of $R_{day}$ greater than or equal to 1 mm d <sup>-1</sup>
10	r95t	%	Fraction (expressed as a percentage) of annual total precipitation due to events exceeding the 1961-1990 95th percentile

# National Gachon Indices of Climate Extremes

18 indices for extreme temperature and precipitation for Canadian regions

- must represent regional Canadian climate conditions;
- must be relevant to climate change impact studies; and
- must be adapted to the main characteristics of climate conditions at the regional scale.

“providing a good mix of information – precipitation indices characterize the frequency, intensity, length of dry spells, magnitude and occurrence of wet extremes while temperature indices refer to variability, season lengths and cold and warm extremes in terms of magnitude, occurrence and duration.”

# Gachon Indices of Climate Extremes

INDEX	DEFINITION	UNIT	TIME SCALE
Frequency	Percentage of wet days (Threshold=1 mm)	% days	Season
Intensity	Simple daily intensity index : sum of daily precip/number of wet days	mm/wet d	Season
Extremes	Maximum number of consecutive dry days (<1 mm)	days	Season
Magnitude	Maximum 3-days precipitation total	mm	Season
and	90th percentile of rainday amount ( Threshold=1 mm)	mm/days	Season
Occurrence	Percentage of days Prec>90th percentile (61-90 based period)	% days	Season

# Gachon Indices of Climate Extremes 2

Daily variability	Mean of diurnal temperature range	°C	Season
	Percentage of days with freeze and thaw cycle (Tmax>0°C, Tmin<0°C)	% days	Month
Season length	Frost season length :Tday<0°C more than 6 d.and Tday>0°C more than 6 d.	days	Year
	Growing season length :Tday>5°C more than 6d.and Tday<5°C more than 6 d.	days	Year
Extremes	Sum of sequences > 3 days where Tmin< daily Tmin normal - 5°C	days	Winter
cold & hot	Sum of sequences > 3 days where Tmax> daily Tmax normal + 3°C	days	summer
Extremes	10th percentile of daily Tmax	°C	Season
Magnitude	90th percentile of daily Tmax	°C	Season
and	10th percentile of daily Tmin	°C	Season
	90th percentile of daily Tmin	°C	Season
Occurrence	Percentage of days Tmax>90th percentile (61-90 based period)	% days	Season
	Percentage of days Tmin<10th percentile (61-90 based period)	% days	Season

## 4. Calculating Climate Indices

### An example – 3 day Max P

1. Create new worksheet 3 day Max P
2. Select Date and Ptotal columns from 30-year climate dataset
3. Cut and Paste into new worksheet

# Identify max for each season

Use template to fill

The screenshot shows a Microsoft Excel spreadsheet titled "Charlottetown A Climate.xlsx". The spreadsheet contains a table with the following columns: Date/Time, Total Prec, 3-day sum, Monthly, 3-dayMax, Seasonal, 3-dayMax Annual, and 3-dayMax. The data spans from 1981 to 2010. The status bar at the bottom indicates an average of 1079.831208, a count of 11983, and a sum of 12802478.8. The system tray shows the date as 13/04/2012 and the time as 2:07 PM.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Date/Time	Total Prec	3-day sum	Monthly	3-dayMax	Seasonal	3-dayMax	Annual	3-dayMax							
2	01/01/1981	0	10.7	Jan-81	29.3	Winter 1981	1981	80.1								
3	02/01/1981	7.7	10.7	Feb-81	9.4	Spring 1981	33.8	1982	90.6							
4	03/01/1981	3	3	Mar-81	33.8	Summer 1981	80.1	1983	60.3							
5	04/01/1981	0	0	Apr-81	33.1	Autumn 1981	76.3	1984	85							
6	05/01/1981	0	1.2	May-81	24	Winter 1981	46.8	1985	60.2							
7	06/01/1981	0	1.2	Jun-81	80.1	Spring 1981	90.6	1986	61.6							
8	07/01/1981	1.2	1.2	Jul-81	40.7	Summer 1981	44.3	1987	76.2							
9	08/01/1981	0	28.1	Aug-81	12.9	Autumn 1981	46.6	1988	66.4							
10	09/01/1981	0	29.3	Sep-81	75.4	Winter 1981	24.2	1989	81.7							
11	10/01/1981	28.1	29.3	Oct-81	70	Spring 1981	60.3	1990	83.6							
12	11/01/1981	1.2	28.7	Nov-81	76.3	Summer 1981	47.2	1991	71.2							
13	12/01/1981	0	27.5	Dec-81	40.9	Autumn 1981	39.8	1992	83.8							
14	13/01/1981	27.5	27.5	Jan-82	46.8	Winter 1982	45.8	1993	54.2							
15	14/01/1981	0	0	Feb-82	35.6	Spring 1982	59.9	1994	47.6							
16	15/01/1981	0	2.6	Mar-82	19	Summer 1982	85	1995	60.7							
17	16/01/1981	0	21.9	Apr-82	90.6	Autumn 1982	44.5	1996	64.7							
18	17/01/1981	2.6	21.9	May-82	32.5	Winter 1982	31.6	1997	41.8							
19	18/01/1981	19.3	20.3	Jun-82	34.8	Spring 1982	30.2	1998	116.1							
20	19/01/1981	0	1	Jul-82	44.3	Summer 1982	60.2	1999	72.2							
21	20/01/1981	1	1.8	Aug-82	43.8	Autumn 1982	39.2	2000	61.3							
22	21/01/1981	0	2.5	Sep-82	46.6	Winter 1982	27.5	2001	72.4							
23	22/01/1981	0.8	2.5	Oct-82	43.6	Spring 1982	59.5	2002	74.8							



# View data as chart

