



Canada's Changing Climate Report

ADVANCING OUR KNOWLEDGE FOR ACTION



Government
of Canada

Gouvernement
du Canada

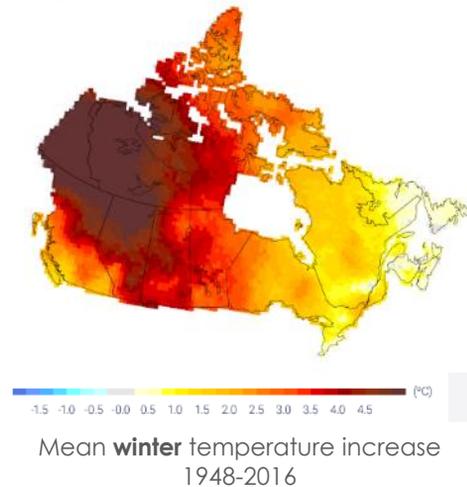
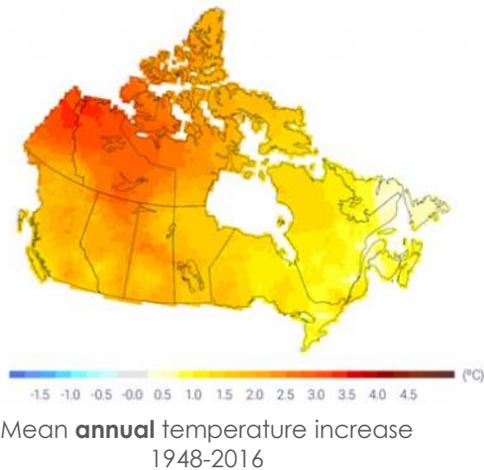
Canada



Both past and future warming in Canada is, on average, about double the magnitude of global warming.

— Canada's Changing Climate Report

- Canada has warmed by 1.7°C between 1948 and 2016, while average winter temperature has increased by 3.3°C
- Warming has not been uniform across Canada. Northern Canada has warmed by 2.3 °C, about three times global warming.
- We understand fully why warming is enhanced over Canada.
- The observed warming is primarily due to human activities and is effectively irreversible.



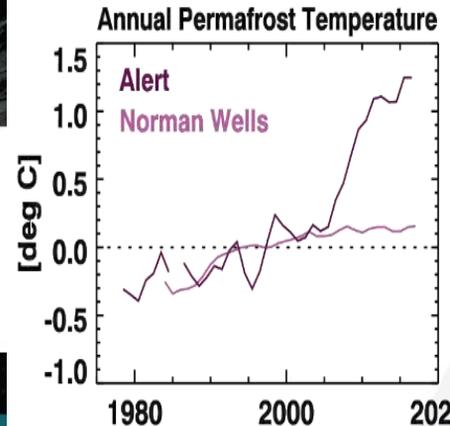


The effects of widespread warming are evident in many parts of Canada and are projected to intensify in the future.

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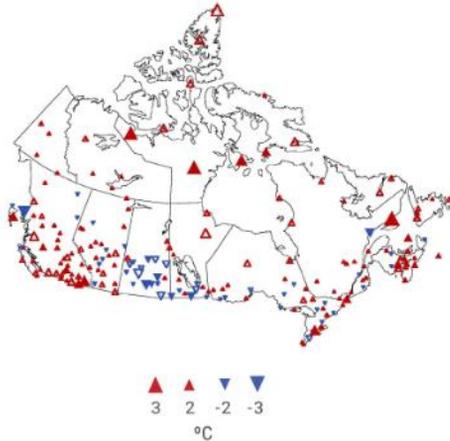
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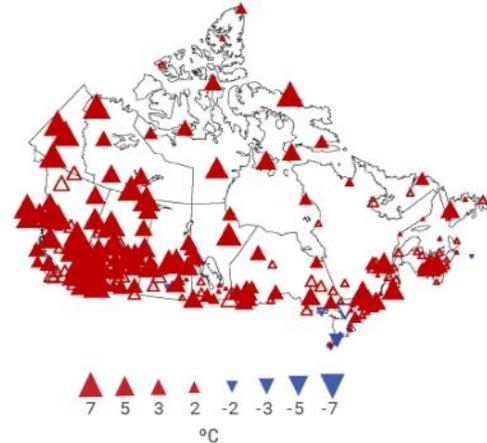
- Across Canada, we are experiencing:
 - more extreme heat/less extreme cold
 - less snow and ice cover
 - thinning glaciers
 - warmer and more acidic oceans
 - increased precipitation
 - earlier spring peak streamflow
 - thawing permafrost
 - rising sea level
- Because some further warming is unavoidable, these observed trends will continue.

More extreme heat and less extreme cold observed, with longer growing seasons

Highest daily maximum (°C)



Lowest daily minimum (°C)



- The annual highest daily maximum temperature, averaged over Canada, increased by 0.61°C between 1948 and 2016
- The annual lowest daily minimum temperature, averaged over Canada, increased by 3.3°C between 1948 and 2016
- An increase in growing season length of about 15 days between 1948 and 2016 has been observed.

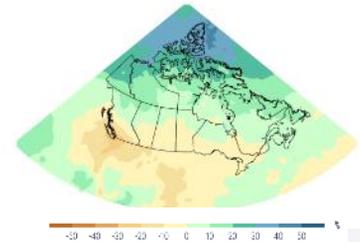
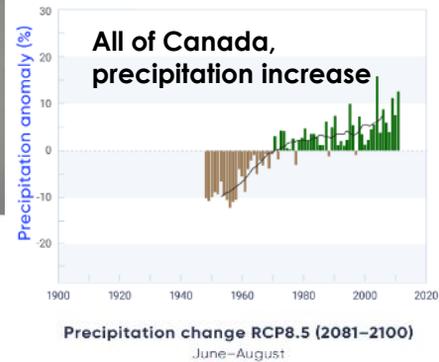


Precipitation is projected to increase for most of Canada, on average, although summer rainfall may decrease in some areas.

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Canada



- Precipitation has increased in many parts of Canada, with a shift toward less snowfall and more rainfall.
- Annual and winter precipitation is projected to increase everywhere in Canada over the 21st century.
- Reductions in summer rainfall are projected for parts of southern Canada under a high emission scenario.

The seasonal availability of freshwater is changing with an increased risk of water supply shortages in summer.

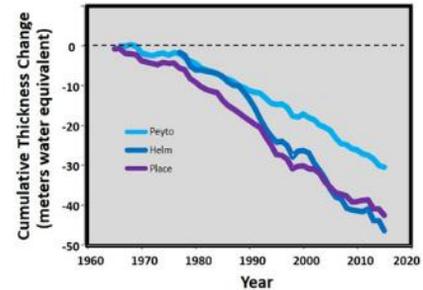
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GLACIER CUMULATIVE THICKNESS



- Warmer winters and earlier snowmelt will combine to produce higher winter streamflows.
- Smaller snowpacks and loss of glacier ice this century will combine to produce lower summer streamflows.
- Warmer summers will increase evaporation of surface water.



Canadian areas of the Arctic and Atlantic Oceans have experienced longer and more widespread sea ice-free conditions.

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Canada

Schematic of the last ice area of the Arctic Ocean



- Canadian Arctic marine areas are projected to have extensive ice-free periods during summer by mid-century.
- The last area with summer sea ice is projected to be within and north of the Canadian Arctic Archipelago.

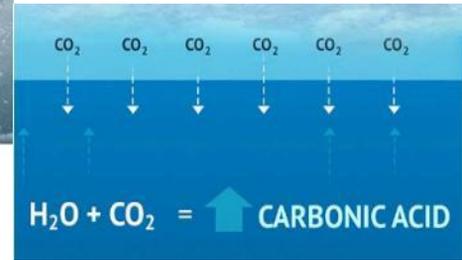


Oceans surrounding Canada have warmed, become more acidic, and less oxygenated, consistent with observed global ocean changes over the past century.

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Canada



- Ocean warming and loss of oxygen will intensify with further emissions of all greenhouse gases.
- Ocean acidification will increase in response to additional carbon dioxide emissions.
- These changes threaten the health of marine ecosystems.



Coastal flooding is expected to increase in many areas of Canada due to local sea-level rise.

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Local sea level changes are from global sea level rise and land uplift and sinking – a response to the retreat of the last great ice sheet

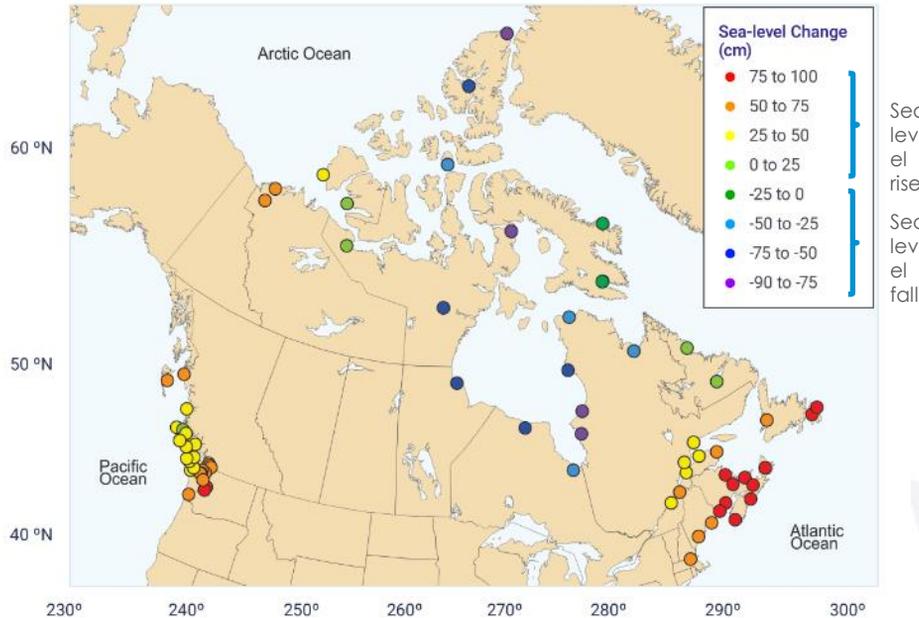


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- Local sea level is projected to rise and increase flooding, along most of the Atlantic and Pacific coasts of Canada and the Beaufort coast in the Arctic.
- The loss of sea ice in Arctic and Atlantic Canada further increases the risk of damage to coastal infrastructure and ecosystem due to larger storm surges and waves.

Global mean sea level is projected to rise, but along Canada's coastlines, sea level will rise in some places, fall elsewhere



End-of-century projected relative (local) sea-level change under a high emission scenario, relative to 1986-2005 reference period



A warmer climate will intensify some weather extremes in the future.

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HEAT WAVES



WILDLAND FIRES



- Extreme hot temperatures will become more frequent and more intense. This will increase the severity of heatwaves, and contribute to increased drought and wildfire risks.
- While inland flooding results from multiple factors, more intense rainfalls will increase urban flood risks.

Climate impacts: Water Quality

- **Hydro-climatic changes** cause increased input of sediments, nutrients and contaminants to aquatic systems.
- **Shifts in terrestrial vegetation** change the balance of carbon and nutrients available to freshwater food webs.
- Reduces ice cover, warms water, and increasing evaporation results **in lower water levels.**
- Impacts **ecosystem health** related to the frequency, timing and intensity of storms on nutrient and contaminant loading resulting in increased **algal blooms and hypoxia in some large lakes.**

Climate impacts: Invasive Species

- Climate change is predicted to **increase the spread of pathogens in wild and domestic birds**, including avian malaria, avian influenza and Newcastle disease.
- Warmer winter temperatures may result in greater negative impacts of **forest insect pests, such as mountain pine beetle, gypsy moth and emerald ash borer.**
- **Lower water levels** could benefit invasive plants such as Phragmites or Purple loosestrife.
- **Non-native fish**, such as **Sea Lamprey** and the **Northern Snakehead**, could thrive, preying on or competing for food resources with native fish species.

**Our future:
choices matter**

The rate and magnitude of climate change under high versus low emission scenarios project two very different futures for Canada.

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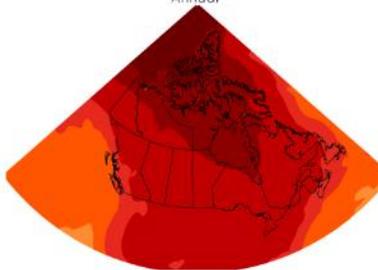
**Low global emissions
limit warming to additional
~2C by mid-century**

Temperature change RCP2.6 in 2081-2100
Annual



**High global emissions
large warming, reaching
>6C by late century**

Temperature change RCP8.5 in 2081-2100
Annual



Annex:

- Future changes in return periods: Temperature and Precipitation
- Key messages – Extremes
- Paris Agreement warming context

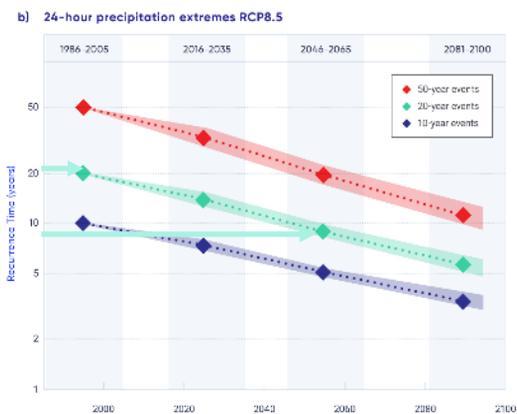
Future increases in the frequency and intensity of extreme events

Change in temperature extremes High emission scenario



- A current 1 in 20-yr hot extreme will become a once in 2-year event by mid-century under a high emission scenario (a ten-fold increase in frequency)

Change in precipitation extremes High emission scenario



- A current 1 in 20-yr rainfall extreme will become a once in 10-yr event by mid-century under the high emission scenario (a two-fold increase in frequency)

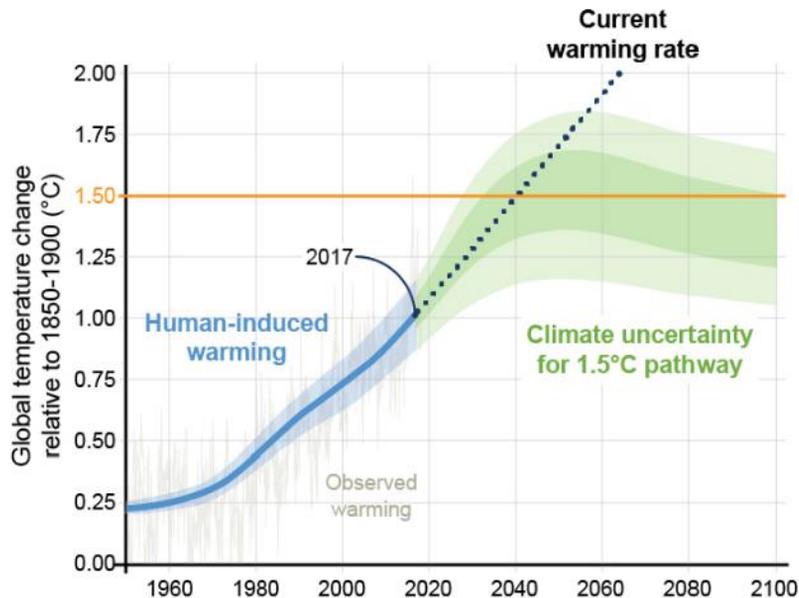
Take home messages on extremes

- The magnitude of future warming will be determined by the extent of future GHG (principally, CO₂) emissions or mitigation
- Across Canada, we have already observed increases in the hottest temperatures and larger increases in the coldest temperatures.
- Substantial future changes are projected in temperature extremes. There will be more hot and fewer cold temperature extremes.
- Warmer temperatures are accompanied by an increase in atmospheric moisture, which increases extreme precipitation.
- Although we cannot focus on individual locations, we can use robust large-scale projections and theoretical understanding to understand future changes in locally-relevant climate extremes.

The Paris Agreement goal is to limit global warming to well below 2°C, and aim for 1.5°C

How close are we to 1.5°C?

- In 2017, human activities are estimated to have caused global warming of approximately 1°C above preindustrial. At the current warming rate, global warming is likely to reach 1.5°C by around 2040.



CANADIAN CENTRE FOR CLIMATE SERVICES

Provides Canadians with information and support to consider climate change in their decisions

Climate services include:

Increasing awareness and access to climate data and information

Providing training and guidance on using climate data

Engaging with users to understand needs

Developing new products by collaborating with experts and users

The CCCS helps answers questions like:

The climate is changing in my region... what can I expect in 10, 50, 100 years?

Will it be cold enough for a winter road in this location in 50 years?

What climate information is available to help my community plan for climate change?

CANADIAN CENTRE FOR CLIMATE SERVICES



Library of climate resources

Datasets, tools, guidance and related resources



Climate information basics

Climate change concepts, trends and role of climate information in decision-making



Climate Services Support Desk

1-833-517-0376
Get help from our climate experts to find, understand and use climate information



Display and download climate data

View selected climate datasets on maps or download data



About the Canadian Centre for Climate Services

The climate is changing. Understand how. We're here to help.

Featuring: changing temperature

- Learn more about [trends and projections in temperature change](#)
- View the [Canadian Drought Monitor](#) from Agriculture and Agri-Food Canada.
- Explore the Prairie Climate Centre's [Climate Atlas of Canada](#)

INCREASING TEMPERATURE IN CANADA

Average temperature in Canada has increased by 1.7°C



www.canada.ca/climate-services

Phone: 1-833-517-0376

Email: info.cccs-ccsc@canada.ca

CANADIAN
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JOINT DELIVERY OF SERVICES TO PROVIDE LOCALLY RELEVANT INFORMATION AND EXPERTISE

THE CANADIAN CENTRE FOR CLIMATE SERVICES



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CLIMATE SERVICES SUPPORT DESK

The Climate Services Support Desk provides support to meet individual needs:

- Helps users find the right datasets and information
- Provides guidance for understanding and using data
- Draws on a network of experts to respond to inquiries



The Climate Services Support Desk can be reached by:



Phone: 1-833-517-0376



Email: info.cccs-ccsc@canada.ca



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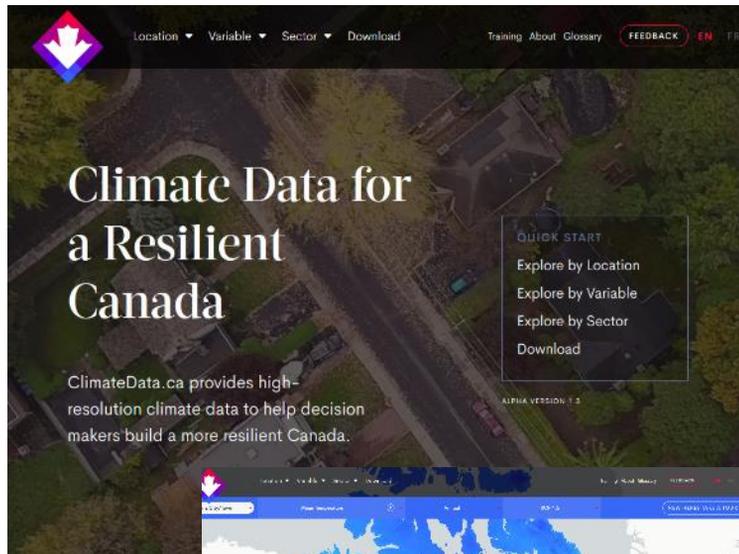
High-resolution climate data to help decision makers build a more resilient Canada

Climate Data

- 10x10km resolution climate data
- Temperature and precipitation variables and climate indices
- Observed climate normals and daily data download
- IDF curves

Helpful resources

- Location-based summaries
- Local and national scale charts and maps
- Ability to compare emission scenarios
- Custom heat wave analysis tool
- Sector modules with tailored case studies
- Training modules



ENGAGEMENT WITH INDIGENOUS COMMUNITIES

- CCCS has begun engaging with First Nation, Inuit, and Métis communities to better understand their unique climate service needs
- Our main engagement with First Nations (FN) to date has been through the **First Nations-Canada Joint Committee on Climate Action (JCCA)** under the Pan-Canadian Framework on Clean Growth and Climate Change
 - Have shared more about our products and services
 - Expressed our interest in feedback to tailor our services to better meet the needs of FN communities
- CCCS has also attended FN workshops and meetings, valuable opportunities to build relationships and seek input

TAILORING PRODUCTS FOR INDIGENOUS AUDIENCES

- Communities engaged to date have indicated they prefer graphical, clear climate summaries for their location
- We have also learned that communities would like training and assistance to translate climate data and information into key risks
- CCCS is working to develop pilot community summaries which would summarize the future climate conditions by location in an easy-to-understand format
- We are interested in hearing more FN perspectives on climate service needs, and how best to engage with your communities

CANADIAN CENTRE FOR CLIMATE SERVICES: CONTACT INFORMATION

Website:

English:

www.canada.ca/climate-services

Français:

www.canada.ca/services-climatiques

Climate Services Support Desk:



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