



Environment and  
Climate Change Canada

Environnement et  
Changement climatique Canada

Canada



# Weather Patterns in Ontario

**Winter Woodlot Conference  
Kemptville, Feb. 22, 2016**

**Peter Kimbell  
Warning Preparedness Meteorologist**



## Environment and Climate Change Canada



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### Climate Change

The Science of Climate  
Change

Canada's Greenhouse  
Gas Emissions

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Emission Regulations

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## Climate Change

### The science compels us to act

The scientific evidence is clear: climate change is one of the greatest threats of our time. From increased incidences of droughts, to coastal flooding, to the expanding melt of sea ice in our Arctic, the widespread impacts of climate change compel Canada to take strong action now. Learn more:

- [Facts on Climate Change](#)
- [What You Can do to Help](#)

### The Government of Canada will take strong action in partnership with provinces and territories

The Government of Canada will provide national leadership and join with the provinces and territories to take action on climate change, put a price on carbon, and reduce carbon pollution. Together, we will attend the Paris climate conference, and within 90 days will formally meet to establish a pan-Canadian framework for combatting climate change. Learn more:

### Highlights

[Canada's Way Forward on Climate Change Provincial and Territorial Action](#)

# Climate Change Science & Research



Government of Canada  
Gouvernement du Canada

Canada.ca | Services | Departments | Français

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Climate Research Activities

Climate Trends and Variations

About Climate Trends and Variations Bulletin

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## Climate Trends and Variations

Much of Canadian economic and social activity is climate dependent. Understanding how Canada's climate is changing, in the context of global climate change, is important for developing adaptive responses. The Climate Trends and Variations Bulletin (CTVB) helps communicate to Canadians how Canada's climate has changed over the recent past and longer, over the period for which Environment Canada has climate observations.

The CTVB describes climate variability through maps of current and past departures from the mean (the 30-year average 1961-1990) temperature and precipitation conditions, both seasonally and annually. This approach provides visualization of the extent to which temperature and precipitation vary above and below longer term average conditions. Maps are presented for each season and year. The data are then analyzed to see if there are longer terms trends detectable against this backdrop of climate variability for Canada as a whole, and for 11 climate regions. This information is presented as graphs with trend lines to assess climate change over the period of record, starting in 1948 when nation-wide records became available.

The CTVB uses [homogenized and adjusted station data](#) for temperature and precipitation. These data have been adjusted to account for discontinuities in the data from non-climatic factors such as changes in observation methods or station location. For a brief description of the data and procedures used in the CTVB reports click [here](#).

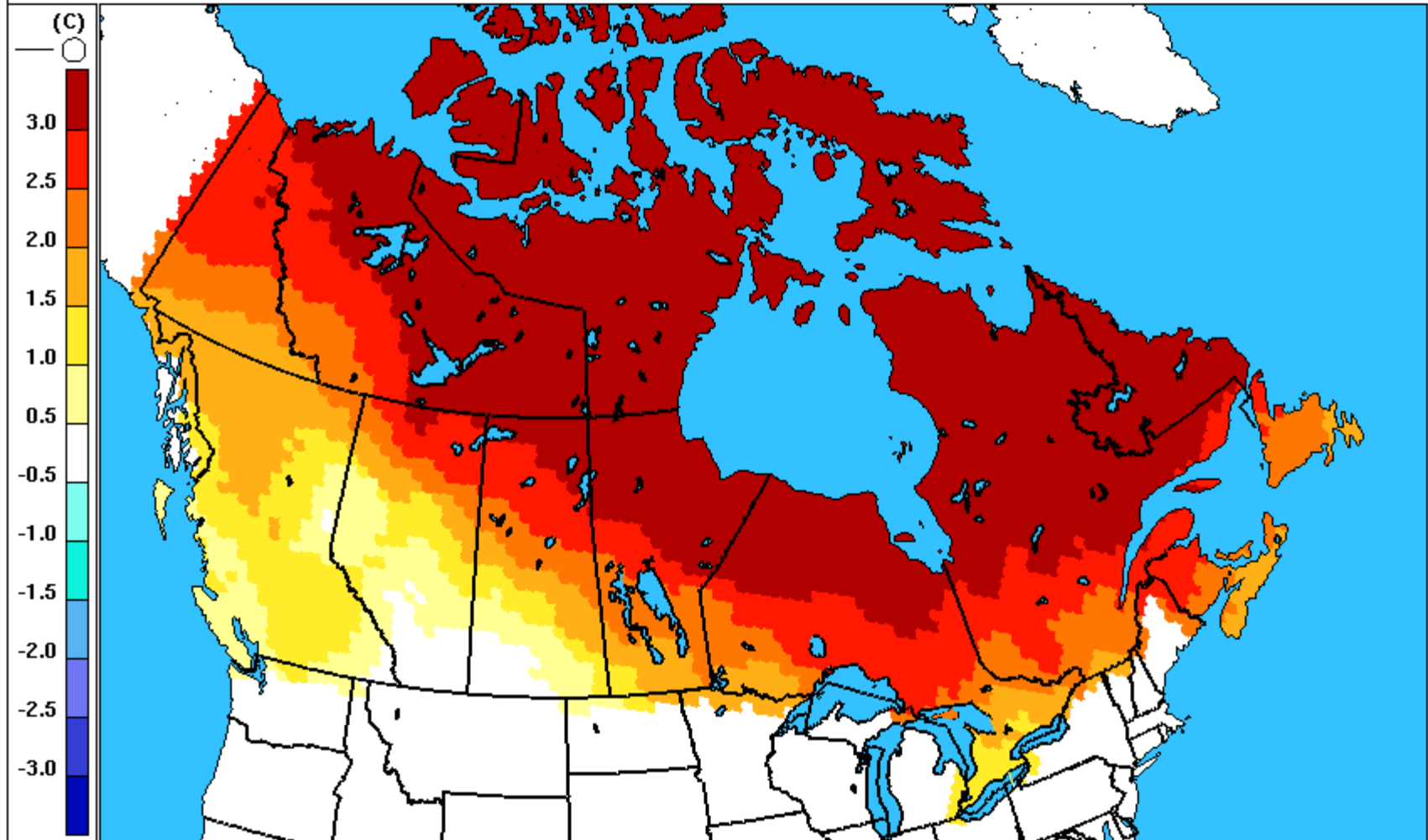
# 2010 – temperature distribution

Anomaly of Tmean, 2010-YEAR  
Anomalie de Tmoy, 2010-YEAR



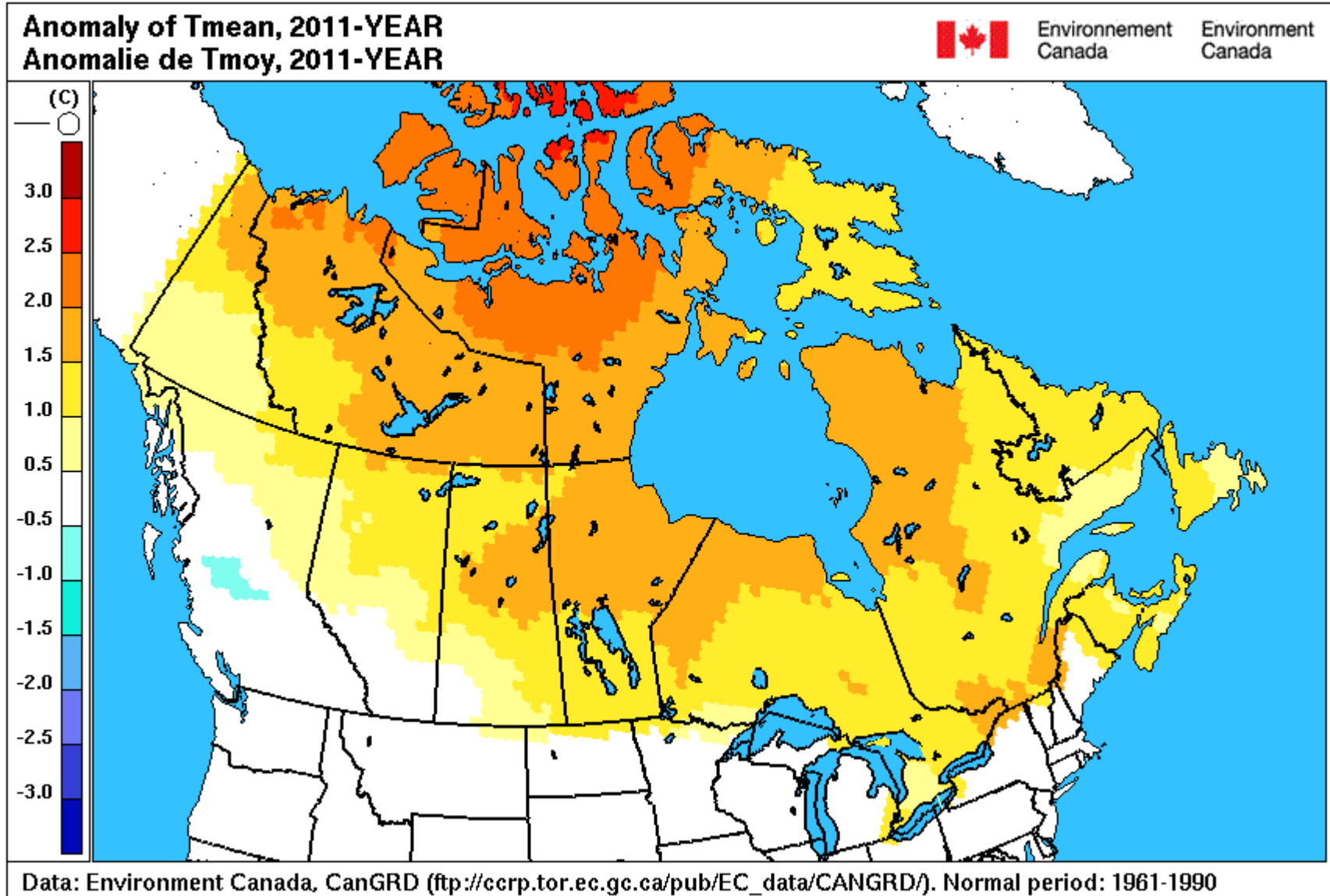
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Data: Environment Canada, CanGRD ([ftp://ccrp.tor.ec.gc.ca/pub/EC\\_data/CANGRD/](ftp://ccrp.tor.ec.gc.ca/pub/EC_data/CANGRD/)). Normal period: 1961-1990

# 2011 – temperature distribution



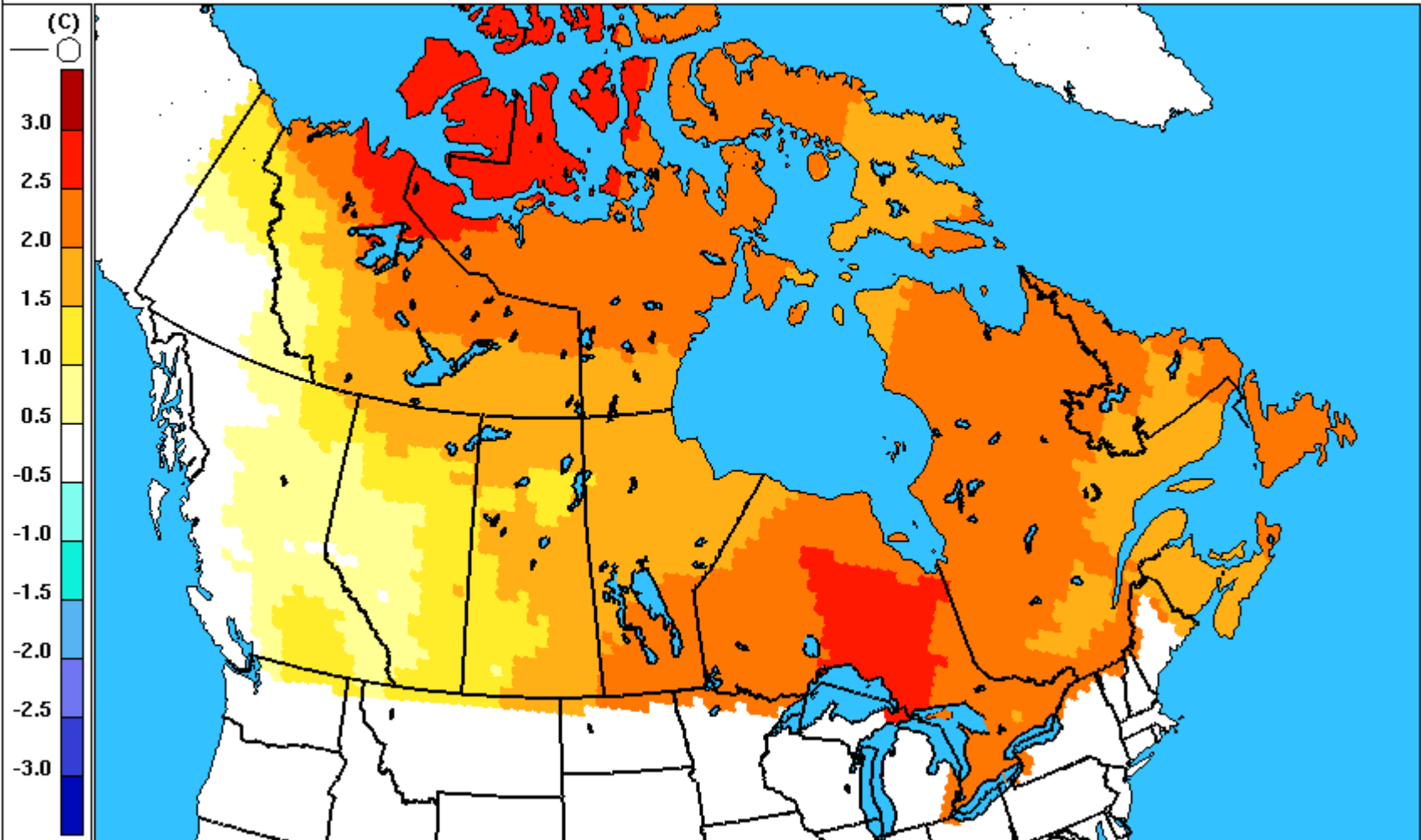
# 2012 – temperature distribution

Anomaly of Tmean, 2012-YEAR  
Anomalie de Tmoy, 2012-YEAR



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Data: Environment Canada, CanGRD ([ftp://ccrp.tor.ec.gc.ca/pub/EC\\_data/CANGRD/](ftp://ccrp.tor.ec.gc.ca/pub/EC_data/CANGRD/)). Normal period: 1961-1990

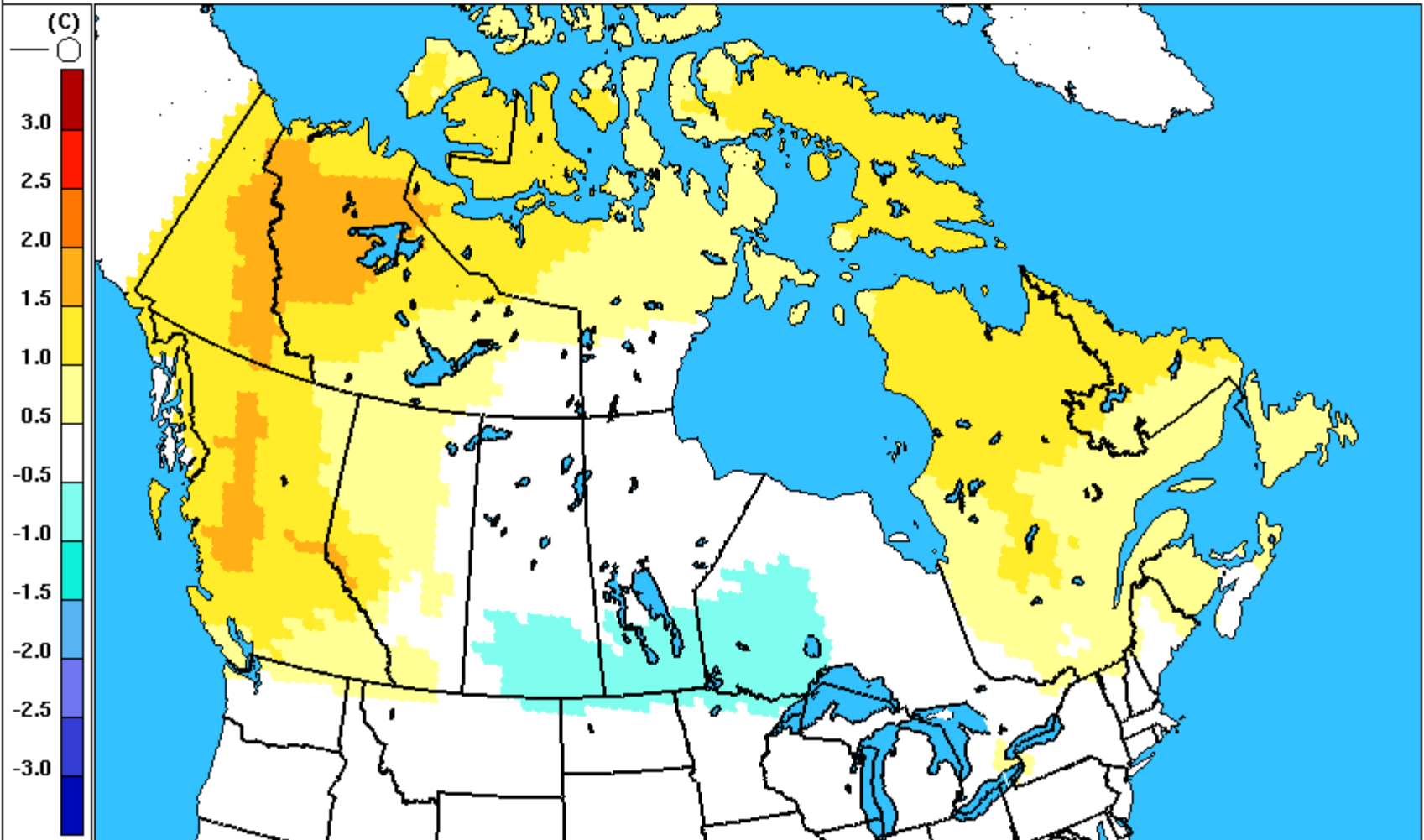
# 2013 – temperature distribution

Anomaly of Tmean, 2013-YEAR  
Anomalie de Tmoy, 2013-YEAR



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Data: Environment Canada, CanGRD ([ftp://ccrp.tor.ec.gc.ca/pub/EC\\_data/CANGRD/](ftp://ccrp.tor.ec.gc.ca/pub/EC_data/CANGRD/)). Normal period: 1961-1990

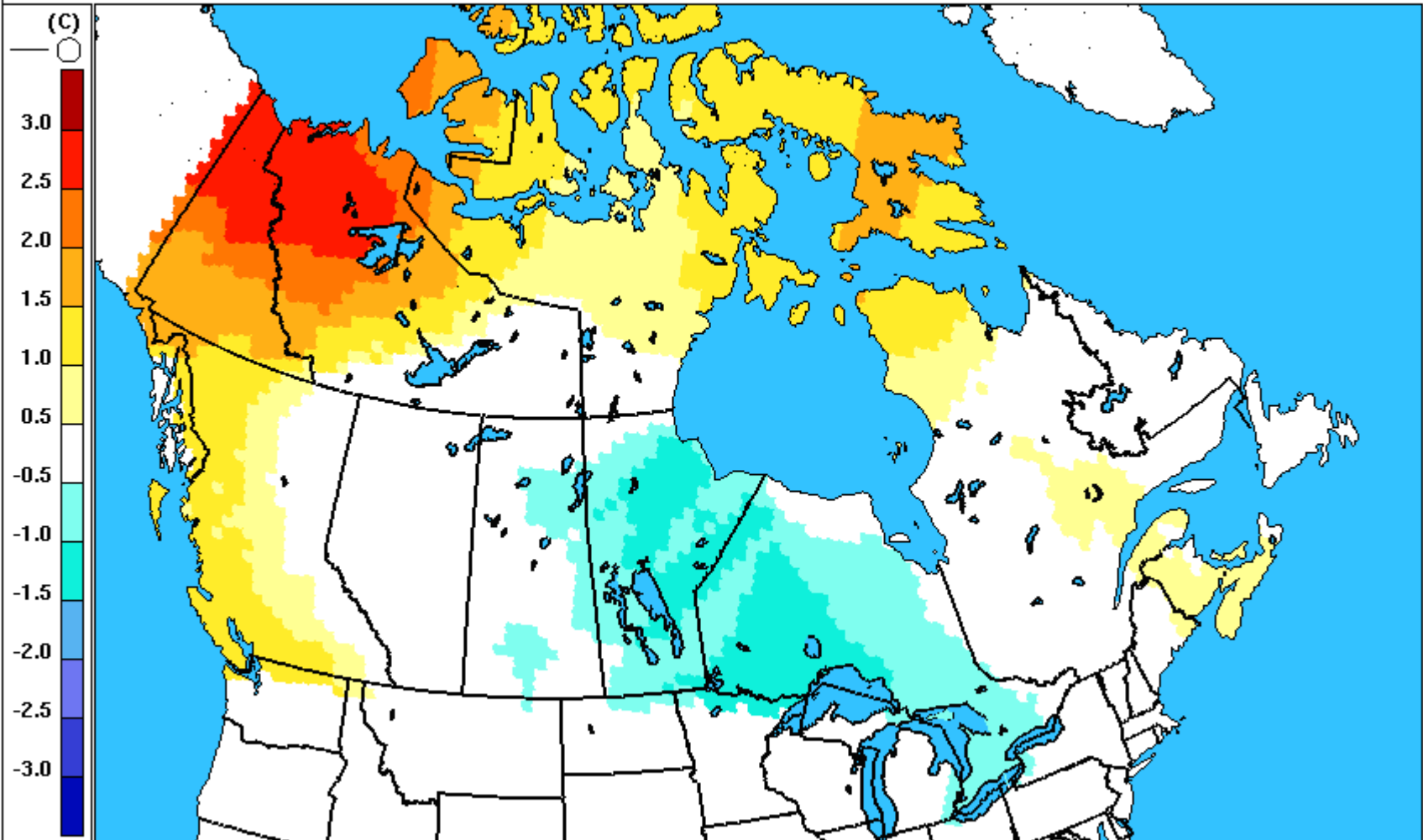
# 2014 – temperature distribution

Anomaly of Tmean, 2014-YEAR  
Anomalie de Tmoy, 2014-YEAR



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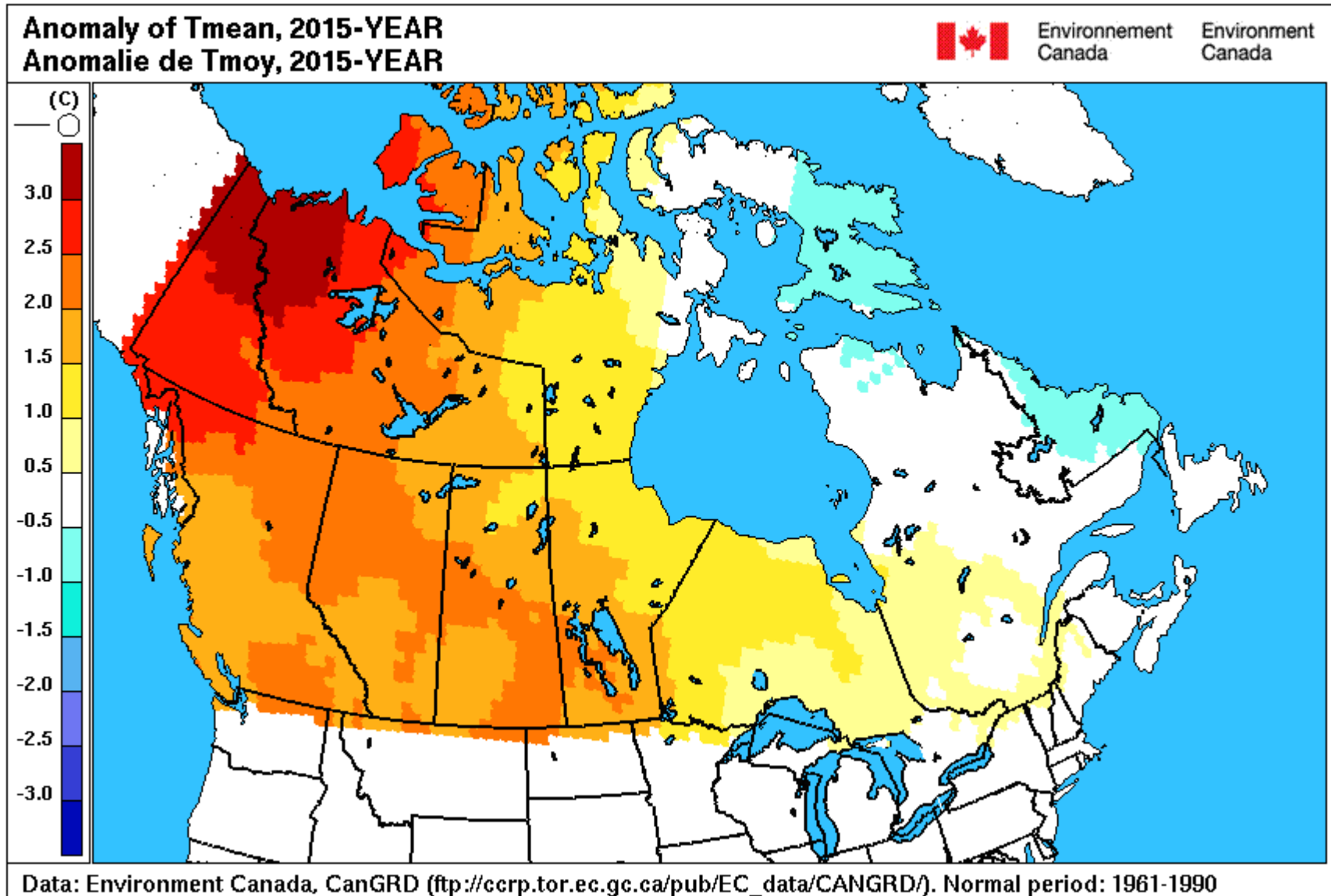
Environnement  
Canada



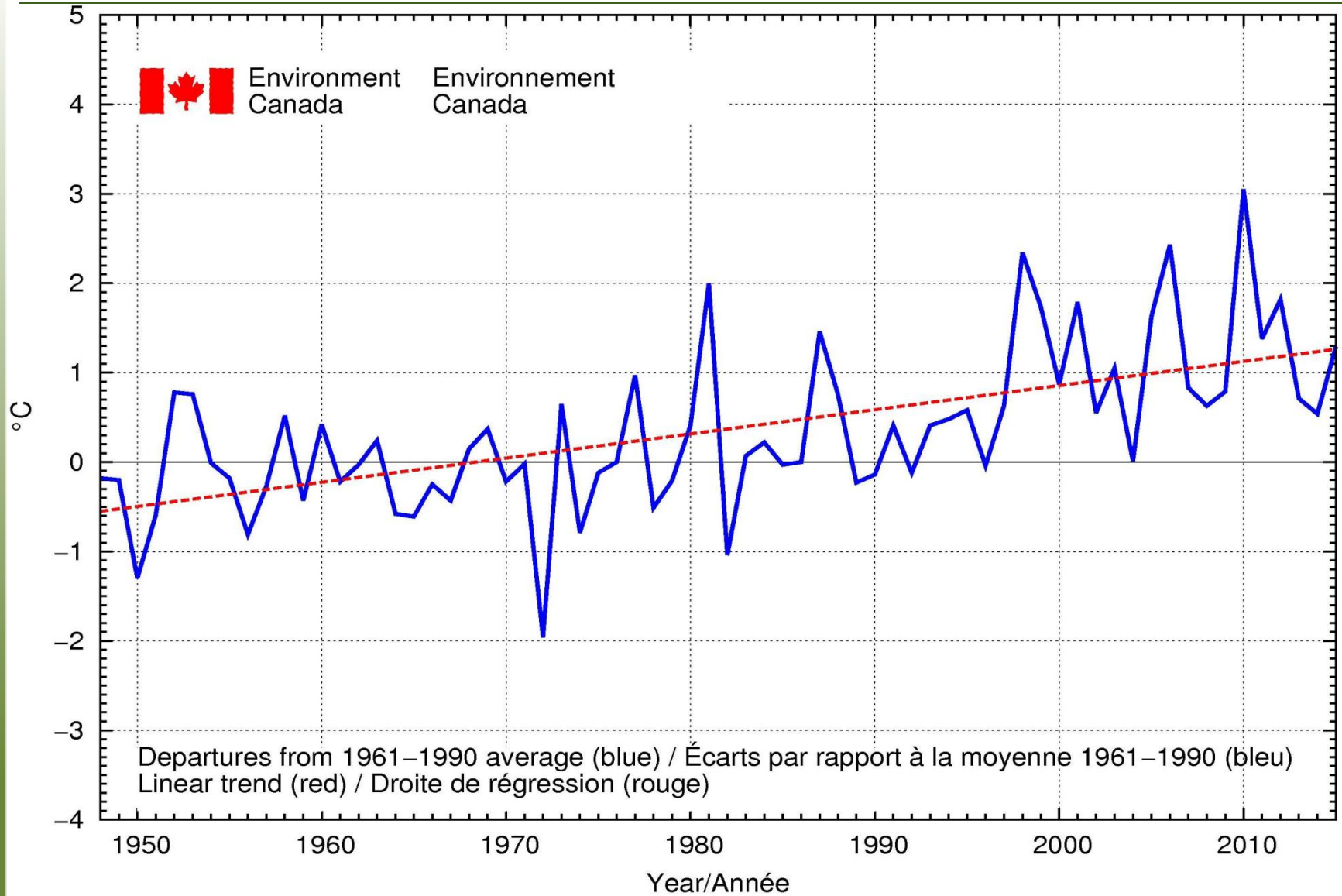
Data: Environment Canada, CanGRD ([ftp://ccrp.tor.ec.gc.ca/pub/EC\\_data/CANGRD/](ftp://ccrp.tor.ec.gc.ca/pub/EC_data/CANGRD/)). Normal period: 1961-1990



# 2015 – temperature distribution



# Temperature Trend Line since 1948



# And by season, 1948-2012

1 JUNE 2015

VINCENT ET AL.

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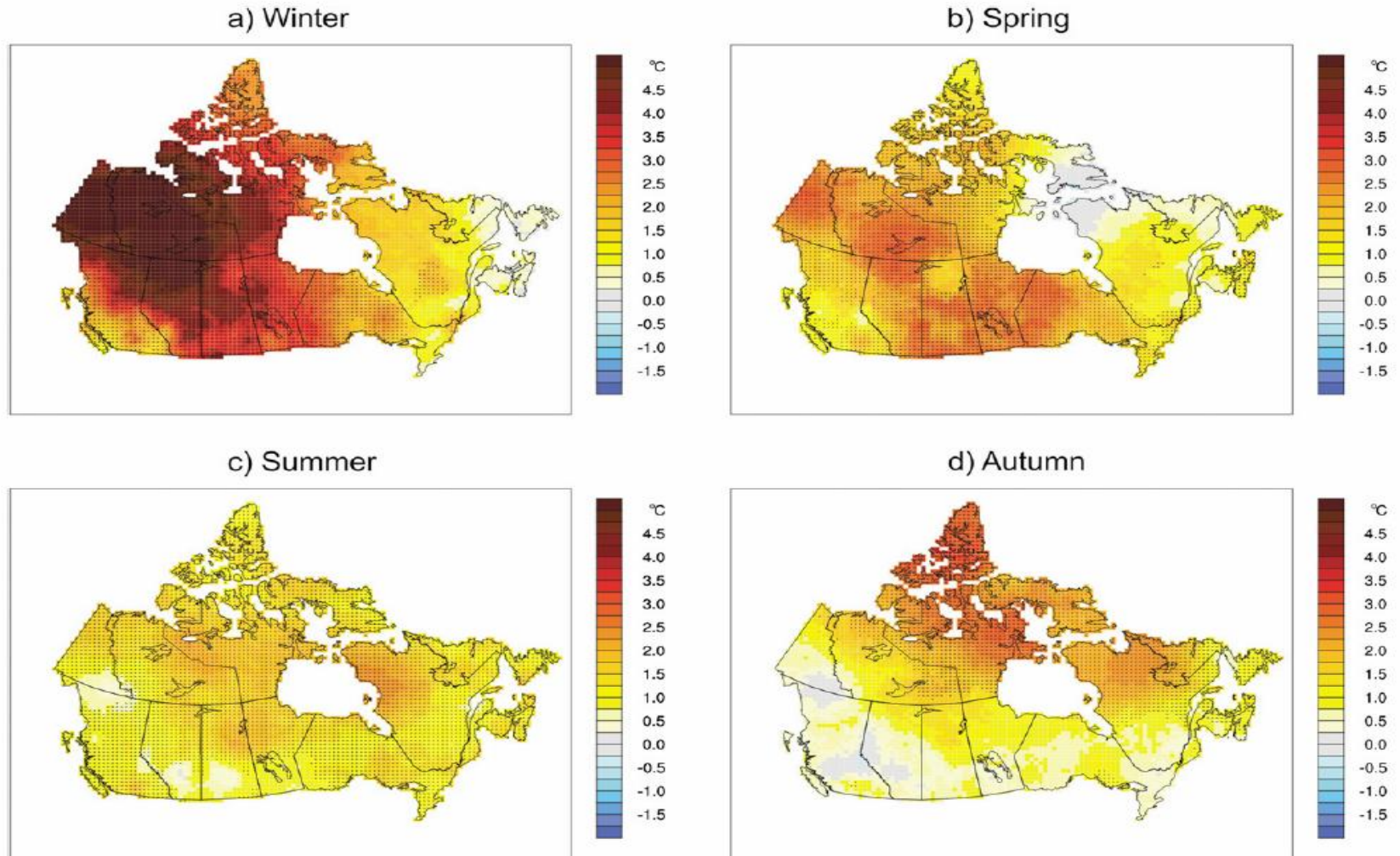
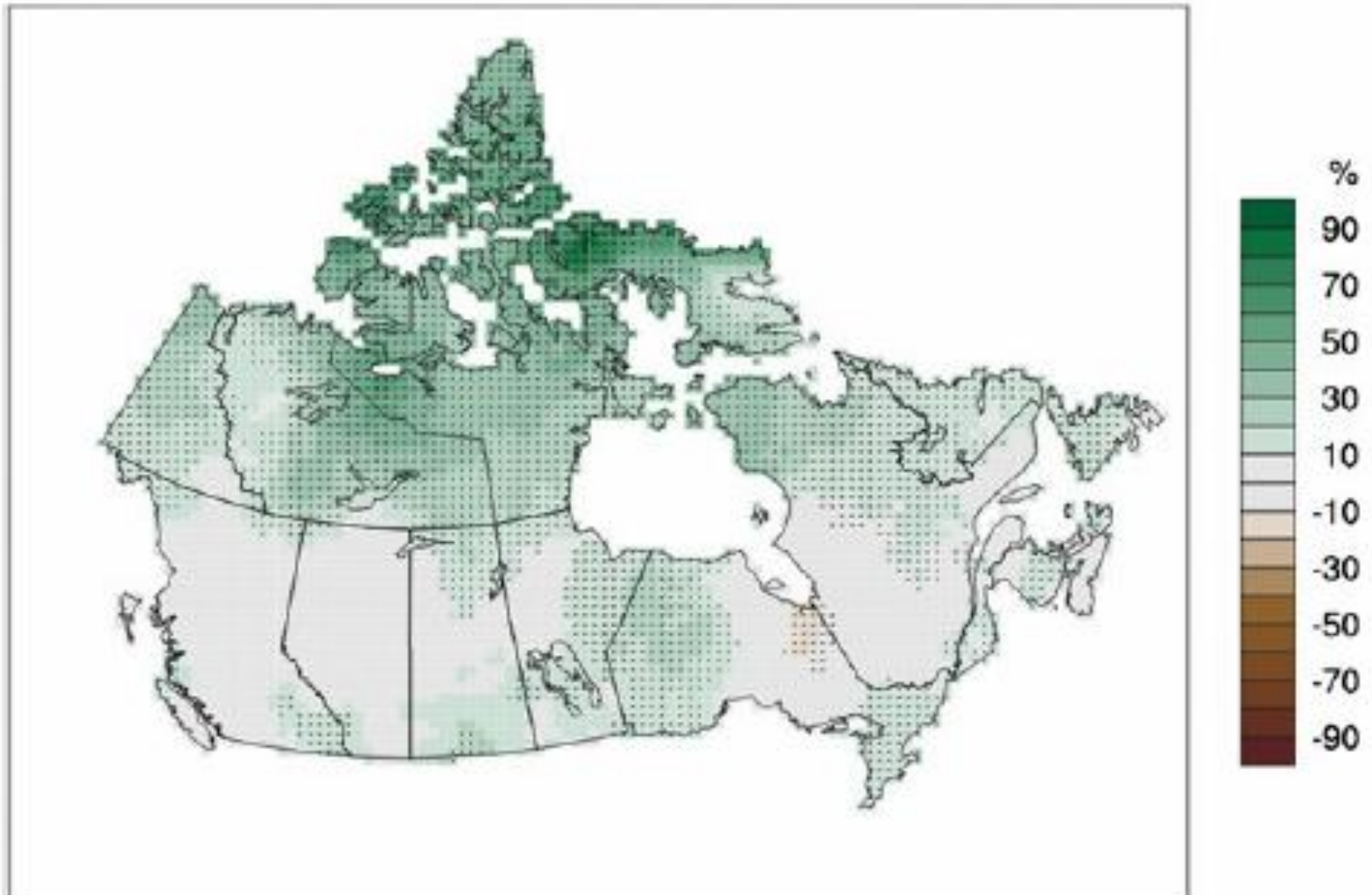


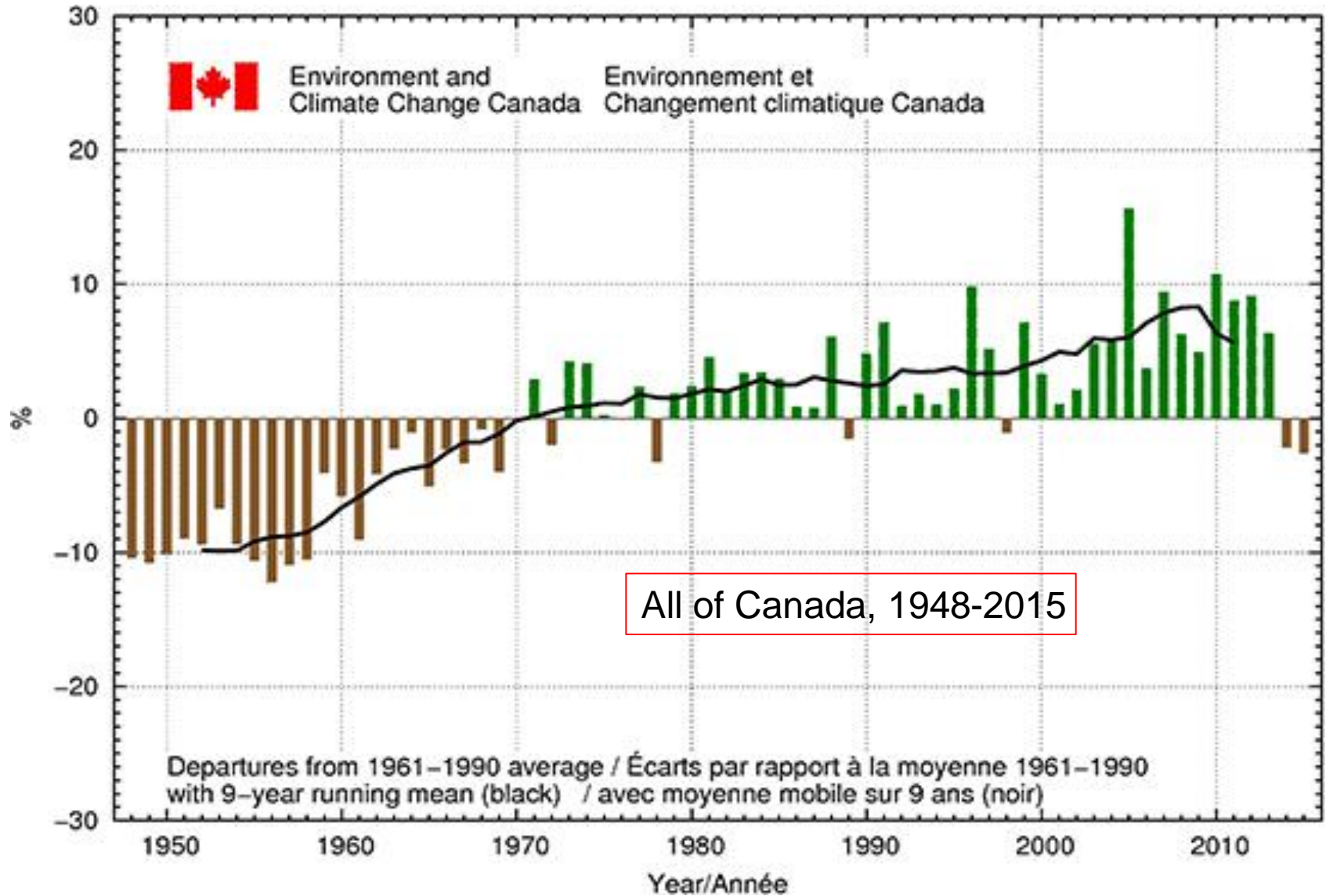
FIG. 3. Trends in mean temperature for 1948–2012 for (a) winter, (b) spring, (c) summer, and (d) autumn. Grid squares with trends statistically significant at the 5% level are marked with a dot. The units are degrees Celsius per 65 yr.

# Trends in precipitation (% change)

a) 1948-2012



# Precipitation Anomaly Trend



# But what does this mean for Ontario?

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- Feb. 2015 – Record cold
- June 17, 2014 – Angus tornado
- December 2013 Ice Storm – southern Ontario
- July 8, 2013 – Toronto flood
- Oct. 25, 2012 – Wawa flash flood



# Insurance Bureau of Canada (IBC)

## 2015 Fact Sheet

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*“Property damage caused by severe weather is now the leading cause of property insurance claims”*

### ***Insured Losses:***

- *1983-2008: Average of \$400 Million / year*
- *2012: \$1.2 Billion*
- *2013: \$3.4 Billion*
- *2014: \$1 Billion*



# Extreme cold

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- Municipalities may have Cold Weather Alert protocols to warn the population of potentially dangerous cold temperatures and to increase services to most vulnerable population (e.g. homeless)
- The criteria for such alerts will be set by the municipality and may vary from region to region



16





# Extreme cold

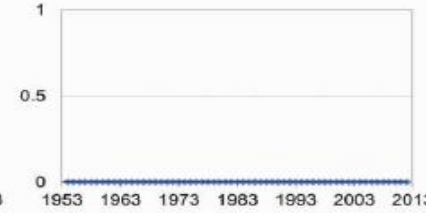
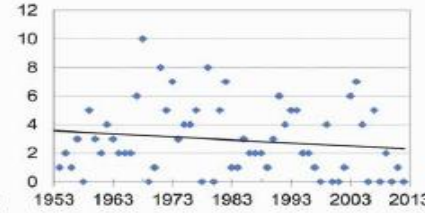
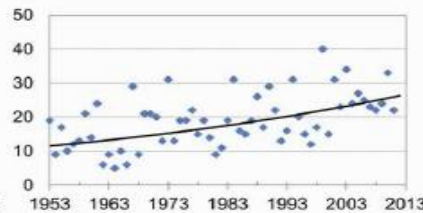
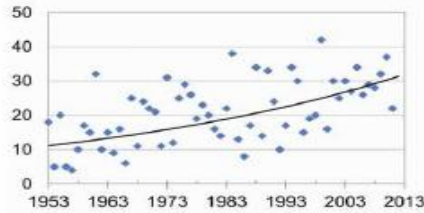
i)  $HX > 30$

ii)  $HX_{night} \geq 20$

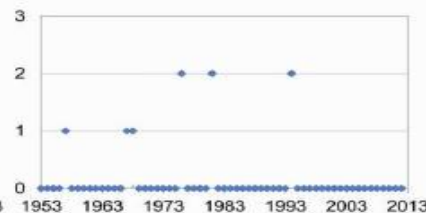
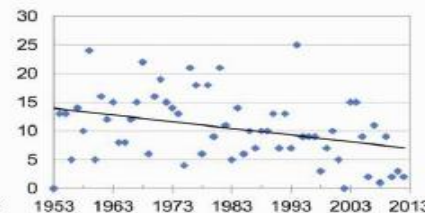
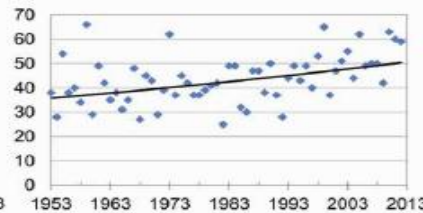
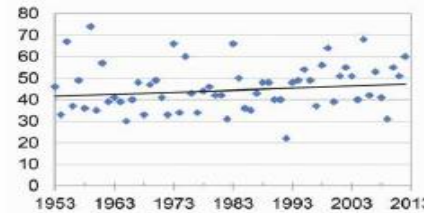
iii)  $WC < -30$

iv)  $WC < -45$

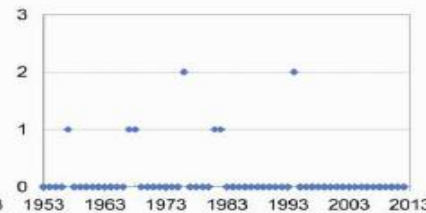
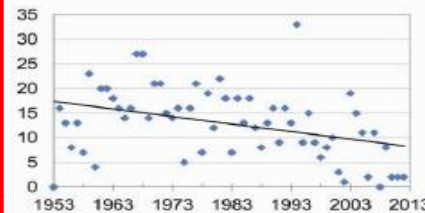
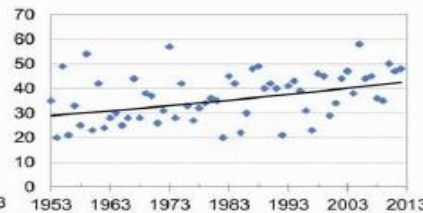
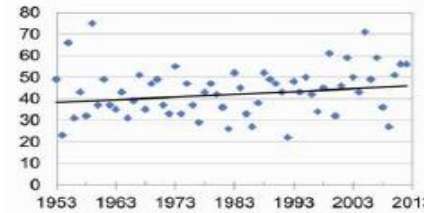
(a) Halifax International Airport (8202200 then 8202250)



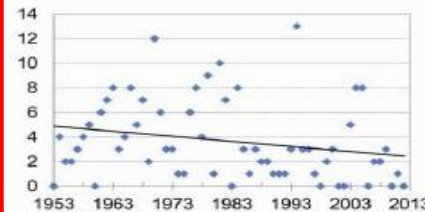
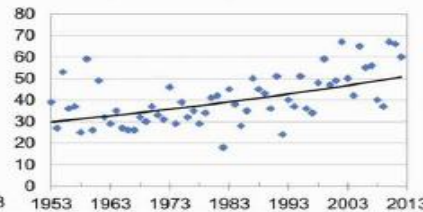
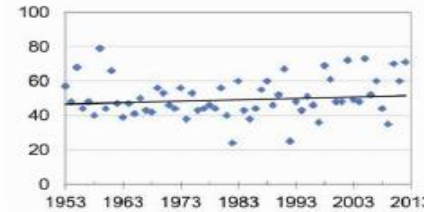
(b) Montréal Pierre Elliott Trudeau International Airport (7025250)



(c) Ottawa (6106000 then 6105978)



(d) Toronto Pearson International Airport (6158733)



# December 2013 Ice Storm Southern Ontario



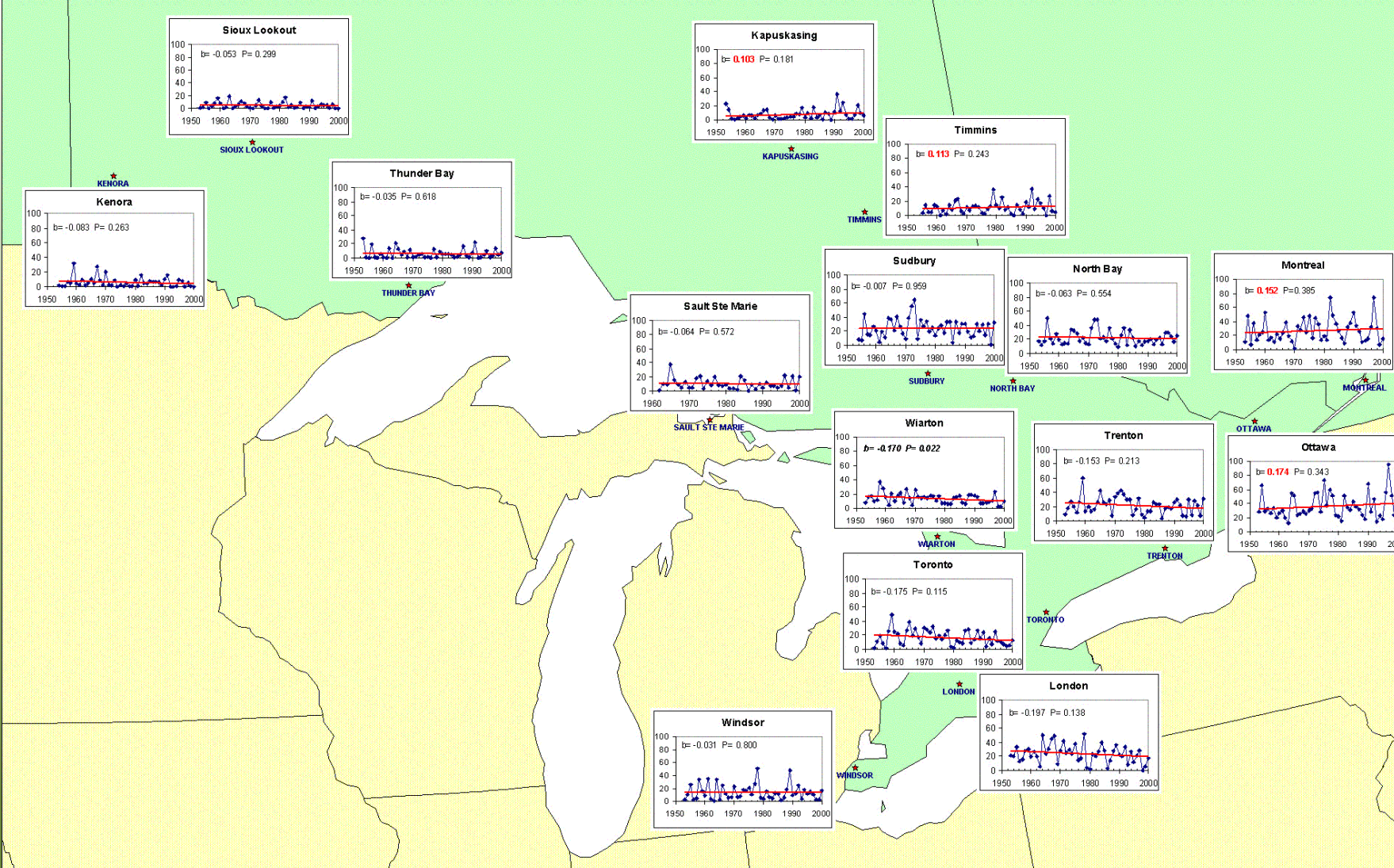
Courtesy Tom Stefanac



Courtesy Tom Stefanac



# Freezing Rain (days per year)

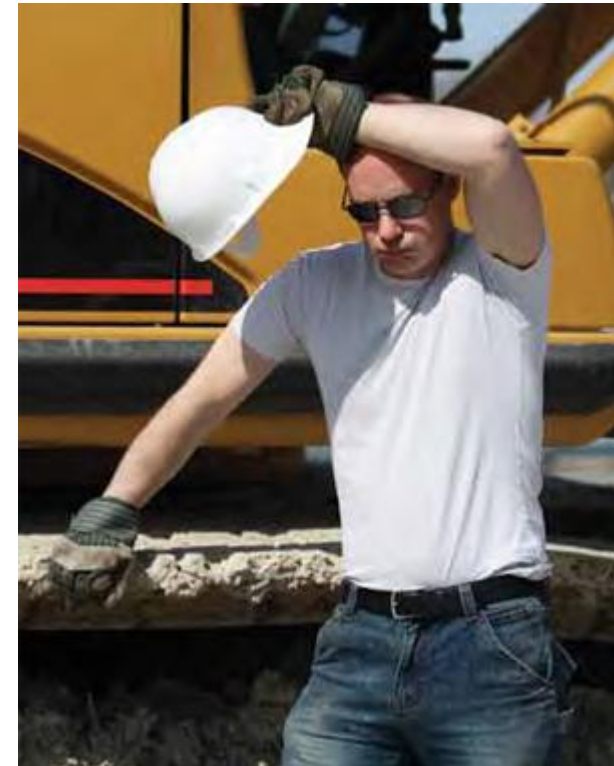


# But what about summer?



# Extreme heat

- Municipal public health units in Ontario have also begun to coordinate HARS (heat alert response systems, newly renamed HWIS – heat warning information system) with each other and with Environment Canada



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# Extreme heat

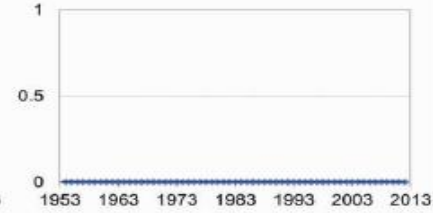
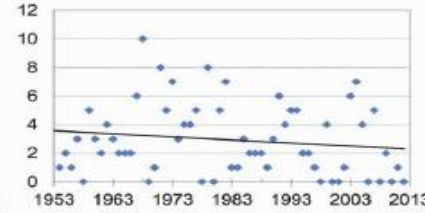
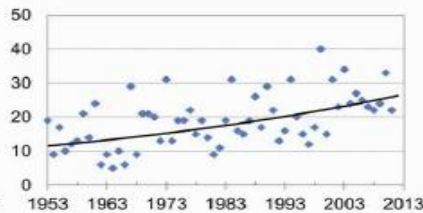
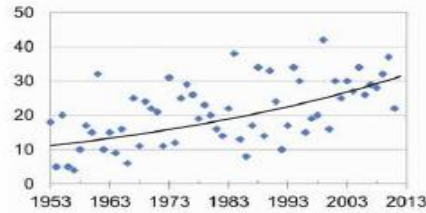
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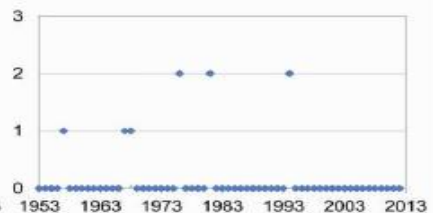
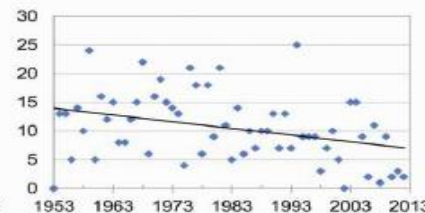
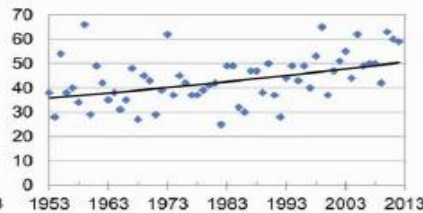
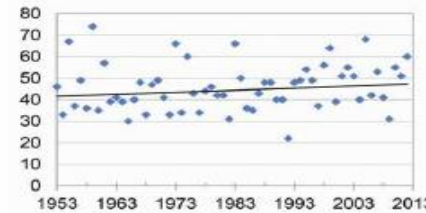
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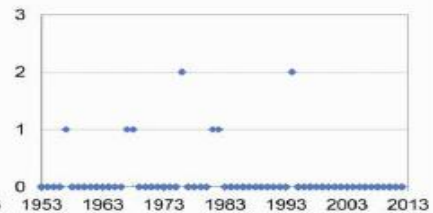
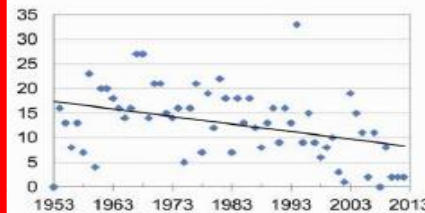
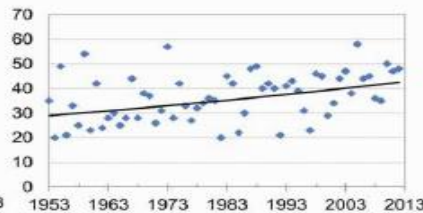
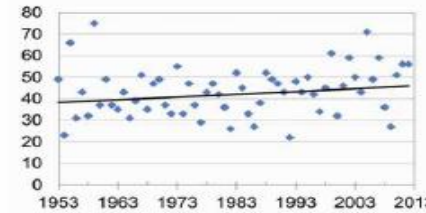
(a) Halifax International Airport (8202200 then 8202230)



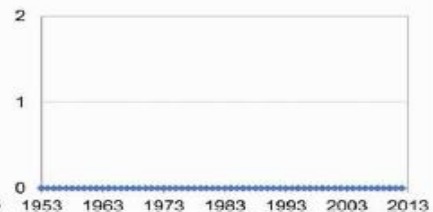
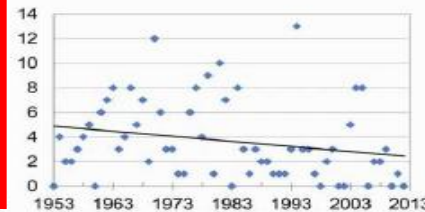
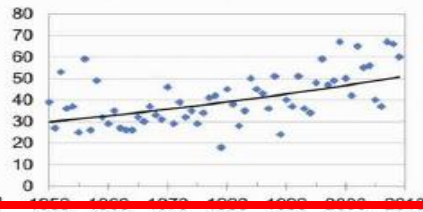
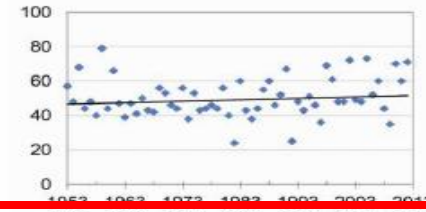
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(c) Ottawa (6106000 then 6105978)

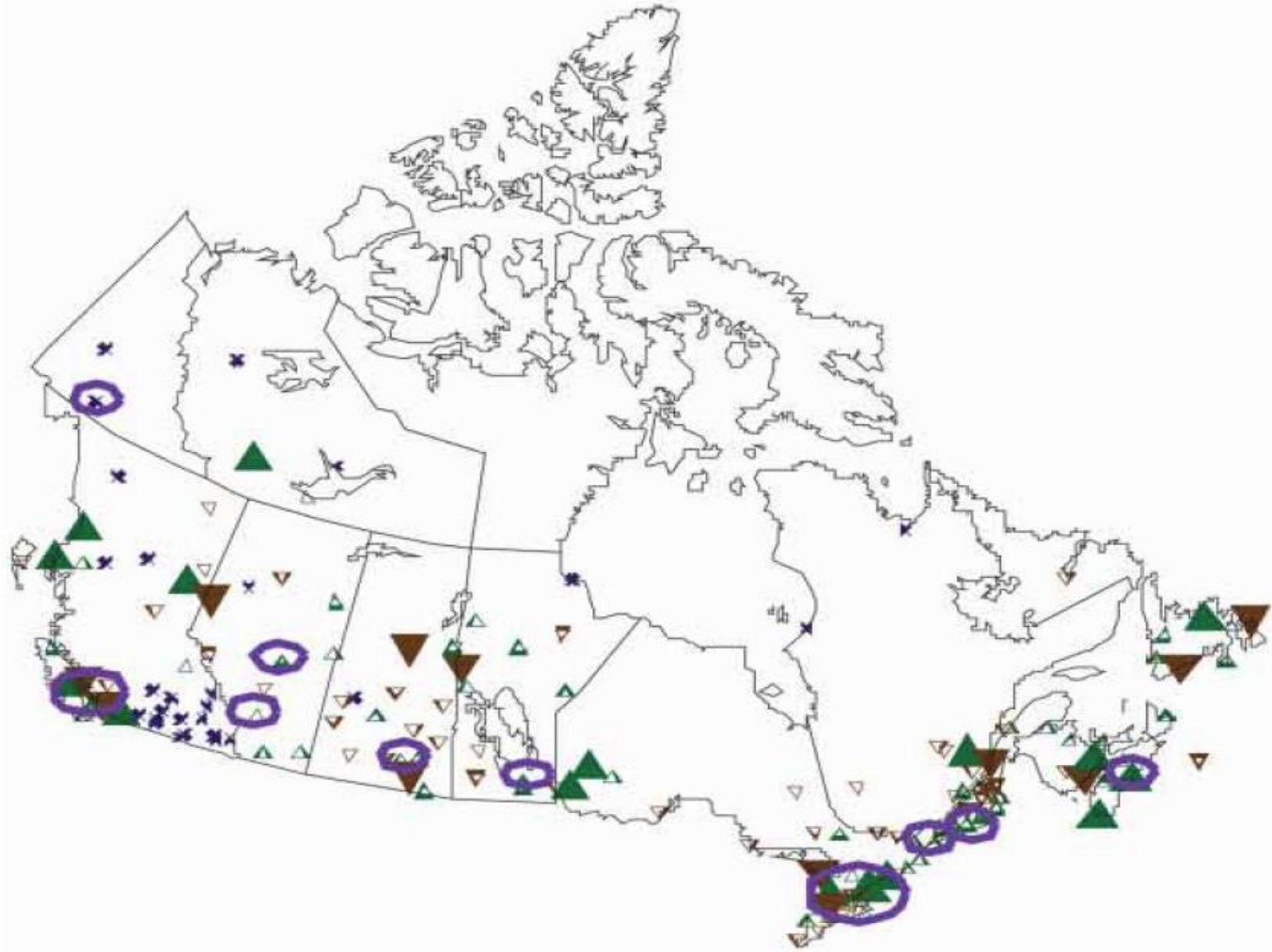


(d) Toronto Pearson International Airport (6158733)



# Heavy Rainfall Events

(c)  $RX_{48} > 50 \text{ mm}$



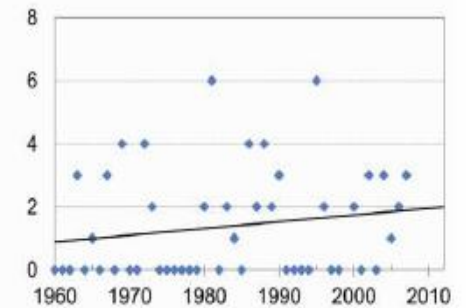
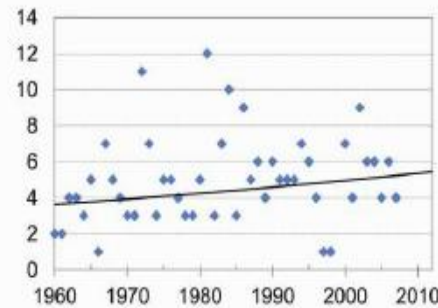
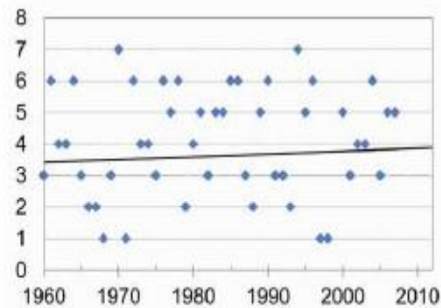
# Heavy Rainfall – Ottawa / Toronto

i)  $RX_1 > 10$  mm

ii)  $RX_{24} > 25$  mm

iii)  $RX_{48} > 50$  mm

(c) Ottawa (6106000 then 6105978)



(d) Toronto Pearson International Airport (6158733)

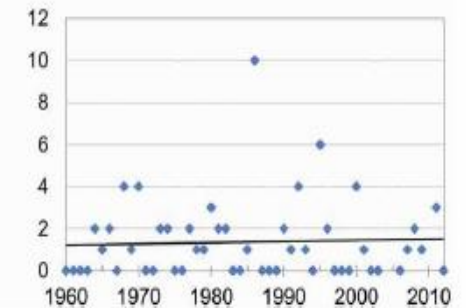
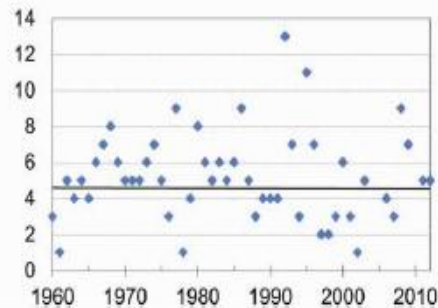
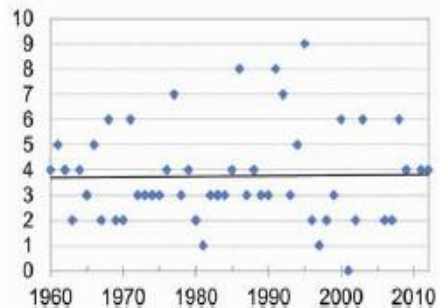


Fig. 9 Annual number of days with heavy rainfall indices for four urban centres in eastern Canada. The station identification number is given in parentheses.





# High Rainfall

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“There was no detectable trend signal in heavy rainfall events at the 5% significant level.”

- Mekis et al, 2015, Atmosphere-Ocean

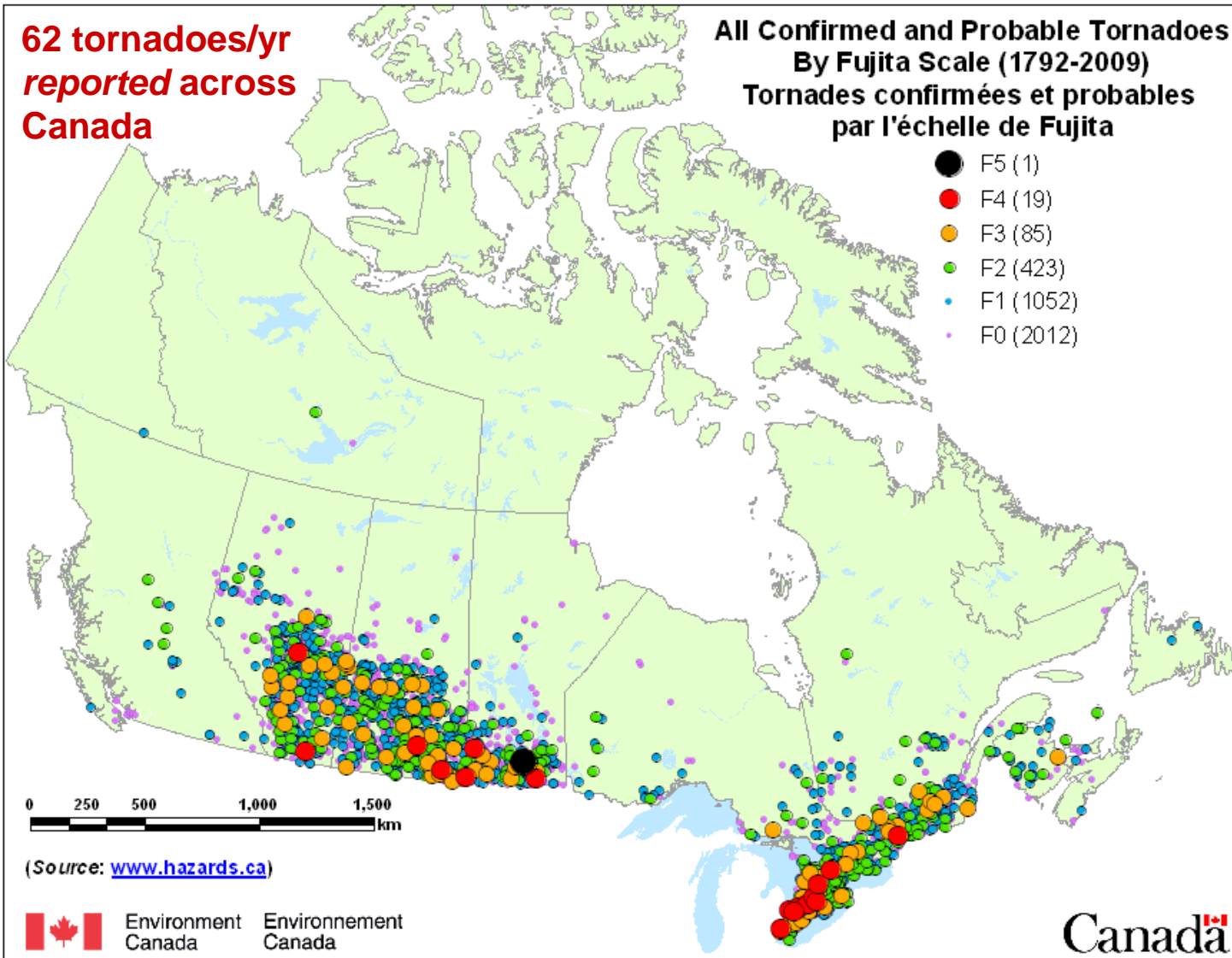


# Tornadoes

**62 tornadoes/yr  
reported across  
Canada**

**All Confirmed and Probable Tornadoes  
By Fujita Scale (1792-2009)  
Tornades confirmées et probables  
par l'échelle de Fujita**

- F5 (1)
- F4 (19)
- F3 (85)
- F2 (423)
- F1 (1052)
- F0 (2012)



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# EF2 (180-220 km/h)



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Canada

Environnement  
Canada

10km

Canada

# EF3 (225-265 km/h)

Goderich, Aug. 21,  
2011



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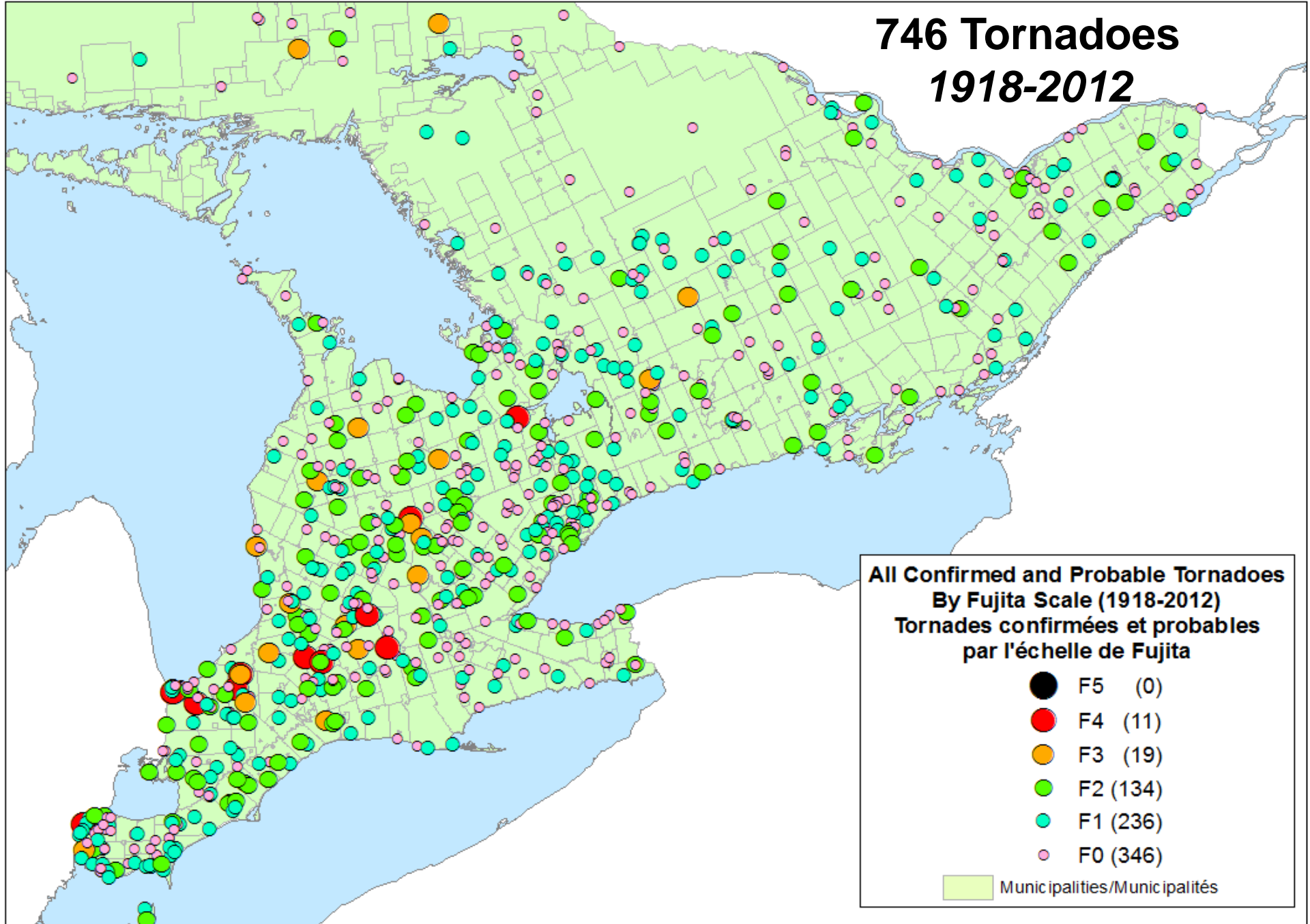


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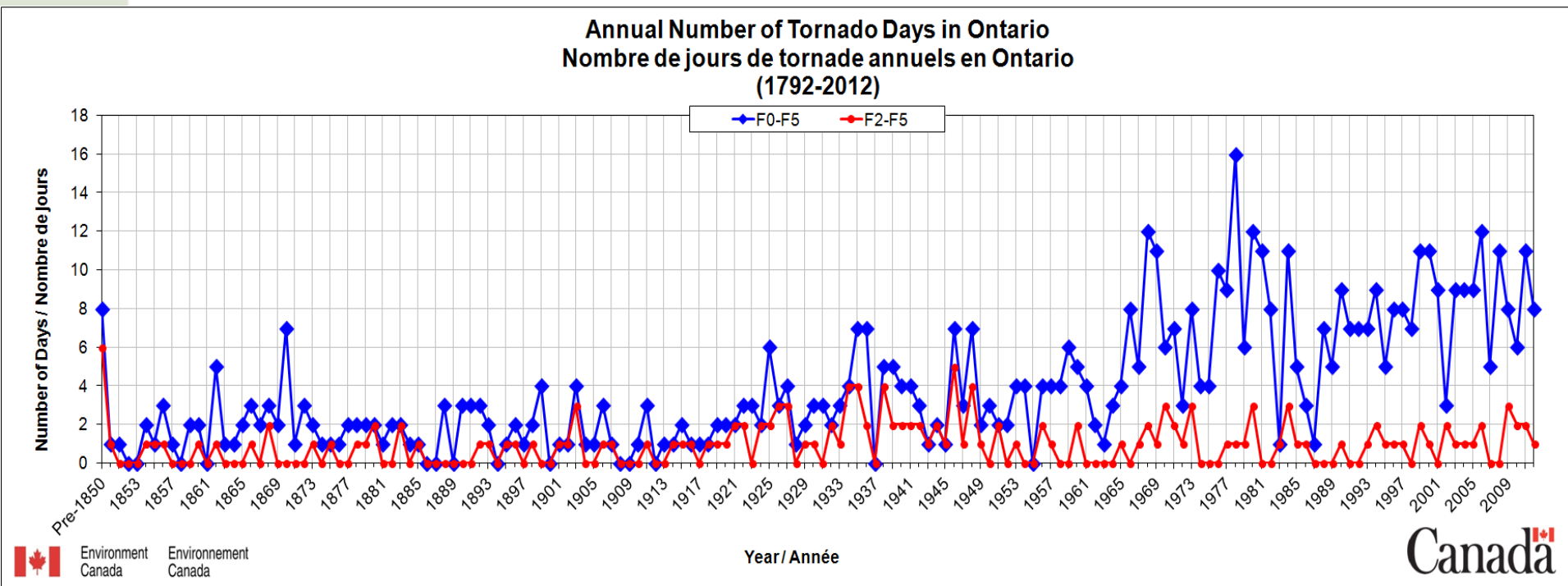
Canada

# 746 Tornadoes 1918-2012



# Tornado Days by F-scale: **1792-2012**

## All Tornadoes, **Significant** Tornadoes



**IMPORTANT**

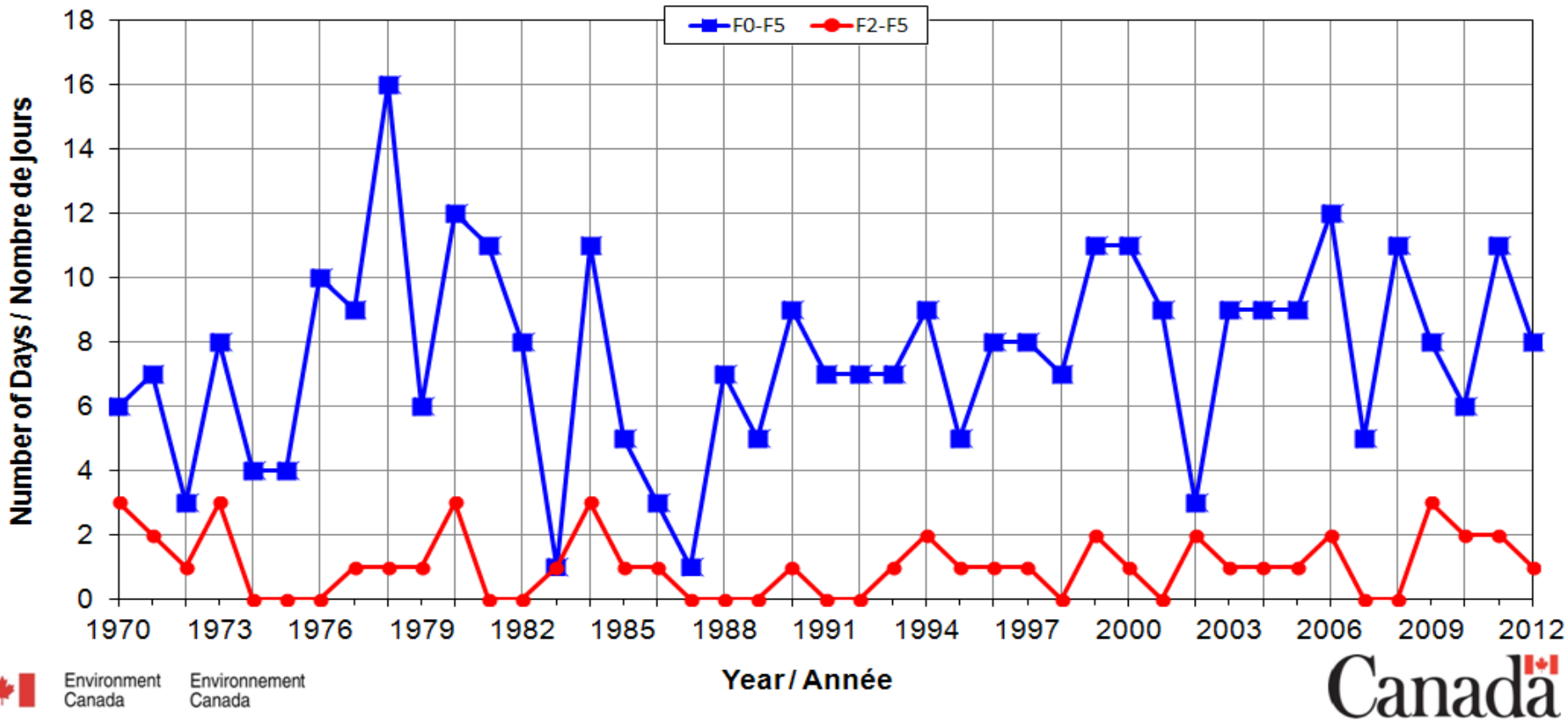
Please refer to Page 14: *Interpretation of Tornado Numbers over Time*

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# Tornado Days by F-scale: 1970-2012

## All Tornadoes, Significant Tornadoes

Annual Number of Tornado Days in Ontario  
 Nombre de jours de tornade annuels en Ontario  
 (1970-2012)



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**IMPORTANT**

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Please refer to Page 14: *Interpretation of Tornado Numbers over Time*



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# Canada's Forests

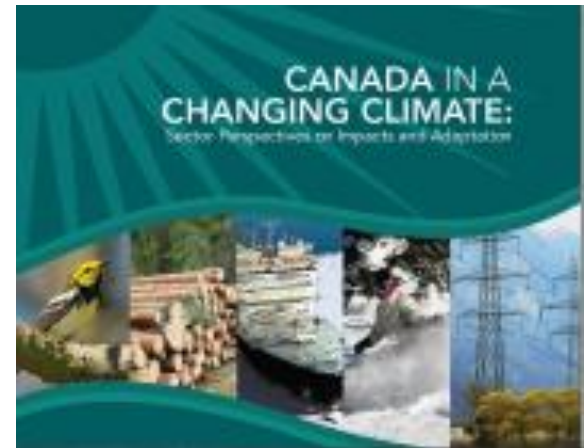


FIGURE 1: Forest regions of Canada (Source: Natural Resources Canada, 2000).



# Canada in a Changing Climate – Sector Perspectives on Impacts and Adaptations

- This 2014 report is an update of the 2008 report “From Impacts to Adaptation: Canada in a Changing Climate”
- <http://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2014/16309>
- Chapter 3 on Natural Resources
  - Forestry



# What's in Store in the Future?

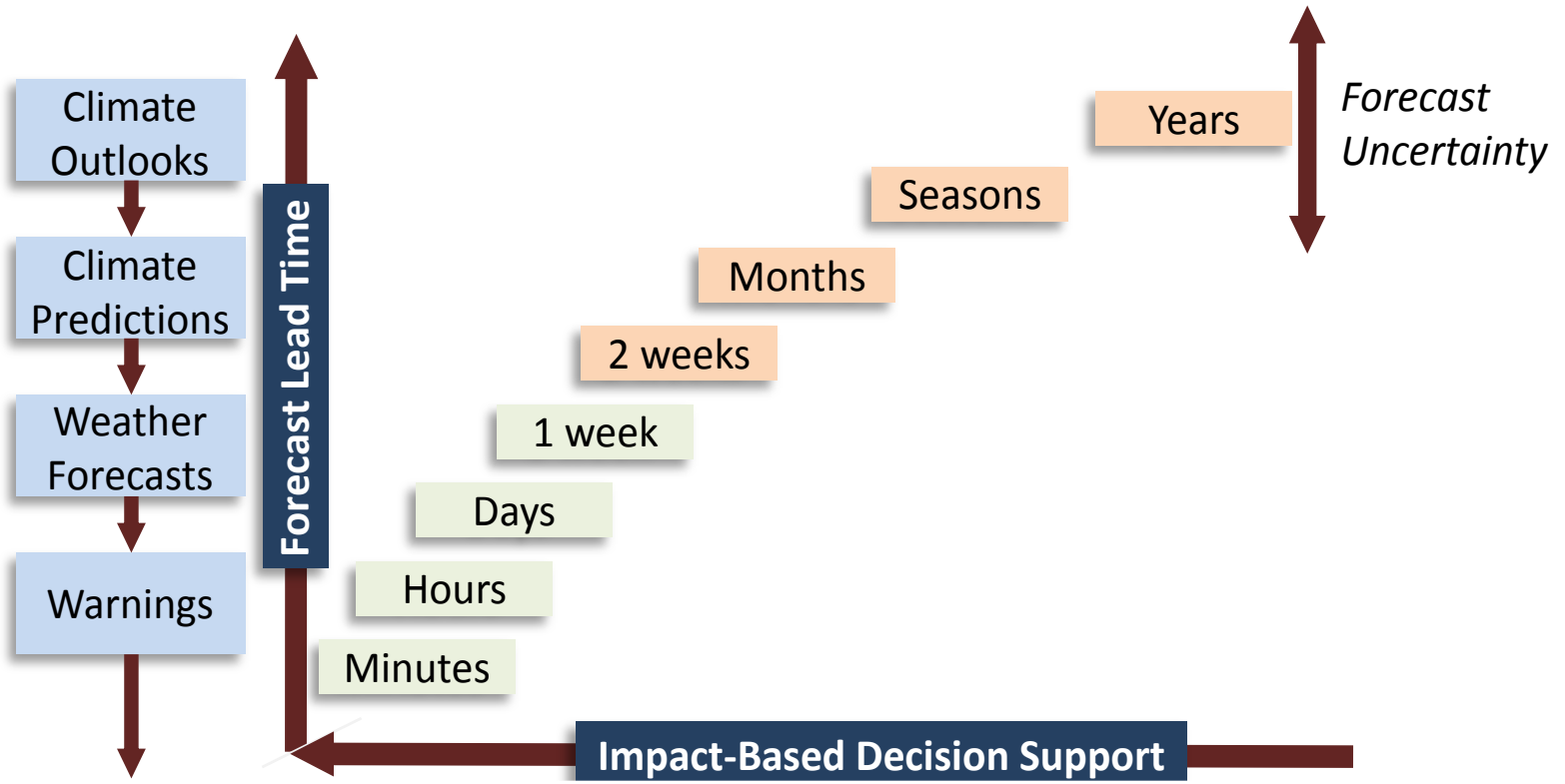


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# Valued-added information over multiple time scales



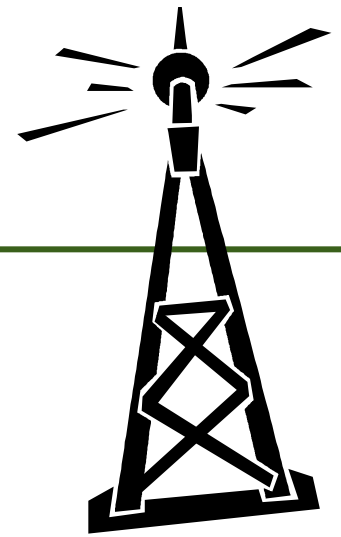
# Ontario Storm Prediction Centre

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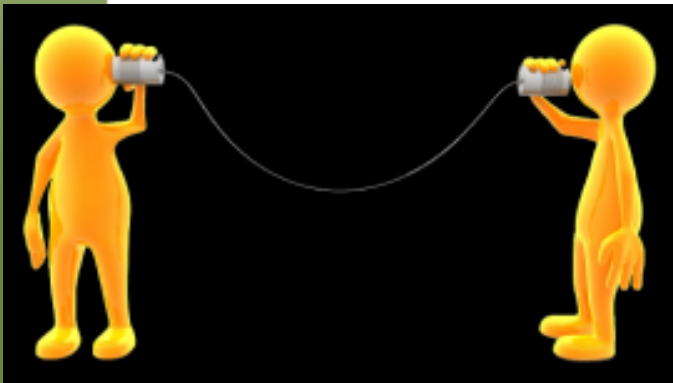
- Responsible for Weather Program across Ontario
- Operates 24/7
- One of 7 EC Weather Centres in Canada



# Our Alert Messages



- Special Weather Statement
  - Interesting, noteworthy, some possible impacts
- Advisory
  - Impacts likely (frost, fog, freezing drizzle, blowing snow)
- Watch
  - Potential for significant weather/impacts
- Warning
  - Significant weather/impacts likely



# Our Warnings



Short-Fuse...perhaps minutes...



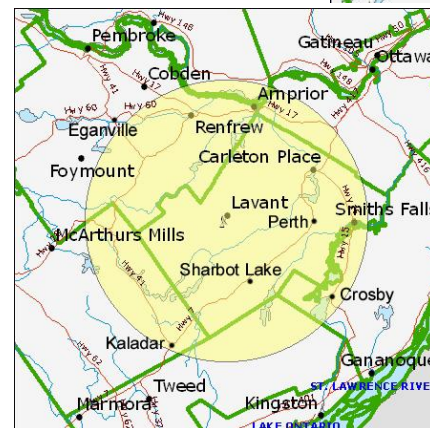
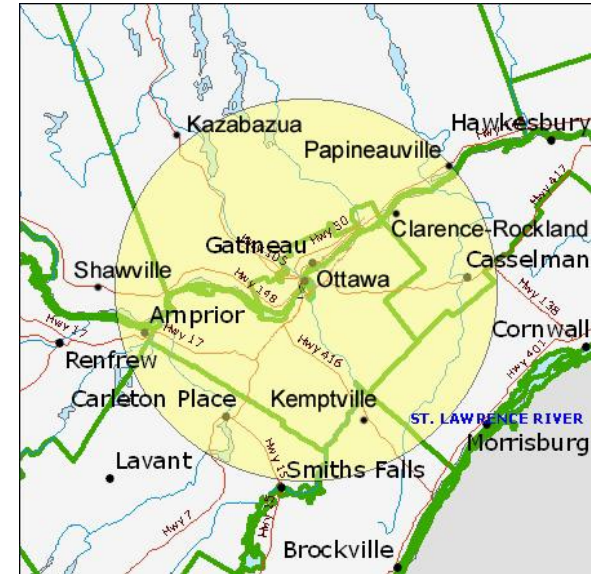
Longer lead time...hours to days

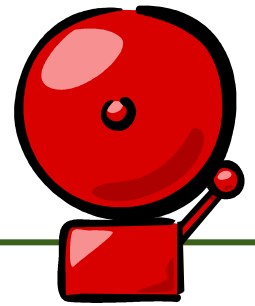


# Weatheradio



- Continuous broadcast of weather info
- Line of sight broadcast...trees, hills may disrupt signal
- Standby mode → Tone Alert when Warnings issued
- Specific Area Messaging – SAME - Get the Warnings for your own area
- Special frequencies... so require a special receiver





# EC Alert ME

- e-mail of watches / warnings / special weather statements for your (specified) regions only.
- watch for a banner advertising this on [weather.gc.ca](http://weather.gc.ca) sometime in March (for a limited one-week trial period)
- Full, operational version later in the summer





# Twitter



- Warning Tweets for all City Page locations on weather.gc.ca, available now using assigned Twitter address
- e.g. Kemptville is @ECAAlertON74
- Google: [Environment Canada Twitter Alerts](#) for more details
- NEW (spring-summer 2017):
  - Weather office will begin tweeting about actual weather events in real-time



# Weather Ready



Introducing **Alert Ready**, Canada's  
New Emergency Alert System

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# WEATHER SAFETY



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Shane Coulas WeatherNetwork

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# Lightning Safety

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- Biggest summer severe weather hazard
- Environment Canada does not issue watches or warnings if lightning is the only threat
- First strike can occur nearby with no previous lightning



Ken Rivas – WeatherNetwork  
Mississauga Aug 24 2011



# Lightning Safety Rule

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- **When Thunder Roars, Go Indoors**
- **Seek solid/best shelter immediately**
- **Remain in that shelter for a full 30 minutes after the last rumble of thunder**



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Canada



# Lightning Safety

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- Don't stand under trees...here's why (ground current)



Photo Credit : Anthony Dodge  
The Champions Course at Weeks Park



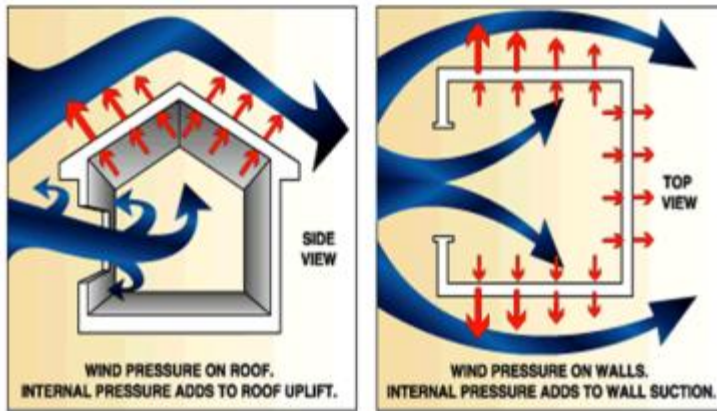
# Tornado/Downburst Safety

- Best shelter...well-constructed building in the basement
- As many walls between you and the outside as possible...away from windows
- AVOID...shopping malls, arenas, gymnasiums



# Dangerous Misconception

- I should open the windows in my house in advance of a strong storm/tornado to “equalize” pressure.  
WRONG...opening windows allow wind forces inside your home...can help to lift off roof and collapse walls



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# Winter Severe Weather

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- Kills and injures many more Canadians than Summer Severe Weather
  - Traffic collisions
  - Snow shovelling
  - Slips and falls
  - Hypothermia/exposure to cold
- Storms on a massive scale with large impacts



# Flash Freeze / Snowsqualls

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# Winter Weather Safety

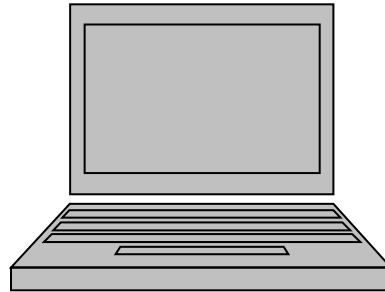
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- Winter driving safety rules
- Monitor the weather forecast
- Dress in layers
- Limit time outdoors
- Get out of the wind, if possible
- Stay dry; stay active
- Watch for signs of frostbite
- Car emergency kit
- Home emergency kit (i.e. 72 Hours)



# Severe Weather Reporting

- e-mail us at: [storm.ontario@ec.gc.ca](mailto:storm.ontario@ec.gc.ca)



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# Winter Storm Reports



- **Dense fog**
  - visibility less than 1 km
- **Any occurrence of freezing rain, freezing drizzle**
- **Heavily accumulating snow (SNOW AMOUNTS)**
  - 2 or more cm/hr
- **Whiteout conditions in snow/blowing snow**
  - Visibility near zero
- **Rapid freezing of road surfaces**
- **E-mail your reports to: [storm.ontario@ec.gc.ca](mailto:storm.ontario@ec.gc.ca)**



# CANWARN Storm Spotter Training (free)



- Ottawa, May 16, 6:30 PM – Greenboro Community Centre
- Cornwall, May 17, 6:30 PM – Cornwall Public Library
- **RSVP please to: [peter.kimbell@canada.ca](mailto:peter.kimbell@canada.ca)**



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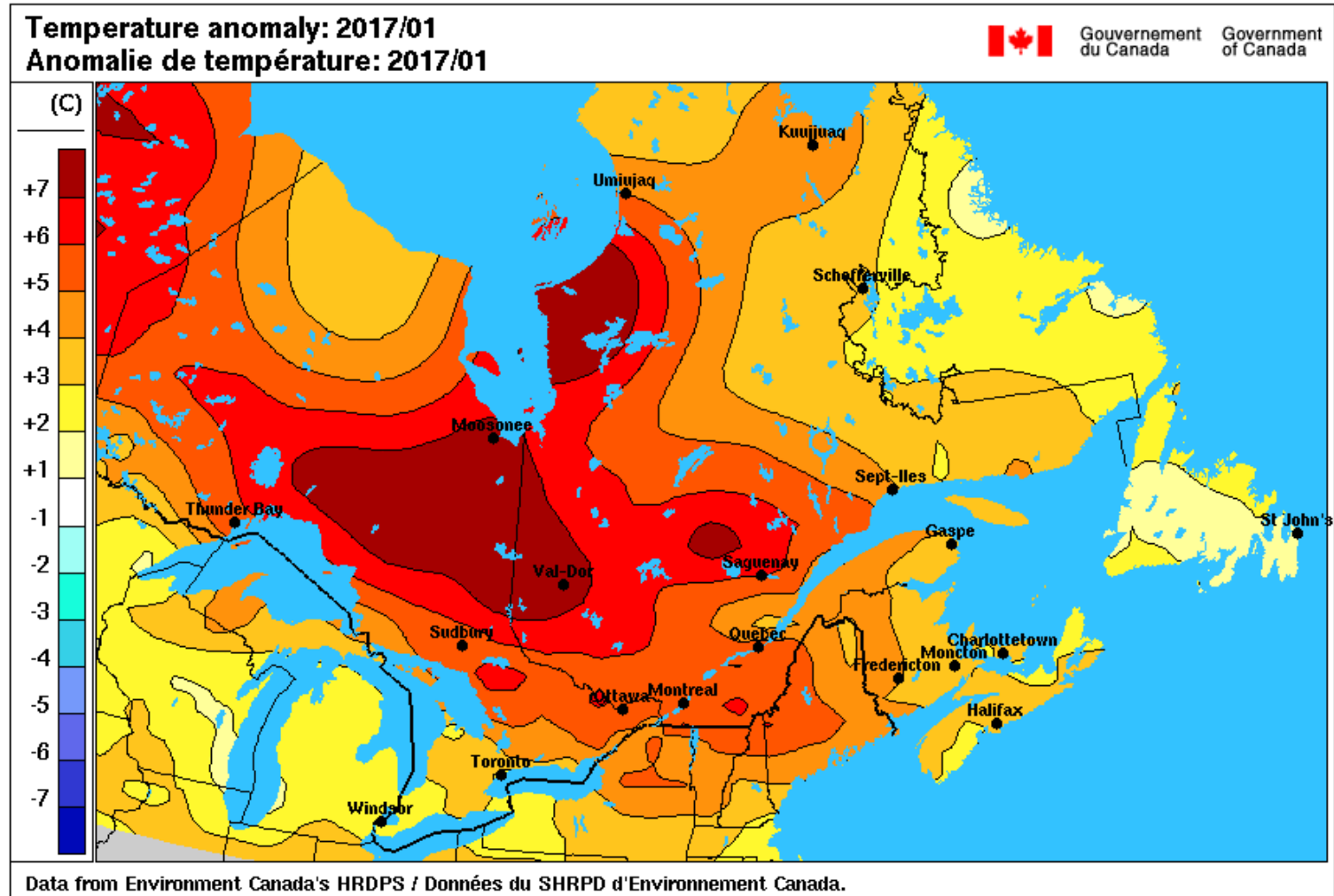


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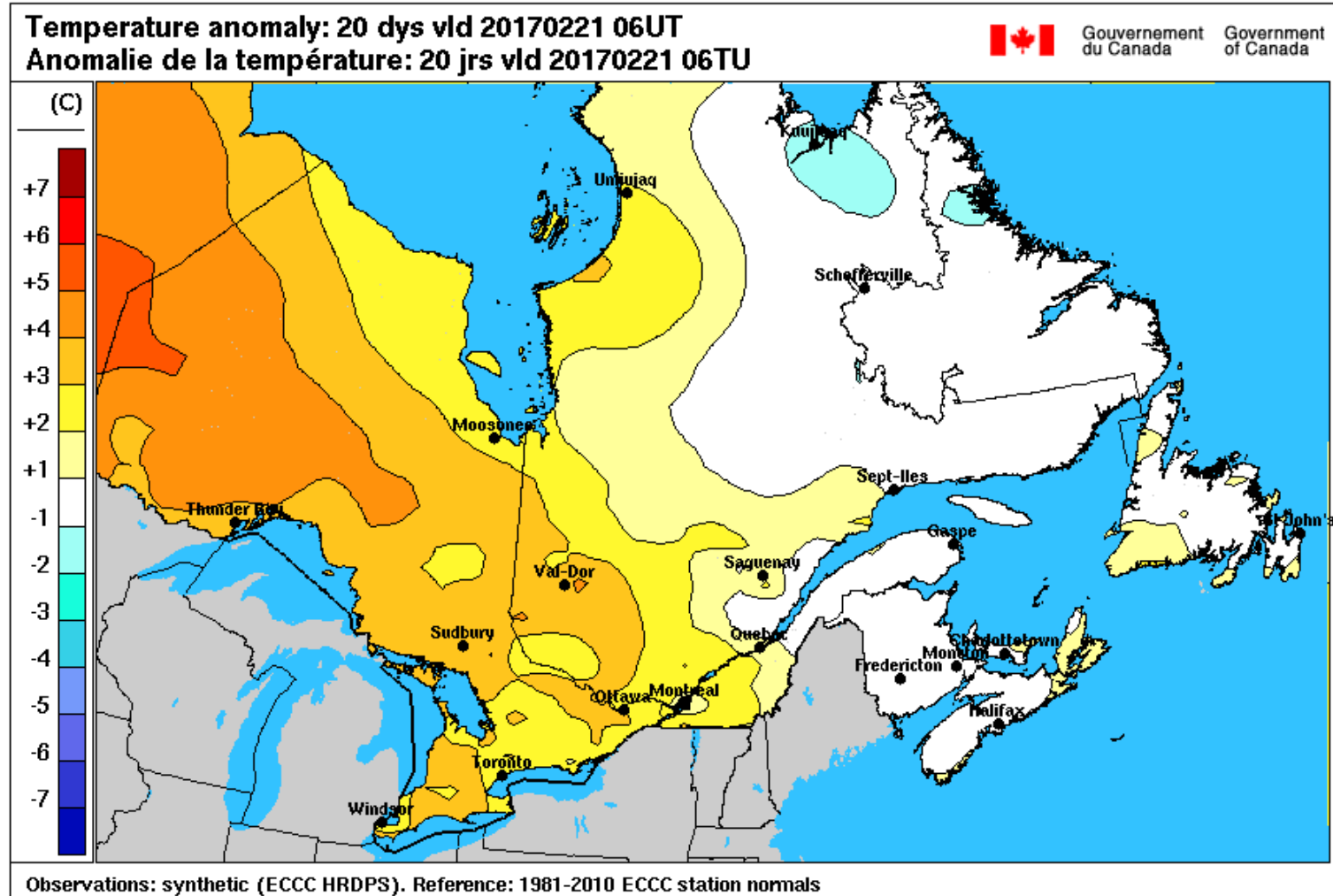
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# January temperature anomaly



# February temperature anomaly (so far)



Gouvernement du Canada  
Government of Canada



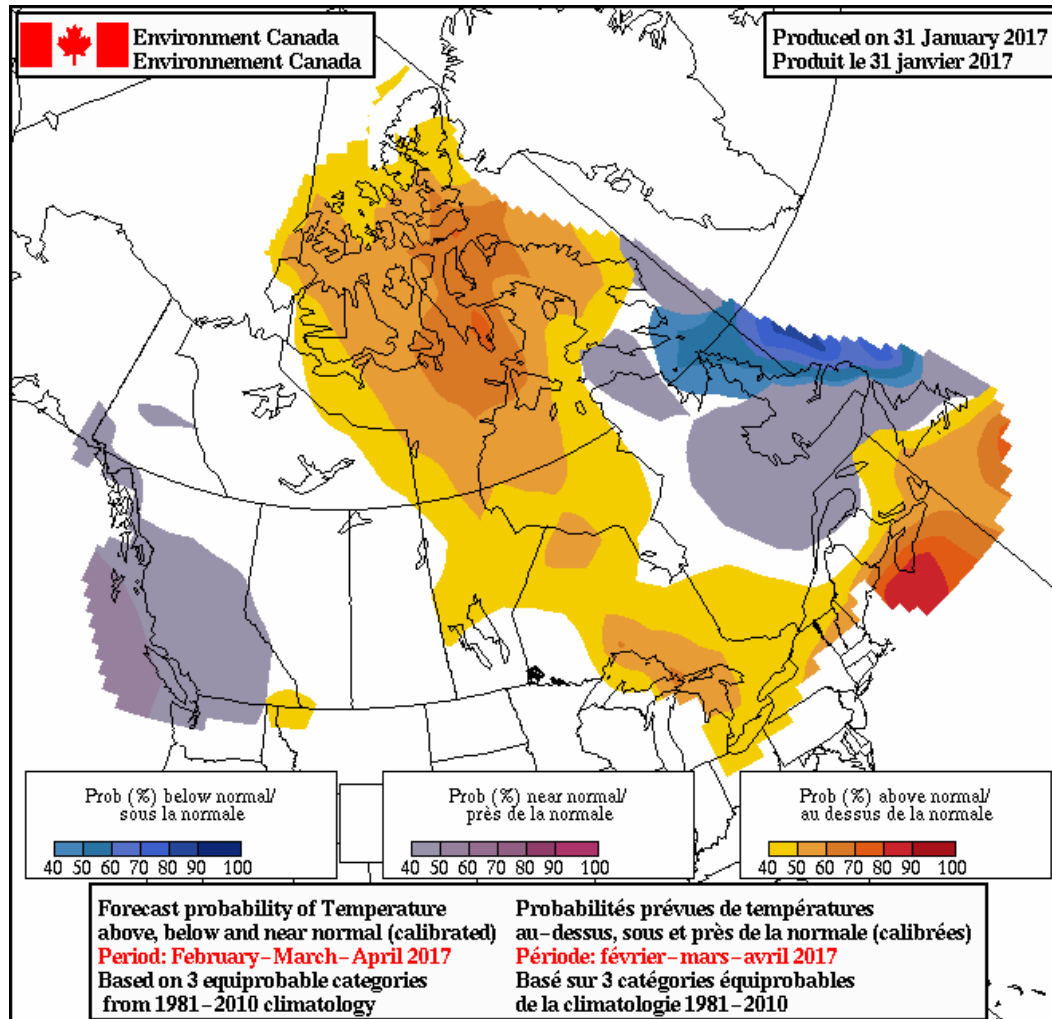
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# Spring forecast



# THANK YOU FOR YOUR INTEREST!



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