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IPCC Special Report:

Managing the risks of extreme events and disasters to advance climate change adaptation (SREX)

FINDINGS FOR CANADA AND RELATED RESEARCH

A briefing with Canadian report authors Gordon McBean, Francis Zwiers, Xuebin Zhang and Paul Kovacs

Gordon McBean

Director of Policy Studies, Institute for Catastrophic Loss Reduction, Departments of Geography and Political Science, University of Western Ontario, Chair of the Canadian Foundation for Climate and Atmospheric Studies (CFACS) and President-Elect of the International Council for Science (ICSU).

SREX Report

- Proposed September 2008
- Nine chapters
- 100 lead authors
- 100 contributing authors
- 20 review editors.

IPCC procedures

- balanced assessment of what is known and what is not known.
- Science presented as policy relevant without being policy prescriptive.

Each chapter –

four separate drafts
four rounds of review
around 20,000 review comments addressed.

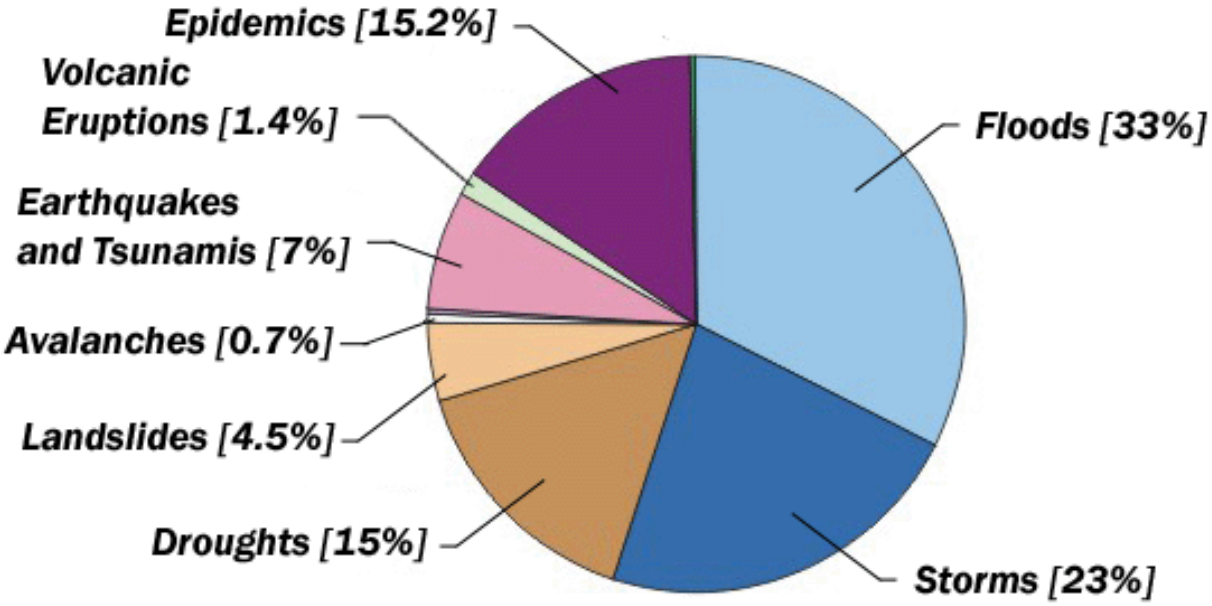
IPCC SPM (draft) Key Findings for Canada

- Increase in frequency of heat waves
- Increase in frequency of hot days
- Decrease in the severity of cold temperatures.
- Significant change in frequency of extreme precipitation (more areas with significant increase than decrease).
- Some evidence that frequency of floods and cyclones are increasing in some areas.

Also…

- Impacts of extreme events are greater in developing countries than in developed countries, but losses are larger in developed countries.

Global Impacts of Hazards



"Over the last two decades (1988-2007), 76% of all disaster events were hydrological, meteorological or climatological in nature; these accounted for 45% of the deaths and 79% of the economic losses caused by natural hazards."

"The real tragedy is that many of these deaths can be avoided."

Mega-Disasters – > 10,000 fatalities

2003-2008

Year	Country	Disaster	Fatalities
1983	Ethiopia	Ethiopian drought	300,000
1976	China	Tangshan earthquake	242,000
2004	South Indian Ocean	Indian Ocean tsunami	226,408
1983	Sudan	Sudan drought	150,000
1991	Bangladesh	Cyclone Gorky	138,866
2008	Myanmar	Cyclone Nargis	133,655
1981	Mozambique	Southern Mozambique drought	100,000
2008	China	Sichuan earthquake	87,476
2005	India, Pakistan	Kashmir earthquake	73,338
2003	Europe	European heat wave	56,809
1990	Iran	Manjil-Rudbar earthquake	40,000
1999	Venezuela	Vargas floods	30,000
2003	Iran	Bam earthquake	26,796
1978	Iran	Tabas earthquake	25,000
1988	Soviet Union	Spitak earthquake	25,000
1976	Guatemala	The Guatemala earthquake	23,000
1985	Colombia	Nevado Del Ruiz volcano	21,800
2001	India	Gujarat earthquake	20,005
1999	Turkey	Izmit earthquake	17,127
1998	Honduras	Hurricane Mitch	14,600
1977	India	Andhra Pradesh cyclone	14,204
1985	Bangladesh	Bangladesh cyclone	10,000
1975	China	Haicheng earthquake	10,000

Climate related

Table 1.1: Disasters with more than 10,000 fatalities, January 1975 – June 2008 4
(Highlighting denotes disasters within the five-year period, 2003–2008.) EMDAT; Analysis by ISDR, 2008

2003-2008

Mega-Disasters – > $US 10 B in losses

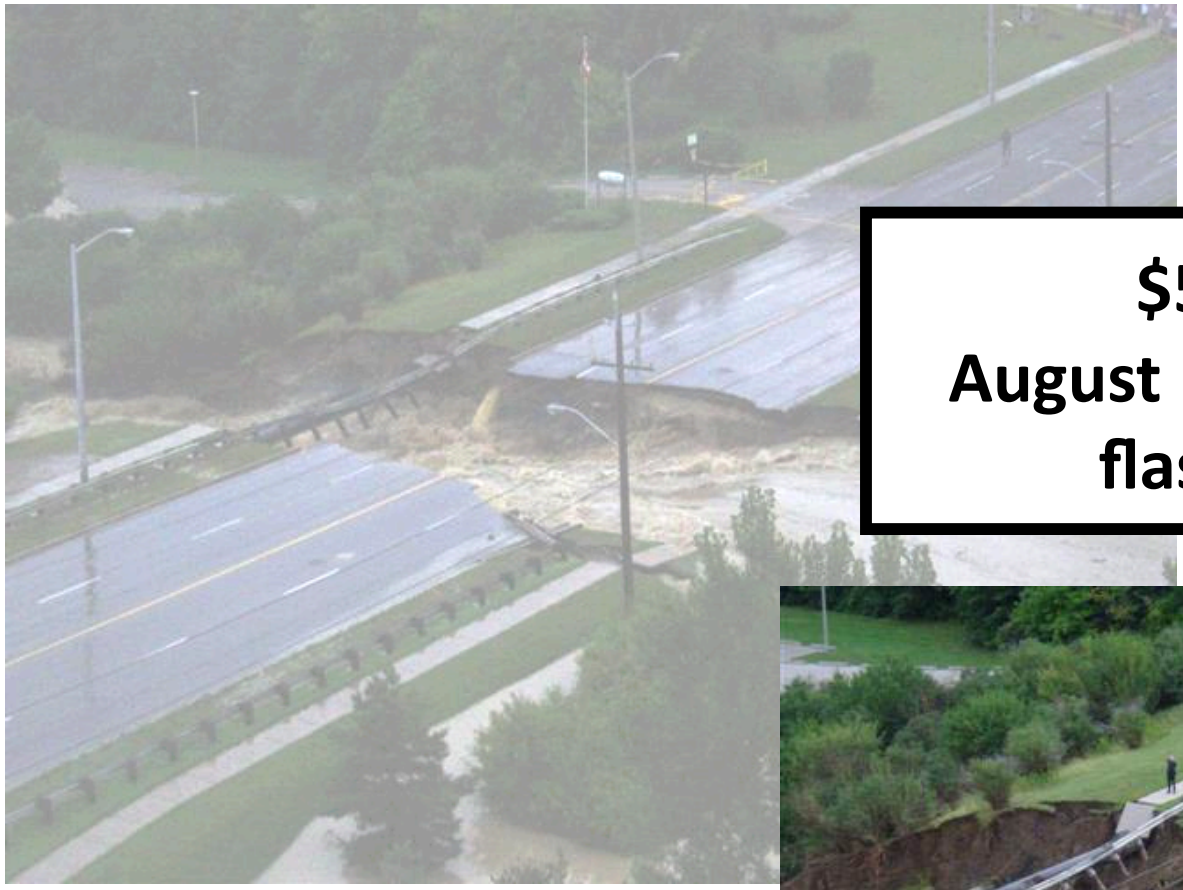
Year	Country	Hazard	Total loss (billion US$)
2005	United States of America	Hurricane Katrina	125
1995	Japan	Kobe earthquake	100
2008	China	Sichuan earthquake	30
1998	China	Yangtze flood	30
2004	Japan	Chuetsu earthquake	28
1992	United States of America	Hurricane Andrew	26.5
1980	Italy	Irpinia earthquake	20
2004	United States of America	Hurricane Ivan	18
1997	Indonesia	Wild fires	17
1994	United States of America	Northridge earthquake	16.5
2005	United States of America	Hurricane Charley	16
2004	United States of America	Hurricane Rita	16
1995	Democratic People's Republic of Korea	Korea floods	15
2005	United States of America	Hurricane Wilma	14.3
1999	Taiwan (China)	Chichi earthquake	14.1
1988	Soviet Union	Spitak earthquake	14
1994	China	China drought	13.8
1991	China	Eastern China floods	13.6
1996	China	Yellow River flood	12.6
2007	Japan	Niigataken Chuetsu-oki earthquake	12.5
1993	United States of America	Great Midwest flood	12
2002	Germany	River Elbe floods	11.7
2004	United States of America	Hurricane Frances	11
1991	Japan	Typhoon Mireille	10
1995	United States of America	Major west coast wind storm	10

Climate related

Table 1.2 Disasters leading to losses of more than US$ 10 billion, January 1975 – June 2008
Source: EMDAT; Analysis by ISDR


Climate Change in Canada


August 19, 2005

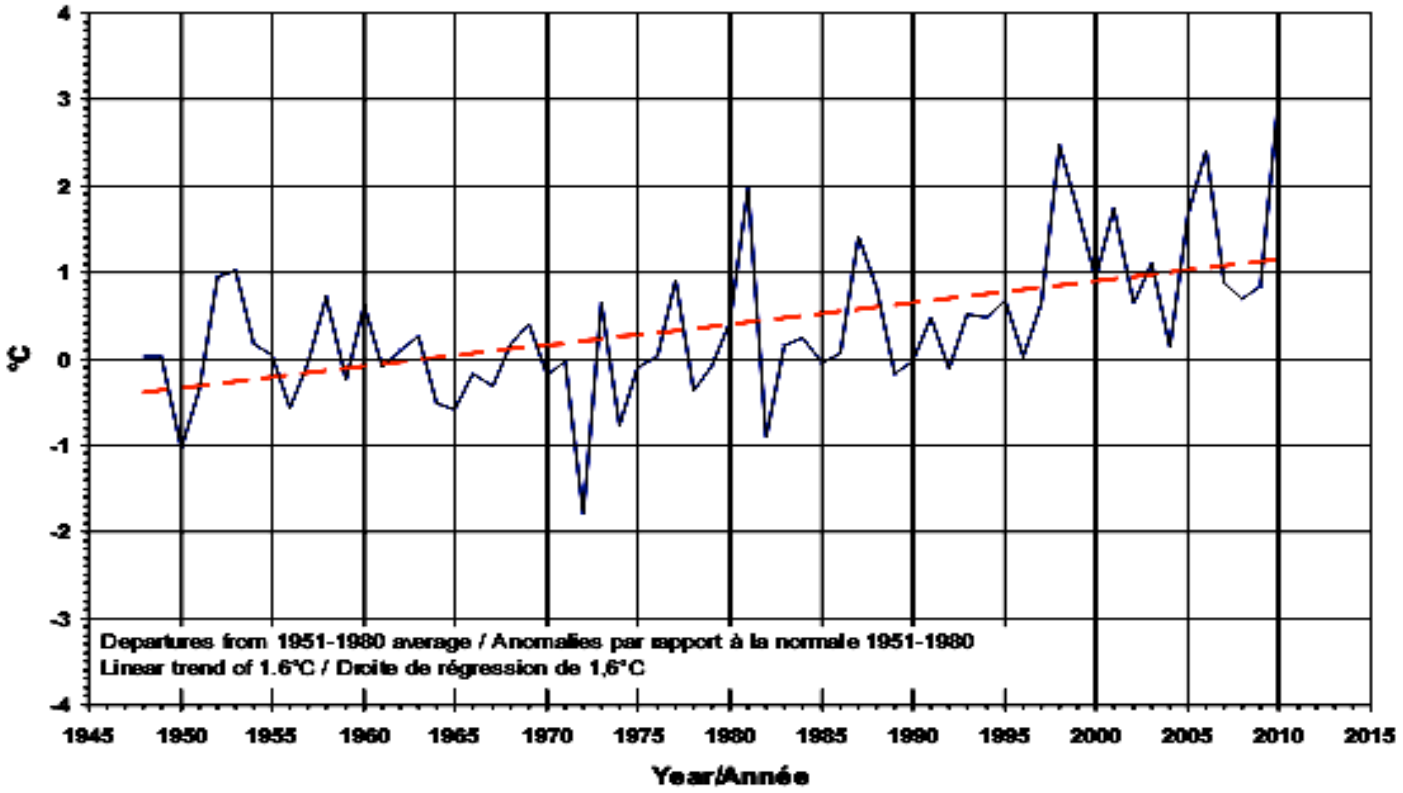


$500M for the
August 19, 2005 wind, rain
flash flood event

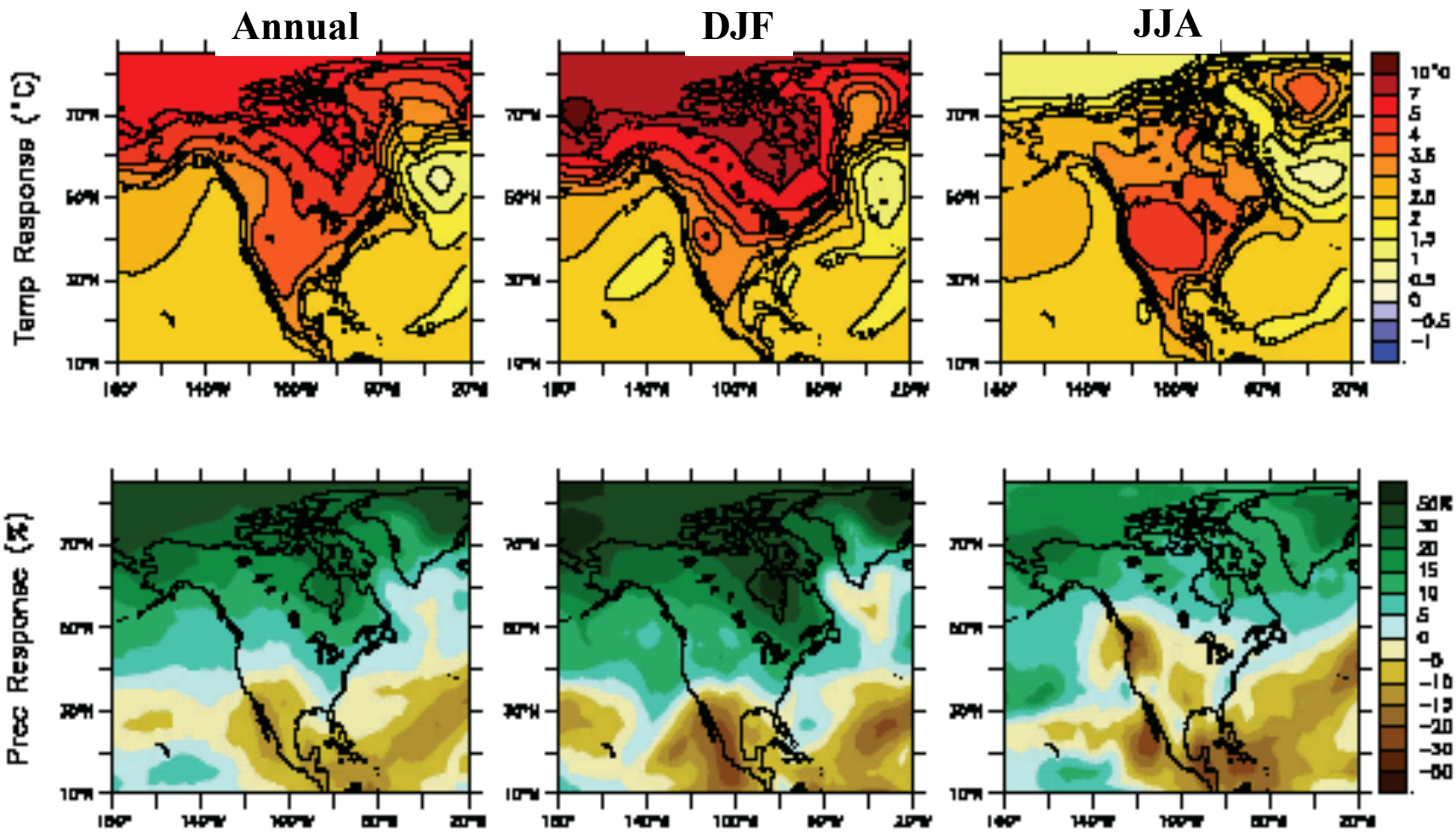
Canadian National Temperature

The national average temperature for the year 2010 was 3.0°C above normal, based on preliminary data, which makes this the warmest year on record since nationwide records began in 1948. The previous warmest year was 1998, 2.5°C above normal. At 1.8°C below normal 1972 was the coolest.

http://www.ec.gc.ca/



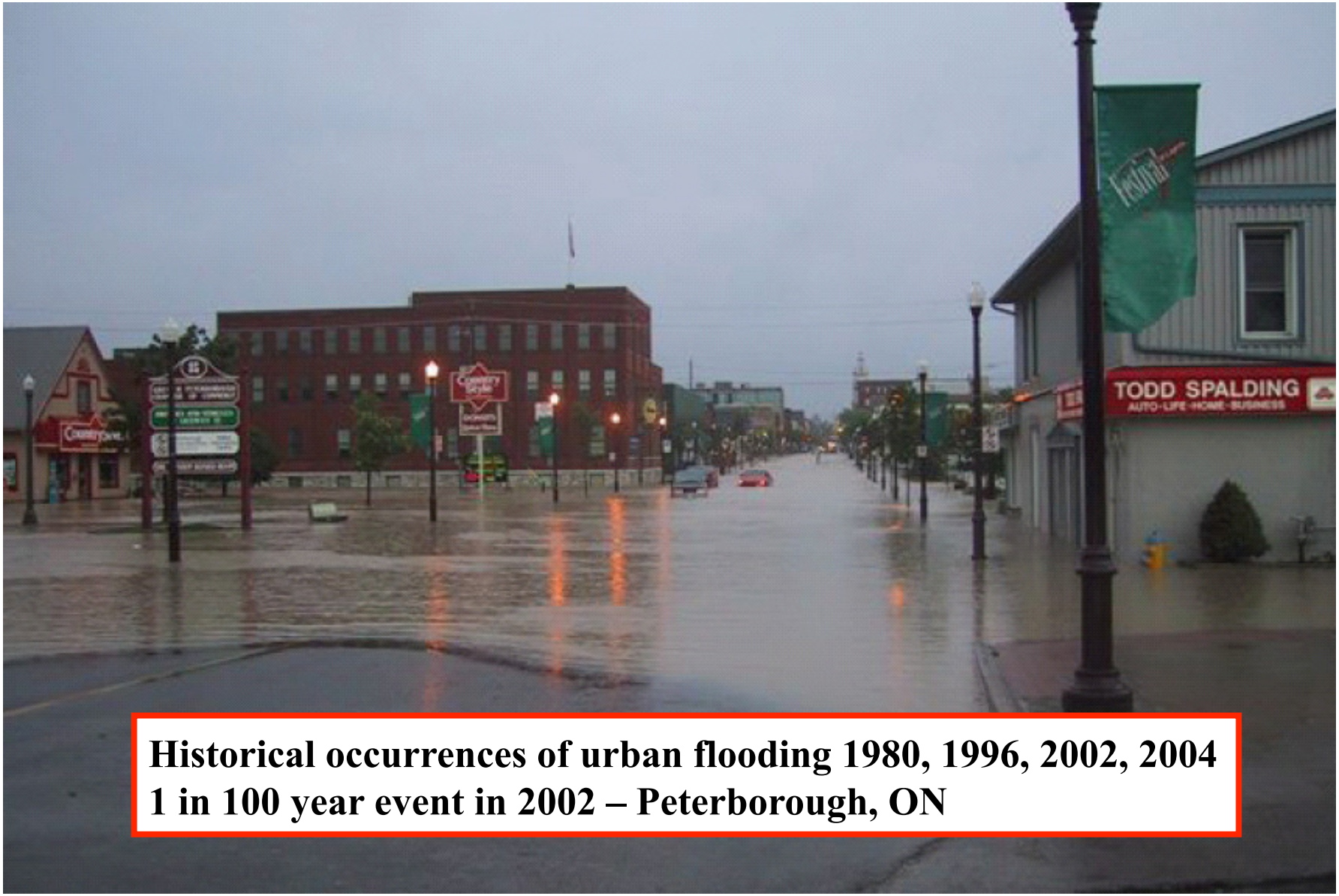
Medium (A1B) scenario (2090-2099): Global mean warming 2.8°C; Much of land area warms by ~3.5°C; Arctic warms by ~6°C.



CLIMATE EXTREMES

IPCC 2007 – Synthesis Report: Changes in extreme weather and climate events, based on projections to the mid- to late 21st century

Phenomenon and direction of trend	Likelihood of Future trend
Warm spells/heat waves. Frequency increases over most land areas	Very likely
Heavy precipitation events. Frequency increases over most areas	Very likely
Area affected by drought increases	Likely
Intense tropical cyclone activity increases	Likely
Increased incidence of extreme high sea level (excludes tsunamis)	Likely



Historical occurrences of urban flooding 1980, 1996, 2002, 2004
1 in 100 year event in 2002 – Peterborough, ON

Francis Zwiers

Adjunct Professor in the Dept. of Mathematics and Statistics of the University of Victoria, Director of the Pacific Climate Impacts Consortium, University of Victoria

Joining from Kampala, Uganda.

Xuebin Zhang

Research Scientist, Theme Lead, Climate Change Detection and Analysis, Environment Canada.

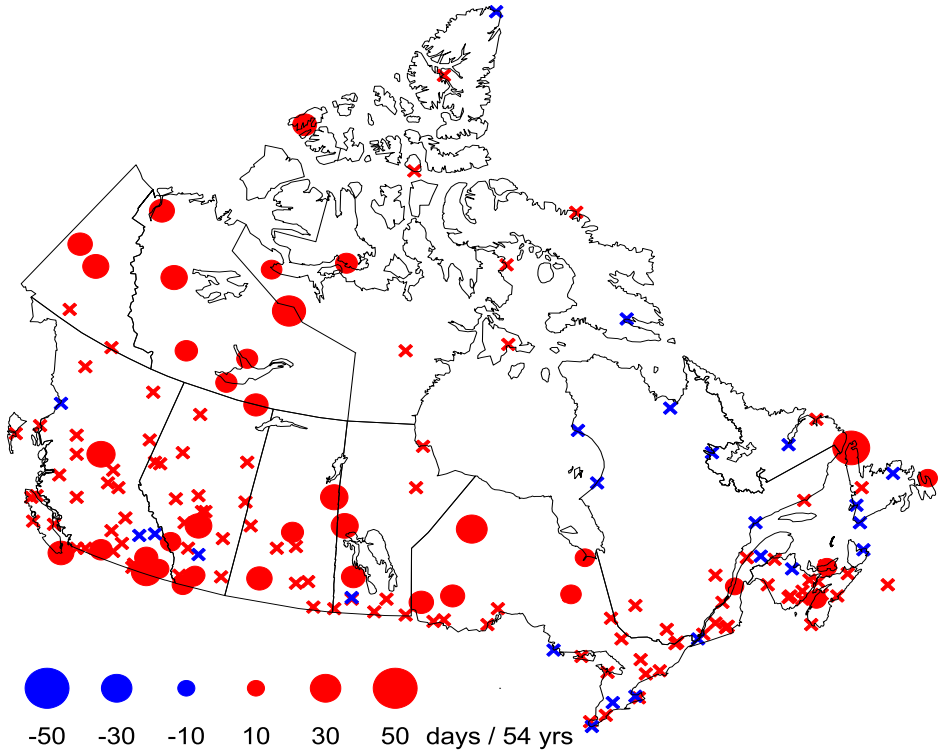
Evidence since 1950 of changes in temperature extremes

Overall since 1950:

- **decrease in number of cold days and nights**
- **increase in the number of warm days and nights, on the global scale and at the continental scale**

Extreme hot temperatures have significantly increased while extreme cold temperatures have become less severe in Canada

Trend from 1950-2003



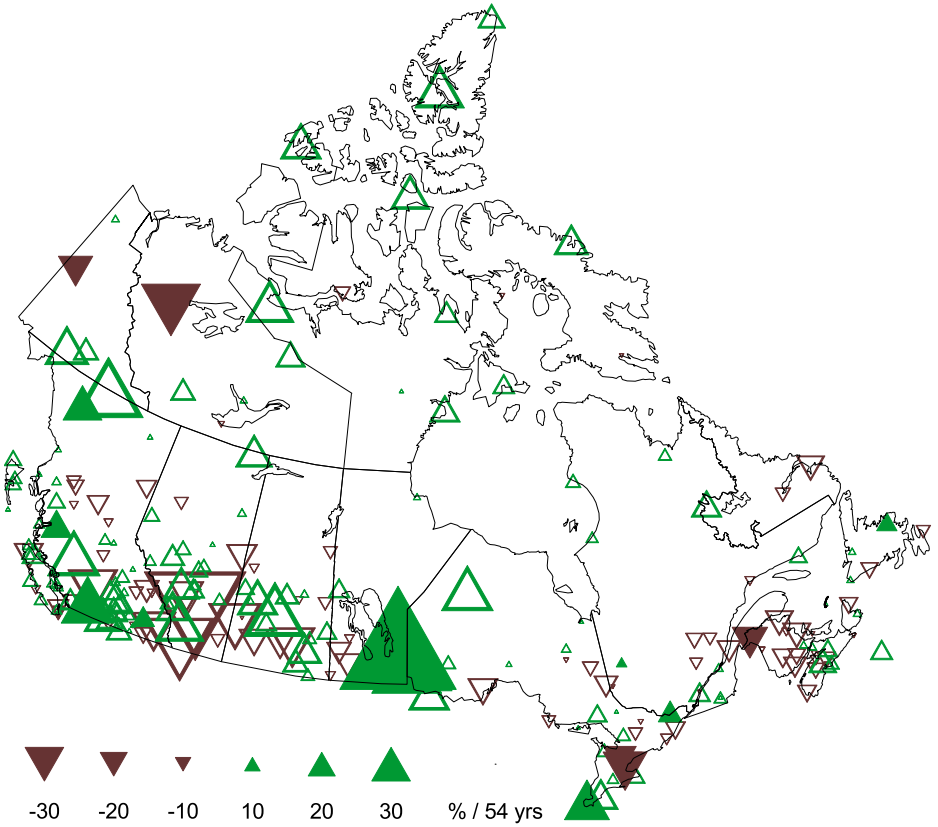
Vincent and Mekis 2006

Evidence since 1950 of changes in extremes of precipitation

- **More regions with statistically significant increases than with statistically significant decreases in the number of heavy precipitation events**

Changes in extreme precipitation in Canada are not very clear, however,
there has been a strong (in percentage) increase in extreme snowfall in the North.

Trend from 1950-2003



Annual Max 5-day prcp. ***Vincent and Mekis 2006***

Some extremes have changed because of anthropogenic influences

- **It is *likely (*66-100% probability) that anthropogenic influences have led to warming of extreme daily minimum and maximum temperature on the global scale**

Anthropogenic influence is detected in extreme temperatures over Canada

Some extremes have changed because of anthropogenic influences

- **There is *medium confidence* that anthropogenic influences have contributed to intensification of extreme precipitation on the global scale**

Some extremes have changed because of anthropogenic influences

- **It is *likely* (66-100% probability) that there has been an anthropogenic influence on increasing extreme coastal high water due to increase in mean sea level**

Climate extremes are projected to change in the future

- **It is *virtually certain* (99-100% probability) that increases in the frequency and magnitude of warm daily temperature extremes and decreases in cold extremes will occur in the 21st century on the global scale**

  - ***The current once in 20-yr maximum daily temperature will likely increase by 2-4 degrees in Canada, by the end of the 21st century***

Climate extremes are projected to change in the future

- **It is *very likely* (90-100% probability) that the length, frequency and/or intensity of warm spells, or heat waves, will continue to increase.**

Climate extremes are projected to change in the future

- **It is *likely* (66-100% probability) that the frequency of heavy precipitation on the proportion of total rainfall from heavy falls will increase in the 21st century over many areas of the globe**
- ***The current once in 20-yr daily maximum precipitation will likely become a once in 5-10 year event in Canada, by the end of the 21st century***

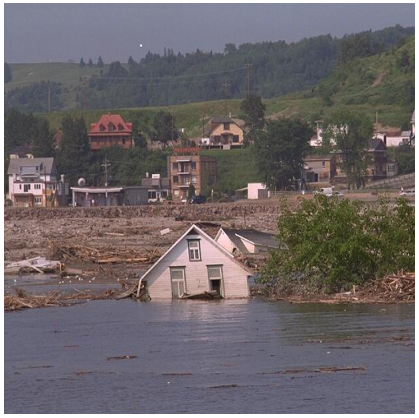
Paul Kovacs

Executive Director, Institute for Catastrophic Loss Reduction; President, Property and Casualty

Canada has had an increasing toll in the the past decades

Saguenay Flood (1996)

10 deaths
15,000 people evacuated
$1.5 billion in losses



Manitoba Flood (1997)

4 deaths
25,000 people evacuated
$1.0 billion in losses



The Eastern Canada Ice storm - 1998

30+ deaths - $7B damages - Months of impact

- Psychological impacts on children

Summary for Policymakers (DRAFT)- DISASTER LOSSES

- **Economic losses from weather- and climate-related disasters have increased, but with large spatial and interannual variability (*high confidence).***
- **Economic, including insured, disasters losses associated with weather, climate, and geophysical events, are higher in developed countries. Fatality rates and economic losses as a proportion of GDP are higher in developing countries (*high confidence).***
- **Increasing exposure of people and economic assets has been the major cause of the long-term increases in economic losses from weather- and climate-related disasters. (*high confidence).***
- ***Long-term trends in economic disaster losses adjusted for wealth and population increases have not been* attributed to climate change, but a role for climate change has not been excluded. (*medium evidence, high agreement).***

Questions?

Thank you

Our Panelists: Gordon McBean, Francis Zwiers, Xuebin Zhang, Paul Kovacs

Canadian Foundation for Climate and Atmospheric Sciences (CFCAS)
Fondation canadienne pour les sciences du climat et de l'atmosphère (FCSCA)

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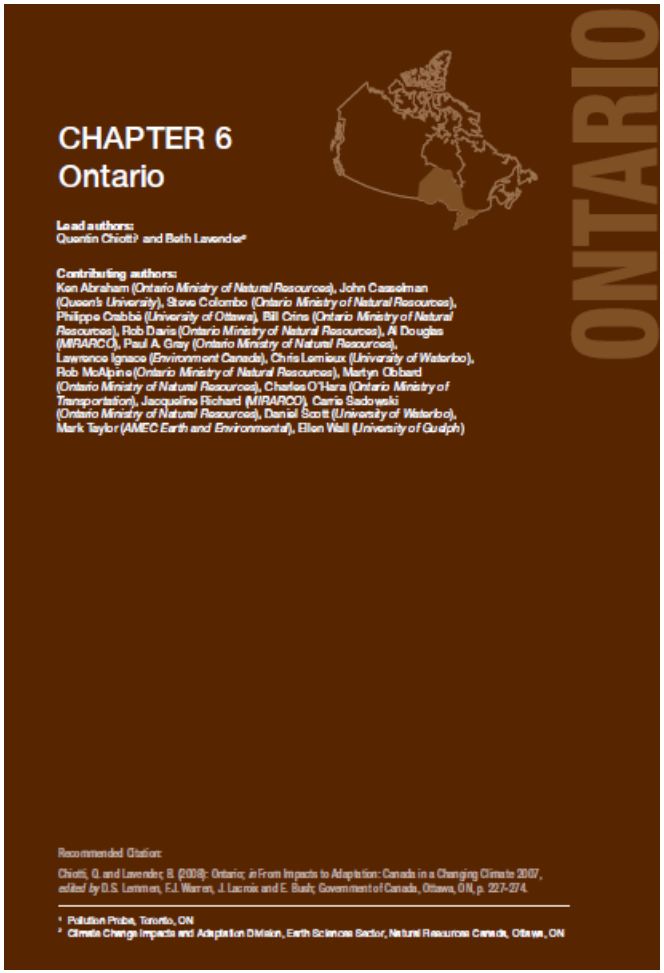
SMC CSM

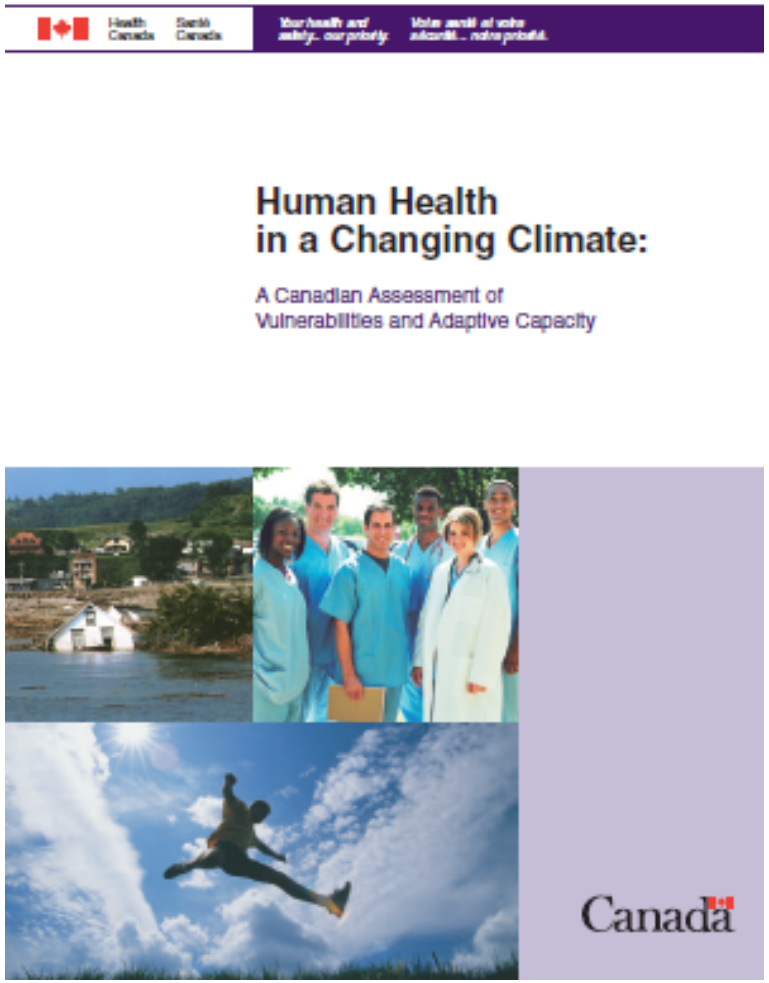
How will climate change affect Canada?



From Impacts to Adaptation: Canada in a Changing Climate 2007

- **Projections - intense rainfall events, heat waves and smog episodes are likely to become more frequent.**
- **Heat-related mortality could more than double in southern and central Ontario by the 2050s**
- **Air pollution mortality could increase about 15 to 25% during the same interval.**

How will climate change affect Canada?



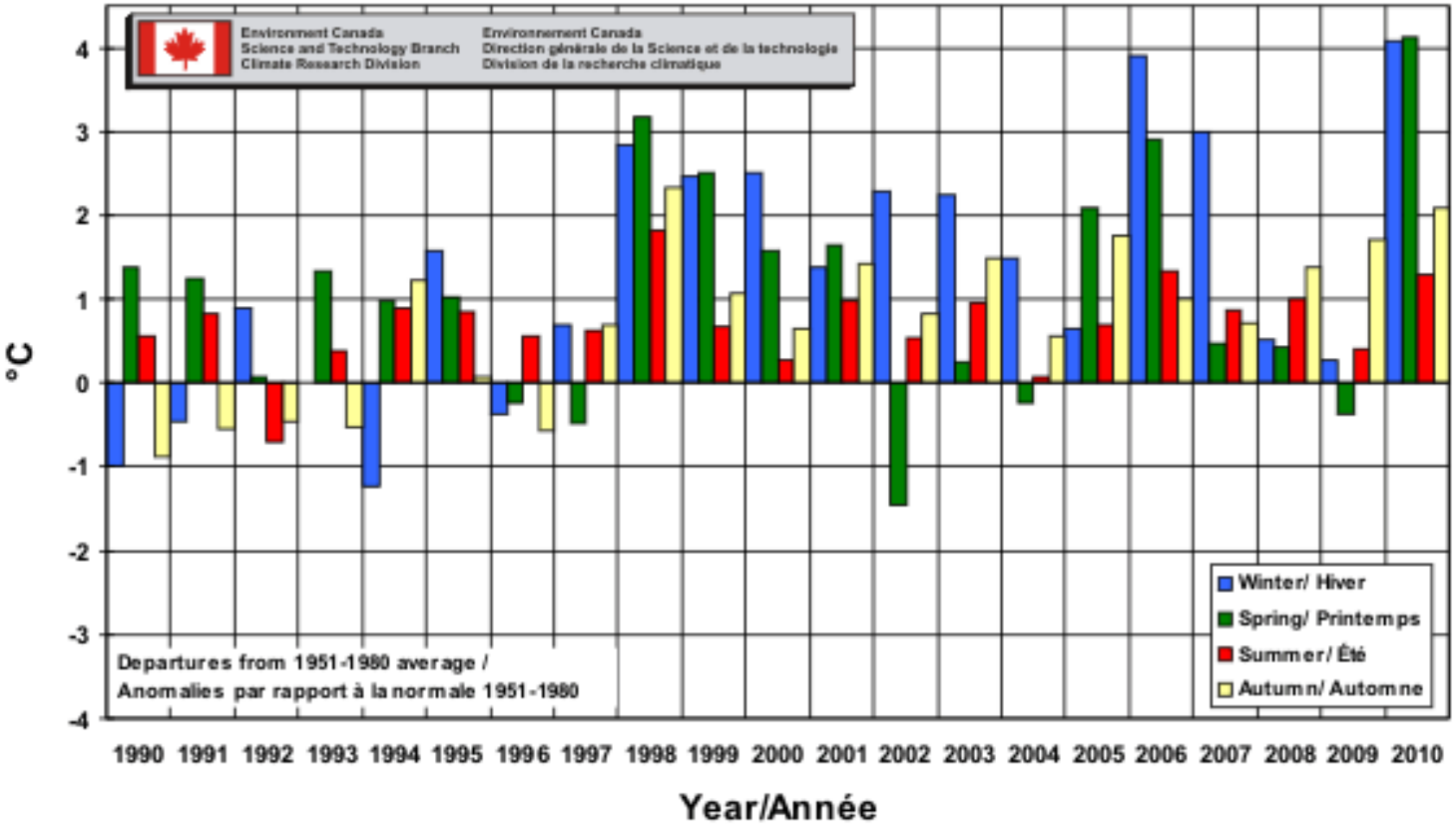
- **"Climate change is expected to increase risk to the health of Canadians through many pathways: they food they eat, the air they breathe, the water they drink, and their exposure to extreme weather events and infectious diseases found in nature."**

Human Health in a Changing Climate:
A Canadian Assessment of Vulnerabilities and Adaptive Capacity (2008)

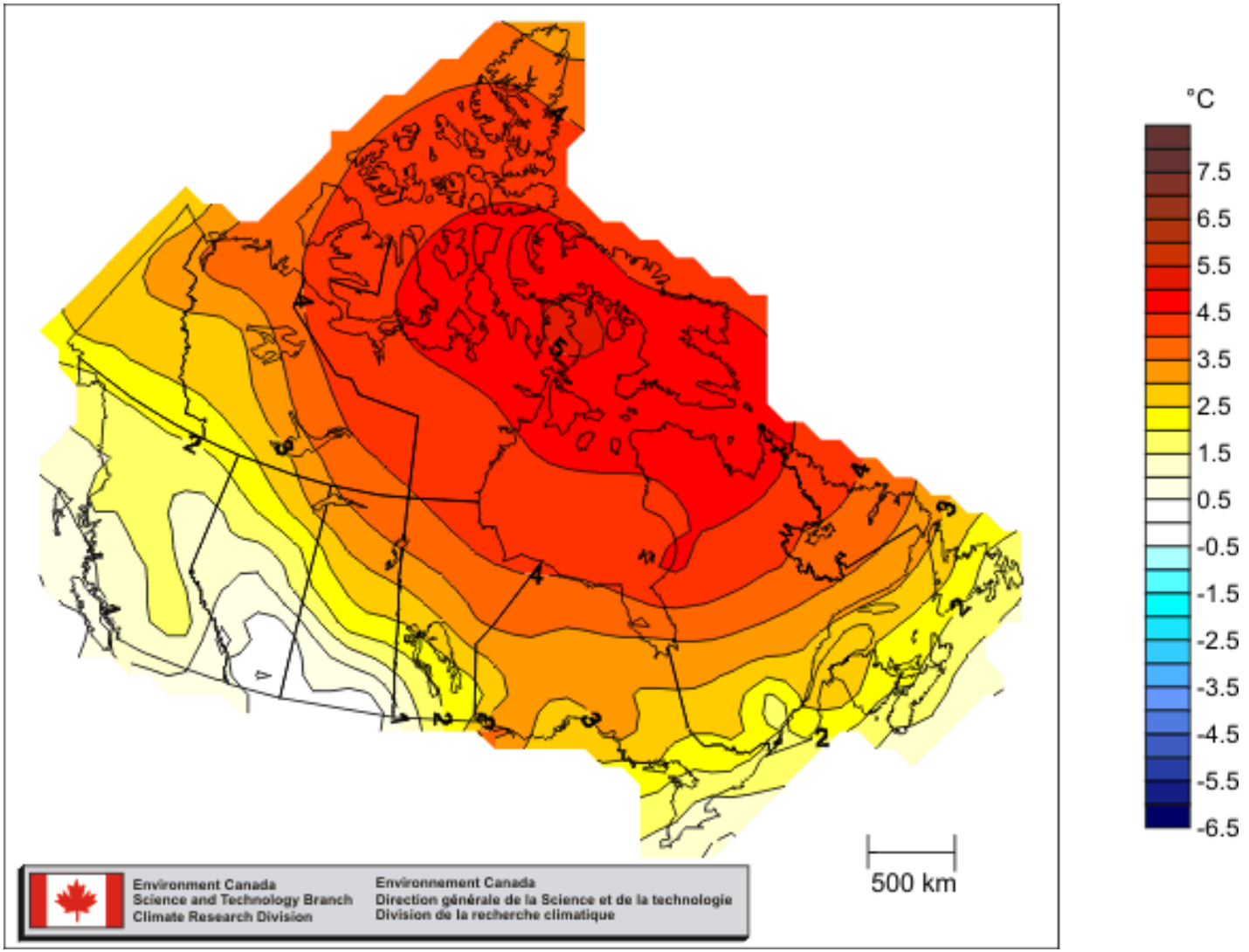
National Round Table on the Environment and the Economy (Canada): Paying the Price: The Economic Impacts of Climate Change for Canada (2011)

Climate change costs for Canada could escalate from roughly $5 billion per year in 2020 — less than 10 years away — to between $21 billion and $43 billion per year by the 2050s. The magnitude of costs depends upon a combination of two factors: global emissions growth and Canadian economic and population growth.

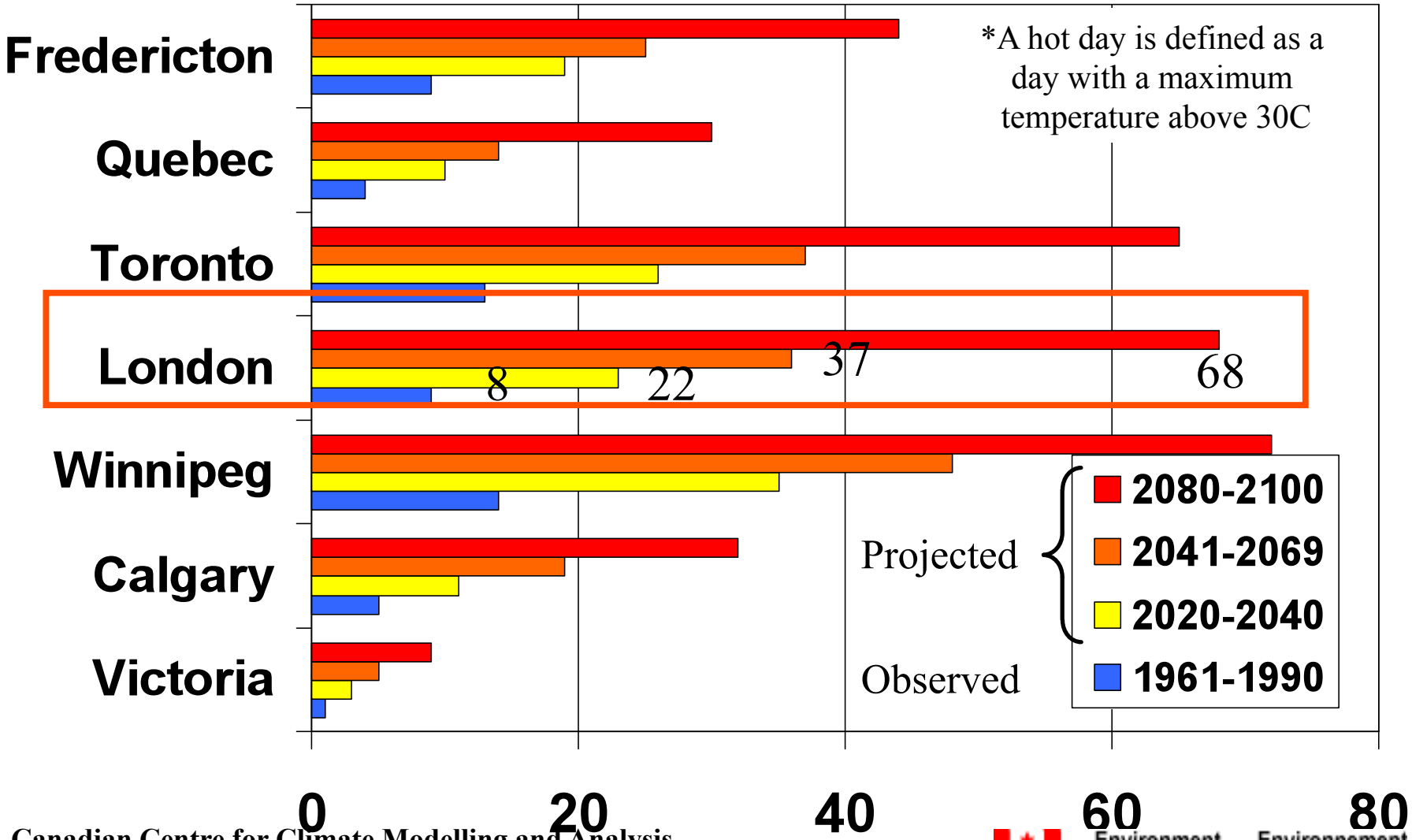
Winters are warming more than other seasons.



The Arctic is warming more than other regions.

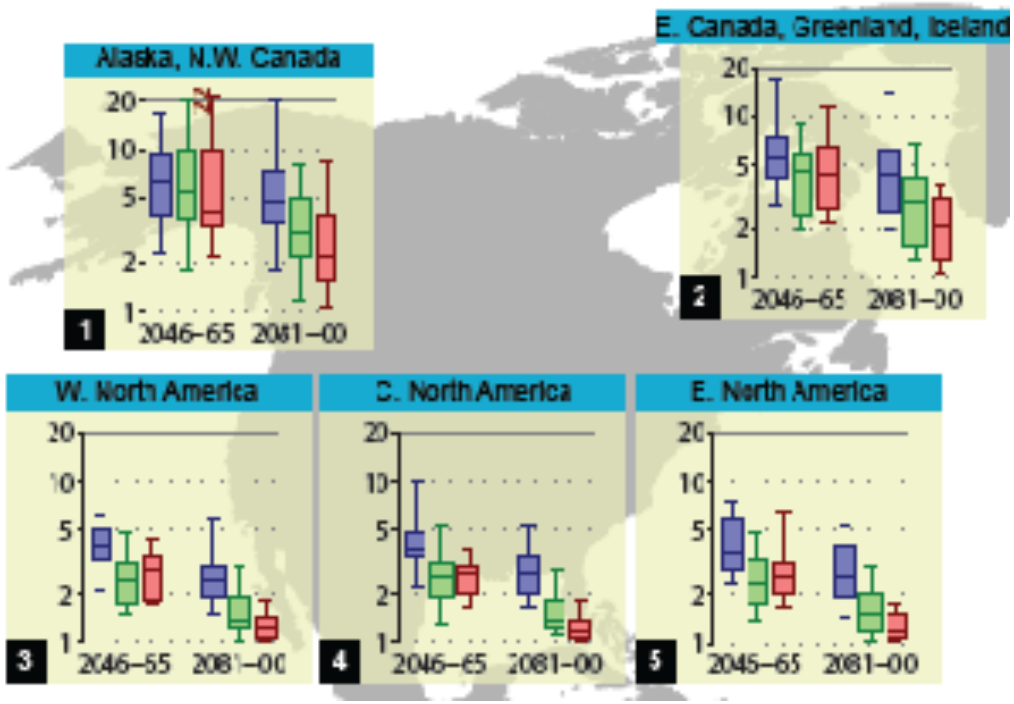


Number of hot days* per year



Canadian Centre for Climate Modelling and Analysis
Centre canadien de la modélisation et de l'analyse climatique

Environment Canada Environnement Canada


Alaska, N.W. Canada
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