

# PREPARING FOR MORE CLIMATE CHANGE

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Saskatchewan Research Council

Invited presentation to the Saskatchewan Energy  
Management Task Forces

12 January 2011, Saskatoon

# MENU

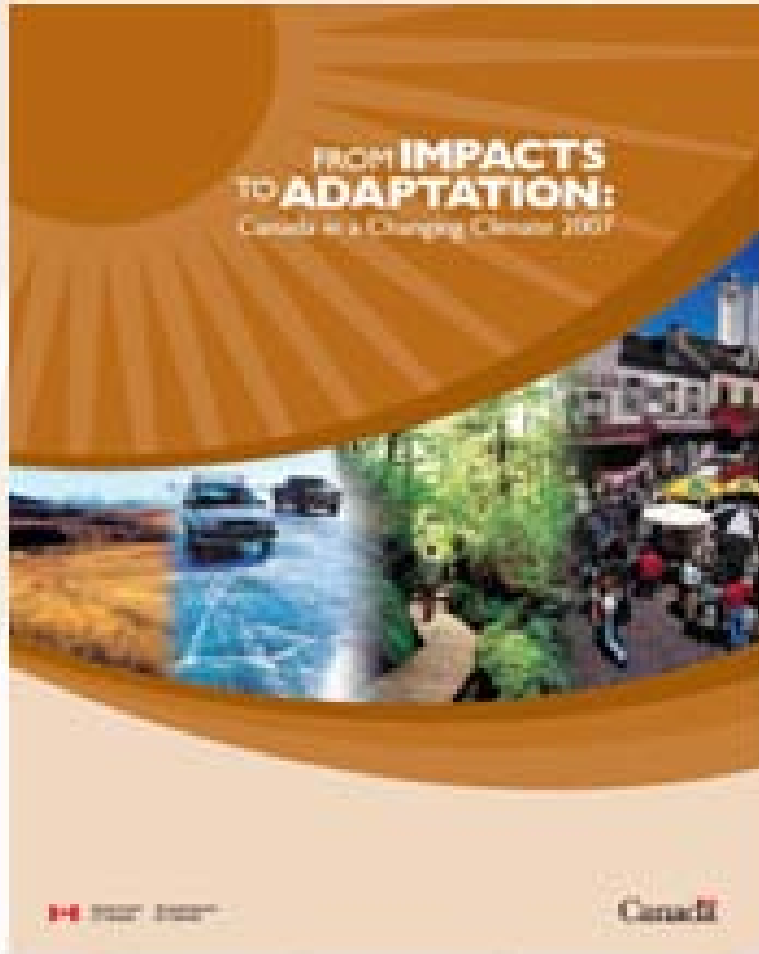


- ◆ Important **information** sources
- ◆ Introduce our **new global and local climates**
- ◆ **Future** possible climates
- ◆ **Impacts expected**
- ◆ Main strategic **responses** are:
  - mitigation
  - adaptation

# Highlights

- ◆ **Rapid** climate changes and their impacts are already evident and more are expected
- ◆ **Winter** advantages are disappearing
- ◆ Weather **extremes** and their effects are more likely
- ◆ Many challenges for the economy, environment and society, e.g. **agriculture, water, health, energy, communities...**
- ◆ **Adaptation** is happening, but more is needed to take advantage of opportunities and avoid/reduce negative impacts

# Canada in a Changing Climate



- Regionally-focused analysis

(North, Atlantic, Quebec, Ontario, Prairies, British Columbia, International)

- 145 Authors, 110 reviewers, over 3000 references

- National Advisory Committee

- Documents impacts, adaptations and vulnerabilities

- Key products

- 500 page bilingual science report

- Synthesis Report and Highlights

# Intergovernmental Panel on Climate Change (IPCC)

Established in 1988 by the  
**World Meteorological  
Organization**  
and the  
**United Nations  
Environment Programme**

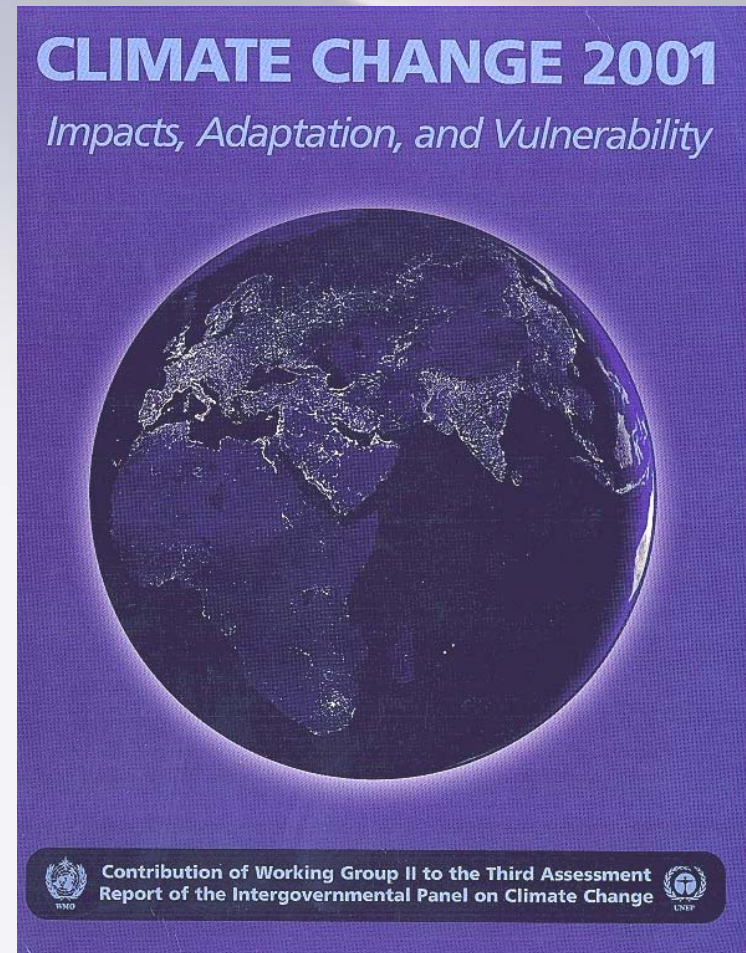
One of the most authoritative  
bodies regarding climate  
change

Co-winner of the  
2007 Nobel Peace Prize

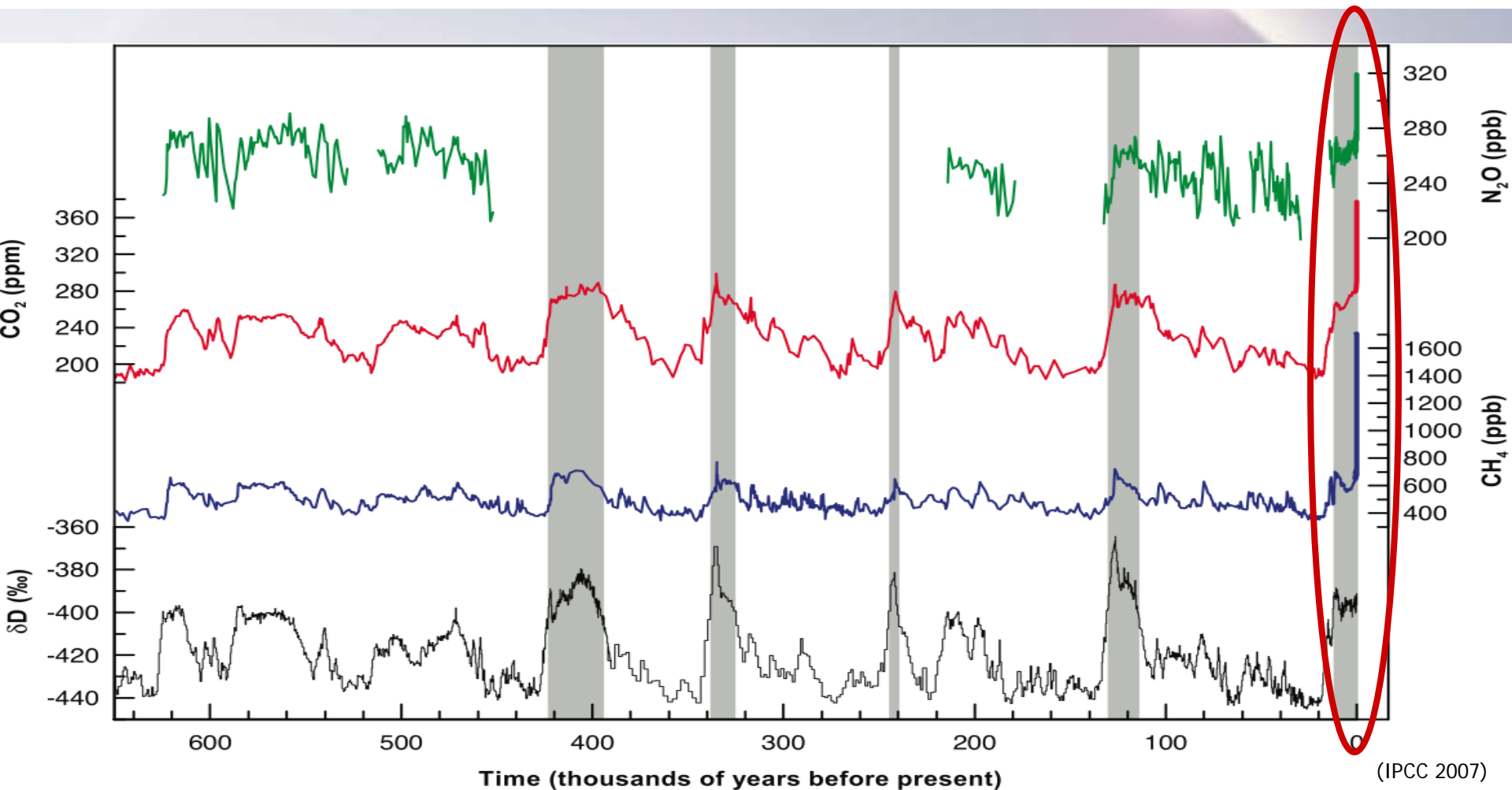


Front

Back

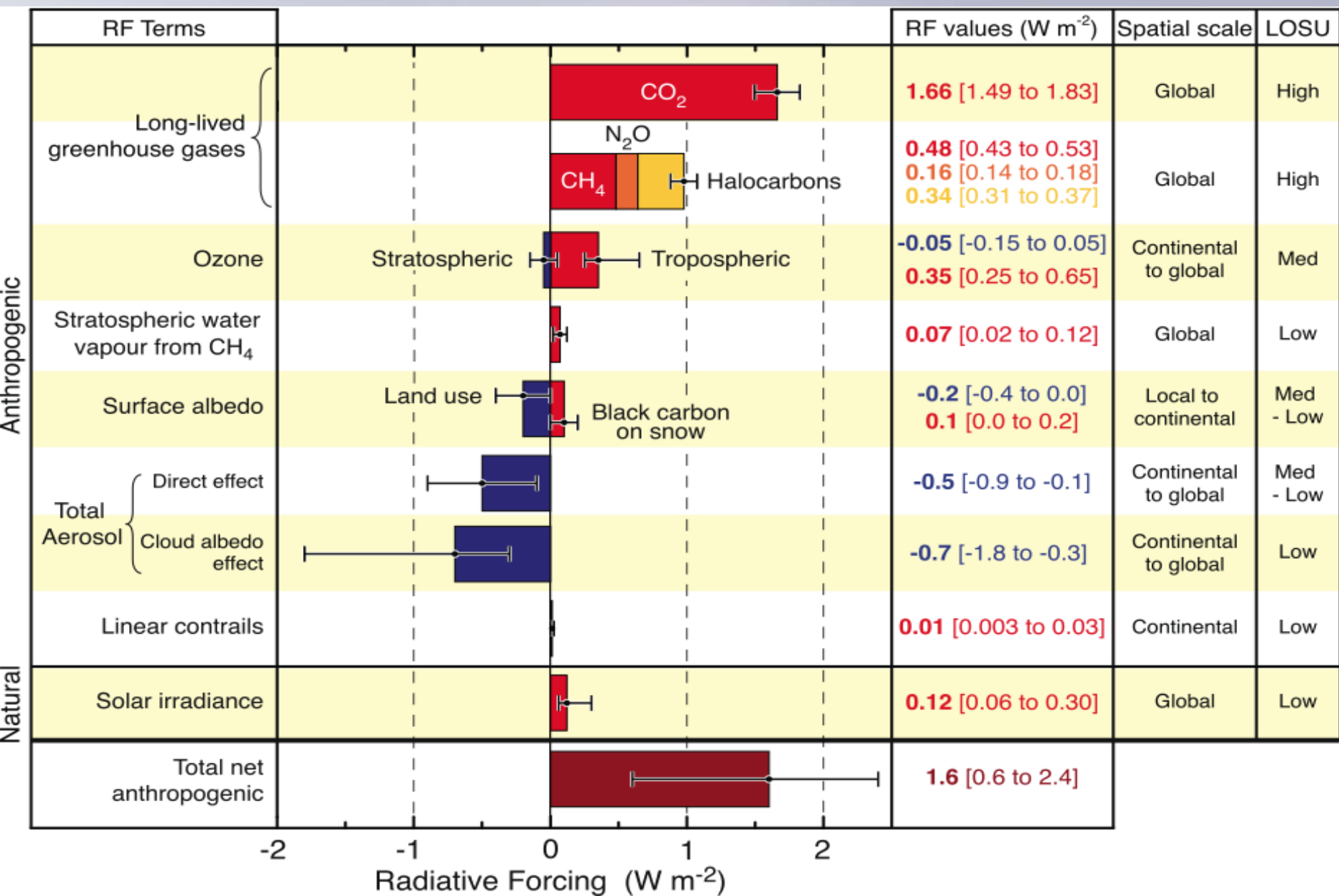


# Current atmospheric concentrations of greenhouse gases far exceed pre-industrial values

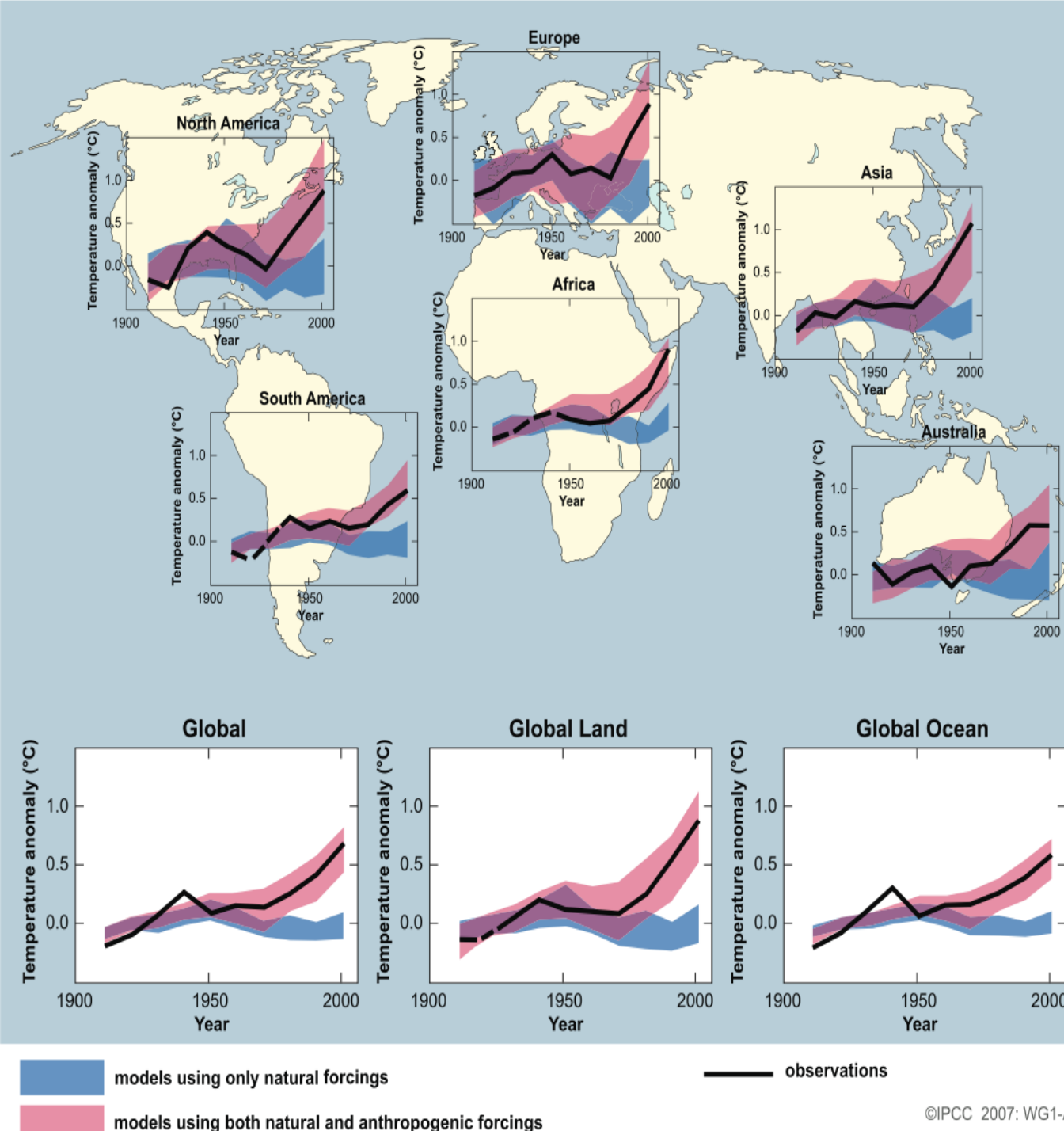




# "Greenhouse gases" are important climate change factors



# Compare natural and human effects on past temperatures

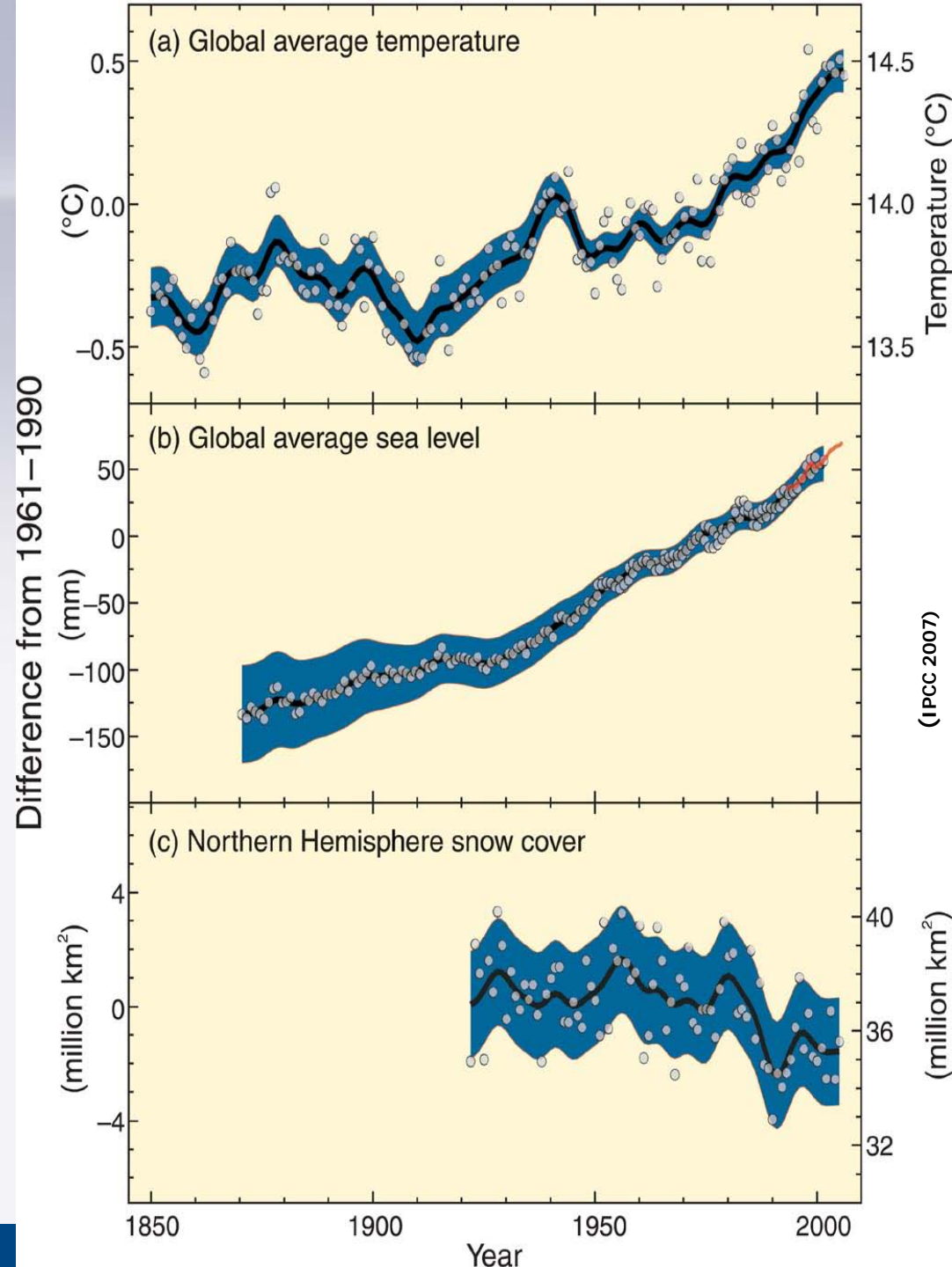




# Changes of the climate system are very clear and very likely (>90%) related to human activities

(IPCC 2007)

- Rising global average sea level
- Reductions of snow and ice
- 11 of the 12 warmest years on record globally were in the past 12 years

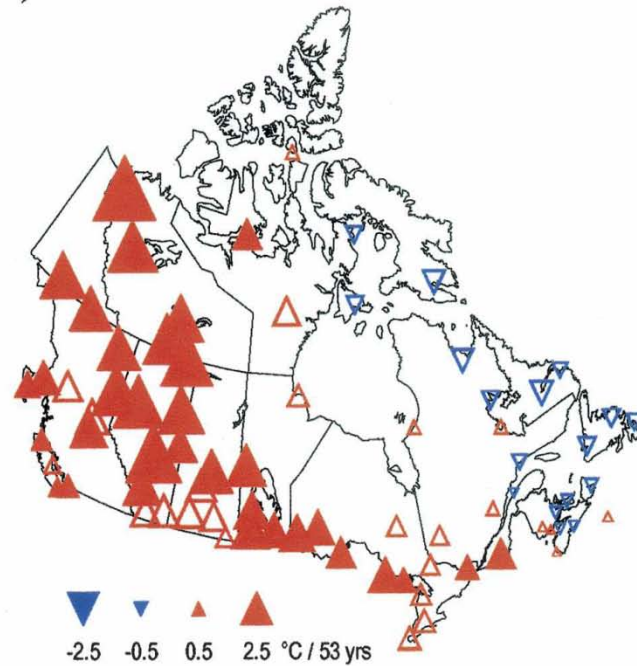


# What is the new Canadian climate like?

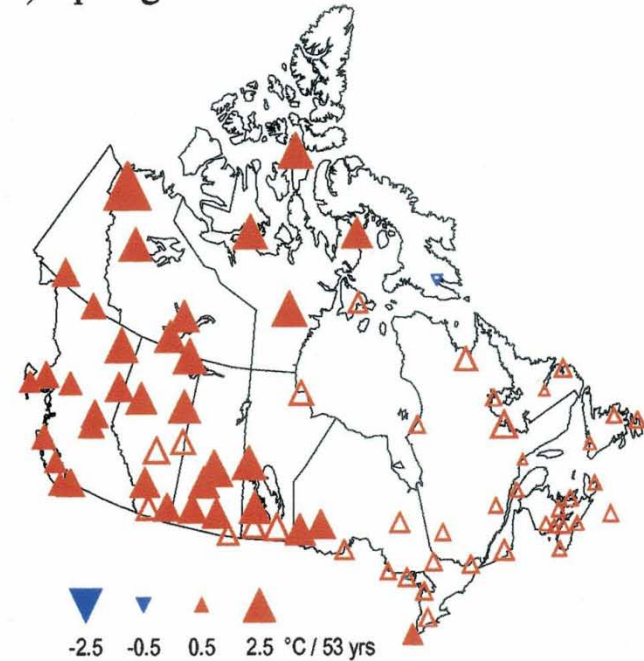
Temperature  
1953-2005

(Vincent et al. 2007)

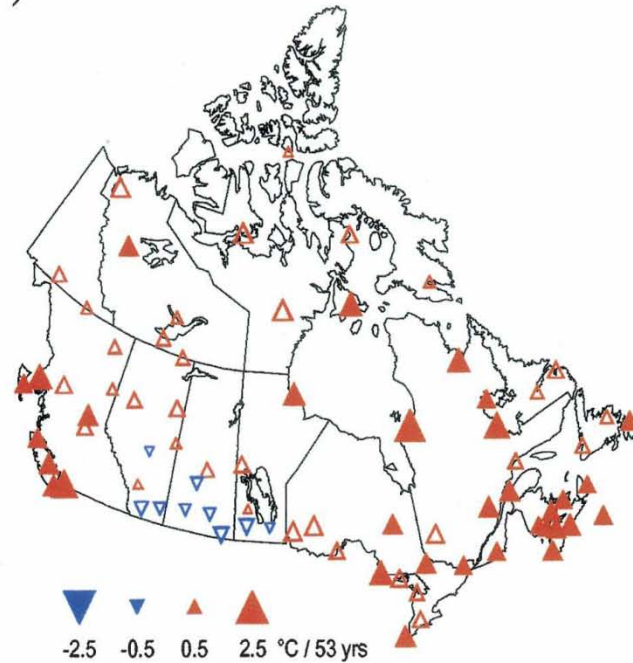
a) Winter



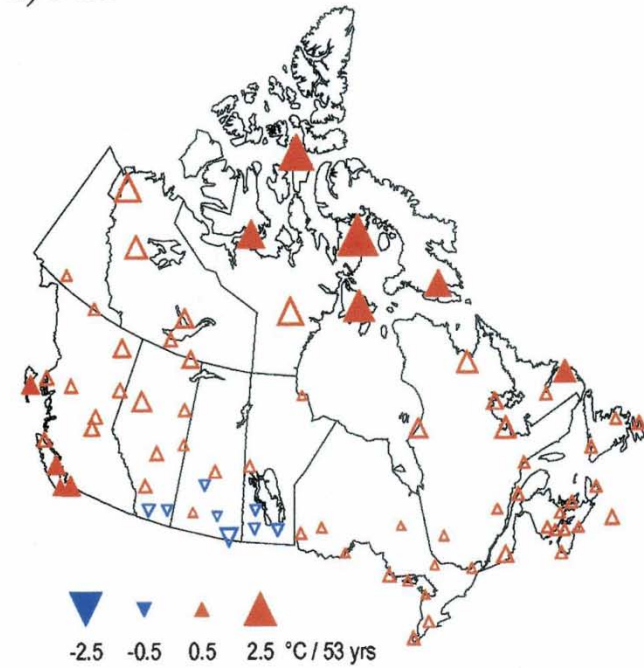
b) Spring



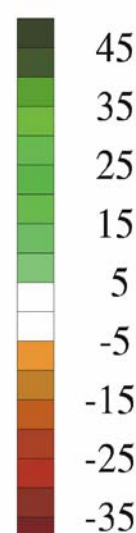
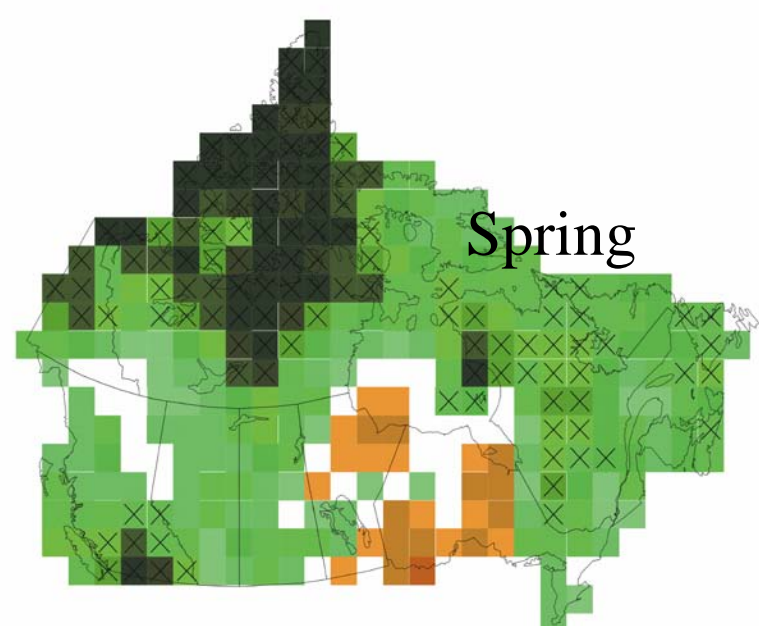
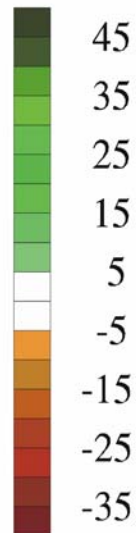
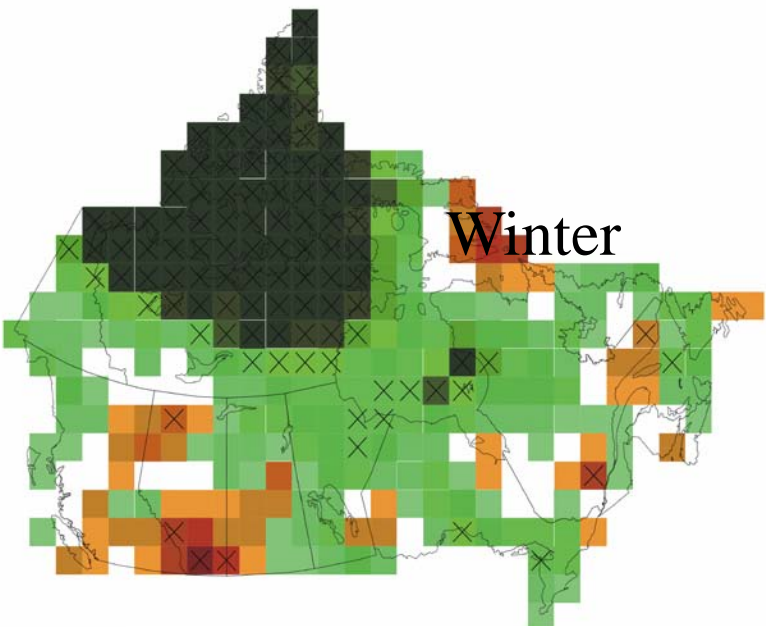
c) Summer



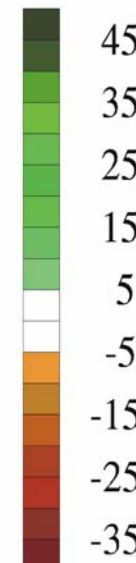
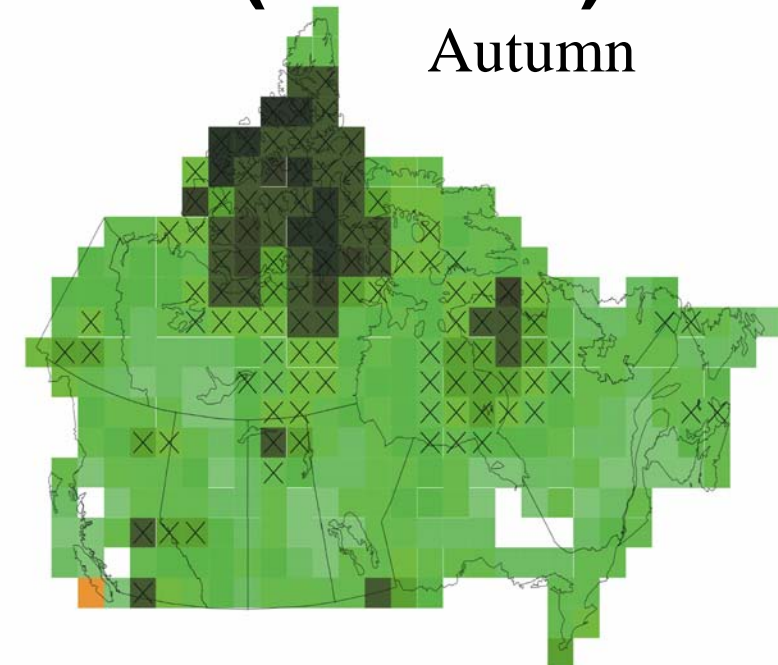
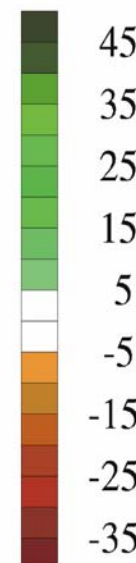
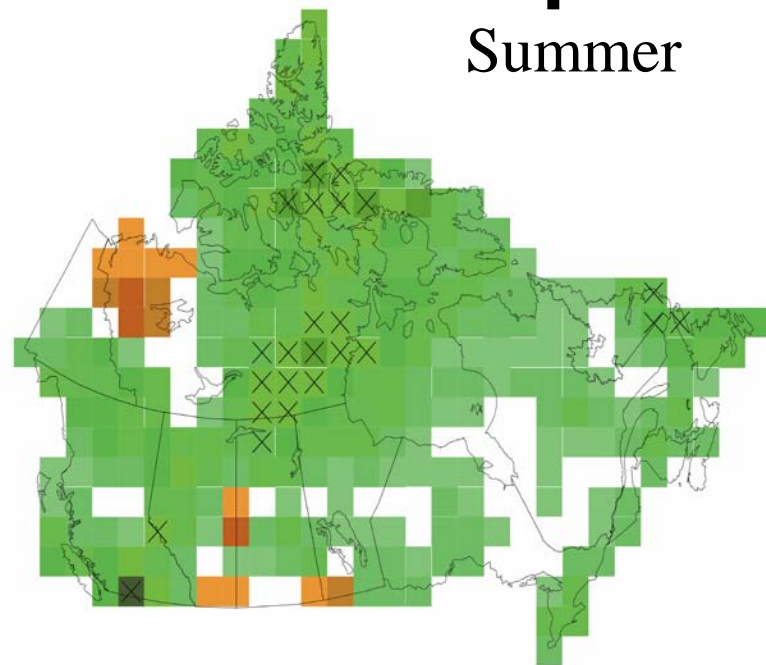
d) Fall







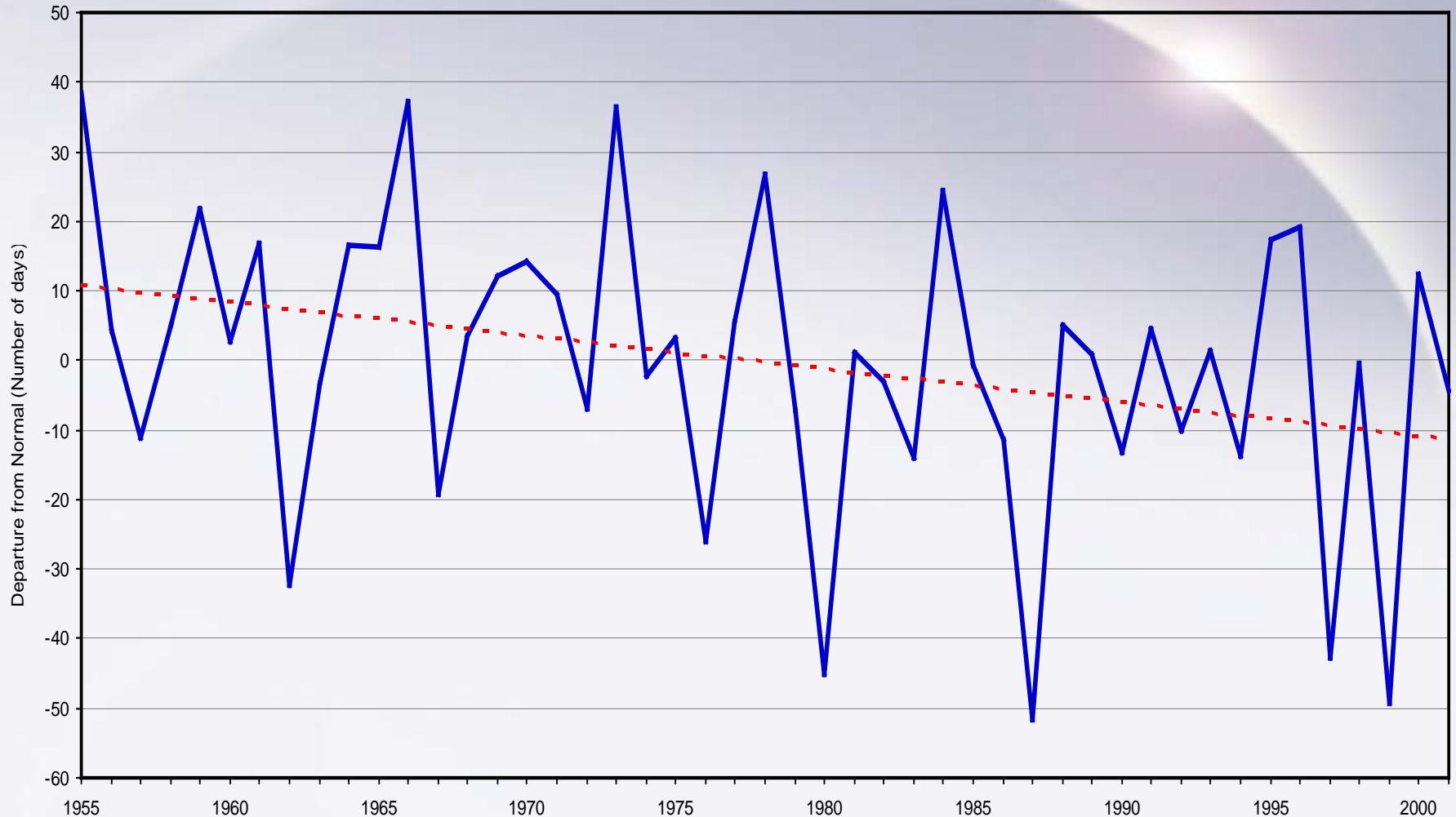
## Precipitation Trends (1950-98)



# The Snow-cover Season is Shrinking

## Canadian Prairies

(Anomalies from 1961 to 1990 mean)



After Wheaton 2005 (Data: Brown 2003)

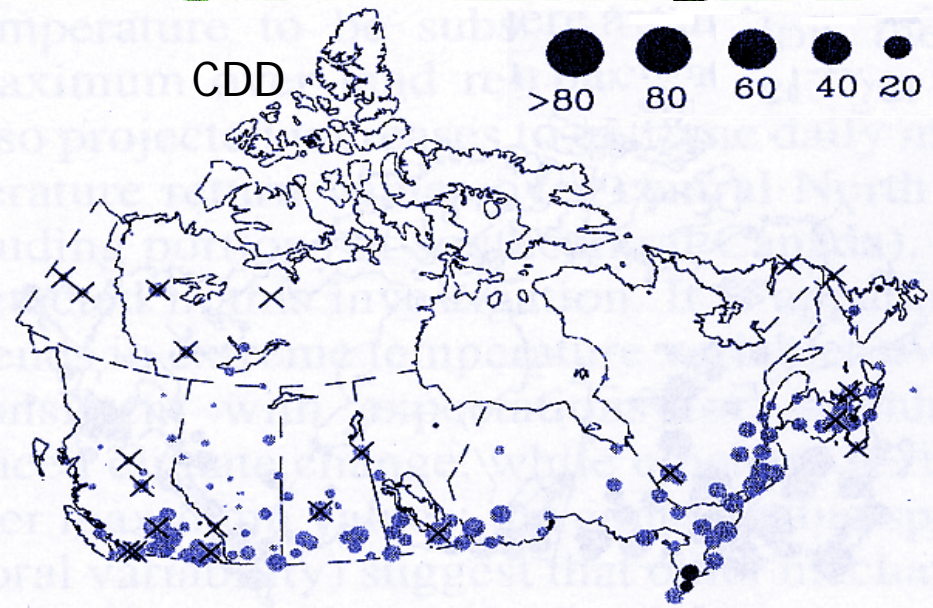
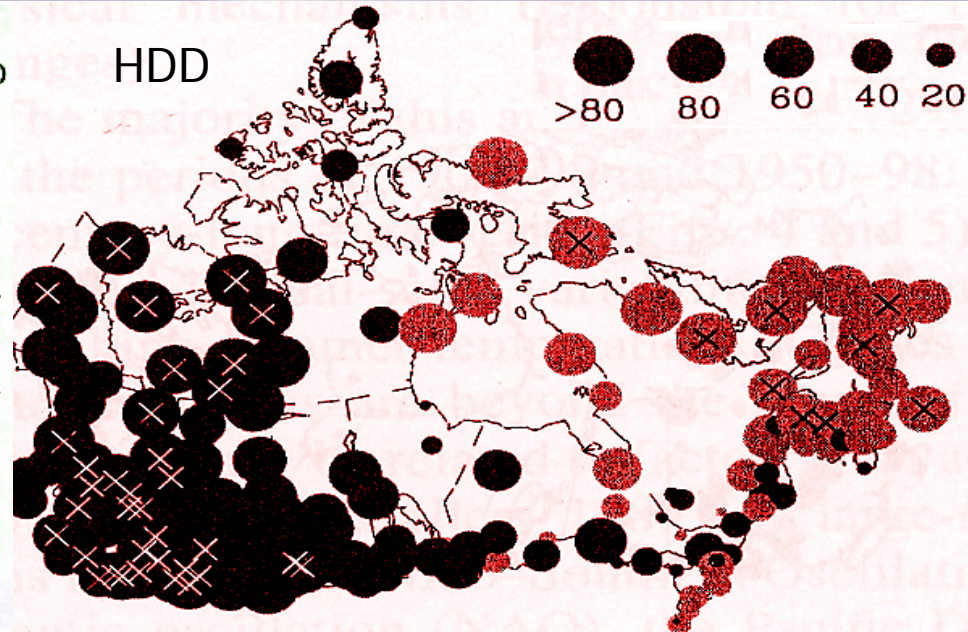
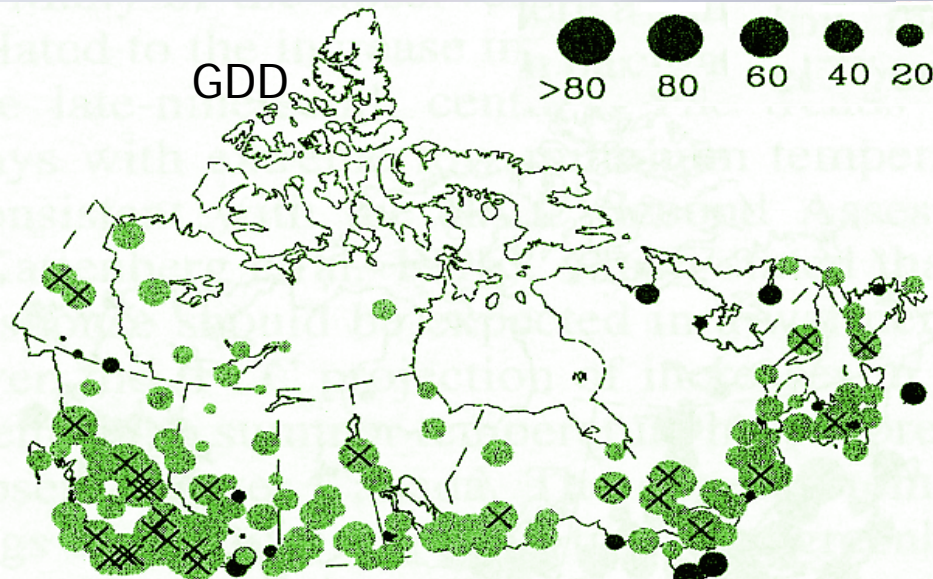
*smart science solutions*

# The number of blizzards has fallen sharply in the Prairies since 1953





# Temperature changes mean changes for crops, heating, and cooling buildings



1950-1988 (dd/10y)

Coloured dots signify positive trends and black signifies negative trends. Crosses: significant trends

Bonsal et. al. 2001





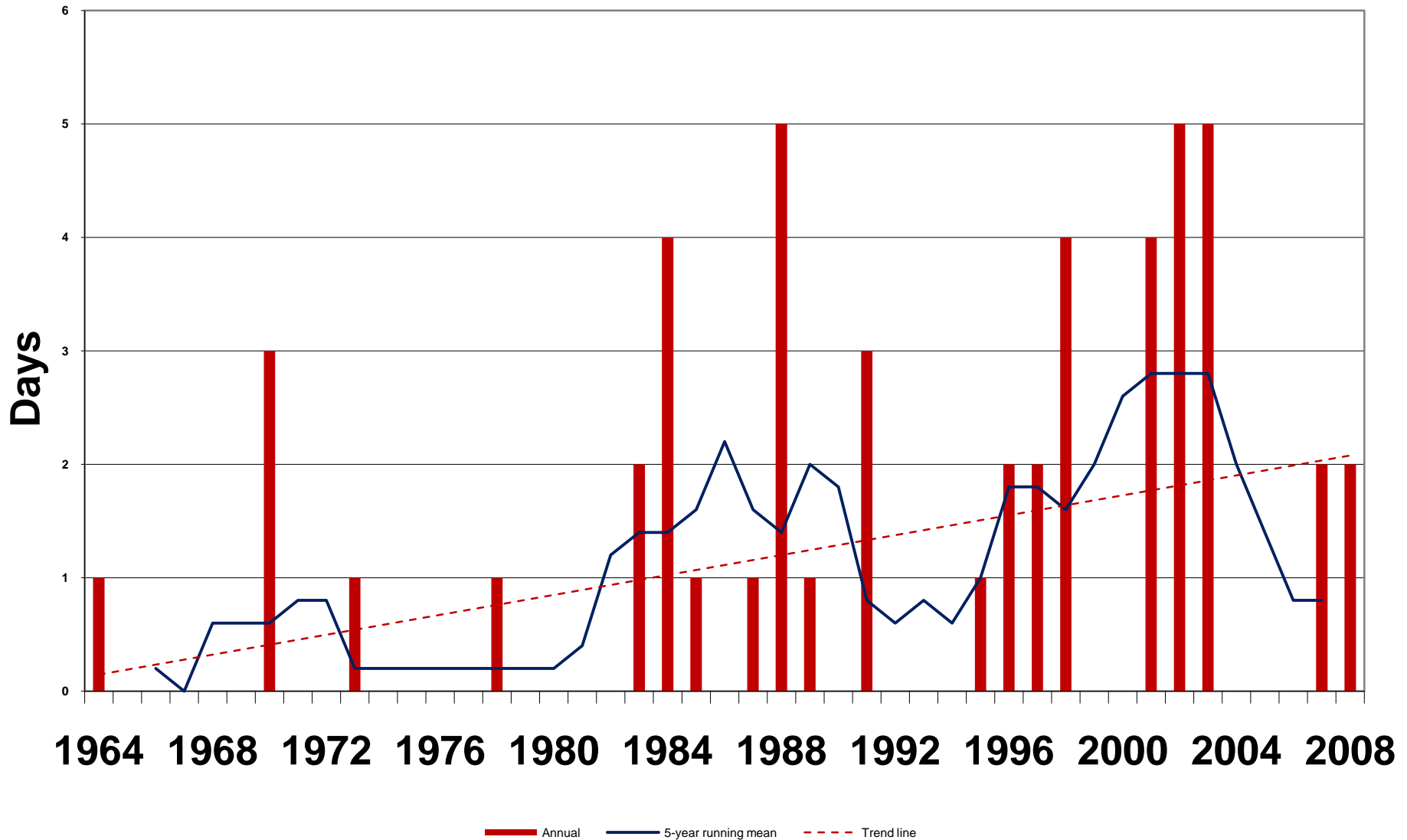
Plants demonstrate  
that spring is  
changing:  
Spring blooming dates  
for **aspen poplar** have  
shifted 26 days earlier  
in the past several  
decades on the Prairies

(Beaubien and Freeland 2000)

**What are the  
implications?**

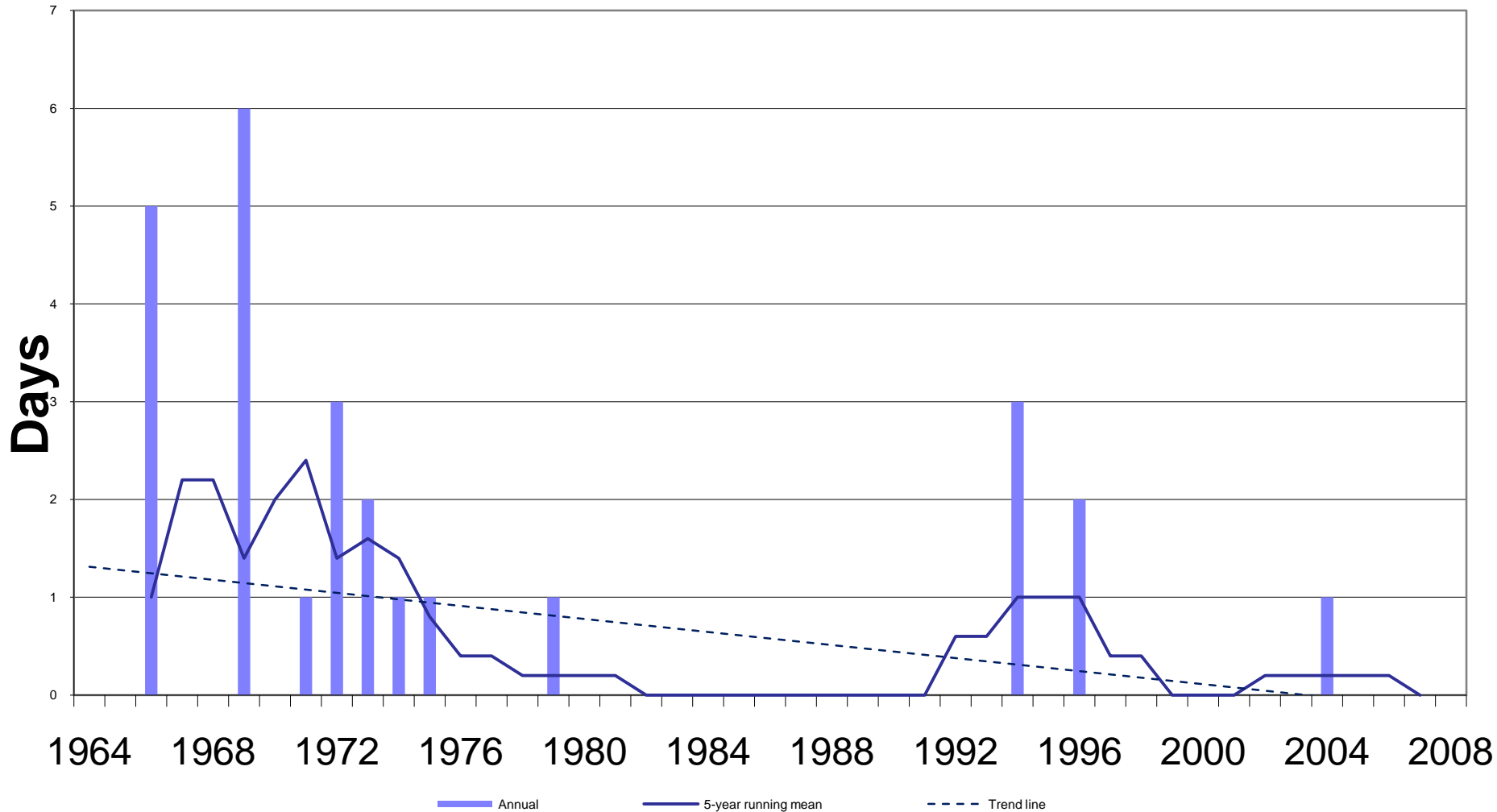
# Hot Days are Increasing

Number of Days with Temperatures 35°C or Greater  
Saskatoon Climate Reference Station SRC



# Cold Days are Vanishing

Days with temperature of minus 40°C or Less  
(1964 to 2008) Saskatoon Climate Reference Station, SRC



# Frost-Free Season is Getting Longer Saskatoon

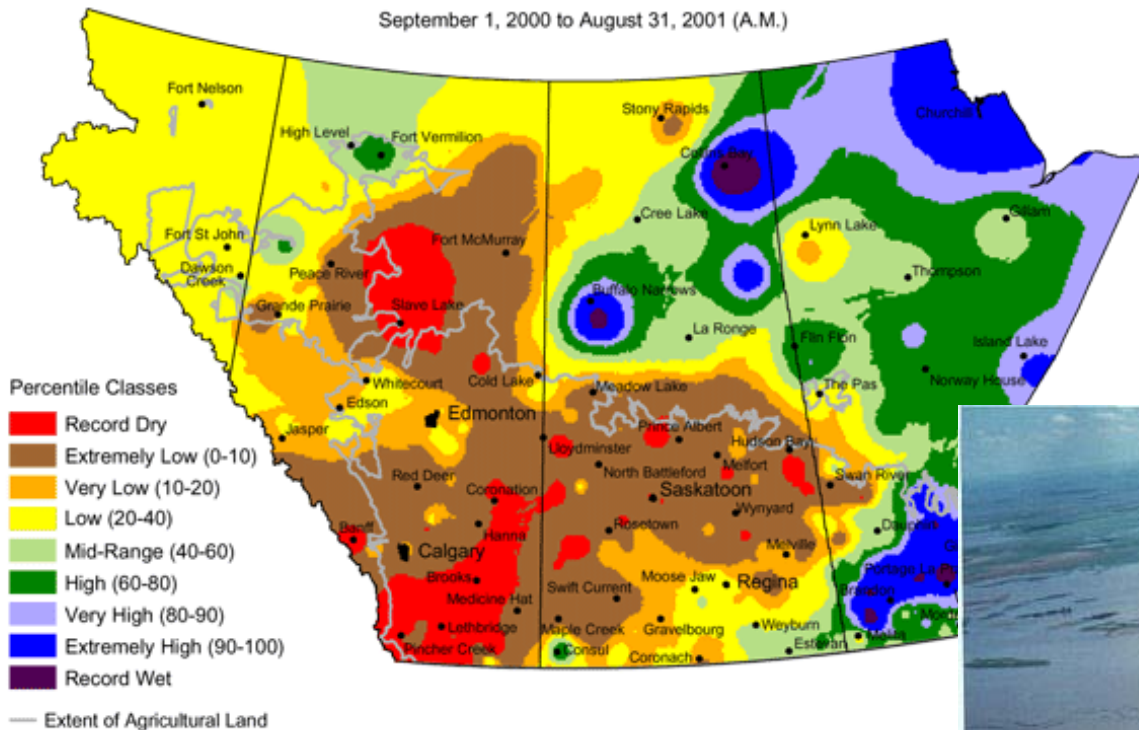




# Recent Extremes include Droughts & Floods and More are Expected

## Current Precipitation Compared to Historical Distribution

September 1, 2000 to August 31, 2001 (A.M.)

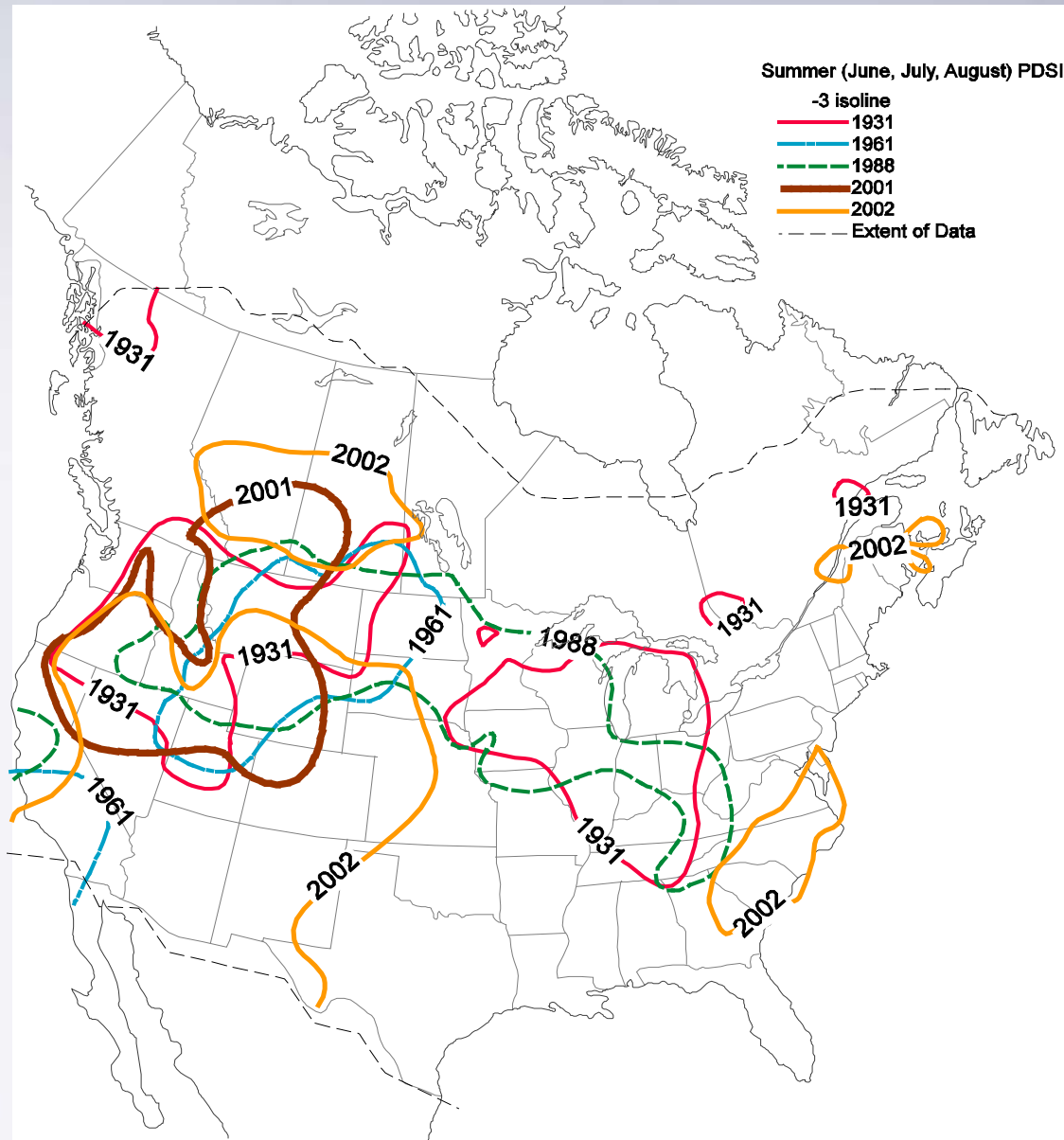


Prepared by PFRA (Prairie Farm Rehabilitation Administration) using data from the Timely Climate Monitoring Network and the many federal and provincial agencies and volunteers that support it.

Flooded agricultural land east of Vanguard  
July 2000: 375 mm in 8 h  
(Hunter et al. 2003 Photo: SWA)



# Drought Spatial Patterns



- 2001 and 2002 drought years appear to be the most **extensive** of this set of major droughts

- **Preferred** area for droughts in Canada is the southern prairie provinces

- **Northward** extension of these recent droughts appears unusual

- 2001-2002 was a major **multi-year** drought, unlike most others

- **Causes** may be changing

(Wheaton et al, 2005)



# Drought Impacts can be Numerous and Severe



(Wheaton et al. 2005)

*smart science solutions*

# Economic Impacts of the 2001-2002 Drought

- Total Canadian agricultural production loss was ~\$3.6 billion
- Gross Domestic Product fell ~\$5.8 billion
- Employment losses > 41,000
- Worst year was 2002
- Alberta and Saskatchewan were hit hardest





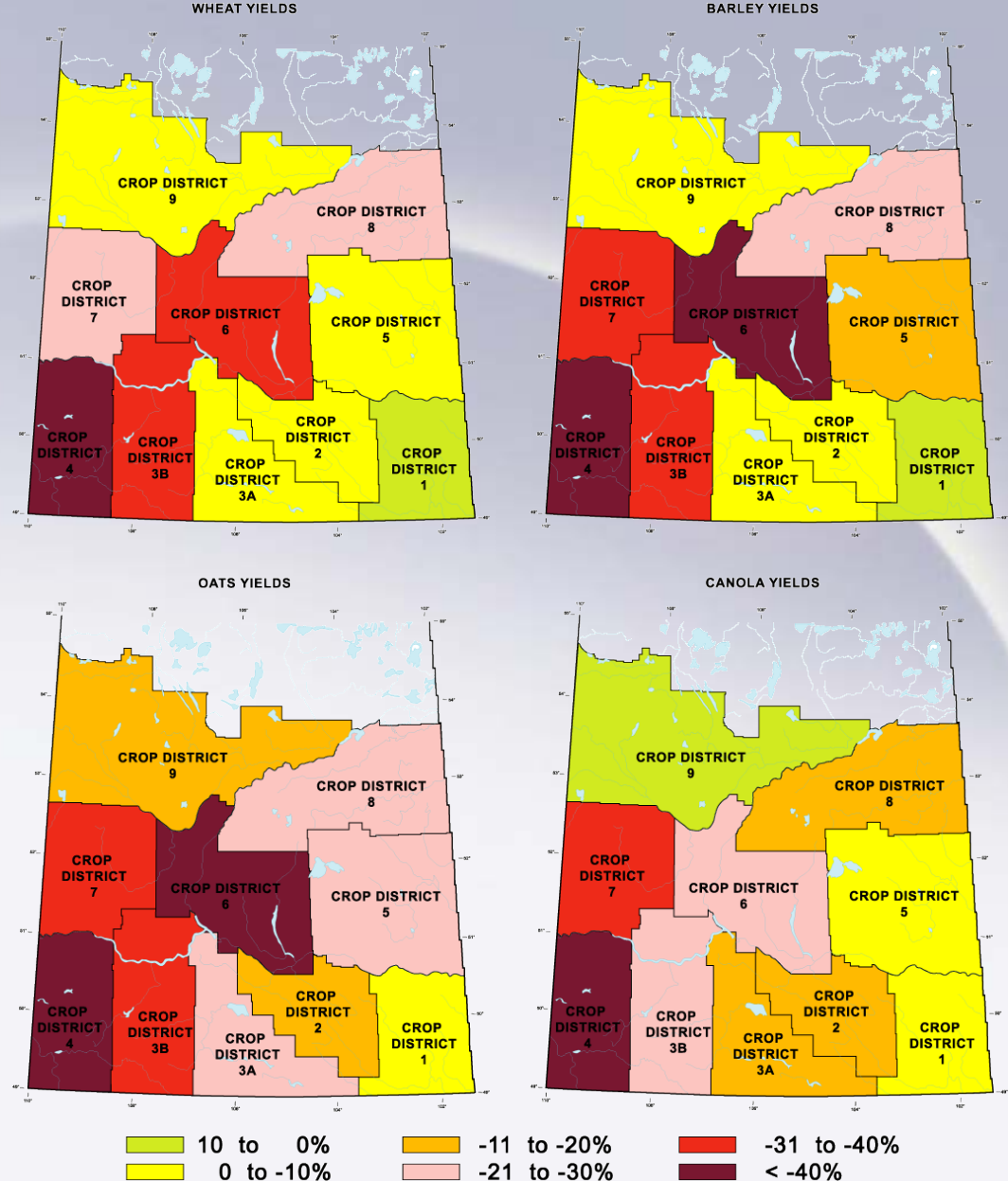
# Impacts of the 2001-2002 Drought

- ◆ Previously reliable and good quality **water** supplies were severely affected, and some failed
- ◆ **Records** were set such as lowest water levels in the Georgian Bay Area
- ◆ The number of prairie **sloughs** was the lowest on record in May 2002

(Wheaton et al. 2005,2008)



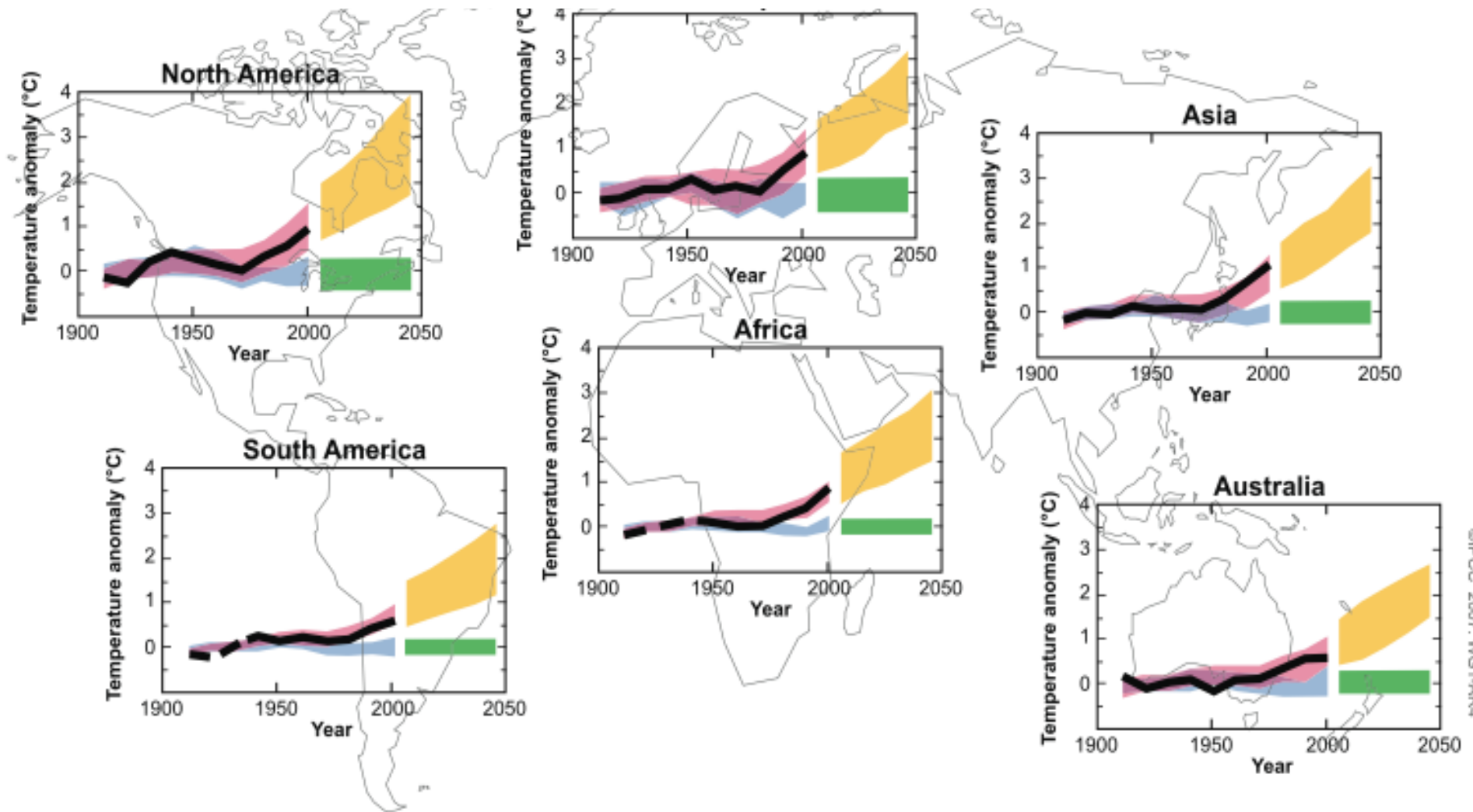
# Spatial patterns of crop production in 2001 drought



Data source: Saskatchewan Agriculture and Food

Percent Above / Below 10-year Average (1991 - 2000 average bu/ac)

# Significant warming is expected for all continents but Antarctica



models using natural forcing only

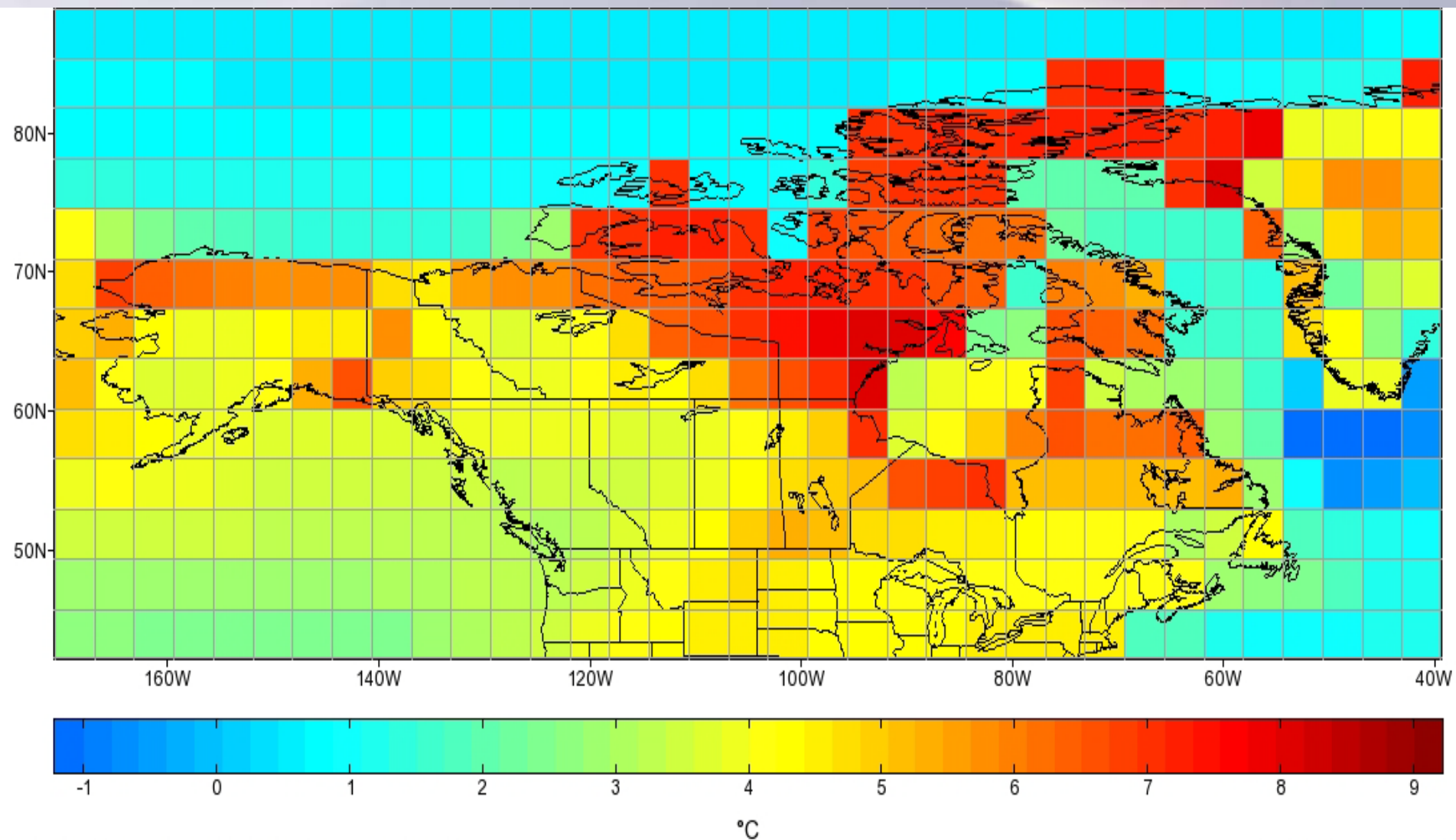
projected changes (A1B scenario)

observations

models using both anthropogenic and natural forcings

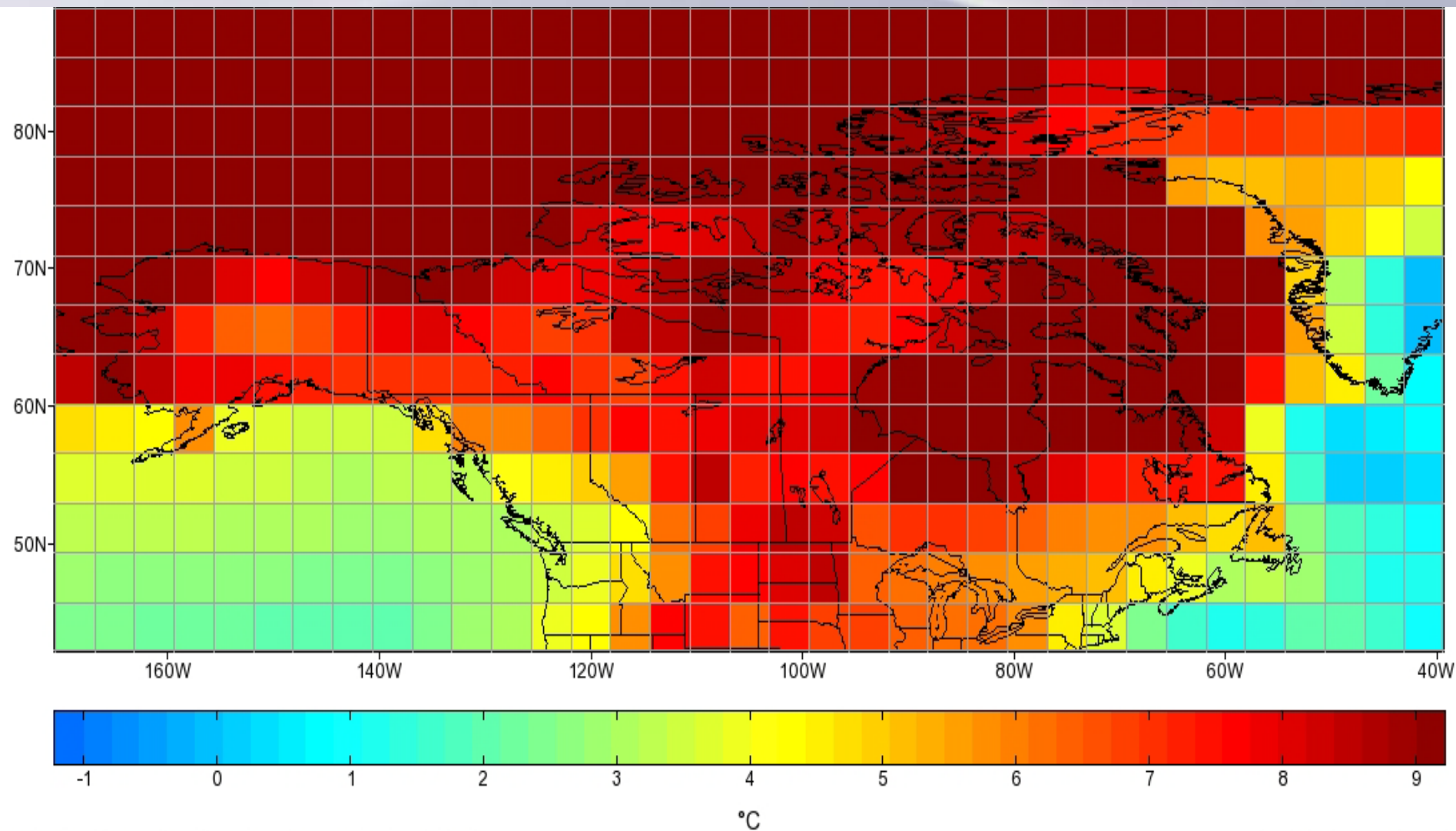
range of anomalies with natural forcing only in 20th century simulations

# Summer Mean Temperature Change 2080s





# Winter Mean Temperature Change 2080s



# Winter advantages are disappearing

- Reduced insect and disease problems
- Better winter ice roads
- Water storage as snow
- Shorter fire season
- Fewer freezing rain hazards
- *ETC...*



# Agriculture: Adapting to climate

- Limited **water** availability and potential interruption of supply for irrigation
- Some current **crops** may become less viable or profitable
- Damage to **transportation** infrastructure or disruptions
- More **cooling** is required for transport and buildings
- Exposure of farm workers to increased heat and **health** problems

(Sussman and Freed 2008 US PEW Center)



# Some Possible Water Futures

- Increased **drying** due to increased temperatures, and ice free season, etc.
- Decreased water **supplies**
- Increased societal **demands** on water resources and conflicts
- Increases in water scarcity represent the most serious **climate risk** (Sauchyn and Kulshreshtha 2008)





# Next?

- ◆Accelerate Adaptation and Mitigation◆
- ◆Prepare for greater climatic risks and opportunities◆
- ◆Knowledge-of climate risks◆
- ◆Leadership◆