



Institute for Catastrophic
Loss Reduction

Institut de Prévention des
Sinistres Catastrophiques

Overview of Climate Change Impacts Related to Water

**Presentation to Conservation Authority
Workshop**

London, 23 February 2011

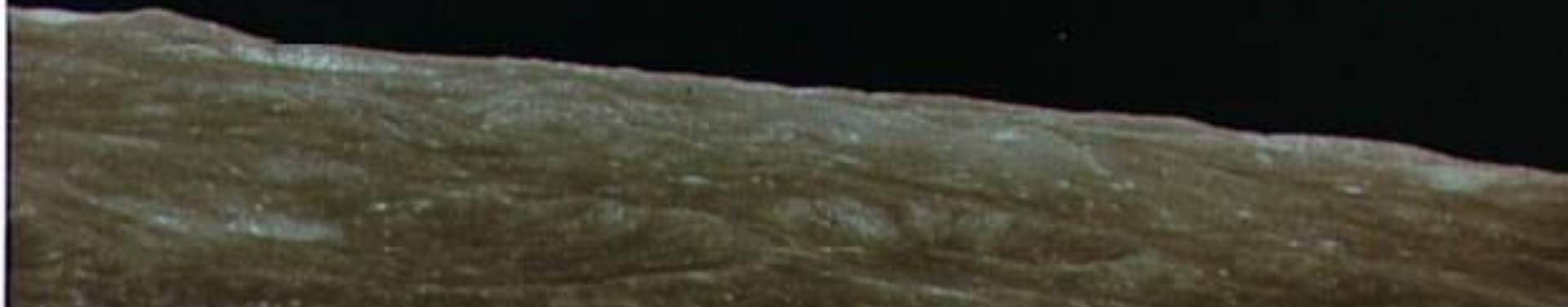
Gordon McBean, CM, OOnt, PhD, FRSC

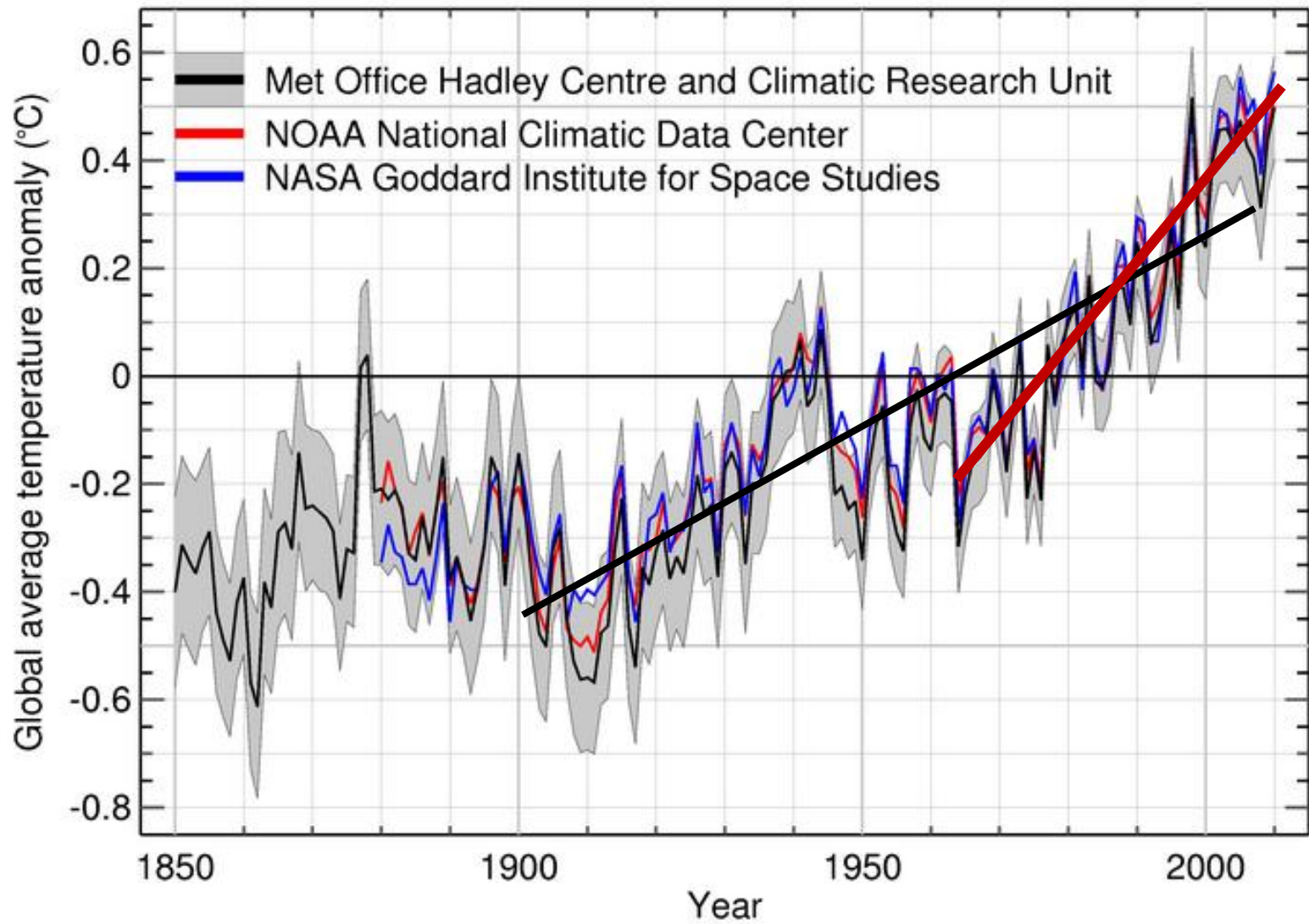
The University of Western Ontario





The climate changing





**World Meteorological Organization
Geneva, 20 January 2011 (WMO)**

The year 2010 ranked as the warmest year on record, together with 2005 and 1998, according to the World Meteorological Organization.

Arctic sea-ice cover in December 2010 was the lowest on record. This follows the third-lowest minimum ice extent recorded in September.

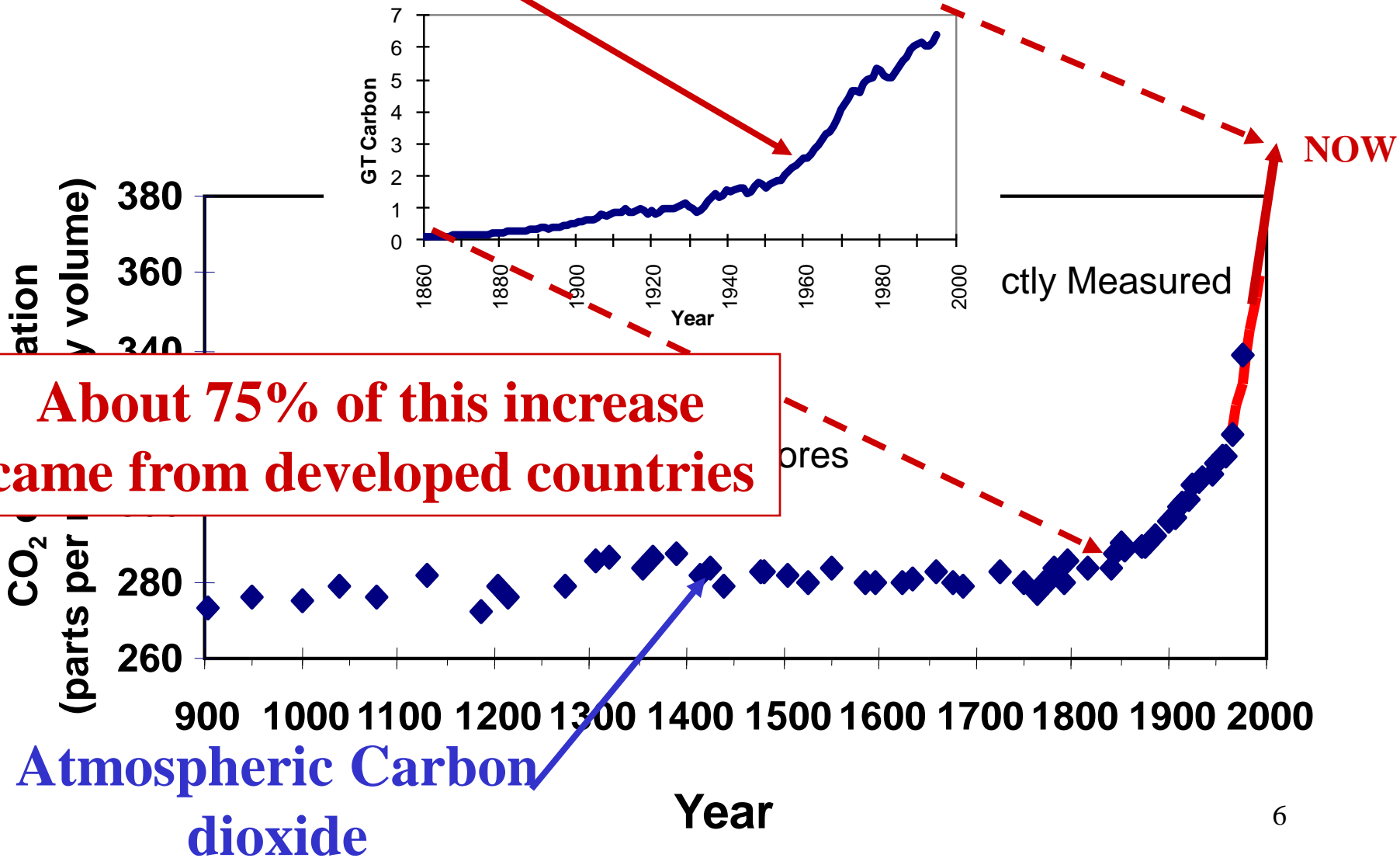
“The 2010 data confirm the Earth’s significant long-term warming trend,” said WMO Secretary-General Michel Jarraud. “The ten warmest years on record have all occurred since 1998.” Over the ten years from 2001 to 2010, global temperatures have averaged 0.46°C above the 1961-1990 average, and are the highest ever recorded for a 10-year period since the beginning of instrumental climate records.



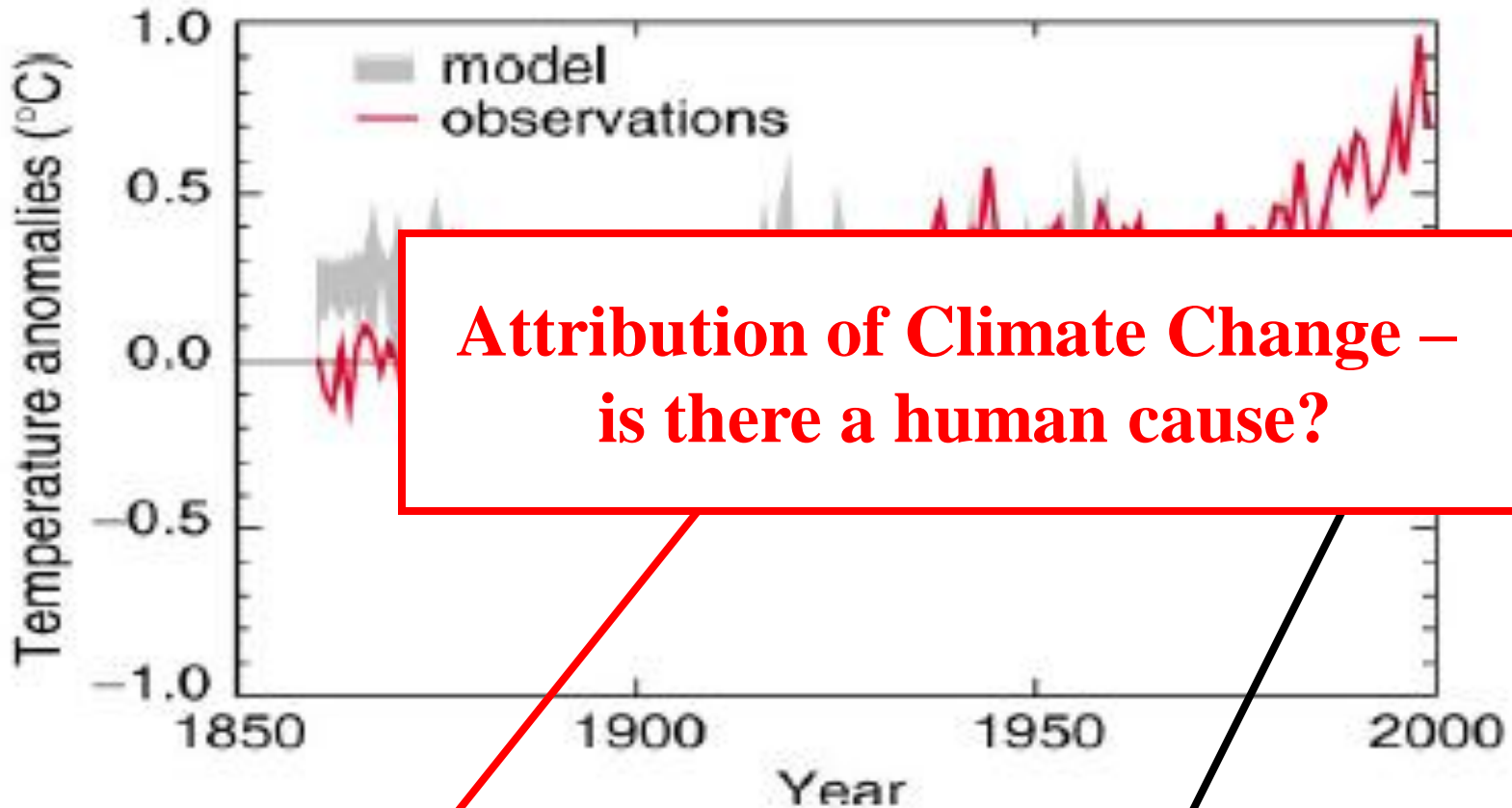
**Why is the climate
changing?**



COAL, OIL, GAS Fuels Carbon dioxide emissions



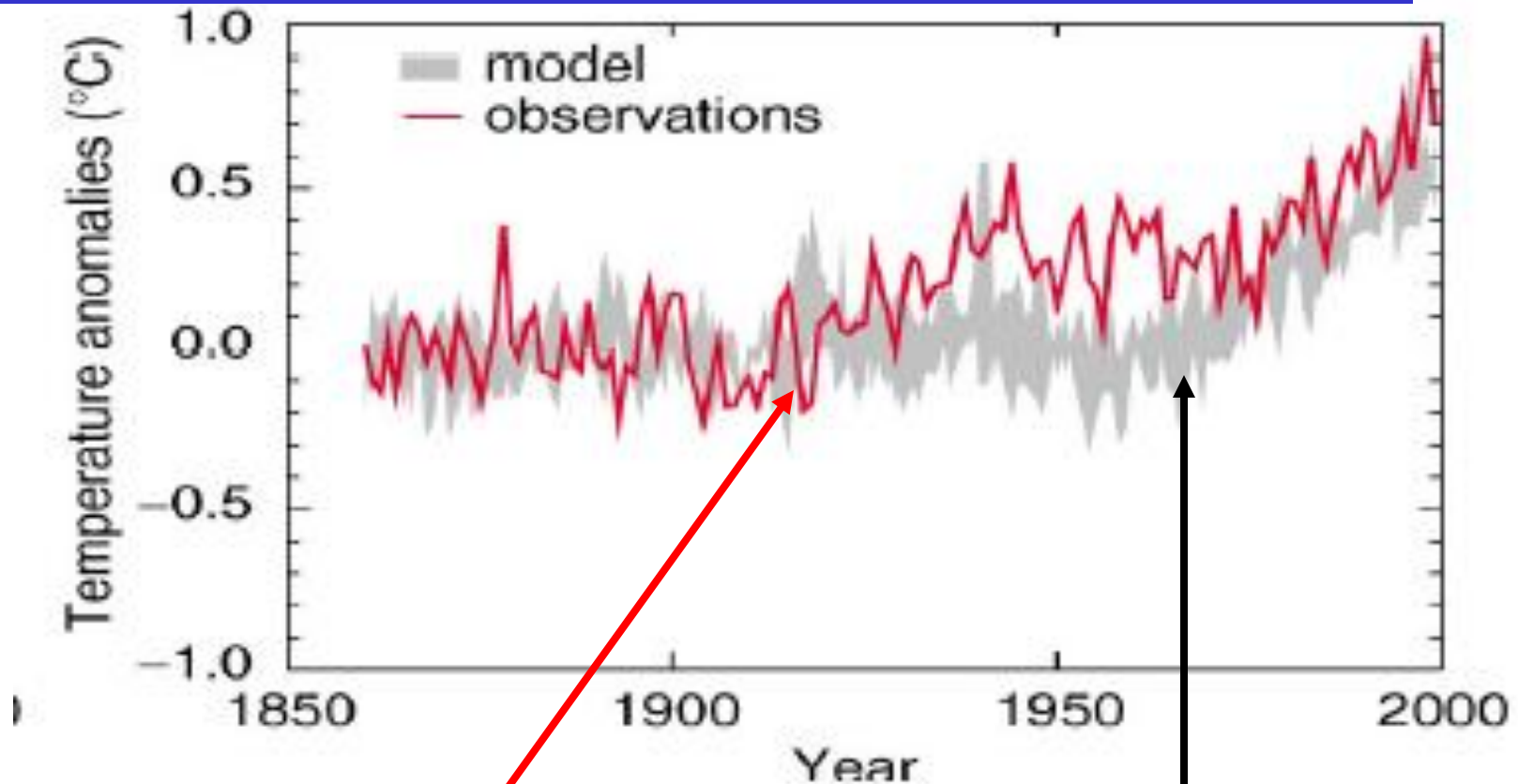
Compare observations with model simulations



Observations

Climate simulated by model
with volcanoes, solar variations and
other **natural** factors included.

Compare observations with model simulations



Observations

Climate simulated by model with greenhouse gases, aerosols, “**anthropogenic** factors” included.

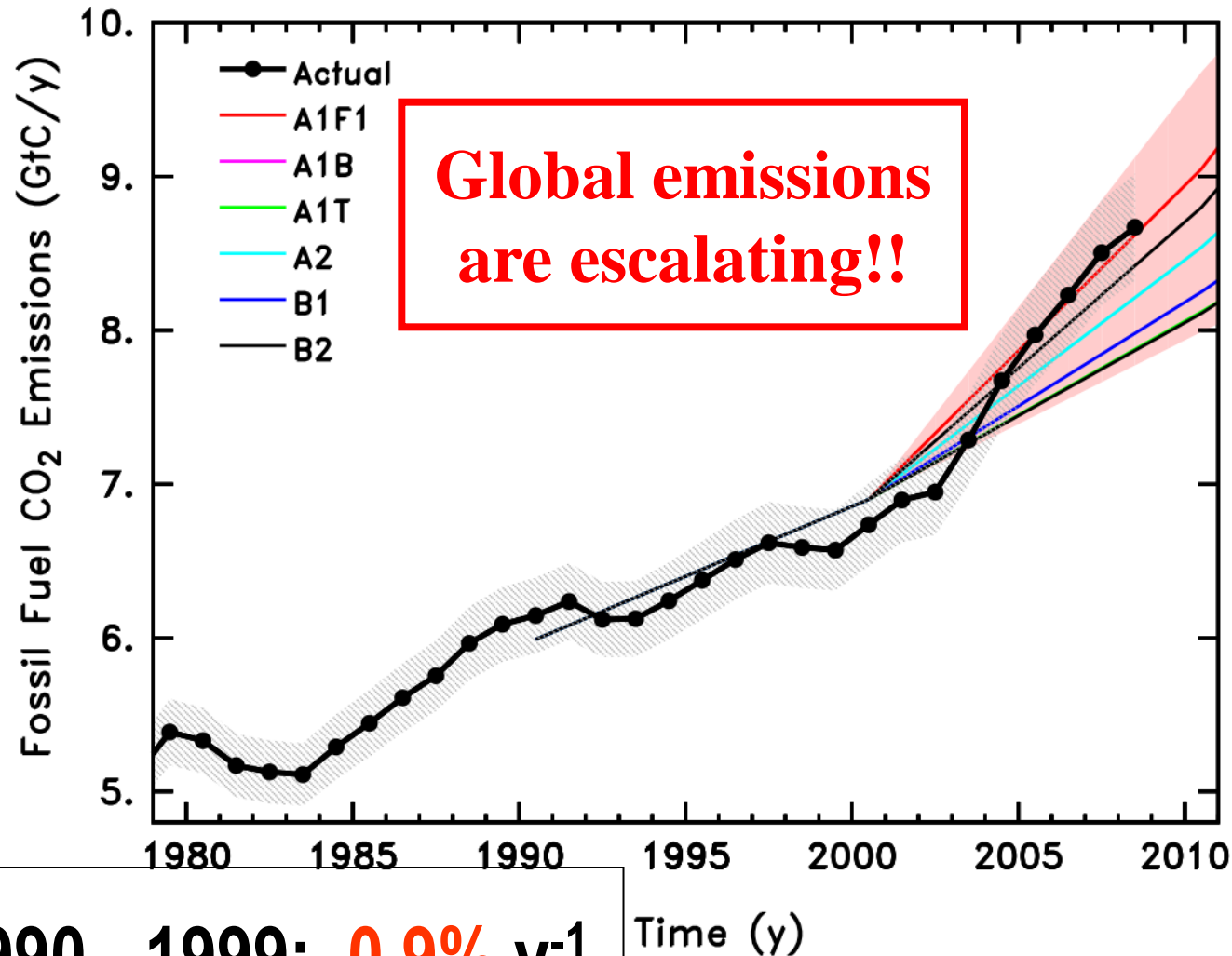
“Most of the observed increase in global average temperatures since the mid-20th century is



***very likely* due to the observed increase in anthropogenic greenhouse gas concentrations.”**

And Canada is a significant contributor to that increase

Global CO₂ Emissions from Fossil Fuels



ES (2000)
aver.
growth
rates in %
y⁻¹ for
2000-
2010:

A1B: 2.42
A1FI: 2.71
 A1T: 1.63
 A2: 2.13
 B1: 1.79
 B2: 1.61

Growth Rates

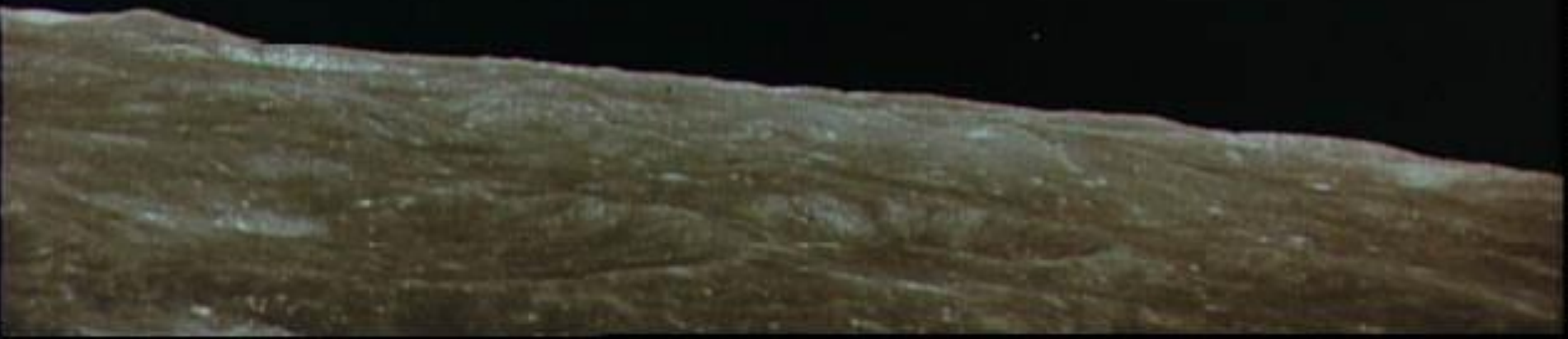
1990 - 1999: **0.9% y⁻¹**

2000 - 2007: **3.5% y⁻¹_{x4}**

Time (y)



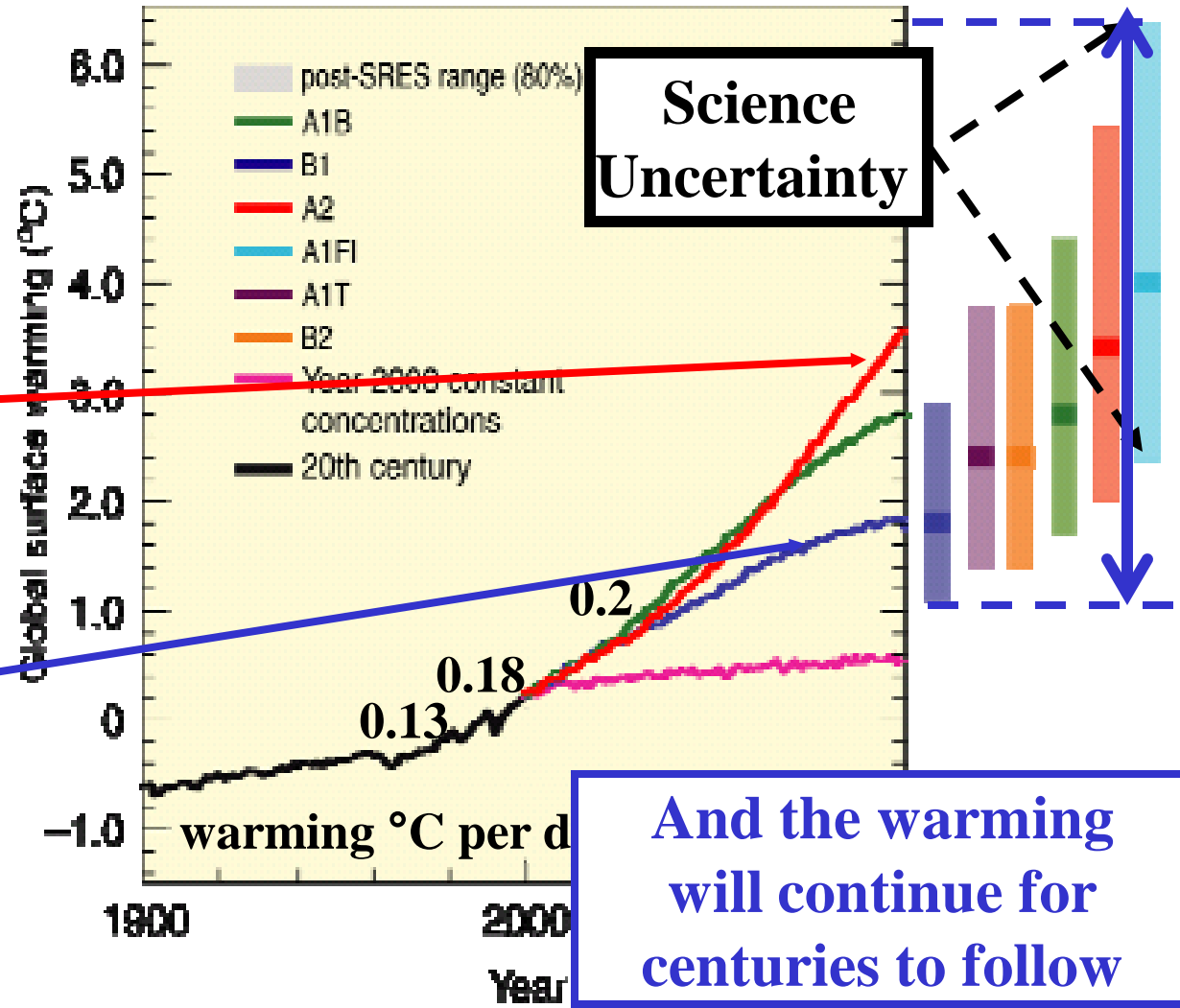
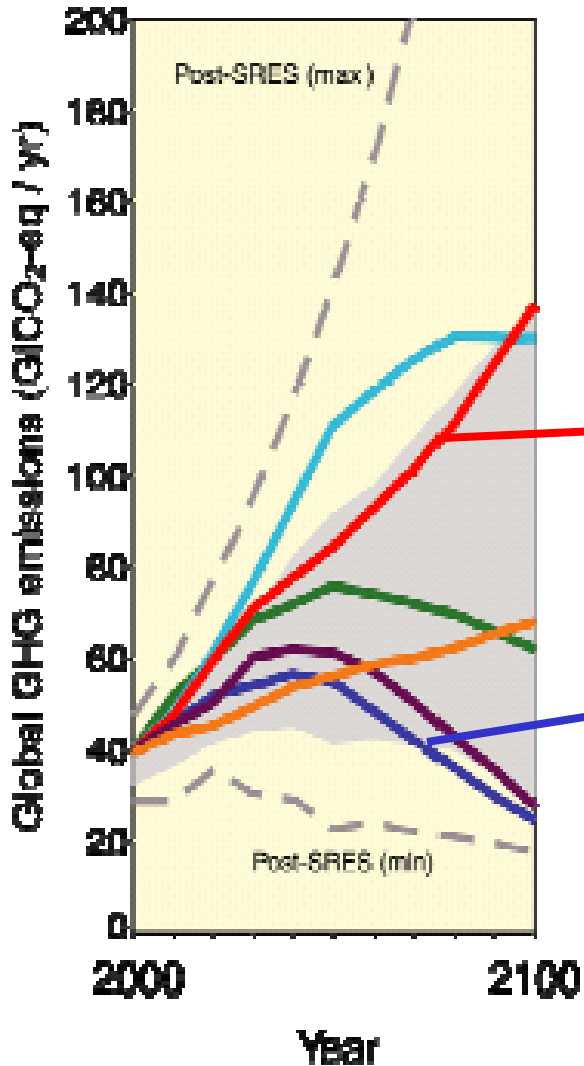
Projections for future



Future climate change

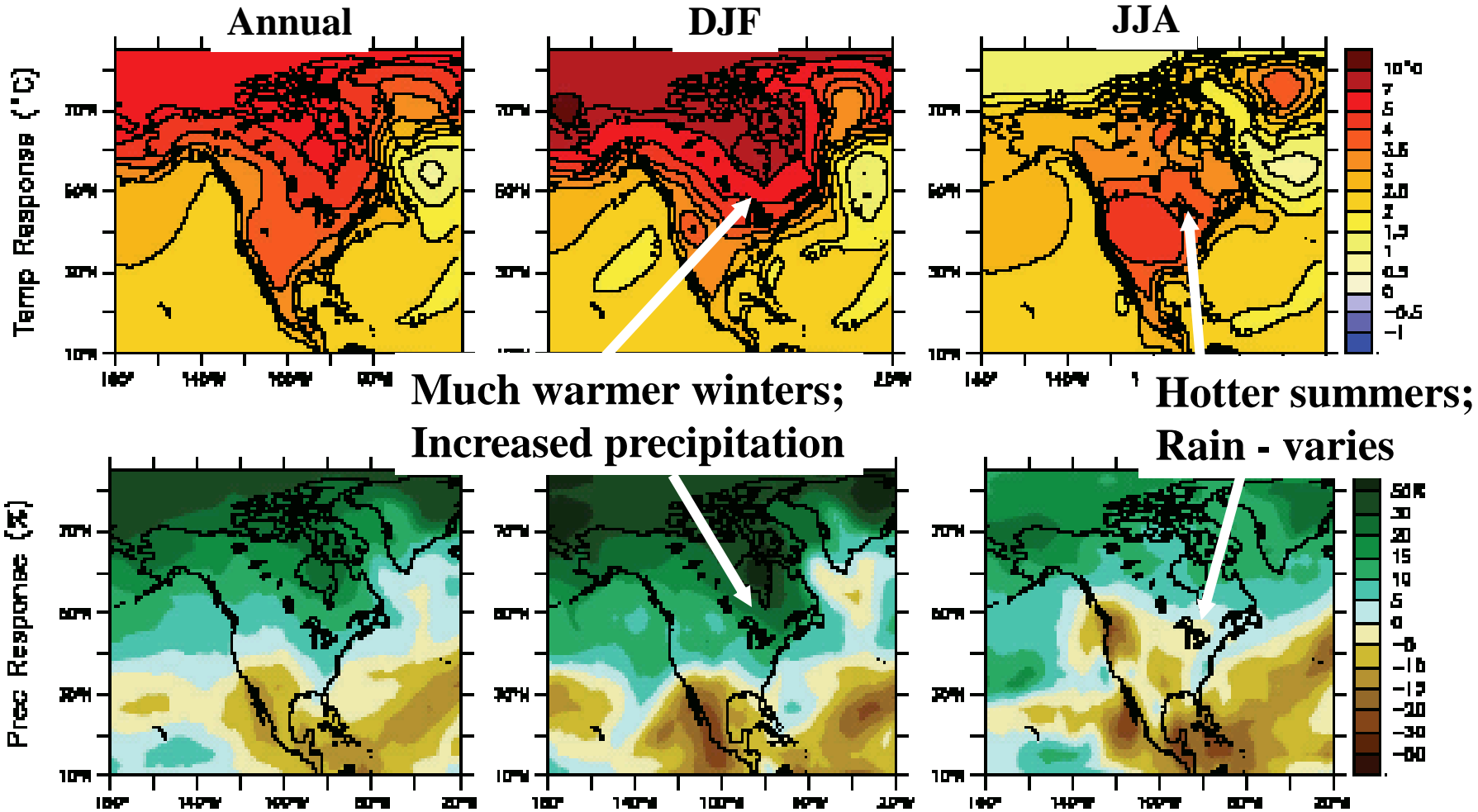
“Our” impact

Emissions GtCO₂ eq/yr



No one lives at the global average

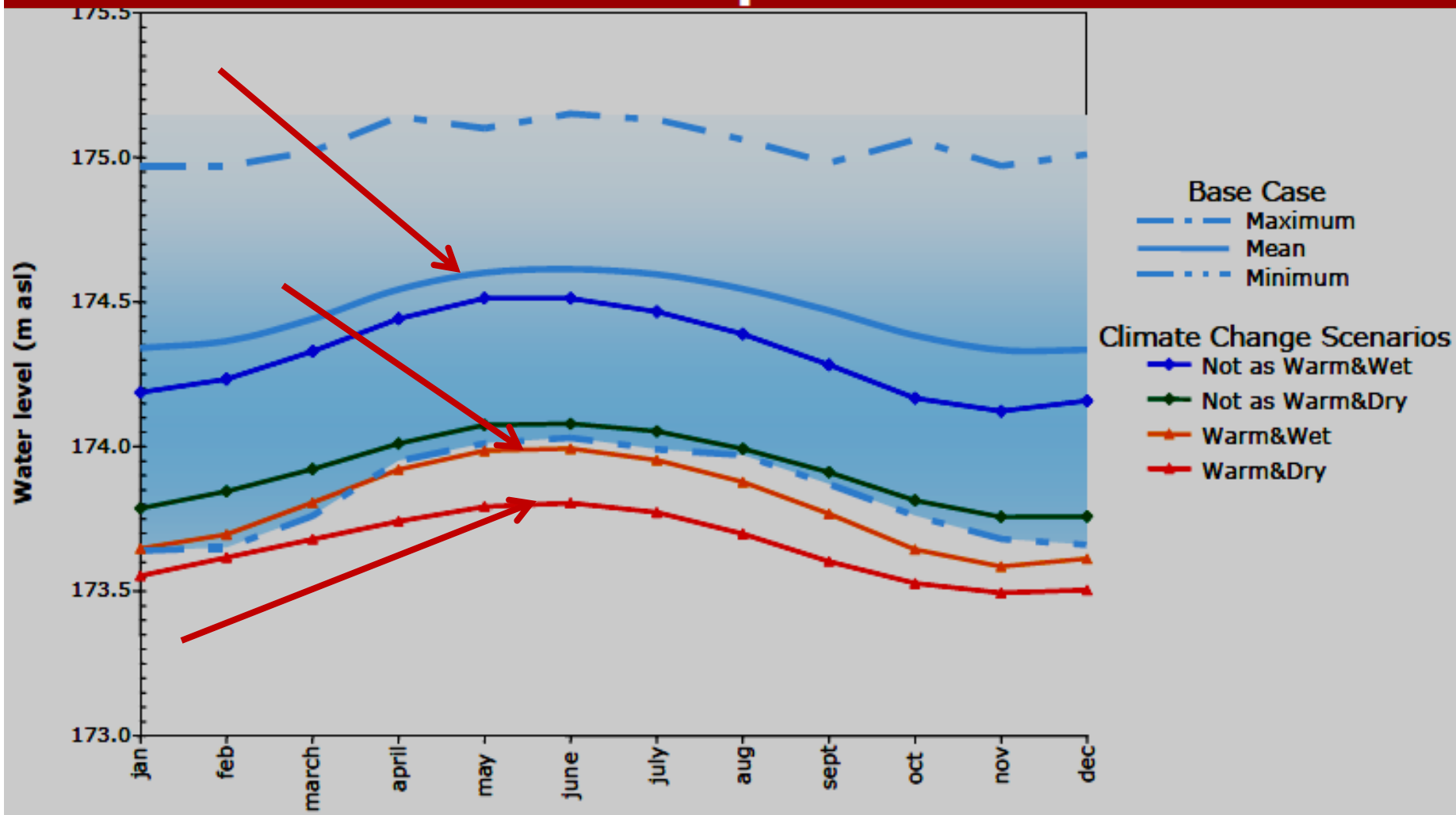
Medium (A1B) scenario (2090-2099): Global mean warming 2.8°C; Much of land area warms by ~3.5°C; Arctic warms by ~6°C.



Changing Precipitation

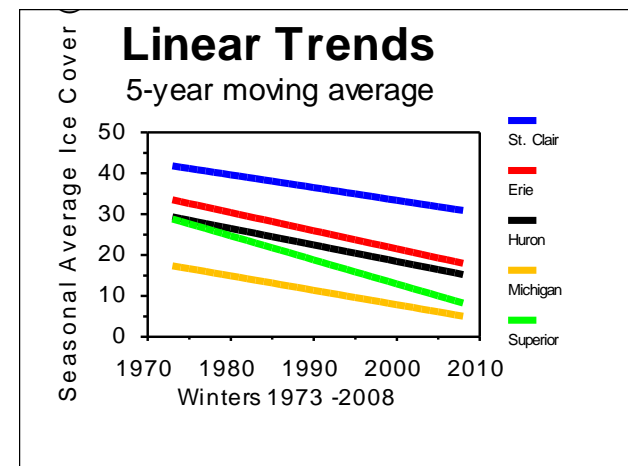
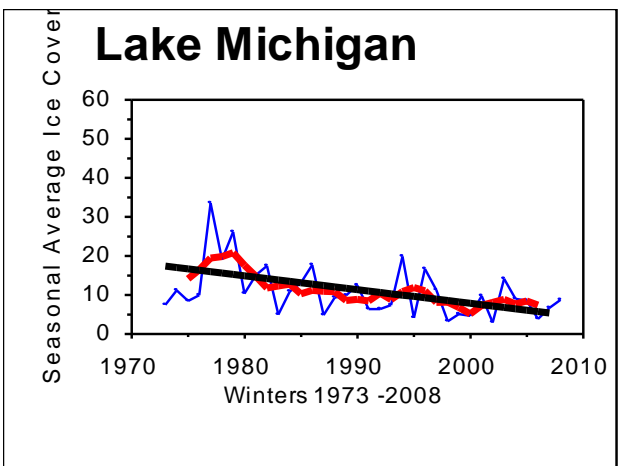
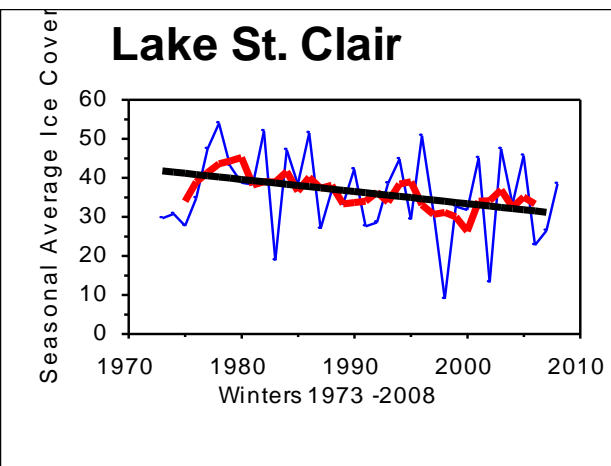
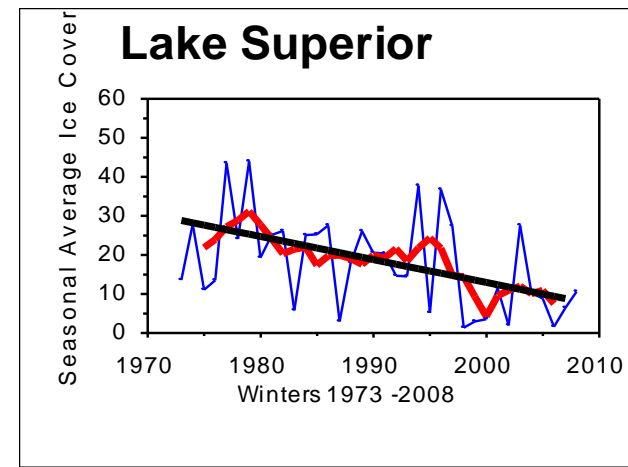
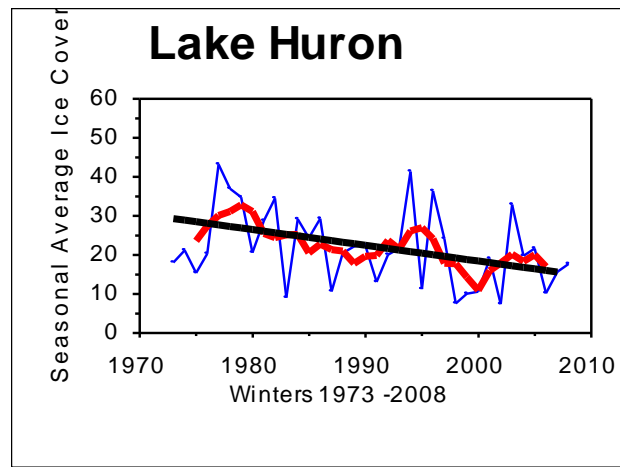
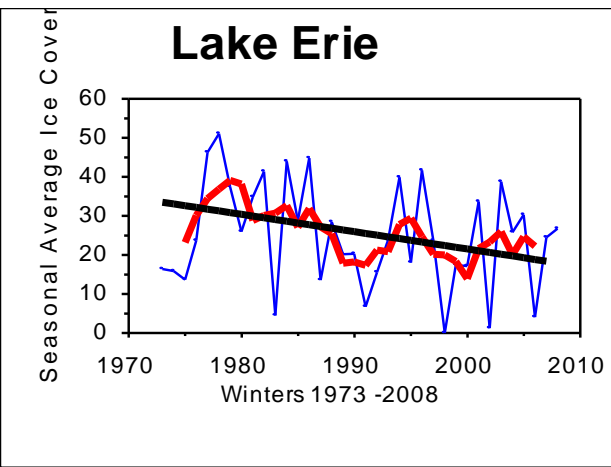
Water-sewage, agriculture
Forestry, floods, droughts

Projected lower water levels 2050s – Lake Erie example...



Source: David Fay & Yin Fan, Environment Canada

Reduction in duration & thickness of lake & river ice



Reduction in depth, distribution, & duration of snowcover

Changing Water Regimes.

- **Summer and fall low flows may be lower & last longer**
 - **pollutant concentration could increase**
 - **challenges in assimilating pollutants from point sources, sewage treatment plants and industry**
- **Mismatch between supply and demand**
 - **Potential conflict between in-stream ecological needs and economic uses of water**
- **Warmer water temperatures**
 - **dissolved oxygen issues**
 - **algae blooms - taste and odour problems**
 - **taste and odour problems in Municipal water?**
- **Changes in plant & animal phenology and shifts in range of species**

More intense precipitation & winter rain
- flooding in winter and summer?

Infrastructure must accommodate higher flows

**Re-evaluate floodplain management &
emergency preparedness**

-more structures & people exposed

- combined sewer overflows

- non-point source pollution

- sediment and nutrient input from erosion

- safety & performance issues; green infrastructure

**The past climate is not a reliable guide for
future planning**

Canadians will have to “adapt”



*“making adjustments in our decisions,
activities and thinking*

*because of observed or expected
changes in climate, in order to
moderate harm or take advantage of
new opportunities.”*



The End



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Thank you for your attention