



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**

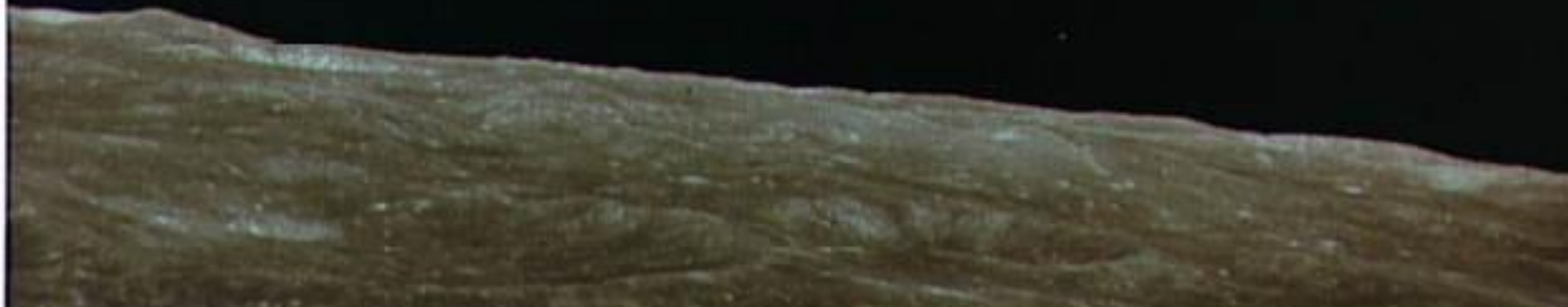
**Gordon McBean, CM, OOnt, PhD, FRSC**

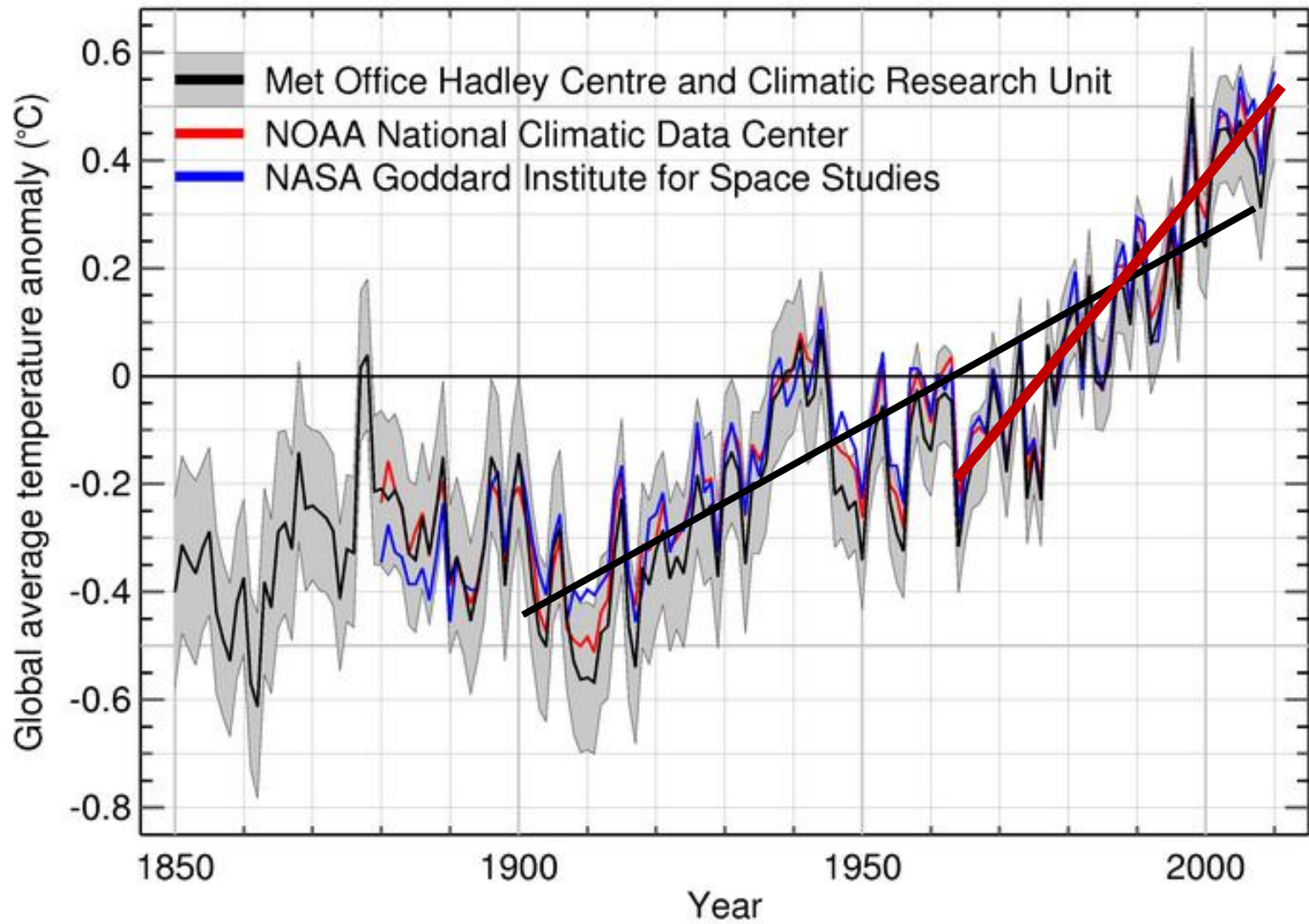
**The University of Western Ontario**





**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.**

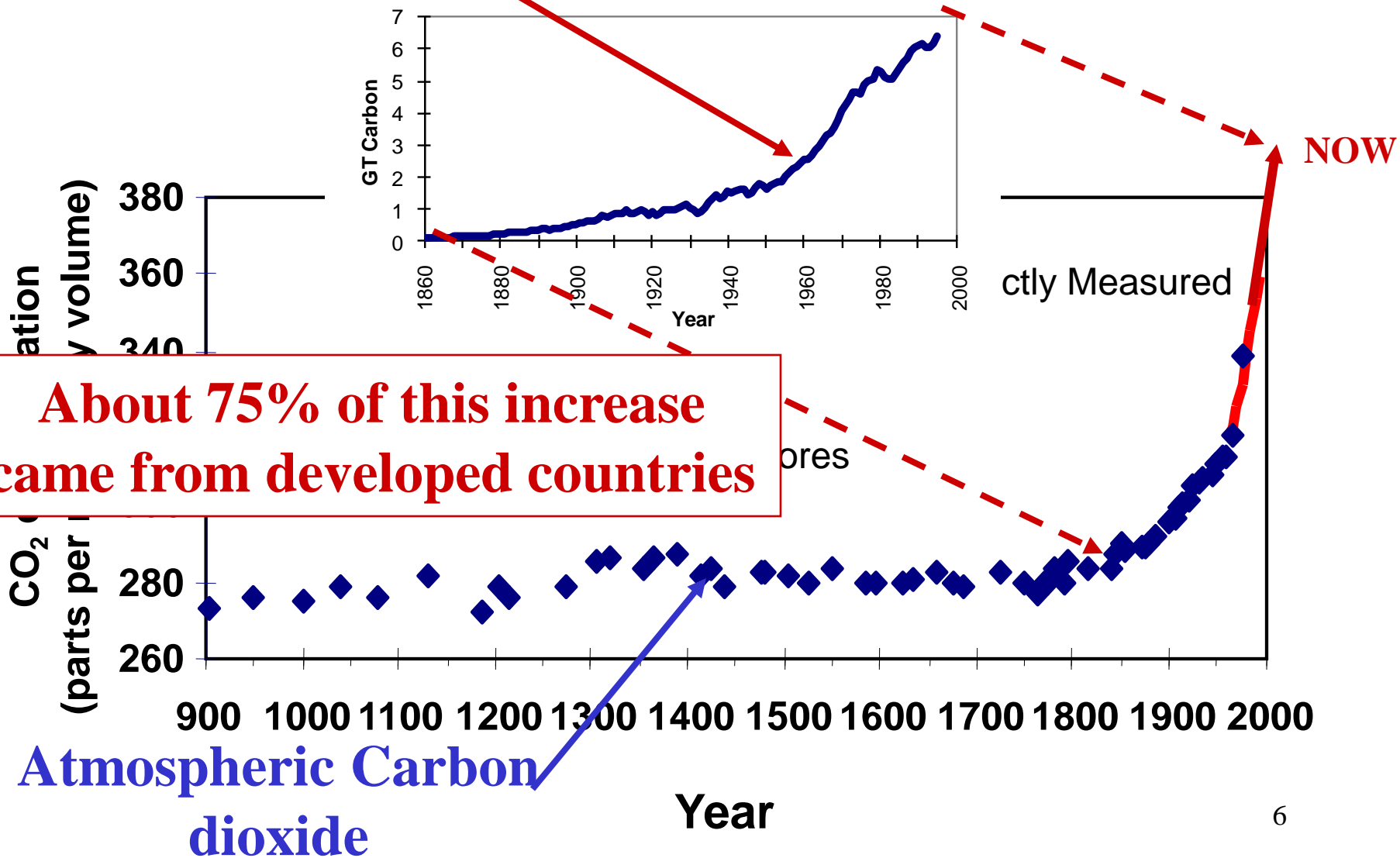
**“The 2010 data confirm the Earth’s significant long-term warming trend,” said WMO Secretary-General Michel Jarraud. “The ten warmest years on record have all occurred since 1998.” Over the ten years from 2001 to 2010, global temperatures have averaged 0.46°C above the 1961-1990 average, and are the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



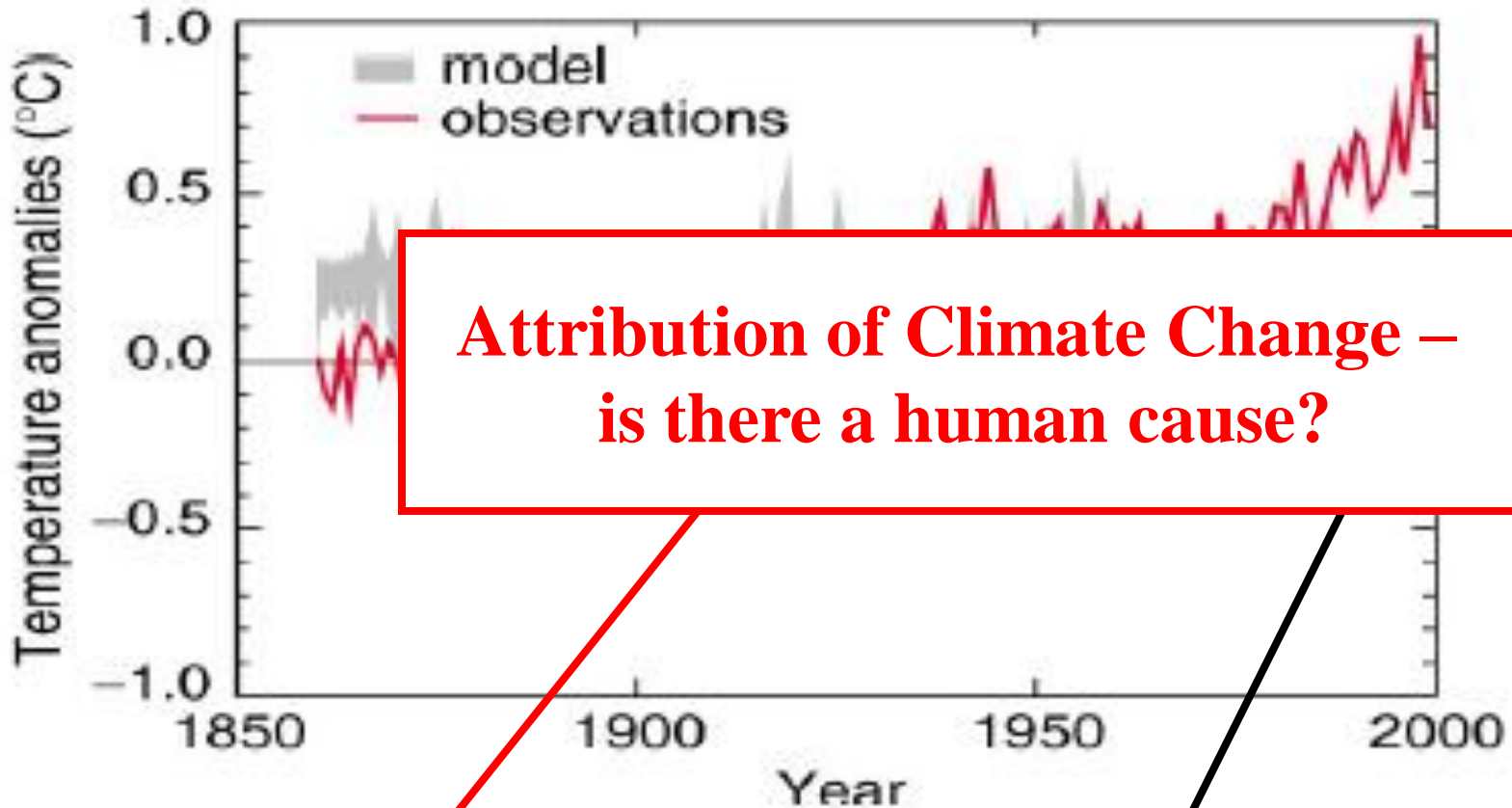
**Why is the climate  
changing?**



# COAL, OIL, GAS Fuels Carbon dioxide emissions



# Compare observations with model simulations

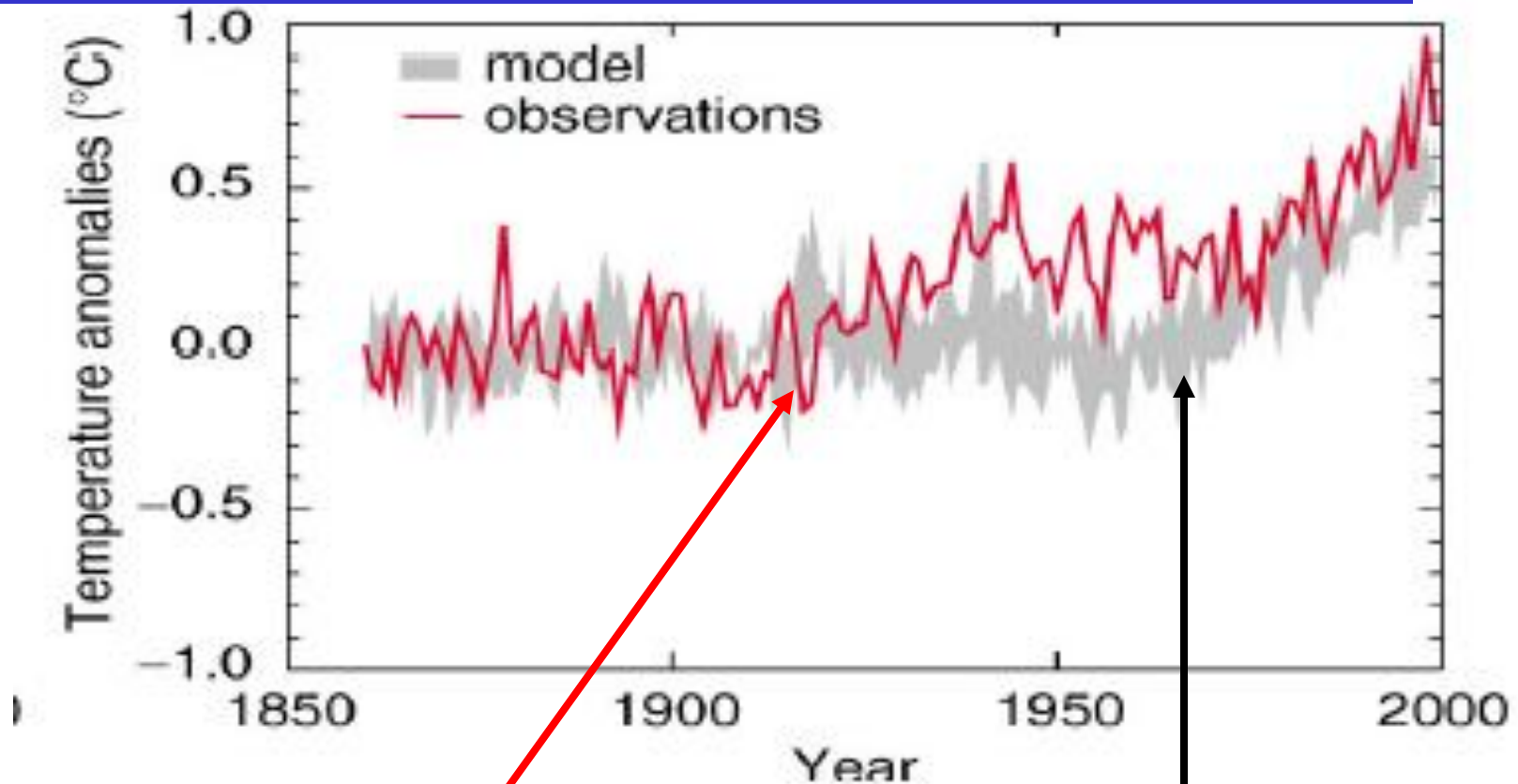


**Attribution of Climate Change –  
is there a human cause?**

**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.



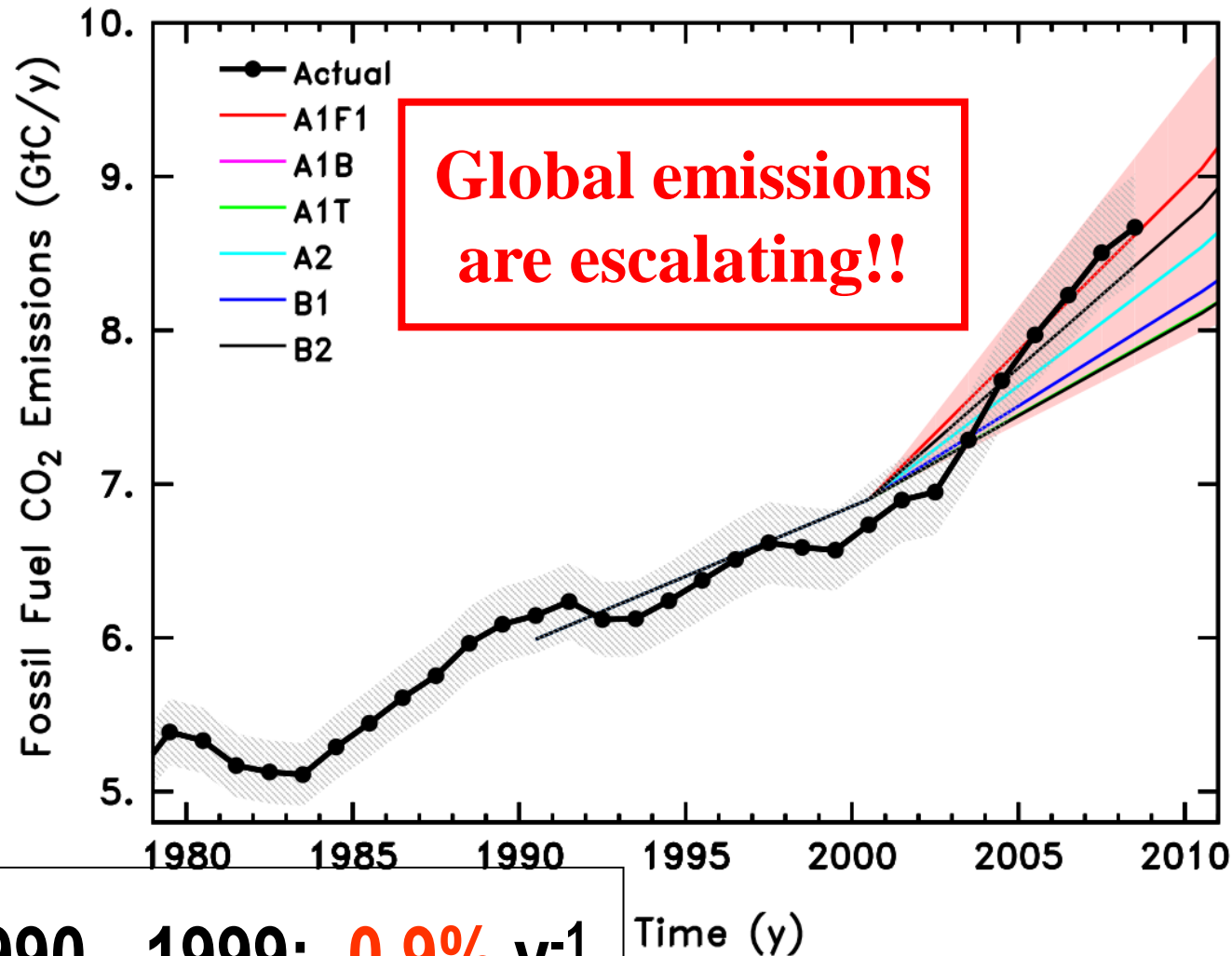
**“Most of the observed increase in global average temperatures since the mid-20th century is**



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

**And Canada is a significant contributor to that increase**

# Global CO<sub>2</sub> Emissions from Fossil Fuels



ES (2000)  
 aver.  
 growth  
 rates in %  
 $y^{-1}$  for  
 2000-  
 2010:

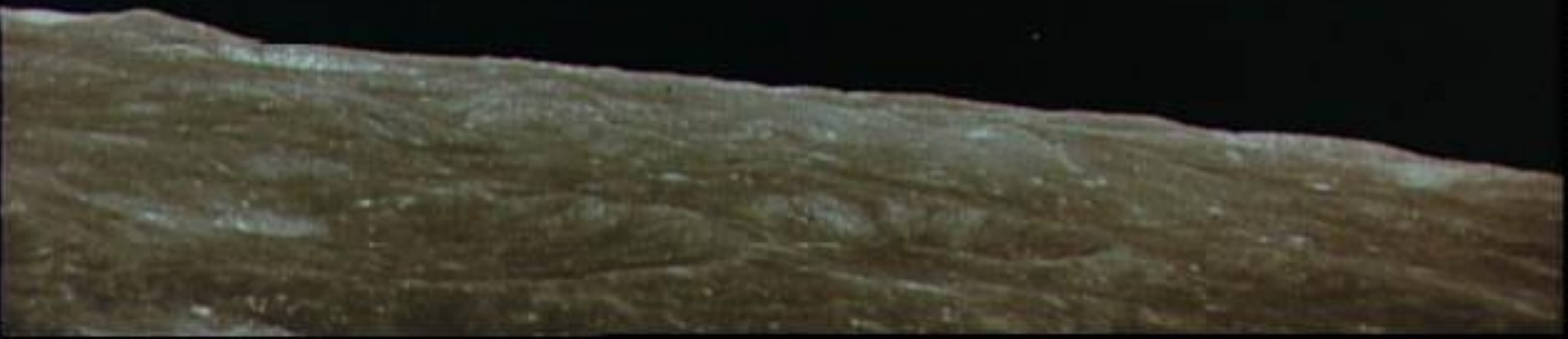
A1B: 2.42  
**A1FI: 2.71**  
 A1T: 1.63  
 A2: 2.13  
 B1: 1.79  
 B2: 1.61

Growth Rates

**1990 - 1999: 0.9%  $y^{-1}$**   
**2000 - 2007: 3.5%  $y^{-1}$ <sub>x4</sub>**



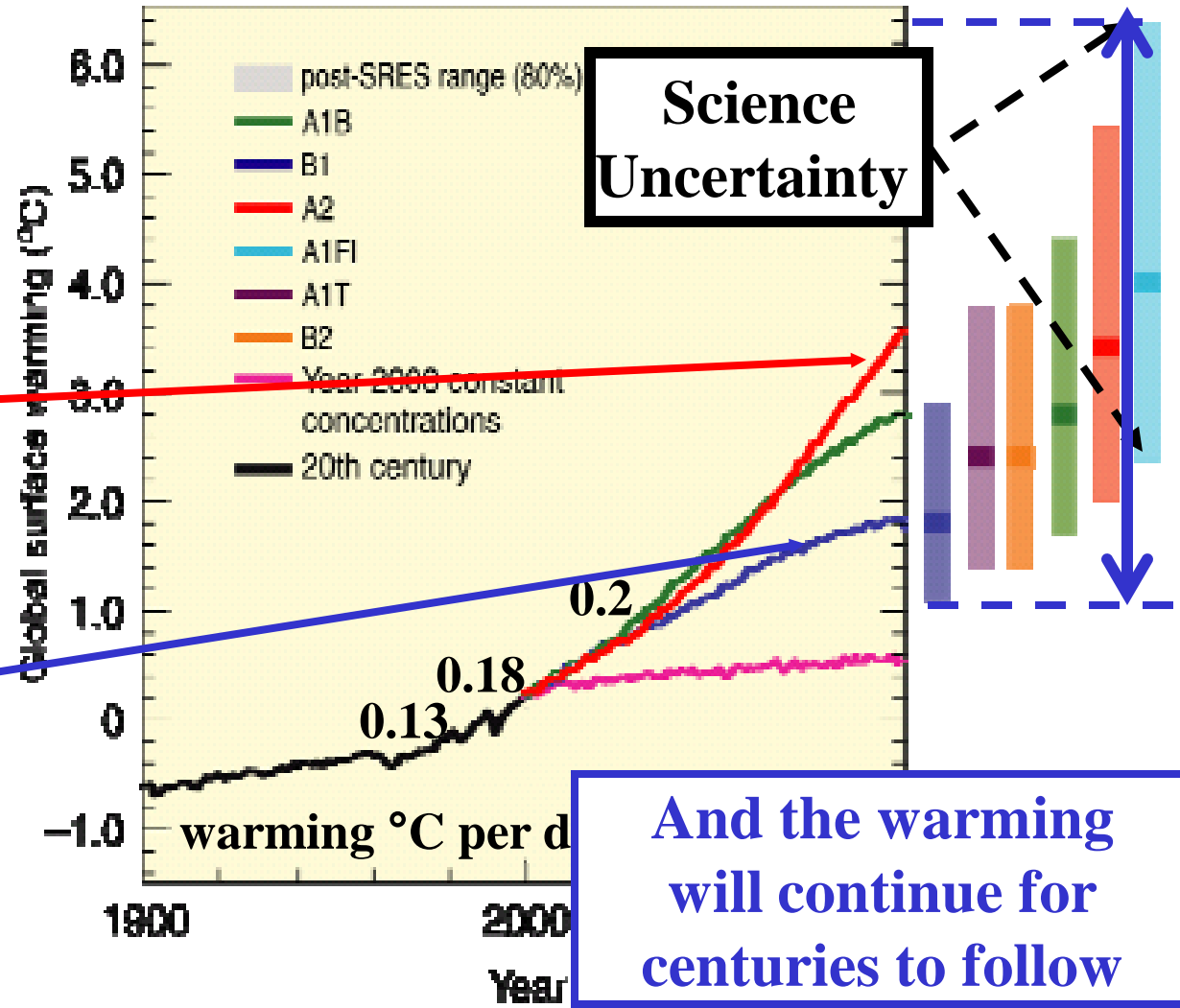
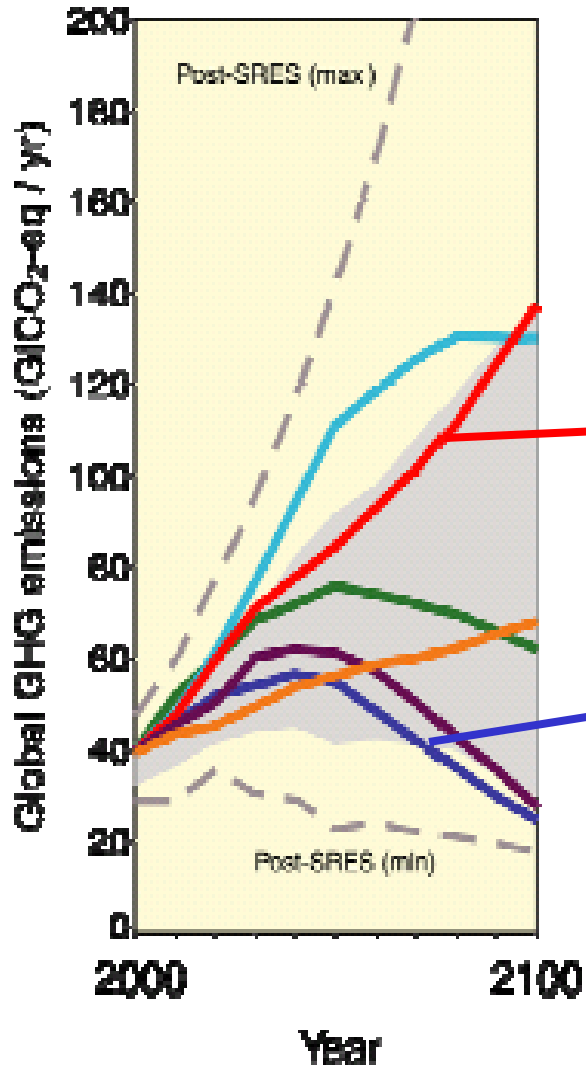
**Projections for future**



# Future climate change

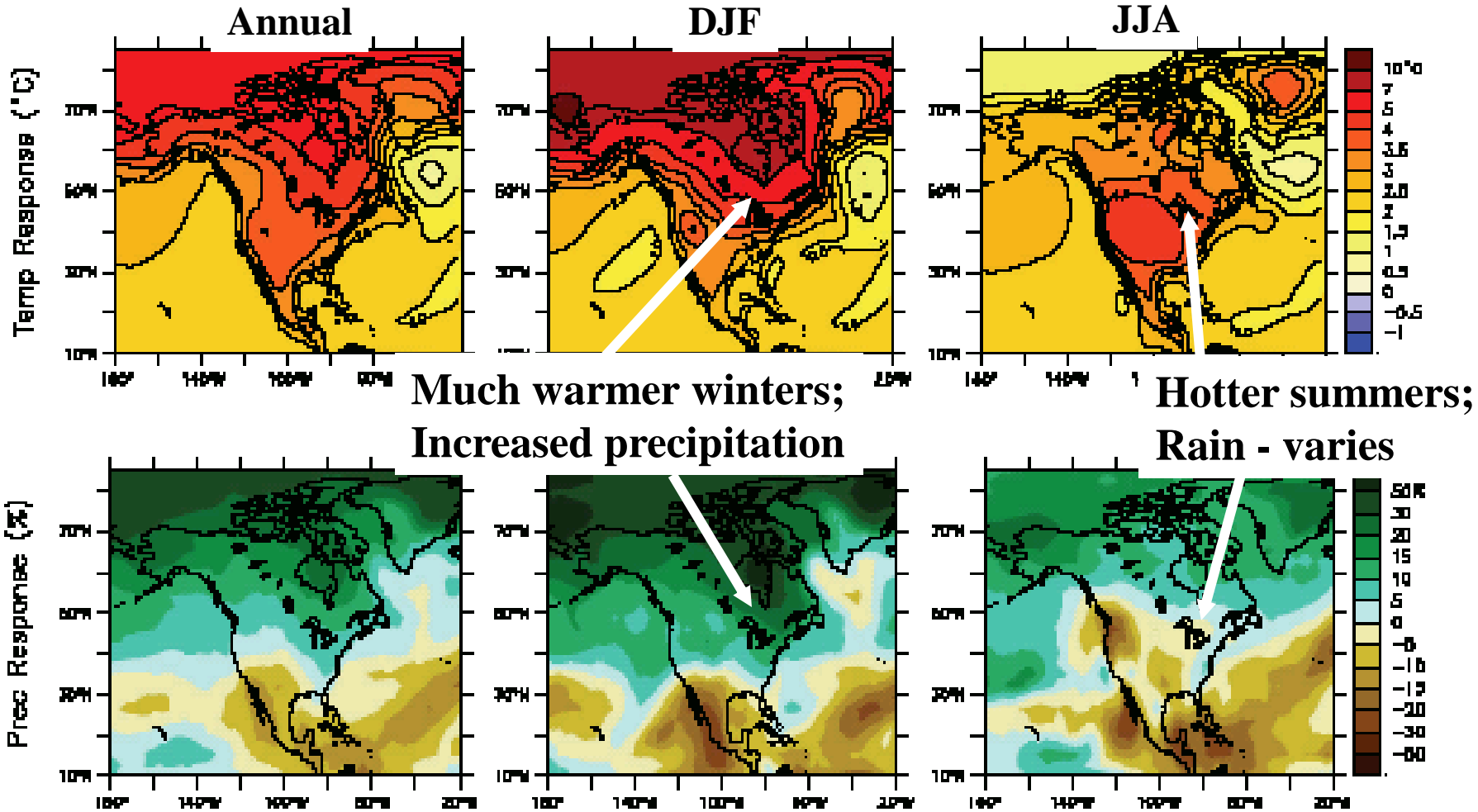
“Our” impact

Emissions GtCO<sub>2</sub> eq/yr



# No one lives at the global average

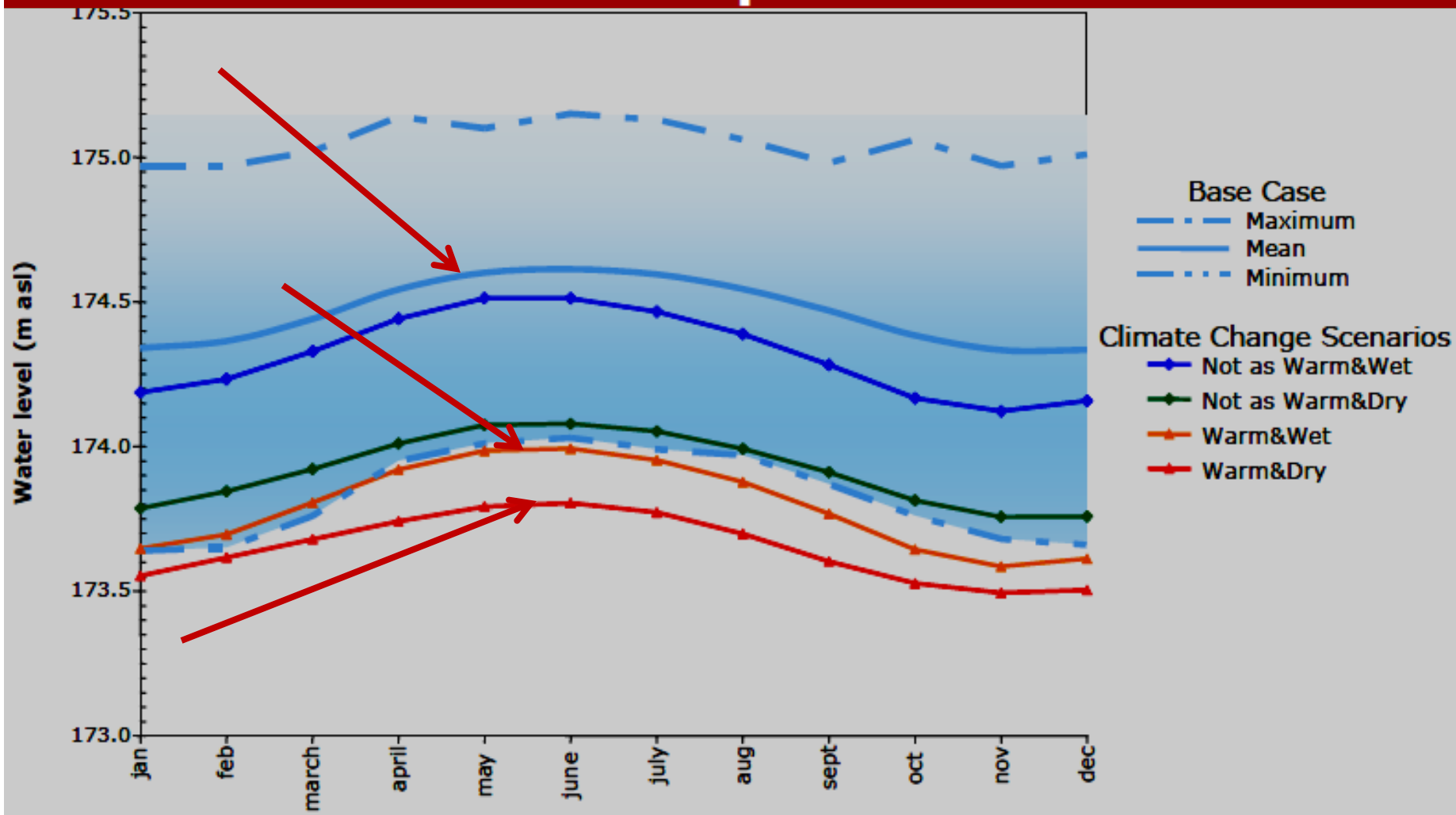
Medium (A1B) scenario (2090-2099): Global mean warming 2.8°C; Much of land area warms by ~3.5°C; Arctic warms by ~6°C.



Changing Precipitation

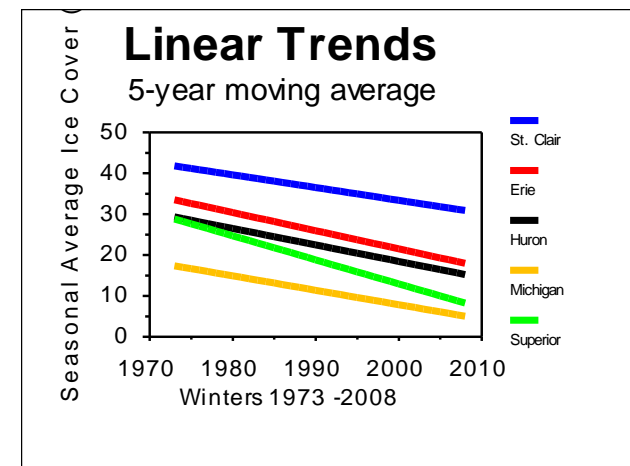
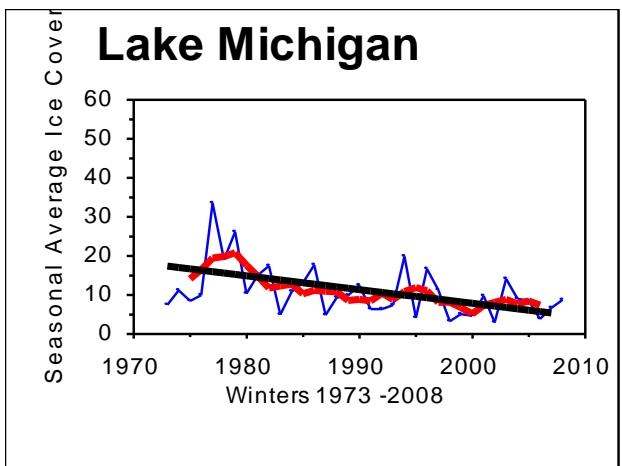
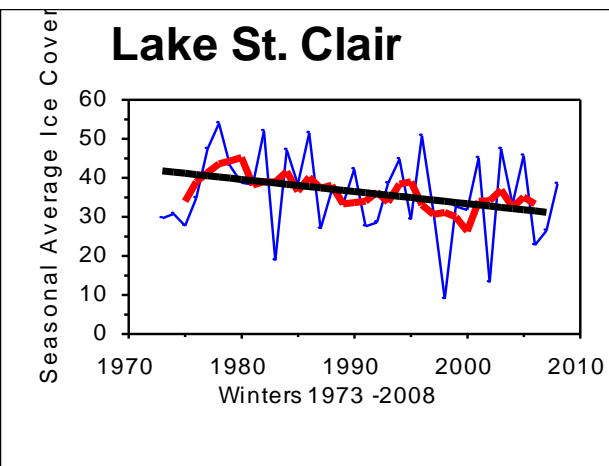
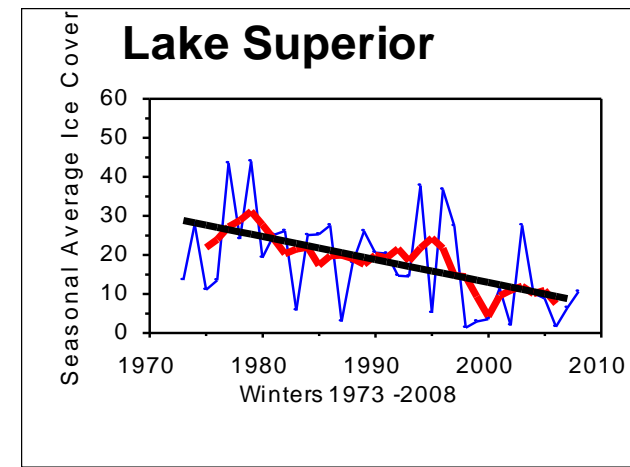
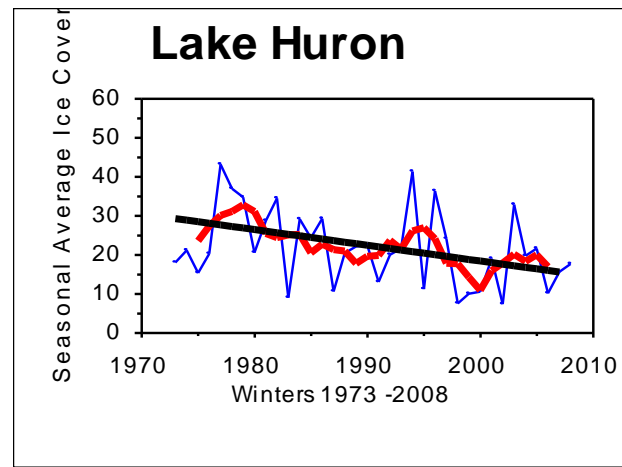
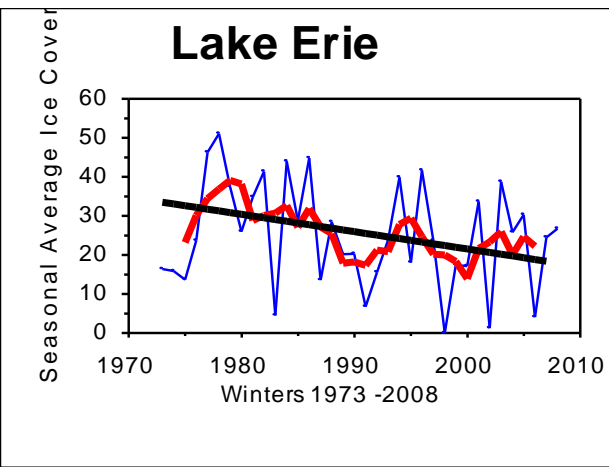
Water-sewage, agriculture  
Forestry, floods, droughts

# 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**