

Global Climate Change: What could we face locally?



DR. DANIEL SCOTT

Director, Interdisciplinary Centre on Climate Change



UNIVERSITY OF
WATERLOO

Interdisciplinary Centre on Climate Change 

Agenda

- **Introduction to IC3**
- **Global Climate Change**
 - Scientific Consensus
 - Observed and Anticipated Climate Change
- **Localizing Climate Projections**
 - Temperature – heat extremes, freeze-thaw
 - Precipitation
 - Extreme Events
- **How do we Respond?**

Interdisciplinary Centre on Climate Change

- **Established in 2008** – building on 25 previous years of climate change research and practice at UW
- **IC3's Mission** – to provide scientific information to improve decision-making in business, government and civil society to respond effectively to weather events and climate change.



UNIVERSITY OF
WATERLOO



Director: Dr. Daniel Scott

Associate Director: Sarah Brown (BES, MPL)



IC3's Deepening Talent Pool

Over 60 affiliated faculty members:

- With diverse expertise in climate adaptation, including: *planning, community health, climate modeling, hydrology, transportation, insurance*
- Research collaborations with over 50 international, Canadian and local government agencies, scientific organizations, NGOs and businesses



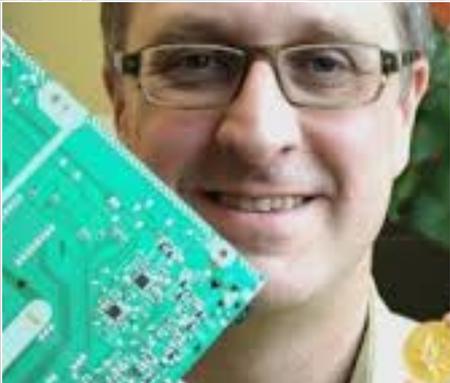
+600

Peer-reviewed
Publications

The logo for the Intergovernmental Panel on Climate Change (IPCC), with 'ipcc' in blue lowercase letters and 'INTERGOVERNMENTAL PANEL ON climate change' in smaller blue uppercase letters to the right.	8	Contributing Authors/Expert Reviewers AR4
	31	Members cited in AR5



Interdisciplinary Centre on Climate Change 





UNIVERSITY OF
WATERLOO

Climate Change is upon us and education is the most effective tool we have to mitigate and adapt to it. The University of Waterloo, as it did in the high tech revolution, is leading the way with an innovative program that will equip Canada to face our greatest challenge.

John Bennett
Executive Director
Sierra Club Canada



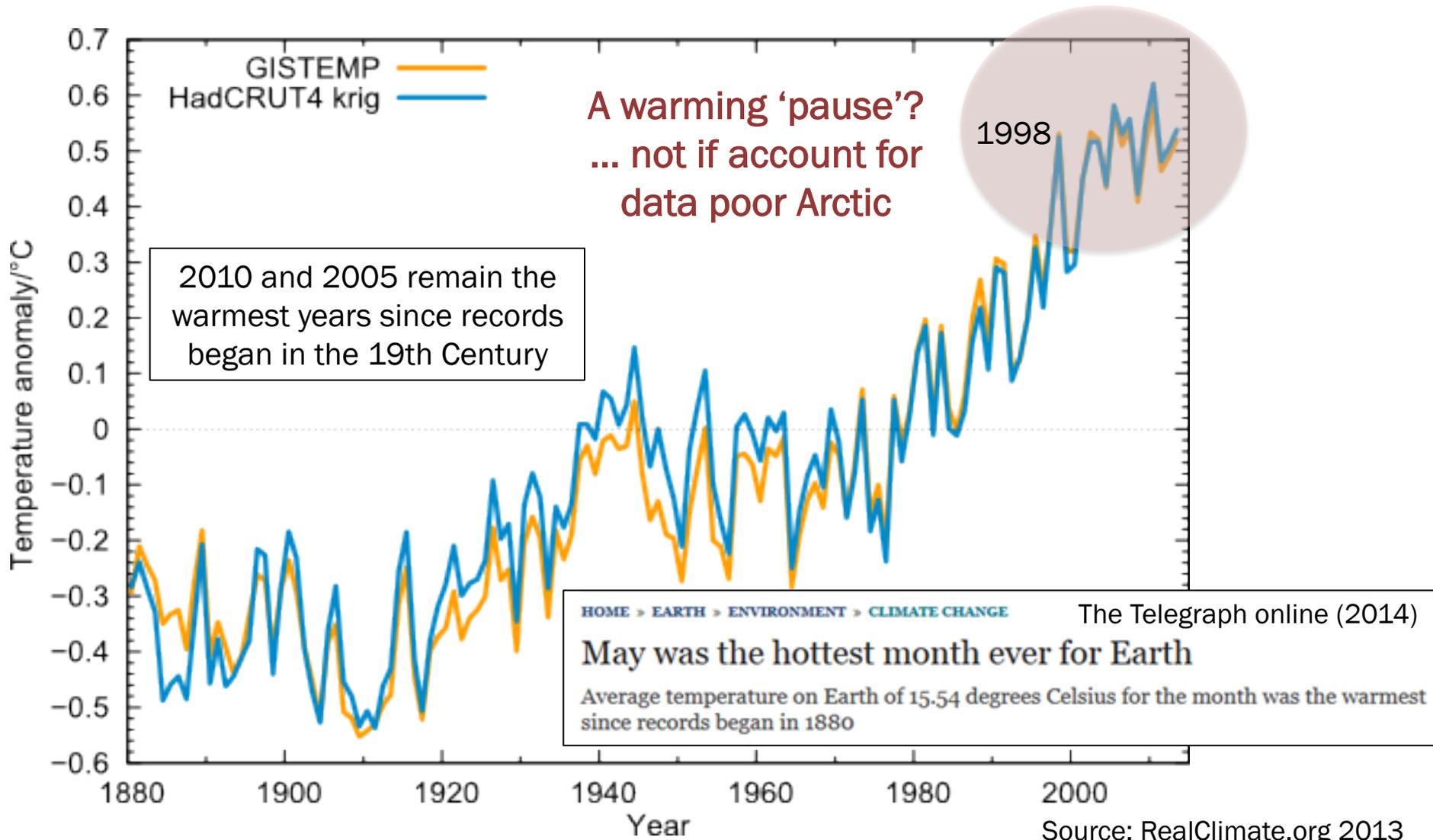
Master of Climate Change

- North America's 1st graduate climate change program (est. 2013)
- 1 year, course-based program with capstone internship or major research paper
- First two cohorts: 31 students from 14 countries

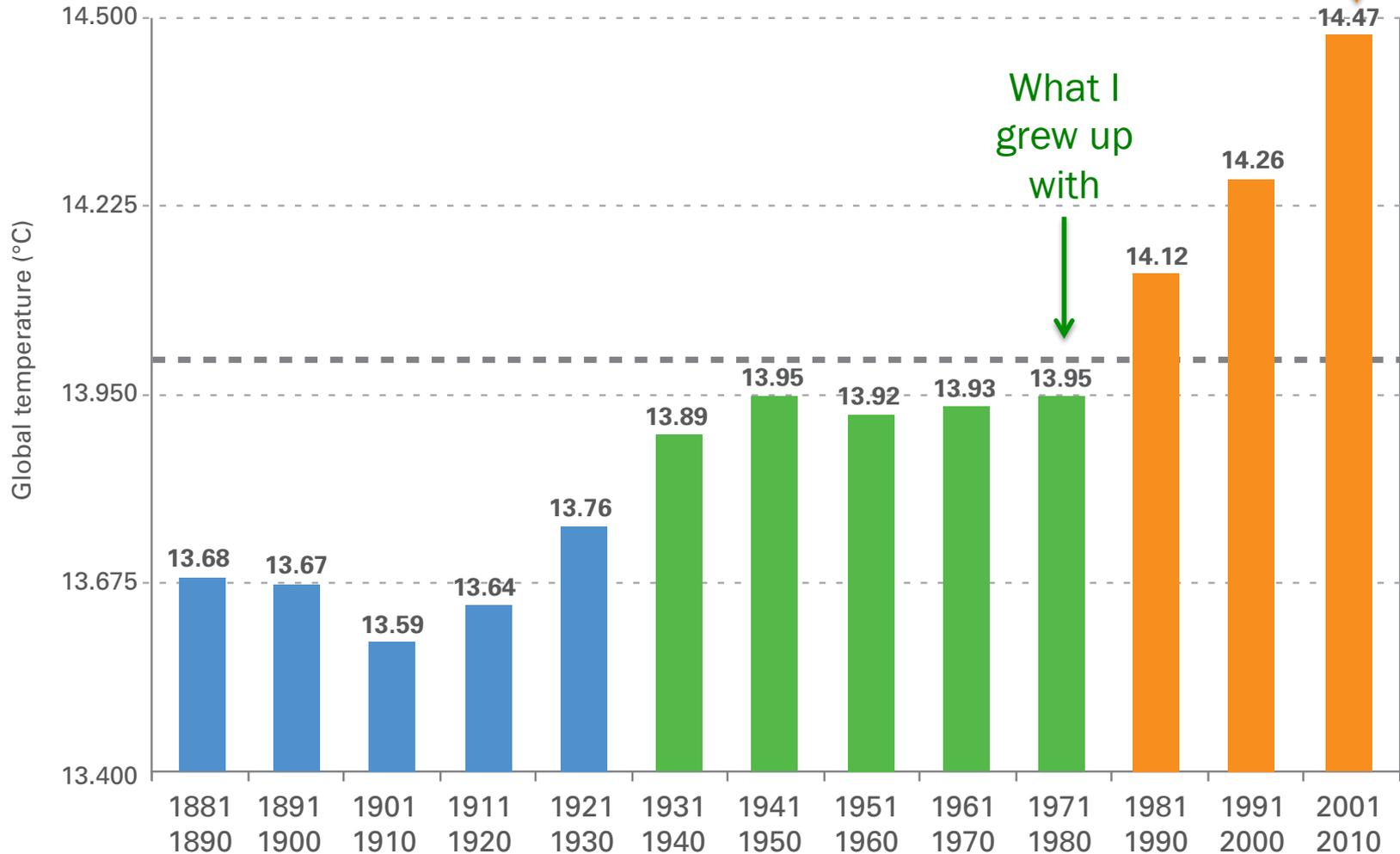


The Climate *IS* Changing:

Instrumental Record of Global Surface Temperatures (as of 2013)



Global Temperature Change: Decadal Averages (°C)

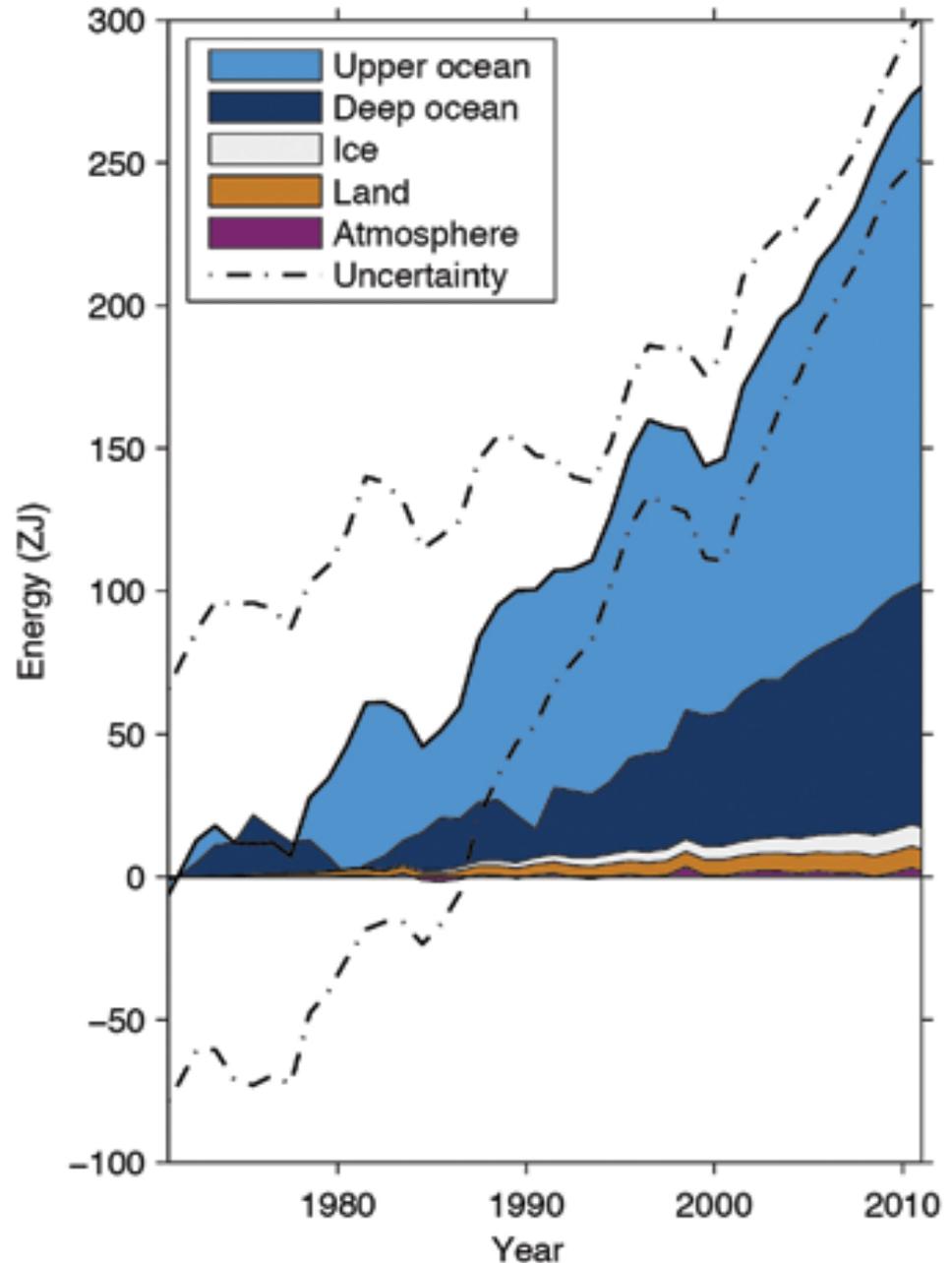


Combined land and sea-surface temperature

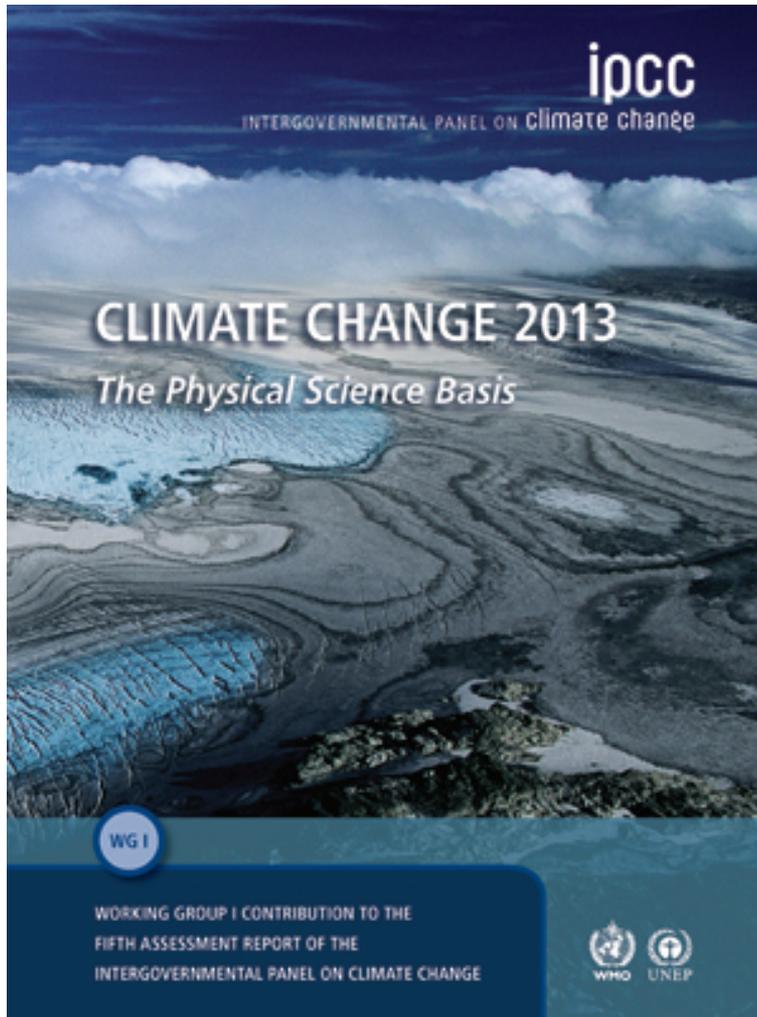
Source: WMO 2013

Energy Accumulation in Each Component of Earth's Climate System between 1971-2010

~ 90% of the Earth's extra heat is stored in the oceans due to the atmosphere's limited storage capacity (only ~2%)



Global Climate Change: IPCC Synopsis

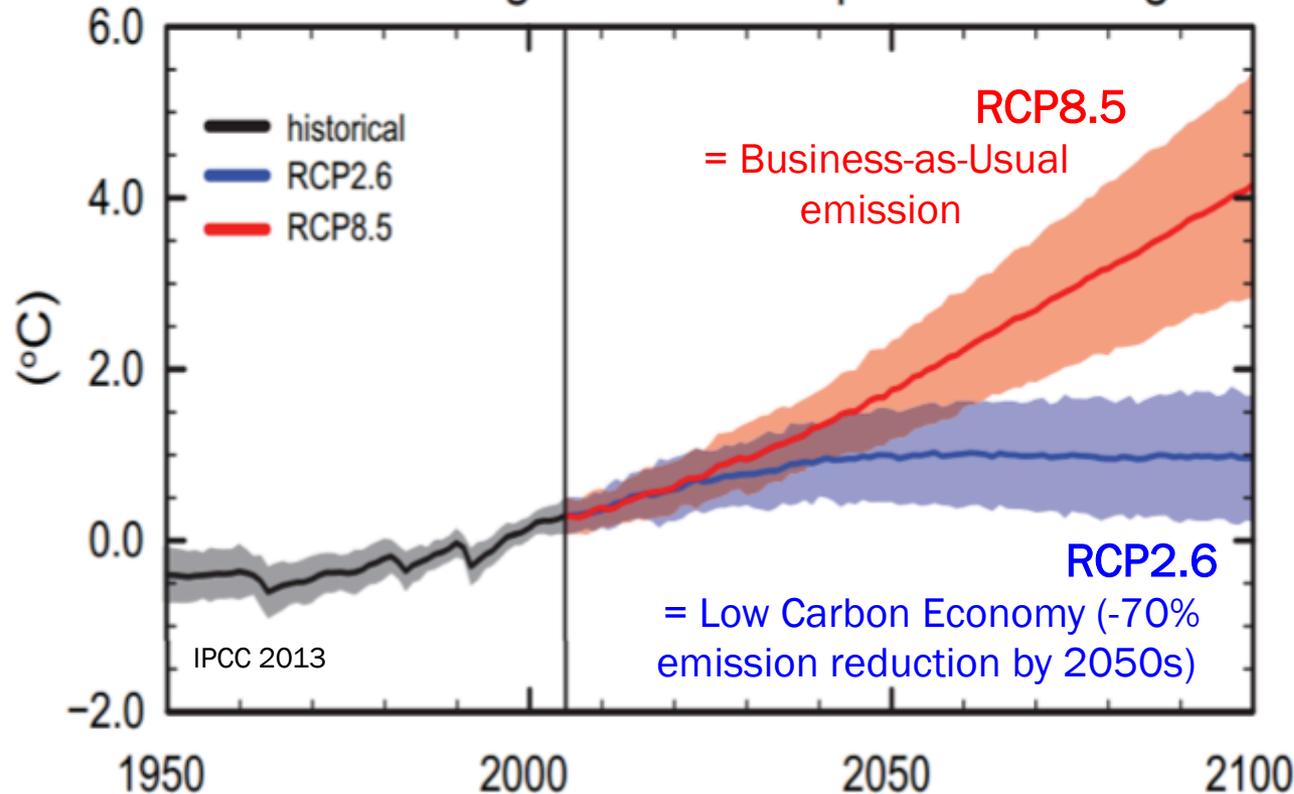


- “Warming of the climate system is unequivocal.”
- “The atmosphere and oceans have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased.”
- “Human influence on the climate system is clear.”
- “Globally CO₂ is by far the *strongest driver* of climate change.”
- “Climate change will persist for many centuries even if emissions of CO₂ are stopped.”

Adaptation is therefore not a choice but an imperative.

Global Climate Changing Has *Just Begun*

Global average surface temperature change



20th century warming
+0.85 °C

21st century warming
+1 °C to +4.2 °C

Current emissions
trajectory slightly higher
than 'worst case' scenario
(RCP8.5)

In 2009, the global community adopted a goal to limit global warming to 2 °C compared to pre-industrial temperatures. We are approaching the half-way point towards threshold of 'dangerous' climate change.

Localizing Climate Change Projections: Southern Ontario in 2050

- **Temperature:**

- Annual increase of 2-4°C
- Doubling of days over 30°C in summer



**Heat
Alert**



**Extreme
Heat Alert**

- **Precipitation (rain and snow):**

- 5 to 20% increase in winter, 10 to 15% in spring
- 40% increased frequency of freezing rain during the months of December, January and February

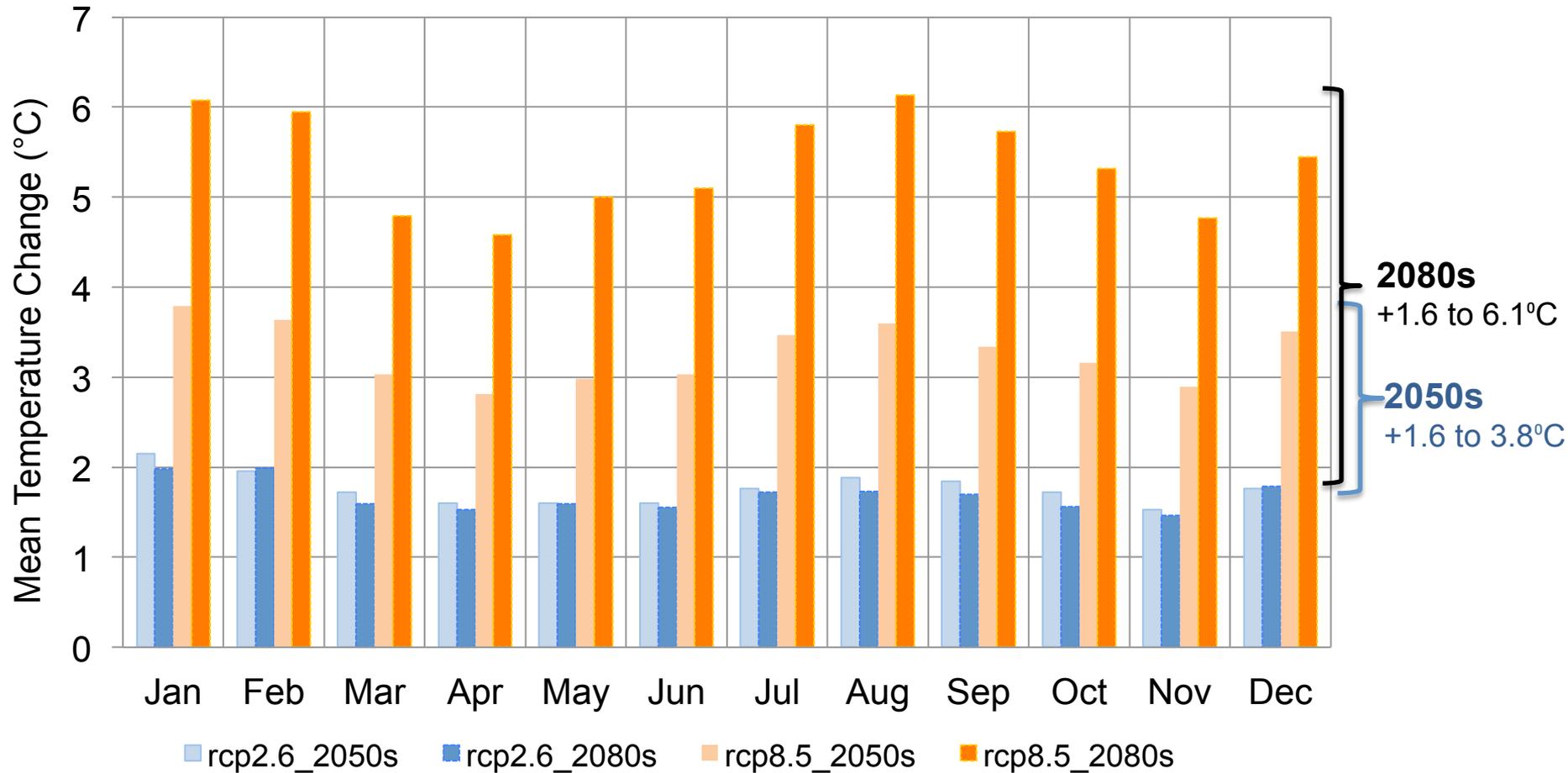
- **Storms:**

- 10% increase in severity, double the frequency
- 8 to 15% increase in intensity of wind

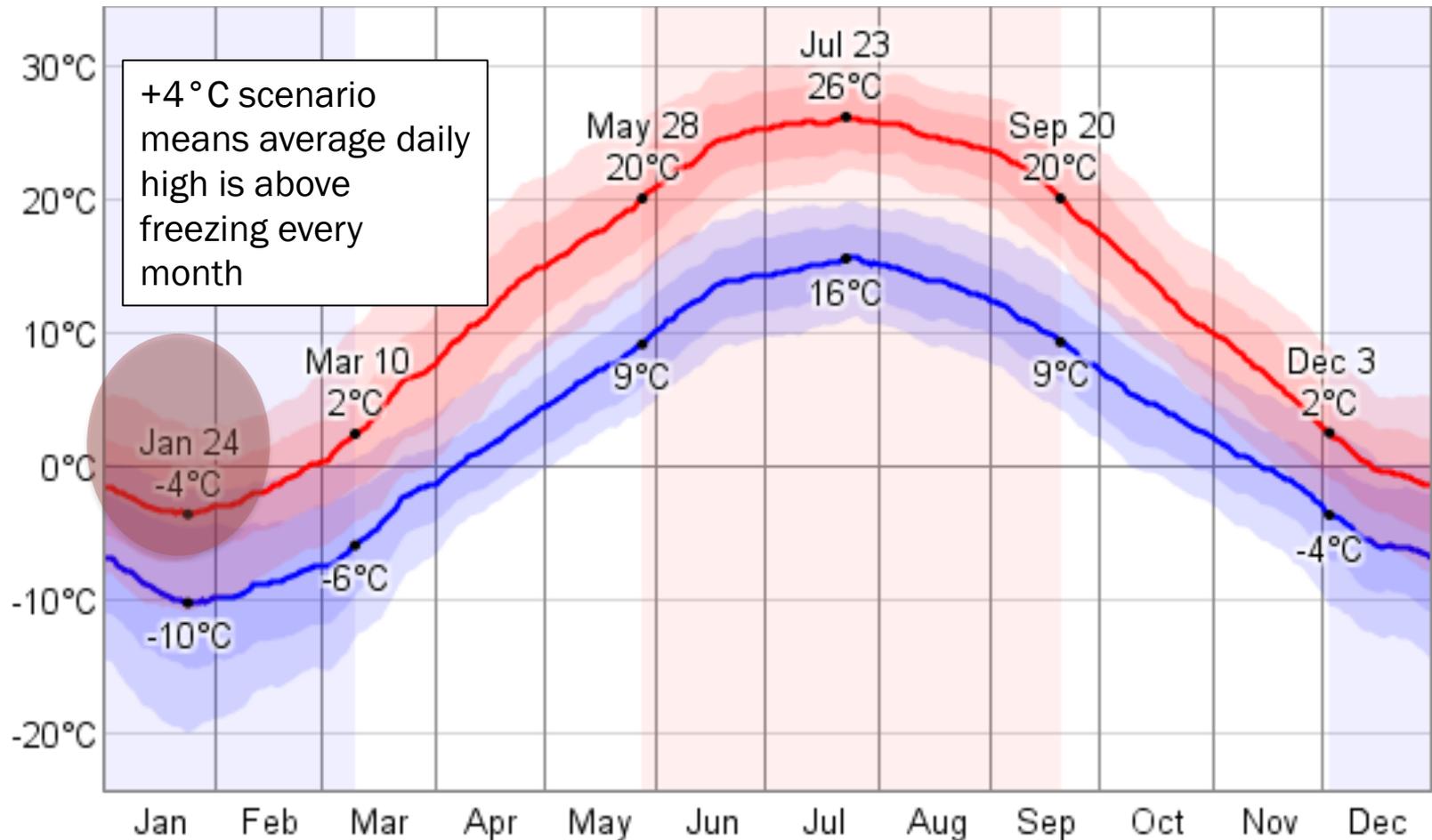


Localized Projections:

Monthly Temperature Change at WR Airport (wrt 1981-2010)



Changing Freeze-Thaw Frequency

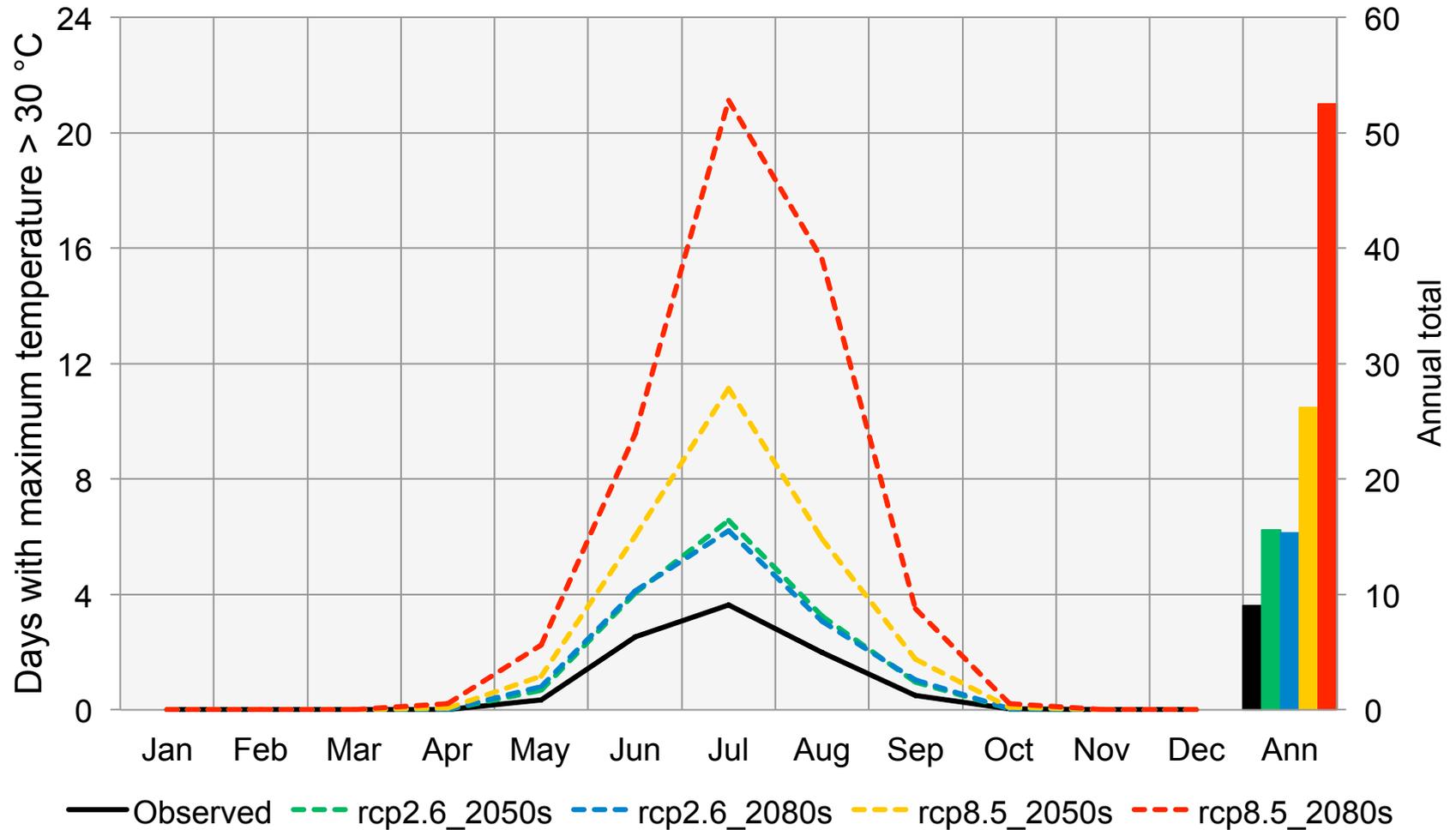


daily average high (red)

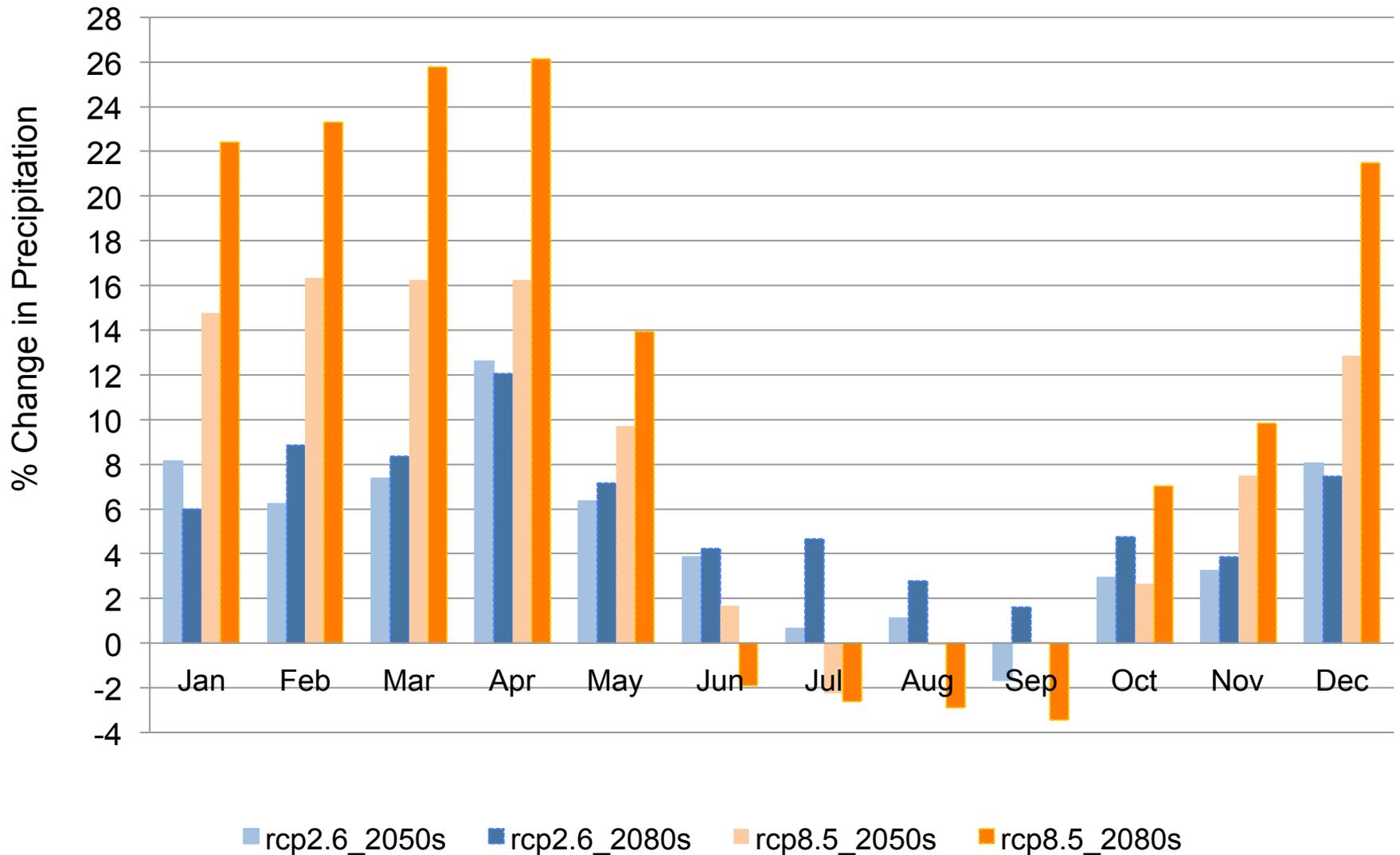
daily average low (blue)

based on 1994-2012

Extreme Heat: days with maximum temperature >30 °C



Localized Projections: Monthly Precipitation Change



CMIP AR5 data downscaled to Waterloo Region

Changing conditions → Impacts

Around the world...



... and close to home



Top Ranked Impacts Identified by Cities



How do we respond?

Mitigation:

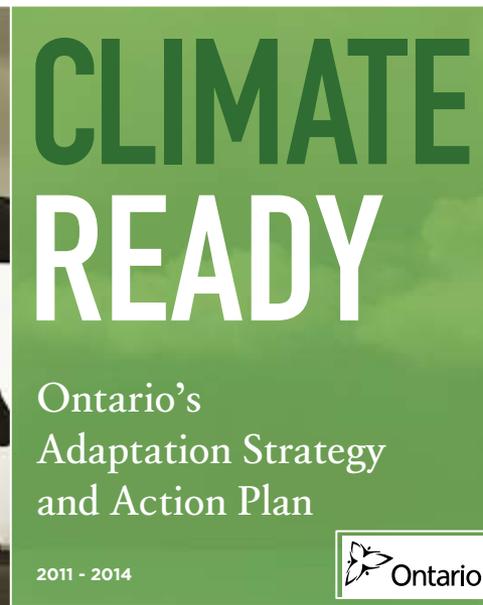
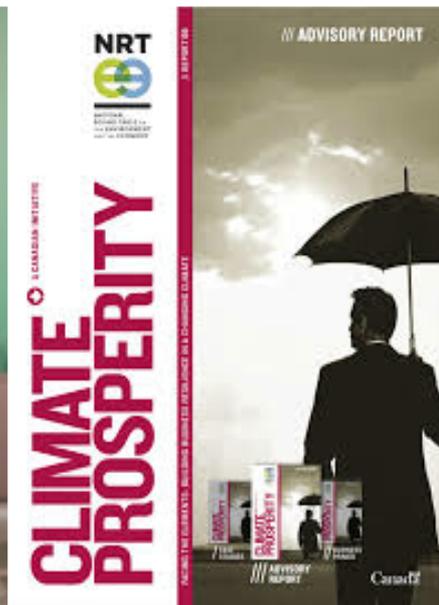
“Implementing policies to reduce greenhouse gas (GHG) emissions and enhance sinks.”

- IPCC, 2007

Adaptation:

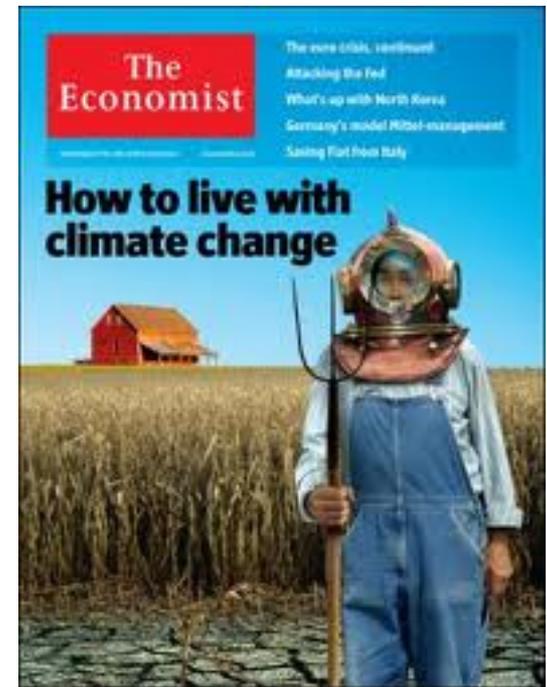
“[An] adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.”

- IPCC, 2007



The Adaptation Imperative

- 'current national emission reduction targets give **virtually no chance** of constraining warming to $+2.0^{\circ}\text{C}$ (Rogelj et al 2009)
- 'Politically realistic (emission reduction) objectives will leave most of the burden of coping with climate change to adaptation.' (Stehr and von Storch 2005)
- 'we should be planning to adapt to at least $+4.0^{\circ}\text{C}$ of warming' (Parry et al. 2009)
- 'The **necessity for adaptation** to climate change is becoming a much higher priority for Ontario ... There is a need to build a more climate-resilient economy and society.'
(Province of Ontario 2010)



grazie Bedankt Danke Schön
 MERCI OBRIGADO gracias Tack GRAZIE
 תודה Merci bedankt
 DANKE SCHÖN obrigado
 Gracías Bedankt Tack شكرا
 thank you
THANK YOU!
 Gracías THANK YOU تَكَرَّ
 Danke Schön TACK thank you TACK
 OBRIGADO TACK. merci thank you BEDANKT bedankt
 MERCI TACK. merci thank you BEDANKT bedankt
 obrigado TACK. merci thank you BEDANKT bedankt
 תודה grazie



» For more information:

daniel.scott@uwaterloo.ca
 519-888-5467 ext. 35497

s6brown@uwaterloo.ca
 519-888-5467 ext. 36755



UNIVERSITY OF
WATERLOO

Interdisciplinary Centre on Climate Change 

January Average Daily Temperature in Toronto

