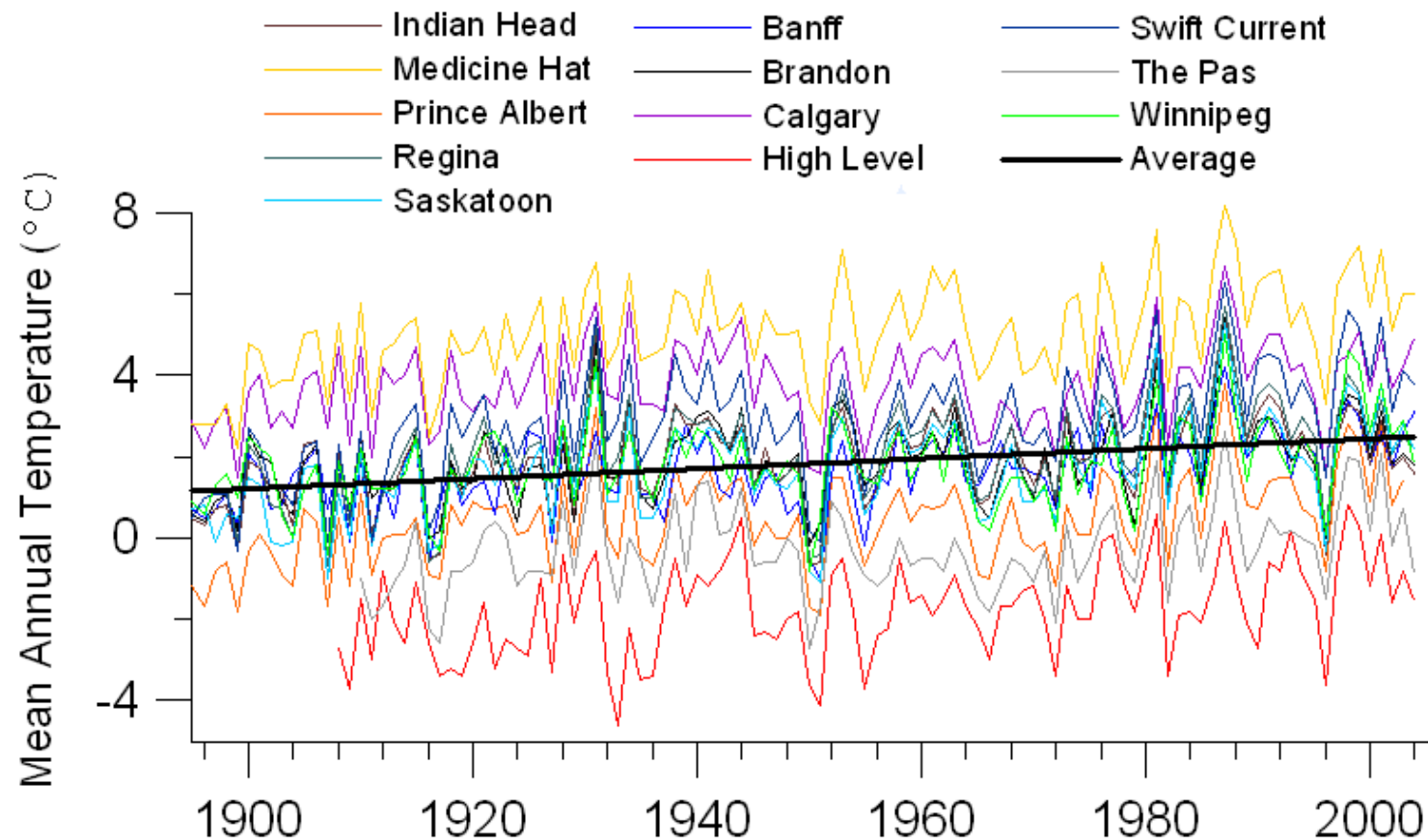


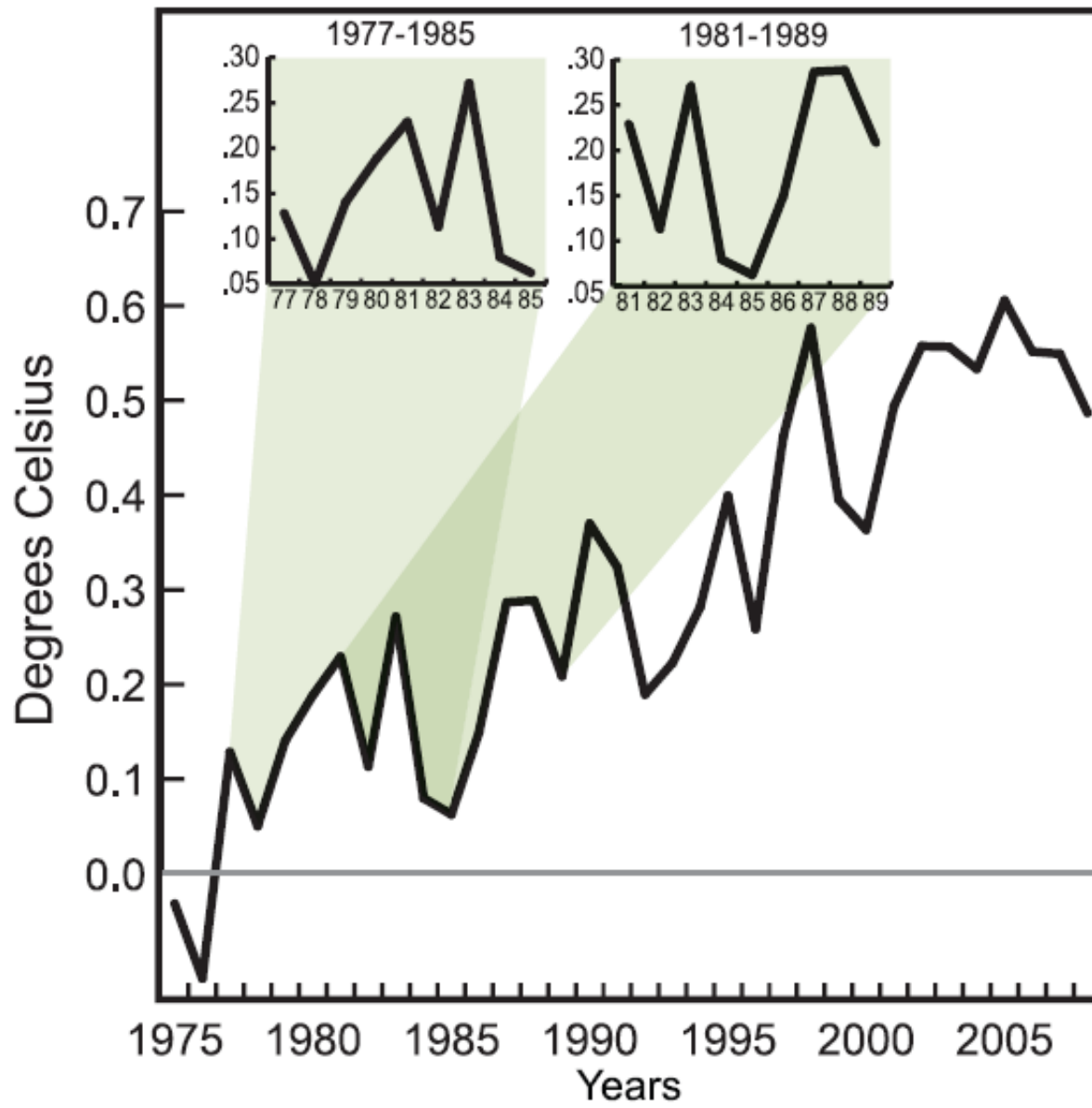
Climate Change Impacts Across the Prairies: Projected climate change trends, impacts and challenges

Dave Sauchyn, Prairie Adaptation Research Collaborative

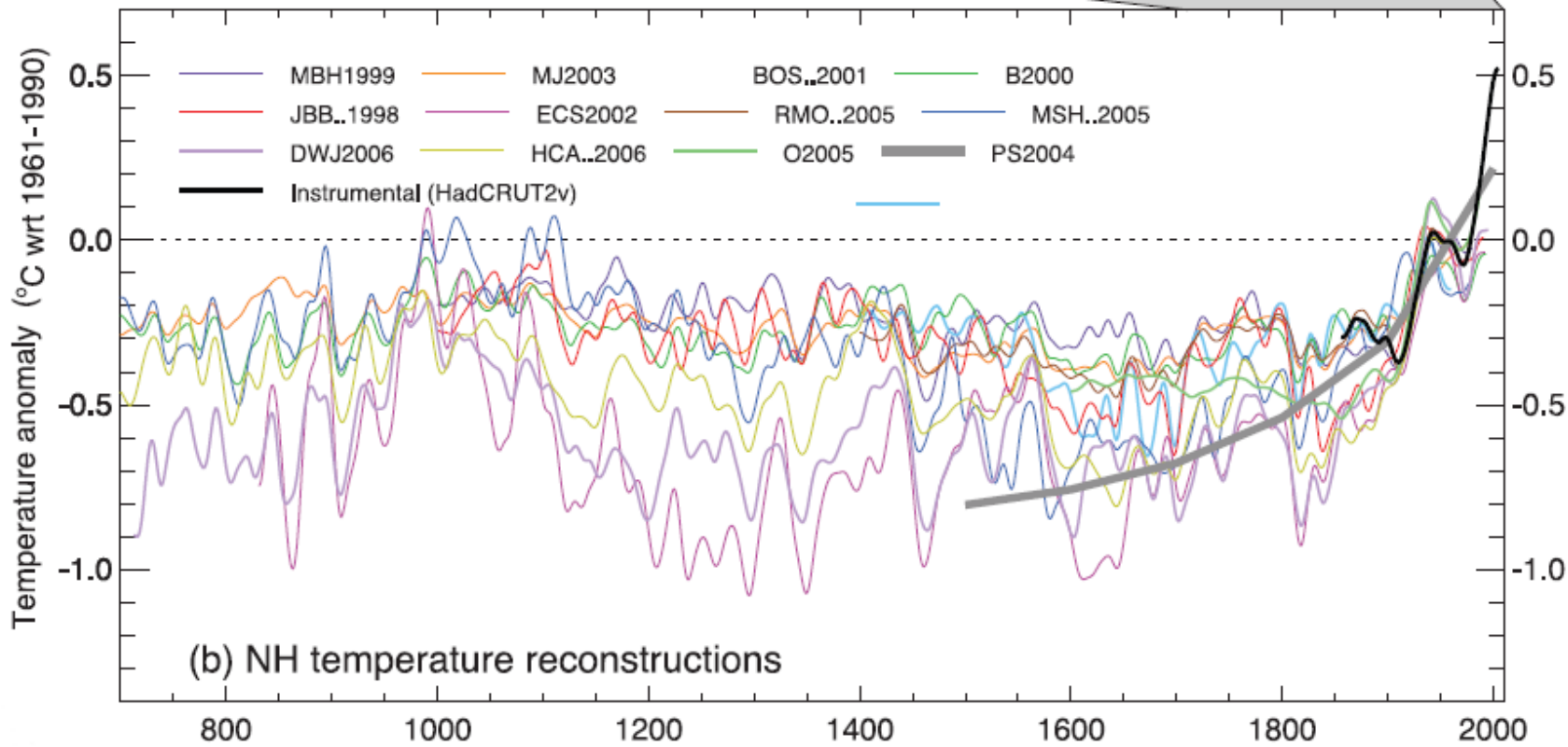
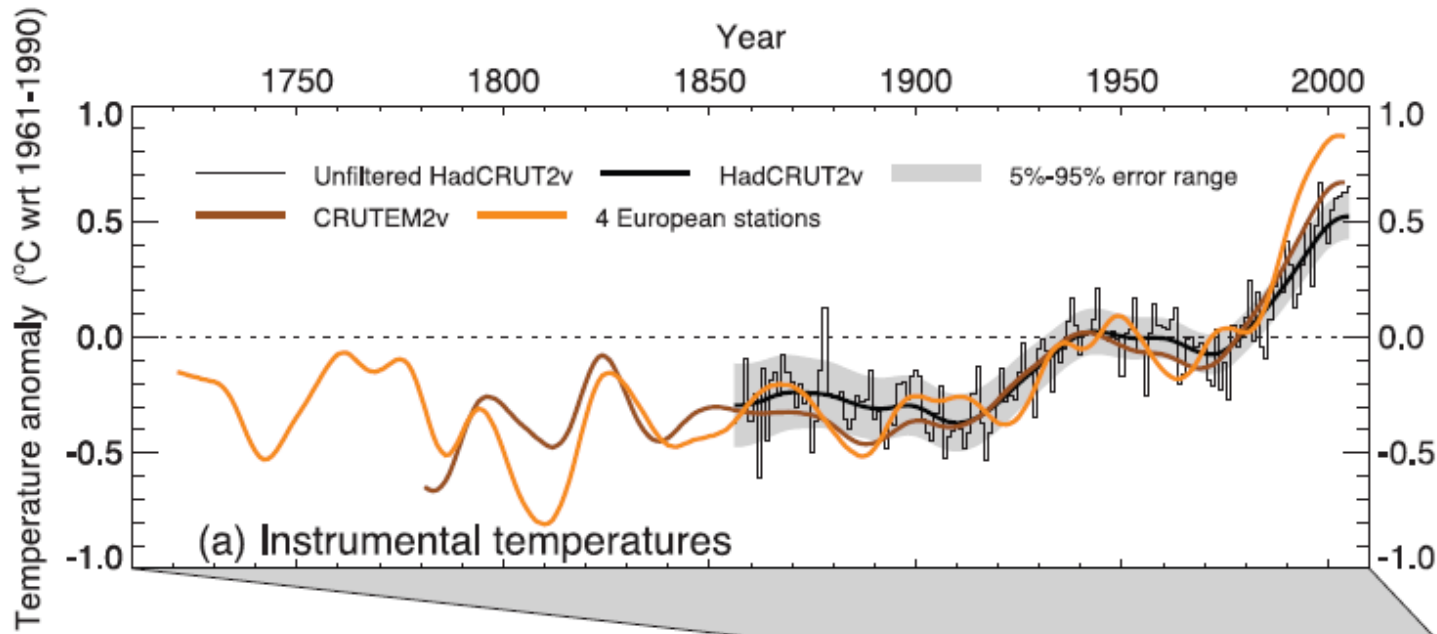


**Leaders' Roundtable on Climate Change Adaptation
Calgary, February 3 - 4, 2010**

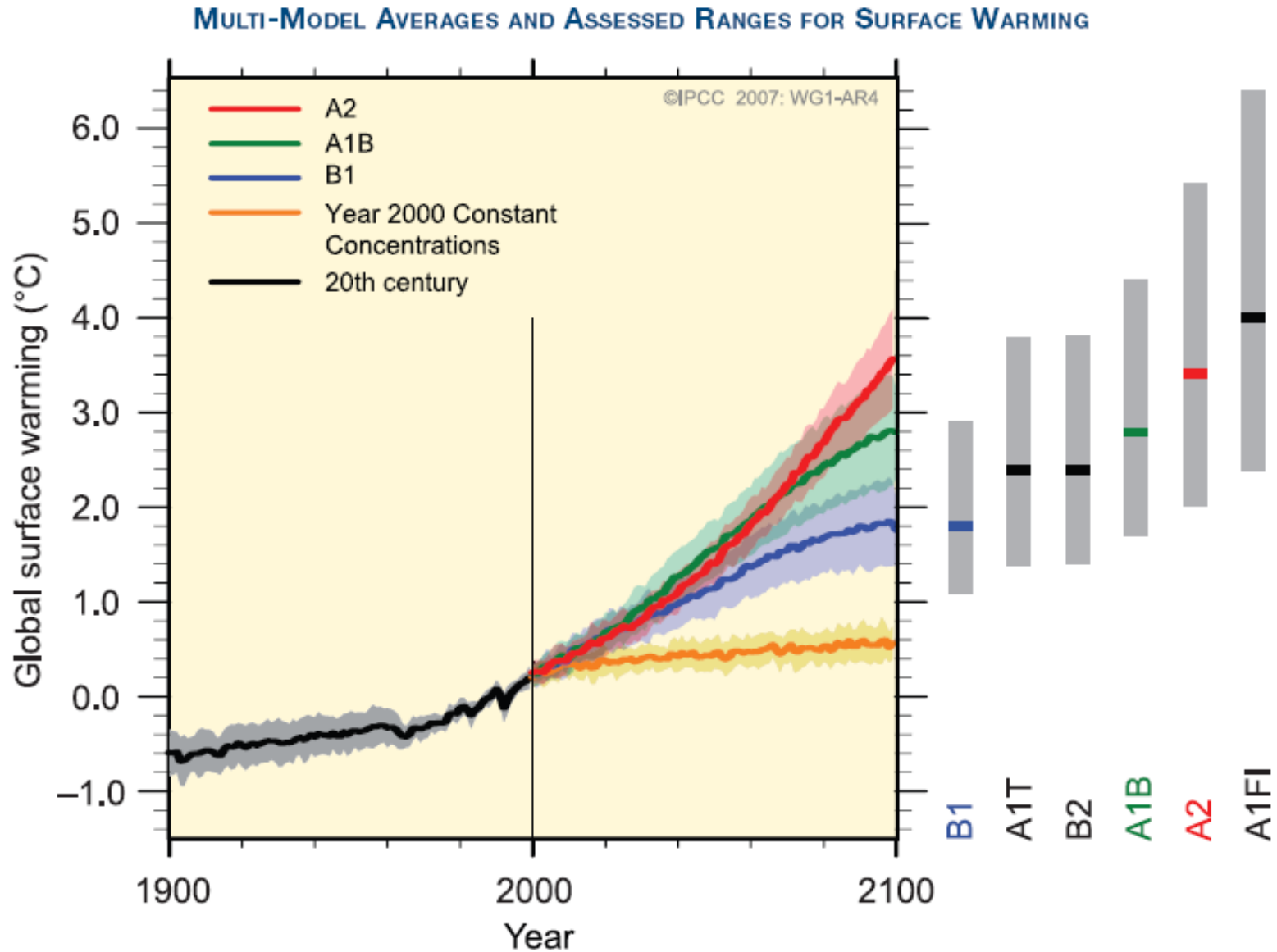
Is the climate warming or cooling?



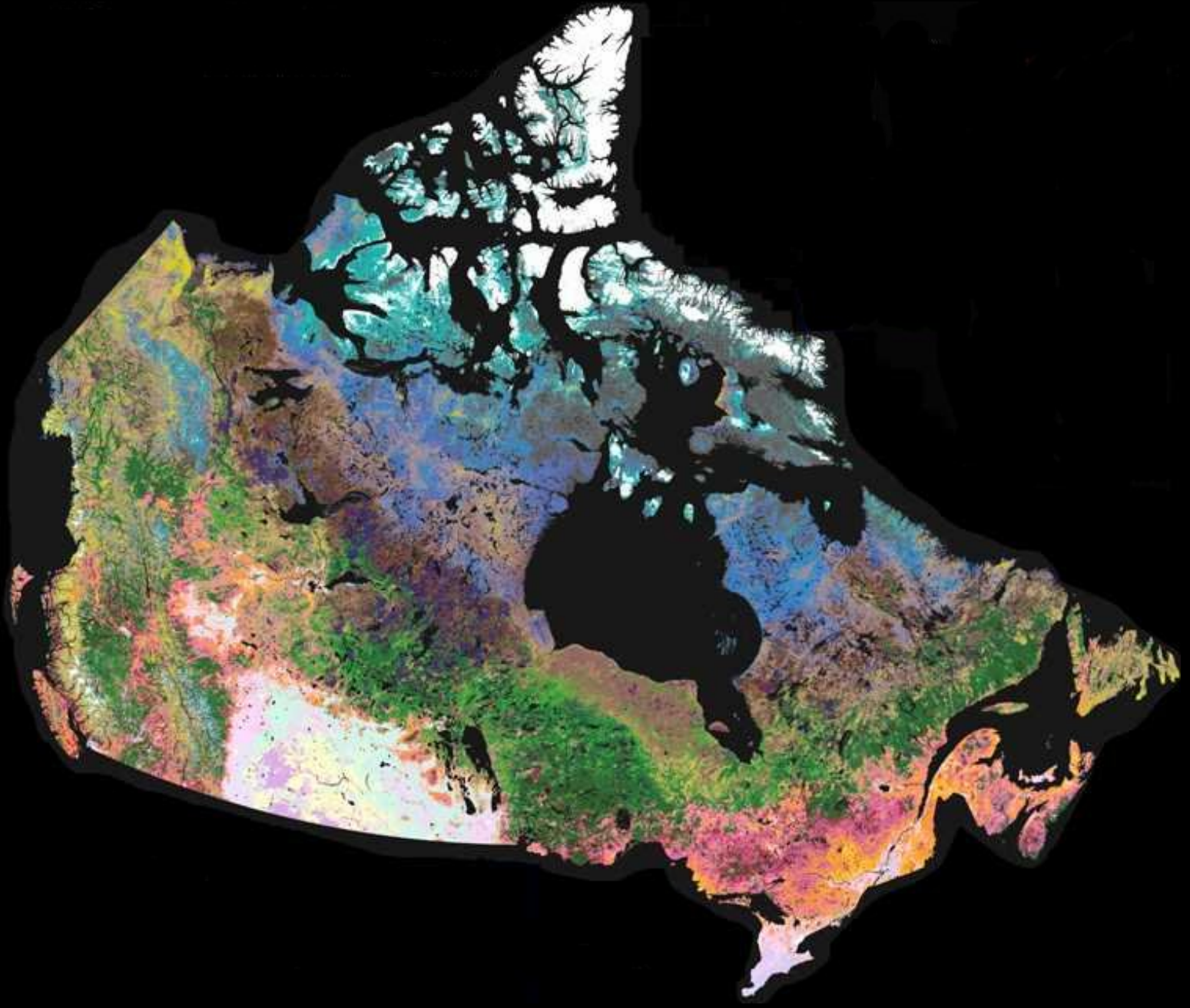
Easterling and Wehner, 2009



Climate Projections (IPCC 2007)



Anthropogenic warming and sea level rise would continue for centuries, even if greenhouse gas concentrations were to be stabilized.



Prairie Adaptation Research Collaborative

PARC is a partnership of the governments of Canada, Alberta, Saskatchewan and Manitoba mandated to pursue climate change impacts and adaptation research in the Prairie Provinces.

- Alberta Vulnerability Assessment Project
 - Climate Change Scenarios
 - Biophysical Impact Assessment
 - Integrated Vulnerability Assessment
- Saskatchewan's Natural Capital In A Changing Climate
 - Climate Change Scenarios
 - Assessment of Biophysical Impacts and Adaptation
- Prairies Chapter, National Assessment of Climate Change Impacts and Adaptation
- Prairies Regional Adaptation Collaborative (**Prairies RAC**)



CHAPTER 7

Prairies



Lead authors:

Dave Sauchyn¹ and Suren Kulshreshtha²

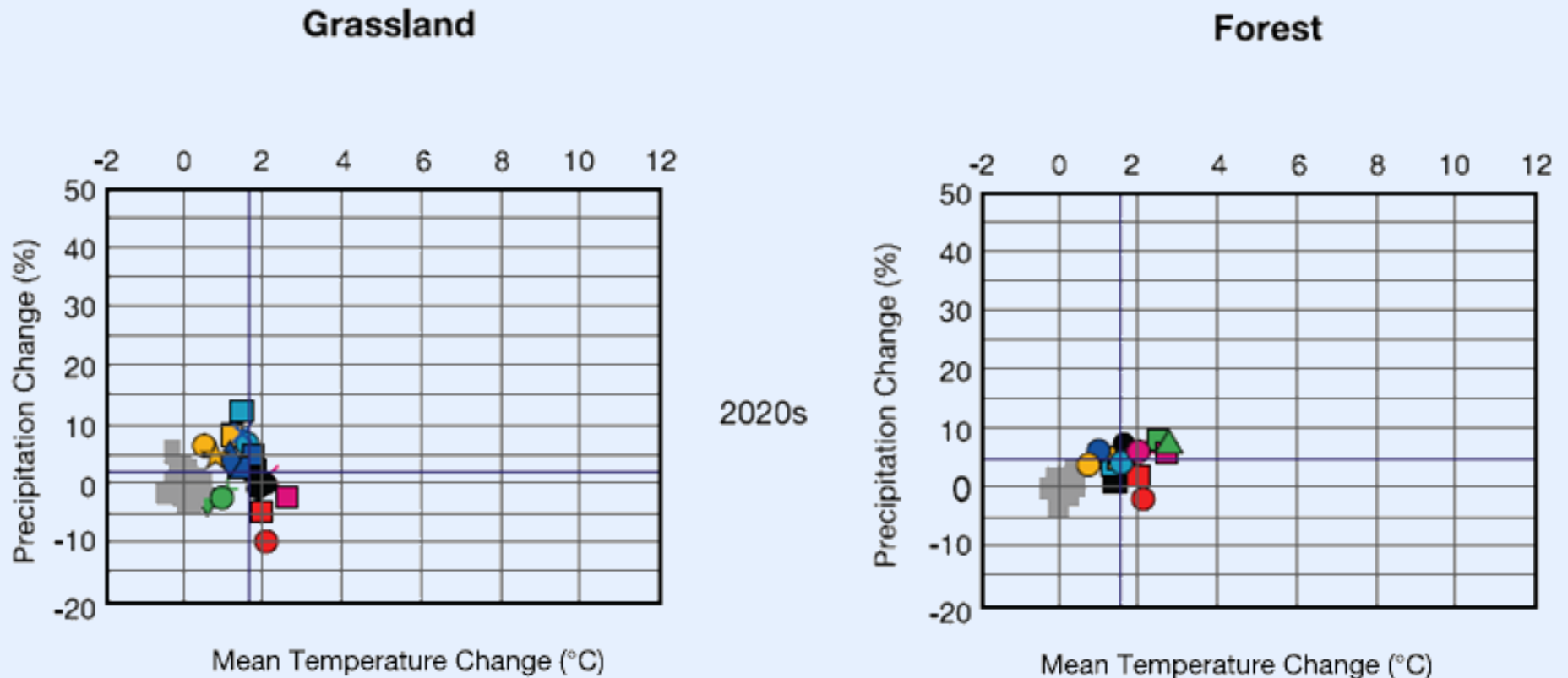
¹ Prairie Adaptation Research Collaborative, University of Regina, Regina, SK

² Department of Agricultural Economics, University of Saskatchewan, Saskatoon, SK

Contributing authors:

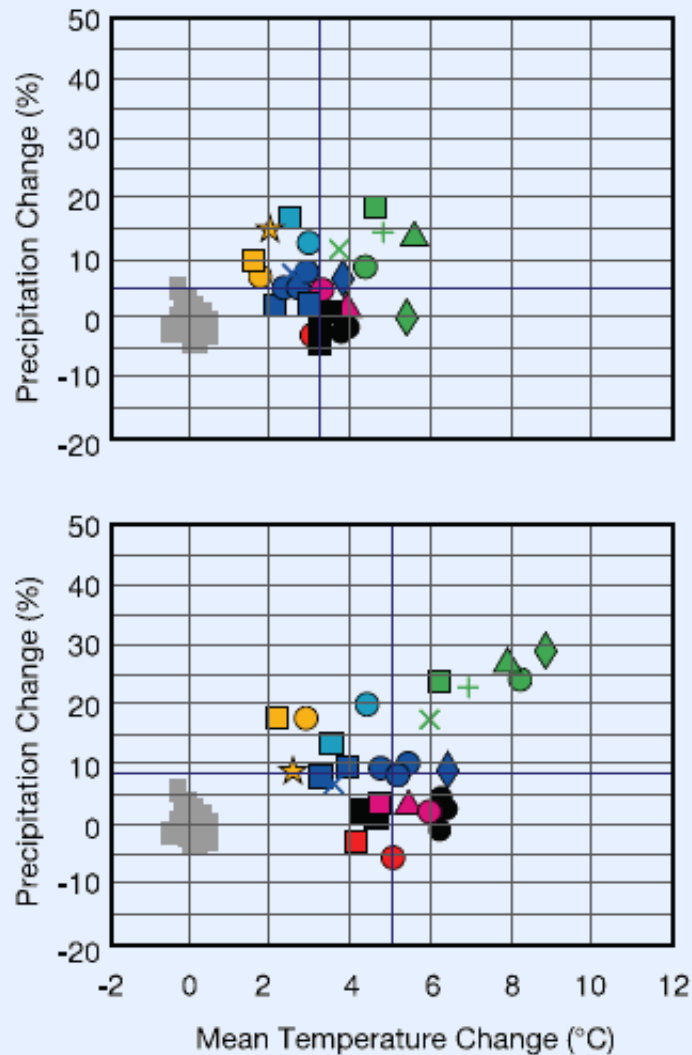
Elaine Barrow (*University of Regina*), Danny Blair (*University of Winnipeg*), Jim Byrne (*University of Lethbridge*), Debra Davidson (*University of Alberta*), Polo Diaz (*University of Regina*), Norm Henderson (*University of Regina*), Dan Johnson (*University of Lethbridge*), Mark Johnston (*Saskatchewan Research Council*), Stefan Kienzle (*University of Lethbridge*), Justine Klaver (*University of Alberta*), Jeff Thorpe (*Saskatchewan Research Council*), Elaine Wheaton (*Saskatchewan Research Council*)

Projected changes in mean annual temperature and precipitation

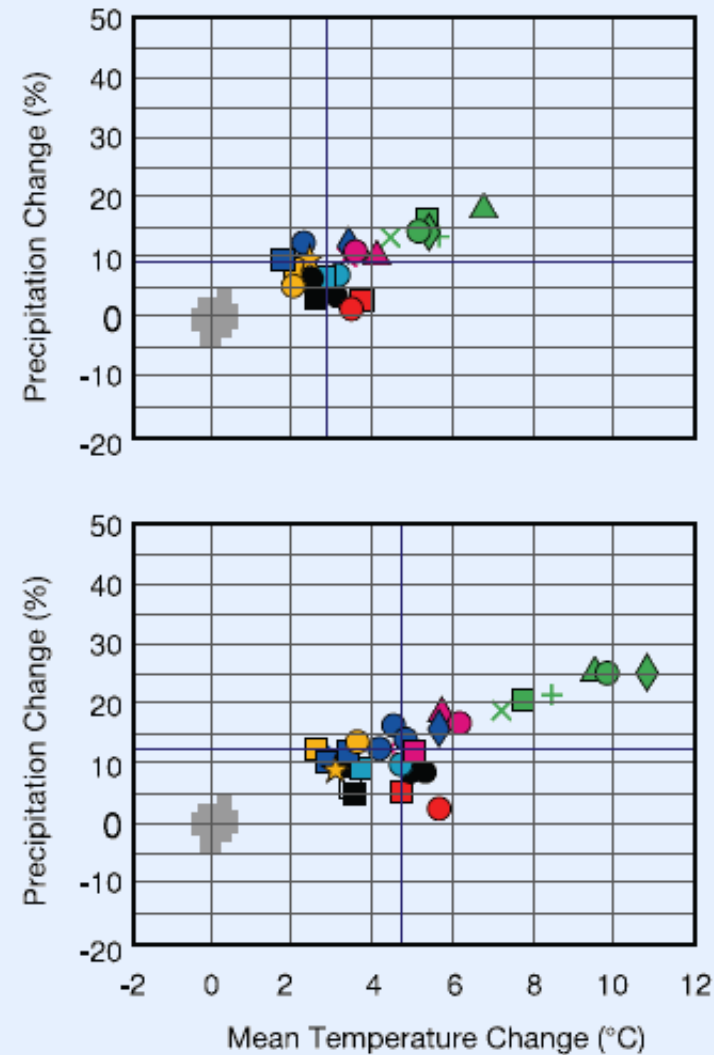


The grey squares indicate the ‘natural’ climate variability simulated by a long control run of the CGCM2.

Projected changes in mean annual temperature and precipitation



2050s



2080s

The recent warming exceeds the global average



Future climates are outside the range of natural variability

Global warming -- it's not all bad

In fact, for people living in places like Edmonton, a warmer climate has plenty of benefits

David Staples, The Edmonton Journal

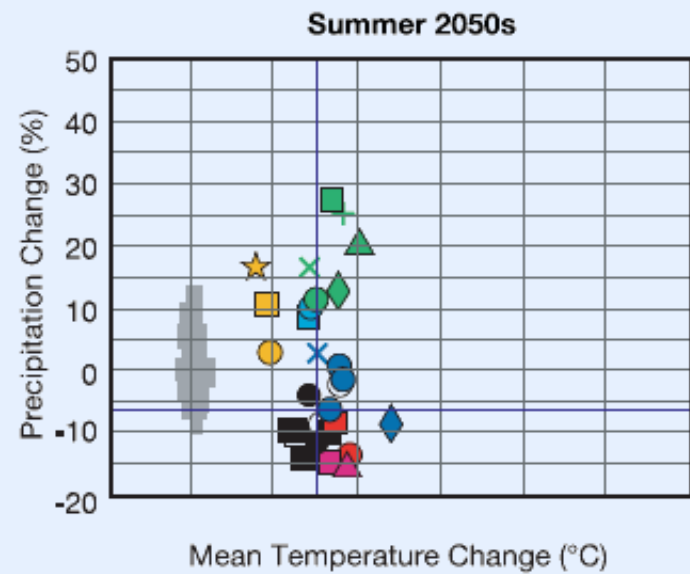
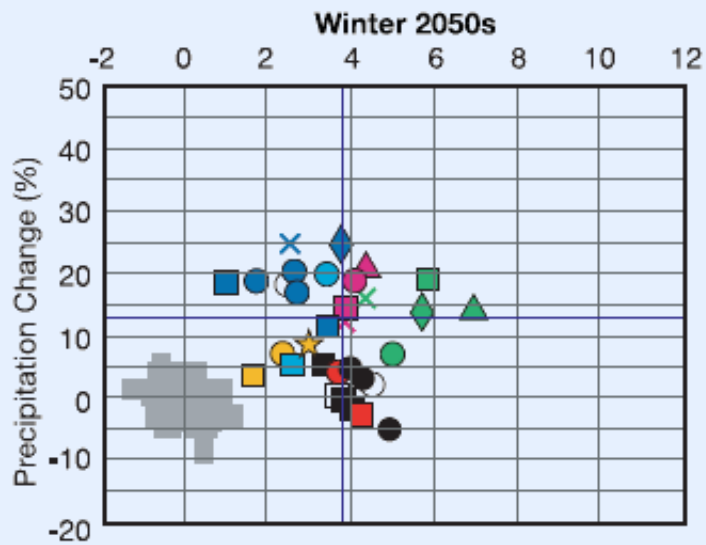
Sunday, November 23, 2008

Robert Mendelsohn, an economics professor at Yale University, who says the benefits of global warming for Canada will be substantial and will outweigh the negative effects. "You're lucky because you're a northern latitude country, Mendelsohn says. **"If you add it all up, it's a good thing for Canada."**

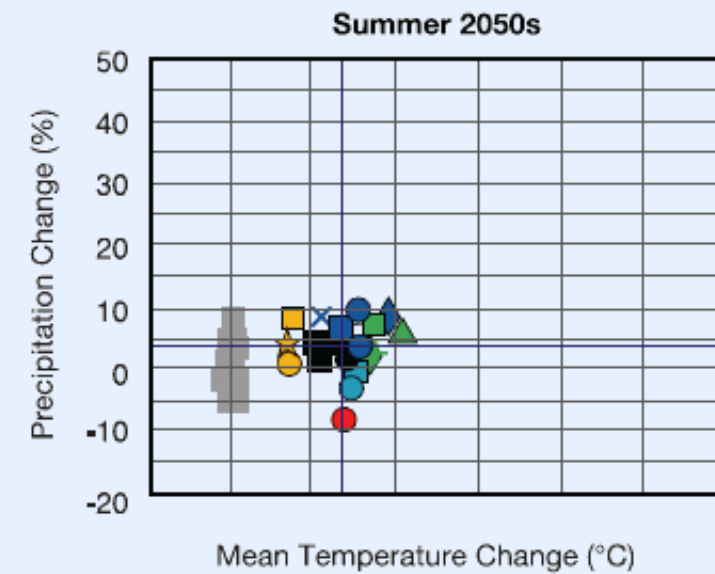
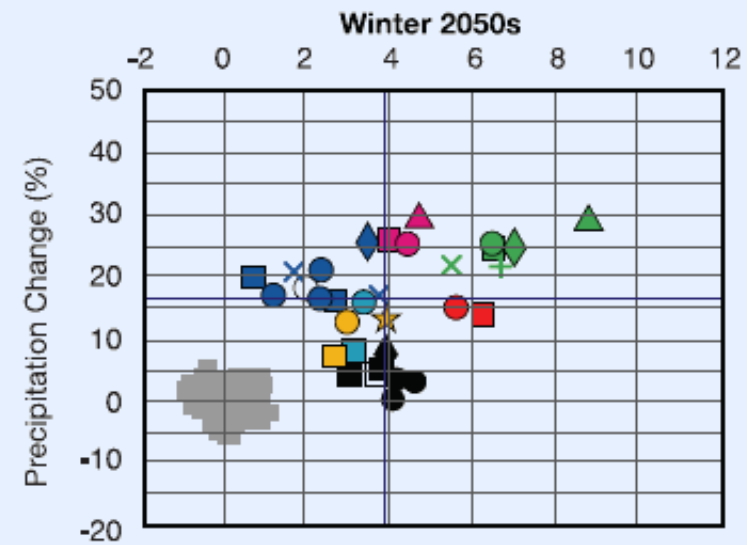
There will be opportunities for Canadian farmers going forward, **Sauchyn says ...** "The most challenging impact of climate change is not going to be a shift in average conditions ..."

Seasonal Scenarios

Grassland



Forest



One of the most certain projections is that extra water will be available in winter and spring, while summers generally will be drier

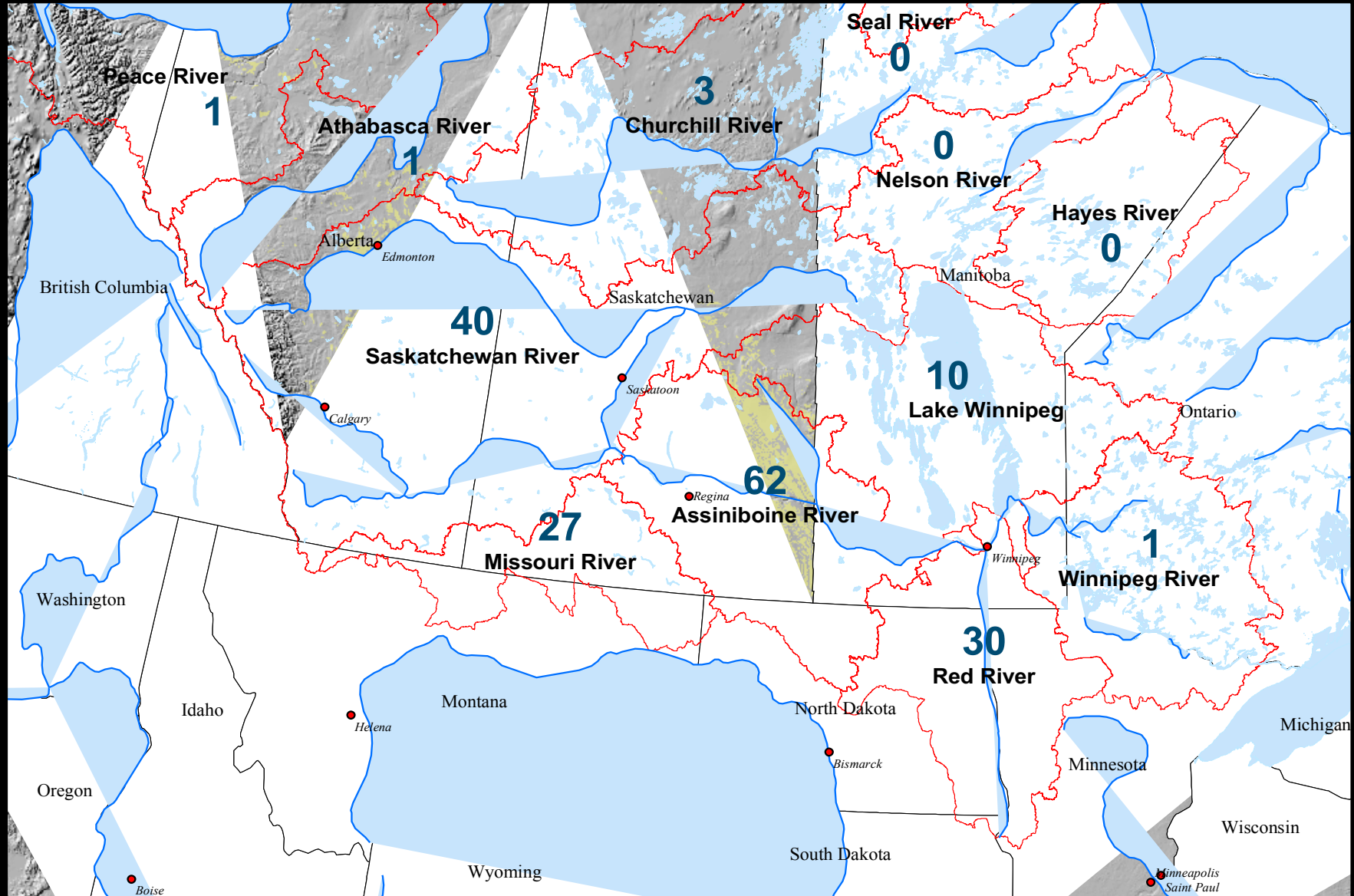


On average, there will be slightly to significantly less surface and soil water

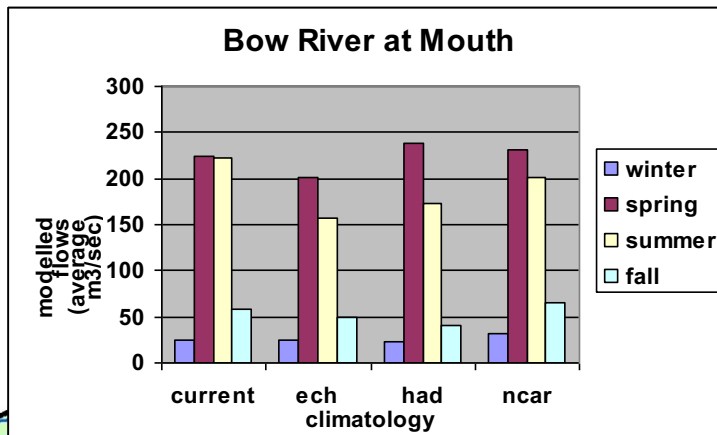
We are losing the advantage of a cold winter



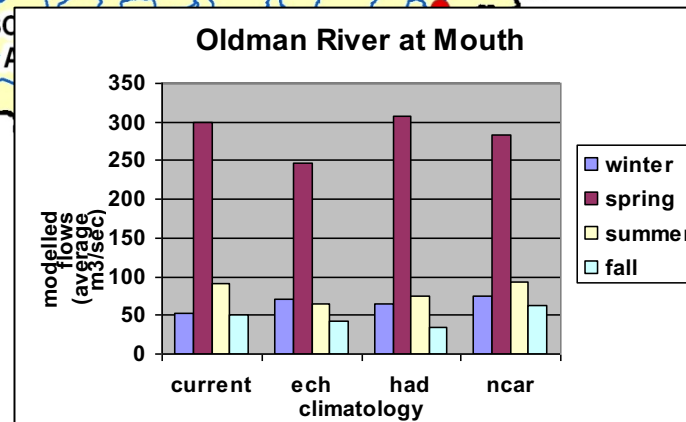
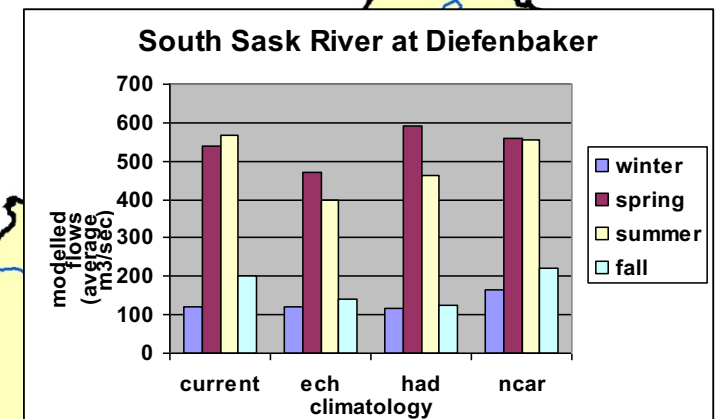
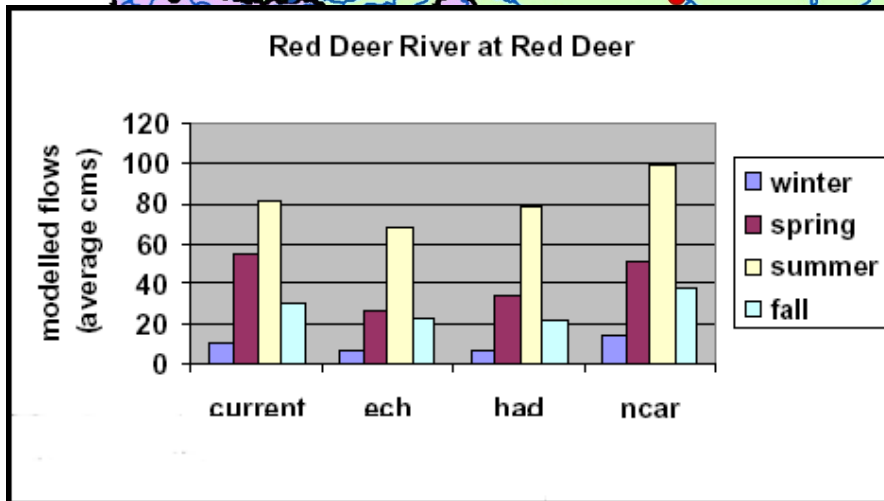
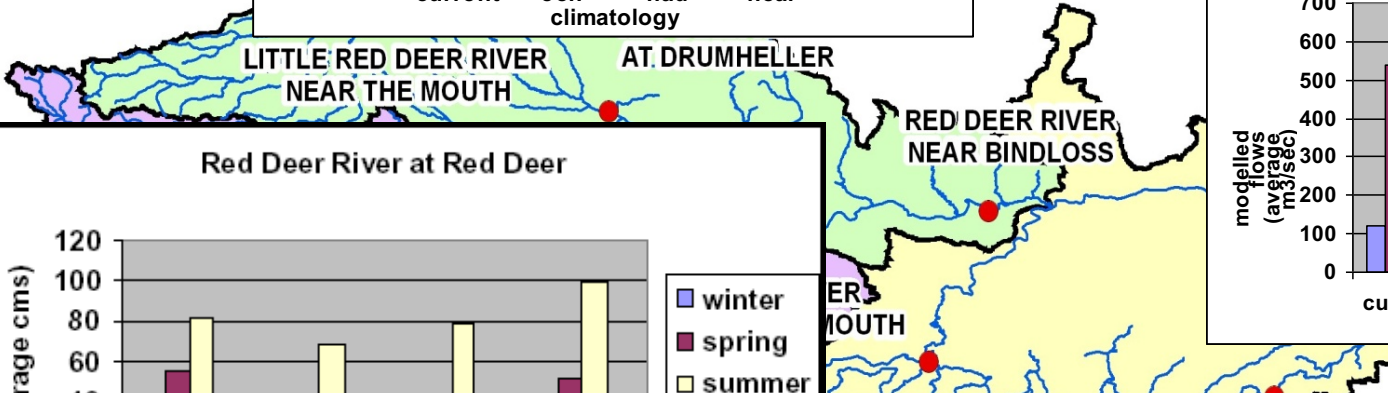
Prairie Drainage Basins (source: PFRA)



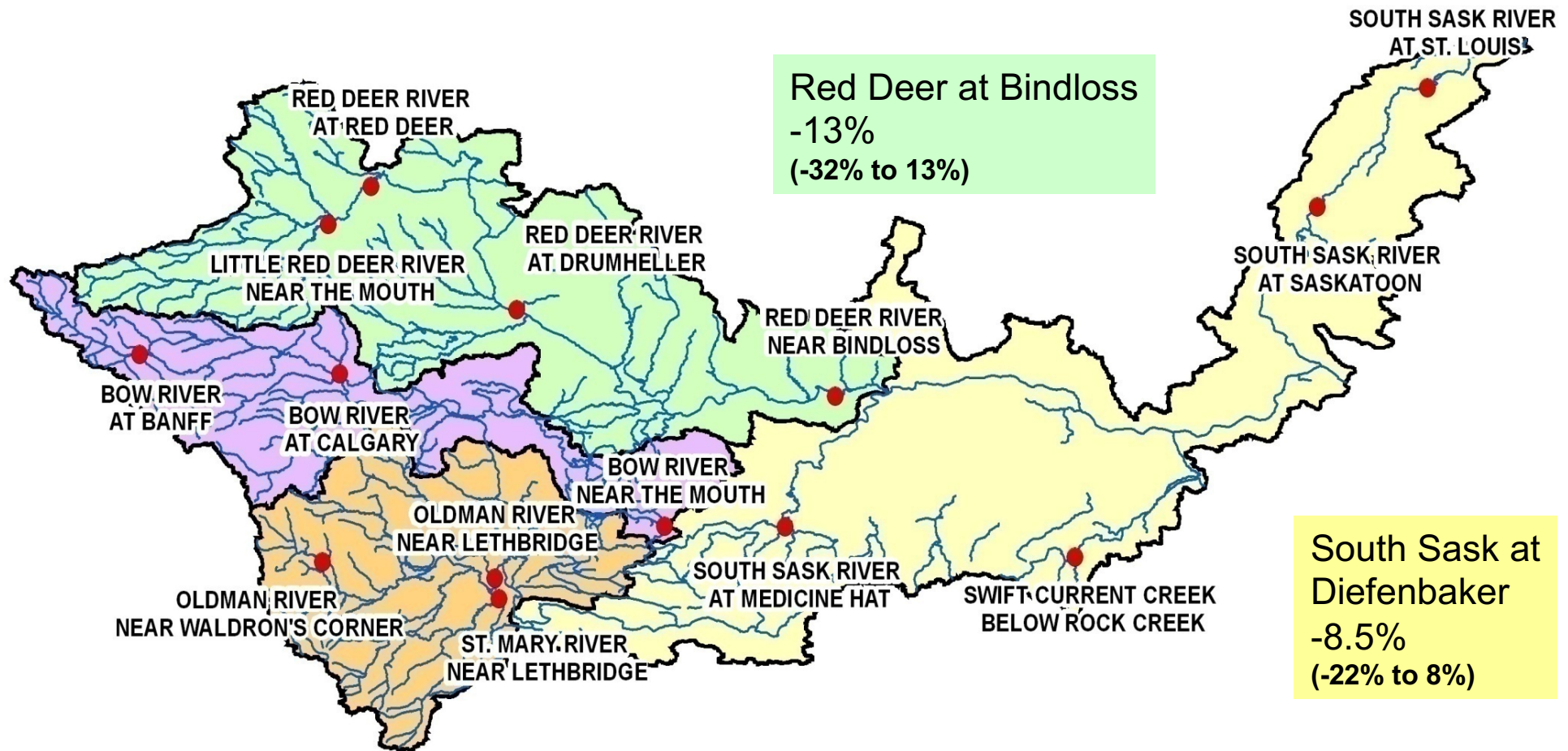
Seasonal flows, SSRB, 2039-2070 (Pietroniro *et al.*, 2006)



GCM	%Precip	+Temp	Description
echa21	-3.8	2.8	driest, warmest
echb21	-2.0	2.8	
hada21	6.4	2.3	moderately wet and warm
hadb21	0.2	2.1	
ncara21	11.5	1.7	wettest and least warm
ncarb21	9.1	1.5	



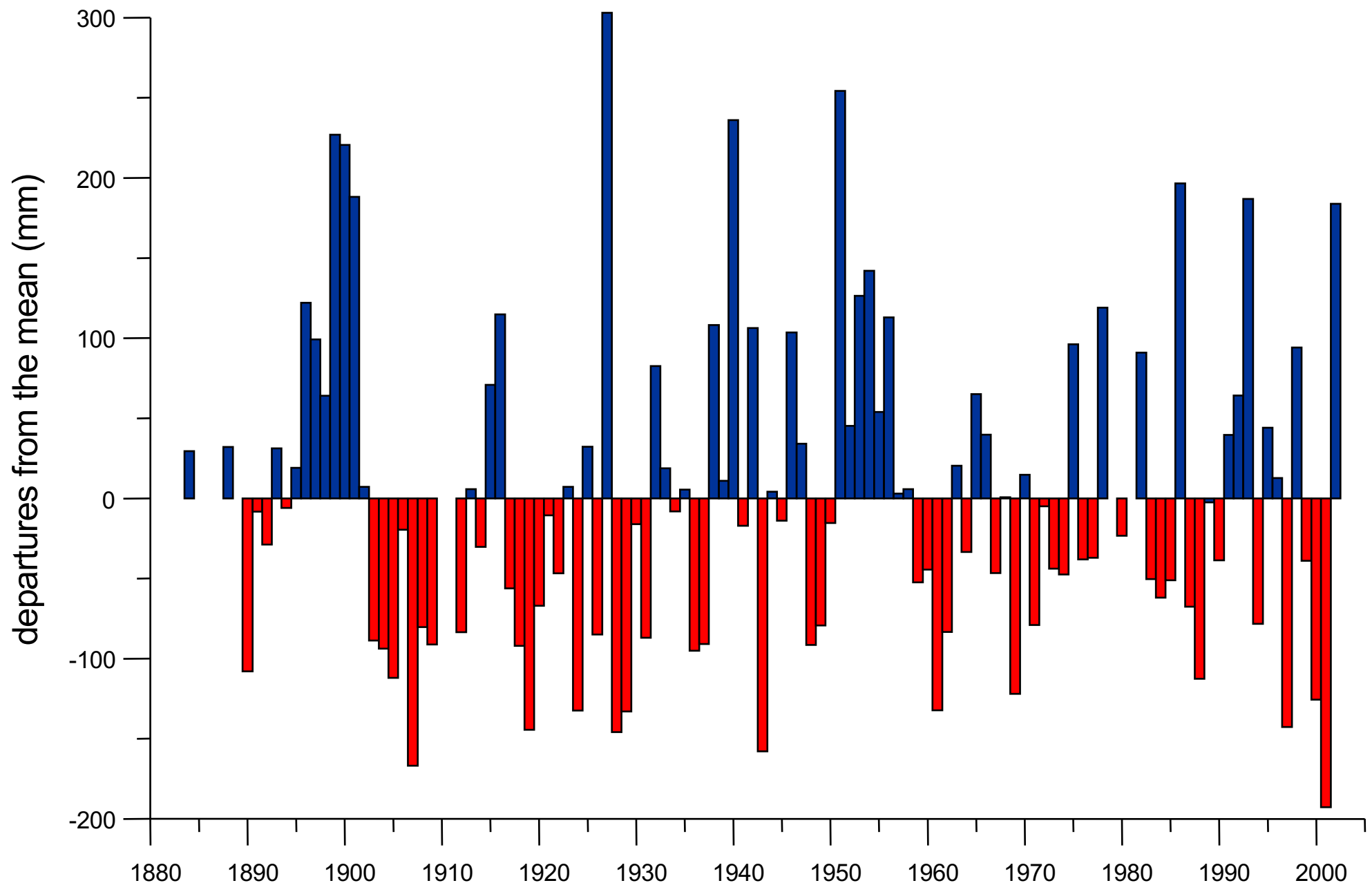
Annual flows, SSRB, 2039 – 2070 (Pietroniro *et al.*, 2006)



Bow River at mouth
-10%
(-19% to 1%)

Oldman at mouth
-4%
(-13% to 8%)

Annual Precipitation, Medicine Hat, 1884-2002



Climate Variability

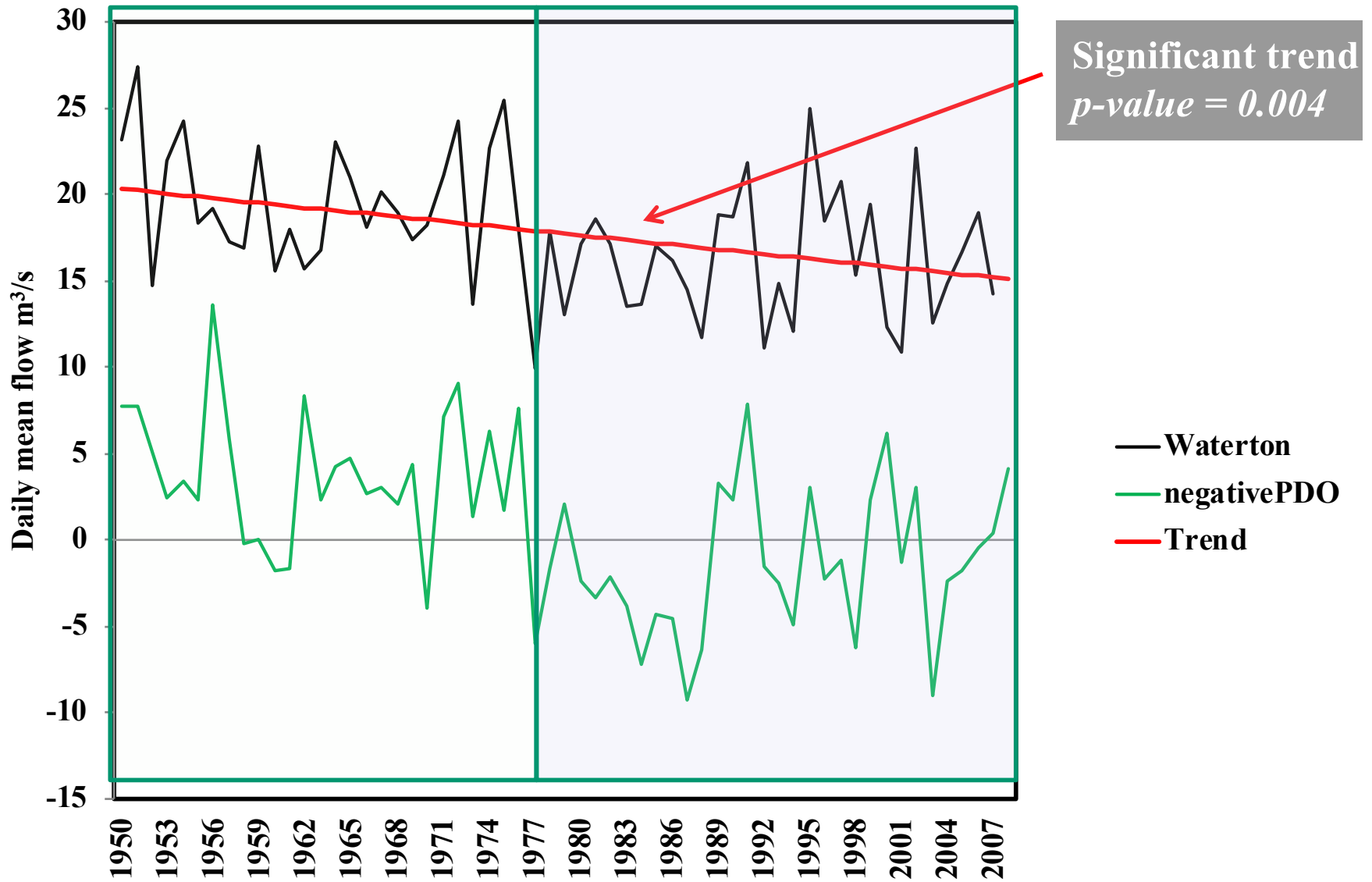
many regional climate changes can be described in terms of **preferred patterns of climate variability**

changes in the strength and phase of these patterns can lead to **larger-amplitude regional responses to forcing** than would otherwise be expected

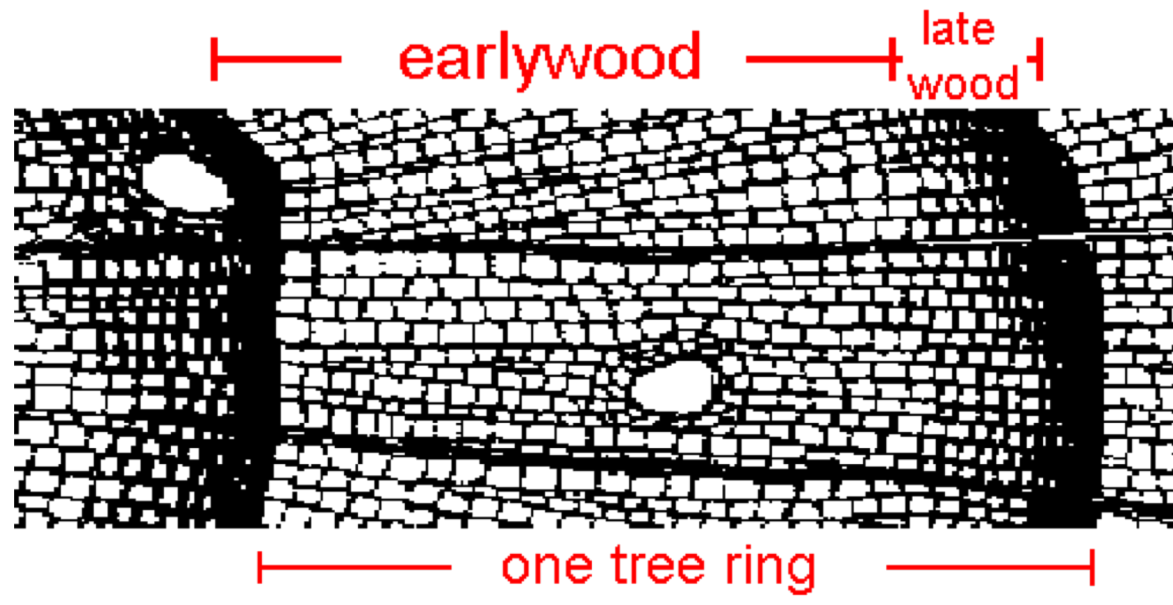
it is therefore important to consider the extent to which **observed changes are linked to internal variability or to anthropogenic climate change**



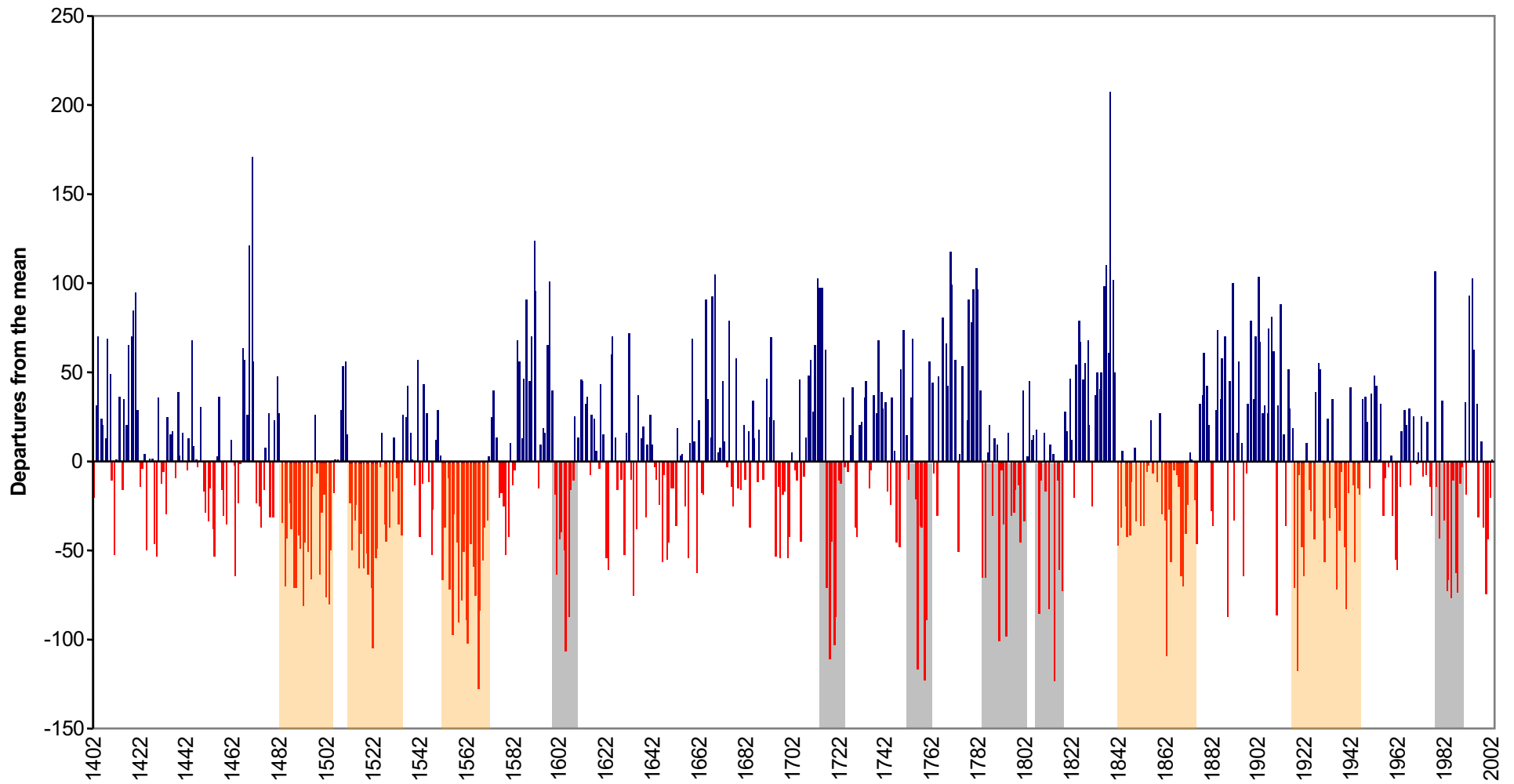
Waterton River near Waterton 1950-2007







South Saskatchewan River at Medicine Hat, 1402-2004

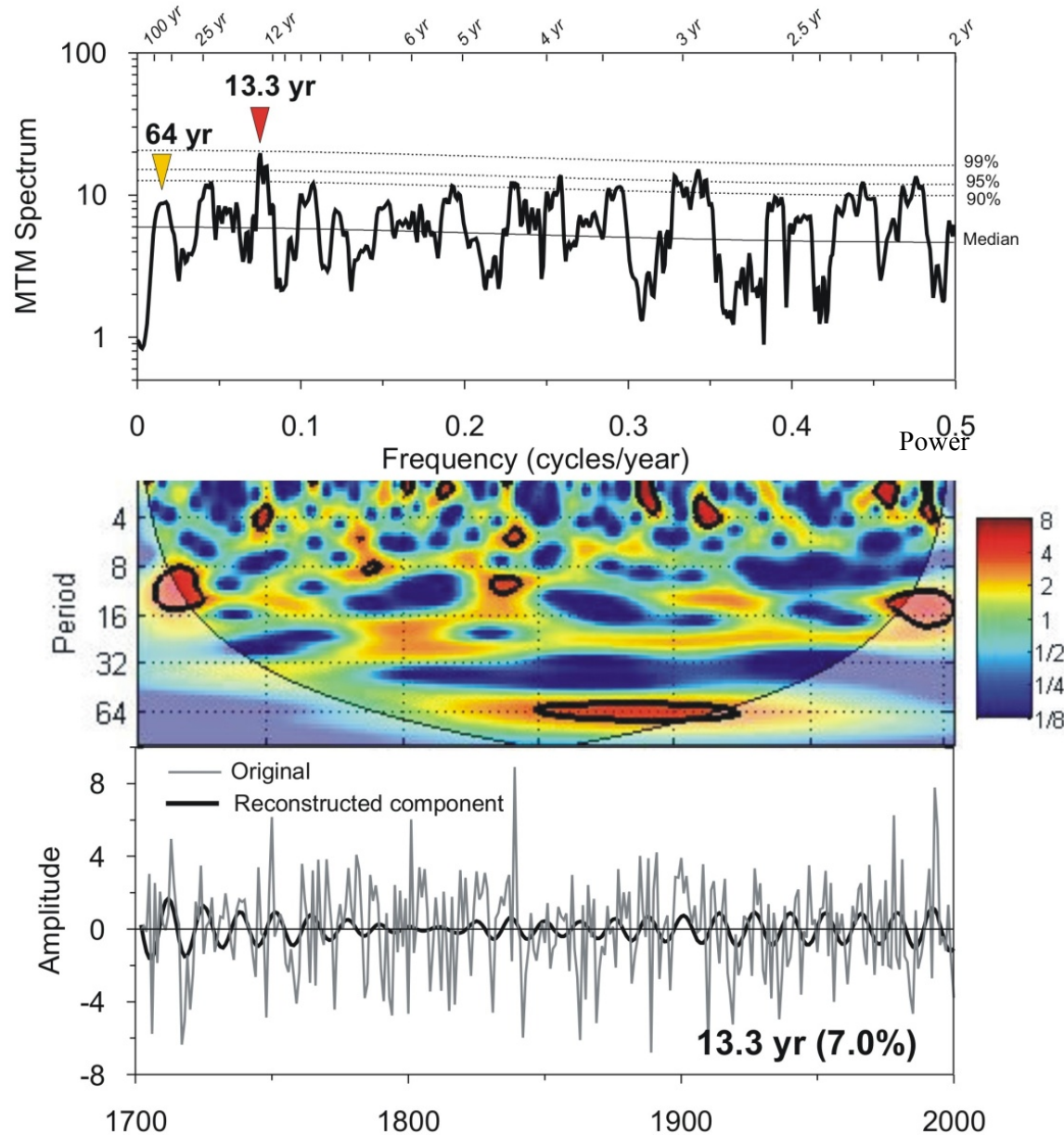


On May 2nd [1796] William Tomison wrote to James Swain that furs could not be moved as, **“there being no water in the river.”**



North Saskatchewan River at Edmonton

Low-frequency signals in the tree rings



The tree rings capture a 13 year summer cycle and a 64 year winter cycle.

Important Climate Feedback Mechanisms

Carbon cycle: the capacity oceans and ecosystems to sequester carbon changes in warmer world; in general, it declines

Changes in snow and ice cover: over 90% of the incident solar radiation is reflected by snow and ice surfaces

Specific humidity: increasing in a warming world; with rising amounts of water vapour in the atmosphere, there are **widespread increases in the numbers of heavy precipitation events; BUT drought duration and intensity has also increased**



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Canadian Disaster Database

The Canadian Disaster Database contains detailed disaster information on over 700 natural, technological and conflict events (excluding war) that have directly affected Canadians over the past century. The database helps citizens and government to better assess and manage risks. As well, it's a valuable resource for researchers and students to see how disasters and our vulnerability to them have changed over time.

- [Enter the Database](#)
- [Data criteria and disclaimer](#)

1. **Drought: Prairie provinces, 1980**

Prairie provinces, 1980. Poor wheat yield due to cereal crop drought that occurred in parts of the Prairies (drought continued from 1979); severe and widespread... [more information.](#)

Dead: 0 Injured: 0 Evacuated: 0

3. **Drought: Prairie Provinces to ON, 1988**

Prairie provinces and Central and Southern ON, Jul 5-11 1988. .

Drought caused damage to Ontario corn. Drought caused dust storm frequency to increase; duck... [more information.](#)

Dead: 0 Injured: 0 Evacuated: 0

4. **Drought: Prairie provinces, 1979**

Prairie provinces, 1979. Poor wheat yield due to cereal crop drought that occurred in parts of the Prairies (drought continued into 1980)... [more information.](#)

Dead: 0 Injured: 0 Evacuated: 0

5. **Drought: Prairie provinces, 1984**

Prairie provinces, 1984. The worst agricultural drought since the 1930s to occur in the Prairies; severe and widespread surface water droughts reported on the Prairies... [more information.](#)

Dead: 0 Injured: 0 Evacuated: 0

9. **Drought: Prairie provinces, 1931**
Prairie provinces, 1931-1938. The "dirty thirties"; dust storms, plant rust, heat waves, grasshopper plagues and water shortages plagued western Canada for almost... [more information.](#)
Dead: 0 Injured: 0 Evacuated: 0
10. **Drought: Prairie provinces, 1989**
Prairie provinces, 1989. Cereal crop drought occurred in parts of the Prairies; severe and widespread surface water droughts reported on the Prairies... [more information.](#)
Dead: 0 Injured: 0 Evacuated: 0
12. **Drought: Prairie provinces, 1961**
Prairie provinces, 1961. One of the worst agricultural droughts to occur in the Prairies; among the most severe and widespread surface water droughts ever to occur... [more information.](#)
Dead: 0 Injured: 0 Evacuated: 0
14. **Drought: Western Canada, 1985**
Western Canada, 1985. Second drought year in a row; one of the worst agricultural droughts to occur in the Prairies; insect infestations. On June 8, there was... [more information.](#)
Dead: 0 Injured: 0 Evacuated: 0
16. **Drought: Prairie provinces, 1977**
Prairie provinces, 1977. Cereal crop drought occurred in parts of the Prairies; among the most severe and widespread surface water droughts ever to occur on the... [more information.](#)
Dead: 0 Injured: 0 Evacuated: 0
17. **Drought: Prairie provinces, 1990**
Prairie provinces, 1990. Cereal crop drought occurred in parts of the Prairies... [more information.](#)
Dead: 0 Injured: 0 Evacuated: 0
18. **Drought: Prairie provinces, 1992**
Prairie provinces, 1992. Livestock yields were low in northern Alberta and Saskatchewan due to dry conditions; severe and widespread surface water droughts reported... [more information.](#)

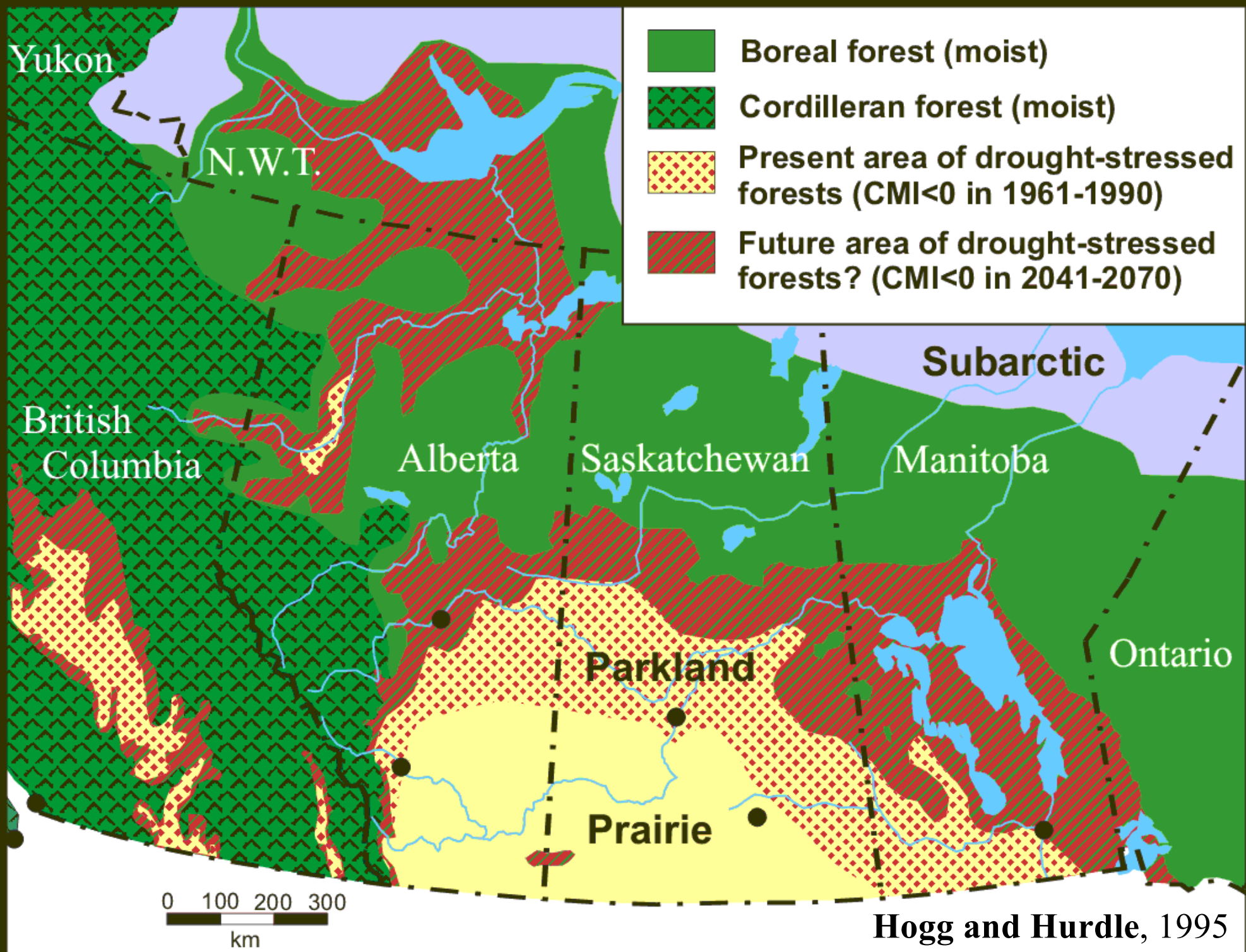
There will be greater variation in hydroclimate



Both drought and unusually wet years could occur with greater frequency and severity

Major ecological changes are expected.





Increased farm and forest productivity during a longer warmer growing season will be constrained by other climate impacts



Extreme weather and climate are “wild cards” because the effects of increasing frequency and severity are generally not considered well or at all in climate change impact assessments.



Most impacts are adverse because we are not presently adapted to the larger range of climate conditions projected



Resources and communities are sensitive to climate variability

The net impacts of climate change are not clear; they depend on rates of climate change and adaptation strategies.

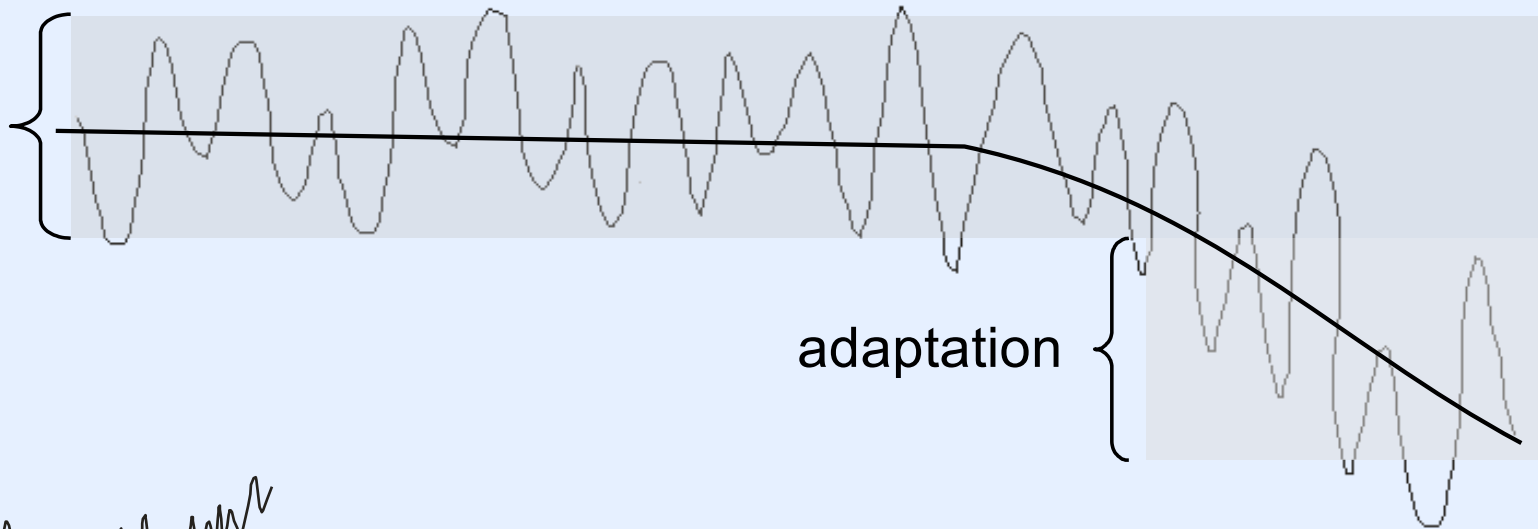


The impacts of climate change will depend on how well we adapt and how much adaptation is required.

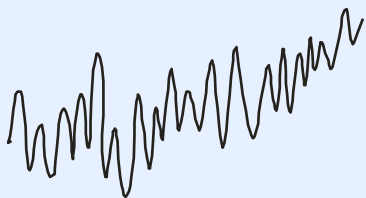
Climate Trends and Variability

———— mean conditions

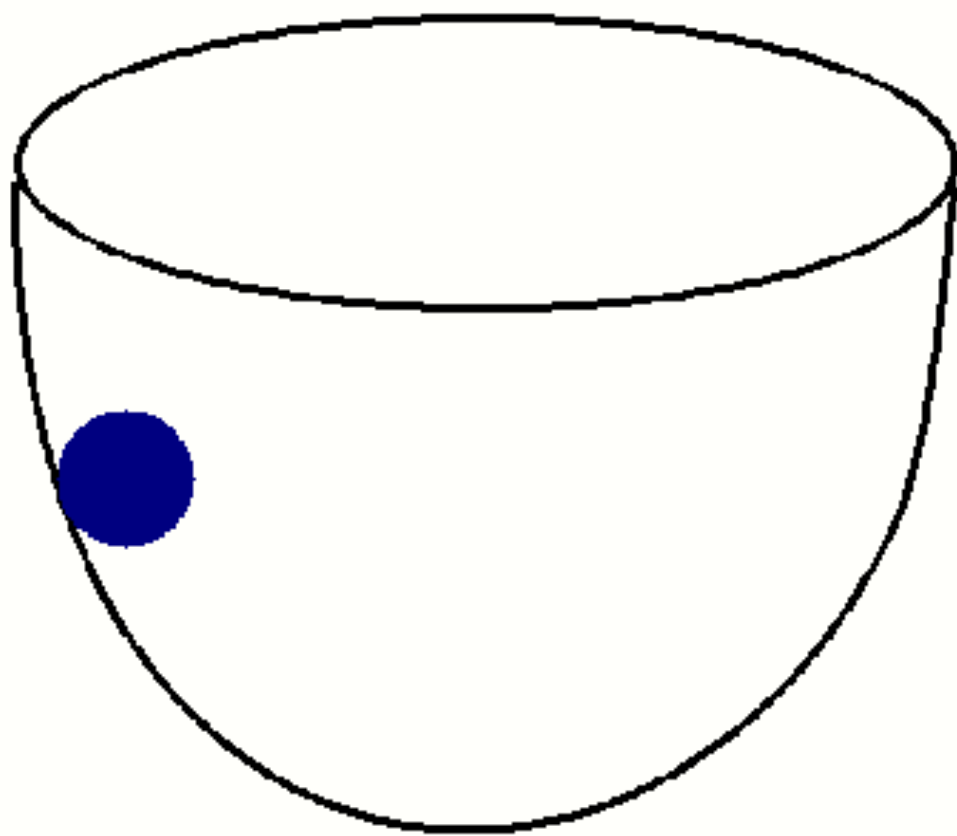
Coping
Range

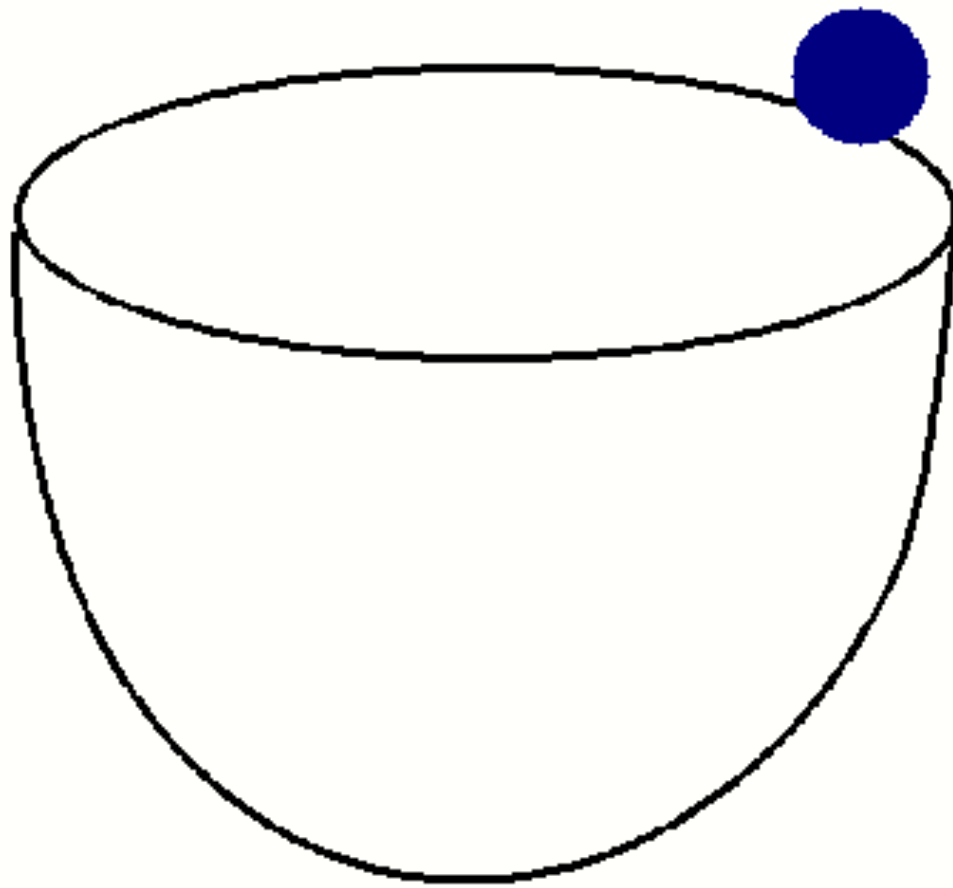


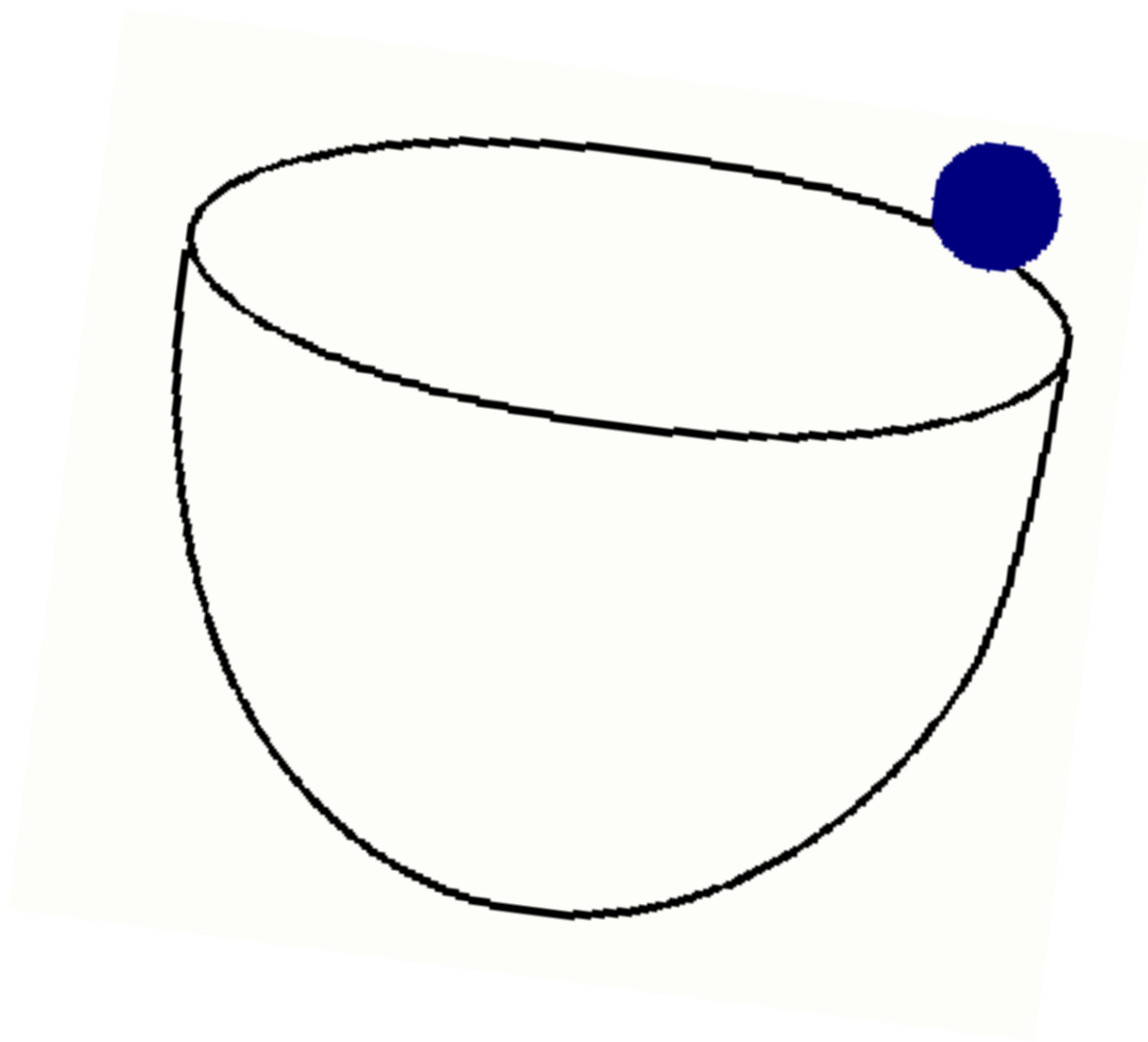
adaptation

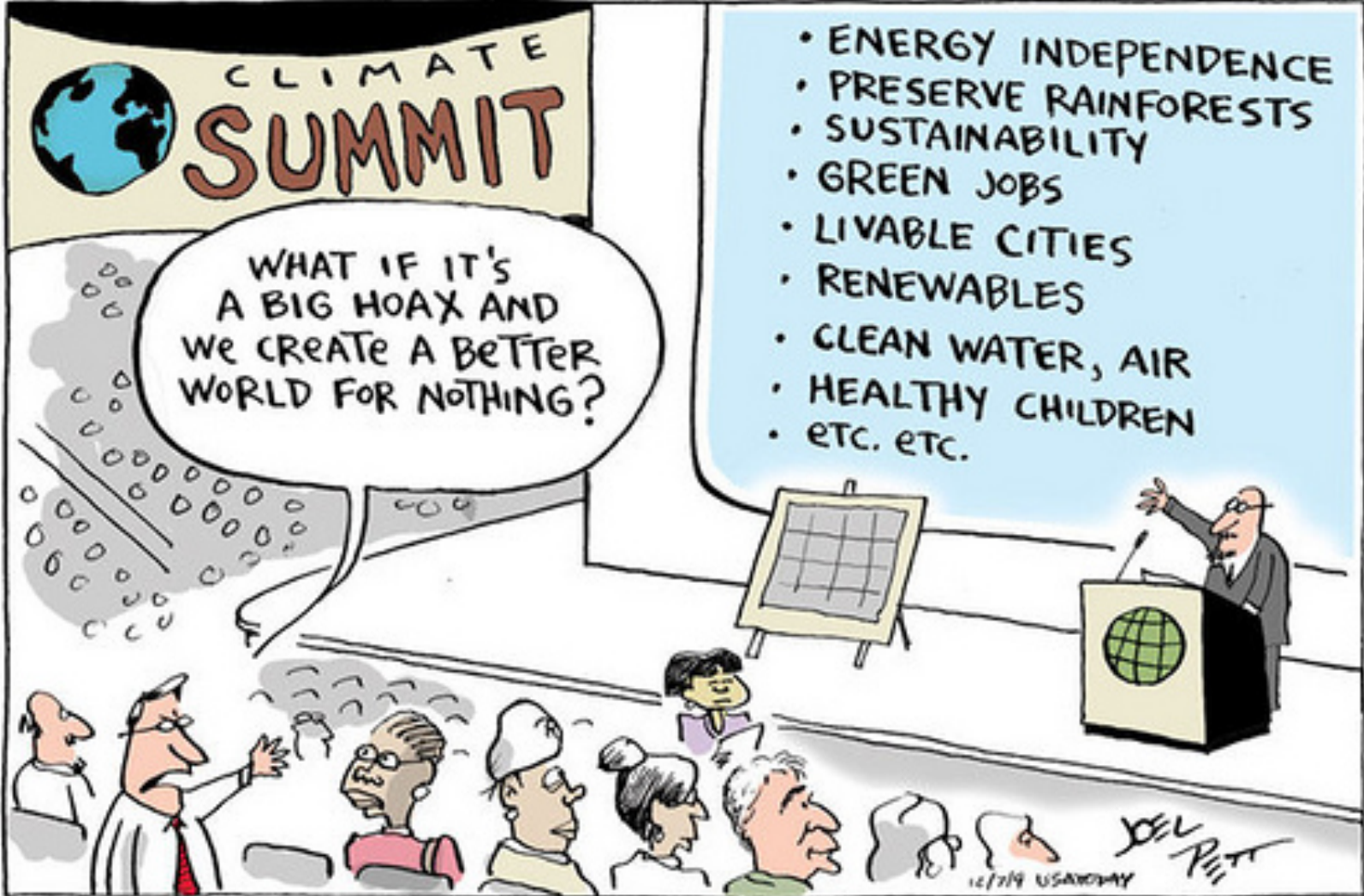


departures from mean conditions









CLIMATE
SUMMIT

WHAT IF IT'S
A BIG HOAX AND
WE CREATE A BETTER
WORLD FOR NOTHING?

- ENERGY INDEPENDENCE
- PRESERVE RAINFORESTS
- SUSTAINABILITY
- GREEN JOBS
- LIVABLE CITIES
- RENEWABLES
- CLEAN WATER, AIR
- HEALTHY CHILDREN
- ETC. ETC.

12/19 USA TODAY

JUL PITT