

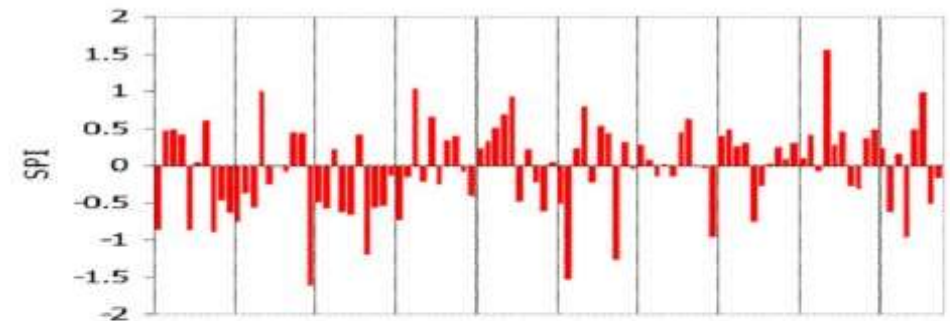
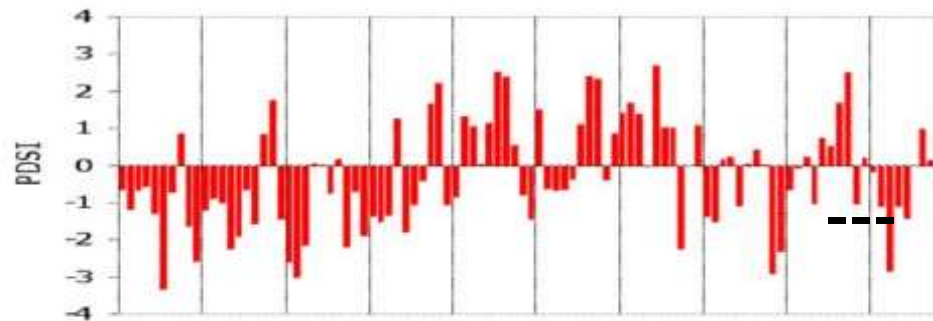
TOWARDS UNDERSTANDING PRAIRIE DROUGHT

*Ronald Stewart
University of
Manitoba*

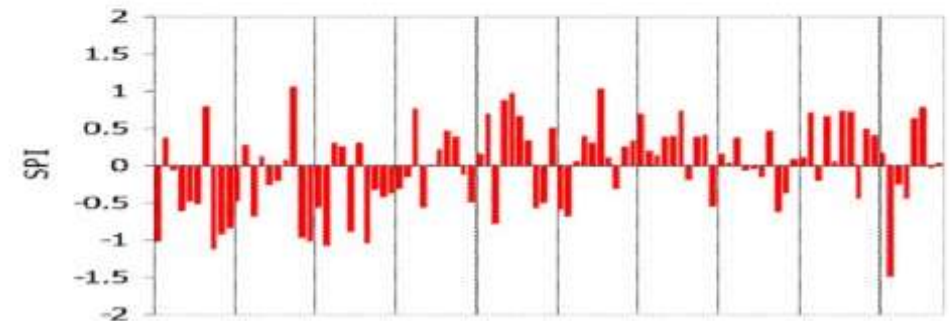
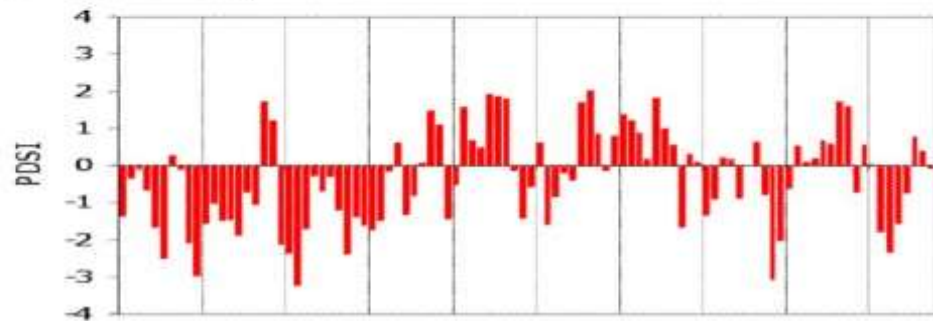
OBJECTIVE

- To examine some aspects of the 1999-2005 drought over the Canadian Prairies
- To briefly consider some implications,

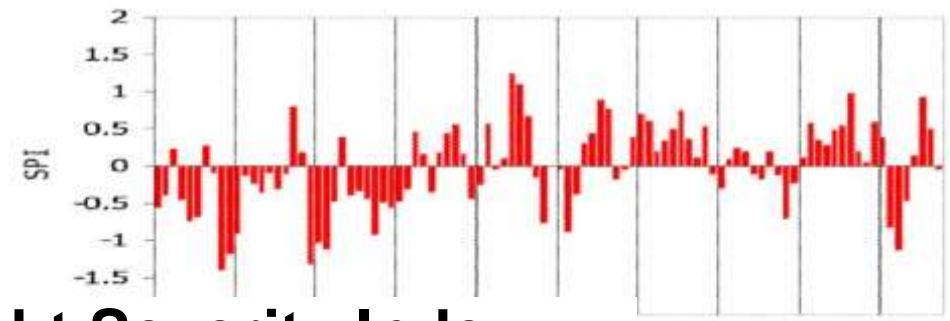
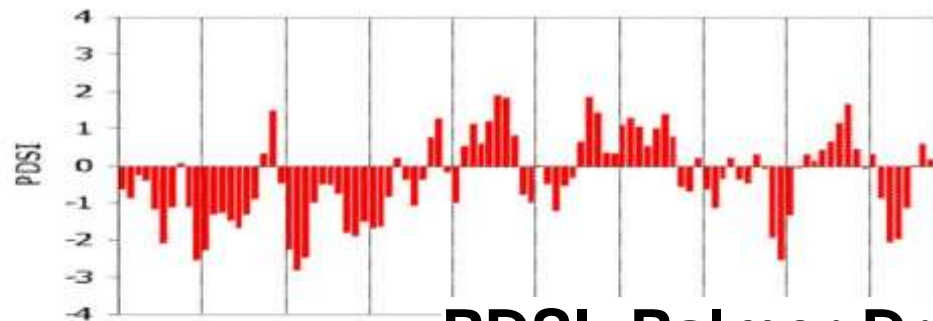
a) Summer Average (June July August)



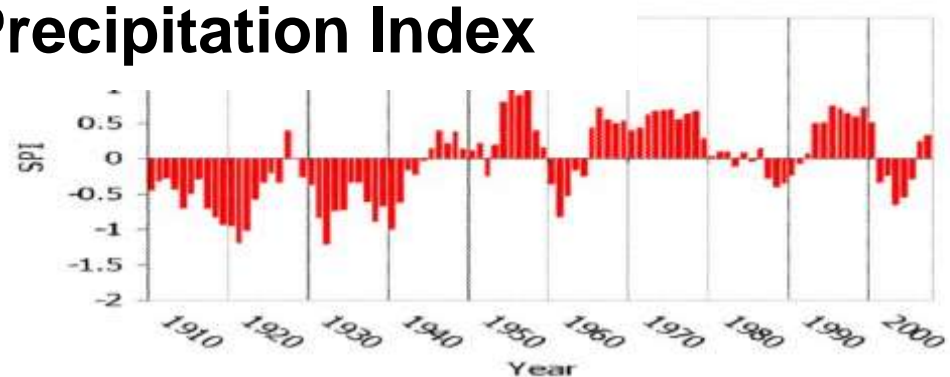
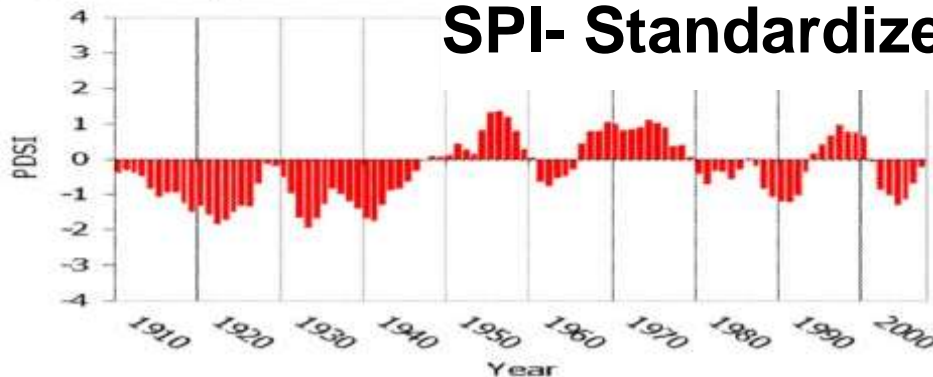
b) Annual Average



c) 2 year Average



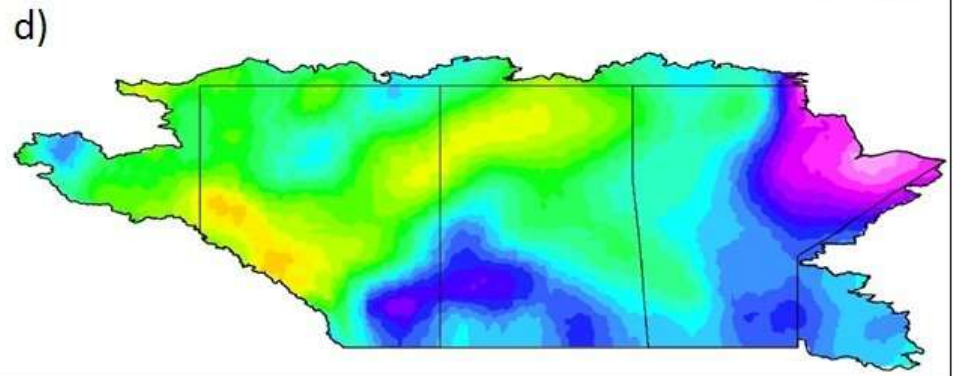
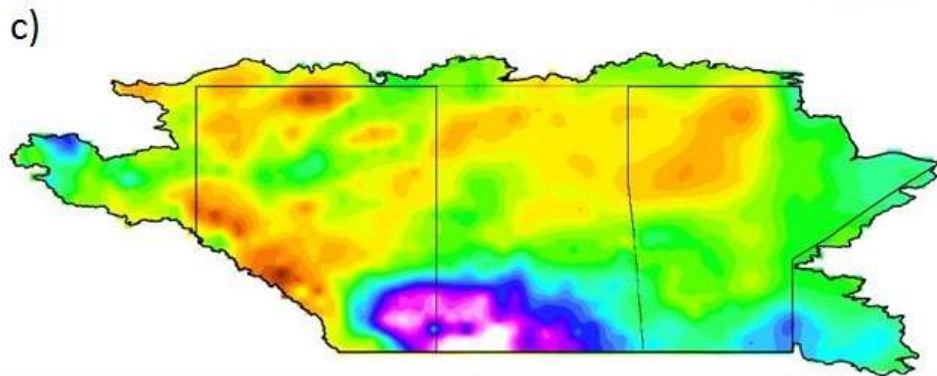
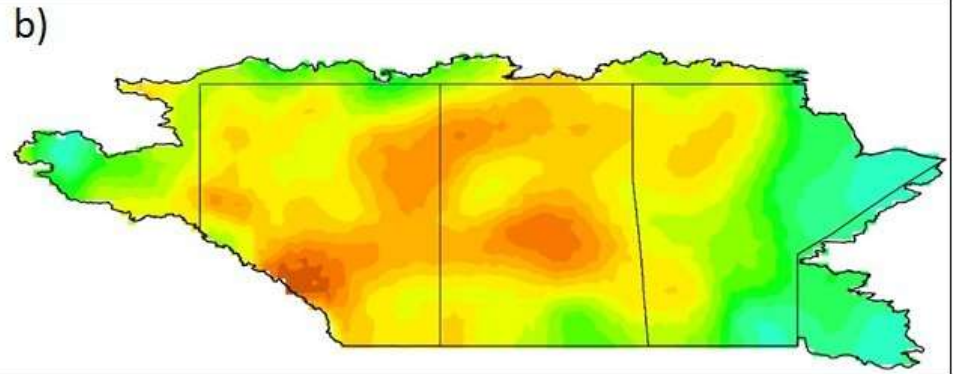
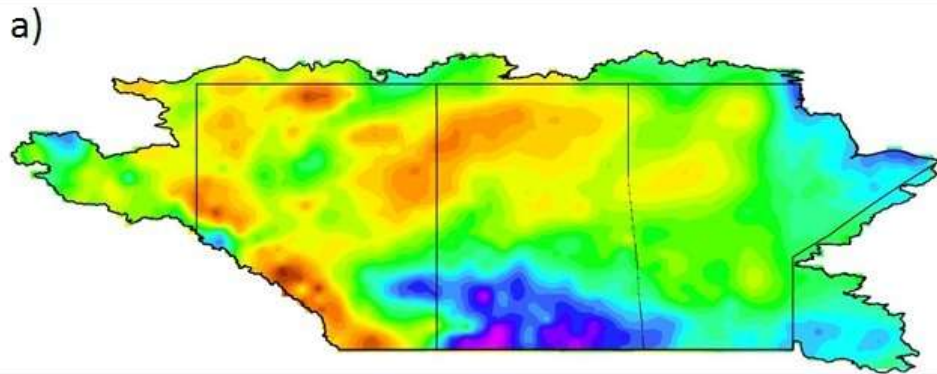
d) 5 year Average



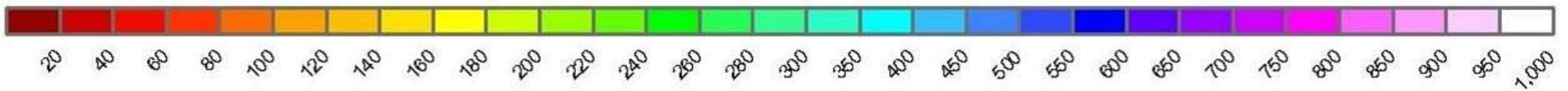
PDSI- Palmer Drought Severity Index
SPI- Standardized Precipitation Index

PHASES

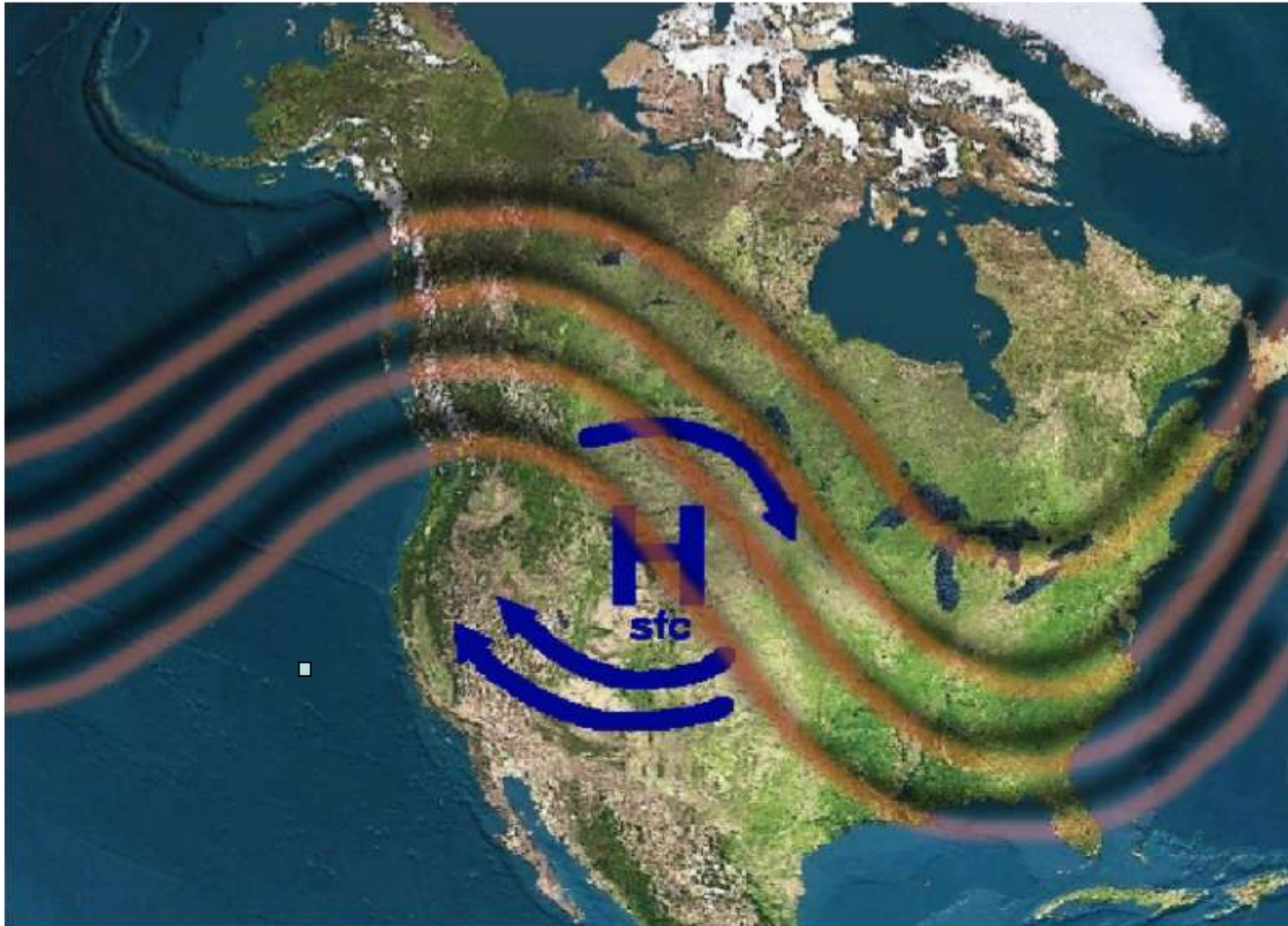
Beginning: Sept 1, 1998 - Aug 30, 2000
Mature/Max. Extent-Severity: Sept 1, 2000 - May 2002
Mature/Major Struct. Changes: June 2002 - Aug 2004
Cessation: Sept 1, 2004 - Aug 30, 2005



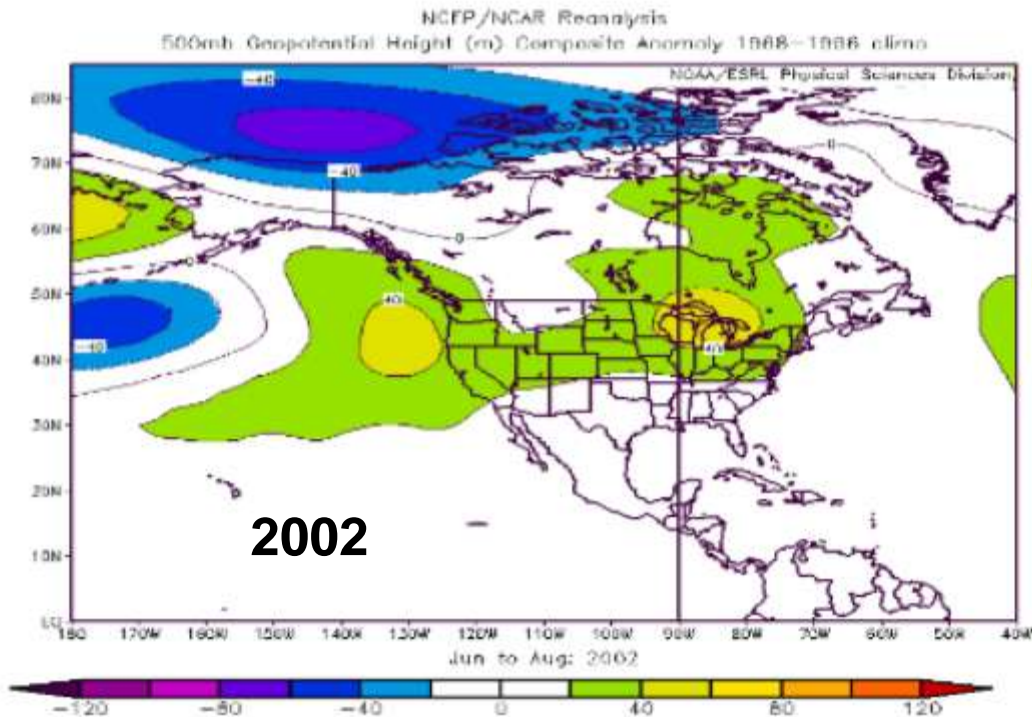
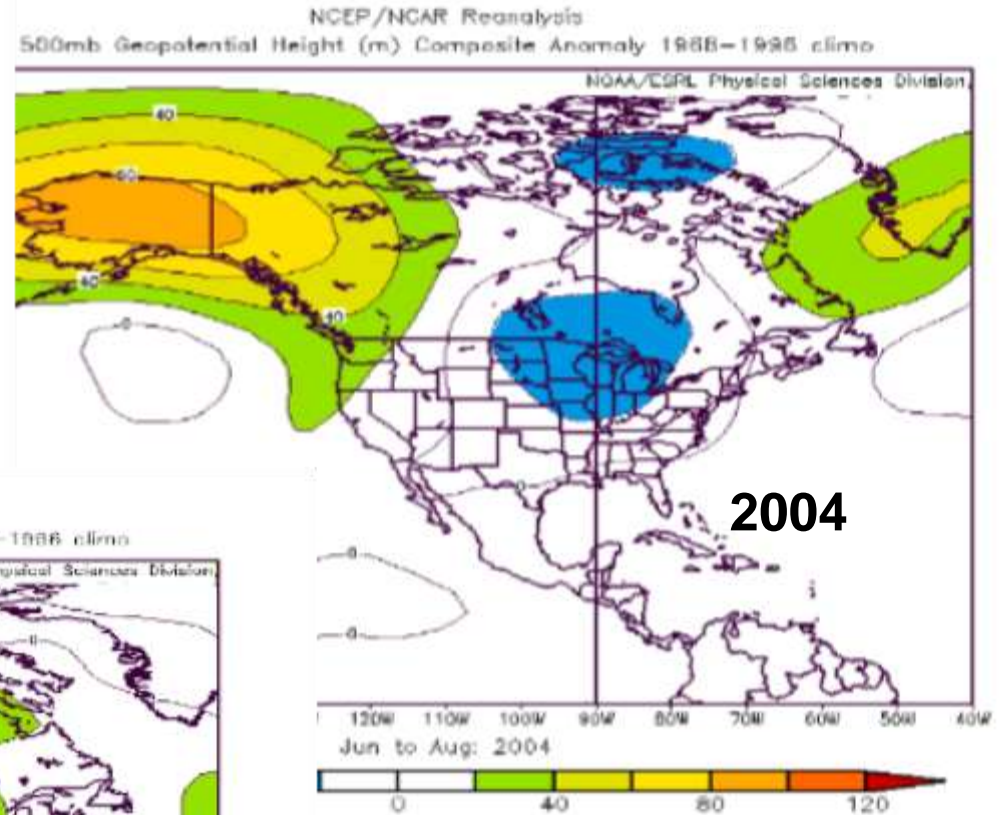
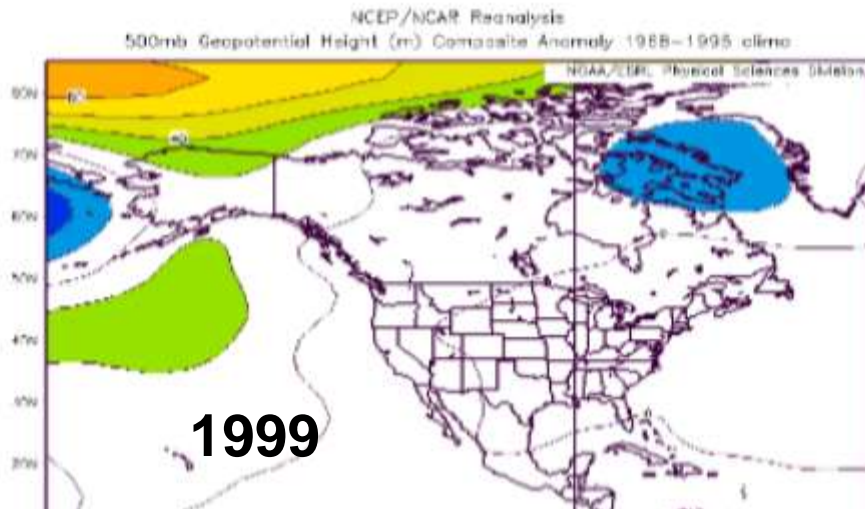
Precipitation Anomaly as Percent of Normal



COMMON VIEW ...

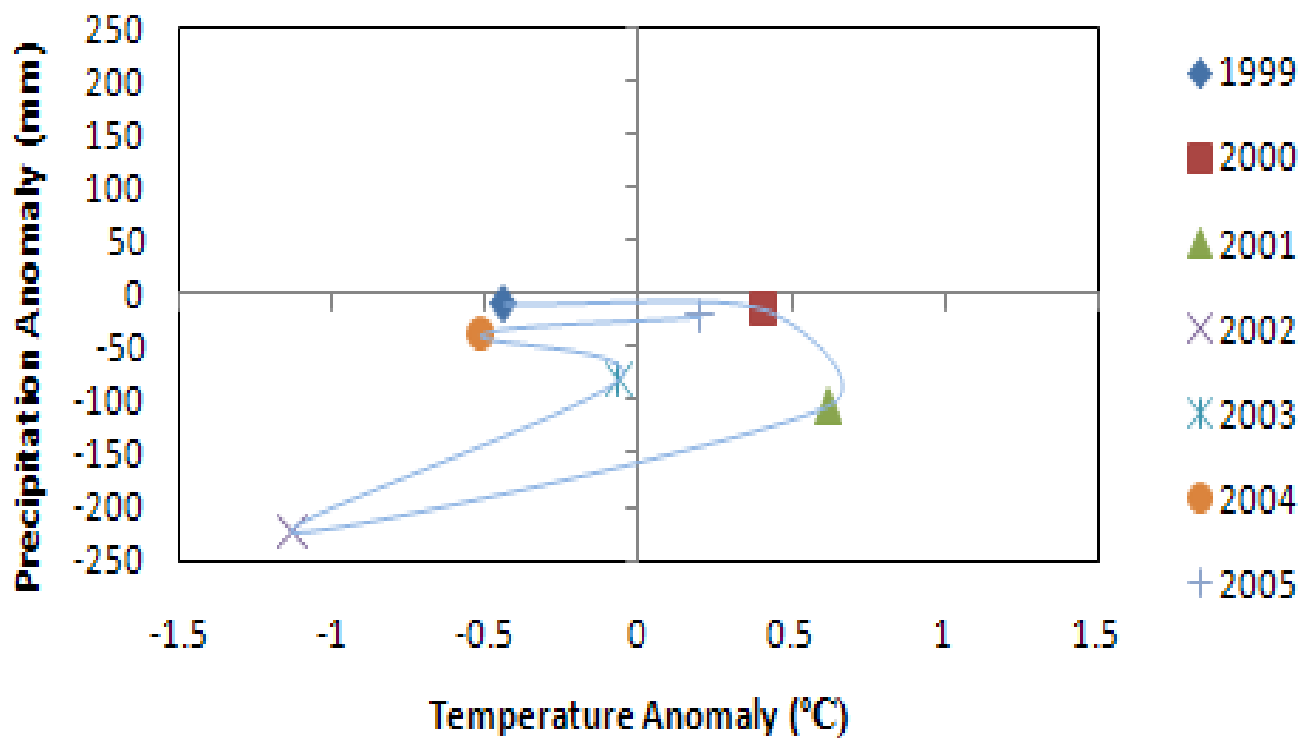


CONTINENTAL SCALE PATTERNS

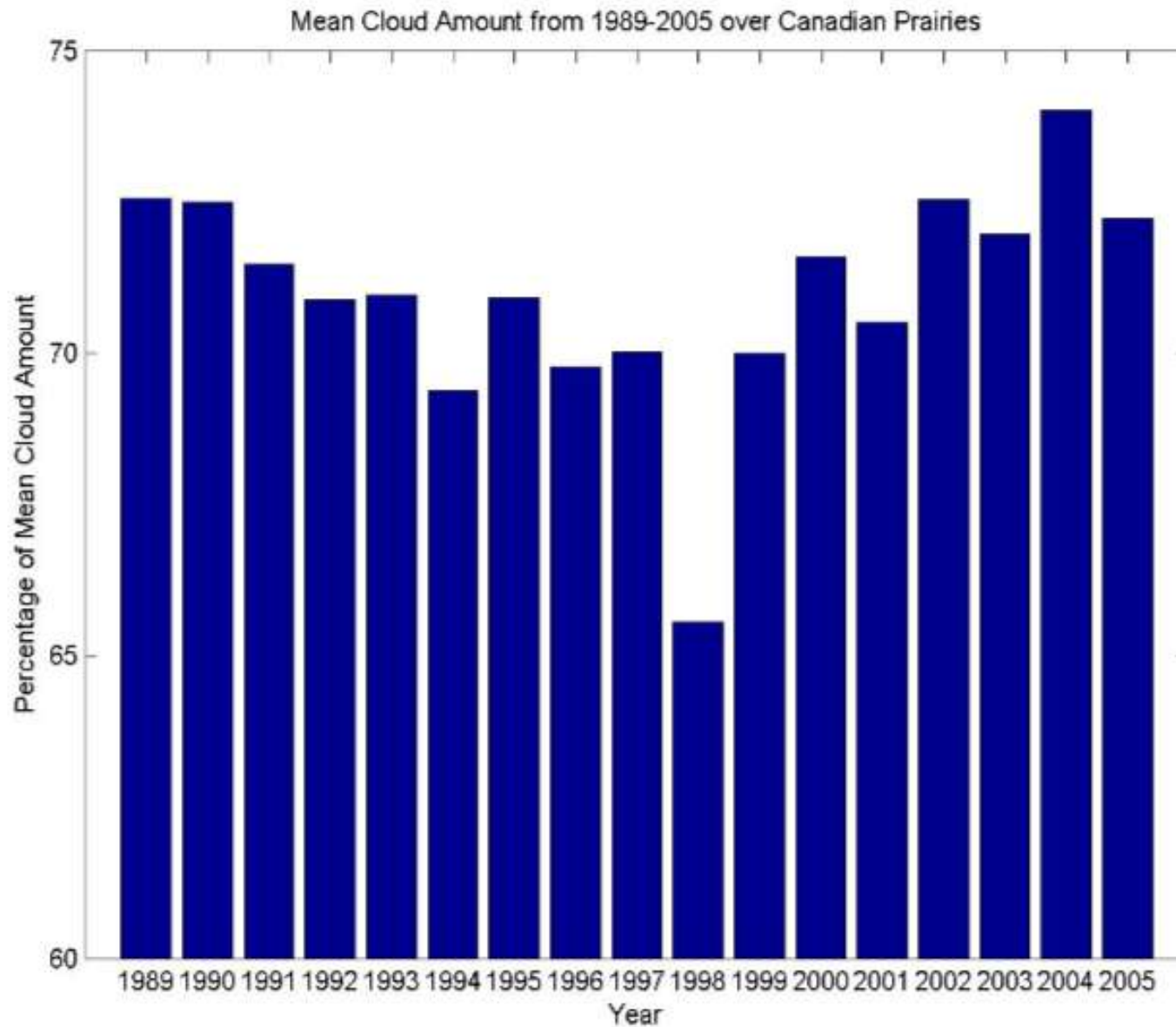


Summer 500 mb

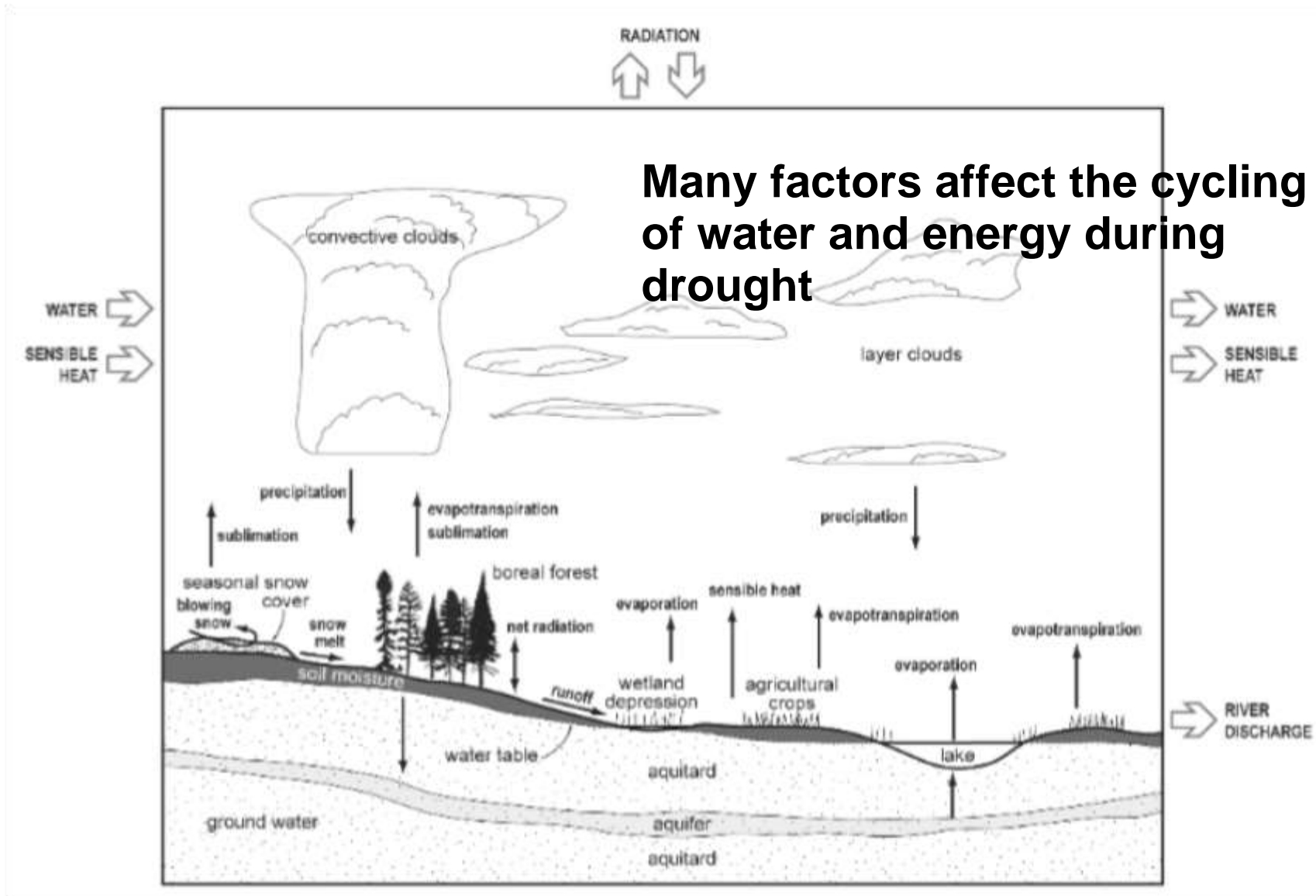
Agricultural year (Oct-Sept) Precipitation vs. Temperature Anomalies at EDMONTON INT'L A



CLOUD AMOUNT



WATER AND ENERGY CYCLING



PRECIPITATION REDUCTION

There are many means of reducing precipitation.

Large scales

Storm track alteration

Lack of water vapour

Reduced and altered types of clouds

High cloud bases/large sub-cloud precipitation loss

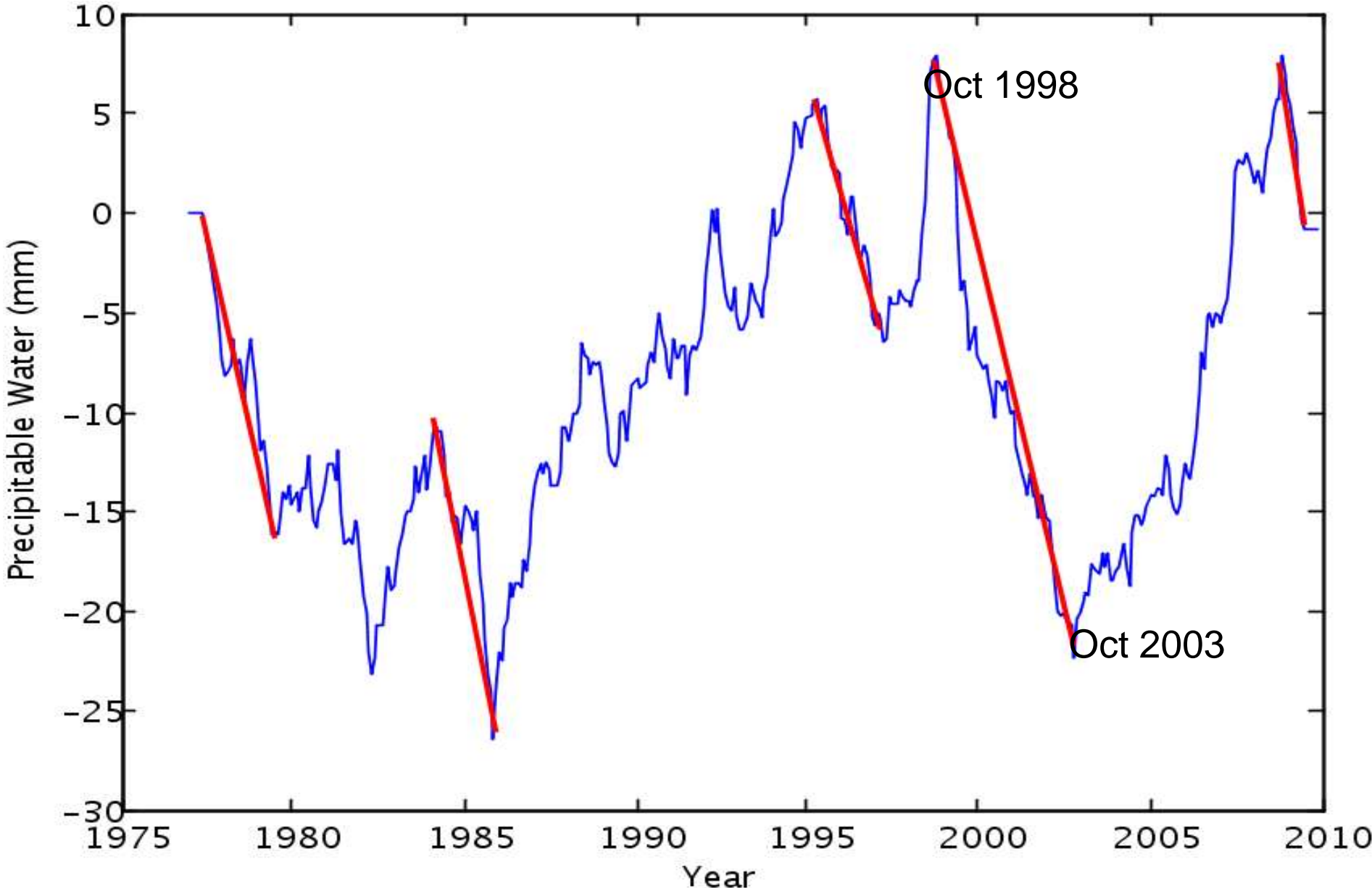
Aerosol effects

Altered surface evaporation

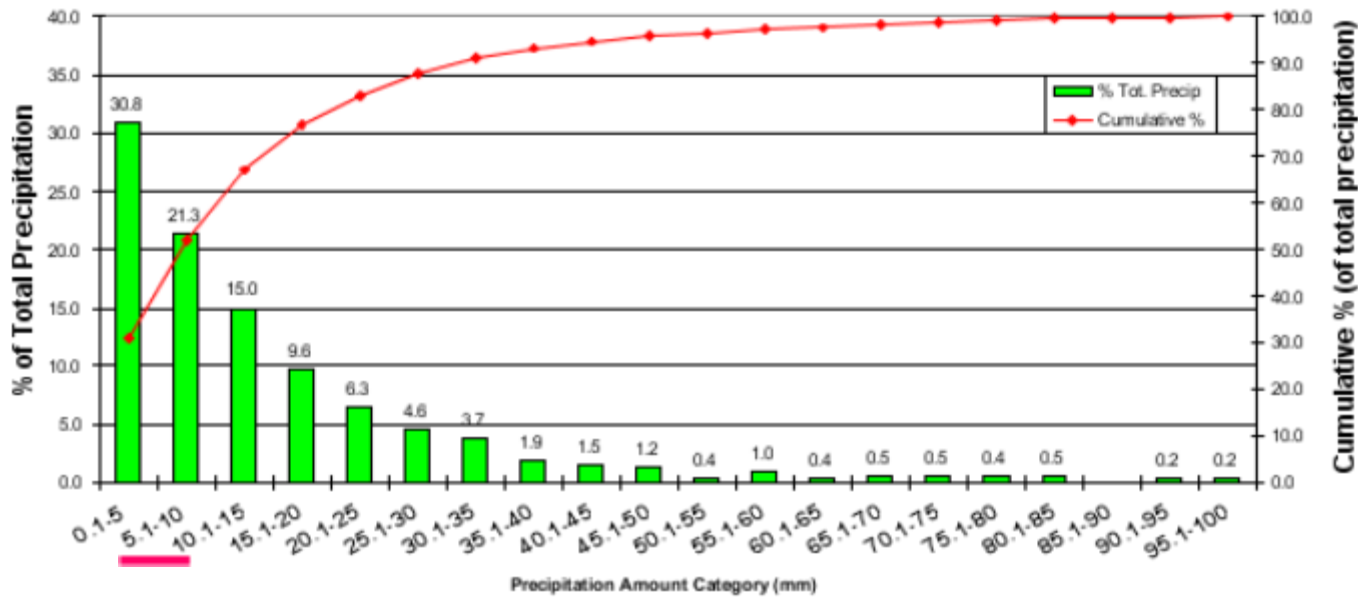
...

All of these may have been significant factors in the 1999-2005 drought

DEVIATION OF MONTHLY WATER VAPOUR Edmonton

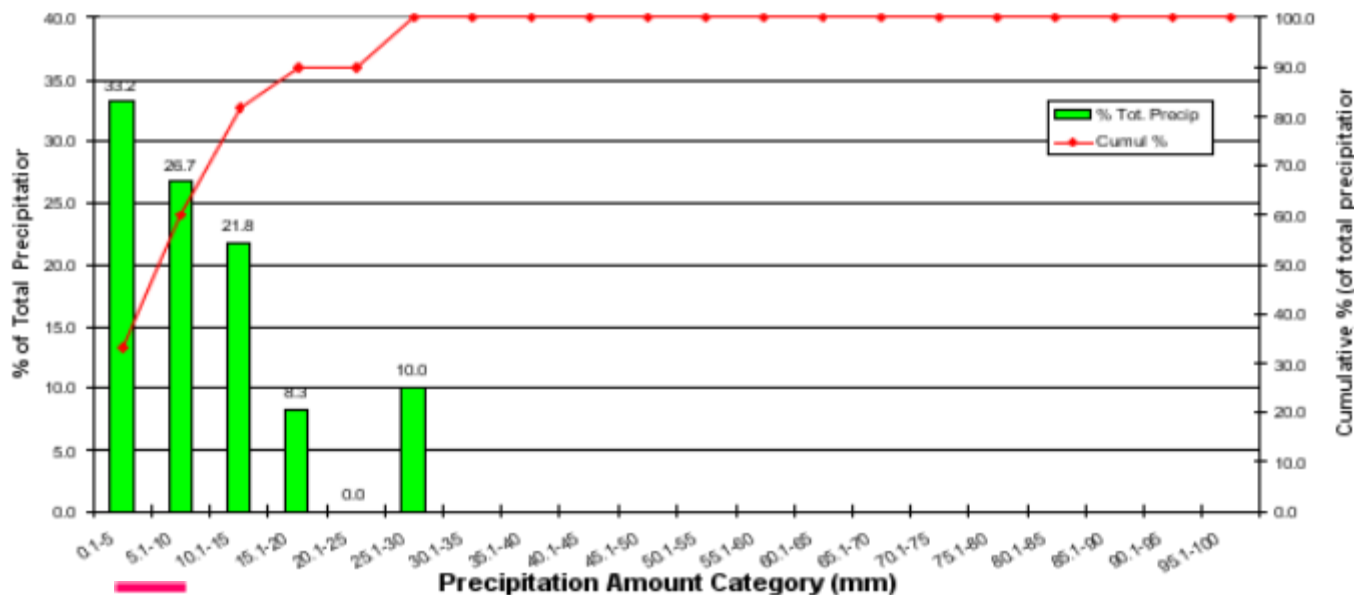


Daily Precipitation Amounts



Low precipitation event:
 < 10 mm

Climatology
 Low precipitation events: 52% of total

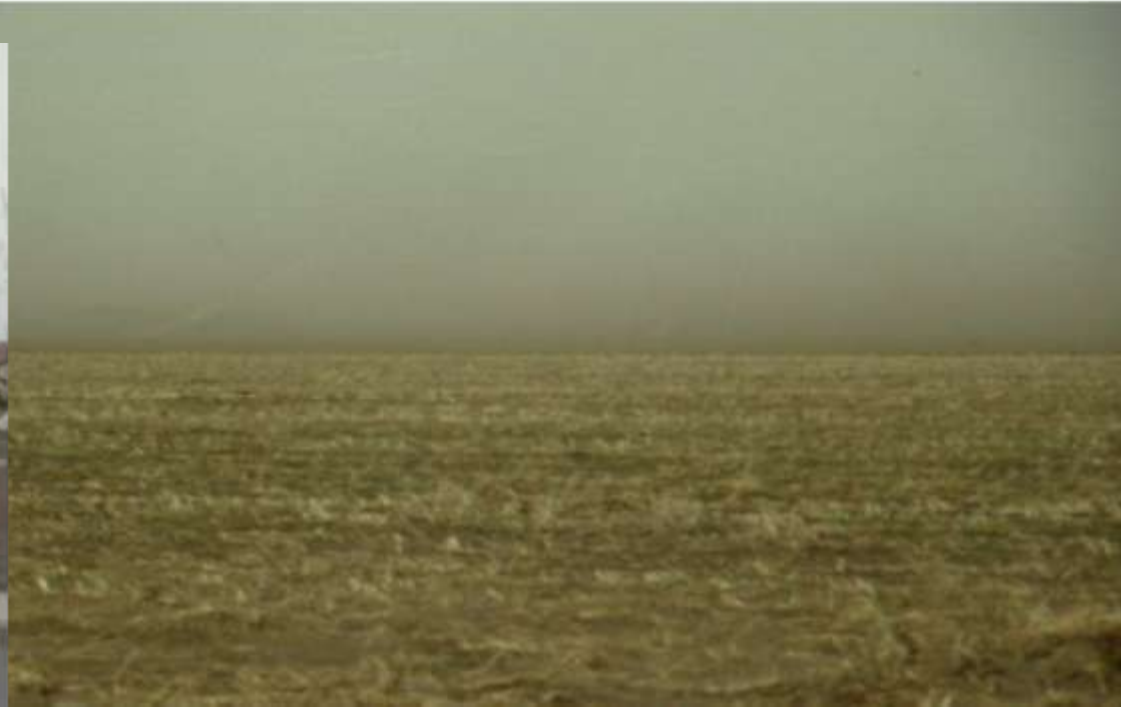


Sub-drought 2002
 Low precipitation events: 60% of total

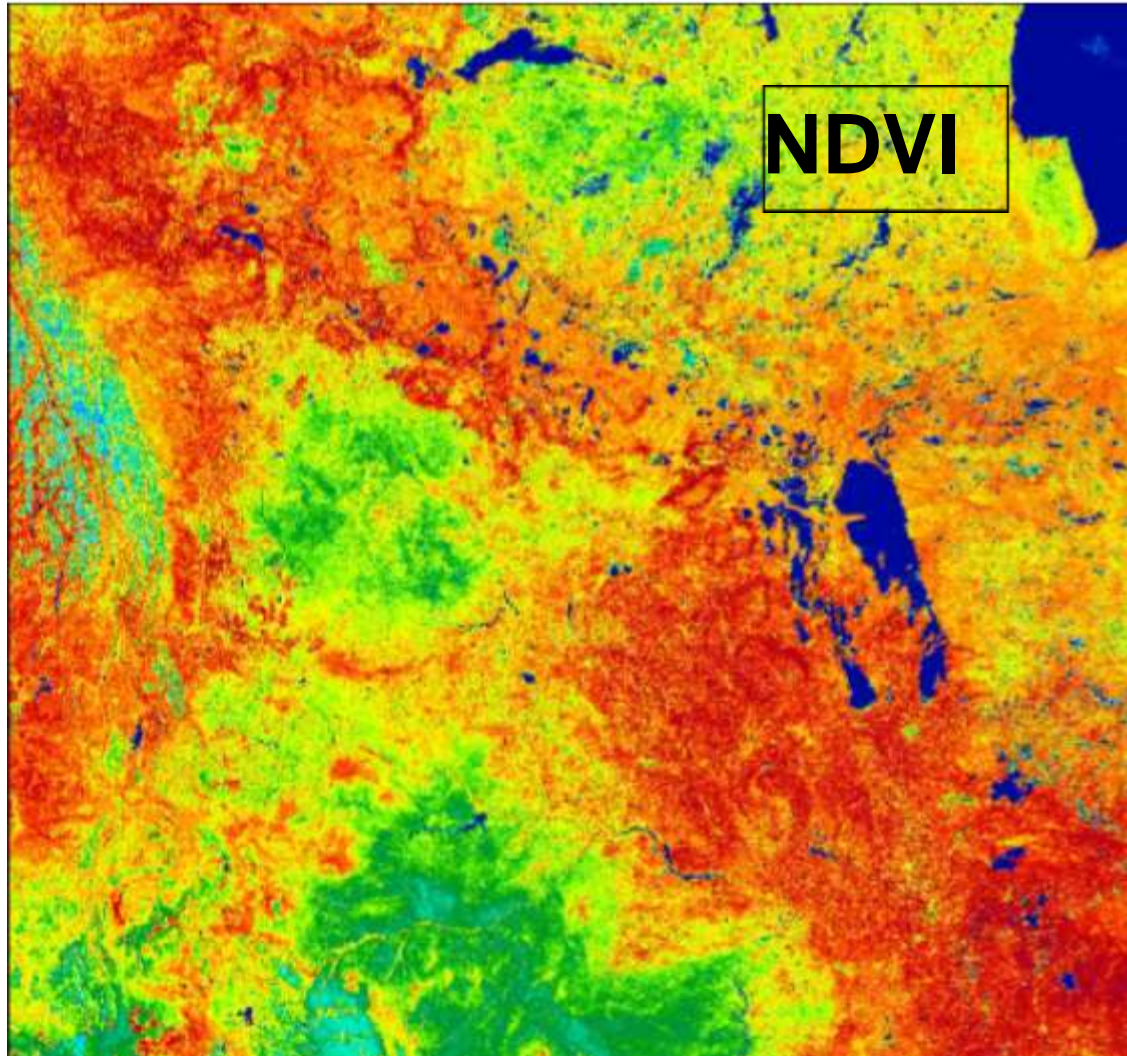
DUSTSTORMS



32 major dust storms in Saskatchewan in 2002

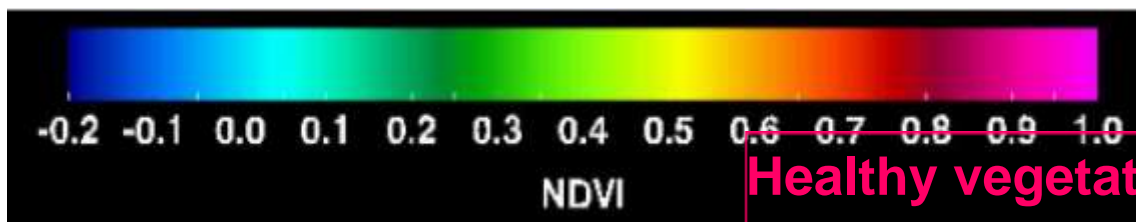


VEGETATION



July 11-20, 2002

NDVI: Normalized Difference Vegetation Index

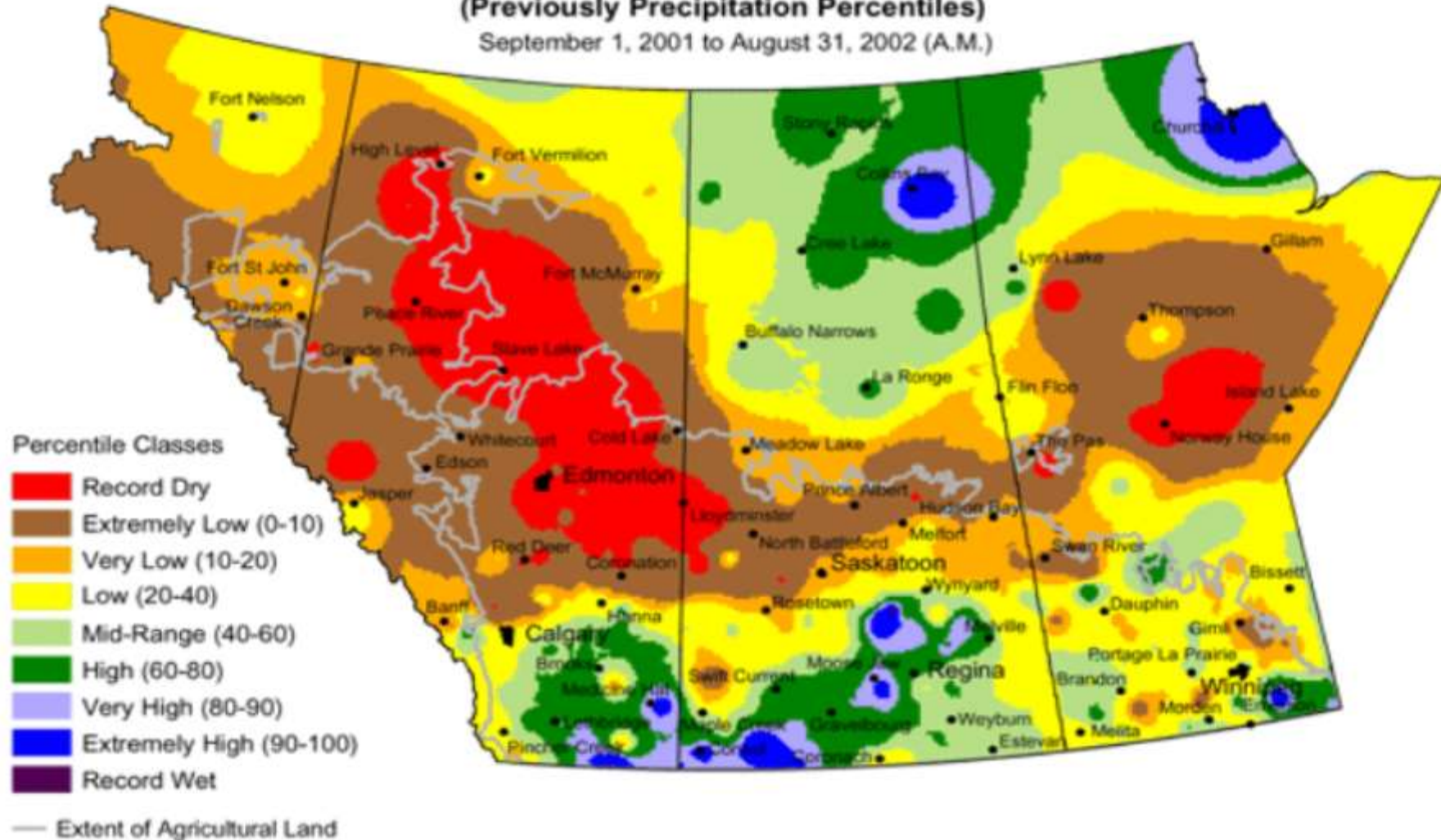


Healthy vegetation

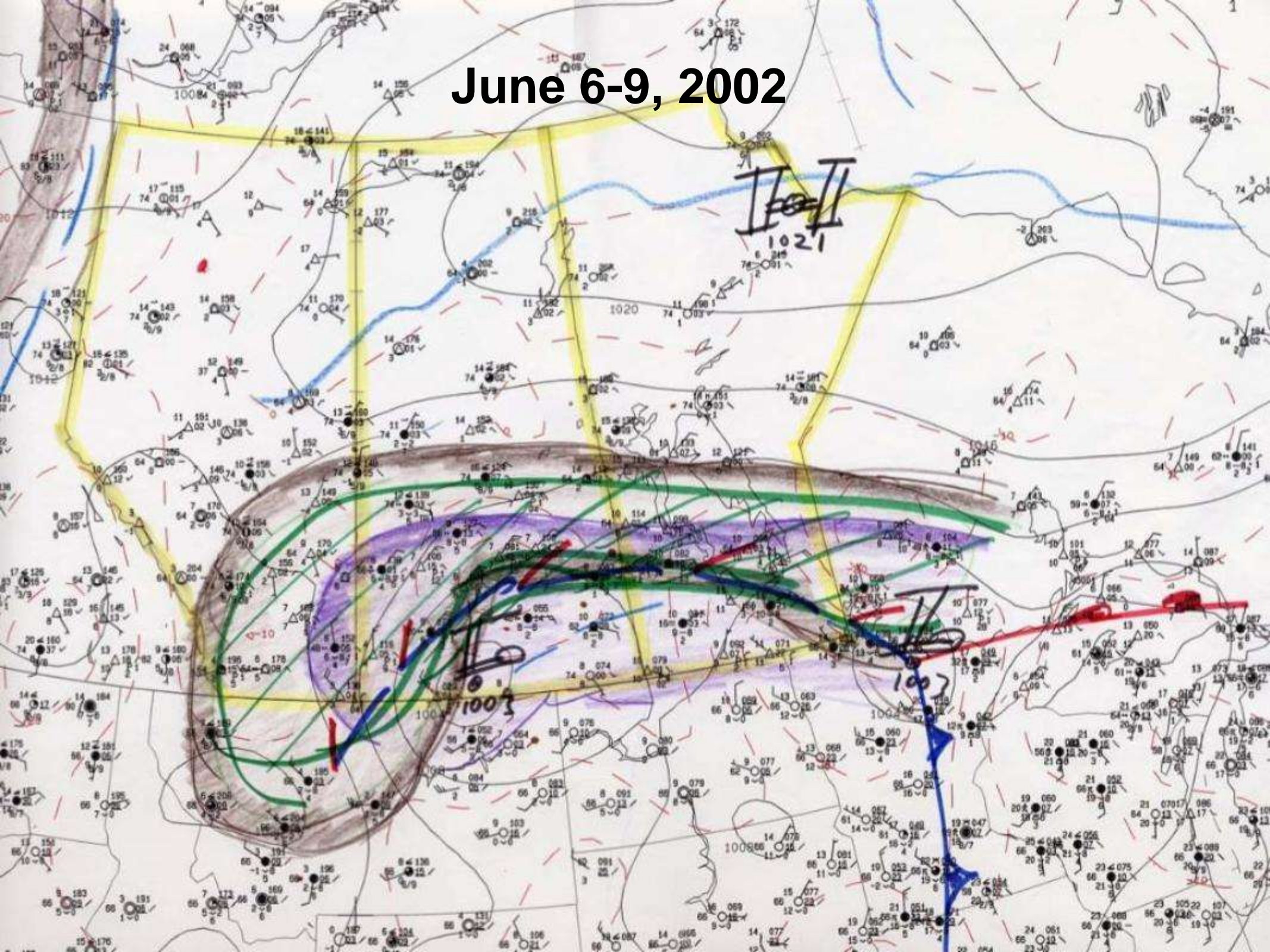
CANADIAN PRAIRIES

2002

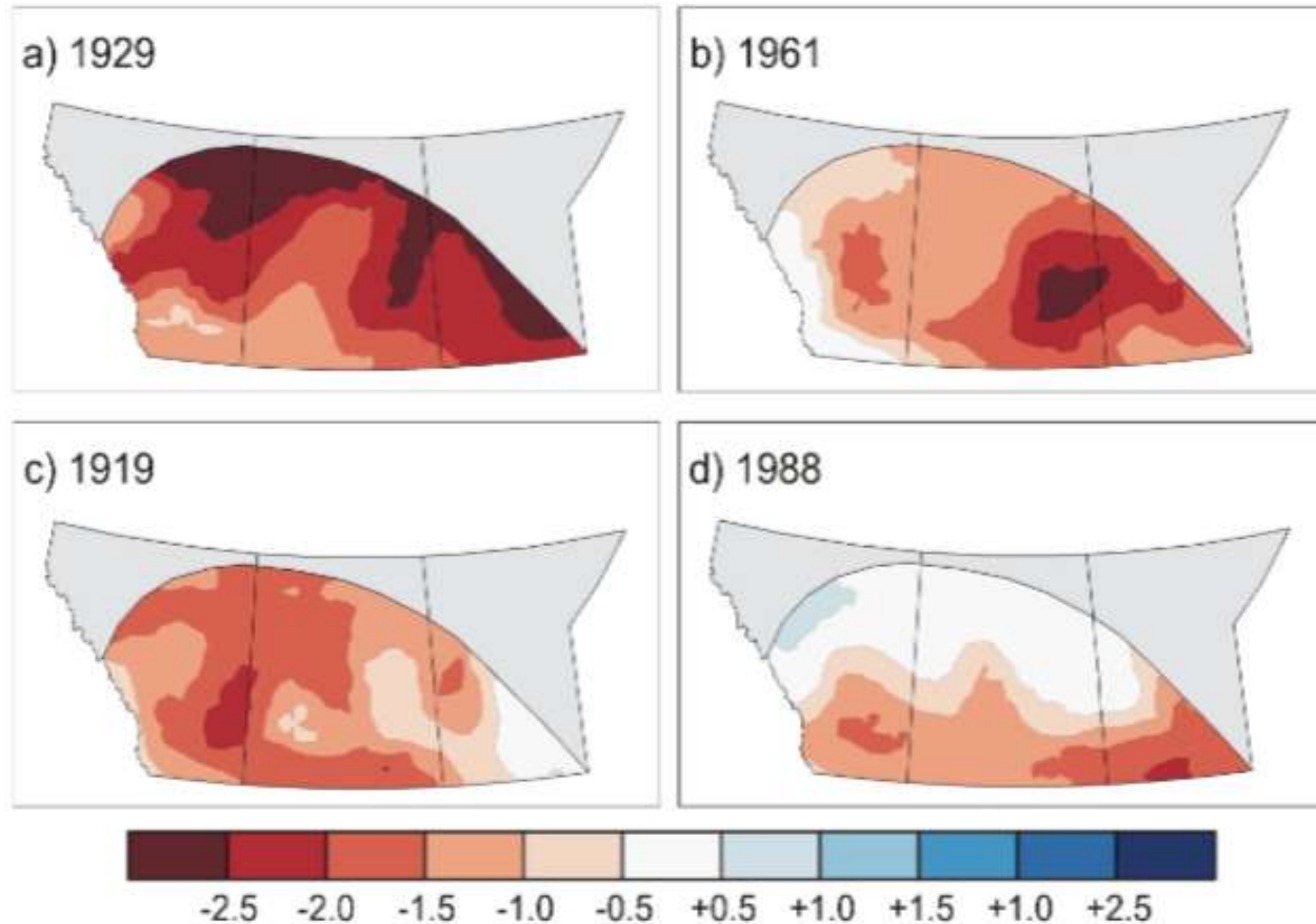
Current Precipitation Compared to Historical Distribution
 (Previously Precipitation Percentiles)
 September 1, 2001 to August 31, 2002 (A.M.)



June 6-9, 2002

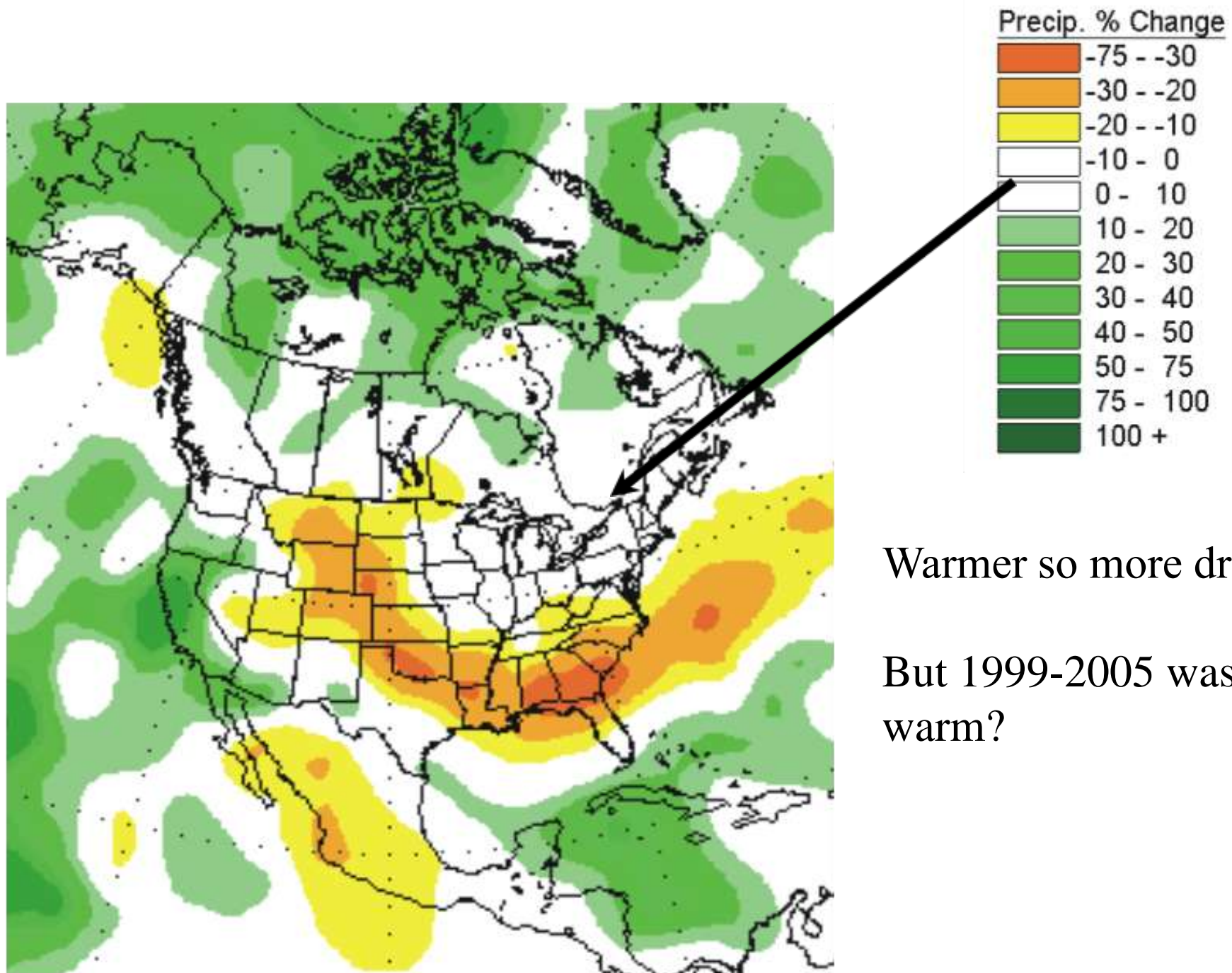


SOME OF CANADA'S WORST DROUGHTS



Standardized Precipitation Index (SPI) for agricultural years with severe drought

FUTURE PRECIPITATION?



Warmer so more drought ...

But 1999-2005 was not warm?

THE 1999-2005 DROUGHT OVER THE CANADIAN PRAIRIES

PART I: Drought Characterization and Indices

How was the drought characterized using typical and unique approaches and what does this imply?

- variables to consider: precipitation, temperature, indices
- key results: several ways to characterize, phases, lots of structure

PART II: Key Surface Impacts and Processes

What features at the surface were affected, what memory terms were present, how do these show 'integrative' features, and how did they feed-back onto the drought?

- variables: evaporation/fluxes, soil moisture, snow cover, NDVI, crops, forests/fires, streamflow, ponds, sub-surface
- key results: many major effects, many showing long-term signatures and some may have fed back onto the drought.

PART III: Key Atmospheric and Related Issues

What atmospheric factors occurred in relation to the drought, how did these operate and how did they contribute to the drought? To what extent did atmospheric processes operate with surface and associated features?

- variables: SSTs, large scales, water budgets, synoptics, storm events, lightning
- key results: factors at many scales, various means of inducing/sustaining drought/wet
- plus: overall summary and comparison with droughts in other regions


CONCLUSIONS

Drought is an **inherent aspect** of the Canadian Prairies climate system.

Some features of a recent drought were **expected** but **others were not**.

These results may have **wide applicability**.

The **future** may bring more drought but **what types?** (circulation, hot/cold, cloudy, precipitation, wind/dust ...)



Thank you for your attention