TOWARDS SYNTHESIZING OUR DRI PROGRESS

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OBJECTIVE

- To illustrate some of our synthesis activities
- To identify some of the gaps needed to be addressed
- To briefly consider some implications,

OBJECTIVES AND STRATEGY

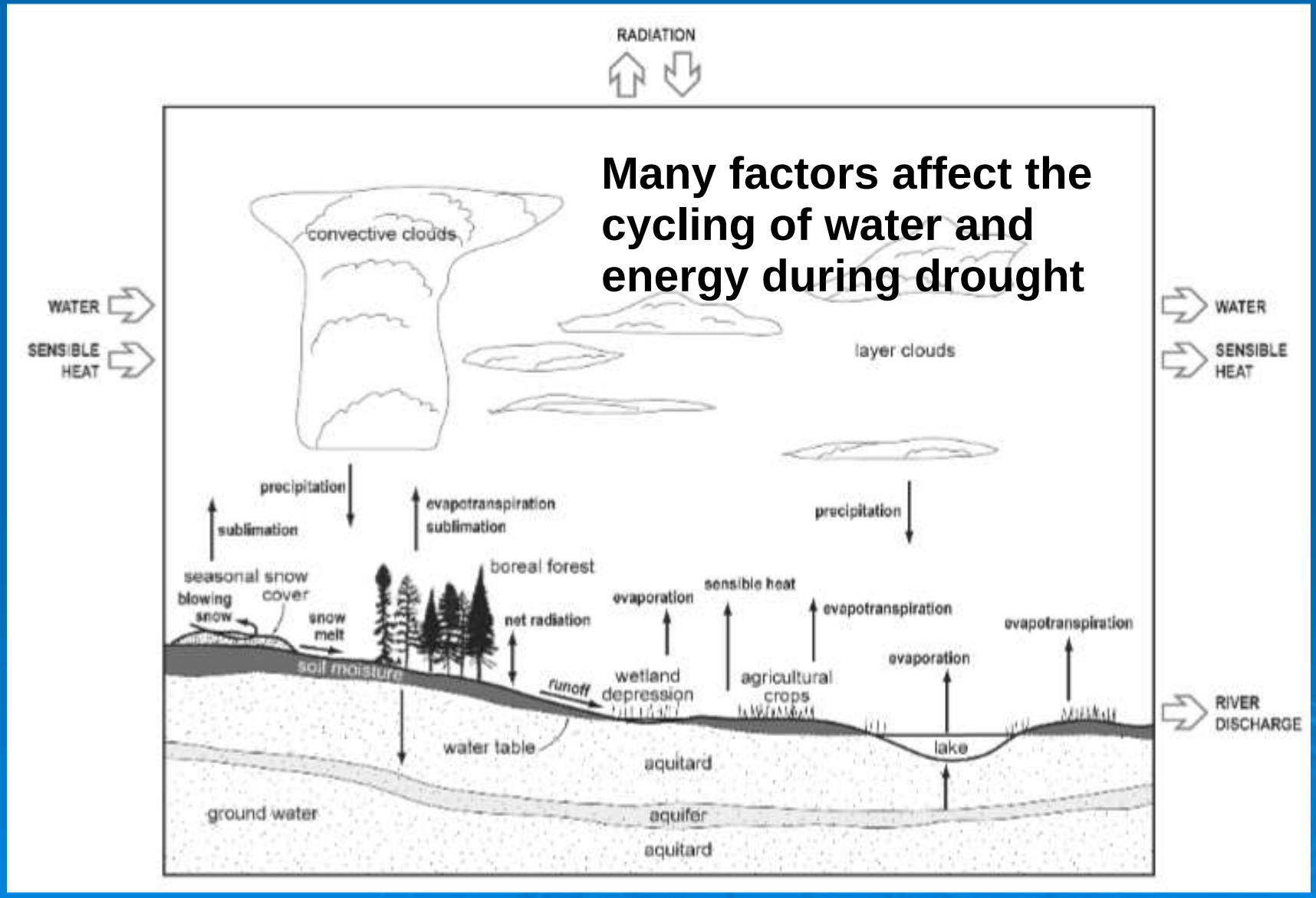
The objectives of DRI are:

- ***To better understand the physical characteristics of and processes influencing Canadian Prairie droughts, and***
- ***To contribute to their better prediction and to improved societal preparation***

Strategy:

- ***Focus on the recent severe drought that began in 1999 and largely ended in 2005***

WATER AND ENERGY CYCLING



To achieve the overall objective, you need to bring together the individual contributions

This is how 'Nature' does it

HOW BRING TOGETHER

Workshops

Joint activities ... such as synthesis articles

SYNTHESIS

Data

Characterize

Understand

Predict

Compare

Apply

DATA ACCESS AND DISTRIBUTION

Summary CMOS Bulletin article

Data legacy including access

...

CHARACTERIZE AND UNDERSTAND

3-4 Synthesis articles

Special Issue

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? (merits of different means, novel approaches, phases, lots of structure)

- variables to consider: precipitation, temperature, indices
- key results: several ways to characterize, phases, different conditions, 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

The DRI strategy (focus on an event) is working

The drought is being described in unprecedented detail

Now the job is to pull this information together to tell 'the story'

PREDICT

Prediction Special Issue article

- General sense of prediction/predictability
  when good, when bad
- Types of products
- Specific events
- Recommendations
  what features must a model have?
  ...

COMPARE

Past and Future

2009-10 CMOS Bulletin article
Past-Future Special Issue article

- Given what we know about 1999-2005:
  how have past droughts compared?
  how will future droughts compare?
  ...

APPLY

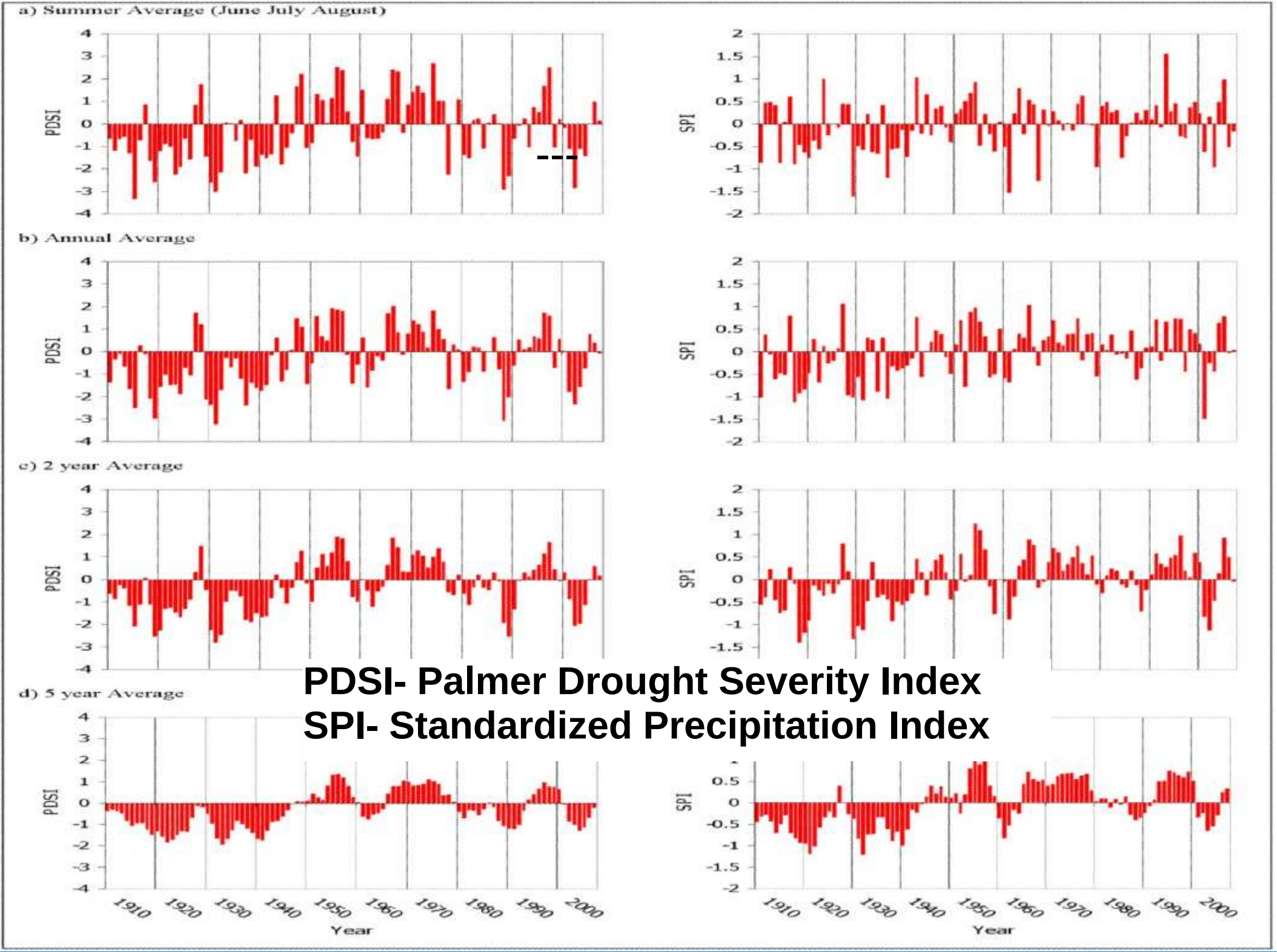
PAC Report(s)

DRI Professional Document

GEO contributions ...

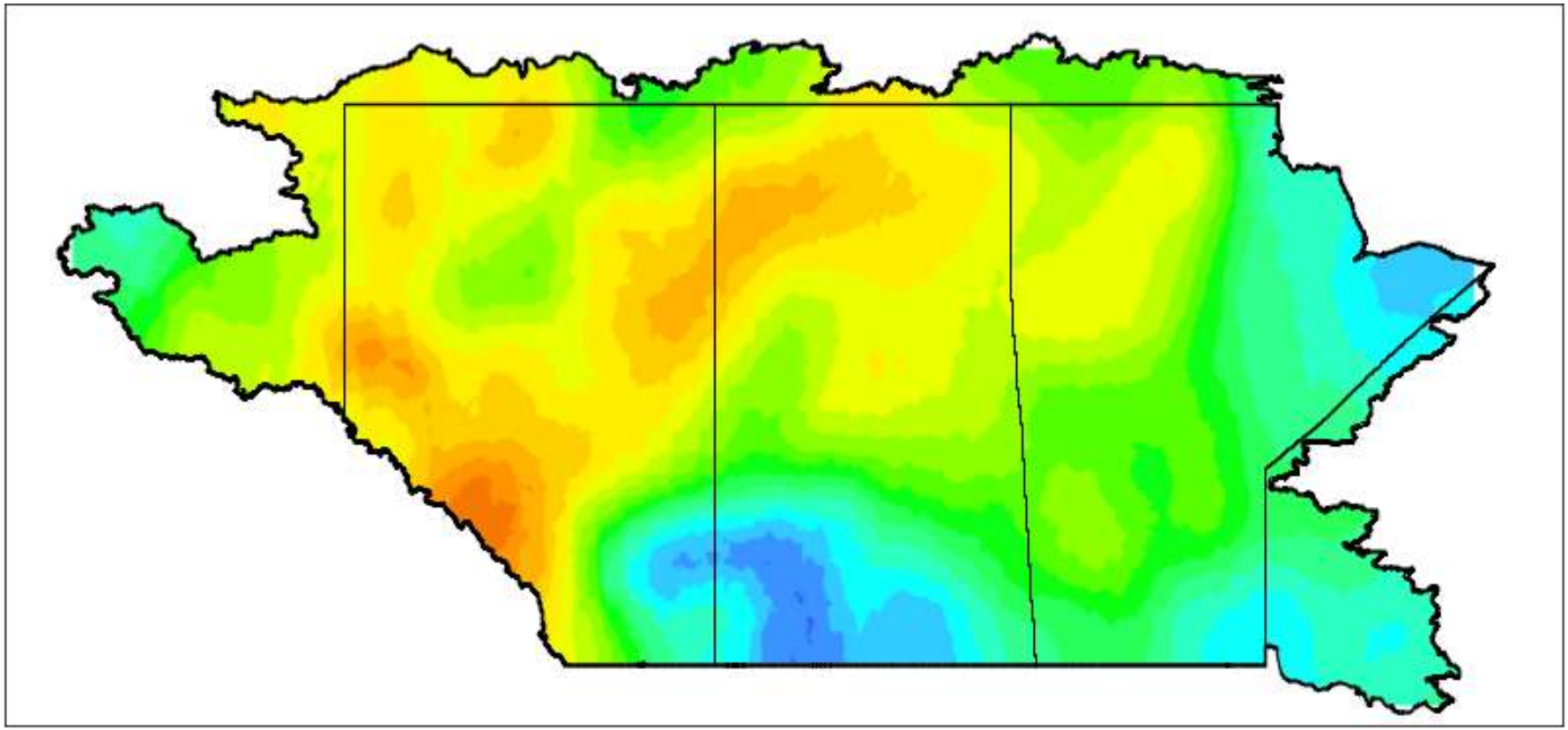
...

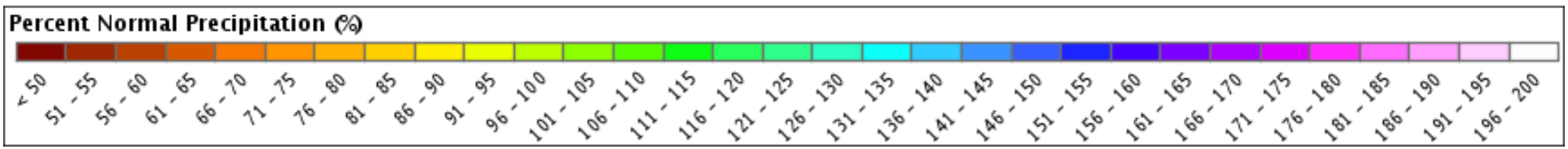

The Canadian
Prairies



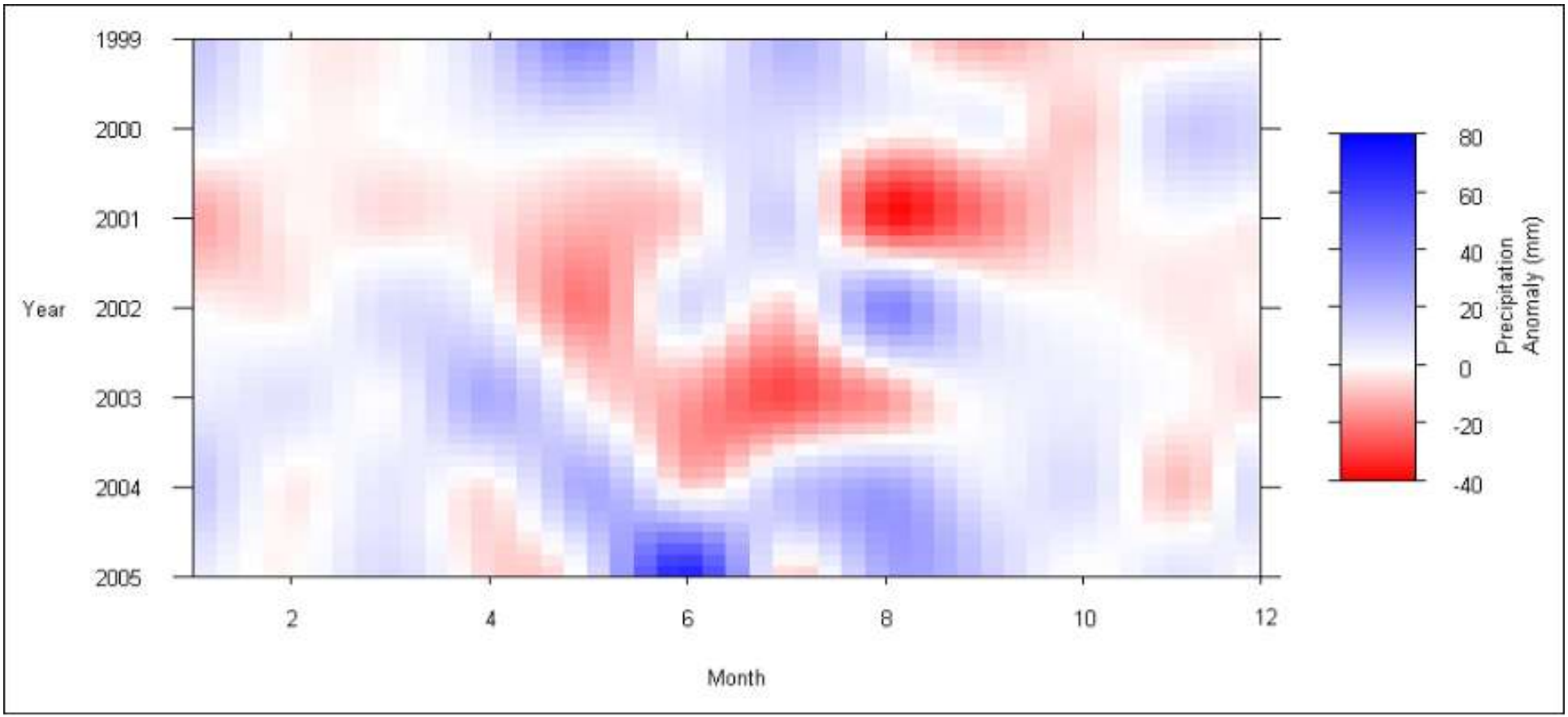
PDSI- Palmer Drought Severity Index
SPI- Standardized Precipitation Index

Precipitation anomaly over the Prairies for 1999-2005.

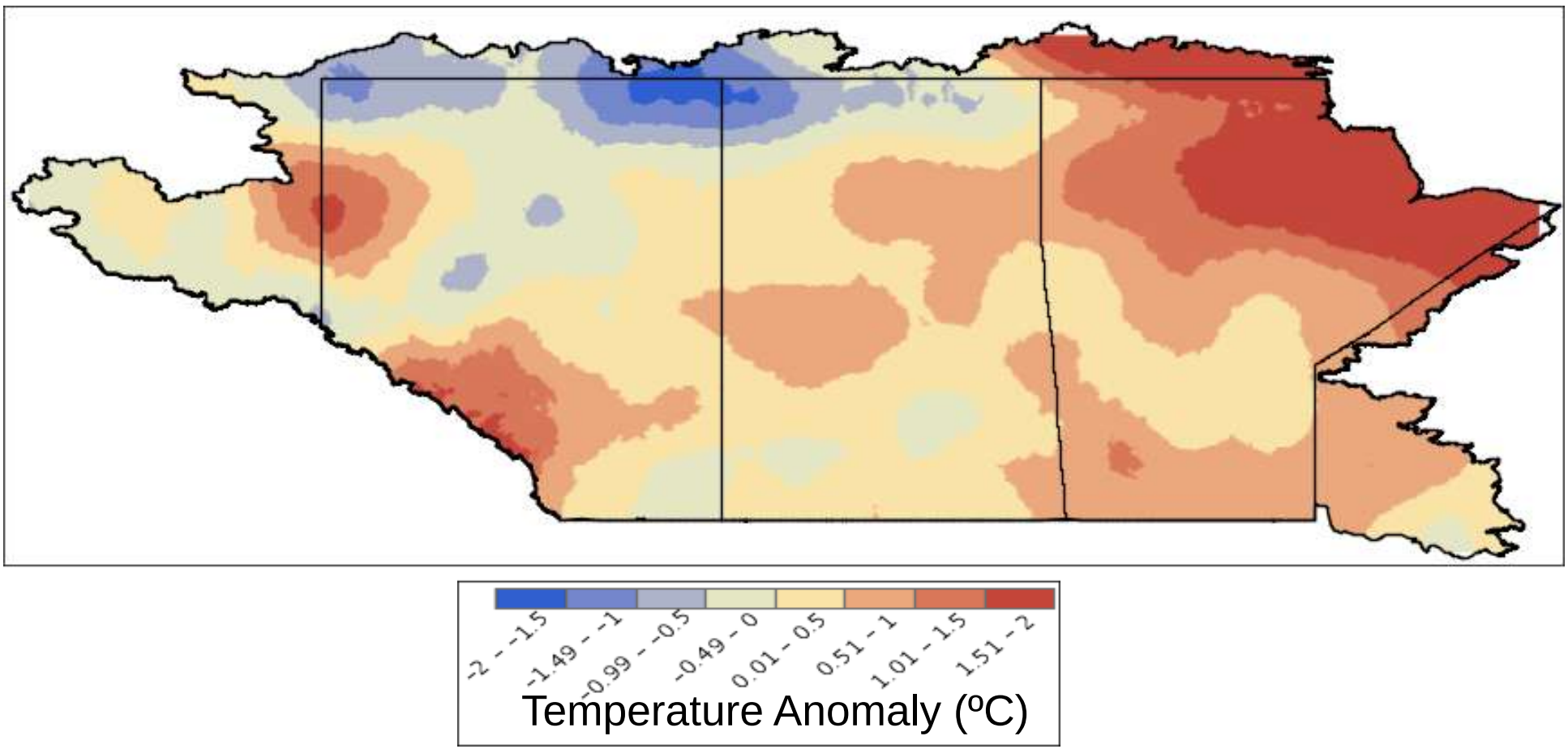




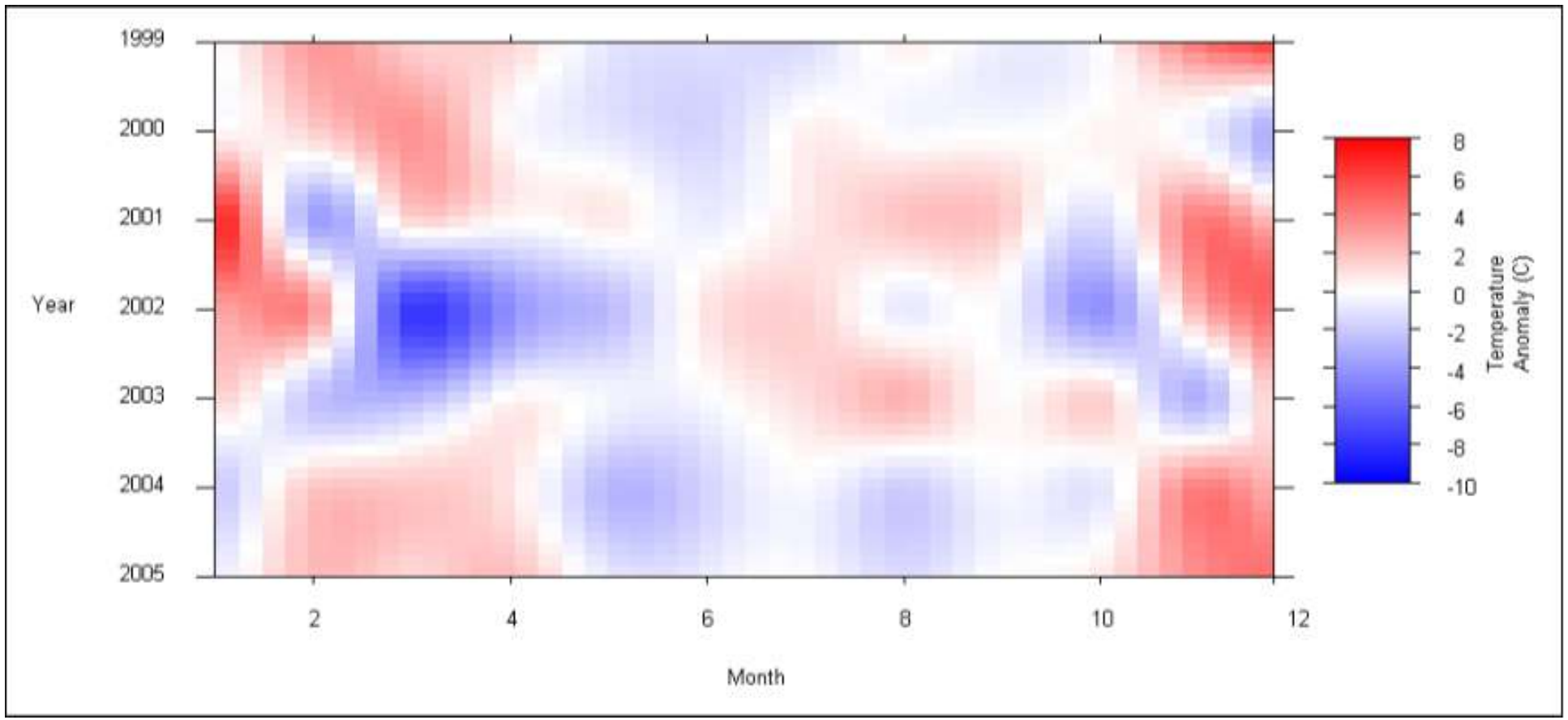
Monthly precipitation anomaly across the Prairie agricultural region 1999-2005



Temperature anomalies over the Prairies for the period 1999-2005



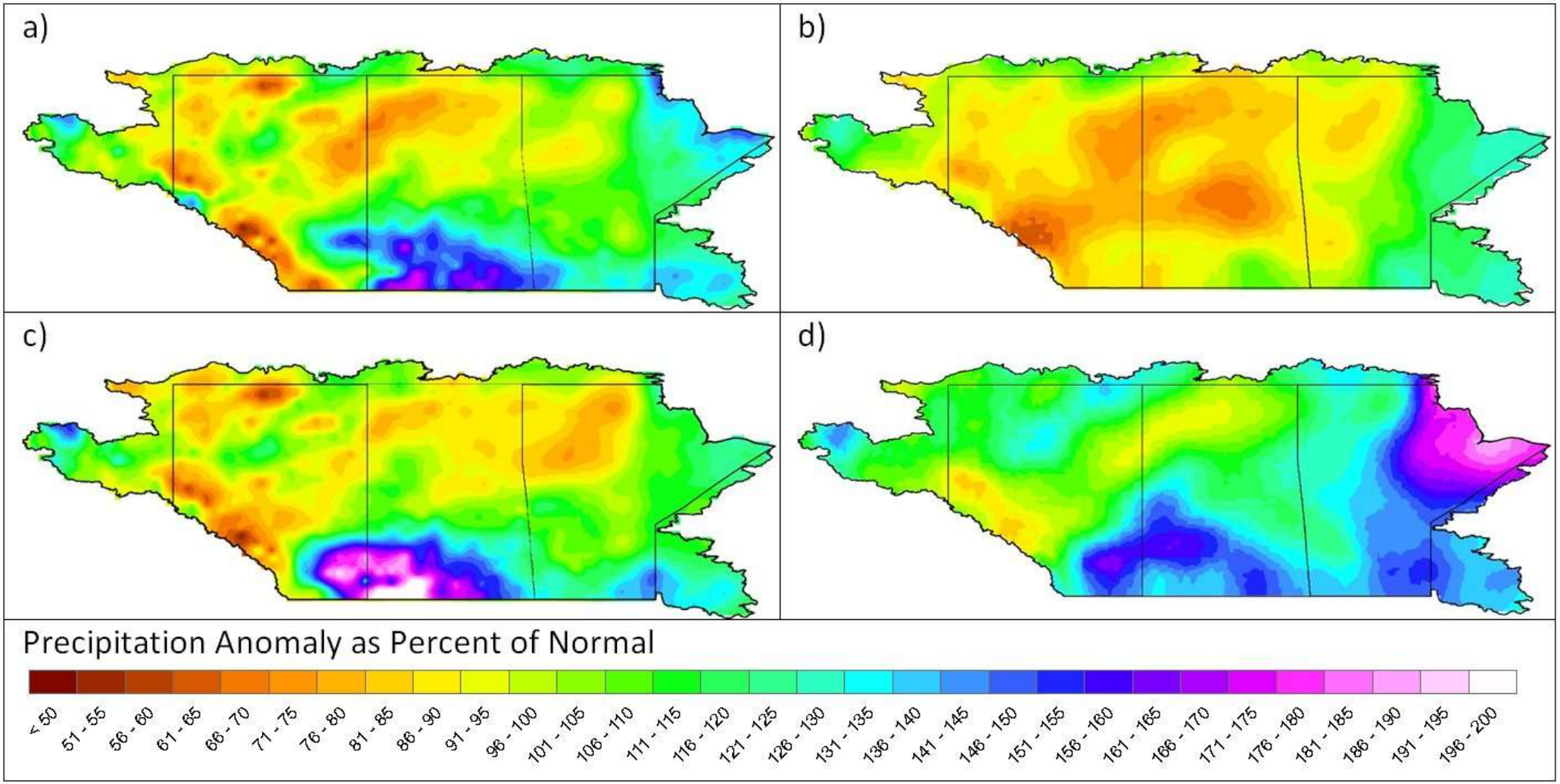
Monthly temperature anomalies across the agricultural region of the Prairies over the period 1999-2005



PHASES

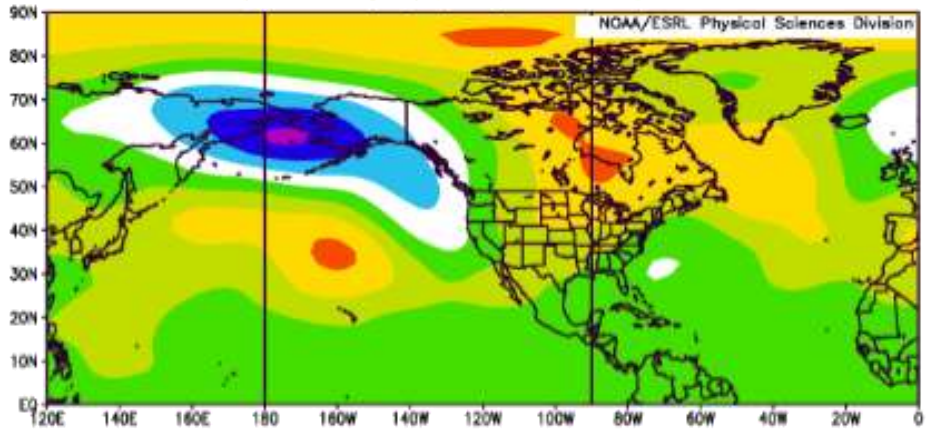
Beginning:	Sept 1, 1998 - Aug 30, 2000
Mature/Max. Extent-Severity:	Sept 1, 2000 - May 2002
Mature/Major Struct. Changes:	June 2002 - August 2004
Cessation:	Sept 1, 2004 - Aug 30, 2005

PRECIPITATION ANOMALY

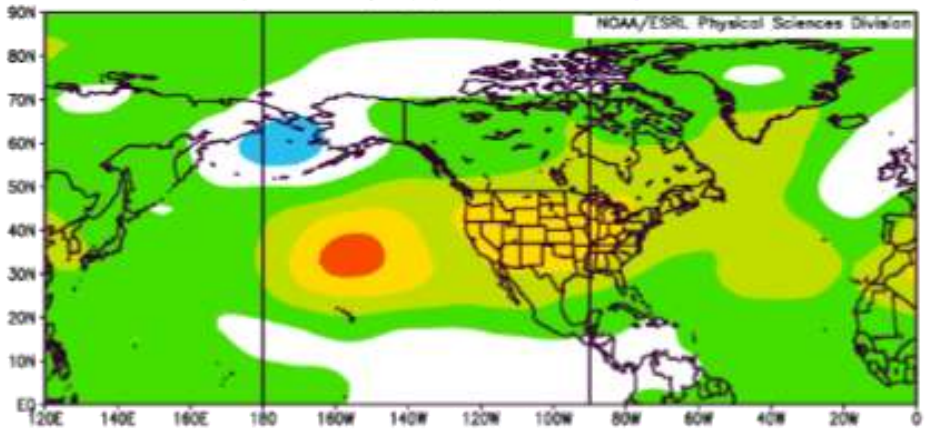


a. Sept 1, 1998 - Aug 30, 2000
b. Sept 1, 2000 - May 2002
c. June 2002 - August 2004
d. Sept 1, 2004 - Aug 30, 2005

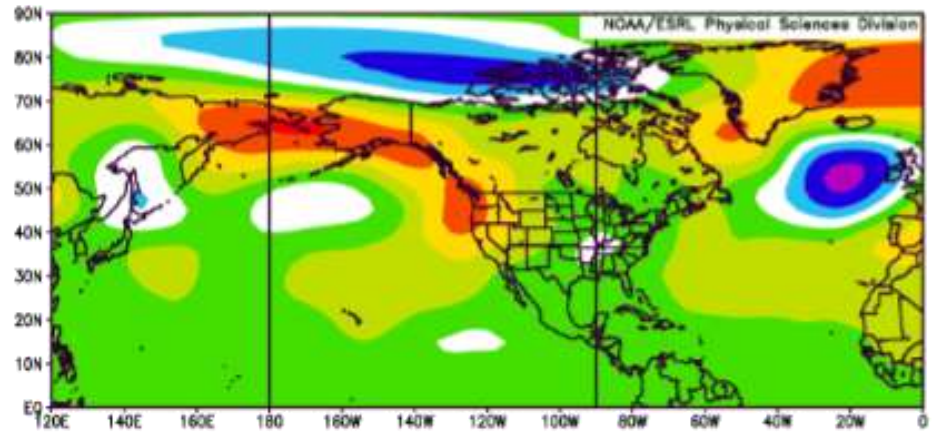
Large scale circulation patterns during drought phases



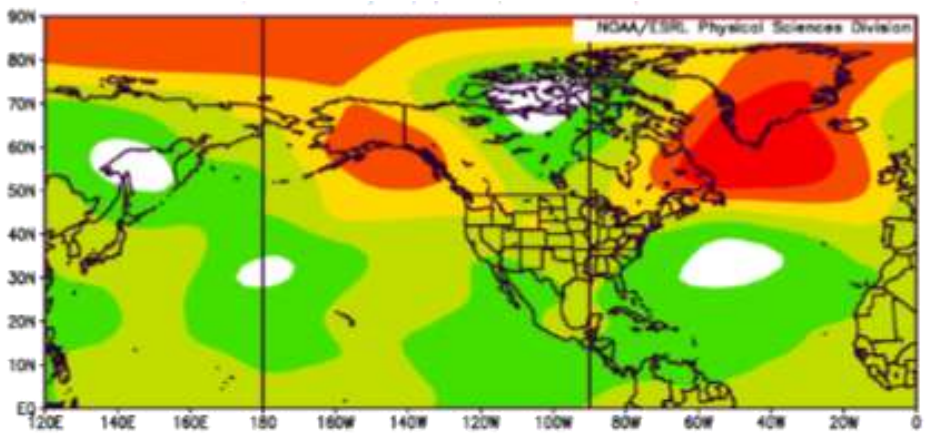
Phase 1: 09/1998 – 08/2000



Phase 2: 09/2000 – 05/2002

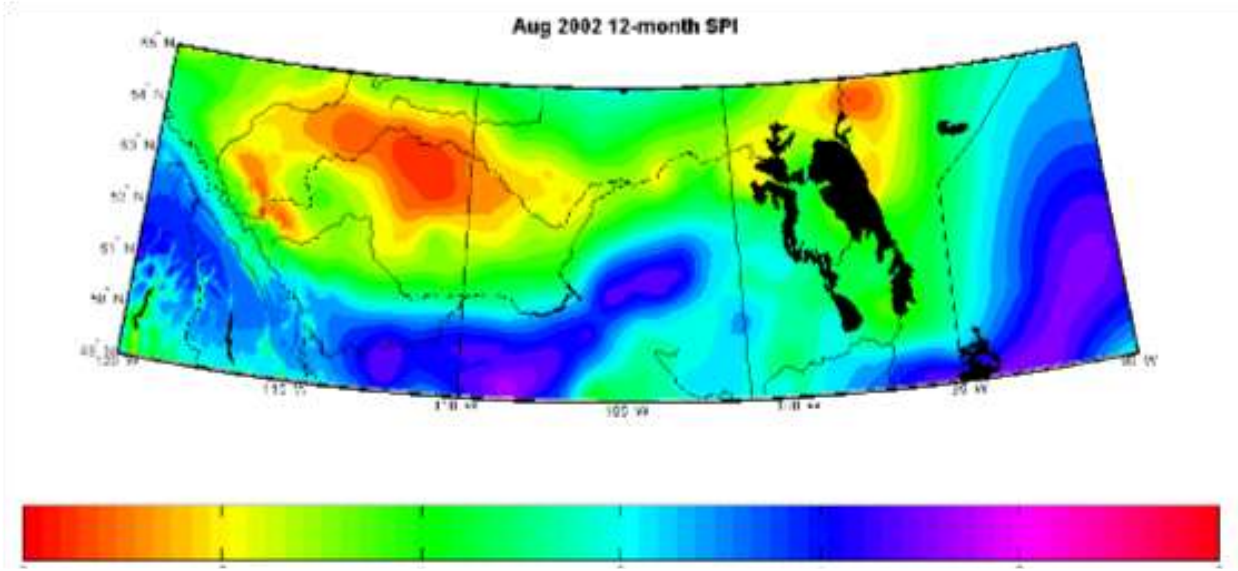


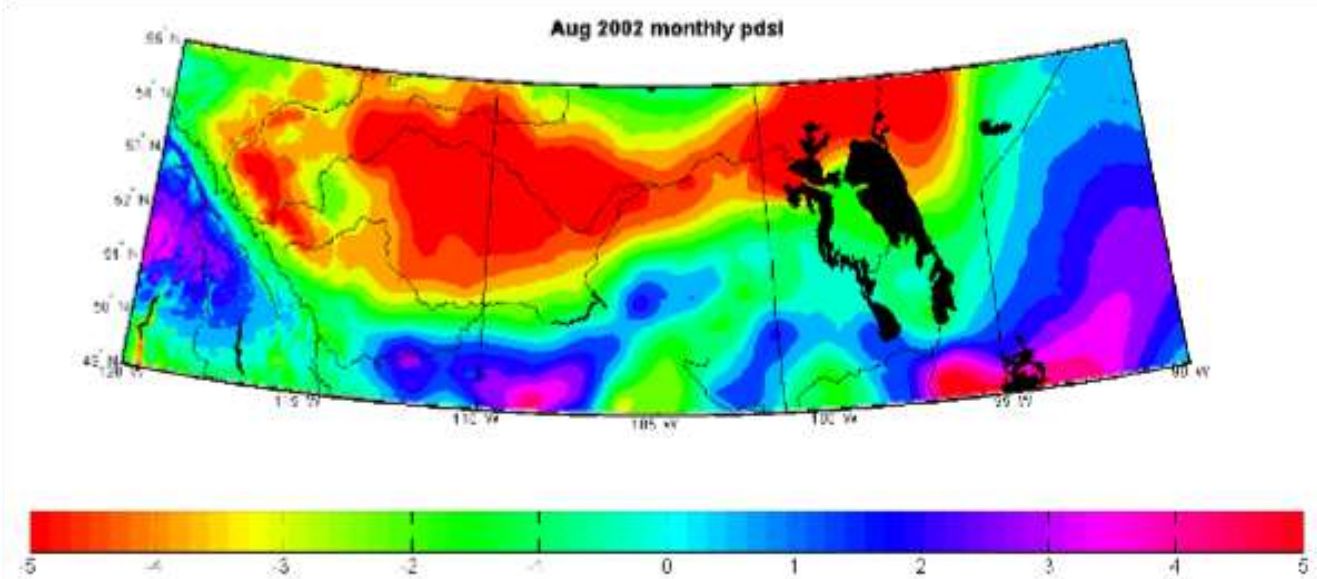
Phase 3: 06/2002 – 08/2004



Phase 4: 09/2004 – 08/2005

Monthly PDSI and 12-month SPI over the southern Prairies, August 2002





We need to explain ...

- How the large scale conditions provided a suitable environment for a multitude of factors to sustain limited precipitation for an extended period
- We have pieces .. we need to fit them together and weave our physics-based story
- This platform of insight will allow us to dictate the requirements for prediction and monitoring

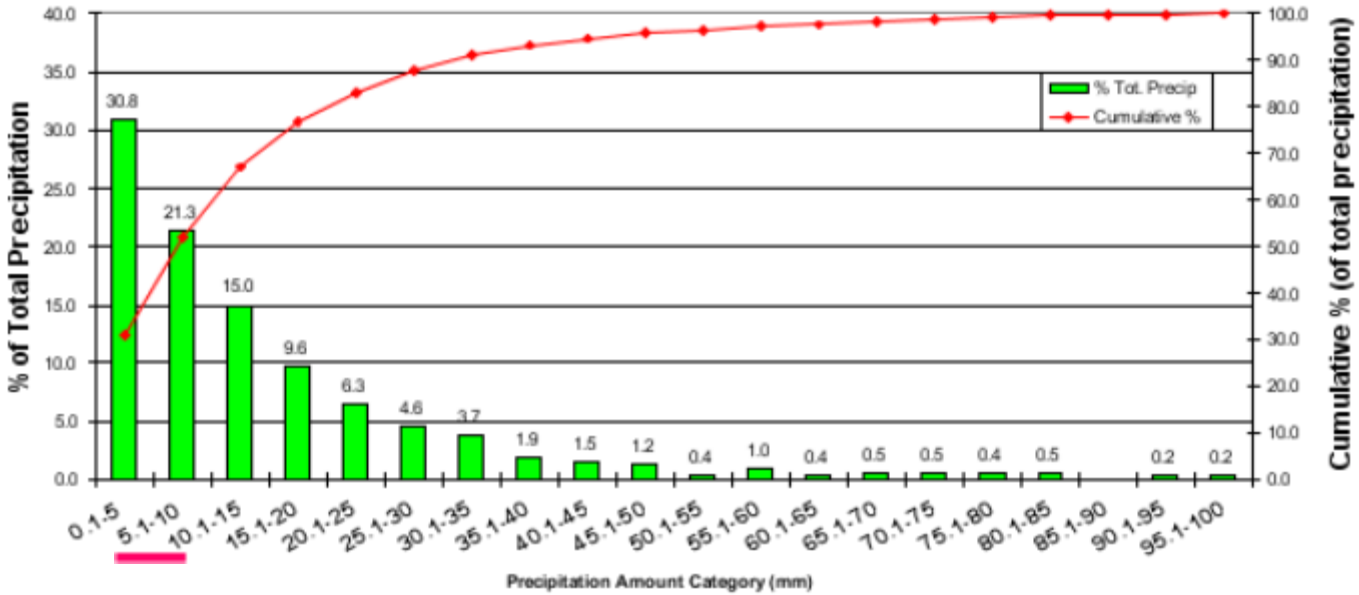
PRECIPITATION REDUCTION

There are many means of reducing precipitation.

Large scales
Storm track alteration
Reduced and altered types of clouds
High cloud bases and large sub-cloud precipitation loss
Aerosol effects
Altered surface evaporation
...

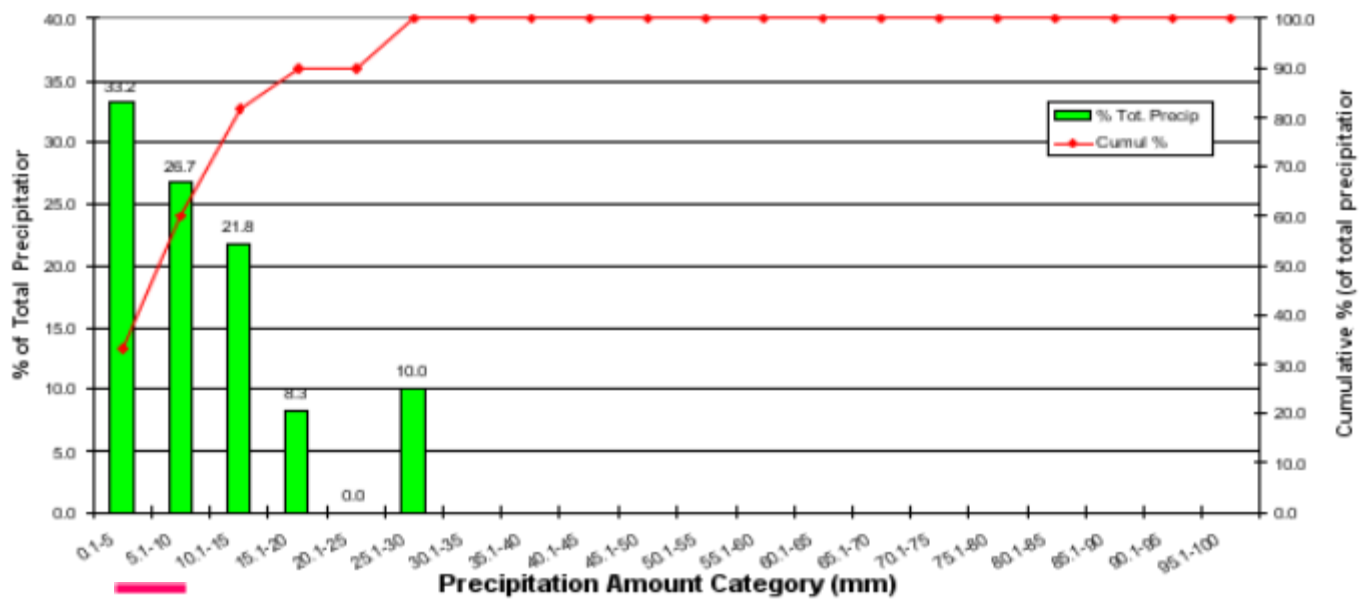
All of these may have been significant factors in the 1999-2005 drought

Daily Precipitation Amounts



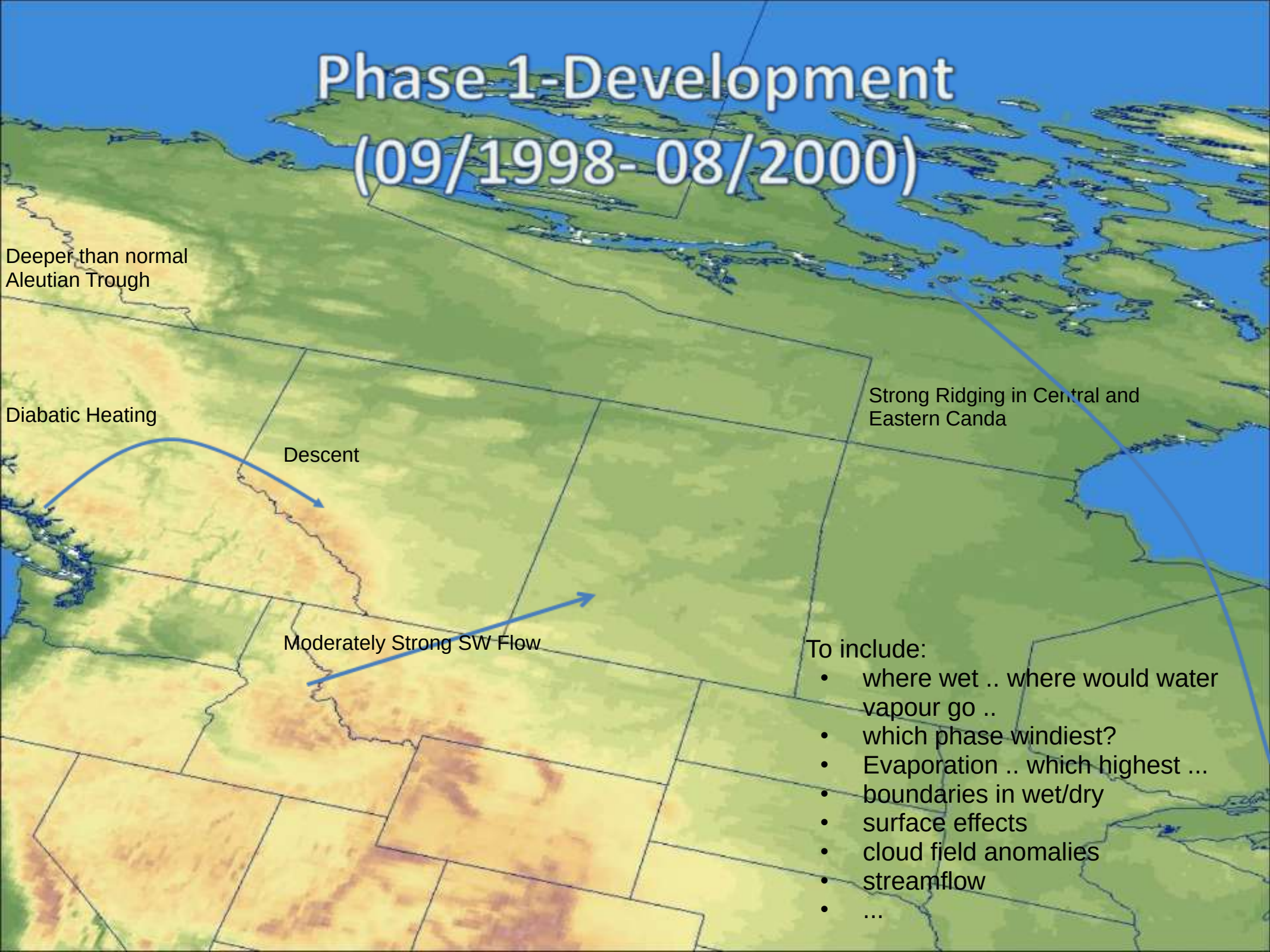
Low precipitation event:
< 10 mm

Climatology
Low precipitation events: 52% of total



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

Phase 1-Development (09/1998- 08/2000)



To include:

- where wet .. where would water vapour go ..
- which phase windiest?
- Evaporation .. which highest ...
- boundaries in wet/dry
- surface effects
- cloud field anomalies
- streamflow
- ...

And ...

Given the resiliency of the drought system:

snow, soil moisture, dry atmosphere, vegetation, groundwater ...

how was this overcome?

or was it?

SO ...

Is drought really just a function of large scales?

not really ...

structure
severity variations

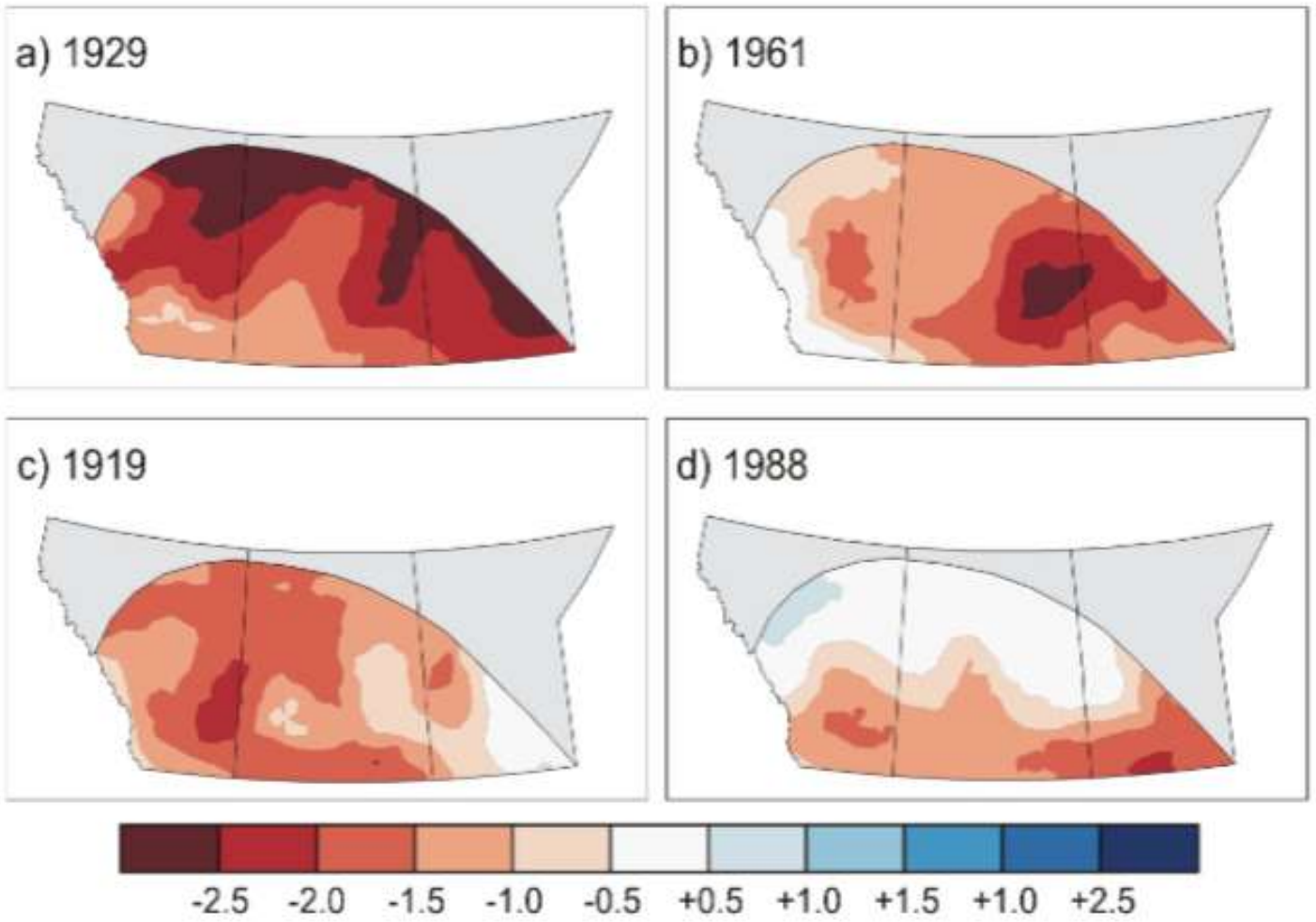
and ...

DROUGHT FEATURES

One needs to be able to account for:

- cold/warm season
- no/small/large precipitation events
- soil moisture/vegetation/runoff alteration
- windy or calm
- dusty/smoky/radiation
- ...

SOME OF CANADA'S WORST DROUGHTS



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

SIMULATING-PREDICTING

We have shown that it is COMPLICATED ...

Without proper (high resolution...) simulation, what will not be simulated, let alone predicted:

- internal structure
- severity
- precipitation rate
- surface and sub-surface features
- ...

So, how move forward ...

- push for high-resolution simulations
- alone or with international efforts
- ...

ULTIMATE GOALS

We always envisioned contributing to major issues:

- **To better predict droughts over Canada, their detailed structure, and their impacts with increasing confidence**
- **To better assess whether there will be a 'drying of the continental interior' in the future**

IN SUMMARY

DRI is a network

We are moving ahead to the final stages

One means of doing this is to synthesize our progress and to recommend future activities and requirements