DRI SYNTHESIS

Team DRI: A Collective Effort

completion .. early 2010

OBJECTIVE

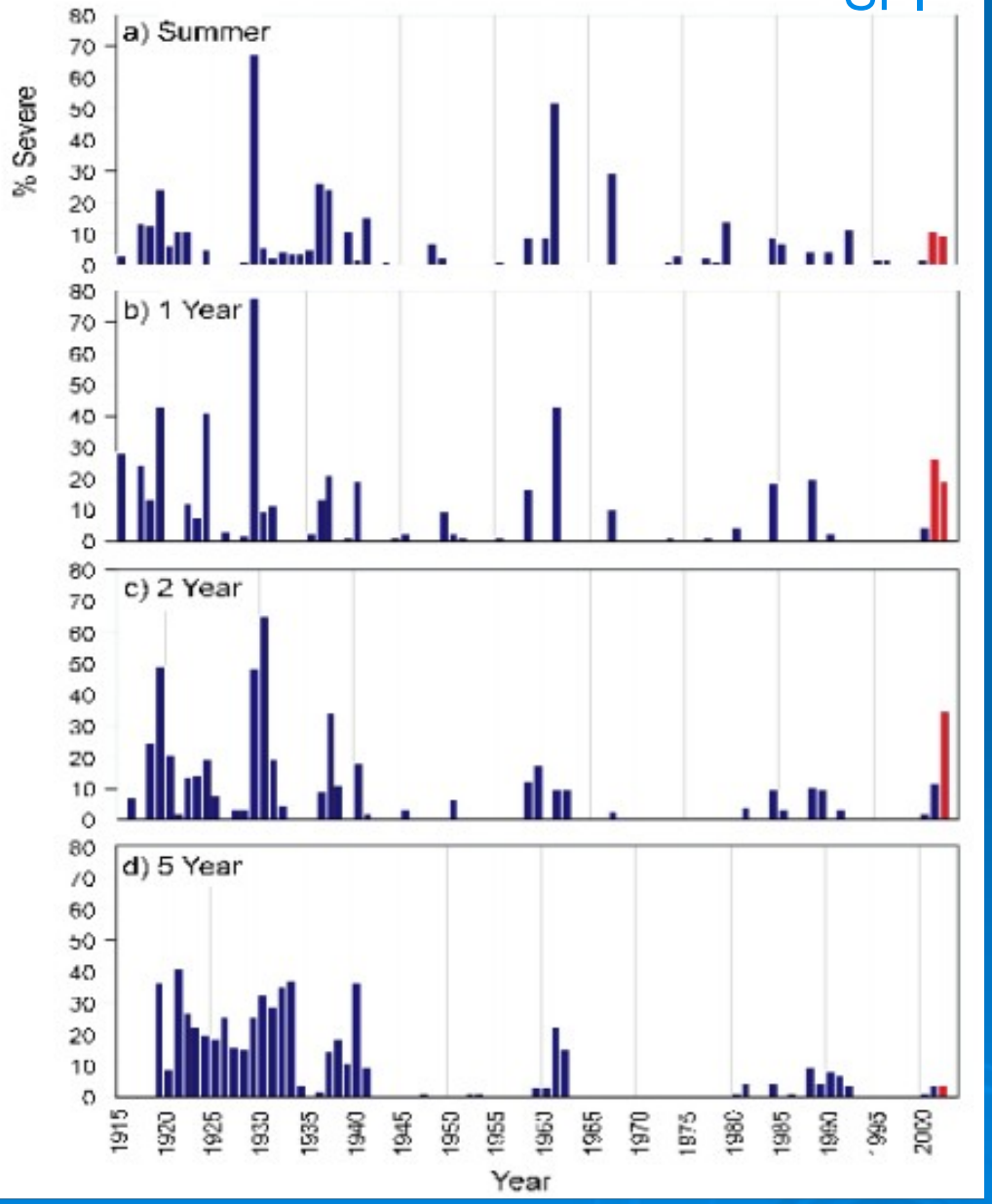
- To explain how the drought was established, continued and ended
- To illustrate the factors controlling the drought's internal evolution
- To recommend needed improvements in monitoring, predicting and adapting

STRUCTURE

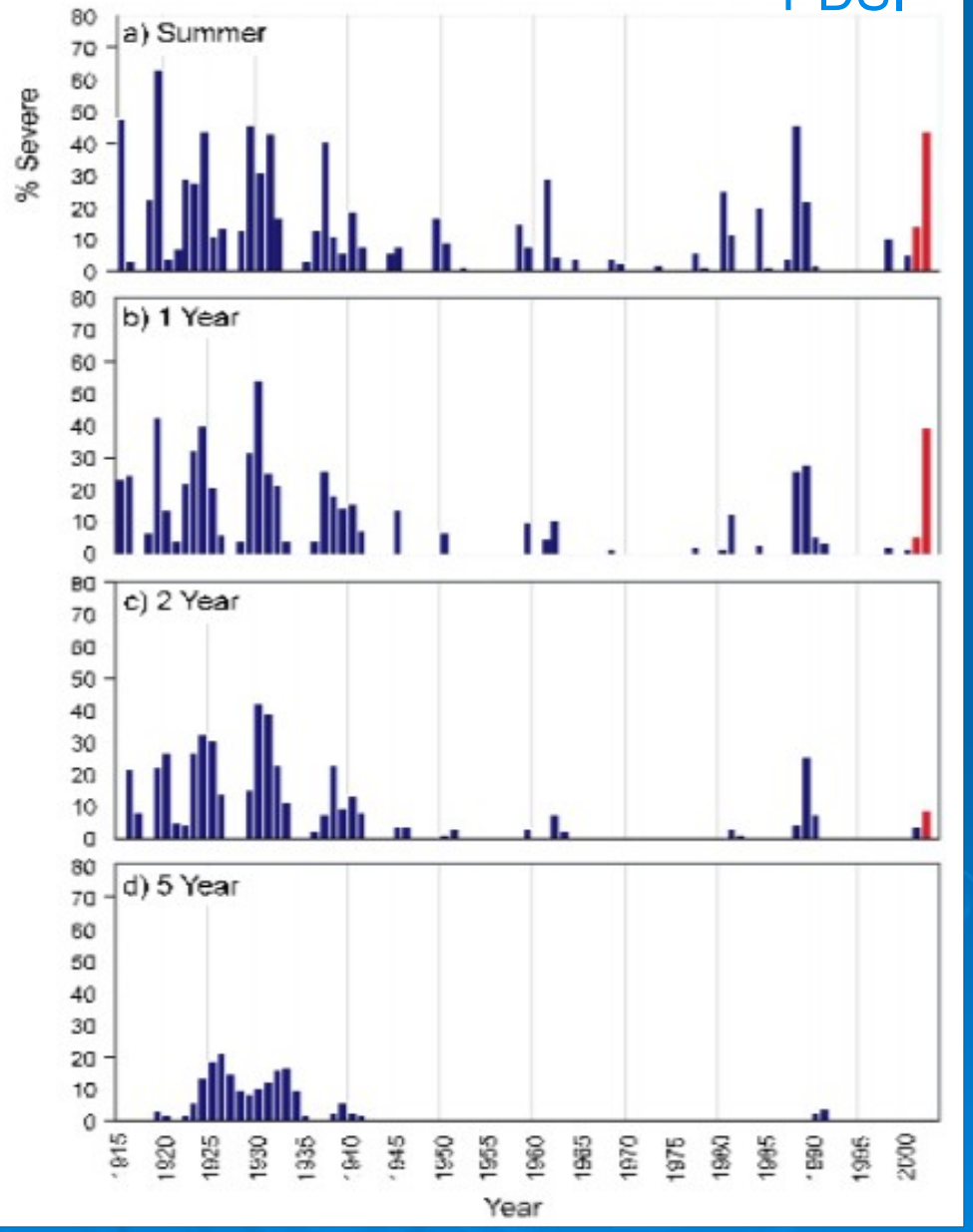
- The Drought
- Large scale setting
- Land area features
- Feedbacks
- Means of sustained lack of precipitation
- Anthropogenic factors
- Assessments of present capabilities
- Implications
- ...
- Concluding Remarks

Drought Occurrence – Southern Prairies (1915-2002)

SPI



PDSI



BIG ISSUES

Given the drought, some key issues include:

1. What maintained it over multiple years?

2. What governed its actual structure?

3. Why did it end?

And, what was the role of the cold season … a natural Canadian focus

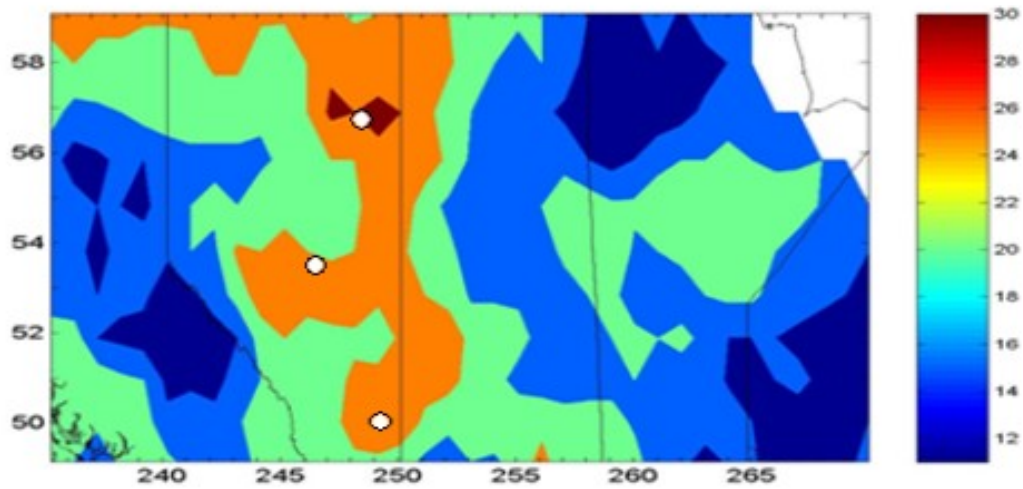
4. What did prediction systems 'miss‘ and why?

5. Given this progress, how can we better cope with drought?

DROUGHT EVOLUTION

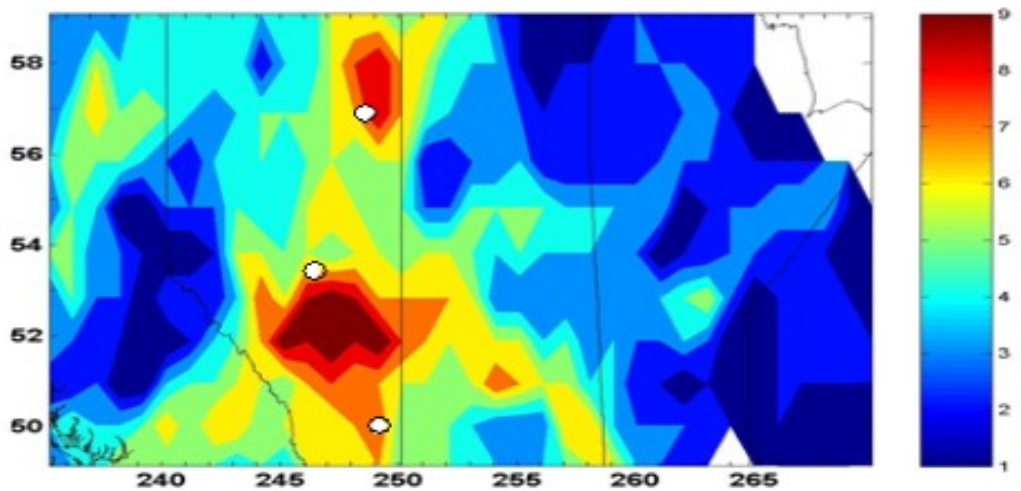
- At what point did the lack of precipitation lead to drought, a phenomenon acting to perpetuate itself
- What was the chain-of-events?
- How close was this drought to NOT occurring?
- What maintained the drought despite many large scale changes?
- What controlled the movement of the drought?

MONTHS EXPERIENCING DROUGHT



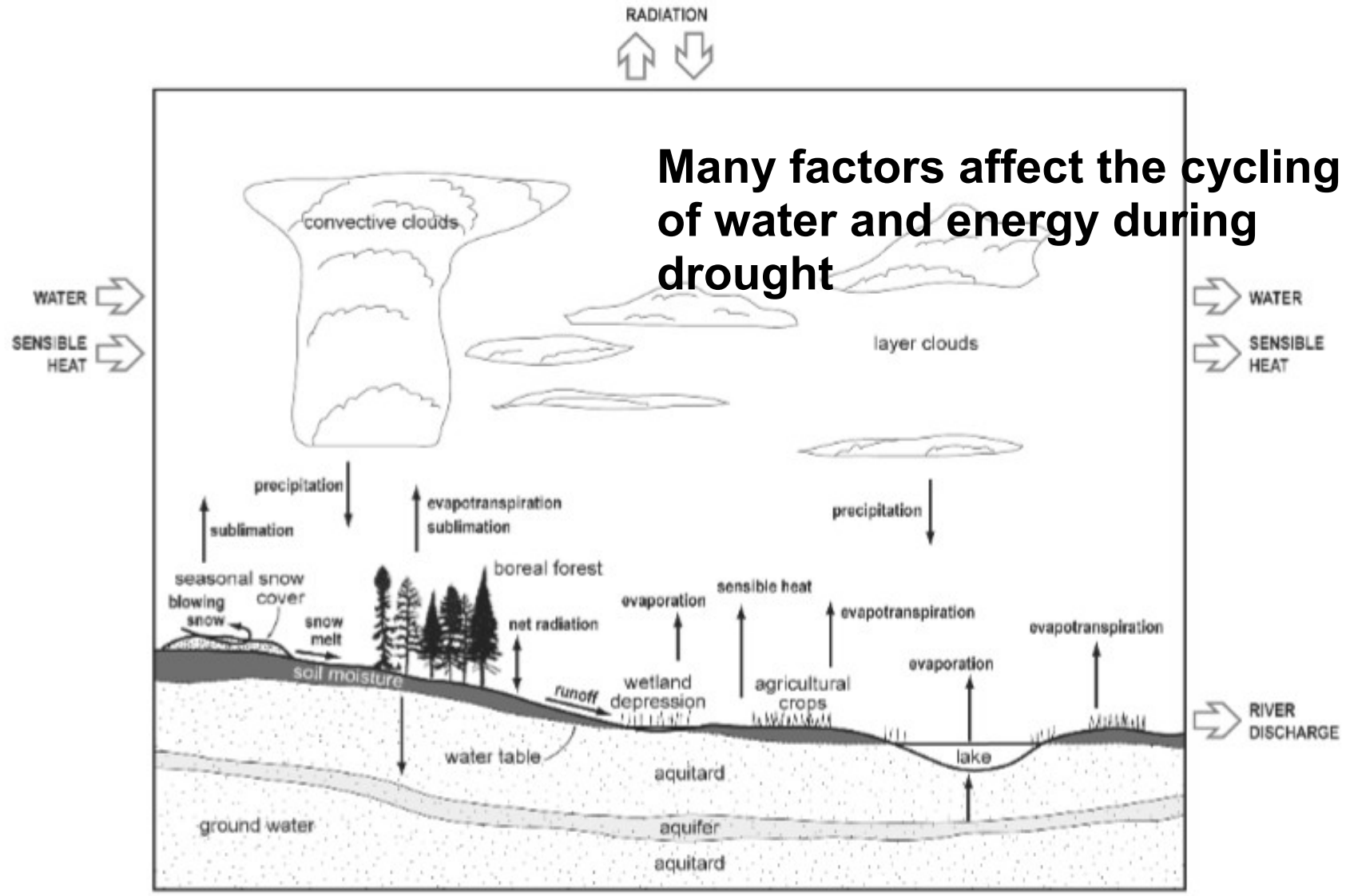
September 1999 – December 2004

SPI ≤ - 0.5



SPI ≤ - 1.5

WATER AND ENERGY CYCLING



Many factors affect the cycling of water and energy during drought

FEEDBACKS

What specific factors were operating in this drought?

- Atmosphere ...
- Land … vegetation, albedo …
- Sub-surface factors

A few examples follow ...

WINTER EFFECTS

- What was the impact of the varying snowcover on the drought?
- Warm and cool winters had what effects on the drought?
- When did the freezing and thawing of the ground occur and how did the timing of these affect the drought?
- How did loss of precipitation through blowing snow affect the drought?
- ...

PRECIPITATION REDUCTION

There are many means of reducing precipitation.

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

How did each/all of the factors act to reduce precipitation?

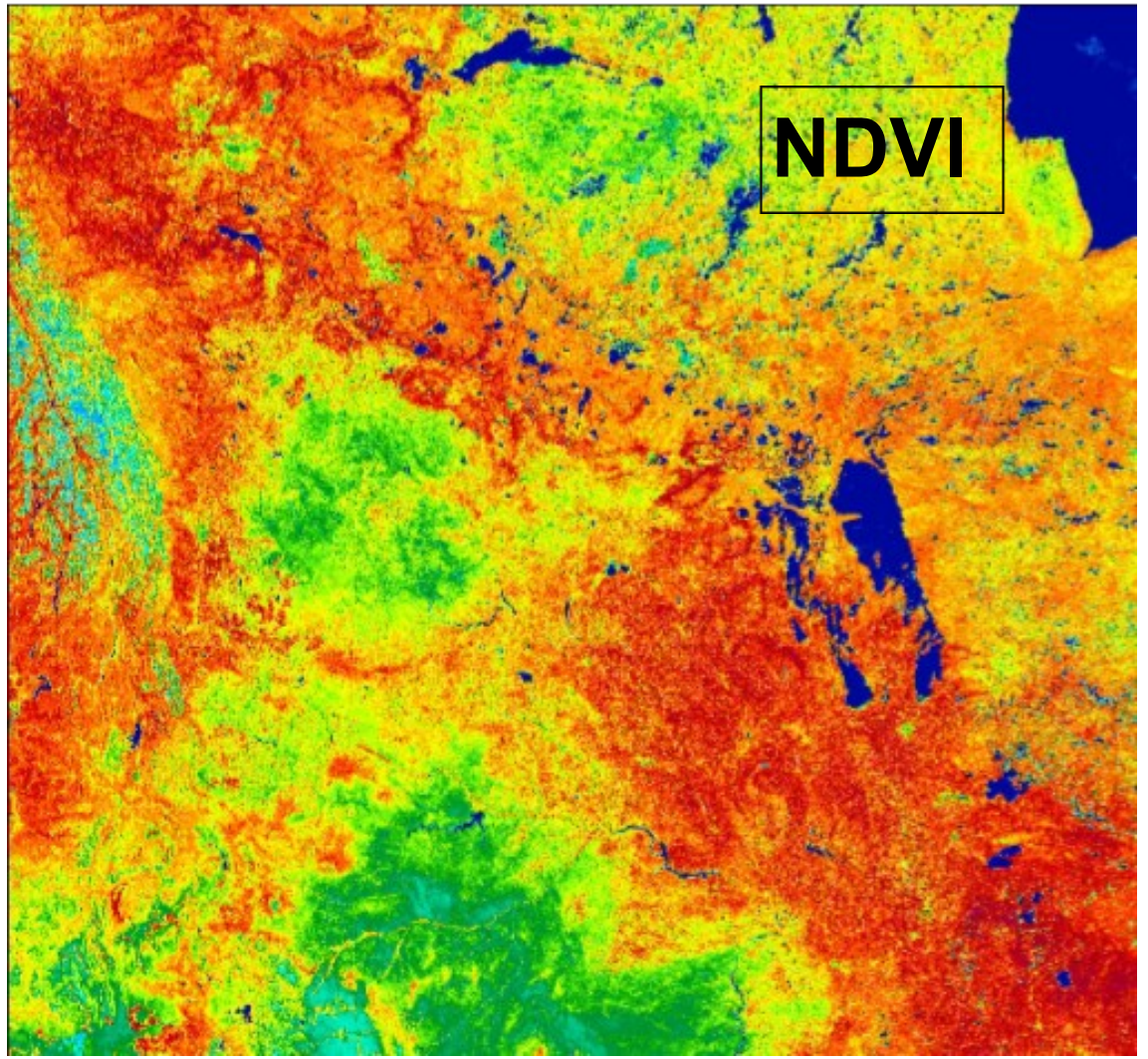
DUSTSTORMS AND FOREST FIRES

32 major dust storms in Saskatchewan in 2002

SURFACE/SUB-SURFACE IMPACTS

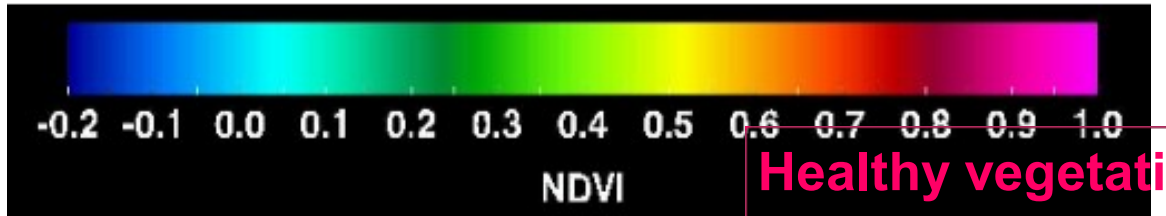
- What was the impact of the varying vegetation?
- What was the impact of the varying soil moisture?
- What was the impact of the drying-up of many ponds and sloughs?
- What was the impact of sub-surface moisture'
- ...

VEGETATION



July 11-20, 2002

NDVI: Normalized Difference Vegetation Index



PRAIRIE LANDSCAPE

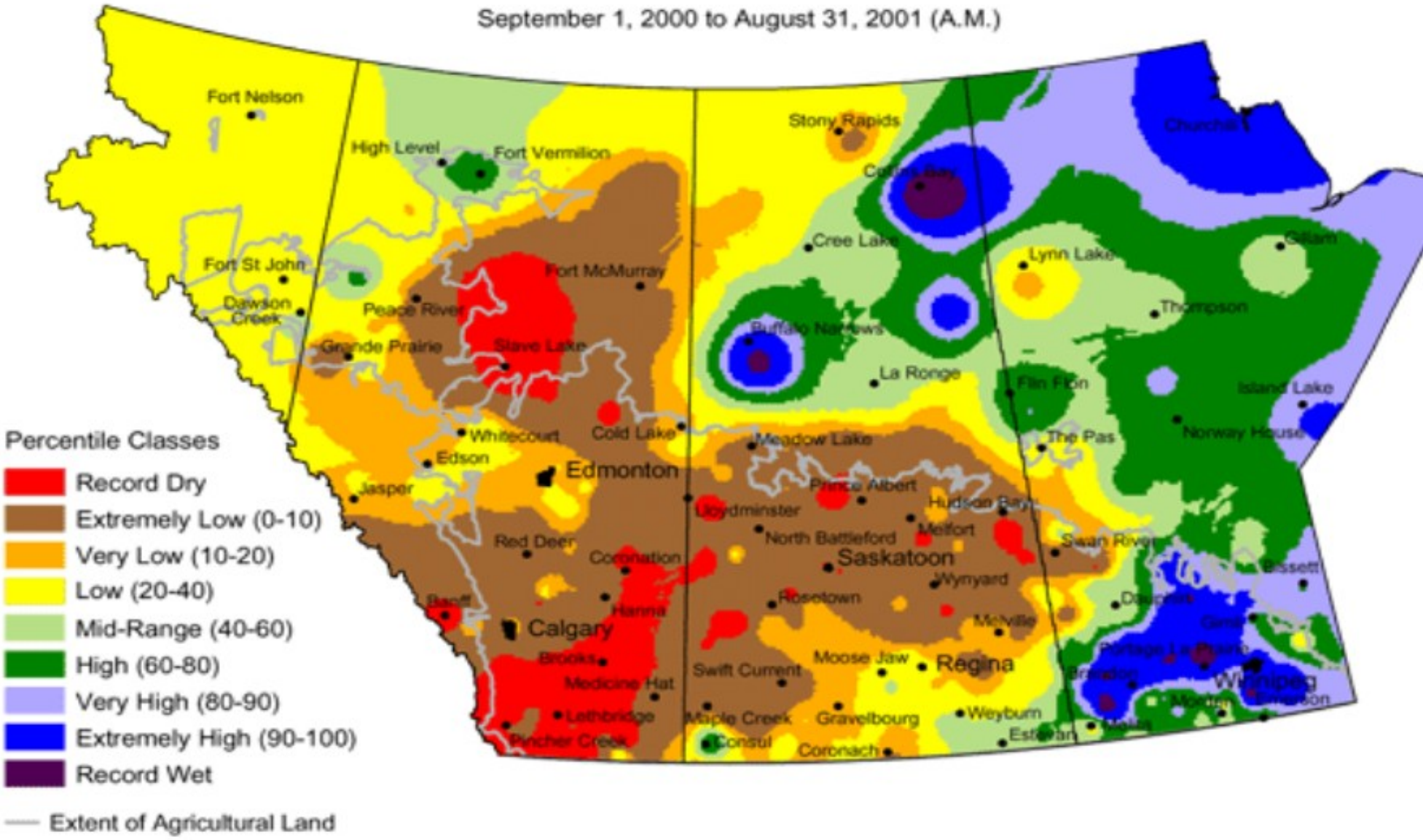
PHYSICS OF ‘EDGES’

- Did processes acting near 'edges' act to perpetuate and/or eliminate the drought?

- Vegetation feedbacks
- Albedo feedbacks
- Atmospheric circulations
- ...

Current Precipitation Compared to Historical Distribution

September 1, 2000 to August 31, 2001 (A.M.)



Prepared by PFRA (Prairie Farm Rehabilitation Administration) using data from the Timely Climate Monitoring Network and the many federal and provincial agencies and volunteers that support it.

BREAK POINTS

- Major changes in drought features

- Specific examples
  - June 2002
  - spring 2005
  - ...

- What happened and why?

SIMULATION CAPABILITIES

- How well were the drought's many features simulated?
  atmosphere, surface, vegetation, hydrology ...
- What are the implications for model improvements?
- ...

PREDICTION

- How good was the seasonal forecast?
- How important were large and small scale factors in limiting capabilities?

ANTHROPOGENIC EFFECTS

- Atmosphere
- Surface

- Were large and regional forcings consistent with global warming patterns?
- Did the altered land surface and agricultural crops act to enhance or reduce the drought?
- ...????

FURTHER INSIGHT AND IMPLICATIONS

- Palliser triangle
- Devil's Lake
- River flows across provincial/national boundaries
- Great Lakes
- Mountains
- ??? others???

- Agriculture
- Hydro development
- Oil sands
- Forestry
- ...

- Future climate projections: water availability, extremes
  Prairies, western Canada, all Canada, other regions

SOCIETAL IMPACTS AND RESPONSES

- How did society respond?

Given our increased understanding ...

- How could this be improved in the future?

CONCLUSIONS

A major multi-year drought affected the Prairies (and other regions) over the 1999-2005 period.

Some features as expected but other features not

Great deal of structure in terms of precipitation, dryness ...

Large as well as small scale factors important

Modelling capability is being improved ...

Harbinger of future climate?

Implications for society

Next steps