



The Drought Research Initiative: *Workshop II*

Ronald Stewart and John Pomeroy

OUTLINE OF PRESENTATION

- ∅ Importance of Drought
- ∅ Drought Issues
- ∅ Recent Drought
- ∅ Themes
- ∅ This Workshop



Droughts in Canada



Drought, from coast to coast

St. Lawrence Seaway
Ship volumes dip 2001
 Drought in parts of the Prairies played a role in reduced grain shipments.

Drought losses mount in Sask., Alta.

Drought fallout widespread

Drought puts pastures in peril

Hot, dry summer hits areas across Canada

Drought-stressed farmers need help

Farm earnings shrivel

Drought costs economy millions

Net farm income

Category	2001	2000	% Change
Grain	1,100	1,200	-8.3
Oilseeds	1,000	1,100	-9.1
Other crops	100	100	0.0
Other income	100	100	0.0
Total	2,200	2,400	-8.3

12.2 per cent
Sask. decline

Grain industry expected to generate \$770 million less than last year

Once fall hits, and winter, you can expect to see layoffs and closures. It's going to affect a lot of rural jobs.

Hot, dry summer hits areas across Canada

Drought-stressed farmers need help

Farm earnings shrivel

Drought costs economy millions

Net farm income

12.2 per cent
Sask. decline

Grain industry expected to generate \$770 million less than last year

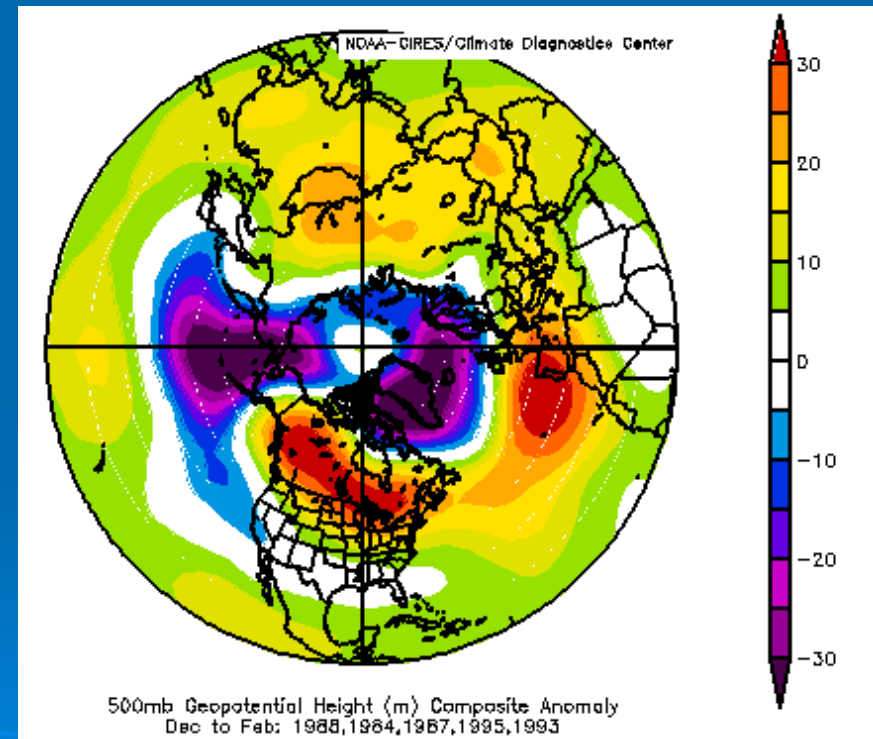
LARGE SCALE FACTORS

Flow features linked with warm dry winters

500mb Flow

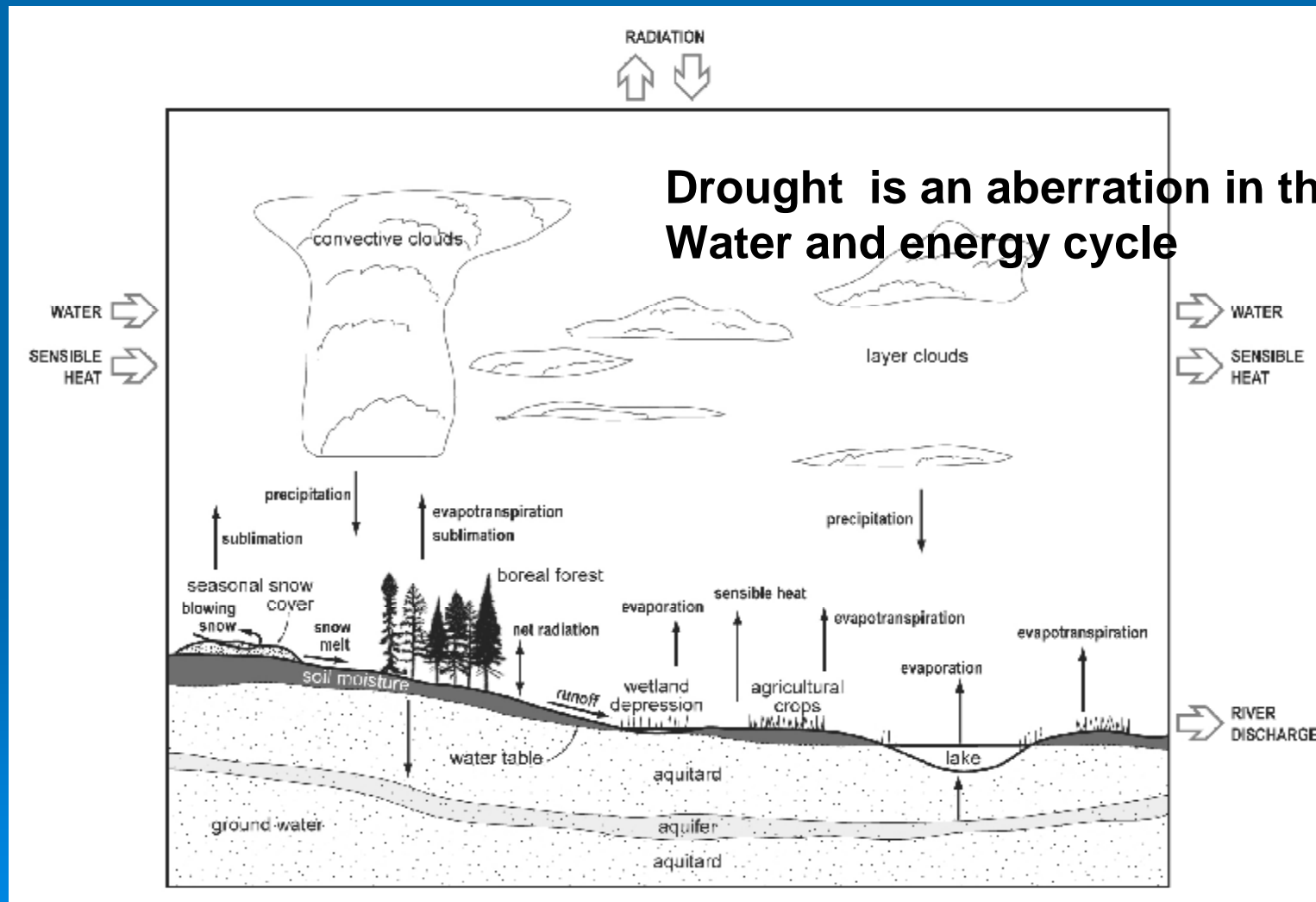


500mb Anomalies



Courtesy Barrie Bonsal

WATER AND ENERGY CYCLING



SOME OF THE ISSUES

- ∅ Will we see more droughts in the future?
- ∅ how will next season look?
- ∅ Will there be any break for me over the next few days?
- ∅ DRI ... aims to contribute to all of these but when we wrote the proposal we of course had to limit our scope... huge issue and likely that nothing would be approved ...
- ∅ In fact, they are all related ... how can you predict the future unless you understand its actual workings ... we are perfectly positioned ...

CONCERNS

There are many concerns associated with drought but many of these can be summarized under two broad categories

Ø Will there be a drought?

decadal

seasonal

'now'

Ø How do we best prepare for and cope with drought?

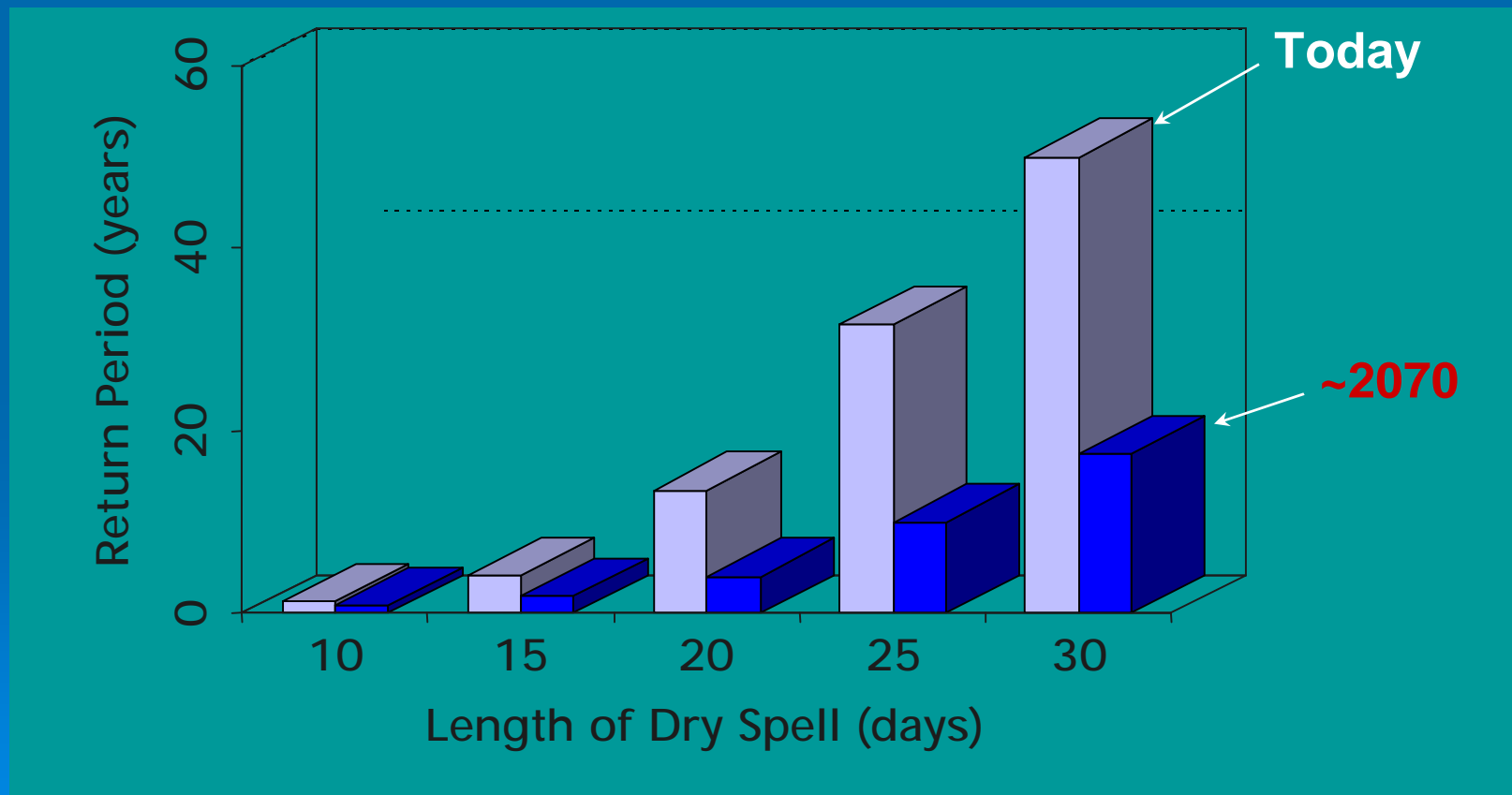
many perspectives

PREDICTION

- ∅ BUT this can include Prediction of FUTURE drought
- ∅
- ∅ prediction
- ∅
- ∅ NOW .. season ;; future
- ∅
- ∅ details, general outlook, occurrence?
- ∅
- ∅ focus of DRI on NOW and Season . so far

The frequency and severity of droughts are likely to increase in southern Canada

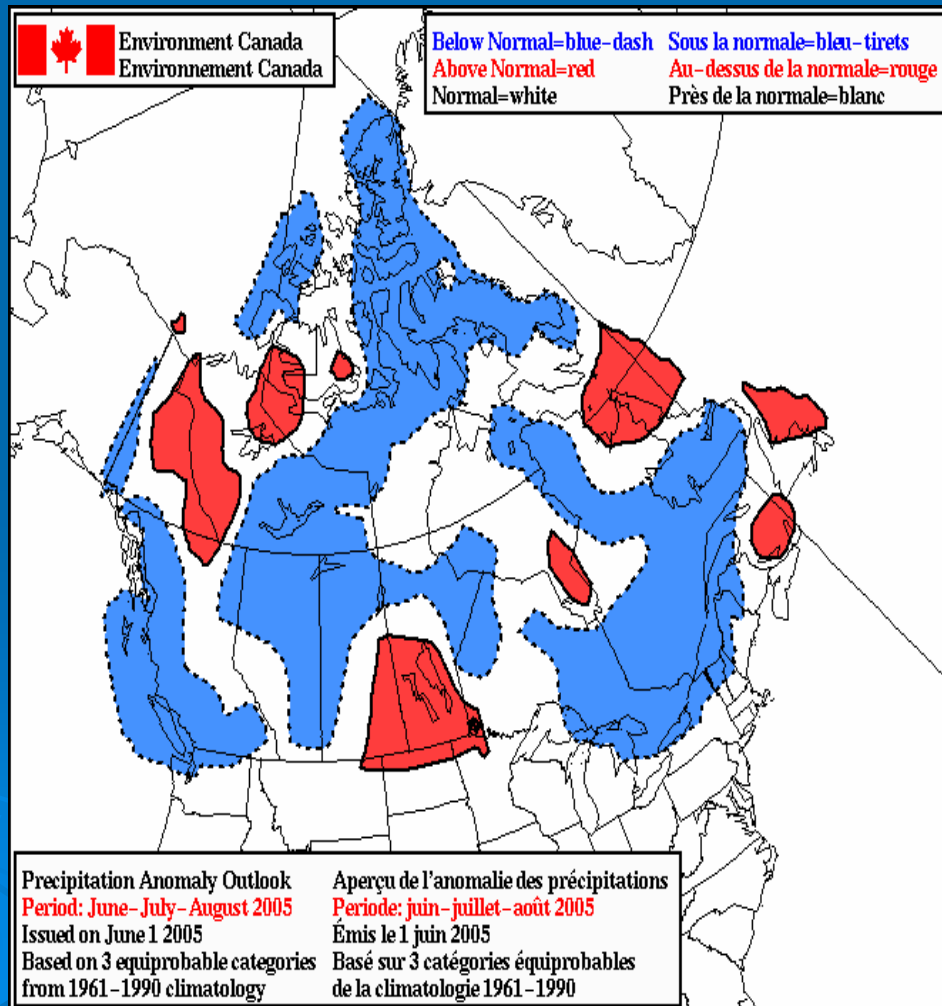
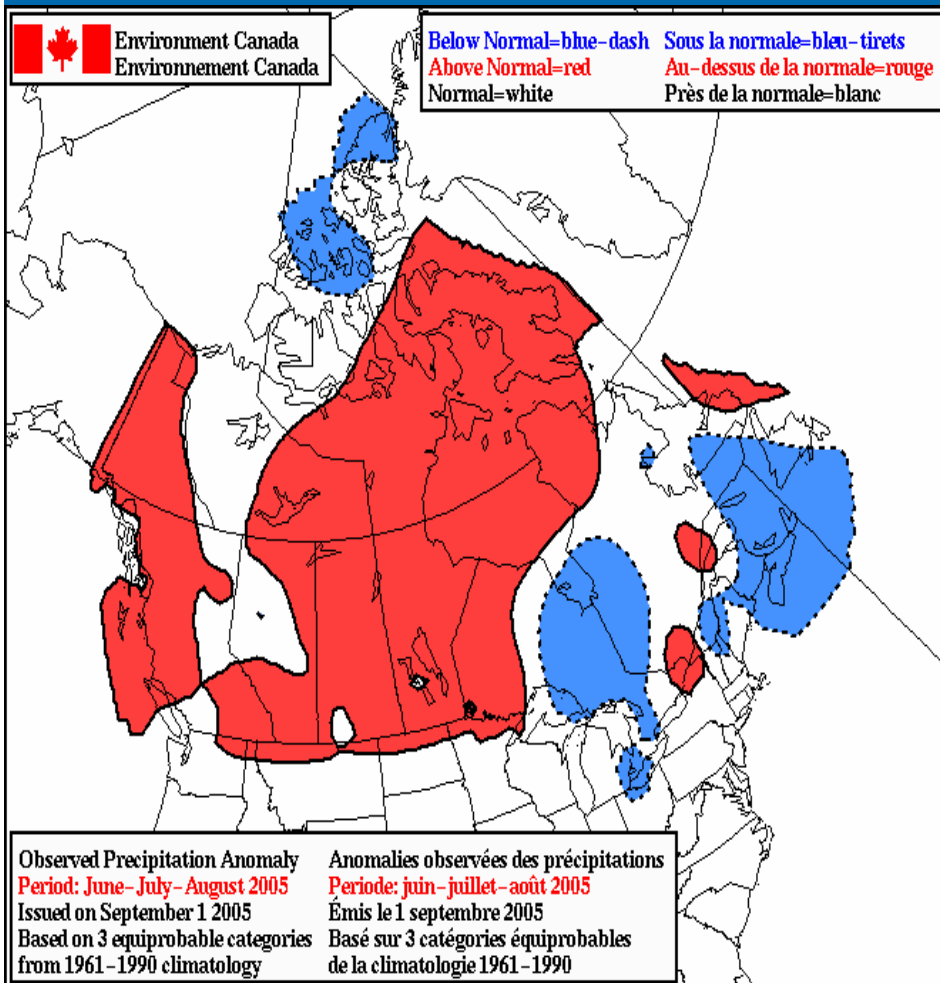
Central North America



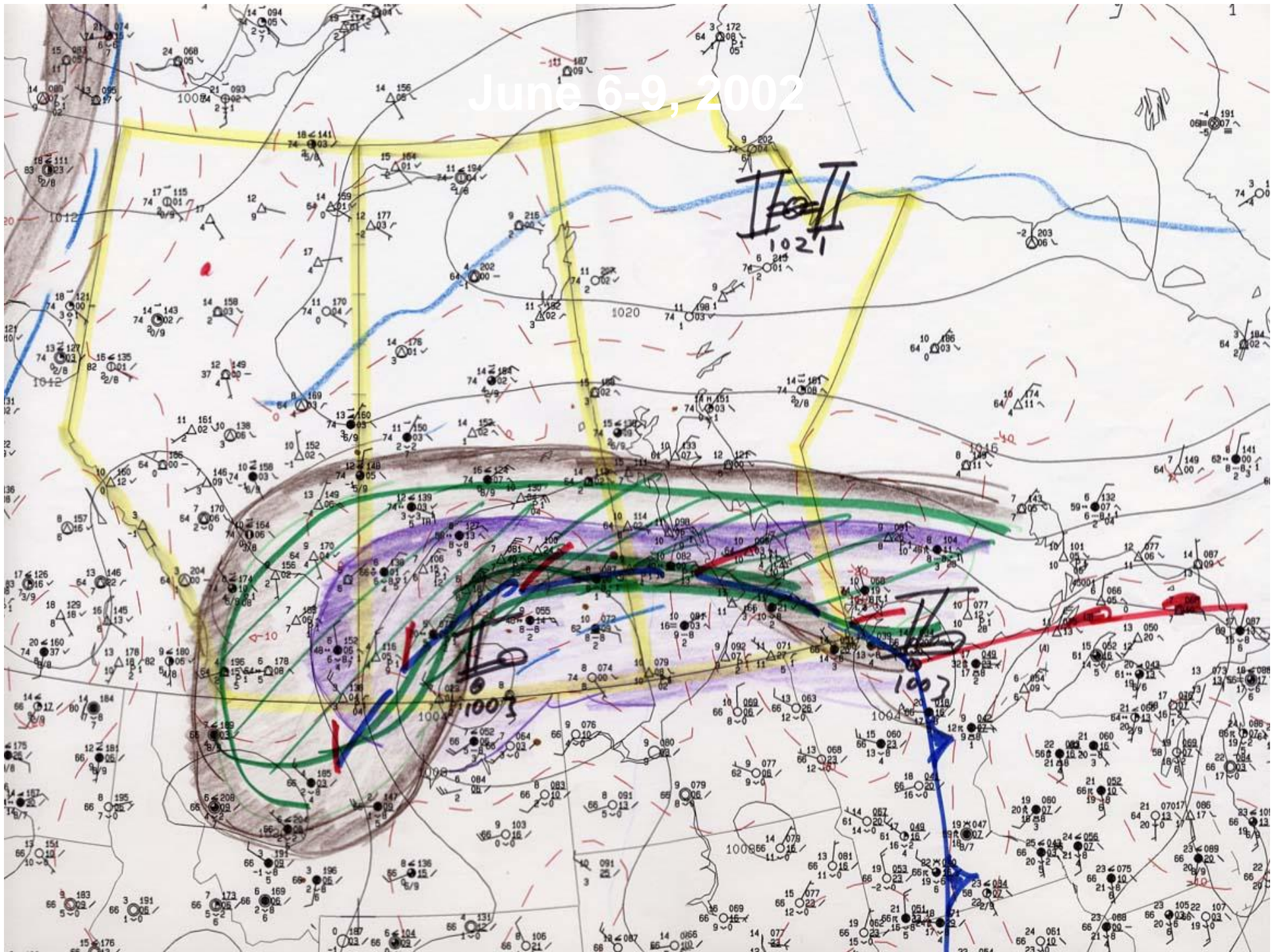
Gregory et al., 1997

SEASONAL PREDICTIONS

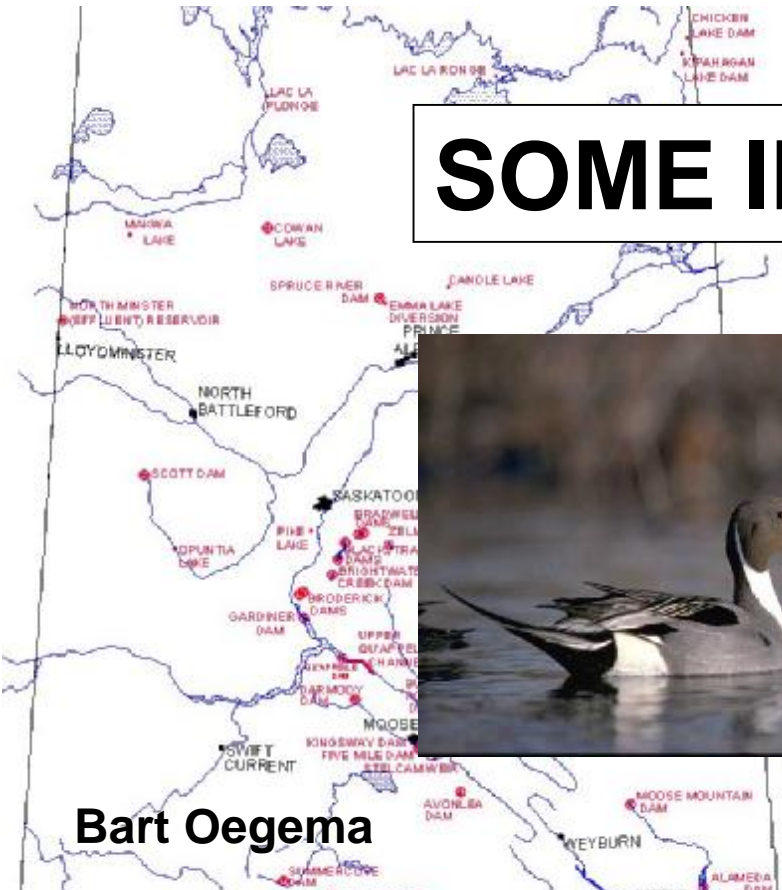
Summer of 2005



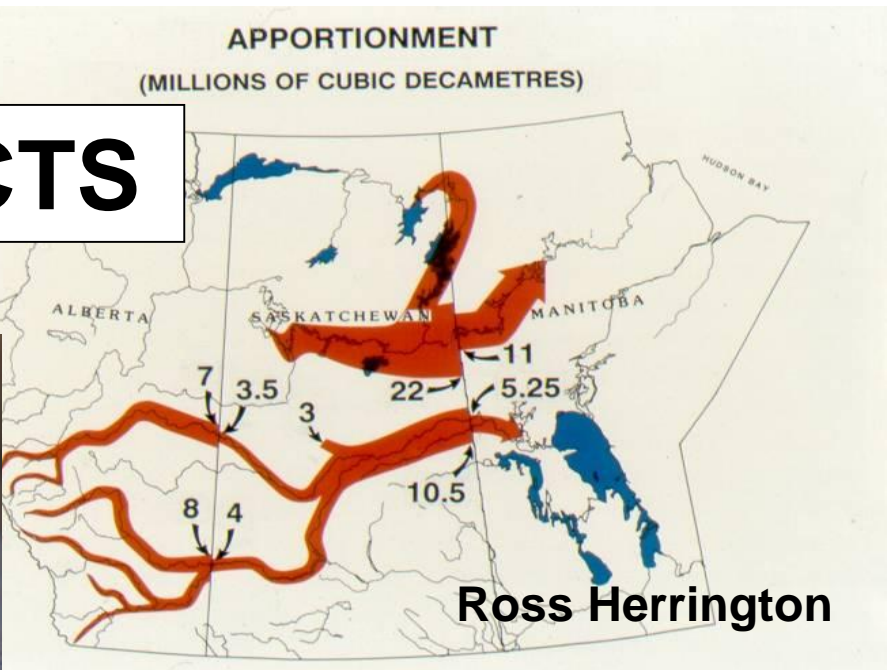
June 6-9, 2002



SOME IMPACTS

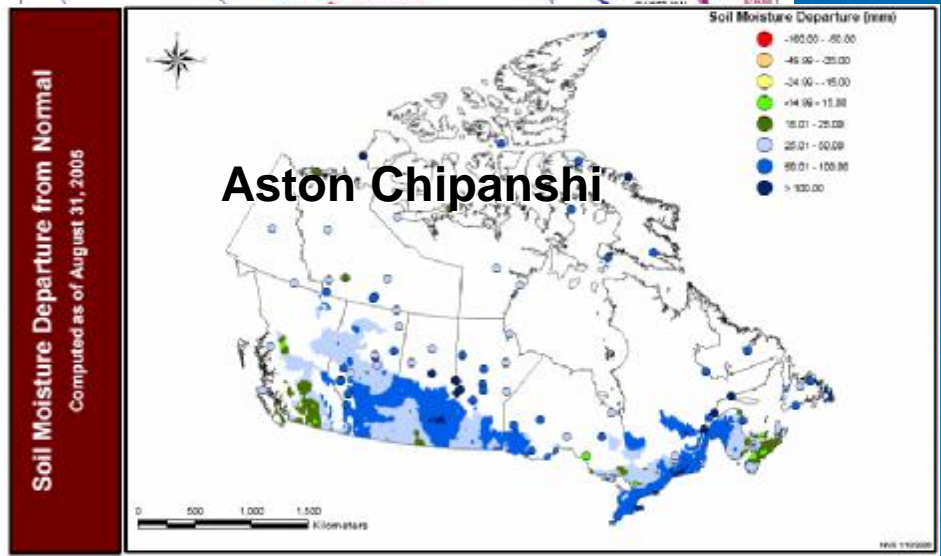


Bob Clark

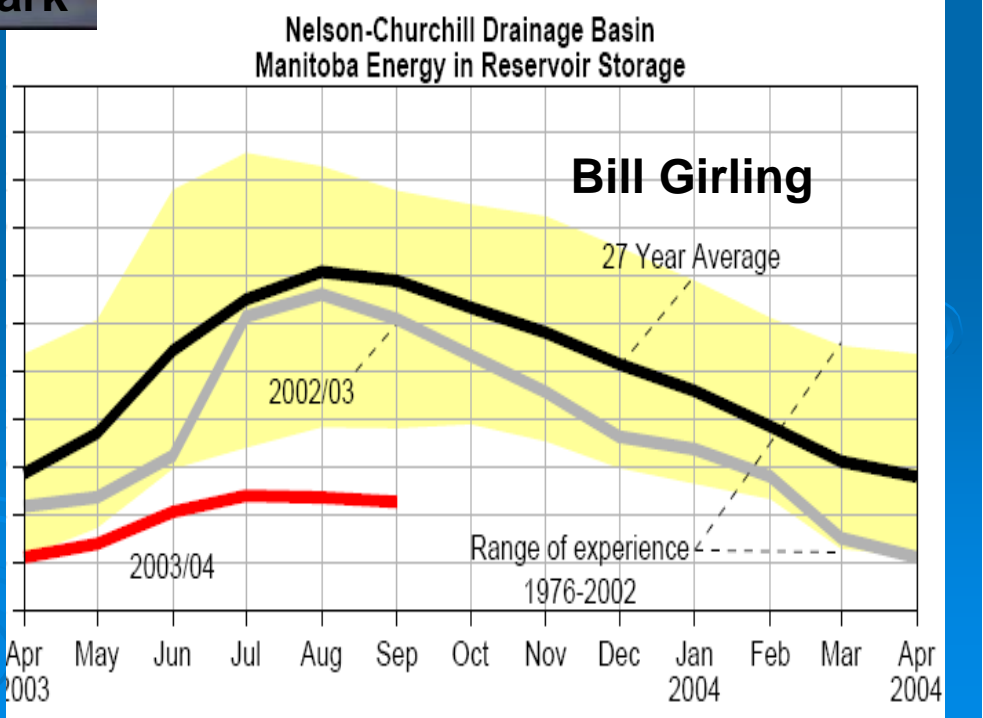


Ross Herrington

Bart Oegema



Aston Chipanshi



Bill Girling

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*

Strategy:

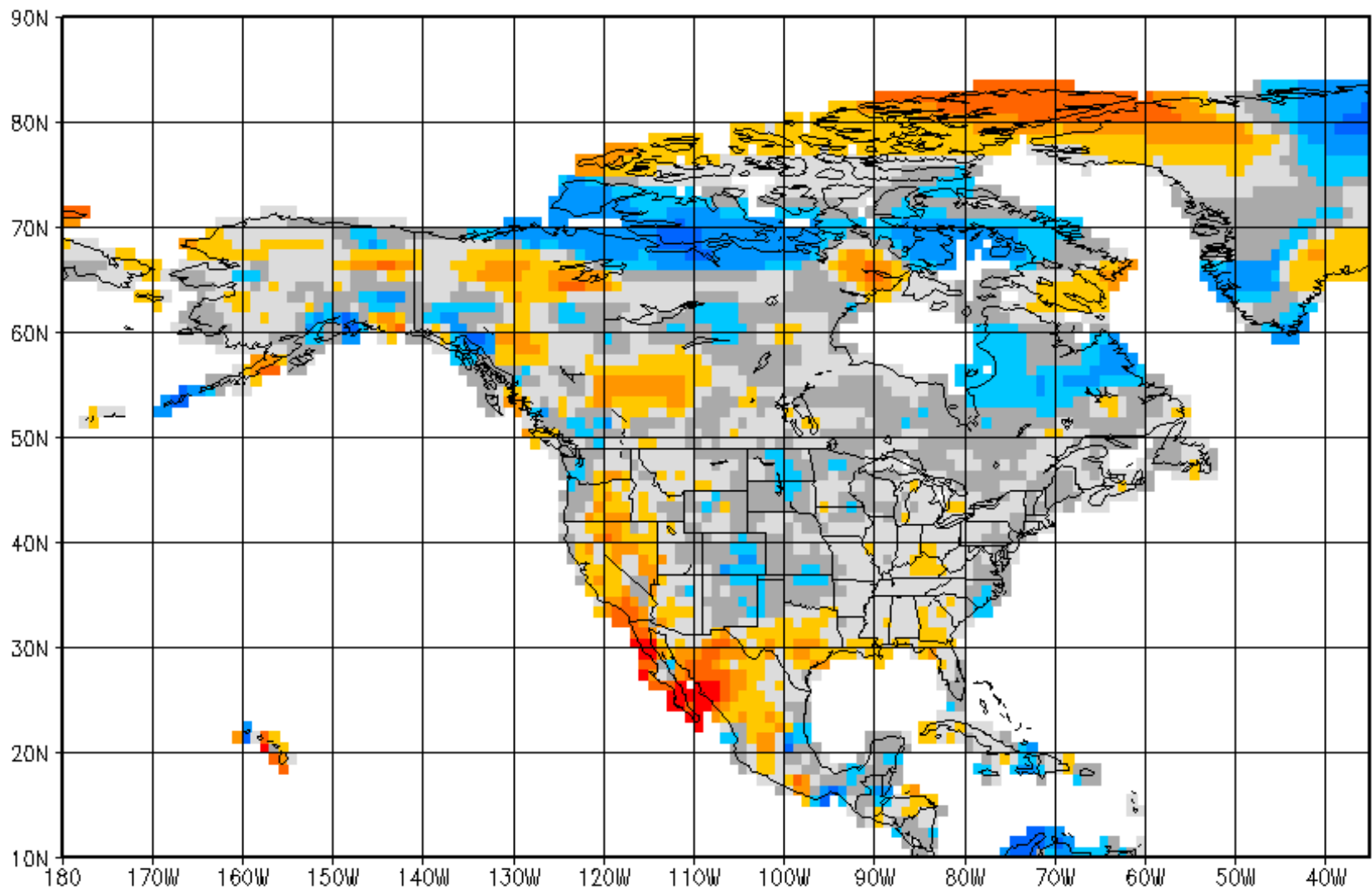
- ∅ Focus on the recent severe drought that began in 1999 and largely ended in 2005*



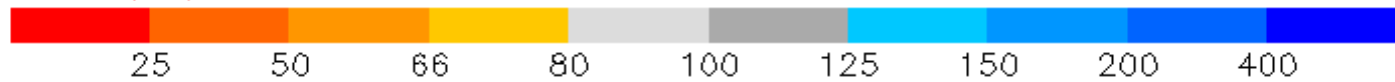
The Canadian
Prairies

A satellite-style map of North America is shown, with the Canadian Prairies region highlighted by a red circle. The map displays various geographical features, including the Rocky Mountains in the west, the Great Lakes in the central-eastern part, and the Gulf of Mexico to the south. The text 'The Canadian Prairies' is overlaid on the circled area in white font. The map is set against a dark blue background, with a lighter blue vertical bar on the right side featuring a subtle ripple pattern.

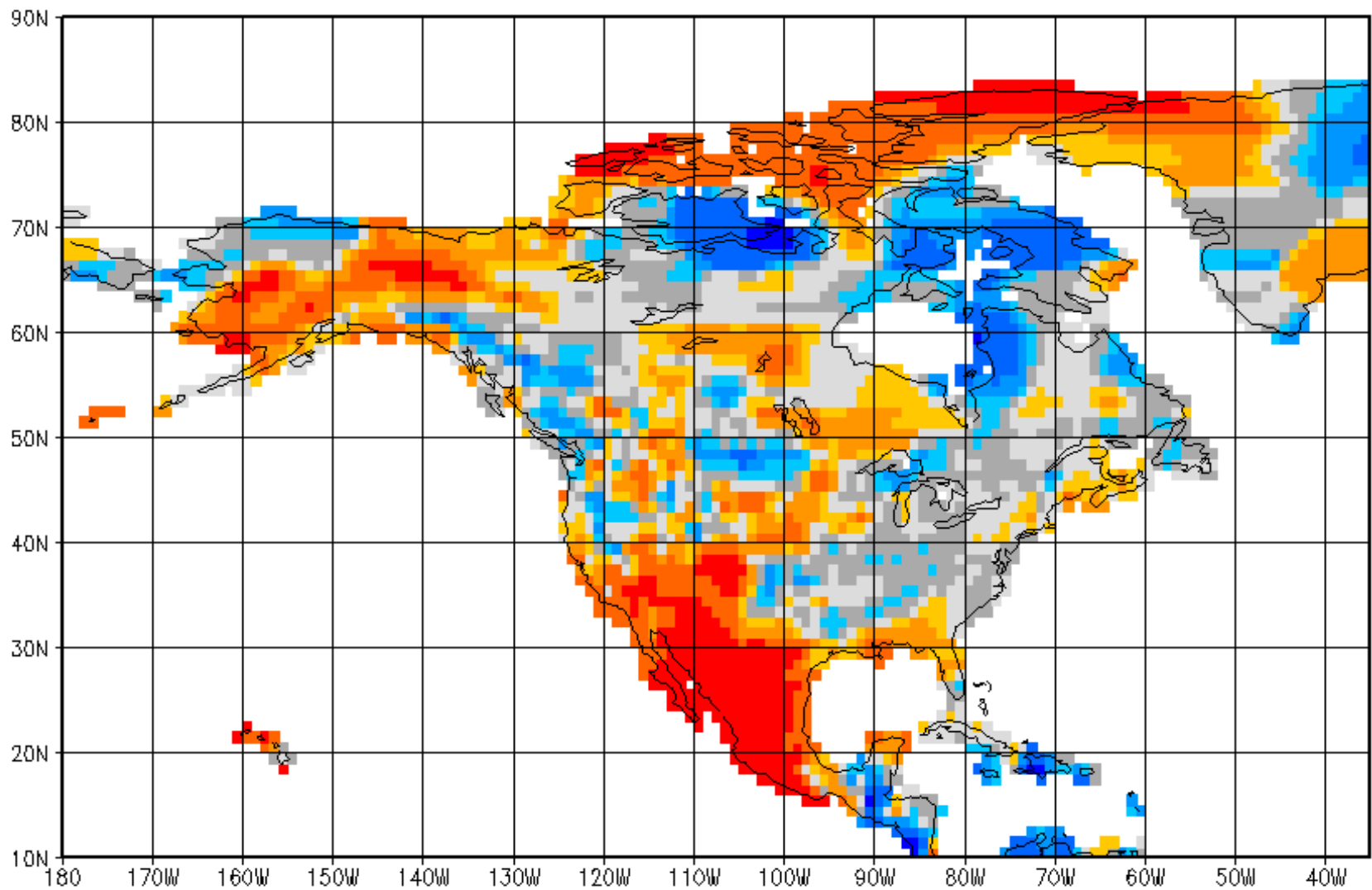
GPCC Full Data Product Version3 Gauge-Based Analysis 1.0 degree
precipitation percentage of normals 61/90 for year (Jan - Dec) 1999
(grid based)



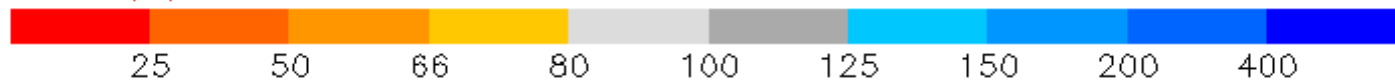
(c) GPCC 2006/11/29



GPCC Monitoring Product Gauge-Based Analysis 1.0 degree
precipitation percentage of normals 61/90 for Season (Dec,Jan,Feb) 1998/1999
(grid based)



(c) GPCC 2007/1/9



STRATEGY

Drought is an aberration in the water and energy cycle that will be studied using a Physical-Dynamical Approach

- Ø **Improve understanding and model representation of processes**
- Ø **Improve understanding and simulation of the whole system**
- Ø **Contribute to better prediction**



Images used and modified with permission by M. Barnes and Digital Saskatchewan, 2003

Why DRI now?

- ∅ The 1999-2004 drought was one of the worst natural disasters that Canada has ever suffered.
- ∅ Recent convergence of modelling and observational technologies
- ∅ Crucial to be better prepared for the next drought period

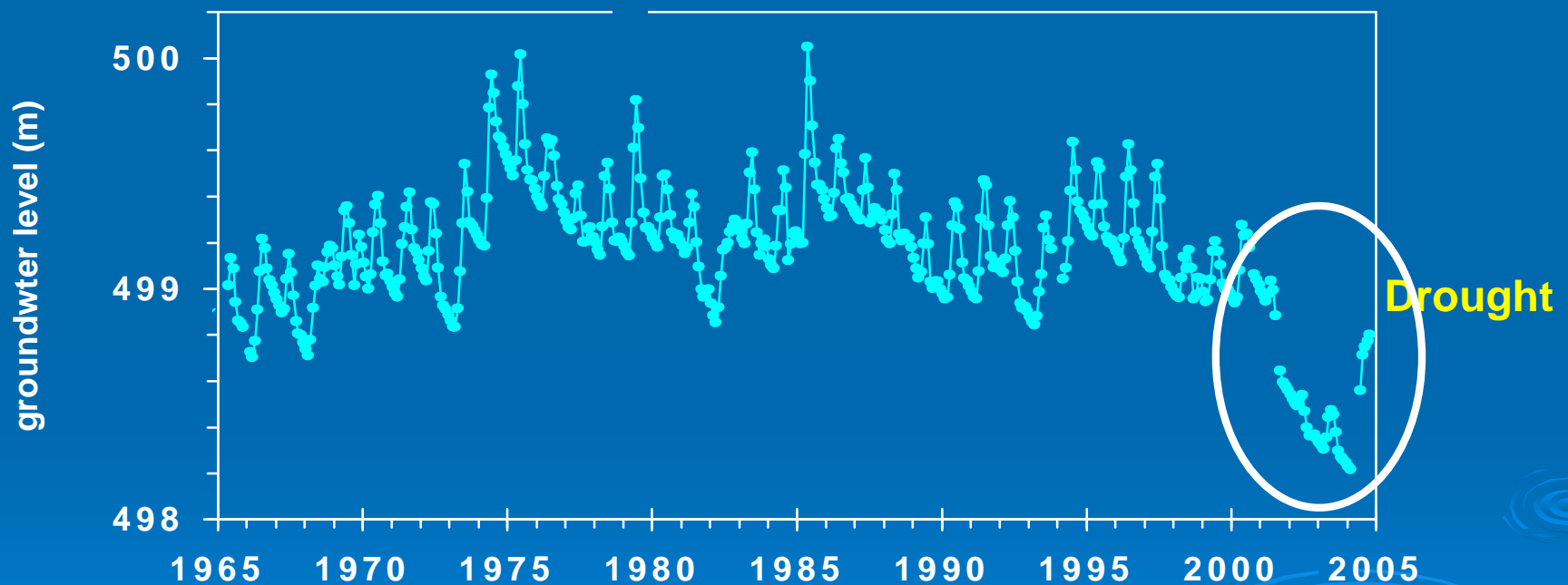


Salt storm in reservoir, Alberta, April 2004



Drifting soil in fields, Saskatchewan, April 2002

Wells show Major Drought Impacts on Sub-Surface Water Levels



Saskatchewan well log

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?

TIMELINE OF DRI

2002

Dec Call for new Network LOIs by CFCAS

2003

Feb Initial LOI submitted to CFCAS

Sept Revised LOI submitted to CFCAS

Nov Acceptance of LOI (3 y Network)

2004

March 18-19 Drought workshop (5 y Network possible)

Dec Proposal submission

2005

June 14 Proposal review

August Proposal formally accepted

2006

Jan 11-12 First workshop

2007

Jan 11-13 Second workshop

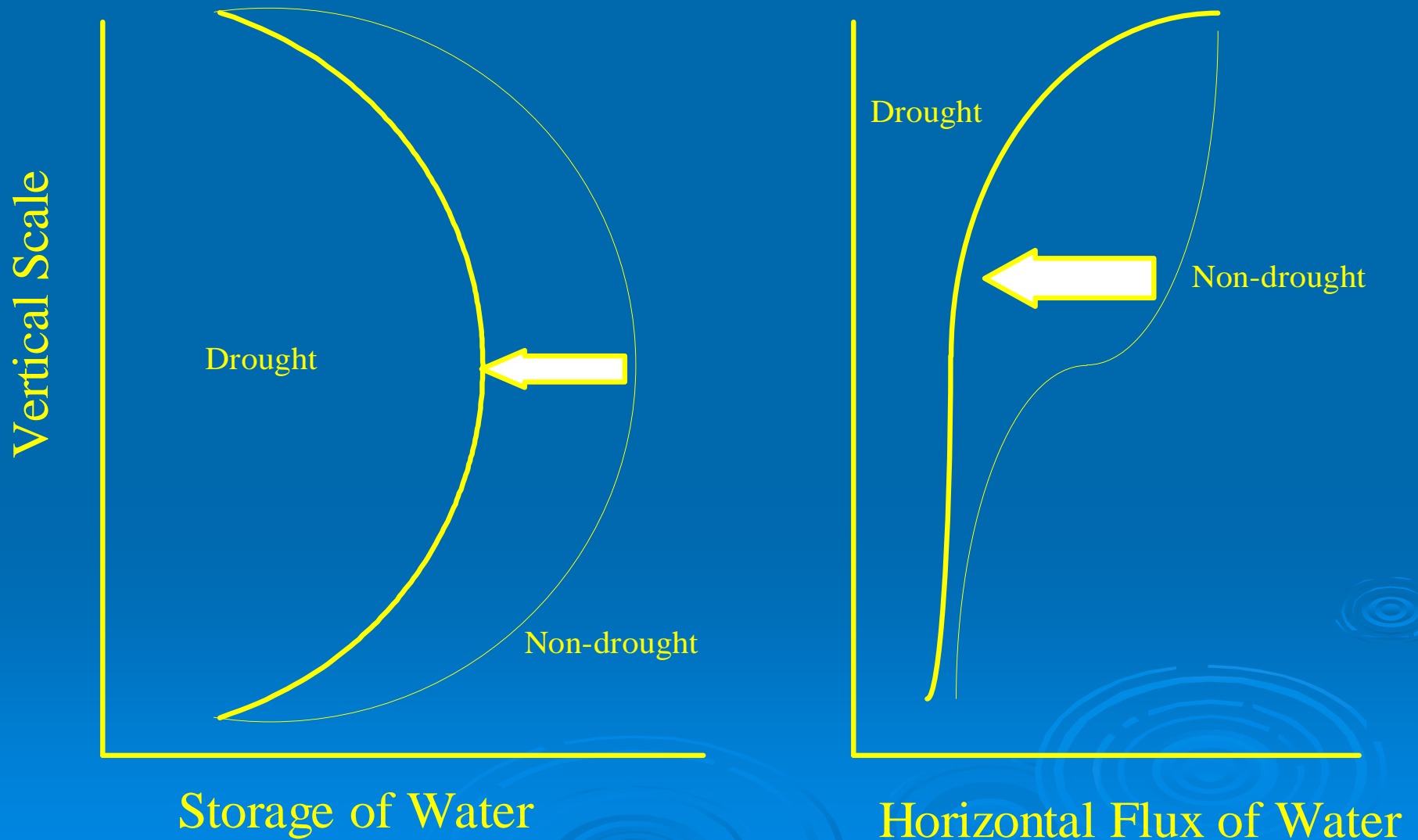
2010

December Completion of all network activities

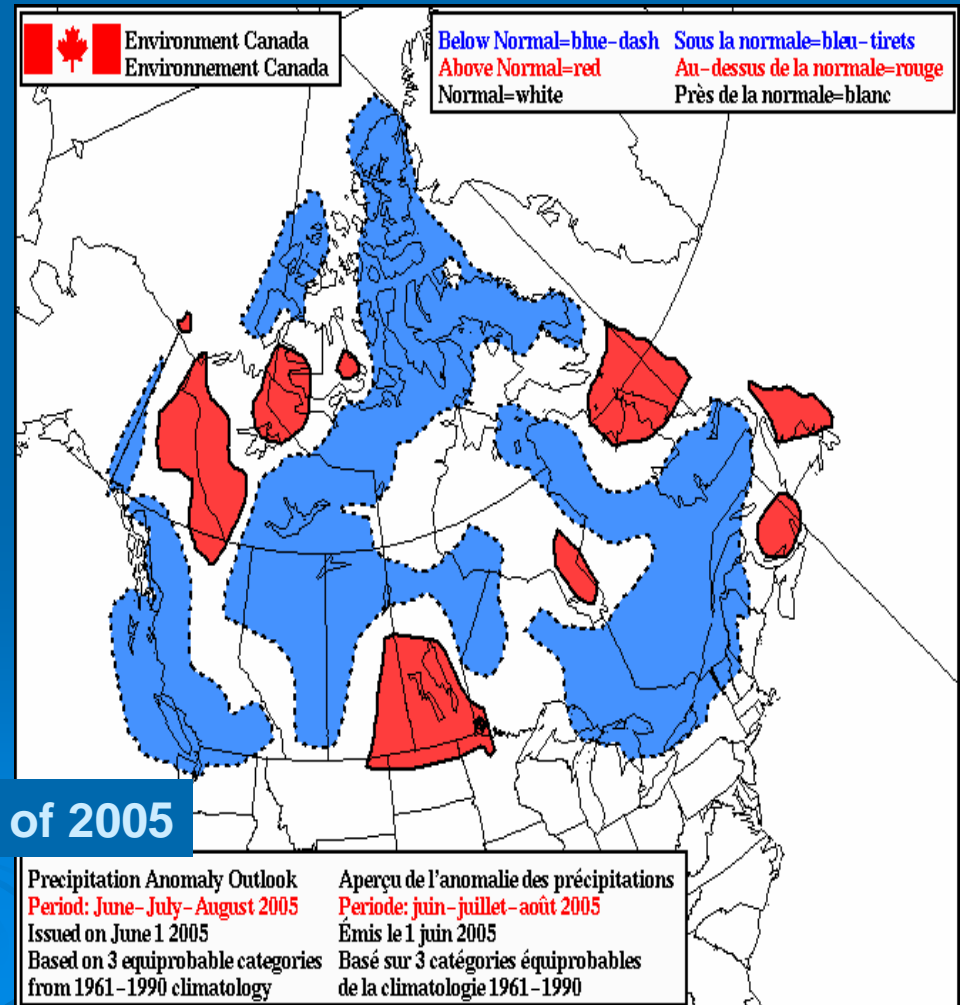
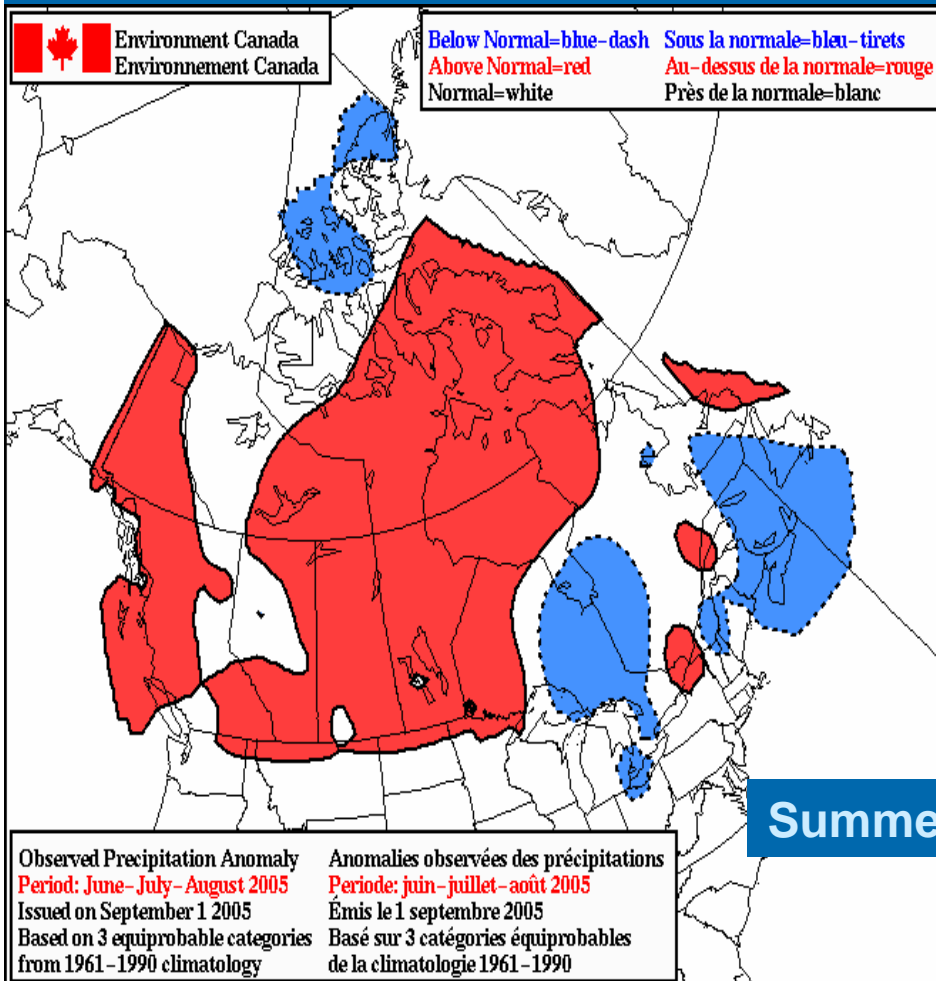
DRI THEMES

1. **Quantify the physical features,**
 - ∅ flows of water and energy into and out of the region, and
 - ∅ storage and redistribution within the region
2. **Improve the understanding** of processes and feedbacks governing the
 - ∅ formation,
 - ∅ evolution,
 - ∅ cessation and
 - ∅ structure of the drought
3. **Assess and contribute to reducing uncertainties in the prediction of drought**
4. **Compare the similarities and differences of current drought to previous droughts and those in other regions**
5. **Apply our progress to address critical issues of importance to society**

2. UNDERSTAND THE DROUGHT



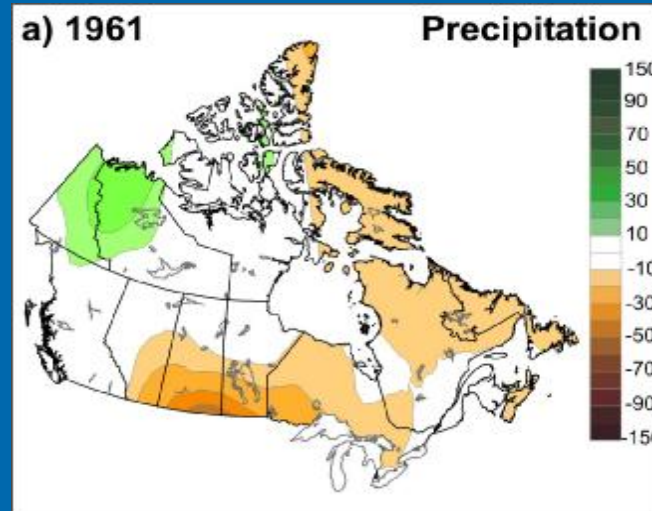
3. Contribute to Improved Predictions



Summer of 2005

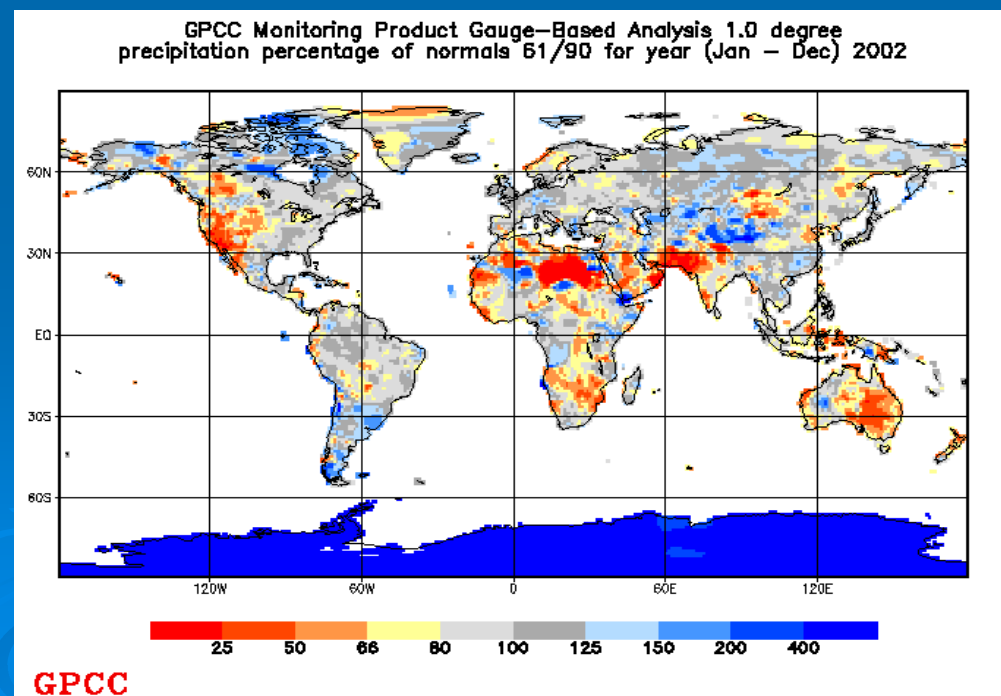
4. COMPARE THE DROUGHT

- ∅ Previous Canadian Prairie Droughts
- ∅ Others in North America
- ∅ Around the world



1961
Precipitation
Anomaly

2002 Global
Precipitation
Anomaly

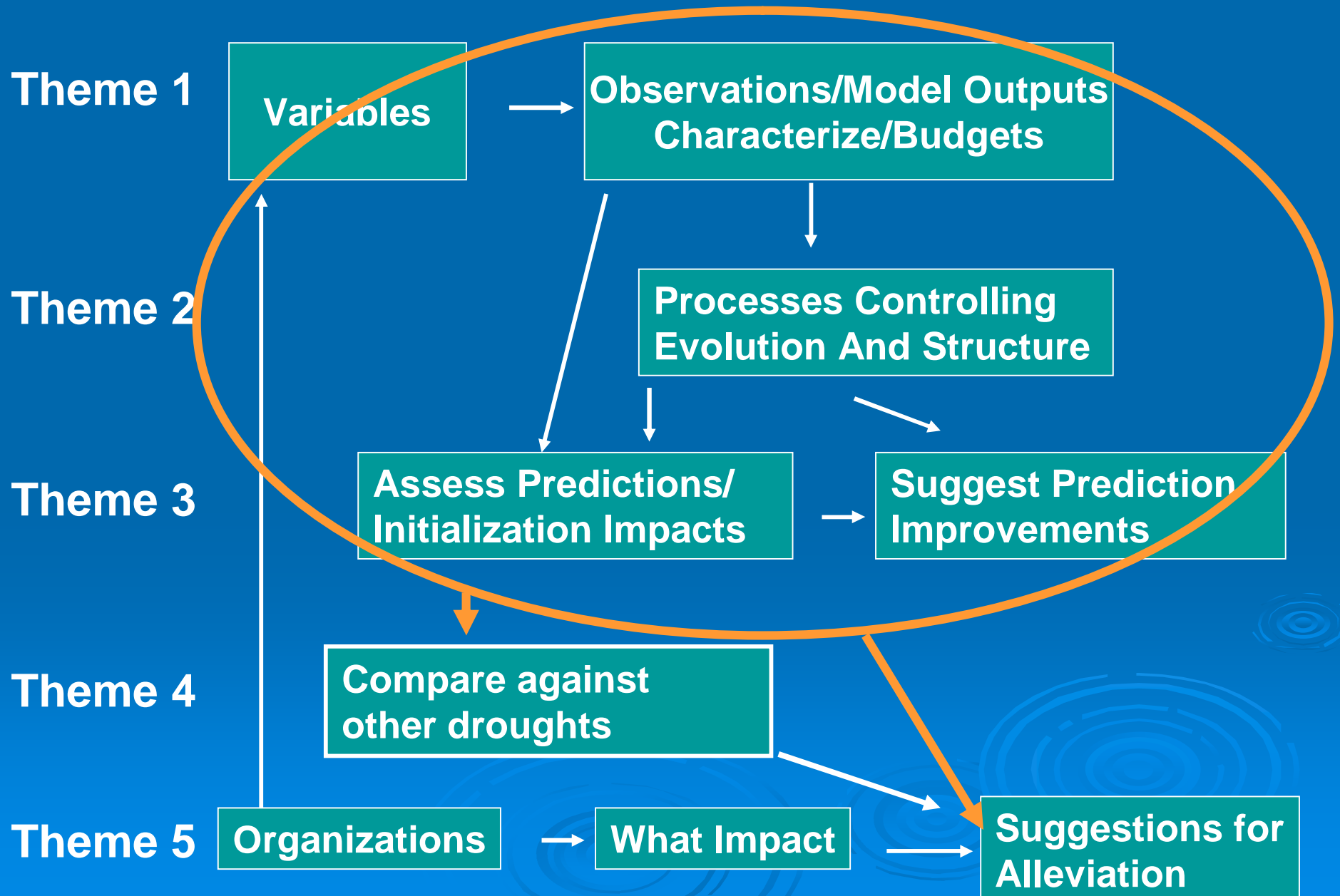


5. INTERACT WITH THOSE AFFECTED BY DROUGHT


Our current list of partners includes:

- Ø Agriculture and Agri-Food Canada
- Ø Alberta Agriculture, Food and Rural Development
- Ø Alberta Environment
- Ø Canadian Forestry Service
- Ø Environment Canada (several components)
- Ø Health Canada
- Ø Manitoba Hydro
- Ø Manitoba Water Stewardship
- Ø Natural Resources Canada
- Ø Saskatchewan Research Council
- Ø SaskWater
- Ø Saskatchewan Watershed Authority
- Ø ... and others are being added

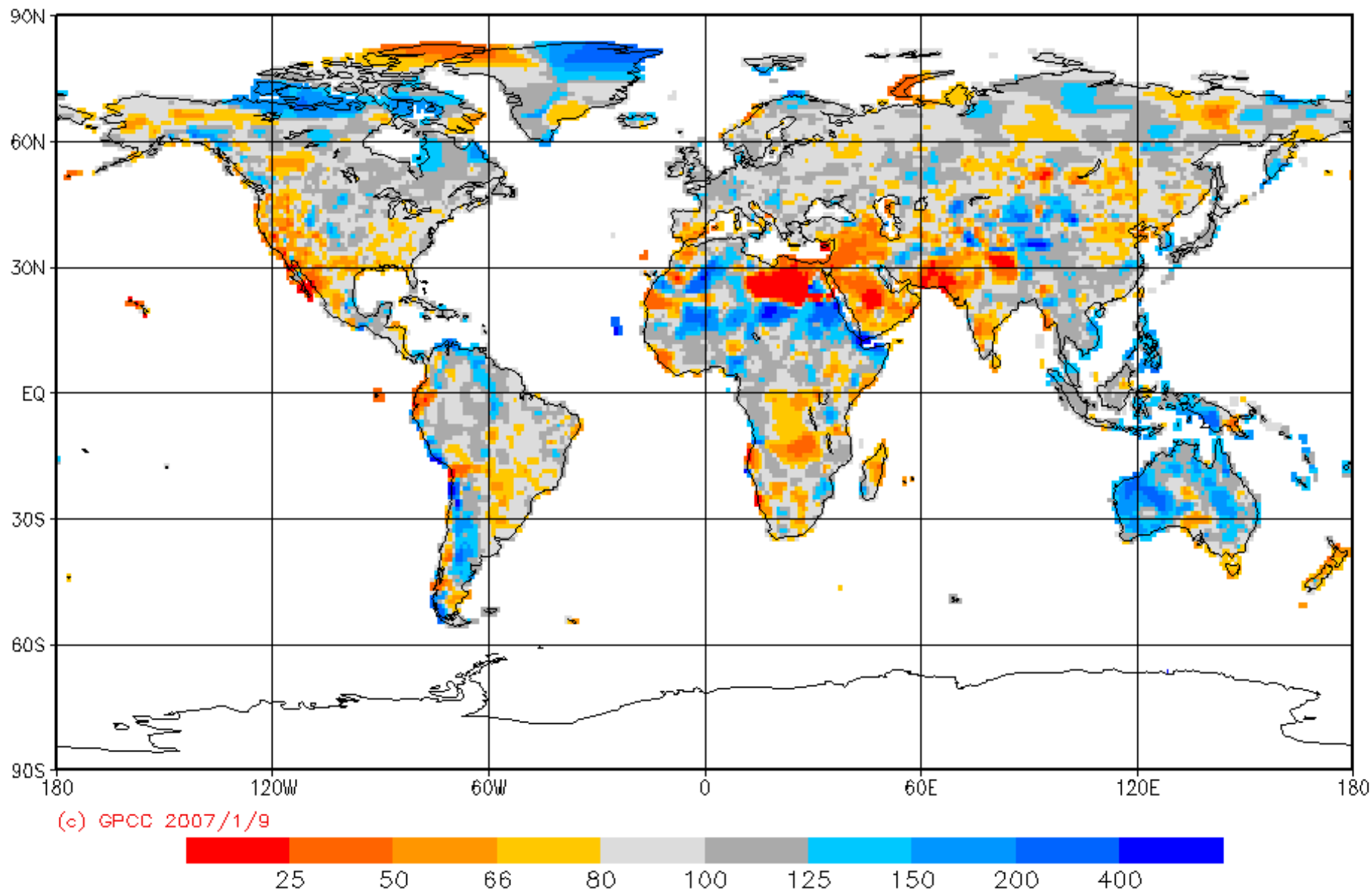
DELIVERABLES AND INTEGRATION OF THEMES



NETWORK DELIVERABLES

- Ø Improved understanding and description of the drought
 - Ø Assessment of simulation and prediction capabilities
 - Ø Recommendations for monitoring, modelling, and predicting drought
 - Ø 'Test bed' for future efforts in integrated water and energy cycle assessment
- 

GPCC Monitoring Product Gauge-Based Analysis 1.0 degree
precipitation percentage of normals 61/90 for year (Jan - Dec) 1999
(grid based)



FINAL STATEMENTS

At the end of DRI:

- ∅ “We have greatly increased our understanding of drought through a focus on the recent 1999-2004/05 one over the Prairies and we have applied this to improved prediction.”
- ∅ “We have left a legacy of comprehensive datasets, improved observational and modelling techniques, a new generation of drought scientists, and a public better educated about drought.”
- ∅ “We have, in partnership with others in Canada and internationally, developed a plan to improve drought and water cycle prediction at multiple scales.”

STATEMENT

January 2006

“We have brought together our diverse teams of researchers and partners for the first time. We have learned more about the importance of drought, we have illustrated our individual research objectives and interests, and we have summarized our overall plans. We also decided to press ahead with addressing comparisons and society interactions. Challenges that we face include improving our data management plans and developing a more specific strategy for working together.”

LAST YEAR'S PROGRESS

- ∅ Research advances
- ∅ Collective efforts
- ∅ Interactions
- ∅ Information management
- ∅ Network management
- ∅ ...



WORKSHOP OBJECTIVES

In general, the objective of this workshop is to:
continue to move the network ahead


Specific sub-objectives include:

- Ø Review our network objectives and strategy
- Ø Identify challenges and opportunities
- Ø Update our plans for scientific delivery
- Ø Enhance collaborations and cohesion

THE TEAM

- ∅ Co-leads:
Ron Stewart (PI, *McGill*) and John Pomeroy (*Sask*)
- ∅ Network Manager:
Rick Lawford (Manitoba)
- ∅ Information Managers:
Matt Regier (HAL, EC), Patrice Constance (Ouranos)
- ∅ Investigators (13):
Bonsal (*Sask/NHRC*), Bullock (*Man*), Gyakum (*McGill*), Hanesiak (*Man*), Hayashi (*Calg*), Leighton (*McGill*), Lin (*McGill*), Pietroniro (*Sask/NHRC*), Snelgrove (*Memorial*), Strong (*Alta*), van der Kamp (*Sask/NHRC*), Wheaton (*Sask/SRC*), Woodbury (*Man*)
- ∅ Collaborators (14):
Boer (*MSC*), Caya (*Ouranos*), Derome (*McGill*), Derksen (*MSC*), Donaldson (*MSC*), Granger (*NHRC*), Martz (*Sask*), Raddatz (*MSC*), Ritchie (*MSC*), Shabbar (*MSC*), Sills (*MSC*), Smith (*MSC*), Szeto (*MSC*), Walker (*MSC*)
- ∅ Research expertise covers critical areas for DRI
- ∅ Solid track record of working together as well as being in and leading networks

ORGANIZATION OF WORKSHOP

- Ø Overviews of the Importance of Drought and Water Resources
 - Ø Specific Research
 - Ø Partner Issues and Research
 - Ø Discussions of Issues and Challenges
 - Ø Future Activities
- 

ONE WORKSHOP QUESTION

Ø Should we evolve into a larger effort?

Ø Developments

other Canadian

US

International (WCRP, UNESCO, ICSU)

WORKSHOP OUTCOMES

- ∅ Collective appreciation of our network goals
 - individual activities
 - issues and challenges
- ∅ Actions for moving forward
- ∅ Summary of our collective status

Enjoy the workshop!

