

---

# **Drought and the Canadian Prairies**

---

---

# Objective

---

To provide a brief overview on the occurrence, features, driving factors and impacts of drought over the Canadian Prairies

Material is largely from:

- Drought Research Initiative (2005-11)

- Changing Cold Regions Network (2013-...)

---

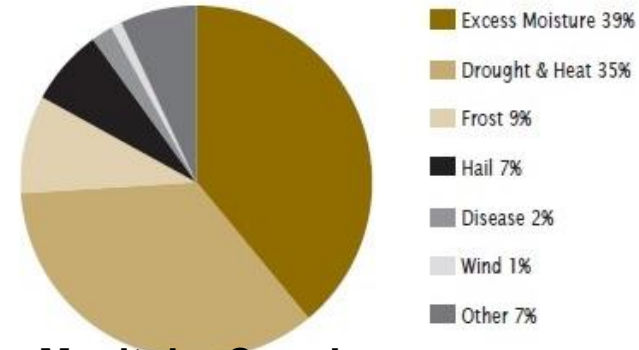


The Canadian  
Prairies

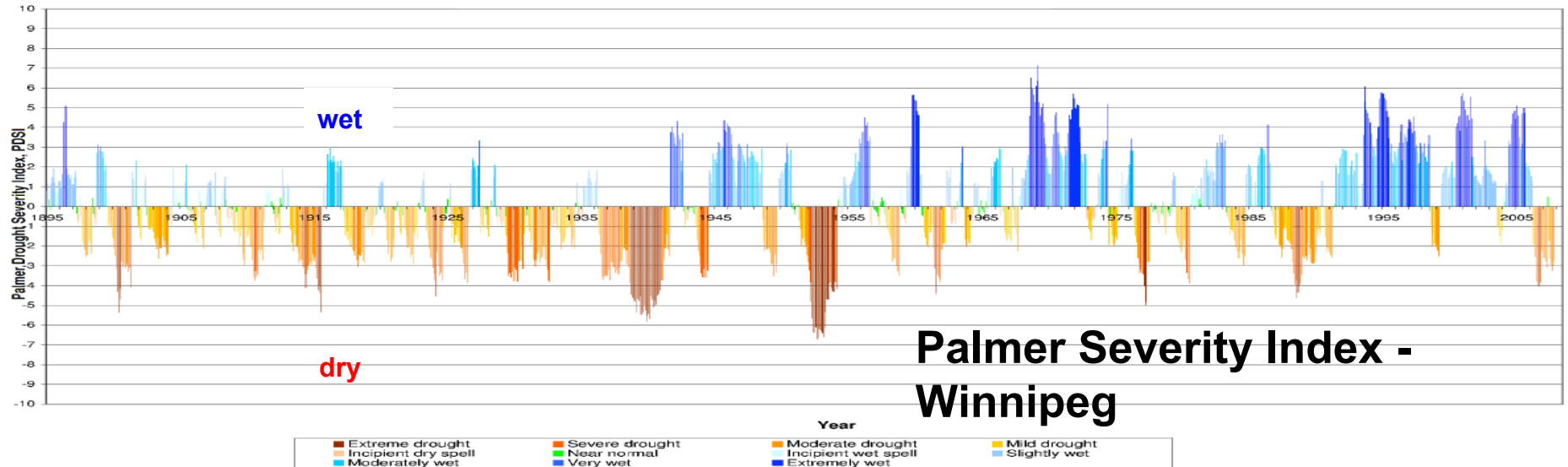
# Wet and Dry

**Note: Drought tends to occur more often on the western side of the Prairies**

Historical Causes of Loss (1966 - 2011)



**Manitoba Crop Insurance**

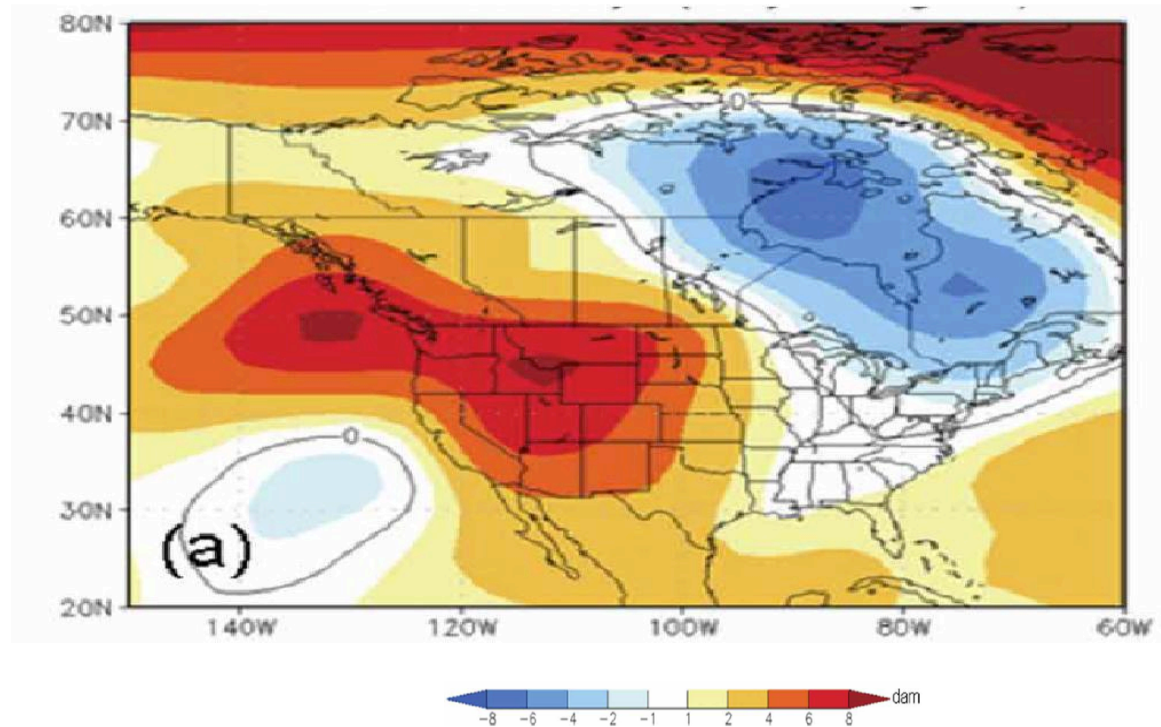




# Common Summer Drought Pattern

May-August

1000-500 mb  
height anomaly



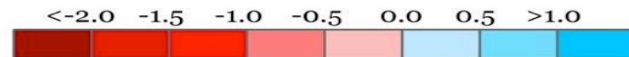
**CRCMccsm - June, July, August  
2040-2069 - 1970-1999 Average SPEI**

# Standardized Precipitation- Evapotranspiration Index

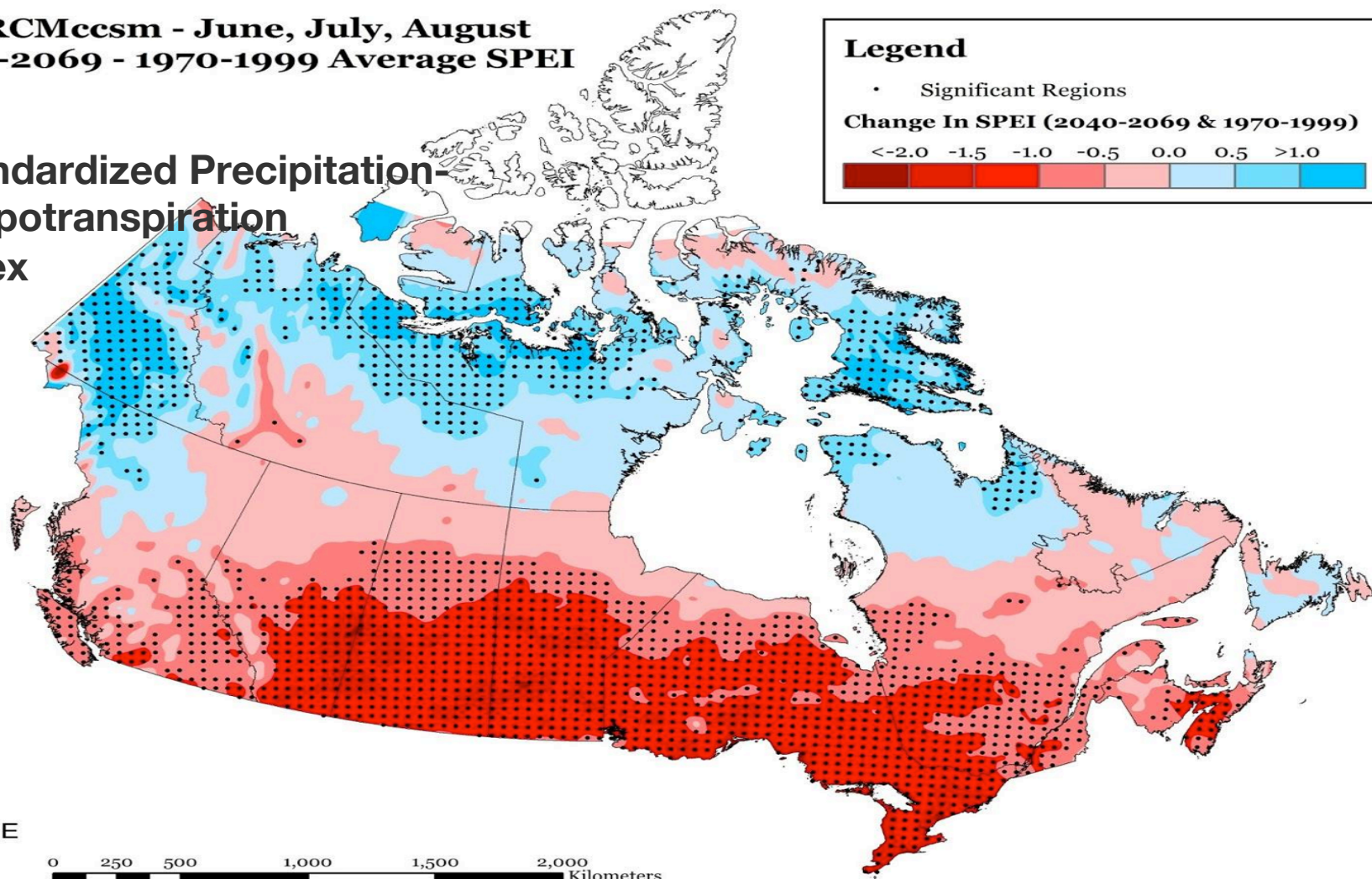
## Legend

- Significant Regions

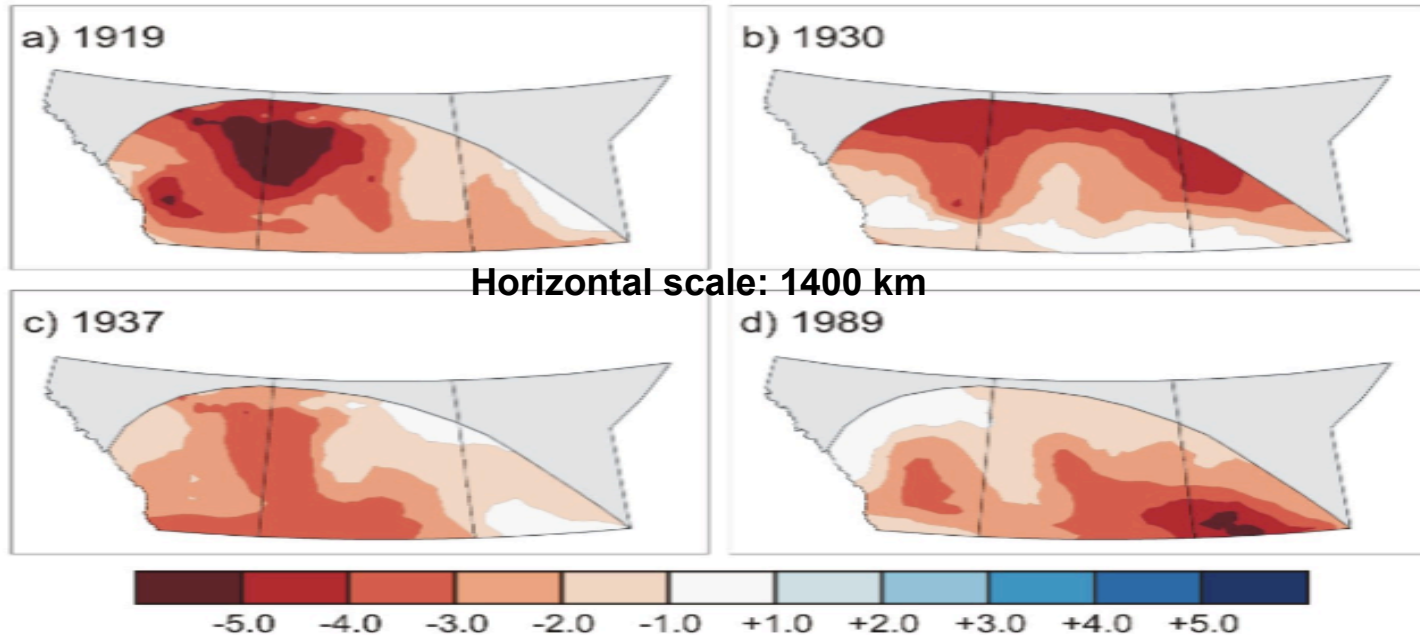
**Change In SPEI (2040-2069 & 1970-1999)**



0 250 500 1,000 1,500 2,000 Kilometers



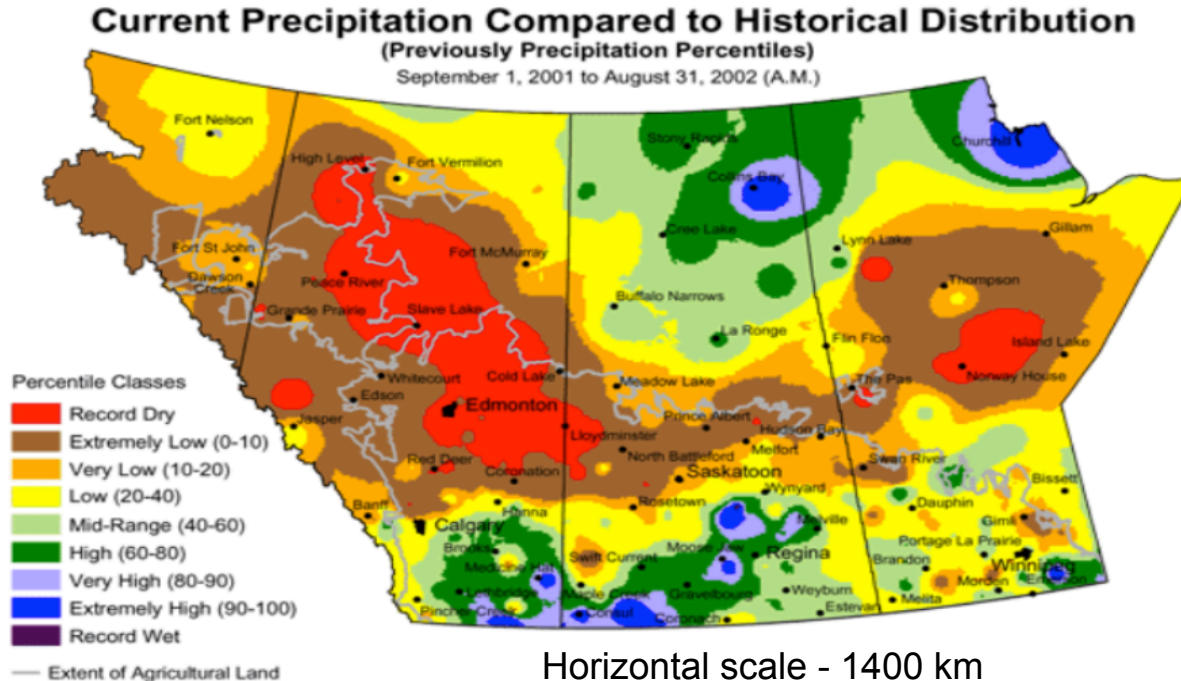
# Previous Severe Droughts



**Palmer Drought Severity Index (PDSI) for  
several agricultural years with severe drought**

# CANADIAN PRAIRIES

## 2002

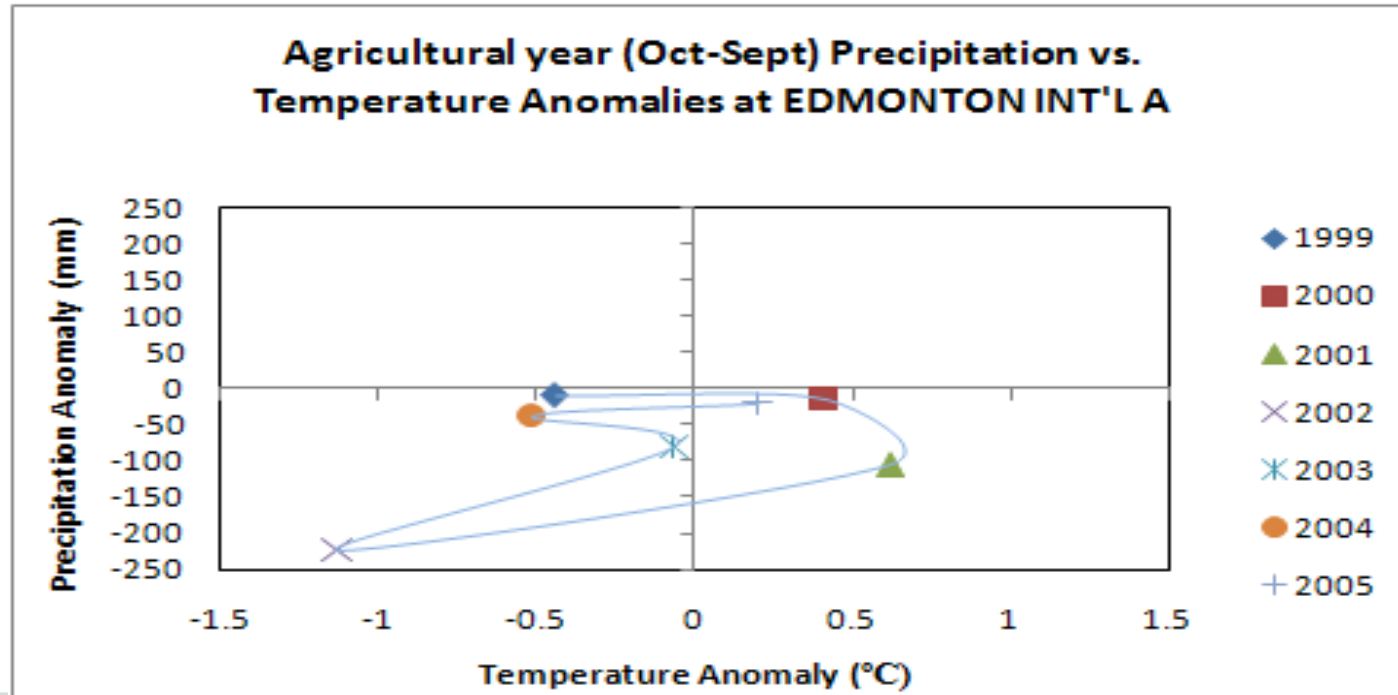


Prepared by PFRA (Prairie Farm Rehabilitation Administration) using data from the Timely Climate Monitoring Network and the many federal and provincial agencies and volunteers that support it.

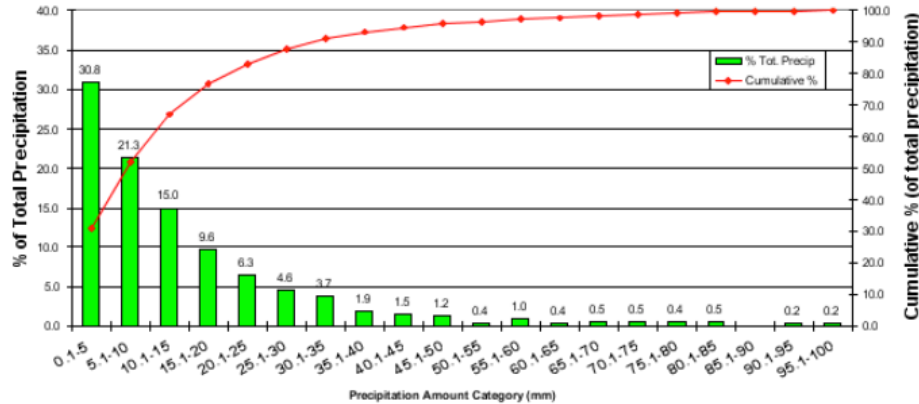
# PRECIPITATION-TEMPERATURE ANOMALY

## Agricultural Years (Sept-Aug) Edmonton

---



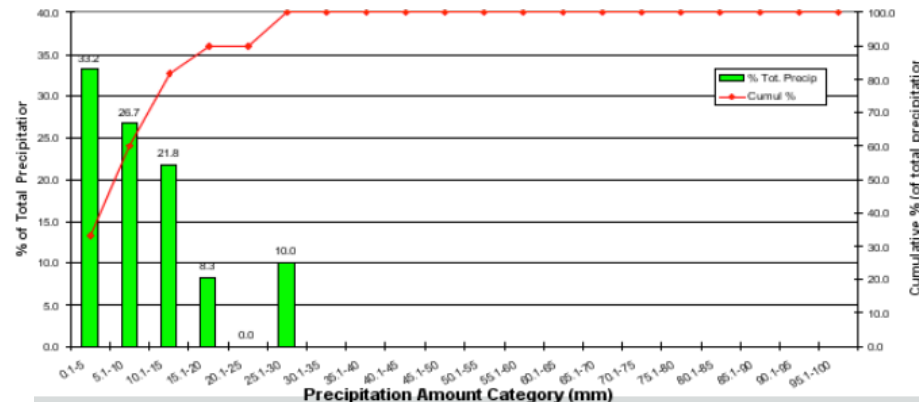
# Daily Precipitation Amounts: Edmonton



Low precipitation event:  
< 10 mm

## Climatology

Low precipitation  
events: 52% of total



## Sub-drought 2002

Low precipitation  
events: 60% of total



# VIRGA

Clouds can be present although they  
are inefficient in terms of precipitation  
production

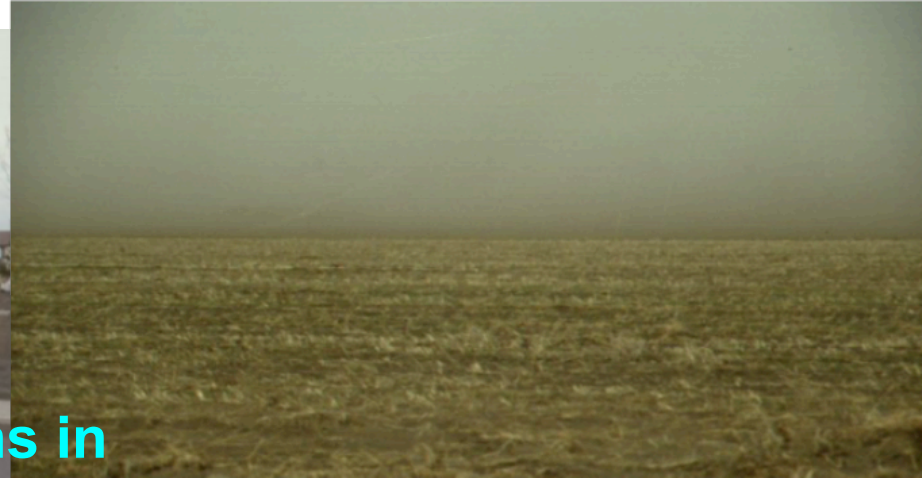
Summer 2002 - Edmonton

Precipitation Amount Reduction (%)	-49
Precipitation (h) (convective/stratiform)	123
Virga (h)	130

# DUSTSTORMS



32 major dust storms in  
Saskatchewan in 2002



Droughts tend to be windy or  
at least have windy periods



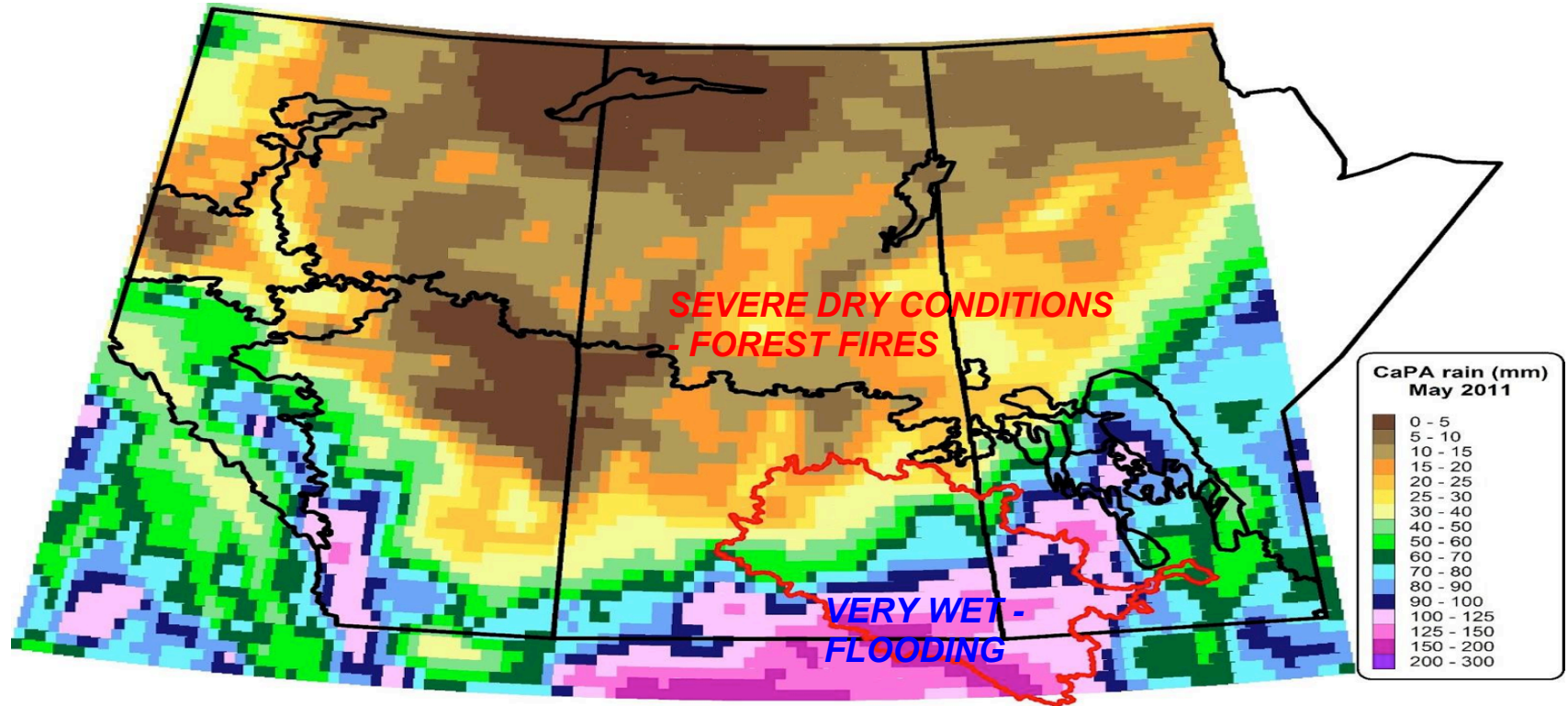
# METEOROLOGICAL DROUGHT TYPES

- The sustained lack of precipitation can be linked with different 'types'

No precipitation	... or ...	Sprinkles
Virga		Chance of catastrophic rain
Steady rain		Torrential rate
Hot		Cold
Windy		Calm
Dusty		Clear
Cloud-free		Cloudy

- A drought can go between 'types'

# May 2011 - Variability



# Drought Impact Mitigation

- Infrastructure construction and management
- Management of surface and groundwater allocation
- Water conservation
- Drought friendly agricultural management
- Transboundary water management and agreements
- Restoration of wetlands
- Education and awareness



# CCRN-Related Drought Studies

---

- Paleo records, monitoring and trends
- Teleconnections and circulations
- Regional and local atmospheric studies
- Surface effects (hydrology, ecology, forest fires, agriculture...)
- Regional scale modelling including land-area feedbacks
- Future projections
- Impacts and adaptation (government agencies...)

*Note: Trevor Hadwin (AAFC) is speaking tomorrow*

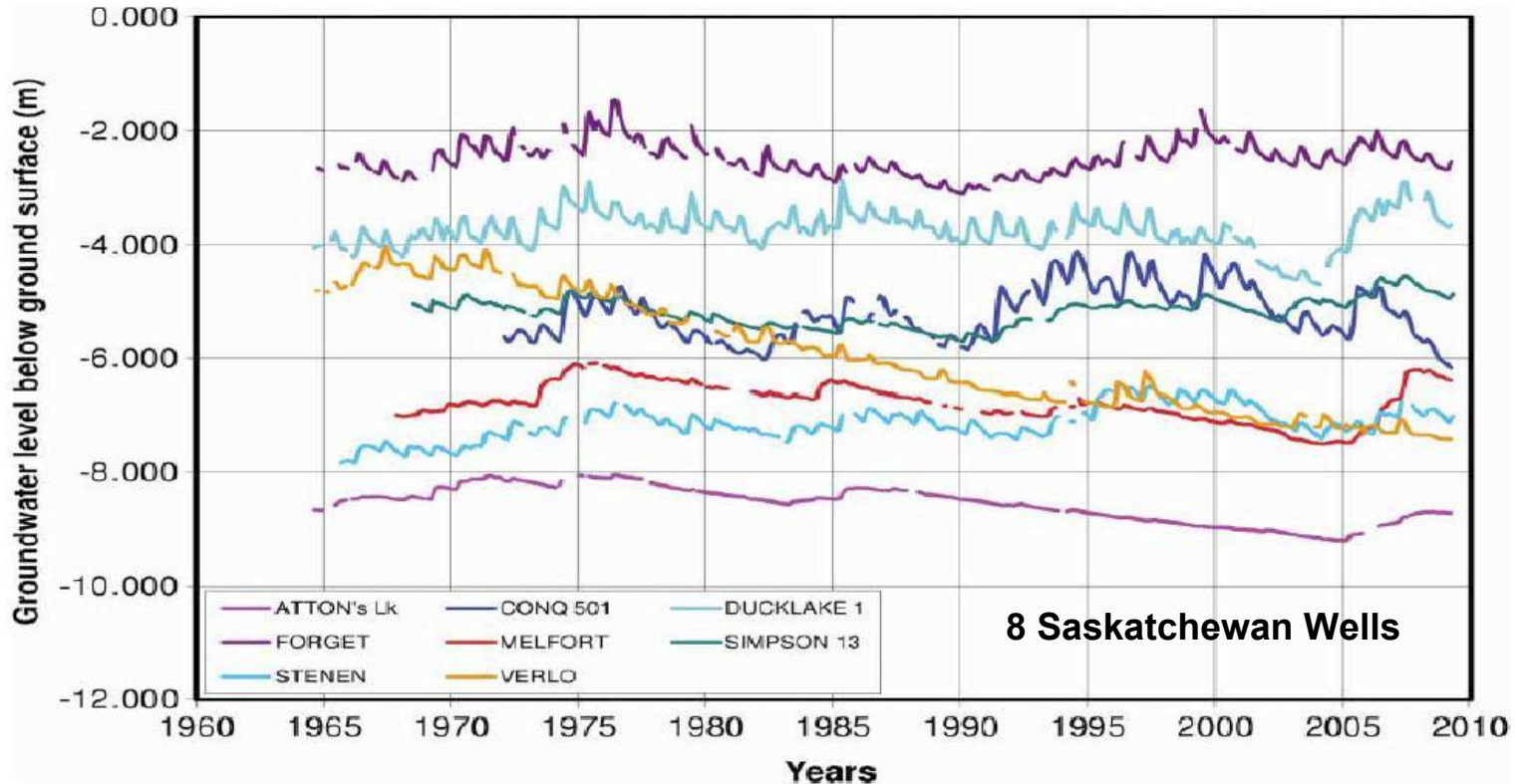
---

# Concluding Remarks

---

- Drought is an inherent issue on the Prairies
  - Drought features are linked with many factors
  - There are immense impacts on many sectors
  - Adaptation approaches are being improved
  - CCRN is carrying on drought research, building on previous activities such as DRI
-

# Groundwater Well Levels

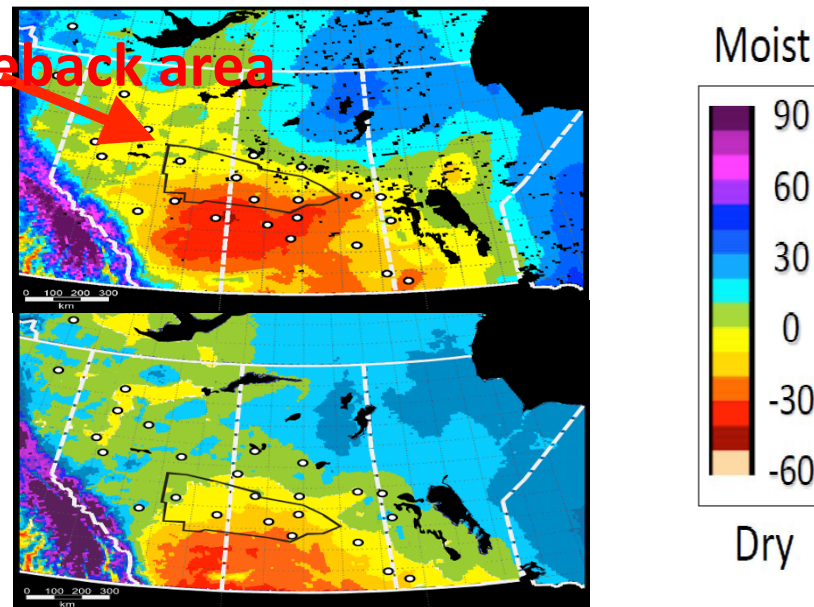




# Climate Moisture Index CMI ( $P-ET_p$ )

2001-02 vs. Long-term  
(Ted Hogg, CFS)

- Drought was unusually severe in 2001-2002, driest in >100 years across a large area
- Led to massive, sustained aspen dieback and mortality, especially along the northern edge of the prairies
- CMI maps by D. Price, M. Siltanen & D. McKenney, CFS



# Regional, post-drought decline in aspen growth of 30%, widespread aspen dieback and mortality



**SK Parklands  
August 2004**

(photo by Mike Michaelian, CFS)

[www.usask.ca/water](http://www.usask.ca/water)



# Drought Response 'Practice'

---

Drought Preparedness Partnership (DPP)

Pilot Exercise: Manitoba

January 13, 2010

- The DPP exercise was developed to test and improve institutional drought preparedness and response in Canada. The DPP simulation approach was first tested in a pilot workshop in Saskatchewan in 2008.
  - The exercise planning team consisted of representatives from Agriculture and Agri-Food Canada (AAFC), Manitoba Water Stewardship (MWS) and Manitoba Agriculture, Food and Rural Initiatives (MAFRI).
  - The exercise assessed current drought capability in terms of the historical droughts of 1988 and 2003 and a future 2030s drought scenario.
-

---

teleconnections

ion general el nino - warm and dry winters

pdo and nao mainly winter

summer less robust

some connection with n pac sst (like pdo) and dry summers

el nino tends to lower precip in west canada

2001 and 02 no clear such connections as in past cases

not linked with el nino

N PAC SST AND CIRCULATIONS MAY HAVE BEEN CRITICAL

north extension of us started drought - other ones developed over canada

POSITIVE PDO IN 2001 TO 02 DIFFERENT FROM PREVIOUS

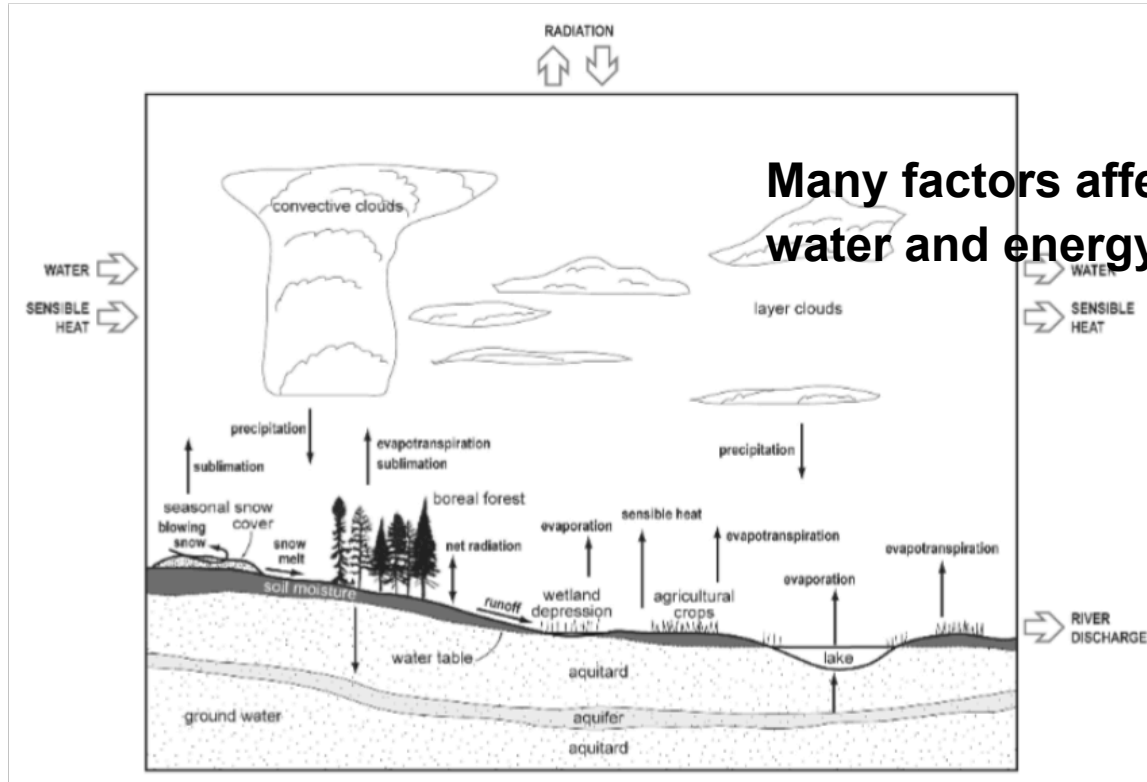
MAINLY WEAK TO MODERATE LA NINA TO ENDED UP WEAK EL NINO

PDO AND PNA MAINLY NEGATIVE IN WORST PART OF DROUGHT BUT POSITOVE AFTER 2002

LACK OF BOTH POSITIVE PDO AND PNA UNUSUAL

---

# WATER AND ENERGY CYCLING



Many factors affect the cycling of water and energy during drought

# Vertical Moisture Flux

---

