Droughts in Canada: An Overview

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Outline

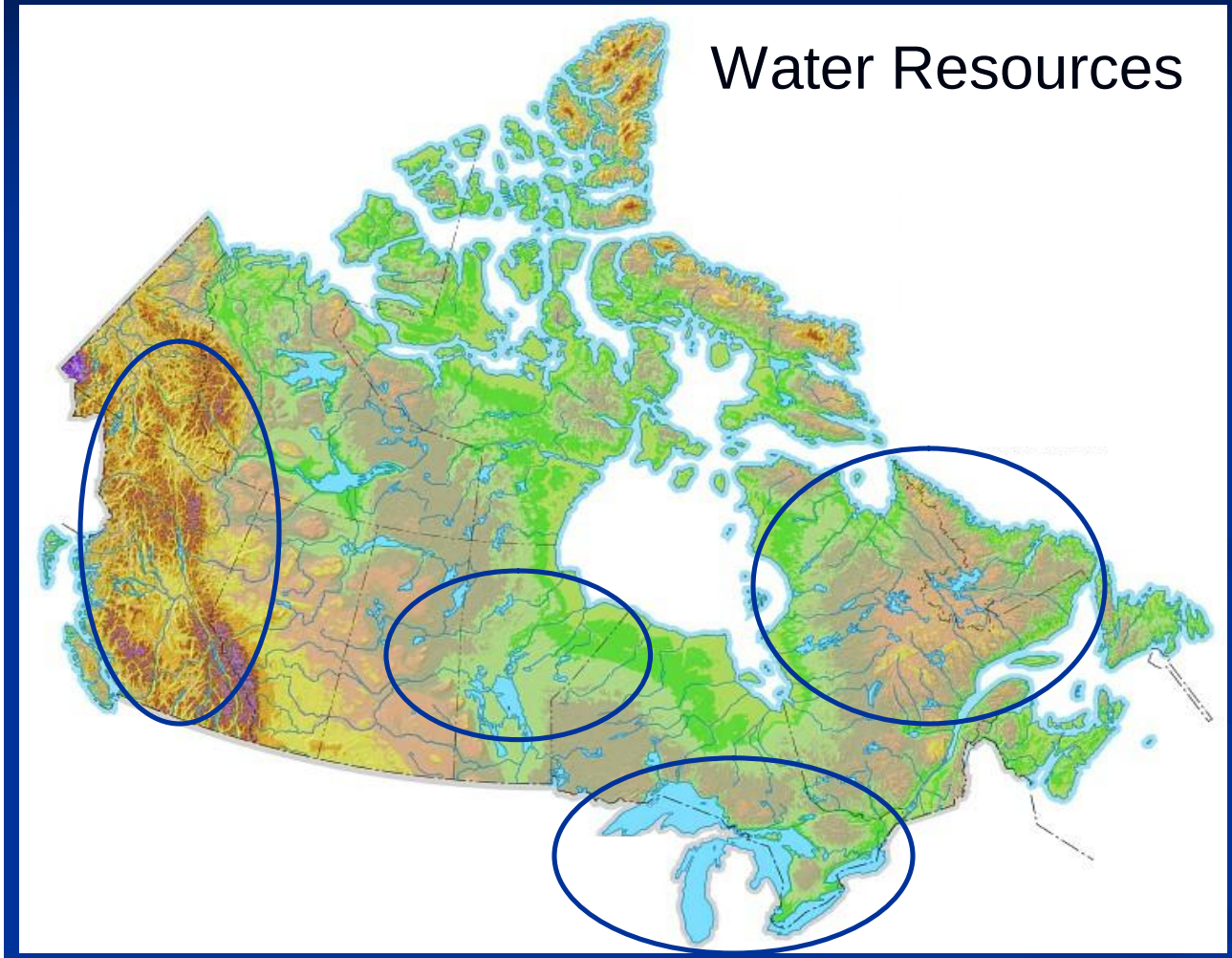
- Background
- Past drought occurrence
- Large-scale atmospheric causes
- Current monitoring & prediction
- Future droughts
- Research requirements

Droughts in Canada

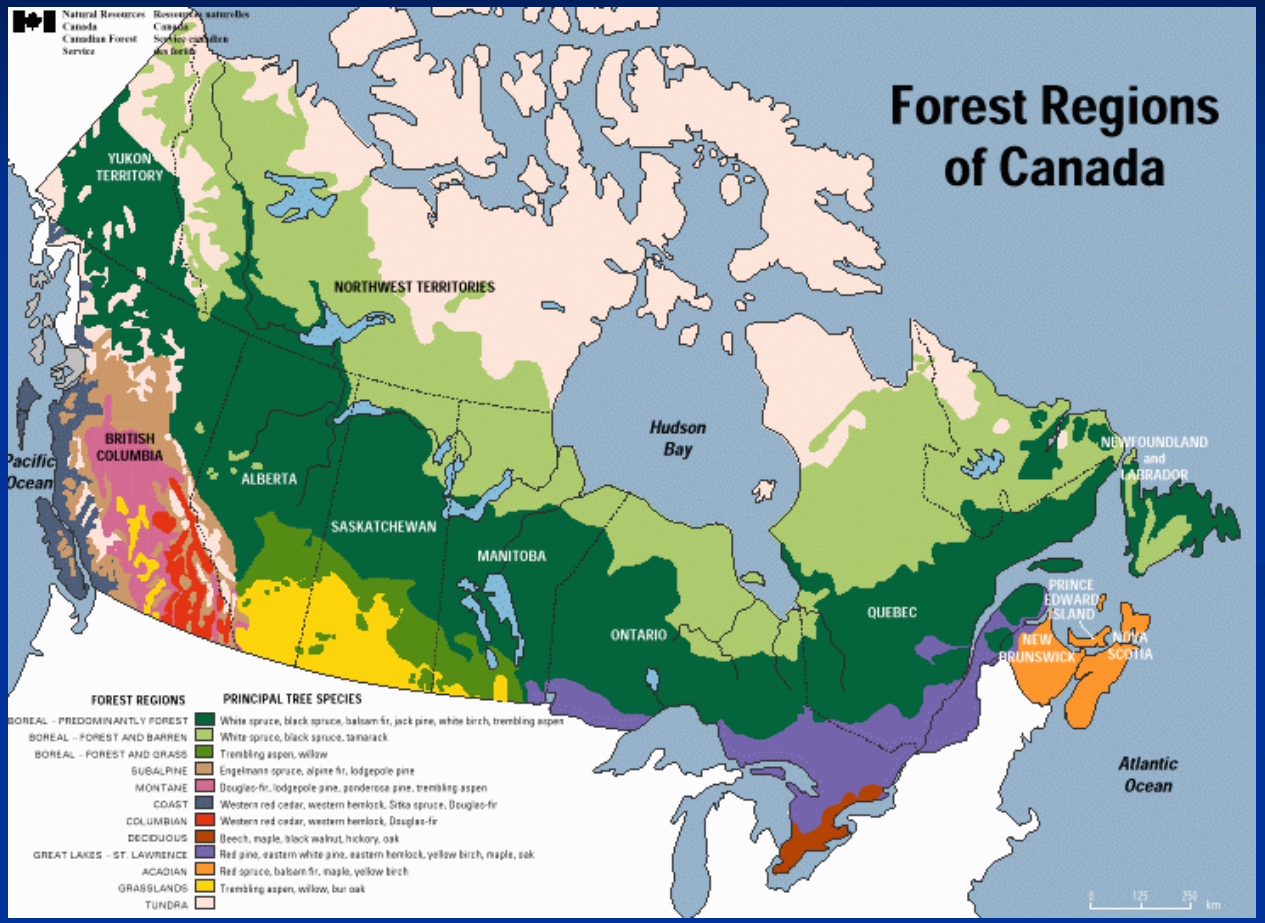
Drought Impacts

Agriculture

Drought Impacts

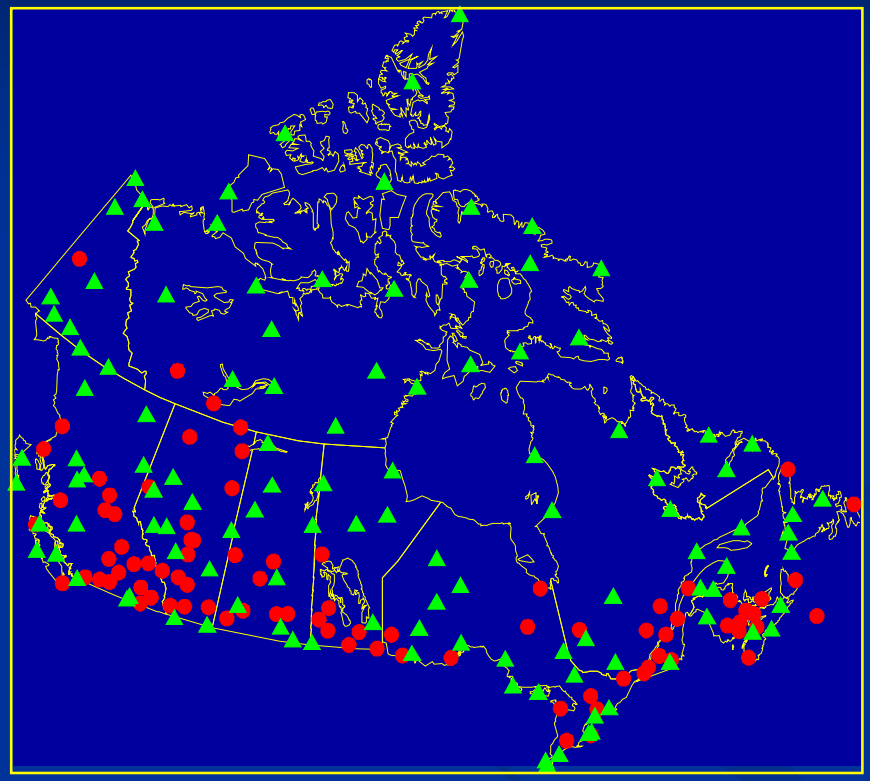


Drought Impacts

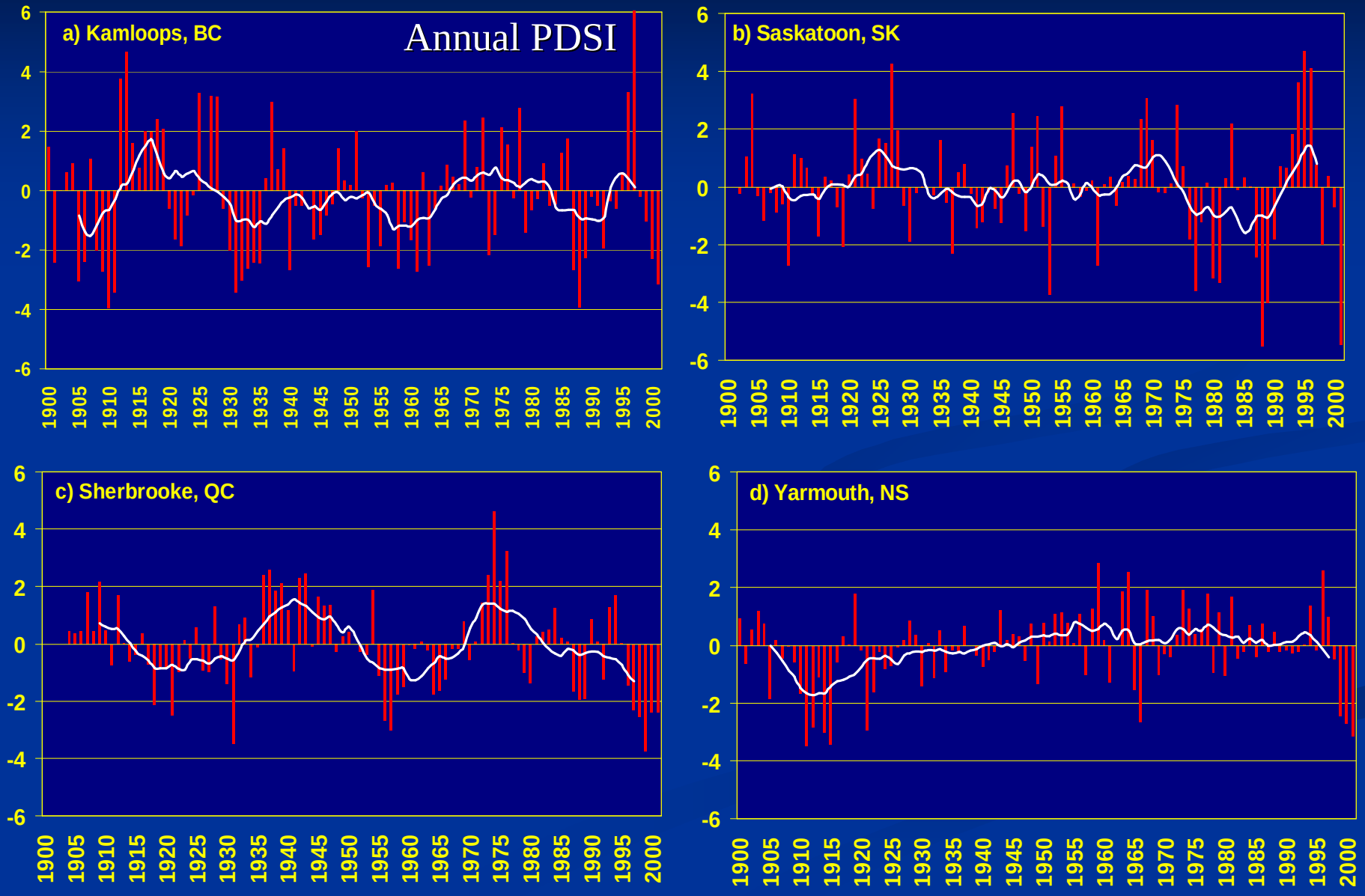


Drought Research in Canada

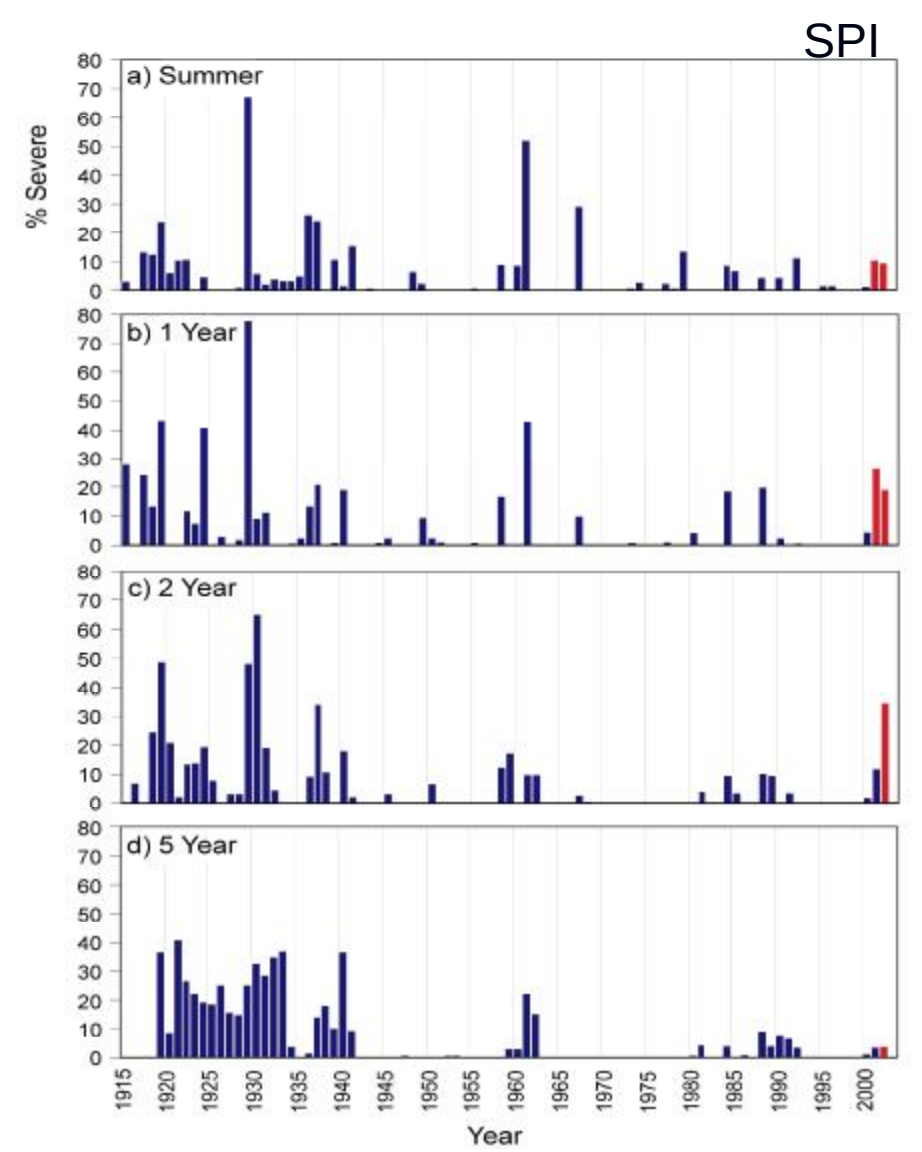
- Fragmented – spatially and temporally
- Based on severe drought occurrence (e.g., 1999-2005)
- Majority for Canadian Prairies
- Historical comparisons difficult due to short and variable climate station records
- Canadian droughts unique – both cold and warm season phenomenon

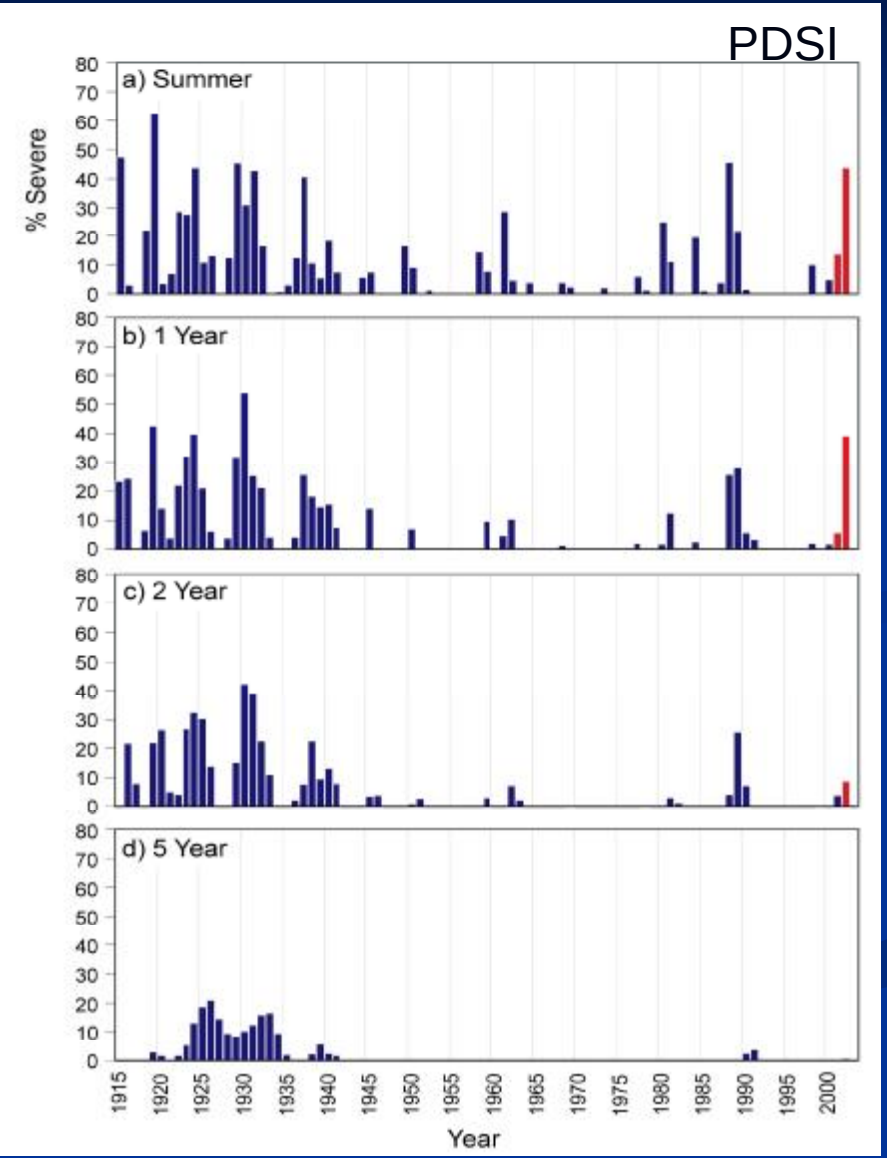


Drought Occurrence



Drought Occurrence – Southern Prairies (1915-2002)

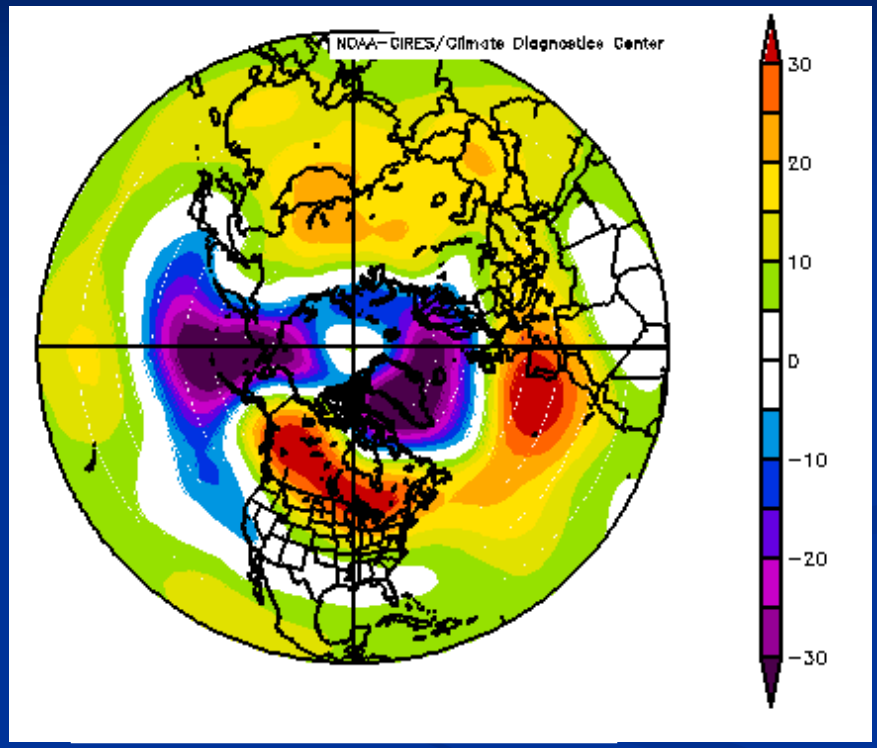




Warm, Dry Winters Over Canada

500mb Flow

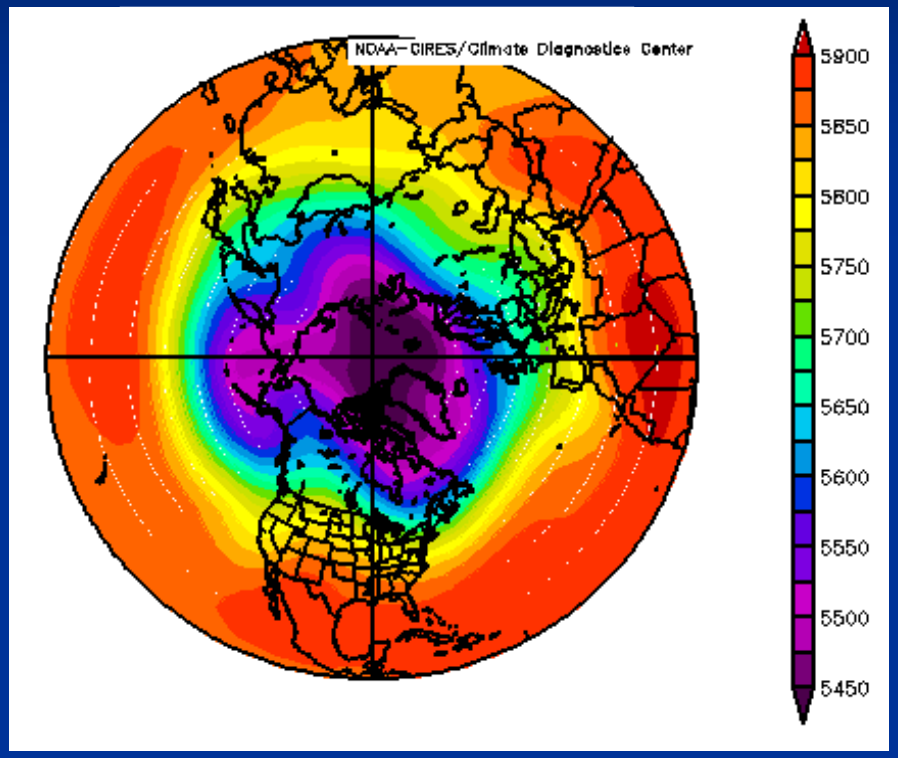
500mb Anomalies



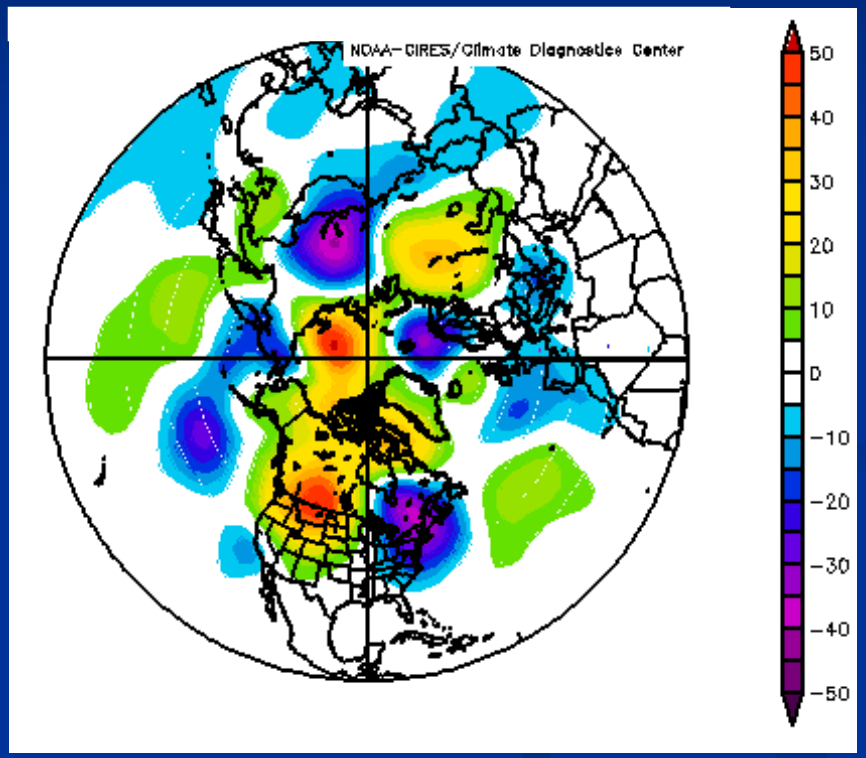
§ El Niño, +PNA, +PDO, Deep Aleutian Low

Hot, Dry Summers Over Western Canada

500mb Flow

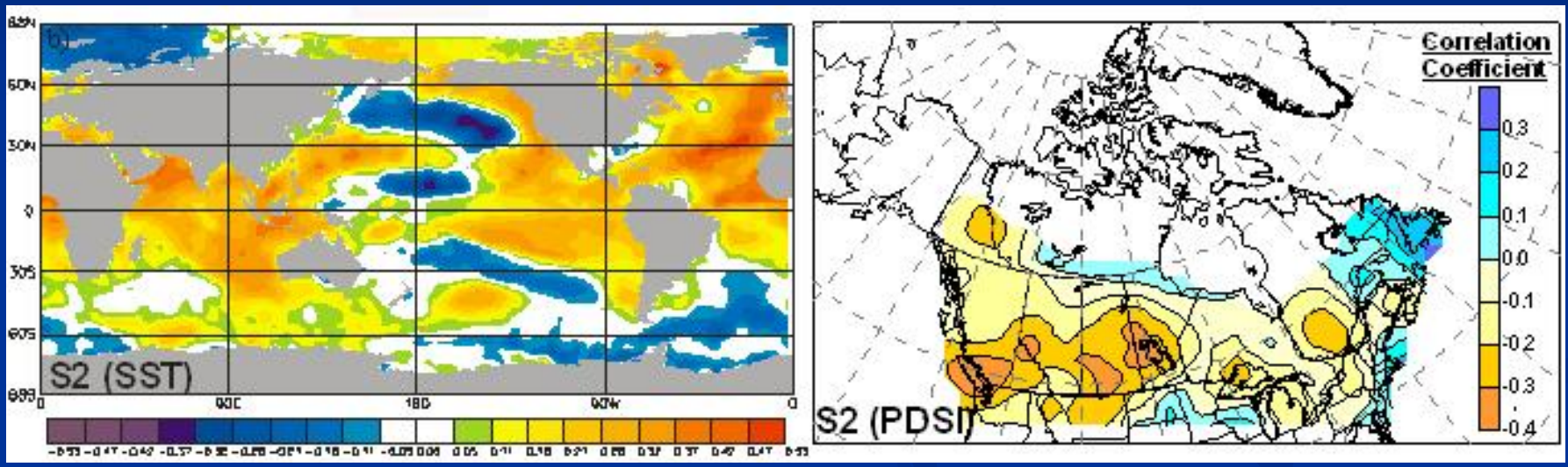


500mb Anomalies



§ +PNA, Meridional Flow, +PDO?

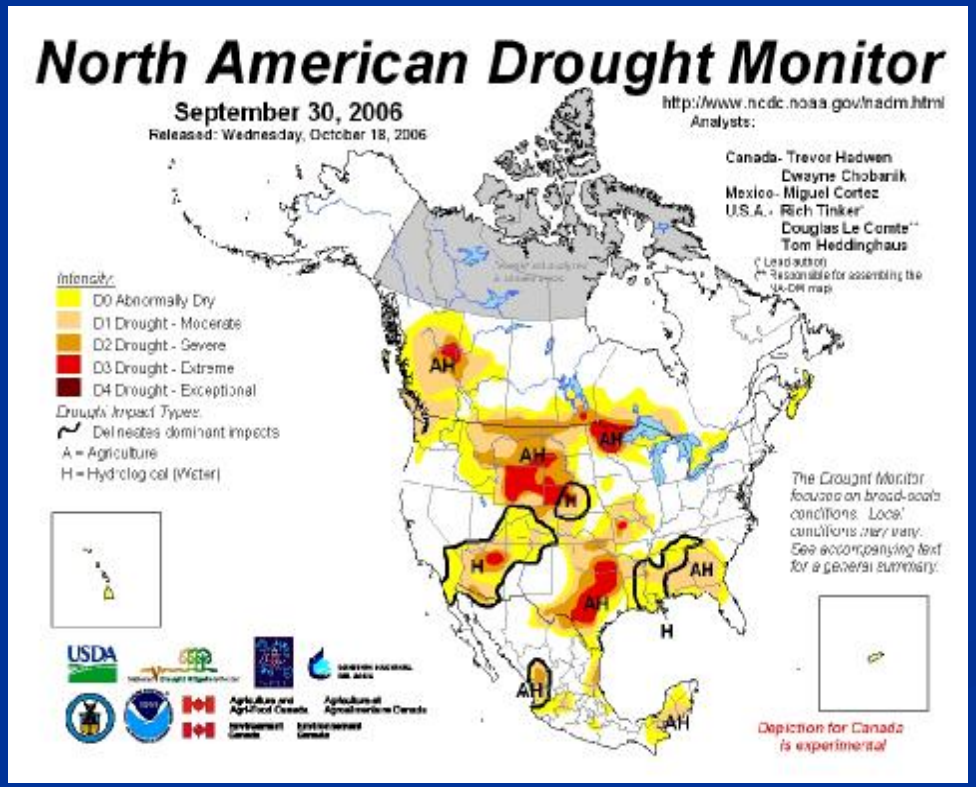
Coupled SVD pattern between Global Winter SSTs and Summer PDSI (1940-2002)



Winter Interannual and interdecadal ENSO-like pattern is associated with dry summer conditions in western and central Canada. Squared Covariance Fraction = 28%, Correlation between time expansion = 0.5

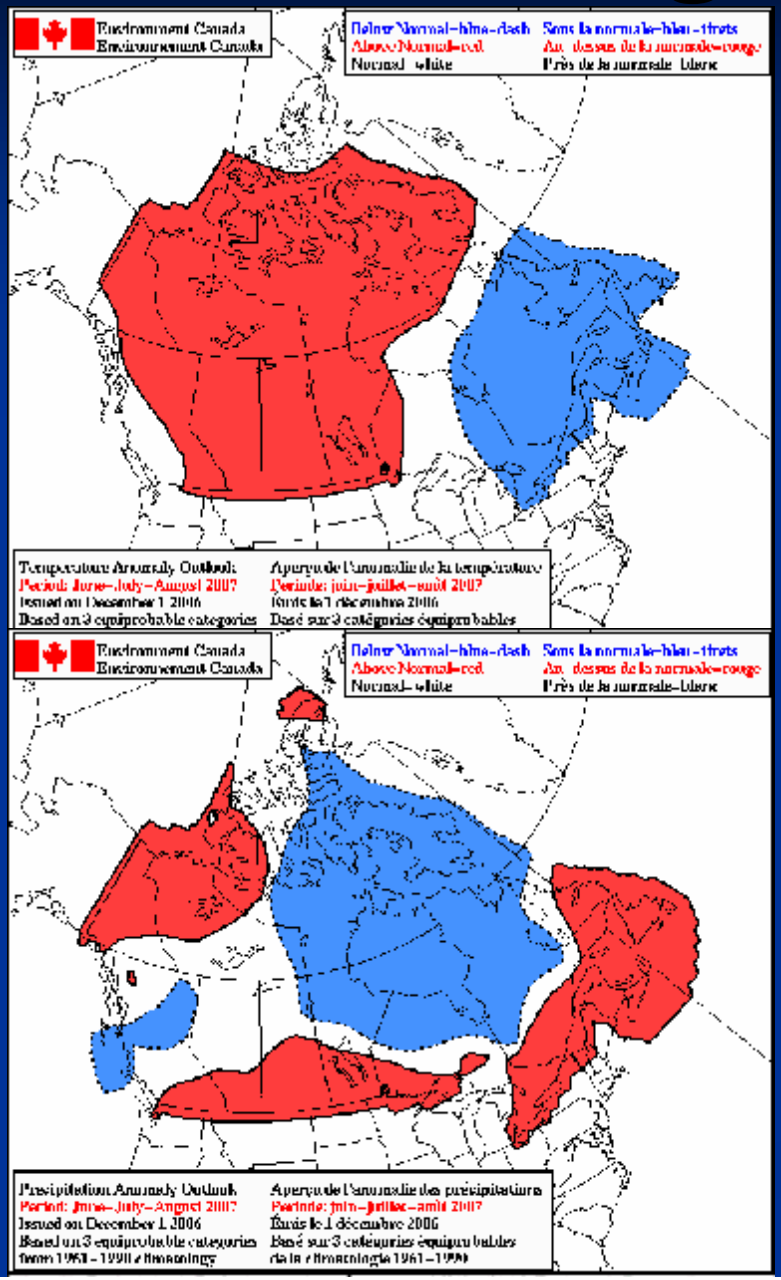
(Shabbar and Skinner, 2004)

Drought Monitoring



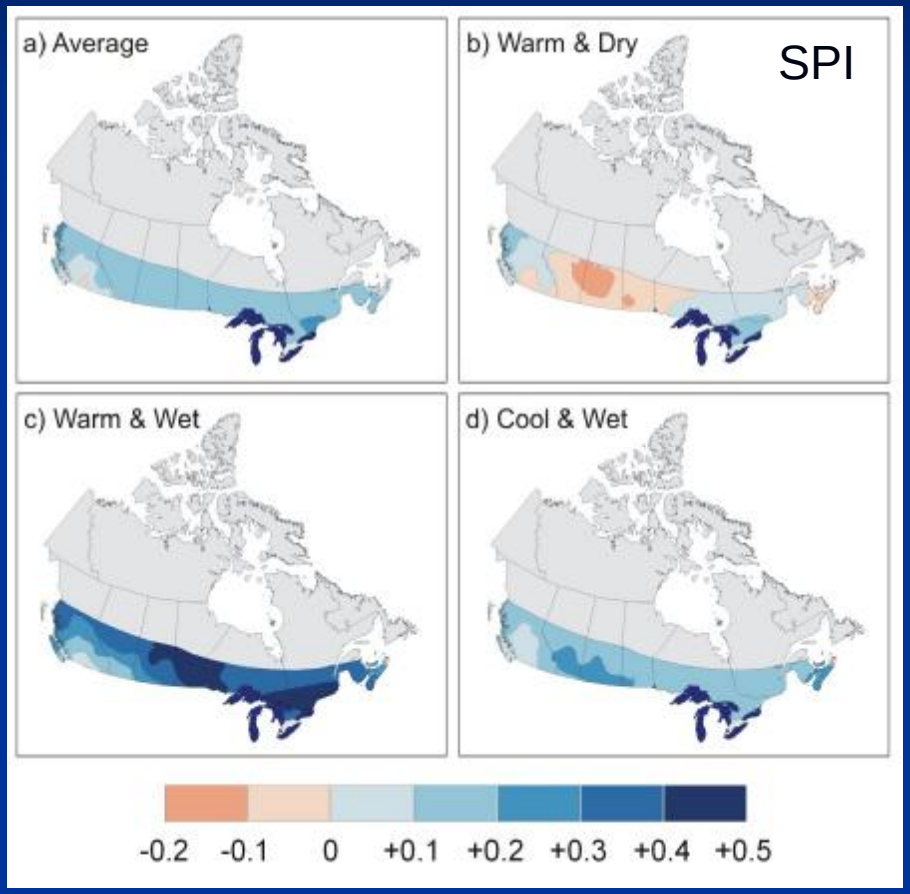
- **Real-time information on drought conditions over agricultural regions of Canada**
- **National map illustrating current and historical temperature, precipitation, and drought index maps (SPI, PDSI) at various time steps**
- **Reports of lake and reservoir levels, stream flows, snowpack accumulations, water-supply volume forecasts, dugout water levels, pasture conditions (for the Prairies)**
- **The North American Drought Monitor**

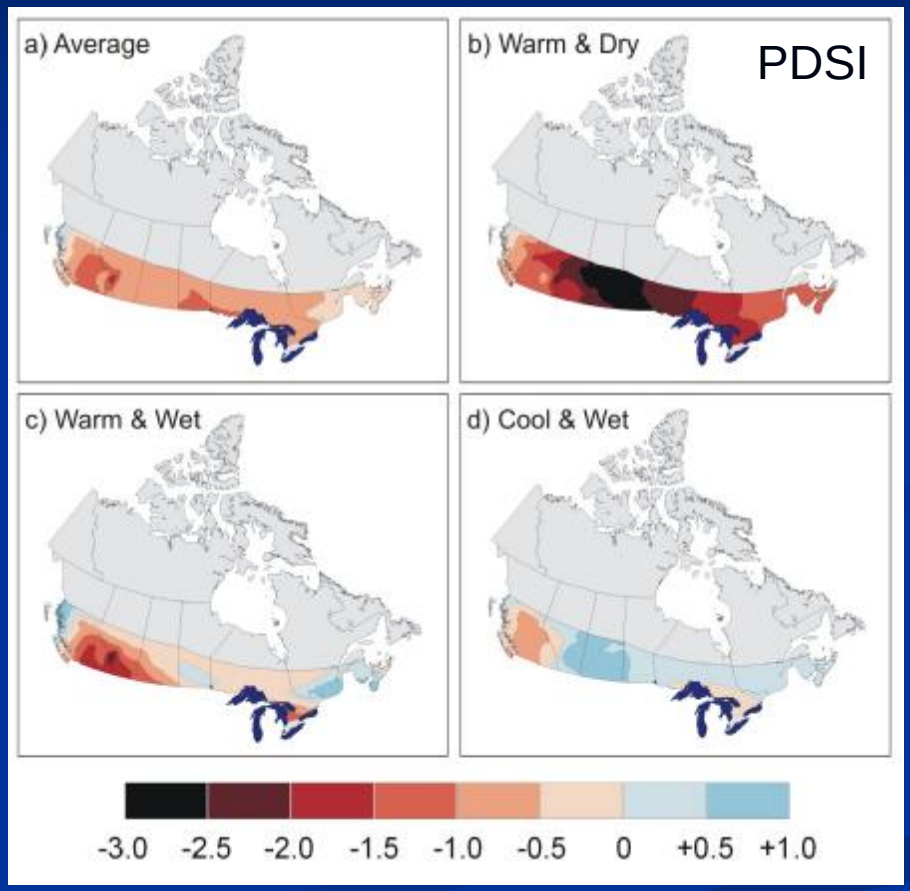
Drought Prediction



- **Drought prediction involves anticipating climatic anomalies that produce unusually hot, dry conditions for extended periods**
- **EC currently produces monthly and seasonal forecasts for T & P for lead times of 3, 6, 9, and 12 months**
- **0 to 3 month forecasts are made using NWP models**
- **Longer lead times use a statistical (CCA) model using SST anomalies over the previous 12 months**
- **Skill higher for cold season and for temperature**

Future Droughts





Research Needs

1. A better understanding of the physical causes of drought initiation, persistence, and termination at a variety of spatial and temporal scales

- Large-scale atmospheric and oceanic oscillations
- Soil moisture anomalies
- Storm tracks
- Moisture sources
- Physical causes of multi-year droughts
- Drought migration

Research Needs

2. Quantification and assessment of past drought occurrences

- Past trends and variability
- Drought indices
- Paleo-drought studies

3. Better knowledge regarding future drought occurrence

- More reliable GCM/RCM output
- Improved downscaling methods
- Future changes to large-scale circulation patterns

Research Needs

4. Ability to more accurately predict drought onset, intensity, and termination

- Improvements in modelling and monitoring of current drought conditions
- More reliable short term (seasonal) climate forecast

5. More effective short and long-term adaptation strategies to defend against future droughts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