Characterizing the Climatological Nature of the 1999-2005 Drought in the Canadian Prairies: Data Sources and Issues

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Research Objectives

Quantify the extent and severity of the 1999-2005 Canadian Prairie drought at a variety of spatial and temporal scales.

- ◆ Use drought indices to examine the spatial, temporal patterns, and intensity of the droughts
- ◆ Compare different methodologies to calculate the drought indices
- ◆ Relate drought patterns to agricultural and hydrological impacts
- ◆ Develop methods to document the dynamics of drought migrations

Study Area

Drought Indices

- Percent of Normal
- Deciles
- Standardized Precipitation Index (SPI)
- Palmer Drought Severity Index (PDSI)
- Palmer Z Index
- (Palmer Moisture Anomaly Index)
- Palmer Hydrological Severity Index (PHSI)
- Surface Water Supply Index (SWSI)
- Crop Moisture Index (CMI)
- Soil moisture anomaly index

- Reclamation Drought Index
- Computed soil moisture
- Rainfall Anomaly Index (RAI)
- Drought Area Index (DAI)
- Total water deficit
- Effective Drought Index (EDI)
- Bhalme-Mooley Drought Index (BMDI)
- Keetch-Byram Drought Index (KBDI)
- NOAA Drought Index
- Drought Monitor – Short-term blend
- Drought Monitor – Long-term blend
- Climate Moisture Index

Drought Indices

◆ Standard Precipitation Index (SPI)

◆ Palmer Drought Severity Index (PDSI)

◆ Palmer Z-Index

◆ Crop Moisture Index

◆ Climate Moisture Index (CMI)

◆ Soil Moisture

◆ Evapotranspiration

Data Requirements

- Gridded datasets of temperature and precipitation

  - Canada
    - Canadian Gridded Climate Data (CANGRID, Environment Canada) – 50km resolution

  - North America
    - Climate Research Unit (CRU TS 2.1, Mitchell and Jones, 2005) – 0.5 degree resolution
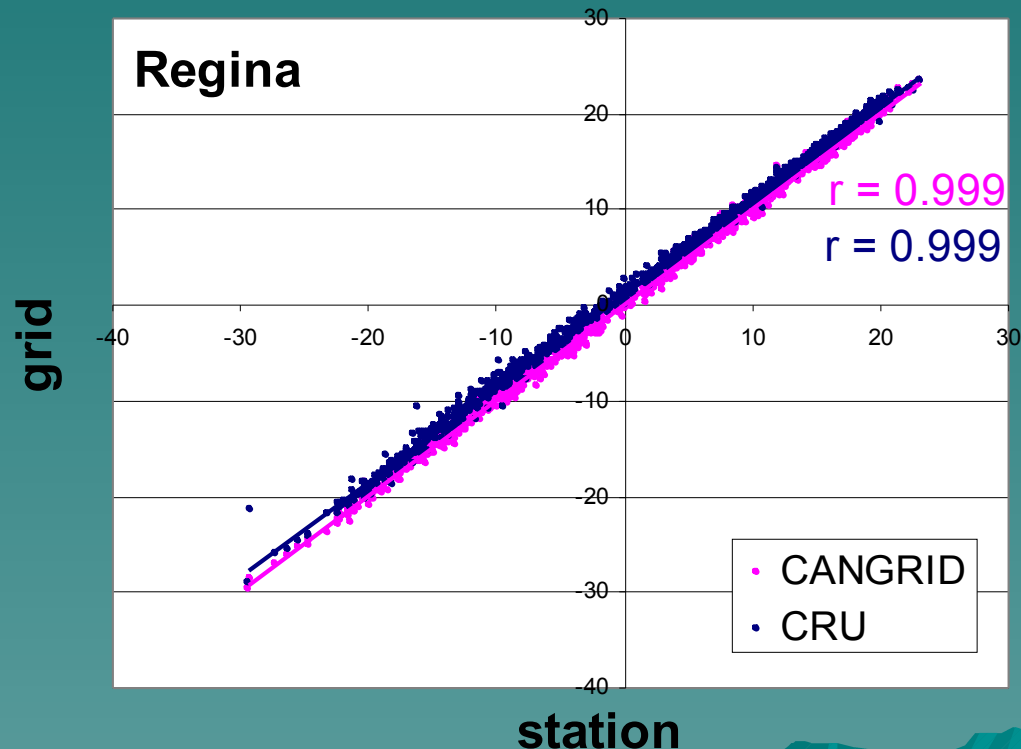   - ANUSPLINE (McKenney et al. 2006) - 10km resolution

What is the reliability of the gridded data?

◆ Comparison of 6 stations with 6 corresponding grid points (CRU and CANGRID)
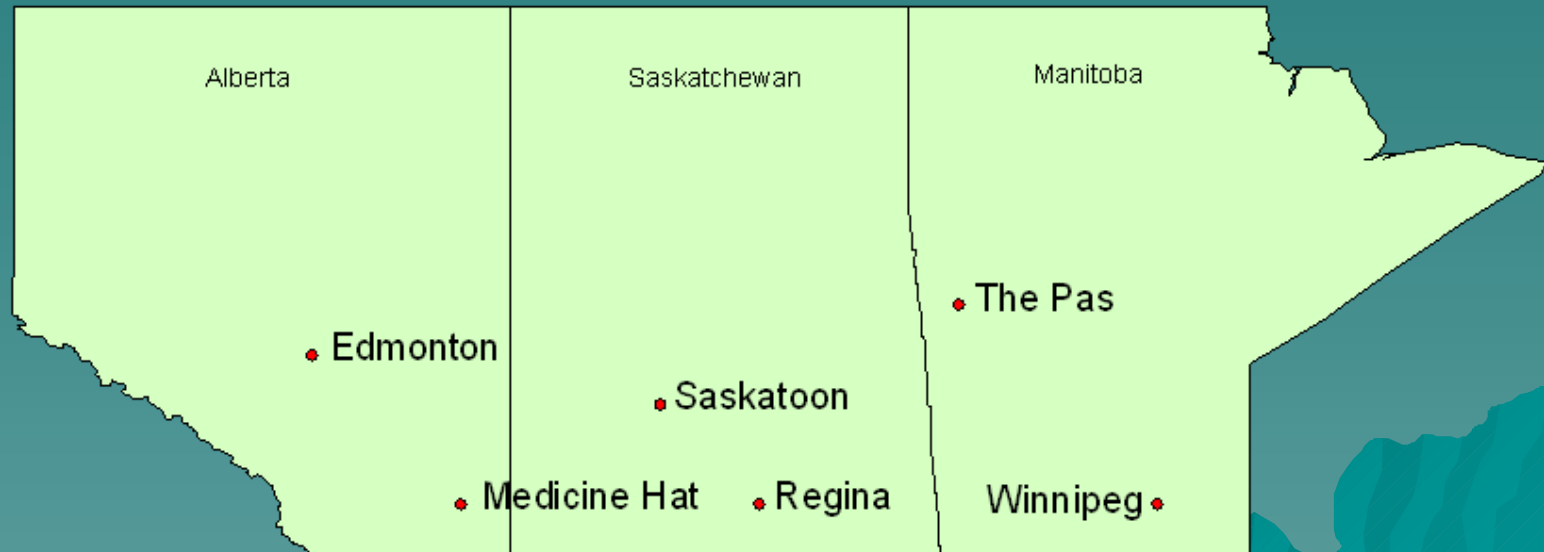
Temperature Data

◆ Correlation coefficients above 0.99 for each dataset
  – Based on monthly mean temperature from 1914-2002

Precipitation Data

◆ Correlation coefficients were 2-16% lower using the CRU data
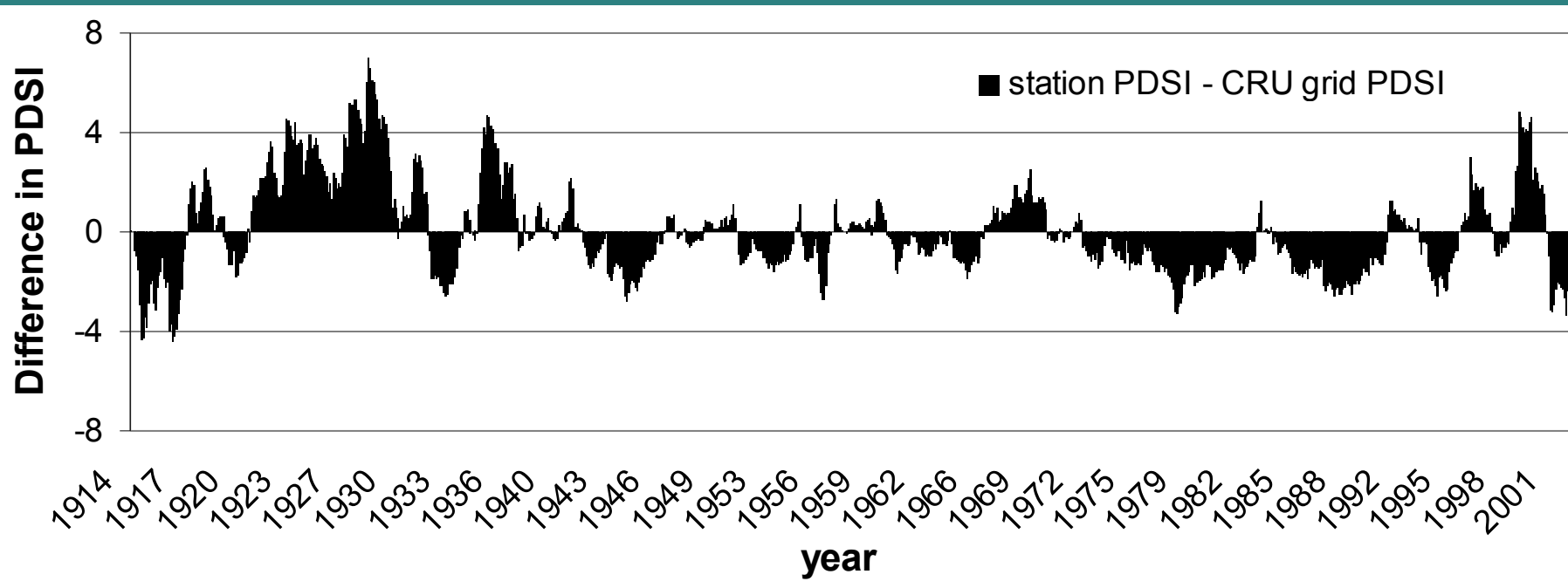 – Based on mean monthly precipitation from 1914-2002

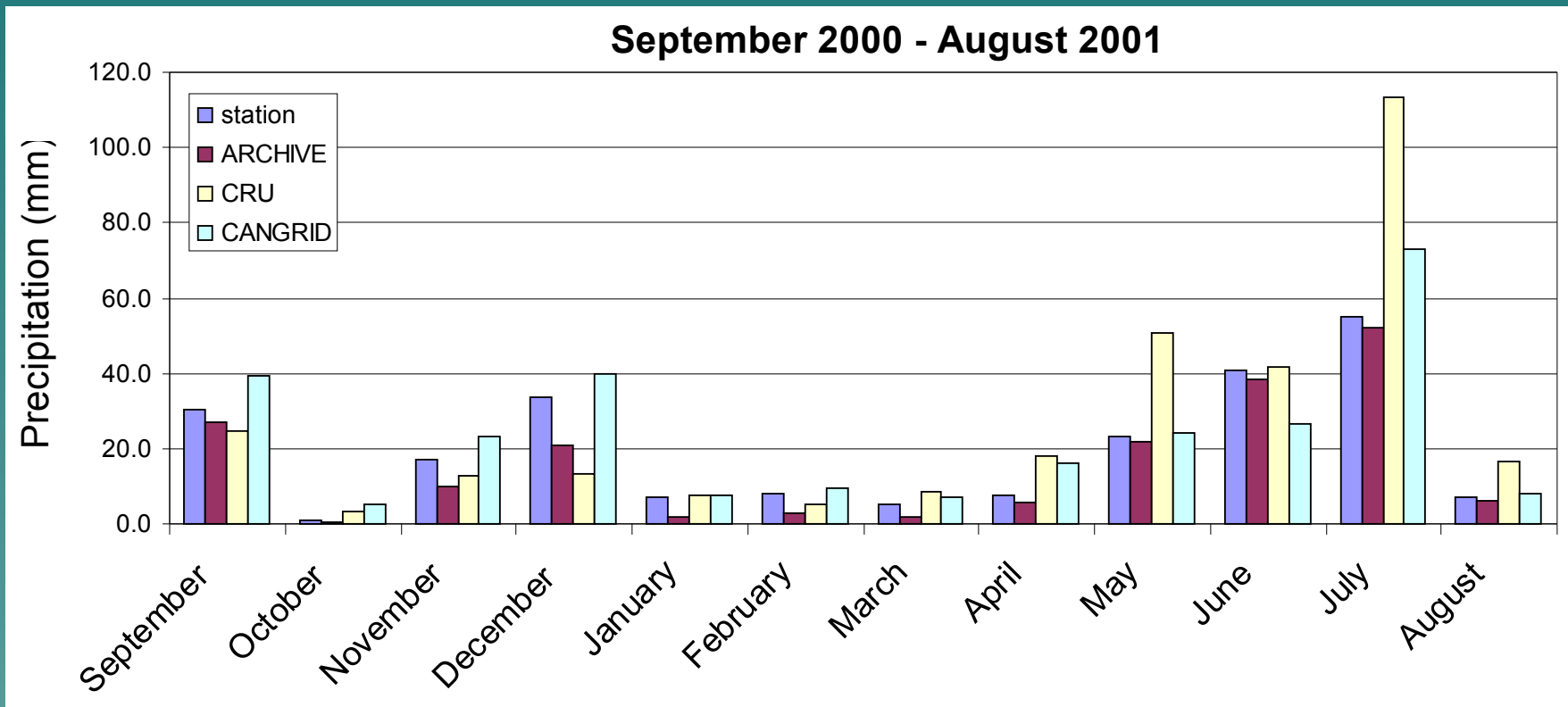|	CRU	CANGRID
Regina	0.894	0.939
Saskatoon	0.854	0.897
Edmonton	0.902	0.919
Medicine Hat	0.830	0.918
Winnipeg	0.822	0.941
The Pas	0.786	0.939
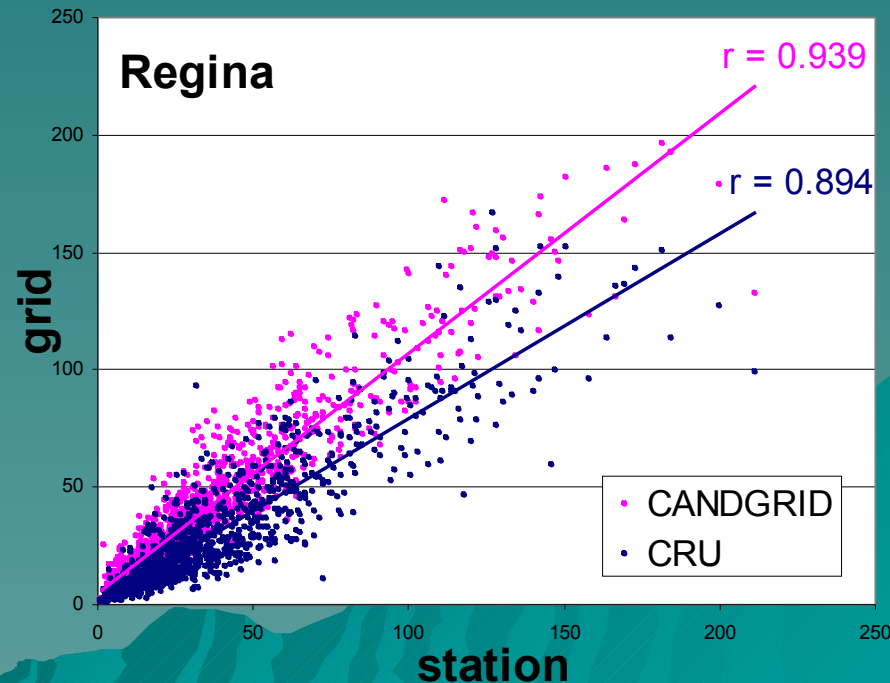
Palmer Drought Severity Index (PDSI)

◆ Calculated the PDSI based on station values and on CRU gridded values for the 6 locations

Saskatoon

2001 Precipitation

◆ In July 2001 there was a difference of over 60mm between the station and CRU gridded values

September 2000 - August 2001

Saskatoon – Ranked 12-month SPI

	STATION	CRU	CANGRID
2001	1	39	2
1919	2	3	5
1924	3	4	3
1933	4	10	6
1929	5	2	1
2002	6	14	29
1998	7	8	25
1930	8	24	8
1952	9	11	19
1984	10	38	32

◆ 12-month SPI based on 2001 Agricultural year (September 2000- August 2001)

Drought Impacts

◆ Relate indices with observed drought impacts
  – Crop yields
  – Pasture growth
  – Water levels (dugouts)
  – Aerosols (dust storms)

◆ These comparisons will provide an indication of the usefulness/applicability of drought indices

Examples of future work and links with other DRI researchers

- Continued assessment of datasets
- Calculate drought indices (PDSI and SPI) and compare these results to previous work over the prairies during the 1999-2005 drought
  - PFRA Drought Watch
  - Indices calculated by John Hanesiak and research team
- Relate drought patterns to agricultural and hydrological impacts
- Develop methods to document the dynamics of drought migrations