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# Temperature Trends in the Semiarid Prairie of Southwestern Saskatchewan

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**Key Words:** climate change, air temperature, southwestern Saskatchewan

## Introduction

Previously, we had analyzed long-term weather data (from 1950 to 1997) to study the annual as well as seasonal change in air temperature within an approximately 15000 km<sup>2</sup> area in the semiarid prairie near Swift Current, SK (Cutforth et al. 1999; Cutforth 2000). We found that the average annual maximum ( $T_{mx}$ ) and minimum ( $T_{mn}$ ) air temperatures had increased linearly with year. Seasonally, we found that the average  $T_{mx}$  and  $T_{mn}$  for January through April (JFMA) had also increased linearly from 1950 to 1997, as had the average  $T_{mn}$  for May through August. Average air temperatures for September through December (SOND) did not change with year. Generally, JFMA experienced the largest warming trend between 1950 and 1997, whereas temperatures during SOND did not change with year.

## Objective

We reexamined the air temperature data gathered at weather recording stations located within a 15000 km<sup>2</sup> tract of land south of Swift Current to see if annual and seasonal trends in temperature from 1950 to 1997 continued through 2003.

## Methods

Daily maximum ( $T_{mx}$ ) and minimum ( $T_{mn}$ ) air temperatures were recorded at Aneroid, Gravelbourg, Maple Creek, Shaunavon and Swift Current in southwestern Saskatchewan from 1950 to 2003, representing a region of approximately 15000 km<sup>2</sup> (Fig. 1). All weather recording sites were manned by volunteers (except Swift Current) using equipment maintained and calibrated by Environment Canada. Average annual and average seasonal - JFMA (January, February, March, April), MJJA (May, June, July, August) and SOND (September, October, November, December) -  $T_{mx}$  and  $T_{mn}$  for the region were determined from the daily temperatures averaged across locations.

## Results

All warming and non-warming trends determined from data collected from 1950 to 1997 continued through 2003. The rates of change from 1950 to 2003 were very similar to those from 1950 to 1997. For those seasons with significant trends, the trend equations for 1950 to 1997 were not significantly different from those for 1950 to 2003 (Table 1). Average annual  $T_{mx}$  and  $T_{mn}$  continued to increase linearly with year between 1950 and 2003; the overall increase was

about 2°C (Fig. 2). Seasonally, the largest temperature increase (4.5°C from 1950 to 2003) occurred in JFMA with both T<sub>mx</sub> and T<sub>mn</sub> increasing linearly since 1950 (Fig. 3). There was a linear increase in T<sub>mn</sub> for MJJA with an overall increase in T<sub>mn</sub> of 1.1°C, however there wasn't any detectable trend in the average T<sub>mx</sub> with year (Fig. 4). Temperatures did not change during SOND (Fig. 5).

**Table 1:** Regression equations describing the linear relationship of annual and seasonal (JFMA - January through April, MJJA - May through August) air temperatures to year from 1950 to 1997 and from 1950 to 2003.

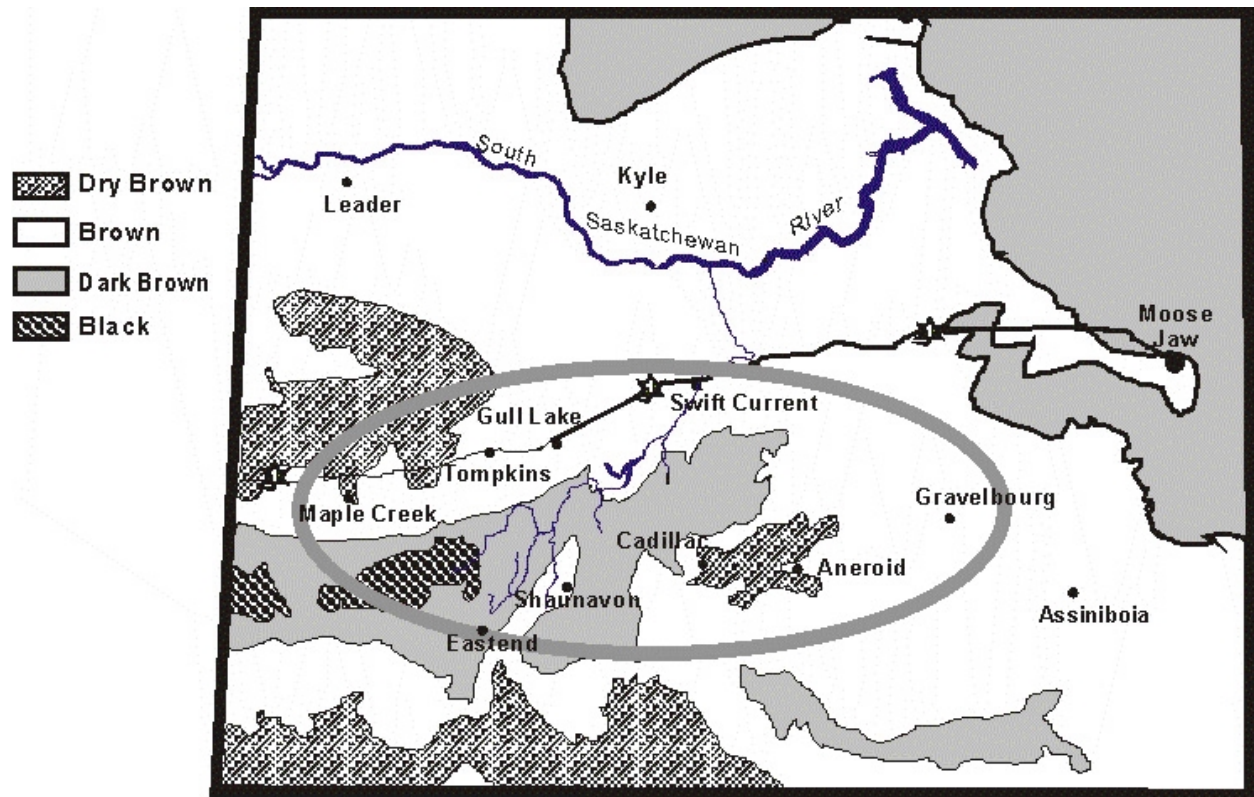
Time	Equation	
	1950-1997	1950-2003
Annual	T <sub>mx</sub> = -53.1 + 0.03221 X Year T <sub>mn</sub> = -72.6 + 0.03562 X Year	T <sub>mx</sub> = -59.3 + 0.03539 X Year T <sub>mn</sub> = -78.2 + 0.03844 X Year
JFMA	T <sub>mx</sub> = -188.2 + 0.09563 X Year T <sub>mn</sub> = -187.6 + 0.08956 X Year	T <sub>mx</sub> = -172.6 + 0.08769 X Year T <sub>mn</sub> = -169.4 + 0.0803 X Year
MJJA	T <sub>mn</sub> = -29.7 + 0.01935 X Year	T <sub>mn</sub> = -31.0 + 0.02004 X Year

### Conclusions

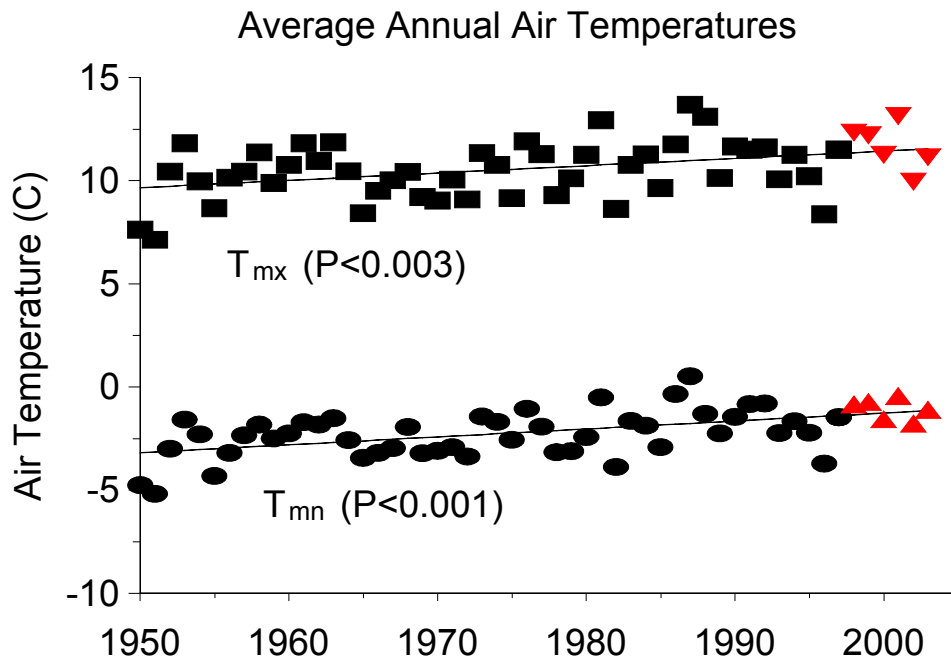
The temperature trends determined from weather data collected from 1950 to 1997 continued with the addition of weather data collected between 1998 and 2003. The annual and seasonal temperature trends determined from weather data collected from 1950 to 1997 continued at similar rates with the addition of data from 1998 to 2003. Generally, over a large area within southwestern Saskatchewan, annual temperatures have continued to increase; seasonally, JFMA continued to experience the largest warming trend whereas SOND has not warmed since 1950.

Cutforth, H.W., McConkey, B.G., Woodvine, R.J., Smith, D.G., Jefferson, P.G. and Akinremi, O.O. 1999. Climate change in the semiarid prairie of southwestern Saskatchewan: late winter-early spring. *Can. J. Plant Sci.* 79: 343-350.

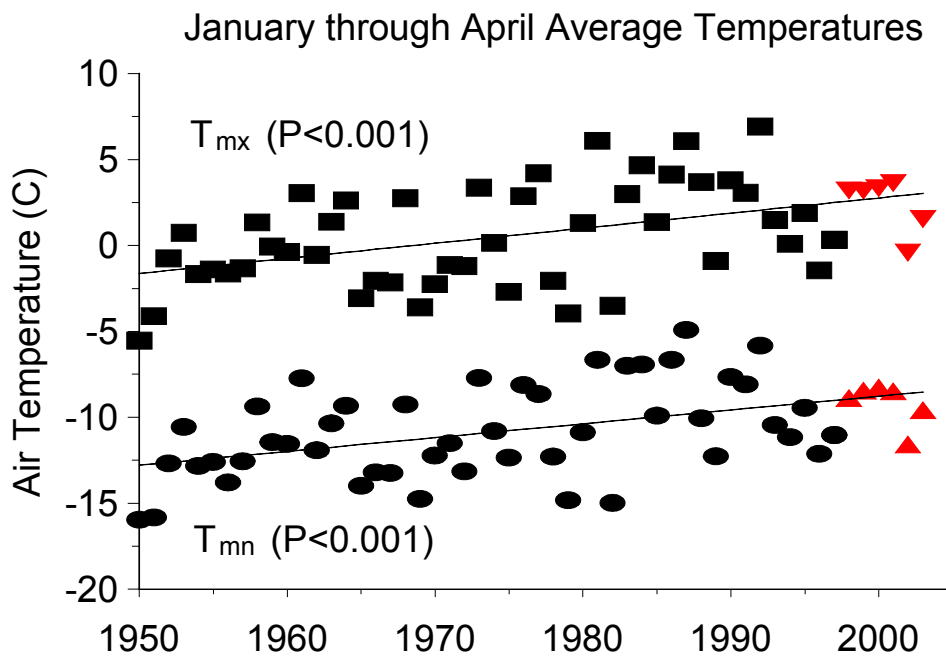
Cutforth, H.W. 2000. Climate change in the semiarid prairie of southwestern Saskatchewan: temperature, precipitation, wind, and incoming solar energy. *Can. J Soil Sci.* 80: 375-385.



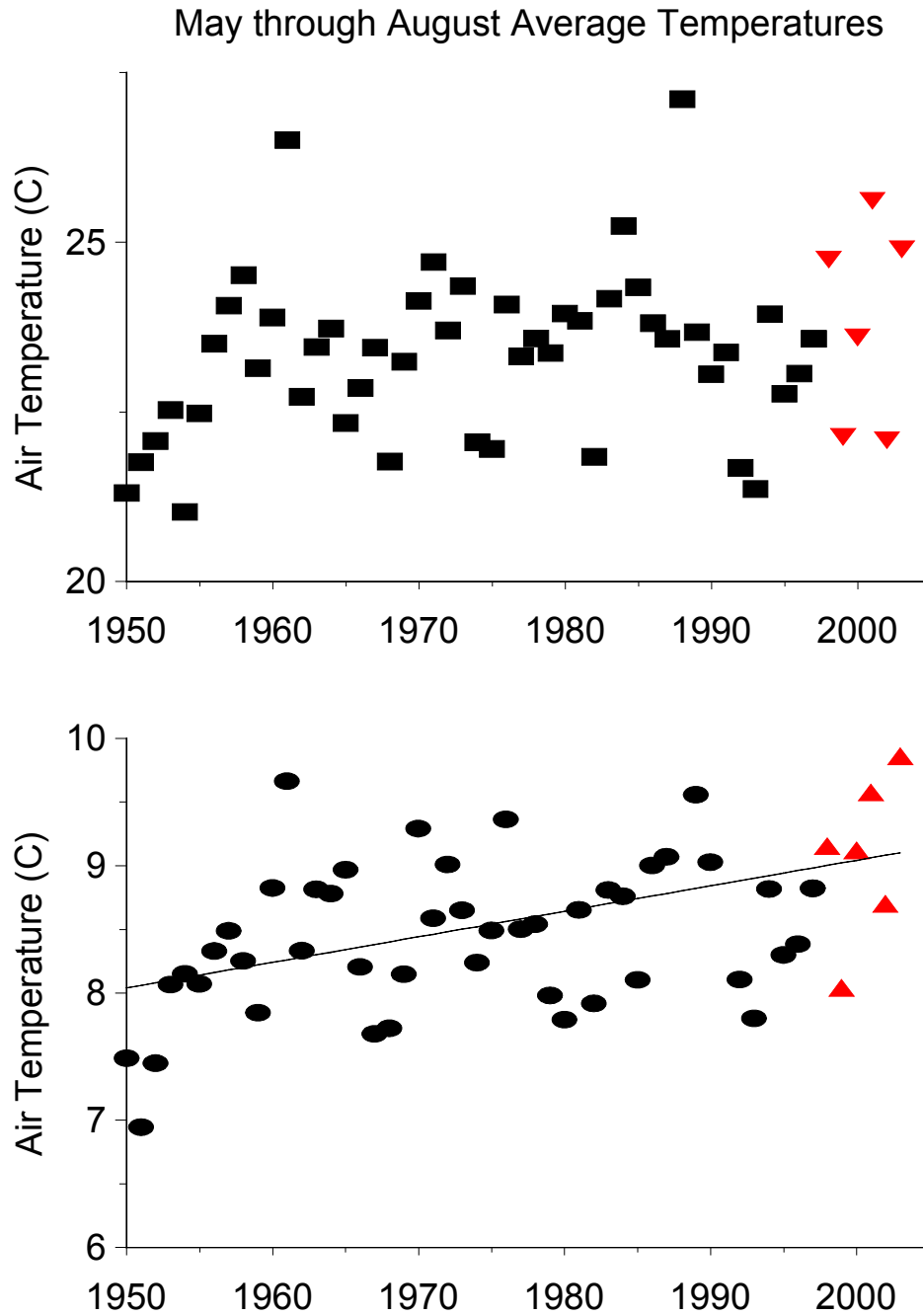
**Figure 1:** Location of the weather recording sites in southwestern Saskatchewan. Circled is the approximate area over which the environmental measurements chosen to detect climate change apply.



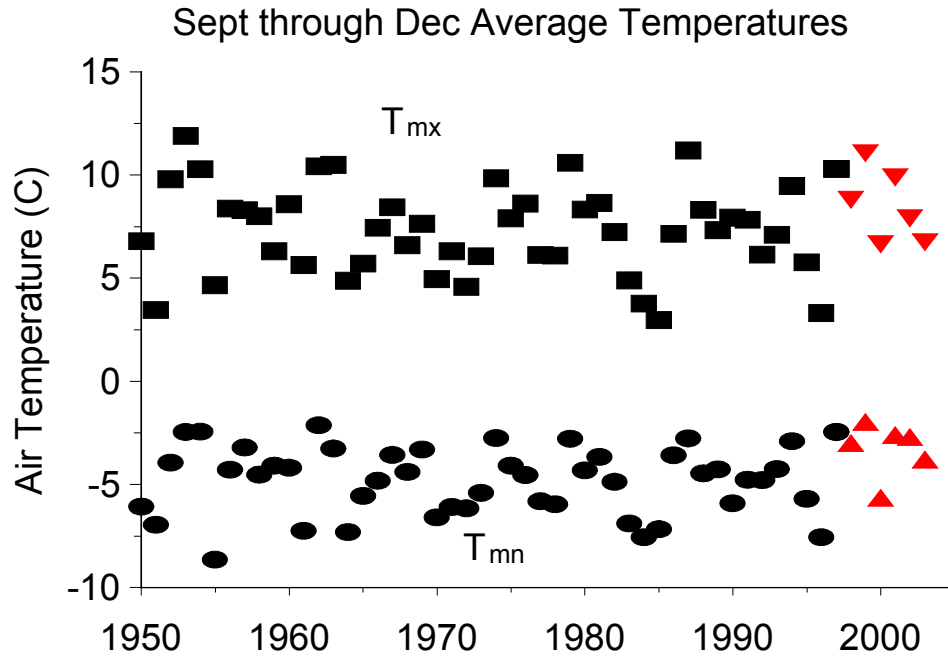
**Figure 2:** The relationships of the annual average maximum ( $T_{mx}$ ) and minimum ( $T_{mn}$ ) air temperatures with years. Lines represent linear relationships between temperature and years from 1950 to 2003. Triangles represent the years from 1998 to 2003.



**Figure 3:** The relationships of the seasonal (January through April - JFMA) average maximum ( $T_{mx}$ ) and minimum ( $T_{mn}$ ) air temperatures with years. Linear relationships are between temperature and years from 1950 to 2003. Triangles represent the years from 1998 to 2003.



**Figure 4:** The relationship of the seasonal average maximum ( $T_{mx}$ ) and minimum ( $T_{mn}$ ) air temperatures for May through August (MJJA) with years. Linear relationship for  $T_{mn}$  is between temperature and years from 1950 to 2003. Triangles represent the years from 1998 to 2003.



**Figure 5:** The relationship of the seasonal average maximum ( $T_{mx}$ ) and minimum ( $T_{mn}$ ) air temperatures for September through December (SOND) with years. Triangles represent the years from 1998 to 2003.