Yukon Weather Centre Ret'd

Internal Report YWC-10-110

Climate Change in the Yukon, Updated Observations

by

Michael Purves
Meteorologist Ret'd
Yukon Weather Centre
2010 December 15

ABSTRACT
Surface observations from the Yukon are examined for evidence of climate change.

Table of Contents

Introduction

This report is an update of Internal Report 109: Climate Change in the Yukon: Some Observations. Surface data collected since 2006 have been used to update the material in the earlier report.

Data Sources

The monthly, daily and hourly climate archives for Yukon stations have been examined using the climate manager program (Purves and Trojan, 1995). Data were provided by Environment Canada and the Yukon Forest Service. The data were extracted using the Yukon Weather Centre's Climate Manager programs, and were ingested into Microsoft Excel where they were graphed and simple linear equations were calculated.

The stations in the Yukon were examined for the length and continuity of their record. From over 150 stations with daily climate records in the Yukon, four were chosen: Dawson, Mayo, Watson Lake and Whitehorse. These stations had the longest and most complete datasets. However, even their records were not continuous. Surface observations from Dawson, Watson Lake and Whitehorse were obtained from a combination of three related stations. Although Mayo has only one station ID throughout its eighty-year history, it had a small shift in position in February, 1969.

In some cases, the effect of using data from a neighbouring station could be estimated, but in other cases, it could not be.

Only one station, Whitehorse, has upper air records. These are available from 1960, but the author is unable to easily acquire data since 2006, so these data have been left unchanged.

Method

The precipitation and temperature data were obtained from the monthly records: Summer was defined as being May 1 to August 31; Winter was defined as being November 1 to the last day in February. The year of the winter considered was taken to be that for November. Changes in temperature are given in degrees Celsius per Century (d/c). Changes in precipitation are given in percent per century or in millimetres per century (mm/c). The change in percent is calculated using the regression coefficients calculated by Excel. Given the regression equation:

Pcp Amt = A + B*Years

the change per century is simply:

B*100 mm

And the percentage change is:

B/A*100%

Several common problems occurred when processing the data. These involved missing data, changes in instrumentation and changes in station locations.

Missing monthly data occurred when one or more daily records were unavailable in the month. In this case, the daily records were examined. If one day was missing, its absence was ignored, and the seasonal average was computed. If several days were missing, up to ten, then the twenty-year average for these days was computed, centered on the missing day, and these averages were used in place of the missing data. Rarely, an entire month was missing. In this case, the twenty-year average for the month was used. For this report, hourly temperature data were also used to fill in holes in the daily and/or monthly record. The mean daily maximum and minimum temperatures from the hourly records were compared to the corresponding daily records in order to calculate mean differences between the two. Normally these are on the order of 0.5 degrees C, with the daily minimum being lower than the lowest hourly value and the daily maximum being higher than the highest hourly value. Hourly records are available only since 1953.

The issue of changes in station location was dealt with in two ways. For temperature data, the difference in the mean temperatures between the two stations were calculated and were used to adjust the temperatures in one station to be similar to the other. For precipitation, the mean precipitation amounts from the two stations were calculated and were used to derive a factor to adjust one station. The temperature and precipitation data used for these calculations were taken only for those days that were present in both stations' records.

Discussion on Data Used

The data used in the analysis of temperature and precipitation will be grouped together and discussed by station. In the case of a few missing observations, the twenty year average was calculated for the month in question, centered on the year of the missing observations. If the missing year was too close to the beginning or end of the record, then either the first or last twenty-year averages were calculated. The calculated average was then used to replace the missing observations. In cases were observations from one station were used to replace those of another, averages for the season in question were calculated using days that were in the record of both stations. As many observations as were available, up to twenty year's worth, were used. The observations from the second station were then adjusted to correspond to the average of the first station. I.e., if the second station average temperatures were 0.5 C warmer than those of the first station, then the observations from the second station were reduced by 0.5 C and used for the missing values of the first station. Precipitation amounts were adjusted by a factor based on the ratio of the averages from the two stations.

Dawson Temperature and Precipitation.

Data from three stations were combined to provide a dataset of over 100 years. These stations are: Dawson, 2100400; Dawson A, 2100402; and, Dawson, 2100LRP. The latter is the automatic station at the Dawson airport. Extracts from the Canadian Climate Centre's Station catalogue are given in Table 1 and illustrate changes in the history of these stations. Fortunately, these stations had periods of overlapping observations, so direct comparisons could be made between them. The stations 2100400 and 2100LRP had their observations adjusted to correspond to those of 2100402. The adjustments were made as follows:

2100400 and 2100402 had overlapping observations between 1976 and 1978. There were 369 matching summer maximum temperatures during this period. The mean daily maximum temperature for 2100400 was 20.8 deg. C. while for 2100402 it was 20.5. There were also 369 observations of precipitation: 2100400 had a total of 354.9 mm., while 2100402 had a total of 319.1 mm. Observations of precipitation from 2100400 were multiplied by 0.90 to adjust them to reflect values we would expect from 2100402. Temperature observations from 2100400 were reduced by 0.3 degrees.

For the winter period, there were 301 days with matching observations of daily minimum temperature. Station 2100400 had a daily mean of –26.0 while 2100402 had a mean of –27.5 deg. C. There were also 301 days with matching observations of precipitation. Station 2100400 had a total of 164.3 mm. while station 2100402 had a total of 185.5 mm. Observations of precipitation from 210400 were multiplied by 1.13 to adjust them to values we would expect from 2100402. Temperature observations from 2100400 were reduced by 1.5 degrees.

For annual precipitation, there are useful data from 1902 to 2001. The year 1913 was missing 77 observations, so it was not included. September 1912 was missing seven days. These were replaced with the twenty-year averages for these days. July 8, 1915 was missing, and this day given a value of zero. The entire month of July 1927 was missing; its twenty-year average was used. In 1977, we had to use observations from station 2100402. Stations 2100400 and 2100402 had 974 matching observations in the period 1976-1978. Station 2100400 had a total off 673.2 mm, and station 2100402 had 688.9 mm. The amounts recorded by station 2100400 were increased by 2% to reflect what we would expect from station 2100402.

2100402 and 2100LRP had 806 days with where both stations reported a daily maximum temperature in summer. 2100402's average was 19.8 deg. C. and 2100LRP had an average of 19.5. Data from 2100LRP were used for the summers of 2004 and 2005. These values were adjusted up by 0.3 deg. C. to correspond to values for 2100402. These two stations had 249 days where they both had summer precipitation records between 1996 and 2004. (Note: an observation of zero was considered to be a record, but an 'M' was not.) For these 249 matching days, 2100LRP recorded 313.4 mm. of precipitation while 2100402 had 252.5 mm. This requires that the observations from 2100LRP be multiplied by a factor of 0.81. In as much as these two stations are at the same site, this discrepancy is troubling, and it may be due to the instruments used by the automatic station to measure precipitation. The August 2004 precipitation from 2100LRP was missing, and so that year was not used. The summer precipitation amount for 2005 from 2100LRP was only 45 mm. which seems like a very small amount, and so it was not used either.

For winter temperatures, there were 928 matching observations. Station 2100LRP had a mean winter daily minimum of –26.7 while station 2100402 had a mean winter daily temperature of –26.1. An adjustment of 0.6 degrees was used to adjust the winter 2004 and 2005 temperatures from 2100LRP to correspond to what we would expect at 2100402. For winter precipitation, there were 33 days with matching records. However, station 2100LRP showed 33 zeroes, while 2100402 shows a total of 24.4 mm. For this reason, the observations from 2100LRP for the winter of 2005 were not considered.

There were too many missing observations from both 2100402 and 2100LRP after 2001 to obtain any reliable estimates of annual precipitation.

Mayo Temperature and Precipitation.

Data for Mayo were from just one station: 2100700. Extracts from the Canadian Climate Centre's Station catalogue are given in Table 2 and illustrate changes in the history of this station. There was a slight change in its position on 1 February 1969, but otherwise the station has remained fairly constant. There are no comparison observations to be had between observations at the two sites, so it is impossible to say what difference this move might have on the long-term regression equations.

For winter temperatures, one winter had missing data: 1926 because December 1926 was missing entirely. Summer 1936 was missing data for nine days in May; these days were given their twenty-year averages. The year 1995 had no records of daily temperatures so hourly temperature records were used and adjusted by comparing the averages using twenty years of daily and the matching hourly records from 1985-2005.

Winter precipitation was missing for 1926, 1946, 1994 and 1995. 18 days were missing in February 1947, and were given their twenty-year average. Summer precipitation was missing for 1995. There were eight missing days in June 1936. These eight days were assigned their twenty-year average values.

For the annual precipitation amounts, the record is from 1927 to 2009. The year 1995 is missing. Eight days in June 1936 were given their twenty-year average, as were 18 days in February, 1947, and April 1989.

Watson Lake Temperature and Precipitation.

Data for Watson Lake were obtained from three stations: Watson Lake A, 2101200; Watson Lake (AUT), 2101204; and, Watson Lake YTG, 2101222. The record spans from 1938 to 2006. As with Dawson, matching observations were used to compute the differences between the stations so that adjustments could be made. For Watson Lake, the observations from 2101204 and 2101222 were adjusted to reflect those of 2101200. For the case of winter precipitation, there were no data from either 2101204 or 2101222. Precipitation records for the winters of 1993, 1994 and 1998 were missing.

For winter temperatures, data from 2101204 were used to supply data for winter 2005. There were 306 days with matching winter temperature observations between 2101200 and 2101204. The mean winter temperature for 2101200 was –22.1 while for 2101204 it was –23.3: fully 1.2 degrees colder. Hourly temperature observations from 2101200 were used for the winter of 1994. Comparison of ten years of winter hourly temperatures and ten years of daily temperatures put the mean daily minimum 0.7 deg. C. colder than the hourly minima.

The annual precipitation was calculated for the years 1939 to 2005. Several years were missing: 1993, 1994, 1995 and 1999. 1998 was used with the twenty-year average for December. 2005 was used with October data from station Watson Lake (AUT), 2101204. No adjustment was made for this amount. As well, March 1942 was missing and its twenty-year average was used in its place.

Whitehorse Temperature and Precipitation.

Data for Whitehorse were obtained from three stations: Whitehorse A, 2101300; Whitehorse Riverdale, 2101400; and, Whitehorse WSO, 2101415. Climate data for Whitehorse A. were not collected from Jan 8, 1996 until May 1, 1998. The Yukon Weather Centre moved approximately 1 km along the Alaska Highway to its new office. Three days later, staff began recording climate data at the new site. There are no overlapping data for the two sites, but staff at the weather centre monitored hourly temperatures from both Whitehorse A and Whitehorse WSO and noted no difference. This visual inspection is not the same as a rigorous comparison, but it is, unfortunately, all we have. Nor do we have any way of comparing precipitation data. For the purposes of this study, data from 2101415 were used without adjustment. For the few days in January 1996, and the month of November 1997, we used data from station 2101400. There are many years of overlap with stations 2101300 and 2101400. As with other datasets, we calculated averages for each station on days that were recorded by both. The observations from 2101400 were then adjusted to represent observations from 2101300. In general, the winter precipitation at the airport is about 90% of that in Riverdale; winter temperatures are 0.3 to 0.4 deg. C lower. We did not need to use 2101400 for the summer data.

For annual precipitation, station 2101300 was used, except for the years 1996 and 1997 and the first four months of 1998. Whitehorse WSO, 2101415 was used for all of 1996, and parts of 1997 and Jan-Mar, 1998. Whitehorse Riverdale, 2101400, was used November 1997, and April 1998. Data from 2101415 were used without adjustment, but data from Whitehorse Riverdale were adjusted to account for differences in the monthly twenty year averages from those of Whitehorse A.

Snow on Ground

Snow on the Ground measured on 28 February is available at our four stations from 1955 to 2010. Each station, however, is missing some data for at least one year, and all stations, except Mayo, are using data from neighbouring stations. It was not possible to estimate the differences in snow depths at the neighbouring stations because there were no data overlaps, as there were for temperature and precipitation. The availability of the data is listed here:

- **Dawson**. Data from 1955 to 1975 were taken from Dawson, 2100400. From 1976 to 2007, data from Dawson A, 2100402 were used. Data from Dawson (AUT), 2100LRP were used for the years, 2008 and 2010. There were no data for February 2009.
- **Mayo**. Only data from 1995 are missing, and all data are from the one station, Mayo, 2100700.
- **Watson Lake**. Data are missing for the years 1994, 1995 and 1999. Data from Watson Lake YTG, 2101222 were used for the years 1994 and 1995. Otherwise, all data came from 2101200.
- **Whitehorse**. Data for Whitehorse were missing for the years 1996-1998. Data for these three years are taken from station 2101415, Whitehorse WSO. No adjustments were made to these data.

Frost Free Days

Frost Free Days were calculated at our four stations for the period of record. Each station, however, is missing some data for at least one year, and all stations, except Mayo, are using data from neighbouring stations. It was difficult to estimate the differences in frost free days at the neighbouring stations: for Dawson the frost temperature was adjusted for stations 2100400 and 2100LRP so that the numbers of frost free days would come closest to the number at station 2100402 for those years with matching observations. The frost temperature calculated for station 2100400 was +2.5C and for station 2100LRP it was –0.5C. The availability of the data is listed here:

- **Dawson**. Data from 2100400 were used from 1901 to 1975, from station 2100402 from 1976 to 2007 and from station 2100LRP for the years 2002, 2003, and 2008-2010.
- **Mayo**. Only data from 1995 are missing, and all data are from the one station, Mayo, 2100700.
- **Watson Lake**. The period of record is from 1939-2010 and data are missing only for the year 1994. All data came from 2101200.
- **Whitehorse**. Data for Whitehorse were missing for the years 1996-1997. Data for these three years are taken from station 2101415, Whitehorse WSO. No adjustments were made to these data.

Mean Hourly Wind Speeds

Mean hourly wind speed averages are calculated for winter, summer and annual periods. Dawson, Mayo, Watson Lake and Whitehorse each have records from 1953 to 2005. Dawson, however, has only records for only partial days and is split between two stations, Dawson, 2100400, and Dawson A., 2100402, with no overlap between them. Mayo also has records for only part of the days until 1974, although it is all from one station. For these reasons, only data from Watson Lake and Whitehorse were considered. All stations were missing data for the year 1991. Watson Lake was missing 21 days in December 1999. These missing observations were given values equal to their twenty-year average. Some years were missing a few observations, but these absences were ignored.

Yukon Summer Lightning

Data from the Yukon Forest Service lightning detector network are available from 1986. Several changes were made to the network in the early 1990s (Kepke, 1993). This network was taken over by Environment Canada around the year 2000. It is difficult to say how the upgrades have affected the counting of strikes. Nevertheless, these data are presented as they are.

Results

The results are presented by the dataset analyzed.

Mean Daily Minimum in Winter.

- **Dawson**. (See Figures 1&2.) The data record covers every winter from 1900 to 2009 inclusive. Station 2100402 was used from 1973 to 2003 inclusive, with 2100400 being adjusted and used before that, and station 2100LRP being adjusted for the last two years. The data show two major periods of warming. The first, from1902 to 1925, had an increase of 10.9 d/c. The second and more significant, from 1964 to 2005, had an increase of 18.0 d/c. There was a period of cooling from 1940 to 1964 with a decrease of 14.5 d/c. Over the period of record, Dawson shows an overall increase of 2.6 d/c. The change over the last 30 years, 6.2 d/c, is very significant and has been noted by many people in terms of their own life experience that winters are not as cold as they used to be.

- **Mayo**. (See Figures 3&4.) The data cover every year, except one, from 1925 to 2009 inclusive. The missing winter was 1926. There were no daily observations for December 1926, nor for the calendar year of 1995. In addition, the temperature for December 24, 2005 was missing. No adjustment was made for this one missing day, but data for the winters of 1994 and 1995 were estimated using hourly temperatures and a correction based on eight winters with matching hourly and data observations from 1980-1989. As in the case of Dawson, there was a period of strong cooling in the middle of the last century. In the case of Mayo, it was from 1943 to 1975 and was at a rate of 16.4 d/c, Over the past thirty years, there has been strong warming, at the rate of 7.1 d/c. The mean daily minimum temperature for winter for Mayo, over the entire period of record is up 2.2 d/c. The mean minimum temperature averaged for the winters 1966 to 1977 was –29.3. For the years 2000-2009 the average was –23.2. This increase of 6 degrees is impressive in itself, but it should be considered in light of the change in latitude required to produce such a change in temperature. For that estimate, the mean minimum temperature for the winters 1966 to 1975 was examined for Fort Nelson B.C. The Fort Nelson temperature was –24.0. In other words, if people in Mayo couldn't wait thirty years for the milder weather to reach them, they would have had to move south of Fort Nelson, a move of 5 degrees latitude to the south.
- **Watson Lake**. (See Figures 5&6.) As with the other Yukon stations, Watson Lake shows a cooling trend from 1943 to 1968. In this case, the cooling occurred at a rate of 14.8 d/c. This is comparable to that found in Dawson and Mayo. There has been warming of 7.3 d/C over the past 30 years.
- **Whitehorse**. (See Figures 7&8.) Whitehorse A has data for the mean daily minimum for winters from 1942 to 2009. Data from station 2101415 were used from January 11, 1996 to Feb 28. 1998. These values were not adjusted. Data from 2101400 were used for Jan 8-10, 1996 and the month of November 1997. The January temperatures were raised 0.4 degrees and the November temperatures by 0.3 deg. to represent values at 2101300. Whitehorse showed a cooling trend of –16.9d/c for the winters 1943-1973 incl. Over the past thirty years, there has been strong warming at 4.3 d/c. Overall, Whitehorse shows daily minimum temperatures in winter rising 3.4 d/C.

Mean Daily Maximum Temperatures in Summer.

- **Dawson**. (See Figures 9&10.) The data record covers all but three summers from 1901 to 2010 inclusive. (The missing summers are 1913, 1927 and 1933.) Data from station 2100402 were used for summer 1973 to 2003 with 2100400 being adjusted and used before that and 2100LRP adjusted for the last two years. As with the winter temperatures, the summer temperatures show two periods of significant warming and one of cooling. The first period of summer warming was from 1901 to 1923 with an increase of 4.0 d/c. Over the past thirty years, there has been an increase of 3.8 d/c. There was a period of cooling from 1941 to 1964 of 7.8 d/c. Over the entire period, the rate of warming of the mean summer daily temperature is 0.9 d/c.
- **Mayo**. (See Figures 11&12.) Only one station was used, with a period of record from 1926 to 2010. As with the case of winter, the year 1995 was missing. Nine days in May 1936 were also missing. The values for these missing days were replaced with the twenty-year average for these days from 1926 to 1946. As in the case of Dawson, there was a period of cooling, from

1941 to 1964. For Mayo, the cooling was measured at a rate of 4.9 d/c. This was less than that in Dawson, where it was 7.8 d/c. The period of warming for the last thirty years is measured at 4.1d/c. Over all, for the full period of record, the warming is measured at 1.4 d/c.

- **Watson Lake**. (See Figures 13&14.) Watson Lake has a period of record from 1939 to 2010, with data for the summers of 1993 and 1994 being calculated using hourly temperatures and adjusted for the normal difference between the daily maximum temperature and the hourly maximum for that day. Watson Lake also shows a cooling trend from 1954 to 1974 with a rate of cooling of 6.9 d/c. This rate is in between that of Dawson and Mayo for their cooling periods, although the cooling period in Watson Lake occurs about ten years later. For the past thirty years, the warming trend was 0.8 d/c. This is less than the rate at Dawson, Mayo and at Whitehorse. Over the entire period, Watson Lake shows no real difference, about 0.1 d/c.
- **Whitehorse**. (See Figures 15&16.) Whitehorse A has data for the mean daily maximum in summer from 1942 to 2010 inclusive. Data for the summers of 1996 and 1997 were obtained from 2101415, with no adjustment. As with the other stations, there is a period of cooling with warming thereafter. For the years 1954 to 1974, the cooling was 5.5 d/c. The period of cooling was similar to that of Watson Lake, but the rate of cooling was slightly less. Over the past thirty years, the increase is measured as 3.0 d/c, and over the entire period of record, there has been an increase of 1.1 d/c.

Mean Annual Temperature.

- **Dawson**. (See Figures 17&18.) The data record covers all years from 1901 to 2009 inclusive except for 2008. Data from station 2100402 were used for years 1977 to 2006 with 2100400 being adjusted and used before that and 2100LRP adjusted for 2007 and 2009. As with the winter temperatures, the annual temperatures show two periods of significant warming and one of cooling. The first period of warming was from 1915 to 1943. There was cooling from 1943 to about 1978 with more warming since that time. Over the past thirty years, there has been an increase of 2.4 d/c. Over the entire period, the rate of warming of the mean annual temperature is 1.8 d/c.
- **Mayo**. (See Figures 19&20.) Only one station was used, with a period of record from 1929 to 2009. As with the case of Winter, the year 1995 was missing with the hourly temperatures being used to calculate the daily means. Nine days in June 1936 were also missing. The values for these missing days were replaced with the twenty-year average for these days from 1926 to 1946. The month of April 1989 was missing and it was replaced with the twenty-year average for that month centered on 1989. As in the case of Dawson, there was a period of cooling, from 1947 to 1977. The period of warming for the last thirty years is measured at 3.3d/c. Over all, for the full period of record, the warming is measured at 2.8 d/c.
- **Watson Lake**. (See Figures 21&22.) Watson Lake has a period of record from 1939 to 2010, with data for the years of 1994 and 1995, and the months Dec 1998 to March 1999 being calculated using hourly temperatures and adjusted for the normal difference between the daily mean temperatures and the hourly mean maximums for that day. March 1942 was replaced with its twenty-year average value. 1993 was missing too many data to be used. Watson Lake also shows a cooling trend from 1944 to 1974. For the past thirty years, the warming trend was 1.7 d/c. This is less than the rate at Dawson, Mayo and at Whitehorse. Over the entire period, Watson Lake shows slight warming of about 0.5 d/c.

- **Whitehorse**. (See Figures 23&24.) Whitehorse A has data for the mean annual temperatures 1942 to 2009 inclusive. Data for the years of 1996 and 1997 were obtained from 2101415, with no adjustment. As with the other stations, there is a period of cooling from 1944 to 1974 with warming thereafter. Over the past thirty years, the increase is measured as 1.2 d/c, and over the entire period of record, there has been an increase of 1.4 d/c.

Total Winter Precipitation.

- **Dawson**. (See Figures 25&26.) The data record covers every winter from 1901 to 2005. Two stations were used: observations from station 2100400 were adjusted and used until 1976 and then station 2100402 was used for the remainder. The observations from 2100LRP were not available for 2004, did not appear to be reliable for 2005 and there was no way to compare them to observations from 2100402. While there are some signs of wetter and drier periods over the length of the record, the record generally shows decreasing amounts of precipitation amounting to a decrease of 35.4 mm/c, a rate of 31% over the last century. Over the past thirty years of record (1976-2005), the precipitation is down 22.6 mm/c, or about 27%.
- **Mayo**. (See Figures 27&28.) The period of record for this evaluation is from the winter of 1925 to 2009. Data from four winters were missing: 1926, 1946, 1994 and 1995. Unlike Dawson, which shows no strong trends during the record, Mayo shows a very strong increase in winter precipitation from 1933 to 1966, amounting to an increase of 560%/c. Just in this thirty-three year period, the precipitation nearly tripled. For the same period, Dawson shows only an increase of about 20%/c. There was a large drop between 1966 and 1968, and then a rise of 74%/c for the thirty years from 1980 to 2009. We can see the effect a couple of years can make: counted from 1966 to 2005 the increase is only 16%/c. Over the entire period, Mayo shows no real change being down about 2%/c.
- **Watson Lake**. (See Figures 29&30.) Watson Lake has a period of record for winter precipitation that covers 1938 to 2009, with three years missing: 1993, 1994 and 1998. Watson Lake shows a trend towards much wetter weather in the decade 1941 to 1951. Precipitation in this decade almost doubled. This rapid increase was followed by an extended drying trend from the years 1951 to 1985, which saw the precipitation cut in half. Over the past thirty years, Watson Lake shows an increase of 153%/c, but using the entire period of record, Watson Lake shows a trend towards drier winters, with a decrease in precipitation of 41%/c or 59 mm/c.
- **Whitehorse**. (See Figures 31&32.) In general, the winter precipitation has been decreasing in Whitehorse. Over the period of record, 1942 to 2009, it has been diminishing at a rate of18%/c (14 mm/c). Over just the past thirty years, however, the rate is up 38%/c or 21 mm/c.

Total Summer Precipitation.

- **Dawson**. (See Figures 33&34.) The period of record is from 1902 to 2006 with three years missing: 1913, 1915 and 1927. Data from June 2002 and from May 2004 were missing and replaced with their ten-year average values. Data from station 2100400 were used until 1975 and then data from station 2100402 were used for the remainder. The first thirty years of record seem drier than the remainder. Overall, summer precipitation seems to be up about 34%/c (41 mm/c). Over the past thirty years, summer precipitation seems unchanged, being down just 3 mm/c or 2%.

- **Mayo**. (See Figures 35&36.) Mayo has records of summer precipitation from 1926 to 2009, except for the year 1995. There were eight days missing in May 1936. These days were given their mean values, averaged over the period 1926 to 1936. There do appear to be some periods of wetter and drier summers; overall there is an increase of 28%/c (37 mm/c). This compares with an increase of 34%/c at Dawson. Over the past thirty years, summer precipitation has greatly increased, but up 64.4 mm/c or 44%.
- **Watson Lake**. (See Figures 37&38.) Watson Lake has data for summer precipitation from 1939 to 2010. Two months were missing, August 1993 and May 1994, and a twenty-year average was used to fill the missing months. Three days in May 2010 were missing, and these were ignored. The record shows fluctuations in the amount of summer precipitation, but overall there is an increase of 37%/c (60 mm/c). Over the past thirty years, precipitation is up 51 mm/c or 27%.
- **Whitehorse**. (See Figures 39&40.) As for the summer temperatures, the period of record is from 1942 to 2010, and data from 2101415 were used with no adjustment for the summers of 1996 and 1997. As with the other stations, there are wide year-to-year swings in summer precipitation amounts. Over the past thirty years, precipitation is up 33 mm/c or 28%, but over the period of record, it is up 17%/c (20 mm/c).

<u>Total Annual Precipitation.</u>

- **Dawson**. (See Figures 41&42.) The period of record is from 1902 to 2001, and data from two stations were used. Data from Dawson A, 2100400 were used to 1977 and were increased to reflect values at 2100402. The data show wide fluctuations from year to year, but a slight decrease is noted overall of about 5 %/c, or about 17 mm/c. Over the last thirty years of record, precipitation is up slightly by 45 mm/c or 14%.
- **Mayo**. (See Figures 43&44.) The period of record for Mayo is from 1927 to 2009. The year 1995 is missing entirely, and twenty-year averages were used for June 5-12 1936; for February 1-18 1947; and for April 1989. Mayo shows a trend of increasing precipitation, up 21%/c or 59 mm/c over the entire period of record. Over the past thirty years, annual precipitation is up 190 mm/c or 67%
- **Watson Lake**. (See Figures 45&46.) Over the seventy-one year history, 1939-2009, Watson Lake shows virtually no change. Over the past thirty years, however, precipitation is up by 306 mm/c or 82%.
- **Whitehorse**. (See Figures 47&48.) Whitehorse, too, shows little change over its 67 year history, having an increase of 4%/c, or 11 mm/c. Over the past thirty years, annual precipitation is up at a rate of 53 mm/c or 20%.

<u>Snow on Ground for February 28</u>

- **Dawson**. (See Figure 49&50.) Snow on Ground Data for the years 1955 to 2010 show a strong decrease over the years, amounting to 65 %/c or 47 cm/c. Over the past thirty years, the snow depth on the last day of February is down at a rate of 28 cm/c or 50%. Station 2100400 was used until 1975 and station 2100402 for the following years, except station 2100LRP was used for the reading for 2008 and 2010 with no observations for the year 2009. It is impossible to say what effect the change in station location has had on the snow depth data.

- **Mayo**. (See Figures 51&2.) Mayo Snow on Ground data for 28 Feb. is available from 1955 to 2010, except for the year 1995. This record also shows a strong and steady decrease, amounting to 105%/c (or 69 cm/c). Over the past thirty years, there is a very slight increase of 3 cm/c or 7%.
- **Watson Lake**. (See Figures 53&54.) Watson Lake also shows a decrease in snow depth for February 28. Using all the data, the decrease comes to 46%/c (34 cm/c). During the last thirty years, however, the snow depth has increased at a rate of 107%/c (55 cm/c).
- **Whitehorse**. (See Figures 55&56.) Whitehorse Snow on Ground data for 28 Feb. for the years 1955 to 2010 show a decrease of 39%/c (13 cm/c). There was a noticeable increase in snow depths in the late 1960s and 1970s. Over the past thirty years, the snow depth at the end of February has decreased at a rate of 32 cm/c or 105%.

Days Below –40 C.

- **Dawson**. (See Figure 57&58.) Although the data from Dawson do show some long-term cycles in the number of days with temperatures below –40C, over the full period of record there is no apparent trend. On the other hand, over the past thirty years, the number of days below with temperatures below –40 have decreased at a rate of 39 Days/c or 168%. If this trend continued, there would be no days below –40 by the year 2040.
- **Mayo**. (See Figures 59&60.) Mayo also has indications of long-term cycles, but over the eighty years of record, there is an indication of about 7 fewer very cold days per century. Over the past thirty years, the decline has increased to a rate of 32 days per century. As with Dawson, if this trend were to continue, there would be no days below –40 by 2047.
- **Watson Lake**. (See Figures 61&62.) Over the past 65 years in Watson Lake, there is an overall trend towards fewer very cold days, about 4 days per century. The rate of decrease has accelerated over the past thirty years, being 21 days per century. If this trend were to continue, there would be no days below –40 by 2041.
- **Whitehorse**. (See Figures 63&64.) Whitehorse also has fewer very cold days, about five days per century. Over the past thirty years, the rate has increased to a loss of 11 days per century or over 200%. At this rate, there would be no more days with temperatures below –40 by 2026.

Frost-Free Days.

- **Dawson**. (See Figures 65&66.) The data for Dawson, from 1901 to the present, show some long-term cycles in the number of frost-free days, but over the full period of record there is an increase of 32 days/century or 75%. Over the past thirty years, the number of frost-free days increased at a rate of 74 days/century or 118%. The data was obtained from three different stations, and they were adjusted to match, as well as possible, data from similar periods from station 2100402. The frost temperature at station 2100400 was set to be +2.5C, while the frost temperature for station 2100LRP was set to be –0.5C. The frost temperature for station 2100402 was set to be 0C. Data from 2100400 were used from 1901 to 1975, from station 2100402 from 1976 to 2007 and from station 2100LRP for the years 2002, 2003, and 2008-2010.
- **Mayo**. (See Figures 67&68.) Mayo also has indications of long-term cycles, but over the 85 years of record, the number of frost-free days is increasing at a rate of 45 days/century of 84%. Over the past thirty years, the increase is at a rate of 35 days/century or 32%.

- **Watson Lake**. (See Figures 69&70.) Over the past 71 years in Watson Lake, there is an overall trend towards more frost-free days, up at a rate of nearly 11 days/century. Over the past thirty years, the rate has increased to 63 days/century or up 62%.
- **Whitehorse**. (See Figures 71&72.) Unlike the other stations, Whitehorse also has slightly fewer frost-free days. Over the period of record from 1942-2010, the number has been decreasing at a rate of about 7 days/century for a decrease of 9%. However, over the last thirty years there has, as with the other stations, been a rapid increase in the number of frost-free days: up at a rate of 42 days/century or 56%.

Mean Hourly Wind Speeds

- **Watson Lake**. (See Figures 73 to 78.) Watson Lake shows a significant decrease in mean hourly wind speeds, being down 6 km/h/century in winter (105%), 8 km/h/century in summer (67%), and 7 km/h/century when averaged over the entire year (75%). This is a reduction of one half over the last fifty years for winter, and about one third over the last fifty years overall. For the past 30 years, the decreases are 7 km/h/century in winter (161%); 14 km/h/century in Summer (130%) and 11 km/h/century over the year (130%).
- **Whitehorse**. (See Figures 79 to 84.) Whitehorse also shows a decrease in mean hourly wind speeds, although not as great as for Watson Lake. The decreases for Whitehorse over the full period of record are: 4 km/h/century in winter (28%); 6 km/h/century in summer (39%); and, and about 5 km/h/century over the year (34%). For the past 30 years, the decreases are 6 km/h/century in winter (39%); 2 km/h/century in Summer (14%) and 3 km/h/century over the year (21%).

Yukon Lightning

Yukon lighting strikes are available from 1986 to the present. (See Figure 85.) Only data from the month of May 2004 are missing. These were replaced with the average May total, some 488 strikes. The effect of these 488 strikes on the total for the summer, some 38,000 strikes, is negligible. The number of summer lightning strikes has increased dramatically over the years, with an increase of 16,500 strikes per century, or 103%. Much of this is due to the strong lightning year of 2004, which also saw a record area of forest burned. Ignoring this year, the increase is still high, being 43%/c. How much, if any, of this increase is due to changes in the network is unclear.

Fine Fuel Moisture Codes

Finally, changes in the average June values for four of the Canadian Forest Service’s Fire Weather Indices were examined for the years 1953 to 2010 for the four stations. The Canadian Forest Fire Danger Rating System provides for the assessment of relative fire potential solely on the basis of weather observations. The FWI System's six components individually and collectively account for the effects of fuel moisture and wind on ignition potential and probable fire behavior in the form of relative numeric ratings. (Canadian Forest Service, 1996.)

The Fine Fuel Moisture Code (FFMC) is a numeric rating of the moisture content of litter and other cured fine fuels. This code is an indicator of the relative ease of ignition and the flammability of fine fuel. (See Figures 86 to 93.)

For the four stations considered, Dawson and Mayo showed very little trend over the 54 year period, rising at a rate of 3-4%/century. Both Watson Lake and Whitehorse showed a decrease of a similar amount, namely around 5 points per century or 6%. Over the past thirty years, Dawson is up at a rate of 14 points per century (18%/c); Mayo is up 7 points per century (9%/c); Watson Lake is down 14 points per century (17%/c); and, Whitehorse is down 5 points per century (7%/c).

Initial Spread Index

The Initial Spread Index (ISI) is a numeric rating of the expected rate of fire spread. It combines the effects of wind and the FFMC on rate of spread without the influence of variable quantities of fuel. (See Figures 94 to 101.)

Dawson and Mayo each showed an increase over the period, equaling about 1.7 points per century (44%/c), while both Watson Lake and Whitehorse had decreasing ISIs of –5.4 and –4.7 points per century (75%/c and 58%/c). These decreases are a consequence of lighter winds and lower FFMCs. Over the past 30 years, Dawson's increase has risen to a rate of 4.7 points per century (125%). Mayo's rate of increase slowed a bit to 1.4 points per century (31%). Watson Lake continues on a downward trend with a decrease of 8.3 points per century (131%/c), while Whitehorse has changed direction and shows a very slight increase in rate to 0.8 points per century of 13%/c.

Drought Code

The Drought Code (DC) is a numeric rating of the average moisture content of deep, compact organic layers. This code is a useful indicator of seasonal drought effects on forest fuels and the amount of smoldering in deep duff layers and large logs. This code is a measure of wet and dry spells. (See Figures 102 to 109.)

Each of the four stations showed changes in Drought Codes over the period of record (1953-2010): Dawson up 91 points per century (35%/c), Mayo up 40 (13%/c), Watson Lake down 13 points per century (7%/c) and Whitehorse up 51 points per century (15%/c). Over the past 30 years, Dawson's rate has increased to 540 points/century (265%/c); Mayo's has reversed and shows a decrease in rate of 21 points per century (6%/c). Dawson's rate of decrease accelerated to a loss at a rate of 230 points per century (103%/c), while Whitehorse has reversed and is showing a decrease at a rate down 115 points per century (30%).

Fire Weather Index

The Fire Weather Index (FWI) component itself combines the ISI and Build Up Index (BUI) to indicate the potential intensity of a fire on level terrain in a stand of mature pine. (See Figures 110 to 117.)

Dawson and Mayo show increases in the FWI (7.0 and 4.5 points/century respectively (68%/c and 37%/c), whereas Watson Lake and Whitehorse show decreases of 9 and 11 points/century (56%/c and 48%/c). Over the past thirty years, Dawson's rate has increased to 24 points per century (260%/c), Mayo has increased its rate to 13 points per century (105%/c), Watson Lake's decrease continues at a rate of 19 points per century (127%/c) and Whitehorse has reversed its trend and is not slightly positive: up 2 points per century (15%/c).

Conclusion

There is strong evidence of climate change in the Yukon in the set of weather data available for the territory. Overall, winters and summers are warmer, with winters showing the greatest change. Each of the four stations had a period of strong cooling approximately between 1940 and 1970. This was followed by even stronger warming from 1970-2000. Over the past thirty years, Dawson, Mayo and Watson Lake had winters warming by 6-7 degrees per century, while the increase for Whitehorse was about 4 degrees per century. Dawson, with a longer record, showed strong warming from 1902 to 1925.

Summer mean maximum temperatures show a similar pattern to winter mean minimum temperatures, with a period of cooling from 1940 to about 1970. For Dawson and Mayo, this period of cooling, 1941 to 1964 was about ten years before the cooling period in Watson Lake and Whitehorse. The warming trend over the past thirty years is between 3 and 4 deg. C/century for Dawson, Mayo and Whitehorse with Watson Lake's summer temperatures increasing by about 1 deg. C/century.

Over the past thirty years, winters, for the most part, are drier, although Dawson has a very slight decrease. Summers are wetter, although Dawson is again the exception with drier summers. Over the year, all stations have an increase, with the largest occurring in Mayo and Watson Lake, where precipitation is increasing at a rate of about 70% per century. It should be noted that Dawson does not have enough data in the last few years, so their period of record is not strictly comparable to those of the other stations.

Over the past thirty years, there has been a remarkable decrease in snow depth for the 28 February at Dawson and Whitehorse, with little change in Mayo and an increase at Watson Lake.

For Whitehorse and Watson Lake, winds are not as strong. Summer lightning across the Yukon is more frequent. The Yukon River is breaking-up earlier.

Forest Fire indices were also examined. Watson Lake and Whitehorse had decreases in the Fine Fuel Moisture Codes, while Dawson showed no trend and Mayo's trend was up. The Initial Spread Index was up in Dawson and Mayo, but down quite strongly in Watson Lake and Whitehorse. All four stations showed increasing Drought Codes, with the strongest increase in Whitehorse and the least in Dawson. Finally, the Fire Weather Index was slightly higher in Dawson and Mayo (up two points) and down about ten points in Whitehorse and Watson Lake.

This study has shown problems with the climate record datasets. Many stations have only very spotty records, and some stations have moved frequently. If there are no overlapping observations with those stations in their old and new locations, it is very difficult to estimate the effect of the move on the data.

Furthermore, there are considerable year-to-year variations in the data, and these variations can cause different results to be calculated depending on whether or not they are included in the sample. There also appear to be long-term trends embedded in the record, and these too can have a marked effect on long-term trend calculations. For example, there was a period of cooling from the 1940s to the 1970s, with the cooling trend occurring earlier at the two northern stations than the two in the south. Atmospheric scientists believe this cooling was caused by an increase in aerosols in the atmosphere from increasing industrial activity in the western world. Clean air acts in the late 1970s saw these emissions reduced, which allowed the atmospheric temperatures to rise sharply (NASA and Figure 118.) The warming in the period 1971-2000 is much stronger than in the period 1981-2010 as the warming effects of reduced aerosols combined with the effect of increased carbon dioxide.

While the Yukon is generally free from the effects of urbanization, there are possible problems with winter minimum temperatures at Whitehorse airport. On very clear cold nights, wood smoke from houses in the Hillcrest subdivision can be seen drifting down and across the airport. This can effect the change in the air temperature, but its effect cannot be reliably estimated from the climate data record.

References

Canadian Forest Service. *Canadian Forest Fire Danger Rating System*. http://fire.cfs.nrcan.gc.ca/research/environment/cffdrs/description_e.htm 1996.

K. J. Clarke K. J., Purves M.A. *Clarke Index Plus Precipitable Water Equals Lightning.* Yukon Weather Centre Internal Report YWC-91-15. 9 September 1991. Unpublished manuscript.

Kepke K., Purves M.A., *Lightning in the Yukon: A Climatology*. Yukon Weather Centre Internal Report. YWC-93-31. 25 January 1993. Unpublished manuscript.

Mac's Fireweed Books. *A Dawson City / Yukon Tradition.* http://www.yukonbooks.com/dawson_webcam/ice_pool_history.html

Purves. M.A., *Forecasting Lightning in the Yukon*. Yukon Weather Centre Internal Report YWC-93-41. 19 May 1993. Unpublished manuscript.

Purves M.A., Trojan G. *Climate Manager 1.0.* Yukon Weather Centre Internal Report. YWC-95-65. 1 November 1995. Unpublished manuscript.

NASA, *From a Dimmer Past to a Brighter Future*. http://earthobservatory.nasa.gov/Features/GISSTemperature/giss_temperature4.php

List of Figures

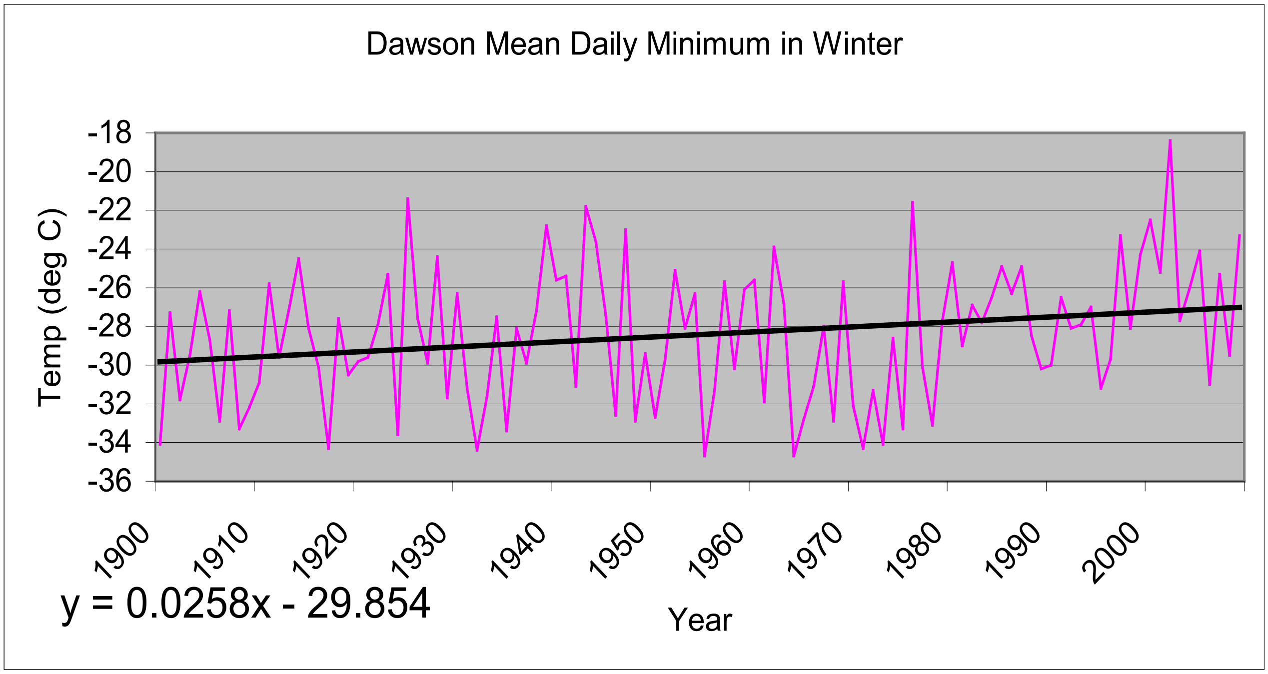

Figure 1. Dawson Mean Daily Minimum in Winter. (1900-2009)

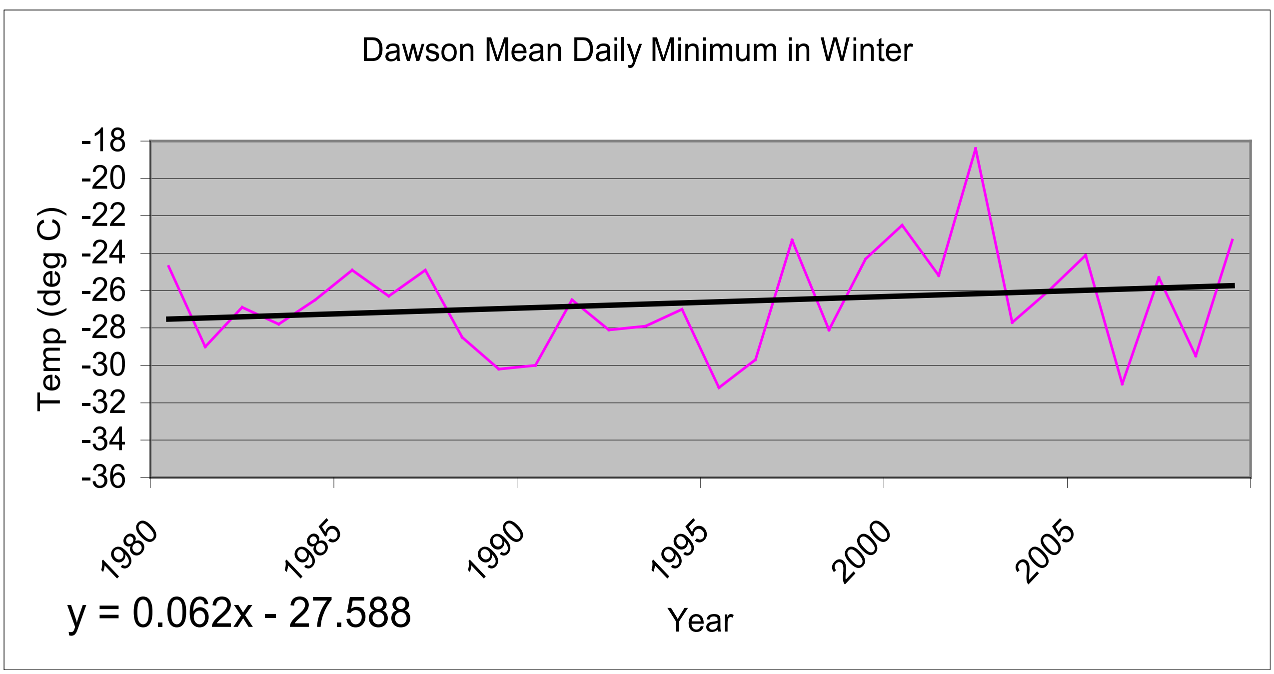

Figure 2. Dawson Mean Daily Minimum in Winter. (1980-2009)

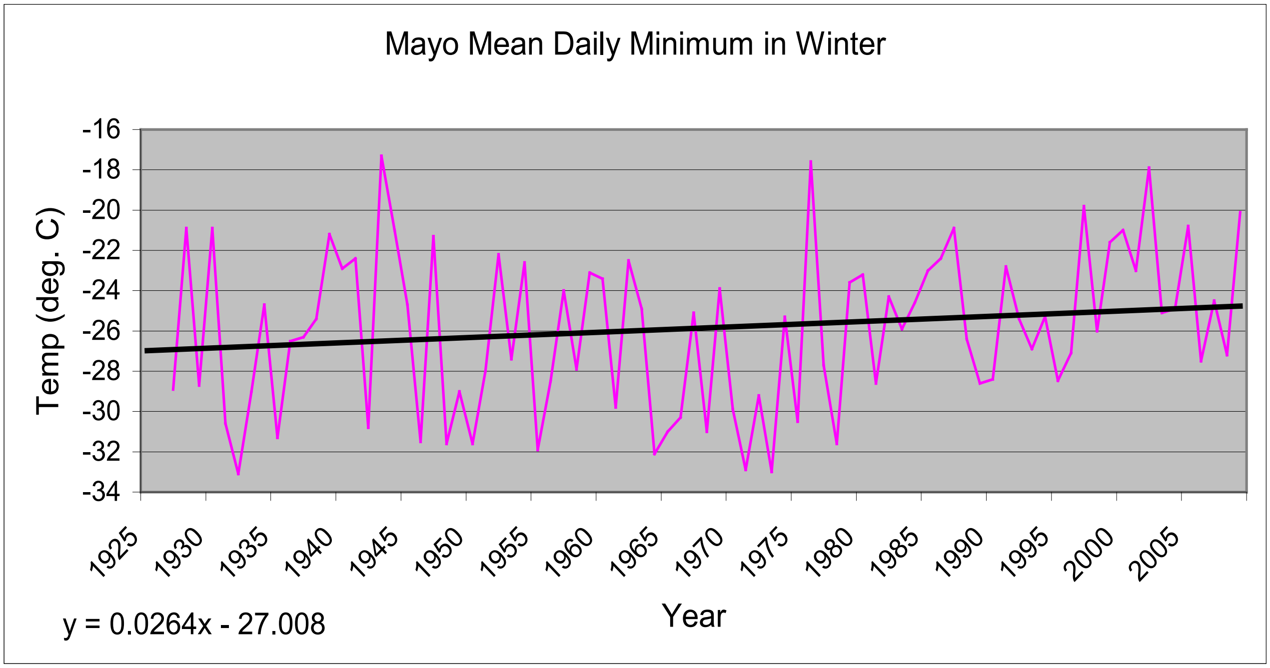

Figure 3. Mayo Mean Daily Minimum in Winter. (1925-2009)

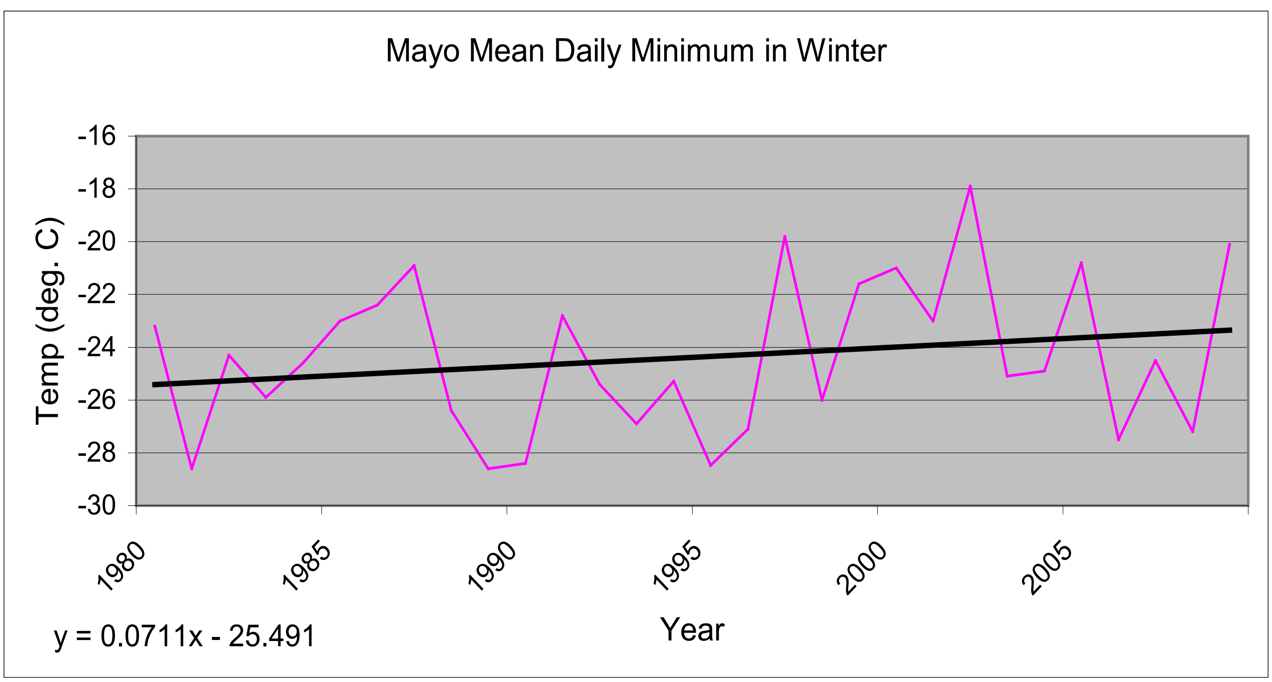

Figure 4. Mayo Mean Daily Minimum in Winter. (1925-2009)

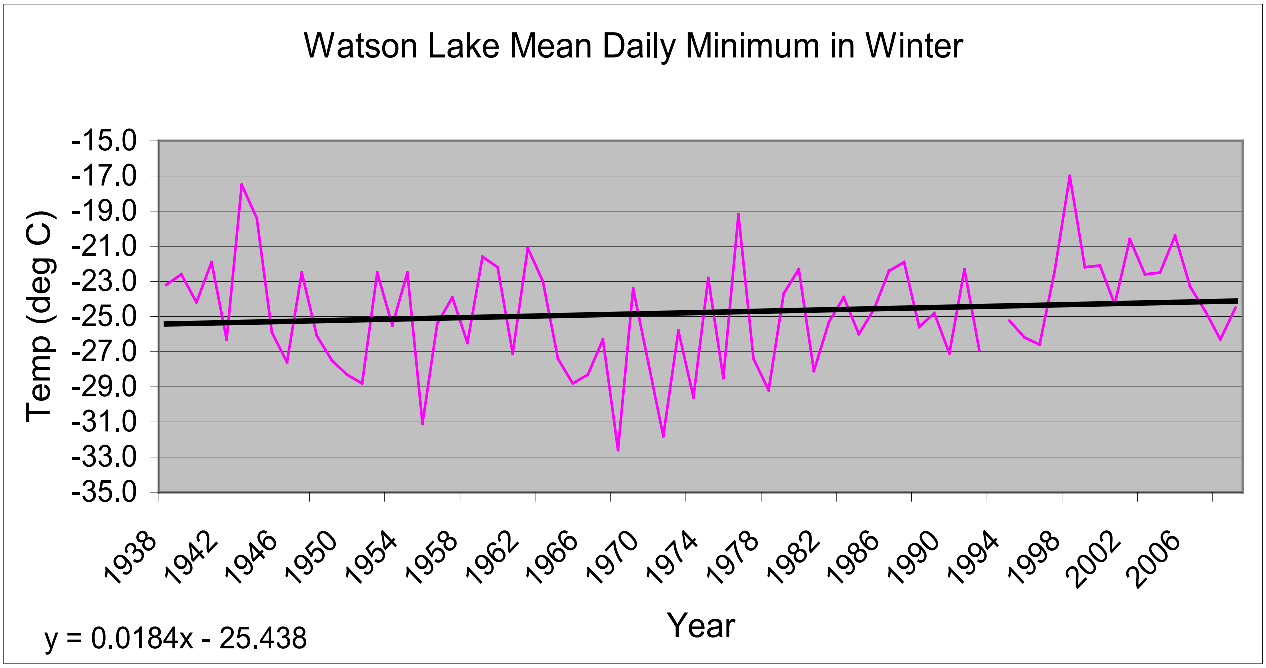

Figure 5. Watson Lake Mean Daily Minimum in Winter. (1938-2009)

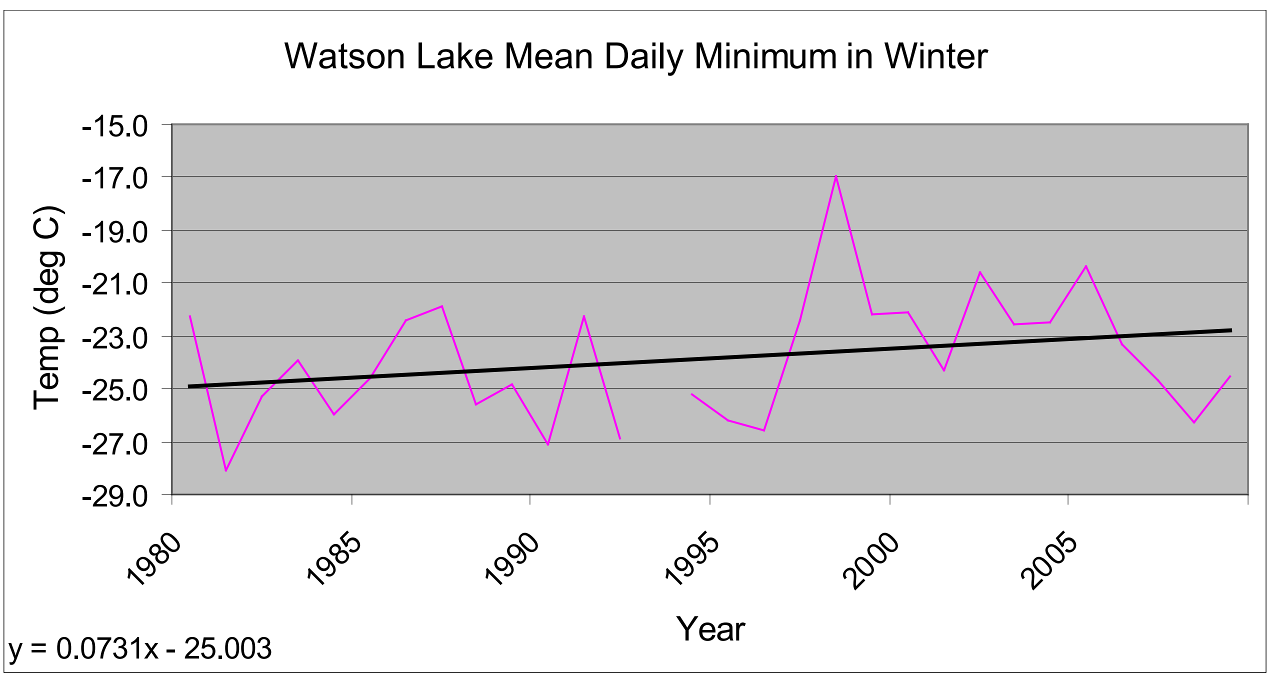

Figure 6. Watson Lake Mean Daily Minimum in Winter. (1980-2009)

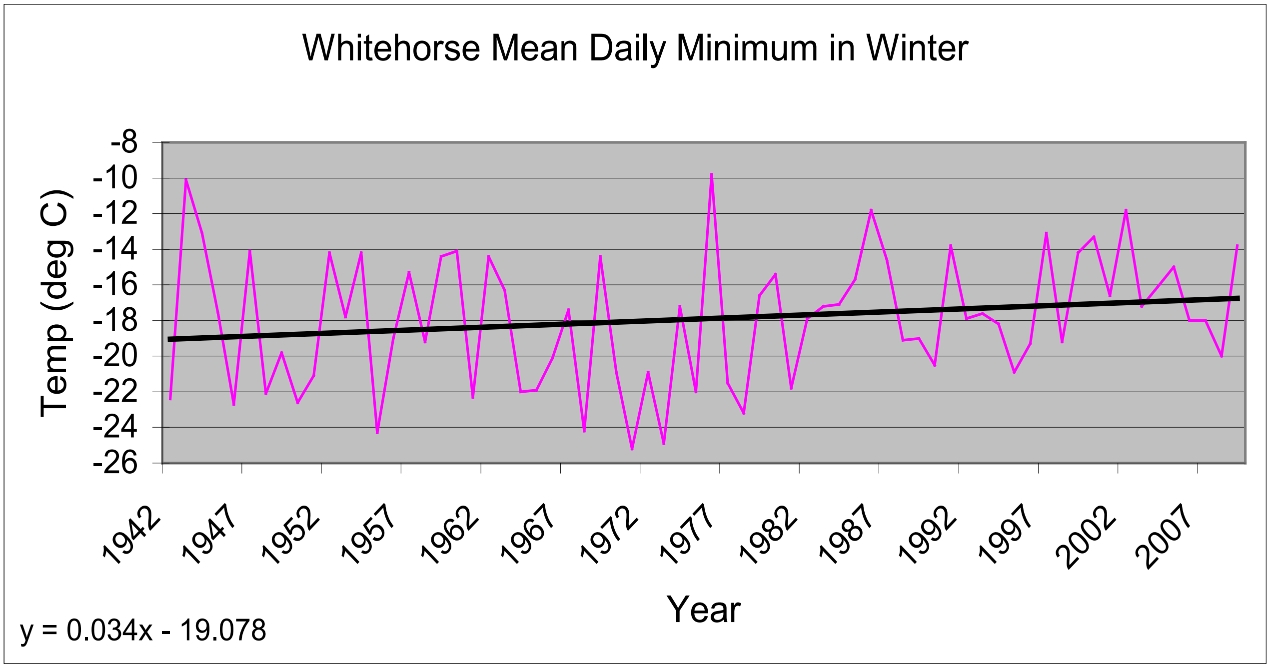

Figure 7. Whitehorse Mean Daily Minimum in Winter. (1942-2009)

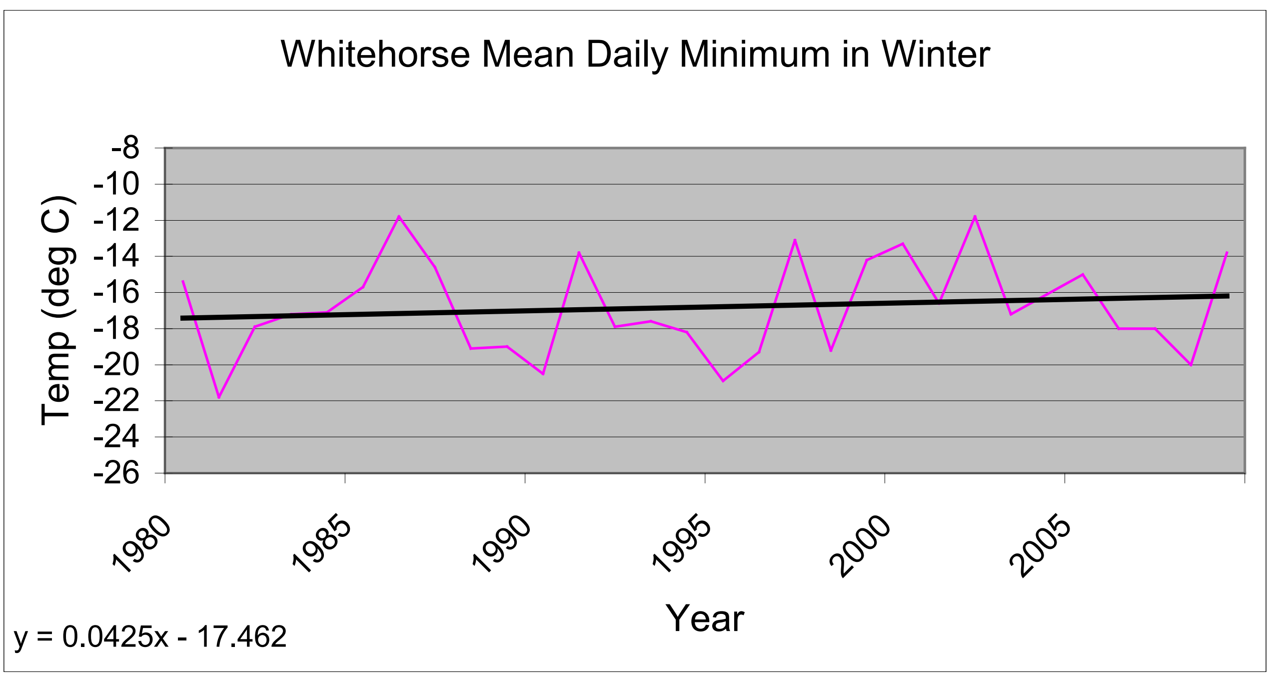

Figure 8. Whitehorse Mean Daily Minimum in Winter. (1980-2009)

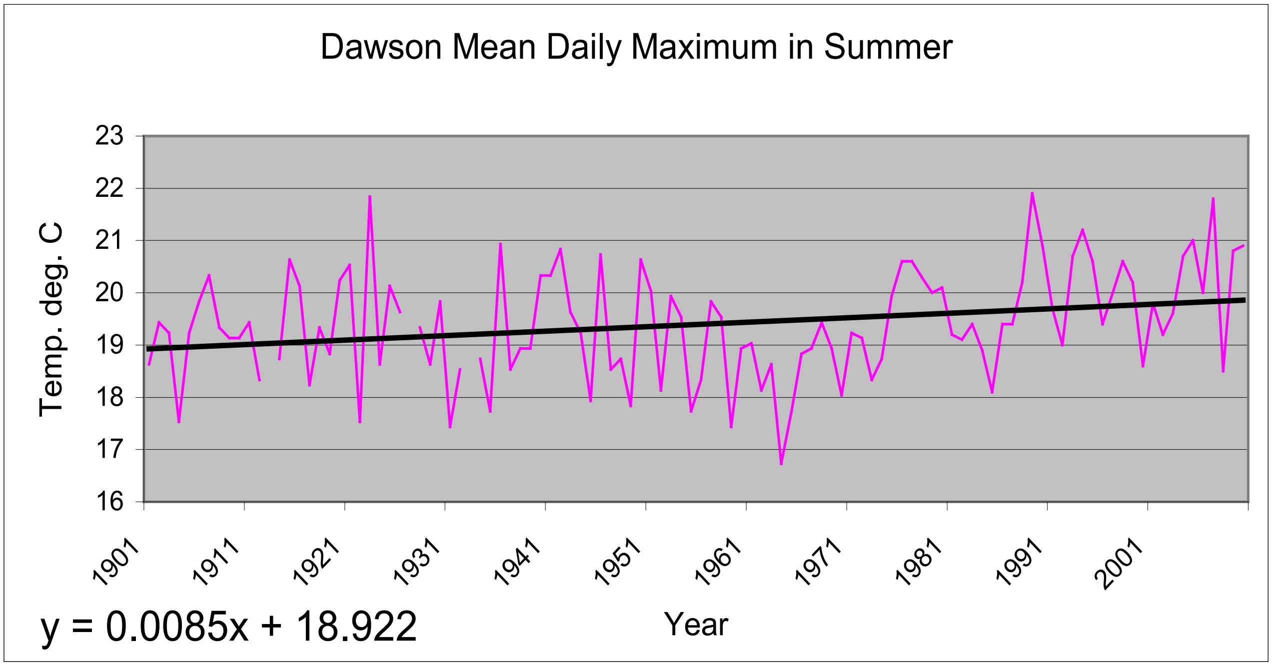

Figure 9. Dawson Mean Daily Maximum in Summer (1900-2010)

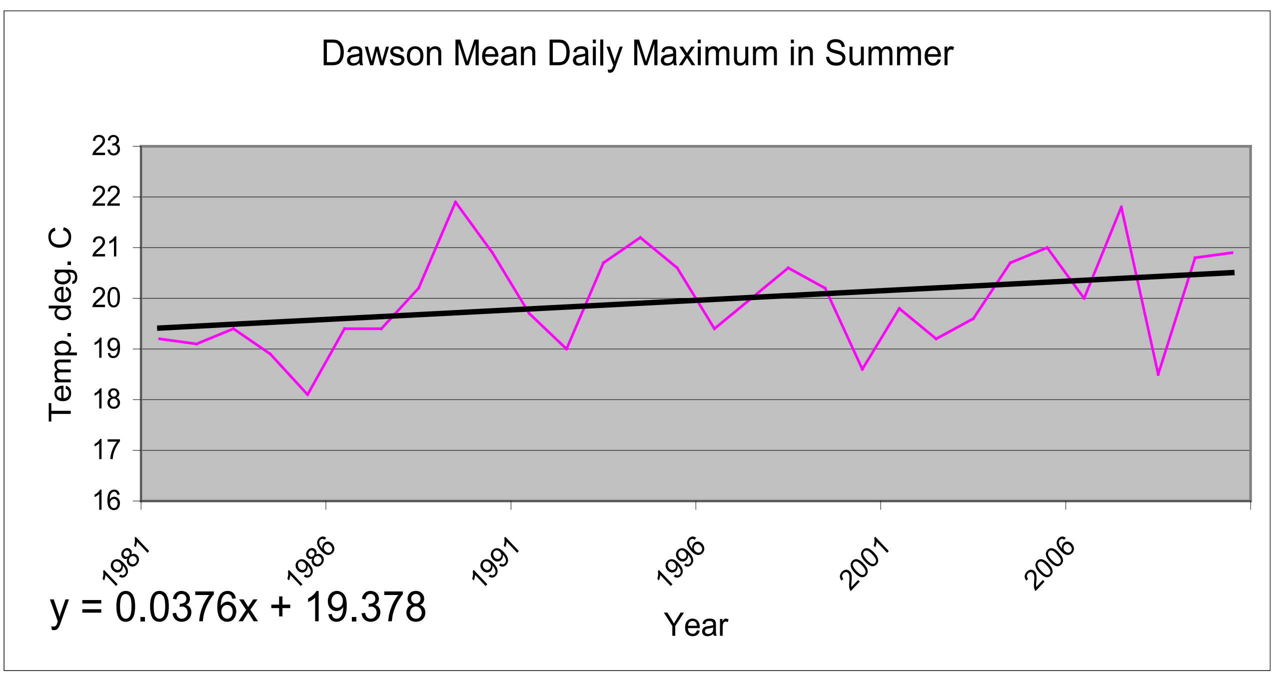

Figure 10. Dawson Mean Daily Maximum in Summer (1981-2010)

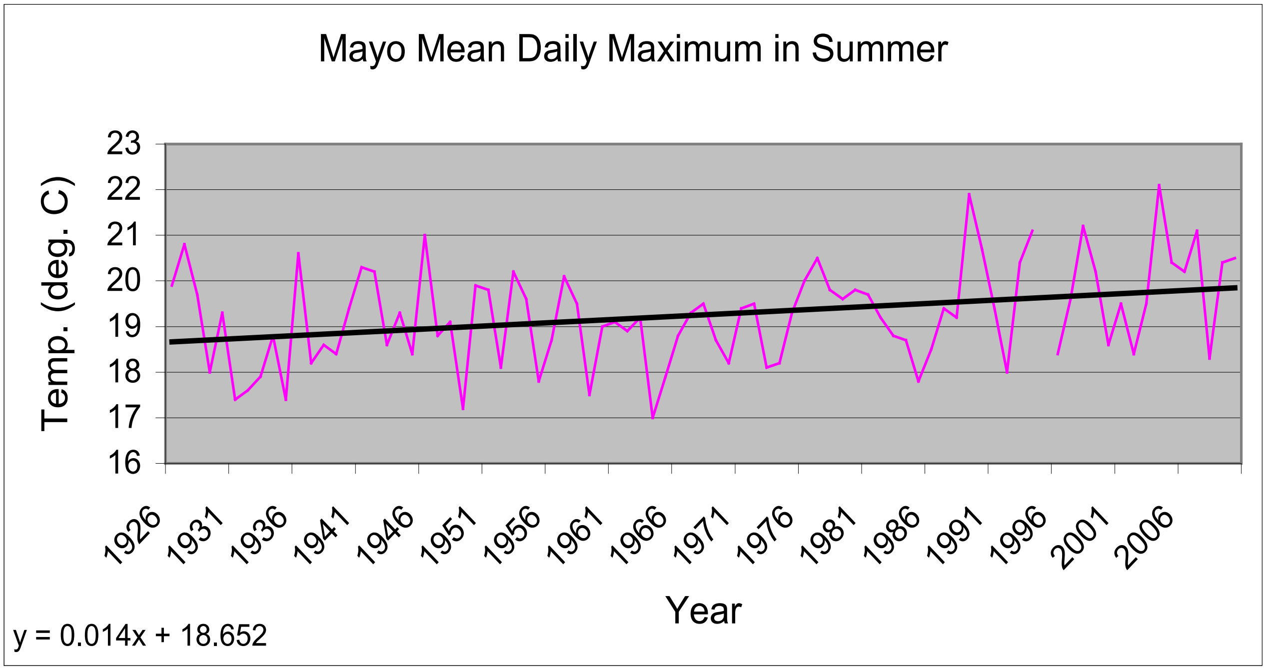

Figure 11. Mayo Mean Daily Maximum in Summer. (1926-2010)

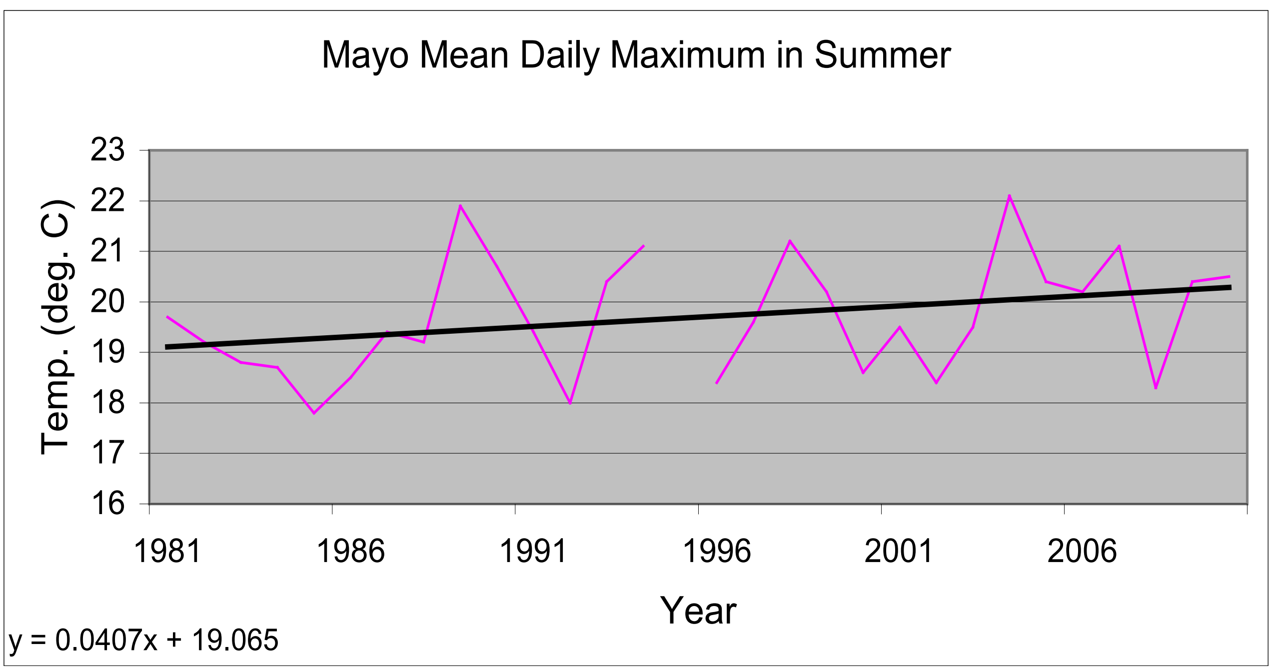

Figure 12. Mayo Mean Daily Maximum in Summer. (1981-2010)

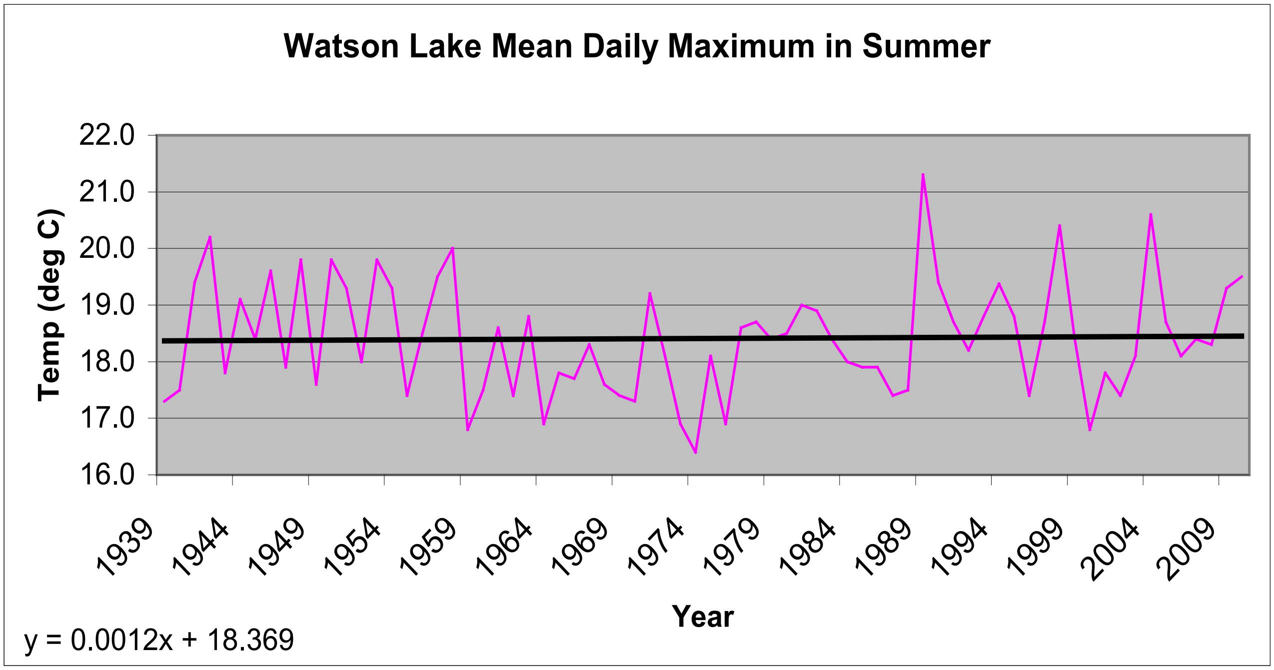

Figure 13. Watson Lake Mean Daily Maximum in Summer. (1939-2010)

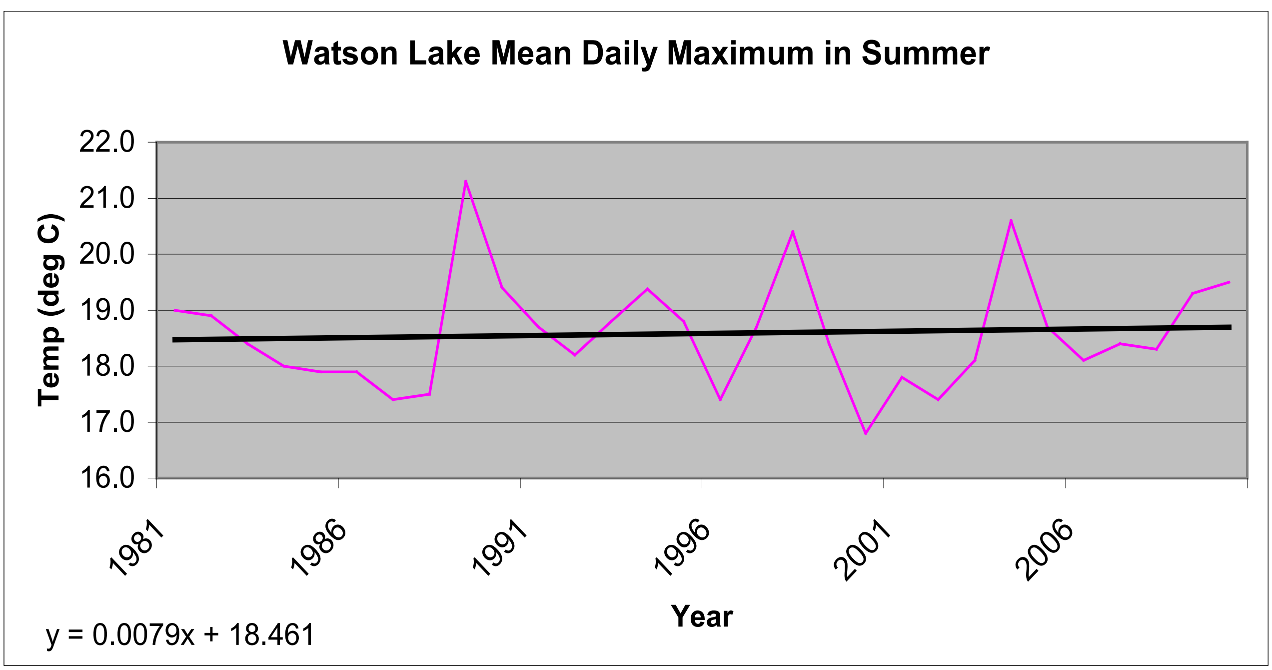

Figure 14. Watson Lake Mean Daily Maximum in Summer. (1981-2010)

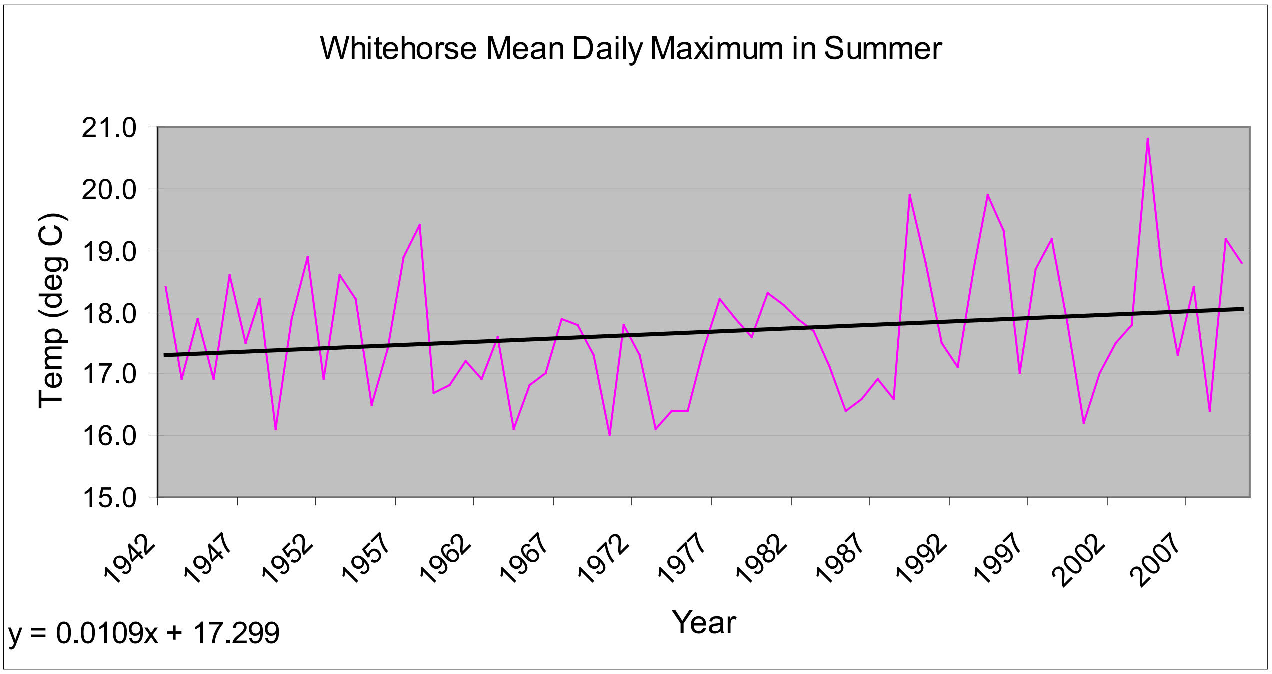

Figure 15. Whitehorse Mean Daily Maximum in Summer. (1942-2010)

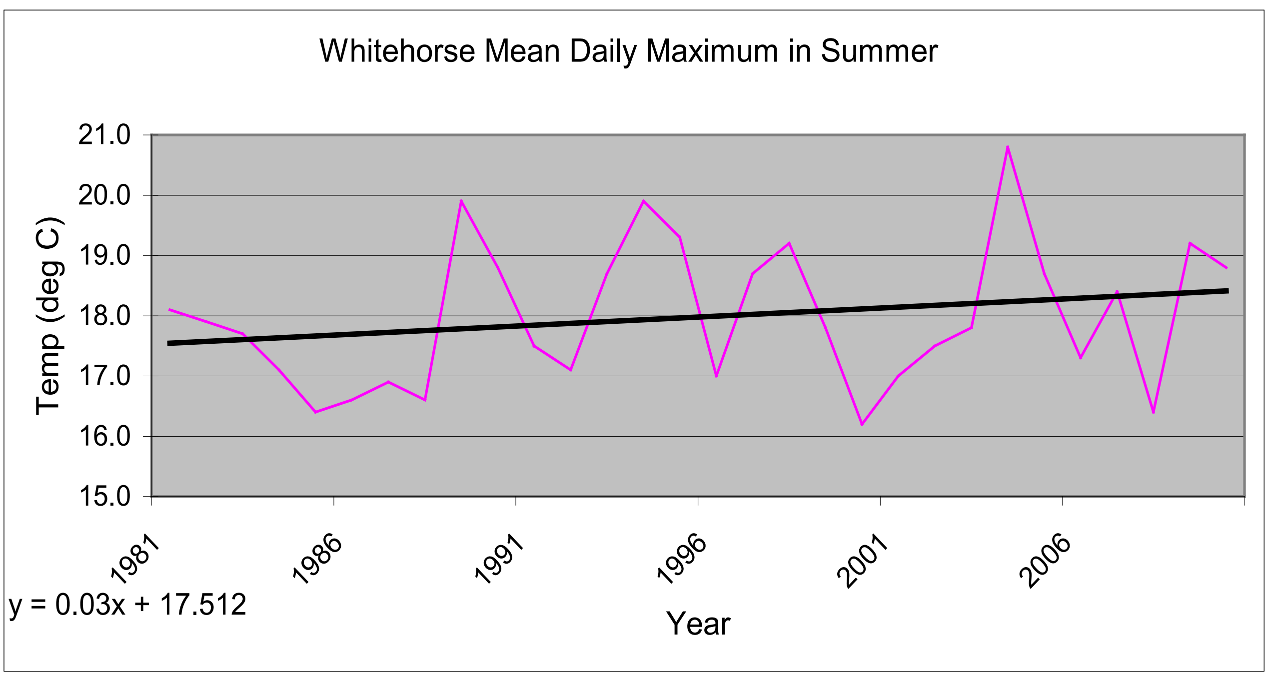

Figure 16. Whitehorse Mean Daily Maximum in Summer. (1981-2010)

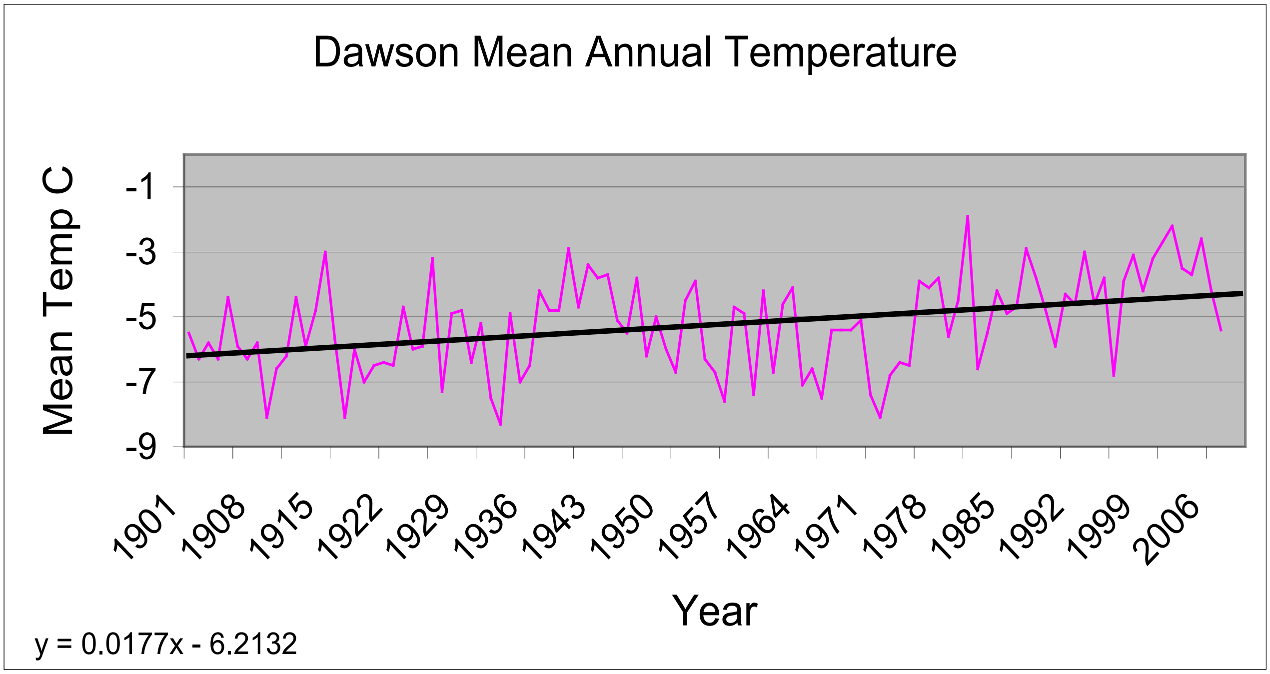

Figure 17. Dawson Mean Annual Temperature. (1901-2009)

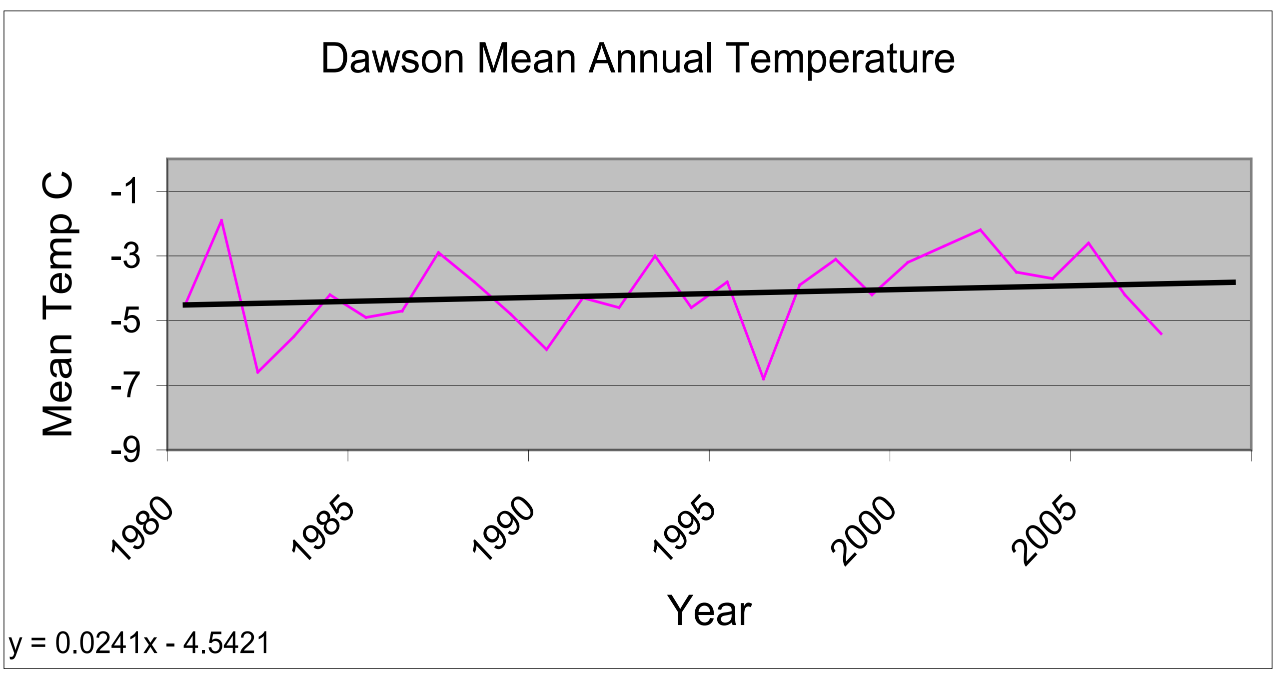

Figure 18. Dawson Mean Annual Temperature. (1980-2009)

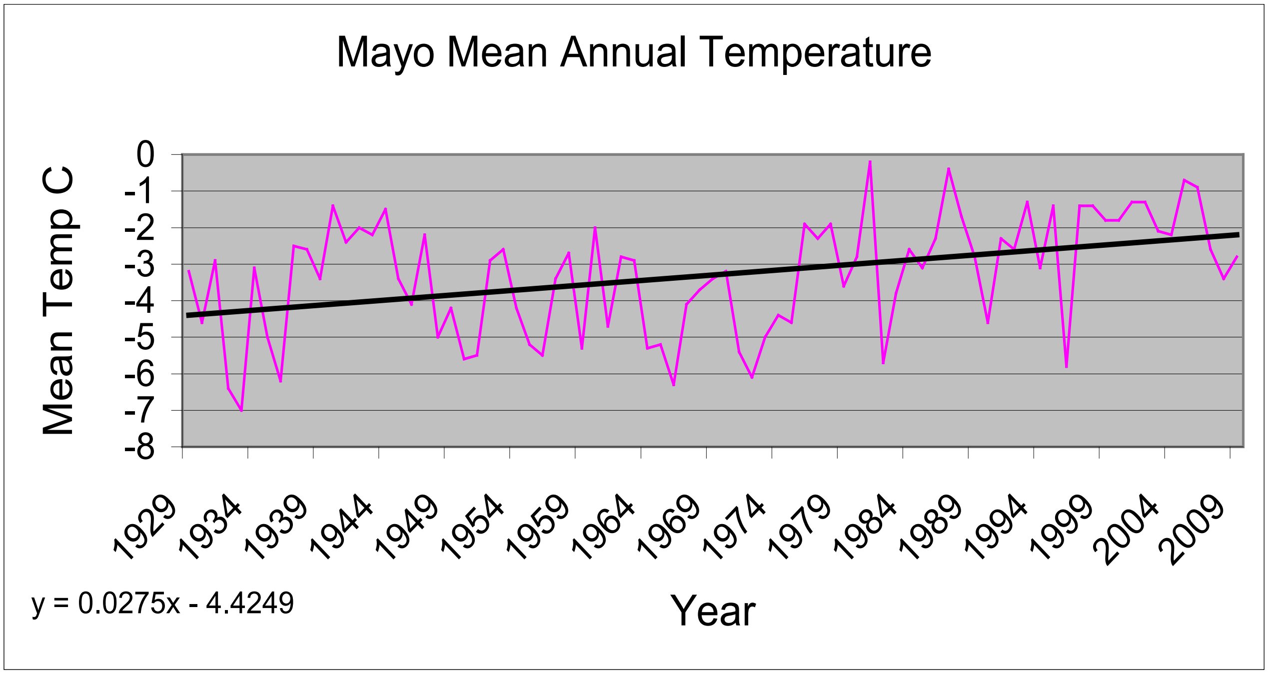

Figure 19. Mayo Mean Annual Temperature. (1929-2009)

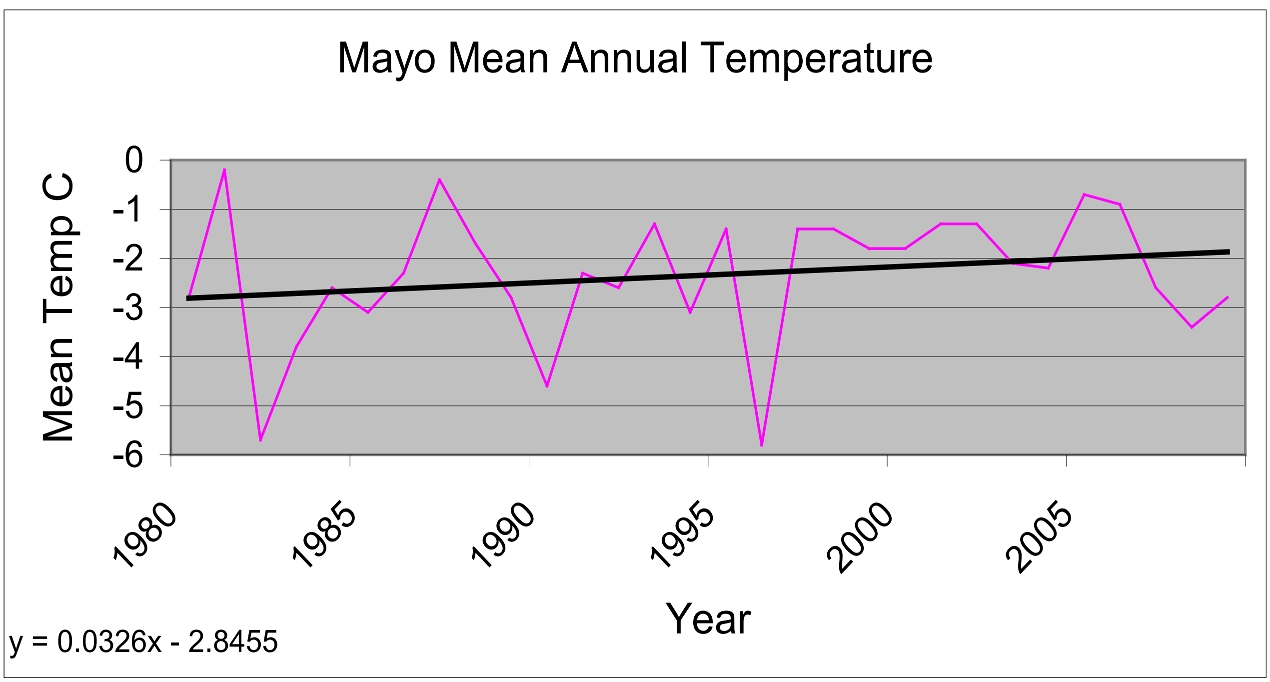

Figure 20. Mayo Mean Annual Temperature. (1980-2009)

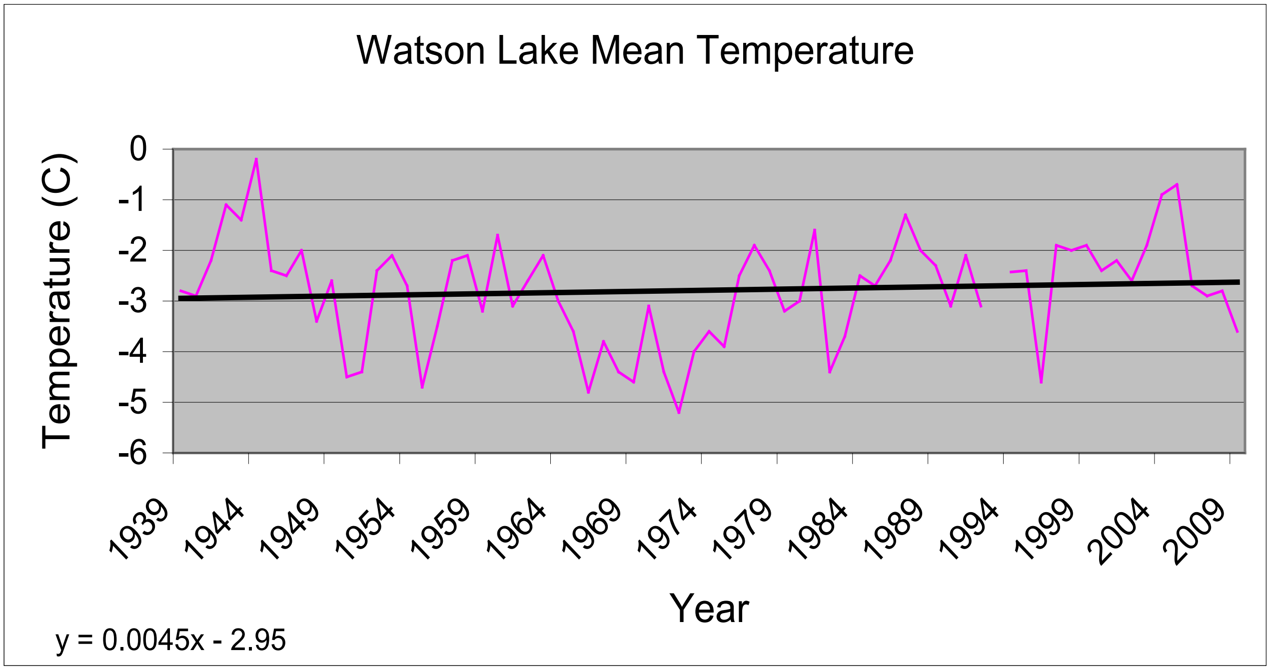

Figure 21. Watson Lake Mean Annual Temperature. (1939-2009)

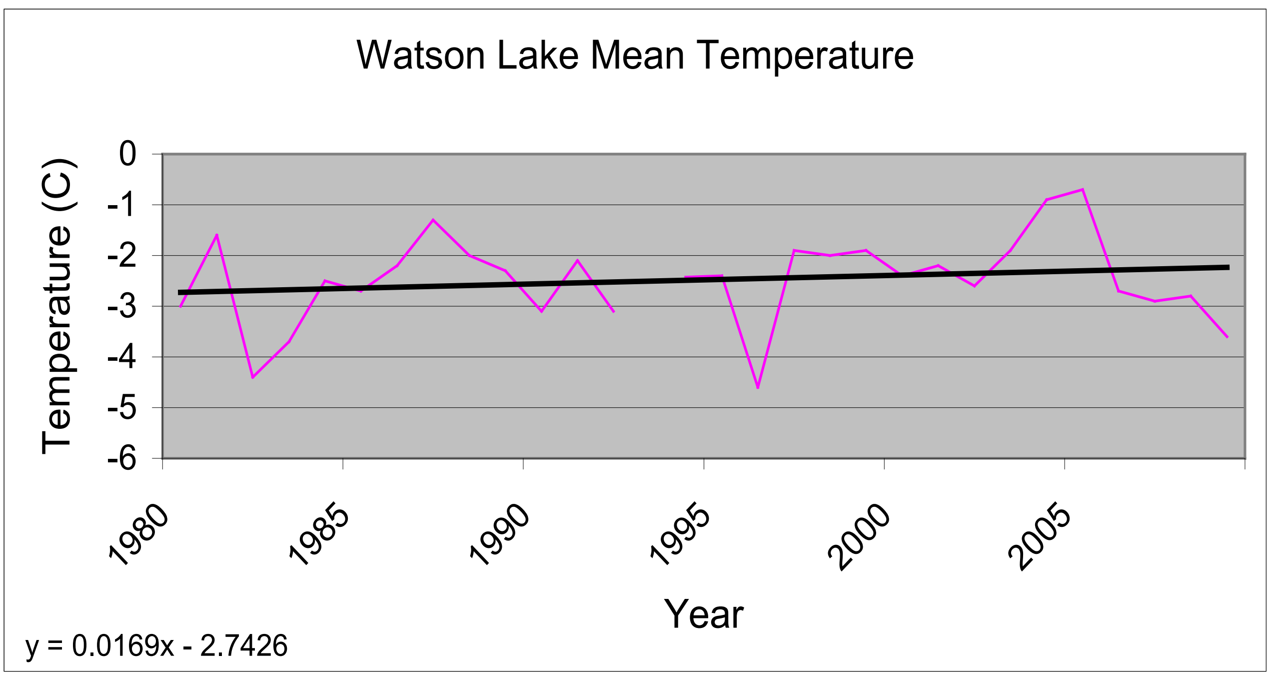

Figure 22. Watson Lake Mean Annual Temperature. (1980-2009)

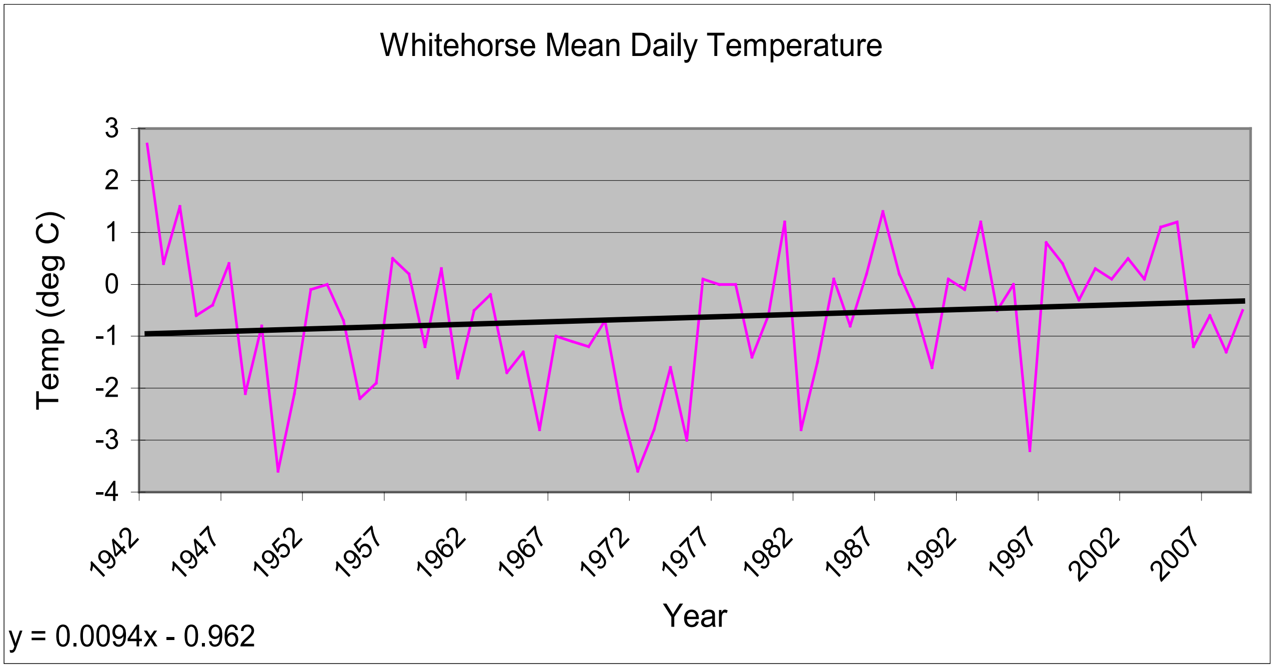

Figure 23. Whitehorse Mean Annual Temperature. (1942-2009)

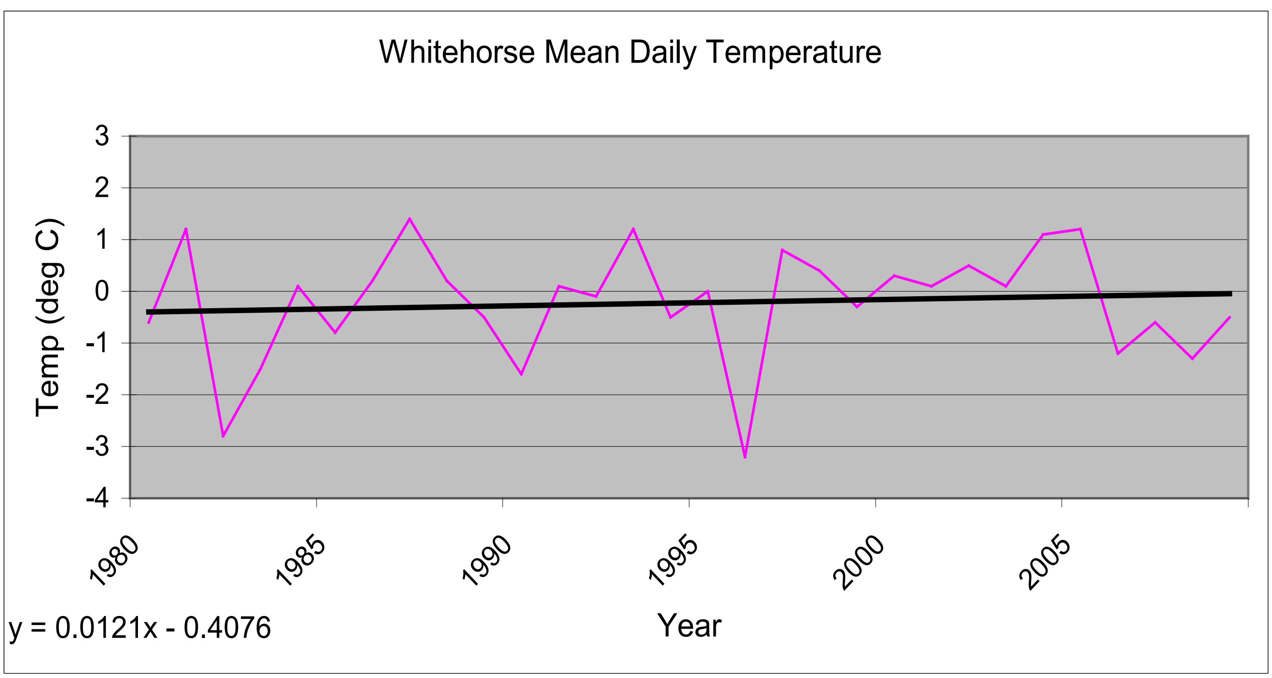

Figure 24. Whitehorse Mean Annual Temperature. (1980-2009)

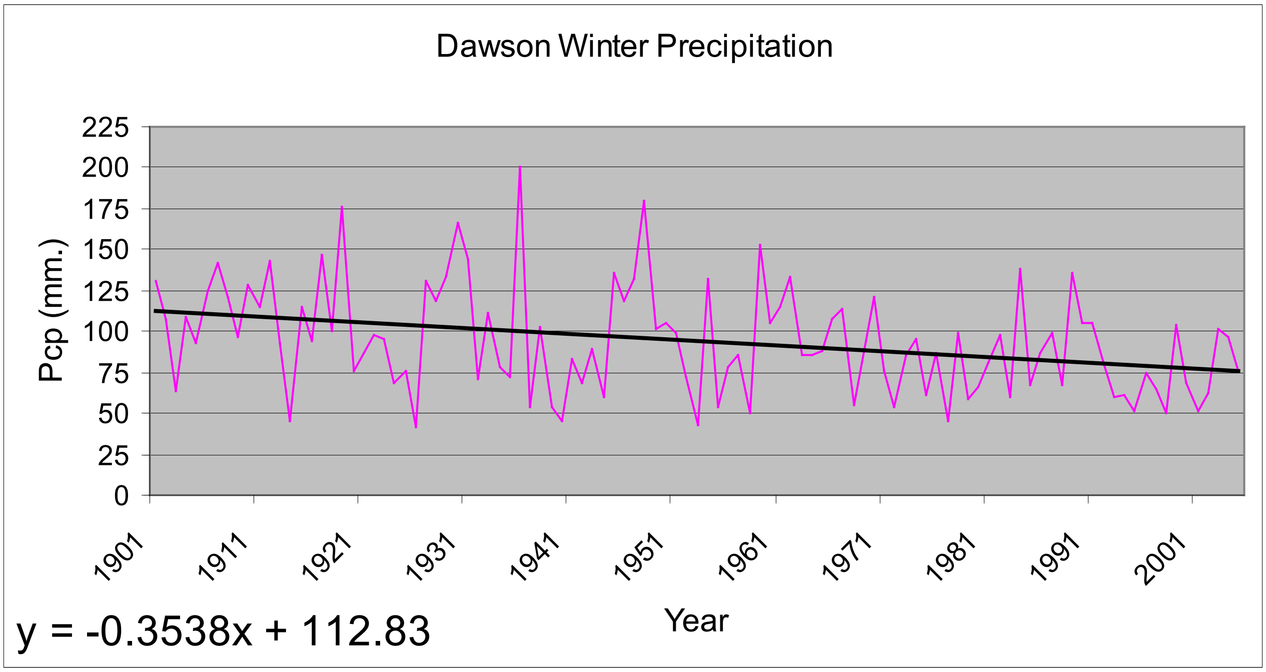

Figure 25. Dawson Winter Precipitation. (1901-2005)

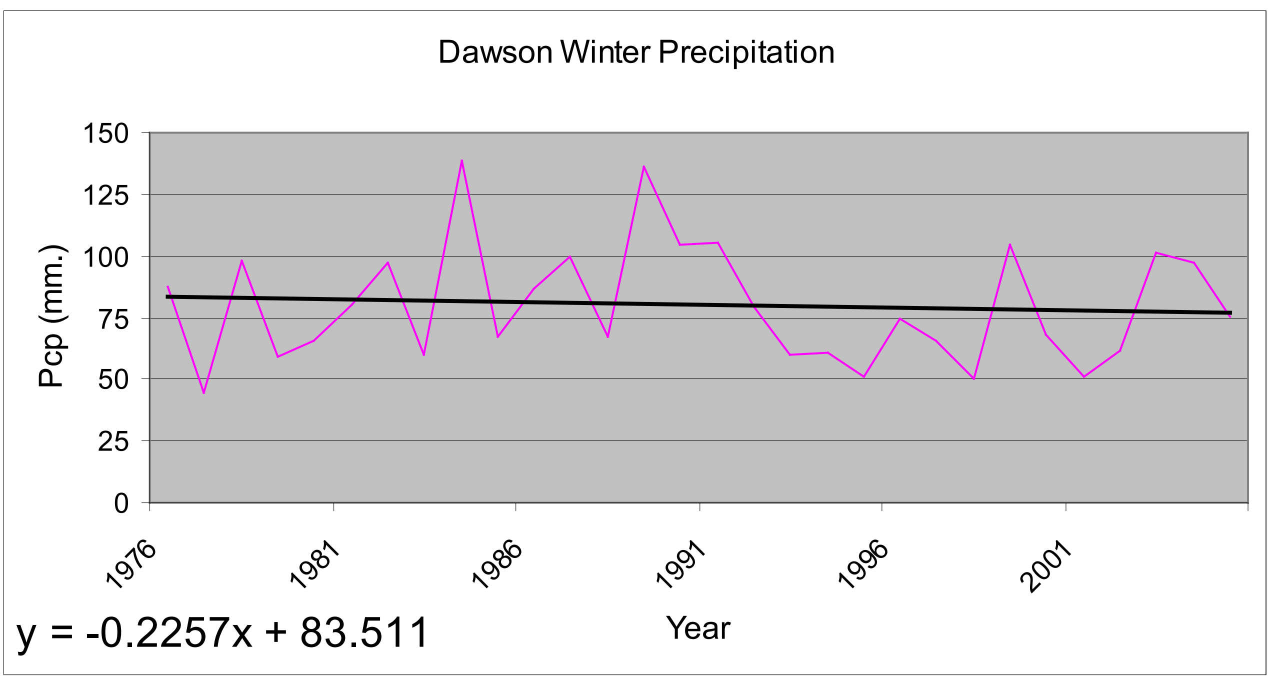

Figure 26. Dawson Winter Precipitation. (1976-2005)

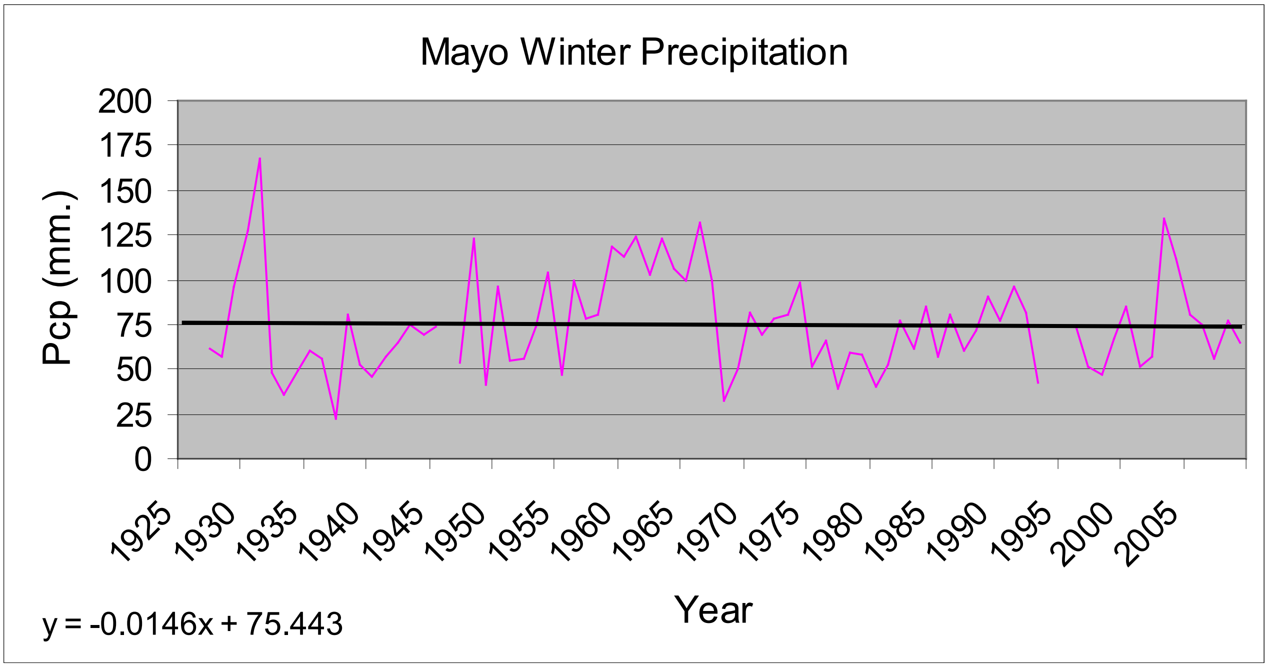

Figure 27. Mayo Winter Precipitation. (1925-2009)

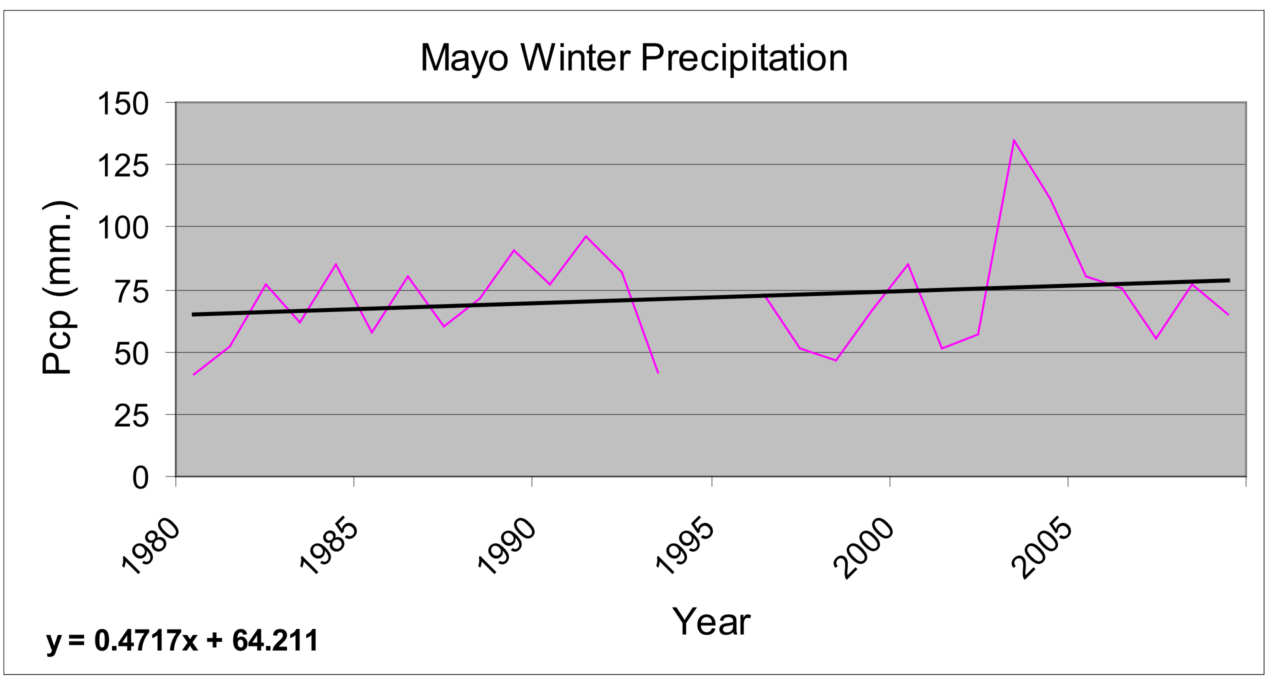

Figure 28. Mayo Winter Precipitation. (1980-2009)

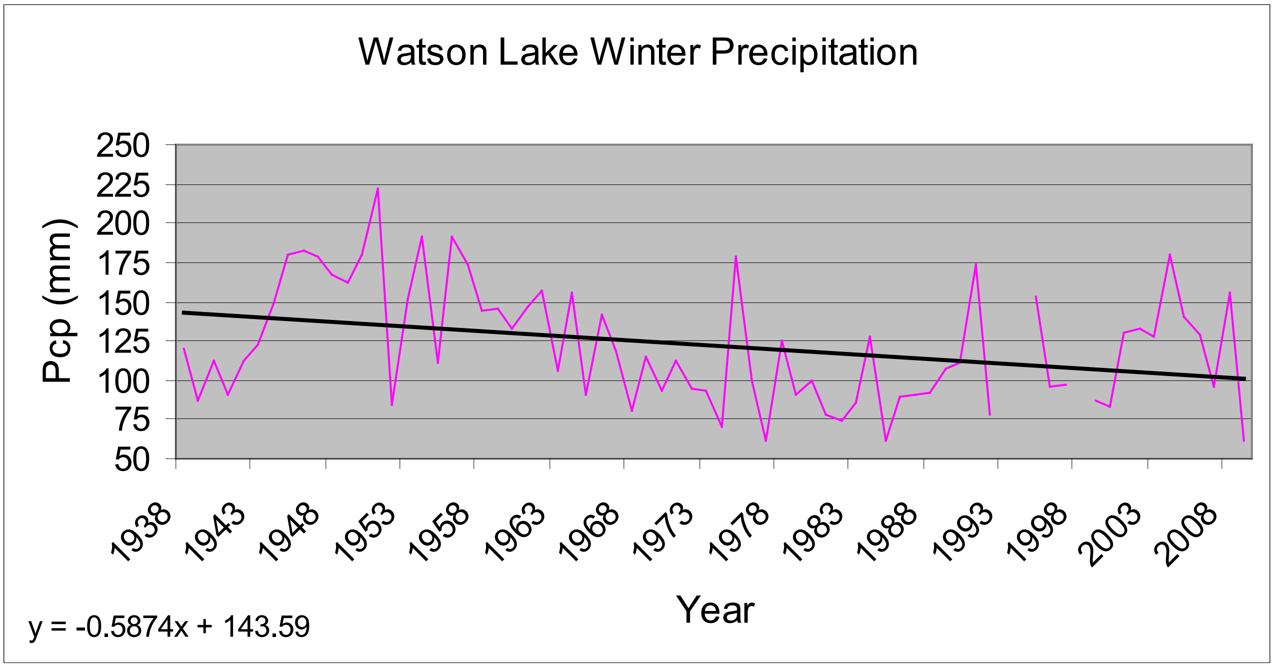

Figure 29. Watson Lake Winter Precipitation. (1938-2009)

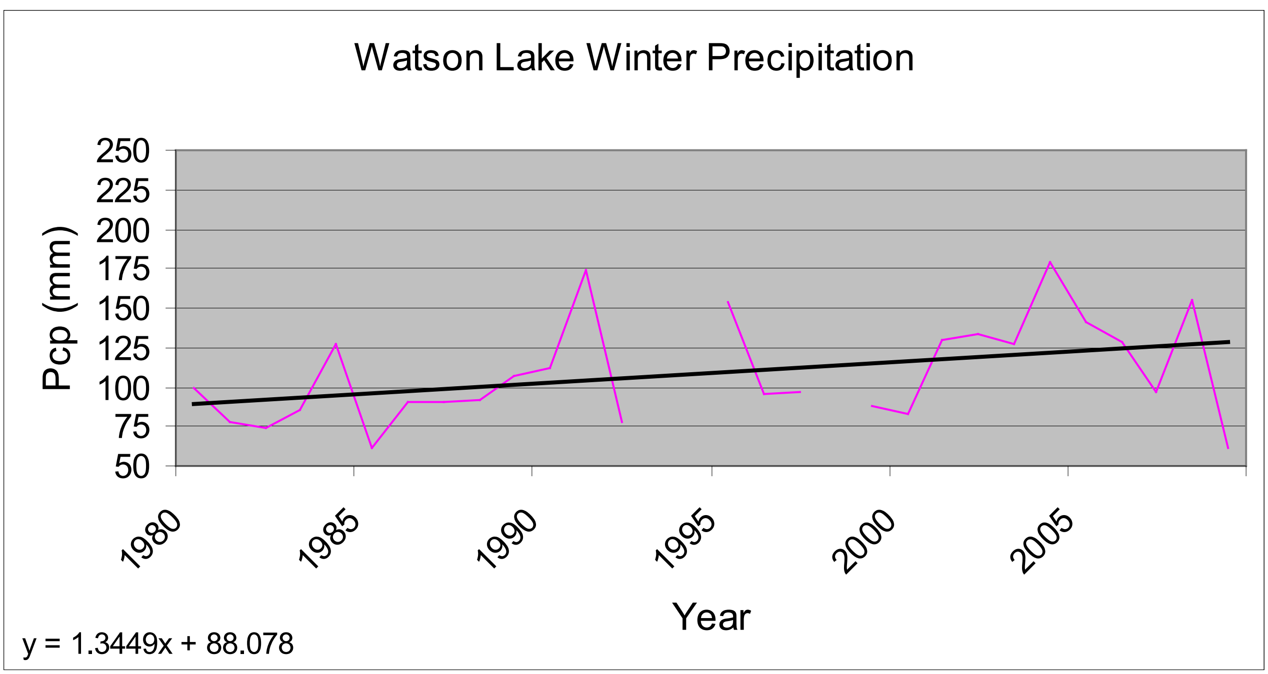

Figure 30. Watson Lake Winter Precipitation. (1980-2009)

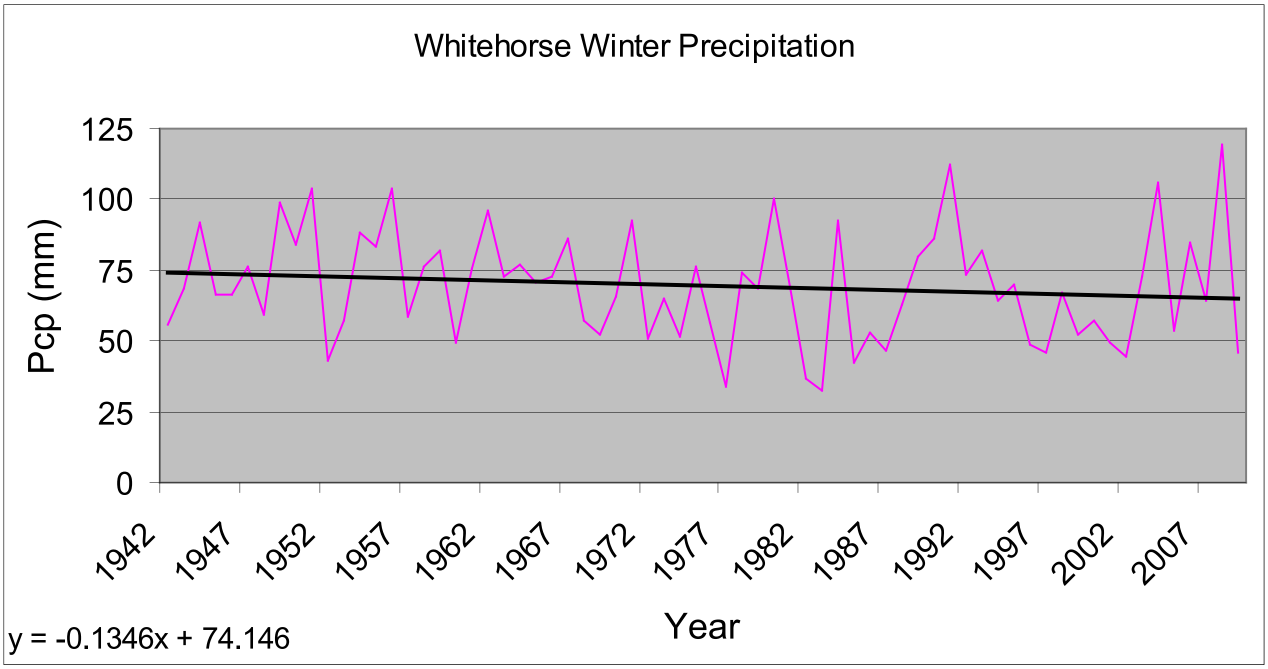

Figure 31. Whitehorse Winter Precipitation. (1938-2009)

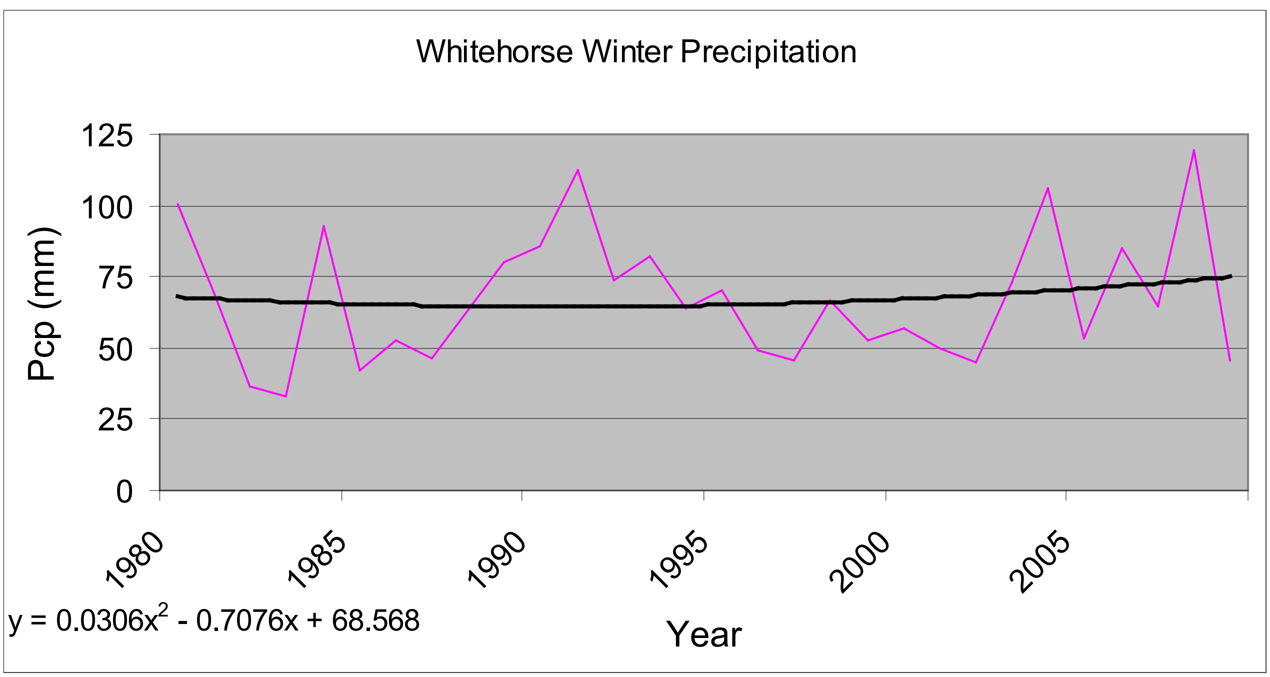

Figure 32. Whitehorse Winter Precipitation. (1980-2009)

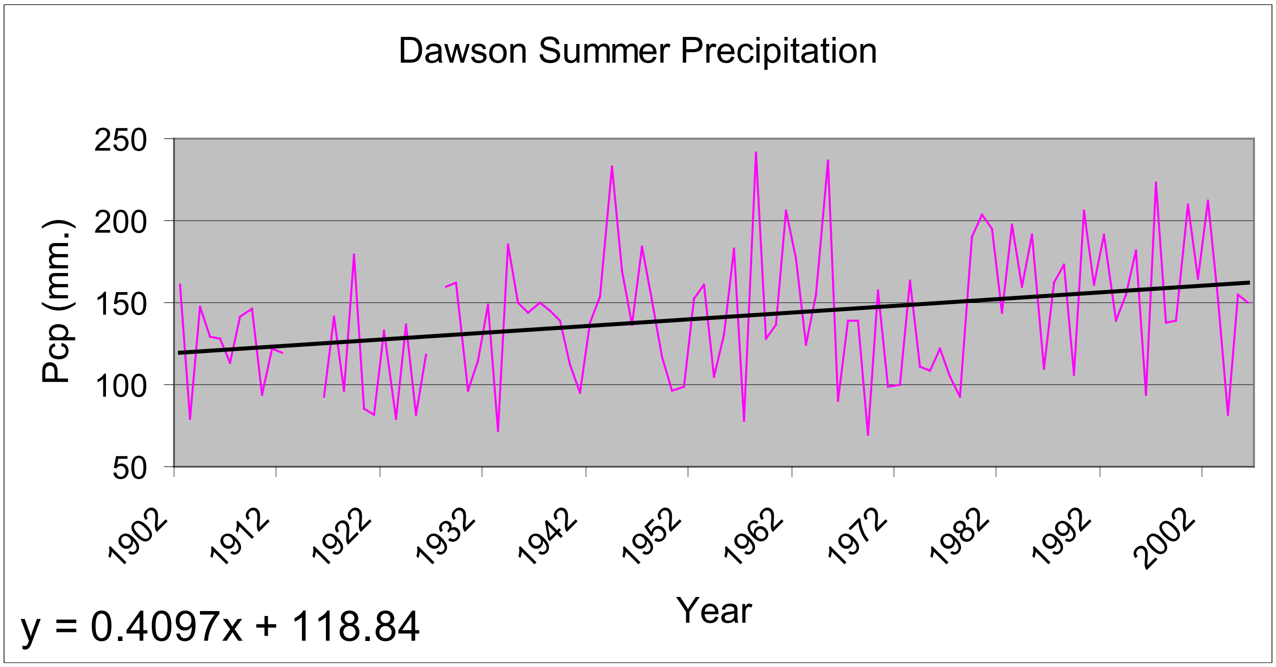

Figure 33. Dawson Summer Precipitation. (1902-2006)

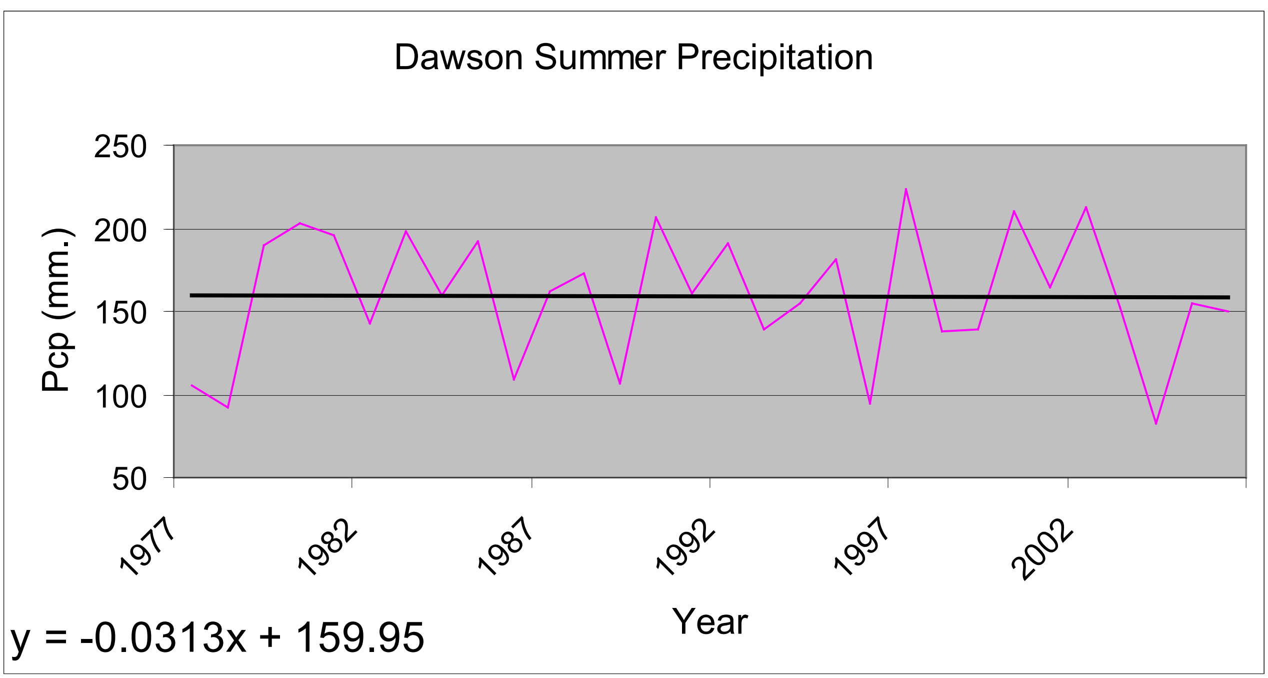

Figure 34. Dawson Summer Precipitation. (1977-2006)

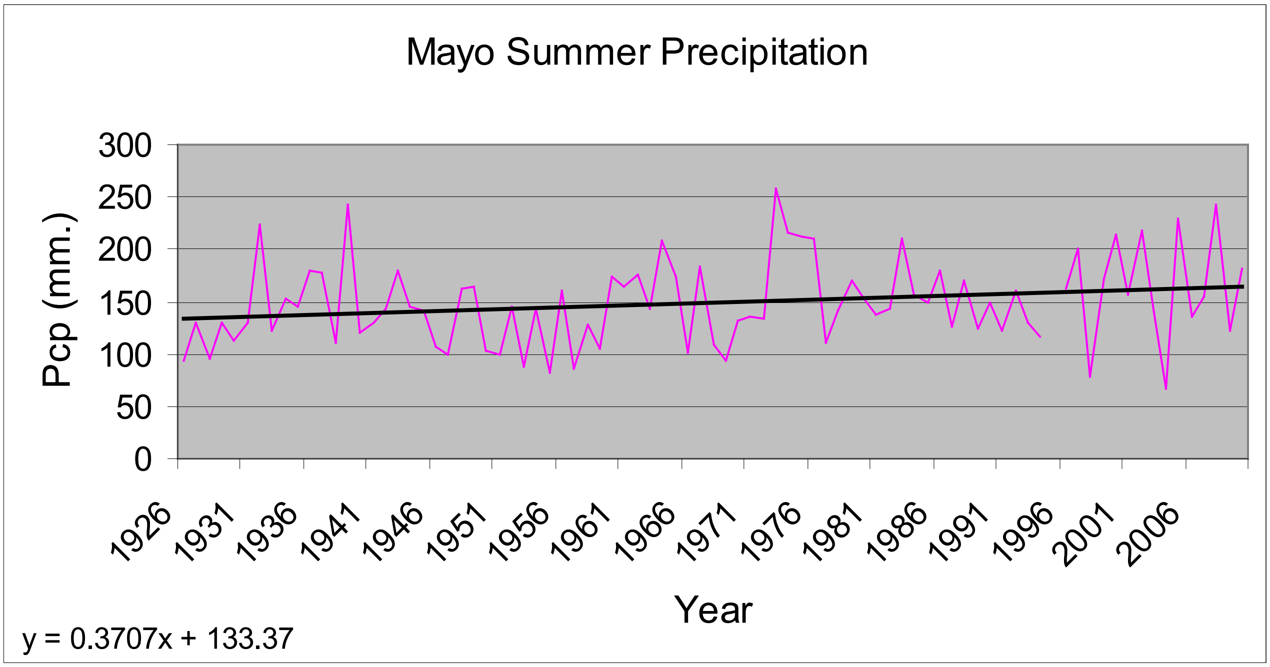

Figure 35. Mayo Summer Precipitation. (1926-2010)

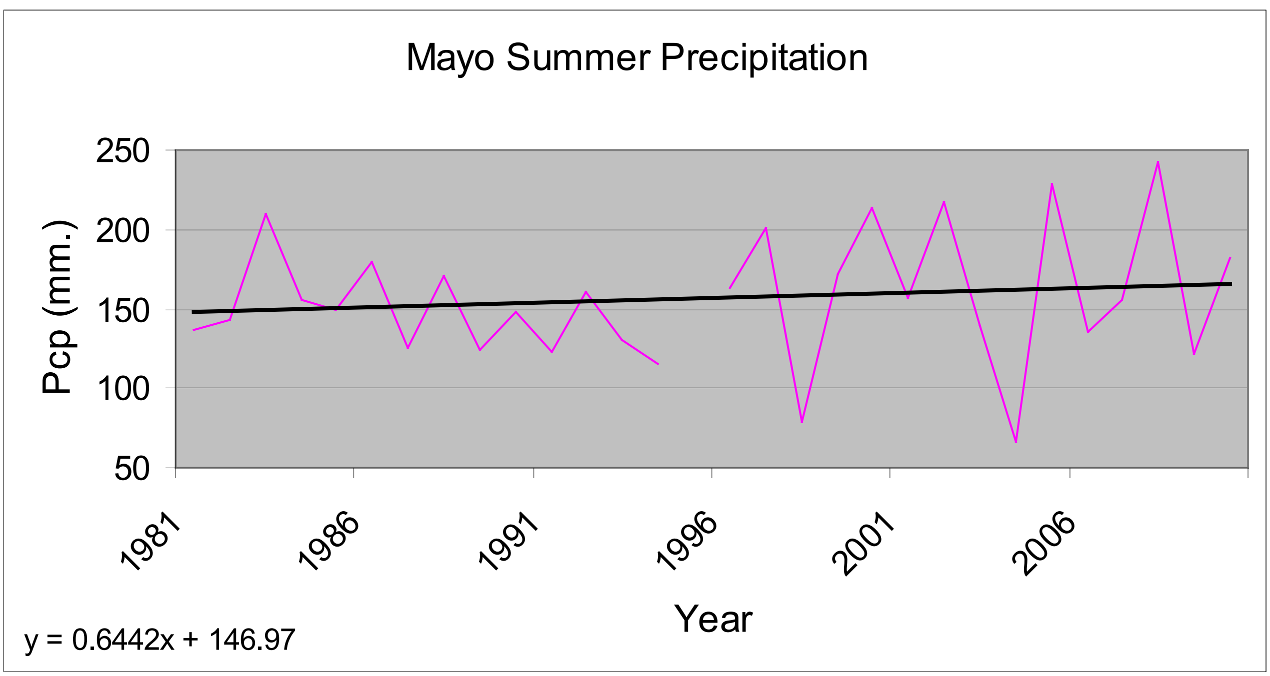

Figure 36. Mayo Summer Precipitation. (1981-2010)

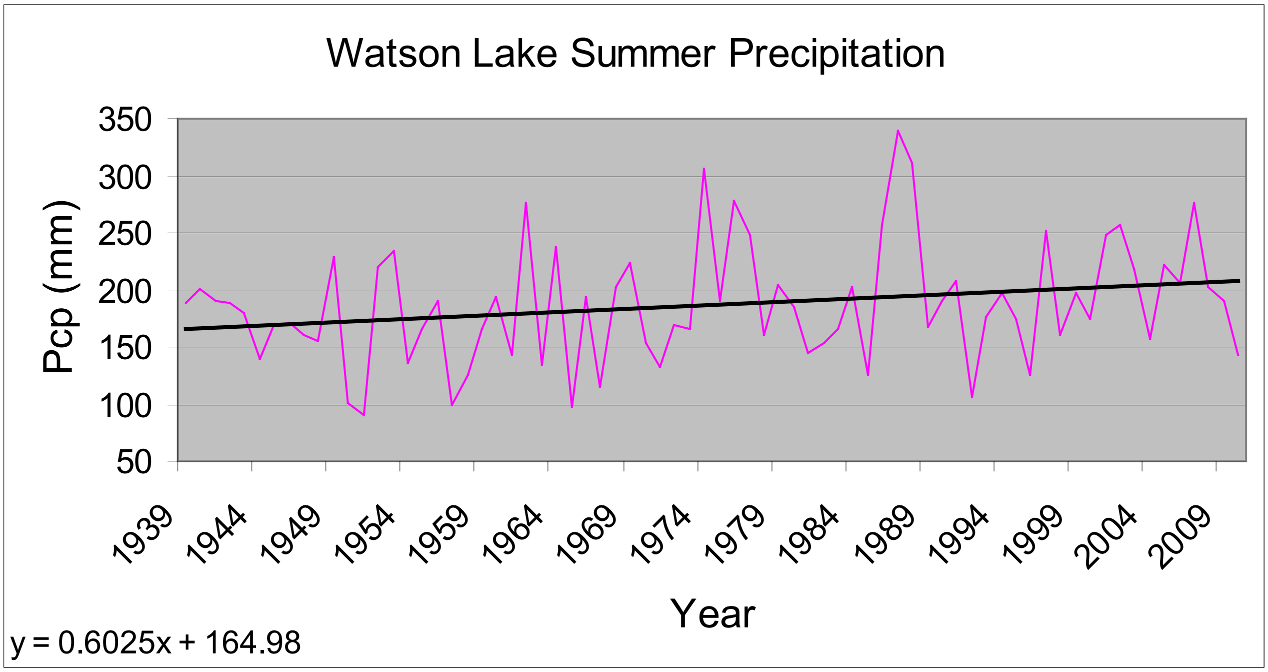

Figure 37. Watson Lake Summer Precipitation. (1939-2010)

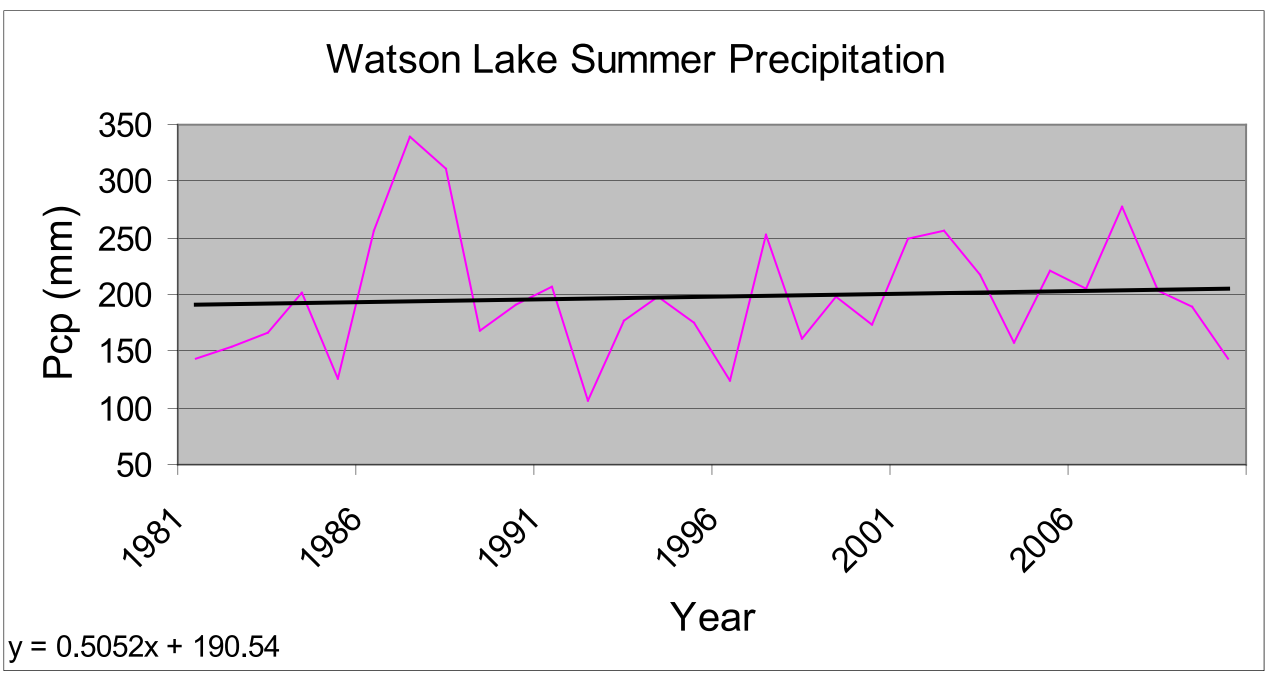

Figure 38. Watson Lake Summer Precipitation. (1981-2010)

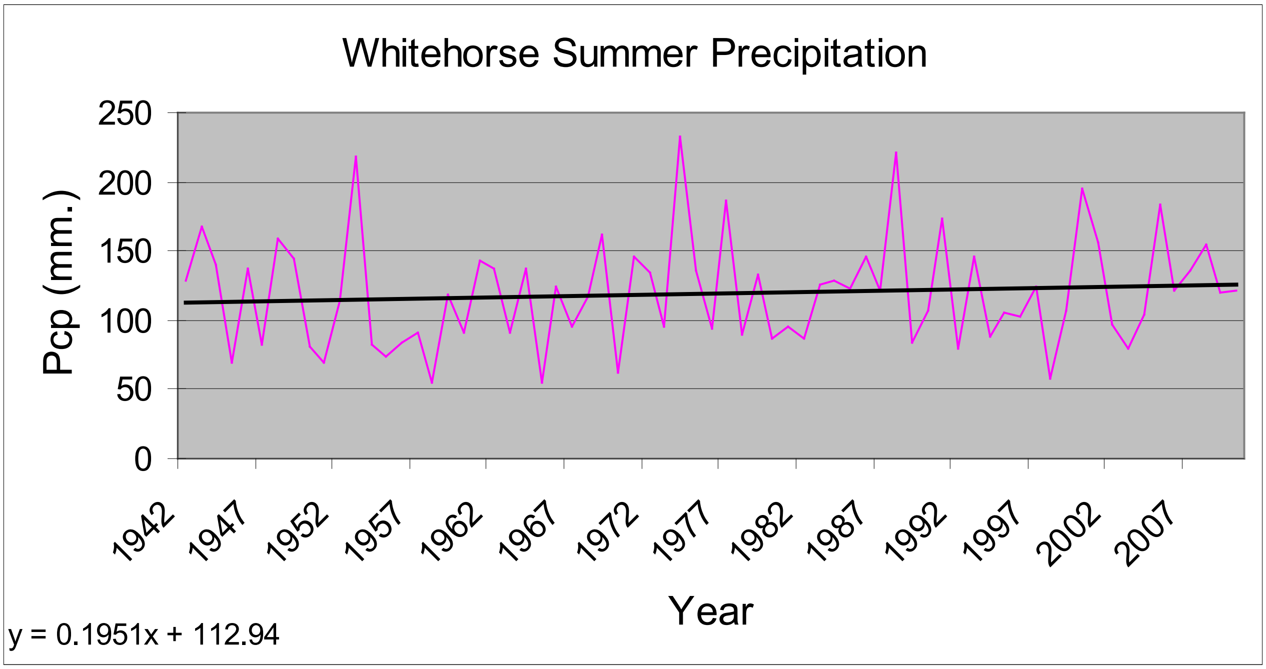

Figure 39. Whitehorse Summer Precipitation. (1942-2010)

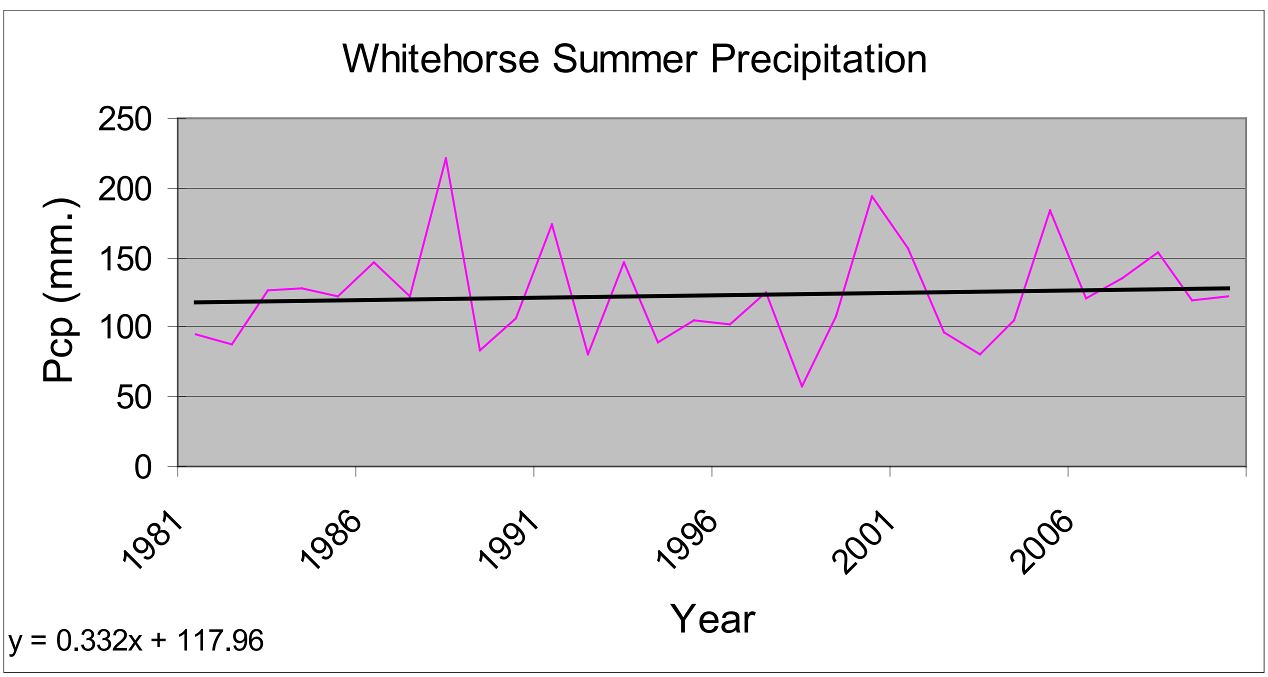

Figure 40. Whitehorse Summer Precipitation. (1981-2010)

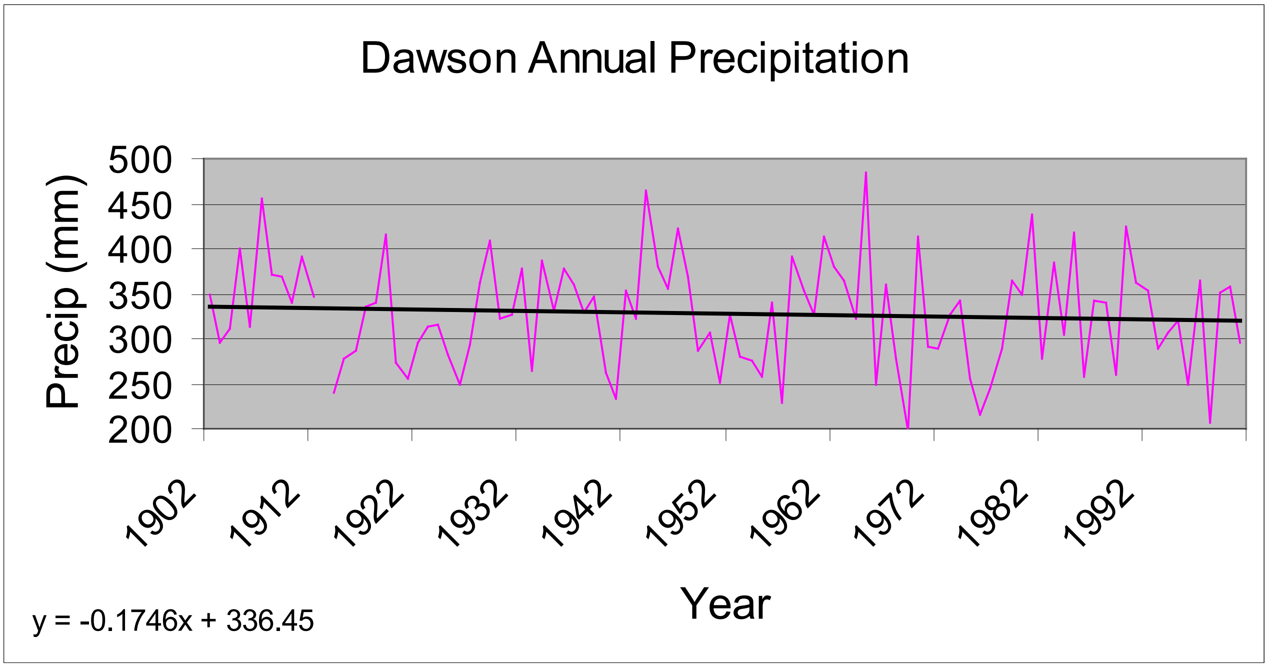

Figure 41. Dawson Annual Precipitation. (1942-2010)

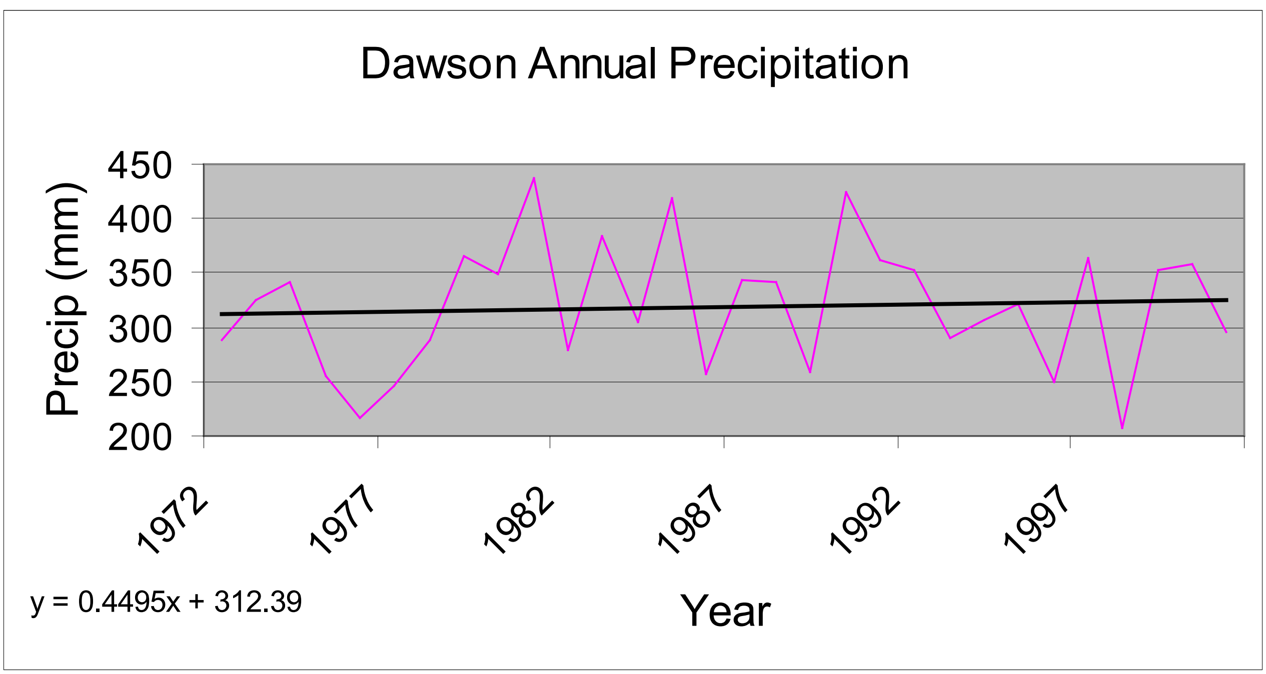

Figure 42. Dawson Summer Precipitation. (1981-2010)

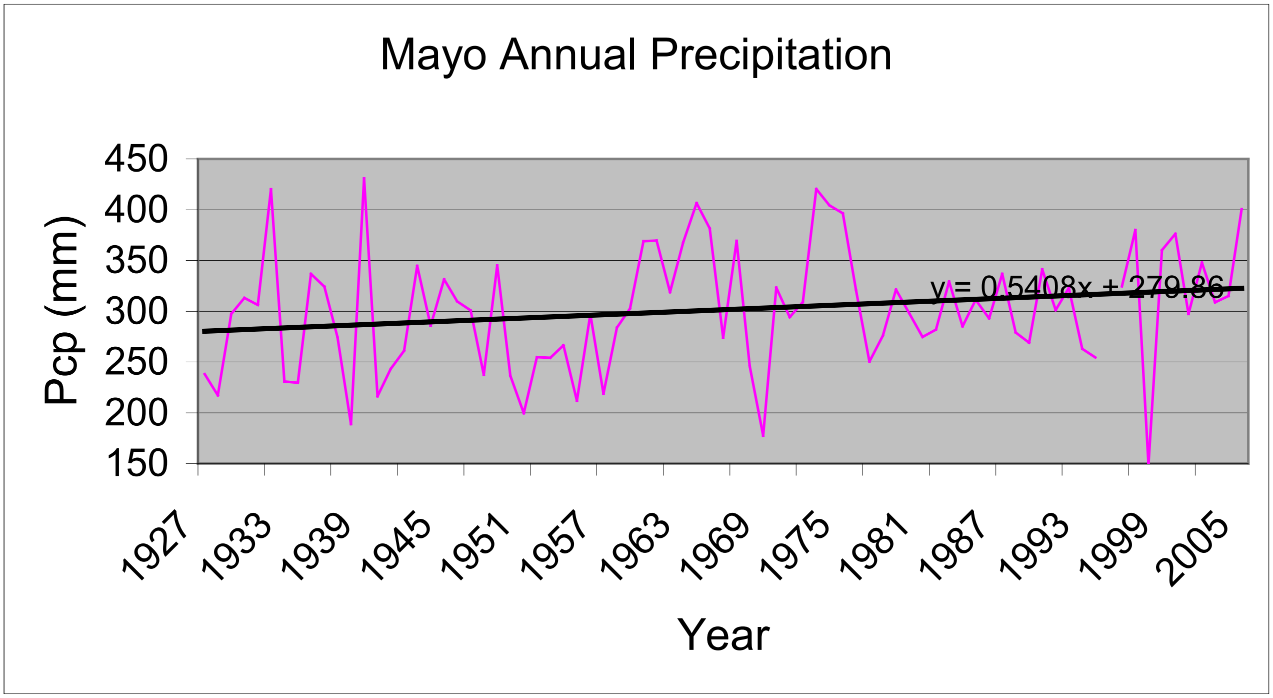

Figure 43. Mayo Annual Precipitation. (1927-2009)

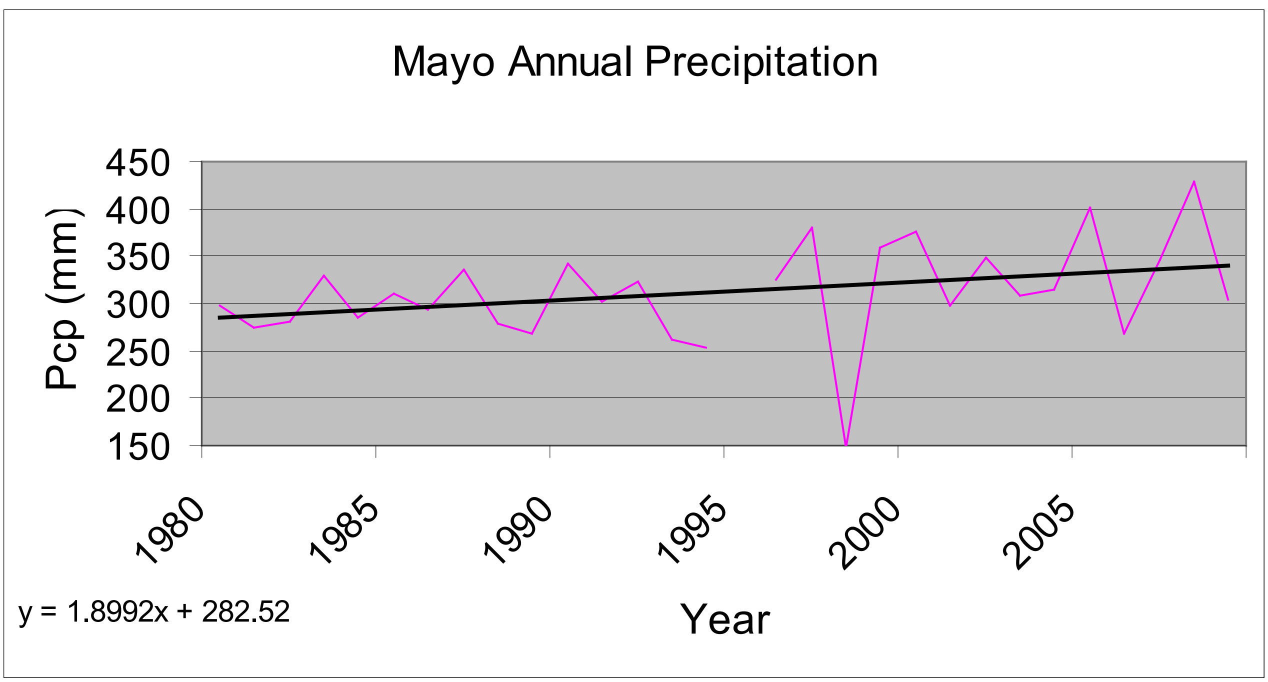

Figure 44. Mayo Annual Precipitation. (1980-2009)

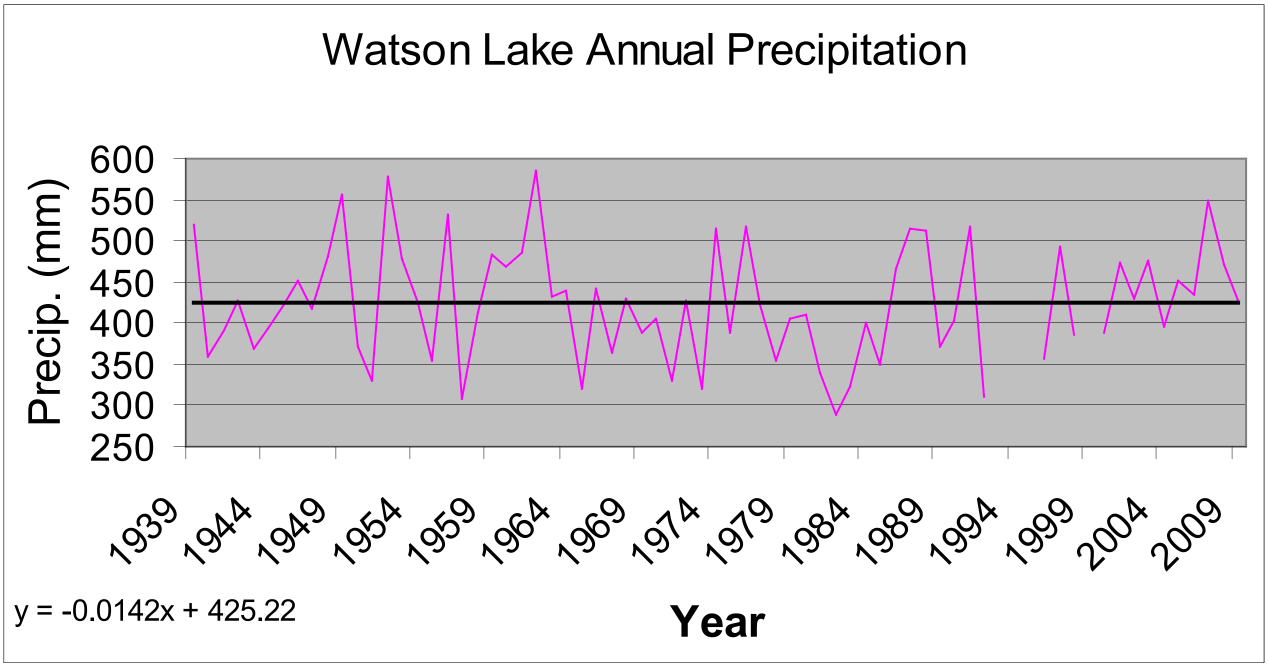

Figure 45. Watson Lake Annual Precipitation. (1939-2009)

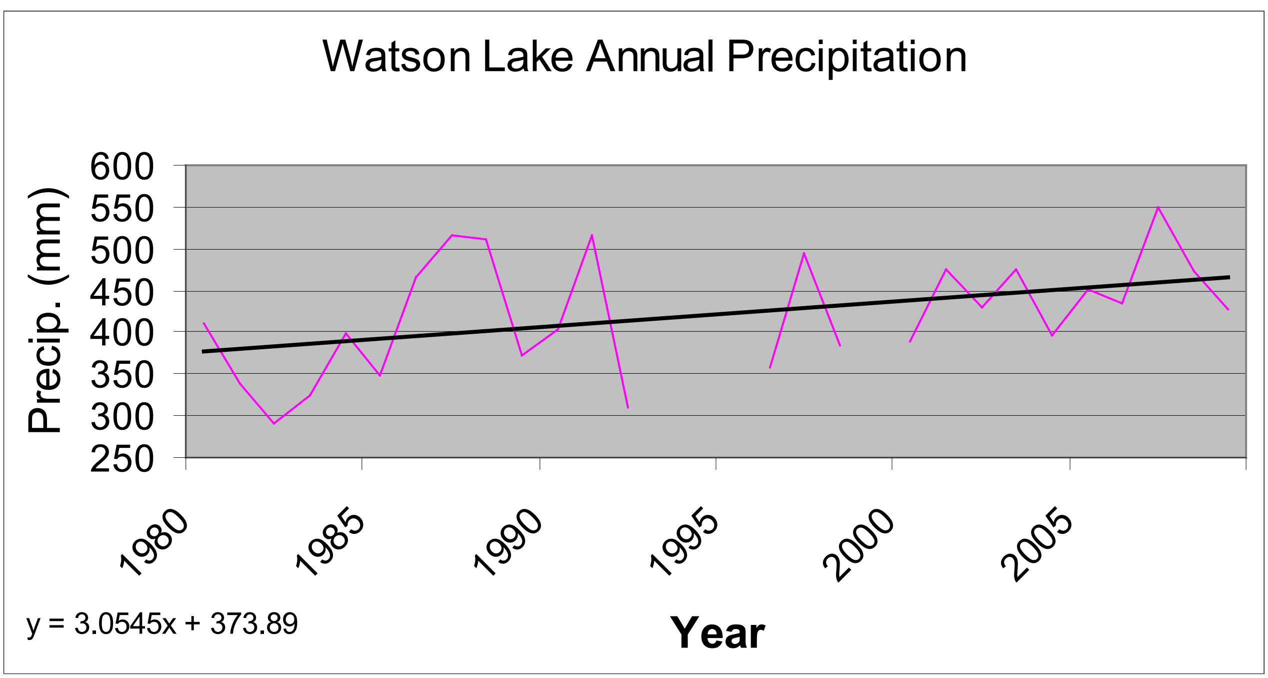

Figure 46. Watson Lake Annual Precipitation. (1980-2009)

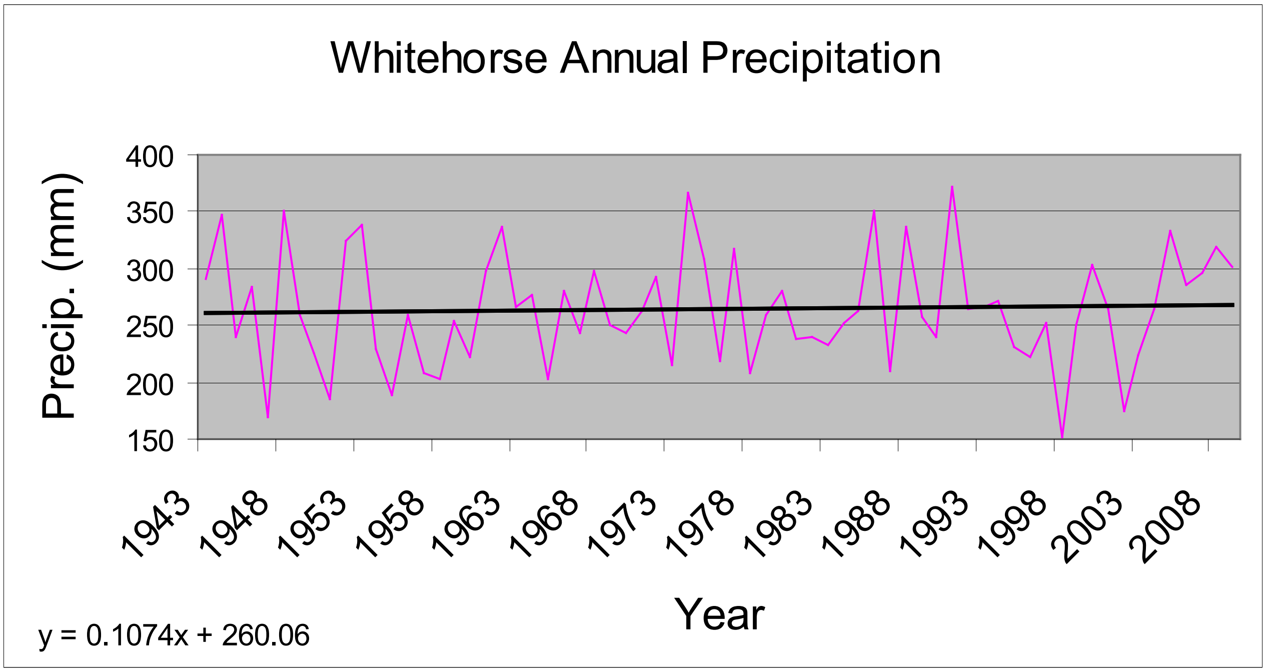

Figure 47. Whitehorse Annual Precipitation. (1943-2009)

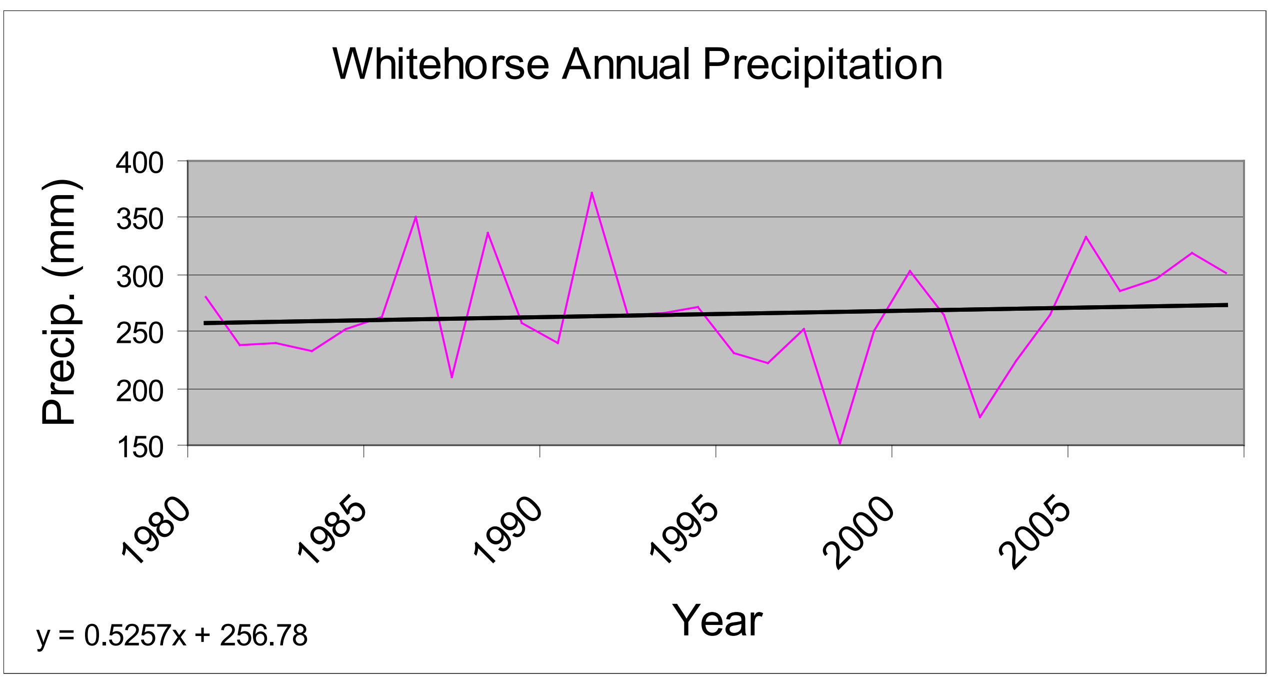

Figure 48. Whitehorse Annual Precipitation. (1980-2009)

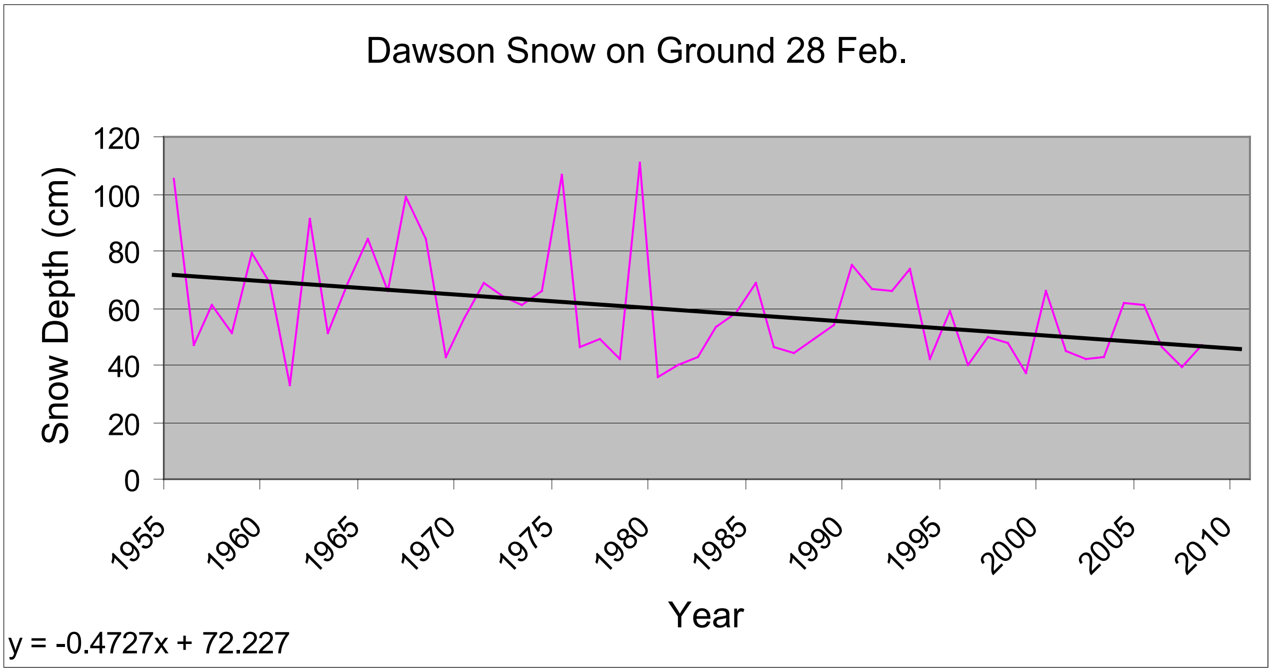

Figure 49. Dawson Snow on Ground. (1955-2010)

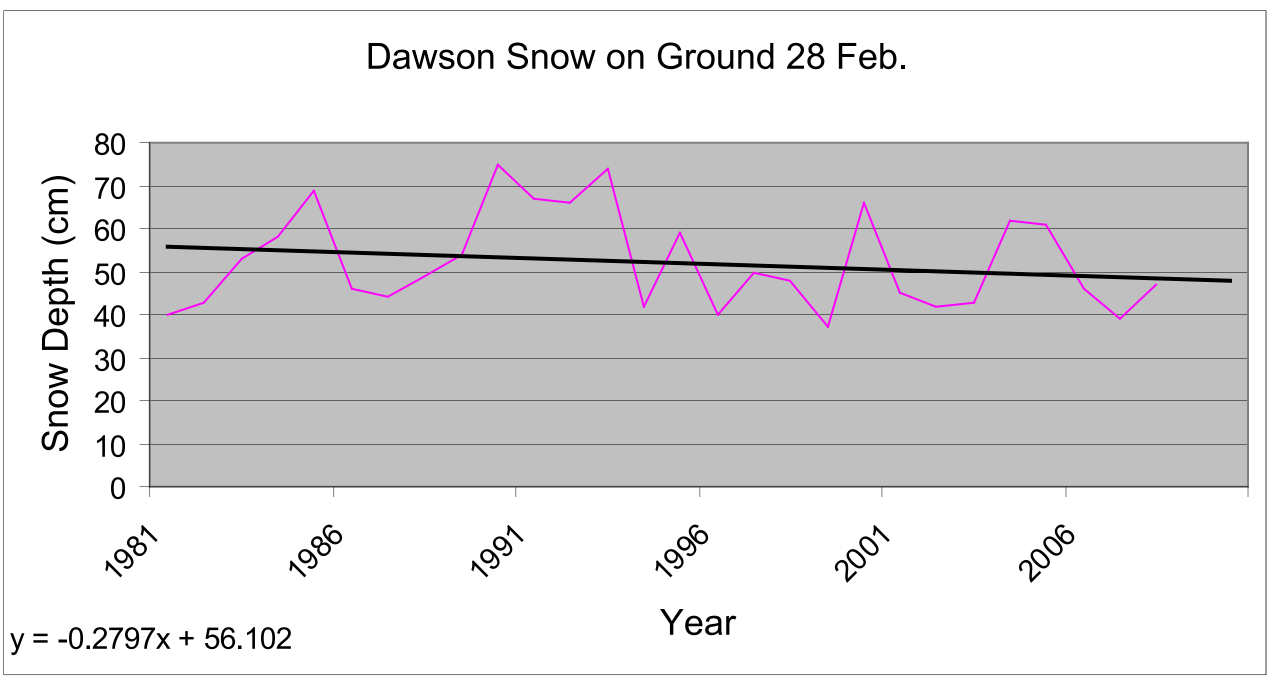

Figure 50. Dawson Snow on Ground. (1981-2010)

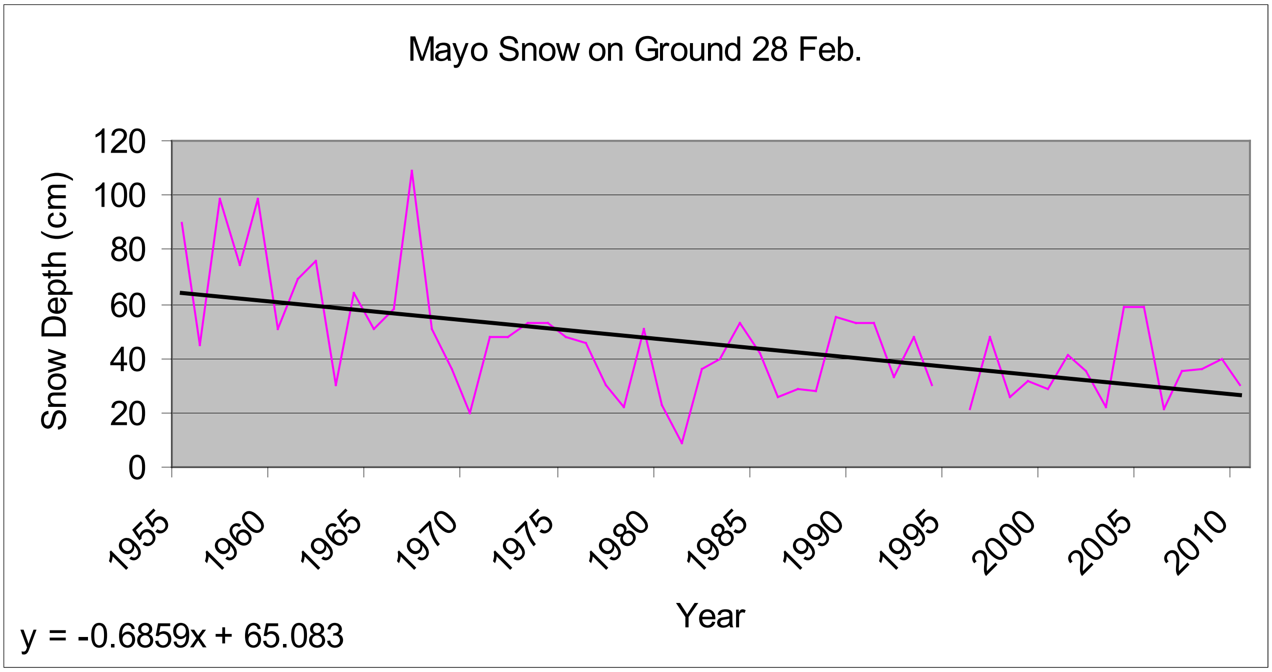

Figure 51. Mayo Snow on Ground. (1955-2010)

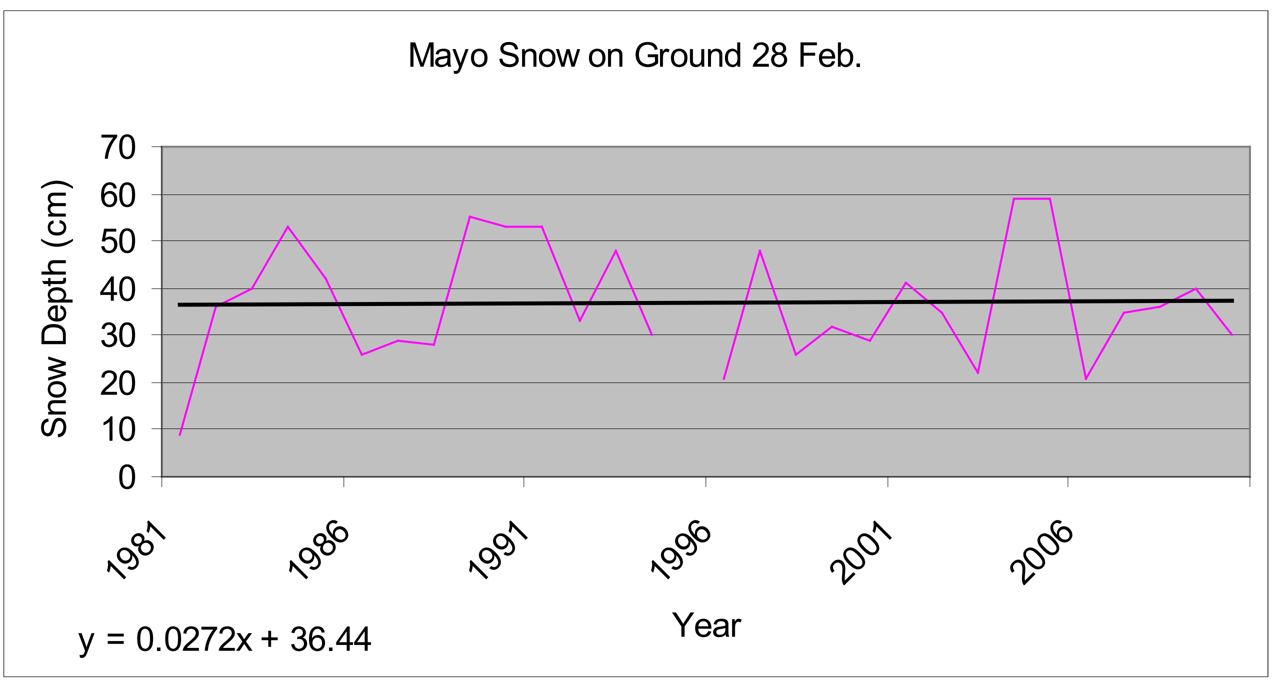

Figure 52. Mayo Snow on Ground. (1981-2010)

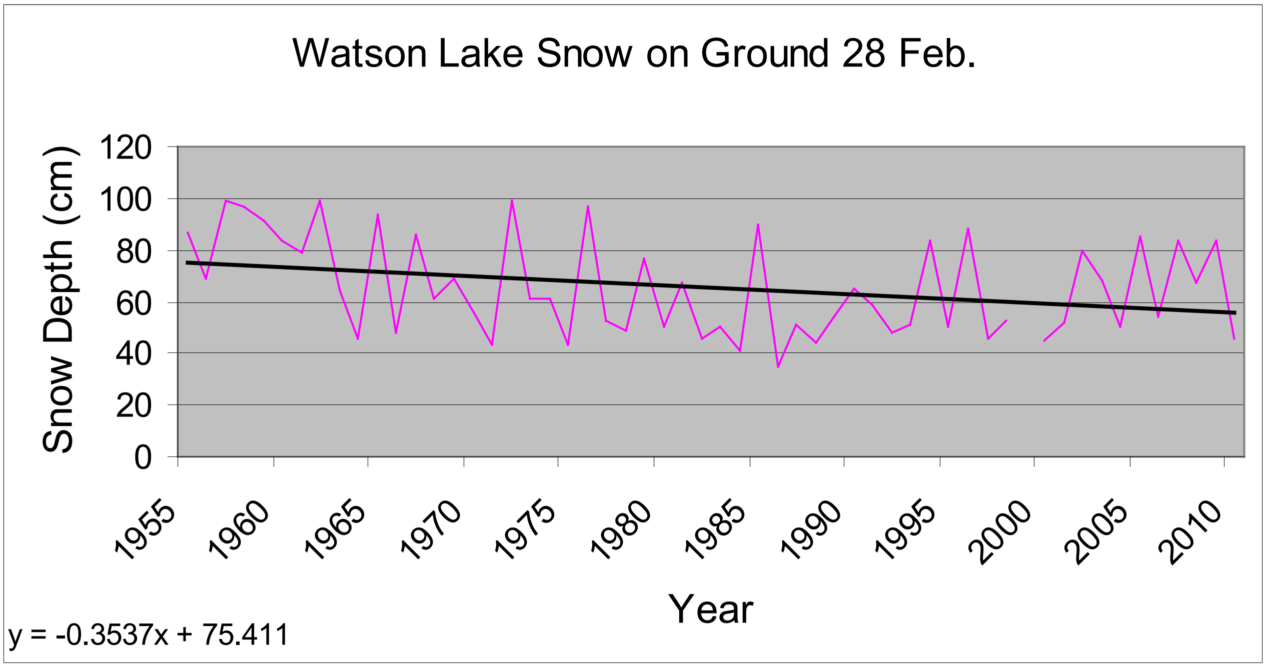

Figure 53. Watson Lake Snow on Ground. (1955-2010)

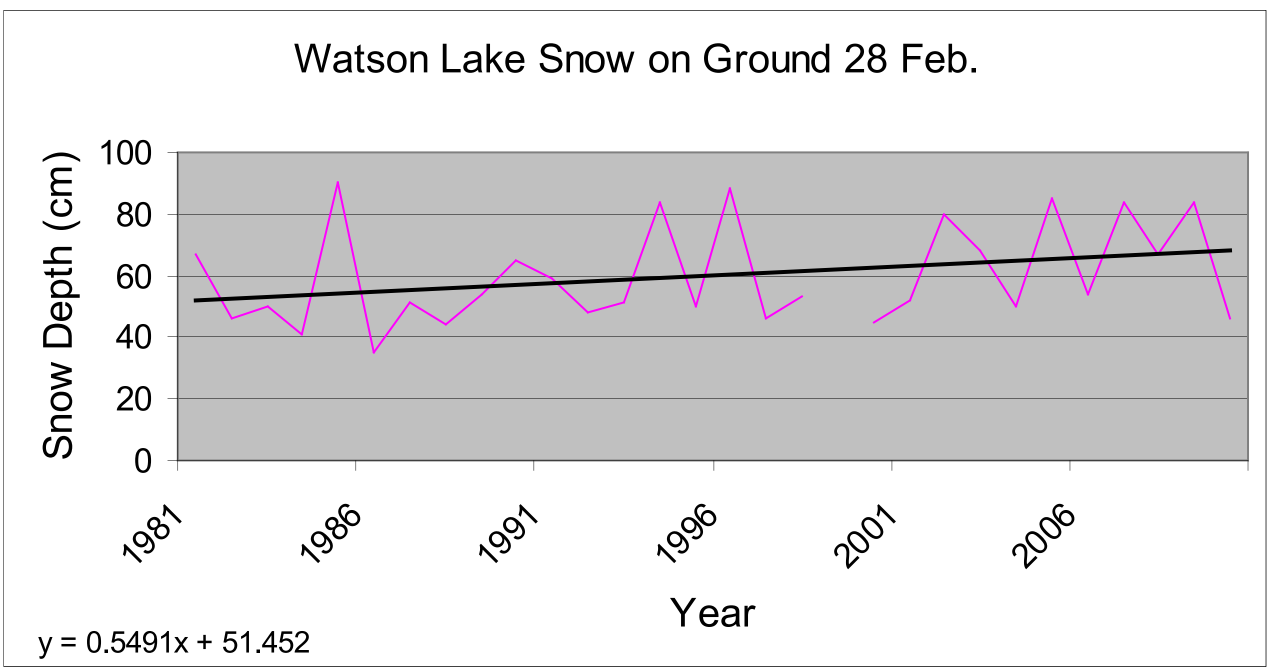

Figure 54. Watson Lake Snow on Ground. (1981-2010)

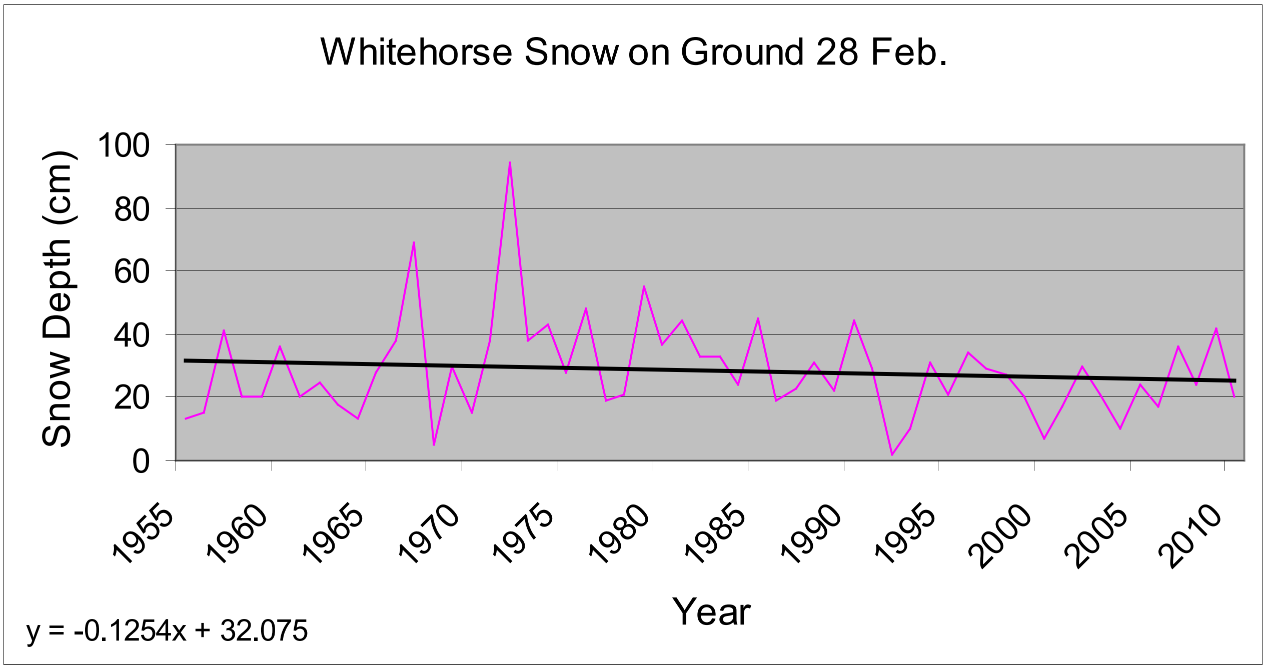

Figure 55. Whitehorse Snow on Ground. (1955-2010)

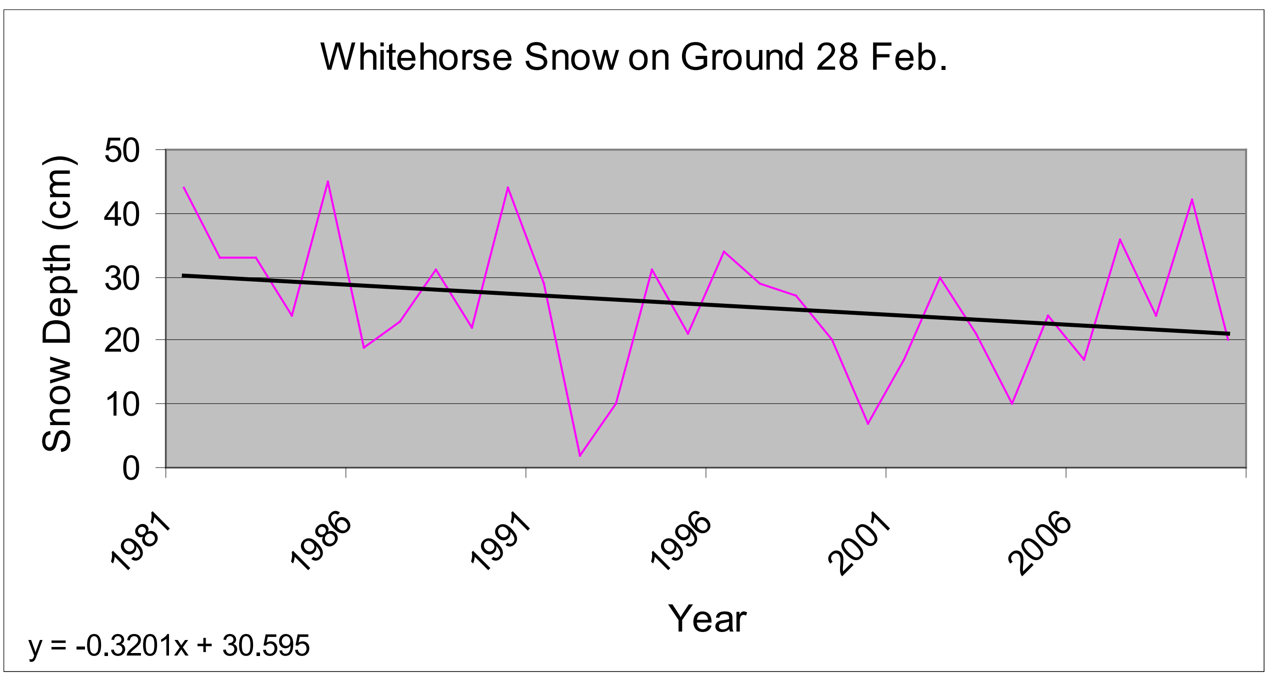

Figure 56. Whitehorse Snow on Ground. (1981-2010)

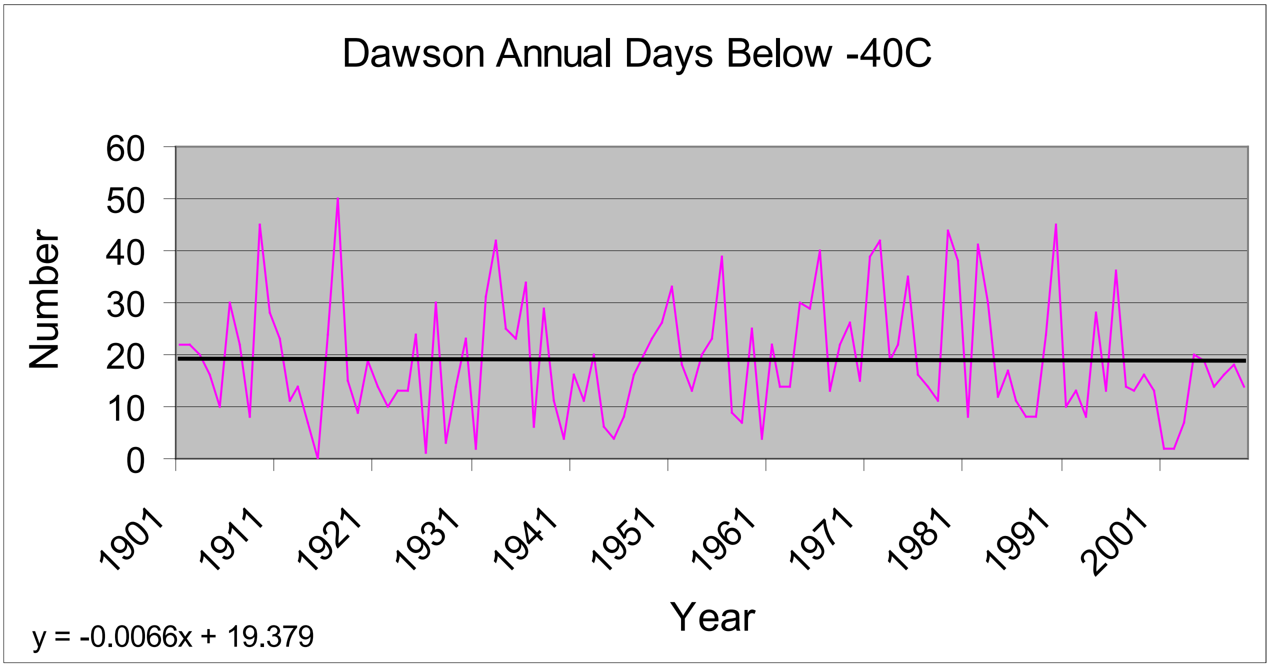

Figure 57. Dawson Annual Days Below –40C. (1901-2009)

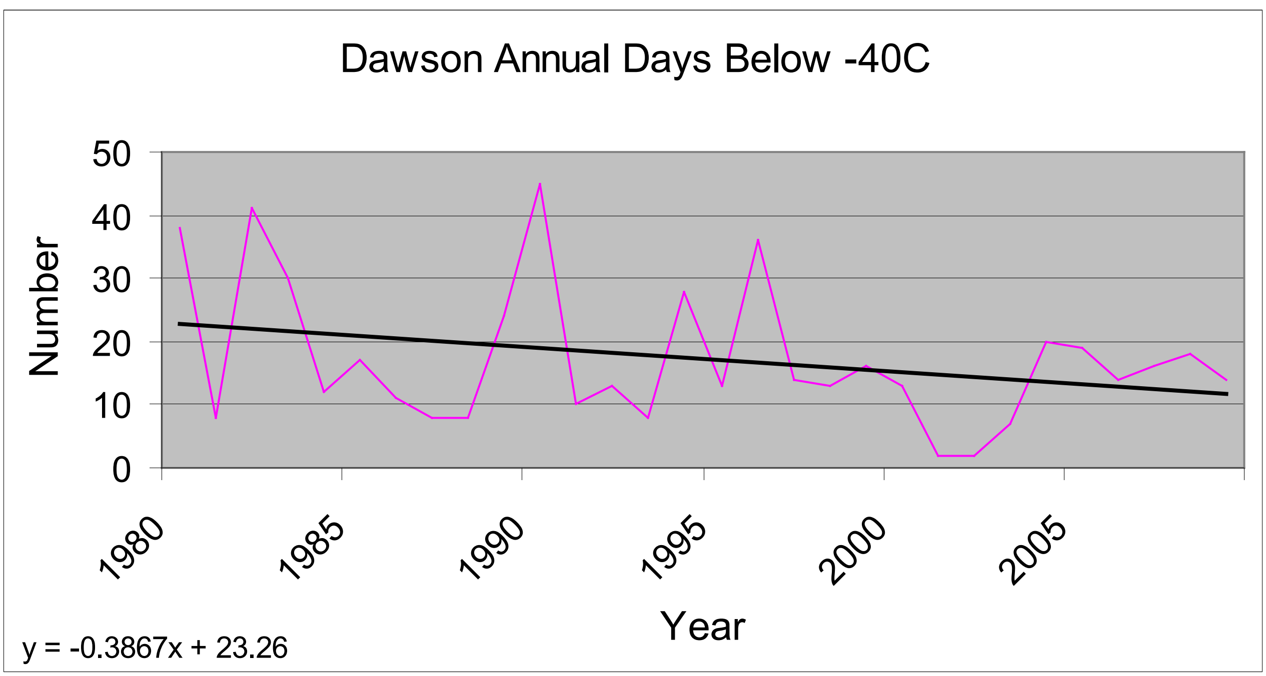

Figure 58. Dawson Annual Days Below –40C. (1980-2009)

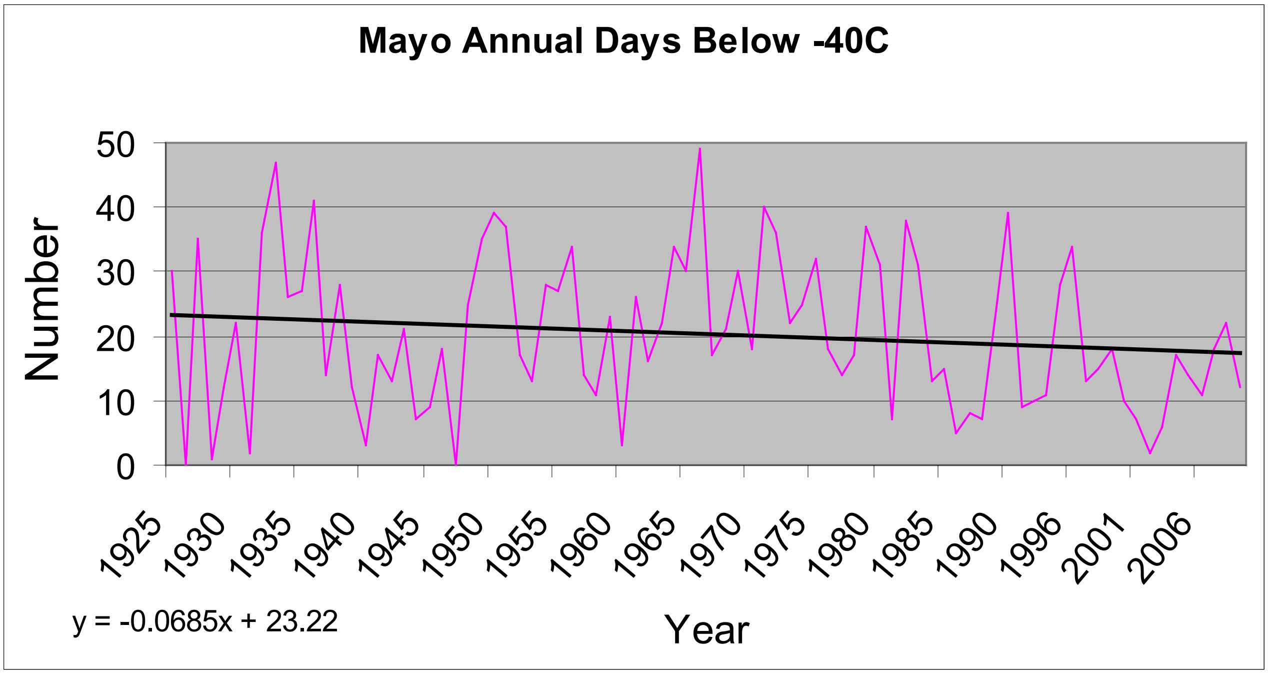

Figure 59. Mayo Annual Days Below –40C. (1925-2009)

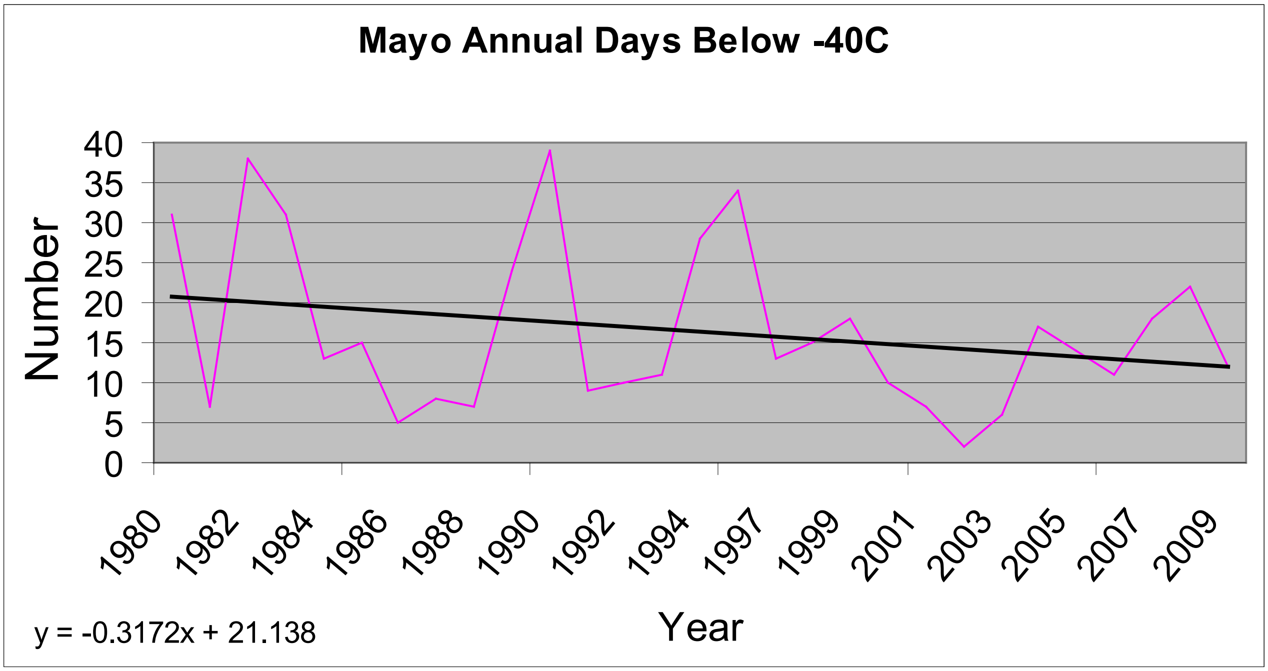

Figure 60. Mayo Annual Days Below –40C. (1980-2009)

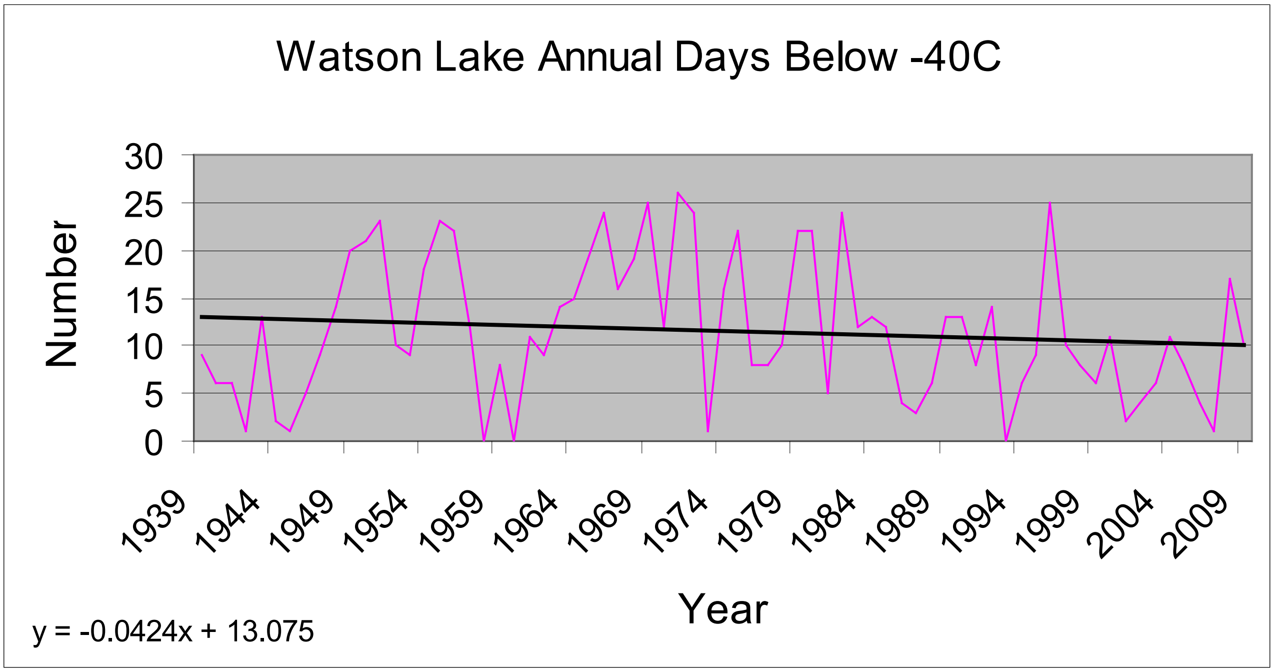

Figure 61. Watson Lake Annual Days Below –40C. (1939-2009)

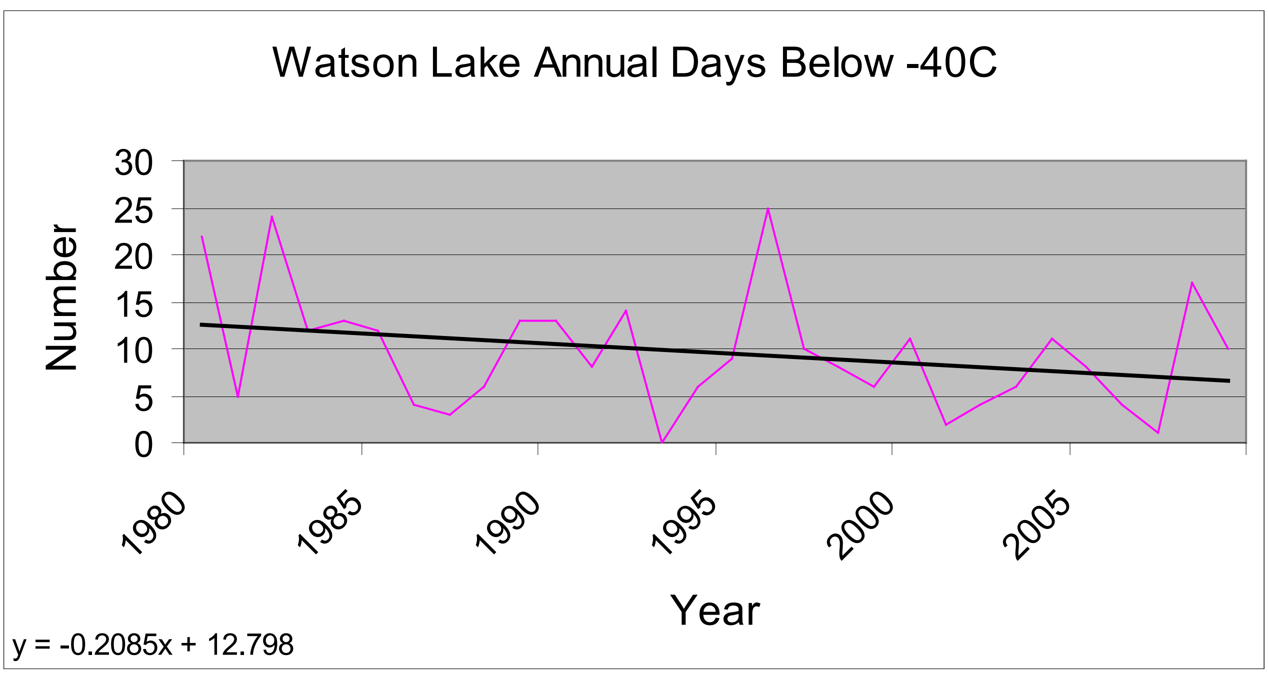

Figure 62. Watson Lake Annual Days Below –40C. (1980-2009)

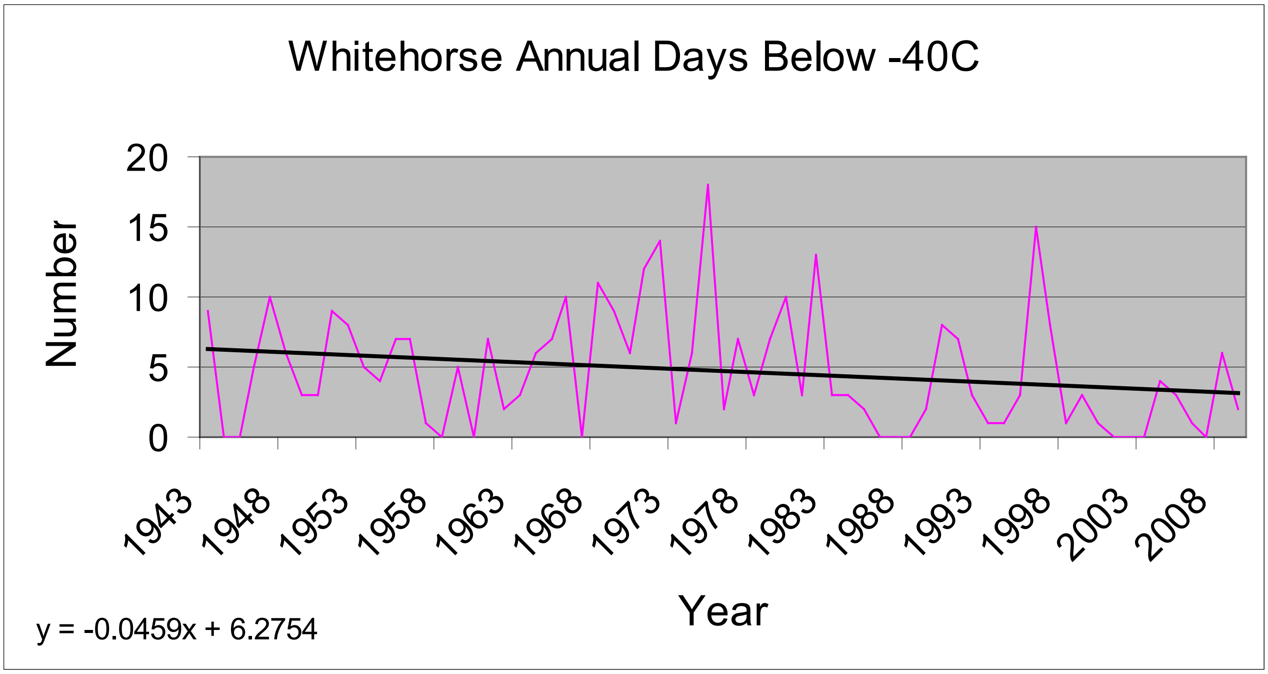

Figure 63. Whitehorse Annual Days Below –40C. (1943-2009)

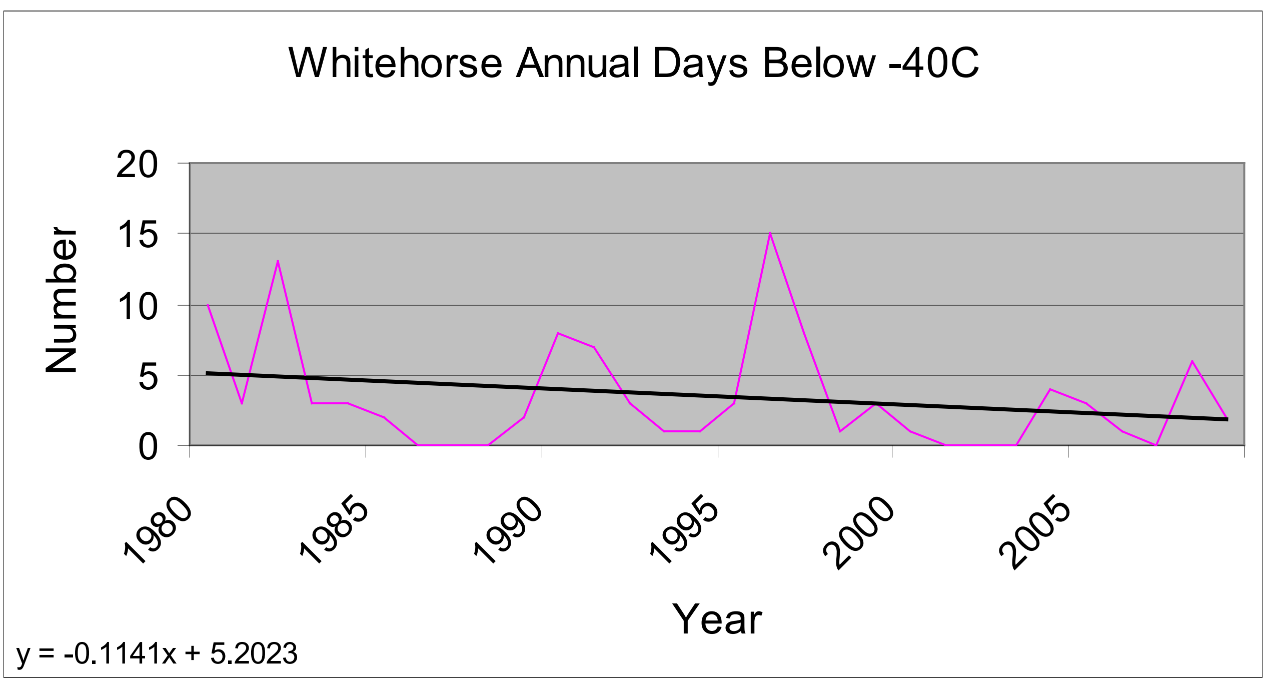

Figure 64. Whitehorse Annual Days Below –40C. (1980-2009)

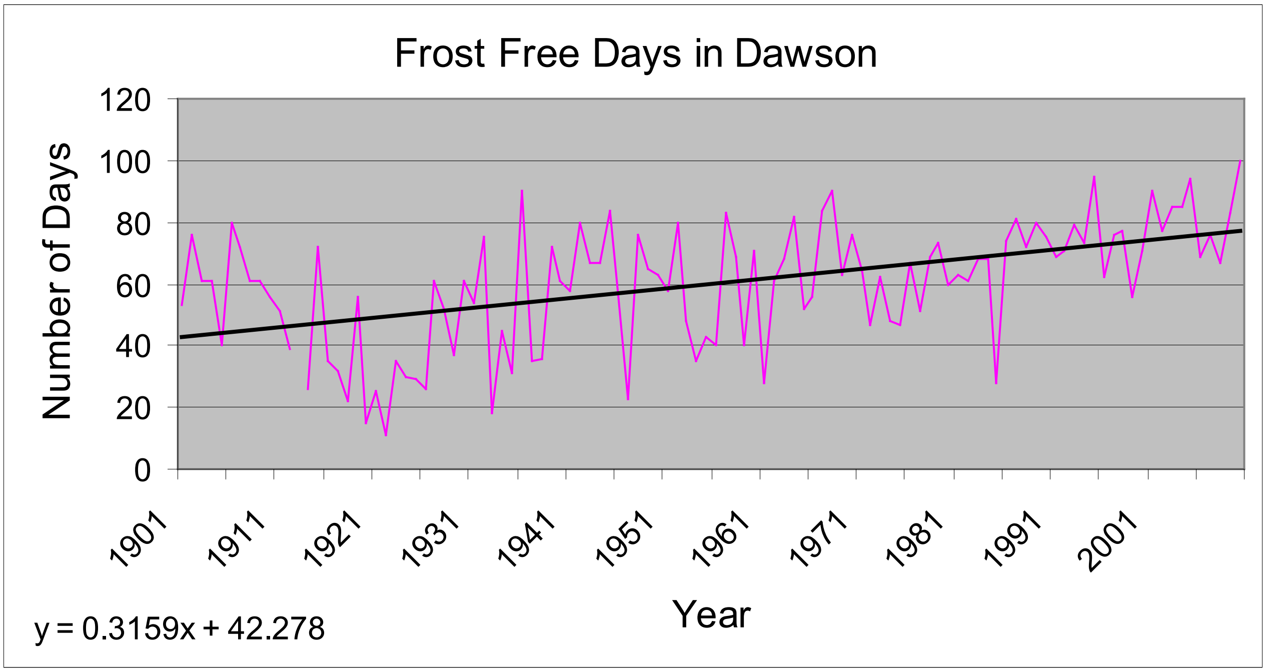

Figure 65. Dawson Frost Free Days. (1901-2010)

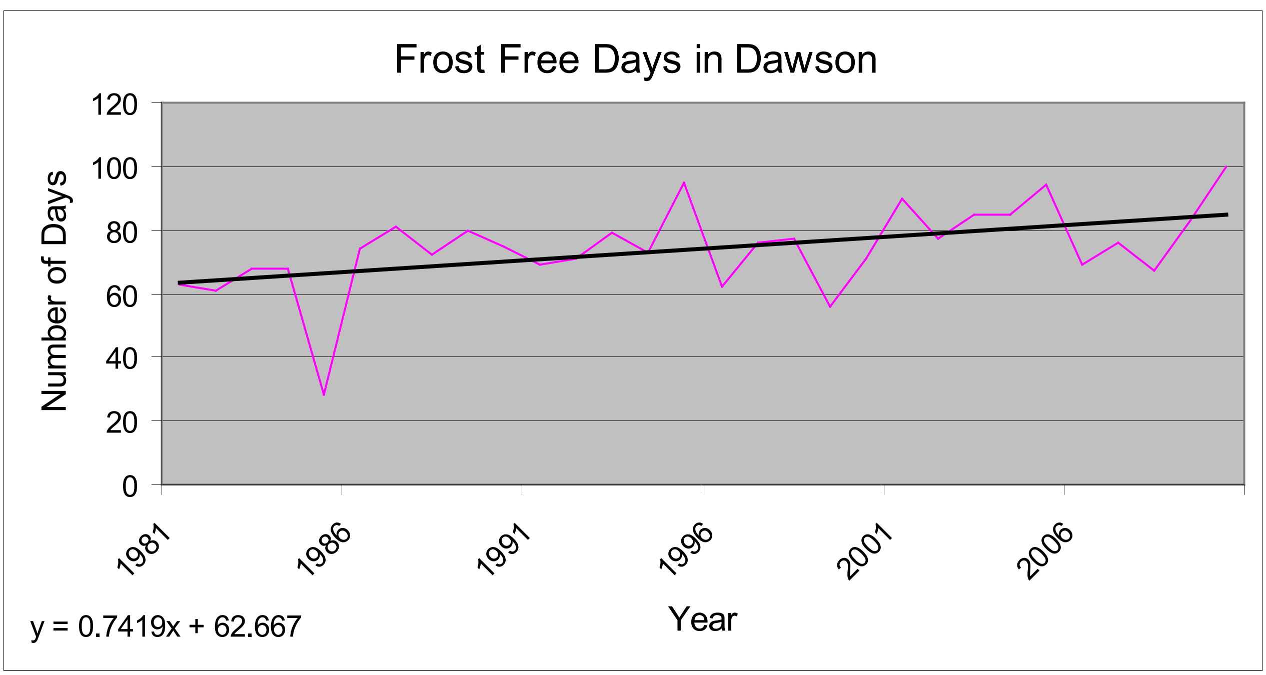

Figure 66. Dawson Frost Free Days. (1981-2010)

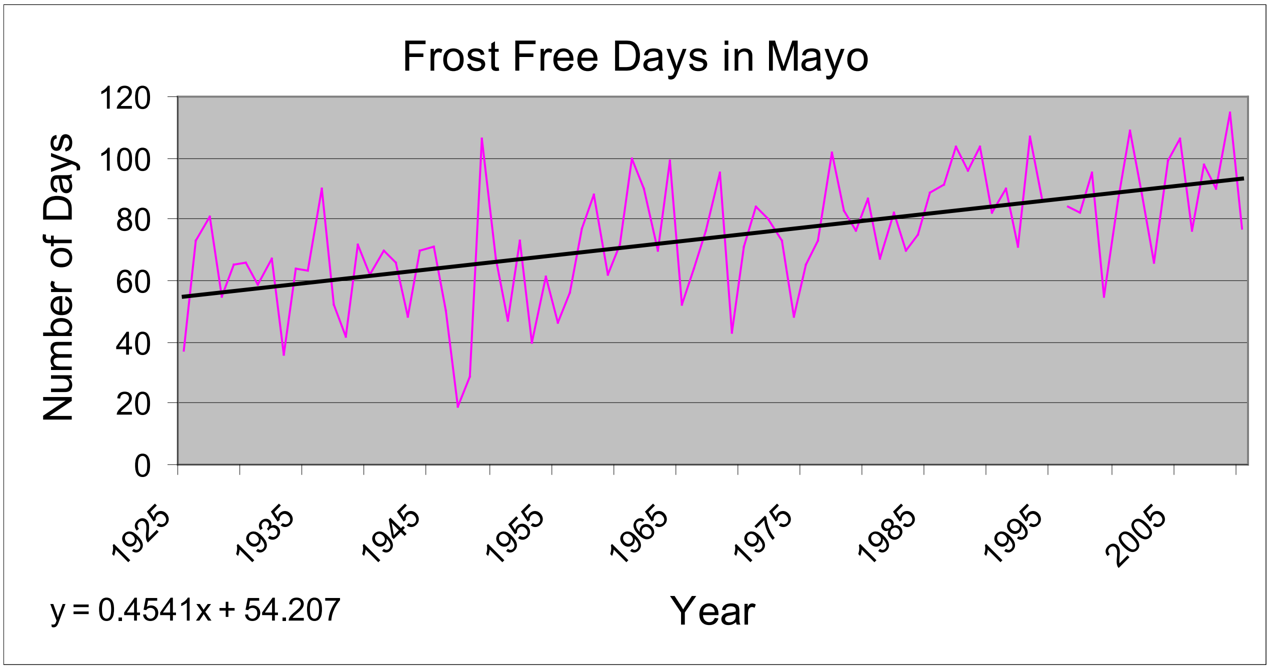

Figure 67. Mayo Frost Free Days. (1925-2010)

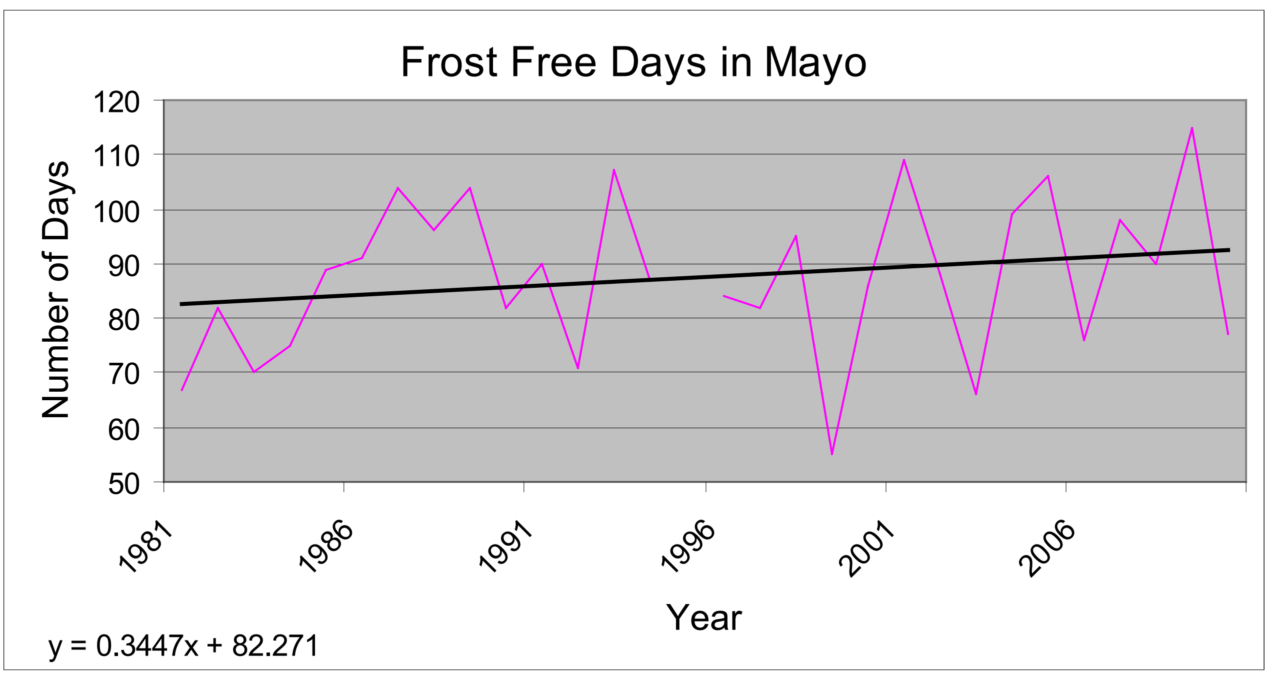

Figure 68. Mayo Frost Free Days. (1981-2010)

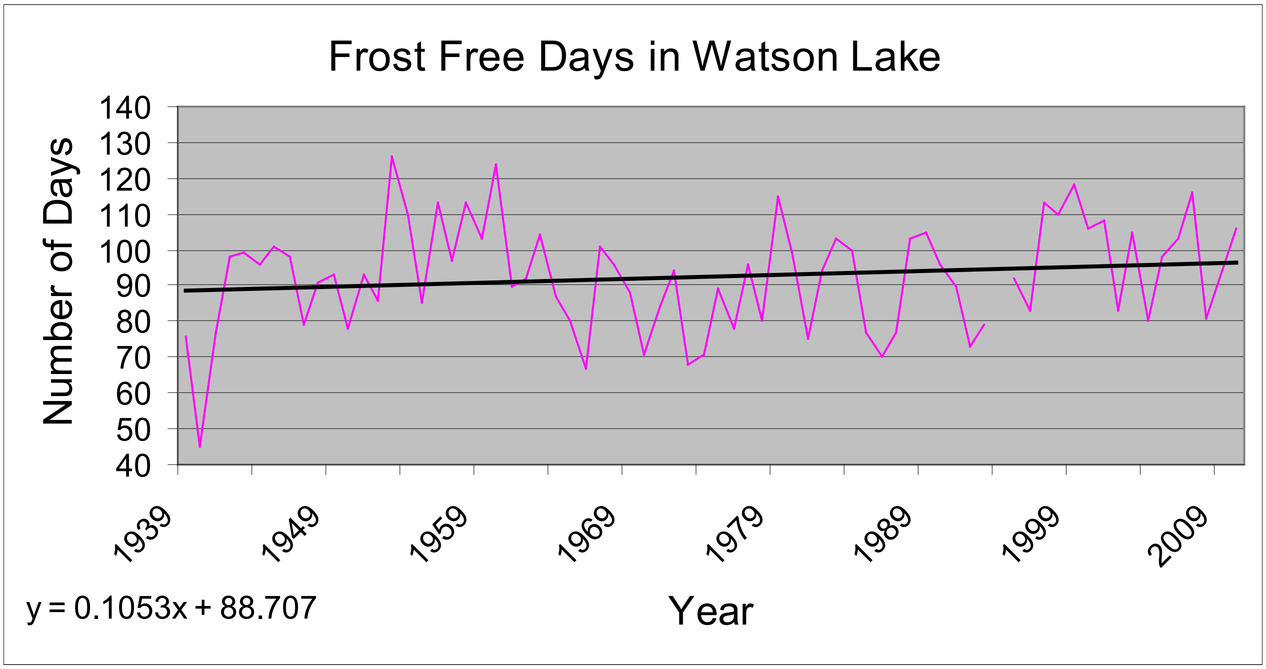

Figure 69. Watson Lake Frost Free Days. (1939-2010)

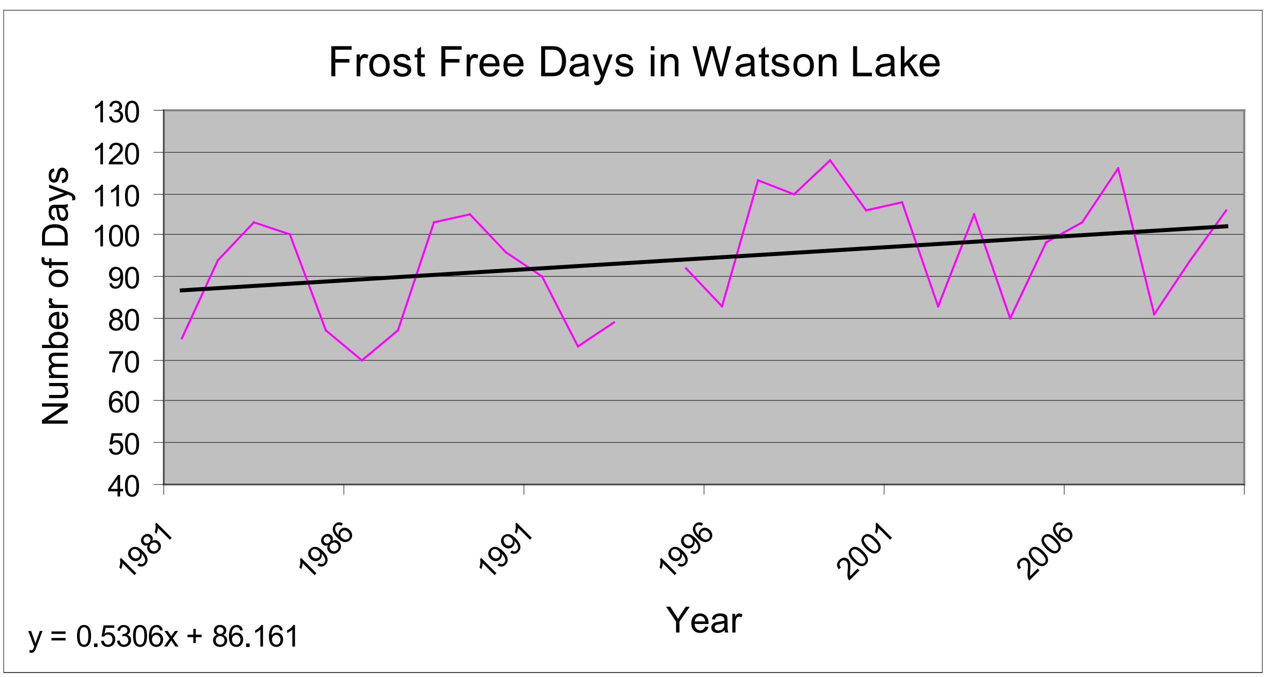

Figure 70. Watson Lake Frost Free Days. (1981-2010)

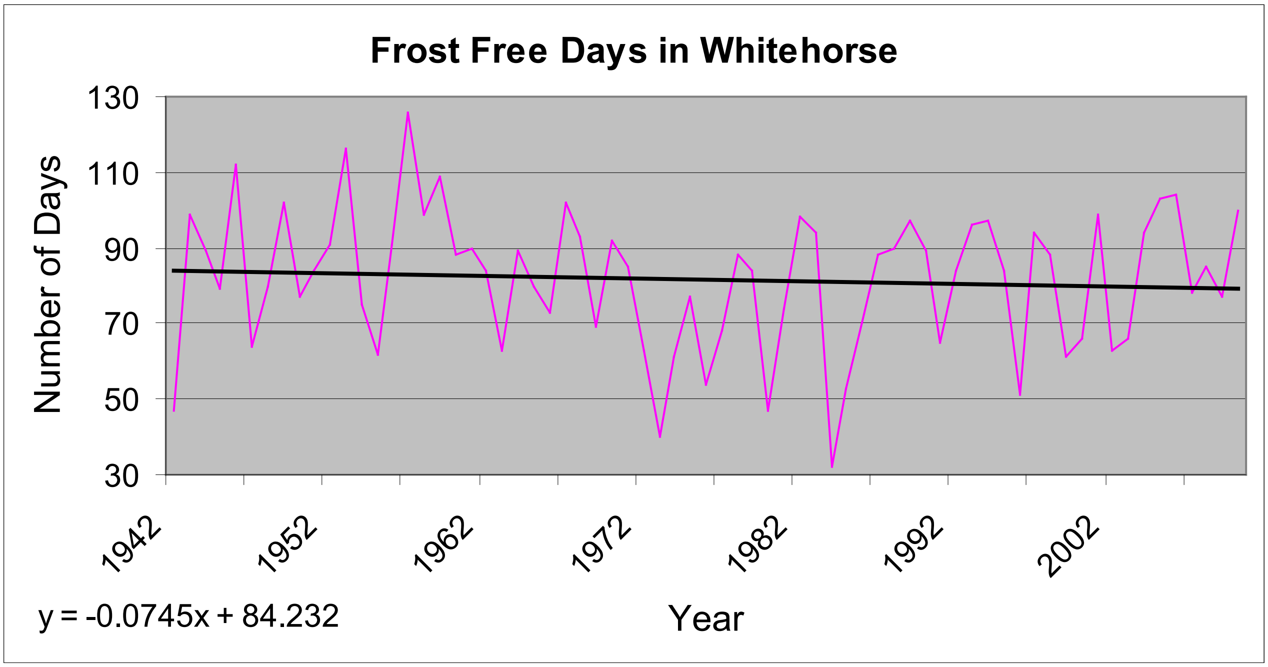

Figure 71. Whitehorse Frost Free Days. (1942-2010)

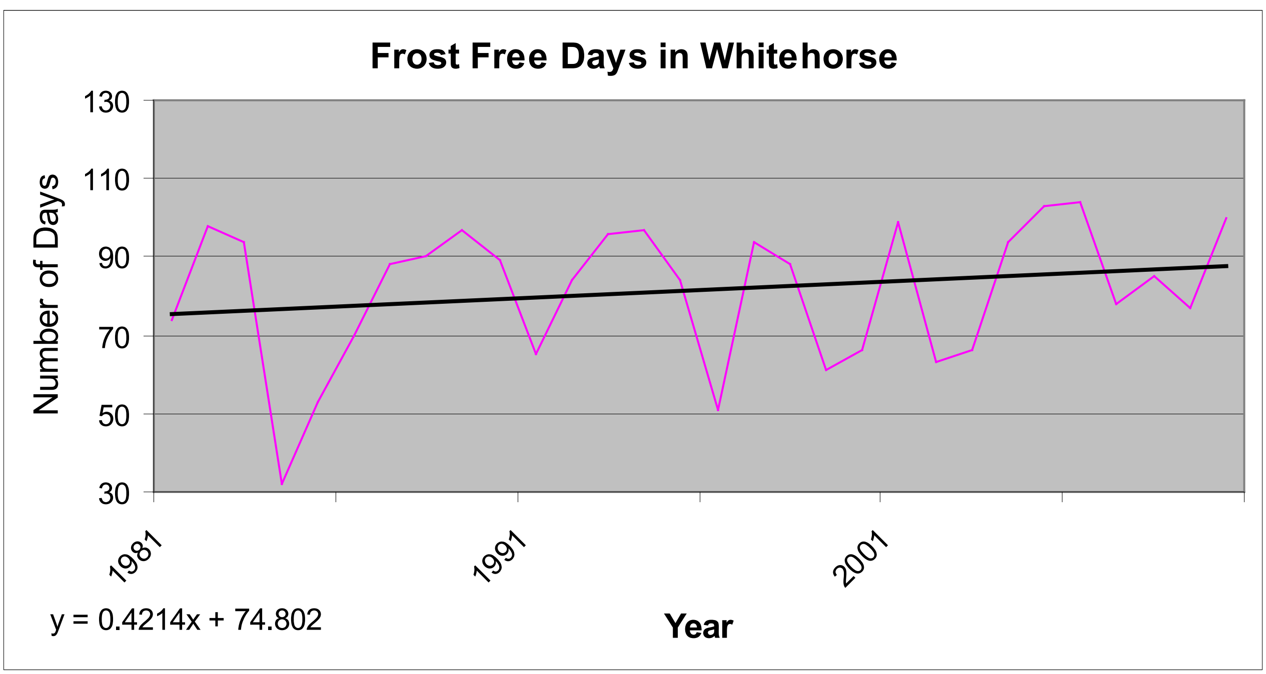

Figure 72. Whitehorse Frost Free Days. (1981-2010)

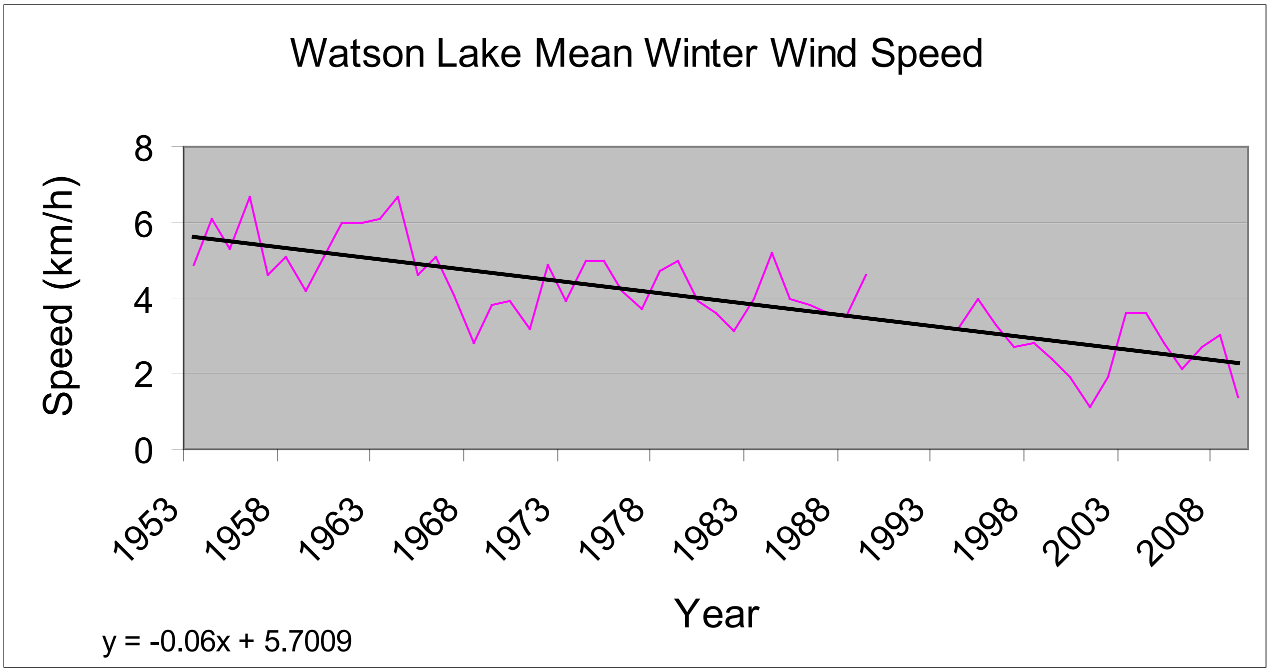

Figure 73. Watson Lake Mean Hourly Wind Speed in Winter. (1953-2009)

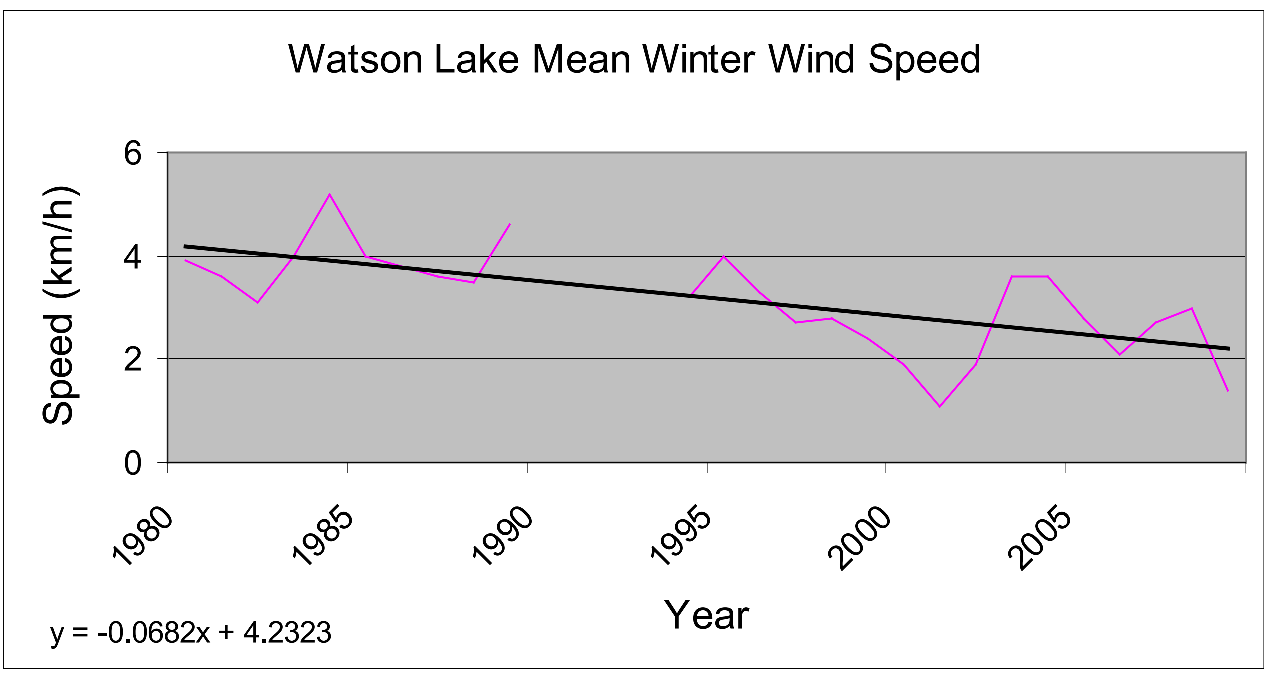

Figure 74. Watson Lake Mean Hourly Wind Speed in Winter. (1980-2009)

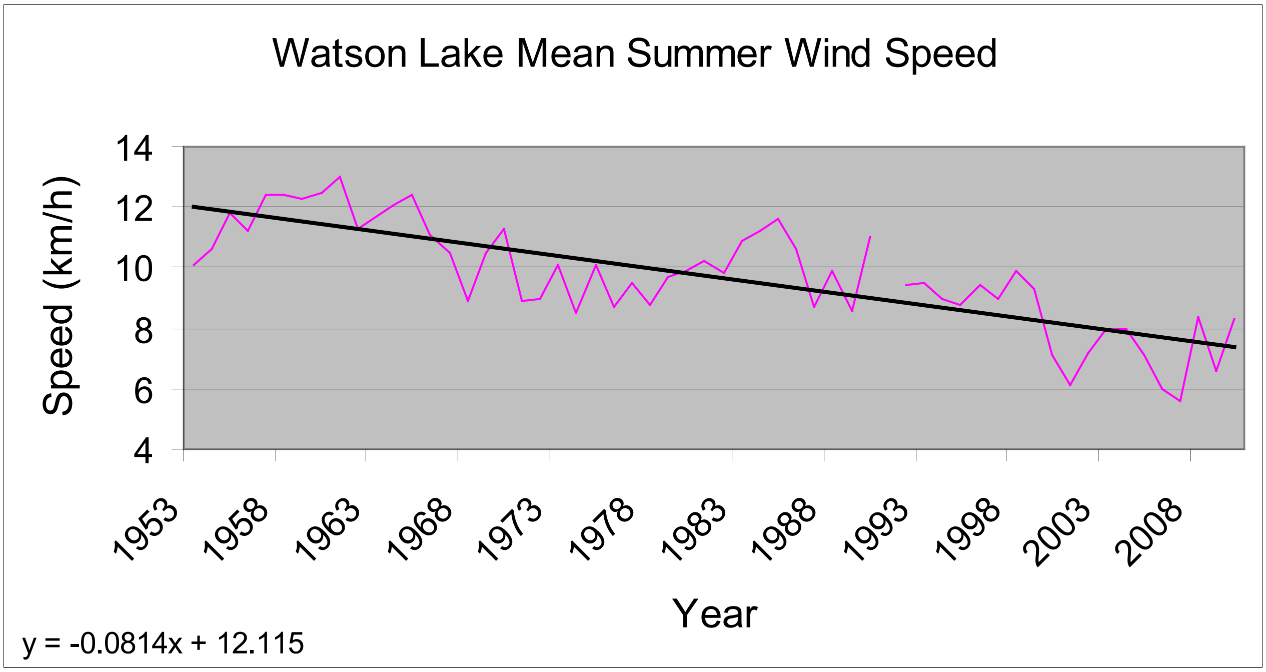

Figure 75. Watson Lake Mean Hourly Wind Speed in Summer. (1953-2010)

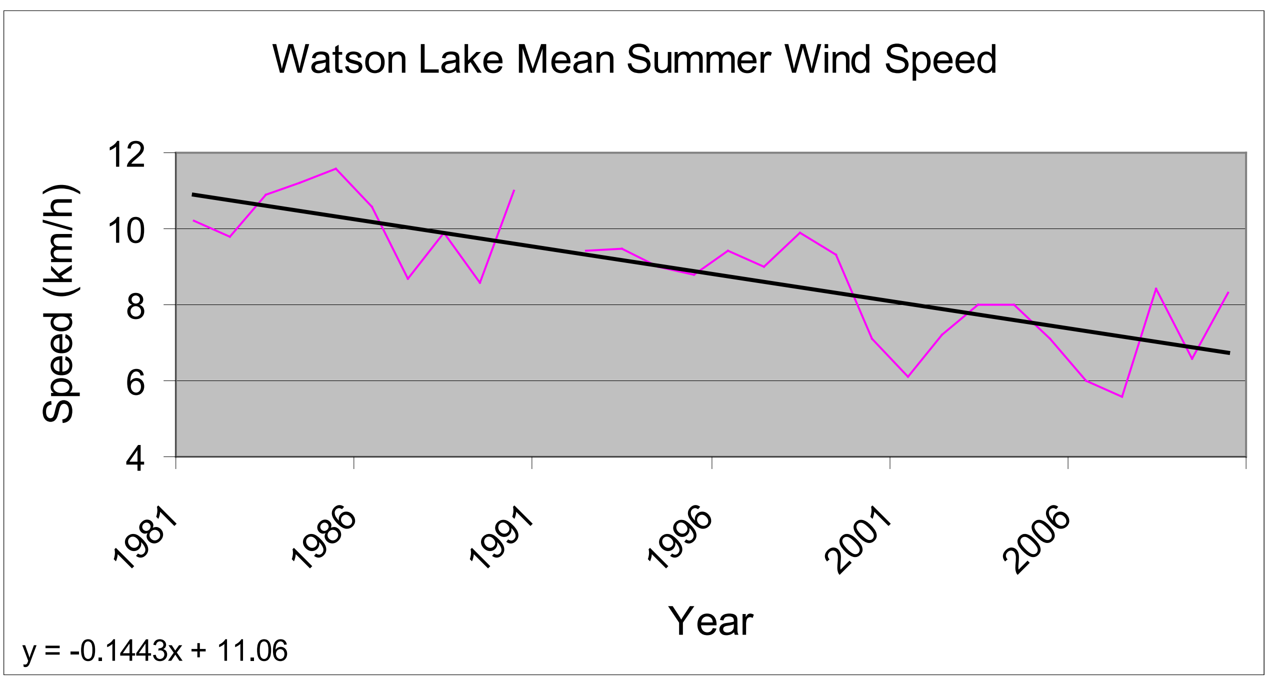

Figure 76. Watson Lake Mean Hourly Wind Speed in Summer. (1981-2010)

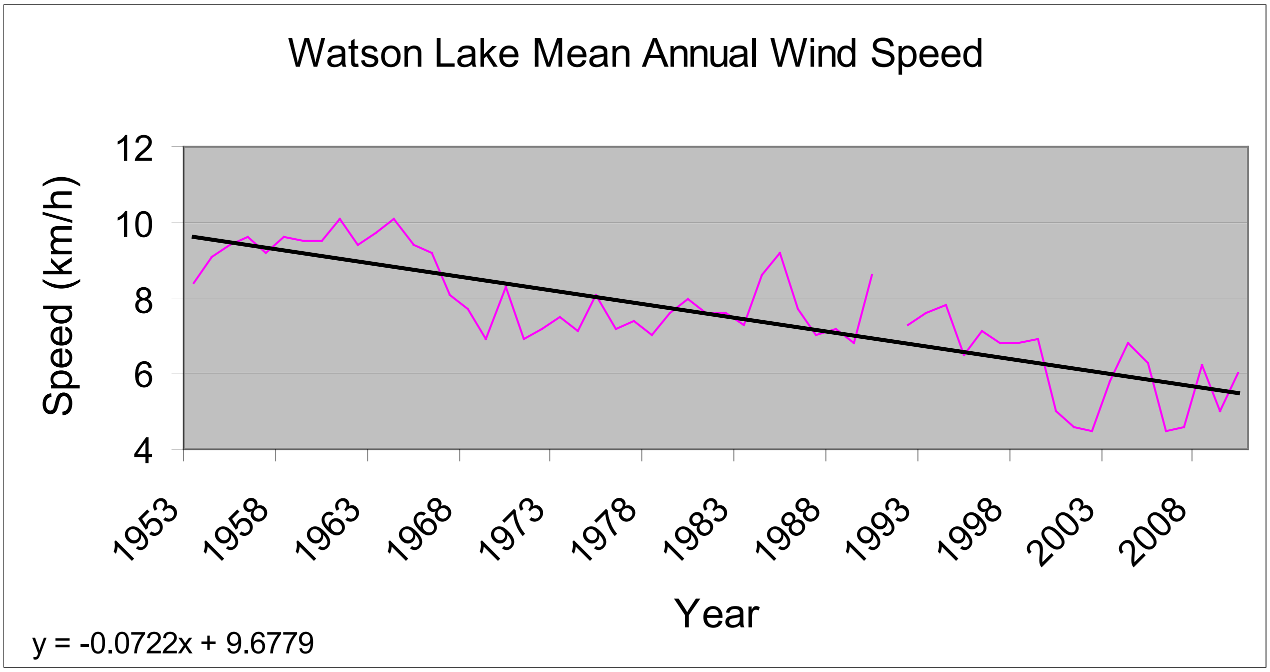

Figure 77. Watson Lake Mean Annual Hourly Wind Speed. (1953-2010)

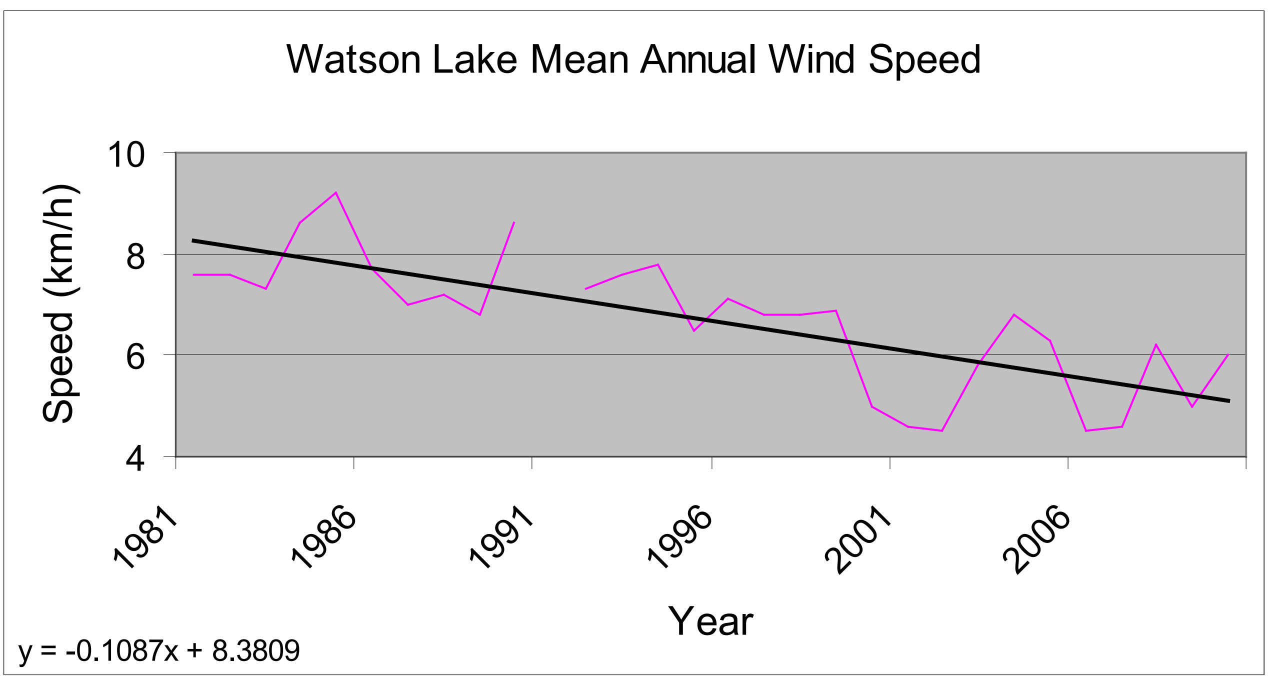

Figure 78. Watson Lake Mean Annual Hourly Wind Speed. (1981-2010)

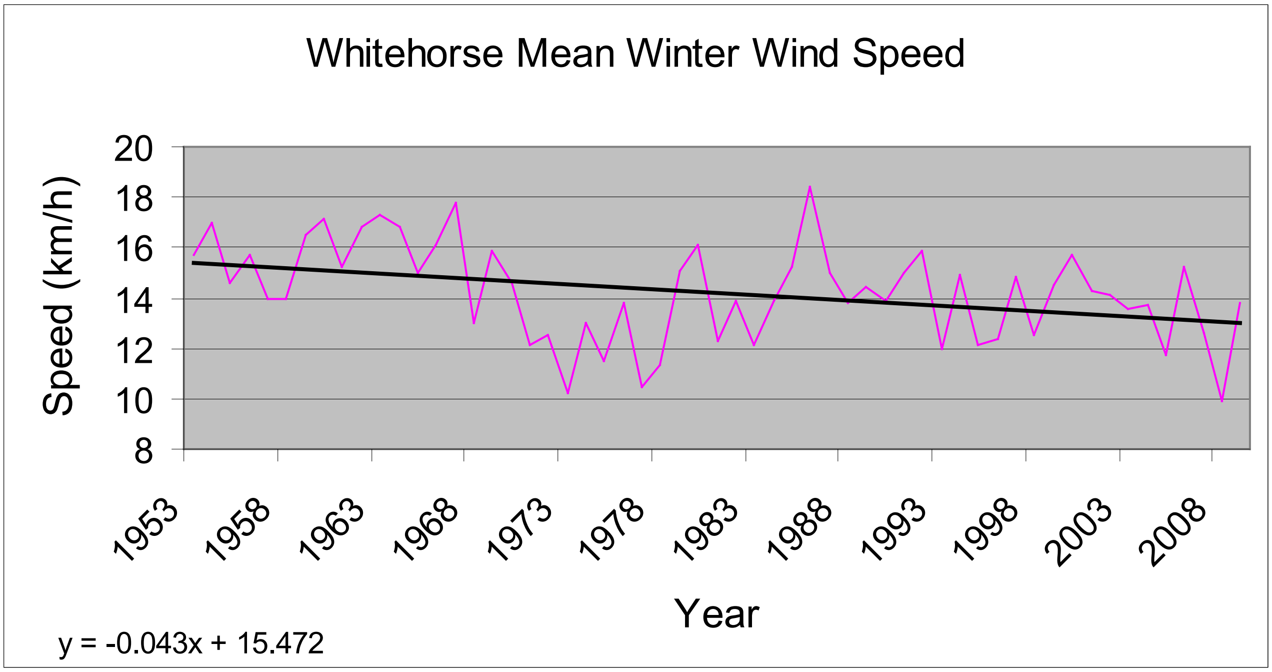

Figure 79. Whitehorse Mean Hourly Wind Speed in Winter. (1953-2009)

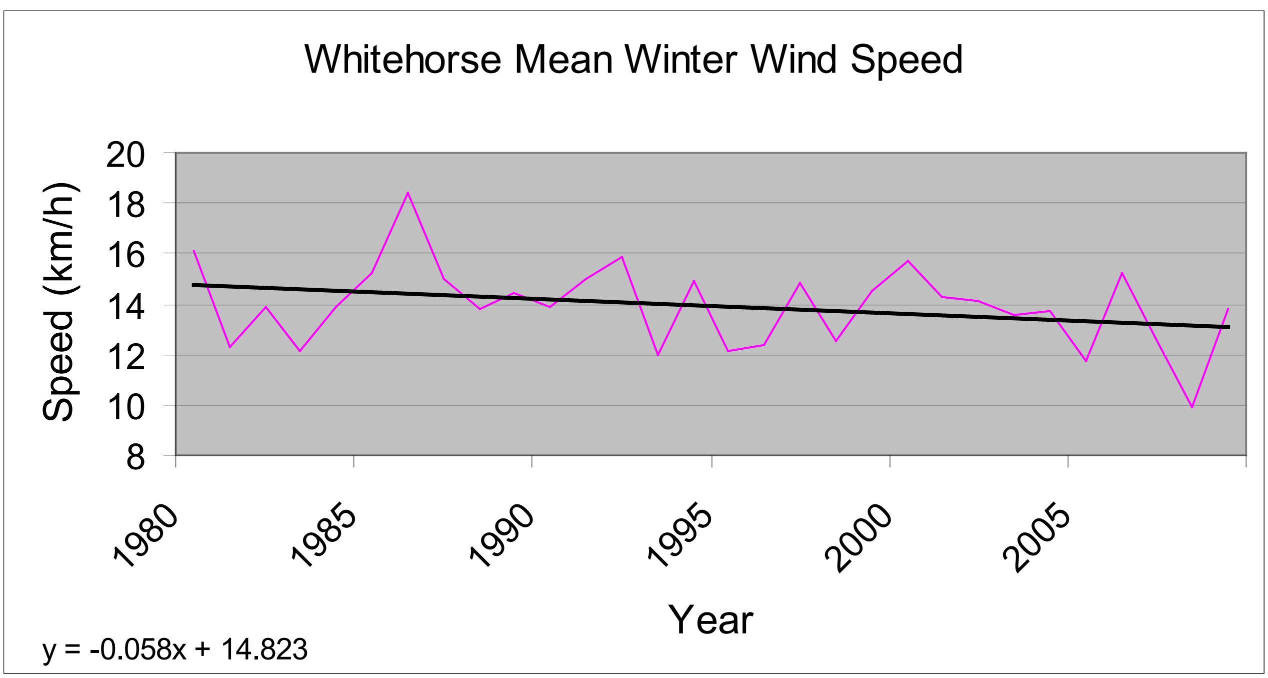

Figure 80. Whitehorse Mean Hourly Wind Speed in Winter. (1980-2009)

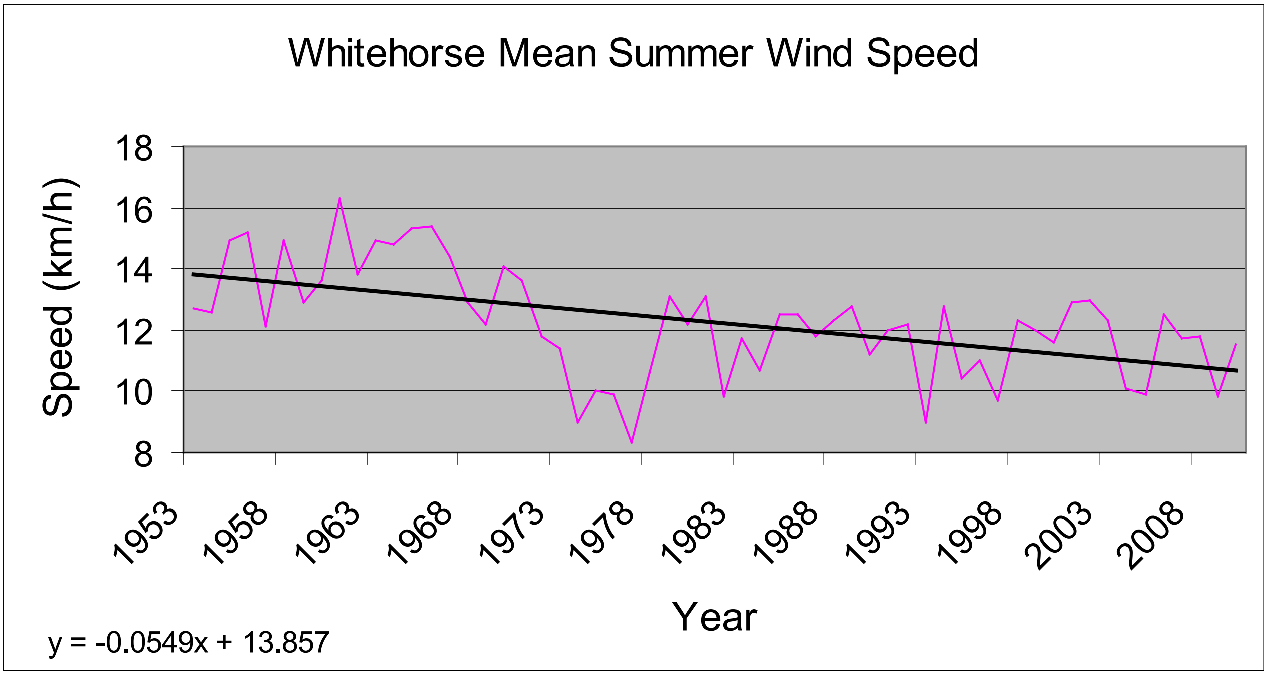

Figure 81. Whitehorse Mean Hourly Wind Speed in Summer. (1953-2010)

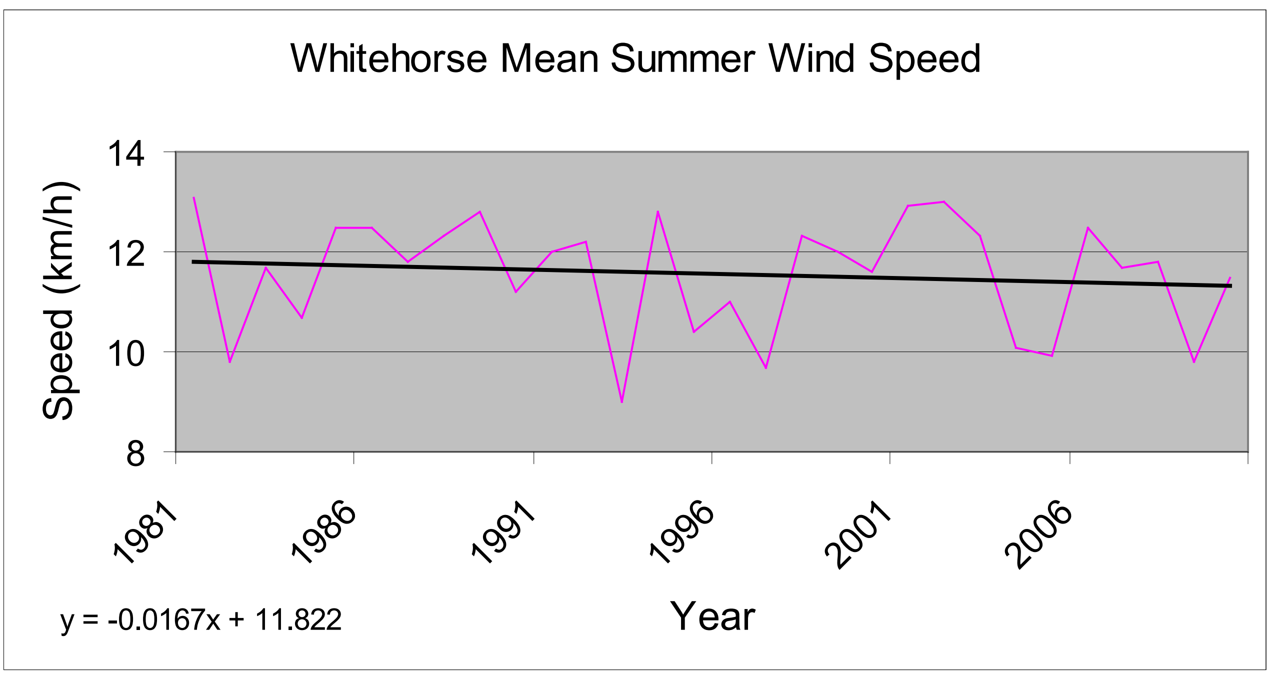

Figure 82. Whitehorse Mean Hourly Wind Speed in Summer. (1981-2010)

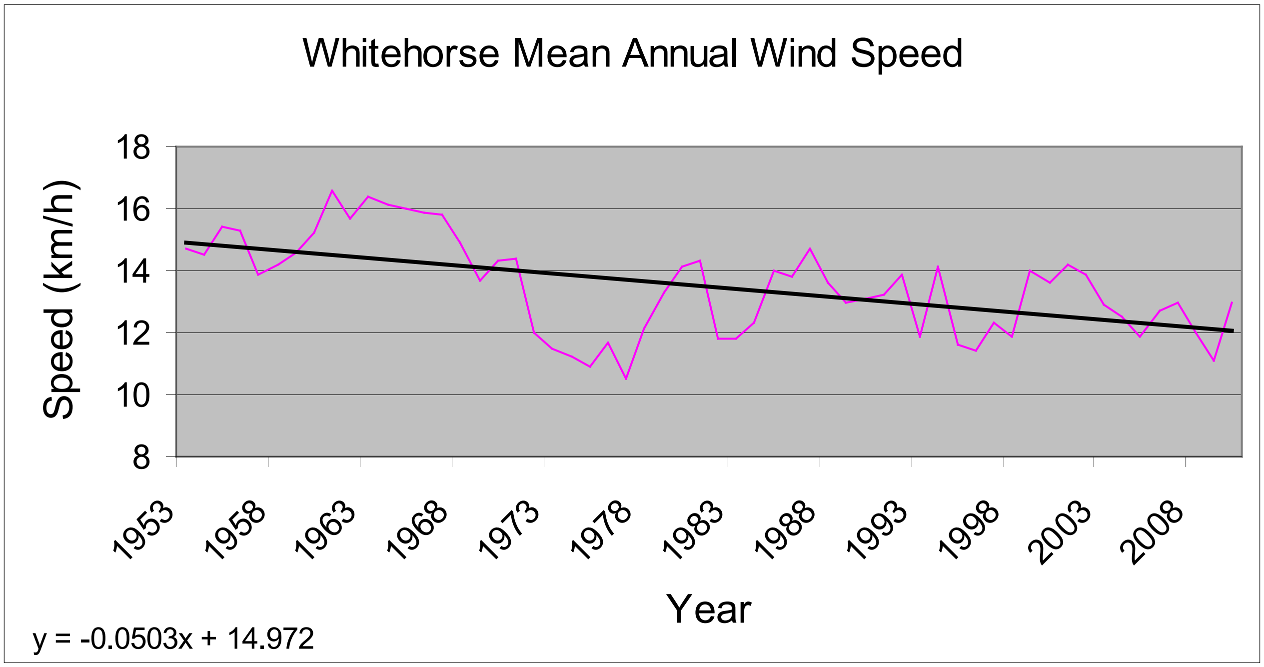

Figure 83. Whitehorse Mean Annual Hourly Wind Speed. (1953-2010)

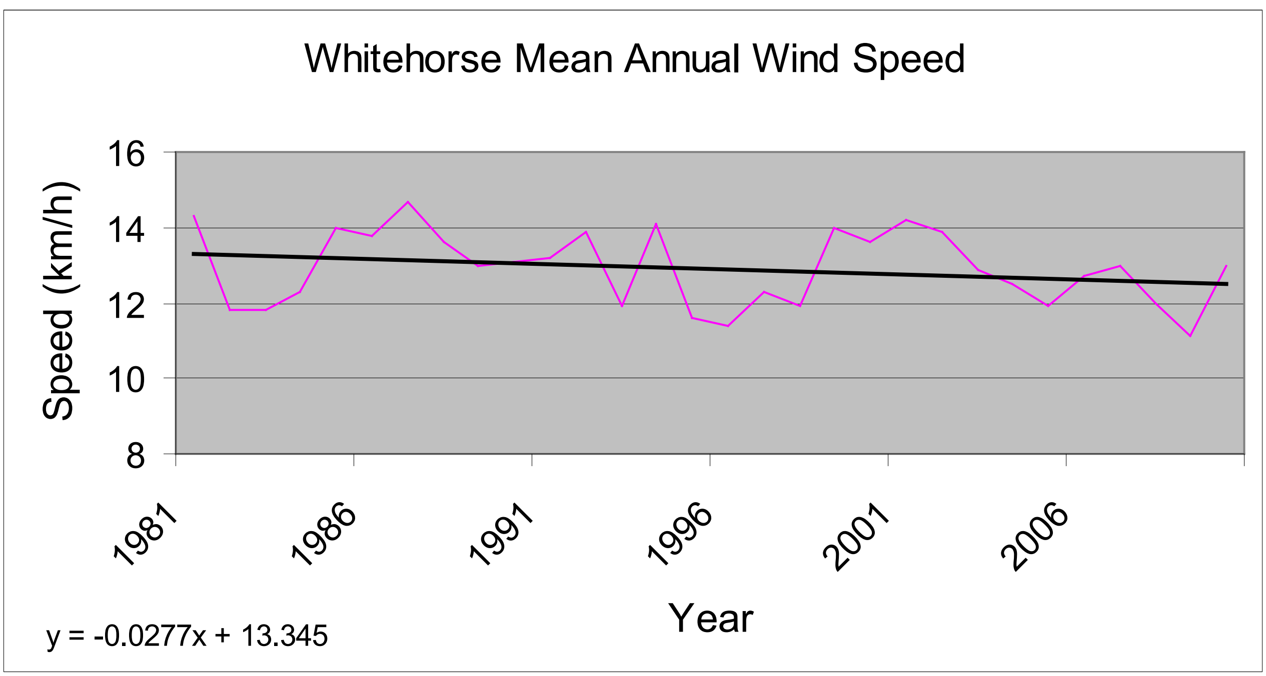

Figure 84. Whitehorse Mean Annual Hourly Wind Speed. (1981-2010)

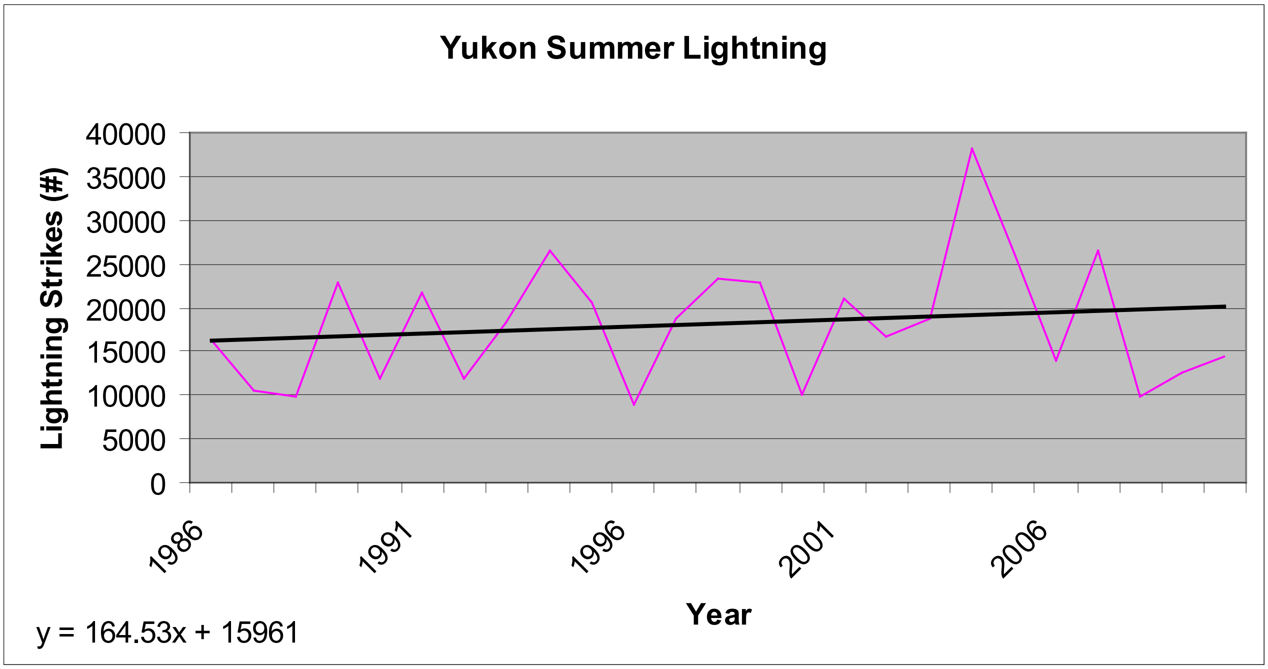

Figure 85. Yukon Summer Lightning (1986-2010)

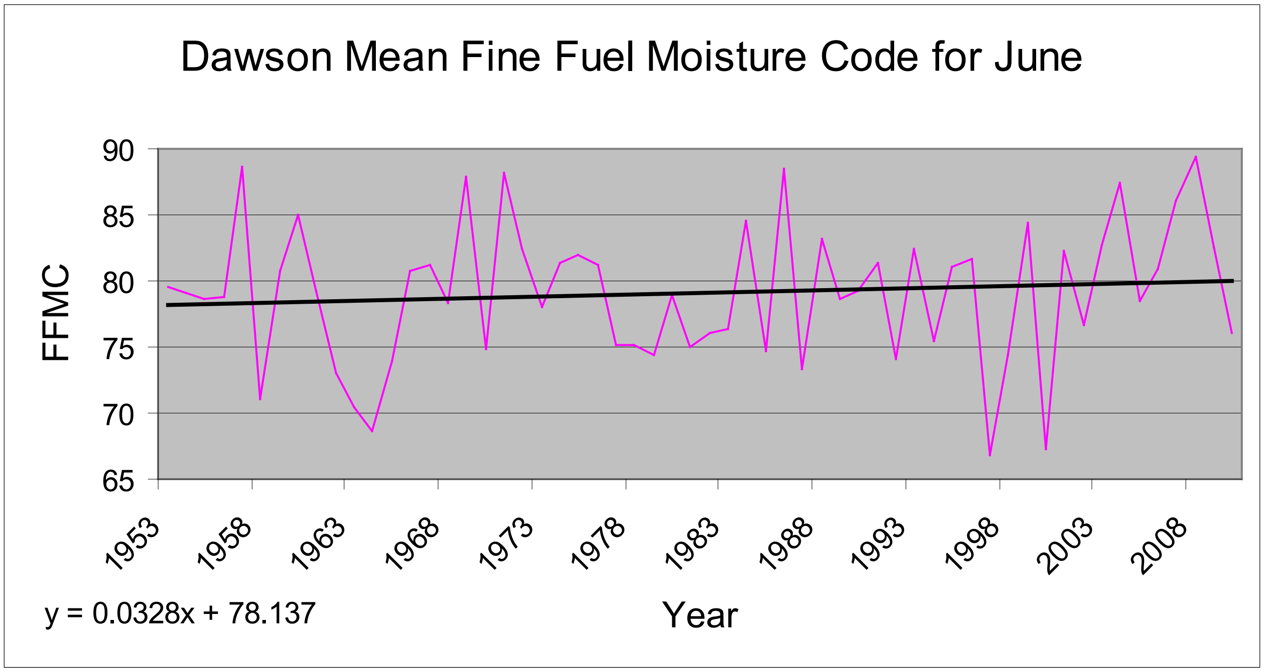

Figure 86. Dawson Mean Fine Fuel Moisture Code for June. (1953-2010)

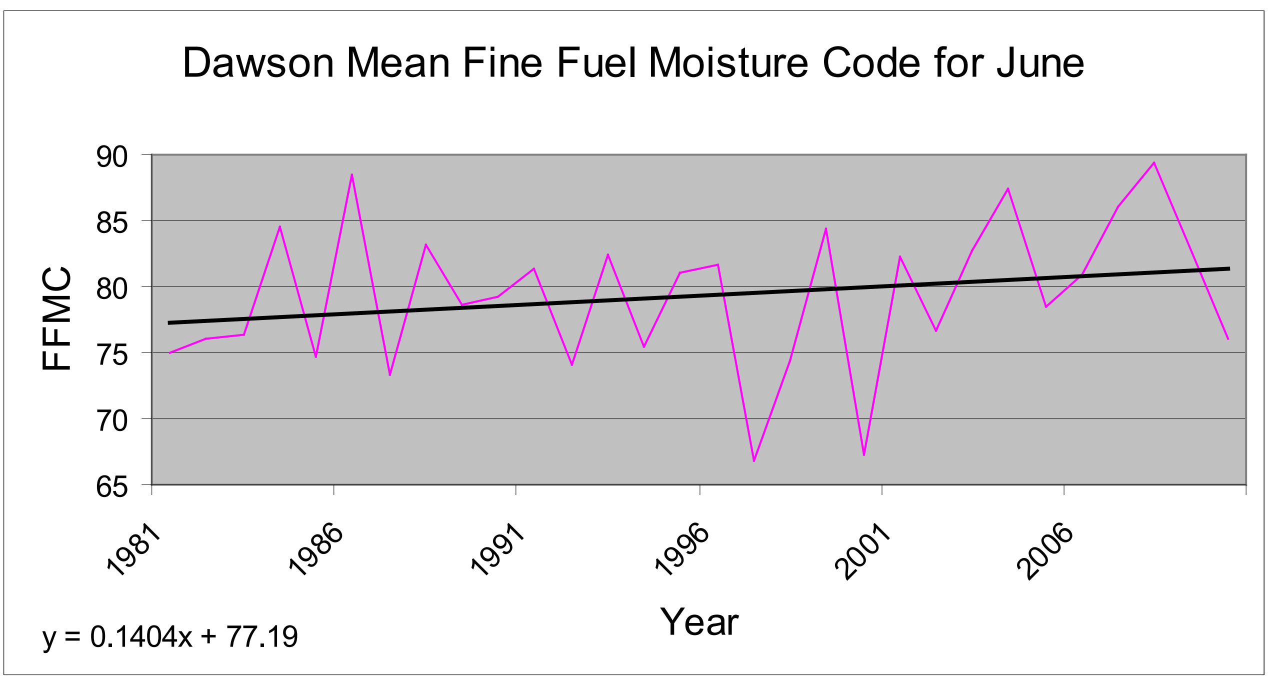

Figure 87. Dawson Mean Fine Fuel Moisture Code for June. (1981-2010)

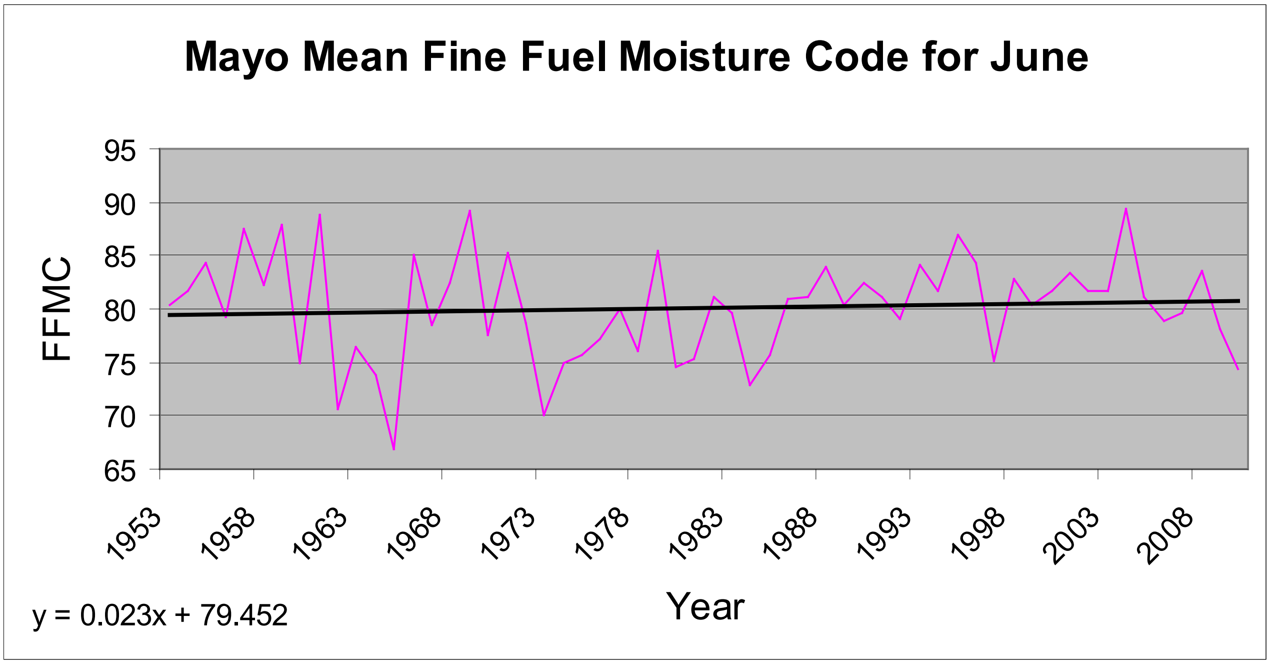

Figure 88. Mayo Mean Fine Fuel Moisture Code for June. (1953-2010)

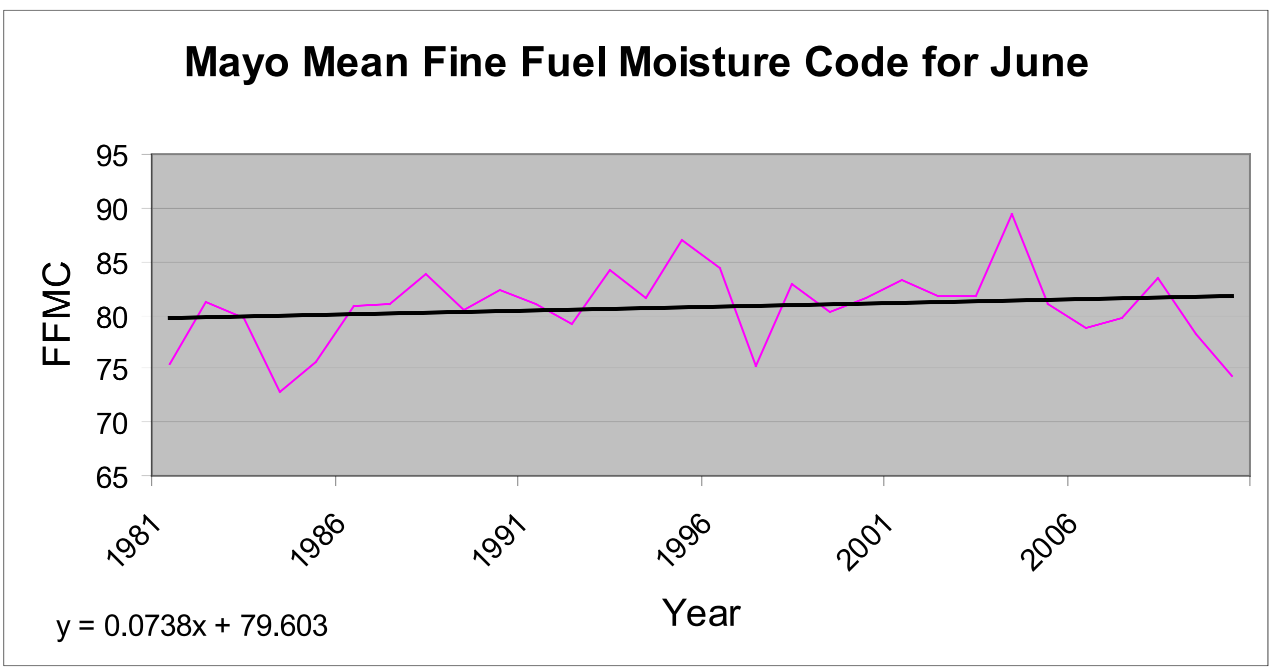

Figure 89. Mayo Mean Fine Fuel Moisture Code for June. (1981-2010)

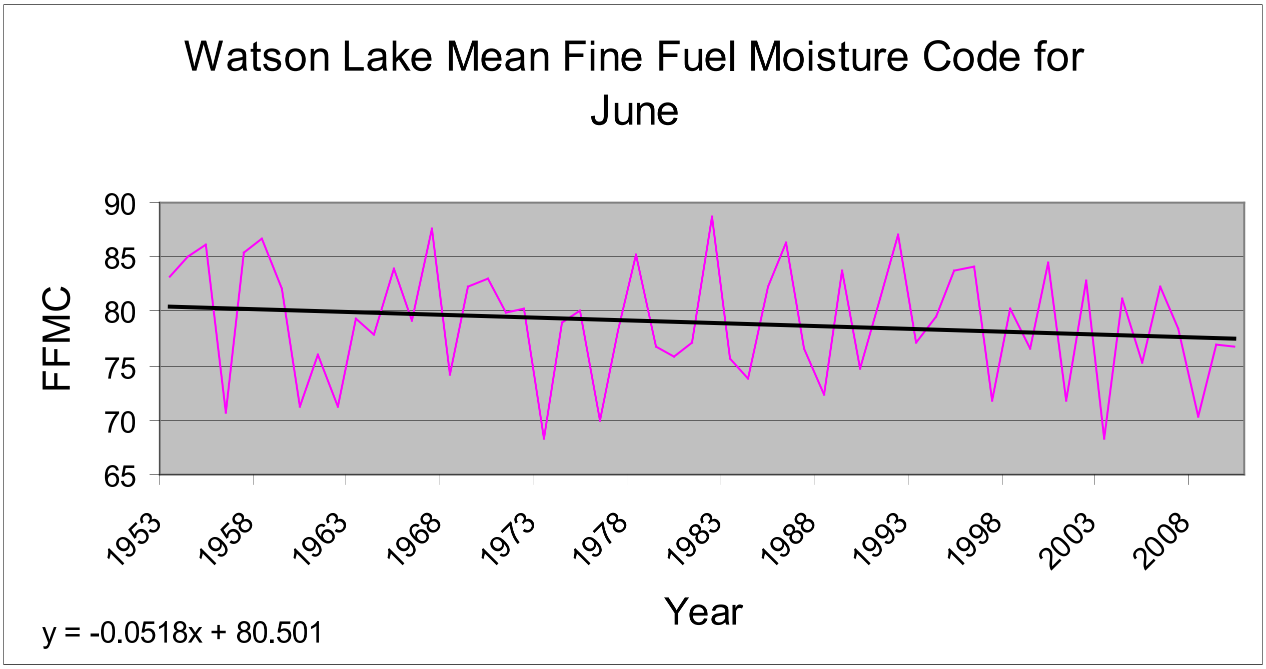

Figure 90. Watson Lake Mean Fine Fuel Moisture Code for June. (1953-2010)

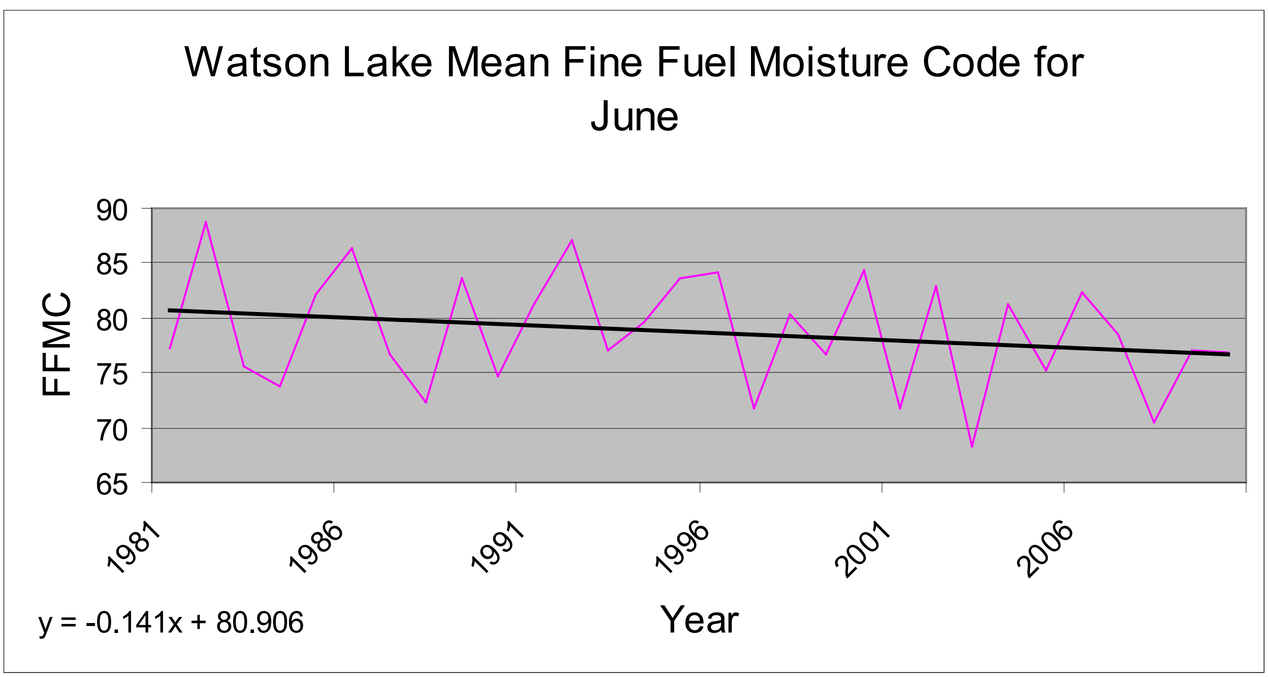

Figure 91. Watson Lake Mean Fine Fuel Moisture Code for June. (1981-2010)

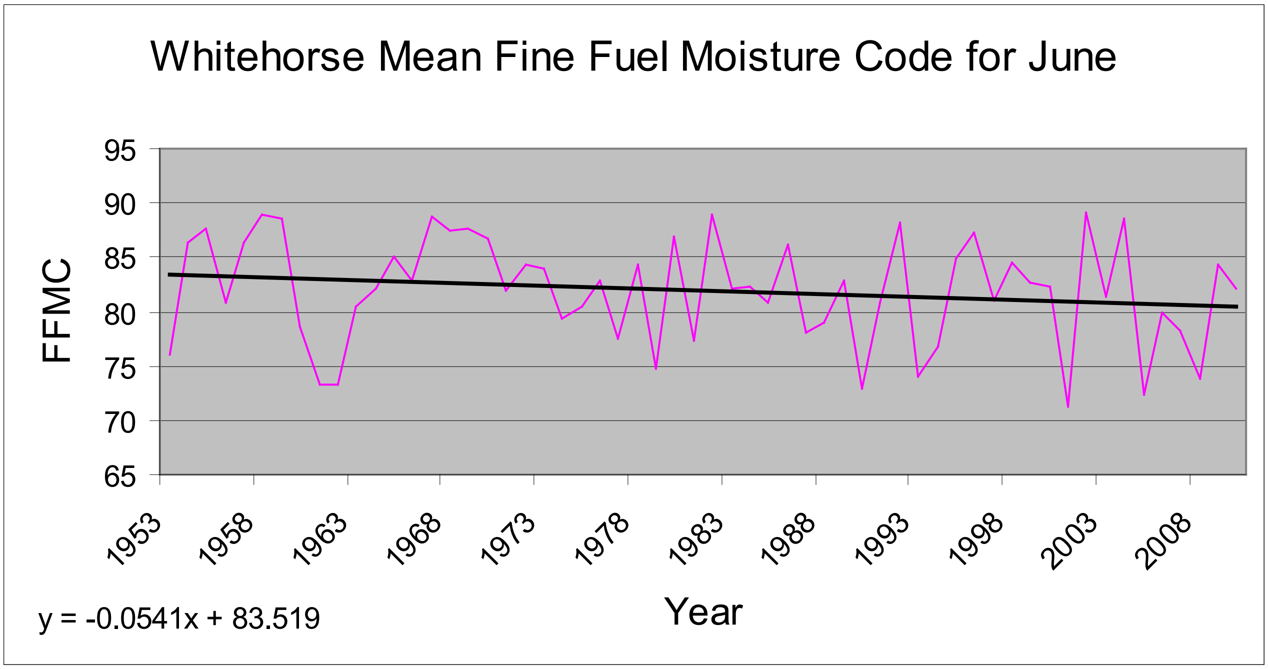

Figure 92. Whitehorse Mean Fine Fuel Moisture Code for June. (1953-2010)

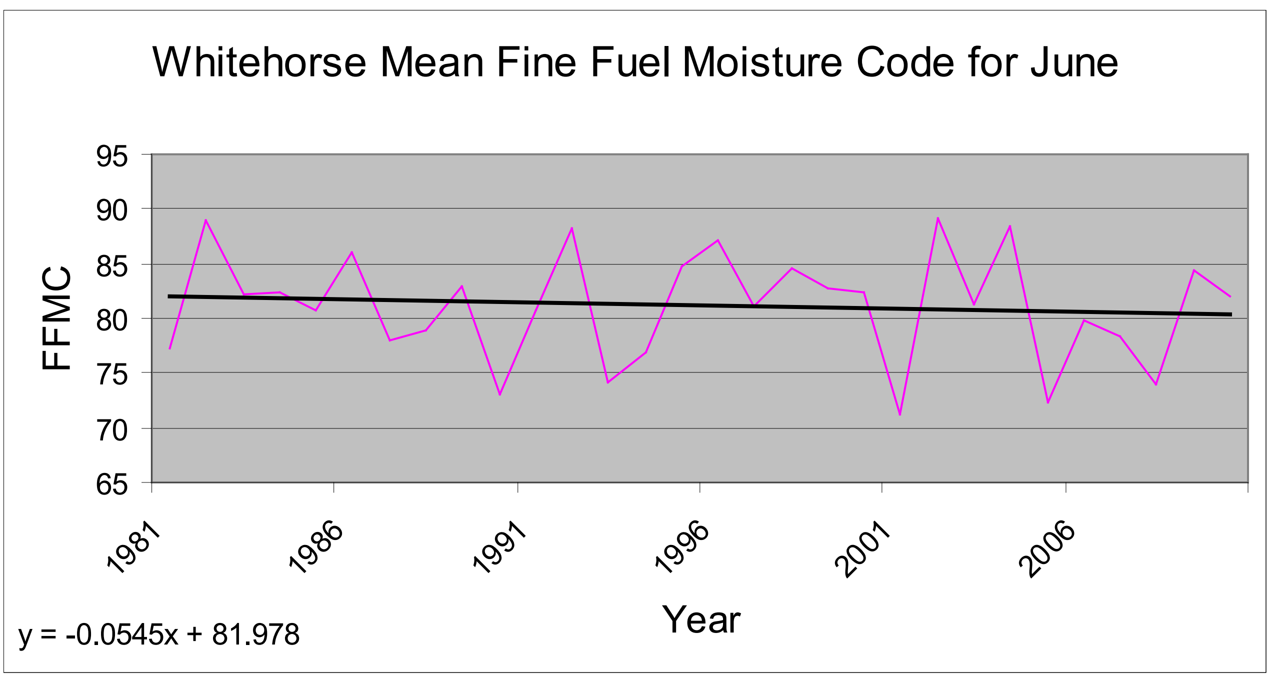

Figure 93. Whitehorse Mean Fine Fuel Moisture Code for June. (1981-2010)

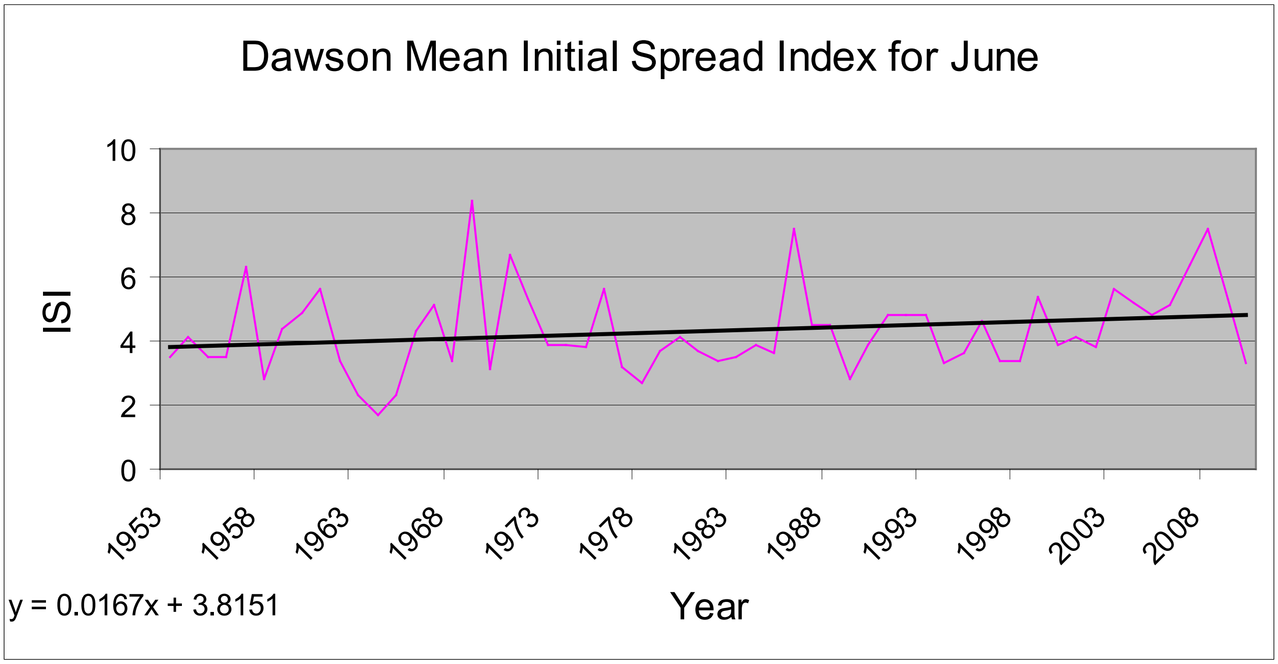

Figure 94. Dawson Mean Initial Spread Index for June. (1953-2010)

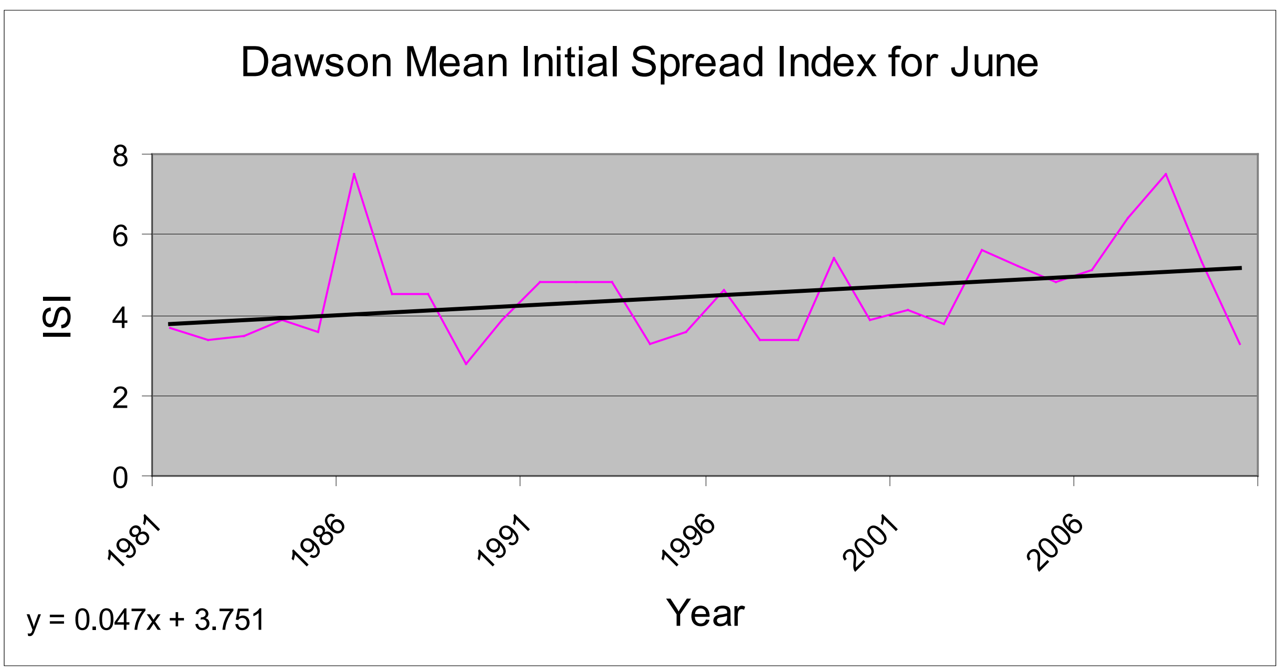

Figure 95. Dawson Mean Initial Spread Index for June. (1981-2010)

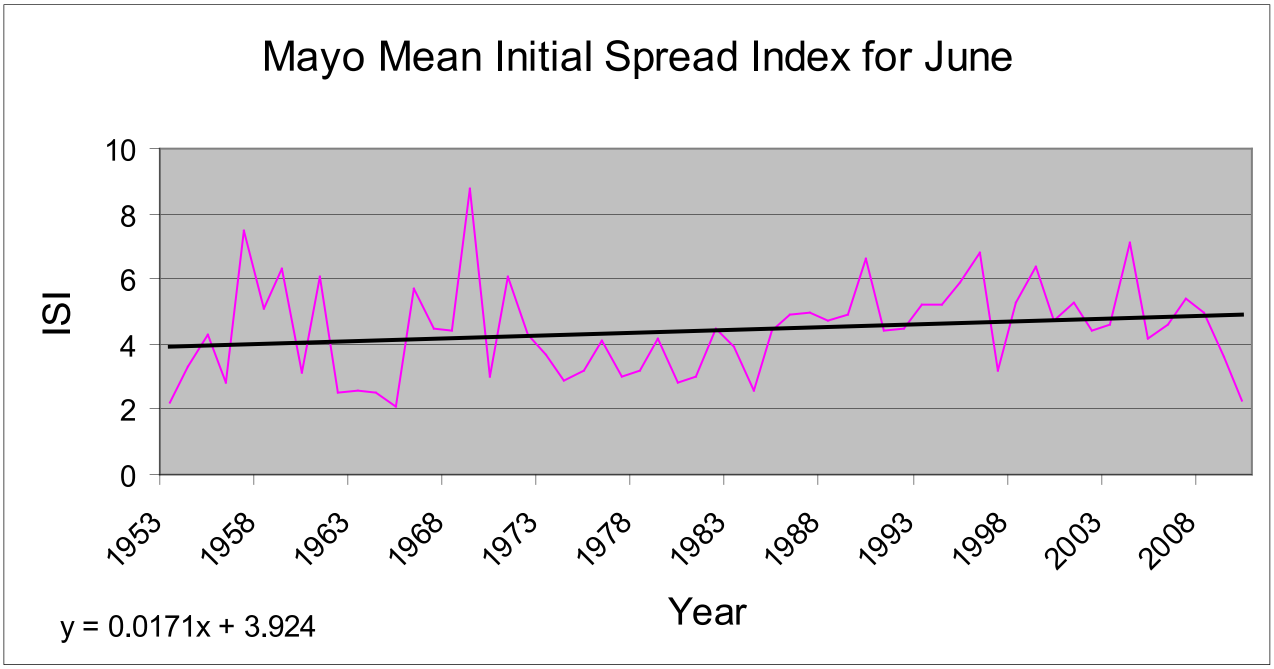

Figure 96. Mayo Mean Initial Spread Index for June. (1953-2010)

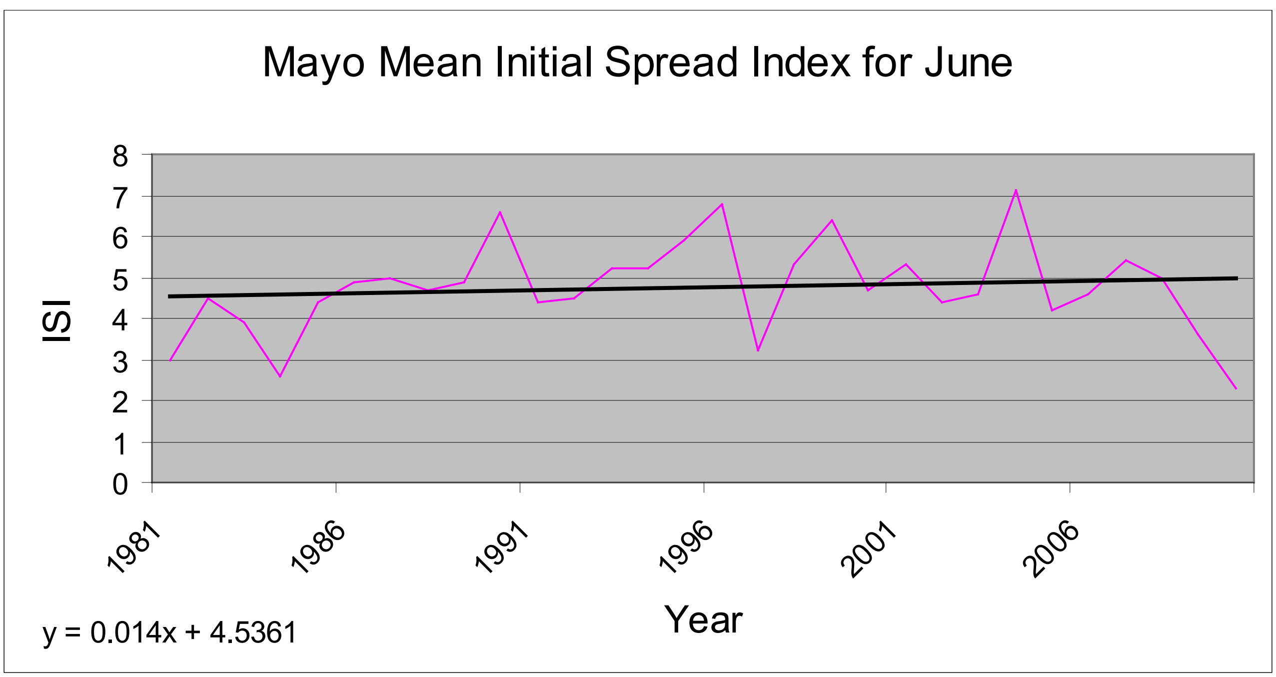

Figure 97. Mayo Mean Initial Spread Index for June. (1981-2010)

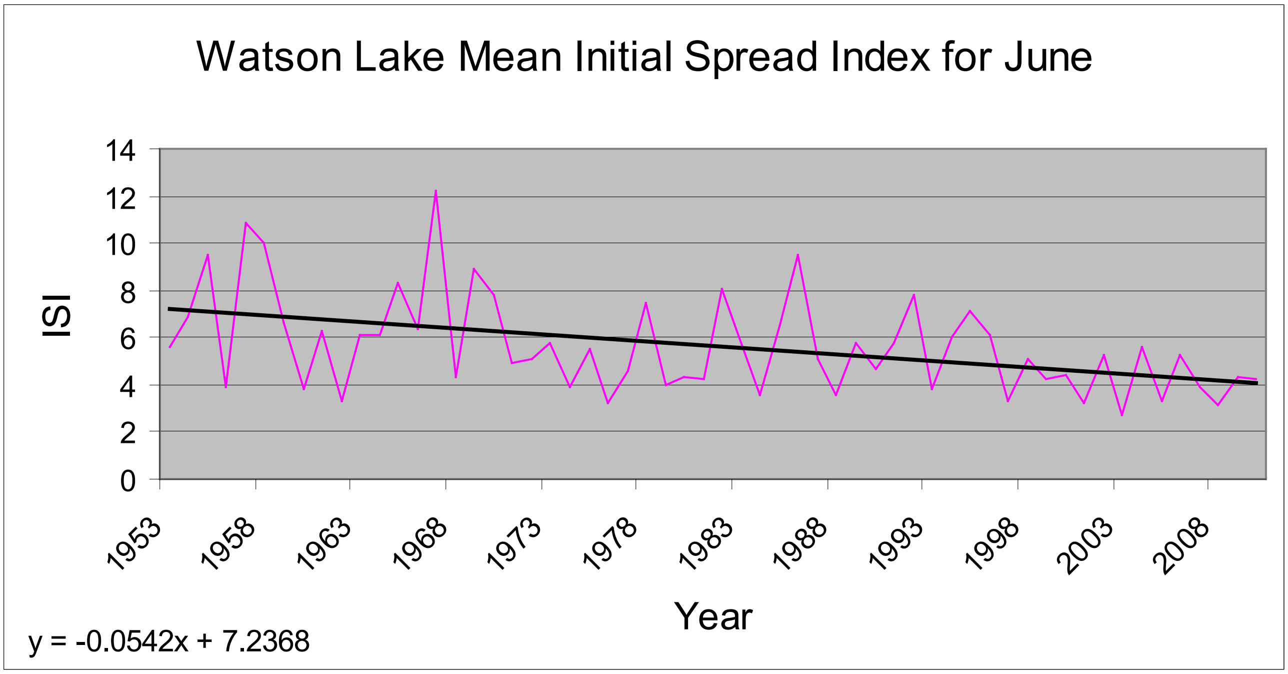

Figure 98. Watson Lake Mean Initial Spread Index for June. (1953-2010)

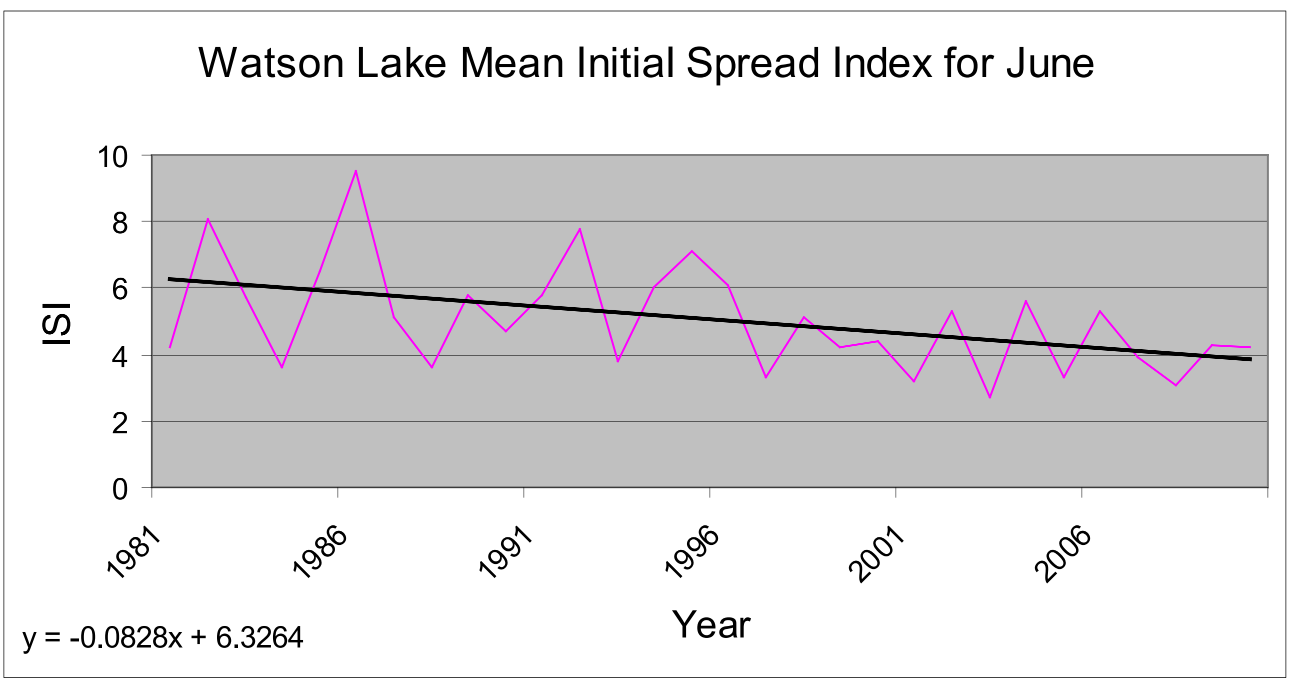

Figure 99. Watson Lake Mean Initial Spread Index for June. (1981-2010)

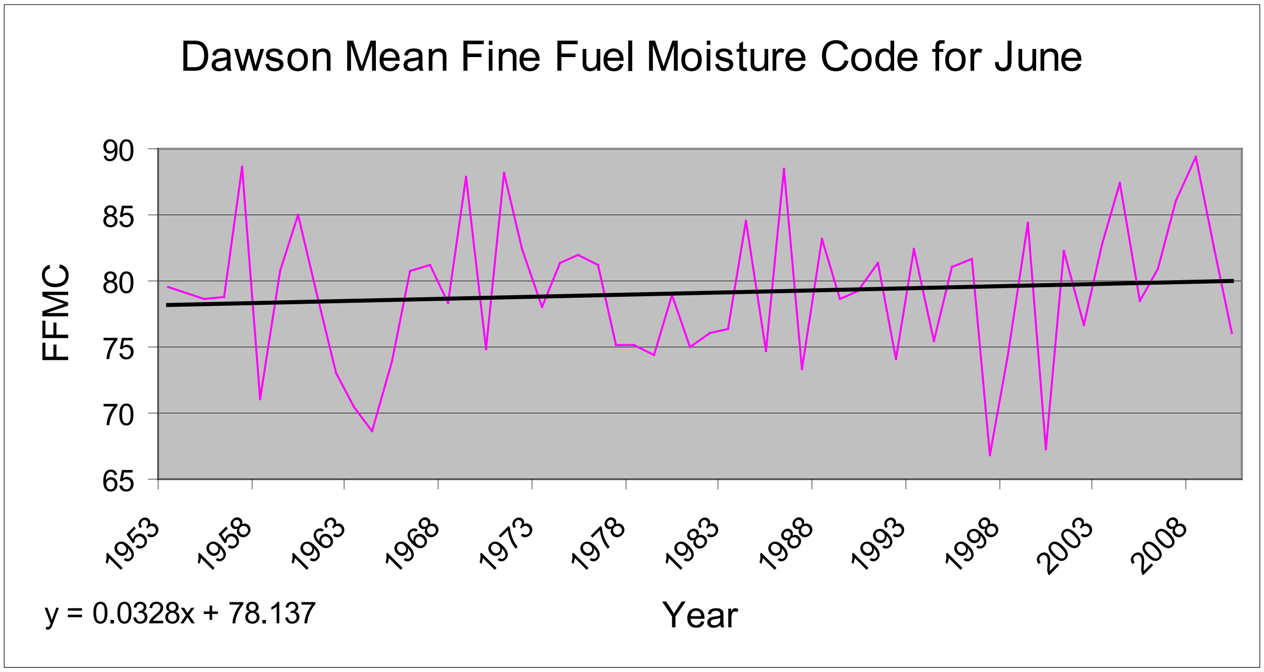

Figure 100. Whitehorse Mean Initial Spread Index for June. (1953-2010)

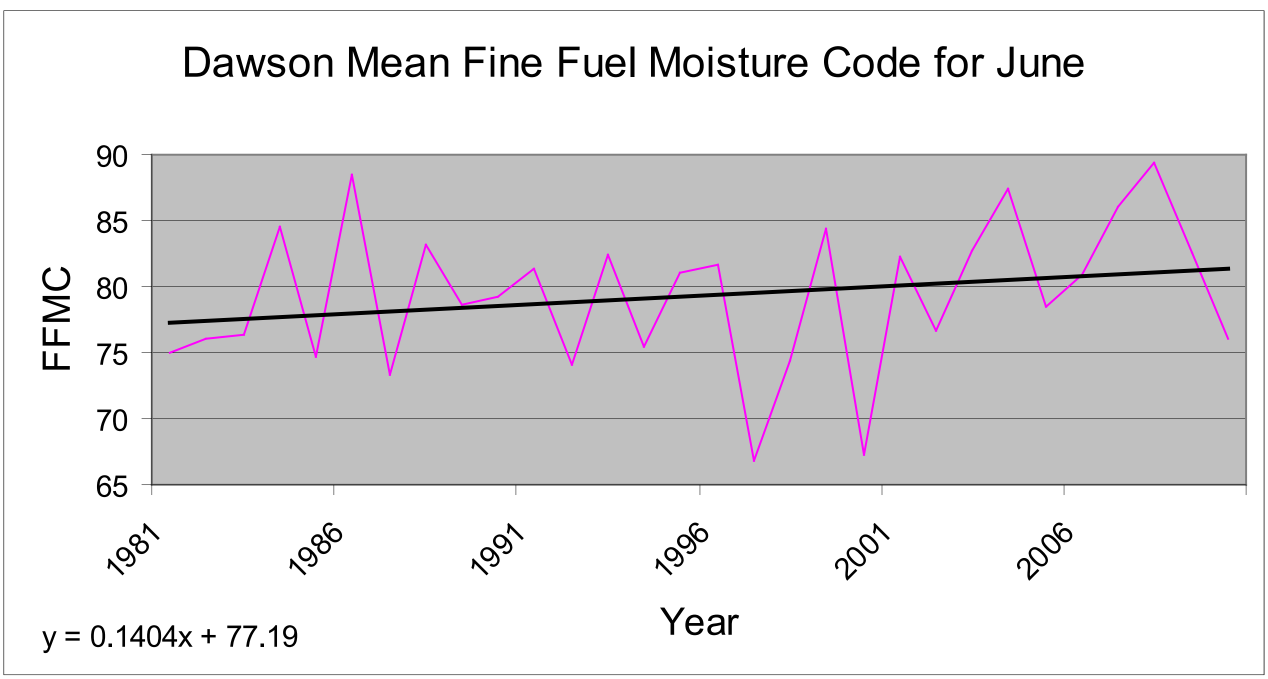

Figure 101. Whitehorse Mean Initial Spread Index for June. (1981-2010)

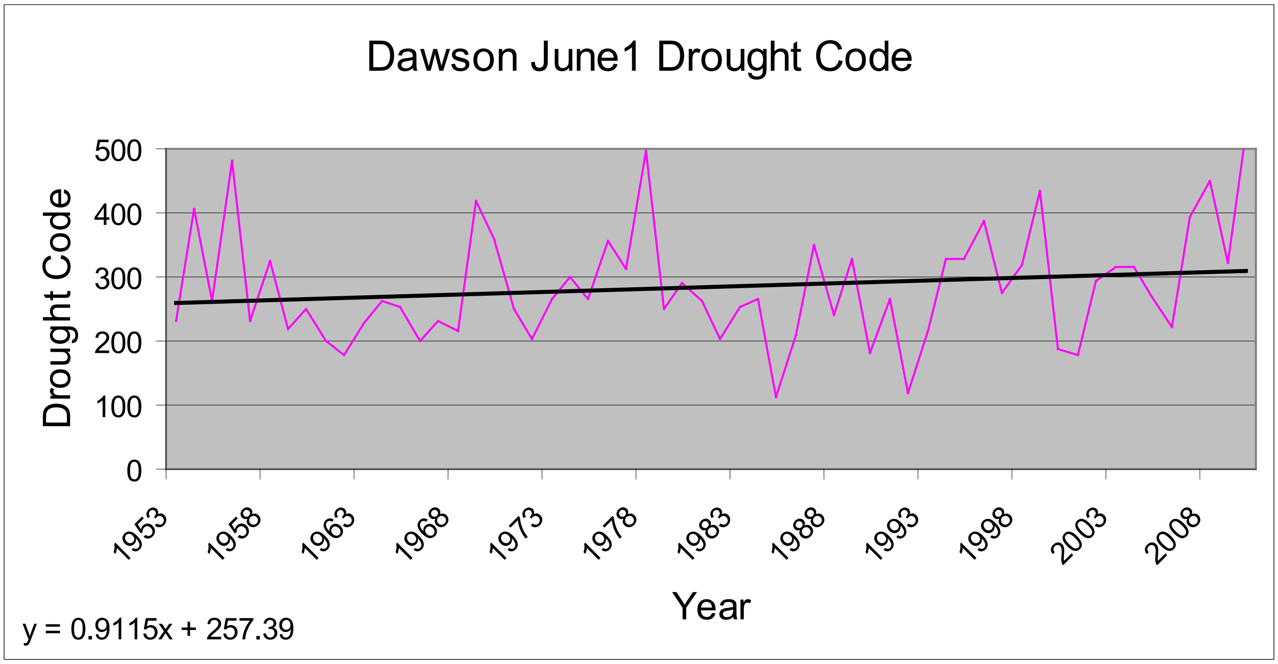

Figure 102. Dawson Mean Drought Code for June. (1953-2010)

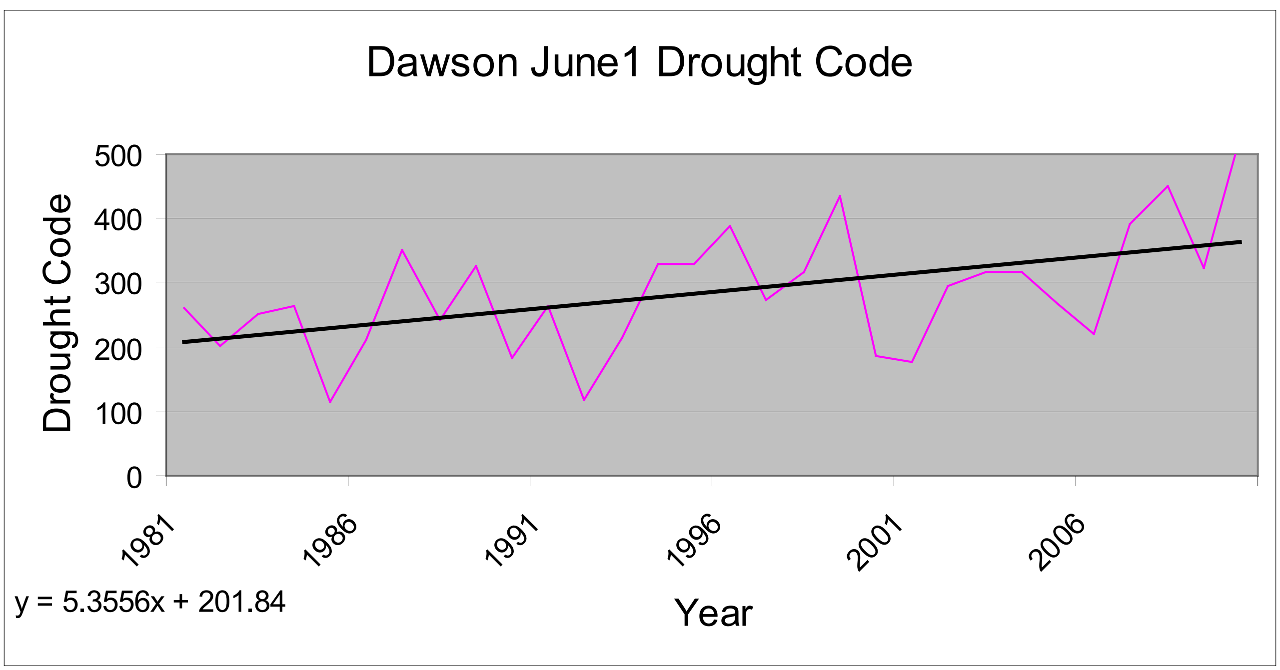

Figure 103. Dawson Mean Drought Code for June. (1981-2010)

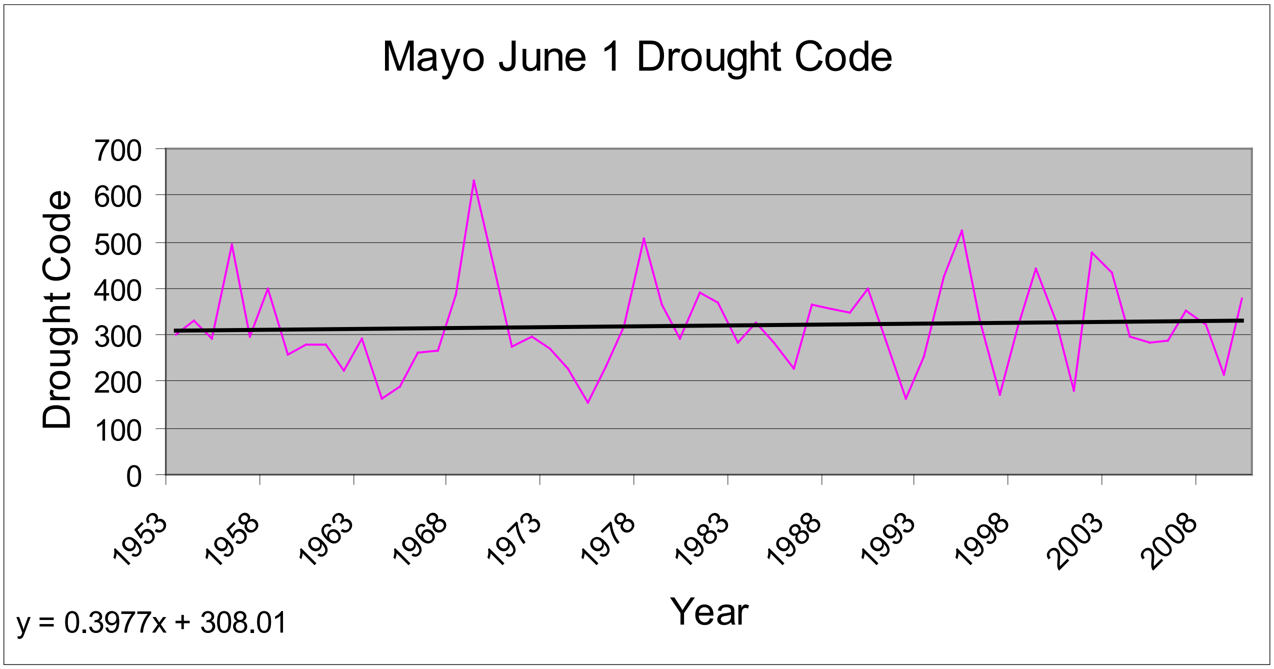

Figure 104. Mayo Mean Drought Code for June. (1953-2010)

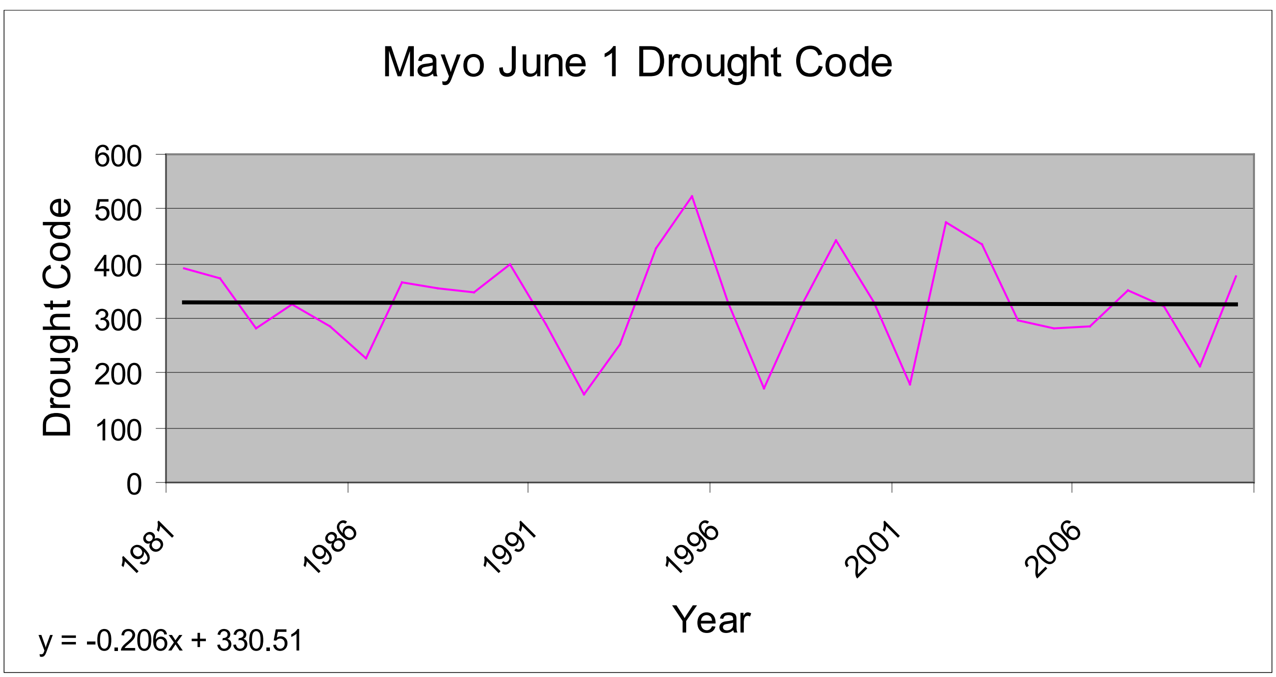

Figure 105. Mayo Mean Drought Code for June. (1981-2010)

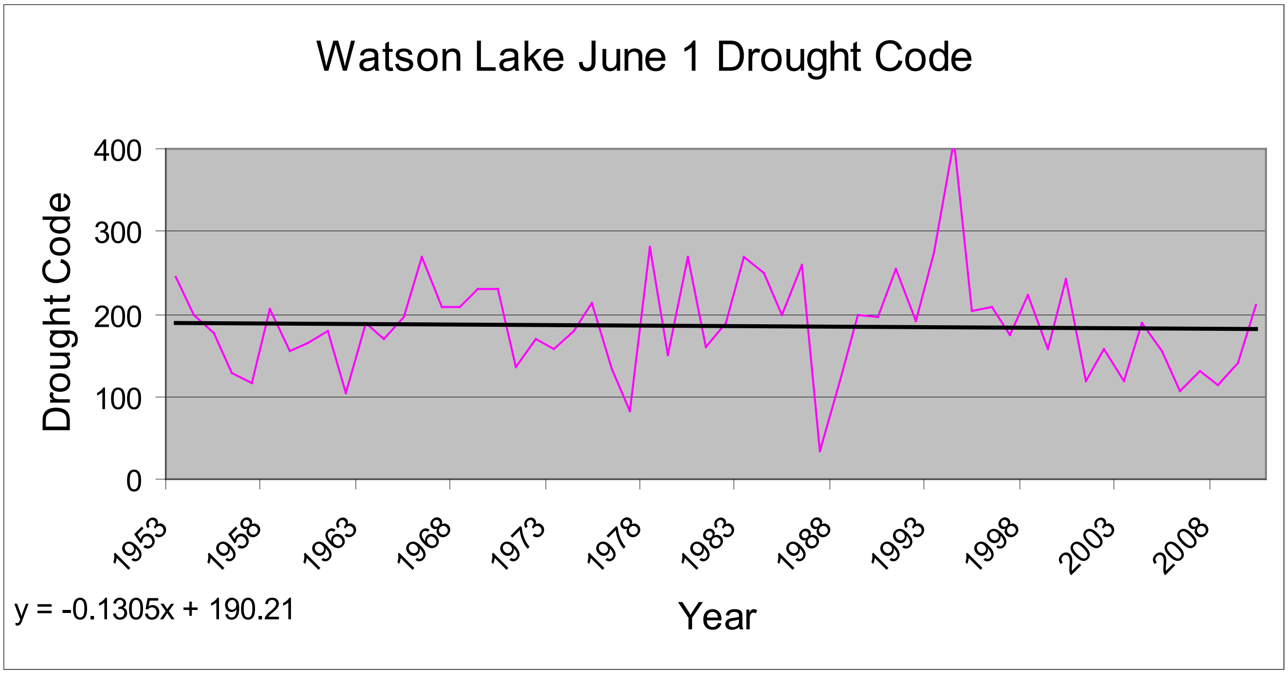

Figure 106. Watson Lake Mean Drought Code for June. (1953-2010)

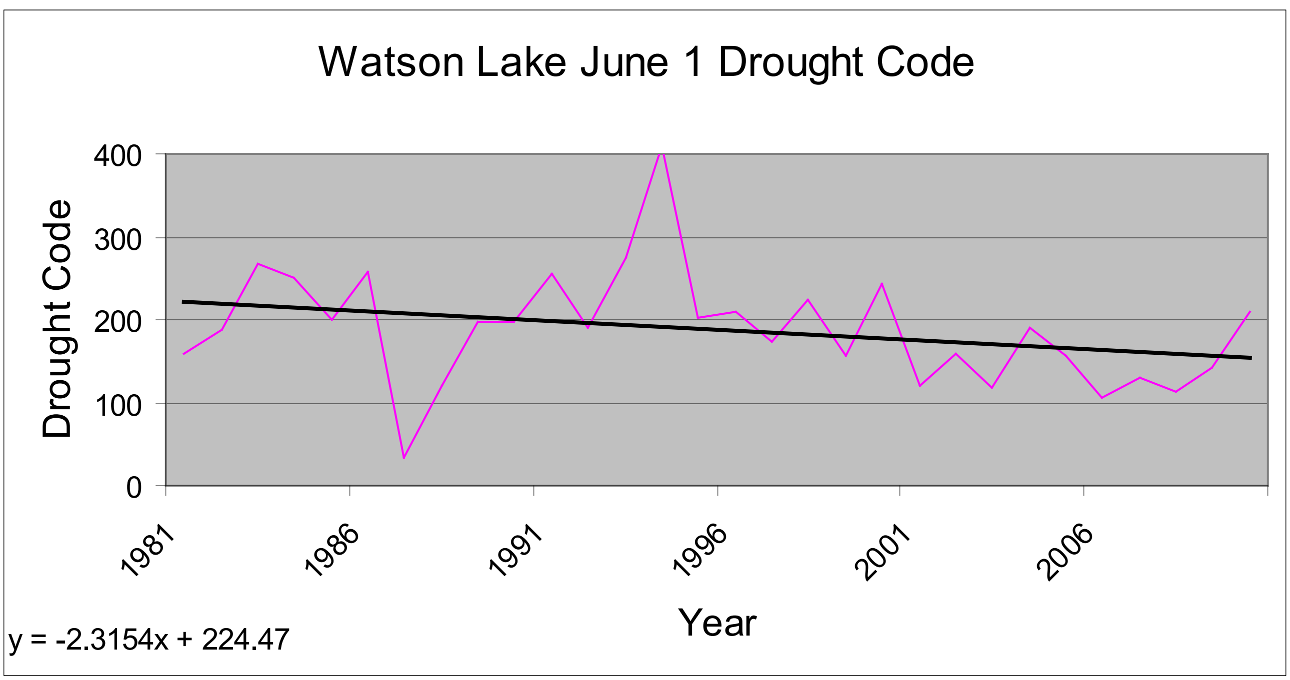

Figure 107. Watson Lake Mean Drought Code for June. (1981-2010)

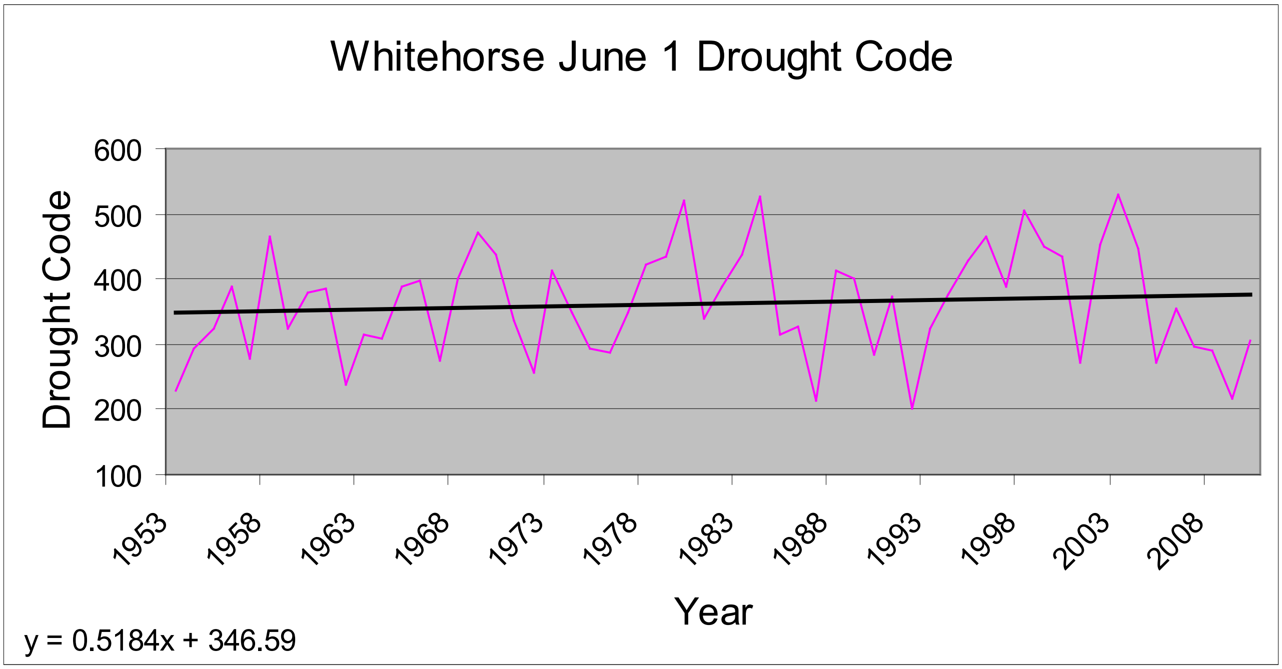

Figure 108. Whitehorse Mean Drought Code for June. (1953-2010)

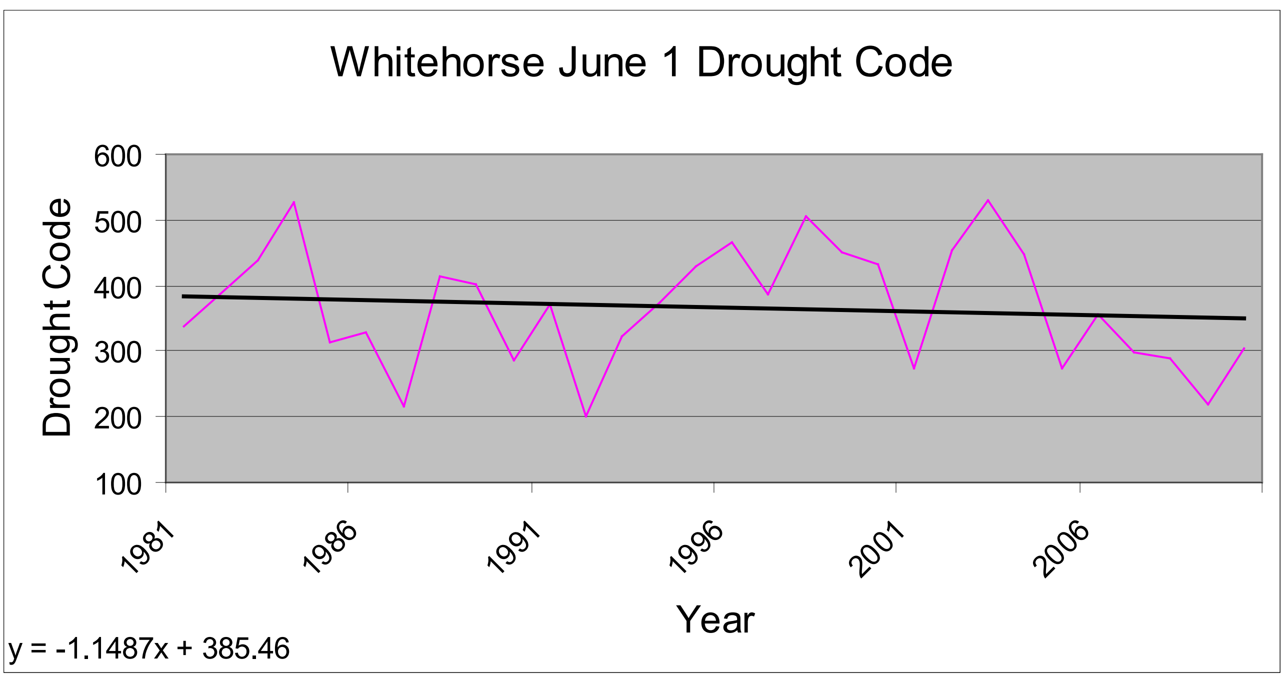

Figure 109. Whitehorse Mean Drought Code for June. (1981-2010)

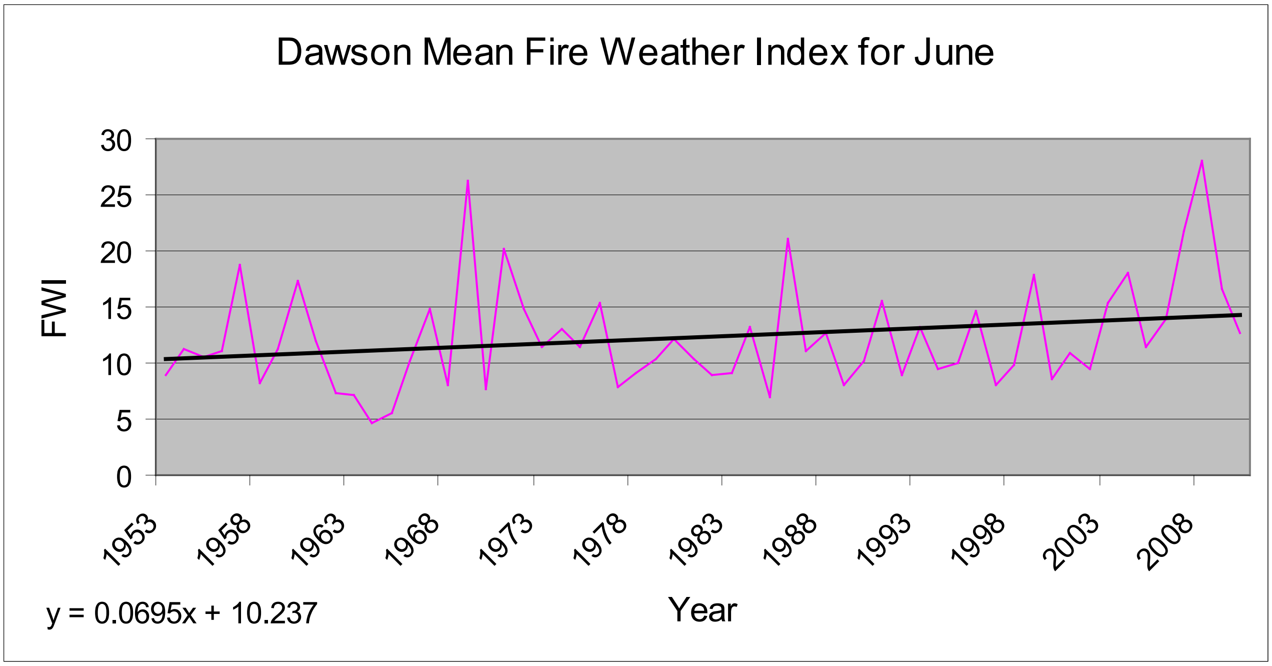

Figure 110. Dawson Mean Fire Weather Index for June. (1953-2010)

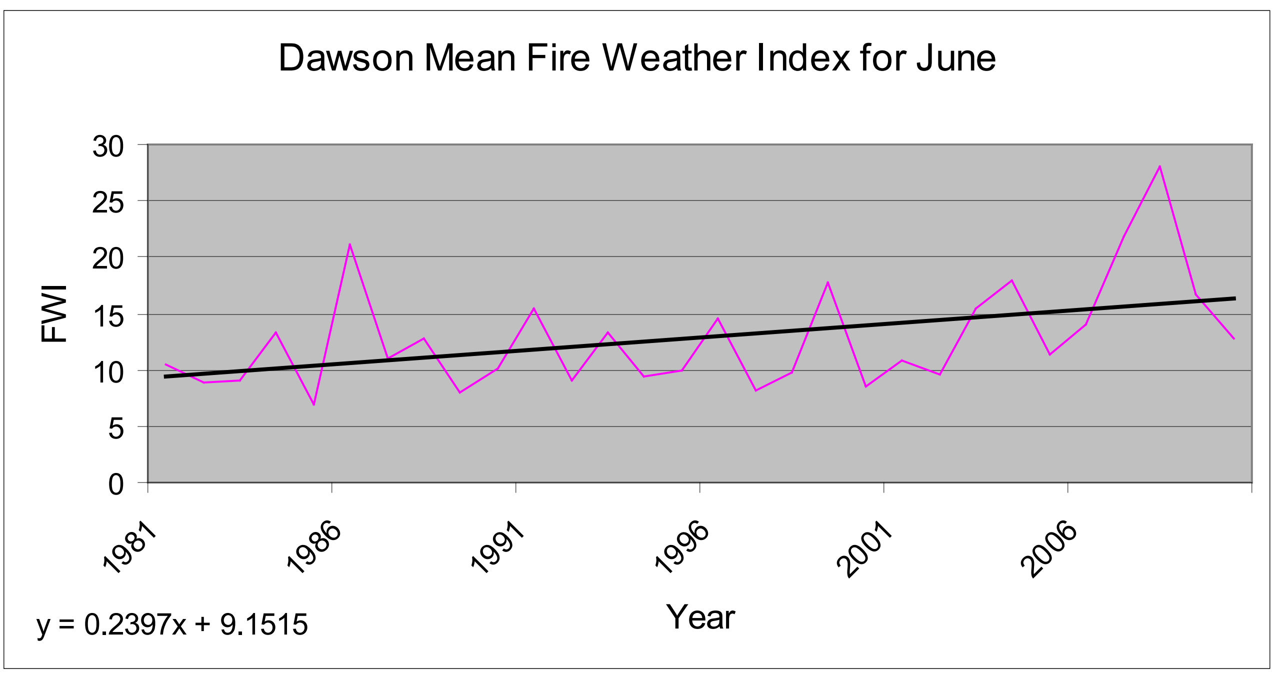

Figure 111. Dawson Mean Fire Weather Index for June. (1981-2010)

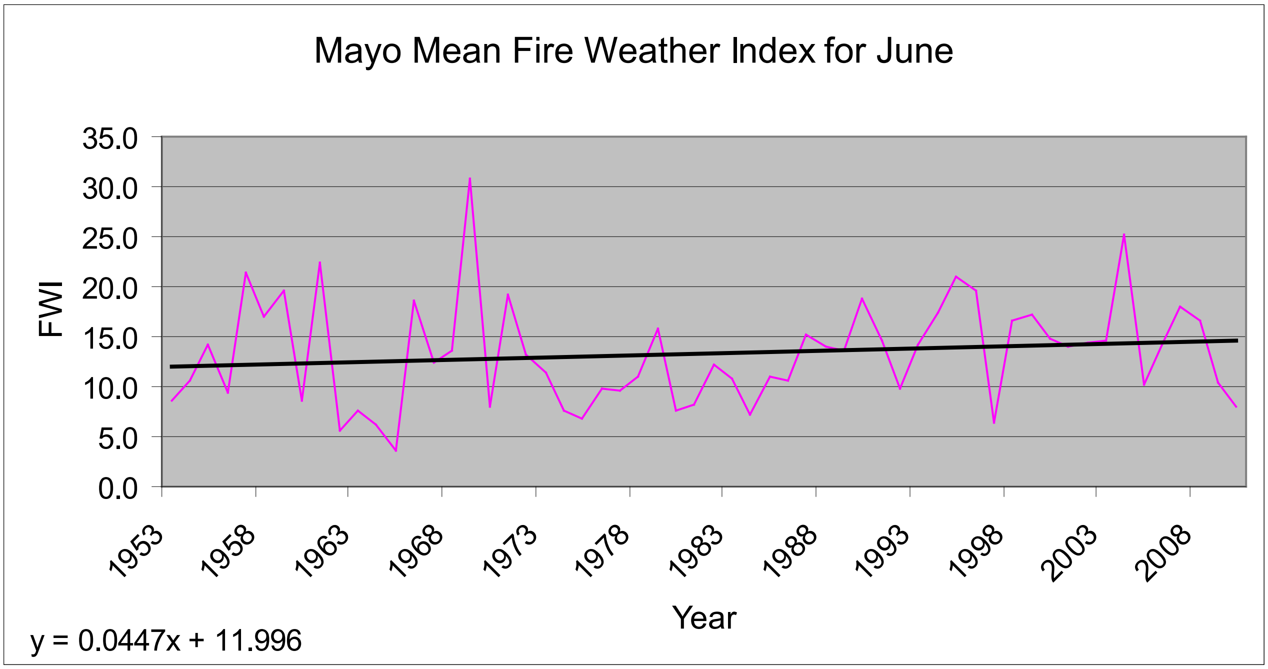

Figure 112. Mayo Mean Fire Weather Index for June. (1953-2010)

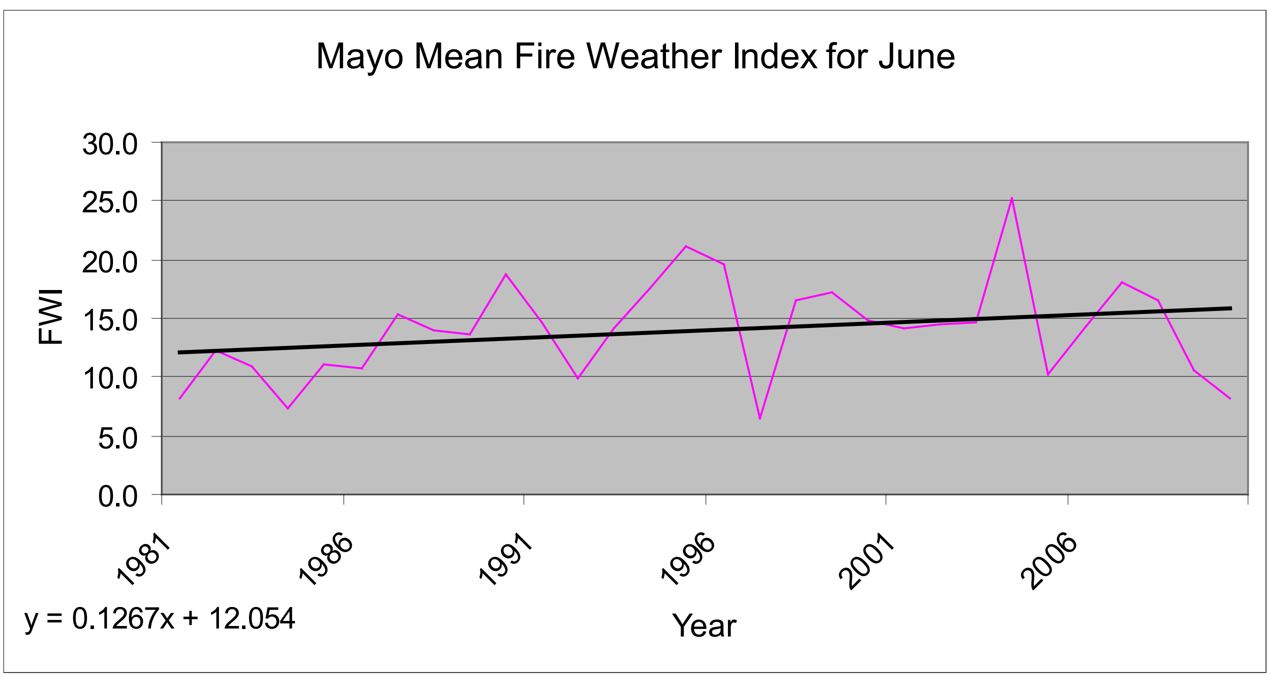

Figure 113. Mayo Mean Fire Weather Index for June. (1981-2010)

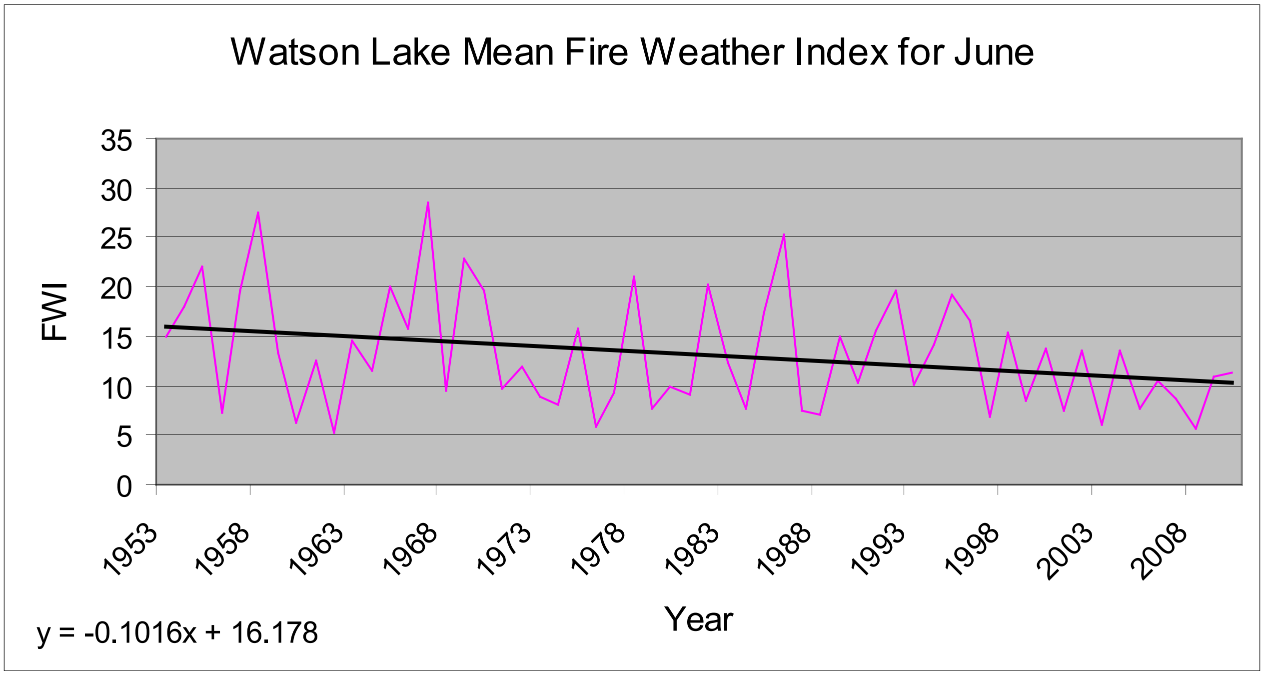

Figure 114. Watson Lake Mean Fire Weather Index for June. (1953-2010)

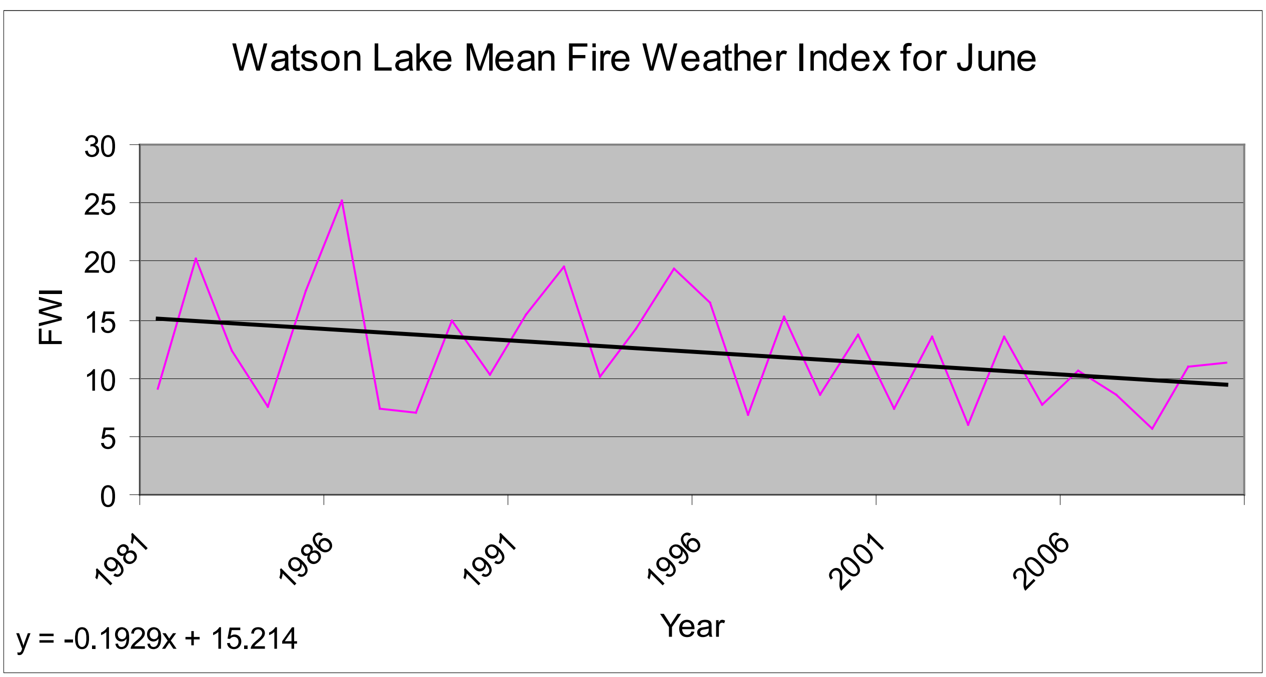

Figure 115. Watson Lake Mean Fire Weather Index for June. (1981-2010)

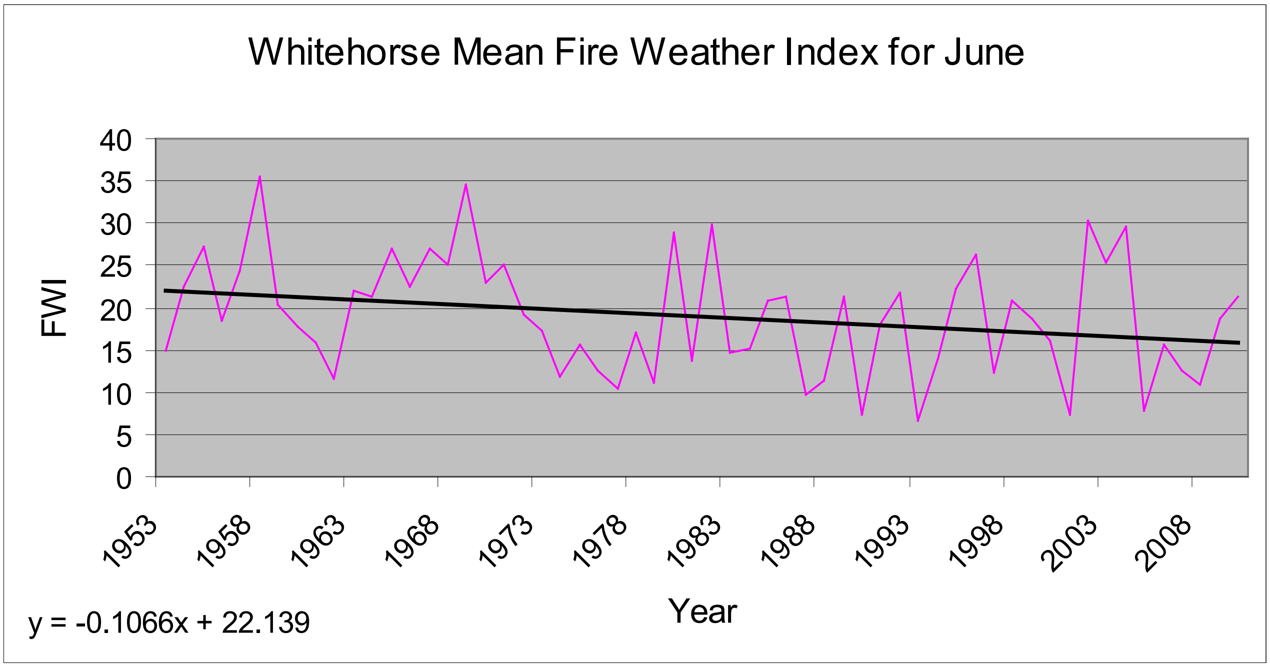

Figure 116. Whitehorse Mean Fire Weather Index for June. (1953-2010)

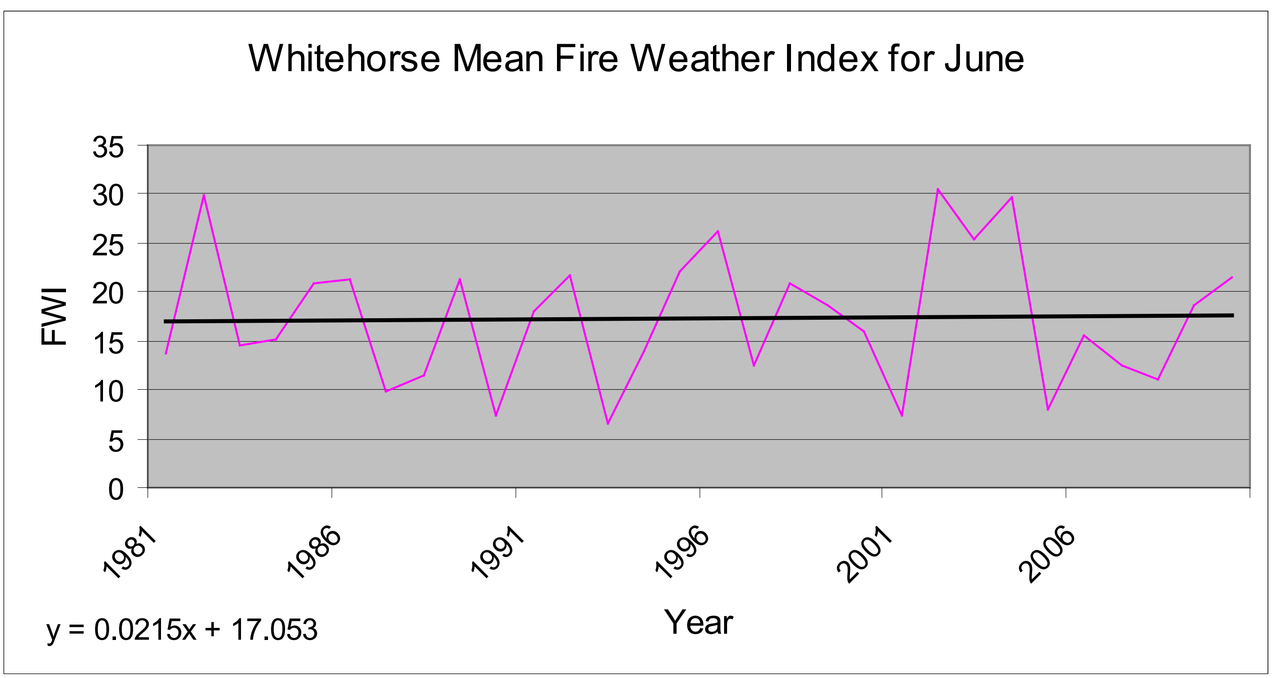

Figure 117. Whitehorse Mean Fire Weather Index for June. (1981-2010)

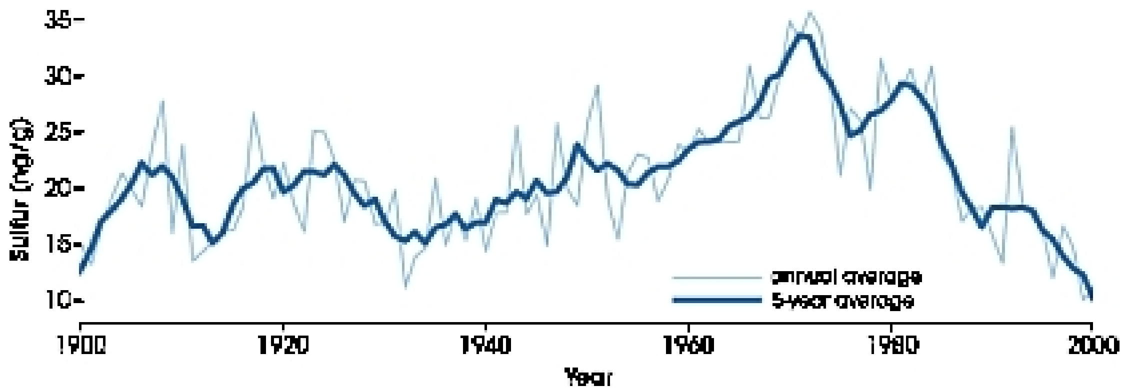

Figure 118. Sulphur trapped in the Greenland Ice Sheets. (1900-2000)

Sulfur trapped in the Greenland Ice Sheet records the presence of reflective sulfate aerosols downwind of the United States and Canada. Emissions of the pollutants that form sulfate aerosols rose sharply in the United States and Europe during and after World War II. This rise may be responsible for the Northern Hemisphere cooling from 1940–1970. By the 1980s, oil embargos and environmental controls had reduced sulfate pollution in North America, but carbon dioxide continued to build up in the atmosphere. (Graph by Robert Simmon, based on data from McConnell et al., NOAA/NCDC Paleoclimatology Program.)

List of Tables

```
+=============================================================================================================================+
|                                                                          SNOW SURVEY---------------------------->:  |A      |
|   +===================+                                              EVAPORATION---------------------->:         :  |I      |
|   | STATION CATALOGUE |                                          RATE OF PRECIPITATION---------->:| |S|:  |R  |U|:  |R      |
|   +===================+                                      PRECIPITATION-------------------->:|:| |O|:|S|A  |P|:  |       |
|                                                          TEMPERATURE------------------------>:|:|:| |I|:|U|D  |P|:  |Q      |
|                                                      HOURLY------------------------------->:|:|:|:| |L|:|N|I  |E|:  |U|N| R |
|                                                  SYNOPTIC------------------------------->:|:|:|:|:| | |:|S|A|O|R|:|T|A|I| E |
|                                                                | PERIOD WITH NO CHANGE  |:|:|:|:|:|W|T|:|H|T|Z| |:|O|L|P| G |
|                                                                |IN PROGRAM LOCATION OR  |:|:|:|:|:|I|E|:|I|I|O|A|:|W|I|H| I |
| CLIMATE STATION NAME              |PROV. | LAT.  | LONG. |ELEV.|NAME (S=SUMMER W=WINTER)|:|:|:|:|:|N|M|:|N|O|N|I|:|E|T|E| O |
|                                          |       |       |     |START YR-MO | END YR-MO |:|:|:|:|:|D|P|:|E|N|E|R|:|R|Y|R| N |
+=============================================================================================================================+

2100400 DAWSON                         YT  |  64 04 139 26 |      | 1897-07-01   1897-12-01| | |@|@| | | | | | | | | | | | | W |
2100400 DAWSON                         YT  |  64 04 139 26 |      | 1898-11-01   1899-02-01| | |@|@| | | | | | | | | | | | | W |
2100400 DAWSON                         YT  |  64 04 139 26 |      | 1900-10-01   1901-08-01| | |@|@| | | | | | | | | | | | | W |
2100400 DAWSON                         YT  |  64 04 139 26 |      | 1901-08-01   1937-04-01|X|D|@|@| | | | | | | | | | | | | W |
2100400 DAWSON                         YT  |  64 04 139 26 |      | 1937-04-01   1937-12-01|X|D|@|@| |B| | | | | | | | | | | W |
2100400 DAWSON                         YT  |  64 04 139 26 |      | 1937-12-01   1953-08-01|X|D|@|@| | | | | | | | | | | | | W |
2100400 DAWSON                         YT  |  64 04 139 26 |      | 1953-08-01   1953-09-01|X| |@|@| | | | | | | | | | | | | W |
2100400 DAWSON                         YT  |  64 04 139 26 |      | 1953-09-01   1954-07-01|X|D|@|@| | | | | | | | | | | | | W |
2100400 DAWSON                         YT  |  64 04 139 26 |      | 1954-07-01   1960-02-01|X|D|@|@| |B| | | | | | | | | | | W |
2100400 DAWSON                         YT  |  64 04 139 26 |      | 1960-02-01   1960-03-01|X| |@|@| |B| | | | | | | | | | | W |
2100400 DAWSON                         YT  |  64 04 139 26 |      | 1960-03-01   1965-09-01|X|X|@|@| |B| | | | | | | | | | | W |
2100400 DAWSON                         YT  |  64 04 139 26 |      | 1965-09-01   1966-12-01|X|X|@|X| |B| | | | | | | | | |N| W |
2100400 DAWSON                         YT  |  64 04 139 26 |      | 1966-12-01   1976-01-01|X|X|@|X| | | | | | | | | | | |N| W |
2100400 DAWSON                         YT  |  64 04 139 26 |      | 1976-01-01   1976-02-01| | |@| | | | | | | | | | | | | | W |
2100400 DAWSON                         YT  |  64 03 139 26 | 0320| 1976-02-01   1979-01-01| | |@|@| | | | | | | | | | | | | W |

2100402 DAWSON A                       YT  |               |      | 1956-10-10   1976-01-01| | | | | | | | | | | | | | | | |   |
2100402 DAWSON A                       YT  |  64 03 139 08 | 0369| 1976-01-01   1976-04-01|X|D|@|X| | | | | | | | | | | |N| W |
2100402 DAWSON A                       YT  |  64 03 139 08 | 0369| 1976-04-01   1986-04-01|X|D|@|X|X| | | | | | | | | | |N| W |
2100402 DAWSON A                       YT  |  64 03 139 08 | 0369| 1986-04-01 W 1988-11-17|X|D|X|X|X| | | | | | | | | | |N| W |
2100402 DAWSON A                       YT  |  64 03 139 08 | 0370| 1988-11-17 W 1994-06-03|X|D|X|X|X| | | | | | | | | | |N| P |
2100402 DAWSON A                       YT  |  64 03 139 08 | 0370| 1994-06-03   1997-09-11| |D|X|X|X| | | | | | | | | | |N| P |
2100402 DAWSON A                       YT  |  64 03 139 08 | 0370| 1997-09-11   1998-04-01| |D|X|X|X| | | | | | | | | | |N| P |
2100402 DAWSON A                       YT  |  64 03 139 08 | 0370| 1998-04-01 S           | |D|X|X|X| | | | | | | | | | |N| P |

2100LRP DAWSON                         YT  |  64 03 139 08 | 0370| 1988-01-13   1992-04-13| |H| | | | | | | | | | | | | | | W |
2100LRP DAWSON                         YT  |  64 03 139 08 | 0370| 1992-04-13   1995-09-29|H|H| | | | | | | | | | | | | | | P |
2100LRP DAWSON                         YT  |  64 03 139 08 | 0370| 1995-09-29             |H|H| | | | | | | | | | | | | | | P |
```

Table 1. Dawson Station History.

```
+=============================================================================================================================+
|                                                                          SNOW SURVEY---------------------------->:  |A      |
|   +===================+                                              EVAPORATION---------------------->:         :  |I      |
|   | STATION CATALOGUE |                                          RATE OF PRECIPITATION---------->:| |S|:  |R  |U|:  |R      |
|   +===================+                                      PRECIPITATION-------------------->:|:| |O|:|S|A  |P|:  |       |
|                                                          TEMPERATURE------------------------>:|:|:| |I|:|U|D  |P|:  |Q      |
|                                                      HOURLY------------------------------->:|:|:|:| |L|:|N|I  |E|:  |U|N| R |
|                                                  SYNOPTIC------------------------------->:|:|:|:|:| | |:|S|A|O|R|:|T|A|I| E |
|                                                                | PERIOD WITH NO CHANGE  |:|:|:|:|:|W|T|:|H|T|Z| |:|O|L|P| G |
|                                                                |IN PROGRAM LOCATION OR  |:|:|:|:|:|I|E|:|I|I|O|A|:|W|I|H| I |
| CLIMATE STATION NAME              |PROV. | LAT.  | LONG. |ELEV.|NAME (S=SUMMER W=WINTER)|:|:|:|:|:|N|M|:|N|O|N|I|:|E|T|E| O |
|                                          |       |       |     |START YR-MO | END YR-MO |:|:|:|:|:|D|P|:|E|N|E|R|:|R|Y|R| N |
+=============================================================================================================================+

2100700+MAYO LANDING                   YT  |  63 36 135 53 |     | 1924-10-01   1937-04-01|X|D|@|@| | | | | | | | | | | | W |
2100700+MAYO LANDING                   YT  |  63 36 135 53 |     | 1937-04-01   1937-10-01|X|D|@|@| |B| | | | | | | | | | W |
2100700+MAYO LANDING                   YT  |  63 36 135 53 |     | 1937-10-01   1953-09-01|X|D|@|@| | | | | | | | | | | | W |
2100700+MAYO LANDING                   YT  |  63 36 135 53 |     | 1953-09-01   1953-10-01|X| |@|@| | | | | | | | | | | | W |
2100700+MAYO LANDING                   YT  |  63 36 135 53 |     | 1953-10-01   1966-10-01|X|D|@|@| |B| | | | | | | | | | W |
2100700+MAYO LANDING                   YT  |  63 36 135 53 |     | 1966-10-01   1967-09-01|X|D|@|X| |B| | | | | | | | |N| W |
2100700+MAYO LANDING                   YT  |  63 36 135 53 |     | 1967-09-01   1967-10-01|X| |@|X| |B| | | | | | | | |N| W |
2100700+MAYO                           YT  |  63 36 135 53 |     | 1967-10-01   1967-12-01|X|D|@|X| |B| | | | | | | | |N| W |
2100700+MAYO                           YT  |  63 36 135 53 |     | 1967-12-01   1968-10-01|X|D|@|X| |B| | | | | | |@| | |N| W |
2100700+MAYO                           YT  |  63 36 135 53 |     | 1968-10-01   1968-11-01|X| |@|X| |B| | | | | | |@| | |N| W |
2100700+MAYO                           YT  |  63 36 135 53 |     | 1968-11-01   1969-02-01|X|D|@|X| |B| | | | | | |@| | |N| W |

2100700+MAYO A                         YT  |  63 37 135 52 |     | 1969-02-01   1971-04-01|X|D|@|X| |B| | | | | | |@| | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 |     | 1971-04-01   1971-05-01|X| |@|X| | | | | | | | |@| | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 |     | 1971-05-01   1971-09-01|X|D|@|X| | | | | | | | |@| | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 |     | 1971-09-01   1971-10-01|X| |@|X| | | | | | | | |@| | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 |     | 1971-10-01   1972-04-01|X|D|@|X| |B| | | | | | |@| | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 |     | 1972-04-01   1972-05-01|X| |@|X| |B| | | | | | |@| | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 |     | 1972-05-01   1972-09-01|X|D|@|X| |B| | | | | | |@| | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 |     | 1972-09-01   1972-10-01|X| |@|X| |B| | | | | | |@| | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 |     | 1972-10-01   1973-04-01|X|D|@|X| |B| | | | | | |@| | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 |     | 1973-04-01   1973-05-01|X| |@|X| |B| | | | | | |@| | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 |     | 1973-05-01   1973-09-01|X|D|@|X| |B| | | | | | |@| | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 |     | 1973-09-01   1973-10-01|X| |@|X| |B| | | | | | |@| | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 |     | 1973-10-01   1974-07-01|X|D|@|X| |B| | | | | | |@| | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 |     | 1974-07-01   1975-06-01|X|D|@|X| | | | | | | | |@| | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 | 0504| 1975-06-01   1985-05-01|X|D|@|X|X| | | | | | | |@| | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 | 0504| 1985-05-01   1985-06-14|X|D|@|X|X| | | | | | | | | | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 | 0504| 1985-06-14   1986-04-01|X|D|@|X|X| | |A| | | | | | | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 | 0504| 1986-04-01   1987-09-30|X|D|X|X|X| | |A| | | | | | | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 | 0504| 1987-09-30   1988-09-30|X|D|X|X|X| | | | | | | | | | |N| W |
2100700+MAYO A                         YT  |  63 37 135 52 | 0504| 1988-09-30   1988-10-01|X|D| | |X| | | | | | | | | | | | W |
2100700+MAYO A                         YT  |  63 37 135 52 | 0504| 1988-10-01             | |D|X|X|X| | | | | | | | | | |N| P |
```

Table 2. Mayo Station History.

```
+=============================================================================================================================+
|                                                                          SNOW SURVEY---------------------------->:  |A      |
|   +===================+                                              EVAPORATION------------------>:             :  |I      |
|   | STATION CATALOGUE |                                          RATE OF PRECIPITATION---------->:| |S|:  |R  |U|:  |R      |
|   +===================+                                      PRECIPITATION-------------------->:|:| |O|:|S|A  |P|:  |       |
|                                                          TEMPERATURE------------------------>:|:|:| |I|:|U|D  |P|:  |Q      |
|                                                      HOURLY------------------------------->:|:|:|:| |L|:|N|I  |E|:  |U|N| R |
|                                                  SYNOPTIC------------------------------->:|:|:|:|:| | |:|S|A|O|R|:|T|A|I| E |
|                                                                | PERIOD WITH NO CHANGE  |:|:|:|:|:|W|T|:|H|T|Z| |:|O|L|P| G |
|                                                                |IN PROGRAM LOCATION OR  |:|:|:|:|:|I|E|:|I|I|O|A|:|W|I|H| I |
| CLIMATE STATION NAME              |PROV. | LAT.  | LONG. |ELEV.|NAME (S=SUMMER W=WINTER)|:|:|:|:|:|N|M|:|N|O|N|I|:|E|T|E| O |
|                                          |       |       |     |START YR-MO | END YR-MO |:|:|:|:|:|D|P|:|E|N|E|R|:|R|Y|R| N |
+=============================================================================================================================+

2101200 WATSON LAKE A                  YT  |  60 07 128 49 | 0690| 1938-10-01   1938-11-01|X|D|@|@| | | | | | | | | | | | | W |
2101200 WATSON LAKE A                  YT  |  60 07 128 49 | 0690| 1938-11-01   1942-02-01|X|D|@|@| |B| | | | | | | | | | | W |
2101200 WATSON LAKE A                  YT  |  60 07 128 49 | 0690| 1942-02-01   1942-04-01| | |@|@| | | | | | | | | | | | | W |
2101200 WATSON LAKE A                  YT  |  60 07 128 49 | 0690| 1942-04-01   1960-11-01|X|D|@|@| |B| | | | | | | | | | | W |
2101200 WATSON LAKE A                  YT  |  60 07 128 49 | 0690| 1960-11-01   1964-12-01|X|D|@|X| |B| | | | | | | | | |N| W |
2101200 WATSON LAKE A                  YT  |  60 07 128 49 | 0690| 1964-12-01   1966-12-01|X|D|@|X| |B| | | | | | |@| | |N| W |
2101200 WATSON LAKE A                  YT  |  60 07 128 49 | 0690| 1966-12-01   1969-06-01|X|D|@|X| | | | | | | | |@| | |N| W |
2101200 WATSON LAKE A                  YT  |  60 07 128 49 | 0690| 1969-06-01   1969-10-01|X|D|@|X| | | | |S| | | |@| | |N| W |
2101200 WATSON LAKE A                  YT  |  60 07 128 49 | 0690| 1969-10-01   1981-07-01|X|D|@|X|X| |D| |S| | | |@| | |N| W |
2101200 WATSON LAKE A                  YT  |  60 07 128 49 | 0690| 1981-07-01   1986-04-01|X|D|@|X|X| |D|A|S| | | |@| | |N| W |
2101200 WATSON LAKE A                  YT  |  60 07 128 49 | 0690| 1986-04-01   1988-03-31|X|D|X|X|X| |D|A|S| | | |@| | |N| W |
2101200 WATSON LAKE A                  YT  |  60 07 128 49 | 0690| 1988-03-31   1990-09-30|X|D|X|X|X| | |A|S| | | | | | |N| W |
2101200 WATSON LAKE A                  YT  |  60 07 128 49 | 0690| 1990-09-30   1993-08-31|X|D|X|X|X| | | |S| | | | | | |N| W |
2101200 WATSON LAKE A                  YT  |  60 07 128 49 | 0690| 1993-08-31   1993-09-01|X|D| | |X| | | |S| | | | | | | | W |
2101200 WATSON LAKE A                  YT  |  60 07 128 49 | 0690| 1993-09-01   1993-10-15|X|D|X|X|X| | | |S| | | | | | | | P |
2101200 WATSON LAKE A                  YT  |  60 07 128 49 | 0690| 1993-10-15   1993-10-18|H|G|X|X|X| | | |S| | | | | | | | P |
2101200 WATSON LAKE A                  YT  |  60 07 128 49 | 0690| 1993-10-18   1997-08-21|H|G|X|X|X| | | | | | | | | | | | P |
2101200 WATSON LAKE A                  YT  |  60 07 128 49 | 0690| 1997-08-21             |H|G|X|X|X| | | | | | | | | | | | P |
2101200 WATSON LAKE (AUT)              YT  |  60 07 128 49 | 0690| 1938-10-01   1938-11-01|X|D|@|@| | | | | | | | | | | | | W |

2101222 WATSON LAKE (YTG)              YT  |  60 04 128 43 | 0701|   (From the Environment Canada Website)
2101204 WATSON LAKE (AUT)              YT  |  60 07 128 49 | 0690|   (From the Environment Canada Website)
```

Table 3. Watson Lake Station History.

```
+=============================================================================================================================+
|                                                                          SNOW SURVEY---------------------------->:  |A      |
|   +===================+                                              EVAPORATION---------------------->:         :  |I      |
|   | STATION CATALOGUE |                                          RATE OF PRECIPITATION---------->:| |S|:  |R  |U|:  |R      |
|   +===================+                                      PRECIPITATION-------------------->:|:| |O|:|S|A  |P|:  |       |
|                                                          TEMPERATURE------------------------>:|:|:| |I|:|U|D  |P|:  |Q      |
|                                                      HOURLY------------------------------->:|:|:|:| |L|:|N|I  |E|:  |U|N| R |
|                                                  SYNOPTIC------------------------------->:|:|:|:|:| | |:|S|A|O|R|:|T|A|I| E |
|                                                                | PERIOD WITH NO CHANGE  |:|:|:|:|:|W|T|:|H|T|Z| |:|O|L|P| G |
|                                                                |IN PROGRAM LOCATION OR  |:|:|:|:|:|I|E|:|I|I|O|A|:|W|I|H| I |
| CLIMATE STATION NAME              |PROV. | LAT.  | LONG. |ELEV.|NAME (S=SUMMER W=WINTER)|:|:|:|:|:|N|M|:|N|O|N|I|:|E|T|E| O |
|                                          |       |       |     |START YR-MO | END YR-MO |:|:|:|:|:|D|P|:|E|N|E|R|:|R|Y|R| N |
+=============================================================================================================================+
2101245+WHITEHORSE RSB                 YT  |               |     |                         | | | | | | | | | | | | | | | | |   |
2101245+WESTERN REGION RSB WHITEHORSE  YT  |  60 43 135 04 | 0702| 1989-01-01   1998-07-16| | | | | | | | | | | | | | | | | P |
2101245+PACIFIC REGION RSB WHITEHORSE  YT  |  60 43 135 04 | 0709| 1998-07-16   1999-01-01| | | | | | | | | | | | | | | | | P |
2101245+WHITEHORSE RSB                 YT  |  60 43 135 04 | 0709| 1999-01-01             | | | | | | | | | | | | | | | | | P |
2101290 WHITEHORSE                     YT  |               |     | 1900-07-01   1900-08-01| | |@|@| | | | | | | | | | | | | W |
2101290 WHITEHORSE                     YT  |  60 45 135 00 |     | 1904-11-01   1907-12-01| | |@|@| | | | | | | | | | | | | W |
2101290 WHITEHORSE                     YT  |  60 45 135 00 |     | 1909-01-01   1911-01-01| | |@|@| | | | | | | | | | | | | W |
2101290 WHITEHORSE                     YT  |  60 43 135 03 | 0636| 1940-09-01   1942-03-01|X|D|@|@| | | | | | | | | | | | | W |
2101290 WHITEHORSE                     YT  |  60 43 135 03 | 0636| 1959-02-01   1960-07-01| | |@|@| | | | | | | | | | | | | W |
2101300 WHITEHORSE A                   YT  |               |     | 1901-11-21   1942-04-01| | | | | | | | | | | | | | | | |   |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1942-04-01   1942-06-01|X|D|@|@| |B| | | | | | | | | | | W |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1942-06-01   1942-07-01|X| |@|@| |B| | | | | | | | | | | W |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1942-07-01   1946-05-01|X|X|@|@| |B| | | | | | | | | | | W |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1946-05-01   1957-03-01|X|X|@|@| |B| | | | | |@| | | | | W |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1957-03-01   1959-08-01|X|X|@|@| |B| | |S| | |@| | | | | W |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1959-08-01   1961-10-01|X|X|@|@|X|B| | |S| | |@| | | | | W |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1961-10-01   1965-03-01|X|X|@|X|X|B| | |S| | |@| | | |N| W |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1965-03-01   1966-12-01|X|X|@|X|X|B| | |S| | |@|@| | |N| W |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1966-12-01   1970-07-01|X|X|@|X|X| | | |S| | |@|@| | |N| W |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1970-07-01   1974-07-01|X|X|@|X|X| | | |S|H| |@|@| | |N| W |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1974-07-01   1977-07-01|X|X|@|X|X| | |A|S|H| |@|@| | |N| W |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1977-07-01   1985-12-31|X|X|@|X|X| | |A|S|H| |@|@| |@|N| W |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1985-12-31   1986-04-01|X|X|@|X|X| | |A|S|H| |@|@| | |N| W |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1986-04-01   1990-12-31|X|X|X|X|X| | |A|S|H| |@|@| | |N| W |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1990-12-31   1991-01-01|X|X|X|X|X| | |A|S|H| | |@| | |N| W |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1991-01-01   1996-01-02|X|X|X|X|X| | |A|S| | | |@| | |N| P |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1996-01-02   1997-08-21| |X|X|X|X| | |A|S| | | |@| | |N| P |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1997-08-21   1997-12-01| |X|X|X|X| | |A|S| | | |@| | |N| P |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0703| 1997-12-01   2000-03-09|X|X|X|X|X| | |A|S| | | |@| | |N| P |
2101300 WHITEHORSE A                   YT  |  60 43 135 04 | 0706| 2000-03-09             |X|X|X|X|X| | |A|S| | | |@| | |N| P |
2101350 WHITEHORSE INSTRUMENT STORAGE  YT  |  40 00  50 00 | 0000| 2000-03-14   **********| | | | | | | | | | | | | | | | | P |
2101400 WHITEHORSE RIVERDALE           YT  |  60 42 135 02 |     | 1959-02-01   1966-01-01| | |@|@| | | | | | | | | | | | | W |
2101400 WHITEHORSE RIVERDALE           YT  |  60 42 135 02 |     | 1966-01-01   1966-02-01| | | | | | | | | | | | | | | | | W |
2101400 WHITEHORSE RIVERDALE           YT  |  60 42 135 02 |     | 1966-02-01   1970-08-01| | |@|@| | | | | | | | | | | | | W |
2101400 WHITEHORSE RIVERDALE           YT  |  60 43 135 01 | 0643| 1970-08-01   1973-08-01| | |@|@| | | | | | | | | | | | | W |
2101400 WHITEHORSE RIVERDALE           YT  |  60 43 135 01 | 0643| 1973-08-01   1973-09-01| | | | | | | | | | | | | | | | | W |
2101400 WHITEHORSE RIVERDALE           YT  |  60 43 135 01 | 0643| 1973-09-01             | | |@|@| | | | | | | | | | | | | P |
2101405 WHITEHORSE UA                  YT  |  60 43 135 04 | 0704| 1991-01-01   1996-01-11| | | | | | | | | |H| |@| | | | | P |
2101405 WHITEHORSE UA                  YT  |  60 44 135 04 | 0707| 1996-01-11             | | | | | | | | | |H| |@| | | | | P |
2101415 WHITEHORSE WSO                 YT  |  60 44 135 05 | 0707| 1996-02-01             | | |@|@| | | | | | | | | | | | |   |
```

Table 4. Whitehorse Station History.