

SOME HISTORICAL WEATHER DATA FROM MADRAS, PRINEVILLE, AND POWELL BUTTE: AIR AND SOIL TEMPERATURES, RAINFALL, AND EVAPOTRANSPIRATION

Peter Sexton and Neysa Farris

Abstract

Weather data from Madras, Prineville, and Powell Butte over a varying time period (5 to 20 years depending on availability) are presented. Average air temperatures are given for each day of the year for all three sites. Minimum soil temperature (4 inch depth), rainfall, and potential evapotranspiration data are given for Madras. Estimates of frost frequency for each day of the year are also presented for areas near Madras (experiment station) and Prineville (KRCO radio station).

Introduction

This article presents average maximum and minimum daily temperatures for Madras, Prineville, and Powell Butte, and soil temperatures (4" depth), potential evapotranspiration, and rainfall data from Madras. The Prineville data was collected at the KRCO station over a 22 year span (1975-1997). The Madras and Powell Butte data were collected at the respective experiment stations (Madras from 1988-1998, and Powell Butte from 1994-1998). Daily averages are graphed out for each day of the year. For the temperature data, the range of extreme temperatures are also shown for both maximum and minimum temperature. Response to temperature varies tremendously among different crops and also between varieties, so one needs to know what the critical temperatures are for a crop at a particular stage before interpreting data. Also one needs to think about how close they are to the place where the weather data was recorded and how the microclimate might be different. Hopefully these graphs will serve as a useful reference for helping to see what is possible in terms of daily temperature over the course of the year.

Methods

Weather data from Prineville were obtained from the Oregon Climate Service (www.ocs.orst.edu). Weather data from Powell Butte and Madras were obtained from AgriMet weather stations maintained by the Bureau of Land Management. All data were sorted for each day of the year (e.g., January 1 = day 1 and December 31 = day 365), and average values for each variable were calculated. Extra days at leap years (Feb. 29) were excluded from analysis. For temperature data, the range of maximum and minimum temperatures, along with the average, were determined for each day of the year. For the 20 years of rainfall data at Madras, precipitation was summed over the first and second halves of each month (approximately two week periods) and then averaged over the course of 20 years. The frequency of frost (temperature of 32°F or less) at Prineville (1975-1997) and Madras (1988-1997) was determined for each day of the year, as was the frequency for frost within the next five days for each day of

the year. All data were plotted using Sigma Plot software, and trend lines where shown are the result of fitting polynomial regressions to the data.

Results

Figure 1 shows daily maximum temperature at the KRCO station near Prineville. For example, for the date of January 1 at Prineville (Fig. 1) from 1975 to 1997 the average high temperature on New Year's Day at KRCO was about 40°F. The warmest high temperature recorded on New Year's Day during this period was a little over 50°F, and on the coldest New Year's Day the high was only 7°F. The lines drawn through the points are "trend lines" which give a kind of running average for each measurement. NOTE THAT TREND LINES DON'T INDICATE EXTREMES. Some points, particularly cold temperatures, are well below the trend line. So it is better to look at individual points rather than trend lines to get an idea of extreme temperatures. Figure 2 shows daily minimum temperatures at the KRCO station. Note that the "lowest low" temperatures at the KRCO station do not go much above freezing even during the summer months.

Figures 3 and 4 show daily maximum and minimum temperatures for the Madras experiment station from 1988 to 1997. Figure 5 shows soil temperature data for Madras. Note the potential for soil temperature to drop well below freezing in October and November. Given that the cold soil temperatures were not prolonged, a mulch may be an effective way to limit freezing damage for sensitive plants here during the winter.

Figures 6 and 7 show maximum and minimum temperatures at Powell Butte over a 5 year period (1994-1998). This data should be interpreted with caution as it doesn't represent a long period of time.

Figures 8 and 9 show average potential evapotranspiration (ET), and precipitation, respectively, at Madras.

Figure 10 and 11 show trend lines for occurrence of frost over the course of the year at the KRCO station, and at Madras, respectively. These lines are based on the historical data mentioned earlier (1975-1997 at KRCO and 1988-1998 at Madras). The lines show trends for how frequently the temperature dropped to 32 F or less for each day of the year. Note that this is not necessarily a "killing frost". The lower line shows the percentage of the times frost occurred on each date, and the upper line shows how often a frost occurred within the next five days for each day of the year. The average last date of frost at KRCO from 1975 to 1997 was June 27 and the average first date of frost was Sept. 1. The average last date of frost at Madras from 1988 to 1997 was May 15 and the average first date of frost was Sept. 27.

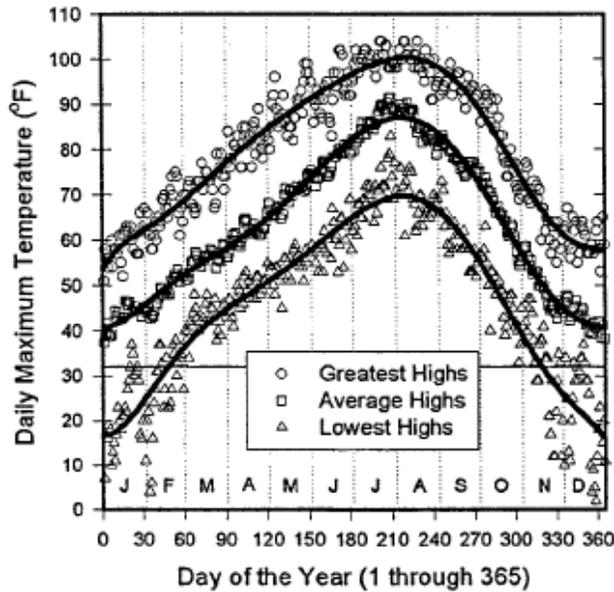


Figure 1. Daily maximum temperatures for Prineville (KRCO Radio Station), 1975-1997. The upper set of points show the highest of the high temperatures, the middle set of points shows the average high temperature for each day of the year, and the lower set of points shows the lowest high temperatures for each day of the year.

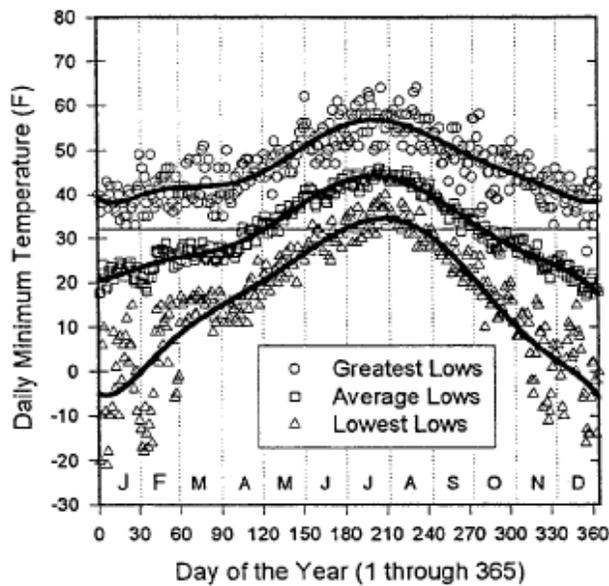


Figure 2. Daily minimum temperatures for Prineville (KRCO Radio Station), 1975-1997. The upper set of points show the highest of the low temperatures, the middle set of points shows the average low temperature for each day of the year, and the lower set of points shows the lowest low temperature for each day of the year.

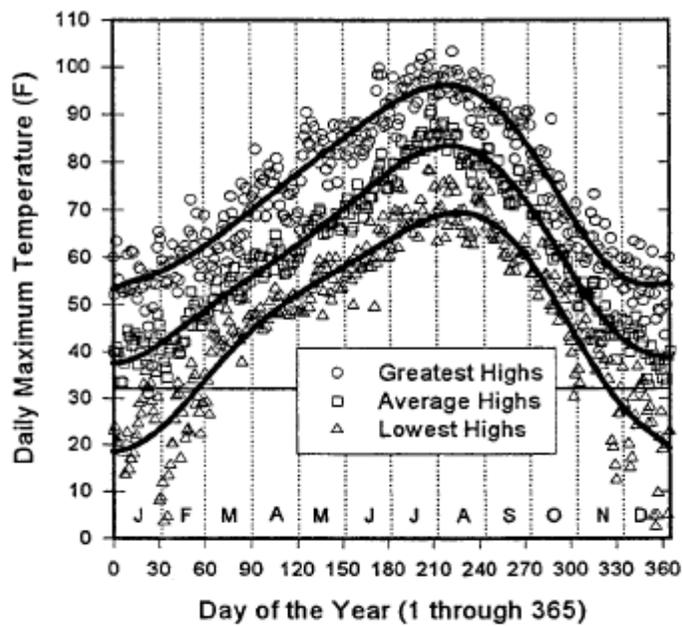


Figure 3. Daily maximum temperatures for the Madras experiment station, 1988-1997. Points and lines are as shown in Fig. 1.

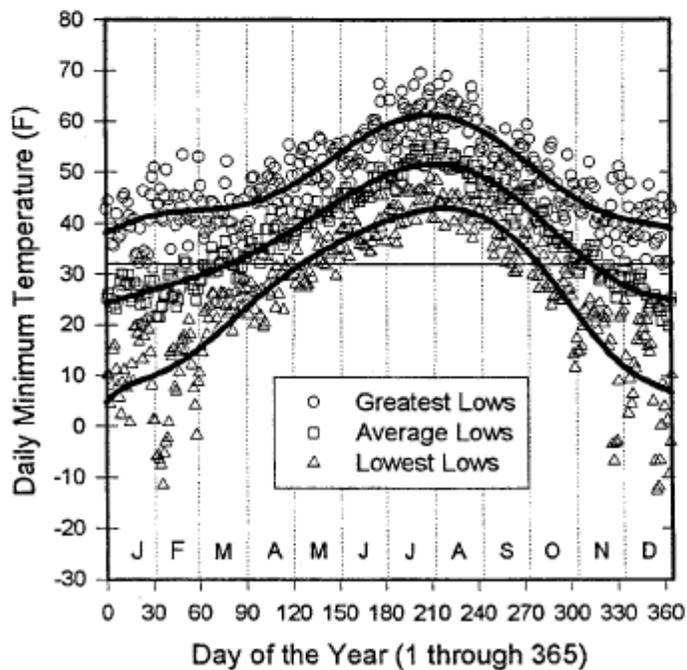


Figure 4. Daily minimum temperatures for the Madras experiment station, 1988-1997. Points and lines are as shown in Fig. 2.

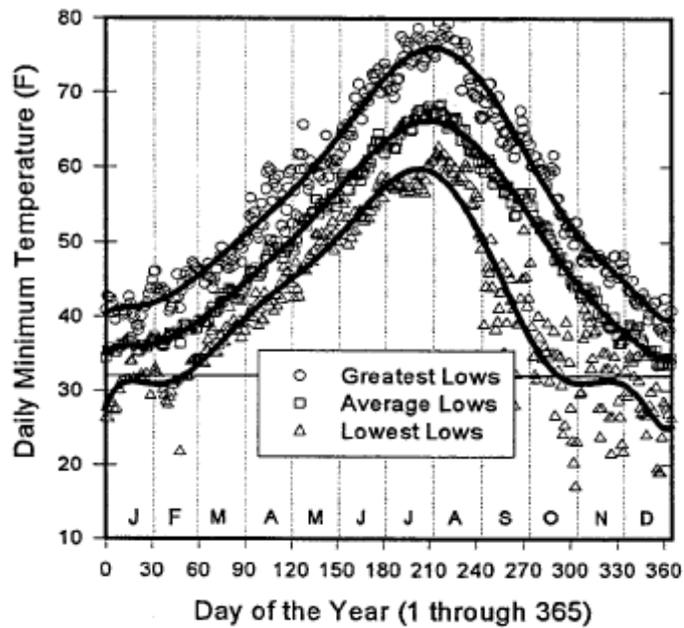


Figure 5. Daily minimum soil temperatures (4" depth) for the Madras experiment station, 1988-1997. Points and lines are as shown in Fig. 2.

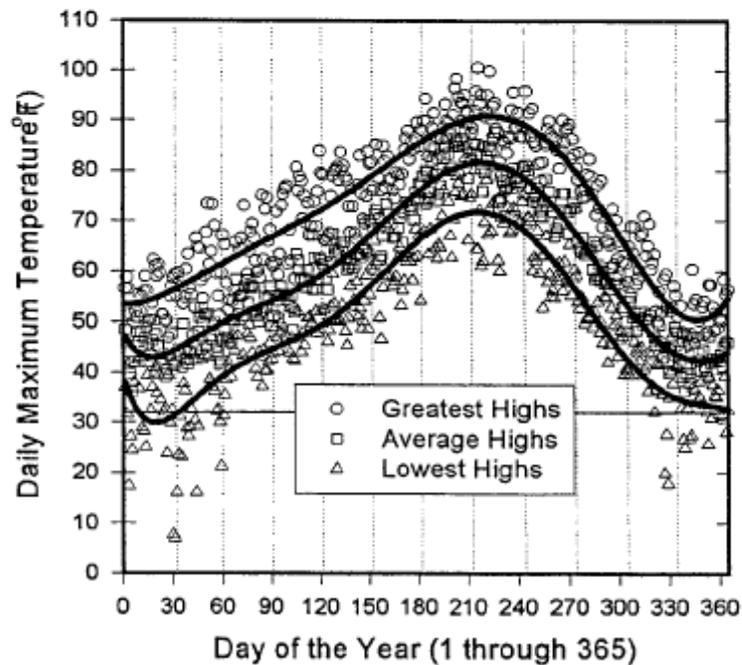


Figure 6. Daily maximum temperatures for Powell Butte experiment station, 1994-1998. Data should be interpreted with extra caution because of the limited time span of the data set. Points and lines are as shown in Fig. 1.

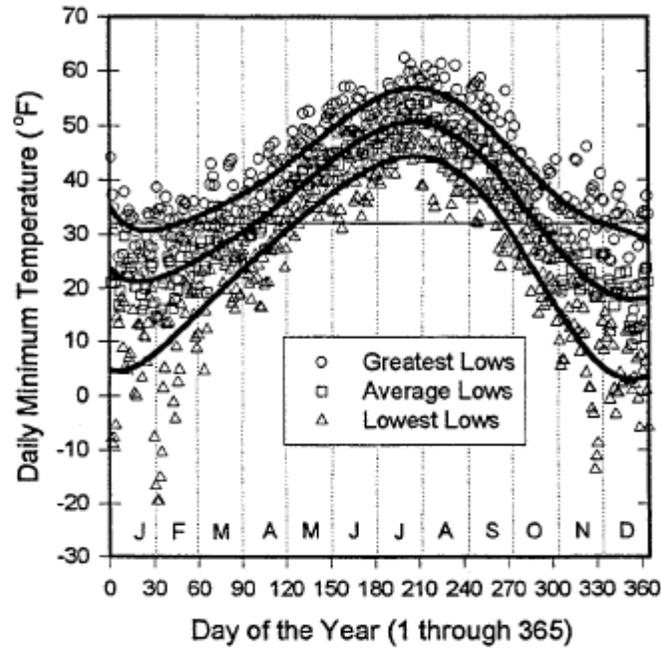


Figure 7. Daily minimum temperatures for Powell Butte experiment station, 1994-1998. Data should be interpreted with extra caution because of the limited time span of the data set. Points and lines are as shown in Fig. 2.

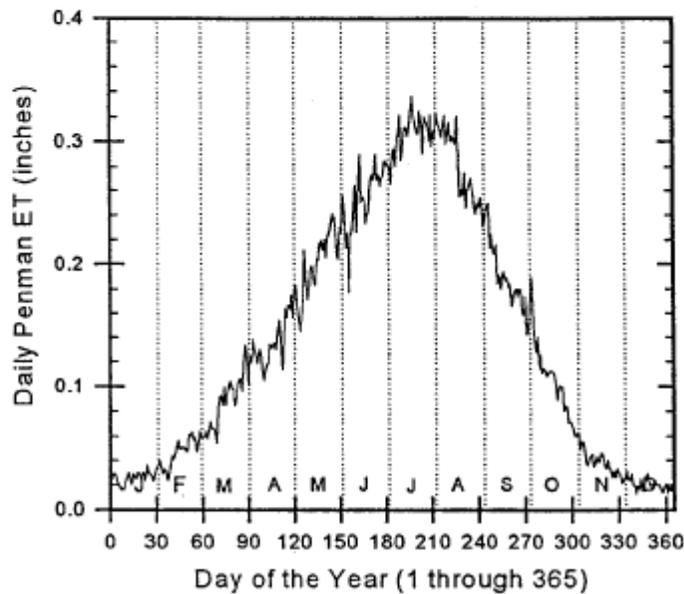


Figure 8. Average daily Penman evapotranspiration (ET) for Madras experiment station, 1991-1998.

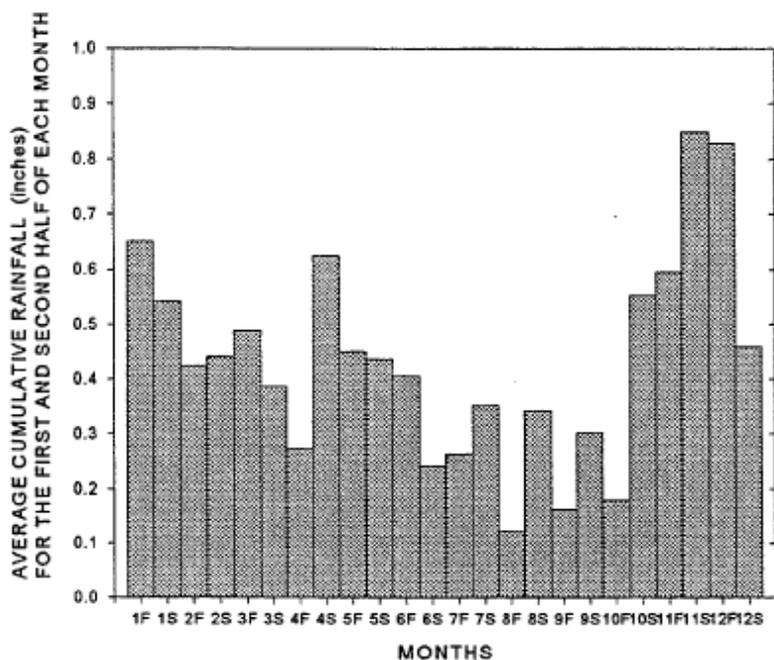


Figure 9. Average cumulative biweekly precipitation at Madras experiment station for each month of the year, 1977-1997. Labels on the x-axis indicate month (1 through 12) and first (f) or second (s) half of each month. Average annual rainfall over the 20 year period was 264 mm (10.4").

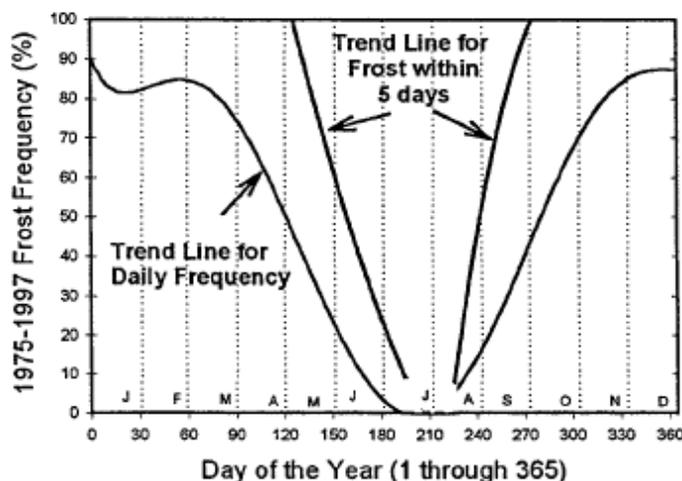


Figure 10. Trend lines for frequency of frost (1975-1997) for each day of the year at the KRCO radio station near Prineville. Frost was defined as low temperatures of 32°F or less. Note this is not necessarily a "killing frost". The average last date of frost at KRCO from 1975 to 1997 was June 27, and the average first date of frost was Sept. 1.

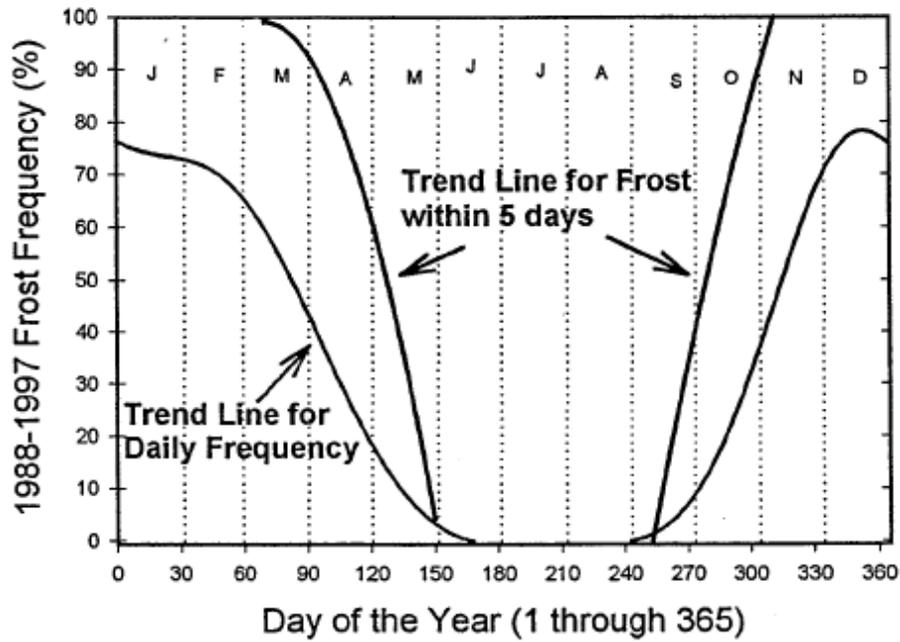


Figure 11. Trend lines for frequency of frost (1988-1997) for each day of the year at Madras (COARC Experiment station). Frost was defined as low temperatures of 32°F or less. Note this is not necessarily a “killing frost”. The average last date of frost at Madras from 1988 to 1997 was May 15, and the average first date of frost was Sept. 27.