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**Statistical Analysis of Climatological Data to
Characterize Erosion Potential:
4. Freezing Events in Eastern Oregon/Washington**

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STATISTICAL ANALYSIS OF CLIMATOLOGICAL DATA

TO CHARACTERIZE EROSION POTENTIAL:

4. FREEZING EVENTS IN EASTERN OREGON/WASHINGTON

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ABSTRACT

The occurrence of frozen soil has a major effect on runoff and soil loss in the Pacific Northwest. Hence, information regarding the probabilities of occurrence of periods during which the soil may be frozen is necessary in order to adequately forecast long-term erosion rates for this region. In order to assign realistic probabilities to the occurrence of these periods, a long record of hourly surface air temperature data from Pendleton in eastern Oregon and Walla Walla in eastern Washington are summarized in terms of freezing events. The values of several characteristics of freezing events which may be useful for predicting soil frost occurrence are examined.

The statistical analysis of the freezing event characteristics includes consideration of the marginal distributions and order and return statistics of the individual characteristics as well as joint and conditional distributions of several pairs of characteristics. The order and return statistics provide information about extreme values of individual characteristics, whereas the probabilities of occurrence of some combinations of characteristics are estimated by the joint distributions. Examination of the conditional distributions suggests the types of relationships that exist among the characteristics. The results of these analyses provide general information regarding the types of freezing events that occur in eastern Oregon and eastern Washington as well as estimates of specific probabilities that are important in the modeling and forecasting of soil erosion in this region.

ACKNOWLEDGMENTS

The development of a computer-accessible temperature data base was a prerequisite for the research described in this report. The difficult and painstaking task of developing the data base was carried out by Bruce A. Peterson. His contribution is gratefully acknowledged. The authors also would like to thank Dr. Moyle Harward, Professor Emeritus of Soil Science, Oregon State University, for his role in initiating this study.

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1. INTRODUCTION

In most erosion studies, the principal climatic variables of interest are precipitation amount and intensity. In the northwestern United States, the occurrence of frozen soil has been shown to be an important additional factor in causing extensive runoff and erosion during the winter months (Zuzel et al., 1982; Harward et al., 1980). Frozen soil acts to increase runoff by decreasing the infiltration rate and, in some situations, by increasing the availability of sediment through frost action (Haupt, 1967). Hence, in attempting to predict runoff and erosion in the Pacific Northwest using weather or climate information, it is necessary to consider both precipitation and freezing conditions and to consider the combined effects of both factors.

A cooperative research project was initiated in 1980 between the Departments of Soil Science and Atmospheric Sciences at Oregon State University (OSU). The primary objective of this project is to determine the frequency of occurrence of certain combinations of weather conditions that are associated with severe soil loss from croplands in the Pacific Northwest. Some characteristics of "precipitation events" at five locations in Oregon and Washington are described in two earlier reports in this series (Brown et al., 1983a,b). The purpose of this report is to summarize the

results of analyses of long-term surface air temperature records (in terms of "freezing events") for two stations in eastern Oregon and Washington (Pendleton, OR, and Walla Walla, WA). Similar analyses of freezing events for three stations in western Oregon are described in Brown et al. (1983c). Moreover, the characteristics of combined freezing and precipitation events will be described in two future reports.

A freezing event is a summary of a series of air temperature measurements in terms of several "characteristics." As well as being a convenient way of summarizing a large set of temperature data, freezing event characteristics may be useful for predicting the occurrence of frozen soil. A more thorough explanation of the definition of a freezing event and of the characteristics associated with a freezing event is presented in Section 2.

The data used in the study and the analysis approach are described in Section 3. The results of evaluations of individual freezing event characteristics are presented in Section 4; the joint and conditional distributions of pairs of freezing event characteristics are considered in Sections 5 and 6, respectively. A summary of the results is presented in Section 7.

Five appendices are included with the report. Appendix A contains a description of the temperature and freezing event data bases. Many of the results of the study are presented in tabular form in the remaining appendices.

2. FREEZING EVENT DEFINITION AND CHARACTERISTICS

Because frost occurrence in soil is not a commonly measured parameter, few long records of such occurrences are available. Hence, in order to consider this factor in predicting runoff or soil loss, it is necessary to utilize models of frost penetration and/or to develop simple models based on long-term climatological data that are summarized, for example, in terms of freezing events. A brief discussion of models of the occurrence of frozen soil and the depth of frost penetration was presented in Brown et al. (1983c). This section consists of an explanation of the definition of a freezing event. Moreover, certain characteristics that are associated with freezing events also are described.

A convenient and meaningful definition of a freezing event is the following: A freezing event begins when the surface air temperature first falls below 32°F and it continues through the ensuing cold period (temperatures below 32°F) and the next warm period (temperatures above 32°F). The event ends and another event begins when the temperature once again falls below 32°F. Hence, each freezing event consists of one cold period and one warm period. A schematic example of the application of this definition to hourly temperature data is illustrated in Figure 1.

Several characteristics are associated with each freezing event. These include several characteristics that describe the cold portion of the event and several others that describe the warm portion. The characteristics and their definitions are listed in Table 1. Moreover, Figure 2 contains an example of the calculation of the values of the characteristics for a particular event.

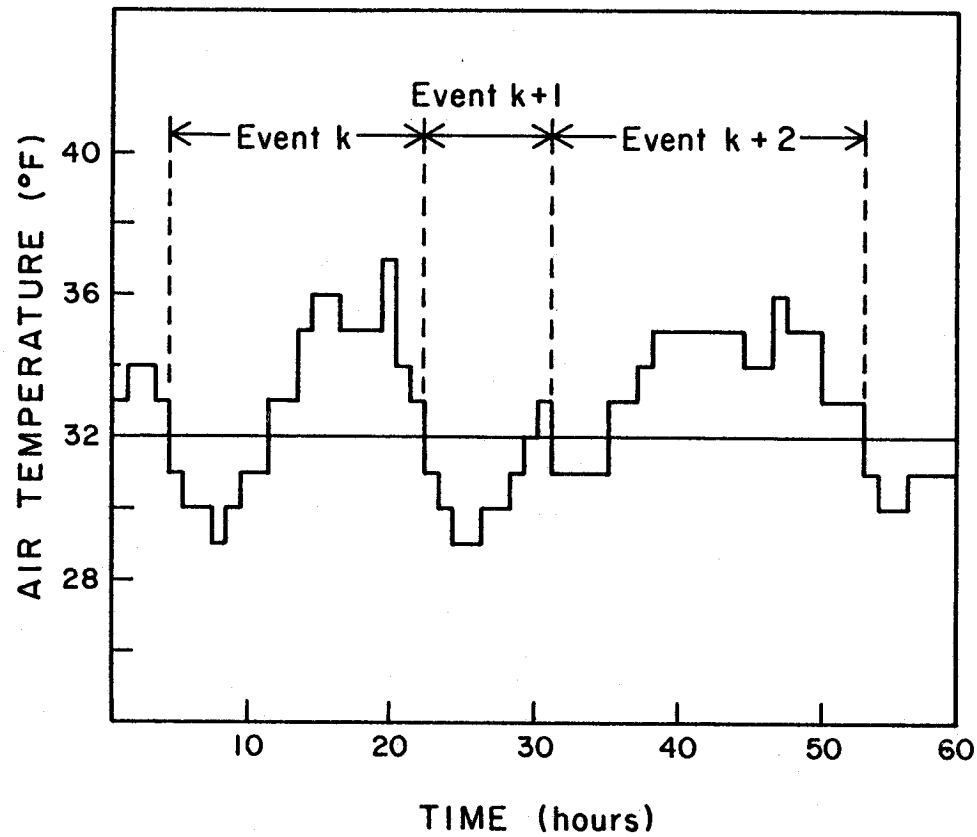


Figure 1. Schematic example of the application of the freezing event definition to a series of hourly temperature data.

Table 1. Definitions of freezing event characteristics for hourly temperature data.

Name	Symbol	Definition [†]
<u>Cold Period Characteristics:</u>		
Hours Below 32°F	Db	$Db_k = W_k - C_k$
Sum Below 32°F (°F)	$\sum Tb$	$\sum Tb_k = \sum_{i=C_k}^{W_k-1} (32 - T_i)$
Average Temperature Below 32°F (°F)	Tab	$Tab_k = 32 - \sum Tb_k / Db_k$
Minimum Temperature (°F)	Tmb	$Tmb_k = \min \{T_i\}, C_k \leq i \leq W_k$

<u>Warm Period Characteristics:</u>		
Hours Above 32°F	Da	$Da_k = C_{k+1} - W_k$
Sum Above 32°F (°F)	$\sum Ta$	$\sum Ta_k = \sum_{i=W_k}^{C_{k+1}-1} (T_i - 32)$
Average Temperature Above 32°F (°F)	Taa	$Taa_k = 32 + \sum Ta_k / Da_k$
Maximum Temperature (°F)	Tma	$Tma_k = \max \{T_i\}, W_k \leq i \leq C_{k+1}$

Duration	De	$De_k = C_{k+1} - C_k$

[†]T_i = temperature in hour i

C_k = index of first hour of event k

W_k = index of first hour of warm period (T_{W_k} > 32°F) in event k

C_{k+1} = index of first hour of event k+1

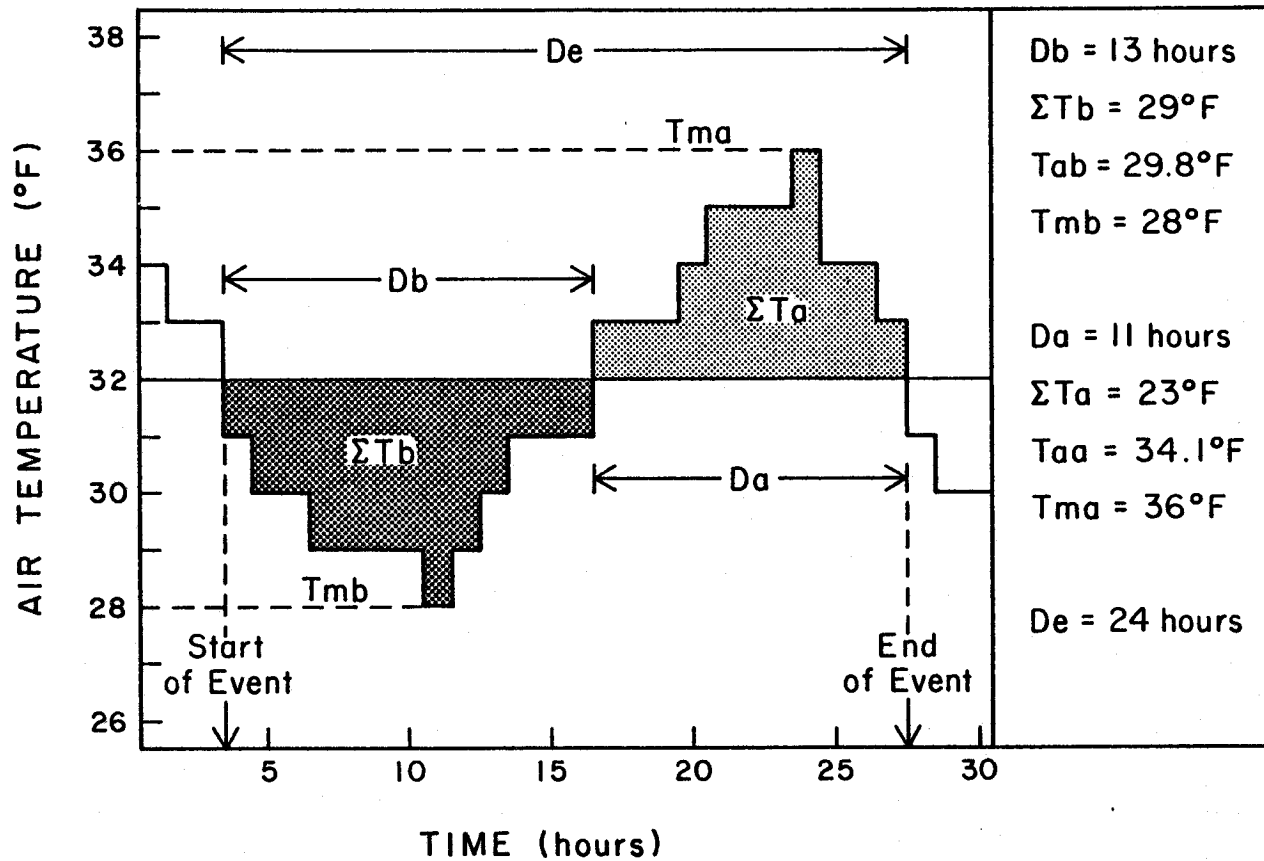


Figure 2. Schematic example of the calculation of the freezing event characteristics defined in Table 1.

The cold period characteristics include the following (defined assuming the temperature data are hourly): (a) D_b , the duration of the cold period (i.e., the number of hours during which the temperature is below 32°F); (b) ΣT_b , the sum of degrees below 32°F during the cold period (i.e., the sum of the differences between 32°F and each hourly temperature during the cold period); (c) T_{ab} , the average temperature during the cold period; and (d) T_{mb} , the minimum temperature during the cold period. The warm period characteristics are complementary to the cold period characteristics and are as follows: (a) D_a , the duration of the warm period (i.e., the number of hours during which the temperature is above 32°F); (b) ΣT_a , the sum of degrees above 32°F during the warm period (i.e., the sum of the differences between each hourly temperature and 32°F for each hour in the warm period); (c) T_{aa} , the average temperature during the warm period; and (d) T_{ma} , the maximum temperature during the warm period. A ninth characteristic, D_e , is the total duration of the freezing event.

3. TEMPERATURE DATA AND ANALYSIS METHODS

Hourly temperature data for two National Weather Service (NWS) stations (Pendleton, OR and Walla Walla, WA) were used in this study. The length of the data record is 31 years at Pendleton (January 1, 1948 - December 31, 1978) and 18 years at Walla Walla (January 1, 1948 - December 31, 1965 and January 1, 1974 - December 31, 1978). The resolution of the temperature values is to the nearest whole degree Fahrenheit. These data were obtained from the National Climatic Center (NCC) in a standard NCC tape format. In the later years (starting in 1964), temperatures were recorded only once every three hours. Temperature values for the remaining hours were estimated by interpolating between the measured temperature values preceding and following the missing hours.

A freezing event data base was created for each of the stations using the freezing event definition described in Section 2. That is, for each station, each series of hours containing a complete freezing event (cold period and warm period) was grouped together. The hourly temperature data for each event were then summarized using the freezing event characteristics defined in Section 2 and in Table 1. Hence, the freezing event data base for each station consists of a set of freezing event characteristics for every freezing event in the data record (1219 events at Pendleton and 850 at Walla Walla). A more complete description of the freezing event data bases is presented in Appendix A.

Several types of analyses were applied to the freezing event data. First, the marginal frequency distribution of each characteristic at each station was examined. Also, the extreme events and return statistics for each characteristic were computed. Next, the frequency distributions of combinations of characteristics (joint distributions) were evaluated to

provide estimates of the probabilities of occurrence of some significant events (e.g., the probability of occurrence of a long cold period accompanied by an extremely low minimum temperature). Finally, the conditional distributions of some pairs of characteristics (e.g., T_{ab} given T_{mb}) were examined in order to investigate the existence of relationships between the characteristics. The results of these analyses are described in Sections 4, 5, and 6.

4. MARGINAL DISTRIBUTIONS OF FREEZING EVENT CHARACTERISTICS

The distributions of the individual freezing event characteristics are described in this section in terms of (a) marginal frequency distributions; (b) order statistics, or extreme values; and (c) return statistics. Useful information may be obtained from the examination of each of these summaries. For example, the marginal distributions provide general descriptions of the distributional properties of the characteristics, whereas the order statistics allow estimation of the values of characteristics of the extreme events.

The marginal distributions of the freezing event characteristics are summarized using diagrams known as box plots (Tukey, 1977). These diagrams provide a simple and useful way of displaying and comparing distributional data. Each point on each plot represents a particular quantile value of interest. An example showing two box plots (the distributions of D_b at Pendleton and Walla Walla) is given in Figure 3. As illustrated in Figure 3, a box surrounds the region from the lower quartile (the 0.25th quantile) to the upper quartile (the 0.75th quantile), the region which contains the middle half of the observations. The length of this region (the interquartile range) provides an estimate of the variability of the characteristic. The line extending from the upper end of each box represents the upper tail of the distribution and, in this case, contains points marking the 0.90th and 0.95th quantile values (the values of some different quantiles may be presented for other characteristics). Typically, lines also would extend from the bottoms of the boxes, depicting the lower tails of the distributions. However, in this case the distributions are quite positively skewed so that the lower tails are very short and are barely distinguishable from the boxes.

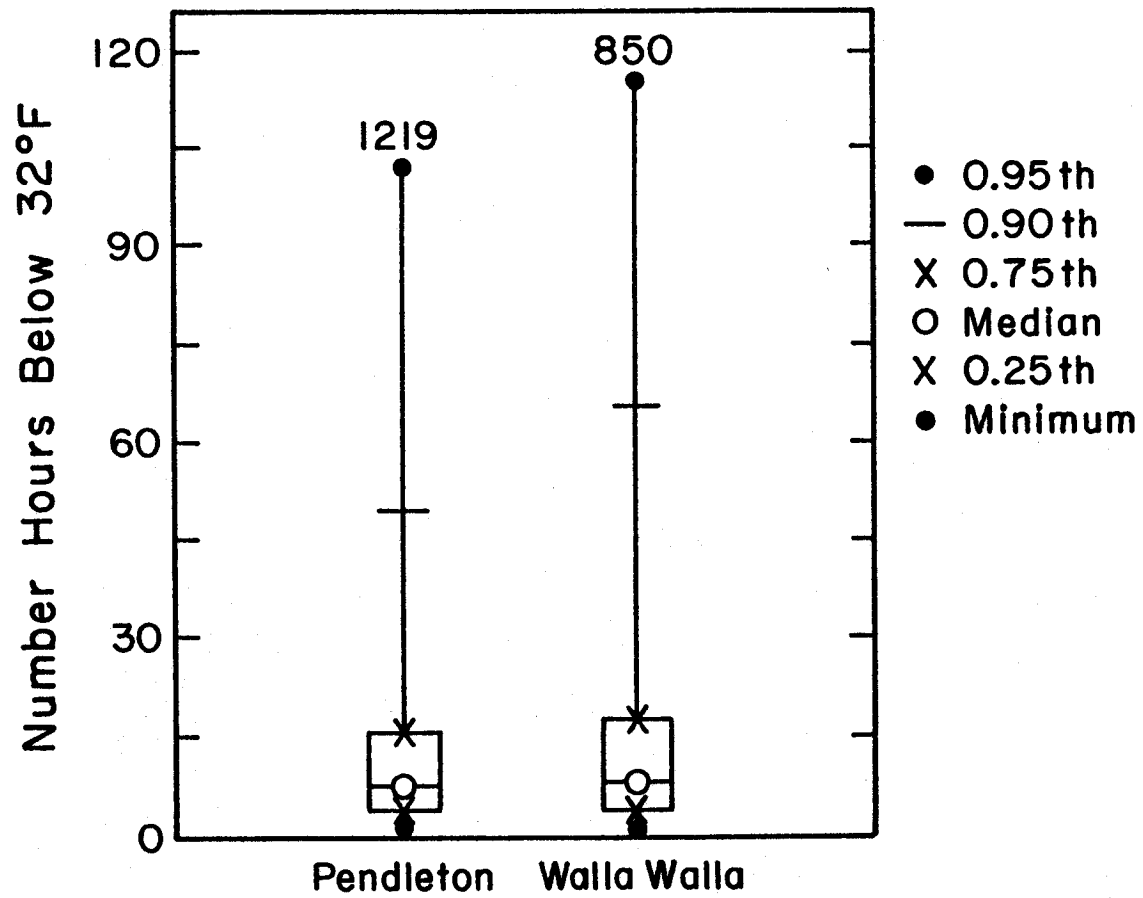


Figure 3. Box plots of number of hours below 32°F (Db) for Pendleton and Walla Walla. The number at the top of each box plot is the number of events.

Another way of describing the distributions of freezing event characteristics is through the order statistics; that is, the values of the characteristic resequenced from largest to smallest (smallest to largest in the cases of T_{ab} and T_{mb}). These statistics can be used to obtain estimates of the extreme values of freezing event characteristics that could be expected to occur in a 31-year period for Pendleton and in an 18-year period for Walla Walla. The values of the characteristics of the coldest or longest lasting freezing events are often of the most interest in predicting the occurrence of soil frost.

The numbers and types of extreme events that can be expected to occur in a given year also are of interest. These extreme events can be estimated using return statistics. The return statistics for a given freezing event characteristic are the values of that characteristic that could be expected to occur once, twice, or more often in a given year. Estimation of the return statistics for a particular freezing event characteristic is accomplished by ordering the events from largest to smallest according to the value of the characteristic (smallest to largest for T_{ab} and T_{mb}) and then listing the characteristics of every 31st event for Pendleton, every 18th event for Walla Walla.

The marginal distributions of eight of the freezing event characteristics at Pendleton and Walla Walla, are described in the following subsections. The distributions of event duration (D_e) are not presented here since they are not as informative as the distributions of the individual durations of the cold and warm periods (D_b and D_a), which are presented. The order statistics and return statistics of the four cold period characteristics also are considered in Sections 4.1-4.4. Because of the large number of tables required for the presentation of the order statistics and

return statistics, these tables are located in Appendices B and C, respectively. The tables of order statistics in Appendix B include all the freezing event characteristics associated with each of the first 100 order statistics, for each characteristic of interest at each station. Similarly, the tables of return statistics in Appendix C consist of all the freezing event characteristics associated with each of the return statistics, for each characteristic of interest at each station.

4.1 Hours below 32°F

The marginal distributions of the freezing event characteristic number of hours below 32°F (Db) at Pendleton and Walla Walla are shown in Figure 3. With the exception of the 0.95th quantiles, the box plots for the two stations are quite similar to one another. The shapes of the box plots indicate that the distributions are positively skewed, with heavy upper tails. That is, there were a few cold periods at each station that lasted many hours, whereas the majority of the cold periods were of fairly short duration. The boxes enclose the region from 3 hours to 15 or 17 hours. Hence, at least 25 percent of the cold periods lasted 3 hours or less and about 50 percent lasted between 2 and 15 hours. That is, most freezing periods in this region are of short duration. Only 25 percent lasted longer than 15 or 17 hours.

The order statistics of Db are shown graphically in Figure 4. The values displayed in this figure are the durations of the 100 longest-lasting cold periods at each station. The curves for the two stations in Figure 4 are quite similar to one another. The first order statistic at each station is quite large and is followed by a rapid decrease in value for the next few order statistics. The curves level off and the decline is

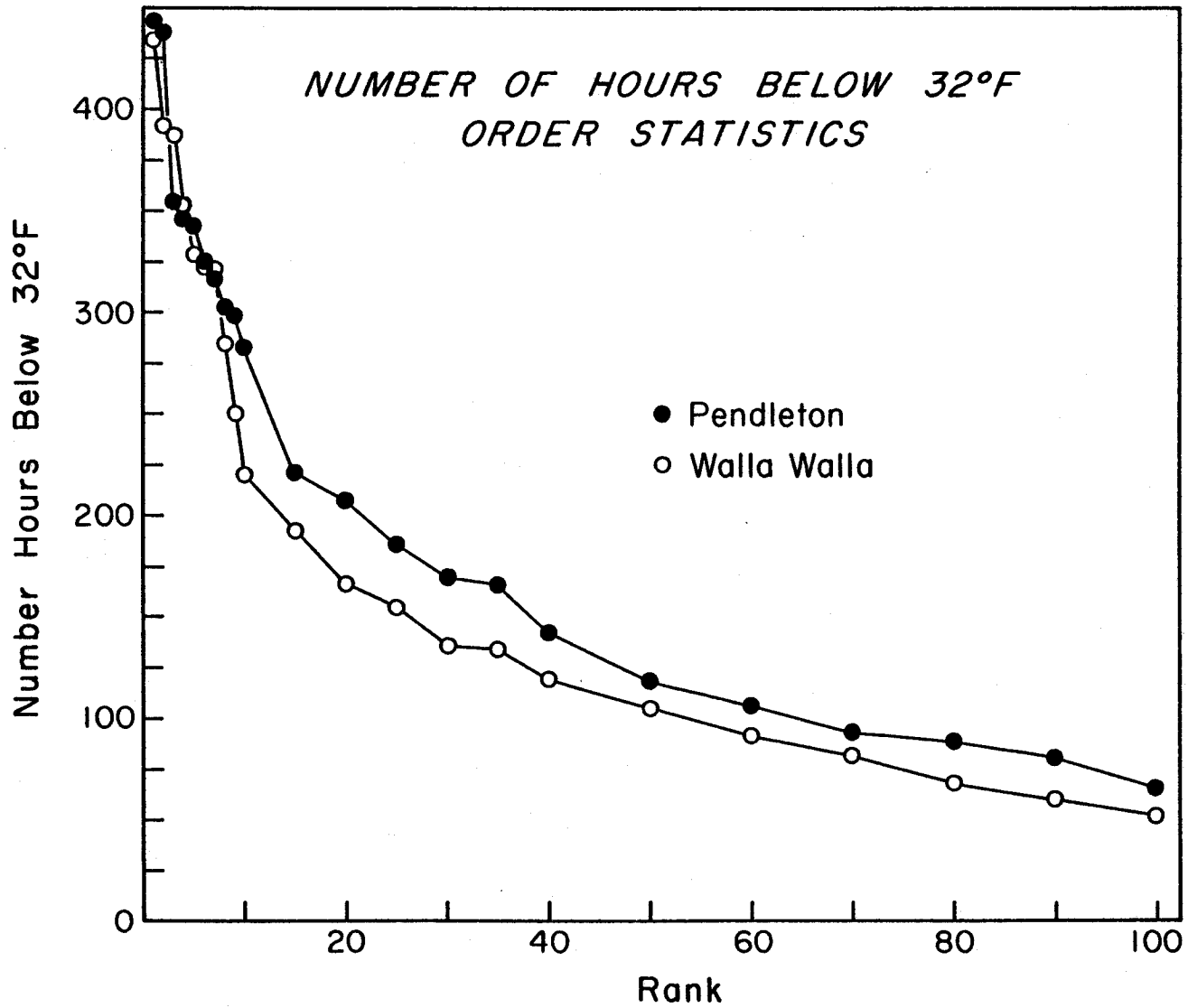


Figure 4. Order statistics of number of hours below 32°F (Db) for Pendleton and Walla Walla.

more gradual after about the 20th statistic. A complete listing of the first 100 Db order statistics is presented in Appendix B.

Figure 5 presents the Db return statistics for Pendleton and Walla Walla. The first statistic is the duration of a cold period expected to occur once a year; the second is the duration of a cold period expected to occur twice a year, and so on. The curves for the two stations are quite similar to one another. As was suggested by the box plots, there are a few large values of Db, but most of the Db return statistics are fairly small. All the values beyond the fifteenth return statistic are less than 10 hours, whereas the first statistics range up to nearly 50 hours. A complete listing of the Db return statistics is presented in Appendix C.

4.2 Sum below 32°F

The variable sum below 32°F (ΣT_b) can be used as a freeze index in models of frost penetration in soils and thus is of particular interest in this study. The box plots representing the distributions of ΣT_b at Pendleton and Walla Walla are displayed in Figure 6. As was the case for the distributions of Db, these distributions are positively skewed, with relatively few large ΣT_b values and relatively many small values. The plots for the two stations are fairly similar, with the box for Walla Walla somewhat larger than the box for Pendleton.

The order and return statistics of ΣT_b at the two stations are shown graphically in Figures 7 and 8, respectively. The curves displayed in these figures exhibit the same behavior as the curves for the Db order and return statistics (Figures 4 and 5). That is, after a few very large values for the first few statistics and a sharp decline at the beginning, the curves level off into trends with gradual downward slopes.

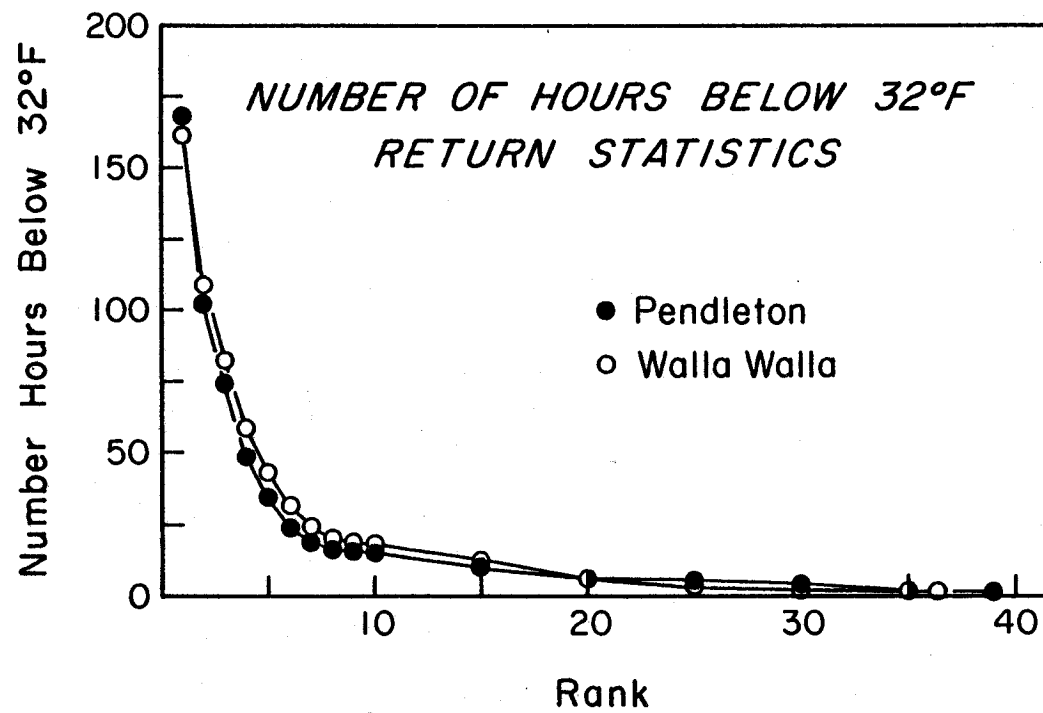


Figure 5. Return statistics of number of hours below 32°F (Db) for Pendleton and Walla Walla.

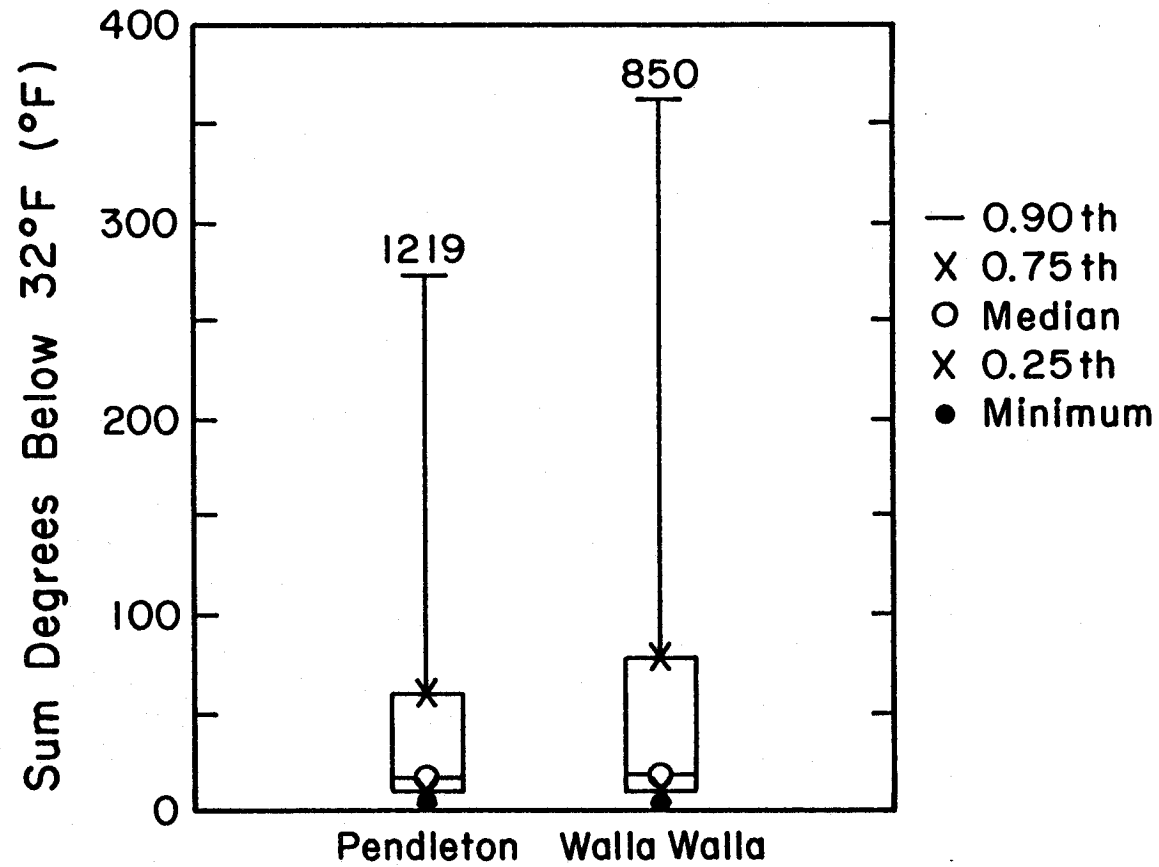


Figure 6. Box plots of sum of degrees below 32°F (ΣT_b) for Pendleton and Walla Walla. The number at the top of each box plot is the number of events.

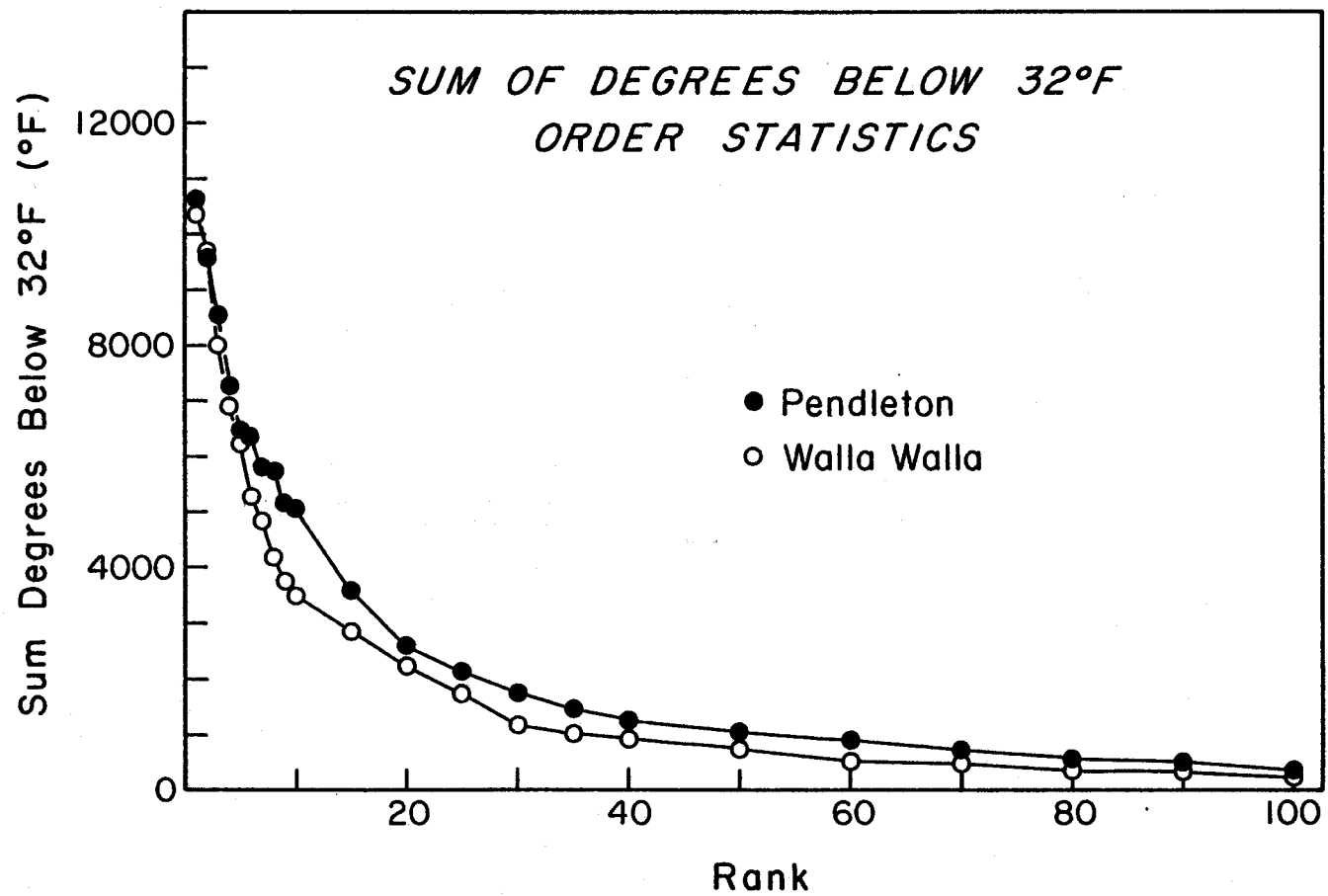


Figure 7. Order statistics of sum of degrees below 32°F (ΣT_b) for Pendleton and Walla Walla.

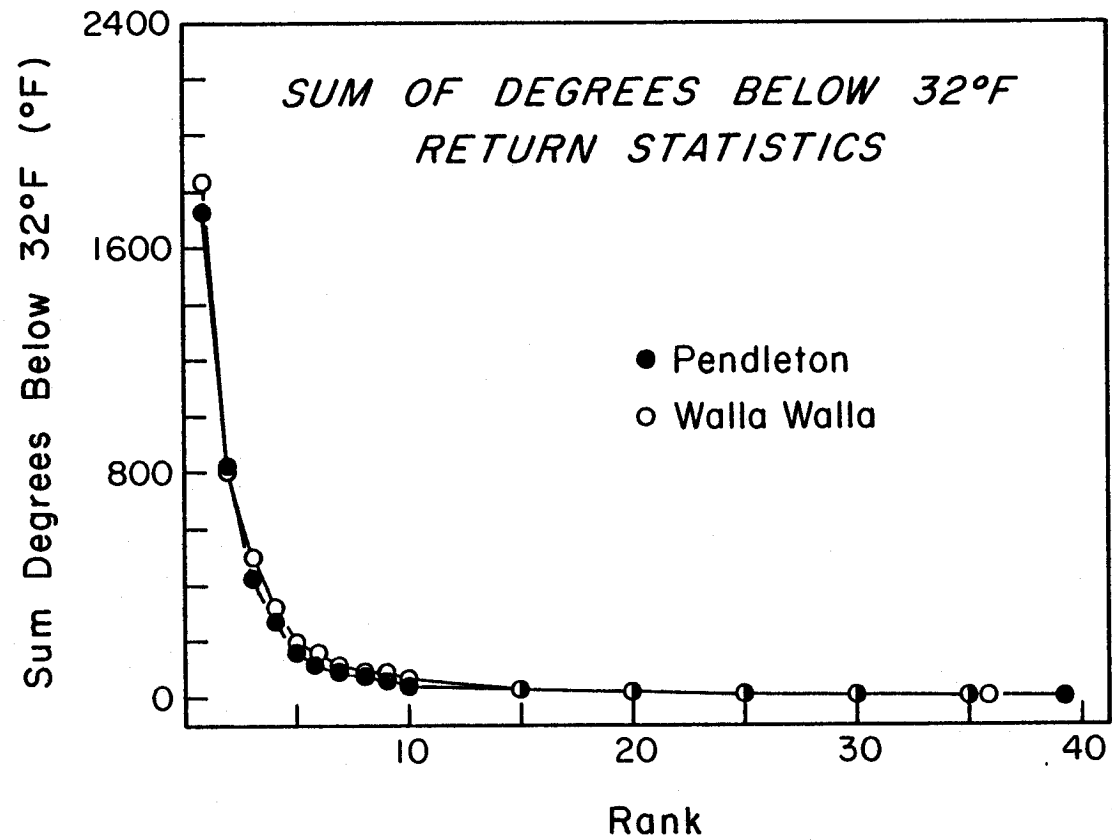


Figure 8. Return statistics of sum of degrees below 32°F (ΣT_b) for Pendleton and Walla Walla.

A complete list of the order statistics of ΣT_b is presented in Appendix B and the return statistics are listed in Appendix C. Additional information regarding the values of ΣT_b ranked according to the values of other cold period freezing event characteristics may be obtained directly from the order statistics for those characteristics which are also presented in Appendix B. Furthermore, the joint frequencies of occurrence of various combinations of values of ΣT_b and other freezing event characteristics are presented and discussed in Section 5.

4.3 Average Temperature below 32°F

Since the average temperature below 32°F (T_{ab}), the average temperature during the cold period, is a function of the ratio of ΣT_b and D_b , it is a summary characteristic which describes the average intensity of the cold period. Figure 9 contains the box plots depicting the marginal distributions of T_{ab} for Pendleton and Walla Walla. In contrast to the shapes of the distributions of D_b and ΣT_b , these distributions are negatively skewed. That is, most of the cold periods had fairly high average temperatures, whereas relatively few were characterized by very low average temperatures. In fact, the median value of T_{ab} for both stations is about 30°F.

Figures 10 and 11 present the order and return statistics of T_{ab} for the two stations. The shapes of these curves are complementary to the shapes of the curves for D_b and ΣT_b . That is, the curves in Figures 10 and 11 rapidly increase through the first few statistics, starting with fairly low values for the first statistics. The curves level off and there is a gradual increase in the values for the later statistics. The shapes of these curves reflect the shapes of the box plots in Figure 9. Tables

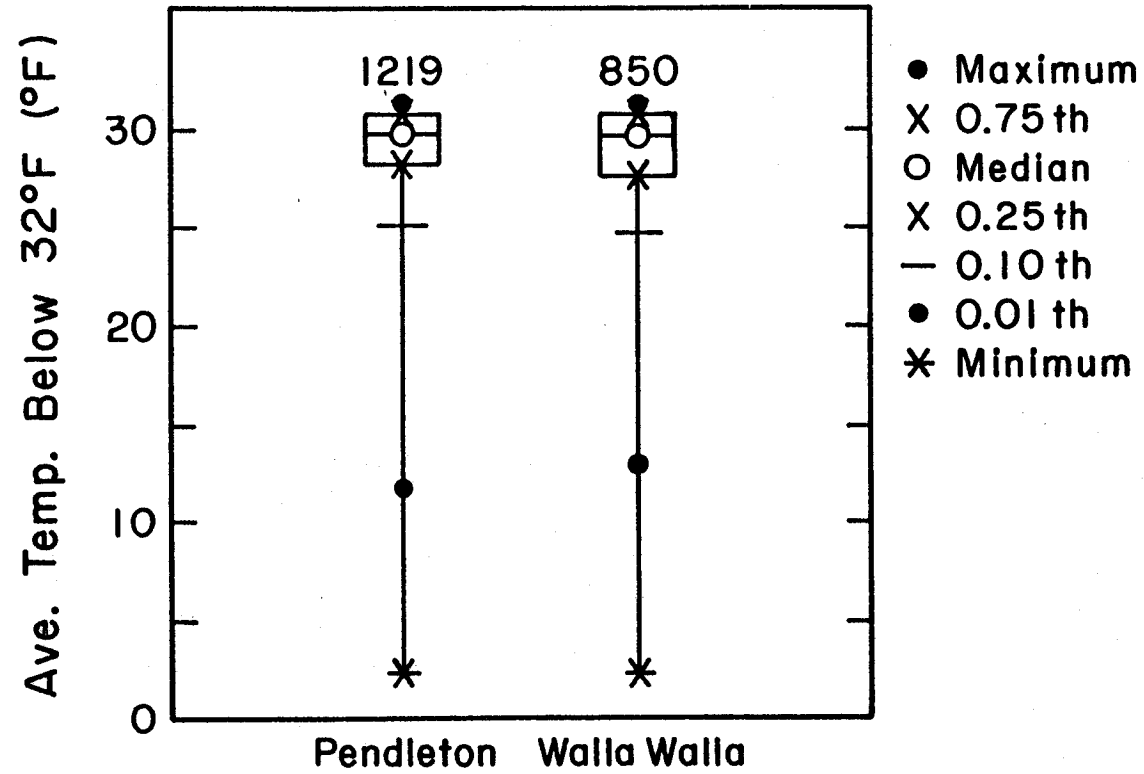


Figure 9. Box plots of average temperature below 32°F (Tab) for Pendleton and Walla Walla. The number at the top of each plot is the number of events.

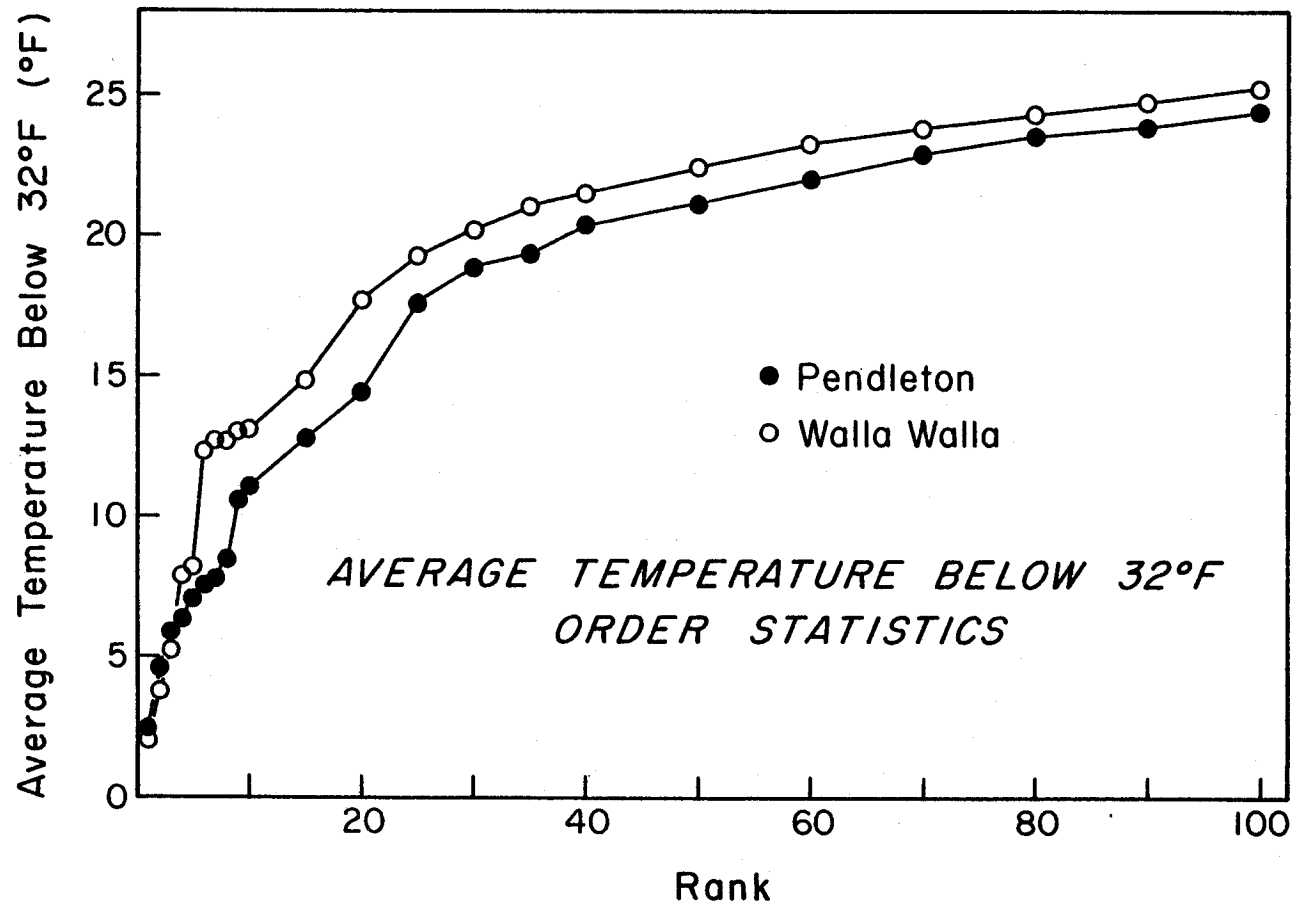


Figure 10. Order statistics of average temperature below 32°F (Tab) for Pendleton and Walla Walla.

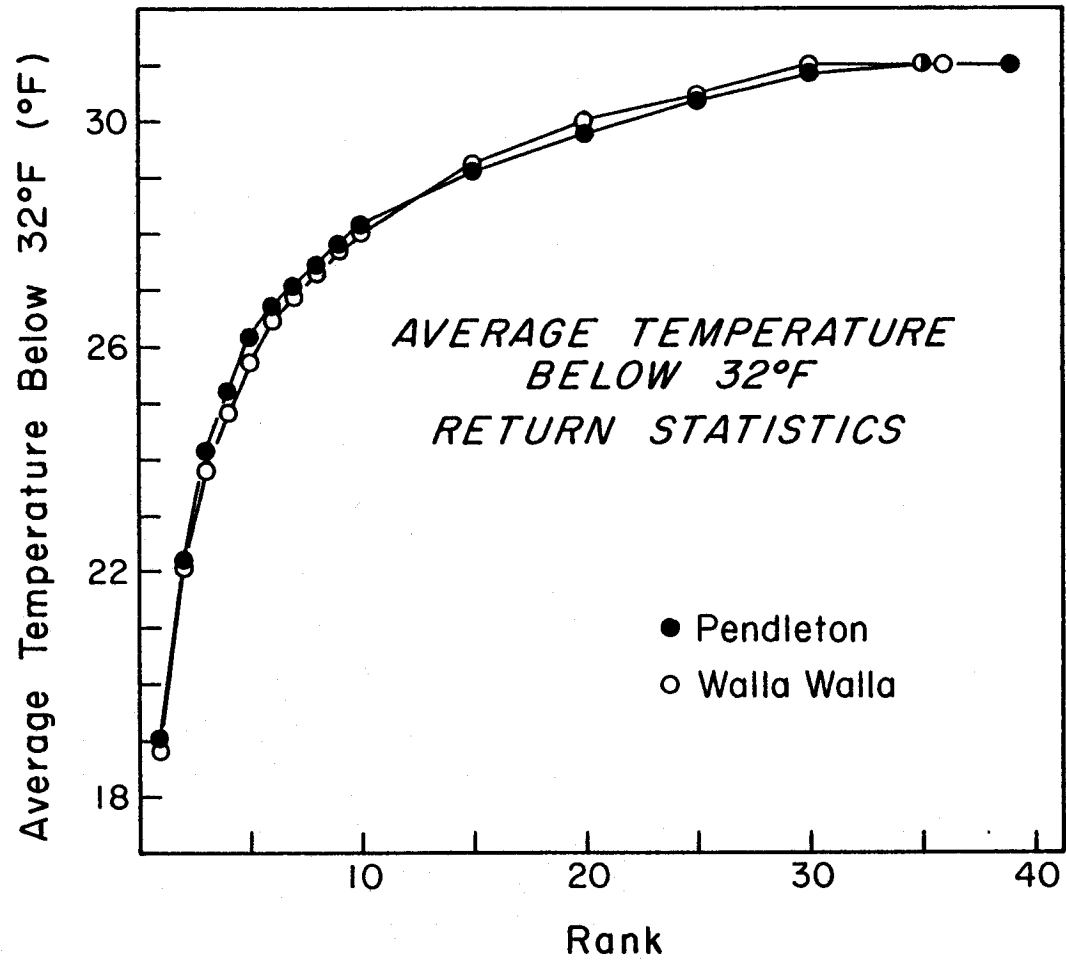


Figure 11. Return statistics of average temperature below 32°F (Tab) for Pendleton and Walla Walla.

containing complete lists of the Tab order and return statistics at the three stations are presented in Appendices B and C.

4.4 Minimum Temperature

Whereas Tab is an index of the "average" coldness of the cold period, the minimum temperature (Tmb) is an index of the maximum coldness. Hence, Tmb can be used as a measure of how extreme a freezing event is in comparison with other freezing events. Box plots depicting the distributions of Tmb at Pendleton and Walla Walla are shown in Figure 12. As was the case with Tab, the distributions of Tmb are negatively skewed. Only ten percent of the freezing events had minimum temperatures that were less than 20°F, whereas more than 75 percent of the minimum temperature values were between 25 and 31°F. The curves of minimum temperature order and return statistics are given in Figures 13 and 14, respectively. The shapes of these curves are similar to those of Tab order and return statistics. The Tmb order statistics are listed in Appendix B and the return statistics are presented in Appendix C.

4.5 Warm Period Characteristics

Characteristics describing the warm period following a freezing period were calculated in order to maintain a complete set of information about the temperature record as well as to characterize the temperature conditions occurring between freezing periods. Box plots of the warm period characteristics for Pendleton and Walla Walla are shown in Figures 15-18. The largest values shown in Figures 15-18 are the 0.90th quantiles. This is because the characteristics of long and/or intense warm periods are not

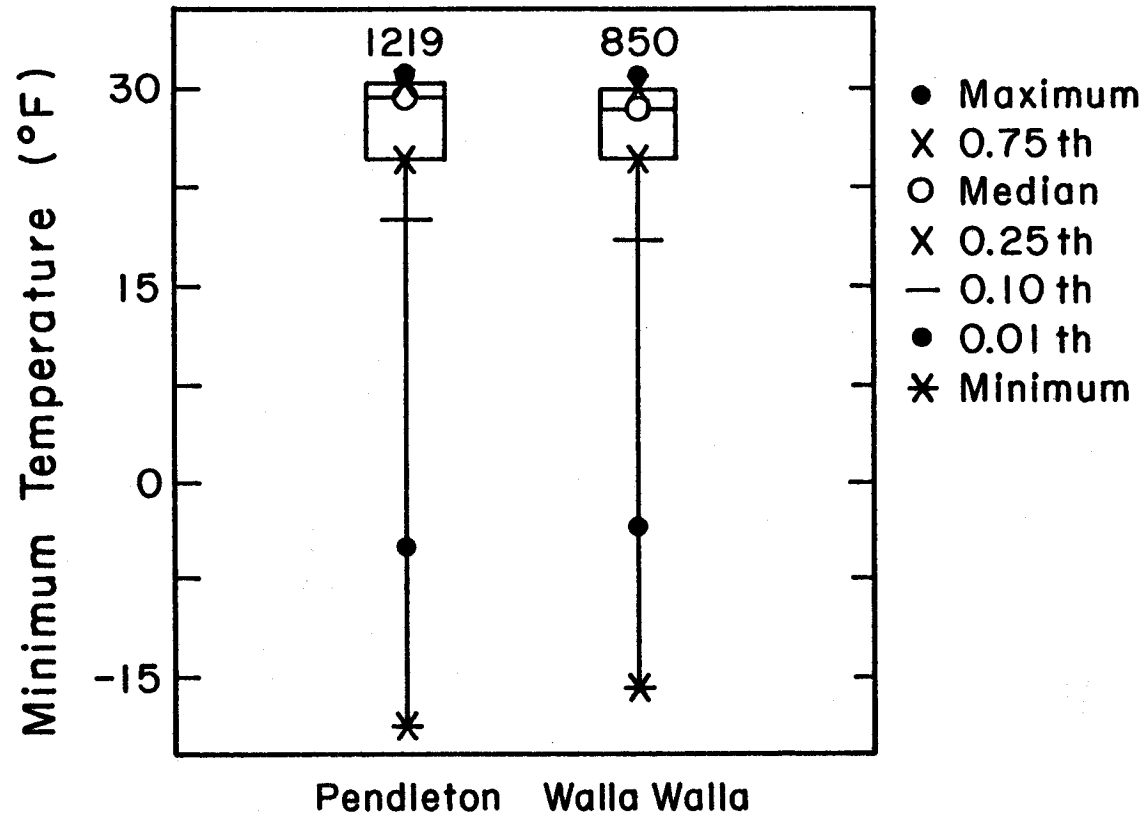


Figure 12. Box plots of minimum temperature (T_{mb}) for Pendleton and Walla Walla. The number at the top of each box plot is the number of events.

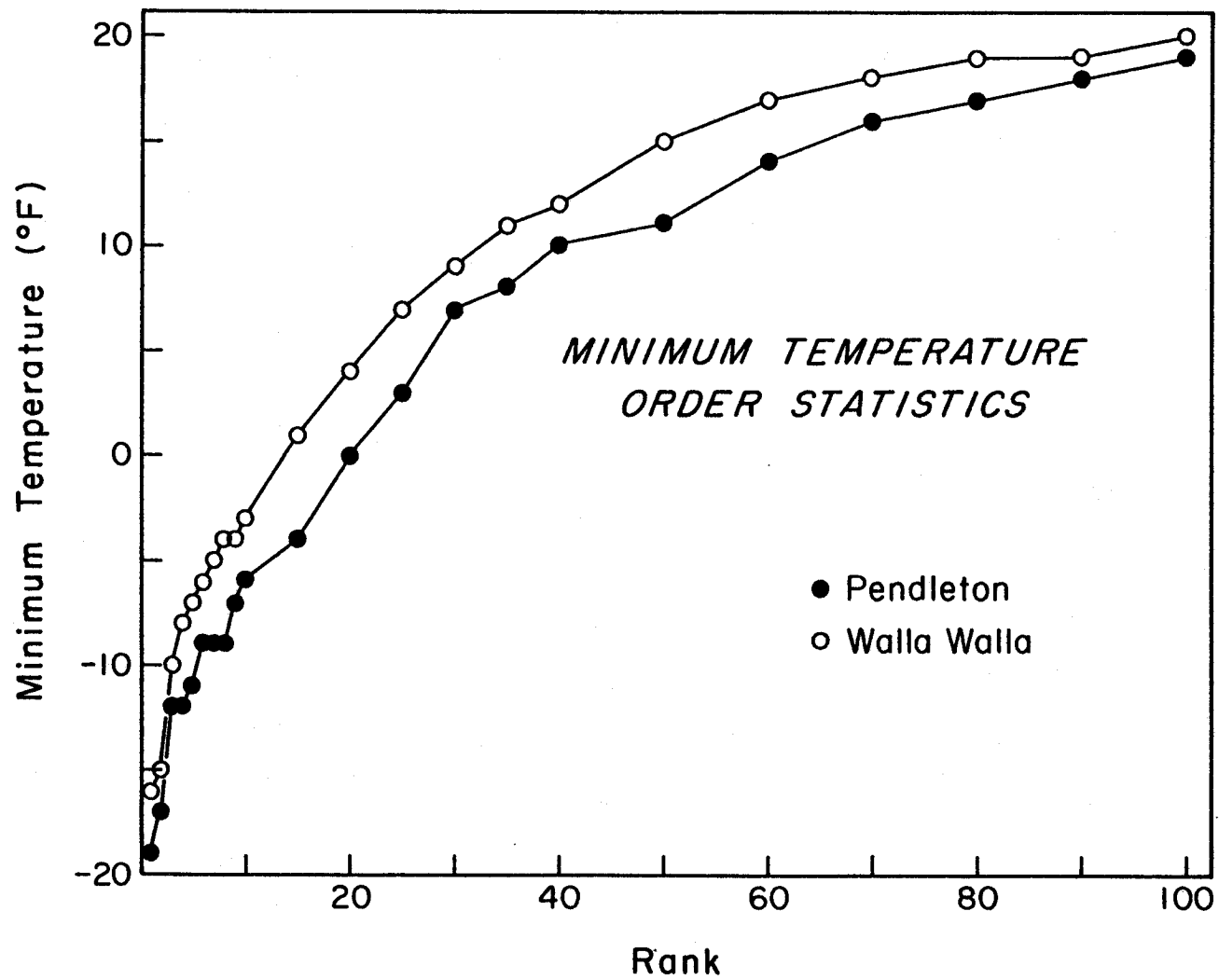


Figure 13. Order statistics of minimum temperature (T_{mb}) for Pendleton and Walla Walla.

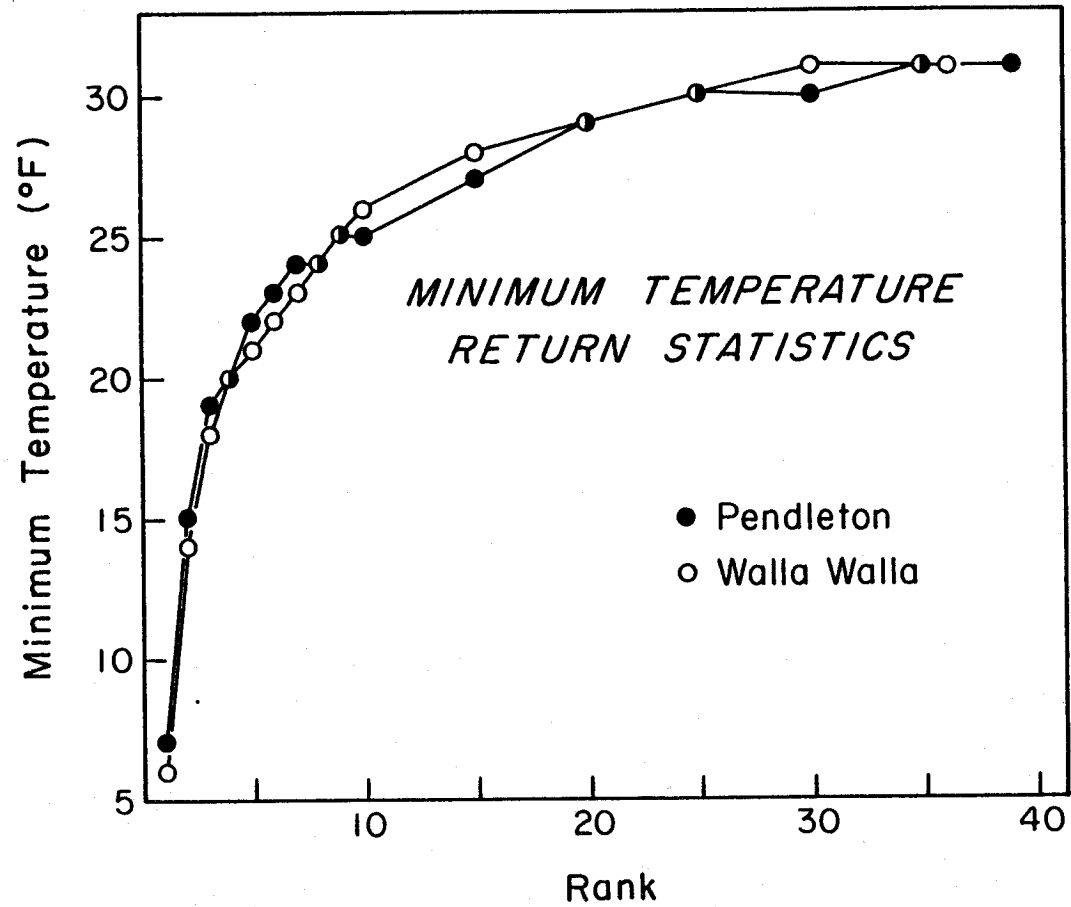


Figure 14. Return statistics of minimum temperature (T_{mb}) for Pendleton and Walla Walla.

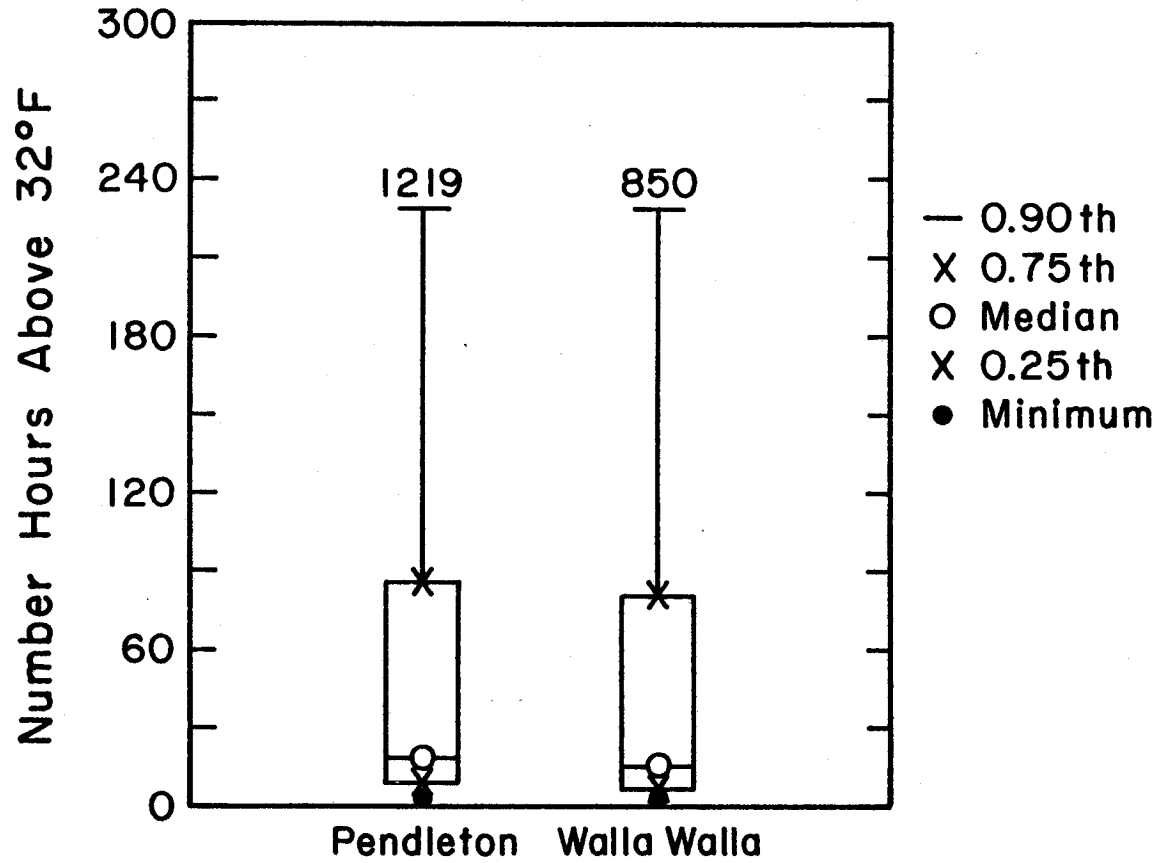


Figure 15. Box plots of number of hours above 32°F (Da) for Pendleton and Walla Walla. The number at the top of each box plot is the number of events.

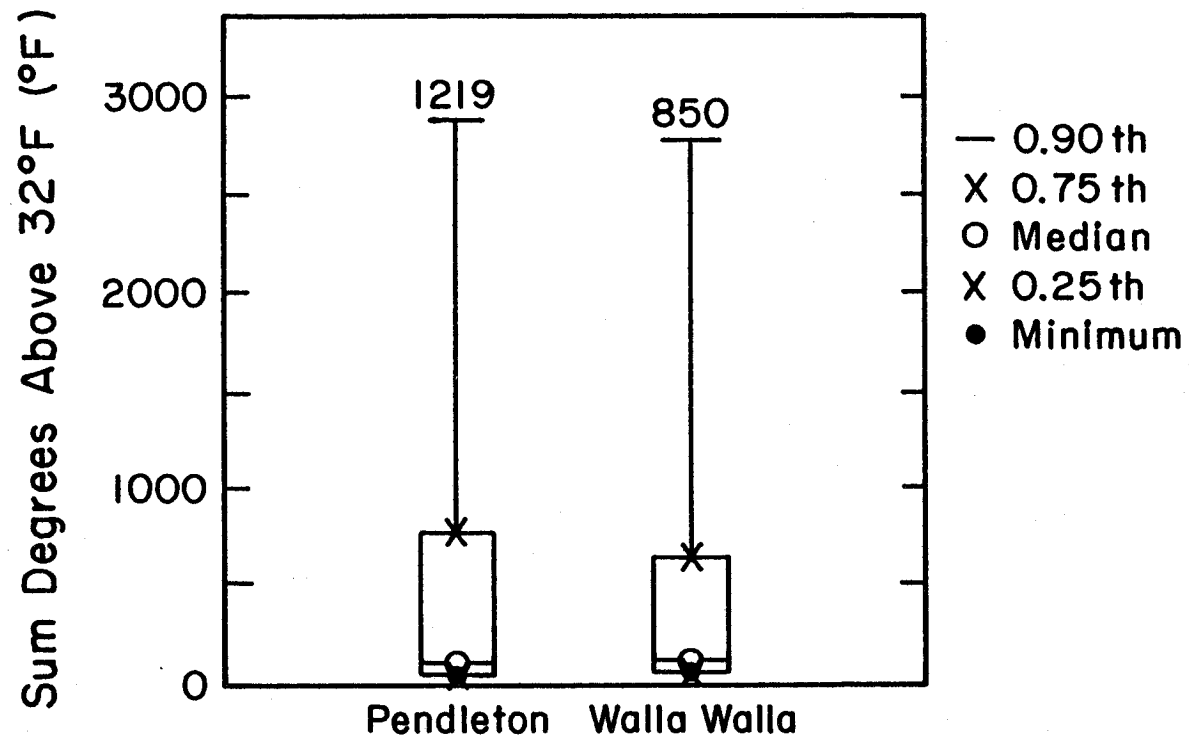


Figure 16. Box plots of sum of degrees above 32°F (ΣTa) for Pendleton and Walla Walla. The number at the top of each box plot is the number of events.

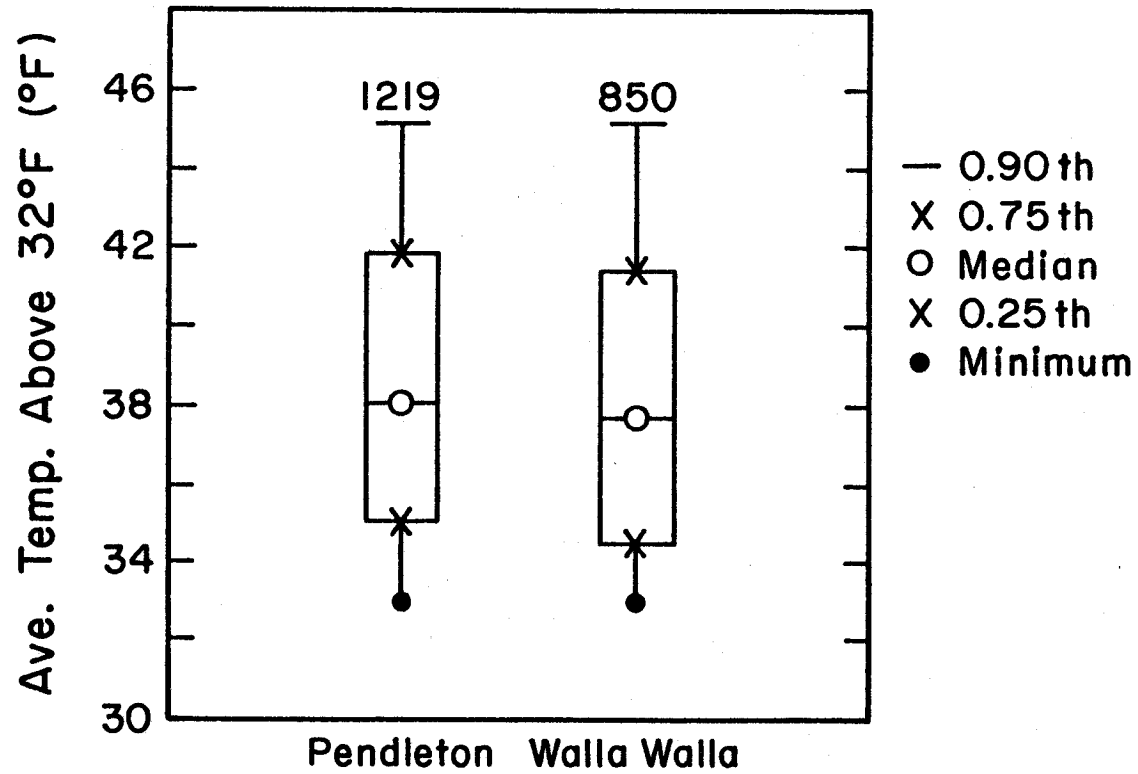


Figure 17. Box plots of average temperature above 32°F (Taa) for Pendleton and Walla Walla. The number at the top of each box plot is the number of events.

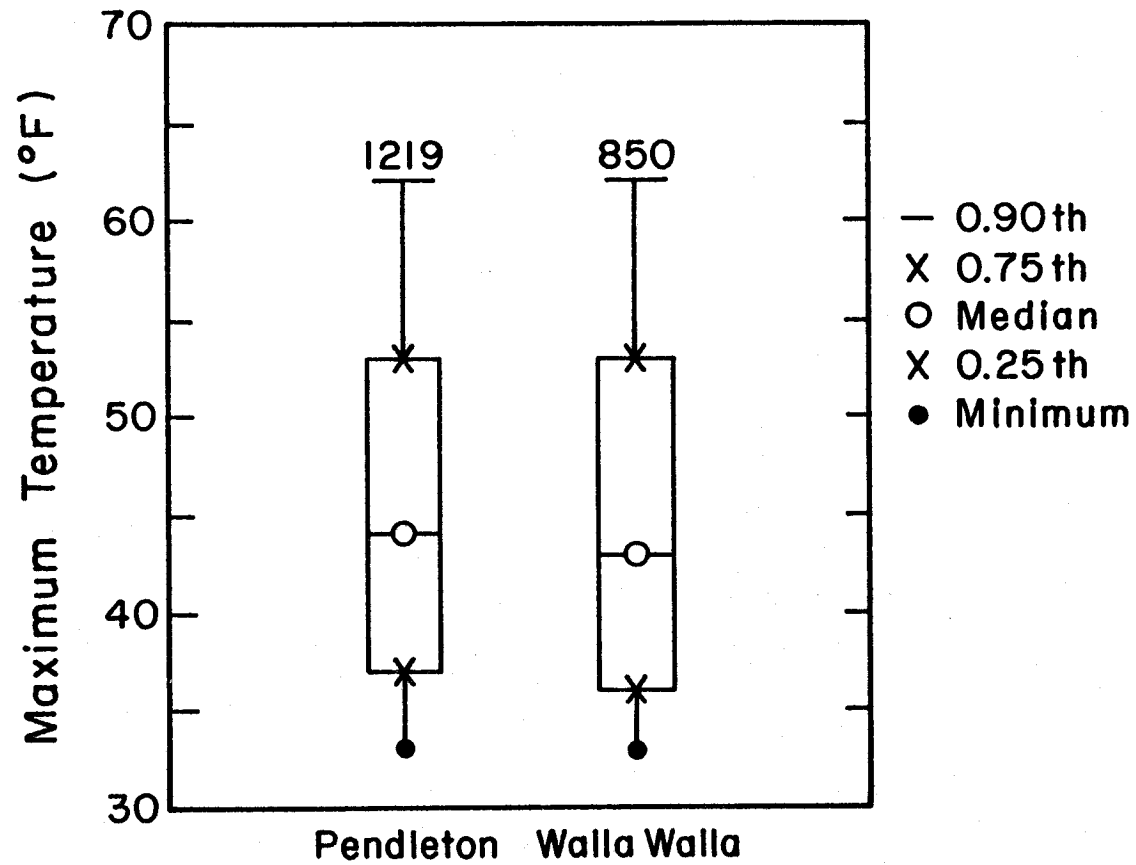


Figure 18. Box plots of maximum temperature (T_{ma}) for Pendleton and Walla Walla. The number at the top of each box plot is the number of events.

of particular interest; after a certain number of warm hours the soil "recovers" from the preceding freezing temperatures.

The distributions of the two characteristics number of hours above 32°F (Da) and sum of degrees above 32°F (ΣTa) are positively skewed, whereas the distributions of average temperature above 32°F (T_{aa}) and maximum temperature (T_{ma}) appear to be fairly symmetric. In general, the distributions of these characteristics at the two sites are quite similar to one another.

Since the warm period characteristics are of most interest when considered in conjunction with the cold period characteristics, tables of order and return statistics were not calculated for these characteristics. However, the values of the warm period characteristics are presented in the tables of order and return statistics for the cold period characteristics. The values of the warm period characteristics in these tables can provide useful information regarding, for example, the amount of time a soil is allowed to "thaw" following a period of severe freezing.

5. JOINT DISTRIBUTIONS OF FREEZING EVENT CHARACTERISTICS

The joint frequency distributions of pairs of freezing event characteristics can be used to obtain estimates of the probabilities of occurrence of events that have particular combinations of values of the two characteristics. For example, it may be of interest to know how frequently long freezing periods are accompanied by very low temperatures. The probability of occurrence of this type of event could be estimated from a table of the joint frequency distribution of Db and Tmb .

Joint frequency distributions are formulated by first dividing the range of values of the characteristics of interest into several categories (in this case, the ranges of the freezing event characteristics were divided into ten categories). Then a matrix can be formed whose columns represent the categories of one characteristic, e.g. Y , and whose rows represent the categories of the other characteristic, e.g. X . The entries in the matrix are the joint frequencies, f_{ij} , where f_{ij} is the number of times the value of X was in category i and the value of characteristic Y was in category j . The joint relative frequencies, P_{ij} , are calculated by dividing the joint frequencies by the total number of events. Total row and column frequencies (which represent the marginal distributions of the row and column variables) are calculated by summing across the rows and columns, respectively, of the joint frequency table.

The joint frequency distributions of several pairs of freezing event characteristics are discussed in the following subsections. Because of the large number of tables required to present all the joint frequency distributions of interest at both sites only some of the tables for Pendleton are presented in this section. However, a complete set of tables of the joint distributions of interest at both sites is presented in Appendix D.

5.1 Average Temperature below 32°F and Hours below 32°F

The joint frequency distribution of Tab and Db is presented in Table 2. Two numerical values are contained in each entry in this table. These are the joint frequency (f_{ij}) and the joint relative frequency of occurrence of each pair of categories. For example, the entries in the second row and ninth column of Table 2 are 21 and 0.0172. This means that 21 of the 1219 Pendleton freezing events had a freezing period that lasted between 30 and 60 hours and had an average temperature during the freezing period that was between 27 and 30°F. The joint relative frequency of this pair of categories is 0.0172 (= 21/1219). The entries in the "ROW TOTALS" column are the marginal row frequencies. They are the sums of the joint frequencies and joint relative frequencies across the table. For example, the second set of entries in the "ROW TOTALS" column, 62 and 0.0509, are the total number and overall relative frequency of occurrence of freezing events that had a value of Db that was between 30 and 60 hours. Similarly, the "COLUMN TOTALS" are the marginal column frequencies.

The highest frequencies in Table 2 are in the upper right corner. That is, most of the freezing events at Pendleton had low values of Db and high values (near 31°F) of Tab. In fact, more than 45 percent of the freezing periods lasted less than 30 hours and had average temperatures of at least 30°F. The less common pairs of categories, representing more intense and/or longer-lasting freezing periods, are of more interest for predicting soil frost.

By setting threshold values of both categories it is possible to estimate the probabilities of occurrence of particular types of freezing events. This is accomplished by summing the joint frequencies of the pairs of categories satisfying the threshold values and then dividing by the

Table 2. Joint frequency distribution of average temperature below 32°F (Tab) and number of hours below 32°F (Db) at Pendleton. The top number in each entry is the joint frequency and the bottom number is the joint relative frequency (n=1219).

LOWER BOUNDS FOR INTERVALS OF NUMBER OF HOURS BELOW 32F	LOWER BOUNDS FOR INTERVALS OF AVERAGE TEMPERATURE BELOW 32F (DEG F)										ROW TOTALS
	3	6	9	12	15	18	21	24	27	30 AND ABOVE	
0	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	3 .0025	18 .0148	69 .0566	383 .3142	577 .4733	1050 .8614
30	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	4 .0033	9 .0074	21 .0172	21 .0172	7 .0057	62 .0509
60	0 0.0000	0 0.0000	0 0.0000	1 .0008	1 .0008	5 .0041	4 .0033	6 .0049	13 .0107	1 .0008	31 .0254
90	1 .0008	1 .0008	1 .0008	1 .0008	0 0.0000	2 .0016	6 .0049	10 .0082	5 .0041	0 0.0000	27 .0221
120	0 0.0000	0 0.0000	1 .0008	0 0.0000	1 .0008	0 0.0000	5 .0041	2 .0016	2 .0016	0 0.0000	11 .0090
150	0 0.0000	0 0.0000	2 .0016	1 .0008	2 .0016	3 .0025	0 0.0000	3 .0025	1 .0008	0 0.0000	12 .0098
180	1 .0008	1 .0008	0 0.0000	0 0.0000	0 0.0000	1 .0008	1 .0008	2 .0016	2 .0016	0 0.0000	8 .0066
210	0 0.0000	0 0.0000	0 0.0000	2 .0016	0 0.0000	0 0.0000	2 .0016	1 .0008	0 0.0000	0 0.0000	5 .0041
240	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	2 .0016	0 0.0000	2 .0016
270 AND ABOVE	1 .0008	3 .0025	1 .0008	3 .0025	1 .0008	1 .0008	0 0.0000	0 0.0000	1 .0008	0 0.0000	11 .0090
COLUMN TOTALS	3 .0025	5 .0041	5 .0041	8 .0066	5 .0041	19 .0156	45 .0369	114 .0935	430 .3527	585 .4799	

total number of events. For example, suppose it is of interest to estimate the probability of occurrence of freezing events in which the freezing period lasts at least 150 hours and the average temperature during the freezing period is less than 18°F. The estimate of this probability, from Table 2, is 0.0148 $[(2+1+2+1+1+2+1+3+1+3+1)/1219]$. Note that the same answer could have been obtained (except for round-off error) by simply summing the appropriate relative frequencies. The probabilities of occurrence of other combinations of categories of Db and Tab can be estimated in a similar manner. Moreover, similar calculations can be made from the tables of the joint frequency distributions of Db and Tab for Walla Walla which are presented in Appendix D.

5.2 Average Temperature below 32°F and Sum below 32°F

Table 3 contains the joint frequency distribution of Tab and ΣTb at Pendleton. As was the case with the joint frequency distribution of Tab and Db, the largest joint frequencies are in the upper right corner of Table 3. That is, most of the freezing events had small values of ΣTb and large values of Tab. This characteristic of the joint distribution is a result of the skewed nature of the marginal distributions of Tab and Db.

The probabilities of occurrence of particular combinations of Tab and ΣTb values can be estimated from the frequencies in Table 3, as they were for Tab and Db using the frequencies in Table 2. For example, at Pendleton, the estimated probability of occurrence of a freezing period in which ΣTb is at least 1000°F and the average temperature is less than 21°F is 0.0287 $[= (2+1+\dots+3+2)/1219]$. Similar probabilities can be estimated from

Table 3. Joint frequency distribution of average temperature below 32°F Tab) and sum of degrees below 32°F (ΣT_b) at Pendleton. The top number in each entry is the joint frequency and the bottom number is the joint relative frequency (n=1219).

LOWER BOUNDS FOR INTERVALS OF SUM OF DEGREES BELOW 32F (DEG F)	LOWER BOUNDS FOR INTERVALS OF AVERAGE TEMPERATURE BELOW 32F (DEG F)										ROW TOTALS
	3	6	9	12	15	18	21	24	27	30 AND ABOVE	
0	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	3 0.0025	18 0.0148	75 0.0615	408 0.3347	585 0.4799	1089 .8934
250	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 0.0008	6 0.0049	21 0.0172	15 0.0123	0 0.0000	43 .0353
500	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	3 0.0025	5 0.0041	8 0.0066	3 0.0025	0 0.0000	19 .0156
750	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	3 0.0025	6 0.0049	4 0.0033	4 0.0033	0 0.0000	17 .0139
1000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	2 0.0016	5 0.0041	3 0.0025	0 0.0000	0 0.0000	10 .0082
1250	0 0.0000	0 0.0000	0 0.0000	1 0.0008	1 0.0008	2 0.0016	1 0.0008	3 0.0025	0 0.0000	0 0.0000	8 .0066
1500	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 0.0008	2 0.0016	0 0.0000	0 0.0000	0 0.0000	3 .0025
1750	0 0.0000	0 0.0000	0 0.0000	1 0.0008	1 0.0008	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	2 .0016
2000	0 0.0000	0 0.0000	1 0.0008	0 0.0000	0 0.0000	2 0.0016	1 0.0008	0 0.0000	0 0.0000	0 0.0000	4 .0033
2250 AND ABOVE	3 .0025	5 .0041	4 .0033	6 .0049	3 .0025	2 .0016	1 .0008	0 0.0000	0 0.0000	0 0.0000	24 .0197
COLUMN TOTALS	3 .0025	5 .0041	5 .0041	8 .0066	5 .0041	19 .0156	45 .0369	114 .0935	430 .3527	585 .4799	

the table of the joint distributions of T_{ab} and ΣT_b for Walla Walla which is presented in Appendix D.

5.3 Average Temperature below 32°F and Minimum Temperature

The joint frequency distribution of T_{ab} and T_{mb} at Pendleton is presented in Table 4. The pattern of frequencies in this table is such that the highest frequencies are in the lower right corner whereas the frequencies in the upper left corner are extremely small. This pattern is due to the negatively skewed shapes of the marginal distributions of the two characteristics. Moreover, all of the nonzero frequencies in Table 4 are in a region along the diagonal from the upper left corner to the lower right corner of the table. This suggests that the two characteristics T_{ab} and T_{mb} are strongly related; that is, freezing periods with low average temperatures also always have low minimum temperatures, and vice versa. This relationship is discussed further in Section 6.5. The patterns of frequencies for the joint distributions of T_{ab} and T_{mb} at Walla Walla is similar to the pattern at Pendleton. Appendix D contains tables of these frequencies.

5.4 Sum below 32°F and Hours below 32°F

Table 5 contains the joint frequency distribution of ΣT_b and D_b at Pendleton. Because of the positively skewed nature of both ΣT_b and D_b , the highest joint frequencies are in the upper left corner of Table 5. In fact, more than 86 percent of the freezing events at Pendleton had freezing periods that lasted less than 30 hours and had a total number of degrees below freezing less than 250°F during the event. The probabilities of occurrence of freezing events with particular combinations of values of

Table 4. Joint frequency distribution of average temperature below 32°F (Tab) and minimum temperature (Tmb) at Pendleton. The top number in each entry is the joint frequency and the bottom number is the joint relative frequency (n=1219).

LOWER BOUNDS FOR INTERVALS OF MINIMUM TEMPERATURE (DEG F)	LOWER BOUNDS FOR INTERVALS OF AVERAGE TEMPERATURE BELOW 32F (DEG F)										ROW TOTALS
	3	6	9	12	15	18	21	24	27	30 AND ABOVE	
-8	3 .0025	5 .0041	2 .0016	4 .0033	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	14 .0115
-4	0 0.0000	0 0.0000	3 .0025	2 .0016	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	5 .0041
0	0 0.0000	0 0.0000	0 0.0000	1 .0008	2 .0016	3 .0025	0 0.0000	0 0.0000	0 0.0000	0 0.0000	6 .0049
4	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0008	3 .0025	2 .0016	0 0.0000	0 0.0000	0 0.0000	6 .0049
8	0 0.0000	0 0.0000	0 0.0000	1 .0008	2 .0016	7 .0057	7 .0057	2 .0016	0 0.0000	0 0.0000	19 .0156
12	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	4 .0033	12 .0098	1 .0008	0 0.0000	0 0.0000	17 .0139
16	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0008	18 .0148	19 .0156	2 .0016	0 0.0000	40 .0328
20	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0008	6 .0049	72 .0591	23 .0189	0 0.0000	102 .0837
24	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	20 .0164	265 .2174	1 .0008	286 .2346
28 AND ABOVE	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	140 .1148	584 .4791	724 .5939
COLUMN TOTALS	3 .0025	5 .0041	5 .0041	8 .0066	5 .0041	19 .0156	45 .0369	114 .0935	430 .3527	585 .4799	

Table 5. Joint frequency distribution of sum of degrees below 32°F (ΣTb) and number of hours below 32°F (Db) at Pendleton. The top number in each entry is the joint frequency and the bottom number is the joint relative frequency (n=1219).

LOWER BOUNDS FOR INTERVALS OF NUMBER OF HOURS BELOW 32F	LOWER BOUNDS FOR INTERVALS OF SUM OF DEGREES BELOW 32F (DEG F)										ROW TOTALS
	0	250	500	750	1000	1250	1500	1750	2000	2250 AND ABOVE	
0	1050 .8614	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1050 .8614
30	33 .0271	23 .0189	6 .0049	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	62 .0509
60	5 .0041	13 .0107	4 .0033	5 .0041	2 .0016	2 .0016	0 0.0000	0 0.0000	0 0.0000	0 0.0000	31 .0254
90	1 .0008	6 .0049	6 .0049	6 .0049	2 .0016	2 .0016	0 0.0000	1 .0008	1 .0008	2 .0016	27 .0221
120	0 0.0000	0 0.0000	2 .0016	2 .0016	3 .0025	1 .0008	1 .0008	1 .0008	0 0.0000	1 .0008	11 .0090
150	0 0.0000	1 .0008	0 0.0000	0 0.0000	1 .0008	2 .0016	1 .0008	0 0.0000	2 .0016	5 .0041	12 .0098
180	0 0.0000	0 0.0000	0 0.0000	2 .0016	2 .0016	0 0.0000	1 .0008	0 0.0000	0 0.0000	3 .0025	8 .0066
210	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0008	0 0.0000	0 0.0000	1 .0008	3 .0025	5 .0041
240	0 0.0000	0 0.0000	1 .0008	1 .0008	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	2 .0016
270 AND ABOVE	0 0.0000	0 0.0000	0 0.0000	1 .0008	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	10 .0082	11 .0090
COLUMN TOTALS	1089 .8934	43 .0353	19 .0156	17 .0139	10 .0082	8 .0066	3 .0025	2 .0016	4 .0033	24 .0197	

ΣT_b and D_b can be estimated from the frequencies in Table 5 in the same manner as they were estimated for other pairs of characteristics. For example, the probability of occurrence of a freezing event at Pendleton for which D_b is at least 150 hours and ΣT_b is 1250°F or more is 0.0238. A table of the joint frequency distribution of ΣT_b and D_b at Walla Walla is presented in Appendix D.

5.5 Sum below 32°F and Minimum Temperature

As shown in Table 6, the highest joint frequencies of ΣT_b and T_{mb} at Pendleton are for high minimum temperatures combined with low values of ΣT_b . Only about 4 percent of the freezing events had minimum temperatures that were less than 20°F and had values of ΣT_b of at least 1000°F. The results for Walla Walla (presented in Appendix D) are similar.

5.6 Hours below 32°F and Minimum Temperature

The joint frequency distribution of D_b and T_{mb} at Pendleton, shown in Table 7, is very much like the joint distribution of ΣT_b and D_b presented in Table 6. That is, very few of the freezing events had small values of T_{mb} and large values of D_b ; on the contrary, most of the events had large values of T_{mb} and small values of D_b . Of the 1219 freezing events at Pendleton, 714 (58.6 percent) had a minimum temperature of 28 to 31°F and had freezing periods that lasted less than 30 hours. Only 52 (4.3 percent) of the events had a minimum temperature that was less than 20°F and had freezing periods that lasted 90 hours or more. Moreover, the freezing periods of only 14 events (1.1 percent) had minimum temperatures that were

Table 6. Joint frequency distribution of sum of degrees below 32°F (ΣT_b) and minimum temperature (T_{mb}) at Pendleton. The number in each entry is the joint frequency and the bottom number is the joint relative frequency (n=1219).

LOWER BOUNDS FOR INTERVALS OF MINIMUM TEMPERATURE (DEG F)	LOWER BOUNDS FOR INTERVALS OF SUM OF DEGREES BELOW 32F (DEG F)										ROW TOTALS
	0	250	500	750	1000	1250	1500	1750	2000	2250 AND ABOVE	
-8	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	14 .0115	14 .0115
-4	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0008	1 .0008	3 .0025	5 .0041
0	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0008	0 0.0000	0 0.0000	2 .0016	3 .0025	6 .0049
4	0 0.0000	0 0.0000	0 0.0000	0 0.0000	3 .0025	2 .0016	0 0.0000	0 0.0000	0 0.0000	1 .0008	6 .0049
8	0 0.0000	3 .0025	4 .0033	4 .0033	2 .0016	2 .0016	1 .0008	1 .0008	0 0.0000	2 .0016	19 .0156
12	2 .0016	2 .0016	3 .0025	3 .0025	2 .0016	1 .0008	2 .0016	0 0.0000	1 .0008	1 .0008	17 .0139
16	19 .0156	12 .0098	3 .0025	5 .0041	1 .0008	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	40 .0328
20	76 .0623	14 .0115	6 .0049	3 .0025	1 .0008	2 .0016	0 0.0000	0 0.0000	0 0.0000	0 0.0000	102 .0837
24	268 .2199	12 .0098	3 .0025	2 .0016	1 .0008	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	286 .2346
28 AND ABOVE	724 .5939	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	724 .5939
COLUMN TOTALS	1089 .8934	43 .0353	19 .0156	17 .0139	10 .0082	8 .0066	3 .0025	2 .0016	4 .0033	24 .0197	

Table 7. Joint frequency distribution of number of hours below 32°F (Db) and minimum temperature (Tmb) at Pendleton. The top number in each entry is the joint frequency and the bottom number is the joint relative frequency (n=1219).

LOWER BOUNDS FOR INTERVALS OF MINIMUM TEMPERATURE (DEG F)	LOWER BOUNDS FOR INTERVALS OF NUMBER OF HOURS BELOW 32F										ROW TOTALS
	0	30	60	90	120	150	180	210	240	270 AND ABOVE	
-8	0 0.0000	0 0.0000	0 0.0000	2 .0016	0 0.0000	2 .0016	2 .0016	1 .0008	0 0.0000	7 .0057	14 .0115
-4	0 0.0000	0 0.0000	0 0.0000	2 .0016	1 .0008	1 .0008	0 0.0000	0 0.0000	0 0.0000	1 .0008	5 .0041
0	0 0.0000	0 0.0000	1 .0008	0 0.0000	0 0.0000	2 .0016	0 0.0000	1 .0008	0 0.0000	2 .0016	6 .0049
4	0 0.0000	0 0.0000	1 .0008	2 .0016	2 .0016	1 .0008	0 0.0000	0 0.0000	0 0.0000	0 0.0000	6 .0049
8	0 0.0000	6 .0049	5 .0041	3 .0025	1 .0008	3 .0025	1 .0008	0 0.0000	0 0.0000	0 0.0000	19 .0156
12	2 .0016	5 .0041	2 .0016	2 .0016	3 .0025	0 0.0000	1 .0008	2 .0016	0 0.0000	0 0.0000	17 .0139
16	17 .0139	13 .0107	3 .0025	5 .0041	0 0.0000	0 0.0000	1 .0008	0 0.0000	1 .0008	0 0.0000	40 .0328
20	69 .0566	13 .0107	6 .0049	7 .0057	3 .0025	2 .0016	1 .0008	1 .0008	0 0.0000	0 0.0000	102 .0837
24	248 .2034	17 .0139	12 .0098	3 .0025	1 .0008	1 .0008	2 .0016	0 0.0000	1 .0008	1 .0008	286 .2346
28 AND ABOVE	714 .5857	8 .0066	1 .0008	1 .0008	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	724 .5939
COLUMN TOTALS	1050 .8614	62 .0509	31 .0254	27 .0221	11 .0090	12 .0098	8 .0066	5 .0041	2 .0016	11 .0090	

less than 8°F and lasted at least 180 hours. The joint frequency distributions of Db and Tmb at Walla Walla are qualitatively similar to the distribution at Pendleton. The table containing this frequency distribution is presented in Appendix D.

6. CONDITIONAL DISTRIBUTIONS OF FREEZING EVENT CHARACTERISTICS

The conditional distributions of pairs of freezing event characteristics can provide indications of the types of interactions and relationships that exist between the characteristics. A conditional distribution is formulated by first selecting the subset of events for which one characteristic, e.g. X , has a particular value, e.g. x . Then the conditional distribution of a second characteristic, e.g. y , given $X=x$ is simply the distribution of Y for the subset of events.

As in the case of the marginal distributions considered in Section 4, the conditional distributions described in this section are characterized by their quantile values (e.g., the values of the 0.10th, 0.25th, 0.50th, 0.75th, and 0.90th quantiles of the distributions). However, instead of using box plots, the quantiles are displayed as in Figure 19. This figure contains the quantile values of the conditional distributions of ΣT_b given many different values of D_b , at Pendleton. Each curve in Figure 19 represents a different quantile of the distributions. For example, the points on the lowest curve represent the 0.25th quantile values of the frequency distributions of ΣT_b for freezing periods lasting 1, 2, 3, ..., 19 hours. The curves in Figure 19 have been smoothed using a 3-point smoothing algorithm to make the trends more visible.

The conditional distributions of five pairs of freezing event characteristics at Pendleton are described in the following subsections. Each of these distributions is represented using a diagram similar to Figure 19. The corresponding figures for Walla Walla are not presented here because they are quite similar to those for Pendleton. The small differences in the distributions at the two stations are not of importance since the purpose of examining the conditional distributions is to obtain general (as

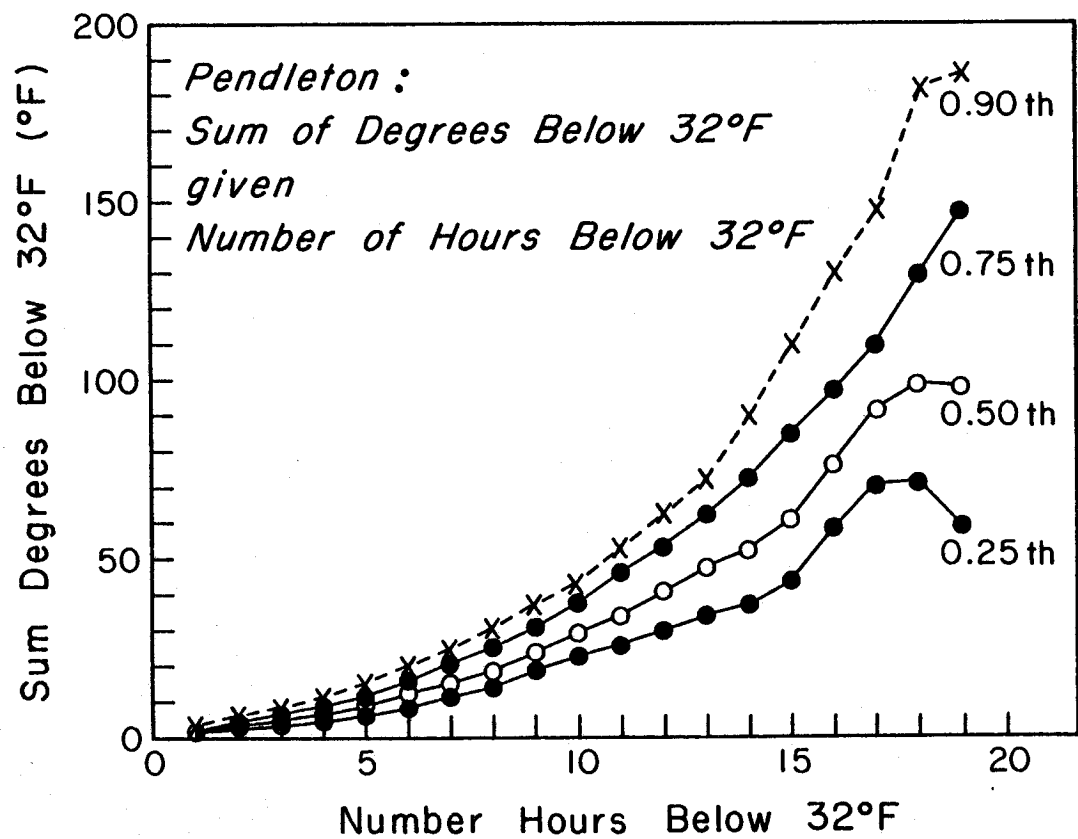


Figure 19. Quantile values of the conditional distributions of sum of degrees below 32°F (ΣT_b) given the number of hours below 32°F (D_b), at Pendleton.

opposed to quantitative) indications of the types of relationships that exist between the freezing event characteristics. However, tables of the quantile values for the five sets of conditional distributions at Pendleton and Walla are presented in Appendix E.

6.1 Sum below 32°F given Hours below 32°F

Figure 19 displays the quantiles of the conditional distributions of ΣT_b given D_b at Pendleton. The curves in this figure indicate that there is a strong relationship between these two freezing event characteristics: as the length of the freezing period increases, the values of all of the conditional quantiles of ΣT_b increase as well. For example, the median value of ΣT_b for freezing periods lasting 5 hours is about 7°F, whereas the median value for freezing periods lasting 15 hours is about 55°F, or almost eight times as large. The shapes of the curves appear to be quadratic rather than linear. In fact, values of the conditional quantiles for values of D_b greater than 19 hours are not shown here because they are so extreme.

Figure 19 also indicates that the variability of ΣT_b increases with increasing duration of the freezing period. This is indicated by the increasing distance between the 0.75th and 0.25th quantile values of ΣT_b (the interquartile range) with increasing values of D_b . For example, the interquartile range of ΣT_b for events with freezing periods lasting 5 hours is about 5°F, whereas the value for events with freezing periods lasting 15 hours is about 44°F.

6.2 Average Temperature below 32°F given Hours below 32°F

There also is a strong relationship between the two freezing event characteristics T_{ab} and D_b , as shown in Figure 20. The quantile values of T_{ab} rapidly decrease with increasing D_b . Apparently, longer cold periods have lower temperatures overall than do shorter cold periods. The trend in the quantile values appears to be approximately linear, at least for D_b values that are less than 20 hours. Note that the observations for larger values of D_b have been combined into several groups in order to ensure that each set of quantile values is based on at least 10 events. Hence, the conditional quantile values of T_{ab} for these longer-lasting cold periods are based on fewer observations than the preceding quantiles and they exhibit some deviations from the decreasing trend. The results for Walla Walla (presented in tabular form in Appendix E) are similar.

6.3 Hours below 32°F given Minimum Temperature

The trend in the quantile values of D_b given T_{mb} , shown in Figure 21, is not as strong as the trends shown in Figures 19 and 20. Disregarding the conditional quantiles for small values of minimum temperature (which are based on small samples and combined values of minimum temperature), the slopes of the curves are quite gradual. There also is no indication in Figure 21 that the conditional variance of D_b is dependent on the value of the minimum temperature. These results suggest that, although there is a relationship between D_b and T_{mb} , it is not a very strong relationship and probably could not be used for predictive purposes.

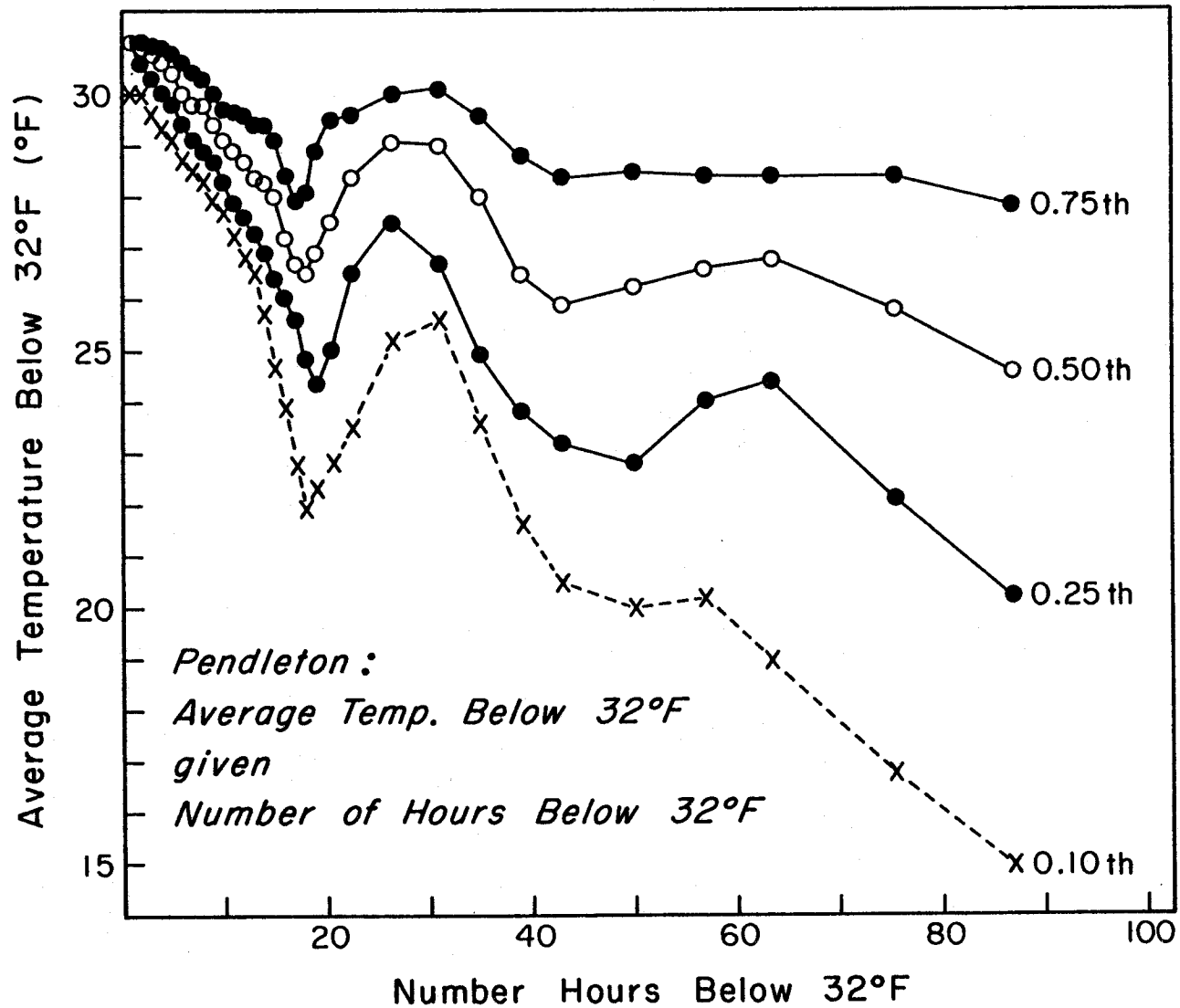


Figure 20. Quantile values of the conditional distributions of average temperature below 32°F (Tab) given the number of hours below 32°F (Db), at Pendleton.

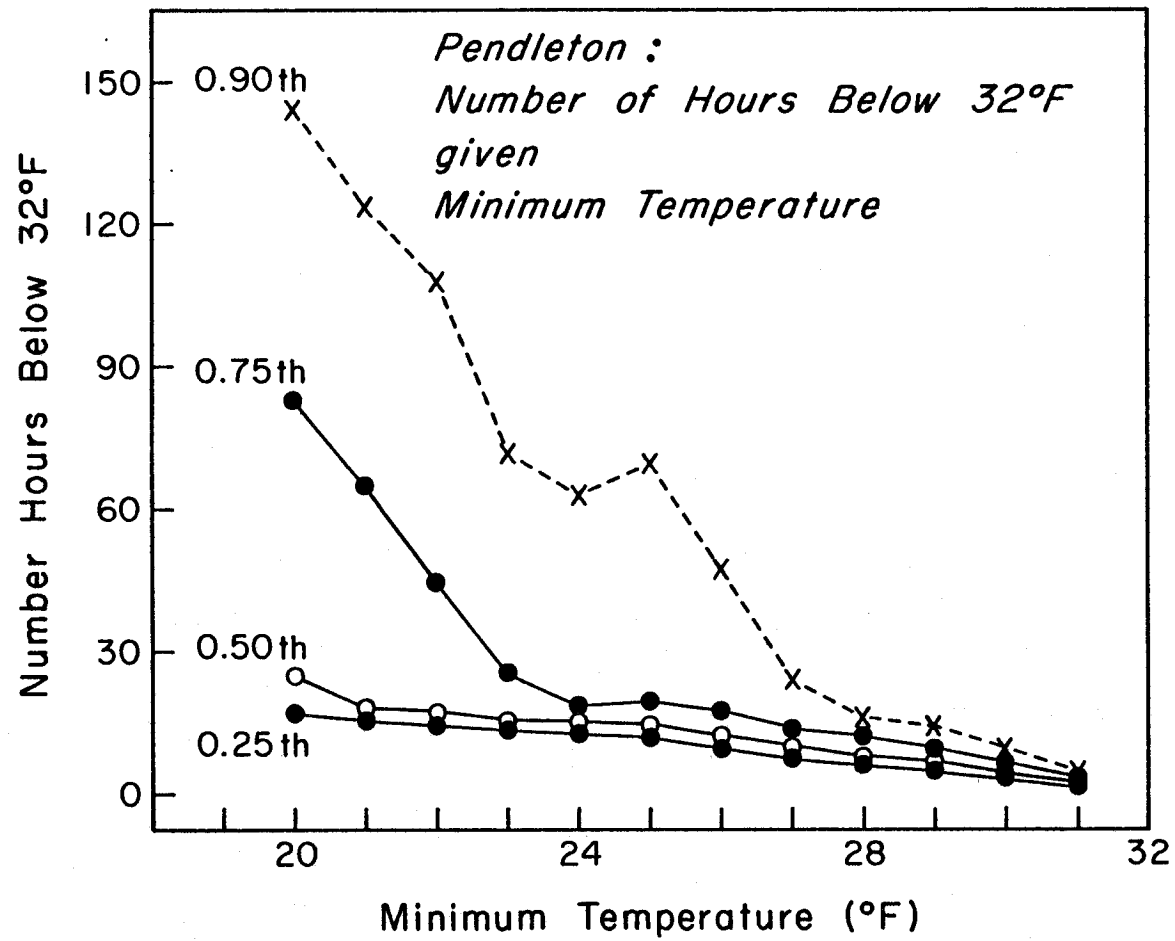


Figure 21. Quantile values of the conditional distributions of number of hours below 32°F (Db) given the minimum temperature (Tmb), at Pendleton.

6.4 Sum below 32°F given Minimum Temperature

The shapes of the curves in Figure 22, showing the conditional quantiles of ΣT_b given T_{mb} , are quite similar to the curves in Figure 21 depicting the conditional quantiles of D_b given T_{mb} . That is, the slopes of the curves are fairly steep for very low values of minimum temperature and are gradual for higher values. Moreover, the variability of ΣT_b is apparently independent of D_b . The shapes of the curves for the Walla Walla distributions also have this form.

6.5 Average Temperature below 32°F given Minimum Temperature

The trend in the conditional quantiles of T_{ab} given T_{mb} , shown in Figure 23, indicates that there is a very strong linear relationship between these two characteristics. In fact, the slope of the curve of the conditional median of T_{ab} (the 0.50th quantile) is nearly one. Since minimum temperature is a commonly measured parameter, whereas the average temperature during a freezing period is not commonly measured, this relationship could potentially be useful for predicting or estimating values of T_{ab} .

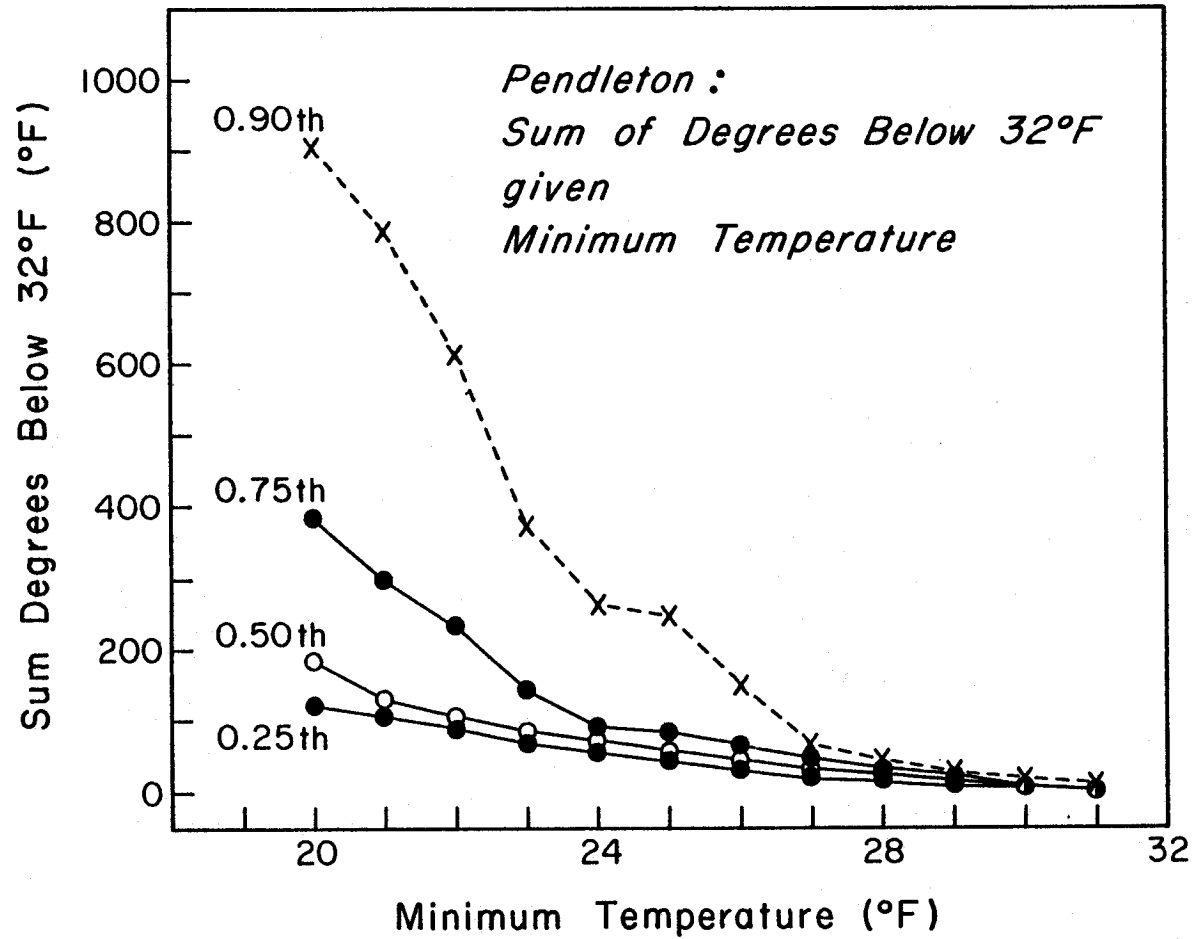


Figure 22. Quantile values of the conditional distributions of sum degrees below 32°F (ΣT_b) given the minimum temperature (T_{mb}), at Pendleton.

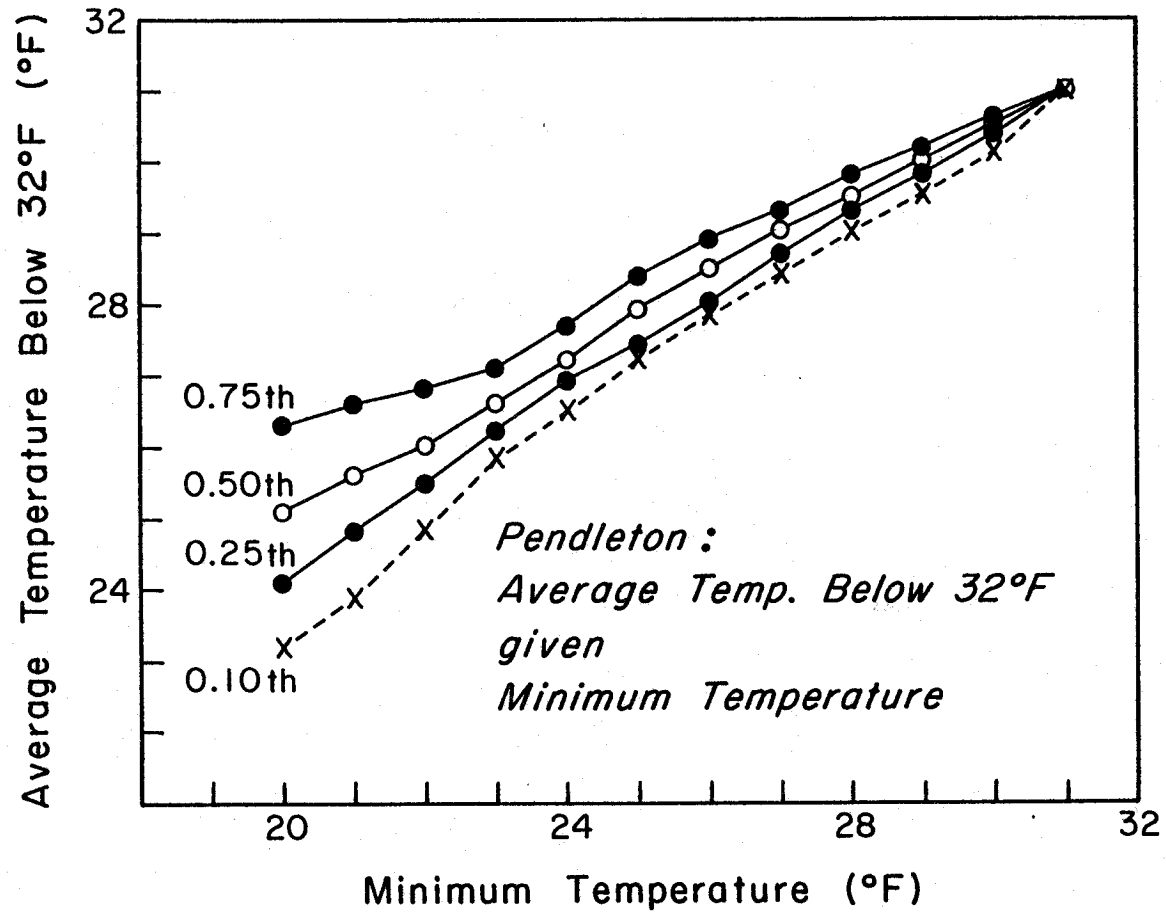


Figure 23. Quantile values of the conditional distributions of average temperature below 32°F (T_{ab}) given the minimum temperature (T_{mb}), at Pendleton.

7. SUMMARY AND CONCLUDING REMARKS

The results of the analyses described in this report have provided general information regarding the characteristics of freezing events in eastern Oregon and eastern Washington. The marginal distributions of the freezing event characteristics have indicated certain properties of the individual characteristics. Moreover, the joint and conditional distributions of the characteristics have provided insights into the types of statistical relationships that exist between pairs of freezing event characteristics. In particular, some general conclusions that may be made regarding the characteristics of freezing events in eastern Oregon and eastern Washington include the following:

- (a) The marginal distributions of the freezing event characteristics measuring the duration and total number of degrees below freezing during the cold period (D_b and ΣT_b) are positively skewed. That is, most freezing events had small values of these characteristics, whereas relatively few freezing events had large values of the characteristics.
- (b) The marginal distribution of the freezing event characteristics minimum temperature (T_{mb}) and average temperature below 32°F (T_{ab}) are negatively skewed. That is, most freezing events had large values of these characteristics (near 31°F), whereas relatively few events had small values of the characteristics.
- (c) The values of certain pairs of freezing event characteristics are not independent. For example, T_{mb} is strongly related to D_b , ΣT_b , and T_{ab} , as is indicated by the plots of the conditional distributions of these characteristics given T_{mb} .

These conclusions are based on the analysis of temperature data from a specific time period at two stations in eastern Oregon/Washington. Nevertheless, they may also characterize freezing events at other locations and for other time periods. Moreover, the methodology described in this report could easily be applied to the analysis of freezing events at any location or for any time period of interest.

The tables of order and return statistics and joint and conditional distributions presented in the appendices are site-specific and are at least somewhat dependent on the time period considered in this study. Nevertheless, the values contained in these tables provide estimates of many specific probabilities that will be useful in future models of soil frost and runoff in eastern Oregon and eastern Washington. Moreover, the consideration of these results in combination with previous results regarding precipitation events in eastern Oregon/Washington (Brown et al., 1983b) will help further the goal of improving predictions of long-term erosion rates for this region.

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APPENDIX A

Data Base Description

Hourly temperature data from Pendleton, Oregon, and Walla Walla, Washington for from 1948 to 1978 were used to create the records of freezing events described and analyzed in this report. These data were obtained from the National Climatic Center (NOAA, U.S. Department of Commerce) at Asheville, North Carolina. The original data tapes that were obtained from the National Climatic Center are stored at the Climatic Research Institute at Oregon State University (OSU).

The hourly data were combined according to the freezing event definition described in Section 2, and an event parameter file was created for both sites. The files consist of individual data records for each freezing event at a site during the period of the data record. All of the freezing event characteristics that were evaluated in the study either are included in the record for each event or may be calculated from the characteristics that are included. The data files are binary and are archived on magnetic tape at the OSU Computer Center under the file names PNDFRZ (Pendleton events), WALFRZ (Walla Walla events). Copies of the files, on magnetic tape, also will be stored by the OSU Department of Soil Science at the conclusion of this project.

The archived data files may be retrieved from tape and copied onto direct access files by submitting the computer routine ARCHYR which is stored under user number GAUI5C. Before submitting ARCHYR it is first necessary to edit that routine to retrieve the desired data files under the appropriate user number. That is, the USER, CHARGE, TITLE, and RETRIEV statements in RCHYR must be changed. The RETRIEV statement is of the form

RETRIEV,RF=pfn1/pfn2/pfn3/...,R.

For example, the statement

RETRIEV,RF=PNDFRZ/WALFRZ,R.

would cause the files PNDFRZ and WALFRZ to be retrieved and stored as direct access files.

Each record on the binary event data files contains the following ten parameters (in the order listed):

- (1) First hour of the event, counting from January 1, 1900
- (2) Last hour of the event, counting from January 1, 1900
- (3) Event duration (hours)
- (4) Sum of degrees below 32°F (°F)
- (5) Number of degrees below 32°F (°F)
- (6) Sum of degrees above 32°F (°F)
- (7) Number of degrees above 32°F (°F)
- (8) Minimum temperature (°F)
- (9) Maximum temperature (°F)

All variables are stored as integers. Note that the freezing event characteristics average temperature below 32°F and average temperature above 32°F can be calculated using the parameters sum of degrees below 32°F and number of degrees below 32°F, and sum of degrees above 32°F and number of degrees above 32°F, respectively (see Table 1).

APPENDIX B

Order Statistics

The following tables contain "order statistics" for each of the cold period freezing event characteristics at each of two sites (Pendleton, Oregon and Walla Walla, Washington). These statistics are the values of the event characteristics for the 100 events with the largest values (or smallest values, for minimum temperature and average temperature below 32°F) of the characteristic of interest. For example, the number of hours below 32°F order statistics are formulated by sorting the events in order of decreasing number of hours below 32°F and listing the characteristics of the first 100 of the ordered events. The tables of order statistics are organized by characteristic, with separate tables for each site. An index listing the location of each table is given in the table of contents for the appendices (p. 61).

ORDER STATISTICS AT PENDLETON
 SORTED BY HOURS BELOW 32

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
1	600107.23	458	5752	442	18.99	49	12	36.08	0	40
2	570112.16	469	10585	437	7.78	198	32	38.19	-19	41
3	490118.17	357	6357	355	14.09	4	2	34.00	-6	34
4	761229.19	350	4900	346	17.84	4	3	33.33	2	34
5	721202.17	353	8537	343	7.11	37	9	36.11	-12	39
6	500123.18	414	9582	324	2.43	484	87	37.56	-17	45
7	690118.00	336	6455	316	11.57	45	15	35.00	-4	39
8	720125.00	307	5800	302	12.79	6	3	34.00	-5	35
9	731231.05	490	7261	297	7.55	3338	192	49.39	-7	68
10	560125.15	290	5073	282	14.01	1	1	33.00	-9	33
11	770127.18	299	814	274	29.03	9	9	33.00	25	33
12	540201.04	671	724	257	29.18	5345	398	45.43	25	64
13	650110.05	304	959	251	28.18	197	37	37.32	18	43
14	521122.16	493	2311	232	22.04	2853	259	43.02	15	59
15	691231.18	239	2117	232	22.88	2	2	33.00	12	33
16	730102.21	413	4077	228	14.12	2549	184	45.85	-5	59
17	781118.18	268	1379	222	25.79	167	42	35.98	20	40
18	490107.17	215	3701	211	14.46	2	1	34.00	2	34
19	571231.15	218	1207	207	26.17	37	9	36.11	19	38
20	561123.20	220	1058	207	26.89	33	13	34.54	24	37
21	500112.16	266	5164	198	5.92	633	67	41.45	-6	52
22	691125.19	218	984	198	27.03	29	10	34.90	22	37
23	681228.00	261	4769	186	6.36	646	71	41.10	-11	52
24	551213.00	356	2351	185	19.29	2039	167	44.21	10	63
25	591227.16	194	1528	185	23.74	12	5	34.40	13	35
26	561225.03	216	907	184	27.07	146	30	36.87	24	42
27	631208.23	218	1277	179	24.87	5	5	33.00	10	33
28	551111.18	174	3590	171	11.01	48	3	48.00	-5	52
29	611208.18	174	2100	171	19.72	2	1	34.00	3	34
30	610120.07	179	411	169	29.57	9	5	33.80	25	35
31	511229.15	177	2838	168	15.11	22	5	36.40	4	38
32	630126.17	370	2002	168	20.08	2296	197	43.65	1	63
33	481222.14	174	2465	167	17.24	19	7	34.71	8	37
34	620117.07	457	3363	166	11.74	3867	289	45.38	-9	62
35	601206.17	183	1257	165	24.38	49	14	35.50	20	42
36	480114.17	243	1096	160	25.15	996	81	44.30	22	52
37	771118.00	499	1726	152	20.64	3850	326	43.81	10	59
38	510126.22	152	3015	151	12.03	1	1	33.00	-1	33
39	511222.23	160	1551	142	21.08	120	16	39.50	12	42
40	760201.01	162	1154	142	23.87	26	7	35.71	7	38
41	710101.17	221	1327	136	22.24	1032	84	44.29	13	50
42	550105.13	247	789	135	26.16	644	111	37.80	23	48
43	651213.21	154	776	131	26.08	107	19	37.63	21	42
44	750204.18	249	638	131	27.13	1522	114	45.35	22	61
45	631130.17	177	602	125	27.18	329	47	39.00	26	45
46	590101.23	311	2501	124	11.83	2363	184	44.84	-1	63
47	490101.16	145	1753	122	17.63	177	21	40.43	8	45
48	711225.19	184	1238	122	21.85	573	59	41.71	15	50
49	570218.20	537	1197	120	22.03	4543	392	43.59	7	61
50	541217.16	120	867	117	24.59	1	1	33.00	19	33

ORDER STATISTICS AT PENDLETON
 SORTED BY HOURS BELOW 32

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
51	591219.17	154	331	116	29.15	133	33	36.03	25	42
52	641215.12	115	3062	112	4.66	4	3	33.33	-12	34
53	671212.15	133	1464	112	18.93	46	17	34.71	4	38
54	511210.17	206	704	112	25.71	569	91	38.25	20	48
55	630109.17	178	2584	110	8.51	523	68	39.69	-9	44
56	781109.19	118	1124	110	21.78	11	5	34.20	8	36
57	520121.18	113	897	110	23.85	3	1	35.00	11	35
58	620109.17	130	789	110	24.83	75	17	36.41	17	41
59	600301.17	201	1125	109	21.68	634	90	39.04	14	48
60	691204.21	124	370	106	28.51	27	9	35.00	23	38
61	601227.06	109	557	102	26.54	15	5	35.00	24	36
62	611125.05	112	526	102	26.84	15	5	35.00	21	38
63	581125.16	102	823	100	23.77	1	1	33.00	18	33
64	700115.23	311	529	100	26.71	1708	207	40.25	21	58
65	621223.00	314	566	99	26.28	2449	206	43.89	19	59
66	591115.04	257	1264	98	19.10	3129	157	51.93	5	65
67	521222.22	98	656	96	25.17	3	1	35.00	20	35
68	540118.01	124	2013	94	10.59	286	30	41.53	-4	57
69	500101.16	150	1764	93	13.03	314	53	37.92	-3	47
70	660117.06	107	368	93	28.04	20	6	35.33	19	38
71	601214.20	146	400	92	27.65	319	47	38.79	25	49
72	620223.17	97	937	91	21.70	11	5	34.20	12	35
73	681218.22	96	486	91	26.66	8	3	34.67	20	36
74	781205.15	118	936	90	21.60	45	20	34.25	10	36
75	660123.20	197	490	90	26.56	666	100	38.66	22	48
76	751218.18	106	211	90	29.66	13	8	33.63	29	35
77	560214.16	92	1441	89	15.81	2	1	34.00	2	34
78	600225.18	96	974	89	21.06	11	5	34.20	11	35
79	551228.16	90	662	88	24.48	2	1	34.00	18	34
80	730211.13	207	334	88	28.20	778	115	38.77	20	48
81	480204.06	133	1130	87	19.01	300	44	38.82	4	51
82	560206.17	182	802	87	22.78	645	88	39.33	17	48
83	550126.22	96	256	87	29.06	3	3	33.00	27	33
84	680126.18	98	977	85	20.51	94	12	39.83	13	43
85	480209.19	225	592	84	24.95	1955	138	46.17	16	65
86	671218.04	85	957	83	20.47	2	1	34.00	12	34
87	750127.16	108	496	83	26.02	121	21	37.76	21	40
88	610101.18	398	721	82	23.21	4134	313	45.21	21	60
89	561205.03	406	1416	81	14.52	4677	325	46.39	8	59
90	481215.17	130	1127	81	18.09	254	47	37.40	8	44
91	510106.12	84	259	79	28.72	12	3	36.00	25	37
92	601221.14	82	290	74	28.08	22	6	35.67	26	38
93	590217.21	98	223	74	28.99	6	6	33.00	26	33
94	501204.02	117	257	71	28.38	244	41	37.95	24	42
95	480131.16	72	655	68	22.37	8	4	34.00	11	35
96	760119.19	105	169	68	29.51	193	34	37.68	27	44
97	591207.20	77	342	67	26.90	5	5	33.00	24	33
98	780107.21	123	93	67	30.61	51	18	34.83	30	38
99	761203.17	202	271	66	27.89	1561	134	43.65	24	62
100	780302.18	297	271	65	27.83	2224	229	41.71	26	56

ORDER STATISTICS AT WALLA WALLA
 SORTED BY HOURS BELOW 32

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
1	570112.16	435	10325	434	8.21	1	1	33.00	-15	33
2	560124.22	480	6223	393	16.17	619	85	39.28	-8	47
3	490118.17	393	6906	387	14.16	8	4	34.00	-4	36
4	761229.12	355	4849	353	18.26	1	1	33.00	-2	33
5	600112.16	447	4211	329	19.20	1607	116	45.85	7	61
6	500123.19	416	9672	322	1.96	702	92	39.63	-16	45
7	771222.22	410	3314	322	21.71	586	75	39.81	2	51
8	740101.08	858	8028	285	3.83	7692	568	45.54	-10	65
9	521121.17	683	2372	249	22.47	3376	419	40.06	14	55
10	490107.20	230	3751	219	14.87	40	11	35.64	4	39
11	591226.22	227	1523	215	24.92	46	7	38.57	11	43
12	561123.19	215	865	210	27.88	1	1	33.00	25	33
13	500112.15	266	5296	198	5.25	632	68	41.29	-7	49
14	611207.21	465	2249	197	20.58	2939	261	43.26	2	60
15	561224.19	226	755	193	28.09	133	30	36.43	26	40
16	551212.23	360	2245	184	19.80	2474	174	46.22	10	62
17	551111.14	211	3522	179	12.32	237	32	39.41	-4	43
18	550103.17	191	1008	176	26.27	22	9	34.44	19	36
19	620116.17	177	3009	175	14.81	6	1	38.00	-3	38
20	481222.15	237	2396	167	17.65	422	57	39.40	8	47
21	540115.17	182	3132	166	13.13	46	13	35.54	-6	37
22	511229.22	170	2817	166	15.03	12	2	38.00	6	38
23	631209.16	278	992	161	25.84	193	53	35.64	15	44
24	510126.22	244	2943	157	13.25	673	87	39.74	2	48
25	610120.21	165	386	155	29.51	14	5	34.80	27	36
26	760131.05	156	769	148	26.80	7	3	34.33	11	35
27	541217.15	142	915	140	25.46	6	2	35.00	19	36
28	601206.18	143	1113	137	23.88	13	5	34.60	20	36
29	480114.15	137	835	136	25.86	10	1	42.00	24	42
30	540206.21	531	488	136	28.41	5581	389	46.35	25	63
31	750204.13	255	1041	135	24.29	1509	117	44.90	17	63
32	590101.23	136	2546	134	13.00	1	1	33.00	-1	33
33	630126.16	137	1833	134	18.32	6	3	34.00	3	36
34	511222.21	138	1536	134	20.54	4	2	34.00	14	35
35	771118.11	467	1194	134	23.09	4470	328	45.63	11	62
36	571231.00	134	720	133	26.59	1	1	33.00	23	33
37	751216.21	143	439	133	28.70	7	7	33.00	26	33
38	631130.12	183	695	126	26.48	294	48	38.13	23	43
39	490101.17	147	1763	123	17.67	262	22	43.91	7	51
40	750126.16	122	1100	120	22.83	4	2	34.00	11	35
41	570218.19	343	1016	120	23.53	3188	222	46.36	9	61
42	641215.14	120	2869	119	7.89	4	1	36.00	-5	36
43	630109.18	156	2183	113	12.68	338	41	40.24	-2	45
44	511210.16	114	607	113	26.63	1	1	33.00	22	33
45	611124.23	286	595	110	26.59	1944	172	43.30	18	53
46	601214.04	162	409	109	28.25	357	51	39.00	24	48
47	560214.19	200	1728	108	16.00	571	84	38.80	1	54
48	781118.19	118	752	108	25.04	1	1	33.00	21	33
49	620109.18	130	770	107	24.80	79	21	35.76	19	40
50	651214.19	130	742	106	25.00	130	20	38.50	21	45

ORDER STATISTICS AT WALLA WALLA
 SORTED BY HOURS BELOW 32

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
51	601227.00	111	570	106	26.62	6	2	35.00	22	36
52	600301.18	101	946	100	22.54	1	1	33.00	17	33
53	551228.16	102	773	97	24.03	8	4	34.00	16	35
54	621223.02	314	573	96	26.03	2834	212	45.37	21	57
55	540201.06	135	143	96	30.51	1	1	33.00	30	33
56	591115.04	263	1170	95	19.68	3329	166	52.05	5	66
57	770127.16	96	337	93	28.38	1	1	33.00	27	33
58	500101.17	100	1778	92	12.67	37	8	36.63	1	39
59	521222.19	92	533	91	26.14	1	1	33.00	22	33
60	650111.17	172	395	91	27.66	44	36	33.22	21	35
61	620223.18	96	987	90	21.03	11	5	34.20	11	35
62	601220.22	101	294	89	28.70	24	7	35.43	28	37
63	770123.02	110	140	88	30.41	2	2	33.00	29	33
64	761202.17	229	408	87	27.31	1728	138	44.52	21	57
65	610101.14	419	770	86	23.05	4685	329	46.24	19	63
66	480204.04	86	898	85	21.44	3	1	35.00	11	35
67	561205.01	474	1508	84	14.05	5425	390	45.91	6	59
68	781205.14	91	833	84	22.08	1	1	33.00	7	33
69	480209.19	226	585	82	24.87	2181	142	47.36	17	68
70	510106.01	87	361	82	27.60	2	2	33.00	25	33
71	481215.18	147	1015	77	18.82	313	64	36.89	9	44
72	550126.05	88	259	77	28.64	7	5	33.40	27	34
73	570103.05	136	318	75	27.76	468	59	39.93	24	48
74	580105.14	90	299	73	27.90	85	16	37.31	24	40
75	600109.17	71	819	69	20.13	2	2	33.00	11	33
76	520121.17	71	525	69	24.39	1	1	33.00	18	33
77	760119.18	101	214	69	28.90	167	29	37.76	28	42
78	581207.23	121	236	68	28.53	210	32	38.56	26	48
79	601128.00	71	220	68	28.76	1	1	33.00	27	33
80	770131.16	88	136	68	30.00	8	8	33.00	29	33
81	600225.18	72	675	67	21.93	8	4	34.00	13	35
82	781110.17	72	550	67	23.79	20	5	36.00	9	37
83	751231.17	72	373	67	26.43	4	3	33.33	20	34
84	630122.19	70	491	66	24.56	7	4	33.75	16	34
85	591207.17	80	191	66	29.11	22	9	34.44	28	39
86	541130.17	76	282	64	27.59	53	10	37.30	22	41
87	771220.00	70	219	63	28.52	3	2	33.50	27	34
88	581213.00	64	178	63	29.17	1	1	33.00	28	33
89	780302.18	297	162	62	29.39	2471	231	42.70	26	61
90	761220.16	83	268	61	27.61	115	22	37.23	26	41
91	501204.14	89	244	61	28.00	183	26	39.04	25	43
92	490218.23	65	329	59	26.42	9	2	36.50	22	40
93	630118.06	59	591	56	21.45	2	1	34.00	12	34
94	751118.02	66	177	55	28.78	7	5	33.40	24	34
95	491209.21	75	203	54	28.24	60	16	35.75	23	38
96	751128.01	58	332	53	25.74	24	5	36.80	21	40
97	511219.04	89	512	52	22.15	265	35	39.57	15	48
98	581115.08	57	434	52	23.65	3	2	33.50	16	34
99	520115.06	58	399	52	24.33	4	2	34.00	19	35
100	551126.23	111	131	52	29.48	172	46	35.74	28	41

ORDER STATISTICS AT PENDLETON
 SORTED BY DEGREES BELOW 32

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
1	570112.16	469	10585	437	7.78	198	32	38.19	-19	41
2	500123.18	414	9582	324	2.43	484	87	37.56	-17	45
3	721202.17	353	8537	343	7.11	37	9	36.11	-12	39
4	731231.05	490	7261	297	7.55	3338	192	49.39	-7	68
5	690118.00	336	6455	316	11.57	45	15	35.00	-4	39
6	490118.17	357	6357	355	14.09	4	2	34.00	-6	34
7	720125.00	307	5800	302	12.79	6	3	34.00	-5	35
8	600107.23	458	5752	442	18.99	49	12	36.08	0	40
9	500112.16	266	5164	198	5.92	633	67	41.45	-6	52
10	560125.15	290	5073	282	14.01	1	1	33.00	-9	33
11	761229.19	350	4900	346	17.84	4	3	33.33	2	34
12	681228.00	261	4769	186	6.36	646	71	41.10	-11	52
13	730102.21	413	4077	228	14.12	2549	184	45.85	-5	59
14	490107.17	215	3701	211	14.46	2	1	34.00	2	34
15	551111.18	174	3590	171	11.01	48	3	48.00	-5	52
16	620117.07	457	3363	166	11.74	3867	289	45.38	-9	62
17	641215.12	115	3062	112	4.66	4	3	33.33	-12	34
18	510126.22	152	3015	151	12.03	1	1	33.00	-1	33
19	511229.15	177	2838	168	15.11	22	5	36.40	4	38
20	630109.17	178	2584	110	8.51	523	68	39.69	-9	44
21	590101.23	311	2501	124	11.83	2363	184	44.84	-1	63
22	481222.14	174	2465	167	17.24	19	7	34.71	8	37
23	551213.00	356	2351	185	19.29	2039	167	44.21	10	63
24	521122.16	493	2311	232	22.04	2853	259	43.02	15	59
25	691231.18	239	2117	232	22.88	2	2	33.00	12	33
26	611208.18	174	2100	171	19.72	2	1	34.00	3	34
27	540118.01	124	2013	94	10.59	286	30	41.53	-4	57
28	630126.17	370	2002	168	20.08	2296	197	43.65	1	63
29	500101.16	150	1764	93	13.03	314	53	37.92	-3	47
30	490101.16	145	1753	122	17.63	177	21	40.43	8	45
31	771118.00	499	1726	152	20.64	3850	326	43.81	10	59
32	511222.23	160	1551	142	21.08	120	16	39.50	12	42
33	591227.16	194	1528	185	23.74	12	5	34.40	13	35
34	671212.15	133	1464	112	18.93	46	17	34.71	4	38
35	560214.16	92	1441	89	15.81	2	1	34.00	2	34
36	561205.03	406	1416	81	14.52	4677	325	46.39	8	59
37	781118.18	268	1379	222	25.79	167	42	35.98	20	40
38	710101.17	221	1327	136	22.24	1032	84	44.29	13	50
39	631208.23	218	1277	179	24.87	5	5	33.00	10	33
40	591115.04	257	1264	98	19.10	3129	157	51.93	5	65
41	601206.17	183	1257	165	24.38	49	14	35.50	20	42
42	711225.19	184	1238	122	21.85	573	59	41.71	15	50
43	571231.15	218	1207	207	26.17	37	9	36.11	19	38
44	570218.20	537	1197	120	22.03	4543	392	43.59	7	61
45	760201.01	162	1154	142	23.87	26	7	35.71	7	38
46	480204.06	133	1130	87	19.01	300	44	38.82	4	51
47	481215.17	130	1127	81	18.09	254	47	37.40	8	44
48	600301.17	201	1125	109	21.68	634	90	39.04	14	48
49	781109.19	118	1124	110	21.78	11	5	34.20	8	36
50	480114.17	243	1096	160	25.15	996	81	44.30	22	52

ORDER STATISTICS AT PENDLETON
 SORTED BY DEGREES BELOW 32

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
51	561123.20	220	1058	207	26.89	33	13	34.54	24	37
52	691125.19	218	984	198	27.03	29	10	34.90	22	37
53	680126.18	98	977	85	20.51	94	12	39.83	13	43
54	600225.18	96	974	89	21.06	11	5	34.20	11	35
55	650110.05	304	959	251	28.18	197	37	37.32	18	43
56	671218.04	85	957	83	20.47	2	1	34.00	12	34
57	620223.17	97	937	91	21.70	11	5	34.20	12	35
58	781205.15	118	936	90	21.60	45	20	34.25	10	36
59	561225.03	216	907	184	27.07	146	30	36.87	24	42
60	520121.18	113	897	110	23.85	3	1	35.00	11	35
61	541217.16	120	867	117	24.59	1	1	33.00	19	33
62	581125.16	102	823	100	23.77	1	1	33.00	18	33
63	770127.18	299	814	274	29.03	9	9	33.00	25	33
64	701121.14	319	813	61	18.67	1612	251	38.42	8	59
65	560206.17	182	802	87	22.78	645	88	39.33	17	48
66	550105.13	247	789	135	26.16	644	111	37.80	23	48
67	620109.17	130	789	110	24.83	75	17	36.41	17	41
68	651213.21	154	776	131	26.08	107	19	37.63	21	42
69	540201.04	671	724	257	29.18	5345	398	45.43	25	64
70	610101.18	398	721	82	23.21	4134	313	45.21	21	60
71	511210.17	206	704	112	25.71	569	91	38.25	20	48
72	540115.18	55	669	53	19.38	4	2	34.00	14	35
73	551228.16	90	662	88	24.48	2	1	34.00	18	34
74	521222.22	98	656	96	25.17	3	1	35.00	20	35
75	480131.16	72	655	68	22.37	8	4	34.00	11	35
76	490211.15	177	650	56	20.39	1023	104	41.84	10	57
77	750204.18	249	638	131	27.13	1522	114	45.35	22	61
78	631130.17	177	602	125	27.18	329	47	39.00	26	45
79	480209.19	225	592	84	24.95	1955	138	46.17	16	65
80	750110.03	264	576	56	21.71	1977	176	43.23	14	59
81	621223.00	314	566	99	26.28	2449	206	43.89	19	59
82	601227.06	109	557	102	26.54	15	5	35.00	24	36
83	591112.13	52	537	49	21.04	1	1	33.00	9	33
84	630118.08	57	533	54	22.13	3	3	33.00	13	33
85	700115.23	311	529	100	26.71	1708	207	40.25	21	58
86	611125.05	112	526	102	26.84	15	5	35.00	21	38
87	550303.18	47	506	43	20.23	5	3	33.67	11	34
88	750127.16	108	496	83	26.02	121	21	37.76	21	40
89	660123.20	197	490	90	26.56	666	100	38.66	22	48
90	681218.22	96	486	91	26.66	8	3	34.67	20	36
91	570201.05	50	437	39	20.79	20	8	34.50	9	36
92	581115.18	221	432	56	24.29	2661	162	48.43	15	68
93	751127.18	180	429	58	24.60	2291	117	51.58	17	64
94	610120.07	179	411	169	29.57	9	5	33.80	25	35
95	601214.20	146	400	92	27.65	319	47	38.79	25	49
96	490219.00	64	392	61	25.57	1	1	33.00	22	33
97	480127.17	47	371	42	23.17	4	2	34.00	16	34
98	691204.21	124	370	106	28.51	27	9	35.00	23	38
99	660117.06	107	368	93	28.04	20	6	35.33	19	38
100	491218.21	140	365	38	22.39	904	102	40.86	19	52

ORDER STATISTICS AT WALLA WALLA
 SORTED BY DEGREES BELOW 32

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
1	570112.16	435	10325	434	8.21	1	1	33.00	-15	33
2	500123.19	416	9672	322	1.96	702	92	39.63	-16	45
3	740101.08	858	8028	285	3.83	7692	568	45.54	-10	65
4	490118.17	393	6906	387	14.16	8	4	34.00	-4	36
5	560124.22	480	6223	393	16.17	619	85	39.28	-8	47
6	500112.15	266	5296	198	5.25	632	68	41.29	-7	49
7	761229.12	355	4849	353	18.26	1	1	33.00	-2	33
8	600112.16	447	4211	329	19.20	1607	116	45.85	7	61
9	490107.20	230	3751	219	14.87	40	11	35.64	4	39
10	551111.14	211	3522	179	12.32	237	32	39.41	-4	43
11	771222.22	410	3314	322	21.71	586	75	39.81	2	51
12	540115.17	182	3132	166	13.13	46	13	35.54	-6	37
13	620116.17	177	3009	175	14.81	6	1	38.00	-3	38
14	510126.22	244	2943	157	13.25	673	87	39.74	2	48
15	641215.14	120	2869	119	7.89	4	1	36.00	-5	36
16	511229.22	170	2817	166	15.03	12	2	38.00	6	38
17	590101.23	136	2546	134	13.00	1	1	33.00	-1	33
18	481222.15	237	2396	167	17.65	422	57	39.40	8	47
19	521121.17	683	2372	249	22.47	3376	419	40.06	14	55
20	611207.21	465	2249	197	20.58	2939	261	43.26	2	60
21	551212.23	360	2245	184	19.80	2474	174	46.22	10	62
22	630109.18	156	2183	113	12.68	338	41	40.24	-2	45
23	630126.16	137	1833	134	18.32	6	3	34.00	3	36
24	500101.17	100	1778	92	12.67	37	8	36.63	1	39
25	490101.17	147	1763	123	17.67	262	22	43.91	7	51
26	560214.19	200	1728	108	16.00	571	84	38.80	1	54
27	511222.21	138	1536	134	20.54	4	2	34.00	14	35
28	591226.22	227	1523	215	24.92	46	7	38.57	11	43
29	561205.01	474	1508	84	14.05	5425	390	45.91	6	59
30	771118.11	467	1194	134	23.09	4470	328	45.63	11	62
31	591115.04	263	1170	95	19.68	3329	166	52.05	5	66
32	601206.18	143	1113	137	23.88	13	5	34.60	20	36
33	750126.16	122	1100	120	22.83	4	2	34.00	11	35
34	750204.13	255	1041	135	24.29	1509	117	44.90	17	63
35	570218.19	343	1016	120	23.53	3188	222	46.36	9	61
36	481215.18	147	1015	77	18.82	313	64	36.89	9	44
37	550103.17	191	1008	176	26.27	22	9	34.44	19	36
38	631209.16	278	992	161	25.84	193	53	35.64	15	44
39	620223.18	96	987	90	21.03	11	5	34.20	11	35
40	600301.18	101	946	100	22.54	1	1	33.00	17	33
41	541217.15	142	915	140	25.46	6	2	35.00	19	36
42	480204.04	86	898	85	21.44	3	1	35.00	11	35
43	561123.19	215	865	210	27.88	1	1	33.00	25	33
44	480114.15	137	835	136	25.86	10	1	42.00	24	42
45	781205.14	91	833	84	22.08	1	1	33.00	7	33
46	600109.17	71	819	69	20.13	2	2	33.00	11	33
47	551228.16	102	773	97	24.03	8	4	34.00	16	35
48	620109.18	130	770	107	24.80	79	21	35.76	19	40
49	610101.14	419	770	86	23.05	4685	329	46.24	19	63
50	760131.05	156	769	148	26.80	7	3	34.33	11	35

ORDER STATISTICS AT WALLA WALLA
 SORTED BY DEGREES BELOW 32

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
51	561224.19	226	755	193	28.09	133	30	36.43	26	40
52	781118.19	118	752	108	25.04	1	1	33.00	21	33
53	651214.19	130	742	106	25.00	130	20	38.50	21	45
54	571231.00	134	720	133	26.59	1	1	33.00	23	33
55	631130.12	183	695	126	26.48	294	48	38.13	23	43
56	600225.18	72	675	67	21.93	8	4	34.00	13	35
57	511210.16	114	607	113	26.63	1	1	33.00	22	33
58	611124.23	286	595	110	26.59	1944	172	43.30	18	53
59	630118.06	59	591	56	21.45	2	1	34.00	12	34
60	480209.19	226	585	82	24.87	2181	142	47.36	17	68
61	621223.02	314	573	96	26.03	2834	212	45.37	21	57
62	601227.00	111	570	106	26.62	6	2	35.00	22	36
63	781110.17	72	550	67	23.79	20	5	36.00	9	37
64	490211.16	46	548	44	19.55	1	1	33.00	12	33
65	521222.19	92	533	91	26.14	1	1	33.00	22	33
66	750110.17	51	527	48	21.02	6	3	34.00	16	35
67	520121.17	71	525	69	24.39	1	1	33.00	18	33
68	511219.04	89	512	52	22.15	265	35	39.57	15	48
69	550303.20	46	494	42	20.24	12	4	35.00	11	36
70	630122.19	70	491	66	24.56	7	4	33.75	16	34
71	591112.15	61	489	51	22.41	71	9	39.89	12	43
72	540206.21	531	488	136	28.41	5581	389	46.35	25	63
73	751216.21	143	439	133	28.70	7	7	33.00	26	33
74	581115.08	57	434	52	23.65	3	2	33.50	16	34
75	601214.04	162	409	109	28.25	357	51	39.00	24	48
76	761202.17	229	408	87	27.31	1728	138	44.52	21	57
77	520115.06	58	399	52	24.33	4	2	34.00	19	35
78	520124.16	79	399	45	23.13	344	33	42.42	18	52
79	650111.17	172	395	91	27.66	44	36	33.22	21	35
80	610120.21	165	386	155	29.51	14	5	34.80	27	36
81	480201.13	63	377	45	23.62	68	16	36.25	12	41
82	751231.17	72	373	67	26.43	4	3	33.33	20	34
83	570201.04	48	373	43	23.33	1	1	33.00	13	33
84	581127.16	78	370	49	24.45	204	27	39.56	19	47
85	491218.23	46	364	36	21.89	29	9	35.22	19	37
86	510106.01	87	361	82	27.60	2	2	33.00	25	33
87	581125.17	47	352	44	24.00	1	1	33.00	18	33
88	770127.16	96	337	93	28.38	1	1	33.00	27	33
89	511207.18	53	336	45	24.53	4	3	33.33	19	34
90	751128.01	58	332	53	25.74	24	5	36.80	21	40
91	490218.23	65	329	59	26.42	9	2	36.50	22	40
92	570103.05	136	318	75	27.76	468	59	39.93	24	48
93	641225.01	46	306	39	24.15	42	7	38.00	20	40
94	580105.14	90	299	73	27.90	85	16	37.31	24	40
95	550226.05	135	295	42	24.98	423	90	36.70	20	48
96	601220.22	101	294	89	28.70	24	7	35.43	28	37
97	590120.12	228	284	51	26.43	2250	172	45.08	22	57
98	541130.17	76	282	64	27.59	53	10	37.30	22	41
99	761220.16	83	268	61	27.61	115	22	37.23	26	41
100	550126.05	88	259	77	28.64	7	5	33.40	27	34

ORDER STATISTICS AT PENDLETON
 SORTED BY AVERAGE TEMPERATURE BELOW 32

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
1	500123.18	414	9582	324	2.43	484	87	37.56	-17	45
2	641215.12	115	3062	112	4.66	4	3	33.33	-12	34
3	500112.16	266	5164	198	5.92	633	67	41.45	-6	52
4	681228.00	261	4769	186	6.36	646	71	41.10	-11	52
5	721202.17	353	8537	343	7.11	37	9	36.11	-12	39
6	731231.05	490	7261	297	7.55	3338	192	49.39	-7	68
7	570112.16	469	10585	437	7.78	198	32	38.19	-19	41
8	630109.17	178	2584	110	8.51	523	68	39.69	-9	44
9	540118.01	124	2013	94	10.59	286	30	41.53	-4	57
10	551111.18	174	3590	171	11.01	48	3	48.00	-5	52
11	690118.00	336	6455	316	11.57	45	15	35.00	-4	39
12	620117.07	457	3363	166	11.74	3867	289	45.38	-9	62
13	590101.23	311	2501	124	11.83	2363	184	44.84	-1	63
14	510126.22	152	3015	151	12.03	1	1	33.00	-1	33
15	720125.00	307	5800	302	12.79	6	3	34.00	-5	35
16	500101.16	150	1764	93	13.03	314	53	37.92	-3	47
17	560125.15	290	5073	282	14.01	1	1	33.00	-9	33
18	490118.17	357	6357	355	14.09	4	2	34.00	-6	34
19	730102.21	413	4077	228	14.12	2549	184	45.85	-5	59
20	490107.17	215	3701	211	14.46	2	1	34.00	2	34
21	561205.03	406	1416	81	14.52	4677	325	46.39	8	59
22	511229.15	177	2838	168	15.11	22	5	36.40	4	38
23	560214.16	92	1441	89	15.81	2	1	34.00	2	34
24	481222.14	174	2465	167	17.24	19	7	34.71	8	37
25	490101.16	145	1753	122	17.63	177	21	40.43	8	45
26	761229.19	350	4900	346	17.84	4	3	33.33	2	34
27	510202.06	2	14	1	18.00	6	1	38.00	18	38
28	481215.17	130	1127	81	18.09	254	47	37.40	8	44
29	701121.14	319	813	61	18.67	1612	251	38.42	8	59
30	671212.15	133	1464	112	18.93	46	17	34.71	4	38
31	600107.23	458	5752	442	18.99	49	12	36.08	0	40
32	480204.06	133	1130	87	19.01	300	44	38.82	4	51
33	591115.04	257	1264	98	19.10	3129	157	51.93	5	65
34	551213.00	356	2351	185	19.29	2039	167	44.21	10	63
35	540115.18	55	669	53	19.38	4	2	34.00	14	35
36	611208.18	174	2100	171	19.72	2	1	34.00	3	34
37	510202.08	104	12	1	20.00	626	99	38.32	20	50
38	630126.17	370	2002	168	20.08	2296	197	43.65	1	63
39	550303.18	47	506	43	20.23	5	3	33.67	11	34
40	490211.15	177	650	56	20.39	1023	104	41.84	10	57
41	671218.04	85	957	83	20.47	2	1	34.00	12	34
42	680126.18	98	977	85	20.51	94	12	39.83	13	43
43	771118.00	499	1726	152	20.64	3850	326	43.81	10	59
44	570201.05	50	437	39	20.79	20	8	34.50	9	36
45	630125.19	22	200	18	20.89	9	4	34.25	15	35
46	520323.12	209	11	1	21.00	3374	205	48.46	21	75
47	591112.13	52	537	49	21.04	1	1	33.00	9	33
48	600225.18	96	974	89	21.06	11	5	34.20	11	35
49	511222.23	160	1551	142	21.08	120	16	39.50	12	42
50	680106.18	121	196	18	21.11	693	90	39.70	16	55

ORDER STATISTICS AT PENDLETON
 SORTED BY AVERAGE TEMPERATURE BELOW 32

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
51	611116.18	23	183	17	21.24	33	6	37.50	16	40
52	650317.17	25	200	19	21.47	16	5	35.20	15	37
53	781205.15	118	936	90	21.60	45	20	34.25	10	36
54	600301.17	201	1125	109	21.68	634	90	39.04	14	48
55	620223.17	97	937	91	21.70	11	5	34.20	12	35
56	750110.03	264	576	56	21.71	1977	176	43.23	14	59
57	781109.19	118	1124	110	21.78	11	5	34.20	8	36
58	711225.19	184	1238	122	21.85	573	59	41.71	15	50
59	570218.20	537	1197	120	22.03	4543	392	43.59	7	61
60	521122.16	493	2311	232	22.04	2853	259	43.02	15	59
61	630118.08	57	533	54	22.13	3	3	33.00	13	33
62	511208.14	25	216	22	22.18	4	2	34.00	17	34
63	710101.17	221	1327	136	22.24	1032	84	44.29	13	50
64	480131.16	72	655	68	22.37	8	4	34.00	11	35
65	611115.19	23	154	16	22.38	19	5	35.80	18	36
66	491218.21	140	365	38	22.39	904	102	40.86	19	52
67	761201.18	23	157	17	22.76	19	5	35.80	17	38
68	560206.17	182	802	87	22.78	645	88	39.33	17	48
69	761126.18	25	175	19	22.79	6	4	33.50	17	34
70	691231.18	239	2117	232	22.88	2	2	33.00	12	33
71	711028.18	174	144	16	23.00	1712	147	43.65	19	58
72	520106.00	48	313	35	23.06	35	12	34.92	19	36
73	540328.19	25	125	14	23.07	69	11	38.27	19	42
74	480127.17	47	371	42	23.17	4	2	34.00	16	34
75	641220.07	7	53	6	23.17	3	1	35.00	20	35
76	490202.14	40	308	35	23.20	4	3	33.33	11	34
77	610101.18	398	721	82	23.21	4134	313	45.21	21	60
78	761202.17	24	174	20	23.30	2	2	33.00	16	33
79	761130.18	24	153	18	23.50	16	5	35.20	19	37
80	701225.17	151	339	40	23.53	1106	109	42.15	20	55
81	541226.18	23	141	17	23.71	31	5	38.20	20	40
82	591227.16	194	1528	185	23.74	12	5	34.40	13	35
83	581125.16	102	823	100	23.77	1	1	33.00	18	33
84	611120.17	108	131	16	23.81	842	85	41.91	20	59
85	720102.11	248	360	44	23.82	1835	202	41.08	15	53
86	651222.17	52	155	19	23.84	222	31	39.16	19	44
87	520121.18	113	897	110	23.85	3	1	35.00	11	35
88	761129.20	22	122	15	23.87	26	6	36.33	19	39
89	760201.01	162	1154	142	23.87	26	7	35.71	7	38
90	480309.18	24	154	19	23.89	9	4	34.25	16	36
91	641220.14	20	8	1	24.00	50	17	34.94	24	37
92	480310.18	31	119	15	24.07	97	14	38.93	22	45
93	781114.17	97	269	34	24.09	716	62	43.55	11	57
94	480125.18	47	324	41	24.10	17	5	35.40	18	37
95	520115.17	43	318	41	24.24	3	2	33.50	19	34
96	600229.18	23	155	20	24.25	1	1	33.00	21	33
97	690205.15	199	356	46	24.26	884	148	37.97	16	46
98	581115.18	221	432	56	24.29	2661	162	48.43	15	68
99	650318.18	27	122	16	24.38	64	11	37.82	21	43
100	601206.17	183	1257	165	24.38	49	14	35.50	20	42

ORDER STATISTICS AT WALLA WALLA
 SORTED BY AVERAGE TEMPERATURE BELOW 32

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
1	500123.19	416	9672	322	1.96	702	92	39.63	-16	45
2	740101.08	858	8028	285	3.83	7692	568	45.54	-10	65
3	500112.15	266	5296	198	5.25	632	68	41.29	-7	49
4	641215.14	120	2869	119	7.89	4	1	36.00	-5	36
5	570112.16	435	10325	434	8.21	1	1	33.00	-15	33
6	551111.14	211	3522	179	12.32	237	32	39.41	-4	43
7	500101.17	100	1778	92	12.67	37	8	36.63	1	39
8	630109.18	156	2183	113	12.68	338	41	40.24	-2	45
9	590101.23	136	2546	134	13.00	1	1	33.00	-1	33
10	540115.17	182	3132	166	13.13	46	13	35.54	-6	37
11	510126.22	244	2943	157	13.25	673	87	39.74	2	48
12	561205.01	474	1508	84	14.05	5425	390	45.91	6	59
13	490118.17	393	6906	387	14.16	8	4	34.00	-4	36
14	620116.17	177	3009	175	14.81	6	1	38.00	-3	38
15	490107.20	230	3751	219	14.87	40	11	35.64	4	39
16	511229.22	170	2817	166	15.03	12	2	38.00	6	38
17	560214.19	200	1728	108	16.00	571	84	38.80	1	54
18	560124.22	480	6223	393	16.17	619	85	39.28	-8	47
19	481222.15	237	2396	167	17.65	422	57	39.40	8	47
20	490101.17	147	1763	123	17.67	262	22	43.91	7	51
21	761229.12	355	4849	353	18.26	1	1	33.00	-2	33
22	630126.16	137	1833	134	18.32	6	3	34.00	3	36
23	500105.21	23	185	14	18.79	122	9	45.56	15	48
24	481215.18	147	1015	77	18.82	313	64	36.89	9	44
25	600112.16	447	4211	329	19.20	1607	116	45.85	7	61
26	490211.16	46	548	44	19.55	1	1	33.00	12	33
27	591115.04	263	1170	95	19.68	3329	166	52.05	5	66
28	551212.23	360	2245	184	19.80	2474	174	46.22	10	62
29	600109.17	71	819	69	20.13	2	2	33.00	11	33
30	550303.20	46	494	42	20.24	12	4	35.00	11	36
31	781113.17	24	208	18	20.44	32	6	37.33	15	40
32	511222.21	138	1536	134	20.54	4	2	34.00	14	35
33	611207.21	465	2249	197	20.58	2939	261	43.26	2	60
34	630125.17	23	216	19	20.63	5	3	33.67	14	35
35	750110.17	51	527	48	21.02	6	3	34.00	16	35
36	620223.18	96	987	90	21.03	11	5	34.20	11	35
37	781114.17	24	195	18	21.17	4	4	33.00	14	33
38	560101.22	16	161	15	21.27	7	1	39.00	18	39
39	480204.04	86	898	85	21.44	3	1	35.00	11	35
40	630118.06	59	591	56	21.45	2	1	34.00	12	34
41	771222.22	410	3314	322	21.71	586	75	39.81	2	51
42	491218.23	46	364	36	21.89	29	9	35.22	19	37
43	600225.18	72	675	67	21.93	8	4	34.00	13	35
44	480128.07	9	50	5	22.00	7	3	34.33	17	35
45	600228.18	25	189	19	22.05	22	5	36.40	15	38
46	781205.14	91	833	84	22.08	1	1	33.00	7	33
47	480127.20	11	99	10	22.10	3	1	35.00	19	35
48	511219.04	89	512	52	22.15	265	35	39.57	15	48
49	650317.18	25	157	16	22.19	52	8	38.50	18	42
50	591112.15	61	489	51	22.41	71	9	39.89	12	43

ORDER STATISTICS AT WALLA WALLA
 SORTED BY AVERAGE TEMPERATURE BELOW 32

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
51	521121.17	683	2372	249	22.47	3376	419	40.06	14	55
52	600301.18	101	946	100	22.54	1	1	33.00	17	33
53	480126.17	24	177	19	22.68	13	4	35.25	18	37
54	750126.16	122	1100	120	22.83	4	2	34.00	11	35
55	760206.17	25	164	18	22.89	33	6	37.50	19	40
56	610101.14	419	770	86	23.05	4685	329	46.24	19	63
57	771118.11	467	1194	134	23.09	4470	328	45.63	11	62
58	520124.16	79	399	45	23.13	344	33	42.42	18	52
59	650323.21	23	114	13	23.23	52	10	37.20	18	39
60	480128.16	25	166	19	23.26	10	4	34.50	18	37
61	570201.04	48	373	43	23.33	1	1	33.00	13	33
62	540328.19	26	119	14	23.50	87	11	39.91	18	43
63	570218.19	343	1016	120	23.53	3188	222	46.36	9	61
64	491220.21	23	169	20	23.55	7	2	35.50	20	36
65	480207.18	49	42	5	23.60	352	44	40.00	23	53
66	480201.13	63	377	45	23.62	68	16	36.25	12	41
67	581115.08	57	434	52	23.65	3	2	33.50	16	34
68	480309.18	25	141	17	23.71	29	8	35.63	18	39
69	781110.17	72	550	67	23.79	20	5	36.00	9	37
70	630120.17	24	147	18	23.83	22	4	37.50	19	39
71	611116.17	24	147	18	23.83	26	6	36.33	20	38
72	601206.18	143	1113	137	23.88	13	5	34.60	20	36
73	581125.17	47	352	44	24.00	1	1	33.00	18	33
74	761126.18	25	136	17	24.00	10	4	34.50	20	35
75	551228.16	102	773	97	24.03	8	4	34.00	16	35
76	611115.18	23	142	18	24.11	16	5	35.20	19	37
77	520106.00	51	259	33	24.15	56	17	35.29	20	38
78	641225.01	46	306	39	24.15	42	7	38.00	20	40
79	561118.15	24	149	19	24.16	7	3	34.33	19	36
80	781109.20	21	108	14	24.29	15	6	34.50	16	35
81	750204.13	255	1041	135	24.29	1509	117	44.90	17	63
82	520115.06	58	399	52	24.33	4	2	34.00	19	35
83	520121.17	71	525	69	24.39	1	1	33.00	18	33
84	581127.16	78	370	49	24.45	204	27	39.56	19	47
85	511207.18	53	336	45	24.53	4	3	33.33	19	34
86	480310.19	30	112	15	24.53	94	14	38.71	22	46
87	760303.18	25	134	18	24.56	20	6	35.33	19	37
88	630122.19	70	491	66	24.56	7	4	33.75	16	34
89	600229.19	23	139	19	24.68	4	3	33.33	20	34
90	761201.17	24	116	16	24.75	33	7	36.71	21	39
91	620109.18	130	770	107	24.80	79	21	35.76	19	40
92	480209.19	226	585	82	24.87	2181	142	47.36	17	68
93	570203.04	96	78	11	24.91	622	83	39.49	18	47
94	591226.22	227	1523	215	24.92	46	7	38.57	11	43
95	550226.05	135	295	42	24.98	423	90	36.70	20	48
96	651214.19	130	742	106	25.00	130	20	38.50	21	45
97	560102.14	16	35	5	25.00	178	11	48.18	23	51
98	590107.15	173	7	1	25.00	2615	171	47.29	25	64
99	781118.19	118	752	108	25.04	1	1	33.00	21	33
100	761130.17	24	122	18	25.22	22	6	35.67	20	37

ORDER STATISTICS AT PENDLETON
 SORTED BY MINIMUM TEMPERATURE

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
1	570112.16	469	10585	437	7.78	198	32	38.19	-19	41
2	500123.18	414	9582	324	2.43	484	87	37.56	-17	45
3	721202.17	353	8537	343	7.11	37	9	36.11	-12	39
4	641215.12	115	3062	112	4.66	4	3	33.33	-12	34
5	681228.00	261	4769	186	6.36	646	71	41.10	-11	52
6	560125.15	290	5073	282	14.01	1	1	33.00	-9	33
7	620117.07	457	3363	166	11.74	3867	289	45.38	-9	62
8	630109.17	178	2584	110	8.51	523	68	39.69	-9	44
9	731231.05	490	7261	297	7.55	3338	192	49.39	-7	68
10	490118.17	357	6357	355	14.09	4	2	34.00	-6	34
11	500112.16	266	5164	198	5.92	633	67	41.45	-6	52
12	720125.00	307	5800	302	12.79	6	3	34.00	-5	35
13	730102.21	413	4077	228	14.12	2549	184	45.85	-5	59
14	551111.18	174	3590	171	11.01	48	3	48.00	-5	52
15	690118.00	336	6455	316	11.57	45	15	35.00	-4	39
16	540118.01	124	2013	94	10.59	286	30	41.53	-4	57
17	500101.16	150	1764	93	13.03	314	53	37.92	-3	47
18	510126.22	152	3015	151	12.03	1	1	33.00	-1	33
19	590101.23	311	2501	124	11.83	2363	184	44.84	-1	63
20	600107.23	458	5752	442	18.99	49	12	36.08	0	40
21	630126.17	370	2002	168	20.08	2296	197	43.65	1	63
22	761229.19	350	4900	346	17.84	4	3	33.33	2	34
23	490107.17	215	3701	211	14.46	2	1	34.00	2	34
24	560214.16	92	1441	89	15.81	2	1	34.00	2	34
25	611208.18	174	2100	171	19.72	2	1	34.00	3	34
26	511229.15	177	2838	168	15.11	22	5	36.40	4	38
27	671212.15	133	1464	112	18.93	46	17	34.71	4	38
28	480204.06	133	1130	87	19.01	300	44	38.82	4	51
29	591115.04	257	1264	98	19.10	3129	157	51.93	5	65
30	570218.20	537	1197	120	22.03	4543	392	43.59	7	61
31	760201.01	162	1154	142	23.87	26	7	35.71	7	38
32	481222.14	174	2465	167	17.24	19	7	34.71	8	37
33	490101.16	145	1753	122	17.63	177	21	40.43	8	45
34	561205.03	406	1416	81	14.52	4677	325	46.39	8	59
35	481215.17	130	1127	81	18.09	254	47	37.40	8	44
36	781109.19	118	1124	110	21.78	11	5	34.20	8	36
37	701121.14	319	813	61	18.67	1612	251	38.42	8	59
38	591112.13	52	537	49	21.04	1	1	33.00	9	33
39	570201.05	50	437	39	20.79	20	8	34.50	9	36
40	551213.00	356	2351	185	19.29	2039	167	44.21	10	63
41	771118.00	499	1726	152	20.64	3850	326	43.81	10	59
42	631208.23	218	1277	179	24.87	5	5	33.00	10	33
43	781205.15	118	936	90	21.60	45	20	34.25	10	36
44	490211.15	177	650	56	20.39	1023	104	41.84	10	57
45	600225.18	96	974	89	21.06	11	5	34.20	11	35
46	520121.18	113	897	110	23.85	3	1	35.00	11	35
47	480131.16	72	655	68	22.37	8	4	34.00	11	35
48	550303.18	47	506	43	20.23	5	3	33.67	11	34
49	490202.14	40	308	35	23.20	4	3	33.33	11	34
50	781114.17	97	269	34	24.09	716	62	43.55	11	57

ORDER STATISTICS AT PENDLETON
SORTED BY MINIMUM TEMPERATURE

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
51	691231.18	239	2117	232	22.88	2	2	33.00	12	33
52	511222.23	160	1551	142	21.08	120	16	39.50	12	42
53	671218.04	85	957	83	20.47	2	1	34.00	12	34
54	620223.17	97	937	91	21.70	11	5	34.20	12	35
55	591227.16	194	1528	185	23.74	12	5	34.40	13	35
56	710101.17	221	1327	136	22.24	1032	84	44.29	13	50
57	680126.18	98	977	85	20.51	94	12	39.83	13	43
58	630118.08	57	533	54	22.13	3	3	33.00	13	33
59	600301.17	201	1125	109	21.68	634	90	39.04	14	48
60	540115.18	55	669	53	19.38	4	2	34.00	14	35
61	750110.03	264	576	56	21.71	1977	176	43.23	14	59
62	521122.16	493	2311	232	22.04	2853	259	43.02	15	59
63	711225.19	184	1238	122	21.85	573	59	41.71	15	50
64	581115.18	221	432	56	24.29	2661	162	48.43	15	68
65	720102.11	248	360	44	23.82	1835	202	41.08	15	53
66	650317.17	25	200	19	21.47	16	5	35.20	15	37
67	630125.19	22	200	18	20.89	9	4	34.25	15	35
68	480209.19	225	592	84	24.95	1955	138	46.17	16	65
69	480127.17	47	371	42	23.17	4	2	34.00	16	34
70	690205.15	199	356	46	24.26	884	148	37.97	16	46
71	781217.16	179	343	58	26.09	1144	115	41.95	16	51
72	680106.18	121	196	18	21.11	693	90	39.70	16	55
73	611116.18	23	183	17	21.24	33	6	37.50	16	40
74	761202.17	24	174	20	23.30	2	2	33.00	16	33
75	560101.10	208	171	23	24.57	1805	172	42.49	16	56
76	480309.18	24	154	19	23.89	9	4	34.25	16	36
77	560206.17	182	802	87	22.78	645	88	39.33	17	48
78	620109.17	130	789	110	24.83	75	17	36.41	17	41
79	751127.18	180	429	58	24.60	2291	117	51.58	17	64
80	701221.00	69	308	57	26.60	16	9	33.78	17	34
81	511208.14	25	216	22	22.18	4	2	34.00	17	34
82	500310.19	343	196	37	26.70	3444	304	43.33	17	59
83	761126.18	25	175	19	22.79	6	4	33.50	17	34
84	761201.18	23	157	17	22.76	19	5	35.80	17	38
85	650110.05	304	959	251	28.18	197	37	37.32	18	43
86	581125.16	102	823	100	23.77	1	1	33.00	18	33
87	551228.16	90	662	88	24.48	2	1	34.00	18	34
88	480125.18	47	324	41	24.10	17	5	35.40	18	37
89	711206.17	112	312	43	24.74	460	64	39.19	18	48
90	611115.19	23	154	16	22.38	19	5	35.80	18	36
91	630122.21	20	121	17	24.88	1	1	33.00	18	33
92	510202.06	2	14	1	18.00	6	1	38.00	18	38
93	571231.15	218	1207	207	26.17	37	9	36.11	19	38
94	541217.16	120	867	117	24.59	1	1	33.00	19	33
95	621223.00	314	566	99	26.28	2449	206	43.89	19	59
96	660117.06	107	368	93	28.04	20	6	35.33	19	38
97	491218.21	140	365	38	22.39	904	102	40.86	19	52
98	520115.17	43	318	41	24.24	3	2	33.50	19	34
99	520106.00	48	313	35	23.06	35	12	34.92	19	36
100	550226.04	111	288	44	25.45	273	60	36.55	19	52

ORDER STATISTICS AT WALLA WALLA
 SORTED BY MINIMUM TEMPERATURE

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
1	500123.19	416	9672	322	1.96	702	92	39.63	-16	45
2	570112.16	435	10325	434	8.21	1	1	33.00	-15	33
3	740101.08	858	8028	285	3.83	7692	568	45.54	-10	65
4	560124.22	480	6223	393	16.17	619	85	39.28	-8	47
5	500112.15	266	5296	198	5.25	632	68	41.29	-7	49
6	540115.17	182	3132	166	13.13	46	13	35.54	-6	37
7	641215.14	120	2869	119	7.89	4	1	36.00	-5	36
8	490118.17	393	6906	387	14.16	8	4	34.00	-4	36
9	551111.14	211	3522	179	12.32	237	32	39.41	-4	43
10	620116.17	177	3009	175	14.81	6	1	38.00	-3	38
11	761229.12	355	4849	353	18.26	1	1	33.00	-2	33
12	630109.18	156	2183	113	12.68	338	41	40.24	-2	45
13	590101.23	136	2546	134	13.00	1	1	33.00	-1	33
14	500101.17	100	1778	92	12.67	37	8	36.63	1	39
15	560214.19	200	1728	108	16.00	571	84	38.80	1	54
16	771222.22	410	3314	322	21.71	586	75	39.81	2	51
17	510126.22	244	2943	157	13.25	673	87	39.74	2	48
18	611207.21	465	2249	197	20.58	2939	261	43.26	2	60
19	630126.16	137	1833	134	18.32	6	3	34.00	3	36
20	490107.20	230	3751	219	14.87	40	11	35.64	4	39
21	591115.04	263	1170	95	19.68	3329	166	52.05	5	66
22	511229.22	170	2817	166	15.03	12	2	38.00	6	38
23	561205.01	474	1508	84	14.05	5425	390	45.91	6	59
24	600112.16	447	4211	329	19.20	1607	116	45.85	7	61
25	490101.17	147	1763	123	17.67	262	22	43.91	7	51
26	781205.14	91	833	84	22.08	1	1	33.00	7	33
27	481222.15	237	2396	167	17.65	422	57	39.40	8	47
28	570218.19	343	1016	120	23.53	3188	222	46.36	9	61
29	481215.18	147	1015	77	18.82	313	64	36.89	9	44
30	781110.17	72	550	67	23.79	20	5	36.00	9	37
31	551212.23	360	2245	184	19.80	2474	174	46.22	10	62
32	591226.22	227	1523	215	24.92	46	7	38.57	11	43
33	771118.11	467	1194	134	23.09	4470	328	45.63	11	62
34	750126.16	122	1100	120	22.83	4	2	34.00	11	35
35	620223.18	96	987	90	21.03	11	5	34.20	11	35
36	480204.04	86	898	85	21.44	3	1	35.00	11	35
37	600109.17	71	819	69	20.13	2	2	33.00	11	33
38	760131.05	156	769	148	26.80	7	3	34.33	11	35
39	550303.20	46	494	42	20.24	12	4	35.00	11	36
40	630118.06	59	591	56	21.45	2	1	34.00	12	34
41	490211.16	46	548	44	19.55	1	1	33.00	12	33
42	591112.15	61	489	51	22.41	71	9	39.89	12	43
43	480201.13	63	377	45	23.62	68	16	36.25	12	41
44	600225.18	72	675	67	21.93	8	4	34.00	13	35
45	570201.04	48	373	43	23.33	1	1	33.00	13	33
46	521121.17	683	2372	249	22.47	3376	419	40.06	14	55
47	511222.21	138	1536	134	20.54	4	2	34.00	14	35
48	630125.17	23	216	19	20.63	5	3	33.67	14	35
49	781114.17	24	195	18	21.17	4	4	33.00	14	33
50	631209.16	278	992	161	25.84	193	53	35.64	15	44

ORDER STATISTICS AT WALLA WALLA
SORTED BY MINIMUM TEMPERATURE

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
51	511219.04	89	512	52	22.15	265	35	39.57	15	48
52	781113.17	24	208	18	20.44	32	6	37.33	15	40
53	600228.18	25	189	19	22.05	22	5	36.40	15	38
54	500105.21	23	185	14	18.79	122	9	45.56	15	48
55	551228.16	102	773	97	24.03	8	4	34.00	16	35
56	750110.17	51	527	48	21.02	6	3	34.00	16	35
57	630122.19	70	491	66	24.56	7	4	33.75	16	34
58	581115.08	57	434	52	23.65	3	2	33.50	16	34
59	781109.20	21	108	14	24.29	15	6	34.50	16	35
60	750204.13	255	1041	135	24.29	1509	117	44.90	17	63
61	600301.18	101	946	100	22.54	1	1	33.00	17	33
62	480209.19	226	585	82	24.87	2181	142	47.36	17	68
63	480128.07	9	50	5	22.00	7	3	34.33	17	35
64	611124.23	286	595	110	26.59	1944	172	43.30	18	53
65	520121.17	71	525	69	24.39	1	1	33.00	18	33
66	520124.16	79	399	45	23.13	344	33	42.42	18	52
67	581125.17	47	352	44	24.00	1	1	33.00	18	33
68	480126.17	24	177	19	22.68	13	4	35.25	18	37
69	480128.16	25	166	19	23.26	10	4	34.50	18	37
70	560101.22	16	161	15	21.27	7	1	39.00	18	39
71	650317.18	25	157	16	22.19	52	8	38.50	18	42
72	781218.16	22	142	21	25.24	1	1	33.00	18	33
73	480309.18	25	141	17	23.71	29	8	35.63	18	39
74	540328.19	26	119	14	23.50	87	11	39.91	18	43
75	650323.21	23	114	13	23.23	52	10	37.20	18	39
76	570203.04	96	78	11	24.91	622	83	39.49	18	47
77	550103.17	191	1008	176	26.27	22	9	34.44	19	36
78	541217.15	142	915	140	25.46	6	2	35.00	19	36
79	620109.18	130	770	107	24.80	79	21	35.76	19	40
80	610101.14	419	770	86	23.05	4685	329	46.24	19	63
81	520115.06	58	399	52	24.33	4	2	34.00	19	35
82	581127.16	78	370	49	24.45	204	27	39.56	19	47
83	491218.23	46	364	36	21.89	29	9	35.22	19	37
84	511207.18	53	336	45	24.53	4	3	33.33	19	34
85	641230.18	127	170	31	26.52	745	92	40.10	19	48
86	760206.17	25	164	18	22.89	33	6	37.50	19	40
87	561118.15	24	149	19	24.16	7	3	34.33	19	36
88	630120.17	24	147	18	23.83	22	4	37.50	19	39
89	611115.18	23	142	18	24.11	16	5	35.20	19	37
90	760303.18	25	134	18	24.56	20	6	35.33	19	37
91	480127.20	11	99	10	22.10	3	1	35.00	19	35
92	601206.18	143	1113	137	23.88	13	5	34.60	20	36
93	751231.17	72	373	67	26.43	4	3	33.33	20	34
94	641225.01	46	306	39	24.15	42	7	38.00	20	40
95	550226.05	135	295	42	24.98	423	90	36.70	20	48
96	520106.00	51	259	33	24.15	56	17	35.29	20	38
97	491220.21	23	169	20	23.55	7	2	35.50	20	36
98	611116.17	24	147	18	23.83	26	6	36.33	20	38
99	600229.19	23	139	19	24.68	4	3	33.33	20	34
100	761126.18	25	136	17	24.00	10	4	34.50	20	35

APPENDIX C

Return Statistics

This appendix contains "return statistics" for each of the cold period freezing event characteristics at each of two sites (Pendleton, Oregon and Walla Walla, Washington). These statistics can be used to obtain an indication of the types of freezing events that are likely to occur once per year, twice per year, three times per year, and so on. The return period statistics are formulated by (1) sorting the events in order of decreasing (or increasing, in the cases of average temperature below 32°F and minimum temperature) value of the characteristic of interest; and (2) selecting and printing the characteristics for every 31st event (every 18th event for Walla Walla). The tables of return statistics are organized according to characteristic, with separate tables for each site. An index listing the location of each table is given in the table of contents for the appendices (p. 61).

RETURN STATISTICS AT PENDLETON
 SORTED BY HOURS BELOW 32

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
1	511229.15	177	2838	168	15.11	22	5	36.40	4	38
2	611125.05	112	526	102	26.84	15	5	35.00	21	38
3	590217.21	98	223	74	28.99	6	6	33.00	26	33
4	591112.13	52	537	49	21.04	1	1	33.00	9	33
5	520106.00	48	313	35	23.06	35	12	34.92	19	36
6	481213.23	42	36	23	30.43	23	9	34.56	30	36
7	680106.18	121	196	18	21.11	693	90	39.70	16	55
8	480109.15	61	84	17	27.06	248	41	38.05	24	48
9	641115.21	22	63	16	28.06	5	4	33.25	25	34
10	510213.20	32	44	15	29.07	43	13	35.31	26	39
11	641230.18	23	46	14	28.71	6	5	33.20	26	34
12	741223.19	103	45	13	28.54	737	88	40.38	27	51
13	711105.21	22	46	12	28.17	55	9	38.11	24	42
14	511030.23	20	48	11	27.64	44	8	37.50	23	41
15	540328.01	18	50	10	27.00	27	8	35.38	24	37
16	520311.22	175	23	10	29.70	1750	162	42.80	28	56
17	601104.23	22	24	9	29.33	113	12	41.42	27	48
18	640227.00	215	25	8	28.88	1999	203	41.85	27	57
19	480129.16	9	10	8	30.75	1	1	33.00	30	33
20	551205.14	113	17	7	29.57	884	106	40.34	28	49
21	521220.03	23	8	7	30.86	33	13	34.54	30	37
22	560314.00	554	14	6	29.67	7875	545	46.45	28	67
23	601122.01	141	8	6	30.67	1419	130	42.92	30	70
24	710304.03	10	11	5	29.80	11	4	34.75	29	37
25	640123.04	242	7	5	30.60	2046	230	40.90	30	54
26	691227.04	18	5	5	31.00	35	10	35.50	31	39
27	720403.04	165	6	4	30.50	2803	161	49.41	30	73
28	571122.03	166	4	4	31.00	2102	159	45.22	31	61
29	770223.05	6068	4	3	30.67	163809	6062	59.02	30	103
30	620328.03	27	3	3	31.00	195	23	40.48	31	50
31	660219.06	231	3	2	30.50	2526	225	43.23	30	56
32	481221.03	14	2	2	31.00	25	10	34.50	31	36
33	520126.11	42	2	2	31.00	307	39	39.87	31	47
34	531105.05	786	2	1	30.00	10663	782	45.64	30	71
35	540310.06	24	1	1	31.00	98	18	37.44	31	44
36	651220.07	40	1	1	31.00	227	38	37.97	31	48
37	581205.18	6	1	1	31.00	1	1	33.00	31	33
38	561115.01	88	1	1	31.00	948	86	43.02	31	60
39	630105.05	2	1	1	31.00	2	1	34.00	31	34

RETURN STATISTICS AT WALLA WALLA
SORTED BY HOURS BELOW 32

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
1	631209.16	278	992	161	25.84	193	53	35.64	15	44
2	601214.04	162	409	109	28.25	357	51	39.00	24	48
3	480209.19	226	585	82	24.87	2181	142	47.36	17	68
4	490218.23	65	329	59	26.42	9	2	36.50	22	40
5	550303.20	46	494	42	20.24	12	4	35.00	11	36
6	761219.03	37	144	31	27.35	9	3	35.00	23	36
7	511117.13	26	92	23	28.00	3	1	35.00	25	35
8	770114.16	25	128	19	25.26	27	4	38.75	22	42
9	641115.22	33	55	18	28.94	14	8	33.75	26	34
10	761201.17	24	116	16	24.75	33	7	36.71	21	39
11	760207.18	513	75	15	27.00	5570	495	43.25	25	61
12	760125.18	107	50	14	28.43	1021	88	43.60	28	57
13	741228.20	53	33	13	29.46	292	38	39.68	28	44
14	581117.17	173	34	12	29.17	2800	161	49.39	29	64
15	750201.05	13	23	11	29.91	2	1	34.00	28	34
16	480219.23	196	20	10	30.00	2103	182	43.55	29	57
17	640203.23	50	17	9	30.11	288	39	39.38	29	53
18	480305.00	114	23	8	29.13	911	105	40.68	27	53
19	650302.02	25	26	7	28.29	164	18	41.11	27	52
20	761224.20	10	14	7	30.00	1	1	33.00	29	33
21	540501.01	5093	15	6	29.50	144446	5082	60.42	28	98
22	750109.02	27	7	6	30.83	27	15	33.80	30	35
23	600312.04	3111	10	5	30.00	88903	3105	60.63	29	108
24	510316.02	21	5	5	31.00	93	15	38.20	31	42
25	560103.06	6	8	4	30.00	3	1	35.00	29	35
26	780112.05	145	4	4	31.00	548	134	36.09	31	41
27	630212.08	16	5	3	30.33	20	10	34.00	30	36
28	591207.06	11	3	3	31.00	20	6	35.33	31	41
29	761215.00	6	4	2	30.00	3	3	33.00	29	33
30	780123.07	17	2	2	31.00	62	11	37.64	31	41
31	600305.23	149	2	2	31.00	1057	139	39.60	31	50
32	550112.10	9	3	1	29.00	15	8	33.88	29	35
33	780118.06	121	1	1	31.00	833	110	39.57	31	49
34	571107.07	20	1	1	31.00	139	18	39.72	31	50
35	640108.07	86	1	1	31.00	593	84	39.06	31	45
36	611124.08	15	1	1	31.00	7	5	33.40	31	35

RETURN STATISTICS AT PENDLETON
 SORTED BY DEGREES BELOW 32

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
1	771118.00	499	1726	152	20.64	3850	326	43.81	10	59
2	581125.16	102	823	100	23.77	1	1	33.00	18	33
3	751127.18	180	429	58	24.60	2291	117	51.58	17	64
4	590120.08	232	266	59	27.49	2076	171	44.14	24	59
5	600229.18	23	155	20	24.25	1	1	33.00	21	33
6	720209.18	1066	118	39	28.97	15367	1021	47.05	28	73
7	511206.19	22	94	15	25.73	13	4	35.25	22	36
8	540302.22	23	80	11	24.73	74	11	38.73	21	42
9	510227.20	27	66	13	26.92	95	12	39.92	24	45
10	690220.19	52	55	33	30.33	44	11	36.00	27	39
11	550118.23	20	49	11	27.55	34	8	36.25	25	41
12	611106.21	26	42	12	28.50	107	13	40.23	26	48
13	481229.20	57	37	13	29.15	333	43	39.74	28	45
14	780201.00	217	32	18	30.22	2419	196	44.34	30	56
15	480304.23	104	29	10	29.10	820	92	40.91	26	52
16	650303.02	25	26	7	28.29	139	17	40.18	26	49
17	520311.22	175	23	10	29.70	1750	162	42.80	28	56
18	680125.22	20	20	9	29.78	40	9	36.44	29	40
19	710113.20	488	18	8	29.75	6782	474	46.31	28	64
20	481028.01	28	16	7	29.71	189	21	41.00	29	49
21	580119.03	17	14	6	29.67	23	7	35.29	28	37
22	741228.02	17	12	6	30.00	51	9	37.67	29	41
23	510223.22	47	10	8	30.75	233	38	38.13	30	45
24	701219.17	31	9	5	30.20	69	21	35.29	29	39
25	510317.02	24	8	5	30.40	111	16	38.94	30	44
26	571108.04	22	7	4	30.25	149	16	41.31	29	49
27	500307.03	25	6	4	30.50	157	20	39.85	30	47
28	690117.01	23	5	5	31.00	15	9	33.67	31	35
29	671207.22	95	4	4	31.00	976	90	42.84	31	55
30	630307.03	148	4	3	30.67	1592	135	43.79	30	62
31	530402.05	5137	3	2	30.50	148982	5133	61.02	30	98
32	751211.04	23	2	2	31.00	60	17	35.53	31	40
33	730318.01	479	2	2	31.00	6989	474	46.74	31	70
34	571116.07	17	2	1	30.00	51	15	35.40	30	37
35	490228.07	18	1	1	31.00	72	15	36.80	31	40
36	630303.02	3	1	1	31.00	1	1	33.00	31	33
37	510303.18	24	1	1	31.00	54	17	35.18	31	38
38	611112.06	18	1	1	31.00	143	15	41.53	31	51
39	620329.06	5587	1	1	31.00	159701	5585	60.59	31	102

RETURN STATISTICS AT WALLA WALLA
 SORTED BY DEGREES BELOW 32

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
1	630126.16	137	1833	134	18.32	6	3	34.00	3	36
2	600109.17	71	819	69	20.13	2	2	33.00	11	33
3	550303.20	46	494	42	20.24	12	4	35.00	11	36
4	570103.05	136	318	75	27.76	468	59	39.93	24	48
5	781114.17	24	195	18	21.17	4	4	33.00	14	33
6	761219.03	37	144	31	27.35	9	3	35.00	23	36
7	650109.21	44	114	37	28.92	9	4	34.25	26	35
8	551120.11	57	95	19	27.00	159	37	36.30	26	40
9	481208.23	118	78	20	28.10	766	97	39.90	26	45
10	511116.22	15	67	14	27.21	1	1	33.00	25	33
11	750203.01	36	55	25	29.80	2	1	34.00	28	34
12	630105.04	48	47	27	30.26	14	11	33.27	29	34
13	751222.20	56	39	15	29.40	164	29	37.66	28	48
14	530301.03	17	32	9	28.44	36	8	36.50	26	40
15	591219.00	16	28	9	28.89	9	5	33.80	26	35
16	491019.19	1053	24	12	30.00	16042	1039	47.44	28	69
17	580311.02	24	22	7	28.86	140	15	41.33	28	49
18	530223.02	20	19	6	28.83	89	13	38.85	28	44
19	590130.00	17	16	11	30.55	3	3	33.00	29	33
20	650109.01	20	14	8	30.25	56	11	37.09	29	40
21	570305.02	21	12	8	30.50	40	10	36.00	30	39
22	560110.20	35	10	7	30.57	81	21	35.86	30	42
23	540307.03	97	9	4	29.75	1425	91	47.66	29	65
24	480127.17	3	8	2	28.00	4	1	36.00	27	36
25	640323.06	17	7	4	30.25	71	12	37.92	30	42
26	631128.07	11	6	2	29.00	42	8	37.25	29	41
27	540123.07	25	5	3	30.33	74	22	35.36	30	38
28	650313.05	93	4	3	30.67	1462	88	48.61	30	67
29	500329.02	5383	3	3	31.00	162609	5374	62.26	31	102
30	781105.04	112	3	2	30.50	1718	107	48.06	30	71
31	631221.06	11	2	2	31.00	10	6	33.67	31	34
32	630209.06	48	2	2	31.00	134	42	35.19	31	37
33	781101.22	9	1	1	31.00	14	7	34.00	31	35
34	610405.05	24	1	1	31.00	321	23	45.96	31	58
35	591110.07	56	1	1	31.00	673	54	44.46	31	58
36	500101.01	6	1	1	31.00	2	1	34.00	31	34

RETURN STATISTICS AT PENDLETON
 SORTED BY AVERAGE TEMPERATURE BELOW 32

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
1	600107.23	458	5752	442	18.99	49	12	36.08	0	40
2	511208.14	25	216	22	22.18	4	2	34.00	17	34
3	781114.17	97	269	34	24.09	716	62	43.55	11	57
4	480113.16	25	143	21	25.19	4	3	33.33	22	34
5	571231.15	218	1207	207	26.17	37	9	36.11	19	38
6	561122.19	25	85	16	26.69	21	7	35.00	24	38
7	480109.15	61	84	17	27.06	248	41	38.05	24	48
8	741228.19	53	73	16	27.44	237	34	38.97	25	44
9	571230.20	19	63	15	27.80	6	2	35.00	23	35
10	660302.19	25	62	16	28.13	13	8	33.63	26	34
11	571104.01	25	29	8	28.38	128	16	40.00	27	48
12	480124.20	22	51	15	28.60	21	6	35.50	25	37
13	660418.02	24	16	5	28.80	186	19	41.79	26	51
14	671103.22	23	33	11	29.00	84	11	39.64	26	44
15	580306.23	29	26	9	29.11	146	20	39.30	28	50
16	770126.17	25	54	20	29.30	4	3	33.33	28	34
17	760301.01	18	23	9	29.44	40	8	37.00	28	40
18	610120.07	179	411	169	29.57	9	5	33.80	25	35
19	770113.18	151	62	27	29.70	1409	120	43.74	27	59
20	711017.02	258	13	6	29.83	3934	252	47.61	28	63
21	730221.01	24	14	7	30.00	122	14	40.71	29	48
22	540124.11	4	2	1	30.00	3	2	33.50	30	34
23	701219.17	31	9	5	30.20	69	21	35.29	29	39
24	650202.01	50	47	28	30.32	12	8	33.50	29	34
25	591217.04	22	8	5	30.40	49	11	36.45	29	38
26	691122.04	22	6	4	30.50	127	17	39.47	30	49
27	631028.06	564	3	2	30.50	7064	560	44.61	30	68
28	601122.01	141	8	6	30.67	1419	130	42.92	30	70
29	690219.03	25	9	7	30.71	20	10	34.00	30	36
30	521220.03	23	8	7	30.86	33	13	34.54	30	37
31	691227.04	18	5	5	31.00	35	10	35.50	31	39
32	620115.18	6	3	3	31.00	1	1	33.00	31	33
33	611030.02	27	2	2	31.00	175	20	40.75	31	51
34	600311.01	26	2	2	31.00	111	22	37.05	31	46
35	520129.18	3	1	1	31.00	2	1	34.00	31	34
36	650201.07	18	1	1	31.00	85	16	37.31	31	42
37	591211.01	50	1	1	31.00	545	47	43.60	31	52
38	490117.01	5	1	1	31.00	9	3	35.00	31	36
39	621222.08	16	1	1	31.00	66	13	37.08	31	42

RETURN STATISTICS AT WALLA WALLA
 SORTED BY AVERAGE TEMPERATURE BELOW 32

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
1	500105.21	23	185	14	18.79	122	9	45.56	15	48
2	781205.14	91	833	84	22.08	1	1	33.00	7	33
3	781110.17	72	550	67	23.79	20	5	36.00	9	37
4	480209.19	226	585	82	24.87	2181	142	47.36	17	68
5	761129.18	23	100	16	25.75	33	7	36.71	23	39
6	760302.19	23	111	20	26.45	2	2	33.00	22	33
7	641229.13	29	51	10	26.90	113	19	37.95	25	41
8	761202.17	229	408	87	27.31	1728	138	44.52	21	57
9	491018.20	23	60	14	27.71	66	9	39.33	24	43
10	611104.22	22	47	12	28.08	54	10	37.40	25	41
11	591206.18	12	18	5	28.40	67	7	41.57	27	45
12	510301.22	21	46	14	28.71	29	7	36.14	26	38
13	591219.00	16	28	9	28.89	9	5	33.80	26	35
14	571102.04	20	12	4	29.00	139	15	41.27	28	51
15	581213.00	64	178	63	29.17	1	1	33.00	28	33
16	760229.03	23	13	5	29.40	114	17	38.71	28	45
17	520218.18	12	17	7	29.57	11	5	34.20	29	35
18	550305.18	173	32	14	29.71	1910	159	44.01	26	65
19	650303.03	27	11	5	29.80	185	19	41.74	29	53
20	550124.02	51	18	9	30.00	331	42	39.88	29	48
21	761215.00	6	4	2	30.00	3	3	33.00	29	33
22	631120.19	180	21	11	30.09	2751	169	48.28	29	64
23	650105.05	92	7	4	30.25	487	81	38.01	29	56
24	651211.06	65	5	3	30.33	269	60	36.48	30	39
25	570215.02	89	14	9	30.44	130	68	33.91	30	37
26	530402.05	5137	3	2	30.50	155415	5132	62.28	30	100
27	501110.16	28	22	16	30.63	25	10	34.50	30	36
28	540127.12	42	10	8	30.75	281	34	40.26	30	43
29	591221.19	47	22	22	31.00	4	3	33.33	31	34
30	501204.01	13	5	5	31.00	4	3	33.33	31	34
31	520331.04	5169	3	3	31.00	168865	5165	64.69	31	102
32	621212.07	193	2	2	31.00	1751	191	41.17	31	59
33	750121.07	123	1	1	31.00	1148	121	41.49	31	52
34	480130.07	11	1	1	31.00	70	10	39.00	31	44
35	580302.05	94	1	1	31.00	831	90	41.23	31	53
36	570108.21	3	1	1	31.00	1	1	33.00	31	33

RETURN STATISTICS AT PENDLETON
 SORTED BY MINIMUM TEMPERATURE

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
1	760201.01	162	1154	142	23.87	26	7	35.71	7	38
2	521122.16	493	2311	232	22.04	2853	259	43.02	15	59
3	571231.15	218	1207	207	26.17	37	9	36.11	19	38
4	550209.18	25	120	16	24.50	33	9	35.67	20	38
5	691125.19	218	984	198	27.03	29	10	34.90	22	37
6	481221.17	21	93	17	26.53	7	3	34.33	23	35
7	501204.02	117	257	71	28.38	244	41	37.95	24	42
8	741222.22	21	60	13	27.38	21	6	35.50	24	37
9	691210.01	140	78	22	28.45	1669	116	46.39	25	58
10	510222.21	25	40	12	28.67	60	11	37.45	25	42
11	561119.16	26	76	17	27.53	40	8	37.00	26	41
12	580312.00	26	36	9	28.00	130	16	40.13	26	47
13	760119.19	105	169	68	29.51	193	34	37.68	27	44
14	641231.17	75	33	11	29.00	417	59	39.07	27	44
15	650301.02	21	24	7	28.57	90	13	38.92	27	45
16	551127.00	136	118	50	29.64	395	75	37.27	28	46
17	680213.00	20	26	11	29.64	19	8	34.38	28	36
18	510106.01	11	18	9	30.00	3	2	33.50	28	34
19	721121.03	17	11	5	29.80	83	10	40.30	28	46
20	690224.21	51	26	17	30.47	47	15	35.13	29	39
21	690312.00	27	15	8	30.13	123	15	40.20	29	46
22	650323.03	18	11	5	29.80	50	11	36.55	29	39
23	491204.18	53	7	4	30.25	304	44	38.91	29	49
24	750108.19	32	20	14	30.57	3	3	33.00	30	33
25	500109.02	45	9	7	30.71	256	37	38.92	30	49
26	531104.02	27	7	5	30.60	157	19	40.26	30	48
27	780130.06	10	5	4	30.75	2	2	33.00	30	33
28	550115.20	5	4	3	30.67	2	1	34.00	30	34
29	570313.05	5612	3	2	30.50	162295	5605	60.96	30	96
30	481108.23	2	2	1	30.00	1	1	33.00	30	33
31	690307.22	28	5	5	31.00	78	16	36.88	31	42
32	651125.03	91	3	3	31.00	719	84	40.56	31	48
33	530221.06	43	2	2	31.00	297	40	39.43	31	49
34	640107.02	17	2	2	31.00	56	11	37.09	31	41
35	701114.01	6	1	1	31.00	4	3	33.33	31	34
36	550116.07	64	1	1	31.00	325	62	37.24	31	44
37	721217.10	279	1	1	31.00	4192	276	47.19	31	66
38	510111.06	119	1	1	31.00	985	101	41.75	31	56
39	591202.19	34	1	1	31.00	233	32	39.28	31	48

RETURN STATISTICS AT WALLA WALLA
SORTED BY MINIMUM TEMPERATURE

	DATE EVENT STARTED (YYMMDD.HH)	DURATION (HOURS)	DEGREES BELOW 32	HOURS BELOW 32	AVE. TEMP BELOW 32 (DEG F)	DEGREES ABOVE 32	HOURS ABOVE 32	AVE. TEMP ABOVE 32 (DEG F)	MINIMUM TEMPERATURE (DEG F)	MAXIMUM TEMPERATURE (DEG F)
1	561205.01	474	1508	84	14.05	5425	390	45.91	6	59
2	521121.17	683	2372	249	22.47	3376	419	40.06	14	55
3	480128.16	25	166	19	23.26	10	4	34.50	18	37
4	601206.18	143	1113	137	23.88	13	5	34.60	20	36
5	480125.20	21	107	17	25.71	13	4	35.25	21	37
6	611114.23	19	66	12	26.50	26	6	36.33	22	38
7	581124.22	19	71	15	27.27	5	3	33.67	23	34
8	761129.00	18	48	10	27.20	28	7	36.00	24	38
9	560311.19	54	70	13	26.62	313	40	39.83	25	47
10	581207.23	121	236	68	28.53	210	32	38.56	26	48
11	480124.23	21	43	11	28.09	44	9	36.89	26	41
12	771220.00	70	219	63	28.52	3	2	33.50	27	34
13	600222.23	59	35	10	28.50	268	46	37.83	27	45
14	480312.01	5245	20	7	29.14	149534	5235	60.56	27	102
15	760125.18	107	50	14	28.43	1021	88	43.60	28	57
16	541225.23	18	25	10	29.50	30	7	36.29	28	38
17	651222.05	13	16	5	28.80	20	7	34.86	28	36
18	781031.03	23	9	5	30.20	161	18	40.94	28	52
19	590207.22	72	31	13	29.62	384	53	39.25	29	50
20	491207.00	69	17	11	30.45	233	53	36.40	29	45
21	480228.03	95	13	6	29.83	661	88	39.51	29	49
22	560103.06	6	8	4	30.00	3	1	35.00	29	35
23	481109.06	426	4	2	30.00	4773	415	43.50	29	67
24	581205.02	23	14	8	30.25	42	14	35.00	30	39
25	571215.05	375	8	6	30.67	4109	367	43.20	30	58
26	600131.07	406	6	4	30.50	4854	397	44.23	30	59
27	761229.08	4	4	3	30.67	1	1	33.00	30	33
28	540311.04	20	3	2	30.50	76	15	37.07	30	43
29	591221.19	47	22	22	31.00	4	3	33.33	31	34
30	550314.03	17	5	5	31.00	68	11	38.18	31	41
31	520217.04	14	3	3	31.00	15	7	34.14	31	35
32	621212.07	193	2	2	31.00	1751	191	41.17	31	59
33	750126.10	6	1	1	31.00	4	3	33.33	31	34
34	571204.23	6	1	1	31.00	6	4	33.50	31	34
35	490328.06	2550	1	1	31.00	78854	2548	62.95	31	99
36	570130.19	33	1	1	31.00	185	32	37.78	31	41

APPENDIX D

Joint Distributions

The tables in this appendix contain the joint distributions of several pairs of freezing event characteristics at two sites (Pendleton, Oregon and Walla Walla Washington). The tables are divided into ten categories for each of the two characteristics (ten rows and ten columns) resulting in 100 joint categories or "cells" in each table. Each cell contains two quantities, the number of events in the cell and the overall relative frequency of the events in the cell. The column and row totals also summarize the marginal distributions for the two characteristics in the form of the row/column absolute and relative frequencies. The tables of joint frequencies are organized by characteristic, with separate tables for each site. An index listing the location of each table is given in the table of contents for the appendices (p. 61).

JOINT FREQUENCIES AND OVERALL RELATIVE FREQUENCIES FOR PENDLETON

LOWER BOUNDS FOR INTERVALS OF NUMBER OF HOURS BELOW 32F	LOWER BOUNDS FOR INTERVALS OF AVERAGE TEMPERATURE BELOW 32F (DEG F)										ROW TOTALS
	3	6	9	12	15	18	21	24	27	30 AND ABOVE	
0	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	3 .0025	18 .0148	69 .0566	383 .3142	577 .4733	1050 .8614
30	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	4 .0033	9 .0074	21 .0172	21 .0172	7 .0057	62 .0509
60	0 0.0000	0 0.0000	0 0.0000	1 .0008	1 .0008	5 .0041	4 .0033	6 .0049	13 .0107	1 .0008	31 .0254
90	1 .0008	1 .0008	1 .0008	1 .0008	0 0.0000	2 .0016	6 .0049	10 .0082	5 .0041	0 0.0000	27 .0221
120	0 0.0000	0 0.0000	1 .0008	0 0.0000	1 .0008	0 0.0000	5 .0041	2 .0016	2 .0016	0 0.0000	11 .0090
150	0 0.0000	0 0.0000	2 .0016	1 .0008	2 .0016	3 .0025	0 0.0000	3 .0025	1 .0008	0 0.0000	12 .0098
180	1 .0008	1 .0008	0 0.0000	0 0.0000	0 0.0000	1 .0008	1 .0008	2 .0016	2 .0016	0 0.0000	8 .0066
210	0 0.0000	0 0.0000	0 0.0000	2 .0016	0 0.0000	0 0.0000	2 .0016	1 .0008	0 0.0000	0 0.0000	5 .0041
240	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	2 .0016	0 0.0000	2 .0016
270 AND ABOVE	1 .0008	3 .0025	1 .0008	3 .0025	1 .0008	1 .0008	0 0.0000	0 0.0000	1 .0008	0 0.0000	11 .0090
COLUMN TOTALS	3 .0025	5 .0041	5 .0041	8 .0066	5 .0041	19 .0156	45 .0369	114 .0935	430 .3527	585 .4799	

JOINT FREQUENCIES AND OVERALL RELATIVE FREQUENCIES FOR WALLA WALLA

LOWER BOUNDS FOR INTERVALS OF NUMBER OF HOURS BELOW 32F	LOWER BOUNDS FOR INTERVALS OF AVERAGE TEMPERATURE BELOW 32F (DEG F)										ROW TOTALS
	3	6	9	12	15	18	21	24	27	30 AND ABOVE	
0	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	3 .0035	16 .0188	54 .0635	244 .2871	391 .4600	708 .8329
30	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	2 .0024	9 .0106	15 .0176	24 .0282	1 .0012	51 .0600
60	0 0.0000	0 0.0000	0 0.0000	1 .0012	0 0.0000	2 .0024	5 .0059	4 .0047	16 .0188	2 .0024	30 .0353
90	0 0.0000	1 .0012	0 0.0000	2 .0024	1 .0012	1 .0012	2 .0024	9 .0106	3 .0035	1 .0012	20 .0235
120	0 0.0000	0 0.0000	0 0.0000	1 .0012	1 .0012	2 .0024	4 .0047	6 .0071	2 .0024	0 0.0000	16 .0188
150	0 0.0000	0 0.0000	0 0.0000	4 .0047	2 .0024	0 0.0000	0 0.0000	2 .0024	1 .0012	0 0.0000	9 .0106
180	1 .0012	0 0.0000	0 0.0000	0 0.0000	0 0.0000	2 .0024	0 0.0000	0 0.0000	1 .0012	0 0.0000	4 .0047
210	0 0.0000	0 0.0000	0 0.0000	1 .0012	0 0.0000	0 0.0000	0 0.0000	1 .0012	1 .0012	0 0.0000	3 .0035
240	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0012	0 0.0000	0 0.0000	0 0.0000	1 .0012
270 AND ABOVE	2 .0024	1 .0012	0 0.0000	1 .0012	1 .0012	2 .0024	1 .0012	0 0.0000	0 0.0000	0 0.0000	8 .0094
COLUMN TOTALS	3 .0035	2 .0024	0 0.0000	10 .0118	5 .0059	14 .0165	38 .0447	91 .1071	292 .3435	395 .4647	

JOINT FREQUENCIES AND OVERALL RELATIVE FREQUENCIES FOR PENDLETON

LOWER BOUNDS FOR INTERVALS OF SUM OF DEGREES BELOW 32F (DEG F)	LOWER BOUNDS FOR INTERVALS OF AVERAGE TEMPERATURE BELOW 32F (DEG F)										ROW TOTALS
	3	6	9	12	15	18	21	24	27	30 AND ABOVE	
0	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	3 .0025	18 .0148	75 .0615	408 .3347	585 .4799	1089 .8934
250	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0008	6 .0049	21 .0172	15 .0123	0 0.0000	43 .0353
500	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	3 .0025	5 .0041	8 .0066	3 .0025	0 0.0000	19 .0156
750	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	3 .0025	6 .0049	4 .0033	4 .0033	0 0.0000	17 .0139
1000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	2 .0016	5 .0041	3 .0025	0 0.0000	0 0.0000	10 .0082
1250	0 0.0000	0 0.0000	0 0.0000	1 .0008	1 .0008	2 .0016	1 .0008	3 .0025	0 0.0000	0 0.0000	8 .0066
1500	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0008	2 .0016	0 0.0000	0 0.0000	0 0.0000	3 .0025
1750	0 0.0000	0 0.0000	0 0.0000	1 .0008	1 .0008	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	2 .0016
2000	0 0.0000	0 0.0000	1 .0008	0 0.0000	0 0.0000	2 .0016	1 .0008	0 0.0000	0 0.0000	0 0.0000	4 .0033
2250 AND ABOVE	3 .0025	5 .0041	4 .0033	6 .0049	3 .0025	2 .0016	1 .0008	0 0.0000	0 0.0000	0 0.0000	24 .0197
COLUMN TOTALS	3 .0025	5 .0041	5 .0041	8 .0066	5 .0041	19 .0156	45 .0369	114 .0935	430 .3527	585 .4799	

JOINT FREQUENCIES AND OVERALL RELATIVE FREQUENCIES FOR WALLA WALLA

LOWER BOUNDS FOR INTERVALS OF SUM OF DEGREES BELOW 32F (DEG F)	LOWER BOUNDS FOR INTERVALS OF AVERAGE TEMPERATURE BELOW 32F (DEG F)										ROW TOTALS
	3	6	9	12	15	18	21	24	27	30 AND ABOVE	
0	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	3 .0035	16 .0188	57 .0671	276 .3247	395 .4647	747 .8788
250	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0012	6 .0071	14 .0165	14 .0165	0 0.0000	35 .0412
500	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0012	5 .0059	10 .0118	0 0.0000	0 0.0000	16 .0188
750	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0012	5 .0059	7 .0082	2 .0024	0 0.0000	15 .0176
1000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	2 .0024	4 .0047	2 .0024	0 0.0000	0 0.0000	8 .0094
1250	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000
1500	0 0.0000	0 0.0000	0 0.0000	1 .0012	1 .0012	1 .0012	0 0.0000	1 .0012	0 0.0000	0 0.0000	4 .0047
1750	0 0.0000	0 0.0000	0 0.0000	1 .0012	1 .0012	1 .0012	0 0.0000	0 0.0000	0 0.0000	0 0.0000	3 .0035
2000	0 0.0000	0 0.0000	0 0.0000	1 .0012	0 0.0000	2 .0024	0 0.0000	0 0.0000	0 0.0000	0 0.0000	3 .0035
2250 AND ABOVE	3 .0035	2 .0024	0 0.0000	7 .0082	3 .0035	2 .0024	2 .0024	0 0.0000	0 0.0000	0 0.0000	19 .0224
COLUMN TOTALS	3 .0035	2 .0024	0 0.0000	10 .0118	5 .0059	14 .0165	38 .0447	91 .1071	292 .3435	395 .4647	

JOINT FREQUENCIES AND OVERALL RELATIVE FREQUENCIES FOR PENDLETON

LOWER BOUNDS FOR INTERVALS OF MINIMUM TEMPERATURE (DEG F)	LOWER BOUNDS FOR INTERVALS OF AVERAGE TEMPERATURE BELOW 32F (DEG F)										ROW TOTALS
	3	6	9	12	15	18	21	24	27	30 AND ABOVE	
-8	3 .0025	5 .0041	2 .0016	4 .0033	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	14 .0115
-4	0 0.0000	0 0.0000	3 .0025	2 .0016	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	5 .0041
0	0 0.0000	0 0.0000	0 0.0000	1 .0008	2 .0016	3 .0025	0 0.0000	0 0.0000	0 0.0000	0 0.0000	6 .0049
4	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0008	3 .0025	2 .0016	0 0.0000	0 0.0000	0 0.0000	6 .0049
8	0 0.0000	0 0.0000	0 0.0000	1 .0008	2 .0016	7 .0057	7 .0057	2 .0016	0 0.0000	0 0.0000	19 .0156
12	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	4 .0033	12 .0098	1 .0008	0 0.0000	0 0.0000	17 .0139
16	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0008	18 .0148	19 .0156	2 .0016	0 0.0000	40 .0328
20	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0008	6 .0049	72 .0591	23 .0189	0 0.0000	102 .0837
24	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	20 .0164	265 .2174	1 .0008	286 .2346
28 AND ABOVE	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	140 .1148	584 .4791	724 .5939
COLUMN TOTALS	3 .0025	5 .0041	5 .0041	8 .0066	5 .0041	19 .0156	45 .0369	114 .0935	430 .3527	585 .4799	

JOINT FREQUENCIES AND OVERALL RELATIVE FREQUENCIES FOR WALLA WALLA

LOWER BOUNDS FOR INTERVALS OF MINIMUM TEMPERATURE (DEG F)	LOWER BOUNDS FOR INTERVALS OF AVERAGE TEMPERATURE BELOW 32F (DEG F)										ROW TOTALS
	3	6	9	12	15	18	21	24	27	30 AND ABOVE	
-8	3 .0035	2 .0024	0 0.0000	1 .0012	1 .0012	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	7 .0082
-4	0 0.0000	0 0.0000	0 0.0000	5 .0059	0 0.0000	1 .0012	0 0.0000	0 0.0000	0 0.0000	0 0.0000	6 .0071
0	0 0.0000	0 0.0000	0 0.0000	2 .0024	1 .0012	2 .0024	1 .0012	0 0.0000	0 0.0000	0 0.0000	6 .0071
4	0 0.0000	0 0.0000	0 0.0000	2 .0024	2 .0024	2 .0024	1 .0012	0 0.0000	0 0.0000	0 0.0000	7 .0082
8	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0012	4 .0047	6 .0071	2 .0024	0 0.0000	0 0.0000	13 .0153
12	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	5 .0059	9 .0106	1 .0012	0 0.0000	0 0.0000	15 .0176
16	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	17 .0200	20 .0235	0 0.0000	0 0.0000	37 .0435
20	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	4 .0047	54 .0635	19 .0224	0 0.0000	77 .0906
24	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	14 .0165	150 .1765	0 0.0000	164 .1929
28 AND ABOVE	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	123 .1447	395 .4647	518 .6094
COLUMN TOTALS	3 .0035	2 .0024	0 0.0000	10 .0118	5 .0059	14 .0165	38 .0447	91 .1071	292 .3435	395 .4647	

JOINT FREQUENCIES AND OVERALL RELATIVE FREQUENCIES FOR PENDLETON

NUMBER OF HOURS BELOW 32F	LOWER BOUNDS FOR INTERVALS OF SUM OF DEGREES BELOW 32F (DEG F)										ROW TOTALS
	0	250	500	750	1000	1250	1500	1750	2000	2250 AND ABOVE	
0	1050 .8614	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1050 .8614
30	33 .0271	23 .0189	6 .0049	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	62 .0509
60	5 .0041	13 .0107	4 .0033	5 .0041	2 .0016	2 .0016	0 0.0000	0 0.0000	0 0.0000	0 0.0000	31 .0254
90	1 .0008	6 .0049	6 .0049	6 .0049	2 .0016	2 .0016	0 0.0000	1 .0008	1 .0008	2 .0016	27 .0221
120	0 0.0000	0 0.0000	2 .0016	2 .0016	3 .0025	1 .0008	1 .0008	1 .0008	0 0.0000	1 .0008	11 .0090
150	0 0.0000	1 .0008	0 0.0000	0 0.0000	1 .0008	2 .0016	1 .0008	0 0.0000	2 .0016	5 .0041	12 .0098
180	0 0.0000	0 0.0000	0 0.0000	2 .0016	2 .0016	0 0.0000	1 .0008	0 0.0000	0 0.0000	3 .0025	8 .0066
210	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0008	0 0.0000	0 0.0000	1 .0008	3 .0025	5 .0041
240	0 0.0000	0 0.0000	1 .0008	1 .0008	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	2 .0016
270 AND ABOVE	0 0.0000	0 0.0000	0 0.0000	1 .0008	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	10 .0082	11 .0090
COLUMN TOTALS	1089 .8934	43 .0353	19 .0156	17 .0139	10 .0082	8 .0066	3 .0025	2 .0016	4 .0033	24 .0197	

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JOINT FREQUENCIES AND OVERALL RELATIVE FREQUENCIES FOR WALLA WALLA

LOWER BOUNDS FOR INTERVALS OF NUMBER OF HOURS BELOW 32F	LOWER BOUNDS FOR INTERVALS OF SUM OF DEGREES BELOW 32F (DEG F)										ROW TOTALS
	0	250	500	750	1000	1250	1500	1750	2000	2250 AND ABOVE	
0	708 .8329	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	708 .8329
30	28 .0329	19 .0224	4 .0047	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	51 .0600
60	10 .0118	10 .0118	4 .0047	4 .0047	1 .0012	0 0.0000	1 .0012	0 0.0000	0 0.0000	0 0.0000	30 .0353
90	1 .0012	3 .0035	6 .0071	5 .0059	1 .0012	0 0.0000	1 .0012	1 .0012	1 .0012	1 .0012	20 .0235
120	0 0.0000	2 .0024	2 .0024	3 .0035	5 .0059	0 0.0000	1 .0012	2 .0024	0 0.0000	1 .0012	16 .0188
150	0 0.0000	1 .0012	0 0.0000	1 .0012	1 .0012	0 0.0000	0 0.0000	0 0.0000	0 0.0000	6 .0071	9 .0106
180	0 0.0000	0 0.0000	0 0.0000	1 .0012	0 0.0000	0 0.0000	0 0.0000	0 0.0000	2 .0024	1 .0012	4 .0047
210	0 0.0000	0 0.0000	0 0.0000	1 .0012	0 0.0000	0 0.0000	1 .0012	0 0.0000	0 0.0000	1 .0012	3 .0035
240	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0012	1 .0012
270 AND ABOVE	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	8 .0094	8 .0094
COLUMN TOTALS	747 .8788	35 .0412	16 .0188	15 .0176	8 .0094	0 0.0000	4 .0047	3 .0035	3 .0035	19 .0224	

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JOINT FREQUENCIES AND OVERALL RELATIVE FREQUENCIES FOR PENDLETON

LOWER BOUNDS FOR INTERVALS OF MINIMUM TEMPERATURE (DEG F)	LOWER BOUNDS FOR INTERVALS OF SUM OF DEGREES BELOW 32F (DEG F)										ROW TOTALS
	0	250	500	750	1000	1250	1500	1750	2000	2250 AND ABOVE	
-8	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	14 .0115	14 .0115
-4	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0008	1 .0008	3 .0025	5 .0041
0	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0008	0 0.0000	0 0.0000	2 .0016	3 .0025	6 .0049
4	0 0.0000	0 0.0000	0 0.0000	0 0.0000	3 .0025	2 .0016	0 0.0000	0 0.0000	0 0.0000	1 .0008	6 .0049
8	0 0.0000	3 .0025	4 .0033	4 .0033	2 .0016	2 .0016	1 .0008	1 .0008	0 0.0000	2 .0016	19 .0156
12	2 .0016	2 .0016	3 .0025	3 .0025	2 .0016	1 .0008	2 .0016	0 0.0000	1 .0008	1 .0008	17 .0139
16	19 .0156	12 .0098	3 .0025	5 .0041	1 .0008	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	40 .0328
20	76 .0623	14 .0115	6 .0049	3 .0025	1 .0008	2 .0016	0 0.0000	0 0.0000	0 0.0000	0 0.0000	102 .0837
24	268 .2199	12 .0098	3 .0025	2 .0016	1 .0008	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	286 .2346
28 AND ABOVE	724 .5939	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	724 .5939
COLUMN TOTALS	1089 .8934	43 .0353	19 .0156	17 .0139	10 .0082	8 .0066	3 .0025	2 .0016	4 .0033	24 .0197	

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JOINT FREQUENCIES AND OVERALL RELATIVE FREQUENCIES FOR WALLA WALLA

LOWER BOUNDS FOR INTERVALS OF MINIMUM TEMPERATURE (DEG F)	LOWER BOUNDS FOR INTERVALS OF SUM OF DEGREES BELOW 32F (DEG F)										ROW TOTALS
	0	250	500	750	1000	1250	1500	1750	2000	2250 AND ABOVE	
-8	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	7 .0082	7 .0082
-4	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0012	5 .0059	6 .0071
0	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	1 .0012	2 .0024	1 .0012	2 .0024	6 .0071
4	0 0.0000	0 0.0000	0 0.0000	1 .0012	1 .0012	0 0.0000	1 .0012	1 .0012	0 0.0000	3 .0035	7 .0082
8	0 0.0000	1 .0012	1 .0012	4 .0047	4 .0047	0 0.0000	1 .0012	0 0.0000	1 .0012	1 .0012	13 .0153
12	5 .0059	3 .0035	4 .0047	1 .0012	0 0.0000	0 0.0000	1 .0012	0 0.0000	0 0.0000	1 .0012	15 .0176
16	18 .0212	8 .0094	4 .0047	5 .0059	2 .0024	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	37 .0435
20	56 .0659	12 .0141	7 .0082	1 .0012	1 .0012	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	77 .0906
24	151 .1776	10 .0118	0 0.0000	3 .0035	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	164 .1929
28 AND ABOVE	517 .6082	1 .0012	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	518 .6094
COLUMN TOTALS	747 .8788	35 .0412	16 .0188	15 .0176	8 .0094	0 0.0000	4 .0047	3 .0035	3 .0035	19 .0224	

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JOINT FREQUENCIES AND OVERALL RELATIVE FREQUENCIES FOR PENDLETON

LOWER BOUNDS FOR INTERVALS OF MINIMUM TEMPERATURE (DEG F)	LOWER BOUNDS FOR INTERVALS OF NUMBER OF HOURS BELOW 32F										ROW TOTALS
	0	30	60	90	120	150	180	210	240	270 AND ABOVE	
-8	0 0.0000	0 0.0000	0 0.0000	2 .0016	0 0.0000	2 .0016	2 .0016	1 .0008	0 0.0000	7 .0057	14 .0115
-4	0 0.0000	0 0.0000	0 0.0000	2 .0016	1 .0008	1 .0008	0 0.0000	0 0.0000	0 0.0000	1 .0008	5 .0041
0	0 0.0000	0 0.0000	1 .0008	0 0.0000	0 0.0000	2 .0016	0 0.0000	1 .0008	0 0.0000	2 .0016	6 .0049
4	0 0.0000	0 0.0000	1 .0008	2 .0016	2 .0016	1 .0008	0 0.0000	0 0.0000	0 0.0000	0 0.0000	6 .0049
8	0 0.0000	6 .0049	5 .0041	3 .0025	1 .0008	3 .0025	1 .0008	0 0.0000	0 0.0000	0 0.0000	19 .0156
12	2 .0016	5 .0041	2 .0016	2 .0016	3 .0025	0 0.0000	1 .0008	2 .0016	0 0.0000	0 0.0000	17 .0139
16	17 .0139	13 .0107	3 .0025	5 .0041	0 0.0000	0 0.0000	1 .0008	0 0.0000	1 .0008	0 0.0000	40 .0328
20	69 .0566	13 .0107	6 .0049	7 .0057	3 .0025	2 .0016	1 .0008	1 .0008	0 0.0000	0 0.0000	102 .0837
24	248 .2034	17 .0139	12 .0098	3 .0025	1 .0008	1 .0008	2 .0016	0 0.0000	1 .0008	1 .0008	286 .2346
28 AND ABOVE	714 .5857	8 .0066	1 .0008	1 .0008	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	724 .5939
COLUMN TOTALS	1050 .8614	62 .0509	31 .0254	27 .0221	11 .0090	12 .0098	8 .0066	5 .0041	2 .0016	11 .0090	

JOINT FREQUENCIES AND OVERALL RELATIVE FREQUENCIES FOR WALLA WALLA

LOWER BOUNDS FOR INTERVALS OF MINIMUM TEMPERATURE (DEG F)	LOWER BOUNDS FOR INTERVALS OF NUMBER OF HOURS BELOW 32F										ROW TOTALS
	0	30	60	90	120	150	180	210	240	270 AND ABOVE	
-8	0 0.0000	0 0.0000	0 0.0000	1 .0012	0 0.0000	1 .0012	1 .0012	0 0.0000	0 0.0000	4 .0047	7 .0082
-4	0 0.0000	0 0.0000	0 0.0000	1 .0012	1 .0012	2 .0024	0 0.0000	0 0.0000	0 0.0000	2 .0024	6 .0071
0	0 0.0000	0 0.0000	0 0.0000	2 .0024	1 .0012	1 .0012	1 .0012	0 0.0000	0 0.0000	1 .0012	6 .0071
4	0 0.0000	0 0.0000	2 .0024	1 .0012	1 .0012	1 .0012	0 0.0000	1 .0012	0 0.0000	1 .0012	7 .0082
8	0 0.0000	1 .0012	4 .0047	1 .0012	4 .0047	1 .0012	1 .0012	1 .0012	0 0.0000	0 0.0000	13 .0153
12	5 .0059	6 .0071	1 .0012	0 0.0000	1 .0012	1 .0012	0 0.0000	0 0.0000	1 .0012	0 0.0000	15 .0176
16	17 .0200	9 .0106	4 .0047	4 .0047	2 .0024	1 .0012	0 0.0000	0 0.0000	0 0.0000	0 0.0000	37 .0435
20	50 .0588	14 .0165	3 .0035	7 .0082	3 .0035	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	77 .0906
24	131 .1541	15 .0176	10 .0118	2 .0024	3 .0035	1 .0012	1 .0012	1 .0012	0 0.0000	0 0.0000	164 .1929
28 AND ABOVE	505 .5941	6 .0071	6 .0071	1 .0012	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	0 0.0000	518 .6094
COLUMN TOTALS	708 .8329	51 .0600	30 .0353	20 .0235	16 .0188	9 .0106	4 .0047	3 .0035	1 .0012	8 .0094	

APPENDIX E

Conditional Distributions

The conditional distributions of five combinations of freezing event characteristics at two sites (Pendleton, Oregon and Walla Walla Washington) are presented in this appendix. These distributions are given in the form of quantiles that are listed in individual tables for each pair of characteristics. The tables of distributions are organized according to the pairs of characteristics, with separate tables for each site. An index listing the location of each table is given in the table of contents for the appendices (p.61).

CONDITIONAL DISTRIBUTIONS OF DEGREES BELOW 32, CONDITIONED ON HOURS BELOW 32, AT PENDLETON

HOURS BELOW 32			DEGREES BELOW 32 QUANTILES										
INTERVAL START	INTERVAL END	N	MINIMUM	.01-TH	.10-TH	.25-TH	MEDIAN	.75-TH	.90-TH	.95-TH	.99-TH	MAXIMUM	
1.00	1.00	183	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	12.32	14.00	
2.00	2.00	94	2.00	2.00	2.00	2.00	2.00	3.00	3.50	5.25	10.00	10.00	
3.00	3.00	71	3.00	3.00	3.00	3.00	4.00	5.00	7.80	9.40	15.00	15.00	
4.00	4.00	65	4.00	4.00	4.00	5.00	6.00	8.50	10.40	13.40	20.00	20.00	
5.00	5.00	81	5.00	5.00	5.00	5.00	7.00	10.00	14.60	17.90	23.00	23.00	
6.00	6.00	71	6.00	6.00	6.20	9.00	13.00	16.00	20.00	22.40	53.00	53.00	
7.00	7.00	61	7.00	7.00	9.00	11.50	16.00	20.50	25.00	26.90	32.00	32.00	
8.00	8.00	45	8.00	8.00	9.20	12.00	16.00	24.50	27.80	30.70	37.00	37.00	
9.00	9.00	44	13.00	13.00	17.00	19.00	24.00	30.00	39.00	42.50	49.00	49.00	
10.00	10.00	41	10.00	10.00	15.40	24.50	30.00	36.50	41.60	49.50	56.00	56.00	
11.00	11.00	35	11.00	11.00	16.40	24.00	33.00	46.00	51.40	64.80	80.00	80.00	
12.00	12.00	42	15.00	15.00	18.90	29.00	40.00	54.00	66.00	77.40	80.00	80.00	
13.00	13.00	32	23.00	23.00	26.30	34.75	48.00	59.75	65.70	70.10	74.00	74.00	
14.00	14.00	33	14.00	14.00	20.40	36.50	52.00	73.00	89.60	104.00	125.00	125.00	
15.00	15.00	34	23.00	23.00	26.50	37.75	55.00	81.50	110.50	119.75	122.00	122.00	
16.00	16.00	31	30.00	30.00	33.60	62.00	80.00	99.00	129.20	148.00	154.00	154.00	
17.00	17.00	21	26.00	26.00	43.40	72.50	91.00	105.00	153.80	180.40	183.00	183.00	
18.00	18.00	20	32.00	32.00	36.80	74.25	102.50	128.75	191.70	199.80	200.00	200.00	
19.00	19.00	14	19.00	19.00	33.00	62.00	97.00	154.25	187.50	200.00	200.00	200.00	
20.00	21.00	10	25.00	25.00	25.80	39.00	93.00	149.75	172.10	174.00	174.00	174.00	
22.00	23.00	10	36.00	36.00	37.30	64.75	85.00	114.75	211.50	216.00	216.00	216.00	
25.00	28.00	10	36.00	36.00	36.70	46.00	66.00	116.75	162.80	167.00	167.00	167.00	
29.00	33.00	10	30.00	30.00	31.60	52.75	98.50	139.50	169.80	172.00	172.00	172.00	
34.00	36.00	11	35.00	35.00	38.80	85.00	112.00	269.00	312.00	313.00	313.00	313.00	
37.00	41.00	13	107.00	107.00	108.20	120.50	256.00	331.50	408.20	437.00	437.00	437.00	
42.00	44.00	10	42.00	42.00	45.30	177.75	274.50	362.75	492.50	506.00	506.00	506.00	
46.00	54.00	10	68.00	68.00	73.00	134.50	271.50	534.00	655.80	669.00	669.00	669.00	
55.00	59.00	10	143.00	143.00	144.90	222.00	325.50	468.00	642.60	650.00	650.00	650.00	
60.00	67.00	11	93.00	93.00	110.80	216.00	286.00	342.00	728.80	813.00	813.00	813.00	
68.00	83.00	11	169.00	169.00	179.80	257.00	496.00	957.00	1358.20	1416.00	1416.00	1416.00	
84.00	90.00	12	211.00	211.00	224.50	373.00	732.00	976.25	1347.70	1441.00	1441.00	1441.00	
91.00	100.00	11	368.00	368.00	374.40	486.00	656.00	1264.00	1963.20	2013.00	2013.00	2013.00	
102.00	112.00	11	370.00	370.00	401.20	557.00	897.00	1464.00	2966.40	3062.00	3062.00	3062.00	
116.00	135.00	10	331.00	331.00	358.10	629.00	828.00	1366.75	2426.20	2501.00	2501.00	2501.00	
136.00	168.00	11	1096.00	1096.00	1107.60	1257.00	1726.00	2838.00	3293.40	3363.00	3363.00	3363.00	
169.00	198.00	10	411.00	411.00	460.60	964.75	1814.00	3884.75	5124.50	5164.00	5164.00	5164.00	
207.00	274.00	10	724.00	724.00	733.00	922.75	1293.00	2658.50	4039.40	4077.00	4077.00	4077.00	
282.00	442.00	10	4900.00	4900.00	4917.30	5582.25	6406.00	8798.25	9957.30	9999.00	9999.00	9999.00	

HOURS BELOW 32		N	DEGREES BELOW 32 QUANTILES									
INTERVAL START	INTERVAL END		MINIMUM	.01-TH	.10-TH	.25-TH	MEDIAN	.75-TH	.90-TH	.95-TH	.99-TH	MAXIMUM
1.00	1.00	123	1.00	1.00	1.00	1.00	1.00	1.00	2.00	3.00	6.28	7.00
2.00	2.00	71	2.00	2.00	2.00	2.00	2.00	3.00	5.00	6.80	9.00	9.00
3.00	3.00	56	3.00	3.00	3.00	3.00	4.00	5.75	7.00	8.75	20.00	20.00
4.00	4.00	40	4.00	4.00	4.00	5.00	7.00	9.00	10.80	11.95	12.00	12.00
5.00	5.00	47	5.00	5.00	5.00	6.00	9.00	12.00	18.20	39.20	50.00	50.00
6.00	6.00	40	6.00	6.00	7.00	8.00	11.50	15.00	18.80	20.90	22.00	22.00
7.00	7.00	38	7.00	7.00	7.00	11.00	16.00	21.25	25.10	26.10	28.00	28.00
8.00	8.00	31	8.00	8.00	8.00	13.00	19.00	24.00	31.80	41.00	50.00	50.00
9.00	9.00	34	11.00	11.00	13.00	15.75	20.00	28.25	34.00	49.75	55.00	55.00
10.00	10.00	20	10.00	10.00	16.40	21.50	29.50	44.00	50.70	96.60	99.00	99.00
11.00	11.00	18	13.00	13.00	13.90	20.00	27.00	45.75	61.80	78.00	78.00	78.00
12.00	12.00	26	12.00	12.00	20.40	28.75	45.50	58.50	68.70	78.90	81.00	81.00
13.00	13.00	20	17.00	17.00	19.30	28.00	39.50	56.00	79.00	112.30	114.00	114.00
14.00	14.00	21	18.00	18.00	23.20	29.50	50.00	81.50	116.80	178.40	185.00	185.00
15.00	15.00	20	22.00	22.00	24.60	45.00	56.00	86.25	110.00	158.55	161.00	161.00
16.00	16.00	17	22.00	22.00	25.20	64.00	73.00	105.00	124.20	157.00	157.00	157.00
17.00	17.00	18	17.00	17.00	26.00	35.50	59.50	95.00	136.50	141.00	141.00	141.00
18.00	18.00	16	33.00	33.00	42.10	60.50	115.00	147.00	198.90	208.00	208.00	208.00
19.00	19.00	17	27.00	27.00	27.80	41.50	95.00	157.50	194.40	216.00	216.00	216.00
20.00	21.00	10	22.00	22.00	22.80	32.25	100.50	133.00	166.30	169.00	169.00	169.00
22.00	24.00	11	22.00	22.00	22.80	35.00	69.00	107.00	144.60	151.00	151.00	151.00
25.00	27.00	10	42.00	42.00	42.50	53.00	77.00	126.75	140.10	141.00	141.00	141.00
28.00	31.00	10	40.00	40.00	42.50	71.75	92.50	141.00	167.40	170.00	170.00	170.00
32.00	36.00	10	79.00	79.00	79.40	95.00	104.50	190.00	353.50	364.00	364.00	364.00
37.00	41.00	10	77.00	77.00	80.70	153.75	176.00	256.75	301.30	306.00	306.00	306.00
42.00	46.00	10	91.00	91.00	103.90	276.25	362.50	422.75	542.60	548.00	548.00	548.00
48.00	52.00	10	98.00	98.00	101.30	182.75	384.50	494.75	525.50	527.00	527.00	527.00
53.00	63.00	10	162.00	162.00	163.50	177.75	231.50	329.75	565.10	591.00	591.00	591.00
64.00	69.00	12	136.00	136.00	152.50	215.50	327.50	543.75	775.80	819.00	819.00	819.00
73.00	86.00	10	259.00	259.00	263.00	313.25	677.50	927.25	1458.70	1508.00	1508.00	1508.00
87.00	96.00	11	140.00	140.00	140.60	294.00	408.00	987.00	1656.40	1778.00	1778.00	1778.00
97.00	113.00	11	409.00	409.00	441.20	595.00	752.00	946.00	2092.00	2183.00	2183.00	2183.00
119.00	134.00	11	439.00	439.00	490.20	720.00	1194.00	1833.00	2804.40	2869.00	2869.00	2869.00
135.00	166.00	11	386.00	386.00	406.40	769.00	992.00	2817.00	3094.20	3132.00	3132.00	3132.00
167.00	215.00	10	755.00	755.00	766.00	972.25	2247.00	3137.25	5118.60	5296.00	5296.00	5296.00
219.00	434.00	10	2372.00	2372.00	2466.20	3641.75	5536.00	8439.00	9966.30	9999.00	9999.00	9999.00

CONDITIONAL DISTRIBUTIONS OF AVERAGE TEMPERATURE BELOW 32, CONDITIONED ON HOURS BELOW 32, AT PENDLETON

HOURS BELOW 32		AVERAGE TEMPERATURE BELOW 32 QUANTILES											
INTERVAL	INTERVAL	N	MINIMUM	.01-TH	.10-TH	.25-TH	MEDIAN	.75-TH	.90-TH	.95-TH	.99-TH	MAXIMUM	
START	END												
1.00	1.00	183	18.00	19.68	30.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00
2.00	2.00	94	27.00	27.00	30.25	30.50	31.00	31.00	31.00	31.00	31.00	31.00	31.00
3.00	3.00	71	27.00	27.00	29.40	30.33	30.67	31.00	31.00	31.00	31.00	31.00	31.00
4.00	4.00	65	27.00	27.00	29.40	29.88	30.50	30.75	31.00	31.00	31.00	31.00	31.00
5.00	5.00	81	27.40	27.40	29.08	30.00	30.60	31.00	31.00	31.00	31.00	31.00	31.00
6.00	6.00	71	23.17	23.17	28.67	29.33	29.83	30.50	30.97	31.00	31.00	31.00	31.00
7.00	7.00	61	27.43	27.43	28.43	29.07	29.71	30.36	30.71	30.99	31.00	31.00	31.00
8.00	8.00	45	27.38	27.38	28.53	28.94	30.00	30.50	30.85	31.00	31.00	31.00	31.00
9.00	9.00	44	26.56	26.56	27.67	28.67	29.33	29.89	30.11	30.22	30.56	30.56	30.56
10.00	10.00	41	26.40	26.40	27.84	28.35	29.00	29.55	30.46	30.68	31.00	31.00	31.00
11.00	11.00	35	24.73	24.73	27.33	27.82	29.00	29.82	30.51	30.93	31.00	31.00	31.00
12.00	12.00	42	25.33	25.33	26.50	27.50	28.67	29.58	30.43	30.57	30.75	30.75	30.75
13.00	13.00	32	26.31	26.31	26.95	27.40	28.31	29.33	29.98	30.23	30.23	30.23	30.23
14.00	14.00	33	23.07	23.07	25.60	26.79	28.29	29.39	30.54	30.75	31.00	31.00	31.00
15.00	15.00	34	23.87	23.87	24.63	26.57	28.33	29.48	30.23	30.42	30.47	30.47	30.47
16.00	16.00	31	22.38	22.38	23.93	25.81	27.00	28.13	29.90	30.09	30.13	30.13	30.13
17.00	17.00	21	21.24	21.24	22.95	25.82	26.65	27.74	29.45	30.37	30.47	30.47	30.47
18.00	18.00	20	20.89	20.89	21.35	24.85	26.31	27.88	29.96	30.21	30.22	30.22	30.22
19.00	19.00	14	21.47	21.47	22.13	23.88	26.89	28.74	30.26	31.00	31.00	31.00	31.00
20.00	21.00	10	23.30	23.30	23.40	24.51	27.47	30.12	30.71	30.75	30.75	30.75	30.75
22.00	23.00	10	22.18	22.18	22.42	27.00	28.30	29.06	30.37	30.43	30.43	30.43	30.43
25.00	28.00	10	25.58	25.58	25.77	27.60	29.56	30.33	30.54	30.56	30.56	30.56	30.56
29.00	33.00	10	26.79	26.79	26.84	27.64	28.78	30.35	30.94	31.00	31.00	31.00	31.00
34.00	36.00	11	23.06	23.06	23.09	24.09	28.80	29.50	30.88	31.00	31.00	31.00	31.00
37.00	41.00	13	20.79	20.79	21.43	23.81	25.76	28.91	29.31	29.39	29.39	29.39	29.39
42.00	44.00	10	20.23	20.23	20.53	23.66	25.76	27.78	30.93	31.00	31.00	31.00	31.00
46.00	54.00	10	19.38	19.38	19.54	21.86	26.45	29.18	30.56	30.67	30.67	30.67	30.67
55.00	59.00	10	20.39	20.39	20.53	23.64	26.34	28.02	29.45	29.49	29.49	29.49	29.49
60.00	67.00	11	18.67	18.67	20.05	26.69	27.47	28.40	30.28	30.61	30.61	30.61	30.61
68.00	83.00	11	14.52	14.52	15.23	20.47	26.02	28.72	29.41	29.51	29.51	29.51	29.51
84.00	90.00	12	15.81	15.81	16.77	20.64	23.63	27.79	29.48	29.66	29.66	29.66	29.66
91.00	100.00	11	10.59	10.59	11.07	19.10	25.17	26.71	27.96	28.04	28.04	28.04	28.04
102.00	112.00	11	4.66	4.66	5.43	18.93	23.85	26.54	28.18	28.51	28.51	28.51	28.51
116.00	135.00	10	11.83	11.83	12.41	20.80	25.33	27.14	28.95	29.15	29.15	29.15	29.15
136.00	168.00	11	11.74	11.74	11.80	15.11	20.64	23.87	25.00	25.15	25.15	25.15	25.15
169.00	198.00	10	5.92	5.92	5.96	9.84	21.73	27.04	29.32	29.57	29.57	29.57	29.57
207.00	274.00	10	14.12	14.12	14.15	20.14	25.98	28.39	29.17	29.18	29.18	29.18	29.18
282.00	442.00	10	2.43	2.43	2.89	7.44	12.18	15.03	18.87	18.99	18.99	18.99	18.99

CONDITIONAL DISTRIBUTIONS OF AVERAGE TEMPERATURE BELOW 32, CONDITIONED ON HOURS BELOW 32, AT WALLA WALLA

HOURS BELOW 32		AVERAGE TEMPERATURE BELOW 32 QUANTILES										
INTERVAL START	INTERVAL END	N	MINIMUM	.01-TH	.10-TH	.25-TH	MEDIAN	.75-TH	.90-TH	.95-TH	.99-TH	MAXIMUM
1.00	1.00	123	25.00	25.72	30.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00
2.00	2.00	71	27.50	27.50	29.50	30.50	31.00	31.00	31.00	31.00	31.00	31.00
3.00	3.00	56	25.33	25.33	29.67	30.08	30.67	31.00	31.00	31.00	31.00	31.00
4.00	4.00	40	29.00	29.00	29.30	29.75	30.25	30.75	31.00	31.00	31.00	31.00
5.00	5.00	47	22.00	22.00	28.36	29.60	30.20	30.80	31.00	31.00	31.00	31.00
6.00	6.00	40	28.33	28.33	28.87	29.50	30.08	30.67	30.83	30.99	31.00	31.00
7.00	7.00	38	28.00	28.00	28.41	28.96	29.71	30.43	31.00	31.00	31.00	31.00
8.00	8.00	31	25.75	25.75	28.03	29.00	29.63	30.38	31.00	31.00	31.00	31.00
9.00	9.00	34	25.89	25.89	28.22	28.86	29.78	30.25	30.56	30.69	30.78	30.78
10.00	10.00	20	22.10	22.10	26.93	27.60	29.05	29.85	30.36	30.97	31.00	31.00
11.00	11.00	18	24.91	24.91	26.38	27.84	29.55	30.18	30.74	30.82	30.82	30.82
12.00	12.00	26	25.25	25.25	26.28	27.13	28.21	29.60	30.30	31.00	31.00	31.00
13.00	13.00	20	23.23	23.23	25.92	27.69	28.96	29.85	30.52	30.68	30.69	30.69
14.00	14.00	21	18.79	18.79	23.66	26.18	28.43	29.89	30.34	30.68	30.71	30.71
15.00	15.00	20	21.27	21.27	24.67	26.25	28.27	29.00	30.36	30.53	30.53	30.53
16.00	16.00	17	22.19	22.19	24.24	25.44	27.44	28.00	30.43	30.63	30.63	30.63
17.00	17.00	18	23.71	23.71	23.97	26.41	28.50	29.91	30.47	31.00	31.00	31.00
18.00	18.00	16	20.44	20.44	20.95	23.83	25.61	28.64	29.66	30.17	30.17	30.17
19.00	19.00	17	20.63	20.63	21.77	23.71	27.00	29.82	30.54	30.58	30.58	30.58
20.00	21.00	10	23.55	23.55	23.72	25.67	27.08	30.45	30.86	30.90	30.90	30.90
22.00	24.00	11	25.71	25.71	25.93	27.14	29.04	30.54	30.97	31.00	31.00	31.00
25.00	27.00	10	26.58	26.58	26.61	27.13	28.98	29.91	30.37	30.38	30.38	30.38
28.00	31.00	10	26.52	26.52	26.58	27.31	28.92	29.57	30.48	30.57	30.57	30.57
32.00	36.00	10	21.89	21.89	22.12	26.12	28.88	29.23	29.59	29.61	29.61	29.61
37.00	41.00	10	24.15	24.15	24.27	25.66	27.54	28.12	29.82	29.92	29.92	29.92
42.00	46.00	10	19.55	19.55	19.61	22.41	23.81	25.54	29.62	29.88	29.88	29.88
48.00	52.00	10	21.02	21.02	21.13	22.35	24.39	28.37	30.05	30.12	30.12	30.12
53.00	63.00	10	21.45	21.45	21.88	26.25	28.12	28.88	29.37	29.39	29.39	29.39
64.00	69.00	12	20.13	20.13	20.67	23.94	27.01	28.87	29.73	30.00	30.00	30.00
73.00	86.00	10	14.05	14.05	14.52	20.78	23.96	27.80	28.56	28.64	28.64	28.64
87.00	96.00	11	12.67	12.67	14.08	21.03	27.31	28.70	30.49	30.51	30.51	30.51
97.00	113.00	11	12.68	12.68	13.35	22.54	25.00	26.62	27.92	28.25	28.25	28.25
119.00	134.00	11	7.89	7.89	8.91	17.67	22.83	26.48	28.28	28.70	28.70	28.70
135.00	166.00	11	13.13	13.13	13.16	15.03	25.46	26.80	29.29	29.51	29.51	29.51
167.00	215.00	10	5.25	5.25	5.96	14.19	20.19	26.67	28.07	28.09	28.09	28.09
219.00	434.00	10	1.96	1.96	2.15	7.12	15.52	19.83	22.40	22.47	22.47	22.47

III

CONDITIONAL DISTRIBUTIONS OF HOURS BELOW 32, CONDITIONED ON MINIMUM TEMPERATURE, AT PENDLETON

MINIMUM TEMPERATURE INTERVAL			HOURS BELOW 32 QUANTILES									
START	END	N	MINIMUM	.01-TH	.10-TH	.25-TH	MEDIAN	.75-TH	.90-TH	.95-TH	.99-TH	MAXIMUM
-19.00	-6.00	11	110.00	110.00	110.40	166.00	282.00	343.00	420.60	437.00	437.00	437.00
-5.00	1.00	10	93.00	93.00	93.10	116.50	169.50	305.50	429.40	442.00	442.00	442.00
2.00	7.00	10	87.00	87.00	87.20	95.75	131.00	181.00	332.50	346.00	346.00	346.00
8.00	10.00	13	39.00	39.00	43.00	58.50	90.00	159.50	182.60	185.00	185.00	185.00
11.00	12.00	10	34.00	34.00	34.10	41.00	86.00	118.00	223.00	232.00	232.00	232.00
13.00	15.00	13	18.00	18.00	18.40	48.50	56.00	129.00	213.20	232.00	232.00	232.00
16.00	17.00	17	17.00	17.00	17.00	19.00	37.00	58.00	91.60	110.00	110.00	110.00
18.00	19.00	23	1.00	1.00	14.40	17.00	41.00	93.00	171.00	242.20	251.00	251.00
20.00	20.00	23	1.00	1.00	9.60	17.00	20.00	88.00	143.80	210.60	222.00	222.00
21.00	21.00	23	1.00	1.00	11.00	15.00	19.00	64.00	101.20	125.20	131.00	131.00
22.00	22.00	24	11.00	11.00	12.00	14.25	16.50	47.00	145.50	188.50	198.00	198.00
23.00	23.00	32	3.00	3.00	7.20	13.00	15.00	18.75	35.80	116.15	135.00	135.00
24.00	24.00	55	1.00	1.00	9.60	13.00	16.00	18.00	66.40	118.40	207.00	207.00
25.00	25.00	57	2.00	2.00	9.00	11.00	14.00	20.50	81.60	177.80	274.00	274.00
26.00	26.00	80	2.00	2.00	6.00	9.00	12.00	18.75	46.20	64.75	125.00	125.00
27.00	27.00	94	2.00	2.00	6.00	7.00	9.00	12.00	15.00	32.25	87.00	87.00
28.00	28.00	105	2.00	2.06	5.00	6.00	8.00	12.00	16.00	19.40	49.34	50.00
29.00	29.00	129	1.00	1.00	3.00	5.00	6.00	10.00	15.00	25.50	75.90	90.00
30.00	30.00	202	1.00	1.00	2.00	3.00	4.00	6.00	11.00	14.85	50.34	67.00
31.00	31.00	288	1.00	1.00	1.00	1.00	1.00	3.00	5.00	6.55	30.55	42.00

CONDITIONAL DISTRIBUTIONS OF HOURS BELOW 32, CONDITIONED ON MINIMUM TEMPERATURE, AT WALLA WALLA

MINIMUM TEMPERATURE INTERVAL		N	HOURS BELOW 32 QUANTILES									
START	END		MINIMUM	.01-TH	.10-TH	.25-TH	MEDIAN	.75-TH	.90-TH	.95-TH	.99-TH	MAXIMUM
-16.00	-3.00	10	119.00	119.00	123.70	172.75	241.50	388.50	429.90	434.00	434.00	434.00
-2.00	4.00	10	92.00	92.00	93.60	111.75	145.50	244.75	349.90	353.00	353.00	353.00
5.00	9.00	10	67.00	67.00	68.00	82.25	107.50	166.25	312.80	329.00	329.00	329.00
10.00	12.00	13	42.00	42.00	42.80	48.00	85.00	141.00	202.60	215.00	215.00	215.00
13.00	15.00	11	14.00	14.00	14.80	18.00	43.00	134.00	231.40	249.00	249.00	249.00
16.00	18.00	22	5.00	5.00	11.60	14.75	32.50	72.25	107.00	131.25	135.00	135.00
19.00	19.00	15	10.00	10.00	14.80	18.00	36.00	86.00	154.40	176.00	176.00	176.00
20.00	20.00	13	12.00	12.00	13.20	17.00	19.00	40.50	109.00	137.00	137.00	137.00
21.00	21.00	18	9.00	9.00	11.70	14.75	17.50	88.00	106.20	108.00	108.00	108.00
22.00	22.00	19	11.00	11.00	12.00	15.00	20.00	59.00	106.00	113.00	113.00	113.00
23.00	23.00	27	3.00	3.00	5.00	12.00	18.00	39.00	68.40	130.20	133.00	133.00
24.00	24.00	18	9.00	9.00	9.90	11.75	15.50	59.50	111.70	136.00	136.00	136.00
25.00	25.00	40	1.00	1.00	9.10	12.00	15.00	28.25	58.90	133.30	210.00	210.00
26.00	26.00	45	5.00	5.00	6.60	9.00	14.00	19.50	61.40	113.50	193.00	193.00
27.00	27.00	61	2.00	2.00	5.00	7.00	10.00	18.50	33.00	76.10	155.00	155.00
28.00	28.00	93	1.00	1.00	4.00	6.00	8.00	13.00	25.60	55.30	89.00	89.00
29.00	29.00	110	1.00	1.00	2.10	4.00	7.00	11.00	17.90	30.25	85.80	88.00
30.00	30.00	131	1.00	1.00	1.00	2.00	4.00	6.00	11.00	19.40	72.64	96.00
31.00	31.00	184	1.00	1.00	1.00	1.00	1.00	3.00	5.00	7.75	17.75	22.00

CONDITIONAL DISTRIBUTIONS OF DEGREES BELOW 32, CONDITIONED ON MINIMUM TEMPERATURE, AT PENDLETON

MINIMUM TEMPERATURE INTERVAL		N	DEGREES BELOW 32 QUANTILES									MAXIMUM
START	END		MINIMUM	.01-TH	.10-TH	.25-TH	MEDIAN	.75-TH	.90-TH	.95-TH	.99-TH	
-19.00	-6.00	11	2584.00	2584.00	2679.60	3363.00	5164.00	8537.00	9915.60	9999.00	9999.00	9999.00
-5.00	1.00	10	1764.00	1764.00	1787.80	2010.25	3302.50	5764.00	6389.50	6455.00	6455.00	6455.00
2.00	7.00	10	1130.00	1130.00	1132.40	1186.25	1452.50	3053.75	4780.10	4900.00	4900.00	4900.00
8.00	10.00	13	437.00	437.00	477.00	731.50	1127.00	1739.50	2419.40	2465.00	2465.00	2465.00
11.00	12.00	10	269.00	269.00	272.90	456.50	917.00	1118.25	2060.40	2117.00	2117.00	2117.00
13.00	15.00	13	200.00	200.00	200.00	396.00	669.00	1282.50	1997.80	2311.00	2311.00	2311.00
16.00	17.00	17	154.00	154.00	156.40	174.50	216.00	400.00	791.60	802.00	802.00	802.00
18.00	19.00	23	14.00	14.00	121.40	144.00	312.00	566.00	922.20	1157.40	1207.00	1207.00
20.00	20.00	23	12.00	12.00	69.00	110.00	148.00	339.00	1035.80	1354.60	1379.00	1379.00
21.00	21.00	23	11.00	11.00	67.40	108.00	129.00	290.00	644.20	765.00	776.00	776.00
22.00	22.00	24	52.00	52.00	70.00	92.50	110.50	279.75	811.00	1068.00	1096.00	1096.00
23.00	23.00	32	15.00	15.00	44.50	61.50	79.00	98.25	192.30	516.65	789.00	789.00
24.00	24.00	55	8.00	8.00	45.00	59.00	76.00	94.00	292.20	627.00	1058.00	1058.00
25.00	25.00	57	10.00	10.00	32.00	42.50	54.00	80.50	273.40	442.30	814.00	814.00
26.00	26.00	80	10.00	10.00	21.10	29.25	43.00	75.25	138.30	222.65	602.00	602.00
27.00	27.00	94	8.00	8.00	16.00	20.75	28.00	37.00	45.50	70.50	256.00	256.00
28.00	28.00	105	6.00	6.06	11.00	14.00	21.00	27.50	39.40	47.80	118.00	118.00
29.00	29.00	129	3.00	3.00	7.00	9.00	13.00	18.00	30.00	45.00	170.20	211.00
30.00	30.00	202	2.00	2.00	3.00	4.00	6.00	9.00	15.00	23.85	67.34	93.00
31.00	31.00	288	1.00	1.00	1.00	1.00	1.00	3.00	5.00	6.55	30.55	42.00

CONDITIONAL DISTRIBUTIONS OF DEGREES BELOW 32, CONDITIONED ON MINIMUM TEMPERATURE, AT WALLA WALLA

MINIMUM TEMPERATURE INTERVAL			DEGREES BELOW 32 QUANTILES									
START	END	N	MINIMUM	.01-TH	.10-TH	.25-TH	MEDIAN	.75-TH	.90-TH	.95-TH	.99-TH	MAXIMUM
-16.00	-3.00	10	2869.00	2869.00	2883.00	3101.25	5759.50	8439.00	9966.30	9999.00	9999.00	9999.00
-2.00	4.00	10	1728.00	1728.00	1733.00	1819.25	2397.50	3423.25	4739.20	4849.00	4849.00	4849.00
5.00	9.00	10	550.00	550.00	578.30	969.50	1339.00	2501.25	4071.60	4211.00	4211.00	4211.00
10.00	12.00	13	377.00	377.00	421.80	521.00	819.00	1147.00	1956.20	2245.00	2245.00	2245.00
13.00	15.00	11	185.00	185.00	185.80	195.00	373.00	992.00	2204.80	2372.00	2372.00	2372.00
16.00	18.00	22	50.00	50.00	87.00	135.50	264.50	541.50	894.10	1026.75	1041.00	1041.00
19.00	19.00	15	99.00	99.00	120.00	147.00	336.00	770.00	952.20	1008.00	1008.00	1008.00
20.00	20.00	13	81.00	81.00	84.20	115.50	147.00	300.50	817.00	1113.00	1113.00	1113.00
21.00	21.00	18	55.00	55.00	73.00	85.50	112.00	398.25	743.00	752.00	752.00	752.00
22.00	22.00	19	60.00	60.00	60.00	87.00	127.00	284.00	570.00	607.00	607.00	607.00
23.00	23.00	27	20.00	20.00	40.60	62.00	104.00	170.00	346.20	710.00	720.00	720.00
24.00	24.00	18	47.00	47.00	47.90	55.75	74.50	207.50	451.60	835.00	835.00	835.00
25.00	25.00	40	7.00	7.00	35.10	50.25	70.50	134.75	239.30	481.65	865.00	865.00
26.00	26.00	45	17.00	17.00	22.60	31.50	51.00	79.00	191.60	387.70	755.00	755.00
27.00	27.00	61	8.00	8.00	16.20	21.00	31.00	60.00	104.40	255.10	386.00	386.00
28.00	28.00	93	4.00	4.00	9.00	13.00	22.00	32.00	67.40	145.10	294.00	294.00
29.00	29.00	110	3.00	3.00	5.00	7.75	13.00	20.00	32.80	60.50	139.56	140.00
30.00	30.00	131	2.00	2.00	2.00	3.00	5.00	9.00	15.60	26.40	108.44	143.00
31.00	31.00	184	1.00	1.00	1.00	1.00	1.00	3.00	5.00	7.75	17.75	22.00

CONDITIONAL DISTRIBUTIONS OF AVERAGE TEMPERATURE BELOW 32, CONDITIONED ON MINIMUM TEMPERATURE, AT PENDLETON

MINIMUM TEMPERATURE INTERVAL		N	AVERAGE TEMPERATURE BELOW 32 QUANTILES									
START	END		MINIMUM	.01-TH	.10-TH	.25-TH	MEDIAN	.75-TH	.90-TH	.95-TH	.99-TH	MAXIMUM
-19.00	-6.00	11	2.43	2.43	2.87	5.92	7.55	11.74	14.08	14.09	14.09	14.09
-5.00	1.00	10	10.59	10.59	10.63	11.43	12.41	15.34	19.97	20.08	20.08	20.08
2.00	7.00	10	14.46	14.46	14.52	15.63	18.97	20.30	23.69	23.87	23.87	23.87
8.00	10.00	13	14.52	14.52	15.61	17.86	20.39	21.32	23.63	24.87	24.87	24.87
11.00	12.00	10	20.23	20.23	20.26	20.91	22.04	23.36	24.06	24.09	24.09	24.09
13.00	15.00	13	19.38	19.38	19.83	21.18	21.85	22.99	24.10	24.29	24.29	24.29
16.00	17.00	17	21.11	21.11	21.21	22.77	23.89	24.89	26.62	26.70	26.70	26.70
18.00	19.00	23	18.00	18.00	22.38	23.07	24.24	25.45	27.52	28.15	28.18	28.18
20.00	20.00	23	20.00	20.00	23.31	24.38	25.16	26.36	27.05	28.03	28.20	28.20
21.00	21.00	23	21.00	21.00	23.62	24.73	25.65	26.84	27.59	28.04	28.13	28.13
22.00	22.00	24	24.07	24.07	24.89	25.36	25.77	26.46	27.20	27.57	27.67	27.67
23.00	23.00	32	24.83	24.83	25.91	26.41	26.76	27.27	27.86	28.18	28.51	28.51
24.00	24.00	55	24.00	24.00	26.48	26.77	27.06	27.50	28.19	28.56	28.79	28.79
25.00	25.00	57	27.00	27.00	27.30	27.52	28.10	28.67	29.20	29.35	29.57	29.57
26.00	26.00	80	27.00	27.00	27.70	27.96	28.40	28.83	29.10	29.25	29.62	29.62
27.00	27.00	94	28.00	28.00	28.41	28.67	29.00	29.28	29.51	29.67	30.33	30.33
28.00	28.00	105	28.67	28.67	29.05	29.32	29.53	29.79	30.00	30.16	30.28	30.29
29.00	29.00	129	29.00	29.00	29.50	29.75	30.00	30.21	30.40	30.49	30.59	30.60
30.00	30.00	202	30.00	30.00	30.00	30.33	30.50	30.67	30.75	30.80	30.86	30.91
31.00	31.00	288	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00

CONDITIONAL DISTRIBUTIONS OF AVERAGE TEMPERATURE BELOW 32, CONDITIONED ON MINIMUM TEMPERATURE, AT WALLA WALLA

MINIMUM TEMPERATURE INTERVAL		N	AVERAGE TEMPERATURE BELOW 32 QUANTILES									
START	END		MINIMUM	.01-TH	.10-TH	.25-TH	MEDIAN	.75-TH	.90-TH	.95-TH	.99-TH	MAXIMUM
-16.00	-3.00	10	1.96	1.96	2.15	4.90	10.27	14.32	16.03	16.17	16.17	16.17
-2.00	4.00	10	12.67	12.67	12.67	12.92	15.44	18.89	21.60	21.71	21.71	21.71
5.00	9.00	10	14.05	14.05	14.15	17.00	19.01	22.45	23.77	23.79	23.79	23.79
10.00	12.00	13	19.55	19.55	19.65	20.18	21.45	23.36	26.05	26.80	26.80	26.80
13.00	15.00	11	18.79	18.79	19.12	20.54	21.93	22.47	25.34	25.84	25.84	25.84
16.00	18.00	22	21.02	21.02	21.49	22.65	23.68	24.43	25.14	26.39	26.59	26.59
19.00	19.00	15	21.89	21.89	22.02	23.05	24.33	24.80	26.37	26.52	26.52	26.52
20.00	20.00	13	23.55	23.55	23.66	23.94	24.68	25.42	26.29	26.43	26.43	26.43
21.00	21.00	18	24.75	24.75	24.98	25.59	25.88	26.97	27.35	27.66	27.66	27.66
22.00	22.00	19	24.53	24.53	25.26	25.95	26.45	26.65	27.59	28.35	28.35	28.35
23.00	23.00	27	23.60	23.60	25.27	25.71	26.59	27.30	28.04	28.23	28.24	28.24
24.00	24.00	18	25.86	25.86	26.50	26.89	27.47	27.80	28.80	28.92	28.92	28.92
25.00	25.00	40	25.00	25.00	26.58	27.02	27.60	28.08	28.63	29.00	29.67	29.67
26.00	26.00	45	27.00	27.00	27.66	28.04	28.53	28.90	29.22	29.62	29.88	29.88
27.00	27.00	61	27.50	27.50	28.15	28.51	28.91	29.26	29.44	29.53	29.90	29.90
28.00	28.00	93	28.00	28.00	28.84	29.05	29.50	29.78	30.00	30.22	30.43	30.43
29.00	29.00	110	29.00	29.00	29.50	29.75	30.00	30.31	30.44	30.54	30.66	30.67
30.00	30.00	131	30.00	30.00	30.00	30.25	30.50	30.67	30.80	30.83	30.89	30.90
31.00	31.00	184	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00