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**AMBIENT WEATHER MODEL
RESEARCH AND DEVELOPMENT**

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FINAL REPORT

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PROJECT STATEMENT

The 1989-1990 year Ambient Weather Model Research and Development Study established climatic transmission line rating regions for the BPA service area along with a transmission line rating methodology. The transmission line rating methodology predicts the probability of exceeding design conditions for a specified transmission line's operating current.

PROJECT SUMMARY

Ratings for BPA transmission lines are based upon the IEEE standard for calculation of bare overhead conductor temperatures and ampacity under steady-state conditions. The effects not accounted for in the IEEE model which include conductor yaw, turbulence, and conductor roughness were examined through a sensitivity study. It was found that conductor yaw is a parameter that could have significant effects at high yaw angles. Of secondary impact is crosswind turbulence, which yields a conservative effect and is potentially of importance to reduce the effect of high yaw angles on the line.

The BPA area is recognized as a large and topographically diverse region which has a wide variation in climate. A climatic classification study was conducted to break the region into similar climatic zones to provide seasonal climatic characteristics such as wind speed and temperature used in the IEEE model. The new climatic classification for the region resulted in seven zones, which results in a finer definition of climatic parameters than the current two zone system for the region i.e. east or west of the Cascade mountains.

A technique was developed incorporating the IEEE model to rate transmission lines based on the frequency of occurrence of the critical climatic conditions. The computed risk is based on the estimated joint frequency of critical wind speed and temperature. The technique which computes the frequency of wind speed and temperature assumes conservatively the two variables are independent. This assumption permits calculation of the joint probability of wind speed and temperature from the product of their individual probabilities. The distribution of temperature is assumed normal and wind speed is assumed to be adequately described by a Weibull distribution with a shape parameter of 1.0. This approach was found to provide slightly conservative estimates of the frequency of low wind speed and high temperature conditions when verified on seasonal data from 26 locations in the Pacific Northwest.

The developed technique was applied to a hypothetical transmission line route which crossed three of the newly defined zones. The results, using a mean wind speed model and a minimum wind speed model, indicated that for the current summer BPA rating the line would have a risk of exceedance of between 2.5% and 7.5%. Using the current winter BPA rating for the other seasons, the technique predicts a risk of exceedance range from 5.5% to 26% for fall, 4.5% to 22% for winter, and 5.0% to 19% for spring.

Recommendations for future investigation include acquiring high resolution, high accuracy wind speed data at low wind speeds and temperature data to verify or improve probability modeling assumptions and transforming the assumed risk transmission line rating methodology or technique into a user-friendly design tool.

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1.0 INTRODUCTION

Ratings for BPA transmission lines are based upon the IEEE Standard for Calculation of Bare Overhead Conductor Temperatures and Ampacity under Steady-State Conditions (1985). This steady-state model is very sensitive to the ambient weather conditions of temperature and wind speed. The model does not account for wind yaw, turbulence, or conductor roughness as proposed by Davis (1976) for a real time rating system. The objective of this research has been to determine (1) how conservative the present rating system is for typical ambient weather conditions, (2) develop a probability-based methodology, (3) compile available weather data into a compatible format, and (4) apply the rating methodology to a hypothetical line.

The potential benefit from this research is to rate transmission lines statistically which will allow BPA to take advantage of any unknown thermal capacity. The present deterministic weather model is conservative overall and studies suggest a refined model will uncover additional unknown capacity.

The research program has been broken down into four major tasks to accomplish the objectives discussed:

1. Determine Sensitivity of IEEE Model to Ambient Weather Conditions.
2. Establish a Climatic Condition Classification System.
3. Develop Technique to Apply a Model for the Thermal Rating of Transmission Lines.
4. Apply Technique to a Simplistic Transmission Line.

These tasks are discussed in detail in Chapters 2 through 5 of this report while Chapter 6 summarizes the results of this research effort and makes recommendations for future research.

2.0 SENSITIVITY STUDY

2.1 INTRODUCTION

One of the four tasks of this research study is to determine the sensitivity of the IEEE model on conductor ratings. The IEEE model which is used by BPA does not account for conductor yaw to the prevailing wind, turbulent effects, and conductor roughness. Only the ambient wind speed and air temperature are used besides solar parameters and the physical properties of the line to determine line ampacity. These other effects of yaw, turbulence, and roughness have been identified as possibly important (Davis, 1976; Morgan, 1985 and 1985+; and Black and Byrd, 1983).

The current BPA model uses the conservative assumptions that the ambient wind speed is 2 ft/s and the ambient temperature is 30°C in the summer and 5°C west of the Cascade Mountains and 0°C east of the Cascades during the winter. To improve modeling of these ambient conditions probably means a reduction in some of the conservatism. Therefore it is important to consider these neglected effects.

The sensitivity task examines several models to account for other possibly important effects in the IEEE model. The magnitudes of the effects are examined to determine if they should be included in the model. Each of these effects are discussed separately in the sections that follow along with ambient temperature and wind speed. Additionally, the ambient weather parameters that are considered important are summarized in Section 2.5.

2.2 TURBULENCE EFFECTS

Turbulence is the irregular flow of wind in three dimensions. In wind tunnel studies, where the scale of turbulence has been approximately the same size as the conductor, heat transfer increases with increasing turbulent intensity. In the atmosphere, the turbulence scale may be 300 times that of the conductor. This means the conductor feels a quasi-steady flow without the effects of longitudinal turbulence (parallel to the flow) and therefore has little effect on the heat transfer of lines in operation. Morgan (1985+) observed this important difference in outdoor measurements. This general effect was also noted by Davis (1976) in his review of turbulence effects. However, Davis goes forward to solve for the maximum case when the length scale to diameter ratio is 1.5 instead of the more realistic case of a length scale ratio of 200-300 for the outdoors.

The cross-wind (perpendicular to the flow) turbulence effects as described by Morgan (1985+) do appear to have an effect. This effect is discussed separately in Section 2.4, Conductor Yaw.

2.3 CONDUCTOR ROUGHNESS EFFECTS

Heat transfer from stranded conductors is always higher than from smooth conductors and is further enhanced when the Reynold's number of the flow exceeds some critical value. Davis (1976) developed an empirical model which defined a Nusselt roughness factor:

$$NR_F = \log_{10}^{-1} \left[0.30 \log_{10} \left(\frac{RE}{RE_o} \right) - 0.11 \left(\log_{10} \left(\frac{RE}{RE_o} \right) \right)^2 \right]$$

where RE is the Reynold's number and RE_o is the critical Reynold's number defined as:

$$RE_o = \frac{e_r - 0.443}{-9.22 \times 10^{-6}}$$

and the parameter e_r is defined as

$$e_r = \frac{d_s}{D_o - d_s}$$

where d_s is the strand diameter and D_o is the outside diameter. A variation study was conducted using this roughness model to understand the importance of the effect. Figure 2.1 shows the percentage increase in ampacity that would result from varying the conductor strand size (i.e. increasing roughness). Most conductor outer strand diameters used by BPA are between 0.10 and 0.17 inches. Therefore, the effect is conservative (increases heat transfer) and varies from 0 to 6% for BPA applications and should be considered negligible.

2.4 CONDUCTOR YAW

Heat transfer equations used in the IEEE model assume that wind impinges perpendicular upon the conductor. Because of prevailing wind directions and local topographical influences the wind may impinge at any yaw angle from 0 degrees (perpendicular) to 90 degrees (parallel). This effect reduces the heat transfer as described by Davis (1976), Morgan (1985, 1985+) and shown from experimental data by Black & Byrd (1983).

Figure 2.1. Conductor roughness effect on ampacity

Davis (1976) modeled this effect based on the Nusselt Number compiled from studies of yaw effects on the heat transfer from cylinders and wires. Davis' model is given by the following equation, and is graphed in Figure 2.2:

$$Y_F = 1.194 - \sin \omega - 0.194 \cos 2\omega + 0.368 \sin 2\omega \quad (2.1)$$

where ω is the yaw angle defined as 0 degrees being flow perpendicular to the conductor and 90 degrees being flow parallel to the conductor.

Morgan (1985) also formulated a model based on wind tunnel studies which is shown in Figure 2.2 and defined by the equation:

$$Y_F = 0.42 + C(\sin \theta)^P \quad (2.2)$$

Figure 2.2. Comparison of yaw effect models on Nusselt number

where $C = 0.68$ and $P = 1.08$ for $0 \leq \theta \leq 24$ deg, $C = 0.58$ and $P = 0.94$ for $24 < \theta \leq 90$ deg. The yaw angle θ is defined as 0 deg for flow parallel to the conductor and 90 deg for flow perpendicular to the conductor. Morgan's model is further modified based on experimental data in the real atmosphere to account for wind direction fluctuations (cross wind turbulence) by

$$\theta^* = 1/\sqrt{2\pi} [2\sigma_\theta e^{-y^2} + \sqrt{2\pi} |\theta| \operatorname{erf} y] \quad (2.3)$$

and

$$y = |\theta|/\sqrt{2\sigma_\theta} \quad (2.4)$$

σ_θ is the standard deviation of wind direction.

A comparison of the models expressed by Davis (1976) and Morgan (1985+) is given in Table 2.1 as a function of yaw angle and cross-wind turbulence and graphed in Figure 2.3. Note the cross-wind turbulence has a minor effect when yaw angle is less than 60 degrees and increases heat transfer at higher yaw angles. Cross-wind turbulence is a meteorological parameter that is generally not measured. Its effect

Table 2.1. Model comparison of yaw factor on Nusselt number

Yaw Angle	Davis Model	Morgan Model				
		$\sigma_\theta = 0^\circ$	5°	10°	20°	30°
0	1.00	1.00	1.00	1.00	1.00	1.00
10	0.96	0.99	0.99	0.99	0.99	0.99
20	0.93	0.97	0.97	0.97	0.97	0.97
30	0.92	0.93	0.93	0.93	0.92	0.93
40	0.88	0.88	0.88	0.87	0.87	0.88
50	0.82	0.81	0.81	0.80	0.80	0.82
60	0.74	0.73	0.72	0.71	0.73	0.77
70	0.64	0.63	0.60	0.61	0.66	0.72
80	0.52	0.52	0.50	0.53	0.61	0.69
90	0.39	0.42	0.46	0.50	0.59	0.68

Figure 2.3. Crosswind turbulence effects on the Morgan yaw model

is conservative and only of importance at high yaw angles. At low wind speeds under daytime conditions in the summer, the vertical wind speed component may range from 1.6 ft/s to 6.5 ft/s (Deardorff, 1985; Skibin, Kaimal, and Gaynor, 1985) and cross-wind turbulence is high. This situation would therefore alleviate some of the effects of yaw at low wind speeds during the summer or for high temperature conditions.

The Davis model is 3 to 4% more conservative than the Morgan model at low yaw angles. The Davis model has been used in the sensitivity studies. Either model can be easily incorporated into the IEEE or BPA procedures.

2.5 AMBIENT AIR TEMPERATURE AND WIND SPEED EFFECTS

The IEEE model is very sensitive to ambient air temperature and wind speed as is shown in Figure 2.4 for the conductor and conditions given in Table 2.2. A ten degree reduction in air temperature from 30°C means an 7.2% increase in ampacity. A 10 ft/sec increase in wind speed from 2 ft/sec (1.4 mph increased to 8.4 mph) means a 52% increase in ampacity. Therefore it is very obvious that wind speed is the common ambient parameter.

2.6 SUMMARY

Of the effects not accounted for in the IEEE model, i.e. conductor yaw, turbulence, and conductor roughness, it seems appropriate to consider the effect of conductor yaw. The primary ambient parameters therefore are ambient air temperature, wind speed, and wind direction (yaw). Of secondary impact is crosswind turbulence—which yields a conservative effect and potentially of importance at high yaw angles.

Ambient temperature and yaw angle variations are shown in Figures 2.5 through 2.7 for wind speeds of 2 ft/s, 7 ft/s, and 12 ft/s. The influence of yaw angle can be illustrated by comparing an ambient air temperature of 30°C and a perpendicular wind speed of 2 ft/sec (0 degrees yaw) to that of a parallel wind speed of 12 ft/sec (90 degrees yaw). The ampacity decreases 1% instead of increasing 52% as with both under perpendicular flow.

Any new rating model should therefore adequately account for the ambient effects of air temperature, wind speed, and wind direction (yaw) as well as their frequency of occurrence.

Figure 2.4. Conductor sensitivity to ambient temperature and wind speed

Table 2.2. Conductor properties and conditions used in sensitivity study calculations

Conductor:	795 Kcmil ACSR 26/7
Conductor Diameter:	1.108 inches
Conductor Resistance in OHM/MILE at 25°C and 75°C:	0.1172, 0.1398
Maximum Conductor Temperature:	100°C
Coefficient of Emissivity:	0.5
Coefficient of Solar Absorption:	0.5
Line Elevation in Feet Above Sea Level:	0
Line Direction is East-West and Atmosphere is Clear	
Line Latitude is 30°	
Local Sun Time is 11 AM

Figure 2.5. Conductor sensitivity to ambient temperature and wind direction at a wind speed of 2 ft/s

Figure 2.6. Conductor sensitivity to ambient temperature and wind direction at a wind speed of 7 ft/s

Figure 2.7. Conductor sensitivity to ambient temperature and wind direction at a wind speed of 12 ft/s

3.0 CLIMATIC CLASSIFICATION SYSTEM

3.1 INTRODUCTION

One of the objectives of this study is to provide climatic information that can be used in rating transmission lines. The conductor rating model is sensitive to several meteorological parameters including: wind speed, direction, temperature and turbulence. The climatic classification system is aimed at providing seasonal climate characteristics of each particular climatic zone within the region. It is recognized that in such a large and topographically diverse region there is wide variation in climate. The intent is to minimize the uncertainty of frequency values for critical climatic conditions by increasing the resolution of the climatic data used in the conductor rating model.

3.2 METHODOLOGY

Thirty-two regions have been defined within BPA's service area as distinct climatic zones by the National Climatic Center (see Figure 3.1). However, a map of the BPA transmission line network shows that there are no transmission lines in several climatic divisions and most lines transect several divisions (see Figure 3.2). The desired approach is to develop a practical and convenient, but still accurate description for rating purposes of climate in the region. The technique first identifies relevant climate for rating transmission lines, assesses variability in space and time of that information and summarizes the information for ready use as input to the conductor rating model.

The three most important climate characteristics were found to be wind speed, temperature and wind direction. Of secondary importance are crosswind variation and gustiness of the wind. The density of information on these variables varies widely. There is a dense network of temperature measurement locations in the Pacific Northwest. Wind data is available only at stations equipped with anemometers. Figure 3.3 shows the locations with temperature and wind data in the region. About 450 locations have temperature data, but only 300 have wind data.

Turbulence information is extremely scarce. Turbulence information is available for less than 20 wind locations monitored by BPA. There is no other published source of turbulence information over a variety of terrain in the Pacific Northwest. Figure 3.4 shows the location of BPA sites where wind, temperature and turbulence data are available.

Figure 3.1. Climatic zones in the Pacific Northwest.

BPA TRANSMISSION GRID

Figure 3.2. The BPA transmission line system.

CLIMATE SITES
IN BPA'S SERVICE AREA

Figure 3.3. Temperature and wind data locations in the Pacific Northwest.

BPA CLIMATE SITES
SPEED, DIRECTION, TEMPERATURE
AND TURBULENCE DATA

Figure 3.4. BPA wind, temperature and turbulence data sites in the Pacific Northwest.

3.3 RESULTS

The statistics for temperature and wind speed for the available data locations are presented in Appendix A. The climatic zones selected were based on the variation of temperature in the 31 climate zones in the BPA service area, distribution of transmission lines, the wind climate of the region, and availability and distribution of data. Figure 3.5 shows the climatic zones selected. Table 3.1 provides the summary statistics for each of the climatic zones in the region.

The boundaries of the climatic zones were based on several considerations. The first was a fairly homogeneous climatology. While the climatological zones in Figure 3.1 selected by the National Climatic Data Center (NCDC) are based on temperature and precipitation climatology, the variables considered in selection of the BPA region climate zones were temperature, maximum temperature, wind speed and direction. The NCDC climate zones consider topography, but climate zones do not cross state borders. In the selection of BPA climate zones, topography and the number of transmission lines within a region were the non-climate factors considered in zone specification.

Since the new classification represents an increase in the number of zones from the two being used now to seven in this new scheme, one might ask why so many? There is a considerable amount of variation within the region in the seasonal variation of wind and temperature. The coastal region exhibits small seasonal temperature variations (about 17°F between winter and summer) and large seasonal wind speed and direction variations. The coastal mountains may get winter snow, however the temperature of the ocean generally moderates seasonal variations in temperature. The Coast & Coast Range zone has stronger winds than either of the two neighboring zones - Puget-Willamette Lowland and Siskiyou-South Cascades. While the Puget-Willamette Lowland exhibits a moderate amount of seasonal temperature variation (about 23°F), the Siskiyou-South Cascades and Cascades exhibit a marked seasonal variation (about 28°F). The minimum wind speeds in both of these mountain regions are low due to the many deep valleys with their characteristically weak winds. The mean speed for the Cascade Mountain zone is larger because of the strong wind corridors through this zone, such as the Columbia Gorge and Snoqualmie Pass. Winds in the Puget-Willamette Lowland are generally low year round compared to the other zones.

The Basin and Range, Columbia Plateau and Rockies all have characteristically large seasonal temperature variations (29, 32 and 37°F, respectively) and strong winds. The Columbia Plateau is distinguished from the Basin and Range to the south by higher temperatures in all seasons and stronger winds in the spring and summer months. The Rockies have stronger mean and minimum wind speeds than the Cascade Mountain zone to the west.

Figure 3.5. Selected climatic zones in the Pacific Northwest.

Table 3.1. Statistical summaries of wind and temperature data for seven climate regions in BPA's service area.

Location	T _{min} (°F)	T _{max} (°F)	T _{mean} (°F)	N	SD (T _{mean}) (°F)	U _{min} (mph)	T _{mean} (U _{min}) (°F)	U _{max} (mph)	U _{mean} (mph)	N	SD (U _{mean}) (mph)
Spring											
Basin & Range	2.5	79.3	45.45	80	4.69	5.60	-	17.47	10.82	56	2.81
Cascade Mountains	15.7	74.9	47.64	52	3.85	3.80	49.55	18.03	10.75	32	3.62
Coast & Coast Range	31.0	71.0	50.15	24	1.76	5.37	-	18.50	11.00	46	2.83
Columbia Plateau	17.5	80.2	50.26	76	2.78	4.93	-	18.60	11.37	76	2.87
Puget Willamette Lowland	30.6	72.9	51.91	50	1.50	3.10	-	12.43	7.43	45	2.12
Rockies	8.4	78.5	46.66	60	3.95	5.20	51.95	19.20	11.00	22	3.82
Siskiyou & South Cascades	17.4	78.4	47.59	20	6.58	3.70	-	12.53	7.23	16	2.02
Summer											
Basin & Range	33.6	95.7	65.84	80	3.66	5.03	-	15.95	9.40	55	2.56
Cascade Mountains	37.3	89.9	61.86	52	3.10	3.93	63.80	20.57	12.09	31	5.27
Coast & Coast Range	42.8	84.3	59.39	24	3.07	4.95	-	20.13	10.57	48	3.15
Columbia Plateau	35.1	94.0	67.75	76	2.98	3.80	-	19.20	10.85	79	3.64
Puget Willamette Lowland	45.2	85.2	63.67	50	2.05	2.97	-	11.50	6.65	46	2.00
Rockies	34.6	95.1	65.52	60	3.02	4.43	70.75	15.35	9.34	20	3.13
Siskiyou & South Cascades	34.0	92.2	63.23	20	5.48	3.93	-	13.37	6.97	16	2.48
Fall											
Basin & Range	9.8	84.8	49.81	80	3.49	4.33	51.05	16.52	9.84	58	3.30
Cascade Mountains	21.9	80.9	51.82	52	2.90	2.90	53.15	15.00	8.66	33	3.32
Coast & Coast Range	33.6	78.8	53.87	24	1.70	5.30	-	18.27	10.86	48	2.99
Columbia Plateau	19.6	83.4	52.64	76	2.42	3.87	-	22.70	9.70	77	3.21
Puget Willamette Lowland	32.4	79.6	55.24	50	1.62	3.07	-	14.20	7.47	45	2.71
Rockies	11.5	86.5	50.26	60	4.09	4.03	56.05	17.80	10.43	21	4.37
Siskiyou & South Cascades	21.3	86.2	53.10	20	5.75	2.90	-	13.27	6.06	15	2.70

Table 3.1. (continued)

Location	T _{min} (°F)	T _{max} (°F)	T _{mean} (°F)	N	SD (T _{mean}) (°F)	U _{min} (mph)	T _{mean} (U _{min}) (°F)	U _{max} (mph)	U _{mean} (mph)	N	SD (U _{mean}) (mph)
Winter											
Basin & Range	-2.7	50.0	26.66	80	5.41	3.83	26.40	21.03	9.84	59	3.82
Cascade Mountains	12.4	51.3	34.35	52	4.31	3.20	-	17.13	8.22	34	3.70
Coast & Coast Range	29.0	56.2	42.59	24	2.41	6.03	-	21.33	12.36	45	3.61
Columbia Plateau	6.8	53.0	31.58	76	3.40	4.17	-	23.30	10.03	79	3.98
Puget Willamette Lowland	28.5	53.8	40.82	50	1.36	2.47	-	19.90	8.78	43	3.79
Rockies	1.3	51.2	28.01	60	4.59	3.93	62.55	21.08	12.48	23	6.16
Siskiyou & South Cascades	13.7	57.7	35.62	20	6.76	3.50	42.20	14.17	7.42	14	3.12
Yearly											
Basin & Range	-2.7	95.7	46.94	320	14.62	3.83	26.40	21.03	9.98	228	3.21
Cascade Mountains	12.4	89.9	48.92	208	10.50	2.90	53.15	20.57	9.88	130	4.32
Coast & Coast Range	29.0	84.3	51.50	96	6.53	4.95	-	21.33	11.18	187	3.23
Columbia Plateau	6.8	94.0	50.56	304	13.17	3.80	-	23.30	10.48	311	3.52
Puget Willamette Lowland	28.5	85.2	52.91	200	8.36	2.47	-	19.90	7.57	179	2.83
Rockies	1.3	95.1	47.61	240	13.92	3.93	62.55	21.08	10.87	86	4.70
Siskiyou & South Cascades	13.7	92.2	49.94	80	11.66	2.90	-	14.17	6.92	61	2.64

- T_{min} = Mean minimum temperature
 T_{max} = Mean maximum temperature
 T_{mean} = Mean temperature for the region from available data
 N = Number of climate stations with temperature data
 SD (T_{mean}) = Standard deviation of mean temperatures
 U_{min} = Minimum observed mean speed
 T_{mean} (U_{min}) = Mean temperature associated with U_{min}
 U_{max} = Maximum mean wind speed
 U_{mean} = Mean wind speed for the region
 N = Number of climate stations with wind speed data
 SD (U_{mean}) = Standard deviation of mean speeds

Since only seven climate zones were selected for a region that covers over 300,000 square miles, one might question whether seven is enough. NCDC divided this region into 31 zones (see Figure 3.1). A large part of the greater resolution in the NCDC classification is due to political boundaries and wide variation in precipitation climatology in this region. Between Port Angeles and Neah Bay, a distance of about 50 miles, there is a difference of over 50 inches per year in rainfall. The large variation in precipitation accounts for the five climate zones in northwest Washington state. Since precipitation has a negligible affect on transmission line rating, little climate information is lost in the climate zones proposed in this report. Another example is no difference in the mean annual temperatures in the Columbia Plateau on the Washington and Oregon side of the border, so NCDC climate zone 6 in Oregon and 8 Washington are different only politically. The mean temperatures in the Puget sound Lowland are very similar to those in the Willamette Lowland. The Willamette Lowland has higher summer temperatures, so combining the two regions results in conservative error.

Many climate zones were lumped together in the Basin and Range lands east of the Cascades and in the Rocky Mountain area because few transmission lines cross eastern Oregon and southern Idaho. High resolution climate zones are not justified by the density of climate data and transmission lines (see Figures 3.2 and 3.3). Nine NCDC climate zones are included in the Basin and Range zone. The mean annual temperature for these nine zones is 45.27°F. The mean annual temperature for the Basin and Range Zone is 46.9°F. The Rockies include parts of seven NCDC climate zones with a mean annual temperature of 43.9°F. The mean annual temperature is 47.6°F for the Columbia Plateau region.

The seven climate zones selected are defined by the latitude longitude boundaries given below:

Coast and Coast Range:	west of 123°W
Puget-Willamette Lowland:	north of 44°N, east of 123.5°W and west of 122°W
Cascade Mountains:	north of 44°N, east of 121°W and west of 122°W
Siskiyou-South Cascades:	south of 44°N, west of 121°W and east of 123.5°W
Columbia Plateau:	north of 45°N, west of 117°W and east of 121°W
Basin and Range:	south of 45°N and east of 121°W
Rockies:	north of 45°N and west of 117°W

4.0 THERMAL RATING OF TRANSMISSION LINE TECHNIQUE

4.1 INTRODUCTION

The objective of this section is to present a technique to rate lines based on the frequency of occurrence of critical climatic conditions. The model currently uses an ambient wind speed of 2 ft/s and 30° C in the summer and 5°C west of the Cascades and 0°C east of the Cascades in the winter. There is a need for better information on the frequency of these critical conditions in different areas of the region.

The two most important variables are wind speed and temperature. For wind speed, the approach used to characterize the frequency of critical low wind speed was to select an appropriate wind speed probability distribution. A probability distribution which best fit the distribution in the low wind speed range was considered the most appropriate. That distribution was verified by comparison to the actual cumulative frequency of winds. For the BPA wind data set the threshold of interest was 2 mph. Wind speed data are available for speeds less than 2 mph, however most anemometer thresholds are between 1.5 and 3 mph. National Weather Service (NWS) and FAA wind data are summarized with low wind speeds grouped in a category between 0 and 4 mph.

Temperature was assumed to be normally distributed. A probability model was developed to predict the likelihood of a given temperature. The model was verified using actual probability distributions at 13 BPA and 13 NWS sites.

4.2 WIND SPEED PROBABILITY

Wind speed, the most important climatological variable affecting line ampacity rating, varies widely in space and time. The approach used to characterize wind developed representative estimates of the frequency of critical winds (light winds) sufficiently conservative to reflect the high degree of uncertainty associated with the spatial and temporal variation of wind. That conservatism resulted in using seasonal mean wind speeds values and their frequencies of 4 mph or less for each location with data (if information was available) and were encoded on a spreadsheet (see Appendix A).

Our approach is to develop a model to estimate the distribution of wind speeds using a fitted probability distribution. Wind speed is a quantity that has only positive values and typically has a skewed distribution rather than a normal distribution. It is typically represented by a one parameter Rayleigh distribution or a two parameter Weibull distribution. In the case of the Weibull distribution, the parameters relate to the average site wind speed modified by the scale parameter (c) and the ratio of the standard deviation of wind speed to the mean through the shape parameter (k).

The probability distribution function $P(v)$ for wind speed (v) is expressed as

$$P(v) = \frac{k}{c} \left(\frac{v}{c} \right)^{k-1} \exp \left[- \left(\frac{v}{c} \right)^k \right] \quad (4.1)$$

where k the shape parameter is equal to

$$k = \left(\frac{\bar{v}}{\sigma} \right)^{-1.086} \quad (4.2)$$

$\bar{v}$ is the mean speed and σ is the standard deviation of wind speed. The scale parameter c is estimated from

$$c = \bar{v} / \Gamma(1 + 1/k) \quad (4.3)$$

where the gamma function Γ is evaluated for $(1 + 1/k)$ and can be obtained from mathematical tables.

The Rayleigh distribution is a special case of the Weibull distribution for a shape parameter of two ($k = 2$). According to Hennessey (1977) the shape parameter has an average value of 2.0 for U.S. stations. There is generally a large range in the value of k . For instance, in Australia, Halliday (1984) found a range of k between 1.09 and 2.55. The BPA data showed seasonal variation for k of 0.737 to 2.20. Hengeveld et al. (1978) pointed out that the characteristic values of k occur in certain wind regimes. In trade wind locations a value of 4 is common, in temperate maritime locations 2 is a common value, while in polar regions a k value of 1 is most representative. Figure 4.1 shows the frequency distribution for various values of the Weibull shape parameter. Justus (1978) found that the Weibull shape parameter is also a function of the mean wind speed and the variance. Sites with larger variance have larger shape parameters and the shape parameter decreases with decreasing wind speed. He found a relationship where $k = 0.87V^{0.5}$ where V is the mean wind speed in meters per second.

In our examination of the fitted distributions, we found that the distribution using a shape parameter of 2.0 often underestimates at low wind speeds. This is generally of little concern to most users of wind speed distributions. Their interest generally lies at the higher wind speed ranges. For our interest, however, this is important! We have found that for low wind speeds setting the shape factor of the Weibull distribution to one, yields values that have reasonable agreement with actual data from National Weather Station sites and the BPA sites once a correction relation is applied. We found the optimum Weibull value by fitting the Weibull distortion to the wind in the lowest quartile of wind speed frequencies (0-4 mph). Justus (1978) found that as the mean speed decreased the Weibull shape parameter converged to a value of one.

Figure 4.1 A comparison of the wind speed frequency in hours per year for three characteristic Weibull shape parameters (k).

We tested the accuracy of the estimated winds below 2 mph for the BPA sites and 4 mph for the National Weather Service locations (the distribution of winds for NWS sites is only provided for speeds less than 4 mph). We found that the estimated frequency using a Weibull distribution with a shape parameter of 1.0 needed to be corrected using the following correction:

$$P_v(\text{cor}) = 160.P_v^2 + 15.6P_v \quad (4.4)$$

Figures 4.2 and 4.3 show the comparison of the corrected estimated values to actual values for NWS sites and BPA sites.

4.3 TEMPERATURE PROBABILITY

As temperature increases line ampacity decreases. One important limiting condition then is high temperatures. Seasonal mean values of maximum and minimum temperature for every location in the region with summarized data was also encoded on the spreadsheet with the winds. The mean maximum and minimum temperatures were calculated for each of the selected climatic zones. Table 3.1 and Appendix A present statistics for each climate zone.

Figure 4.2. A comparison of actual and estimated cumulative wind speed frequency at BPA sites.

Figure 4.3. A comparison of actual and estimated cumulative wind speed frequency at NWS sites.

Temperature was assumed to be normally distributed. Given a maximum and minimum temperature the mean can be estimated by the relation:

$$T_{\text{mean}} = (T_{\text{max}} - T_{\text{min}})/2 \quad (4.5)$$

The standard deviation of the temperature was derived from an empirically derived relationship between the mean and standard deviation for each season. We did not have hourly standard deviation data for most temperature sites in the Pacific Northwest. Thirteen BPA climate stations were used to develop a relationship between mean hourly temperature and the standard deviation for each season. The standard deviation is estimated to be 25% of the mean for the transition season of spring and fall 28% for winter and 16% for summer. Table 4.1 summarizes statistics for the relationship of mean and standard deviation.

Table 4.1. The percentage that standard deviation represents of the mean for data collected at 13 BPA meteorological stations for each season.

	Spring	Summer	Fall	Winter
Mean percent	25	16	25	28
Standard Error % of the Estimate	±2	±1	±2	±4
Number	11	12	12	12

The assumption of a normal distribution for temperature is adequate for most locations (see Kunkel and Court, 1990). Temperature can thus be represented as:

$$\text{Prob}(T > T_{\text{crit}}) = 1 - \text{Prob}(T < T_{\text{crit}}) \quad (4.6)$$

$$\text{Prob}(T < T_{\text{crit}}) = \frac{1}{\sqrt{2\pi} \sigma_T} \int_{-\infty}^{T_{\text{crit}}} \exp\left(-\frac{(y - \mu_T)^2}{2\sigma_T^2}\right) dy \quad (4.7)$$

where

σ_T is standard deviation of temperature

μ_T is mean temperature.

A comparison of the estimated and actual frequency of the cumulative probability of temperature is given in Figures 4.4 and 4.5. The results suggest good agreement between the estimates and actual frequencies for Figure 4.4. In Figure 4.5 estimated frequencies are conservative when comparison is made to actual BPA cumulative frequencies.

Figure 4.4. A comparison of estimated and actual cumulative frequency of temperature at NWS sites. Note: National Weather Service cumulative frequency is for temperatures greater than 70°F.

Figure 4.5. A comparison of estimated and actual cumulative frequency of temperature at NWS sites. Note: BPA cumulative frequencies are for temperatures greater than 85°F.

4.4 WIND DIRECTION OR CONDUCTOR YAW

The present conductor rating model assumes wind is perpendicular to the conductor. This is not a conservative assumption for horizontal winds. As wind direction varies widely in time and space its effectiveness for convective heat transfer is reduced for all directions other than perpendicular flow. We reviewed the limited data on frequency of wind direction for light winds (see Appendix A) and found no reliable correlation to characterize wind direction in the region. Recognizing the lack of high resolution data required to characterize wind direction, the simplifying assumption of perpendicular wind flow is adopted. This assumption is probably adequate for daytime summer conditions considering the therms generated by strong solar heating and vertical drafts (see Oke, 1978; Deardorff and Willis, 1985; and Skibin et al., 1985). Figure 4.6 shows the relationship between daytime vertical wind variations and fluctuations in air temperature and heat flux. Since vertical flow approximates perpendicular flow, the perpendicular flow assumption seems reasonable for daytime conditions. Under stable or neutral air flow conditions (night), the vertical winds are low and the assumption of perpendicular flow to the conductor becomes nonconservative.

Figure 4.6. The relationship between vertical air velocity (w), temperature (T) and sensible heat flux (Q_H) (from Oke, 1978).

Convective heat transfer is dependent on (among other variables) wind direction and crosswind turbulence (see Section 1). Crosswind turbulence effectively enhances convective cooling at low yaw angles and decreases in effectiveness as wind direction approaches perpendicular flow. Since wind direction is highly variable and this variability enhances convective heat flow, it would potentially be useful to quantify

crosswind turbulence. There are limited locations recording crosswind turbulence data, but some general characteristics of crosswind turbulence are discussed in the meteorological literature.

Most often under clear skies and strong daytime heating, crosswind turbulence (σ_θ) is greater than 10 degrees and increases with decreasing wind speed. For neutral conditions, which occur in the absence of intense solar heating, σ_θ is typically between 5 and 10 degrees. For very stable situations such as laminar flow (nighttime conditions) σ_θ is often less than 5 degrees and increases with increasing wind speed. Figure 4.7 shows the variation in the range of wind direction over a 15 minute averaging period as a function of season and time of day. [Note the range is lower than σ_θ .] During the summer months in the afternoon directions fluctuate widely, whereas during the winter, or at night, the wind direction variation is less pronounced. Also direction variation is greatest at the surface and decreases with increasing height (see Figure 4.8). The value of σ_θ also varies with surface roughness. Larger values of σ_θ occur over tree covered surfaces and rough terrain rather than over smooth and flat terrain.

Figures 4.9 to 4.10 show the distribution of σ_θ at two locations that typify the kind of terrain and surface roughness over which transmission lines are built. The Kittitas Microwave (Figure 4.9) is near the area where the BPA 500 kV lines between Grand Coulee and the Seattle area cross the Kittitas Hills. Figure 4.10 represents data collected at span 76/3 on the Garrison-Taft line in western Montana on tree covered ridge. Figure 4.9 and 4.10 show the difference that roughness and terrain have on crosswind variation as a function of temperature and wind speed. At Kittitas (Figure 4.9) there is little difference between the crosswind variations for various temperature categories. At higher temperatures there are greater crosswind variations but because the terrain is gently rolling and the roughness is only small shrubs, the differences between temperature and wind speed categories is small. On the tree-covered ridge site, 76/3 (see Figure 4.10), there is dramatic variation in crosswind turbulence with wind speed and temperature.

4.5 JOINT PROBABILITY DISTRIBUTION FOR WIND SPEED AND TEMPERATURE

At some of the BPA sites, concurrent hourly wind speed and temperature data were available to allow calculation of the dependance of the two parameters. This correlation of temperature and wind speed was found to be very small (R less than ± 0.1). This means that it may be appropriate to calculate the joint probability distribution as if temperature and wind speed are independent. The joint probability distribution can then be given by the product of the individual probability distributions:

$$\text{Prob}(T > T_{\text{crit}} \text{ and } WS < WS_{\text{crit}}) = \text{Prob}(WS < WS_{\text{crit}}) * \text{Prob}(T > T_{\text{crit}}) \quad (4.8)$$

Figure 4.7. Wind direction range variation in Idaho as a function of time of day and month (from Slade, 1968).

Figure 4.8. The crosswind variation as a function of height and stability (from Slade, 1968).

Figure 4.9. Crosswind turbulence intensity as a function of wind speed category and temperature category at Kittitas.

Figure 4.10. Crosswind turbulence intensity as a function of wind speed category and temperature category at Span 76/3 Garrison-Taft.

At two locations with significant correlations ($R = 0.28$ and 0.35) we tested the degree of error in this assumption. For a positive correlation of summer temperature and wind speed of $R = 0.28$, the actual probability of winds less than 4 ft/sec and temperature greater than 30°C was 0.13%. If we assume independence and take the product of the probability of a temperature greater than 30°C and wind speed less than 4 ft/sec we get 0.5%. At a location with an R value of 0.35 the actual joint frequency was 0% and the estimated joint frequency using the independent assumption was .07%. This assumption appears conservative even though the assumption of independence of temperature and wind speed is counter-intuitive. Figure 4.11 shows the variation of temperature and wind speed at a climate data site near the intersection of the John Day and Chandler transmission lines. The wind speed increases from a low in the early morning hours to a high in the late afternoon. This pattern is typical of summer days with the wind speed increasing as temperature increases. This suggests a positive correlation between the two variables. If the diurnal cycle is removed from the wind and temperature data at this site shown in Figure 4.11 the two variables are negatively correlated (-0.13).

Figure 4.11. The relationship between temperature and wind speed on a typical summer day in the Columbia Basin. Temperature is given by triangles and wind speed by a solid line.

The assumption of independence of wind speed and temperature is justified from a statistical point of view since the variables temperature and wind speed can be shown to be poorly correlated. However, physically, the assumption is invalid. Wind speed and temperature are related in a nonlinear fashion.

Unfortunately, there is insufficient information on the joint frequency of wind speed and temperature at low wind speeds. The reason for the dearth of information is that most wind data has been collected from anemometers with high thresholds of sensitivity (1.5 to 3 mph). This forces simplifying assumptions as to the relationship of these variables.

A comparison of the estimated joint probability and the actual probability is given in Figures 4.12 and 4.13. In general, the estimated probability of the selected critical condition is conservative using this model.

4.6 ASSURANCE LEVEL (EXCEEDANCE LEVEL OR RISK)

Stipulating an assurance level which must be met to deem a risk acceptable; a statistical current rating which meets the required assurance level can be determined for a transmission line passing through one of the seven climatic regions. That allowable current rating is dependent on the lines conductor and topological geometry plus the statistical climatic model of temperature, wind speed, and wind direction (i.e., 95% assurance level of maintaining minimum ground clearance). The process would calculate assurance levels for a range of current values individually as one minus the cumulative probability of exceeding minimum ground clearance (exceedance level) for all pertinent combinations of air temperature, wind speed, and wind direction. This range of current values and their associated exceedance levels can be combined into a Risk Chart (see Figures 4.14 and 4.15). The allowable current rating is the value of current whose risk of exceeding minimum ground clearance is equal to one minus the assurance level. For a line which spans several climate regions, the lines rated ampacity is the ampacity of the most limiting region.

4.7 SUMMARY

Wind speed, temperature and wind direction have been found to be the most critical climatic variables in the thermal rating of transmission lines. These variables have been summarized for over 500 locations in the Pacific Northwest. Seven climatic regions in BPA's service area were defined and wind speed, direction and temperature data were summarized for each zone. These computed statistics will be used as input to a statistical model which calculates line ampacity for a given level of risk. The computed risk is based on the estimated joint frequency of critical wind speed and temperatures. The model which computes the frequency of wind speed and temperature assumes conservatively the two variables are independent. This assumption permits calculation of the joint probability of wind speed and temperature from the product of their individual probabilities. The distribution of temperature is assumed normal and wind speed is assumed to be adequately described by a Weibull distribution with a shape parameter of 1.0. This model was found to provide slightly conservative estimates of the frequency of low wind speed and high temperature conditions when verified on seasonal data from 26 locations in the Pacific Northwest.

Figure 4.12. The joint cumulative probability of a critical wind speed and temperature condition at NWS sites.

Figure 4.13. The joint cumulative probability of a critical wind speed and temperature condition at BPA sites.

SUMMER RISK CHART - REDMOND, OREGON

Figure 4.14. Percent exceedance for a summer case at Redmond, OR, given a current rating of 30°C and 2 ft/sec.

WINTER RISK CHART - REDMOND, OREGON

Figure 4.15. Percent exceedance for a winter case at Redmond, OR, given a current rating of 0°C and 2 ft/sec.

5.0 APPLICATION OF THERMAL RATING TECHNIQUE

5.1 INTRODUCTION

A hypothetical transmission line route was selected as an illustrative example of how the technique is applied. The transmission line runs from Chief Joseph to the Seattle area, which is approximately east to west at a latitude of about 48 degrees, as shown in Figure 5.1. This line crosses three climatic regions whose characteristics are shown in Table 5.1.

Figure 5.1. Transmission line from Chief Joseph to the Seattle area

Table 5.1. Selected regional climatic conditions

Region	T (°F)	COV	WS Min (mph)	WS Mean (mph)	Elevation (ft)
Summer					
Puget Willamette Lowlands	63.7	0.16	2.97	6.65	500
Cascades	61.9	0.16	3.93	12.09	5000
Columbia Plateau	67.8	0.16	3.80	10.85	3000
Fall					
Puget Willamette Lowlands	55.2	0.25	3.07	7.47	500
Cascades	51.8	0.25	2.90	8.66	5000
Columbia Plateau	52.6	0.25	3.87	9.70	3000
Winter					
Puget Willamette Lowlands	40.8	0.28	2.47	8.78	500
Cascades	34.4	0.28	3.20	8.22	5000
Columbia Plateau	31.6	0.28	4.17	10.03	3000
Spring					
Puget Willamette Lowlands	51.9	0.25	3.10	7.43	500
Cascades	47.6	0.25	3.80	10.75	5000
Columbia Plateau	50.3	0.25	4.93	11.37	3000

The rating model was run for our hypothetical line (795 Kcmil ACSR 26/7 line) as defined in Table 5.2 and compared against the summer rating conditions of 30°C and 2 ft/s wind speed and the winter rating conditions of 5°C and 2 ft/s wind speed for areas west of the Cascades and 0°C and 2 ft/s wind speed for areas east of the Cascades. The model, using these rating conditions for the transmission line route selected, gave a line ampacity rating of 1026 amps for the summer and 1237 amps for the winter.

The thermal rating technique developed is demonstrated for the example case using region mean wind speed statistics and for a possible worst case condition by using region minimum wind speed statistics plus the effect of using different transmission line design temperatures in the following sections.

Table 5.2. Conductor properties and conditions used

Conductor	795 Kcmil ACSR 26/7
Conductor Diameter	1.108 inches
Conductor Resistance in OHM/MILE at 25°C and 75°C	0.1172, 0.1398
Maximum Conductor Temperature	100°C
Coefficient of Emissivity	0.5
Coefficient of Solar Absorption	0.5
Line Elevation in Feet Above Sea Level	500 or 5000 or 3000 (depending on region)
Line Direction	East-West
Atmosphere	Clear
Line Latitude	48°
Local Sun Time	11 AM

5.2 EXAMPLE OF TECHNIQUE USING MEAN SPEED STATISTICS

The model was applied using mean wind speed statistics for each region. The mean wind speed for each region is the mean of its sites' seasonal average wind speeds. Figures 5.2 through 5.5 shows the results of the application of the technique for all four seasons for the three regions that our example line crosses. The overall line risk is the lowest ampacity for each assumed risk or as shown in the summary risk chart Figure 5.6 for each season of the year. This would indicate that the current BPA rating system operates at about 2.5% assumed summer risk and that this risk is controlled by the Puget Willamette Lowlands. Assuming the winter BPA winter rating conditions apply for fall through spring seasons, Figure 5.6 shows that the current BPA rating system operates at about a 5% risk of exceedance of the design line temperature of 100°C for these seasons and that the Cascade region controls during the fall and winter and the Puget Willamette Lowlands controls during the spring.

5.3 EXAMPLE OF TECHNIQUE USING MINIMUM WIND SPEED STATISTICS

The model was applied using minimum wind speed statistics for each region. The minimum wind speed for each region is the data site within a region with the lowest average wind speed for the season. This may be considered a worst case condition. Figures 5.7 through 5.10 show the results of the application of the technique using minimum region wind speed for all four seasons for the three regions that our example line crosses. The overall line risk for each season is the lowest ampacity for each assumed risk or as summarized in Figure 5.11 for the seasons of the year. This would indicate that the current BPA rating system operates at about 7.5% assumed risk for the summer rating conditions and at 26%, 22%, and 19% for fall, winter, and spring seasons using winter rating conditions.

Figure 5.2. Fall risk for each region the transmission line crosses using mean wind speed statistics.

WINTER RISK CHART

Figure 5.3. Winter risk for each region the transmission line crosses using mean wind speed statistics.

Figure 5.4. Spring risk for each region the transmission line crosses using mean wind speed statistics.

SUMMER RISK CHART

Figure 5.5. Summer risk for each region the transmission line crosses using mean wind speed statistics.

SUMMARY RISK CHART

Figure 5.6. Summary risk chart for all seasons using mean wind speed statistics.

SUMMER RISK CHART

Figure 5.7. Summer risk for each region the transmission line crosses using minimum wind speed statistics.

Figure 5.8. Fall risk for each region the transmission line crosses using minimum wind speed statistics.

WINTER RISK CHART

Figure 5.9. Winter risk for each region the transmission line crosses using minimum wind speed statistics.

Figure 5.10. Spring risk for each region the transmission line crosses using minimum wind speed statistics.

SUMMARY RISK CHART

Figure 5.11. Summary risk chart for all seasons using minimum wind speed statistics.

The difference between using region mean wind speed and minimum wind speed statistics is shown by Figures 5.12 and 5.13 for the summer and winter seasons. Table 5.3 compares the assumed risks using mean and minimum region wind statistics for all four seasons. Summer rating conditions are used for the summer season and winter rating conditions are used for the fall, winter, and spring seasons.

Table 5.3 Comparison of assumed risks using mean and minimum wind statistics.

Season	Mean Region Wind Statistics	Minimum Region Wind Statistics
Summer	2.5	7.5
Fall	5.5	26.0
Winter	4.5	22.0
Spring	5.0	19.0

5.4 SUMMARY

The technique developed indicates that the assumed risk for the current summer BPA rating would be between 2.5% (average wind statistics) and 7.5% (minimum wind statistics) risk. Using the winter BPA rating for the other seasons, the technique predicts a risk of exceedance range from 5.5% to 26% for fall, 4.5% to 22% for winter, and 5.0% to 19% for spring.

Figure 5.12. Comparison of risk for the summer season using mean and minimum wind speed statistics.

WINTER RISK CHART

Figure 5.13. Comparison of risk for the winter season using mean and minimum wind speed statistics.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

The 1989-1990 year research effort on ambient weather model research and development accomplished the following objectives:

- o Developed an understanding of influence of meteorological parameters on rating transmission lines.
- o Established climatic transmission line rating regions for BPA service territory.
- o Developed an assumed risk transmission line rating methodology or technique.
- o Application of the developed methodology or technique to a hypothetical transmission line.

The overall result of the research was:

- o The assumed risk transmission line rating methodology along with the climatic rating region definitions allow the determination of probability of exceedance (risk assumption) of allowable ratings for a given transmission line and the region that controls the rating of the line when a line crosses several regions.

6.2 RECOMMENDATIONS

The overall objectives of future work in this area should be:

- o Acquire high resolution, high accuracy wind speed data at low wind speeds and temperature data to verify or improve probability modeling assumptions.
- o Transform assumed risk transmission line rating methodology into a user friendly design tool.

Detailed work objectives are described as follows:

Task 1. Direct, Process and Summarize Meteorological and Line Data to Evaluate a Data Acquisition System (DAS)

Meteorological and line data should be acquired at a site in order to investigate and verify a potential design for a data acquisition system (DAS). Such a data acquisition system is outlined below. This acquisition system may involve changing sampling rates and averaging times to investigate different research objectives.

Task 2. Analysis of Meteorological and Line Characteristic Data

The current probability model is based on the distribution of the horizontal component of hourly wind speed and ambient air temperature data. Values are the highest mean temperature month for a three month period (season) using an existing data base established from sensors with high thresholds and coarse frequency data reduction.

The following items need to be investigated:

- o Will the distribution of hourly wind speed and temperature data change significantly if low threshold sensors and finer frequency data reduction is used and if the independence of wind speed and temperature still exists.
- o Will the independence of wind speed and temperature data be retained with refined data.
- o Should the distribution of wind speed and temperature data be based on 5 minute or 10 minute periods instead of one hour periods.
- o Can a correction methodology be developed to correct hourly frequency data down to 5 or 10 minute periods applied to the current data base.
- o Investigate the dependence of wind speed and temperature over 5 min, 10 min, 60 min, daily, monthly averaging times.
- o Verify the conservativeness of the model's risk estimates over various averaging time scales.
- o Investigate vertical wind speed influence on total wind speed frequency distributions.
- o Examine the relationship of ambient air temperature, wind velocity, line temperature, and line ampacity, and ground clearance over various averaging times (ie. 1 min, 5 min, 10 min, hour, day, month, and season).
- o Investigate the relevancy of wind yaw at low wind speeds.

Task 3. Refinement and Transformation of Computer Model into a Design Tool

Any refinements determined from task 2 will be incorporated into the existing model. The computer model will be refined into a user friendly design tool and documented in an instructional manual. The model will be able to run from a desk top or mainframe computer.

RECOMMENDED METEOROLOGICAL MEASUREMENT PROGRAM TO EVALUATE DAS PROTOTYPE

Location

The equipment will be located at Ross complex near the Nitech Line Monitoring System. The u-v-w anemometer and ambient temperature sensor should be set at transmission line height (about 40 ft). Ideally

a 2 meter (5 ft) temperature measurement and a 10 meter (30 ft) wind speed measurement should be made to compare line height data to standard measurement levels.

Equipment and Calibration

OSU could provide a u-v-w anemometer with a 0.6 m/s threshold. BPA has purchased a u-v-w translator with a 0 to 5 volt output. BPA should also supply two temperature sensors and the data logger. OSU would be responsible for the u-v-w calibration and BPA for calibration of the temperature sensors and Nitech monitoring system. Ideally the temperature sensors should be matched and have identical characteristics. A solar radiation sensor would also be useful and is recommended. The DAS, as configured lacks a means to measure and record ground clearance, but should be included in the next prototype.

Data Acquisition

Sampling frequency should be at least 1Hz and the averaging time should be ten minutes. The statistics that will be in the output table will be adjusted after examination of some high frequency information. In the interim the following parameters should be collected for each 10-minute period:

- o site id.
- o julian day, hour and minute.
- o average scalar wind speed (using all three u, v and w components).
- o average scalar using u and v components.
- o average vector wind direction.
- o standard deviation of wind speed and direction.
- o average absolute vertical wind speeds.
- o maximum and minimum wind speeds for 1 and 5 minute sampling periods.
- o average temperatures or delta temperature.
- o average solar radiation.
- o line average temperature.
- o line maximum temperature.
- o line standard deviation of temperature.
- o line average current.
- o line standard deviation of current.
- o line ground clearance

Units will be mph for wind speeds, degrees for wind direction, degrees C for temperatures, watts per centimeter squared for solar radiation, and amperes for line current.

7.0 REFERENCES

- Black, W.Z. and W.R. Byrd, Real-Time Ampacity Model for Overhead Lines, IEEE Transactions on Power Apparatus and Systems, Vol PAS-102, No. 7, July 1983.
- Davis, Murray W., A New Thermal Rating Approach: The Real Time Thermal Rating System for Strategic Overhead Conductor Transmission Lines, Part II, Steady State Thermal Rating Program, IEEE PES Summer Meeting, Portland, OR, July 18-23, 1976.
- Deardorff, J.W. and G.E. Willis, Further Results from a Laboratory Model of the Convective Planetary Boundary Layer, Boundary-Layer Meteorology, No. 32, pp 205-236, 1985.
- Halliday, J.A., 1984: "Analysis of wind speed data recorded at 14 widely spaced U.K. meteorological stations," Wind Engineering, 8, pp. 50-73.
- Hengreid, H.J., E.H. Lysen, and L.M. Paullissen, 1978: Matching of wind rotors to low powered Electrical generators, Publication SED 78-3 SWD, Steering Committee, Amsfort, Netherlands.
- Hennessey, T.P., 1977: "Some aspects of wind power statistics," J. Appl. Meteor., 16, pp. 119-128.
- IEEE Standard for Calculation of Bare Overhead Conductor Temperature and Ampacity Under Steady-State Conditions, ANSI/IEEE Std 738-1986, IEEE, New York, December 31, 1985.
- Justus, C.G., 1978: Winds and Wind System Performance, Franklin Press, Philadelphia, 120 pp.
- Kunkel, K.E. and A. Court, 1990: "Climatic means and normals - A Statement of American Association of State Climatologist," Bul. of Amer. Meteor. Soc., 71, pp. 201-203.
- Morgan, V.T., Some Factors which Influence the Continuous and Dynamic Thermal Ratings of Overhead-line Conductors, CIGRE Symposium 06-85, Brussels, 1985, Paper 230-08.
- Morgan, V.T., The Real-Time Heat Balance for Overhead Conductors, CSIRO Division of Applied Physics, Australia, (Date unknown -after 1985)
- Oke, T.R., 1978: Boundary Layer Climates, Halstead Press, New York, 372 pp.
- Skibin, D., J.C. Kaimal and J.E. Gaynor, 1985: Measurement Errors in Vertical Wind Velocity at the Boulder Atmospheric Observatory, J. Ocean Atmos. Technology.
- Slade, D.H., 1963: Meteorology and Atomic Energy, published by the U.S. Atomic Energy Commission, 445 pp.

APPENDIX A

Summarized Temperature and Wind Data

	Pages
Coastal Region	A1-A5
Puget Sound Lowland	A6-A10
Siskiyou and South Cascades	A11-A12
Cascade Mountains	A13-A17
Columbia Plateau	A18-A28
Basin and Range	A29-A33
Rockies	A34-A37

Table Definitions

#	=	site number in the selected region
LOCATION	=	site name
ST	=	state two letter identification
EL	=	site elevation
LAT	=	latitude in degrees and ten of minutes
LON	=	longitude in degrees and ten of minutes
SEASON	=	season (i.e. winter = Dec-Feb; spring = Mar-May, etc.)
T _{max}	=	mean maximum temperature
T _{min}	=	mean minimum temperature
T _{mean}	=	mean temperature
WS	=	mean wind speed
FREQ	=	frequency of winds less than 4 mph
DIR	=	prevailing direction of light winds

COAST & COAST RANGE -- WIND AND TEMPERATURE DATA

#	LOCATION	ST	EL	LAT.	LONG.	SEASON	Tmax	Tmin	Tmean	WS	FREQ.	DIR
1	Astoria	OR	10	46.15	123.90	SPRING					8.67	
1	Astoria	OR	10	46.15	123.90	SUMMER					8.73	
1	Astoria	OR	10	46.15	123.90	FALL					8.47	
1	Astoria	OR	10	46.15	123.90	WINTER					8.97	
2	Astoria AP	OR	8	46.15	123.83	SPRING					6.33	7.4 SE
2	Astoria AP	OR	8	46.15	123.83	SUMMER					5.77	7.7 SE
2	Astoria AP	OR	8	46.15	123.83	FALL					5.30	11.9 SE
2	Astoria AP	OR	8	46.15	123.83	WINTER					7.13	5.9 E
3	Brookings	OR	120	42.05	124.28	SPRING	65.5	40.5	53.00		8.23	
3	Brookings	OR	120	42.05	124.28	SUMMER	67.7	48.7	58.20		5.87	
3	Brookings	OR	120	42.05	124.28	FALL	68.8	43.2	56.00		6.90	
3	Brookings	OR	120	42.05	124.28	WINTER	56.2	40.0	48.10		9.00	
4	Bullards Beach	OR	20	43.15	124.40	SPRING					11.53	
4	Bullards Beach	OR	20	43.15	124.40	SUMMER					10.03	
4	Bullards Beach	OR	20	43.15	124.40	FALL					11.30	
4	Bullards Beach	OR	20	43.15	124.40	WINTER					11.20	
5	Bullards Hill	OR	100	43.15	124.42	SPRING					6.70	
5	Bullards Hill	OR	100	43.15	124.42	SUMMER					5.83	
5	Bullards Hill	OR	100	43.15	124.42	FALL					6.13	
5	Bullards Hill	OR	100	43.15	124.42	WINTER					6.47	
6	Cape BL M/U	OR	217	42.83	124.57	SPRING					18.50	
6	Cape BL M/U	OR	217	42.83	124.57	SUMMER					18.47	
6	Cape BL M/U	OR	217	42.83	124.57	FALL					18.27	
6	Cape BL M/U	OR	217	42.83	124.57	WINTER					21.33	
7	Cape BL Tower	OR	180	42.83	124.52	SPRING					10.97	
7	Cape BL Tower	OR	180	42.83	124.52	SUMMER					14.00	
7	Cape BL Tower	OR	180	42.83	124.52	FALL					10.40	
7	Cape BL Tower	OR	180	42.83	124.52	WINTER						
8	Cape Blanco AP	OR	200	42.85	124.52	SPRING					9.00	
8	Cape Blanco AP	OR	200	42.85	124.52	SUMMER					13.10	
8	Cape Blanco AP	OR	200	42.85	124.52	FALL					8.87	
8	Cape Blanco AP	OR	200	42.85	124.52	WINTER					9.70	
9	Cape Blanco CGLS	OR	200	42.83	124.57	SPRING					14.70	
9	Cape Blanco CGLS	OR	200	42.83	124.57	SUMMER					14.83	
9	Cape Blanco CGLS	OR	200	42.83	124.57	FALL					13.73	
9	Cape Blanco CGLS	OR	200	42.83	124.57	WINTER					17.20	
10	Cape Blanco R.S.	OR	217	42.83	124.57	SPRING					15.93	
10	Cape Blanco R.S.	OR	217	42.83	124.57	SUMMER					20.13	
10	Cape Blanco R.S.	OR	217	42.83	124.57	FALL					15.50	
10	Cape Blanco R.S.	OR	217	42.83	124.57	WINTER					18.77	
11	Cape Lookout Rdg	OR	951	45.33	123.98	SPRING					11.20	
11	Cape Lookout Rdg	OR	951	45.33	123.98	SUMMER					9.07	
11	Cape Lookout Rdg	OR	951	45.33	123.98	FALL					8.93	
11	Cape Lookout Rdg	OR	951	45.33	123.98	WINTER					7.70	
12	Cascadia St Park	OR	750	44.37	123.50	SPRING	70.8	32.1	51.45			
12	Cascadia St Park	OR	750	44.37	123.50	SUMMER	84.3	46.3	65.30			
12	Cascadia St Park	OR	750	44.37	123.50	FALL	78.8	33.6	56.20			
12	Cascadia St Park	OR	750	44.37	123.50	WINTER	52.4	29.0	40.70			
13	Clatsop Co #15	OR	25	46.10	123.92	SPRING					5.37	
13	Clatsop Co #15	OR	25	46.10	123.92	SUMMER					6.23	
13	Clatsop Co #15	OR	25	46.10	123.92	FALL					6.80	
13	Clatsop Co #15	OR	25	46.10	123.92	WINTER						

14 Coos Co #26	OR	400	42.97	124.42	SPRING				11.80
14 Coos Co #26	OR	400	42.97	124.42	SUMMER				10.40
14 Coos Co #26	OR	400	42.97	124.42	FALL				12.65
14 Coos Co #26	OR	400	42.97	124.42	WINTER				12.03
15 Florence Jetty	OR	13	44.02	124.12	SPRING				12.57
15 Florence Jetty	OR	13	44.02	124.12	SUMMER				14.20
15 Florence Jetty	OR	13	44.02	124.12	FALL				10.70
15 Florence Jetty	OR	13	44.02	124.12	WINTER				10.57
16 Fort Stevens	OR	2	46.18	123.97	SPRING				11.93
16 Fort Stevens	OR	2	46.18	123.97	SUMMER				9.50
16 Fort Stevens	OR	2	46.18	123.97	FALL				11.67
16 Fort Stevens	OR	2	46.18	123.97	WINTER				13.77
17 Hilltop	OR	608	42.43	124.43	SPRING				11.10
17 Hilltop	OR	608	42.43	124.43	SUMMER				10.93
17 Hilltop	OR	608	42.43	124.43	FALL				9.87
17 Hilltop	OR	608	42.43	124.43	WINTER				16.13
18 Knapp Ranch	OR	20	42.93	124.48	SPRING				
18 Knapp Ranch	OR	20	42.93	124.48	SUMMER				12.23
18 Knapp Ranch	OR	20	42.93	124.48	FALL				10.77
18 Knapp Ranch	OR	20	42.93	124.48	WINTER				12.70
19 Knox	OR	608	42.43	124.43	SPRING				
19 Knox	OR	608	42.43	124.43	SUMMER				
19 Knox	OR	608	42.43	124.43	FALL				10.90
19 Knox	OR	608	42.43	124.43	WINTER				14.80
20 Lane Co #23	OR	10	44.02	124.12	SPRING				7.27
20 Lane Co #23	OR	10	44.02	124.12	SUMMER				7.87
20 Lane Co #23	OR	10	44.02	124.12	FALL				6.10
20 Lane Co #23	OR	10	44.02	124.12	WINTER				8.00
21 Langlois MTN	OR	1120	42.92	124.42	SPRING				13.50
21 Langlois MTN	OR	1120	42.92	124.42	SUMMER				11.57
21 Langlois MTN	OR	1120	42.92	124.42	FALL				14.20
21 Langlois MTN	OR	1120	42.92	124.42	WINTER				14.87
22 Leneve	OR	607	43.25	124.25	SPRING				9.53
22 Leneve	OR	607	43.25	124.25	SUMMER				10.90
22 Leneve	OR	607	43.25	124.25	FALL				11.00
22 Leneve	OR	607	43.25	124.25	WINTER				9.13
23 Mary's Peak	OR	4100	44.50	123.57	SPRING				15.90
23 Mary's Peak	OR	4100	44.50	123.57	SUMMER				11.80
23 Mary's Peak	OR	4100	44.50	123.57	FALL				16.33
23 Mary's Peak	OR	4100	44.50	123.57	WINTER				
24 Mount Hebo	OR	3150	45.20	123.70	SPRING				9.13
24 Mount Hebo	OR	3150	45.20	123.70	SUMMER				6.10
24 Mount Hebo	OR	3150	45.20	123.70	FALL				11.33
24 Mount Hebo	OR	3150	45.20	123.70	WINTER				14.20
25 Nehalem Bay	OR	20	45.70	123.95	SPRING				11.53
25 Nehalem Bay	OR	20	45.70	123.95	SUMMER				8.53
25 Nehalem Bay	OR	20	45.70	123.95	FALL				12.43
25 Nehalem Bay	OR	20	45.70	123.95	WINTER				15.17
26 Newport	OR	124	44.63	124.07	SPRING	61.3	38.7	50.00	
26 Newport	OR	124	44.63	124.07	SUMMER	65.1	48.2	56.65	
26 Newport	OR	124	44.63	124.07	FALL	64.9	41.3	53.10	
26 Newport	OR	124	44.63	124.07	WINTER	52.5	37.5	45.00	
27 North Bend	OR	16	43.42	124.07	SPRING				9.70
27 North Bend	OR	16	43.42	124.07	SUMMER				10.80
27 North Bend	OR	16	43.42	124.07	FALL				8.53
27 North Bend	OR	16	43.42	124.07	WINTER				9.67

28 North Bend AP	OR	20	43.42	124.23	SPRING	62.8	39.5	51.15	9.40	2.4 SE
28 North Bend AP	OR	20	43.42	124.23	SUMMER	67.4	49.9	58.65	10.40	1.5 SE
28 North Bend AP	OR	20	43.42	124.23	FALL	66.9	41.8	54.35	7.23	3.2 SE
28 North Bend AP	OR	20	43.42	124.23	WINTER	54.2	38.2	46.20	8.70	2.2 SE
29 Praire MTN	OR	3200	44.28	123.60	SPRING				15.83	
29 Praire MTN	OR	3200	44.28	123.60	SUMMER				12.27	
29 Praire MTN	OR	3200	44.28	123.60	FALL				15.80	
29 Praire MTN	OR	3200	44.28	123.60	WINTER				19.10	
30 Raven Tower	OR	165	42.80	124.50	SPRING				10.63	
30 Raven Tower	OR	165	42.80	124.50	SUMMER				12.17	
30 Raven Tower	OR	165	42.80	124.50	FALL				11.83	
30 Raven Tower	OR	165	42.80	124.50	WINTER				9.70	
31 Roque Substation	OR	300	42.48	124.40	SPRING				7.30	
31 Roque Substation	OR	300	42.48	124.40	SUMMER				9.47	
31 Roque Substation	OR	300	42.48	124.40	FALL				7.20	
31 Roque Substation	OR	300	42.48	124.40	WINTER				6.03	
32 Sexton AP	OR	3836	42.62	123.53	SPRING				8.23	2.9 NNW
32 Sexton AP	OR	3836	42.62	123.53	SUMMER				7.73	2.7 N
32 Sexton AP	OR	3836	42.62	123.53	FALL				9.47	1.8 NNW
32 Sexton AP	OR	3836	42.62	123.53	WINTER				11.30	1.5 NNW
33 Shipler 1	OR	160	42.87	124.48	SPRING				8.97	
33 Shipler 1	OR	160	42.87	124.48	SUMMER				8.97	
33 Shipler 1	OR	160	42.87	124.48	FALL				8.07	
33 Shipler 1	OR	160	42.87	124.48	WINTER				9.00	
34 Shipler 2	OR	80	42.88	124.50	SPRING					
34 Shipler 2	OR	80	42.88	124.50	SUMMER				8.43	
34 Shipler 2	OR	80	42.88	124.50	FALL					
34 Shipler 2	OR	80	42.88	124.50	WINTER				8.40	
35 South Beach	OR	20	44.60	124.07	SPRING				11.20	
35 South Beach	OR	20	44.60	124.07	SUMMER				7.33	
35 South Beach	OR	20	44.60	124.07	FALL				9.93	
35 South Beach	OR	20	44.60	124.07	WINTER				11.93	
36 Valsetz	OR	1135	44.83	123.67	SPRING	71.0	32.2	51.60		
36 Valsetz	OR	1135	44.83	123.67	SUMMER	80.4	42.8	61.60		
36 Valsetz	OR	1135	44.83	123.67	FALL	76.0	34.1	55.05		
36 Valsetz	OR	1135	44.83	123.67	WINTER	50.5	30.4	40.45		
37 Wahl Ranch	OR	84	42.80	124.52	SPRING				10.58	
37 Wahl Ranch	OR	84	42.80	124.52	SUMMER				13.60	
37 Wahl Ranch	OR	84	42.80	124.52	FALL				8.40	
37 Wahl Ranch	OR	84	42.80	124.52	WINTER				14.87	
38 Wahl Tower	OR	84	42.80	124.52	SPRING				12.23	
38 Wahl Tower	OR	84	42.80	124.52	SUMMER				13.80	
38 Wahl Tower	OR	84	42.80	124.52	FALL				13.60	
38 Wahl Tower	OR	84	42.80	124.52	WINTER				11.00	
39 Wedderburn	OR	720	42.45	124.42	SPRING				11.77	
39 Wedderburn	OR	720	42.45	124.42	SUMMER				10.63	
39 Wedderburn	OR	720	42.45	124.42	FALL				12.83	
39 Wedderburn	OR	720	42.45	124.42	WINTER				13.43	
40 Whiskey Run	OR	120	43.22	124.38	SPRING				10.43	
40 Whiskey Run	OR	120	43.22	124.38	SUMMER				10.10	
40 Whiskey Run	OR	120	43.22	124.38	FALL				9.47	
40 Whiskey Run	OR	120	43.22	124.38	WINTER				11.30	
41 Wickiup Ridge	OR	2690	46.03	123.55	SPRING				8.25	
41 Wickiup Ridge	OR	2690	46.03	123.55	SUMMER				11.90	
41 Wickiup Ridge	OR	2690	46.03	123.55	FALL				13.03	
41 Wickiup Ridge	OR	2690	46.03	123.55	WINTER				14.27	

42 Yaquina Comm Sta	OR	371	44.67	124.07	SPRING				13.13
42 Yaquina Comm Sta	OR	371	44.67	124.07	SUMMER				12.63
42 Yaquina Comm Sta	OR	371	44.67	124.07	FALL				14.60
42 Yaquina Comm Sta	OR	371	44.67	124.07	WINTER				17.60
43 Yaquina Jetty	OR	29	44.70	124.07	SPRING				10.60
43 Yaquina Jetty	OR	29	44.70	124.07	SUMMER				9.30
43 Yaquina Jetty	OR	29	44.70	124.07	FALL				10.90
43 Yaquina Jetty	OR	29	44.70	124.07	WINTER				14.23
44 Yaquina Lthouse	OR	72	44.68	124.08	SPRING				12.60
44 Yaquina Lthouse	OR	72	44.68	124.08	SUMMER				13.00
44 Yaquina Lthouse	OR	72	44.68	124.08	FALL				10.27
44 Yaquina Lthouse	OR	72	44.68	124.08	WINTER				15.30
45 Yaquina Tower	OR	240	44.68	124.08	SPRING				14.33
45 Yaquina Tower	OR	240	44.68	124.08	SUMMER				14.00
45 Yaquina Tower	OR	240	44.68	124.08	FALL				10.03
45 Yaquina Tower	OR	240	44.68	124.08	WINTER				11.33
46 Aberdeen	WA	12	46.98	123.82	SPRING	65.4	34.6	50.00	
46 Aberdeen	WA	12	46.98	123.82	SUMMER	71.1	48.2	59.65	
46 Aberdeen	WA	12	46.98	123.82	FALL	70.9	37.1	54.00	
46 Aberdeen	WA	12	46.98	123.82	WINTER	50.8	33.6	42.20	
47 Aberdeen ZONNE	WA	435	47.27	123.70	SPRING	70.6	31.0	50.80	
47 Aberdeen ZONNE	WA	435	47.27	123.70	SUMMER	79.2	48.0	63.60	
47 Aberdeen ZONNE	WA	435	47.27	123.70	FALL	73.8	34.5	54.15	
47 Aberdeen ZONNE	WA	435	47.27	123.70	WINTER	52.2	30.2	41.20	
48 Cheeka Peak	WA	1360	48.30	124.62	SPRING				14.87
48 Cheeka Peak	WA	1360	48.30	124.62	SUMMER				11.60
48 Cheeka Peak	WA	1360	48.30	124.62	FALL				17.43
48 Cheeka Peak	WA	1360	48.30	124.62	WINTER				
49 Clearwater	WA	78	47.58	124.30	SPRING	63.8	32.2	48.00	
49 Clearwater	WA	78	47.58	124.30	SUMMER	70.4	45.5	57.95	
49 Clearwater	WA	78	47.58	124.30	FALL	71.0	36.2	53.60	
49 Clearwater	WA	78	47.58	124.30	WINTER	49.5	31.9	40.70	
50 Forks	WA	350	47.95	124.37	SPRING	65.0	33.2	49.10	
50 Forks	WA	350	47.95	124.37	SUMMER	71.7	46.3	59.00	
50 Forks	WA	350	47.95	124.37	FALL	70.4	36.4	53.40	
50 Forks	WA	350	47.95	124.37	WINTER	48.9	32.1	40.50	
51 Hoquiam	WA	14	46.98	123.93	SPRING				10.37
51 Hoquiam	WA	14	46.98	123.93	SUMMER				8.97
51 Hoquiam	WA	14	46.98	123.93	FALL				9.43
51 Hoquiam	WA	14	46.98	123.93	WINTER				11.53
52 Hoquiam AP	WA	26	46.97	123.95	SPRING				9.90
52 Hoquiam AP	WA	26	46.97	123.95	SUMMER				8.50
52 Hoquiam AP	WA	26	46.97	123.95	FALL				9.10
52 Hoquiam AP	WA	26	46.97	123.95	WINTER				10.47
53 Moclips	WA	127	47.25	124.22	SPRING				9.17
53 Moclips	WA	127	47.25	124.22	SUMMER				7.57
53 Moclips	WA	127	47.25	124.22	FALL				8.30
53 Moclips	WA	127	47.25	124.22	WINTER				9.67
54 North Head	WA	194	46.28	124.05	SPRING				15.40
54 North Head	WA	194	46.28	124.05	SUMMER				14.30
54 North Head	WA	194	46.28	124.05	FALL				13.20
54 North Head	WA	194	46.28	124.05	WINTER				16.60
55 Point Grenville	WA	100	47.30	124.28	SPRING	59.3	34.3	46.80	
55 Point Grenville	WA	100	47.30	124.28	SUMMER	63.2	48.4	55.80	
55 Point Grenville	WA	100	47.30	124.28	FALL	63.4	37.6	50.50	
55 Point Grenville	WA	100	47.30	124.28	WINTER	49.3	35.0	42.15	

56 Queets Hill	WA	330	47.57	124.32	SPRING					8.00	
56 Queets Hill	WA	330	47.57	124.32	SUMMER					4.95	
56 Queets Hill	WA	330	47.57	124.32	FALL					10.53	
56 Queets Hill	WA	330	47.57	124.32	WINTER					15.25	
57 Quinault	WA	221	47.47	123.83	SPRING	68.6	35.0	51.80			
57 Quinault	WA	221	47.47	123.83	SUMMER	75.7	48.1	61.90			
57 Quinault	WA	221	47.47	123.83	FALL	72.7	37.7	55.20			
57 Quinault	WA	221	47.47	123.83	WINTER	49.4	32.8	41.10			
58 Tatoosh Island	WA	101	48.48	124.73	SPRING	56.6	39.6	48.10	11.60	2.7 W	
58 Tatoosh Island	WA	101	48.48	124.73	SUMMER	59.7	49.1	54.40	8.77	2.9 W	
58 Tatoosh Island	WA	101	48.48	124.73	FALL	59.4	42.3	50.85	13.40	2.1 W	
58 Tatoosh Island	WA	101	48.48	124.73	WINTER	47.5	38.1	42.80	16.83	1.5 E	

PUGET WILLAMETTE LOWLAND -- WIND AND TEMPERATURE DATA

#	LOCATION	ST	EL	LAT.	LONG.	SEASON	Tmax	Tmin	Tmean	WS	FRFQ.	DIR
1	Albany	OR	212	44.58	123.07	SPRING	72.1	35.9	54.00			
1	Albany	OR	212	44.58	123.07	SUMMER	84.0	49.7	66.85			
1	Albany	OR	212	44.58	123.07	FALL	77.9	36.4	57.15			
1	Albany	OR	212	44.58	123.07	WINTER	53.8	31.8	42.80			
2	Bunker Hill	OR	900	44.87	123.07	SPRING				7.77		
2	Bunker Hill	OR	900	44.87	123.07	SUMMER				11.50		
2	Bunker Hill	OR	900	44.87	123.07	FALL				7.60		
2	Bunker Hill	OR	900	44.87	123.07	WINTER				9.87		
3	Cooper MTN	OR	994	45.50	122.70	SPRING				11.93		
3	Cooper MTN	OR	994	45.50	122.70	SUMMER				9.73		
3	Cooper MTN	OR	994	45.50	122.70	FALL				9.73		
3	Cooper MTN	OR	994	45.50	122.70	WINTER				12.30		
4	Corbett	OR	960	45.53	122.28	SPRING				3.10		
4	Corbett	OR	960	45.53	122.28	SUMMER				3.40		
4	Corbett	OR	960	45.53	122.28	FALL				6.47		
4	Corbett	OR	960	45.53	122.28	WINTER				16.73		
5	Crown Point	OR	718	45.53	122.25	SPRING				8.20		
5	Crown Point	OR	718	45.53	122.25	SUMMER				5.53		
5	Crown Point	OR	718	45.53	122.25	FALL				11.77		
5	Crown Point	OR	718	45.53	122.25	WINTER				19.90		
6	Dallas	OR	325	44.93	123.32	SPRING	71.5	33.1	52.30			
6	Dallas	OR	325	44.93	123.32	SUMMER	83.9	45.2	64.55			
6	Dallas	OR	325	44.93	123.32	FALL	79.6	34.1	56.85			
6	Dallas	OR	325	44.93	123.32	WINTER	52.2	30.7	41.45			
7	Eugene	OR	364	44.12	123.22	SPRING				7.40		
7	Eugene	OR	364	44.12	123.22	SUMMER				7.43		
7	Eugene	OR	364	44.12	123.22	FALL				7.17		
7	Eugene	OR	364	44.12	123.22	WINTER				7.47		
8	Eugene AP	OR	364	44.12	123.22	SPRING	70.7	34.7	52.70	6.97	2.5 N	
8	Eugene AP	OR	364	44.12	123.22	SUMMER	83.6	47.8	65.70	6.83	2.2 N	
8	Eugene AP	OR	364	44.12	123.22	FALL	78.8	35.7	57.25	5.80	3.1 S	
8	Eugene AP	OR	364	44.12	123.22	WINTER	52.6	31.9	42.25	7.13	2.6 S	
9	Forest Grove	OR	175	45.53	123.10	SPRING	72.9	34.4	53.65			
9	Forest Grove	OR	175	45.53	123.10	SUMMER	84.2	48.0	66.10			
9	Forest Grove	OR	175	45.53	123.10	FALL	79.1	35.5	57.30			
9	Forest Grove	OR	175	45.53	123.10	WINTER	52.1	30.0	41.05			
10	Gresham	OR	500	45.50	122.43	SPRING				3.27		
10	Gresham	OR	500	45.50	122.43	SUMMER				2.97		
10	Gresham	OR	500	45.50	122.43	FALL						
10	Gresham	OR	500	45.50	122.43	WINTER						
11	Headworks Ptld	OR	748	45.45	122.15	SPRING	69.5	33.5	51.50			
11	Headworks Ptld	OR	748	45.45	122.15	SUMMER	79.8	47.5	63.85			
11	Headworks Ptld	OR	748	45.45	122.15	FALL	75.5	34.4	54.95			
11	Headworks Ptld	OR	748	45.45	122.15	WINTER	49.2	31.3	40.25			
12	Kings Valley	OR	400	44.70	123.43	SPRING				4.83		
12	Kings Valley	OR	400	44.70	123.43	SUMMER				4.90		
12	Kings Valley	OR	400	44.70	123.43	FALL				3.97		
12	Kings Valley	OR	400	44.70	123.43	WINTER				4.63		
13	McColloch Peak	OR	2200	44.67	123.35	SPRING				12.43		
13	McColloch Peak	OR	2200	44.67	123.35	SUMMER				10.97		
13	McColloch Peak	OR	2200	44.67	123.35	FALL				12.73		
13	McColloch Peak	OR	2200	44.67	123.35	WINTER				12.70		

14 McMinnville	OR	182	45.20	123.17	SPRING	72.6	34.9	53.75		
14 McMinnville	OR	182	45.20	123.17	SUMMER	85.2	46.7	65.95		
14 McMinnville	OR	182	45.20	123.17	FALL	79.1	36.0	57.55		
14 McMinnville	OR	182	45.20	123.17	WINTER	52.5	30.9	41.70		
15 Mount Scott	OR	1000	45.45	122.53	SPRING				7.87	
15 Mount Scott	OR	1000	45.45	122.53	SUMMER				6.25	
15 Mount Scott	OR	1000	45.45	122.53	FALL				14.20	
15 Mount Scott	OR	1000	45.45	122.53	WINTER					
16 Mulino AP	OR	240	45.20	122.58	SPRING				6.03	
16 Mulino AP	OR	240	45.20	122.58	SUMMER				4.77	
16 Mulino AP	OR	240	45.20	122.58	FALL				5.33	
16 Mulino AP	OR	240	45.20	122.58	WINTER				5.47	
17 Multnomah Co #11	OR	640	45.53	122.35	SPRING				7.07	
17 Multnomah Co #11	OR	640	45.53	122.35	SUMMER				3.97	
17 Multnomah Co #11	OR	640	45.53	122.35	FALL				10.37	
17 Multnomah Co #11	OR	640	45.53	122.35	WINTER				18.50	
18 Newberg Ridge	OR	1430	45.37	123.05	SPRING				8.23	
18 Newberg Ridge	OR	1430	45.37	123.05	SUMMER				6.93	
18 Newberg Ridge	OR	1430	45.37	123.05	FALL				9.70	
18 Newberg Ridge	OR	1430	45.37	123.05	WINTER				11.67	
19 Polk Co #16	OR	600	45.03	123.13	SPRING				9.07	
19 Polk Co #16	OR	600	45.03	123.13	SUMMER				7.23	
19 Polk Co #16	OR	600	45.03	123.13	FALL				7.63	
19 Polk Co #16	OR	600	45.03	123.13	WINTER				7.87	
20 Polk Co #19	OR	220	45.03	123.30	SPRING				5.67	
20 Polk Co #19	OR	220	45.03	123.30	SUMMER				6.23	
20 Polk Co #19	OR	220	45.03	123.30	FALL				4.57	
20 Polk Co #19	OR	220	45.03	123.30	WINTER				3.73	
21 Polk Co #35	OR	450	44.78	123.18	SPRING				7.90	
21 Polk Co #35	OR	450	44.78	123.18	SUMMER				7.13	
21 Polk Co #35	OR	450	44.78	123.18	FALL				6.70	
21 Polk Co #35	OR	450	44.78	123.18	WINTER				7.10	
22 Portland	OR	100	45.58	122.60	SPRING				7.90	
22 Portland	OR	100	45.58	122.60	SUMMER				7.70	
22 Portland	OR	100	45.58	122.60	FALL				7.93	
22 Portland	OR	100	45.58	122.60	WINTER				9.87	
23 Portland WB City	OR	98	45.53	122.67	SPRING	70.8	39.2	55.00	6.10	6.1 NW
23 Portland WB City	OR	98	45.53	122.67	SUMMER	80.7	53.8	67.25	5.70	6.0 NW
23 Portland WB City	OR	98	45.53	122.67	FALL	76.1	39.9	58.00	5.70	6.1 NW
23 Portland WB City	OR	98	45.53	122.67	WINTER	52.2	34.1	43.15	8.27	2.8 NW
24 Salem AP	OR	200	44.92	123.02	SPRING	71.9	34.7	53.30	6.40	3.4 S
24 Salem AP	OR	200	44.92	123.02	SUMMER	84.4	48.2	66.30	5.73	2.7 NW
24 Salem AP	OR	200	44.92	123.02	FALL	78.8	36.0	57.40	5.93	3.7 S
24 Salem AP	OR	200	44.92	123.02	WINTER	53.2	31.1	42.15	7.47	3.0 S
25 Sheridan	OR	500	45.10	123.40	SPRING				6.13	
25 Sheridan	OR	500	45.10	123.40	SUMMER				7.37	
25 Sheridan	OR	500	45.10	123.40	FALL				4.70	
25 Sheridan	OR	500	45.10	123.40	WINTER				3.27	
26 Snow Peak	OR	4200	44.63	122.58	SPRING					
26 Snow Peak	OR	4200	44.63	122.58	SUMMER				8.00	
26 Snow Peak	OR	4200	44.63	122.58	FALL				11.83	
26 Snow Peak	OR	4200	44.63	122.58	WINTER				12.20	
27 Three Lynx	OR	1135	45.12	122.07	SPRING	68.6	32.4	50.50		
27 Three Lynx	OR	1135	45.12	122.07	SUMMER	80.7	47.8	64.25		
27 Three Lynx	OR	1135	45.12	122.07	FALL	76.6	34.6	55.60		
27 Three Lynx	OR	1135	45.12	122.07	WINTER	48.5	29.5	39.00		

28 Washington Co #14	OR	260	45.42	122.87	SPRING				4.50	
28 Washington Co #14	OR	260	45.42	122.87	SUMMER				3.83	
28 Washington Co #14	OR	260	45.42	122.87	FALL				3.80	
28 Washington Co #14	OR	260	45.42	122.87	WINTER				4.23	
29 Yamhill Co #17	OR	490	45.32	122.92	SPRING				6.93	
29 Yamhill Co #17	OR	490	45.32	122.92	SUMMER				5.83	
29 Yamhill Co #17	OR	490	45.32	122.92	FALL				6.87	
29 Yamhill Co #17	OR	490	45.32	122.92	WINTER				8.20	
30 Yamhill Co #18	OR	600	45.13	123.33	SPRING				7.07	
30 Yamhill Co #18	OR	600	45.13	123.33	SUMMER				5.70	
30 Yamhill Co #18	OR	600	45.13	123.33	FALL				5.60	
30 Yamhill Co #18	OR	600	45.13	123.33	WINTER				5.30	
31 Anacortes	WA	30	48.52	122.62	SPRING	67.3	36.6	51.95		
31 Anacortes	WA	30	48.52	122.62	SUMMER	73.3	49.9	61.60		
31 Anacortes	WA	30	48.52	122.62	FALL	69.4	39.2	54.30		
31 Anacortes	WA	30	48.52	122.62	WINTER	49.3	34.4	41.85		
32 Bellingham	WA	159	48.75	122.48	SPRING				7.47	2.6 S-SE
32 Bellingham	WA	159	48.75	122.48	SUMMER				6.70	4.4 S
32 Bellingham	WA	159	48.75	122.48	FALL				6.27	3.3 N
32 Bellingham	WA	159	48.75	122.48	WINTER				8.73	3.3 N
33 Biddle Butte	WA	1465	45.58	122.22	SPRING				10.60	
33 Biddle Butte	WA	1465	45.58	122.22	SUMMER				8.57	
33 Biddle Butte	WA	1465	45.58	122.22	FALL				13.90	
33 Biddle Butte	WA	1465	45.58	122.22	WINTER					
34 Cathlamet Hills	WA	1100	46.20	123.38	SPRING				4.05	
34 Cathlamet Hills	WA	1100	46.20	123.38	SUMMER				4.77	
34 Cathlamet Hills	WA	1100	46.20	123.38	FALL				3.07	
34 Cathlamet Hills	WA	1100	46.20	123.38	WINTER				2.47	
35 Centralia	WA	185	46.72	122.95	SPRING	71.7	34.1	52.90		
35 Centralia	WA	185	46.72	122.95	SUMMER	80.2	47.6	63.90		
35 Centralia	WA	185	46.72	122.95	FALL	76.0	36.8	56.40		
35 Centralia	WA	185	46.72	122.95	WINTER	51.7	31.9	41.80		
36 Chehalis	WA	171	46.67	122.98	SPRING				7.60	
36 Chehalis	WA	171	46.67	122.98	SUMMER				6.63	
36 Chehalis	WA	171	46.67	122.98	FALL				7.03	
36 Chehalis	WA	171	46.67	122.98	WINTER				8.63	
37 Clearbrook	WA	64	48.97	122.33	SPRING	69.1	32.2	50.65		
37 Clearbrook	WA	64	48.97	122.33	SUMMER	77.2	46.7	61.95		
37 Clearbrook	WA	64	48.97	122.33	FALL	73.5	34.0	53.75		
37 Clearbrook	WA	64	48.97	122.33	WINTER	48.5	28.7	38.60		
38 Cushman Dam	WA	760	47.42	123.22	SPRING	70.5	32.8	51.65		
38 Cushman Dam	WA	760	47.42	123.22	SUMMER	79.7	47.8	63.75		
38 Cushman Dam	WA	760	47.42	123.22	FALL	74.8	34.4	54.60		
38 Cushman Dam	WA	760	47.42	123.22	WINTER	48.9	30.9	39.90		
39 Everett-Paine fld	WA	598	47.90	122.28	SPRING				6.90	1.4 SE
39 Everett-Paine fld	WA	598	47.90	122.28	SUMMER				6.07	1.5 N
39 Everett-Paine fld	WA	598	47.90	122.28	FALL				6.43	1.7 N
39 Everett-Paine fld	WA	598	47.90	122.28	WINTER				7.33	1.7 SE
40 Friday Harbor	WA	100	48.53	123.02	SPRING				6.67	
40 Friday Harbor	WA	100	48.53	123.02	SUMMER				4.83	
40 Friday Harbor	WA	100	48.53	123.02	FALL				5.65	
40 Friday Harbor	WA	100	48.53	123.02	WINTER				6.20	
41 Hood Canal Br	WA	10	47.85	122.62	SPRING				9.73	
41 Hood Canal Br	WA	10	47.85	122.62	SUMMER				7.03	
41 Hood Canal Br	WA	10	47.85	122.62	FALL				8.23	
41 Hood Canal Br	WA	10	47.85	122.62	WINTER				10.30	

42 Kelso	WA	17	46.13	122.90	SPRING				6.30	4.6 N
42 Kelso	WA	17	46.13	122.90	SUMMER				5.43	7.3 N
42 Kelso	WA	17	46.13	122.90	FALL				6.10	7.8 N
42 Kelso	WA	17	46.13	122.90	WINTER				7.67	4.2 N
43 Kelso Castle Rock	WA	16	46.12	122.90	SPRING				7.90	
43 Kelso Castle Rock	WA	16	46.12	122.90	SUMMER				6.97	
43 Kelso Castle Rock	WA	16	46.12	122.90	FALL				7.60	
43 Kelso Castle Rock	WA	16	46.12	122.90	WINTER				9.33	
44 Kosmos	WA	775	46.50	122.18	SPRING	70.0	31.7	50.85		
44 Kosmos	WA	775	46.50	122.18	SUMMER	81.1	45.4	63.25		
44 Kosmos	WA	775	46.50	122.18	FALL	75.6	32.4	54.00		
44 Kosmos	WA	775	46.50	122.18	WINTER	49.1	28.8	38.95		
45 Longview	WA	12	46.17	122.92	SPRING	70.4	33.4	51.90		
45 Longview	WA	12	46.17	122.92	SUMMER	79.1	47.4	63.25		
45 Longview	WA	12	46.17	122.92	FALL	75.1	36.0	55.55		
45 Longview	WA	12	46.17	122.92	WINTER	51.7	31.0	41.35		
46 McMillin Res	WA	579	47.13	122.27	SPRING	68.3	31.9	50.10		
46 McMillin Res	WA	579	47.13	122.27	SUMMER	77.2	46.3	61.75		
46 McMillin Res	WA	579	47.13	122.27	FALL	73.6	33.8	53.70		
46 McMillin Res	WA	579	47.13	122.27	WINTER	48.7	28.5	38.60		
47 Olga 2SE	WA	80	48.62	122.80	SPRING	64.7	35.9	50.30		
47 Olga 2SE	WA	80	48.62	122.80	SUMMER	70.7	47.5	59.10		
47 Olga 2SE	WA	80	48.62	122.80	FALL	66.7	38.1	52.40		
47 Olga 2SE	WA	80	48.62	122.80	WINTER	47.9	33.7	40.80		
48 Olympia AP	WA	190	46.97	122.90	SPRING	69.2	30.6	49.90	5.73	3.0 NE
48 Olympia AP	WA	190	46.97	122.90	SUMMER	78.7	45.9	62.30	4.80	3.2 SSW-SSE
48 Olympia AP	WA	190	46.97	122.90	FALL	73.6	34.5	54.05	4.83	4.3 N-NNE-NE
48 Olympia AP	WA	190	46.97	122.90	WINTER	49.1	29.4	39.25	6.37	2.8 NE
49 Pioneer Air Park	WA	270	45.82	122.68	SPRING				7.53	
49 Pioneer Air Park	WA	270	45.82	122.68	SUMMER				8.63	
49 Pioneer Air Park	WA	270	45.82	122.68	FALL				6.50	
49 Pioneer Air Park	WA	270	45.82	122.68	WINTER				6.50	
50 Port Angeles	WA	99	48.12	123.43	SPRING				8.60	3.6 SSW
50 Port Angeles	WA	99	48.12	123.43	SUMMER				10.07	2.6 W
50 Port Angeles	WA	99	48.12	123.43	FALL				6.40	3.4 SSW
50 Port Angeles	WA	99	48.12	123.43	WINTER				7.50	2.3 SSW
51 Pt. Wilson	WA	30	48.15	122.75	SPRING				11.50	
51 Pt. Wilson	WA	30	48.15	122.75	SUMMER				10.03	
51 Pt. Wilson	WA	30	48.15	122.75	FALL				11.43	
51 Pt. Wilson	WA	30	48.15	122.75	WINTER				11.83	
52 Puyallup E.S.	WA	50	47.20	122.33	SPRING	71.0	33.1	52.05		
52 Puyallup E.S.	WA	50	47.20	122.33	SUMMER	79.6	46.8	63.20		
52 Puyallup E.S.	WA	50	47.20	122.33	FALL	74.4	34.8	54.60		
52 Puyallup E.S.	WA	50	47.20	122.33	WINTER	51.4	30.4	40.90		
53 Seattle Maple Leaf	WA	422	47.70	122.32	SPRING	66.3	34.3	50.30		
53 Seattle Maple Leaf	WA	422	47.70	122.32	SUMMER	75.8	49.6	62.70		
53 Seattle Maple Leaf	WA	422	47.70	122.32	FALL	71.2	36.9	54.05		
53 Seattle Maple Leaf	WA	422	47.70	122.32	WINTER	47.0	32.8	39.90		
54 Seattle WB City	WA	14	47.60	122.33	SPRING	67.3	38.4	52.85	7.27	2.2 N
54 Seattle WB City	WA	14	47.60	122.33	SUMMER	75.1	51.7	63.40	6.43	2.5 N
54 Seattle WB City	WA	14	47.60	122.33	FALL	69.5	40.1	54.60	6.20	3.3 SSE
54 Seattle WB City	WA	14	47.60	122.33	WINTER	49.6	35.8	42.70	7.30	2.9 S
55 Seattle-Tacoma AP	WA	386	47.45	122.30	SPRING	67.4	34.0	50.70	9.73	0.9 ESE
55 Seattle-Tacoma AP	WA	386	47.45	122.30	SUMMER	75.9	49.7	62.80	8.40	0.8 S - SW
55 Seattle-Tacoma AP	WA	386	47.45	122.30	FALL	71.3	37.0	54.15	8.70	0.8 E-SSE-SE
55 Seattle-Tacoma AP	WA	386	47.45	122.30	WINTER	47.8	31.9	39.85	10.17	1.3 SE

56 Sea-lac	WA	410	47.45	122.30	SPRING				9.73	
56 Sea-lac	WA	410	47.45	122.30	SUMMER				8.40	
56 Sea-lac	WA	410	47.45	122.30	FALL				8.70	
56 Sea-lac	WA	410	47.45	122.30	WINTER				10.17	
57 Sedro Woolley	WA	56	48.50	122.22	SPRING	68.9	33.9	51.40		
57 Sedro Woolley	WA	56	48.50	122.22	SUMMER	75.8	48.5	62.15		
57 Sedro Woolley	WA	56	48.50	122.22	FALL	71.8	35.7	53.75		
57 Sedro Woolley	WA	56	48.50	122.22	WINTER	50.0	30.4	40.20		
58 Sequim	WA	180	48.08	123.10	SPRING	65.9	32.7	49.30		
58 Sequim	WA	180	48.08	123.10	SUMMER	72.4	47.3	59.85		
58 Sequim	WA	180	48.08	123.10	FALL	69.9	34.9	52.40		
58 Sequim	WA	180	48.08	123.10	WINTER	49.3	30.0	39.65		
59 Smith Island	WA	30	48.32	122.25	SPRING				12.03	
59 Smith Island	WA	30	48.32	122.25	SUMMER				10.50	
59 Smith Island	WA	30	48.32	122.25	FALL				12.30	
59 Smith Island	WA	30	48.32	122.25	WINTER				13.70	
60 Tacoma McChord	WA	420	47.13	122.48	SPRING				6.03	
60 Tacoma McChord	WA	420	47.13	122.48	SUMMER				5.20	
60 Tacoma McChord	WA	420	47.13	122.48	FALL				4.60	
60 Tacoma McChord	WA	420	47.13	122.48	WINTER				5.33	
61 Toledo	WA	351	46.48	122.80	SPRING				5.90	3.1 NNW
61 Toledo	WA	351	46.48	122.80	SUMMER				5.17	5.6 N
61 Toledo	WA	351	46.48	122.80	FALL				4.67	4.2 N
61 Toledo	WA	351	46.48	122.80	WINTER				5.97	4.0 SSE
62 Vancouver	WA	100	45.63	122.68	SPRING	71.7	36.8	54.25		
62 Vancouver	WA	100	45.63	122.68	SUMMER	81.3	50.7	66.00		
62 Vancouver	WA	100	45.63	122.68	FALL	75.6	37.2	56.40		
62 Vancouver	WA	100	45.63	122.68	WINTER	52.4	32.3	42.35		
63 Washougal	WA	120	45.57	122.25	SPRING				6.13	
63 Washougal	WA	120	45.57	122.25	SUMMER				4.23	
63 Washougal	WA	120	45.57	122.25	FALL				8.03	
63 Washougal	WA	120	45.57	122.25	WINTER				13.10	
64 Whidbey Island	WA	32	48.28	122.62	SPRING				8.17	4.9 E
64 Whidbey Island	WA	32	48.28	122.62	SUMMER				6.77	3.2 SW
64 Whidbey Island	WA	32	48.28	122.62	FALL				7.33	6.5 E
64 Whidbey Island	WA	32	48.28	122.62	WINTER				10.03	4.5 E
65 Williamson	WA	100	46.18	123.17	SPRING				6.17	
65 Williamson	WA	100	46.18	123.17	SUMMER				4.83	
65 Williamson	WA	100	46.18	123.17	FALL				5.90	
65 Williamson	WA	100	46.18	123.17	WINTER				5.03	

SISKI & SOUTH CASCADES -- WIND AND TEMPERATURE DATA

#	LOCATION	ST	EL	LAT.	LONG.	SEASON	Tmax	Tmin	Tmean	WS	FREQ.	DIR
1	Ashland	OR	1300	42.20	122.78	SPRING				5.80		
1	Ashland	OR	1300	42.20	122.78	SUMMER				5.23		
1	Ashland	OR	1300	42.20	122.78	FALL				4.90		
1	Ashland	OR	1300	42.20	122.78	WINTER				10.20		
2	Cottage Grove Dam	OR	831	43.72	123.05	SPRING	67.8	33.6	50.70			
2	Cottage Grove Dam	OR	831	43.72	123.05	SUMMER	81.2	47.7	64.45			
2	Cottage Grove Dam	OR	831	43.72	123.05	FALL	78.6	35.3	56.95			
2	Cottage Grove Dam	OR	831	43.72	123.05	WINTER	51.5	30.9	41.20			
3	Crater Lake NP HQ	OR	6475	42.90	122.13	SPRING	54.3	17.4	35.85			
3	Crater Lake NP HQ	OR	6475	42.90	122.13	SUMMER	72.7	34.0	53.35			
3	Crater Lake NP HQ	OR	6475	42.90	122.13	FALL	65.1	22.4	43.75			
3	Crater Lake NP HQ	OR	6475	42.90	122.13	WINTER	37.2	16.7	26.95			
4	Deschutes Co #24	OR	4210	43.73	121.48	SPRING				6.25		
4	Deschutes Co #24	OR	4210	43.73	121.48	SUMMER				4.80		
4	Deschutes Co #24	OR	4210	43.73	121.48	FALL				3.87		
4	Deschutes Co #24	OR	4210	43.73	121.48	WINTER				3.93		
5	Douglas Co #20	OR	2060	43.08	123.27	SPRING				7.73		
5	Douglas Co #20	OR	2060	43.08	123.27	SUMMER				7.97		
5	Douglas Co #20	OR	2060	43.08	123.27	FALL						
5	Douglas Co #20	OR	2060	43.08	123.27	WINTER				9.10		
6	Fish Lake	OR	4839	42.38	122.35	SPRING	63.6	20.3	41.95			
6	Fish Lake	OR	4839	42.38	122.35	SUMMER	80.2	38.3	59.25			
6	Fish Lake	OR	4839	42.38	122.35	FALL	74.5	25.5	50.00			
6	Fish Lake	OR	4839	42.38	122.35	WINTER	43.2	18.9	31.05			
7	Grants Pass	OR	925	42.43	123.32	SPRING	78.4	33.4	55.90			
7	Grants Pass	OR	925	42.43	123.32	SUMMER	92.2	47.4	69.80			
7	Grants Pass	OR	925	42.43	123.32	FALL	86.2	35.1	60.65			
7	Grants Pass	OR	925	42.43	123.32	WINTER	57.7	31.3	44.50			
8	Jackson Co #5	OR	1760	42.23	122.73	SPRING				7.73		
8	Jackson Co #5	OR	1760	42.23	122.73	SUMMER				7.30		
8	Jackson Co #5	OR	1760	42.23	122.73	FALL				8.23		
8	Jackson Co #5	OR	1760	42.23	122.73	WINTER				10.63		
9	Jackson Co #8	OR	4480	42.13	122.52	SPRING				7.23		
9	Jackson Co #8	OR	4480	42.13	122.52	SUMMER				5.60		
9	Jackson Co #8	OR	4480	42.13	122.52	FALL				6.83		
9	Jackson Co #8	OR	4480	42.13	122.52	WINTER				9.90		
10	Klamath Co #22	OR	4300	42.50	121.55	SPRING				7.70		
10	Klamath Co #22	OR	4300	42.50	121.55	SUMMER				6.70		
10	Klamath Co #22	OR	4300	42.50	121.55	FALL				5.10		
10	Klamath Co #22	OR	4300	42.50	121.55	WINTER						
11	Klamath Co #28	OR	4400	42.20	121.80	SPRING				8.07		
11	Klamath Co #28	OR	4400	42.20	121.80	SUMMER				8.80		
11	Klamath Co #28	OR	4400	42.20	121.80	FALL				6.27		
11	Klamath Co #28	OR	4400	42.20	121.80	WINTER				5.27		
12	Klamath Falls	OR	4064	42.15	121.77	SPRING				6.83		
12	Klamath Falls	OR	4064	42.15	121.77	SUMMER				4.90		
12	Klamath Falls	OR	4064	42.15	121.77	FALL				4.83		
12	Klamath Falls	OR	4064	42.15	121.77	WINTER				5.57		
13	Klamath Falls 2SW	OR	4098	42.20	121.78	SPRING	70.4	26.8	48.60	6.73	4.5 W	
13	Klamath Falls 2SW	OR	4098	42.20	121.78	SUMMER	87.0	44.4	65.70	5.10	4.9 W	
13	Klamath Falls 2SW	OR	4098	42.20	121.78	FALL	77.8	26.0	51.90	4.90	5.1 N	
13	Klamath Falls 2SW	OR	4098	42.20	121.78	WINTER	45.5	20.1	32.80	5.87	4.3 N	

14 Lane Co #4	OR	600	43.98	122.95	SPRING				3.70	
14 Lane Co #4	OR	600	43.98	122.95	SUMMER				3.93	
14 Lane Co #4	OR	600	43.98	122.95	FALL				2.90	
14 Lane Co #4	OR	600	43.98	122.95	WINTER					
15 Medford	OR	1329	42.37	122.87	SPRING				6.47	
15 Medford	OR	1329	42.37	122.87	SUMMER				6.70	
15 Medford	OR	1329	42.37	122.87	FALL				4.63	
15 Medford	OR	1329	42.37	122.87	WINTER				4.80	
16 Medford AP	OR	1315	42.37	122.87	SPRING	76.1	33.2	54.65	5.00	2.4 N
16 Medford AP	OR	1315	42.37	122.87	SUMMER	91.8	49.1	70.45	5.00	1.7 NW
16 Medford AP	OR	1315	42.37	122.87	FALL	84.5	32.6	58.55	3.17	2.9 S
16 Medford AP	OR	1315	42.37	122.87	WINTER	55.4	29.0	42.20	3.50	2.8 N
17 Odell Lake	OR	4792	43.58	122.05	SPRING	59.2	22.4	40.80		
17 Odell Lake	OR	4792	43.58	122.05	SUMMER	76.4	36.7	56.55		
17 Odell Lake	OR	4792	43.58	122.05	FALL	66.7	24.6	45.65		
17 Odell Lake	OR	4792	43.58	122.05	WINTER	38.4	18.0	28.20		
18 Prospect	OR	2482	42.73	122.52	SPRING	73.1	28.2	50.65		
18 Prospect	OR	2482	42.73	122.52	SUMMER	88.4	42.7	65.55		
18 Prospect	OR	2482	42.73	122.52	FALL	82.5	29.7	56.10		
18 Prospect	OR	2482	42.73	122.52	WINTER	51.7	26.0	38.85		
19 Rose Mtn	OR	1488	43.23	123.15	SPRING				8.23	
19 Rose Mtn	OR	1488	43.23	123.15	SUMMER				8.83	
19 Rose Mtn	OR	1488	43.23	123.15	FALL				8.40	
19 Rose Mtn	OR	1488	43.23	123.15	WINTER				6.83	
20 Roseburg	OR	479	43.22	123.33	SPRING	73.0	36.2	54.60	5.30	6.2 N
20 Roseburg	OR	479	43.22	123.33	SUMMER	85.7	49.7	67.70	6.17	5.3 N
20 Roseburg	OR	479	43.22	123.33	FALL	80.5	38.3	59.40	4.07	7.9 NW
20 Roseburg	OR	479	43.22	123.33	WINTER	55.0	33.8	44.40	4.00	6.8 NW
21 Sexton Summit	OR	3841	42.62	123.37	SPRING				12.53	
21 Sexton Summit	OR	3841	42.62	123.37	SUMMER				13.37	
21 Sexton Summit	OR	3841	42.62	123.37	FALL				13.27	
21 Sexton Summit	OR	3841	42.62	123.37	WINTER				14.17	
22 Siskiyou Summit	OR	4480	42.08	122.57	SPRING				10.37	
22 Siskiyou Summit	OR	4480	42.08	122.57	SUMMER				11.20	
22 Siskiyou Summit	OR	4480	42.08	122.57	FALL				9.53	
22 Siskiyou Summit	OR	4480	42.08	122.57	WINTER				10.10	
23 Wickiup Dam	OR	4330	43.68	121.70	SPRING	65.6	18.9	42.25		
23 Wickiup Dam	OR	4330	43.68	121.70	SUMMER	82.7	36.4	59.55		
23 Wickiup Dam	OR	4330	43.68	121.70	FALL	74.7	21.3	48.00		
23 Wickiup Dam	OR	4330	43.68	121.70	WINTER	42.4	13.7	28.05		

CASCADE MOUNTAINS -- WIND AND TEMPERATURE DATA

#	LOCATION	ST	EL	LAT.	LONG.	SEASON	Tmax	Tmin	Tmean	WS	FREQ.	DIR
1	Bend	OR	3600	44.07	121.32	SPRING	69.0	23.9	46.45			
1	Bend	OR	3600	44.07	121.32	SUMMER	85.1	40.4	62.75			
1	Bend	OR	3600	44.07	121.32	FALL	75.7	25.2	50.45			
1	Bend	OR	3600	44.07	121.32	WINTER	46.7	18.4	32.55			
2	Bend Warner	OR	3000	44.05	121.28	SPRING				5.80		
2	Bend Warner	OR	3000	44.05	121.28	SUMMER				3.93		
2	Bend Warner	OR	3000	44.05	121.28	FALL				4.93		
2	Bend Warner	OR	3000	44.05	121.28	WINTER				4.53		
3	Cascade Locks	OR	100	45.68	121.87	SPRING				13.83		
3	Cascade Locks	OR	100	45.68	121.87	SUMMER				14.77		
3	Cascade Locks	OR	100	45.68	121.87	FALL				15.00		
3	Cascade Locks	OR	100	45.68	121.87	WINTER				17.13		
4	DC Test Site	OR	499	45.57	121.10	SPRING				8.97		
4	DC Test Site	OR	499	45.57	121.10	SUMMER				10.63		
4	DC Test Site	OR	499	45.57	121.10	FALL				5.87		
4	DC Test Site	OR	499	45.57	121.10	WINTER				5.40		
5	Deschutes Co #25	OR	3680	44.05	121.27	SPRING				6.73		
5	Deschutes Co #25	OR	3680	44.05	121.27	SUMMER				5.60		
5	Deschutes Co #25	OR	3680	44.05	121.27	FALL				6.13		
5	Deschutes Co #25	OR	3680	44.05	121.27	WINTER				6.63		
6	Deschutes Co #43	OR	3355	44.08	121.03	SPRING				7.03		
6	Deschutes Co #43	OR	3355	44.08	121.03	SUMMER				6.67		
6	Deschutes Co #43	OR	3355	44.08	121.03	FALL				4.90		
6	Deschutes Co #43	OR	3355	44.08	121.03	WINTER				7.20		
7	Deschutes Co #6	OR	3540	44.18	121.45	SPRING				5.97		
7	Deschutes Co #6	OR	3540	44.18	121.45	SUMMER				5.80		
7	Deschutes Co #6	OR	3540	44.18	121.45	FALL				2.97		
7	Deschutes Co #6	OR	3540	44.18	121.45	WINTER				5.63		
8	Dufur	OR	1325	45.45	121.13	SPRING	74.9	29.0	51.95			
8	Dufur	OR	1325	45.45	121.13	SUMMER	88.8	45.4	67.10			
8	Dufur	OR	1325	45.45	121.13	FALL	80.9	28.7	54.80			
8	Dufur	OR	1325	45.45	121.13	WINTER	50.3	20.8	35.55			
9	Fossil	OR	2660	45.00	121.20	SPRING	71.2	23.9	47.55			
9	Fossil	OR	2660	45.00	121.20	SUMMER	88.3	40.6	64.45			
9	Fossil	OR	2660	45.00	121.20	FALL	78.9	25.9	52.40			
9	Fossil	OR	2660	45.00	121.20	WINTER	48.9	20.6	34.75			
10	Frazier Ranch	OR	1400	45.53	121.18	SPRING				7.73		
10	Frazier Ranch	OR	1400	45.53	121.18	SUMMER				8.93		
10	Frazier Ranch	OR	1400	45.53	121.18	FALL				5.33		
10	Frazier Ranch	OR	1400	45.53	121.18	WINTER				5.13		
11	Hood River E.S.	OR	500	45.68	121.52	SPRING	72.1	31.9	52.00			
11	Hood River E.S.	OR	500	45.68	121.52	SUMMER	82.5	49.3	65.90			
11	Hood River E.S.	OR	500	45.68	121.52	FALL	77.3	32.3	54.80			
11	Hood River E.S.	OR	500	45.68	121.52	WINTER	49.9	25.3	37.60			
12	Madras	OR	2256	44.63	121.13	SPRING	74.1	23.7	48.90			
12	Madras	OR	2256	44.63	121.13	SUMMER	89.9	39.6	64.75			
12	Madras	OR	2256	44.63	121.13	FALL	80.1	24.4	52.25			
12	Madras	OR	2256	44.63	121.13	WINTER	51.3	18.4	34.85			
13	Martin Marietta	OR	151	45.63	121.20	SPRING						
13	Martin Marietta	OR	151	45.63	121.20	SUMMER				9.30		
13	Martin Marietta	OR	151	45.63	121.20	FALL						
13	Martin Marietta	OR	151	45.63	121.20	WINTER				3.20		

14 Mosier	OR	640	45.68	121.40	SPRING					11.43
14 Mosier	OR	640	45.68	121.40	SUMMER					14.37
14 Mosier	OR	640	45.68	121.40	FALL					8.10
14 Mosier	OR	640	45.68	121.40	WINTER					6.87
15 MT Hood Meadows	OR	5916	45.33	121.65	SPRING					9.73
15 MT Hood Meadows	OR	5916	45.33	121.65	SUMMER					8.27
15 MT Hood Meadows	OR	5916	45.33	121.65	FALL					12.00
15 MT Hood Meadows	OR	5916	45.33	121.65	WINTER					10.25
16 Ortley	OR	1880	45.65	121.28	SPRING					18.03
16 Ortley	OR	1880	45.65	121.28	SUMMER					18.97
16 Ortley	OR	1880	45.65	121.28	FALL					12.37
16 Ortley	OR	1880	45.65	121.28	WINTER					15.90
17 Ortley Pt	OR	2040	45.65	121.28	SPRING					14.87
17 Ortley Pt	OR	2040	45.65	121.28	SUMMER					18.87
17 Ortley Pt	OR	2040	45.65	121.28	FALL					11.97
17 Ortley Pt	OR	2040	45.65	121.28	WINTER					9.50
18 Parkdale	OR	1740	45.58	121.50	SPRING	69.9	27.8	48.85		
18 Parkdale	OR	1740	45.58	121.50	SUMMER	82.7	43.8	63.25		
18 Parkdale	OR	1740	45.58	121.50	FALL	75.9	28.4	52.15		
18 Parkdale	OR	1740	45.58	121.50	WINTER	47.9	20.6	34.25		
19 Redmond KPRB	OR	2994	44.30	121.17	SPRING	71.9	25.2	48.55	6.67	2.8 SSE
19 Redmond KPRB	OR	2994	44.30	121.17	SUMMER	87.2	42.0	64.60	5.73	3.3 SSE
19 Redmond KPRB	OR	2994	44.30	121.17	FALL	78.6	26.6	52.60	6.07	3.5 SSE
19 Redmond KPRB	OR	2994	44.30	121.17	WINTER	50.0	20.3	35.15	7.27	1.9 SSE
20 Robbins Farm	OR	2050	45.55	121.37	SPRING					15.30
20 Robbins Farm	OR	2050	45.55	121.37	SUMMER					
20 Robbins Farm	OR	2050	45.55	121.37	FALL					11.23
20 Robbins Farm	OR	2050	45.55	121.37	WINTER					6.90
21 Roberts Fld	OR	3064	44.30	121.17	SPRING					7.00
21 Roberts Fld	OR	3064	44.30	121.17	SUMMER					5.87
21 Roberts Fld	OR	3064	44.30	121.17	FALL					6.10
21 Roberts Fld	OR	3064	44.30	121.17	WINTER					6.80
22 Sauter Ranch	OR	1348	45.63	121.28	SPRING					11.37
22 Sauter Ranch	OR	1348	45.63	121.28	SUMMER					16.80
22 Sauter Ranch	OR	1348	45.63	121.28	FALL					7.73
22 Sauter Ranch	OR	1348	45.63	121.28	WINTER					4.93
23 Sauter RR	OR	800	45.58	121.30	SPRING					13.13
23 Sauter RR	OR	800	45.58	121.30	SUMMER					20.57
23 Sauter RR	OR	800	45.58	121.30	FALL					9.03
23 Sauter RR	OR	800	45.58	121.30	WINTER					3.43
24 Seven Mile Bell	OR	1840	45.63	121.30	SPRING					15.70
24 Seven Mile Bell	OR	1840	45.63	121.30	SUMMER					20.50
24 Seven Mile Bell	OR	1840	45.63	121.30	FALL					10.93
24 Seven Mile Bell	OR	1840	45.63	121.30	WINTER					9.23
25 Seven Mile Hill	OR	1880	45.65	121.27	SPRING					15.70
25 Seven Mile Hill	OR	1880	45.65	121.27	SUMMER					20.30
25 Seven Mile Hill	OR	1880	45.65	121.27	FALL					11.37
25 Seven Mile Hill	OR	1880	45.65	121.27	WINTER					9.34
26 Tygh Ridge	OR	3083	45.32	121.03	SPRING					11.20
26 Tygh Ridge	OR	3083	45.32	121.03	SUMMER					7.43
26 Tygh Ridge	OR	3083	45.32	121.03	FALL					4.80
26 Tygh Ridge	OR	3083	45.32	121.03	WINTER					7.60
27 Wasco Lookout	OR	2346	45.53	121.37	SPRING					
27 Wasco Lookout	OR	2346	45.53	121.37	SUMMER					
27 Wasco Lookout	OR	2346	45.53	121.37	FALL					13.25
27 Wasco Lookout	OR	2346	45.53	121.37	WINTER					14.40

28 Augspurger	WA	2880	45.73	121.68	SPRING				14.77	
28 Augspurger	WA	2880	45.73	121.68	SUMMER				18.97	
28 Augspurger	WA	2880	45.73	121.68	FALL				14.90	
28 Augspurger	WA	2880	45.73	121.68	WINTER				15.40	
29 Baldwin	WA	2040	45.75	121.45	SPRING				14.53	
29 Baldwin	WA	2040	45.75	121.45	SUMMER				16.80	
29 Baldwin	WA	2040	45.75	121.45	FALL				10.17	
29 Baldwin	WA	2040	45.75	121.45	WINTER				8.17	
30 Beeks	WA	400	45.65	121.18	SPRING				14.20	
30 Beeks	WA	400	45.65	121.18	SUMMER				18.90	
30 Beeks	WA	400	45.65	121.18	FALL				9.90	
30 Beeks	WA	400	45.65	121.18	WINTER				5.00	
31 Buckley INE	WA	685	47.17	122.00	SPRING	68.7	33.8	51.25		
31 Buckley INE	WA	685	47.17	122.00	SUMMER	77.4	47.4	62.40		
31 Buckley INE	WA	685	47.17	122.00	FALL	72.4	35.4	53.90		
31 Buckley INE	WA	685	47.17	122.00	WINTER	49.4	31.2	40.30		
32 Bumping Lake	WA	3440	46.87	121.30	SPRING	62.5	15.7	39.10		
32 Bumping Lake	WA	3440	46.87	121.30	SUMMER	77.2	37.3	57.25		
32 Bumping Lake	WA	3440	46.87	121.30	FALL	71.4	21.9	46.65		
32 Bumping Lake	WA	3440	46.87	121.30	WINTER	41.1	12.4	26.75		
33 Cedar Lake	WA	1560	47.42	121.73	SPRING	64.0	31.7	47.85		
33 Cedar Lake	WA	1560	47.42	121.73	SUMMER	73.1	46.0	59.55		
33 Cedar Lake	WA	1560	47.42	121.73	FALL	69.2	34.7	51.95		
33 Cedar Lake	WA	1560	47.42	121.73	WINTER	43.9	29.0	36.45		
34 Concrete	WA	270	48.53	121.75	SPRING	71.6	33.3	52.45		
34 Concrete	WA	270	48.53	121.75	SUMMER	79.2	49.6	64.40		
34 Concrete	WA	270	48.53	121.75	FALL	75.6	36.2	55.90		
34 Concrete	WA	270	48.53	121.75	WINTER	49.5	30.0	39.75		
35 Crystal MTN	WA	6870	46.93	121.50	SPRING				10.50	
35 Crystal MTN	WA	6870	46.93	121.50	SUMMER					
35 Crystal MTN	WA	6870	46.93	121.50	FALL					
35 Crystal MTN	WA	6870	46.93	121.50	WINTER				12.00	
36 Dallesport AP	WA	222	45.62	121.15	SPRING				9.40	3.3 SW
36 Dallesport AP	WA	222	45.62	121.15	SUMMER				11.50	1.8 SW
36 Dallesport AP	WA	222	45.62	121.15	FALL				5.93	5.1 SW
36 Dallesport AP	WA	222	45.62	121.15	WINTER				5.30	4.9 E-NE
37 Darrington R.S.	WA	550	48.25	121.60	SPRING	70.2	30.7	50.45		
37 Darrington R.S.	WA	550	48.25	121.60	SUMMER	79.9	46.6	63.25		
37 Darrington R.S.	WA	550	48.25	121.60	FALL	74.6	31.7	53.15		
37 Darrington R.S.	WA	550	48.25	121.60	WINTER	47.5	25.6	36.55		
38 Diablo Dam	WA	891	48.72	121.15	SPRING	69.2	29.9	49.55	3.80	
38 Diablo Dam	WA	891	48.72	121.15	SUMMER	80.1	47.5	63.80	3.93	
38 Diablo Dam	WA	891	48.72	121.15	FALL	73.9	32.4	53.15	2.90	
38 Diablo Dam	WA	891	48.72	121.15	WINTER	44.1	25.9	35.00	4.03	
39 Echelman Bell	WA	2013	45.77	121.17	SPRING				6.70	
39 Echelman Bell	WA	2013	45.77	121.17	SUMMER				11.13	
39 Echelman Bell	WA	2013	45.77	121.17	FALL				8.43	
39 Echelman Bell	WA	2013	45.77	121.17	WINTER				6.50	
40 Greenwater	WA	1708	47.15	121.65	SPRING	63.3	29.1	46.20		
40 Greenwater	WA	1708	47.15	121.65	SUMMER	73.7	44.2	58.95		
40 Greenwater	WA	1708	47.15	121.65	FALL	70.1	29.9	50.00		
40 Greenwater	WA	1708	47.15	121.65	WINTER	40.8	25.5	33.15		
41 KCIU	WA	45	45.70	121.10	SPRING				14.53	
41 KCIU	WA	45	45.70	121.10	SUMMER				14.80	
41 KCIU	WA	45	45.70	121.10	FALL				13.03	
41 KCIU	WA	45	45.70	121.10	WINTER				14.70	

42 Lake Kachess	WA	2270	47.27	121.20	SPRING	66.1	23.2	44.65		
42 Lake Kachess	WA	2270	47.27	121.20	SUMMER	79.4	43.6	61.50		
42 Lake Kachess	WA	2270	47.27	121.20	FALL	73.8	26.5	50.15		
42 Lake Kachess	WA	2270	47.27	121.20	WINTER	40.9	17.8	29.35		
43 Lake Keechelus	WA	2475	47.32	121.33	SPRING	61.9	21.4	41.65		
43 Lake Keechelus	WA	2475	47.32	121.33	SUMMER	74.7	42.5	58.60		
43 Lake Keechelus	WA	2475	47.32	121.33	FALL	70.7	27.1	48.90		
43 Lake Keechelus	WA	2475	47.32	121.33	WINTER	39.0	17.8	28.40		
44 Landsburg	WA	535	47.38	121.97	SPRING	68.5	32.4	50.45		
44 Landsburg	WA	535	47.38	121.97	SUMMER	77.3	45.6	61.45		
44 Landsburg	WA	535	47.38	121.97	FALL	73.0	33.8	53.40		
44 Landsburg	WA	535	47.38	121.97	WINTER	49.6	29.8	39.70		
45 Mud Mountain Dam	WA	1308	47.15	121.93	SPRING	63.6	31.4	47.50		
45 Mud Mountain Dam	WA	1308	47.15	121.93	SUMMER	73.7	46.4	60.05		
45 Mud Mountain Dam	WA	1308	47.15	121.93	FALL	70.6	35.2	52.90		
45 Mud Mountain Dam	WA	1308	47.15	121.93	WINTER	46.1	29.7	37.90		
46 Palmer 3ESE	WA	895	47.30	121.83	SPRING	67.3	32.4	49.85		
46 Palmer 3ESE	WA	895	47.30	121.83	SUMMER	77.0	46.8	61.90		
46 Palmer 3ESE	WA	895	47.30	121.83	FALL	72.8	35.4	54.10		
46 Palmer 3ESE	WA	895	47.30	121.83	WINTER	46.7	29.9	38.30		
47 Pierson	WA	1950	45.77	121.43	SPRING				8.07	
47 Pierson	WA	1950	45.77	121.43	SUMMER				9.63	
47 Pierson	WA	1950	45.77	121.43	FALL				5.40	
47 Pierson	WA	1950	45.77	121.43	WINTER				5.90	
48 Rainier Longmire	WA	2762	46.75	121.82	SPRING	64.7	26.1	45.40		
48 Rainier Longmire	WA	2762	46.75	121.82	SUMMER	76.6	42.8	59.70		
48 Rainier Longmire	WA	2762	46.75	121.82	FALL	71.6	30.0	50.80		
48 Rainier Longmire	WA	2762	46.75	121.82	WINTER	41.2	23.7	32.45		
49 Rimrock Tieton Dam	WA	2730	46.65	121.13	SPRING	68.5	20.4	44.45		
49 Rimrock Tieton Dam	WA	2730	46.65	121.13	SUMMER	81.8	42.6	62.20		
49 Rimrock Tieton Dam	WA	2730	46.65	121.13	FALL	74.9	23.6	49.25		
49 Rimrock Tieton Dam	WA	2730	46.65	121.13	WINTER	41.4	15.1	28.25		
50 Signal Peak	WA	5111	46.22	121.13	SPRING					
50 Signal Peak	WA	5111	46.22	121.13	SUMMER				9.70	
50 Signal Peak	WA	5111	46.22	121.13	FALL				10.50	
50 Signal Peak	WA	5111	46.22	121.13	WINTER					
51 Skagit Power Plant	WA	525	48.68	121.25	SPRING	72.3	32.2	52.25		
51 Skagit Power Plant	WA	525	48.68	121.25	SUMMER	81.0	48.7	64.85		
51 Skagit Power Plant	WA	525	48.68	121.25	FALL	76.6	34.9	55.75		
51 Skagit Power Plant	WA	525	48.68	121.25	WINTER	47.0	28.2	37.60		
52 Snowqualmie Falls	WA	440	47.55	121.85	SPRING	69.1	32.8	50.95		
52 Snowqualmie Falls	WA	440	47.55	121.85	SUMMER	77.9	46.8	62.35		
52 Snowqualmie Falls	WA	440	47.55	121.85	FALL	72.8	35.8	54.30		
52 Snowqualmie Falls	WA	440	47.55	121.85	WINTER	49.2	31.2	40.20		
53 Snowqualmie Pass	WA	3020	47.42	121.42	SPRING	61.5	23.6	42.55		
53 Snowqualmie Pass	WA	3020	47.42	121.42	SUMMER	73.4	39.6	56.50		
53 Snowqualmie Pass	WA	3020	47.42	121.42	FALL	67.9	26.2	47.05		
53 Snowqualmie Pass	WA	3020	47.42	121.42	WINTER	38.2	18.0	28.10		
54 Spring Crk Hatch	WA	76	45.72	121.55	SPRING				8.00	
54 Spring Crk Hatch	WA	76	45.72	121.55	SUMMER				11.27	
54 Spring Crk Hatch	WA	76	45.72	121.55	FALL				5.47	
54 Spring Crk Hatch	WA	76	45.72	121.55	WINTER				5.03	
55 Stampede Pass	WA	3958	47.28	121.33	SPRING	55.0	21.8	38.40	11.20	1.5 E
55 Stampede Pass	WA	3958	47.28	121.33	SUMMER	66.8	39.8	53.30	10.50	1.3 SW
55 Stampede Pass	WA	3958	47.28	121.33	FALL	63.0	24.0	43.50	10.13	2.1 E-SW
55 Stampede Pass	WA	3958	47.28	121.33	WINTER	31.7	18.0	24.85	10.57	2.4 E

56 Stevens Pass	WA	5100	47.75	121.10	SPRING				9.85
56 Stevens Pass	WA	5100	47.75	121.10	SUMMER				
56 Stevens Pass	WA	5100	47.75	121.10	FALL				8.55
56 Stevens Pass	WA	5100	47.75	121.10	WINTER				9.17
57 Wind MTN	WA	960	45.72	121.75	SPRING				12.37
57 Wind MTN	WA	960	45.72	121.75	SUMMER				14.20
57 Wind MTN	WA	960	45.72	121.75	FALL				10.30
57 Wind MTN	WA	960	45.72	121.75	WINTER				10.53
58 Wind River	WA	1145	45.80	121.93	SPRING	70.4	28.3	49.35	
58 Wind River	WA	1145	45.80	121.93	SUMMER	82.3	44.6	63.45	
58 Wind River	WA	1145	45.80	121.93	FALL	75.4	30.7	53.05	
58 Wind River	WA	1145	45.80	121.93	WINTER	46.7	24.1	35.40	

COLUMBIA PLATEAU -- WIND AND TEMPERATURE DATA

#	LOCATION	ST	EL	LAT.	LONG.	SEASON	Tmax	Tmin	Tmean	WS	FREQ.	DIR
1	Biggs	OR	650	45.67	120.83	SPRING				11.30		
1	Biggs	OR	650	45.67	120.83	SUMMER				15.10		
1	Biggs	OR	650	45.67	120.83	FALL				10.80		
1	Biggs	OR	650	45.67	120.83	WINTER				7.80		
2	Boardman	OR	320	45.85	119.73	SPRING				10.47		
2	Boardman	OR	320	45.85	119.73	SUMMER				12.40		
2	Boardman	OR	320	45.85	119.73	FALL				9.20		
2	Boardman	OR	320	45.85	119.73	WINTER				6.20		
3	Cabbage Hill	OR	3000	45.60	118.58	SPRING				10.00		
3	Cabbage Hill	OR	3000	45.60	118.58	SUMMER				8.13		
3	Cabbage Hill	OR	3000	45.60	118.58	FALL				11.83		
3	Cabbage Hill	OR	3000	45.60	118.58	WINTER				10.93		
4	Carty	OR	700	45.63	119.82	SPRING				12.13		
4	Carty	OR	700	45.63	119.82	SUMMER				12.27		
4	Carty	OR	700	45.63	119.82	FALL				8.47		
4	Carty	OR	700	45.63	119.82	WINTER				8.00		
5	Condon	OR	2844	45.23	120.18	SPRING	70.2	26.7	48.45			
5	Condon	OR	2844	45.23	120.18	SUMMER	86.8	44.0	65.40			
5	Condon	OR	2844	45.23	120.18	FALL	76.2	27.2	51.70			
5	Condon	OR	2844	45.23	120.18	WINTER	45.3	19.0	32.15			
6	Craig MTN	OR	4400	45.22	117.97	SPRING				10.20		
6	Craig MTN	OR	4400	45.22	117.97	SUMMER				8.45		
6	Craig MTN	OR	4400	45.22	117.97	FALL						
6	Craig MTN	OR	4400	45.22	117.97	WINTER				15.85		
7	Enterprise	OR	3760	45.43	117.27	SPRING	69.8	19.2	44.50			
7	Enterprise	OR	3760	45.43	117.27	SUMMER	85.7	37.4	61.55			
7	Enterprise	OR	3760	45.43	117.27	FALL	76.4	20.2	48.30			
7	Enterprise	OR	3760	45.43	117.27	WINTER	42.2	11.8	27.00			
8	Haines	OR	4000	45.02	119.90	SPRING				8.97		
8	Haines	OR	4000	45.02	119.90	SUMMER				7.10		
8	Haines	OR	4000	45.02	119.90	FALL				6.83		
8	Haines	OR	4000	45.02	119.90	WINTER				7.77		
9	Heppner	OR	1950	45.35	119.55	SPRING	71.7	29.8	50.75			
9	Heppner	OR	1950	45.35	119.55	SUMMER	86.4	46.6	66.50			
9	Heppner	OR	1950	45.35	119.55	FALL	77.5	29.7	53.60			
9	Heppner	OR	1950	45.35	119.55	WINTER	48.9	22.1	35.50			
10	Hermiston 2S	OR	624	45.82	119.28	SPRING	80.2	29.3	54.75			
10	Hermiston 2S	OR	624	45.82	119.28	SUMMER	93.5	51.3	72.40			
10	Hermiston 2S	OR	624	45.82	119.28	FALL	82.1	28.8	55.95			
10	Hermiston 2S	OR	624	45.82	119.28	WINTER	53.0	20.7	36.85			
11	High Valley	OR	3926	45.22	117.78	SPRING						
11	High Valley	OR	3926	45.22	117.78	SUMMER				12.90		
11	High Valley	OR	3926	45.22	117.78	FALL				13.30		
11	High Valley	OR	3926	45.22	117.78	WINTER						
12	Hill Ranch	OR	2700	45.25	117.93	SPRING				9.07		
12	Hill Ranch	OR	2700	45.25	117.93	SUMMER				7.67		
12	Hill Ranch	OR	2700	45.25	117.93	FALL				11.00		
12	Hill Ranch	OR	2700	45.25	117.93	WINTER				16.50		
13	Hot Lakes	OR	4400	45.25	117.97	SPRING						
13	Hot Lakes	OR	4400	45.25	117.97	SUMMER				9.05		
13	Hot Lakes	OR	4400	45.25	117.97	FALL				12.40		
13	Hot Lakes	OR	4400	45.25	117.97	WINTER				23.30		

14 Hurlburt Flats	OR	603	45.72	120.10	SPRING					
14 Hurlburt Flats	OR	603	45.72	120.10	SUMMER					8.47
14 Hurlburt Flats	OR	603	45.72	120.10	FALL					4.30
14 Hurlburt Flats	OR	603	45.72	120.10	WINTER					5.60
15 Irrigon	OR	300	45.89	119.48	SPRING					8.77
15 Irrigon	OR	300	45.88	119.48	SUMMER					7.33
15 Irrigon	OR	300	45.88	119.48	FALL					6.67
15 Irrigon	OR	300	45.88	119.48	WINTER					5.93
16 John Day Dam	OR	200	45.70	120.70	SPRING					12.47
16 John Day Dam	OR	200	45.70	120.70	SUMMER					13.70
16 John Day Dam	OR	200	45.70	120.70	FALL					8.23
16 John Day Dam	OR	200	45.70	120.70	WINTER					6.33
17 La Grande	OR	2705	45.30	118.02	SPRING					9.37
17 La Grande	OR	2705	45.30	118.02	SUMMER					7.13
17 La Grande	OR	2705	45.30	118.02	FALL					8.00
17 La Grande	OR	2705	45.30	118.02	WINTER					12.60
18 La Grande AP	OR	2709	45.28	118.03	SPRING					8.33
18 La Grande AP	OR	2709	45.28	118.03	SUMMER				4.2 NW	5.1 NW
18 La Grande AP	OR	2709	45.28	118.03	FALL				6.2 NW	7.13
18 La Grande AP	OR	2709	45.28	118.03	WINTER				3.7 NW	11.17
19 La Grande Elev	OR	3149	45.32	117.97	SPRING					12.67
19 La Grande Elev	OR	3149	45.32	117.97	SUMMER					3.80
19 La Grande Elev	OR	3149	45.32	117.97	FALL					8.90
19 La Grande Elev	OR	3149	45.32	117.97	WINTER					15.33
20 LaGrande Andrews	OR	2700	45.30	117.97	SPRING					8.53
20 LaGrande Andrews	OR	2700	45.30	117.97	SUMMER					6.97
20 LaGrande Andrews	OR	2700	45.30	117.97	FALL					8.00
20 LaGrande Andrews	OR	2700	45.30	117.97	WINTER					12.60
21 Meacham AP	OR	4050	45.50	118.40	SPRING				2.8 ESE-SE	6.23
21 Meacham AP	OR	4050	45.50	118.40	SUMMER				3.3 ESE	5.43
21 Meacham AP	OR	4050	45.50	118.40	FALL				6.3 ESE	5.33
21 Meacham AP	OR	4050	45.50	118.40	WINTER				5.2 ESE	6.40
22 Milton-freewater	OR	962	45.97	118.43	SPRING	77.7	32.8	55.25		
22 Milton-freewater	OR	962	45.97	118.43	SUMMER	92.2	52.8	72.50		
22 Milton-freewater	OR	962	45.97	118.43	FALL	81.1	31.4	56.25		
22 Milton-freewater	OR	962	45.97	118.43	WINTER	51.6	22.8	37.20		
23 Moro	OR	1858	45.48	120.72	SPRING	72.1	29.3	50.70		
23 Moro	OR	1858	45.48	120.72	SUMMER	86.5	47.2	66.85		
23 Moro	OR	1858	45.48	120.72	FALL	78.4	28.7	53.55		
23 Moro	OR	1858	45.48	120.72	WINTER	46.8	21.0	33.90		
24 Pebble Springs	OR	712	45.70	120.13	SPRING					14.87
24 Pebble Springs	OR	712	45.70	120.13	SUMMER					15.10
24 Pebble Springs	OR	712	45.70	120.13	FALL					10.30
24 Pebble Springs	OR	712	45.70	120.13	WINTER					11.83
25 Pendleton	OR	1492	45.68	118.85	SPRING					8.50
25 Pendleton	OR	1492	45.68	118.85	SUMMER					7.70
25 Pendleton	OR	1492	45.68	118.85	FALL					6.60
25 Pendleton	OR	1492	45.68	118.85	WINTER					6.67
26 Pendleton AP	OR	1489	45.68	118.85	SPRING	75.2	32.2	53.70	2.3 SE	8.67
26 Pendleton AP	OR	1489	45.68	118.85	SUMMER	91.5	51.6	71.55	2.5 SE	8.30
26 Pendleton AP	OR	1489	45.68	118.85	FALL	80.6	31.1	55.85	3.4 SE	6.97
26 Pendleton AP	OR	1489	45.68	118.85	WINTER	49.6	22.6	36.10	3.5 SE	7.33
27 Pumpkin Ridge	OR	3200	45.37	118.13	SPRING					4.93
27 Pumpkin Ridge	OR	3200	45.37	118.13	SUMMER					4.03
27 Pumpkin Ridge	OR	3200	45.37	118.13	FALL					3.87
27 Pumpkin Ridge	OR	3200	45.37	118.13	WINTER					8.40

28 Pyle Canyon	OR	3640	45.17	117.88	SPRING				8.70
28 Pyle Canyon	OR	3640	45.17	117.88	SUMMER				6.80
28 Pyle Canyon	OR	3640	45.17	117.88	FALL				
28 Pyle Canyon	OR	3640	45.17	117.88	WINTER				20.20
29 Ramo Flat	OR	3860	45.17	117.83	SPRING				9.67
29 Ramo Flat	OR	3860	45.17	117.83	SUMMER				7.87
29 Ramo Flat	OR	3860	45.17	117.83	FALL				11.67
29 Ramo Flat	OR	3860	45.17	117.83	WINTER				15.43
30 Reid Farm	OR	1262	45.67	120.67	SPRING				11.87
30 Reid Farm	OR	1262	45.67	120.67	SUMMER				14.13
30 Reid Farm	OR	1262	45.67	120.67	FALL				9.67
30 Reid Farm	OR	1262	45.67	120.67	WINTER				7.73
31 Sherman Co #41	OR	2300	45.38	120.75	SPRING				9.07
31 Sherman Co #41	OR	2300	45.38	120.75	SUMMER				10.03
31 Sherman Co #41	OR	2300	45.38	120.75	FALL				9.43
31 Sherman Co #41	OR	2300	45.38	120.75	WINTER				11.97
32 Sherman Co #9	OR	1600	45.60	120.63	SPRING				16.37
32 Sherman Co #9	OR	1600	45.60	120.63	SUMMER				16.87
32 Sherman Co #9	OR	1600	45.60	120.63	FALL				12.85
32 Sherman Co #9	OR	1600	45.60	120.63	WINTER				9.57
33 Shutler Flat	OR	1180	45.52	120.17	SPRING				13.33
33 Shutler Flat	OR	1180	45.52	120.17	SUMMER				13.50
33 Shutler Flat	OR	1180	45.52	120.17	FALL				9.97
33 Shutler Flat	OR	1180	45.52	120.17	WINTER				7.10
34 Ukiah	OR	3212	45.13	118.93	SPRING	68.4	19.9	44.10	
34 Ukiah	OR	3212	45.13	118.93	SUMMER	87.1	35.1	61.10	
34 Ukiah	OR	3212	45.13	118.93	FALL	77.7	20.9	49.30	
34 Ukiah	OR	3212	45.13	118.93	WINTER	43.4	12.6	28.00	
35 Union	OR	2765	45.22	117.08	SPRING	71.2	27.2	49.20	
35 Union	OR	2765	45.22	117.08	SUMMER	86.4	43.4	64.90	
35 Union	OR	2765	45.22	117.08	FALL	77.3	28.8	53.05	
35 Union	OR	2765	45.22	117.08	WINTER	44.6	21.0	32.80	
36 Union Co #1	OR	3460	45.10	117.80	SPRING				8.93
36 Union Co #1	OR	3460	45.10	117.80	SUMMER				12.25
36 Union Co #1	OR	3460	45.10	117.80	FALL				8.60
36 Union Co #1	OR	3460	45.10	117.80	WINTER				8.73
37 Upper Pyle	OR	3660	45.10	117.83	SPRING				13.57
37 Upper Pyle	OR	3660	45.10	117.83	SUMMER				13.32
37 Upper Pyle	OR	3660	45.10	117.83	FALL				14.82
37 Upper Pyle	OR	3660	45.10	117.83	WINTER				15.56
38 Wallula	OR	1050	45.93	119.03	SPRING				8.03
38 Wallula	OR	1050	45.93	119.03	SUMMER				6.00
38 Wallula	OR	1050	45.93	119.03	FALL				5.73
38 Wallula	OR	1050	45.93	119.03	WINTER				4.40
39 Wasco	OR	1800	45.53	120.70	SPRING				12.30
39 Wasco	OR	1800	45.53	120.70	SUMMER				13.87
39 Wasco	OR	1800	45.53	120.70	FALL				9.70
39 Wasco	OR	1800	45.53	120.70	WINTER				8.23
40 Angstrom	WA	2816	47.75	118.53	SPRING				12.80
40 Angstrom	WA	2816	47.75	118.53	SUMMER				9.03
40 Angstrom	WA	2816	47.75	118.53	FALL				7.00
40 Angstrom	WA	2816	47.75	118.53	WINTER				10.23
41 Beezley Hills	WA	2530	47.30	119.67	SPRING				14.90
41 Beezley Hills	WA	2530	47.30	119.67	SUMMER				16.83
41 Beezley Hills	WA	2530	47.30	119.67	FALL				7.60
41 Beezley Hills	WA	2530	47.30	119.67	WINTER				9.50

42 Beightol	WA	750	45.93	119.92	SPRING				11.17	
42 Beightol	WA	750	45.93	119.92	SUMMER				15.40	
42 Beightol	WA	750	45.93	119.92	FALL				7.23	
42 Beightol	WA	750	45.93	119.92	WINTER				5.90	
43 Beverly	WA	2320	46.85	119.83	SPRING				11.53	
43 Beverly	WA	2320	46.85	119.83	SUMMER					
43 Beverly	WA	2320	46.85	119.83	FALL				10.40	
43 Beverly	WA	2320	46.85	119.83	WINTER				9.63	
44 Bickleton	WA	3023	46.00	120.30	SPRING	69.2	26.7	47.95		
44 Bickleton	WA	3023	46.00	120.30	SUMMER	84.9	45.8	65.35		
44 Bickleton	WA	3023	46.00	120.30	FALL	74.9	27.4	51.15		
44 Bickleton	WA	3023	46.00	120.30	WINTER	41.7	19.2	30.45		
45 Boyleston MTN	WA	2400	46.95	120.33	SPRING				13.83	
45 Boyleston MTN	WA	2400	46.95	120.33	SUMMER				13.63	
45 Boyleston MTN	WA	2400	46.95	120.33	FALL				9.17	
45 Boyleston MTN	WA	2400	46.95	120.33	WINTER				7.80	
46 Cheney	WA	2450	47.50	117.58	SPRING				10.87	
46 Cheney	WA	2450	47.50	117.58	SUMMER				9.17	
46 Cheney	WA	2450	47.50	117.58	FALL				9.53	
46 Cheney	WA	2450	47.50	117.58	WINTER				8.20	
47 Cle Elum	WA	1935	47.18	120.95	SPRING	71.7	25.1	48.40		
47 Cle Elum	WA	1935	47.18	120.95	SUMMER	84.3	44.6	64.45		
47 Cle Elum	WA	1935	47.18	120.95	FALL	78.0	25.9	51.95		
47 Cle Elum	WA	1935	47.18	120.95	WINTER	44.5	17.1	30.80		
48 Colville	WA	1635	48.55	117.90	SPRING	75.7	24.7	50.20		
48 Colville	WA	1635	48.55	117.90	SUMMER	89.1	44.8	66.95		
48 Colville	WA	1635	48.55	117.90	FALL	67.7	25.8	46.75		
48 Colville	WA	1635	48.55	117.90	WINTER	44.4	14.4	29.40		
49 Colville AP	WA	1874	48.53	117.88	SPRING	73.2	21.0	47.10		
49 Colville AP	WA	1874	48.53	117.88	SUMMER	88.1	45.1	66.60		
49 Colville AP	WA	1874	48.53	117.88	FALL	79.0	24.4	51.70		
49 Colville AP	WA	1874	48.53	117.88	WINTER	41.0	13.2	27.10		
50 Connel	WA	900	46.67	118.87	SPRING				10.70	
50 Connel	WA	900	46.67	118.87	SUMMER				9.47	
50 Connel	WA	900	46.67	118.87	FALL				10.57	
50 Connel	WA	900	46.67	118.87	WINTER				8.33	
51 Creston	WA	2500	47.75	118.52	SPRING				13.50	
51 Creston	WA	2500	47.75	118.52	SUMMER				11.97	
51 Creston	WA	2500	47.75	118.52	FALL				12.70	
51 Creston	WA	2500	47.75	118.52	WINTER				11.90	
52 Dayton	WA	1557	46.32	118.00	SPRING	73.8	30.2	52.00		
52 Dayton	WA	1557	46.32	118.00	SUMMER	89.4	49.2	69.30		
52 Dayton	WA	1557	46.32	118.00	FALL	79.9	30.1	55.00		
52 Dayton	WA	1557	46.32	118.00	WINTER	47.6	23.0	35.30		
53 Deer Park 2E	WA	2114	47.95	117.43	SPRING	72.7	22.3	47.50		
53 Deer Park 2E	WA	2114	47.95	117.43	SUMMER	87.8	42.0	64.90		
53 Deer Park 2E	WA	2114	47.95	117.43	FALL	75.5	24.2	49.85		
53 Deer Park 2E	WA	2114	47.95	117.43	WINTER	43.1	13.7	28.40		
54 Ellensburg	WA	1627	47.00	120.52	SPRING	73.7	26.1	49.90		
54 Ellensburg	WA	1627	47.00	120.52	SUMMER	86.8	46.7	66.75		
54 Ellensburg	WA	1627	47.00	120.52	FALL	76.1	24.6	50.35		
54 Ellensburg	WA	1627	47.00	120.52	WINTER	46.6	16.0	31.30		
55 Ellensburg AP	WA	1727	47.03	120.52	SPRING	71.9	23.9	47.90	11.63	2.1 E
55 Ellensburg AP	WA	1727	47.03	120.52	SUMMER	85.1	47.2	66.15	13.37	2.3 E
55 Ellensburg AP	WA	1727	47.03	120.52	FALL	79.3	25.1	52.20	6.60	3.4 E
55 Ellensburg AP	WA	1727	47.03	120.52	WINTER	44.2	11.2	28.05	5.40	3.2 E

56 Ephrata	WA	1250	47.30	119.55	SPRING	79.6	30.4	55.00	
56 Ephrata	WA	1250	47.30	119.55	SUMMER	92.5	55.0	73.75	
56 Ephrata	WA	1250	47.30	119.55	FALL	82.3	28.2	55.25	
56 Ephrata	WA	1250	47.30	119.55	WINTER	48.3	19.5	33.90	
57 Goldendale	WA	1635	45.82	120.83	SPRING	73.0	27.9	50.45	
57 Goldendale	WA	1635	45.82	120.83	SUMMER	87.0	45.1	66.05	
57 Goldendale	WA	1635	45.82	120.83	FALL	78.5	27.3	53.40	
57 Goldendale	WA	1635	45.82	120.83	WINTER	48.4	21.0	34.70	
58 Goldendale Bell	WA	2120	45.70	120.87	SPRING				15.70
58 Goldendale Bell	WA	2120	45.70	120.87	SUMMER				17.67
58 Goldendale Bell	WA	2120	45.70	120.87	FALL				13.75
58 Goldendale Bell	WA	2120	45.70	120.87	WINTER				7.60
59 Goldendale Obs	WA	2140	45.83	120.82	SPRING				9.37
59 Goldendale Obs	WA	2140	45.83	120.82	SUMMER				10.05
59 Goldendale Obs	WA	2140	45.83	120.82	FALL				7.53
59 Goldendale Obs	WA	2140	45.83	120.82	WINTER				8.47
60 Goodnoe H Doe	WA	2600	45.78	120.55	SPRING				15.80
60 Goodnoe H Doe	WA	2600	45.78	120.55	SUMMER				10.43
60 Goodnoe H Doe	WA	2600	45.78	120.55	FALL				11.47
60 Goodnoe H Doe	WA	2600	45.78	120.55	WINTER				18.00
61 Goodnoe Hills Luna	WA	2565	45.78	120.55	SPRING				19.17
61 Goodnoe Hills Luna	WA	2565	45.78	120.55	SUMMER				13.60
61 Goodnoe Hills Luna	WA	2565	45.78	120.55	FALL				12.67
61 Goodnoe Hills Luna	WA	2565	45.78	120.55	WINTER				11.77
62 Goodnoe Hills Tower	WA	2540	45.80	120.57	SPRING				12.17
62 Goodnoe Hills Tower	WA	2540	45.80	120.57	SUMMER				10.07
62 Goodnoe Hills Tower	WA	2540	45.80	120.57	FALL				9.60
62 Goodnoe Hills Tower	WA	2540	45.80	120.57	WINTER				13.50
63 G-6	WA	2400	45.78	120.50	SPRING				12.87
63 G-6	WA	2400	45.78	120.50	SUMMER				10.90
63 G-6	WA	2400	45.78	120.50	FALL				11.80
63 G-6	WA	2400	45.78	120.50	WINTER				9.30
64 Hactor	WA	1761	45.78	120.82	SPRING				9.73
64 Hactor	WA	1761	45.78	120.82	SUMMER				7.20
64 Hactor	WA	1761	45.78	120.82	FALL				7.13
64 Hactor	WA	1761	45.78	120.82	WINTER				18.00
65 Juniper Point	WA	3129	45.73	120.72	SPRING				19.20
65 Juniper Point	WA	3129	45.73	120.72	SUMMER				22.70
65 Juniper Point	WA	3129	45.73	120.72	FALL				16.25
65 Juniper Point	WA	3129	45.73	120.72	WINTER				14.50
66 J-15	WA	2700	45.73	120.70	SPRING				18.00
66 J-15	WA	2700	45.73	120.70	SUMMER				13.03
66 J-15	WA	2700	45.73	120.70	FALL				14.90
66 J-15	WA	2700	45.73	120.70	WINTER				
67 J-2	WA	2700	45.75	120.73	SPRING				
67 J-2	WA	2700	45.75	120.73	SUMMER				
67 J-2	WA	2700	45.75	120.73	FALL				
67 J-2	WA	2700	45.75	120.73	WINTER				
68 J-3	WA	2400	45.75	120.73	SPRING				11.23
68 J-3	WA	2400	45.75	120.73	SUMMER				11.70
68 J-3	WA	2400	45.75	120.73	FALL				9.50
68 J-3	WA	2400	45.75	120.73	WINTER				11.00
69 J-4	WA	1880	45.77	120.73	SPRING				10.27
69 J-4	WA	1880	45.77	120.73	SUMMER				12.37
69 J-4	WA	1880	45.77	120.73	FALL				9.63
69 J-4	WA	1880	45.77	120.73	WINTER				9.13

70 Kennewick	WA	2200	46.10	119.13	SPRING				16.47	
70 Kennewick	WA	2200	46.10	119.13	SUMMER				14.93	
70 Kennewick	WA	2200	46.10	119.13	FALL				14.77	
70 Kennewick	WA	2200	46.10	119.13	WINTER				19.57	
71 Kittitas MW	WA	110	46.97	120.22	SPRING				14.37	
71 Kittitas MW	WA	110	46.97	120.22	SUMMER				13.93	
71 Kittitas MW	WA	110	46.97	120.22	FALL				11.67	
71 Kittitas MW	WA	110	46.97	120.22	WINTER				11.00	
72 Knosher	WA	2150	45.85	120.77	SPRING				9.03	
72 Knosher	WA	2150	45.85	120.77	SUMMER				8.43	
72 Knosher	WA	2150	45.85	120.77	FALL				6.87	
72 Knosher	WA	2150	45.85	120.77	WINTER				7.97	
73 La Crosse	WA	1476	46.82	117.88	SPRING	75.2	29.1	52.15		
73 La Crosse	WA	1476	46.82	117.88	SUMMER	91.3	46.6	68.95		
73 La Crosse	WA	1476	46.82	117.88	FALL	80.8	29.6	55.20		
73 La Crosse	WA	1476	46.82	117.88	WINTER	48.5	21.9	35.20		
74 Lind E.S.	WA	1625	47.00	118.58	SPRING	77.2	28.5	52.85		
74 Lind E.S.	WA	1625	47.00	118.58	SUMMER	92.3	47.6	69.95		
74 Lind E.S.	WA	1625	47.00	118.58	FALL	81.6	28.0	54.80		
74 Lind E.S.	WA	1625	47.00	118.58	WINTER	46.7	20.4	33.55		
75 Lookout MTN	WA	2786	47.15	120.78	SPRING				12.23	
75 Lookout MTN	WA	2786	47.15	120.78	SUMMER				12.23	
75 Lookout MTN	WA	2786	47.15	120.78	FALL				13.33	
75 Lookout MTN	WA	2786	47.15	120.78	WINTER				16.95	
76 Mica Peak	WA	5163	47.57	117.08	SPRING				9.50	
76 Mica Peak	WA	5163	47.57	117.08	SUMMER				8.70	
76 Mica Peak	WA	5163	47.57	117.08	FALL				10.05	
76 Mica Peak	WA	5163	47.57	117.08	WINTER				13.20	
77 Monument Hill	WA	2600	47.30	119.67	SPRING				14.03	
77 Monument Hill	WA	2600	47.30	119.67	SUMMER				7.53	
77 Monument Hill	WA	2600	47.30	119.67	FALL				10.97	
77 Monument Hill	WA	2600	47.30	119.67	WINTER				10.30	
78 Moses Lake	WA	1208	47.12	119.20	SPRING	77.4	25.4	51.40	8.17	1.2 N
78 Moses Lake	WA	1208	47.12	119.20	SUMMER	89.8	47.6	68.70	6.97	1.5 SW
78 Moses Lake	WA	1208	47.12	119.20	FALL	79.8	25.3	52.55	6.67	1.3 N
78 Moses Lake	WA	1208	47.12	119.20	WINTER	45.3	14.8	30.05	7.03	2.1 N
79 Moses Lake AFB	WA	1185	47.15	119.25	SPRING				8.37	
79 Moses Lake AFB	WA	1185	47.15	119.25	SUMMER				7.37	
79 Moses Lake AFB	WA	1185	47.15	119.25	FALL				6.53	
79 Moses Lake AFB	WA	1185	47.15	119.25	WINTER				6.43	
80 Hespelen	WA	1890	48.13	118.98	SPRING	75.7	23.4	49.55		
80 Hespelen	WA	1890	48.13	118.98	SUMMER	90.2	45.5	67.8		
80 Hespelen	WA	1890	48.13	118.98	FALL	80.7	24.5	52.60		
80 Hespelen	WA	1890	48.13	118.98	WINTER	43.1	14.4	28.75		
81 Newport	WA	2135	48.18	117.05	SPRING	73.2	21.6	47.40		
81 Newport	WA	2135	48.18	117.05	SUMMER	88.9	41.1	65.00		
81 Newport	WA	2135	48.18	117.05	FALL	77.1	25.4	51.25		
81 Newport	WA	2135	48.18	117.05	WINTER	42.7	13.4	28.05		
82 Northport	WA	1347	48.92	117.78	SPRING	77.0	24.6	50.80		
82 Northport	WA	1347	48.92	117.78	SUMMER	91.6	47.2	69.40		
82 Northport	WA	1347	48.92	117.78	FALL	79.7	28.1	53.90		
82 Northport	WA	1347	48.92	117.78	WINTER	42.7	15.1	28.90		
83 Onak 2NW	WA	1228	48.43	119.53	SPRING	77.8	25.1	51.45		
83 Onak 2NW	WA	1228	48.43	119.53	SUMMER	90.1	49.8	69.95		
83 Onak 2NW	WA	1228	48.43	119.53	FALL	79.7	25.6	52.65		
83 Onak 2NW	WA	1228	48.43	119.53	WINTER	43.1	15.9	29.50		

84 Othello	WA	1110	46.83	119.17	SPRING	79.0	26.9	52.95	
84 Othello	WA	1110	46.83	119.17	SUMMER	92.7	49.9	71.30	
84 Othello	WA	1110	46.83	119.17	FALL	83.4	27.7	55.55	
84 Othello	WA	1110	46.83	119.17	WINTER	48.0	18.5	33.25	
85 Pasco Tri-C AP	WA	404	46.27	119.12	SPRING				9.53
85 Pasco Tri-C AP	WA	404	46.27	119.12	SUMMER				8.17
85 Pasco Tri-C AP	WA	404	46.27	119.12	FALL				6.87
85 Pasco Tri-C AP	WA	404	46.27	119.12	WINTER				7.30
86 Pomeroy	WA	3679	46.38	117.58	SPRING				12.77
86 Pomeroy	WA	3679	46.38	117.58	SUMMER				8.67
86 Pomeroy	WA	3679	46.38	117.58	FALL				8.47
86 Pomeroy	WA	3679	46.38	117.58	WINTER				11.23
87 Priest Rapids Dam	WA	455	46.63	119.92	SPRING				9.33
87 Priest Rapids Dam	WA	455	46.63	119.92	SUMMER				10.07
87 Priest Rapids Dam	WA	455	46.63	119.92	FALL				5.90
87 Priest Rapids Dam	WA	455	46.63	119.92	WINTER				6.50
88 Prosser 4NE	WA	830	46.25	119.75	SPRING	77.8	28.6	53.20	
88 Prosser 4NE	WA	830	46.25	119.75	SUMMER	90.2	49.3	69.75	
88 Prosser 4NE	WA	830	46.25	119.75	FALL	80.9	28.7	54.80	
88 Prosser 4NE	WA	830	46.25	119.75	WINTER	51.5	22.2	36.85	
89 Pullman 2NW	WA	2545	46.77	117.20	SPRING	69.4	27.1	48.25	
89 Pullman 2NW	WA	2545	46.77	117.20	SUMMER	85.1	45.8	65.45	
89 Pullman 2NW	WA	2545	46.77	117.20	FALL	76.0	28.4	52.20	
89 Pullman 2NW	WA	2545	46.77	117.20	WINTER	41.5	19.7	30.60	
90 Quincy	WA	1315	47.25	119.83	SPRING	77.5	25.3	51.40	
90 Quincy	WA	1315	47.25	119.83	SUMMER	91.4	51.1	71.25	
90 Quincy	WA	1315	47.25	119.83	FALL	82.2	25.0	53.60	
90 Quincy	WA	1315	47.25	119.83	WINTER	45.5	13.8	29.65	
91 Rassmussen	WA	2485	45.82	120.42	SPRING				13.07
91 Rassmussen	WA	2485	45.82	120.42	SUMMER				13.10
91 Rassmussen	WA	2485	45.82	120.42	FALL				9.47
91 Rassmussen	WA	2485	45.82	120.42	WINTER				9.10
92 Rattlesnake Batel	WA	3524	46.38	119.58	SPRING				18.60
92 Rattlesnake Batel	WA	3524	46.38	119.58	SUMMER				13.50
92 Rattlesnake Batel	WA	3524	46.38	119.58	FALL				16.50
92 Rattlesnake Bate	WA	3524	46.38	119.58	WINTER				18.90
93 Ritzville	WA	1800	47.13	118.38	SPRING				16.10
93 Ritzville	WA	1800	47.13	118.38	SUMMER				16.10
93 Ritzville	WA	1800	47.13	118.38	FALL				15.60
93 Ritzville	WA	1800	47.13	118.38	WINTER				10.90
94 Roberts	WA	2550	46.33	120.15	SPRING				12.37
94 Roberts	WA	2550	46.33	120.15	SUMMER				10.73
94 Roberts	WA	2550	46.33	120.15	FALL				11.10
94 Roberts	WA	2550	46.33	120.15	WINTER				13.83
95 Roosevelt	WA	1761	45.77	120.23	SPRING				15.37
95 Roosevelt	WA	1761	45.77	120.23	SUMMER				16.63
95 Roosevelt	WA	1761	45.77	120.23	FALL				12.07
95 Roosevelt	WA	1761	45.77	120.23	WINTER				13.23
96 Royal Slope	WA	1100	46.78	119.85	SPRING				
96 Royal Slope	WA	1100	46.78	119.85	SUMMER				
96 Royal Slope	WA	1100	46.78	119.85	FALL				7.90
96 Royal Slope	WA	1100	46.78	119.85	WINTER				5.95
97 Rye Glass Flats	WA	1284	46.58	118.70	SPRING				10.10
97 Rye Glass Flats	WA	1284	46.58	118.70	SUMMER				8.27
97 Rye Glass Flats	WA	1284	46.58	118.70	FALL				
97 Rye Glass Flats	WA	1284	46.58	118.70	WINTER				6.00

98 Sophelia Lookout	WA	4600	46.00	120.55	SPRING						
98 Sophelia Lookout	WA	4600	46.00	120.55	SUMMER				8.00		
98 Sophelia Lookout	WA	4600	46.00	120.55	FALL				7.90		
98 Sophelia Lookout	WA	4600	46.00	120.55	WINTER						
99 Spokane AP	WA	2357	47.62	117.52	SPRING	71.5	27.6	49.55	7.57	2.8 NE	
99 Spokane AP	WA	2357	47.62	117.52	SUMMER	86.6	49.5	68.05	6.87	3.7 NE	
99 Spokane AP	WA	2357	47.62	117.52	FALL	74.2	28.3	51.25	6.47	6.9 NE	
99 Spokane AP	WA	2357	47.62	117.52	WINTER	42.8	20.9	31.85	7.27	6.0 NE	
100 Status Lookout	WA	4111	46.00	120.70	SPRING						
100 Status Lookout	WA	4111	46.00	120.70	SUMMER				12.30		
100 Status Lookout	WA	4111	46.00	120.70	FALL				15.10		
100 Status Lookout	WA	4111	46.00	120.70	WINTER						
101 Stehekin 3NW	WA	1150	48.33	120.70	SPRING	72.3	26.4	49.35			
101 Stehekin 3NW	WA	1150	48.33	120.70	SUMMER	83.9	46.7	65.30			
101 Stehekin 3NW	WA	1150	48.33	120.70	FALL	73.6	28.4	51.00			
101 Stehekin 3NW	WA	1150	48.33	120.70	WINTER	42.4	21.9	32.15			
102 Sunnyside	WA	3000	46.48	119.98	SPRING				14.23		
102 Sunnyside	WA	3000	46.48	119.98	SUMMER				12.33		
102 Sunnyside	WA	3000	46.48	119.98	FALL				13.10		
102 Sunnyside	WA	3000	46.48	119.98	WINTER				12.07		
103 Tekoa Butte	WA	3910	47.27	117.08	SPRING				12.75		
103 Tekoa Butte	WA	3910	47.27	117.08	SUMMER						
103 Tekoa Butte	WA	3910	47.27	117.08	FALL				14.60		
103 Tekoa Butte	WA	3910	47.27	117.08	WINTER				9.57		
104 Thorp	WA	1600	47.05	120.67	SPRING				12.53		
104 Thorp	WA	1600	47.05	120.67	SUMMER				9.60		
104 Thorp	WA	1600	47.05	120.67	FALL				8.43		
104 Thorp	WA	1600	47.05	120.67	WINTER				4.17		
105 Vantage Farms	WA	900	46.90	119.80	SPRING				9.27		
105 Vantage Farms	WA	900	46.90	119.80	SUMMER				10.70		
105 Vantage Farms	WA	900	46.90	119.80	FALL				7.17		
105 Vantage Farms	WA	900	46.90	119.80	WINTER				6.40		
106 Vantage Substa	WA	900	46.88	119.93	SPRING				12.05		
106 Vantage Substa	WA	900	46.88	119.93	SUMMER				7.40		
106 Vantage Substa	WA	900	46.88	119.93	FALL						
106 Vantage Substa	WA	900	46.88	119.93	WINTER				13.03		
107 Walla Walla	WA	1188	46.03	118.33	SPRING				8.70		
107 Walla Walla	WA	1188	46.03	118.33	SUMMER				8.00		
107 Walla Walla	WA	1188	46.03	118.33	FALL				6.83		
107 Walla Walla	WA	1188	46.03	118.33	WINTER				7.50		
108 Walla Walla 3W	WA	800	46.05	118.40	SPRING	78.7	32.0	55.35	6.97	2.8 S	
108 Walla Walla 3W	WA	800	46.05	118.40	SUMMER	94.0	51.1	72.55	6.60	2.5 E	
108 Walla Walla 3W	WA	800	46.05	118.40	FALL	83.2	31.6	57.40	5.37	4.8 E	
108 Walla Walla 3W	WA	800	46.05	118.40	WINTER	51.7	24.7	38.20	6.33	3.6 S	
109 Wanapum	WA	520	46.88	119.70	SPRING				13.07		
109 Wanapum	WA	520	46.88	119.70	SUMMER				14.73		
109 Wanapum	WA	520	46.88	119.70	FALL				9.70		
109 Wanapum	WA	520	46.88	119.70	WINTER				8.07		
110 Waterville	WA	2605	47.65	120.08	SPRING	71.1	22.6	46.85	8.87		
110 Waterville	WA	2605	47.65	120.08	SUMMER	84.6	46.0	65.30	8.93		
110 Waterville	WA	2605	47.65	120.08	FALL	74.3	22.7	48.50			
110 Waterville	WA	2605	47.65	120.08	WINTER	40.2	13.5	26.85	6.05		
111 Wenatchee	WA	634	47.42	120.32	SPRING	77.0	27.5	52.25			
111 Wenatchee	WA	634	47.42	120.32	SUMMER	89.3	53.2	71.25			
111 Wenatchee	WA	634	47.42	120.32	FALL	80.8	28.4	54.60			
111 Wenatchee	WA	634	47.42	120.32	WINTER	46.3	18.3	32.30			

112 Wilber	WA	2163	47.75	118.70	SPRING	73.6	24.8	49.20		
112 Wilber	WA	2163	47.75	118.70	SUMMER	87.7	44.4	66.05		
112 Wilber	WA	2163	47.75	118.70	FALL	76.2	24.9	50.55		
112 Wilber	WA	2163	47.75	118.70	WINTER	42.2	15.3	28.75		
113 Winthrop	WA	1755	48.47	120.18	SPRING	75.5	17.5	46.50		
113 Winthrop	WA	1755	48.47	120.18	SUMMER	88.9	44.7	66.80		
113 Winthrop	WA	1755	48.47	120.18	FALL	79.8	19.6	49.70		
113 Winthrop	WA	1755	48.47	120.18	WINTER	40.7	6.8	23.75		
114 Yakima AP	WA	1061	46.57	120.53	SPRING	77.8	25.1	51.45	7.00	3.3 W
114 Yakima AP	WA	1061	46.57	120.53	SUMMER	90.1	46.9	68.50	6.43	2.5 NW-WNW
114 Yakima AP	WA	1061	46.57	120.53	FALL	81.4	25.1	53.25	5.50	6.0 W
114 Yakima AP	WA	1061	46.57	120.53	WINTER	49.4	16.4	32.90	4.90	7.5 W

BASIN AND RANGE -- WIND AND TEMPERATURE DATA

#	LOCATION	ST	EL	LAT.	LONG.	SEASON	Tmax	Tmin	Tmean	WS	FREQ.	DIR
1	Aberdeen E.S.	ID	4400	42.95	112.83	SPRING	73.5	19.0	46.25			
1	Aberdeen E.S.	ID	4400	42.95	112.83	SUMMER	90.7	43.0	66.85			
1	Aberdeen E.S.	ID	4400	42.95	112.83	FALL	80.5	19.4	49.95			
1	Aberdeen E.S.	ID	4400	42.95	112.83	WINTER	39.4	9.4	24.40			
2	Albion Butte	ID	7110	42.37	113.45	SPRING				12.50		
2	Albion Butte	ID	7110	42.37	113.45	SUMMER				12.18		
2	Albion Butte	ID	7110	42.37	113.45	FALL				15.67		
2	Albion Butte	ID	7110	42.37	113.45	WINTER				15.07		
3	Ashton IS	ID	5220	44.07	111.45	SPRING	70.4	12.0	41.20			
3	Ashton IS	ID	5220	44.07	111.45	SUMMER	84.8	39.7	62.25			
3	Ashton IS	ID	5220	44.07	111.45	FALL	75.6	14.8	45.20			
3	Ashton IS	ID	5220	44.07	111.45	WINTER	34.9	5.9	20.40			
4	Bennett Peak	ID	7440	43.25	115.43	SPRING				15.90		
4	Bennett Peak	ID	7440	43.25	115.43	SUMMER				13.07		
4	Bennett Peak	ID	7440	43.25	115.43	FALL				14.97		
4	Bennett Peak	ID	7440	43.25	115.43	WINTER				21.03		
5	Bliss	ID	3269	42.93	114.95	SPRING	77.4	23.8	50.60			
5	Bliss	ID	3269	42.93	114.95	SUMMER	95.2	47.1	71.15			
5	Bliss	ID	3269	42.93	114.95	FALL	84.6	25.0	54.80			
5	Bliss	ID	3269	42.93	114.95	WINTER	45.3	16.0	30.65			
6	Boise	ID	2840	43.57	116.22	SPRING				9.20		
6	Boise	ID	2840	43.57	116.22	SUMMER				8.13		
6	Boise	ID	2840	43.57	116.22	FALL				8.13		
6	Boise	ID	2840	43.57	116.22	WINTER				7.93		
7	Boise AP	ID	2842	43.57	116.22	SPRING	74.2	27.4	50.80	8.90	1.4 NW	
7	Boise AP	ID	2842	43.57	116.22	SUMMER	92.1	50.1	71.10	7.57	1.6 NW	
7	Boise AP	ID	2842	43.57	116.22	FALL	81.1	27.9	54.50	7.63	1.7 NW	
7	Boise AP	ID	2842	43.57	116.22	WINTER	45.8	19.5	32.65	8.40	1.6 NW	
8	Burley AP	ID	4146	42.53	113.77	SPRING				9.50	1.7 NE-SSW	
8	Burley AP	ID	4146	42.53	113.77	SUMMER				7.17	3.7 SW	
8	Burley AP	ID	4146	42.53	113.77	FALL				6.83	3.9 SW	
8	Burley AP	ID	4146	42.53	113.77	WINTER				9.00	3.1 NE	
9	Caldwell	ID	2370	43.67	116.68	SPRING	78.2	27.0	52.60			
9	Caldwell	ID	2370	43.67	116.68	SUMMER	93.8	47.3	70.55			
9	Caldwell	ID	2370	43.67	116.68	FALL	82.9	25.5	54.20			
9	Caldwell	ID	2370	43.67	116.68	WINTER	49.8	19.1	34.45			
10	Cambridge	ID	2650	44.57	116.68	SPRING	77.4	21.1	49.25			
10	Cambridge	ID	2650	44.57	116.68	SUMMER	95.4	44.3	69.85			
10	Cambridge	ID	2650	44.57	116.68	FALL	84.8	21.9	53.35			
10	Cambridge	ID	2650	44.57	116.68	WINTER	41.6	10.9	26.25			
11	Cedar Butte	ID	5000	43.67	112.67	SPRING						
11	Cedar Butte	ID	5000	43.67	112.67	SUMMER						
11	Cedar Butte	ID	5000	43.67	112.67	FALL				9.10		
11	Cedar Butte	ID	5000	43.67	112.67	WINTER				7.90		
12	Challis	ID	5175	44.50	114.23	SPRING	70.6	17.0	43.80			
12	Challis	ID	5175	44.50	114.23	SUMMER	87.6	43.3	65.15			
12	Challis	ID	5175	44.50	114.23	FALL	77.3	16.6	46.95			
12	Challis	ID	5175	44.50	114.23	WINTER	40.4	7.1	23.75			
13	Deadwood Dam	ID	5375	44.32	115.63	SPRING	66.0	6.1	36.05			
13	Deadwood Dam	ID	5375	44.32	115.63	SUMMER	84.4	33.6	59.00			
13	Deadwood Dam	ID	5375	44.32	115.63	FALL	75.5	13.4	44.45			
13	Deadwood Dam	ID	5375	44.32	115.63	WINTER	38.6	2.4	20.50			

14 Driggs	ID	6097	43.73	111.12	SPRING	66.6	10.3	38.45		
14 Driggs	ID	6097	43.73	111.12	SUMMER	83.6	38.7	61.15		
14 Driggs	ID	6097	43.73	111.12	FALL	74.1	12.9	43.50		
14 Driggs	ID	6097	43.73	111.12	WINTER	35.9	0.8	18.35		
15 Dubois E.S.	ID	5148	44.17	112.22	SPRING	68.8	14.7	41.75	8.17	3.0 SE
15 Dubois E.S.	ID	5148	44.17	112.22	SUMMER	87.5	43.7	65.60	8.27	2.5 NE
15 Dubois E.S.	ID	5148	44.17	112.22	FALL	76.2	18.1	47.15	6.20	3.0 NE
15 Dubois E.S.	ID	5148	44.17	112.22	WINTER	23.3	8.5	15.90	6.10	3.6 E
16 Duncan MTN	ID	6240	42.35	116.07	SPRING				11.52	
16 Duncan MTN	ID	6240	42.35	116.07	SUMMER				10.10	
16 Duncan MTN	ID	6240	42.35	116.07	FALL				11.03	
16 Duncan MTN	ID	6240	42.35	116.07	WINTER				10.50	
17 Gooding AP	ID	3668	42.92	114.77	SPRING				9.43	2.1 W
17 Gooding AP	ID	3668	42.92	114.77	SUMMER				7.73	3.1 SW
17 Gooding AP	ID	3668	42.92	114.77	FALL				7.73	3.0 E
17 Gooding AP	ID	3668	42.92	114.77	WINTER				8.60	3.6 E
18 Grace	ID	5400	42.58	111.73	SPRING	68.1	14.2	41.15	9.83	
18 Grace	ID	5400	42.58	111.73	SUMMER	84.7	41.5	63.10	7.27	
18 Grace	ID	5400	42.58	111.73	FALL	75.9	17.5	46.70	9.50	
18 Grace	ID	5400	42.58	111.73	WINTER	35.5	7.7	21.60	9.80	
19 Hailey R.S.	ID	5328	43.52	114.32	SPRING	70.3	13.9	42.10		
19 Hailey R.S.	ID	5328	43.52	114.32	SUMMER	88.3	41.4	64.85		
19 Hailey R.S.	ID	5328	43.52	114.32	FALL	78.5	16.5	47.50		
19 Hailey R.S.	ID	5328	43.52	114.32	WINTER	37.6	5.4	21.50		
20 Hill City	ID	5000	43.30	115.05	SPRING	68.6	9.9	39.25		
20 Hill City	ID	5000	43.30	115.05	SUMMER	88.3	38.7	63.50		
20 Hill City	ID	5000	43.30	115.05	FALL	78.0	14.5	46.25		
20 Hill City	ID	5000	43.30	115.05	WINTER	34.6	3.3	18.95		
21 Idaho City	ID	3965	43.83	115.83	SPRING	73.5	16.0	44.75		
21 Idaho City	ID	3965	43.83	115.83	SUMMER	91.9	38.4	65.15		
21 Idaho City	ID	3965	43.83	115.83	FALL	81.6	18.3	49.95		
21 Idaho City	ID	3965	43.83	115.83	WINTER	43.7	10.3	27.00		
22 Idaho Falls	ID	4751	43.52	112.07	SPRING				12.97	
22 Idaho Falls	ID	4751	43.52	112.07	SUMMER				10.67	
22 Idaho Falls	ID	4751	43.52	112.07	FALL				10.50	
22 Idaho Falls	ID	4751	43.52	112.07	WINTER				10.97	
23 Idaho Falls AP	ID	4730	43.52	112.07	SPRING	71.6	17.8	44.70	10.33	2.0 NNE
23 Idaho Falls AP	ID	4730	43.52	112.07	SUMMER	87.3	44.5	65.90	8.37	2.6 N
23 Idaho Falls AP	ID	4730	43.52	112.07	FALL	77.7	18.6	48.15	8.20	2.7 N
23 Idaho Falls AP	ID	4730	43.52	112.07	WINTER	36.3	8.2	22.25	10.07	3.4 NNE
24 Island Park Dam	ID	6300	44.42	111.40	SPRING	64.5	2.5	33.50		
24 Island Park Dam	ID	6300	44.42	111.40	SUMMER	80.7	36.4	58.55		
24 Island Park Dam	ID	6300	44.42	111.40	FALL	71.8	9.8	40.80		
24 Island Park Dam	ID	6300	44.42	111.40	WINTER	31.3	-2.7	14.30		
25 King Hill	ID	2746	42.98	115.22	SPRING				12.63	
25 King Hill	ID	2746	42.98	115.22	SUMMER				10.07	
25 King Hill	ID	2746	42.98	115.22	FALL				8.97	
25 King Hill	ID	2746	42.98	115.22	WINTER				9.87	
26 Mackay R.S.	ID	5897	43.92	113.62	SPRING	69.0	12.5	40.75		
26 Mackay R.S.	ID	5897	43.92	113.62	SUMMER	86.4	41.1	63.75		
26 Mackay R.S.	ID	5897	43.92	113.62	FALL	76.8	14.3	45.55		
26 Mackay R.S.	ID	5897	43.92	113.62	WINTER	35.7	4.0	19.85		
27 Malad	ID	4420	42.20	112.27	SPRING	72.8	20.9	46.85	5.77	6.9 N
27 Malad	ID	4420	42.20	112.27	SUMMER	90.7	45.0	67.85	5.63	6.7 N
27 Malad	ID	4420	42.20	112.27	FALL	81.3	20.8	51.05	4.33	11.5 N
27 Malad	ID	4420	42.20	112.27	WINTER	40.8	12.0	26.40	3.83	10.0 N

28 McCall	ID	5025	44.90	116.12	SPRING	64.7	12.1	38.40		
28 McCall	ID	5025	44.90	116.12	SUMMER	83.3	39.1	61.20		
28 McCall	ID	5025	44.90	116.12	FALL	72.3	17.4	44.85		
28 McCall	ID	5025	44.90	116.12	WINTER	35.6	7.6	21.60		
29 Menon Butte	ID	5000	43.88	112.03	SPRING					
29 Menon Butte	ID	5000	43.88	112.03	SUMMER					
29 Menon Butte	ID	5000	43.88	112.03	FALL				6.60	
29 Menon Butte	ID	5000	43.88	112.03	WINTER				5.87	
30 Montpelier R.S.	ID	6053	42.32	111.30	SPRING	69.5	10.8	40.15		
30 Montpelier R.S.	ID	6053	42.32	111.30	SUMMER	87.7	40.0	63.85		
30 Montpelier R.S.	ID	6053	42.32	111.30	FALL	78.2	14.4	46.30		
30 Montpelier R.S.	ID	6053	42.32	111.30	WINTER	35.3	5.3	20.30		
31 Mountain Home	ID	3180	43.13	115.70	SPRING				8.57	1.4 E
31 Mountain Home	ID	3180	43.13	115.70	SUMMER				7.43	1.5 W
31 Mountain Home	ID	3180	43.13	115.70	FALL				6.53	2.2 E
31 Mountain Home	ID	3180	43.13	115.70	WINTER				6.77	2.5 E
32 NW Pipeline	ID	3160	43.03	115.50	SPRING					
32 NW Pipeline	ID	3160	43.03	115.50	SUMMER				8.10	
32 NW Pipeline	ID	3160	43.03	115.50	FALL				8.97	
32 NW Pipeline	ID	3160	43.03	115.50	WINTER				6.13	
33 Oakley	ID	4191	42.25	113.90	SPRING	72.4	23.6	48.00		
33 Oakley	ID	4191	42.25	113.90	SUMMER	89.2	45.2	67.20		
33 Oakley	ID	4191	42.25	113.90	FALL	80.1	24.7	52.40		
33 Oakley	ID	4191	42.25	113.90	WINTER	45.1	16.5	30.80		
34 Parma E.S.	ID	2215	43.80	116.95	SPRING	78.1	26.0	52.05		
34 Parma E.S.	ID	2215	43.80	116.95	SUMMER	94.4	47.1	70.75		
34 Parma E.S.	ID	2215	43.80	116.95	FALL	83.1	24.5	53.80		
34 Parma E.S.	ID	2215	43.80	116.95	WINTER	49.9	17.6	33.75		
35 Pocatello	ID	4450	42.92	112.58	SPRING				10.87	
35 Pocatello	ID	4450	42.92	112.58	SUMMER				8.93	
35 Pocatello	ID	4450	42.92	112.58	FALL				9.30	
35 Pocatello	ID	4450	42.92	112.58	WINTER				9.87	
36 Pocatello AP	ID	4444	42.92	112.60	SPRING	71.7	21.3	46.50	9.70	1.6 NE-SW
36 Pocatello AP	ID	4444	42.92	112.60	SUMMER	90.1	46.1	68.10	8.50	2.3 S
36 Pocatello AP	ID	4444	42.92	112.60	FALL	79.5	22.6	51.05	8.33	2.7 NE
36 Pocatello AP	ID	4444	42.92	112.60	WINTER	39.8	12.4	26.10	9.57	2.6 NE
37 Rupert	ID	4204	42.62	113.68	SPRING	74.0	22.2	48.10		
37 Rupert	ID	4204	42.62	113.68	SUMMER	91.6	46.5	69.05		
37 Rupert	ID	4204	42.62	113.68	FALL	81.1	21.7	51.40		
37 Rupert	ID	4204	42.62	113.68	WINTER	42.5	13.2	27.85		
38 Shoshone	ID	3950	42.97	114.43	SPRING	76.0	20.7	48.35		
38 Shoshone	ID	3950	42.97	114.43	SUMMER	93.8	45.5	69.65		
38 Shoshone	ID	3950	42.97	114.43	FALL	82.1	21.9	52.00		
38 Shoshone	ID	3950	42.97	114.43	WINTER	41.1	13.0	27.05		
39 Soda Springs	ID	7800	42.62	111.68	SPRING					
39 Soda Springs	ID	7800	42.62	111.68	SUMMER				12.00	
39 Soda Springs	ID	7800	42.62	111.68	FALL				12.30	
39 Soda Springs	ID	7800	42.62	111.68	WINTER					
40 Strevell	ID	5276	42.00	113.20	SPRING				11.43	
40 Strevell	ID	5276	42.00	113.20	SUMMER				10.30	
40 Strevell	ID	5276	42.00	113.20	FALL				10.70	
40 Strevell	ID	5276	42.00	113.20	WINTER				12.73	
41 Sun Valley	ID	9100	43.70	114.18	SPRING				8.30	
41 Sun Valley	ID	9100	43.70	114.18	SUMMER					
41 Sun Valley	ID	9100	43.70	114.18	FALL					
41 Sun Valley	ID	9100	43.70	114.18	WINTER				8.73	

42 Three Creek	ID	5420	42.08	115.15	SPRING	69.1	17.0	43.05	
42 Three Creek	ID	5420	42.08	115.15	SUMMER	89.3	34.2	61.75	
42 Three Creek	ID	5420	42.08	115.15	FALL	78.8	17.5	48.15	
42 Three Creek	ID	5420	42.08	115.15	WINTER	43.6	9.8	26.70	
43 Twin Falls 2NNE	ID	3770	42.58	114.47	SPRING	75.2	25.2	50.20	11.57
43 Twin Falls 2NNE	ID	3770	42.58	114.47	SUMMER	93.1	46.7	69.90	9.20
43 Twin Falls 2NNE	ID	3770	42.58	114.47	FALL	82.5	24.2	53.35	8.90
43 Twin Falls 2NNE	ID	3770	42.58	114.47	WINTER	45.1	17.4	31.25	10.50
44 Carlin	NU	4950	40.72	116.10	SPRING				6.10
44 Carlin	NU	4950	40.72	116.10	SUMMER				5.03
44 Carlin	NU	4950	40.72	116.10	FALL				4.53
44 Carlin	NU	4950	40.72	116.10	WINTER				4.55
45 Elko	NU	5050	40.83	115.78	SPRING				6.70
45 Elko	NU	5050	40.83	115.78	SUMMER				6.03
45 Elko	NU	5050	40.83	115.78	FALL				4.87
45 Elko	NU	5050	40.83	115.78	WINTER				5.07
46 Fenelon 1	NU	6235	41.20	114.65	SPRING				11.45
46 Fenelon 1	NU	6235	41.20	114.65	SUMMER				10.40
46 Fenelon 1	NU	6235	41.20	114.65	FALL				12.90
46 Fenelon 1	NU	6235	41.20	114.65	WINTER				9.13
47 Grindstone MTN	NU	7377	40.70	115.88	SPRING				12.57
47 Grindstone MTN	NU	7377	40.70	115.88	SUMMER				10.80
47 Grindstone MTN	NU	7377	40.70	115.88	FALL				11.07
47 Grindstone MTN	NU	7377	40.70	115.88	WINTER				8.60
48 Indep Valley 1	NU	5900	41.08	114.67	SPRING				9.43
48 Indep Valley 1	NU	5900	41.08	114.67	SUMMER				9.53
48 Indep Valley 1	NU	5900	41.08	114.67	FALL				8.87
48 Indep Valley 1	NU	5900	41.08	114.67	WINTER				7.70
49 Moor Summit 2	NU	6110	41.12	114.77	SPRING				10.57
49 Moor Summit 2	NU	6110	41.12	114.77	SUMMER				9.27
49 Moor Summit 2	NU	6110	41.12	114.77	FALL				10.13
49 Moor Summit 2	NU	6110	41.12	114.77	WINTER				9.17
50 Pequop Summit	NU	7538	41.10	114.53	SPRING				16.97
50 Pequop Summit	NU	7538	41.10	114.53	SUMMER				13.47
50 Pequop Summit	NU	7538	41.10	114.53	FALL				13.70
50 Pequop Summit	NU	7538	41.10	114.53	WINTER				17.23
51 Pequop Tower	NU	7540	41.10	114.55	SPRING				15.27
51 Pequop Tower	NU	7540	41.10	114.55	SUMMER				14.07
51 Pequop Tower	NU	7540	41.10	114.55	FALL				15.57
51 Pequop Tower	NU	7540	41.10	114.55	WINTER				16.93
52 Radar Hill	NU	5800	41.13	114.97	SPRING				10.77
52 Radar Hill	NU	5800	41.13	114.97	SUMMER				8.43
52 Radar Hill	NU	5800	41.13	114.97	FALL				8.17
52 Radar Hill	NU	5800	41.13	114.97	WINTER				11.03
53 Silver Zone 1	NU	6100	40.92	114.28	SPRING				13.95
53 Silver Zone 1	NU	6100	40.92	114.28	SUMMER				
53 Silver Zone 1	NU	6100	40.92	114.28	FALL				12.30
53 Silver Zone 1	NU	6100	40.92	114.28	WINTER				10.50
54 Silver Zone 2	NU	5960	40.90	114.32	SPRING				12.07
54 Silver Zone 2	NU	5960	40.90	114.32	SUMMER				11.43
54 Silver Zone 2	NU	5960	40.90	114.32	FALL				11.47
54 Silver Zone 2	NU	5960	40.90	114.32	WINTER				9.60
55 Silver Zone 3	NU	6000	40.93	114.32	SPRING				11.07
55 Silver Zone 3	NU	6000	40.93	114.32	SUMMER				9.70
55 Silver Zone 3	NU	6000	40.93	114.32	FALL				10.13
55 Silver Zone 3	NU	6000	40.93	114.32	WINTER				8.07

56 Valmy Tower	NU	4700	40.77	117.12	SPRING				9.43	
56 Valmy Tower	NU	4700	40.77	117.12	SUMMER				7.80	
56 Valmy Tower	NU	4700	40.77	117.12	FALL				8.00	
56 Valmy Tower	NU	4700	40.77	117.12	WINTER				5.37	
57 Welcome	NU	5720	41.10	115.08	SPRING				10.90	
57 Welcome	NU	5720	41.10	115.08	SUMMER				6.57	
57 Welcome	NU	5720	41.10	115.08	FALL				8.60	
57 Welcome	NU	5720	41.10	115.08	WINTER				7.47	
58 Wells West	NU	6400	41.08	116.02	SPRING				12.67	
58 Wells West	NU	6400	41.08	116.02	SUMMER				11.60	
58 Wells West	NU	6400	41.08	116.02	FALL				11.17	
58 Wells West	NU	6400	41.08	116.02	WINTER				13.47	
59 Winnemucca MTN	NU	6650	41.00	117.75	SPRING				11.40	
59 Winnemucca MTN	NU	6650	41.00	117.75	SUMMER				11.60	
59 Winnemucca MTN	NU	6650	41.00	117.75	FALL				12.73	
59 Winnemucca MTN	NU	6650	41.00	117.75	WINTER				9.75	
60 Adel	OR	6571	42.18	119.92	SPRING				15.17	
60 Adel	OR	6571	42.18	119.92	SUMMER				13.18	
60 Adel	OR	6571	42.18	119.92	FALL				16.52	
60 Adel	OR	6571	42.18	119.92	WINTER				17.17	
61 Adrian	OR	2231	43.73	117.07	SPRING	79.3	27.0	53.15		
61 Adrian	OR	2231	43.73	117.07	SUMMER	95.7	49.3	72.50		
61 Adrian	OR	2231	43.73	117.07	FALL	83.6	24.8	54.20		
61 Adrian	OR	2231	43.73	117.07	WINTER	50.0	17.3	33.65		
62 Antelope	OR	2758	44.92	120.72	SPRING	72.2	26.5	49.35		
62 Antelope	OR	2758	44.92	120.72	SUMMER	89.2	43.2	66.20		
62 Antelope	OR	2758	44.92	120.72	FALL	79.1	27.1	53.10		
62 Antelope	OR	2758	44.92	120.72	WINTER	48.4	19.5	33.95		
63 Baker	OR	3373	44.83	117.82	SPRING				8.47	
63 Baker	OR	3373	44.83	117.82	SUMMER				8.20	
63 Baker	OR	3373	44.83	117.82	FALL				7.97	
63 Baker	OR	3373	44.83	117.82	WINTER				7.90	
64 Baker KBKR	OR	3444	44.78	117.83	SPRING	70.8	24.1	47.45	7.70	3.0 S-SW
64 Baker KBKR	OR	3444	44.78	117.83	SUMMER	87.2	44.0	65.60	6.00	4.3 SW
64 Baker KBKR	OR	3444	44.78	117.83	FALL	77.1	24.1	50.60	5.73	4.5 SW
64 Baker KBKR	OR	3444	44.78	117.83	WINTER	43.1	15.2	29.15	6.67	3.9 NW
65 Buchanan	OR	4300	43.72	118.48	SPRING				9.90	
65 Buchanan	OR	4300	43.72	118.48	SUMMER				9.55	
65 Buchanan	OR	4300	43.72	118.48	FALL				9.70	
65 Buchanan	OR	4300	43.72	118.48	WINTER				9.07	
66 Burns	OR	4151	43.58	119.05	SPRING	69.7	22.0	45.85	5.93	5.2 N
66 Burns	OR	4151	43.58	119.05	SUMMER	87.7	43.2	65.45	5.73	4.9 NW
66 Burns	OR	4151	43.58	119.05	FALL	78.5	22.4	50.45	4.90	8.1 N
66 Burns	OR	4151	43.58	119.05	WINTER	43.1	15.1	29.10	4.40	6.3 N-NW
67 Burns Butte	OR	5307	43.57	119.13	SPRING				14.43	
67 Burns Butte	OR	5307	43.57	119.13	SUMMER				12.20	
67 Burns Butte	OR	5307	43.57	119.13	FALL				12.43	
67 Burns Butte	OR	5307	43.57	119.13	WINTER				12.63	
68 Coyote Hills	OR	6369	42.55	120.08	SPRING				14.62	
68 Coyote Hills	OR	6369	42.55	120.08	SUMMER				13.37	
68 Coyote Hills	OR	6369	42.55	120.08	FALL				14.97	
68 Coyote Hills	OR	6369	42.55	120.08	WINTER				13.77	
69 Danner	OR	4397	42.93	117.33	SPRING	73.9	21.3	47.60		
69 Danner	OR	4397	42.93	117.33	SUMMER	92.8	39.6	66.20		
69 Danner	OR	4397	42.93	117.33	FALL	82.5	19.9	51.20		
69 Danner	OR	4397	42.93	117.33	WINTER	45.5	12.0	28.75		

70 Dead Indian	OR	7060	42.98	120.83	SPRING				12.20
70 Dead Indian	OR	7060	42.98	120.83	SUMMER				9.70
70 Dead Indian	OR	7060	42.98	120.83	FALL				14.30
70 Dead Indian	OR	7060	42.98	120.83	WINTER				15.70
71 Deschutes Co #37	OR	4630	43.82	120.60	SPRING				9.50
71 Deschutes Co #37	OR	4630	43.82	120.60	SUMMER				6.83
71 Deschutes Co #37	OR	4630	43.82	120.60	FALL				8.13
71 Deschutes Co #37	OR	4630	43.82	120.60	WINTER				10.00
72 Domingo Pass	OR	7000	42.18	118.75	SPRING				17.47
72 Domingo Pass	OR	7000	42.18	118.75	SUMMER				15.95
72 Domingo Pass	OR	7000	42.18	118.75	FALL				14.50
72 Domingo Pass	OR	7000	42.18	118.75	WINTER				16.10
73 Grizzly Mtn	OR	5537	42.43	120.95	SPRING				12.17
73 Grizzly Mtn	OR	5537	42.43	120.95	SUMMER				8.73
73 Grizzly Mtn	OR	5537	42.43	120.95	FALL				15.33
73 Grizzly Mtn	OR	5537	42.43	120.95	WINTER				16.47
74 Hampton Butte	OR	6343	43.77	120.28	SPRING				16.13
74 Hampton Butte	OR	6343	43.77	120.28	SUMMER				12.53
74 Hampton Butte	OR	6343	43.77	120.28	FALL				13.93
74 Hampton Butte	OR	6343	43.77	120.28	WINTER				16.60
75 Hart Mountain	OR	5555	42.55	119.65	SPRING	64.5	19.3	41.90	11.53
75 Hart Mountain	OR	5555	42.55	119.65	SUMMER	83.2	37.8	60.50	10.03
75 Hart Mountain	OR	5555	42.55	119.65	FALL	74.6	21.2	47.90	11.87
75 Hart Mountain	OR	5555	42.55	119.65	WINTER	42.0	16.3	29.15	11.37
76 John Day	OR	3065	44.43	118.95	SPRING	72.5	25.8	49.15	9.53
76 John Day	OR	3065	44.43	118.95	SUMMER	90.3	44.6	67.45	8.23
76 John Day	OR	3065	44.43	118.95	FALL	82.0	28.6	55.30	7.27
76 John Day	OR	3065	44.43	118.95	WINTER	47.6	20.6	34.10	8.20
77 John Day Ridge	OR	5000	44.33	118.80	SPRING				7.50
77 John Day Ridge	OR	5000	44.33	118.80	SUMMER				
77 John Day Ridge	OR	5000	44.33	118.80	FALL				
77 John Day Ridge	OR	5000	44.33	118.80	WINTER				9.40
78 Juniper Ranch	OR	4200	42.88	118.40	SPRING				5.60
78 Juniper Ranch	OR	4200	42.88	118.40	SUMMER				6.64
78 Juniper Ranch	OR	4200	42.88	118.40	FALL				5.10
78 Juniper Ranch	OR	4200	42.88	118.40	WINTER				6.93
79 Lakeview	OR	4756	42.18	120.35	SPRING	67.9	24.0	45.95	
79 Lakeview	OR	4756	42.18	120.35	SUMMER	86.5	42.7	64.60	
79 Lakeview	OR	4756	42.18	120.35	FALL	76.8	23.7	50.25	
79 Lakeview	OR	4756	42.18	120.35	WINTER	42.2	16.9	29.55	
80 Line	OR	4970	44.45	117.25	SPRING				13.20
80 Line	OR	4970	44.45	117.25	SUMMER				15.03
80 Line	OR	4970	44.45	117.25	FALL				15.90
80 Line	OR	4970	44.45	117.25	WINTER				13.37
81 Ontario	OR	2190	44.02	117.02	SPRING				8.23
81 Ontario	OR	2190	44.02	117.02	SUMMER				8.90
81 Ontario	OR	2190	44.02	117.02	FALL				8.90
81 Ontario	OR	2190	44.02	117.02	WINTER				5.07
82 Ontario AP	OR	2194	44.02	117.02	SPRING				7.80
82 Ontario AP	OR	2194	44.02	117.02	SUMMER				6.97
82 Ontario AP	OR	2194	44.02	117.02	FALL				5.33
82 Ontario AP	OR	2194	44.02	117.02	WINTER				5.57
83 Prineville 2NW	OR	2868	44.32	120.87	SPRING	70.8	24.1	47.45	
83 Prineville 2NW	OR	2868	44.32	120.87	SUMMER	86.8	37.5	62.15	
83 Prineville 2NW	OR	2868	44.32	120.87	FALL	78.7	24.1	51.40	
83 Prineville 2NW	OR	2868	44.32	120.87	WINTER	48.9	17.0	32.95	

2.5 W
3.0 E
4.1 WSW
3.9 WSW

84 Prineville AP	OR	3246	44.30	120.83	SPRING				9.90
84 Prineville AP	OR	3246	44.30	120.83	SUMMER				5.07
84 Prineville AP	OR	3246	44.30	120.83	FALL				5.45
84 Prineville AP	OR	3246	44.30	120.83	WINTER				4.07
85 Squaw Butte E.S.	OR	4675	43.48	119.68	SPRING	69.1	20.5	44.80	
85 Squaw Butte E.S.	OR	4675	43.48	119.68	SUMMER	87.6	39.9	63.75	
85 Squaw Butte E.S.	OR	4675	43.48	119.68	FALL	78.1	22.0	50.05	
85 Squaw Butte E.S.	OR	4675	43.48	119.68	WINTER	42.5	14.8	28.65	
86 The Poplars	OR	4316	43.27	120.93	SPRING	70.1	20.0	45.05	
86 The Poplars	OR	4316	43.27	120.93	SUMMER	86.2	35.3	60.75	
86 The Poplars	OR	4316	43.27	120.93	FALL	78.5	19.3	48.90	
86 The Poplars	OR	4316	43.27	120.93	WINTER	44.6	14.9	29.75	
87 Vale	OR	2300	43.98	117.27	SPRING	78.6	25.8	52.20	
87 Vale	OR	2300	43.98	117.27	SUMMER	95.3	47.4	71.35	
87 Vale	OR	2300	43.98	117.27	FALL	82.0	23.6	52.80	
87 Vale	OR	2300	43.98	117.27	WINTER	49.0	17.2	33.10	
88 Wamsprings Res	OR	3352	43.58	118.22	SPRING	75.3	23.9	49.60	
88 Wamsprings Res	OR	3352	43.58	118.22	SUMMER	94.2	45.5	69.85	
88 Wamsprings Res	OR	3352	43.58	118.22	FALL	83.1	22.9	53.00	
88 Wamsprings Res	OR	3352	43.58	118.22	WINTER	46.4	13.9	30.15	
89 Whitehorse Ranch	OR	4350	42.33	118.23	SPRING				10.47
89 Whitehorse Ranch	OR	4350	42.33	118.23	SUMMER				7.83
89 Whitehorse Ranch	OR	4350	42.33	118.23	FALL				8.73
89 Whitehorse Ranch	OR	4350	42.33	118.23	WINTER				7.47

ROCKIES -- WIND AND TEMPERATURE DATA

#	LOCATION	ST	EL	LAT.	LOH.	SEASON	Tmax	Tmin	Tmean	WS	FREQ.	DIR
1	Avery R.S.	ID	2492	47.25	115.80	SPRING	75.5	24.4	49.95			
1	Avery R.S.	ID	2492	47.25	115.80	SUMMER	90.4	44.5	67.45			
1	Avery R.S.	ID	2492	47.25	115.80	FALL	80.3	27.6	53.95			
1	Avery R.S.	ID	2492	47.25	115.80	WINTER	42.7	18.6	30.65			
2	Bonnars Ferry 1SW	ID	1810	48.68	116.32	SPRING	72.7	22.3	47.50			
2	Bonnars Ferry 1SW	ID	1810	48.68	116.32	SUMMER	85.9	45.6	65.75			
2	Bonnars Ferry 1SW	ID	1810	48.68	116.32	FALL	75.9	25.8	50.85			
2	Bonnars Ferry 1SW	ID	1810	48.68	116.32	WINTER	40.9	15.8	28.35			
3	Coeur d'Alene R.S.	ID	2158	47.68	116.75	SPRING	73.5	24.5	49.00	7.80	3.3	SE
3	Coeur d'Alene R.S.	ID	2158	47.68	116.75	SUMMER	89.0	46.4	67.70	6.93	4.2	SE
3	Coeur d'Alene R.S.	ID	2158	47.68	116.75	FALL	78.6	28.4	53.50	6.90	3.8	SE
3	Coeur d'Alene R.S.	ID	2158	47.68	116.75	WINTER	42.8	19.0	30.90	7.93	2.9	SE
4	Cottonwood	ID	3411	46.05	116.35	SPRING	67.6	22.9	45.25			
4	Cottonwood	ID	3411	46.05	116.35	SUMMER	84.1	43.2	63.65			
4	Cottonwood	ID	3411	46.05	116.35	FALL	75.5	24.8	50.15			
4	Cottonwood	ID	3411	46.05	116.35	WINTER	41.5	16.7	29.10			
5	Fenn R.S.	ID	1580	46.10	115.55	SPRING	75.6	27.6	51.60			
5	Fenn R.S.	ID	1580	46.10	115.55	SUMMER	93.8	47.2	70.50			
5	Fenn R.S.	ID	1580	46.10	115.55	FALL	82.3	28.7	55.50			
5	Fenn R.S.	ID	1580	46.10	115.55	WINTER	45.9	21.2	33.55			
6	Grangeville	ID	3355	45.92	116.13	SPRING	68.4	24.1	46.25			
6	Grangeville	ID	3355	45.92	116.13	SUMMER	85.4	44.6	65.00			
6	Grangeville	ID	3355	45.92	116.13	FALL	75.4	26.1	50.75			
6	Grangeville	ID	3355	45.92	116.13	WINTER	42.4	18.4	30.40			
7	Kellogg	ID	2305	47.53	116.13	SPRING	72.9	25.3	49.10			
7	Kellogg	ID	2305	47.53	116.13	SUMMER	88.1	46.5	67.30			
7	Kellogg	ID	2305	47.53	116.13	FALL	77.7	27.2	52.45			
7	Kellogg	ID	2305	47.53	116.13	WINTER	42.7	18.3	30.50			
8	Kooskia	ID	1261	46.15	115.98	SPRING	78.5	27.7	53.10			
8	Kooskia	ID	1261	46.15	115.98	SUMMER	94.5	46.0	70.25			
8	Kooskia	ID	1261	46.15	115.98	FALL	84.5	27.9	56.20			
8	Kooskia	ID	1261	46.15	115.98	WINTER	50.3	20.7	35.50			
9	Lewiston AP	ID	1413	46.38	117.02	SPRING	75.3	28.6	51.95	5.20	3.7	E
9	Lewiston AP	ID	1413	46.38	117.02	SUMMER	90.9	50.6	70.75	4.43	5.7	NE
9	Lewiston AP	ID	1413	46.38	117.02	FALL	81.9	30.2	56.05	4.03	5.7	E
9	Lewiston AP	ID	1413	46.38	117.02	WINTER	47.2	21.3	34.25	5.40	4.6	E
10	Moscow U of I	ID	2628	46.73	117.00	SPRING	70.0	28.3	49.15			
10	Moscow U of I	ID	2628	46.73	117.00	SUMMER	86.5	46.9	66.70			
10	Moscow U of I	ID	2628	46.73	117.00	FALL	76.0	29.5	52.75			
10	Moscow U of I	ID	2628	46.73	117.00	WINTER	42.8	20.3	31.55			
11	Mullan Pass	ID	5962	47.45	115.67	SPRING				9.20		
11	Mullan Pass	ID	5962	47.45	115.67	SUMMER				7.07		
11	Mullan Pass	ID	5962	47.45	115.67	FALL				7.97		
11	Mullan Pass	ID	5962	47.45	115.67	WINTER				9.30		
12	Pierce	ID	3171	46.38	115.62	SPRING	70.8	18.6	44.70			
12	Pierce	ID	3171	46.38	115.62	SUMMER	87.9	40.7	64.30			
12	Pierce	ID	3171	46.38	115.62	FALL	76.5	23.7	50.10			
12	Pierce	ID	3171	46.38	115.62	WINTER	40.0	13.0	26.50			
13	Porthill	ID	1800	49.00	116.50	SPRING	73.4	21.6	47.50			
13	Porthill	ID	1800	49.00	116.50	SUMMER	85.9	45.0	65.45			
13	Porthill	ID	1800	49.00	116.50	FALL	75.5	25.2	50.35			
13	Porthill	ID	1800	49.00	116.50	WINTER	40.0	13.9	26.95			

14 Potlatch	ID	2520	46.92	116.90	SPRING	72.5	24.8	48.65		
14 Potlatch	ID	2520	46.92	116.90	SUMMER	87.7	43.2	65.45		
14 Potlatch	ID	2520	46.92	116.90	FALL	77.4	27.1	52.25		
14 Potlatch	ID	2520	46.92	116.90	WINTER	43.8	20.0	31.90		
15 Priest River E.S.	ID	2380	48.35	116.83	SPRING	71.8	20.6	46.20		
15 Priest River E.S.	ID	2380	48.35	116.83	SUMMER	85.4	42.2	63.80		
15 Priest River E.S.	ID	2380	48.35	116.83	FALL	75.0	25.4	50.20		
15 Priest River E.S.	ID	2380	48.35	116.83	WINTER	40.1	14.7	27.40		
16 Riggins R.S.	ID	1801	45.42	116.32	SPRING	77.6	31.0	54.30		
16 Riggins R.S.	ID	1801	45.42	116.32	SUMMER	95.1	50.9	73.00		
16 Riggins R.S.	ID	1801	45.42	116.32	FALL	86.5	33.2	59.85		
16 Riggins R.S.	ID	1801	45.42	116.32	WINTER	51.2	24.7	37.95		
17 Salmon	ID	3961	45.20	113.87	SPRING	73.8	17.8	45.80		
17 Salmon	ID	3961	45.20	113.87	SUMMER	91.1	41.3	66.20		
17 Salmon	ID	3961	45.20	113.87	FALL	79.0	16.1	47.55		
17 Salmon	ID	3961	45.20	113.87	WINTER	41.7	4.9	23.30		
18 Sandpoint E.S.	ID	2100	48.28	116.57	SPRING	71.2	24.3	47.75		
18 Sandpoint E.S.	ID	2100	48.28	116.57	SUMMER	84.5	44.8	64.65		
18 Sandpoint E.S.	ID	2100	48.28	116.57	FALL	73.7	26.9	50.30		
18 Sandpoint E.S.	ID	2100	48.28	116.57	WINTER	39.9	17.6	28.75		
19 St. Maries	ID	2085	47.48	116.57	SPRING	73.9	25.8	49.85		
19 St. Maries	ID	2085	47.48	116.57	SUMMER	89.0	44.4	66.70		
19 St. Maries	ID	2085	47.48	116.57	FALL	79.3	27.7	53.50		
19 St. Maries	ID	2085	47.48	116.57	WINTER	43.6	19.2	31.40		
20 Wallace	ID	2770	47.47	115.93	SPRING	70.9	24.3	47.60		
20 Wallace	ID	2770	47.47	115.93	SUMMER	86.3	43.8	65.05		
20 Wallace	ID	2770	47.47	115.93	FALL	75.3	26.8	51.05		
20 Wallace	ID	2770	47.47	115.93	WINTER	41.5	19.1	30.30		
21 Blackfoot	MT	4280	48.58	112.88	SPRING				14.60	
21 Blackfoot	MT	4280	48.58	112.88	SUMMER				13.13	
21 Blackfoot	MT	4280	48.58	112.88	FALL				16.22	
21 Blackfoot	MT	4280	48.58	112.88	WINTER				21.08	
22 Bridger Bowl	MT	8650	45.80	111.10	SPRING				12.50	
22 Bridger Bowl	MT	8650	45.80	111.10	SUMMER					
22 Bridger Bowl	MT	8650	45.80	111.10	FALL					
22 Bridger Bowl	MT	8650	45.80	111.10	WINTER				13.43	
23 Browning Depot	MT	4500	48.53	113.02	SPRING				14.53	
23 Browning Depot	MT	4500	48.53	113.02	SUMMER				11.47	
23 Browning Depot	MT	4500	48.53	113.02	FALL				14.43	
23 Browning Depot	MT	4500	48.53	113.02	WINTER				19.27	
24 Butte AP	MT	5530	45.95	112.50	SPRING	64.5	8.4	36.45	7.87	3.2 S
24 Butte AP	MT	5530	45.95	112.50	SUMMER	82.3	39.1	60.70	7.20	2.8 S
24 Butte AP	MT	5530	45.95	112.50	FALL	70.3	11.5	40.90	6.47	3.5 S
24 Butte AP	MT	5530	45.95	112.50	WINTER	35.1	1.3	18.20	6.27	3.9 S
25 Drummond	MT	4240	46.62	113.20	SPRING	68.6	12.7	40.65	7.37	2.2 N-NE-NW
25 Drummond	MT	4240	46.62	113.20	SUMMER	84.7	38.9	61.80	6.73	2.1 NE
25 Drummond	MT	4240	46.62	113.20	FALL	72.6	14.0	43.30	5.60	3.9 N
25 Drummond	MT	4240	46.62	113.20	WINTER	37.0	3.7	20.35	6.30	4.0 N
26 Drummond AP	MT	4238	46.67	113.13	SPRING				7.37	
26 Drummond AP	MT	4238	46.67	113.13	SUMMER				6.73	
26 Drummond AP	MT	4238	46.67	113.13	FALL				5.60	
26 Drummond AP	MT	4238	46.67	113.13	WINTER				6.30	
27 Duck Lake	MT	5580	48.83	113.33	SPRING				14.67	
27 Duck Lake	MT	5580	48.83	113.33	SUMMER				14.30	
27 Duck Lake	MT	5580	48.83	113.33	FALL				13.77	
27 Duck Lake	MT	5580	48.83	113.33	WINTER				18.53	

28 Fortine 1N	MT	3000	48.78	114.90	SPRING	70.5	14.1	42.30		
28 Fortine 1N	MT	3000	48.78	114.90	SUMMER	83.0	38.6	60.80		
28 Fortine 1N	MT	3000	48.78	114.90	FALL	73.6	20.1	46.85		
28 Fortine 1N	MT	3000	48.78	114.90	WINTER	38.1	5.5	21.80		
29 Great Falls	MT	3688	47.48	111.37	SPRING				11.90	
29 Great Falls	MT	3688	47.48	111.37	SUMMER				9.83	
29 Great Falls	MT	3688	47.48	111.37	FALL				12.17	
29 Great Falls	MT	3688	47.48	111.37	WINTER				13.87	
30 Hamilton	MT	3529	46.25	114.15	SPRING	72.4	22.2	47.30		
30 Hamilton	MT	3529	46.25	114.15	SUMMER	88.3	45.0	66.65		
30 Hamilton	MT	3529	46.25	114.15	FALL	75.9	22.5	49.20		
30 Hamilton	MT	3529	46.25	114.15	WINTER	42.1	13.8	27.95		
31 Haugan	MT	3150	47.38	115.40	SPRING	71.9	16.6	44.25		
31 Haugan	MT	3150	47.38	115.40	SUMMER	87.2	37.2	62.20		
31 Haugan	MT	3150	47.38	115.40	FALL	77.0	20.4	48.70		
31 Haugan	MT	3150	47.38	115.40	WINTER	41.3	10.0	25.65		
32 Heart Butte	MT	5161	48.30	112.88	SPRING				19.20	
32 Heart Butte	MT	5161	48.30	112.88	SUMMER				12.84	
32 Heart Butte	MT	5161	48.30	112.88	FALL				15.45	
32 Heart Butte	MT	5161	48.30	112.88	WINTER				20.43	
33 Hungry Horse Dam	MT	3160	48.35	114.00	SPRING	69.7	14.8	42.25		
33 Hungry Horse Dam	MT	3160	48.35	114.00	SUMMER	83.2	44.2	63.70		
33 Hungry Horse Dam	MT	3160	48.35	114.00	FALL	71.8	22.7	47.25		
33 Hungry Horse Dam	MT	3160	48.35	114.00	WINTER	37.6	9.9	23.75		
34 Kalispell	MT	2960	48.20	114.32	SPRING	67.6	19.9	43.75	5.90	
34 Kalispell	MT	2960	48.20	114.32	SUMMER	83.2	45.1	64.15	5.63	
34 Kalispell	MT	2960	48.20	114.32	FALL	66.7	22.8	44.75	7.27	
34 Kalispell	MT	2960	48.20	114.32	WINTER	36.9	13.7	25.30	4.23	
35 Kalispell AP	MT	2965	48.30	114.27	SPRING	71.9	17.2	44.55	8.10	2.5 N
35 Kalispell AP	MT	2965	48.30	114.27	SUMMER	83.4	43.8	63.60	6.80	1.9 SE
35 Kalispell AP	MT	2965	48.30	114.27	FALL	72.4	23.1	47.75	5.77	2.4 S
35 Kalispell AP	MT	2965	48.30	114.27	WINTER	37.5	12.1	24.80	6.43	2.7 SW
36 Libby 1NE R.S.	MT	2080	48.40	115.53	SPRING	77.0	19.6	48.30		
36 Libby 1NE R.S.	MT	2080	48.40	115.53	SUMMER	92.3	41.7	67.00		
36 Libby 1NE R.S.	MT	2080	48.40	115.53	FALL	79.6	23.0	51.30		
36 Libby 1NE R.S.	MT	2080	48.40	115.53	WINTER	43.0	11.1	27.05		
37 Livingston TWR	MT	4700	45.68	110.55	SPRING				13.00	
37 Livingston TWR	MT	4700	45.68	110.55	SUMMER				11.27	
37 Livingston TWR	MT	4700	45.68	110.55	FALL				14.40	
37 Livingston TWR	MT	4700	45.68	110.55	WINTER				20.63	
38 Missoula AP	MT	3200	46.92	114.08	SPRING	70.6	20.9	45.75	5.90	3.9 W
38 Missoula AP	MT	3200	46.92	114.08	SUMMER	87.2	44.6	65.90	5.63	4.3 SE
38 Missoula AP	MT	3200	46.92	114.08	FALL	73.4	21.4	47.40	4.27	5.2 SE
38 Missoula AP	MT	3200	46.92	114.08	WINTER	39.8	13.3	26.55	3.93	5.1 W
39 Ovando 1SW	MT	4101	47.02	113.15	SPRING	68.0	9.9	38.90		
39 Ovando 1SW	MT	4101	47.02	113.15	SUMMER	84.3	34.6	59.45		
39 Ovando 1SW	MT	4101	47.02	113.15	FALL	73.4	13.0	43.20		
39 Ovando 1SW	MT	4101	47.02	113.15	WINTER	37.3	2.1	19.70		
40 Rainbow Field	MT	4850	48.35	113.13	SPRING					
40 Rainbow Field	MT	4850	48.35	113.13	SUMMER					
40 Rainbow Field	MT	4850	48.35	113.13	FALL				17.80	
40 Rainbow Field	MT	4850	48.35	113.13	WINTER				18.90	
41 Pocky Point	MT	4882	46.85	112.25	SPRING				14.43	
41 Pocky Point	MT	4882	46.85	112.25	SUMMER				11.55	
41 Pocky Point	MT	4882	46.85	112.25	FALL				14.00	
41 Pocky Point	MT	4882	46.85	112.25	WINTER				14.30	

42 Sieben Ranch	MT	6507	46.92	113.27	SPRING	17.10
42 Sieben Ranch	MT	6507	46.92	113.27	SUMMER	15.35
42 Sieben Ranch	MT	6507	46.92	113.27	FALL	
42 Sieben Ranch	MT	6507	46.92	113.27	WINTER	20.40
43 Silver Bow Co AP	MT	5540	45.95	112.50	SPRING	9.07
43 Silver Bow Co AP	MT	5540	45.95	112.50	SUMMER	8.37
43 Silver Bow Co AP	MT	5540	45.95	112.50	FALL	7.53
43 Silver Bow Co AP	MT	5540	45.95	112.50	WINTER	6.97
44 Swift Dam	MT	4920	48.22	112.78	SPRING	10.93
44 Swift Dam	MT	4920	48.22	112.78	SUMMER	9.50
44 Swift Dam	MT	4920	48.22	112.78	FALL	14.33
44 Swift Dam	MT	4920	48.22	112.78	WINTER	17.20
45 Whitehall M/U	MT	6369	45.93	112.08	SPRING	14.33
45 Whitehall M/U	MT	6369	45.93	112.08	SUMMER	11.95
45 Whitehall M/U	MT	6369	45.93	112.08	FALL	14.20
45 Whitehall M/U	MT	6369	45.93	112.08	WINTER	17.97
46 Pequop #1	HU	6160	47.20	114.58	SPRING	10.95
46 Pequop #1	HU	6160	47.20	114.58	SUMMER	
46 Pequop #1	HU	6160	47.20	114.58	FALL	10.80
46 Pequop #1	HU	6160	47.20	114.58	WINTER	7.90

END

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