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Characterization of Present and Possible Future (Wetter) Climatic Regimes Utilizing the Historical Climatic Record and an Analogue Technique in the Southern Great Basin.

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by

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ABSTRACT

The historical climatic record and an analogue technique were used to characterize present and possible future (wetter) climatic regimes in the southern Great Basin. The analogue technique considers wet years under current conditions to be representative of average years under pluvial conditions. Data were grouped on the basis of wet, average, and dry years to compare characteristics of the seasonal and daily distribution of precipitation under various climatic conditions. Precipitation during wet years increased most from January to March. Wet- and dry-day sequences were modeled well with first- and third-order Markov chains, respectively. Daily storm depths were modeled best with the Weibull distribution. Maximum temperatures were 3 to 15 °F higher on dry days as compared to wet days, depending on the month and station. Results of this study provide useful climatic input data for a water balance model to determine effects of climatic variability upon recharge.

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INTRODUCTION

Yucca Mountain, in southern Nevada, is currently under consideration as the site for a permanent federal nuclear repository. The expected life of this repository is on the order of 10,000 years - enough time for stored radioactive waste to decay to a safe level. An important consideration, to ensure safety of the repository, is that the site remains suitable to prevent migration of stored waste regardless of future climatic changes.

The climate of a region is determined by average weather conditions over a period of time. Hydrologic systems form in response to the existing climate. Climatic conditions are likely to undergo dramatic changes over a 10,000 year period, which will affect hydrologic processes such as recharge and runoff. Therefore, it is important to examine the climate - recharge relationship; and to determine how future climatic changes will affect flow through the unsaturated zone, groundwater flow rates, and the height of the water table.

PURPOSE AND OBJECTIVES

The purpose of this study is to utilize the historical climatic record and an analogue technique to characterize present and possible future (wetter) climatic regimes in the southern Great Basin. The analogue method is based on the idea that wet years in the historical record can be considered to be representative of average years under a wetter climatic regime. Precipitation and temperature data were examined on an annual, seasonal, monthly, and daily basis to provide detailed information about different climatic conditions.

The specific objectives of this study are as follows:

1) to provide a complete characterization of regional climate based on the historical record;

2) to use the analogue method to provide the seasonal and daily structure of wetter climatic regimes that may occur in the Yucca Mountain region;

3) to provide climatic input data for a water balance model to determine the effect of climatic variability upon recharge in the Yucca Mountain environment.

SOUTHERN GREAT BASIN CLIMATOLOGY

AIR MASS TYPES

An air mass is a relatively large body of air with uniform temperature and moisture characteristics (Houghton et al.,1975). The five different air mass types and their relative rates of occurrence in Nevada are shown in Table 1.

Table 1. Frequency of Air Mass Types Over Nevada During the Period 1962-1965 (after Houghton et al., 1975).

Air Mass Type	Percentage of Days With Each Air Mass Type				
	Winter	Spring	Summer	Fall	Annual
Continental Arctic	11	1	0	1	3
Continental Polar	56	42	7	32	34
Maritime Polar	26	27	11	18	21
Maritime Tropical	5	3	16	6	7
Continental Tropical	2	27	66	43	35

Continental arctic air forms over Alaska or northern Canada and then moves southward into the United States. However, arctic air masses rarely reach Nevada because they are usually carried east of the Rocky Mountains by the prevailing westerlies. Strong northerly winds bring very cold, dry arctic air over Nevada occasionally each winter.

Continental polar air originates in western Canada and comes to Nevada with northerly winds. This air mass type is associated with cool, dry weather and is most common from November to April. It is often associated with stagnant Great Basin highs.

Maritime polar air is the primary source of precipitation in Nevada, and alternates with continental polar air from November to April. It usually brings cloudy, wet weather associated with Pacific storms or Great Basin lows. This air mass type is transitory and usually passes over Nevada more quickly than continental polar air.

Maritime tropical air is relatively rare in Nevada and occurs primarily in the summer. This air mass originates in the tropical Pacific Ocean, and occasionally brings warm, moist air to Nevada in fall or winter months. However, it is most often associated with local thundershowers from July to September.

Continental tropical air is the most common warm air mass and occurs on over 50 percent of all days from May to October. It brings warm, dry weather to Nevada for extended periods of time. It is associated with the subtropical high-pressure belt, and often results in 100 degree plus temperatures over southern Nevada.

Summer is the only season which is dominated by one air mass type, continental tropical. Continental and maritime air alternate during fall, winter, and spring; whereas polar and tropical air alternate during spring and fall. Therefore, despite the light precipitation, Nevada is characterized by variable weather patterns (Houghton et al., 1975)

GEOGRAPHICAL INFLUENCES

The southern Great Basin spans approximately two degrees of latitude from 36 to 38 degrees North, and the longitude ranges from 114 to 118 degrees West. The general atmospheric circulation varies significantly with latitude and longitude, even within the relatively narrow range encompassing the southern Great Basin. This results in important temperature differences - cooler to the north and warmer in the south, and significant differences in the relative contributions of each of the three precipitation mechanisms (Houghton, 1969; Houghton et al., 1975).

Elevation and exposure are also important factors to climatic conditions in the Great Basin. Topography of the area consists of alternating valleys and high mountain ranges elongated in a north-south direction. Elevation varies approximately from 2,000 to 13,000 feet; and results in cooler, wetter climates at higher elevations in contrast to the hot, dry valleys. Exposure is important because windward slopes often receive more precipitation than leeward slopes (Houghton et al., 1975; Houghton, 1969).

Another important geographical factor contributing to Nevada's climate is continentality. The continental effect is manifested in the form of dryness and large temperature variations. This effect is caused by the Sierra Nevada mountain range along the western edge of the Great Basin, which shields Nevada from maritime winds off the Pacific Ocean. These moisture laden winds are forced to rise, cool, and condense, thereby causing the vast majority of precipitation to fall on the western slopes of the Sierras. This results in the rainshadow effect which is the primary reason for Nevada's dry climate (Houghton et al., 1975).

The temperature regime is also greatly affected by the blocking out of maritime air. Maritime air tends to produce relatively mild winters and cool summers, because ocean temperatures change much slower than land temperatures. However, the Sierra Nevada mountain barrier creates a continental climate with well developed seasons - including hot summers and cold winters.

Great Basin climate is also characterized by large daily temperature ranges due to the abundant occurrence of dry, clear air. This allows maximum penetration of solar radiation during the day which causes intense heating. However, clear skies at night result in rapid loss of energy and cool temperatures (Houghton et al., 1975).

MOISTURE SOURCES AND ATMOSPHERIC CIRCULATION

The moisture sources for precipitation in the Great Basin are: Pacific Ocean, Gulf of Mexico, and Gulf of California. The Pacific Ocean is the primary source, and provides virtually all precipitation from October to June. Moisture from the Gulfs may penetrate the southern Great Basin triggering summer thunderstorms from July to mid-September (Houghton, 1969; Houghton et al., 1975).

The Aleutian Low and Pacific High are the controlling factors for precipitation from the Pacific source. The Pacific High maintains a relatively stable position with its center located between 30 to 40 degrees North and 140 to 150 degrees West. It expands in summer months, thereby blocking out Pacific fronts from the southern Great Basin, reaching its most northwestern position in August. It shrinks in winter months, allowing Pacific fronts to pass over the Great Basin, and is situated farthest southeast in January (Houghton, 1969).

The Aleutian Low originates along the frontal zone in the western Pacific, and its primary energy source is the outflow of continental polar air from central Asia. This area of low pressure extends farthest south in January when it has the greatest influence on Great Basin climate. The Aleutian Low produces precipitation along the coast and inland by fronts trailing southward from the great low pressure belt in the subpolar North Pacific. The heaviest precipitation south of 40 degrees North occurs when secondary lows develop along these fronts and move across the southern Great Basin (Houghton, 1969).

The movement of moisture into southern Nevada from the Gulf in summer months is partially controlled by the positioning of the Pacific and Bermuda Highs. Westward shifts in these high pressure centers combine with a thermally induced low (California Low) over the desert southwest to bring warm, moist air from the Gulfs into the southern Great Basin. This can result in localized late afternoon and evening convective thunderstorms (Houghton, 1969; Houghton et al., 1975).

STORM TYPES

Precipitation in the southern Great Basin results from three different mechanisms: Pacific fronts, continental cyclones, and summer convection. The relative importance of each mechanism varies both seasonally and geographically. Houghton (1969) has made a detailed quantitative assessment of the relative contributions of each mechanism in different portions of the Great Basin.

Pacific fronts provide a majority of the precipitation from October to June. A typical Pacific type storm begins when a strong low pressure center develops off the northwest coast of the United States. A cold front moves through California, and into western Nevada. Southwesterly winds bring in moisture from the ocean and push it landward over Nevada. A majority of the precipitation falls west of the Great Basin due to the high mountain barrier created by the Sierra Nevada. However, the western Great Basin may receive significant amounts of precipitation, depending on the particular storm event. As the front continues to move eastward it loses moisture, and the eastern Great Basin is less affected by Pacific fronts (Houghton et al.,1975).

Pacific fronts have a winter maximum and summer minimum. There is essentially no contribution from this mechanism during summer months since Pacific fronts pass far north of the Great Basin during this time. However, the remainder of the year (and especially winter), when a vast majority of total precipitation falls, is dominated by Pacific fronts (Houghton, 1969).

A second mechanism of precipitation in the Great Basin is continental cyclones. A typical Great Basin low (cyclone) occurs when a surface low develops along a cold front moving inland from the Pacific Ocean. Northerly winds bring cold polar air southward to replace warm air ahead of the front. Because the low develops over the interior, the eastern and central Great Basin receive most of the precipitation from this storm type. Continental cyclones have a primary spring maximum, a secondary fall maximum, and a summer minimum. Interaction of contrasting air masses, which leads to formation of Great Basin Lows, is most favorable during spring (Houghton et al., 1975).

The third mechanism of precipitation in the southern Great Basin operates exclusively during summer months. It involves convection in moist air brought in from either the Gulf of Mexico or Gulf of California (Houghton, 1969). Convection storms occur when the proper positioning of lows and highs allow winds to bring moist air in from the Gulf. Strong surface heat during the day in summer months causes a thermal low to develop. This may cause scattered afternoon and evening thunderstorms if moisture is available (Houghton et al.,1975). Essentially all summer precipitation in the Great Basin results from the convection mechanism.

A controversy exists concerning the moisture source for summer convection thunderstorms over the southern Great Basin. Originally, it was widely accepted that the Gulf of Mexico was the primary source, and weather patterns could explain the importation of tropical moisture into the desert southwest (Houghton, 1969). However, some researchers (Hales 1972,1974; Smith, 1986) suggest that the Gulf of California may be the most important source of summer moisture. Furthermore, Hales (1974) suggests that, " . . . the importance of the Gulf of Mexico as a moisture source for the area west of the Continental Divide is minimal." The evidence provided by Hales (1972,1974) and Smith (1986) gives strong support to the Gulf of California as the primary source of summer moisture in the desert southwest.

ANALYSIS OF PRECIPITATION DATA

STUDY AREA

The regional study area lies in the southern Great Basin, and includes southern Nevada and a portion of southeastern California. The western boundary is formed by the Sierra Nevada Mountains, and the eastern boundary lies at the Nevada border with Utah and Arizona. Figure 1 shows a location map with the seven climate stations used in this study. These climate stations surround Yucca Mountain to a radius of approximately 100 miles. Climate data in this region are relatively sparse, but the station network selected for this study is considered sufficient to represent regional weather patterns.

SEASONAL AND MONTHLY PRECIPITATION DATA

Methods

The monthly precipitation data available for the climate station network used in this study are summarized in Table 2. Mean monthly, seasonal, and annual precipitation for each station is given in Table 3. A double mass analysis was performed for the Beatty station to check for a change in slope due to the 1972 station move. The results, shown in Figure 2, indicate no discernible change in slope. Therefore, the precipitation records at Beatty are assumed to be compatible for the entire period of record. The seasons are defined as follows: winter - December, January, and February; spring - March, April, and May; summer - June, July, and August; fall - September, October, and November. The monthly and seasonal distribution of precipitation varies considerably from station to

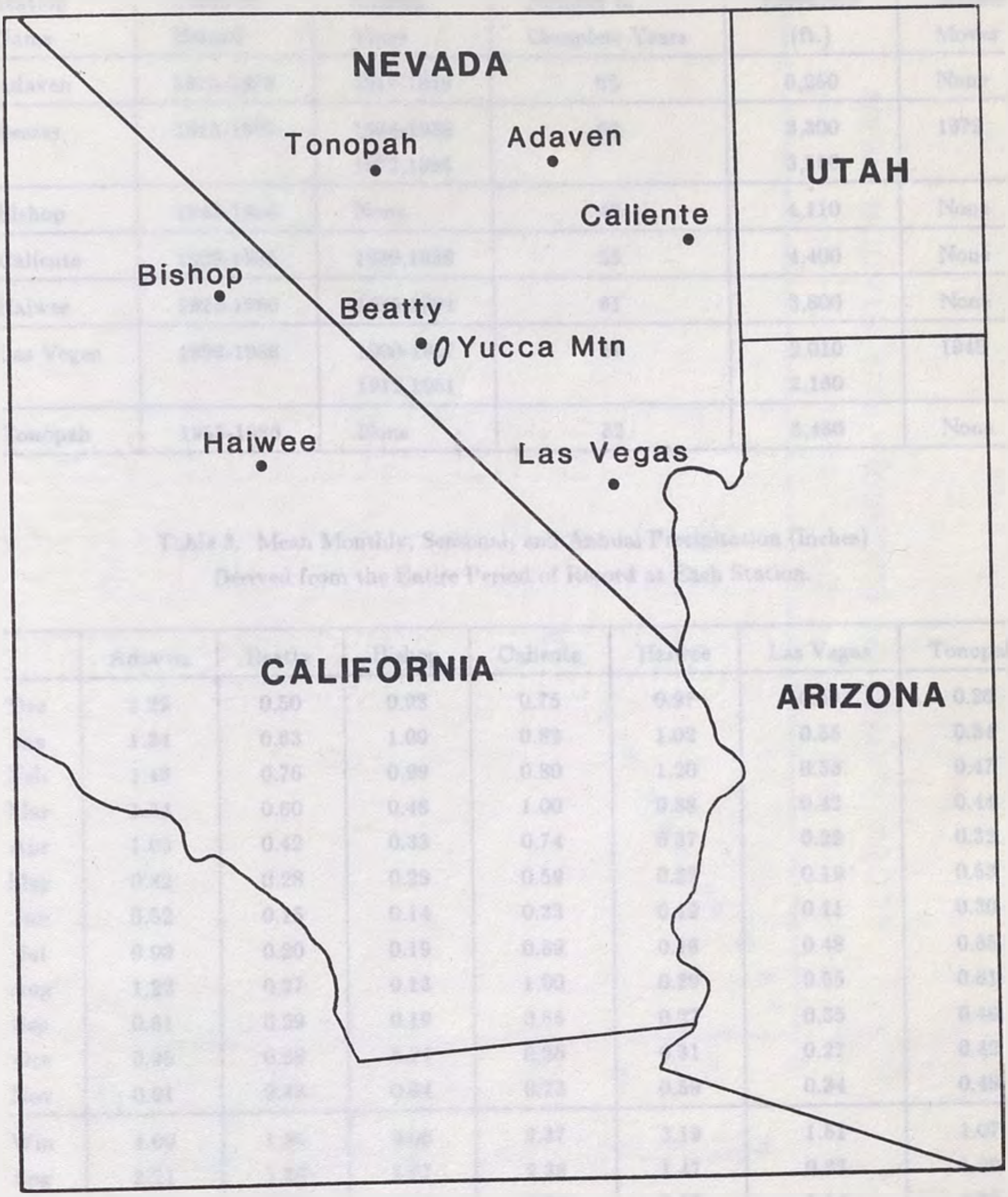


Figure 1. Location Map of Study Area and Climate Stations.

Table 2. Monthly Precipitation Data.

Station Name	Years of Record	Missing Years	Number of Complete Years	Elevation (ft.)	Station Moves
Adaven	1915-1978	1917-1918	62	6,250	None
Beatty	1918-1986	1934-1938 1972,1984	62	3,300 3,550	1972
Bishop	1945-1986	None	42	4,110	None
Caliente	1929-1985	1930,1938	55	4,400	None
Haiwee	1924-1986	1965,1984	61	3,800	None
Las Vegas	1896-1986	1900-1907 1912,1951	81	2,010 2,160	1948
Tonopah	1955-1986	None	32	5,430	None

Table 3. Mean Monthly, Seasonal, and Annual Precipitation (Inches) Derived from the Entire Period of Record at Each Station.

	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Dec	1.29	0.50	0.98	0.75	0.97	0.43	0.26
Jan	1.34	0.63	1.09	0.82	1.02	0.55	0.34
Feb	1.46	0.76	0.99	0.80	1.20	0.53	0.47
Mar	1.34	0.60	0.46	1.00	0.88	0.42	0.44
Apr	1.05	0.42	0.33	0.74	0.37	0.22	0.32
May	0.82	0.28	0.28	0.59	0.22	0.19	0.53
Jun	0.52	0.15	0.14	0.33	0.12	0.11	0.30
Jul	0.93	0.20	0.19	0.89	0.16	0.48	0.65
Aug	1.22	0.27	0.13	1.00	0.29	0.55	0.61
Sep	0.61	0.29	0.19	0.65	0.27	0.35	0.49
Oct	0.95	0.28	0.24	0.86	0.31	0.27	0.42
Nov	0.91	0.43	0.64	0.73	0.59	0.34	0.48
Win	4.09	1.89	3.06	2.37	3.19	1.51	1.07
Spg	3.21	1.30	1.07	2.33	1.47	0.83	1.29
Sum	2.67	0.62	0.46	2.22	0.57	1.14	1.56
Fal	2.47	1.00	1.07	2.24	1.17	0.96	1.39
Year	12.44	4.81	5.66	9.16	6.40	4.44	5.31

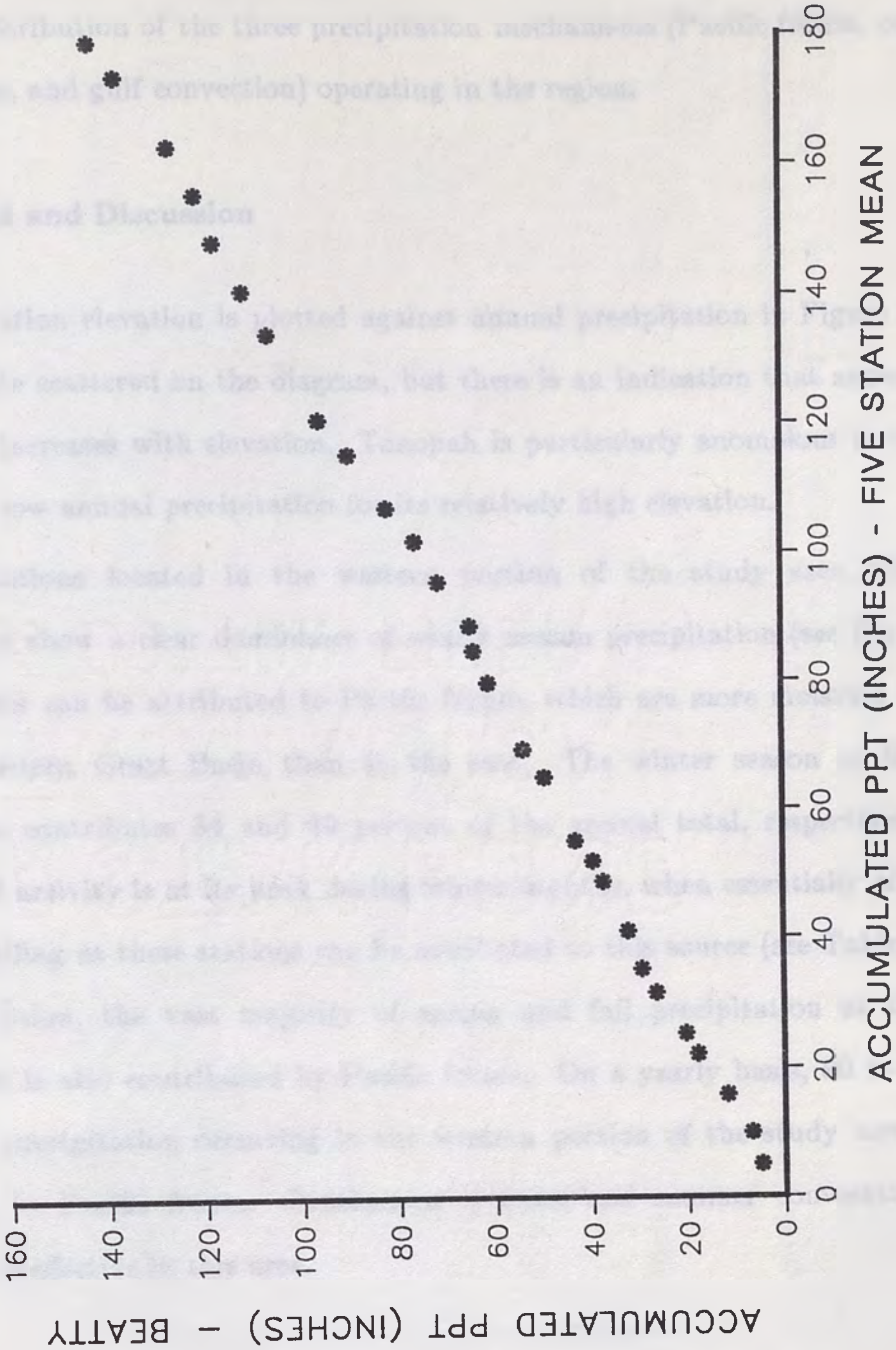


Figure 2. Double Mass Analysis for Beatty. Five Station Mean: Bishop, Caliente, Haiwee, Las Vegas, and Tonopah.

station. This variability is due to differences in elevation and changes in the relative contribution of the three precipitation mechanisms (Pacific fronts, continental cyclones, and gulf convection) operating in the region.

Results and Discussion

Station elevation is plotted against annual precipitation in Figure 3. Points are quite scattered on the diagram, but there is an indication that annual precipitation increases with elevation. Tonopah is particularly anomalous in that is has a very low annual precipitation for its relatively high elevation.

Stations located in the western portion of the study area (Bishop and Haiwee) show a clear dominance of winter season precipitation (see Figures 4 and 5). This can be attributed to Pacific fronts, which are more moisture laden over the western Great Basin than to the east. The winter season at Bishop and Haiwee contributes 54 and 49 percent of the annual total, respectively. Pacific frontal activity is at its peak during winter months, when essentially all precipitation falling at these stations can be attributed to this source (see Tables 4 and 5). In addition, the vast majority of spring and fall precipitation at Bishop and Haiwee is also contributed by Pacific fronts. On a yearly basis, 80 to 90 percent of all precipitation occurring in the western portion of the study area is contributed by Pacific fronts. Continental cyclones and summer convection are relatively ineffective in this area.

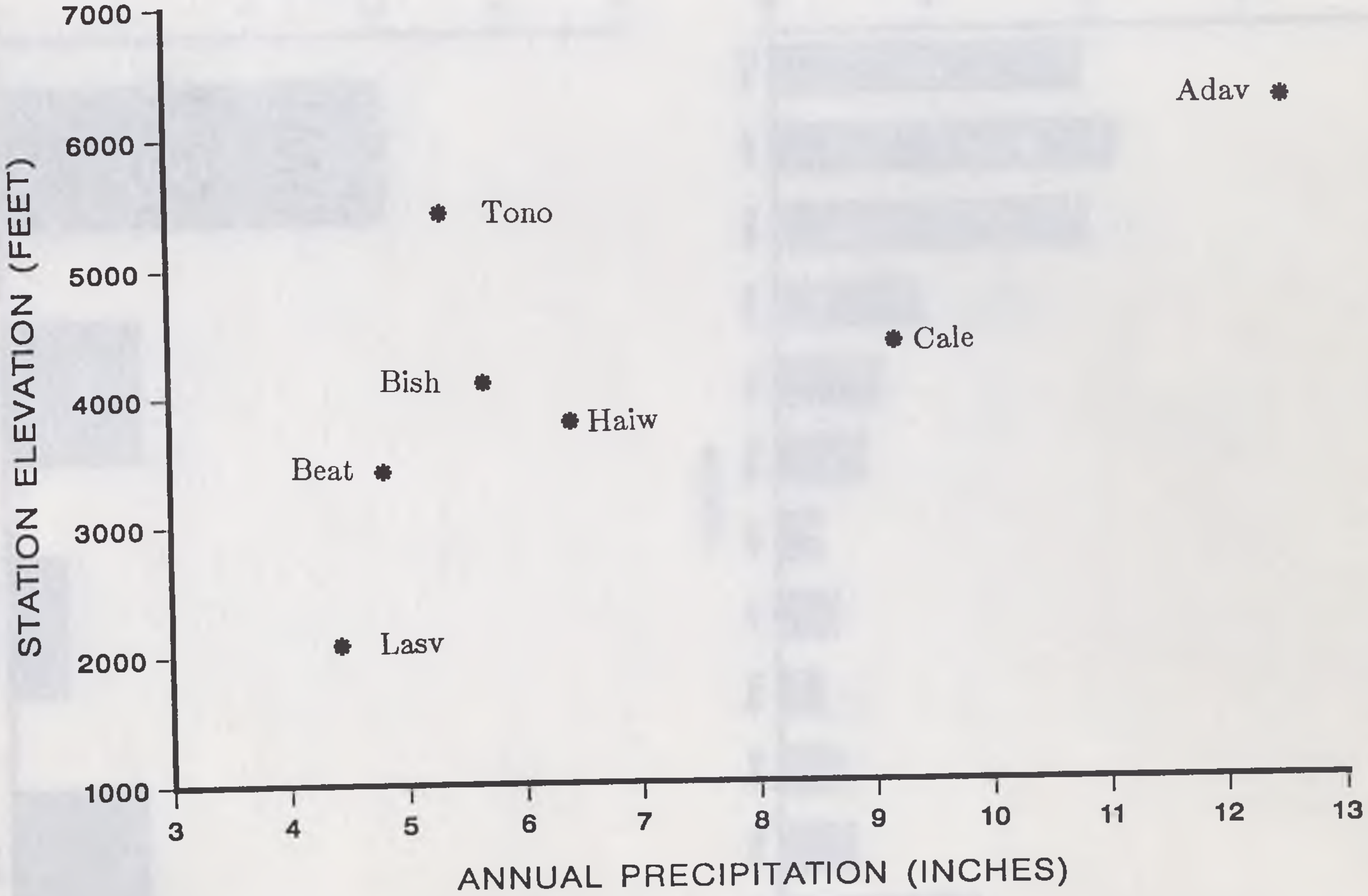


Figure 3. Station Elevation VS. Annual Precipitation.

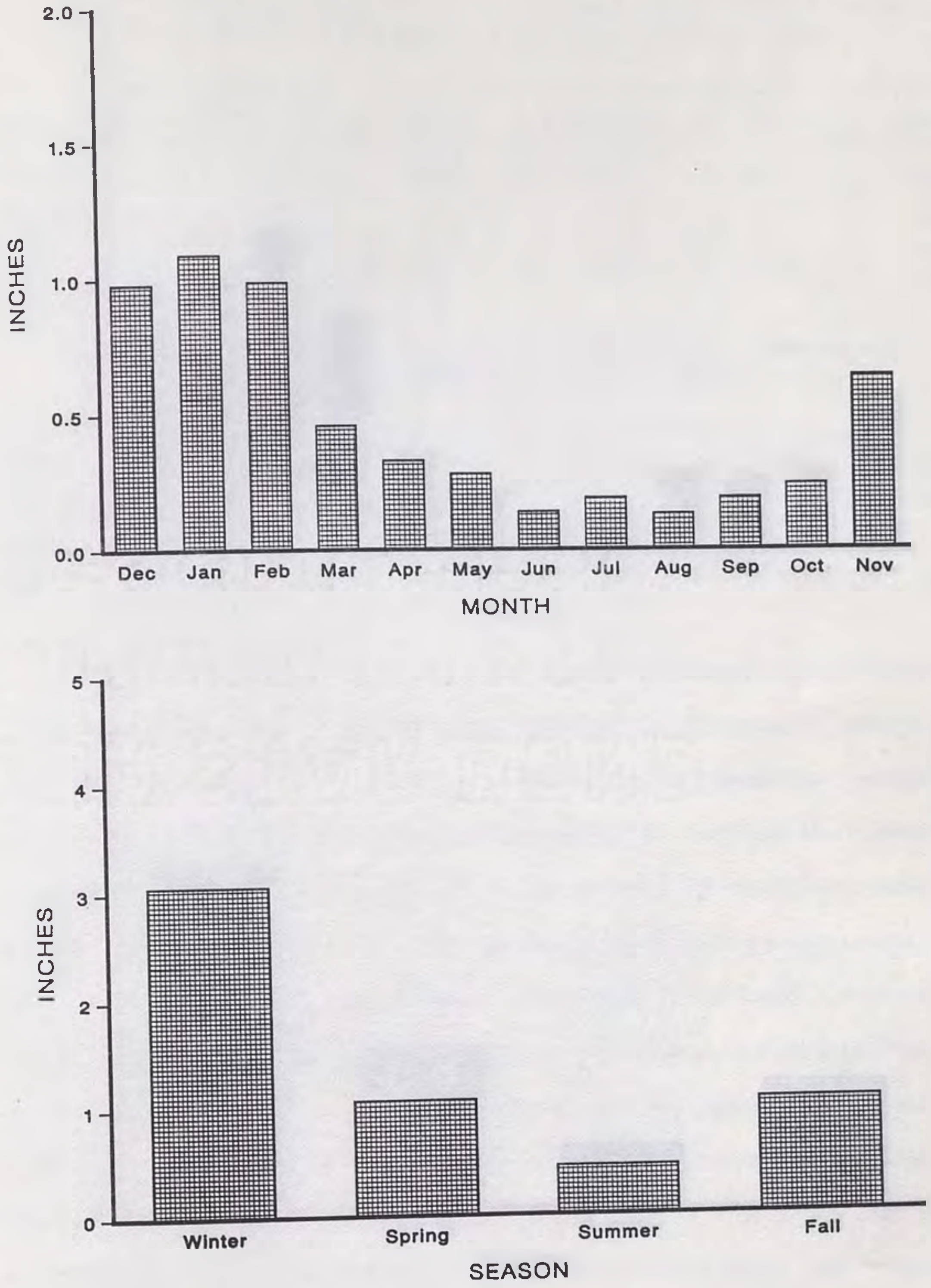


Figure 4. Bishop, Mean Monthly and Seasonal Precipitation.

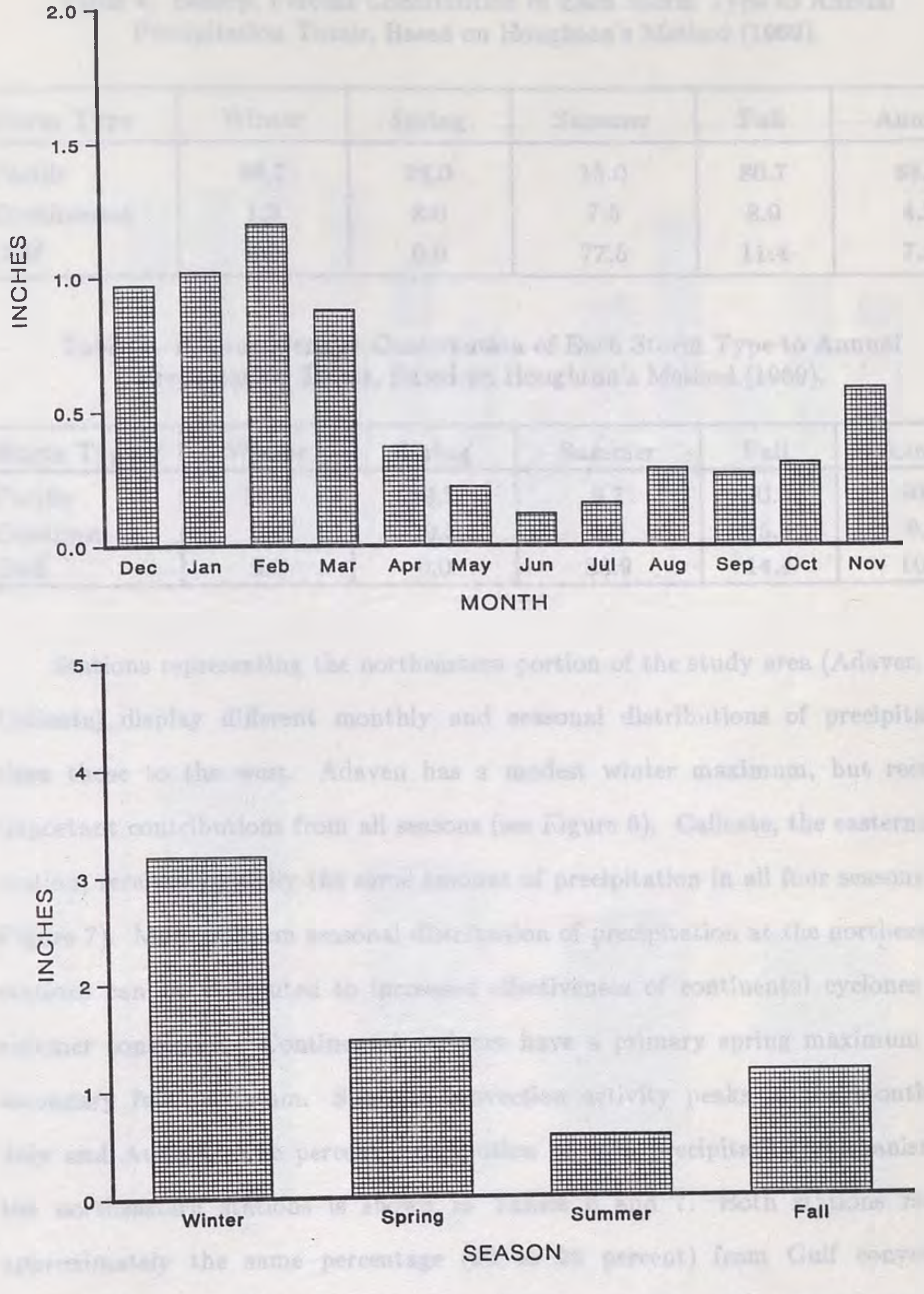


Figure 5. Haiwee, Mean Monthly and Seasonal Precipitation.

Table 4. Bishop, Percent Contribution of Each Storm Type to Annual Precipitation Totals, Based on Houghton's Method (1969).

Storm Type	Winter	Spring	Summer	Fall	Annual
Pacific	98.7	92.0	15.0	80.7	88.4
Continental	1.3	8.0	7.5	8.0	4.3
Gulf	0.0	0.0	77.5	11.4	7.3

Table 5. Haiwee, Percent Contribution of Each Storm Type to Annual Precipitation Totals, Based on Houghton's Method (1969).

Storm Type	Winter	Spring	Summer	Fall	Annual
Pacific	93.6	89.7	9.7	70.3	80.8
Continental	6.4	10.3	6.5	15.3	9.1
Gulf	0.0	0.0	83.9	14.4	10.1

Stations representing the northeastern portion of the study area (Adaven and Caliente) display different monthly and seasonal distributions of precipitation than those to the west. Adaven has a modest winter maximum, but receives important contributions from all seasons (see Figure 6). Caliente, the easternmost station, receives virtually the same amount of precipitation in all four seasons (see Figure 7). More uniform seasonal distribution of precipitation at the northeastern stations can be attributed to increased effectiveness of continental cyclones and summer convection. Continental cyclones have a primary spring maximum and secondary fall maximum. Summer convection activity peaks in the months of July and August. The percent contribution of each precipitation mechanism at the northeastern stations is shown in Tables 6 and 7. Both stations receive approximately the same percentage (20 to 26 percent) from Gulf convection storms. However, Pacific fronts are still the most important mechanism at Adaven, whereas continental cyclones predominate at Caliente.

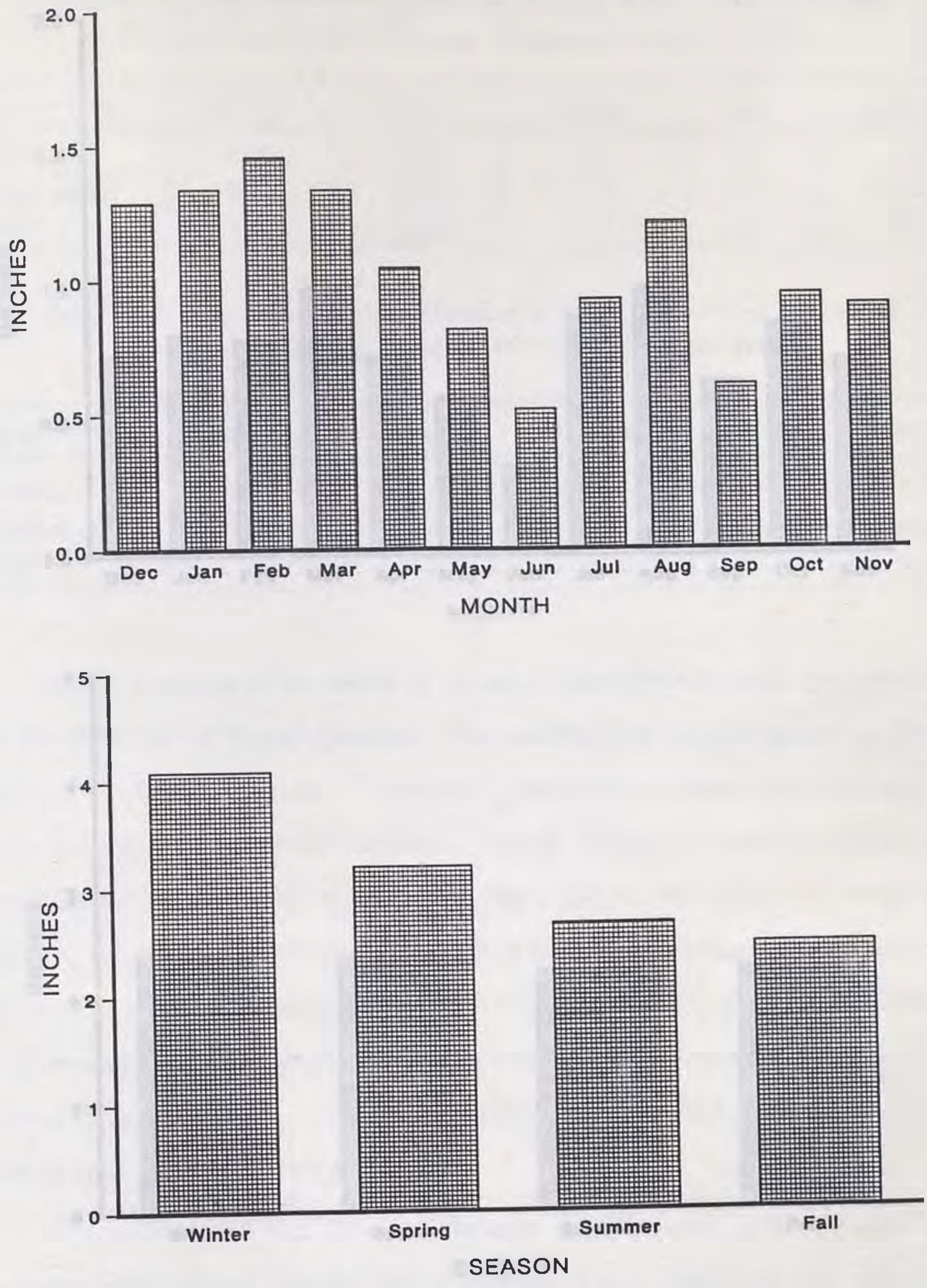


Figure 6. Adaven, Mean Monthly and Seasonal Precipitation.

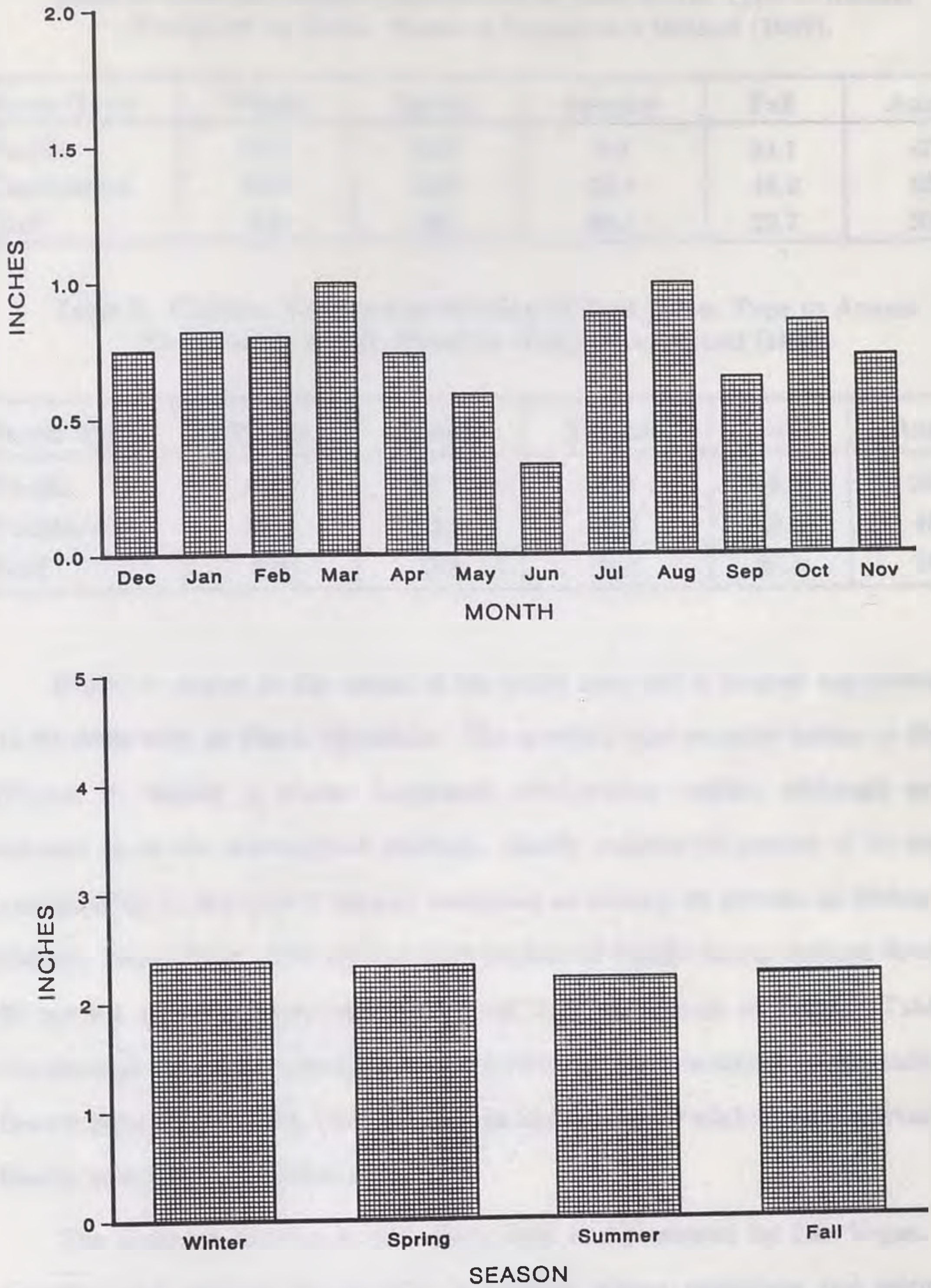


Figure 7. Caliente, Mean Monthly and Seasonal Precipitation.

Table 6. Adaven, Percent Contribution of Each Storm Type to Annual Precipitation Totals, Based on Houghton's Method (1969).

Storm Type	Winter	Spring	Summer	Fall	Annual
Pacific	79.1	46.7	2.9	34.1	47.3
Continental	20.9	53.3	16.4	42.2	32.6
Gulf	0.0	0.0	80.7	23.7	20.1

Table 7. Caliente, Percent Contribution of Each Storm Type to Annual Precipitation Totals, Based on Houghton's Method (1969).

Storm Type	Winter	Spring	Summer	Fall	Annual
Pacific	62.0	27.7	1.3	18.6	28.6
Continental	38.0	72.3	17.7	53.3	45.4
Gulf	0.0	0.0	81.0	28.1	26.1

Beatty is closest to the center of the study area and is located approximately 15-20 miles west of Yucca Mountain. The monthly and seasonal means at Beatty (Figure 8) display a winter dominated precipitation regime, although not as extreme as at the westernmost stations. Beatty receives 40 percent of its annual precipitation in the winter season, compared to 54 and 49 percent at Bishop and Haiwee, respectively. The annual contribution of Pacific fronts declines from 80-90 percent at the western stations to less than 60 percent at Beatty (Table 8). Continental cyclones contribute the majority of the remaining precipitation at Beatty (30 percent). The Gulf mechanism increases only slightly in importance at Beatty compared to western stations.

The southern portion of the study area is represented by Las Vegas. The monthly and seasonal means show a primary winter maximum and secondary summer maximum (see Figure 9). However, the overall seasonal distribution is

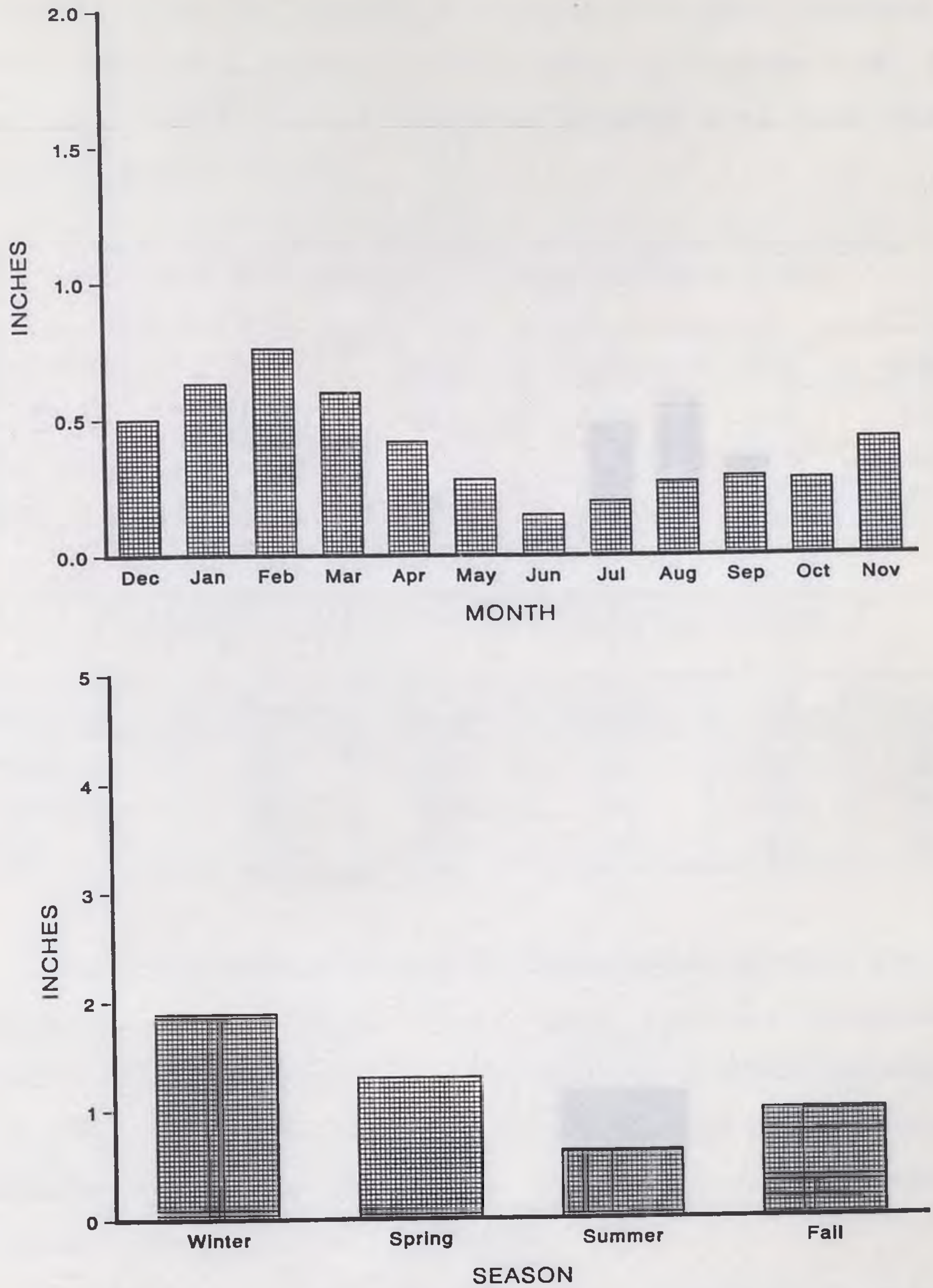


Figure 8. Beatty, Mean Monthly and Seasonal Precipitation.

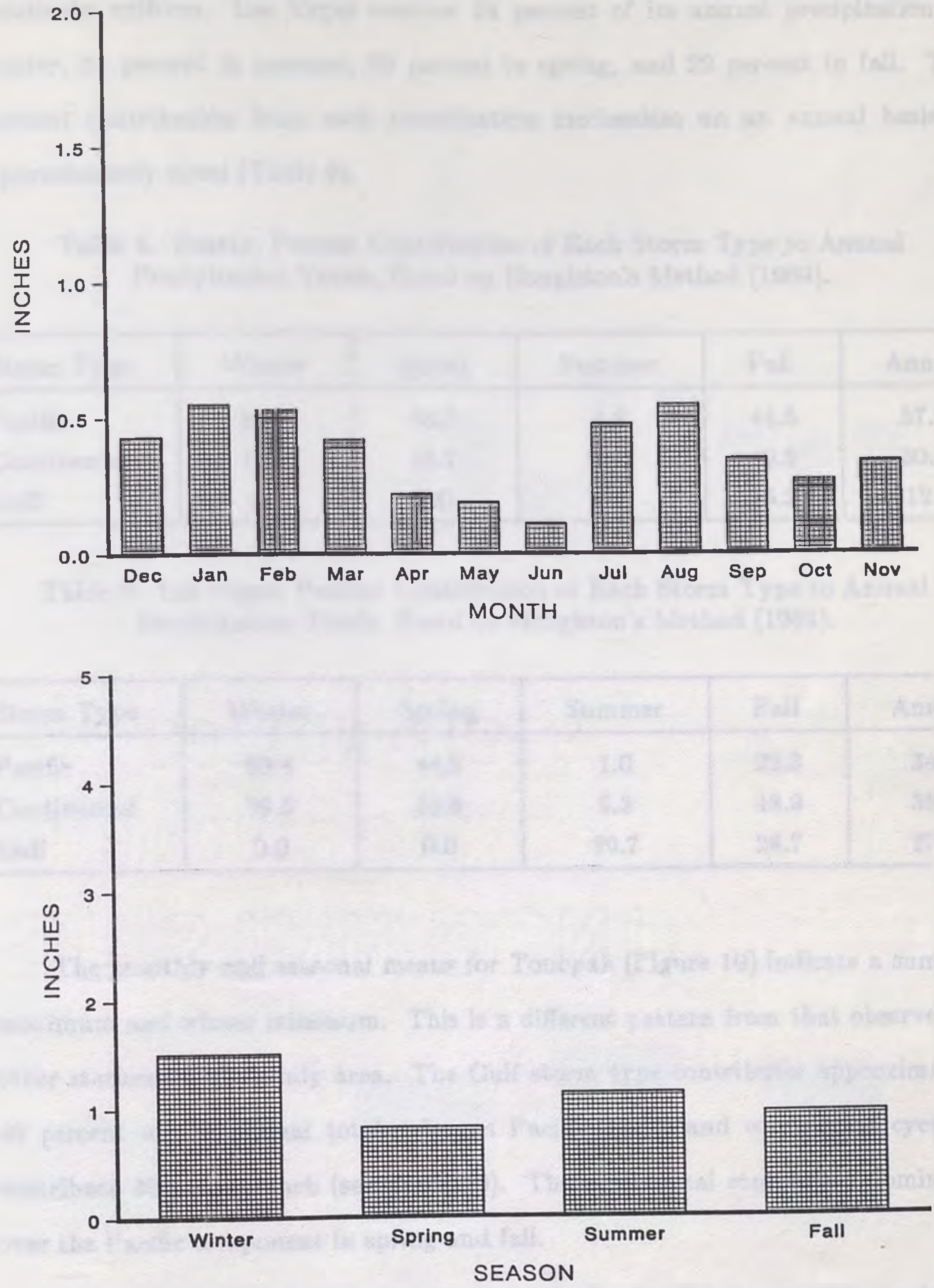


Figure 9. Las Vegas, Mean Monthly and Seasonal Precipitation.

relatively uniform. Las Vegas receives 34 percent of its annual precipitation in winter, 24 percent in summer, 20 percent in spring, and 22 percent in fall. The percent contribution from each precipitation mechanism on an annual basis is approximately equal (Table 9).

Table 8. Beatty, Percent Contribution of Each Storm Type to Annual Precipitation Totals, Based on Houghton's Method (1969).

Storm Type	Winter	Spring	Summer	Fall	Annual
Pacific	83.3	53.3	4.8	44.6	57.8
Continental	16.7	46.7	22.2	40.2	30.0
Gulf	0.0	0.0	73.0	15.2	12.2

Table 9. Las Vegas, Percent Contribution of Each Storm Type to Annual Precipitation Totals, Based on Houghton's Method (1969).

Storm Type	Winter	Spring	Summer	Fall	Annual
Pacific	60.4	44.2	1.0	22.3	34.9
Continental	39.6	55.8	9.3	48.9	38.0
Gulf	0.0	0.0	89.7	28.7	27.1

The monthly and seasonal means for Tonopah (Figure 10) indicate a summer maximum and winter minimum. This is a different pattern from that observed at other stations in the study area. The Gulf storm type contributes approximately 40 percent of the annual total, whereas Pacific fronts and continental cyclones contribute 30 percent each (see Table 10). The continental component dominates over the Pacific component in spring and fall.

In general, the relative contribution of the Pacific component gradually decreases on a gradient from west to east. Conversely, the relative contribution of

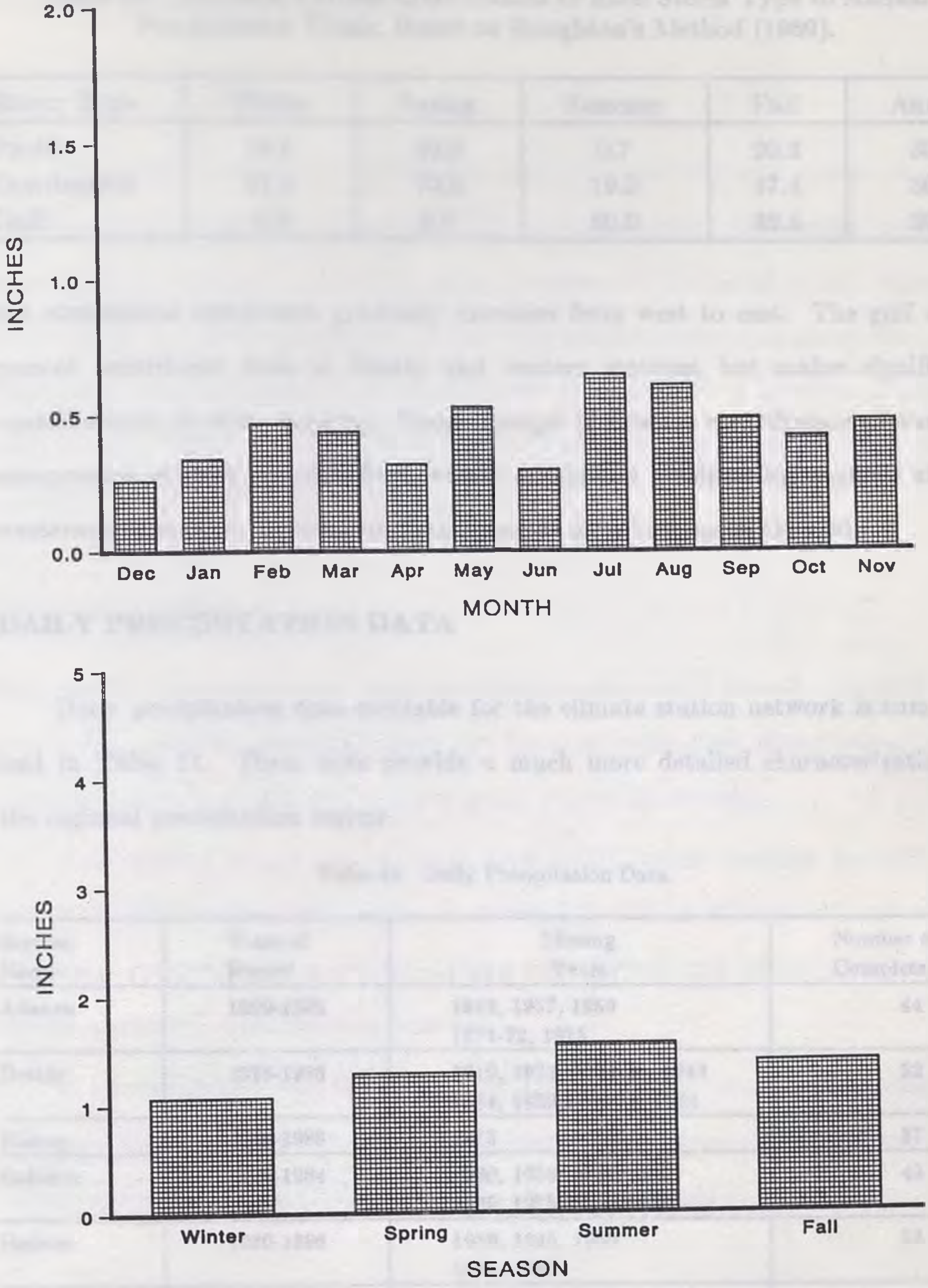


Figure 10. Tonopah, Mean Monthly and Seasonal Precipitation.

Table 10. Tonopah, Percent Contribution of Each Storm Type to Annual Precipitation Totals, Based on Houghton's Method (1969).

Storm Type	Winter	Spring	Summer	Fall	Annual
Pacific	78.5	29.5	0.7	20.2	30.5
Continental	21.5	70.5	19.3	47.4	30.0
Gulf	0.0	0.0	80.0	32.5	39.5

the continental component gradually increases from west to east. The gulf component contributes little at Beatty and western stations, but makes significant contributions at other stations. These changes in relative contribution of various components explain the shift from winter dominated precipitation regimes at the westernmost stations to more uniform seasonal distributions to the east.

DAILY PRECIPITATION DATA

Daily precipitation data available for the climate station network is summarized in Table 11. These data provide a much more detailed characterization of the regional precipitation regime.

Table 11. Daily Precipitation Data.

Station Name	Years of Record	Missing Years	Number of Complete Years
Adaven	1929-1978	1942, 1957, 1959 1971-72, 1975	44
Beatty	1918-1986	1919, 1922, 1934-40, 1943 1954, 1958,1969-72, 1984	52
Bishop	1949-1986	1973	37
Caliente	1929-1984	1930, 1938, 1957, 1967 1969, 1973-78, 1981-82	43
Haiwee	1930-1986	1939, 1945, 1950 1965, 1984	52
Las Vegas	1931-1986	1933, 1936, 1938, 1946-48 1950-52, 1954	46
Tonopah	1955-1986	None	32

Frequency and Average Depth

Methods

The daily frequency of precipitation was calculated for each station at various threshold values: 0.01, 0.10, 0.25, 0.50, and 1.00 inches. The results, averaged on a monthly, seasonal, and yearly basis, are shown in Tables 12 to 18. Values in these tables are given as days per month with precipitation at or above the given threshold. Average daily storm depths were calculated on a monthly, seasonal, and annual basis. The results, shown in Table 19, are given as the average amount of precipitation occurring on wet days.

Results and Discussion

In general, winter and spring have considerably more rainy days (at the 0.01 inch level) than summer and fall. Winter has the most rainy days of any season at all stations except Tonopah, which has a spring season maximum.

The rainiest month (at the 0.01 inch level) occurs between January and March at all stations. January is the rainiest month at Bishop and Las Vegas; February is the rainiest month at Adaven and Haiwee; and March is the rainiest month at Beatty, Caliente, and Tonopah.

In general, winter and fall have greater average storm depths than spring and summer. However, average daily storm depths are greater during summer than winter at three stations: Caliente, Las Vegas, and Tonopah.

Table 12. Adaven, Daily Frequency of Precipitation. Table Values Given as Number of Days with Precipitation Depths at or Above Threshold Value.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	3.98	2.86	1.79	0.82	0.18
Jan	5.23	3.75	1.98	1.00	0.20
Feb	5.41	4.02	2.48	1.09	0.25
Mar	4.95	3.55	2.07	0.93	0.18
Apr	4.59	3.11	1.75	0.82	0.16
May	3.16	2.05	1.07	0.32	0.05
Jun	2.27	1.41	0.82	0.43	0.07
Jul	4.02	2.70	1.27	0.52	0.14
Aug	4.54	2.86	1.57	0.70	0.18
Sep	2.05	1.50	0.84	0.50	0.14
Oct	2.48	1.86	1.16	0.64	0.14
Nov	2.82	2.21	1.27	0.73	0.23
Win	14.62	10.63	6.25	2.91	0.63
Spg	12.70	8.71	4.89	2.07	0.39
Sum	10.83	6.97	3.66	1.65	0.39
Fal	7.35	5.57	3.27	1.87	0.51
Year	45.50	31.88	18.07	8.50	1.92

Table 13. Beatty, Daily Frequency of Precipitation. Table Values Given as Number of Days with Precipitation Depths at or Above Threshold Value.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	2.50	1.37	0.65	0.23	0.02
Jan	2.83	1.69	0.87	0.31	0.02
Feb	2.73	1.69	0.98	0.42	0.10
Mar	3.46	1.77	0.87	0.27	0.06
Apr	2.23	1.23	0.56	0.17	0.04
May	1.98	0.98	0.46	0.13	0.02
Jun	0.87	0.46	0.23	0.06	0.02
Jul	1.42	0.67	0.21	0.08	0.00
Aug	1.79	0.79	0.35	0.19	0.06
Sep	1.10	0.67	0.38	0.15	0.04
Oct	1.48	0.85	0.56	0.08	0.02
Nov	1.94	1.13	0.67	0.15	0.08
Win	8.06	4.75	2.50	0.96	0.14
Spg	7.67	3.98	1.89	0.57	0.12
Sum	4.08	1.92	0.79	0.33	0.08
Fal	4.52	2.65	1.61	0.38	0.14
Year	24.33	13.30	6.79	2.24	0.48

Table 14. Bishop, Daily Frequency of Precipitation. Table Values Given as Number of Days with Precipitation Depths at or Above Threshold Value.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	3.11	1.70	1.03	0.57	0.27
Jan	3.95	2.11	1.13	0.73	0.33
Feb	3.27	1.70	1.14	0.54	0.16
Mar	3.16	1.05	0.57	0.24	0.08
Apr	2.46	0.84	0.43	0.16	0.05
May	2.54	0.84	0.35	0.08	0.00
Jun	1.43	0.41	0.11	0.08	0.00
Jul	2.46	0.68	0.19	0.03	0.00
Aug	1.84	0.49	0.14	0.00	0.00
Sep	1.97	0.73	0.22	0.05	0.00
Oct	1.68	0.57	0.16	0.03	0.00
Nov	2.73	1.32	0.73	0.49	0.03
Win	10.33	5.51	3.30	1.84	0.76
Spg	8.16	2.73	1.35	0.48	0.13
Sum	5.73	1.58	0.44	0.11	0.00
Fal	6.38	2.62	1.11	0.57	0.03
Year	30.60	12.44	6.20	3.00	0.92

Table 15. Caliente, Daily Frequency of Precipitation. Table Values Given as Number of Days with Precipitation Depths at or Above Threshold Value.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	4.30	2.49	1.05	0.33	0.05
Jan	4.35	2.44	0.95	0.28	0.00
Feb	4.91	2.65	1.02	0.23	0.00
Mar	5.00	2.77	1.30	0.28	0.02
Apr	4.28	2.19	1.09	0.33	0.05
May	3.58	1.75	0.58	0.16	0.02
Jun	1.93	0.84	0.44	0.14	0.00
Jul	4.79	2.37	1.26	0.40	0.07
Aug	4.95	2.72	1.49	0.44	0.07
Sep	2.54	1.35	0.86	0.35	0.02
Oct	3.42	1.95	1.09	0.42	0.09
Nov	2.93	1.79	0.95	0.42	0.05
Win	13.56	7.58	3.02	0.84	0.05
Spg	12.86	6.71	2.97	0.77	0.09
Sum	11.67	5.93	3.19	0.98	0.14
Fal	8.89	5.09	2.90	1.19	0.16
Year	46.98	25.31	12.08	3.78	0.44

Table 16. Haiwee, Daily Frequency of Precipitation. Table Values Given as Number of Days with Precipitation Depths at or Above Threshold Value.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	3.17	2.12	1.25	0.65	0.27
Jan	3.56	2.12	1.35	0.73	0.29
Feb	3.73	2.40	1.69	0.92	0.35
Mar	3.48	1.87	1.02	0.71	0.15
Apr	1.94	0.87	0.46	0.15	0.08
May	1.42	0.56	0.31	0.13	0.00
Jun	0.62	0.27	0.13	0.04	0.00
Jul	1.40	0.65	0.17	0.02	0.00
Aug	1.31	0.60	0.38	0.19	0.06
Sep	1.23	0.67	0.37	0.13	0.02
Oct	1.25	0.44	0.27	0.13	0.00
Nov	2.06	1.27	0.62	0.35	0.13
Win	10.46	6.64	4.29	2.30	0.91
Spg	6.84	3.30	1.79	0.99	0.23
Sum	3.33	1.52	0.68	0.25	0.06
Fal	4.54	2.38	1.26	0.61	0.15
Year	25.17	13.84	8.02	4.15	1.35

Table 17. Las Vegas, Daily Frequency of Precipitation. Table Values Given as Number of Days with Precipitation Depths at or Above Threshold Value.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	2.76	1.50	0.65	0.22	0.00
Jan	3.07	1.70	0.80	0.15	0.00
Feb	3.02	1.69	0.85	0.37	0.02
Mar	2.63	1.11	0.50	0.28	0.02
Apr	1.80	0.76	0.33	0.09	0.00
May	1.28	0.61	0.33	0.07	0.00
Jun	0.61	0.30	0.09	0.02	0.00
Jul	2.19	0.89	0.46	0.20	0.11
Aug	2.81	1.22	0.74	0.30	0.13
Sep	1.80	0.94	0.37	0.17	0.09
Oct	1.76	0.61	0.26	0.09	0.00
Nov	1.85	0.87	0.48	0.28	0.07
Win	8.85	4.89	2.30	0.74	0.02
Spg	5.71	2.48	1.16	0.44	0.02
Sum	5.61	2.41	1.29	0.52	0.24
Fal	5.41	2.42	1.11	0.54	0.16
Year	25.58	12.20	5.86	2.24	0.44

Table 18. Tonopah, Daily Frequency of Precipitation. Table Values Given as Number of Days with Precipitation Depths at or Above Threshold Value.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	2.34	1.03	0.16	0.03	0.00
Jan	3.62	1.25	0.28	0.00	0.00
Feb	3.22	1.41	0.53	0.22	0.06
Mar	4.10	1.38	0.63	0.06	0.00
Apr	2.84	1.00	0.35	0.06	0.00
May	3.31	1.53	0.91	0.16	0.00
Jun	2.06	0.94	0.38	0.16	0.00
Jul	3.38	1.72	0.69	0.38	0.16
Aug	3.41	1.59	0.72	0.25	0.06
Sep	2.72	1.25	0.62	0.31	0.06
Oct	2.06	1.16	0.63	0.28	0.00
Nov	2.81	1.37	0.66	0.16	0.06
Win	9.18	3.69	0.97	0.25	0.06
Spg	10.25	3.91	1.89	0.28	0.00
Sum	8.85	4.25	1.79	0.79	0.22
Fal	7.59	3.78	1.91	0.75	0.12
Year	35.87	15.63	6.56	2.07	0.40

Table 19. Average Daily Storm Depths (in Inches) for Days on which at Least 0.01 inches of Precipitation was Recorded.

	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Dec	0.31	0.19	0.32	0.19	0.32	0.17	0.10
Jan	0.28	0.20	0.29	0.17	0.32	0.16	0.09
Feb	0.31	0.26	0.28	0.16	0.35	0.20	0.15
Mar	0.29	0.17	0.14	0.18	0.26	0.16	0.11
Apr	0.26	0.18	0.14	0.17	0.19	0.12	0.11
May	0.23	0.15	0.11	0.13	0.17	0.15	0.16
Jun	0.26	0.18	0.10	0.17	0.16	0.13	0.15
Jul	0.25	0.14	0.08	0.19	0.12	0.19	0.19
Aug	0.27	0.18	0.08	0.20	0.24	0.21	0.18
Sep	0.34	0.26	0.11	0.22	0.21	0.18	0.18
Oct	0.35	0.20	0.10	0.24	0.17	0.12	0.20
Nov	0.35	0.21	0.22	0.23	0.29	0.21	0.17
Win	0.30	0.22	0.30	0.17	0.33	0.18	0.11
Spg	0.27	0.17	0.13	0.16	0.22	0.15	0.13
Sum	0.26	0.16	0.09	0.19	0.17	0.19	0.18
Fal	0.35	0.22	0.16	0.23	0.23	0.17	0.18
Year	0.29	0.19	0.18	0.18	0.26	0.17	0.15

Calculating the daily frequencies of precipitation and average daily storm depths is the first step in defining the daily structure of the precipitation regime. However, it is also necessary to examine the occurrence of sequences of wet and dry days, as well as the distribution of daily storm depths. Wet and dry day sequences are important in determining antecedent moisture conditions, which have significant effects on the process of infiltration. The distribution of daily storm depths is equally important, because only the heaviest precipitation events are likely to contribute to recharge.

Markov Chain Analysis

Methods

A Markov chain model was first applied to daily rainfall occurrence by Gabriel and Neumann (1962). It can be applied to the observed frequency distributions of wet and dry spells. A wet spell is defined as one or more consecutive days with rain, and a dry spell as one or more consecutive days without rain. A rainy day is defined as a 24 hour period having at least 0.01 inches of precipitation.

Markov chain models are based on conditional probabilities. First order models assume that the probability of precipitation occurring on any given day depends only on whether or not precipitation occurred on the previous day (Weiss, 1964). Second order models consider the two previous days, whereas third order models consider the three previous days. These models are based on the assumption that weather patterns tend to be persistent; and there is a greater probability of precipitation on a given day if a wet day occurred the previous day.

Results and Discussion

The results of Markov chain analysis on the climate station network are shown in Appendices A and B. These tables compare observed and expected (from modeling) frequencies of wet and dry spells of various lengths for each season. The chi-square goodness of fit test was used to check for statistical significance. Appendices A and B show the results for chi-square goodness of fit tests at the 0.05 level.

Wet day sequences are modeled quite well by a first order Markov chain. Goodness of fit tests indicate that the null hypothesis is rejected for 3 of 28 seasonal data sets at the 0.05 level. The null hypothesis states that the observed distribution of wet day sequences is given by a first-order Markov chain. These results indicate an excellent match between observed and expected values. A consistent pattern occurs among the data sets for which the null hypothesis is rejected at the 0.05 level. Each of these data sets has greater expected than observed values for one day sequences, greater observed than expected values for two day sequences, and greater expected than observed values for three day sequences . This indicates a tendency for wet weather to persist for two days more often than expected.

Dry day sequences are modeled best by a third-order Markov chain. Goodness of fit tests indicate that the null hypothesis is rejected for 5 of 28 seasonal data sets at the 0.05 level. The null hypothesis states that the observed distribution of dry day sequences is given by a third-order Markov chain. The third-order chain provides a better fit than the first-order chain due to the more random nature of observed dry day sequences. There is no consistent pattern among the data sets for which the null hypothesis is rejected.

Observed Wet Day Sequence Distributions

Examination of observed wet-day sequence distributions at the various stations reveals some interesting seasonal patterns. Defining an event as any sequence of consecutive wet days, the percentage of events that occur as a given length can be calculated (see Table 20). Results indicate a tendency for winter to have a smaller percentage of one day events compared to other seasons. Also, in most cases summer has the highest percentage of one day events. Similarly, winter has a greater tendency toward multiple day events compared to other seasons.

These results can be explained in terms of regional synoptic patterns. The greater tendency toward multiple day events during winter is caused by the persistent nature of Pacific fronts. This storm type is characteristically large in areal extent and often remains in the area longer than one day. Conversely, summer convective storms generally have durations on the order of a few hours or less. Thus, it is not surprising to have a higher percentage of one day events in summer months.

Spring and fall are seasons of complex interactions between two or three different storm types. Spring season precipitation may be caused by Pacific fronts or continental cyclones. It is also a season of markedly contrasting air masses interacting together. Large temperature differences between adjacent air masses generally cause storm systems to move through an area more quickly than in winter. This results in relatively higher percentages of one day events and fewer events of longer duration (as compared to winter).

Fall season precipitation is contributed by any of the three storm types. The fall season has a tendency toward markedly contrasting air masses (like spring) which move storms through quickly. September is also a month with short

Table 20. Percentage of precipitation events at various durations.

Season	Duration (Days)	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Winter	1	63	67	53	58	57	62	63
	2	24	23	33	29	28	25	25
	3	8	5	7	6	7	8	7
	4 -	6	5	7	7	8	5	4
Spring	1	66	68	61	60	70	75	66
	2	21	22	31	22	21	19	26
	3	7	6	5	11	6	4	5
	4 -	6	4	2	7	3	2	3
Summer	1	62	75	69	61	73	76	64
	2	24	20	22	22	19	17	25
	3	9	4	7	10	6	5	7
	4 -	5	1	3	7	2	2	5
Fall	1	66	68	62	60	55	73	61
	2	25	23	28	25	33	23	27
	3	5	5	6	10	8	3	7
	4 -	4	4	5	6	3	1	5

duration convective storms. Therefore, one would again expect higher percentages of one day events during fall (as compared to winter).

Modeling Storm Depths with the Weibull Distribution

Methods

The distributions of daily storm depths were modeled by categorizing the observed data into 0.05 inch blocks. Thus, all daily storm depths between 0.01 and 0.05 inches were grouped together, 0.06 to 0.10 inches, 0.11 to 0.15 inches, etc. This provided the observed daily storm depth distribution. Three different distributions were applied to these data: exponential, gamma, and Weibull. The best fit, according to the chi-square goodness of fit test, was obtained with the Weibull distribution. Parameter estimates for the Weibull distribution were obtained using the method of moments (see Appendix C).

Results and Discussion

Appendix C shows the observed and expected values modeled with the Weibull distribution, and the chi-square goodness of fit test run on the results. The chi-square tests indicate that the null hypothesis is rejected for 12 of 28 data sets at the 0.05 level. The null hypothesis states that the observed distribution of storm depths is given by the Weibull distribution. The most difficult aspect of the observed distribution to model is that there are many more observations in the 0.01 to 0.05 inch category than the model distribution can predict.

Observed Daily Storm Depth Distributions

Examination of the observed distributions of daily storm depths reveal some general seasonal patterns. Table 21 shows a seasonal breakdown of the percentage of daily storm depths falling in various categories. The percentage of daily depths falling into the 0.01 to 0.05 inch category steadily increases from a minimum in winter to a higher percentage in spring, and a maximum in summer. There is a decline in percentage of 0.01 to 0.05 inch depths going into the fall months. The percentage of daily depths in the 0.31 inches and greater category is generally higher in winter and fall. However, Caliente, Las Vegas, and Tonopah have high percentages of daily depths in the 0.31 inches and greater category during summer months.

Table 21. Percentage of daily storm depths falling in various categories.

Season	Depth (inches)	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
	0.01 - 0.05	17	29	36	29	24	36	49
	0.06 - 0.10	17	17	12	20	14	13	13
Winter	0.11 - 0.20	19	18	16	22	17	20	22
	0.21 - 0.30	13	12	9	13	10	12	9
	0.31 -	34	25	28	16	35	18	6
	0.01 - 0.05	19	37	54	36	39	43	50
	0.06 - 0.10	18	16	16	16	15	19	15
Spring	0.11 - 0.20	20	19	12	21	15	16	13
	0.21 - 0.30	12	11	5	12	9	7	10
	0.31 -	31	17	13	15	21	15	12
	0.01 - 0.05	22	40	61	37	40	45	36
	0.06 - 0.10	18	17	16	15	16	15	21
Summer	0.11 - 0.20	23	19	12	16	17	14	18
	0.21 - 0.30	9	9	6	11	10	6	8
	0.31 -	28	15	5	21	17	20	17
	0.01 - 0.05	15	31	45	33	34	43	40
	0.06 - 0.10	12	14	15	12	16	17	13
Fall	0.11 - 0.20	23	13	17	19	18	15	19
	0.21 - 0.30	13	17	8	10	8	9	10
	0.31 -	37	26	14	26	24	16	19

Regional synoptic patterns are again in general agreement with the observed distributions. Pacific fronts are usually stronger and more intense during winter months when the jet stream is farthest south. This results in longer duration and higher intensity precipitation events over a 24 hour period. Therefore, Pacific fronts will tend to produce greater daily depths during winter months than in either spring or fall. Spring and fall months are generally characterized by weaker, less intense Pacific fronts caused by the more northerly position of the jet stream.

Summer months are characterized by convective thunderstorm activity. A vast majority of these events are brief and sparse in nature, resulting in daily depths in the 0.01 to 0.05 category. However, areas of more frequent convective activity, such as extreme eastern and extreme southern Nevada, tend to get more intense and longer duration thunderstorms. These types of thunderstorms may produce locally large daily depths, as seen at Caliente, Las Vegas, and Tonopah.

SOUTHERN GREAT BASIN PALEOCLIMATOLOGY

The Quaternary paleoclimatic conditions of the southwestern United States have been studied extensively using various methods. Three studies in particular have attempted to estimate climatic conditions as they existed 18,000 years ago (during the last glacial maximum or LGM) within the study area encompassed by the climate station network. These studies are: 1) Spaulding's (1983) packrat midden study; 2) Mifflin and Wheat's (1979) pluvial lake shorelines study, and 3) the Kent State (1985) computer model study. The results of these studies provide a basis for defining wet years in the historical record.

SPAULDING'S STUDY

Spaulding (1983) examined plant macrofossils from ancient packrat middens around the Nevada Test Site to determine climatic conditions over the past 45,000 years. It was assumed that packrat middens can provide a reasonably accurate history of late Quaternary environments. Plant macrofossils were radiocarbon dated to allow reconstruction of past vegetation and a chronology of its change over the years. Spaulding examined 100 different plant fossil assemblages from southern Nevada covering 5,250 feet of vertical relief.

Spaulding concluded that climatic conditions over the past 45,000 years were both cooler and wetter. The greatest departure from present conditions occurred approximately 18,000 years ago during the LGM (see Table 22). Plant fossil evidence suggests an average temperature drop of 11 to 13 °F, and a precipitation increase of 30 to 40 percent compared to modern conditions. A seasonal breakdown shows a 60 to 70 percent increase in winter precipitation and a 40 to 50 percent decrease in summer precipitation.

MIFFLIN AND WHEAT'S STUDY

Mifflin and Wheat (1979) mapped pluvial lake shorelines and distributions, and established age relationships in order to estimate pluvial climates in closed basins. The surface areas of pluvial lakes were taken as quantitative measures of the climate existing at that time.

Mifflin and Wheat proceeded to develop a set of equations based on observed evidence. Results of their study indicate a 5 °F decrease in mean annual temperature, and a 70 percent increase in precipitation under full pluvial conditions. However, they indicated a range of precipitation increases from 50 to 80 percent, depending on location, with southern Nevada averaging closer to 50 percent.

Table 22. Comparison of Paleoclimate Estimates for 18,000 Years Ago. Precipitation Given as Percent Change from Modern; Temperature in °F.

Study	Annual ppt	Winter ppt	Summer ppt	Annual temp	Winter temp	Summer temp
Spaulding(1983)	+30 to +40	+60 to +70	-40 to -50	-11 to -13	-11	-13 to -14
Mifflin and Wheat (1979)	+55	-	-	-5	-	-
Kent State (1985)	+35	+24	+42	+2	+5	-2

KENT STATE STUDY

The Kent State computer model, developed by Craig and Roberts (1985), is a regression based statistical model. It provides mean monthly values of precipitation and temperature for southern Nevada and southeastern California, and can be solved under modern or LGM conditions. The model uses a 7.5 minute grid spacing to provide individual climate estimates for each grid square. Sea surface temperature, wind direction, and topography are important in developing the regression equations upon which the model is based.

Results from the modeling study (see Table 22) indicate a 35 percent increase in annual precipitation and a 2 °F increase in mean annual temperature under LGM conditions. A seasonal breakdown shows a 42 percent increase in summer (June to August) precipitation and a 24 percent increase in winter (December to February) precipitation. Temperatures were slightly cooler in summer and warmer in winter.

DISCUSSION

The overall results of the three paleoclimate studies indicate an increase for annual precipitation in the range of 30 to 55 percent during LGM conditions. However, there is not good agreement concerning the seasonal distribution of precipitation under pluvial conditions. Temperature estimates derived from these paleoclimatic studies are also not in agreement, although the general consensus is that pluvial conditions were cooler than present.

THE ANALOGUE TECHNIQUE

METHODS

An analogue method makes the assumption that present day climatic variability includes extreme events which were significantly more frequent in the past to comprise a different mean climatic regime (Barry, 1981). This idea has been used by some to map hypothetical patterns of LGM atmospheric circulation conditions (Willett, 1950; Lamb, 1964). This study uses the analogue approach to compare the seasonal, monthly, and daily distribution of precipitation under current mean conditions versus current extreme-wet conditions. The current extreme-wet conditions are considered to be representative of past mean conditions.

The paleoclimatic studies are used as a basis to define extreme wet years in this study. The three previous studies indicate an increase in annual precipitation of 30 to 55 percent during LGM over modern conditions in the southern Great Basin. For the climate station network used in this study it was necessary to use the wettest 1/3 of the years in each data set. For example, a precipitation data set with 60 years of record would require the 20 wettest years to define current extreme-wet conditions (equal to past mean regime). The 20 wettest years are averaged together to define extreme conditions. Table 23 shows the percent increase in annual precipitation obtained at each station when defining extreme wet years as 1/3 of the entire data set. The increases in annual precipitation ranged from 34 to 69 percent, very close to the range of 30 to 55 percent estimated in the literature.

Although there is general agreement in the literature concerning the increase in annual precipitation under LGM conditions, it is possible that climatic conditions may have been even wetter than these studies indicate. Therefore, it is desirable to use this analogue approach to estimate climatic conditions under an even wetter regime. This can be accomplished using 1/2 of the years previously defined as extreme wet years - the wettest 1/6 of the years in the entire record. For example, a data set with 60 years of record would require the wettest 10 years to define current extreme-wet conditions for this scenario. Table 23 shows the range of increases in annual precipitation, 49 to 103 percent, obtained using 1/6 of the record. Tables 24 and 25 show the monthly, seasonal, and annual mean precipitation for data sets representing the wettest (1/3) and wettest (1/6) years, respectively.

Table 23. Definition of Extreme Wet Year Data Sets, and Percent Increase in Annual precipitation Represented by Each Data Set.

Station	Total Years of Record	Wettest 1/3		Wettest 1/6	
		Number of Years	Percent Increase	Number of Years	Percent Increase
Adaven	62	21	34	11	51
Beatty	62	21	52	11	75
Bishop	42	14	66	7	103
Caliente	55	18	35	9	49
Haiwee	61	20	69	10	103
Las Vegas	80	27	49	14	72
Tonopah	32	11	44	5	69

RESULTS AND DISCUSSION

Clustering of Wet Years

Wet years were analyzed to determine whether or not they tend to occur in groups. Years comprising the wettest (1/3) data sets for each station are plotted in Figure 11. The runs test was applied for each station to test for randomness in the sequential occurrence of wet and non-wet (middle 1/3 and driest 1/3) years. The observed number of runs was tested against the expected number of runs for randomness. The null hypothesis, which states that runs of wet and non-wet years are random, was tested at the 0.05 level of significance. Table 26 shows results of the runs tests.

Table 24. Mean Monthly, Seasonal, and Annual Precipitation (Inches) for the Wettest (1/3) Years.

	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Dec	1.84	0.65	1.73	0.74	1.40	0.57	0.32
Jan	1.79	1.06	2.31	1.23	1.90	0.98	0.45
Feb	2.00	1.10	2.05	1.26	2.46	0.88	0.69
Mar	2.05	1.04	0.84	1.47	1.69	0.64	0.76
Apr	1.53	0.71	0.50	1.08	0.64	0.32	0.46
May	0.71	0.43	0.21	0.65	0.24	0.24	0.55
Jun	0.67	0.23	0.19	0.51	0.13	0.22	0.31
Jul	1.28	0.26	0.14	1.25	0.21	0.63	1.21
Aug	1.42	0.41	0.15	1.12	0.47	0.76	0.99
Sep	0.85	0.47	0.23	0.86	0.44	0.53	0.75
Oct	1.24	0.30	0.35	1.17	0.52	0.34	0.48
Nov	1.33	0.66	0.64	1.02	0.73	0.51	0.65
Win	5.63	2.81	6.09	3.23	5.76	2.43	1.46
Spg	4.29	2.18	1.55	3.20	2.57	1.20	1.77
Sum	3.37	0.90	0.48	2.88	0.81	1.61	2.51
Fal	3.42	1.43	1.22	3.05	1.69	1.38	1.88
Year	16.71	7.32	9.34	12.36	10.83	6.62	7.62

Table 25. Mean Monthly, Seasonal, and Annual Precipitation (Inches) for the Wettest (1/6) Years.

	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Dec	1.51	0.74	2.83	0.84	2.03	0.63	0.34
Jan	2.35	1.32	3.08	0.89	2.64	1.29	0.50
Feb	2.31	1.52	2.30	1.36	2.55	1.09	0.83
Mar	2.77	1.47	0.97	1.60	2.13	0.79	1.26
Apr	1.96	0.87	0.62	1.40	0.74	0.39	0.89
May	0.89	0.16	0.14	0.60	0.10	0.30	0.85
Jun	0.94	0.17	0.06	0.45	0.14	0.14	0.11
Jul	1.23	0.35	0.19	1.77	0.28	0.74	0.67
Aug	1.49	0.34	0.13	1.16	0.63	0.81	0.85
Sep	1.22	0.49	0.21	1.19	0.34	0.60	1.17
Oct	1.08	0.36	0.52	1.44	0.85	0.34	0.47
Nov	1.06	0.61	0.42	0.97	0.57	0.50	1.03
Win	6.17	3.58	8.21	3.09	7.22	3.01	1.67
Spg	5.62	2.50	1.73	3.60	2.97	1.48	3.00
Sum	3.66	0.86	0.38	3.38	1.05	1.69	1.63
Fal	3.36	1.46	1.15	3.60	1.76	1.44	2.67
Year	18.81	8.40	11.47	13.67	13.00	7.62	8.97

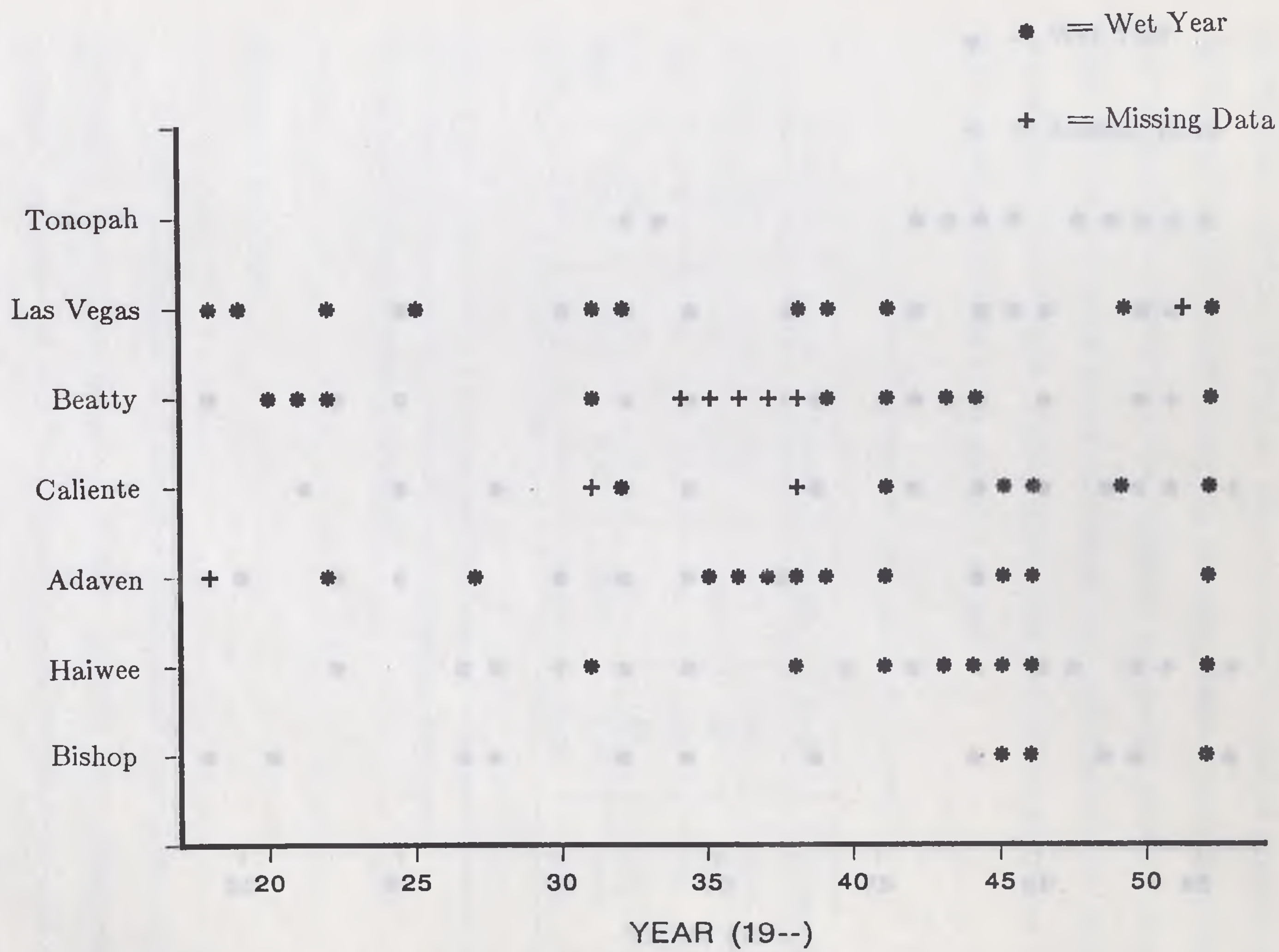


Figure 11. Wet and Non-wet Years for Each Station.

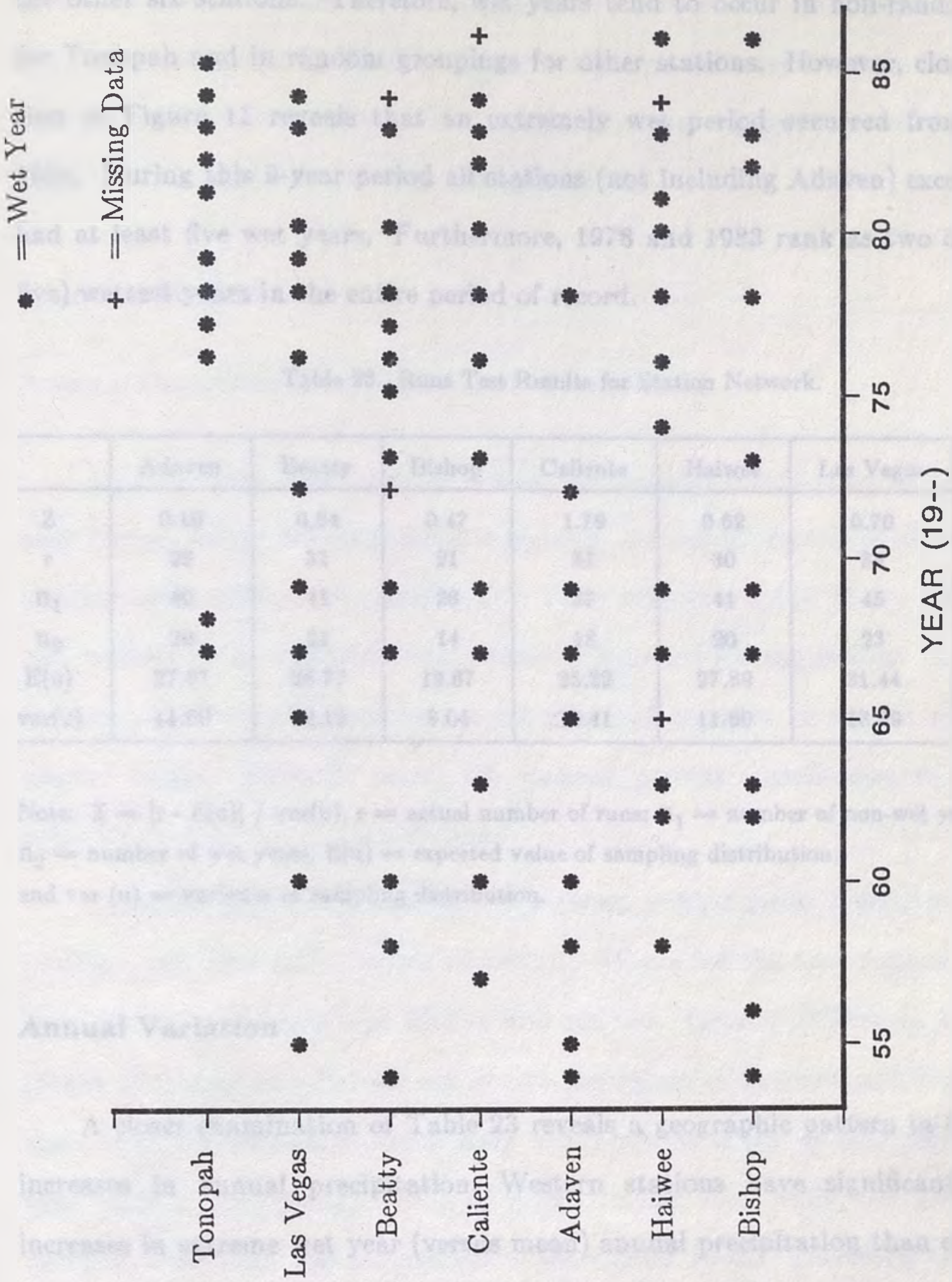


Figure 11. Wet and Non-wet Years for Each Station.

The null hypothesis was rejected for Tonopah, and failed to be rejected for the other six stations. Therefore, wet years tend to occur in non-random groups for Tonopah and in random groupings for other stations. However, closer inspection of Figure 11 reveals that an extremely wet period occurred from 1976 to 1984. During this 9-year period all stations (not including Adaven) except Bishop had at least five wet years. Furthermore, 1978 and 1983 rank as two of the (top five) wettest years in the entire period of record.

Table 26. Runs Test Results for Station Network.

	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Z	0.10	0.64	0.47	1.79	0.62	0.70	-3.37
r	28	31	21	31	30	34	7
n_1	40	41	28	37	41	45	21
n_2	20	21	14	18	20	23	11
E(u)	27.67	28.77	19.67	25.22	27.89	31.44	15.44
var(u)	11.60	12.19	8.04	10.41	11.60	13.39	6.26

Note: $Z = [r - E(u)] / var(u)$; r = actual number of runs; n_1 = number of non-wet years; n_2 = number of wet years; E(u) = expected value of sampling distribution; and var (u) = variance of sampling distribution.

Annual Variation

A closer examination of Table 23 reveals a geographic pattern in the percent increases in annual precipitation. Western stations have significantly greater increases in extreme wet year (versus mean) annual precipitation than eastern stations. Precipitation at Bishop and Haiwee increases 66 and 69 percent for the wettest (1/3) years, compared to 34 percent and 35 percent for Adaven and Caliente. Similarly, precipitation at both Bishop and Haiwee increases 103 percent for the wettest (1/6) years, compared to 51 percent and 49 percent for

Adaven and Caliente. Beatty, with its more central location, increases its precipitation 52 percent for the wettest (1/3) and 75 percent for the wettest (1/6) years. The increases shown for Beatty are approximately midway between those for the western and eastern stations. The percent increases for extreme wet years at Las Vegas and Tonopah are close to those for Beatty.

Seasonal Variation

Seasonal Contribution to Total Annual Precipitation

An important consideration is how the seasonal distribution of precipitation may change under different climatic regimes. In this study the precipitation data sets for each station are grouped into three subsets - driest (1/3), middle (1/3), and wettest (1/3). An additional subset is included for the wettest (1/6) at each station. The years in each subset are averaged together to obtain seasonal and annual means. Table 27 shows the seasonal percent contribution to the annual total for each subset at each station.

Table 28 provides a comparison between annual mean precipitation for the middle years and entire period of record. Means for the two data sets are very close for all stations except Bishop and Haiwee. Greater differences between the means at Bishop and Haiwee are due to the nature of extreme wet years at those stations. The western stations have wet years as much as 300 percent greater than their annual (entire period of record) mean. Meanwhile, dry years can not decrease more than 100 percent below the annual mean. Therefore, the mean for the middle years is below the mean for the entire period of record. Wet years at other stations do not increase as much as 300 percent above the annual mean.

Table 27. Seasonal Percent Contributions to Annual Means for the Driest (1/3), Middle (1/3), Wettest (1/3), and Wettest (1/6) Years.

Station	Subset	Number of Years	Range (Inches)	Annual Mean (In.)	Percent of Annual Mean			
					Winter	Spring	Summer	Fall
Adaven	Driest 1/3	21	5.75 - 10.55	8.47	34.9	22.2	20.1	22.8
	Middle 1/3	20	10.82 - 13.55	12.21	30.2	28.7	24.1	17.0
	Wettest 1/3	21	13.65 - 23.60	16.71	33.7	25.7	20.2	20.5
	Wettest 1/6	11	15.19 - 23.60	18.81	32.8	29.9	19.5	17.9
Beatty	Driest 1/3	21	0.70 - 3.38	2.37	46.0	23.6	14.8	15.6
	Middle 1/3	20	3.65 - 5.59	4.79	37.0	24.4	13.2	25.5
	Wettest 1/3	21	5.78 - 12.15	7.32	38.4	29.8	12.3	19.5
	Wettest 1/6	11	6.60 - 12.15	8.40	42.6	29.8	10.2	17.4
Bishop	Driest 1/3	14	1.50 - 3.66	2.60	36.9	24.6	15.4	23.1
	Middle 1/3	14	3.86 - 6.36	4.96	42.7	20.0	9.7	27.6
	Wettest 1/3	14	6.37 - 17.37	9.34	65.2	16.6	5.1	13.1
	Wettest 1/6	7	8.58 - 17.37	11.47	71.6	15.1	3.3	10.0
Caliente	Driest 1/3	18	2.24 - 8.07	6.15	32.2	17.1	26.5	24.2
	Middle 1/3	19	8.10 - 10.43	9.05	21.4	30.2	23.9	24.5
	Wettest 1/3	18	10.48 - 18.15	12.36	26.1	25.9	23.3	24.7
	Wettest 1/6	9	11.85 - 18.15	13.67	22.6	26.3	24.7	26.3
Haiwee	Driest 1/3	20	1.56 - 4.02	2.80	45.8	24.6	12.5	17.1
	Middle 1/3	21	4.05 - 7.53	5.60	45.7	21.1	9.3	23.9
	Wettest 1/3	20	7.54 - 17.80	10.85	53.2	23.7	7.5	15.6
	Wettest 1/6	10	10.09 - 17.80	13.00	55.5	22.8	8.1	13.5
Las Vegas	Driest 1/3	27	1.12 - 3.27	2.39	28.0	19.2	28.0	24.7
	Middle 1/3	26	3.28 - 4.97	4.32	33.8	19.2	26.4	20.6
	Wettest 1/3	27	5.02 - 10.00	6.62	36.7	18.1	24.3	20.8
	Wettest 1/6	14	6.63 - 10.00	7.62	39.5	19.4	22.2	18.9
Tonopah	Driest 1/3	11	2.06 - 4.13	3.13	20.8	24.9	31.0	23.3
	Middle 1/3	10	4.15 - 6.01	5.08	19.9	26.0	23.2	30.9
	Wettest 1/3	11	6.06 - 10.65	7.62	19.2	23.2	32.9	24.7
	Wettest 1/6	5	7.14 - 10.65	8.97	18.6	33.4	18.2	29.8

Table 28. Comparison of Annual Mean Precipitation for the Entire Period of Record and Middle (1/3) Years.

Station	Annual Mean PPT (Inches) for Entire Period of Record	Annual Mean PPT (Inches) for Middle (1/3) Years	Middle (1/3)/Entire Record
Adaven	12.44	12.21	0.98
Beatty	4.81	4.79	1.00
Bishop	5.66	4.96	0.88
Caliente	9.16	9.05	0.99
Haiwee	6.40	5.60	0.88
Las Vegas	4.44	4.32	0.97
Tonopah	5.31	5.08	0.96

The western stations (Bishop and Haiwee) show substantial increases in percent contribution for the winter season under increasingly wetter conditions (see Table 27). Bishop receives 37 percent of its annual total during winter in dry years, 43 percent during winter in average (i.e. middle 1/3) years, 65 percent during winter in wet (1/3) years, and 72 percent during winter in wet (1/6) years. Haiwee receives approximately 46 percent of its annual total during winter in dry to average years, 53 percent during winter in wet (1/3) years, and 56 percent during winter in wet (1/6) years.

Conversely, the western stations show steadily decreasing summer contributions under increasingly wetter conditions. Bishop receives 15 percent of its annual total during summer in dry years, 10 percent during summer in average years, 5 percent during summer in wet (1/3) years, and 3 percent during summer in wet (1/6) years. Similarly, Haiwee receives a greater summer percent contribution during dry years than during wet years.

The spring and fall seasons at Bishop and Haiwee do not show distinct patterns as do winter and summer. The spring season at Bishop shows a steady decrease in percent contribution going from dry to wet years. However, the spring season at Haiwee displays a relatively constant contribution in each subset. The pattern of change in fall season contribution is similar for both stations. The greatest percent contribution for the fall season at Bishop and Haiwee is during average years, whereas the smallest fall percent contribution is during wet years.

Patterns of change in seasonal percent contribution at the northeastern stations (Adaven and Caliente) are less apparent than those for the western stations. In general, the winter contribution to annual totals at Adaven and Caliente is greater during drier years than during wetter years. The spring contribution is greater during wet years as compared to dry years. The summer contribution at Caliente is slightly greater during dry years; whereas at Adaven summer contributes its greatest percentage during average years. Fall contributions at Adaven are slightly greater during dry years, and approximately constant at Caliente.

The patterns of change in seasonal percent contribution at Beatty represent a combination of those observed at western and northeastern stations. Winter at Beatty more closely resembles northeastern sites in that the greatest percent contribution occurs during dry years. The spring season contributes greater percentages of the annual total during wet years. The summer season at Beatty is similar to western stations in that it contributes less during wetter years. The fall season contributes most during average years.

The southern portion of the study area is represented by Las Vegas. The winter season contributes an increasingly higher percentage of annual precipitation in going from drier to wetter climatic regimes. Conversely, the summer season contribution steadily decreases under increasingly wetter conditions. The spring season remains virtually constant under all climatic conditions, whereas fall displays a tendency to contribute a higher percentage of annual precipitation under drier conditions.

Seasonal percent contributions to annual totals at Tonopah do not show any uniform patterns. Summer contributes the greatest percentage during the driest and wettest (1/3) years. Fall contributes the most during the middle years, and spring contributes the most during the wettest (1/6) years. Winter contributes the least under all climatic conditions.

Overall, some similar patterns exist among the stations. Winter contributes significantly greater percentages of the annual total during wet years at the following stations: Bishop, Haiwee, and Las Vegas. Winter contributes less during wet years (compared to dry years) at Adaven, Beatty, Caliente, and Tonopah. Spring contributes greater percentages of the annual total during wet years (compared to dry years) at Adaven, Beatty, and Caliente. The spring percentage is less under wetter conditions at Bishop. Summer contributes smaller percentages of the annual total under increasingly wetter conditions at Beatty, Bishop, Haiwee, and Las Vegas. The fall season contributes less during wet years (as compared to dry years) at Adaven, Bishop, Haiwee, and Las Vegas.

Percent Increase in Seasonal Precipitation

Another method of examining shifts in the seasonal distribution of precipitation is to calculate the percent increase in precipitation for each season during wet years as compared to modern mean conditions (the entire period of record) as given in Tables 29 and 30. During the wettest (1/3) years winter precipitation increases more than other seasons at three stations: Bishop, Haiwee, and Las Vegas. The maximum precipitation increase at Beatty occurs during spring and at Tonopah during summer. Each season has approximately the same percent increase in precipitation at Adaven and Caliente.

Table 29. Percent Annual and Seasonal Increase in Precipitation for the Wettest (1/3) Years Compared to the Entire Period of Record.

Station	Winter	Spring	Summer	Fall	Annual
Adaven	+38	+34	+26	+38	+34
Beatty	+49	+68	+45	+43	+52
Bishop	+99	+45	+7	+18	+66
Caliente	+36	+37	+30	+36	+35
Haiwee	+81	+75	+42	+44	+69
Las Vegas	+60	+45	+41	+45	+49
Tonopah	+36	+37	+61	+35	+44
Average	+57	+49	+36	+37	+50

In general, the greatest precipitation increases for the wettest (1/3) years occur during the season of maximum precipitation under modern mean conditions. The only exception occurs at Beatty which has a winter maximum but a much larger increase in spring season precipitation. The seven station seasonal averages show that winter is the season of maximum increase at 57 percent followed by spring at 49 percent.

The increases in seasonal precipitation for the wettest (1/6) years are given in Table 30. Winter is again the season of maximum increase at Bishop, Haiwee, and Las Vegas. Spring is the season of maximum increase at Adaven, Beatty, and Tonopah. Fall is the season of maximum increase at Caliente. Overall results indicate that spring season precipitation increases nearly as much as winter season precipitation for the wettest (1/6) years.

Table 30. Percent Annual and Seasonal Increase in Precipitation for the Wettest (1/6) Years Compared to the Entire Period of Record.

Station	Winter	Spring	Summer	Fall	Annual
Adaven	+51	+75	+37	+36	+51
Beatty	+89	+92	+39	+46	+75
Bishop	+168	+62	-17	+7	+103
Caliente	+30	+55	+52	+61	+49
Haiwee	+126	+102	+84	+50	+103
Las Vegas	+99	+78	+48	+50	+72
Tonopah	+56	+133	+4	+92	+69
Average	+88	+85	+35	+49	+75

Monthly Variation

Comparing monthly values of precipitation under various climatic conditions, the western stations (Bishop and Haiwee) show very similar patterns (Figures 12 and 13). In general, the only significant differences between wet, average (i.e. middle 1/3), and dry years occur from December to March. The months from April to November make little difference in determining the wet or dry status of a given year at western stations.

December receives the most precipitation during dry years at Bishop and Haiwee. November is an unusually wet month during average years. January and February are the months of maximum precipitation during wet years. The driest time of year under all climatic conditions is either June or July.

A comparison of the two wet climatic regimes, selected for this study, are shown in Figures 12 and 13 for Bishop and Haiwee. Once again the general pattern for the two western stations is quite similar.

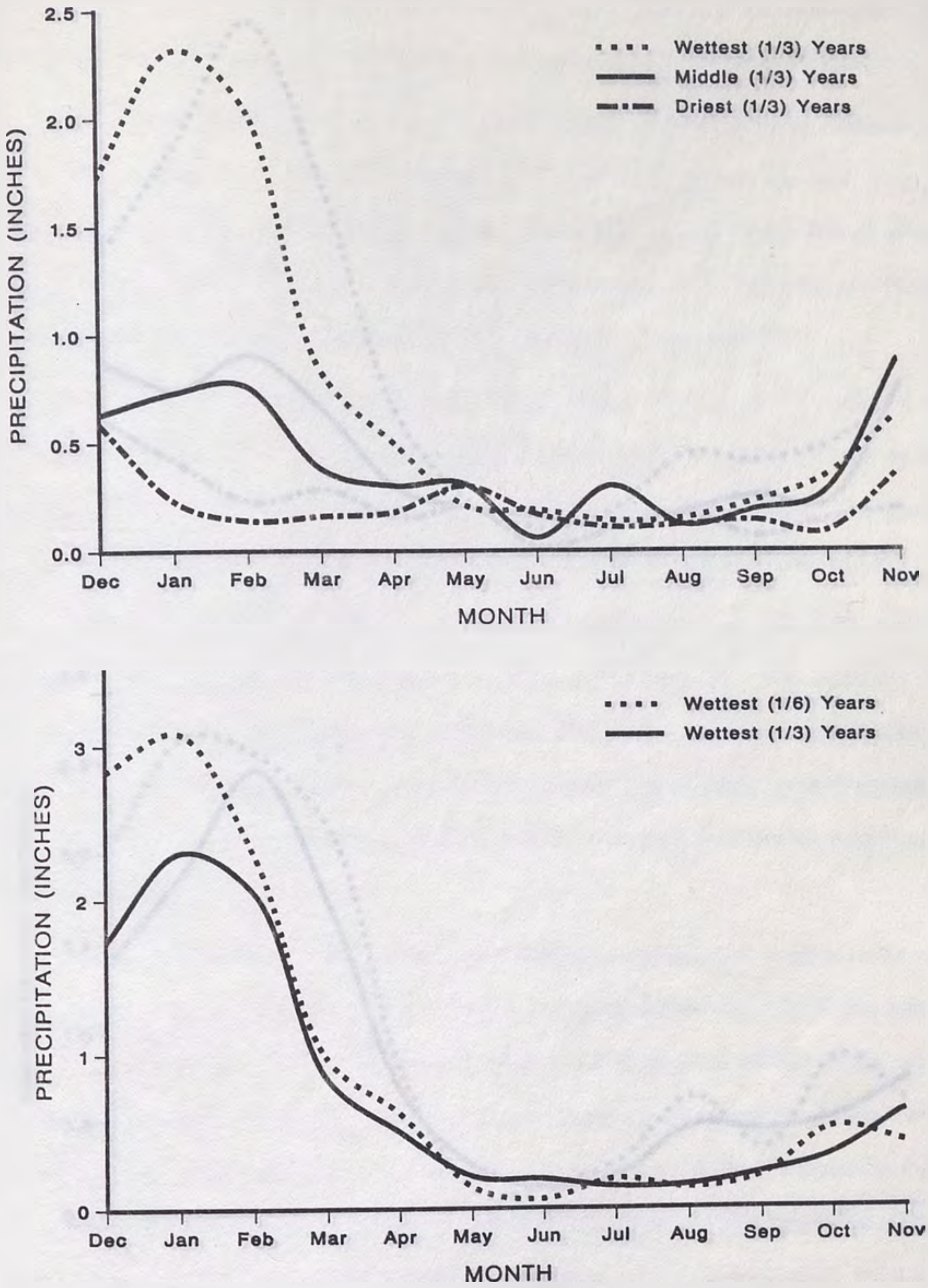


Figure 12. Bishop, Mean Monthly Precipitation Under Various Climatic Conditions: Wettest (1/6), Wettest (1/3), Middle (1/3), and Driest (1/3).

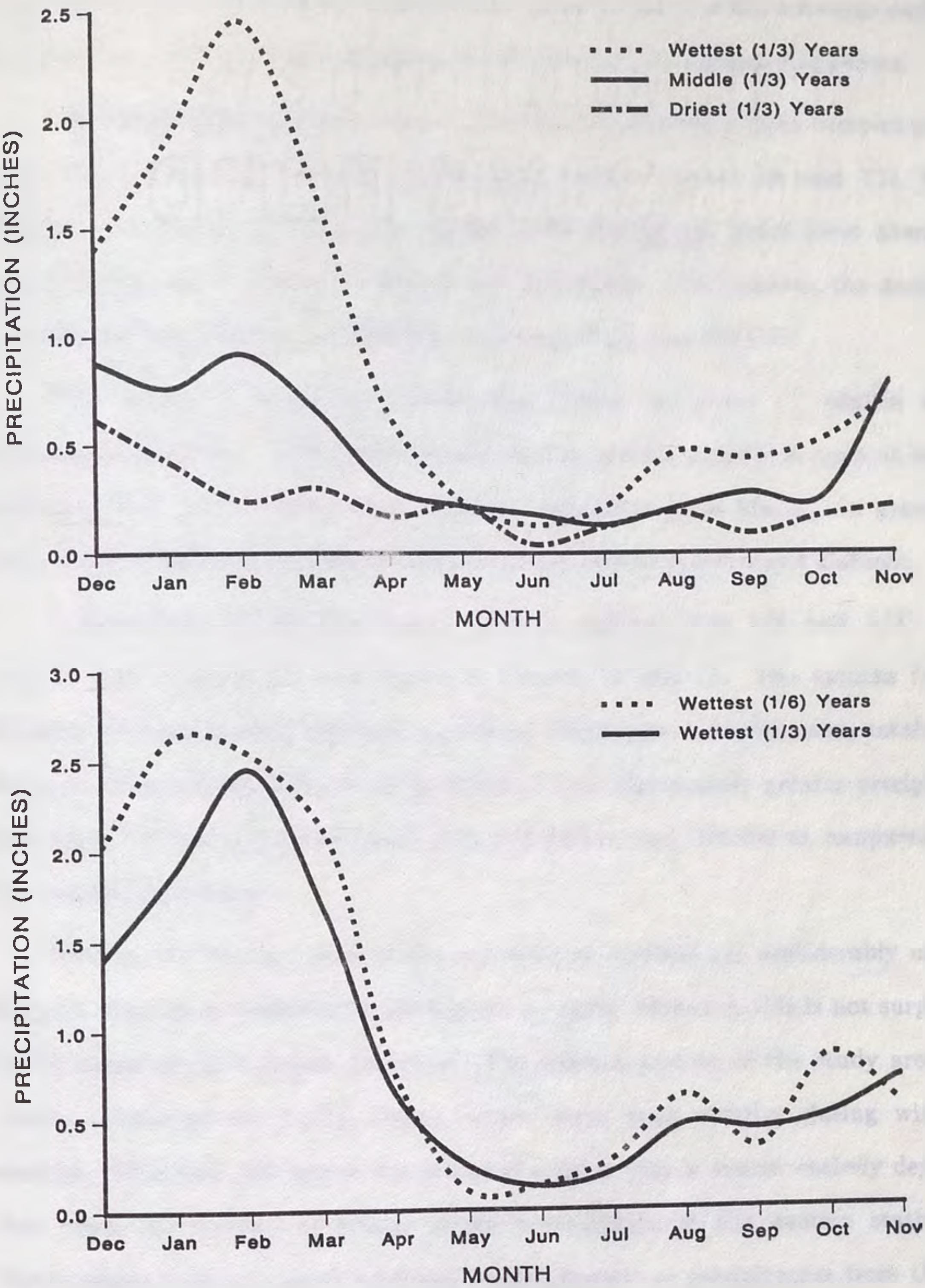


Figure 13. Haiwee, Mean Monthly Precipitation Under Various Climatic Conditions: Wettest (1/6), Wettest (1/3), Middle (1/3), and Driest (1/3).

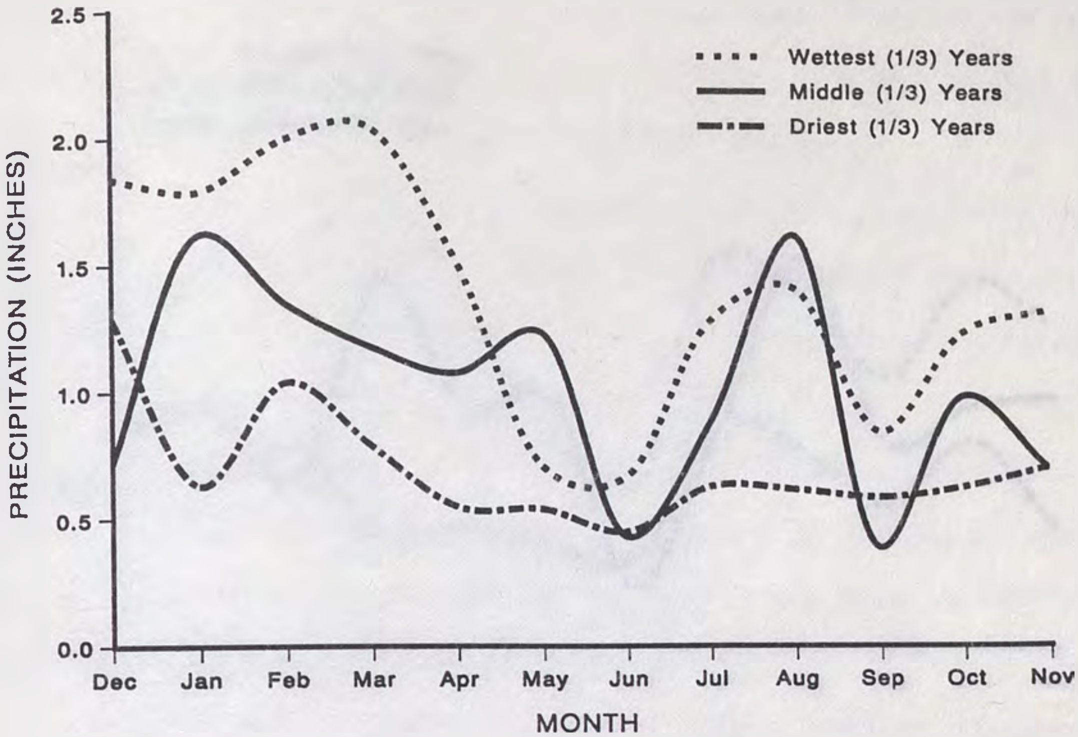
The wettest (1/6) years receive substantially greater precipitation amounts during the months of December and January, as compared to the wettest (1/3) years.

The northeastern stations, Adaven and Caliente, present a more complex pattern when comparing monthly precipitation totals (Figures 14 and 15). For Adaven, the months showing the biggest gains during wet years (over average years) are December, February, March, and November. For Caliente, the months showing the biggest gains are January, February, July, and October.

The month of maximum precipitation during dry years at Adaven and Caliente is December. The wettest month during average years is August at both stations. Wet years receive their maximum precipitation in March. In general, June is the driest month under all climatic conditions at Adaven and Caliente.

Comparisons of the two wetter climatic regimes (top 1/6 and 1/3) for Adaven and Caliente are also shown in Figures 14 and 15. The months from January to April present the most significant differences in precipitation totals at Adaven. The wettest (1/6) years at Caliente have significantly greater precipitation totals for the months of April, July, September, and October as compared to the wettest (1/3) years.

Overall, the patterns seen at the northeastern stations are considerably more complex than those observed at the western stations. However, this is not surprising in terms of the synoptic situation. The western portion of the study area is clearly dominated by Pacific fronts, which reach peak activity during winter months. Therefore, the wet or dry status of a given year is almost entirely dependent upon the amount of winter season precipitation at the western stations. Northeastern stations receive relatively equal amounts of precipitation from three storm types: Pacific fronts, continental cyclones, and summer convection. Each storm type has a peak activity in different seasons and monthly precipitation



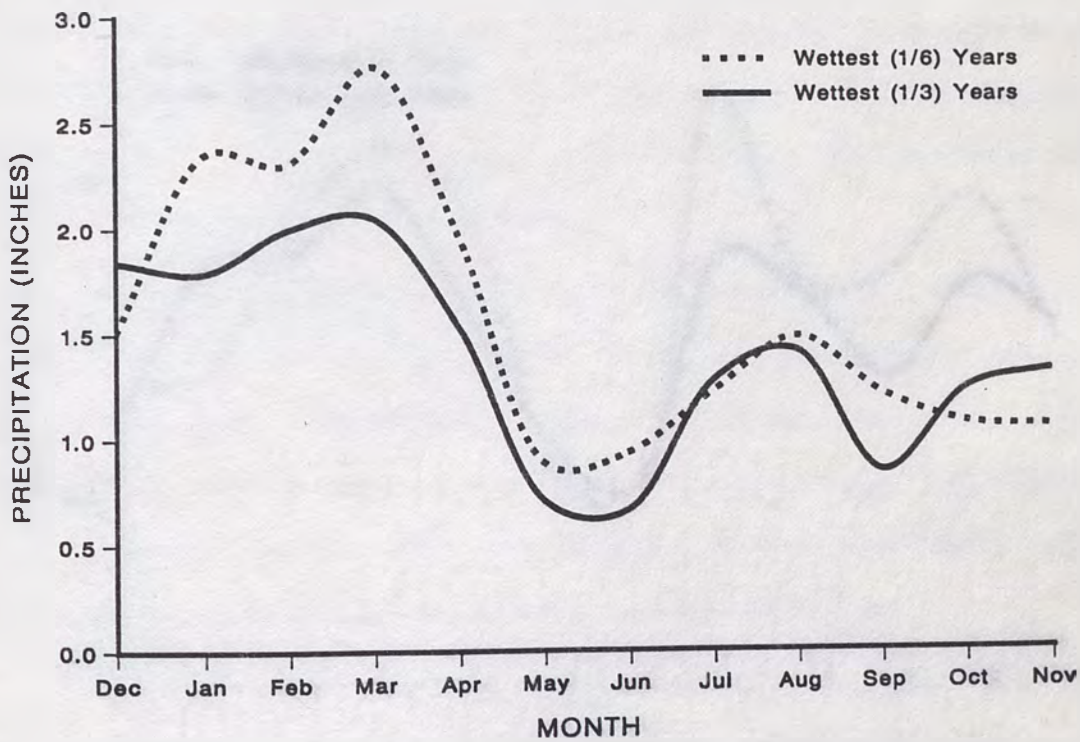


Figure 14. Adaven, Mean Monthly Precipitation Under Various Climatic Conditions: Wettest (1/6), Wettest (1/3), Middle (1/3), and Driest (1/3).

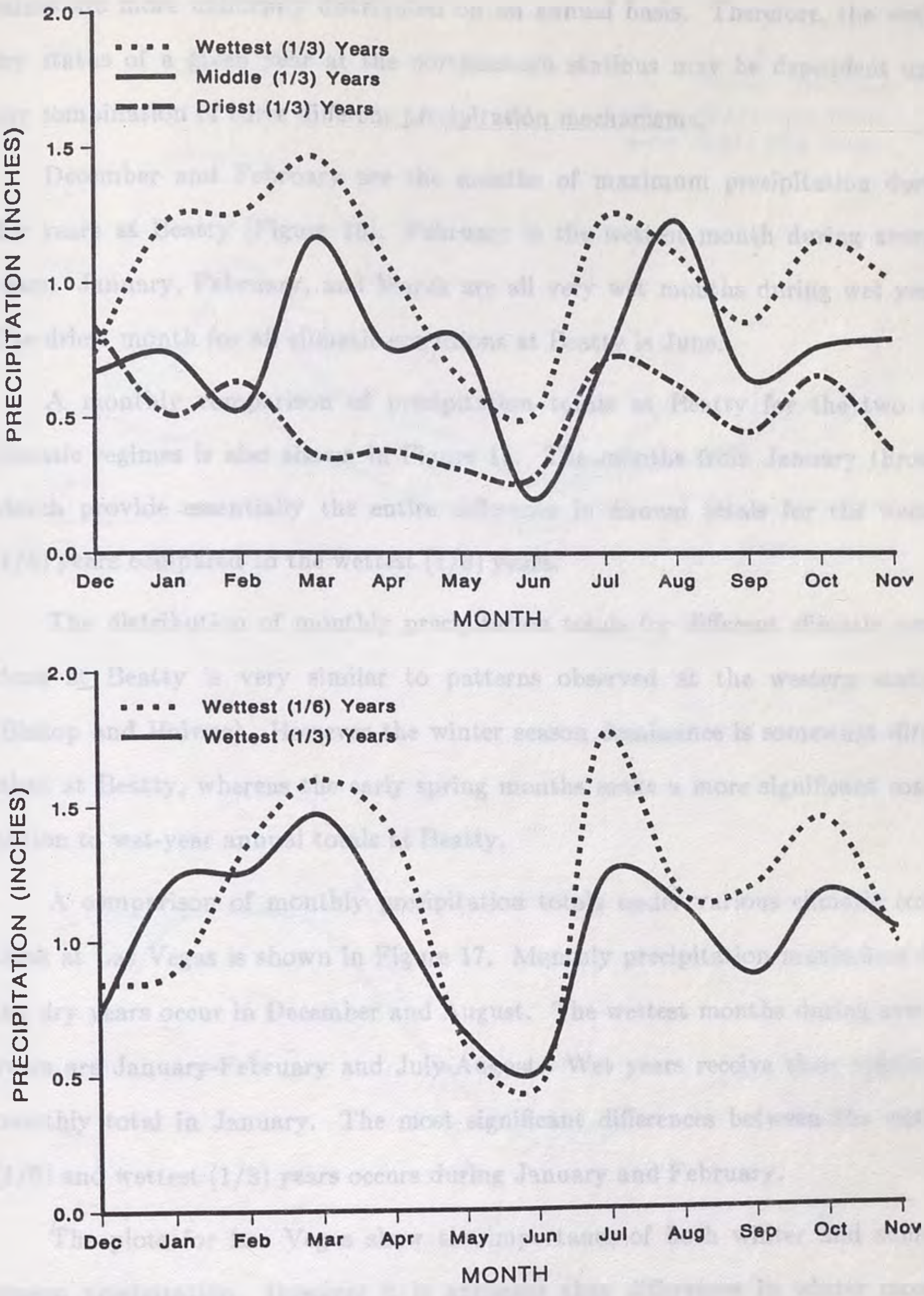


Figure 15. Caliente, Mean Monthly Precipitation Under Various Climatic Conditions: Wettest (1/6), Wettest (1/3), Middle (1/3), and Driest (1/3).

values are more uniformly distributed on an annual basis. Therefore, the wet or dry status of a given year at the northeastern stations may be dependent upon any combination of three different precipitation mechanisms.

December and February are the months of maximum precipitation during dry years at Beatty (Figure 16). February is the wettest month during average years. January, February, and March are all very wet months during wet years. The driest month for all climatic conditions at Beatty is June.

A monthly comparison of precipitation totals at Beatty for the two wet climatic regimes is also shown in Figure 16. The months from January through March provide essentially the entire difference in annual totals for the wettest (1/6) years compared to the wettest (1/3) years.

The distribution of monthly precipitation totals for different climatic conditions at Beatty is very similar to patterns observed at the western stations (Bishop and Haiwee). However the winter season dominance is somewhat diminished at Beatty, whereas the early spring months make a more significant contribution to wet-year annual totals at Beatty.

A comparison of monthly precipitation totals under various climatic conditions at Las Vegas is shown in Figure 17. Monthly precipitation maximums during dry years occur in December and August. The wettest months during average years are January-February and July-August. Wet years receive their maximum monthly total in January. The most significant differences between the wettest (1/6) and wettest (1/3) years occurs during January and February.

The plots for Las Vegas show the importance of both winter and summer season precipitation. However it is apparent that differences in winter months play a more important role in determining the wet or dry status of a given year.

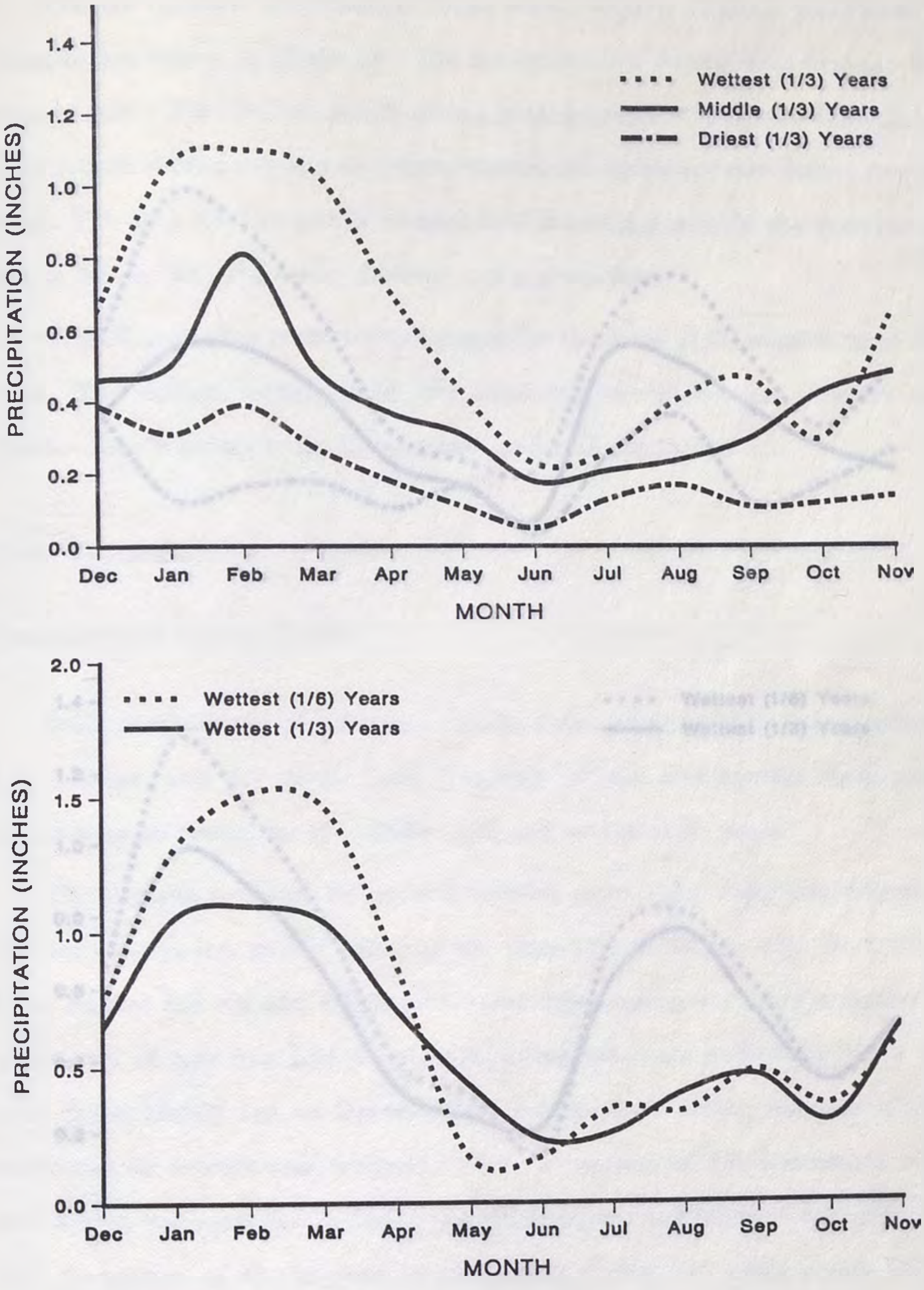


Figure 16. Beatty, Mean Monthly Precipitation Under Various Climatic Conditions: Wettest (1/6), Wettest (1/3), Middle (1/3), and Driest (1/3).

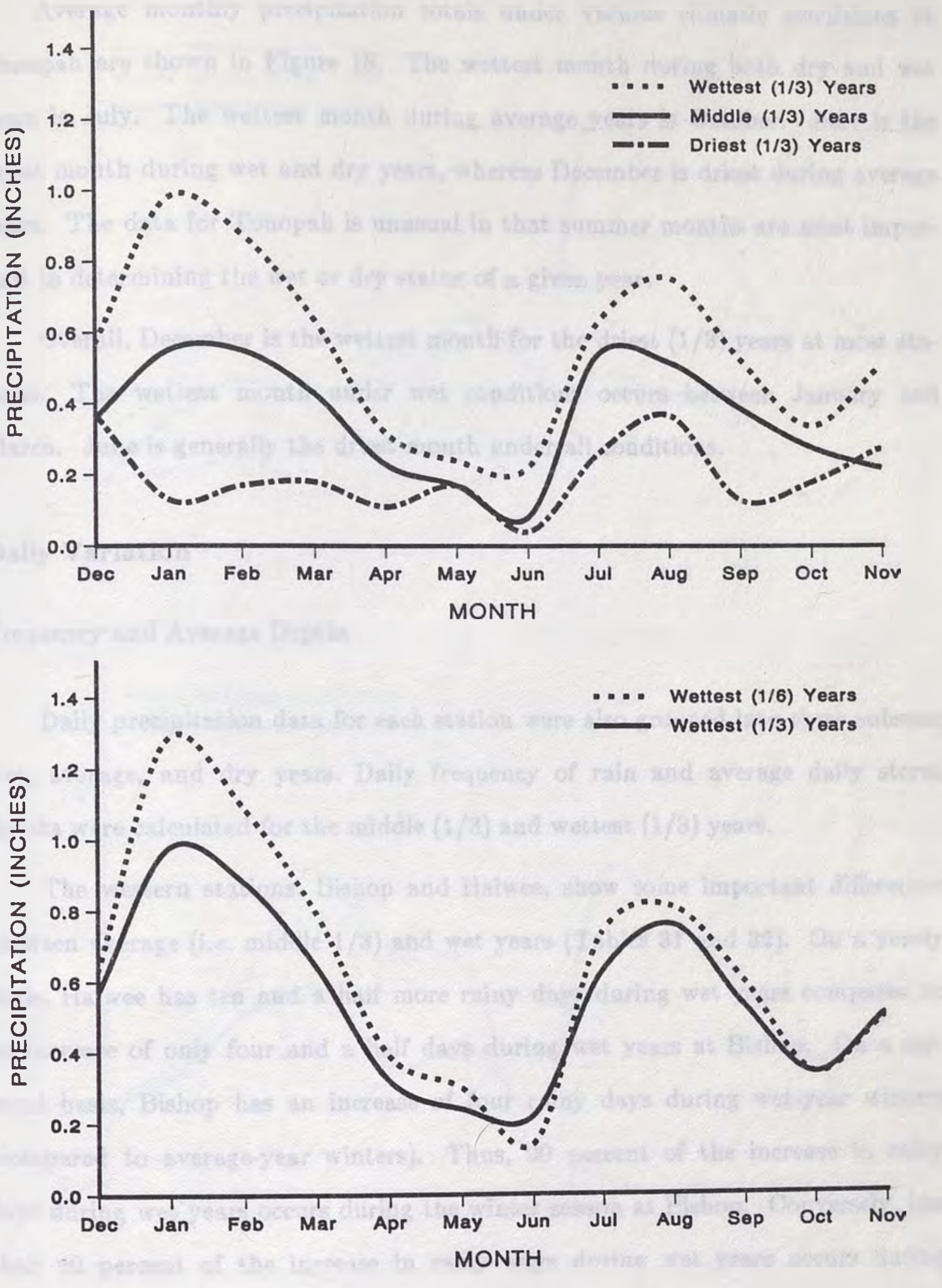


Figure 17. Las Vegas, Mean Monthly Precipitation Under Various Climatic Conditions: Wettest (1/6), Wettest (1/3), Middle (1/3), and Driest (1/3).

Average monthly precipitation totals under various climatic conditions at Tonopah are shown in Figure 18. The wettest month during both dry and wet years is July. The wettest month during average years is October. June is the driest month during wet and dry years, whereas December is driest during average years. The data for Tonopah is unusual in that summer months are most important in determining the wet or dry status of a given year.

Overall, December is the wettest month for the driest (1/3) years at most stations. The wettest month under wet conditions occurs between January and March. June is generally the driest month under all conditions.

Daily Variation

Frequency and Average Depths

Daily precipitation data for each station were also grouped into three subsets: wet, average, and dry years. Daily frequency of rain and average daily storm depths were calculated for the middle (1/3) and wettest (1/3) years.

The western stations, Bishop and Haiwee, show some important differences between average (i.e. middle 1/3) and wet years (Tables 31 and 32). On a yearly basis, Haiwee has ten and a half more rainy days during wet years compared to an increase of only four and a half days during wet years at Bishop. On a seasonal basis, Bishop has an increase of four rainy days during wet-year winters (compared to average-year winters). Thus, 90 percent of the increase in rainy days during wet years occurs during the winter season at Bishop. Conversely, less than 40 percent of the increase in rainy days during wet years occurs during winter at Haiwee.

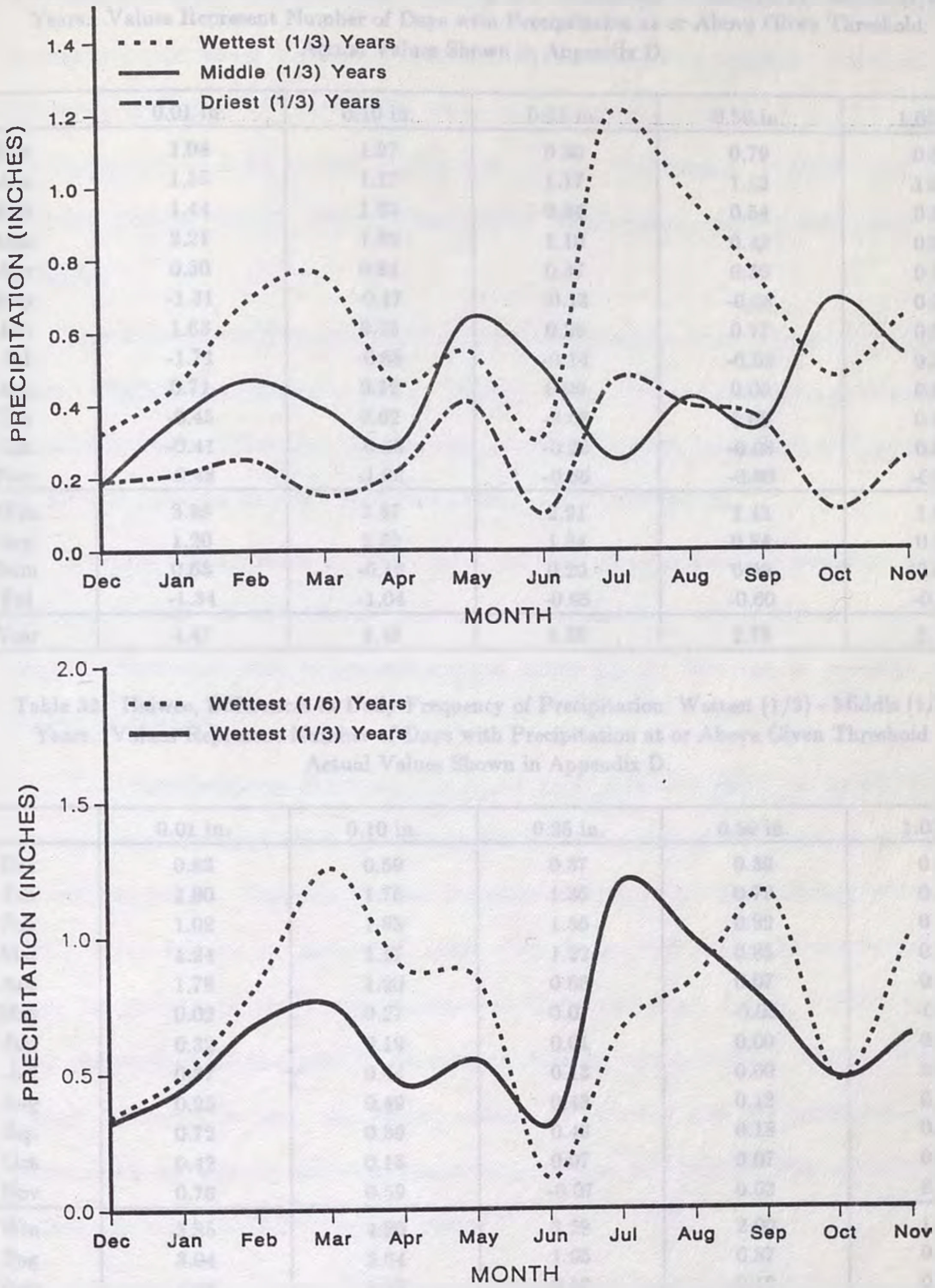


Figure 18. Tonopah, Mean Monthly Precipitation Under Various Climatic Conditions: Wettest (1/6), Wettest (1/3), Middle (1/3), and Driest (1/3).

Table 31. Bishop, Differences in Daily Frequency of Precipitation: Wettest (1/3) - Middle (1/3) Years. Values Represent Number of Days with Precipitation at or Above Given Threshold. Actual Values Shown in Appendix D.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	1.04	1.27	0.90	0.79	0.59
Jan	1.50	1.17	1.17	1.12	1.00
Feb	1.44	1.23	0.84	0.54	0.34
Mar	2.21	1.38	1.10	0.42	0.09
Apr	0.30	0.81	0.37	0.50	0.17
May	-1.31	-0.17	-0.13	-0.08	0.00
Jun	1.63	0.35	0.25	0.17	0.00
Jul	-1.71	-0.66	-0.14	-0.08	0.00
Aug	0.71	0.12	0.09	0.00	0.00
Sep	-0.45	0.62	-0.06	0.08	0.00
Oct	-0.41	-0.66	-0.23	-0.08	0.00
Nov	-0.48	-1.00	-0.66	-0.60	-0.08
Win	3.98	3.67	2.91	2.45	1.93
Spg	1.20	2.02	1.34	0.84	0.26
Sum	0.63	-0.19	0.20	0.09	0.00
Fal	-1.34	-1.04	-0.95	-0.60	-0.08
Year	4.47	4.46	3.50	2.78	2.11

Table 32. Haiwee, Differences in Daily Frequency of Precipitation: Wettest (1/3) - Middle (1/3) Years. Values Represent Number of Days with Precipitation at or Above Given Threshold. Actual Values Shown in Appendix D.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	0.93	0.59	0.37	0.39	0.42
Jan	1.90	1.76	1.36	0.79	0.31
Feb	1.02	1.85	1.56	0.82	0.48
Mar	1.24	1.17	1.22	0.85	0.35
Apr	1.78	1.20	0.66	0.07	0.12
May	0.02	0.27	0.07	-0.05	-0.06
Jun	0.32	0.19	0.01	0.00	0.00
Jul	0.37	0.44	0.13	0.00	0.00
Aug	0.95	0.49	0.43	0.12	0.06
Sep	0.72	0.39	0.43	0.18	0.06
Oct	0.42	0.15	0.07	0.07	0.00
Nov	0.76	0.59	-0.07	0.03	0.07
Win	3.85	4.20	3.29	2.00	1.21
Spg	3.04	2.64	1.95	0.87	0.41
Sum	1.64	1.12	0.57	0.12	0.06
Fal	1.90	1.13	0.43	0.28	0.13
Year	10.43	9.09	6.24	3.27	1.81

Average daily storm depths, shown in Table 33, increase from 0.15 inches during average years to 0.26 inches during wet years at Bishop. Most of this difference is due to an increase in winter season average depths, from 0.21 during average years to 0.45 inches during wet years. Fall season average depths are actually greater during average years (0.18 inches) than during wet years (0.12 inches).

The average daily storm depths at Haiwee increase from 0.24 to 0.32 for wet years. Significant increases occur during both winter and spring seasons to account for this difference. The winter average increases from 0.29 to 0.42 inches, whereas the spring average increases from 0.18 to 0.29 inches.

Overall, the increase in wet-year precipitation over average years at western stations is due to substantial increases in both rainy days and average daily depths. However, wet years are caused more by an increase in average daily depths at Bishop.

The northeastern stations, Caliente and Adaven, show a much greater increase in rainy days than in average daily depths during wet years as compared to average years. Caliente has an increase of nine rainy days during wet years, and Adaven has an increase of 14 rainy days during wet years (Tables 34 and 35). Over 50 percent of the yearly increase at Caliente occurs during winter, whereas only 30 percent of the yearly increase at Adaven occurs during winter. Another major difference is that the spring season at Adaven has the same increase in rainy days as winter; whereas the spring season at Caliente has essentially no increase in rainy days during wet years.

Average daily depths at Adaven increase from 0.30 to 0.31 inches on a yearly basis in going from average to wet years (Table 33). There are slight decreases in wet-year average depths during winter and summer, and increases during spring

Table 33. Differences in Average Daily Depth: Wettest (1/3) - Middle (1/3) Years. All Values Given in Inches. Actual Values Shown in Appendix D.

	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Dec	-0.05	-0.03	0.31	-0.02	0.12	-0.01	0.04
Jan	0.00	0.01	0.26	-0.01	0.11	0.04	0.01
Feb	0.01	-0.03	0.16	0.03	0.16	0.11	0.05
Mar	0.09	0.07	0.08	0.05	0.17	0.02	0.06
Apr	0.01	0.00	0.15	0.02	0.06	-0.01	0.00
May	0.00	0.04	0.00	0.00	-0.01	0.04	0.07
Jun	0.09	0.06	0.00	0.10	0.01	0.03	-0.02
Jul	-0.03	0.09	-0.01	0.11	0.03	0.12	0.16
Aug	-0.06	0.15	-0.02	-0.01	0.03	0.06	0.06
Sep	0.10	-0.02	0.04	-0.12	0.07	0.02	0.03
Oct	0.09	-0.10	-0.07	0.04	-0.01	0.08	0.01
Nov	-0.02	0.09	-0.14	0.08	-0.06	0.16	0.00
Win	-0.01	-0.01	0.24	0.02	0.13	0.05	0.03
Spg	0.05	0.04	0.09	0.03	0.11	0.01	0.03
Sum	-0.02	0.11	0.00	0.05	0.03	0.07	0.09
Fal	0.06	0.01	-0.06	0.02	0.00	0.10	0.01
Year	0.01	0.03	0.11	0.03	0.08	0.05	0.04

Table 34. Adaven, Differences in Daily Frequency of Precipitation: Wettest (1/3) - Middle (1/3) Years. Values Represent Number of Days with Precipitation at or Above Given Threshold. Actual Values Shown in Appendix D.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	2.68	2.02	1.19	0.56	-0.08
Jan	0.77	0.46	-0.10	0.18	0.26
Feb	0.89	0.09	0.07	0.26	0.26
Mar	3.27	3.23	2.03	1.43	0.26
Apr	1.89	1.21	0.76	0.47	0.06
May	-0.88	-0.87	-0.30	-0.23	0.07
Jun	0.46	1.00	0.42	0.31	0.00
Jul	1.76	1.52	0.45	0.23	0.06
Aug	0.26	0.44	0.07	-0.34	-0.16
Sep	0.53	0.24	0.41	0.64	0.06
Oct	0.53	0.70	0.40	0.44	0.20
Nov	1.67	1.03	0.80	0.63	0.06
Win	4.34	2.57	1.16	1.00	0.44
Spg	4.28	3.57	2.49	1.67	0.39
Sum	2.48	2.96	0.94	0.20	-0.10
Fal	2.73	1.97	1.61	1.71	0.32
Year	13.83	11.07	6.20	4.58	1.05

and fall. Average daily depths at Caliente increase from 0.18 to 0.21 inches on a yearly basis. Each season displays a slight increase in average daily depth.

Overall, the increase in precipitation during wet years (compared to average years) at the northeastern stations is due primarily to an increase in rainy days. Increases in average daily depths are relatively insignificant.

Daily precipitation data for Beatty indicate a significant increase in rainy days during wet years (eight more than average years), and a small increase in average daily depths (0.19 to 0.22 inches). Winter and spring seasons at Beatty each have approximately four and a half more rainy days during wet years (Table 36). The summer season has a decrease in rainy days during wet years, whereas the number of rainy days during fall remains approximately equal during both average and wet years.

The average daily depth at Beatty increases only 0.03 inches on a yearly basis in going from average to wet years (Table 33). There is a slight decrease in wet-year average depth during winter, and a large increase in summer. Spring and fall seasons display slight increases in average depth during wet years.

Overall, the characteristics of daily precipitation data at Beatty more closely resemble northeastern stations than western stations (when comparing wet to average years). This is because the increase in precipitation during wet years is caused primarily by increases in number of rainy days, and not so much by increases in average daily depths.

The southern portion of the study area, represented by Las Vegas, has a slight increase in rainy days and average daily depths during wet years. On a yearly basis, wet years have approximately four more rainy days than average years (Table 37). On a seasonal basis, winter and summer each have approximately two more rainy days during wet years. Spring shows a slight decrease in

Table 35. Caliente, Differences in Daily Frequency of Precipitation: Wettest (1/3) - Middle (1/3) Years. Values Represent Number of Days with Precipitation at or Above Given Threshold. Actual Values Shown in Appendix D.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	-0.16	0.53	0.29	-0.04	0.00
Jan	2.21	1.59	0.36	-0.11	0.00
Feb	2.97	1.93	0.70	0.36	0.00
Mar	0.96	0.51	0.73	0.44	0.07
Apr	-0.07	0.25	0.09	0.10	0.14
May	-0.54	-0.88	0.05	0.01	0.00
Jun	0.96	0.89	0.59	0.22	0.00
Jul	0.69	1.00	0.72	0.51	0.21
Aug	0.10	-0.06	-0.28	-0.03	0.07
Sep	1.83	1.21	0.21	0.17	0.00
Oct	1.26	0.92	0.71	0.44	0.14
Nov	-1.43	-0.61	0.09	-0.37	0.00
Win	5.02	4.05	1.35	0.21	0.00
Spg	0.35	-0.12	0.87	0.55	0.21
Sum	1.75	1.83	1.03	0.70	0.28
Fal	1.66	1.52	1.01	0.24	0.14
Year	8.78	7.28	4.26	1.70	0.63

Table 36. Beatty, Differences in Daily Frequency of Precipitation: Wettest (1/3) - Middle (1/3) Years. Values Represent Number of Days with Precipitation at or Above Given Threshold. Actual Values Shown in Appendix D.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	0.43	0.20	0.15	0.01	-0.06
Jan	2.03	1.03	0.57	0.08	0.06
Feb	1.89	1.43	0.76	0.32	0.07
Mar	2.24	1.44	0.81	0.54	0.12
Apr	1.23	1.12	0.50	0.12	0.00
May	1.29	0.41	0.55	0.23	0.06
Jun	0.06	0.09	-0.09	0.06	0.06
Jul	-0.60	-0.02	0.13	0.06	0.00
Aug	-1.07	0.22	0.03	0.07	0.18
Sep	0.82	0.39	0.20	-0.04	0.12
Oct	-0.01	-0.51	-0.24	0.01	-0.06
Nov	-0.49	0.20	0.11	-0.10	0.12
Win	4.35	2.66	1.48	0.41	0.07
Spg	4.76	2.97	1.86	0.89	0.18
Sum	-1.61	0.29	0.07	0.19	0.24
Fal	0.32	0.08	0.07	-0.13	0.18
Year	7.82	6.00	3.48	1.36	0.67

wet-year rainy days (compared to average years), whereas fall has a very slight increase in wet-year rainy days. Average daily depths at Las Vegas increase from 0.16 inches for average years to 0.21 inches for wet years (Table 33). All seasons, except for spring, display significant increases in average daily depths during wet years.

Data for Tonopah indicate that increases in both rainy days and average daily depths make significant contributions to wet-year precipitation totals. There is an increase of six rainy days during wet years (as compared to average years), with 1/2 of the yearly increase occurring in the summer season (Table 38). Average daily depths increases from 0.14 to 0.18 inches for wet years (Table 33). The most significant seasonal increase occurs during the summer season, which increases from 0.14 to 0.23 inches.

Distribution of Wet Day Sequences

Observed distributions of wet day sequences were calculated separately for both the middle (1/3) and wettest (1/3) years at each station. First-order Markov chains were applied to the data sets in order to model observed distributions. Comparisons of observed and expected values are shown in Appendix A. Chi-square goodness of fit tests indicate an excellent fit between observed and expected values (see Appendix A).

The null hypothesis is rejected for 2 of 28 seasonal data sets at the 0.05 level for the middle (1/3) years. The null hypothesis is rejected for 4 of 28 seasonal data sets at the .05 level for the wettest (1/3) years. The null hypothesis states that the observed distribution of wet day sequences is given by a first-order Markov chain. Results show that the first-order Markov chain applies equally well to

Table 37. Las Vegas, Differences in Daily Frequency of Precipitation: Wettest (1/3) - Middle (1/3) Years. Values Represent Number of Days with Precipitation at or Above Given Threshold. Actual Values Shown in Appendix D.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	1.53	0.68	-0.01	0.21	0.00
Jan	0.77	1.24	0.72	0.08	0.00
Feb	-0.25	0.26	0.14	0.49	0.07
Mar	-1.42	-0.75	-0.16	-0.05	-0.06
Apr	0.72	0.19	0.03	0.00	0.00
May	-0.04	0.17	0.09	0.01	0.00
Jun	0.82	0.41	0.20	0.07	0.00
Jul	1.56	0.97	0.62	0.34	0.27
Aug	0.08	0.48	0.18	0.08	0.14
Sep	0.46	0.27	0.35	0.14	0.00
Oct	-0.52	-0.27	0.15	0.14	0.00
Nov	0.66	0.39	0.49	0.40	0.20
Win	2.05	2.18	0.85	0.78	0.07
Spg	-0.74	-0.39	-0.04	-0.04	-0.06
Sum	2.46	1.86	1.00	0.49	0.41
Fal	0.60	0.39	0.99	0.68	0.20
Year	4.37	4.04	2.80	1.91	0.62

Table 38. Tonopah, Differences in Daily Frequency of Precipitation: Wettest (1/3) - Middle (1/3) Years. Values Represent Number of Days with Precipitation at or Above Given Threshold. Actual Values Shown in Appendix D.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	0.45	0.55	0.27	0.09	0.00
Jan	0.55	0.23	0.26	0.00	0.00
Feb	0.25	0.14	0.22	0.26	0.18
Mar	0.98	0.78	1.05	0.18	0.00
Apr	0.34	0.85	0.34	-0.01	0.00
May	-1.86	-0.35	-0.10	-0.02	0.00
Jun	-1.00	-0.69	-0.24	-0.12	0.00
Jul	2.15	0.97	1.17	0.81	0.46
Aug	1.74	1.46	0.68	0.35	-0.01
Sep	1.97	1.19	0.31	0.36	0.09
Oct	-0.99	-0.54	-0.08	-0.14	0.00
Nov	0.56	0.13	-0.36	0.07	0.18
Win	1.25	0.92	0.75	0.35	0.18
Spg	0.46	1.28	1.29	0.15	0.00
Sum	2.89	1.74	1.61	1.04	0.45
Fal	1.54	0.78	-0.13	0.29	0.27
Year	6.14	4.72	3.52	1.83	0.90

the smaller subsets of data (middle 1/3 and wettest 1/3) as it does to the entire data sets.

The percentage of observed events at various durations for the average (middle 1/3) and wettest (1/3) years are given in Tables 39 and 40. Bishop has higher percentages of multiple day events during winters and summers of wet years. Conversely, spring and fall of wet years have greater percentages of one day events (compared to average years).

All seasons (except summer) at Haiwee have greater percentages of multiple day events during wet years. Summer has a greater percentage of one day events during wet years (as compared to dry years).

Spring and fall, at Adaven, have greater percentages of multiple day events during wet years. Summer has greater percentages of one day events during wet years, whereas winter shows no significant differences between wet and average years.

Winter and fall, at Caliente, have greater percentages of multiple day events during wet years. Spring and summer have greater percentages of one day events during wet years.

Winter and spring, at Beatty, have greater percentages of multiple day events during wet years. Fall has a greater percentage of one day events during wet years, whereas summer shows little change between wet and average years.

Spring, summer, and fall at Las Vegas have greater percentages of multiple day events during wet years. Winter has the same percentage of one day events during wet and average years, but wet years have greater percentages of three or more day events.

Winter and spring, at Tonopah, have greater percentages of multiple day events during wet years. Summer has a greater percentage of one day events

Table 39. Percentage of Precipitation Events at Various Durations for the Middle (1/3) Years.

Season	Duration (Days)	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Winter	1	63	77	58	60	54	60	69
	2	24	20	26	29	34	29	23
	3	7	2	8	5	8	6	6
	4 -	7	1	8	6	5	4	2
Spring	1	70	72	54	51	69	78	66
	2	13	19	35	26	21	16	25
	3	10	5	7	15	7	5	4
	4 -	7	5	3	8	2	1	5
Summer	1	51	76	71	54	68	76	54
	2	31	17	22	28	28	19	34
	3	13	7	6	13	5	2	6
	4 -	6	0	2	5	0	3	6
Fall	1	70	66	51	61	60	75	58
	2	21	25	33	25	27	19	27
	3	3	3	5	10	8	6	4
	4 -	5	6	11	5	4	0	10

Table 40. Percentage of Precipitation Events at Various Durations for the Wettest (1/3) Years.

Season	Duration (Days)	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Winter	1	62	58	37	54	52	60	54
	2	20	27	43	31	24	24	30
	3	11	5	7	7	9	9	10
	4 -	6	10	12	9	15	8	6
Spring	1	59	59	60	58	63	70	61
	2	26	26	32	25	24	19	31
	3	5	9	5	7	7	6	7
	4 -	10	6	3	10	4	5	1
Summer	1	63	74	62	60	75	70	62
	2	20	23	23	21	13	18	22
	3	11	4	11	9	9	10	10
	4 -	6	0	4	10	4	1	7
Fall	1	64	70	65	51	49	67	59
	2	26	18	23	26	23	29	25
	3	6	9	10	13	10	3	11
	4 -	4	3	2	10	5	1	5

during wet years, whereas fall shows little change between wet and average years.

Overall, there is a tendency for winter, spring, and fall to have greater percentages of multiple day events during wet years. Summer tends to have greater percentages of one day events during wet years.

Distribution of Dry Day Sequences

Observed distributions of dry day sequences were calculated for the middle (1/3) and wettest (1/3) years at each station. Third-order Markov chains were applied to the data sets in order to model observed distributions. Comparisons of observed and expected values and chi-square goodness of fit tests are shown in Appendix B.

The null hypothesis is rejected for 9 of 28 seasonal data sets at the 0.05 level for the middle (1/3) years, and for 8 of 28 seasonal data sets for the wettest (1/3) years. Results indicate that a third-order Markov chain models larger data sets a little better (only 5 of 28 rejected) than smaller subsets.

Distribution of Daily Storm Depths

Observed distributions of daily storm depths were calculated for the middle (1/3) and wettest (1/3) years at each station. The Weibull distribution was applied to the data sets in order to model observed distributions. Comparisons of observed and expected values and chi-square goodness of fit tests are given in Appendix C.

The null hypothesis is rejected for 3 of 28 seasonal data sets at the 0.05 level for the middle (1/3) years, and for 5 of 28 seasonal data sets for the wettest (1/3) years. Results indicate that the Weibull distribution is more successful at modeling the smaller subsets of data than the entire data set (12 of 28 rejected).

The percentage of daily storm depths in various categories for the average (middle 1/3) and wettest (1/3) years are shown in Tables 41 and 42. The western stations, Bishop and Haiwee, have significantly higher percentages of events in the range from 0.01 to 0.10 inches during winters of average years (as compared to winters of wet years). Wet-year winters have a much higher percentage of events over 1.00 inch as compared to average years.

The spring season at the western stations has much higher percentages of events in the range from 0.01 to 0.05 inches during average years. Wet-year springs have fewer small events and more in the range from 0.31 inches and greater.

The summer season shows no distinct patterns at the western stations. The fall season is characterized by a pattern opposite to winter and spring. Average years have a higher percentage of large events during fall, whereas wet years have higher percentages of events in the range from 0.01 to 0.05 inches.

A fairly consistent pattern is apparent for all seasons at the northeastern stations, Adaven and Caliente, with regard to the percent of daily storm depths in various categories. Wet years are characterized by higher percentages of large events (0.31 inches and greater) and lower percentages of small events (as compared to average years). The only exception occurs during winter at Adaven, which has higher percentages of small events and lower percentages of large events during wet years.

The spring and summer seasons at Beatty are characterized by the same pattern observed at most other stations - higher percentages of large events during wet years and higher percentages of small events during average years. Winter and fall seasons at Beatty do not show significant differences between average and

Table 41. Percentage of Daily Storm Depths Falling in Various Categories for the Middle (1/3) Years.

Season	Depth(inches)	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Winter	0.01 - 0.05	17	29	39	32	25	34	45
	0.06 - 0.10	13	17	13	21	16	16	16
	0.11 - 0.20	18	19	14	18	18	16	23
	0.21 - 0.30	13	10	9	14	7	12	11
	0.31 - 1.00	34	22	24	16	27	21	5
	1.01 -	4	2	2	0	6	0	0
Spring	0.01 - 0.05	19	37	63	36	43	43	51
	0.06 - 0.10	18	18	13	11	18	18	16
	0.11 - 0.20	20	19	11	27	15	15	15
	0.21 - 0.30	13	12	5	11	8	8	5
	0.31 - 1.00	27	14	8	15	14	15	13
	1.01 -	2	1	1	0	3	0	0
Summer	0.01 - 0.05	22	47	58	36	55	50	35
	0.06 - 0.10	22	18	14	17	11	14	22
	0.11 - 0.20	18	12	15	16	11	13	23
	0.21 - 0.30	9	11	7	10	11	8	9
	0.31 - 1.00	24	12	6	21	11	14	10
	1.01 -	5	0	0	1	2	1	1
Fall	0.01 - 0.05	20	27	44	33	28	47	35
	0.06 - 0.10	7	15	13	13	21	15	14
	0.11 - 0.20	23	10	18	18	13	17	16
	0.21 - 0.30	16	20	8	8	11	11	15
	0.31 - 1.00	28	26	17	27	24	9	21
	1.01 -	7	2	1	1	4	2	0

Table 42. Percentage of Daily Storm Depths Falling in Various Categories for the Wettest (1/3) Years.

Season	Depth(inches)	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
	0.01 - 0.05	18	30	29	23	20	31	45
	0.06 - 0.10	16	14	9	20	10	9	13
Winter	0.11 - 0.20	18	18	16	26	17	22	24
	0.21 - 0.30	14	13	8	15	10	15	9
	0.31 - 1.00	29	24	23	16	30	23	8
	1.01 -	5	2	15	0	13	1	2
	0.01 - 0.05	15	34	42	30	34	35	46
	0.06 - 0.10	15	14	20	19	13	24	11
Spring	0.11 - 0.20	19	20	14	18	14	15	11
	0.21 - 0.30	15	12	5	12	10	6	15
	0.31 - 1.00	32	19	16	19	22	19	17
	1.01 -	4	2	3	1	6	0	0
	0.01 - 0.05	19	28	61	33	36	36	40
	0.06 - 0.10	14	13	19	11	18	13	14
Summer	0.11 - 0.20	25	30	9	18	19	20	12
	0.21 - 0.30	11	4	5	14	9	6	10
	0.31 - 1.00	29	22	5	22	16	18	19
	1.01 -	3	3	0	2	3	6	5
	0.01 - 0.05	14	29	49	30	34	39	38
	0.06 - 0.10	13	13	17	11	13	14	10
Fall	0.11 - 0.20	21	15	19	17	18	13	25
	0.21 - 0.30	10	14	6	12	10	7	7
	0.31 - 1.00	34	26	9	27	20	21	17
	1.01 -	8	4	0	3	5	5	3

wet years with regard to percentage of events at various depths.

All seasons at Las Vegas display the general pattern of greater percentages of large events and lesser percentages of small events during wet years (as compared to average years). All seasons at Tonopah, except fall, have higher percentages of events in the range greater than 0.30 inches during wet years. The percentage of small events (less than 0.11 inches) remains relatively constant between average and wet years at Tonopah.

ANALYSIS OF TEMPERATURE DATA

METHODS

Daily temperature data were examined for each station in the network. In general, temperature records were more incomplete than precipitation records. Most years with missing data were not included in the analysis. However, years with one or two missing days were completed by estimating the missing temperature as an average of the previous and following days temperatures. Table 43 shows the years of temperature record for each station available for further examination.

Table 43. Daily Temperature Data.

Station Name	Years of Record	Missing Years	Number of Complete Years
Adaven	1931-1978	1933, 1936-37, 1941-44, 1946-47 1952-53, 1956-57, 1970-72, 1977	31
Beatty	1949-1986	1954, 1958, 1960 1962-72, 1975, 1984	22
Bishop	1949-1986	1960, 1973	36
Caliente	1932-1983	1938-39, 1948, 1951-52, 1954-57 1966-1971, 1973, 1975-76, 1978-81	30
Haiwee	1949-1986	1950, 1952 1962-1967, 1984	29
Las Vegas	1949-1986	1951	37
Tonopah	1955-1986	None	32

The primary emphasis in analyzing the temperature data was on its relationship to precipitation. Therefore, temperature data were grouped on the basis of wet, average, and dry years. Mean temperatures were calculated separately for the wettest (1/3), middle (1/3), and driest (1/3) years at each station. This data includes only those years for which complete temperature and precipitation data were available.

Temperature data were also examined on a daily basis. Individual days were grouped into wet days (at least 0.01 inch) and dry days (trace or less) within each month for each station.

RESULTS

Mean monthly temperatures (maximum, minimum, and average) for each station are shown in Tables 44, 45, and 46. July is the hottest month and January is the coldest at all stations. Las Vegas has the highest mean annual temperature (of the stations shown) due to its lower elevation and more southerly latitude. Adaven has the lowest mean annual temperature due to its higher elevation and more northerly latitude. Large annual and daily temperature ranges occur at all stations.

Annual and Seasonal Variation

Mean temperatures for the wettest (1/3), middle (1/3), and driest (1/3) years at each station are given in Appendix E. Temperature differences between the middle (1/3) years and entire period of record are shown in Table 47; and differences between the wettest (1/3), middle (1/3), and driest (1/3) years are shown in Table 48. Temperatures are very similar for middle (1/3) years and

Table 44. Mean Maximum Temperatures in °F for Entire Period of Record.

	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Dec	44.7	56.3	54.8	49.0	52.3	57.3	45.4
Jan	42.3	52.8	52.9	45.6	50.7	56.2	43.9
Feb	44.4	58.4	58.5	52.5	56.3	62.5	48.9
Mar	50.7	63.4	63.3	60.4	61.6	68.5	54.6
Apr	60.2	72.8	71.2	69.6	69.2	77.6	62.5
May	70.6	80.5	80.5	78.5	78.1	87.7	72.9
Jun	79.9	92.4	90.6	88.6	89.3	98.6	83.9
Jul	87.6	98.0	97.3	95.6	95.1	104.1	90.9
Aug	85.0	95.6	95.1	93.0	92.7	101.8	88.5
Sep	77.2	88.9	87.6	85.6	86.4	94.2	79.8
Oct	66.3	77.8	76.5	73.6	74.2	81.0	67.8
Nov	53.2	64.4	63.5	59.3	61.4	66.4	53.4
Win	43.8	55.8	55.3	48.9	53.0	58.5	46.0
Spg	60.5	72.2	71.7	69.5	69.6	78.0	63.3
Sum	84.2	95.4	94.4	92.5	92.4	101.5	87.8
Fall	65.6	77.0	75.9	72.9	74.0	80.5	67.0
Year	63.6	75.2	74.4	71.0	72.4	79.7	66.1

Table 45. Mean Minimum Temperatures in °F for Entire Period of Record.

	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Dec	20.8	29.0	22.2	19.0	29.7	33.9	19.8
Jan	18.5	28.0	21.3	15.9	28.9	33.2	18.4
Feb	21.2	30.8	26.0	22.0	32.2	37.8	23.2
Mar	24.2	34.5	29.6	27.1	36.2	42.8	27.1
Apr	30.8	41.0	35.8	33.7	42.8	50.2	32.4
May	38.9	48.1	43.7	41.5	50.2	59.4	41.6
Jun	46.4	56.2	50.9	48.8	59.9	68.8	50.5
Jul	54.1	61.9	56.2	56.0	65.5	75.8	56.1
Aug	52.4	59.8	53.8	55.0	63.4	73.7	54.5
Sep	45.6	53.9	46.8	45.8	57.2	65.6	46.7
Oct	36.6	44.4	37.2	35.6	46.4	53.2	36.6
Nov	26.6	33.9	27.8	24.9	36.1	41.4	25.9
Win	20.1	29.2	23.1	18.9	30.2	34.9	20.4
Spg	31.3	41.2	36.4	34.1	43.1	50.8	33.7
Sum	51.1	59.3	53.6	53.3	63.0	72.8	53.8
Fall	36.3	44.1	37.2	35.4	46.5	53.4	36.4
Year	34.7	43.5	37.7	35.5	45.8	53.1	36.1

Table 46. Average (Max + Min / 2) Temperatures in °F for the Entire Period of Record.

	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Dec	32.7	42.6	38.5	34.0	41.0	45.6	32.6
Jan	30.4	40.4	37.1	30.7	39.8	44.7	31.1
Feb	32.8	44.6	42.2	37.3	44.2	50.1	36.1
Mar	37.4	48.9	46.5	43.8	48.9	55.7	40.8
Apr	45.5	56.9	53.5	51.6	56.0	63.9	47.4
May	54.7	64.3	62.1	60.0	64.2	73.5	57.2
Jun	63.2	74.3	70.7	68.7	74.6	83.7	67.2
Jul	70.9	79.9	76.7	75.8	80.3	90.0	73.5
Aug	68.7	77.7	74.4	74.0	78.1	87.7	71.5
Sep	61.4	71.4	67.2	65.7	71.8	79.9	63.2
Oct	51.5	61.1	56.9	54.6	60.3	67.1	52.2
Nov	39.9	49.1	45.6	42.1	48.7	53.9	39.6
Win	32.0	42.5	39.2	33.9	41.6	46.7	33.2
Spg	45.9	56.7	54.0	51.8	56.3	64.4	48.5
Sum	67.6	77.3	74.0	72.9	77.7	87.2	70.8
Fal	50.9	60.5	56.6	54.1	60.3	67.0	51.7
Year	49.2	59.3	56.0	53.3	59.1	66.4	51.1

entire period of record. There is less than 1 °F difference between most seasonal and annual values.

Most stations (six of seven) show an increase in mean annual maximum temperature during dry years as compared to wet years. The range of this increase varies from 0.5 to 3.7 °F (Table 48). Haiwee is the only station recording a greater mean annual maximum temperature during wet years.

Mean annual minimum temperatures are approximately the same for wet and dry years at all stations except Beatty. The difference between wet- and dry-year minimum temperatures is less than 0.5 °F at six of seven stations. However, minimum temperatures are 1.6 °F cooler during wet years at Beatty on an annual basis.

Seasonal trends in the temperature data are apparent when comparing wet and dry years (Table 48). The greatest difference in maximum temperature usually occurs during spring. All stations have greater maximum spring temperatures

Table 47. Temperature Differences (in °F) Between the Middle (1/3) Years and Entire Period of Record.

Station	Season	Entire Record - Middle (1/3)		
		Max	Min	Avg
Adaven	Win	+1.2	+1.3	+1.3
	Spg	-0.3	+0.3	0.0
	Sum	-0.9	-0.1	-0.5
	Fal	+0.1	+0.6	+0.3
	Annual	0.0	+0.4	+0.3
Beatty	Win	+3.2	+1.3	+2.3
	Spg	0.0	-0.4	-0.2
	Sum	+0.4	0.0	+0.2
	Fal	+1.3	+0.5	+0.9
	Annual	+1.2	+0.3	+0.7
Bishop	Win	-0.1	+0.8	+0.4
	Spg	-0.9	-0.5	-0.8
	Sum	-0.4	+0.1	-0.1
	Fal	-0.1	-0.6	-0.3
	Annual	-0.4	0.0	-0.2
Caliente	Win	-1.2	-0.1	-0.6
	Spg	+1.3	+0.6	+1.0
	Sum	-0.2	+0.6	+0.2
	Fal	0.0	+0.7	+0.3
	Annual	-0.1	+0.4	+0.2
Haiwee	Win	+0.2	+0.7	+0.4
	Spg	+0.2	+0.9	+0.5
	Sum	-0.1	+0.6	+0.2
	Fal	-0.1	+0.7	+0.4
	Annual	+0.1	+0.7	+0.4
Las Vegas	Win	-0.3	-0.5	-0.4
	Spg	+0.9	-0.3	+0.3
	Sum	+0.2	-0.6	-0.2
	Fal	+0.8	-0.3	+0.3
	Annual	+0.3	-0.4	0.0
Tonopah	Win	+2.1	+1.6	+1.8
	Spg	+1.0	+0.2	+0.6
	Sum	+0.9	+0.6	+0.7
	Fal	+0.3	-0.2	0.0
	Annual	+1.0	+0.5	+0.8

Table 48. Temperature Differences Between the Wettest (1/3), Middle (1/3), and Driest (1/3) Years in °F.

Station	Season	Wettest (1/3) - Middle (1/3)			Wettest (1/3) - Driest (1/3)		
		Max	Min	Avg	Max	Min	Avg
Adaven	Win	+1.0	+1.9	+1.5	-1.6	-0.3	-0.9
	Spg	-2.2	-0.2	-1.2	-3.5	-1.2	-2.3
	Sum	-2.1	-0.5	-1.3	-1.6	-0.4	-1.0
	Fal	-0.1	+1.1	+0.5	-0.4	+0.4	0.0
	Annual	-0.9	+0.5	-0.1	-1.8	-0.4	-1.0
Beatty	Win	+3.2	+2.1	+2.7	-3.5	+0.1	-1.7
	Spg	-2.7	-1.8	-2.2	-5.5	-2.3	-3.9
	Sum	-1.5	-1.8	-1.6	-4.2	-3.6	-3.9
	Fal	+1.4	+0.4	+1.0	-1.5	-0.6	-1.0
	Annual	0.0	-0.3	-0.1	-3.7	-1.6	-2.6
Bishop	Win	-0.3	+1.6	+0.7	-0.8	+0.8	0.0
	Spg	-2.1	-0.8	-1.5	-1.4	0.0	-0.7
	Sum	-1.5	-0.6	-1.0	-1.7	-1.6	-1.7
	Fal	0.0	-0.5	-0.2	+0.4	+0.6	+0.5
	Annual	-1.0	-0.1	-0.5	-0.9	-0.1	-0.5
Caliente	Win	-3.1	-0.1	-1.5	-2.7	+0.2	-1.2
	Spg	+0.4	+1.3	+0.9	-3.2	+0.7	-1.2
	Sum	-1.3	+0.8	-0.3	-1.8	-0.2	-1.1
	Fal	-1.4	+1.2	-0.1	-2.7	+0.2	-1.2
	Annual	-1.4	+0.8	-0.3	-2.6	+0.3	-1.2
Haiwee	Win	+1.1	+1.9	+1.4	+1.5	+1.8	+1.6
	Spg	+0.1	+1.1	+0.6	-0.5	-0.3	-0.4
	Sum	+0.1	+0.2	+0.1	+0.4	-1.3	-0.4
	Fal	+0.2	+1.3	+0.8	+0.7	+0.4	+0.6
	Annual	+0.4	+1.0	+0.7	+0.6	+0.1	+0.3
Las Vegas	Win	-1.0	-0.8	-0.9	-1.1	0.0	-0.5
	Spg	+1.0	-0.4	+0.3	-0.7	+0.2	-0.3
	Sum	-0.1	-1.4	-0.8	-0.9	-1.2	-1.0
	Fal	+1.5	-0.1	+0.7	+0.4	+0.6	+0.5
	Annual	+0.3	-0.7	-0.2	-0.5	-0.1	-0.4
Tonopah	Win	+2.5	+2.1	+2.3	-1.1	-0.3	-0.6
	Spg	+0.7	+0.4	+0.6	-1.6	+0.3	-0.6
	Sum	+0.4	+0.5	+0.4	-1.9	-0.6	-1.2
	Fal	0.0	+0.3	+0.1	-0.8	+1.1	+0.1
	Annual	+0.8	+0.8	+0.9	-1.4	+0.1	-0.6

during dry years. The least difference in maximum temperatures generally occurs during fall. Three of seven stations actually have cooler fall maximum temperatures during dry years.

Minimum temperatures also have seasonal trends despite relatively insignificant differences on an annual basis. Spring and summer minimum temperatures are generally warmer during dry years, whereas winter and fall minimum temperatures are generally warmer during wet years. The greatest difference in minimum temperatures between wet years and dry years occurs during summer.

Temperature differences between the wettest (1/3) and middle (1/3) years are less substantial than those between the wettest and driest years. Five of seven stations are slightly cooler, from 0.1 to 0.5 °F, during the wettest (1/3) years compared to middle (1/3) years based on annual average temperatures. Haiwee and Tonopah are slightly warmer during wet years. No seasonal trends are apparent in comparing the wettest (1/3) and middle (1/3) years.

Monthly and Daily Variation

Mean temperatures for wet and dry days in each month (calculated from the entire period of record) are shown in Tables 49 to 51. Dry days have a significantly greater maximum temperature than wet days in every month at all stations. Minimum temperatures are greater on wet days in some months, but greater on dry days in other months.

The difference between dry- and wet-day maximum temperatures for each month is shown in Table 52. The greatest differences between dry- and wet-day mean maximum temperatures occur from April to June and in October. The smallest differences in dry- and wet-day maximum temperatures occur from

December to February and July to August.

Differences between dry- and wet-day minimum temperatures are shown in Table 53. The greatest positive difference (i.e. dry days warmer than wet days) occurs from April to June. The greatest negative difference (i.e. wet days warmer than dry days) occur from December to February.

Differences between dry- and wet-day average temperatures are shown in Table 54. The greatest differences occur in the months from April to June, and the smallest differences occur from December to February and July to August.

Mean temperatures for wet and dry days were calculated separately for the three subsets: wettest (1/3), middle (1/3), and driest (1/3) years. Actual temperatures and differences between the three data sets are given in Appendix E. Table 55 shows the average monthly difference between wet and dry years, and between wet and middle years. Differences between the three data sets are less than 1 °F in most cases. However, differences at Beatty are significantly greater than at other stations - especially between wet and dry years.

DISCUSSION

It is interesting to evaluate results of the preceding temperature data analysis in terms of regional synoptic conditions. Transitory Pacific cold fronts dominate atmospheric circulation over the southern Great Basin from October to June, whereas convective thunderstorms dominate from July to September. Pacific cold fronts bring precipitation and cool air which often remain over relatively large areas for one or more days. This usually results in well below normal (maximum) temperatures. Convective storms occur in late afternoon and evening after the hottest time of day, and are not associated with a cold air mass. Therefore, maximum temperatures do not get too far below normal on rainy summer days.

Table 49. Mean Maximum Temperatures for Dry Days and Wet Days in Each Month.

Month	Type	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Dec	Dry Days	45.5	56.9	55.7	49.6	52.8	57.6	45.9
	Wet Days	37.6	48.6	46.6	43.7	47.4	53.0	39.9
Jan	Dry Days	43.4	53.9	54.1	46.8	51.2	56.8	44.7
	Wet Days	35.8	45.5	44.4	41.6	47.5	51.5	38.2
Feb	Dry Days	46.0	59.2	59.5	53.2	57.1	62.8	49.7
	Wet Days	39.0	51.8	51.2	48.0	50.9	57.1	42.8
Mar	Dry Days	52.4	64.9	64.4	62.5	62.8	69.7	56.0
	Wet Days	42.0	54.5	53.9	52.2	53.5	60.5	45.6
Apr	Dry Days	62.2	73.7	72.2	71.8	70.0	78.1	63.6
	Wet Days	49.4	62.1	60.3	58.4	59.3	63.8	51.6
May	Dry Days	71.8	81.7	81.6	80.0	78.8	88.2	74.1
	Wet Days	60.2	68.7	69.3	68.7	68.6	72.9	62.8
Jun	Dry Days	80.8	92.6	91.1	89.2	89.6	99.0	84.7
	Wet Days	67.7	81.6	81.0	77.9	76.8	91.1	73.1
Jul	Dry Days	88.2	98.3	97.6	96.1	95.3	104.7	91.3
	Wet Days	83.0	93.0	94.1	92.8	91.1	97.9	87.6
Aug	Dry Days	85.5	95.9	95.5	93.6	93.0	102.3	89.0
	Wet Days	81.8	91.4	88.5	89.3	87.5	96.2	84.1
Sep	Dry Days	77.9	89.4	88.2	86.5	86.7	94.4	80.5
	Wet Days	70.8	79.4	78.5	78.7	79.4	87.4	72.7
Oct	Dry Days	67.2	78.4	77.1	75.3	74.6	81.2	68.5
	Wet Days	56.0	65.5	65.7	63.4	65.1	71.5	58.0
Nov	Dry Days	54.0	65.1	64.5	60.5	62.0	66.9	54.4
	Wet Days	43.6	52.9	53.0	51.4	54.1	58.4	43.1

Table 50. Mean Minimum Temperatures for Dry Days and Wet Days in Each Month.

Month	Type	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Dec	Dry Days	20.4	28.7	21.7	17.7	29.5	33.5	19.4
	Wet Days	22.2	32.4	26.5	26.3	31.6	39.6	24.3
Jan	Dry Days	18.1	27.5	20.9	14.9	28.5	33.1	17.8
	Wet Days	19.6	31.3	24.5	21.9	31.7	37.4	22.4
Feb	Dry Days	21.0	30.3	25.3	20.4	31.9	37.5	22.8
	Wet Days	22.6	35.6	31.1	30.1	34.0	42.1	26.6
Mar	Dry Days	24.4	34.2	29.4	26.4	36.5	43.0	26.8
	Wet Days	22.7	35.9	31.8	30.2	34.2	43.2	28.6
Apr	Dry Days	31.3	40.9	35.8	33.7	43.1	50.2	32.5
	Wet Days	28.3	42.0	36.1	34.8	38.4	46.5	31.2
May	Dry Days	39.4	48.3	43.8	41.6	50.6	59.6	41.7
	Wet Days	34.9	46.3	43.0	40.1	44.9	53.6	40.2
Jun	Dry Days	46.6	56.2	50.9	48.6	60.0	69.3	50.6
	Wet Days	41.7	53.7	51.0	49.0	52.8	65.5	48.7
Jul	Dry Days	53.9	61.6	55.7	55.3	65.5	76.1	55.8
	Wet Days	54.6	65.9	61.0	60.9	64.8	74.0	59.2
Aug	Dry Days	52.3	59.4	53.4	54.2	63.4	73.9	54.1
	Wet Days	53.2	65.1	59.5	59.3	64.3	73.0	57.7
Sep	Dry Days	45.4	53.7	46.5	45.0	57.1	65.6	46.5
	Wet Days	48.1	57.1	50.7	51.8	58.4	67.0	49.1
Oct	Dry Days	36.8	44.4	36.9	34.9	46.4	53.2	36.5
	Wet Days	35.2	44.7	41.4	40.9	45.6	53.4	38.6
Nov	Dry Days	26.7	33.8	27.4	24.0	36.0	41.3	25.8
	Wet Days	26.0	35.7	32.0	32.3	36.4	44.0	27.5

Table 51. Average Temperatures for Dry Days and Wet Days in Each Month.

Month	Type	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Dec	Dry	33.0	42.8	38.7	33.7	41.2	45.6	32.6
	Wet	29.9	40.5	36.6	35.0	39.5	46.3	32.1
Jan	Dry	30.8	40.7	37.5	30.8	39.9	45.0	31.3
	Wet	27.7	38.4	34.4	31.8	39.6	44.5	30.3
Feb	Dry	33.5	44.7	42.4	36.8	44.5	50.1	36.2
	Wet	30.8	43.7	41.2	39.0	42.5	49.6	34.7
Mar	Dry	38.4	49.6	46.9	44.4	49.7	56.3	41.4
	Wet	32.4	45.2	42.9	41.2	43.8	51.8	37.1
Apr	Dry	46.7	57.3	54.0	52.8	56.5	64.2	48.1
	Wet	38.8	52.0	48.2	46.6	48.8	55.2	41.4
May	Dry	55.6	65.0	62.7	60.8	64.7	73.9	57.9
	Wet	47.5	57.5	56.2	54.4	56.8	63.2	51.5
Jun	Dry	63.7	74.4	71.0	68.9	74.8	84.1	67.7
	Wet	54.7	67.7	66.0	63.5	64.8	78.3	60.9
Jul	Dry	71.0	80.0	76.7	75.7	80.4	90.4	73.5
	Wet	68.8	79.4	77.6	76.9	78.0	86.0	73.4
Aug	Dry	68.9	77.6	74.5	73.9	78.2	88.1	71.6
	Wet	67.5	78.2	74.0	74.3	75.9	84.6	70.9
Sep	Dry	61.6	71.6	67.3	65.7	71.9	80.0	63.5
	Wet	59.4	68.2	64.6	65.3	68.9	77.2	60.9
Oct	Dry	52.0	61.4	57.0	55.1	60.5	67.2	52.5
	Wet	45.6	55.1	53.6	52.2	55.3	62.5	48.3
Nov	Dry	40.4	49.4	45.9	42.3	49.0	54.1	40.1
	Wet	34.8	44.3	42.5	41.8	45.3	51.2	35.3

Table 52. Difference Between Monthly Maximum Dry Day and Wet Day Temperatures as shown in Table 49.

	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Dec	7.9	8.3	9.1	5.9	5.4	4.6	6.0
Jan	7.6	8.4	9.7	5.2	3.7	5.3	6.5
Feb	7.0	7.4	8.3	5.2	6.2	5.7	6.9
Mar	10.4	10.4	10.5	10.3	9.3	9.2	10.4
Apr	12.8	11.6	11.9	13.4	10.7	14.3	12.0
May	11.6	13.0	12.3	11.3	10.2	15.3	11.3
Jun	13.1	11.0	10.1	11.3	12.8	7.9	11.6
Jul	5.2	5.3	3.5	3.3	4.2	6.8	3.7
Aug	3.7	4.5	7.0	4.3	5.5	6.1	4.9
Sep	7.1	10.0	9.7	7.8	7.3	7.0	7.8
Oct	11.2	12.9	11.4	11.9	9.5	9.7	10.5
Nov	10.4	12.2	11.5	9.1	7.9	8.5	11.3

Table 53. Difference Between Monthly Minimum Dry Day and Wet Day Temperatures as Shown in Table 50. Values Calculated as: Dry Day Temp - Wet Day Temp.

	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Dec	-1.8	-3.7	-4.8	-8.6	-2.1	-6.1	-4.9
Jan	-1.5	-3.8	-3.6	-7.0	-3.2	-4.3	-4.6
Feb	-1.6	-5.3	-5.8	-9.7	-2.1	-4.6	-3.8
Mar	+1.7	-1.7	-2.4	-3.8	+2.3	-0.2	-1.8
Apr	+3.0	-1.1	-0.3	-1.1	+4.7	+3.7	+1.3
May	+4.5	+2.0	+0.8	+1.5	+5.7	+6.0	+1.5
Jun	+4.9	+2.5	-0.1	-0.4	+7.2	+3.8	+1.9
Jul	-0.7	-4.3	-5.3	-5.6	+0.7	+2.1	-3.4
Aug	-0.9	-5.7	-6.1	-5.1	-0.9	+0.9	-3.6
Sep	-2.7	-3.4	-4.2	-6.8	-1.3	-1.4	-2.6
Oct	+1.6	-0.3	-4.5	-6.0	+0.8	-0.2	-2.1
Nov	+0.7	-1.9	-4.6	-8.3	-0.4	-2.7	-1.7

Table 54. Differences Between Average Monthly Temperatures for Dry Days and Wet Days as Shown in Table 51. Values Calculated as Dry Day Temp - Wet Day Temp.

	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Dec	3.1	2.3	2.1	-1.3	1.7	-0.7	0.5
Jan	3.1	2.3	3.1	-1.0	0.3	0.5	1.0
Feb	2.7	1.0	1.2	-2.2	2.0	0.5	1.5
Mar	6.0	4.4	4.0	3.2	5.9	4.5	4.3
Apr	7.9	5.3	5.8	6.2	7.7	9.0	6.7
May	8.1	7.5	6.5	6.4	7.9	10.7	6.4
Jun	9.0	6.7	5.0	5.4	10.0	5.8	6.8
Jul	2.2	0.6	-0.9	-1.2	2.4	4.4	0.1
Aug	1.4	-0.6	0.5	-0.4	2.3	3.5	0.7
Sep	2.2	3.4	2.7	0.4	3.0	2.8	2.6
Oct	6.4	6.3	3.4	2.9	5.2	4.7	4.2
Nov	5.6	5.1	3.4	0.5	3.7	2.9	4.8

Table 55. Differences in Average Monthly Temperatures Between the Wettest (1/3) and Middle (1/3) Years, and Between the Wettest (1/3) and Driest (1/3) Years.

Station	Day	Wettest (1/3) - Middle (1/3)			Wettest (1/3) - Driest (1/3)		
		Max	Min	Avg	Max	Min	Avg
Adaven	Dry	-0.5	+0.8	+0.2	-1.5	-0.7	-1.1
	Wet	-0.2	+1.9	+0.8	-1.1	+0.2	-0.5
Beatty	Dry	+0.1	-0.5	-0.2	-3.2	-1.9	-2.5
	Wet	+1.6	+1.4	+1.5	-3.0	-0.5	-1.7
Bishop	Dry	-0.9	-0.2	-0.6	-0.6	-0.4	-0.5
	Wet	-0.1	+1.5	+0.7	-0.6	+1.5	+0.5
Caliente	Dry	-0.7	+0.6	-0.1	-1.8	+0.1	-0.9
	Wet	-0.8	+0.1	-0.4	-2.7	+0.2	-1.3
Haiwee	Dry	+0.6	+1.1	+0.8	+0.8	0.0	+0.4
	Wet	+0.4	+1.0	+0.7	+0.7	+1.4	+1.0
Las Vegas	Dry	+0.6	-0.7	-0.1	-0.1	-0.2	-0.1
	Wet	+0.9	+0.1	+0.5	-0.9	0.0	-0.5
Tonopah	Dry	+1.1	+0.8	+0.9	-0.9	+0.1	-0.4
	Wet	+0.5	+0.1	+0.4	-1.5	-0.4	-0.9

Greater temperature differences between wet and dry days during spring and fall (as compared to winter) occur because the transition seasons are characterized by more variable air masses (refer to Table 1). Winter is dominated by polar air masses and summer by tropical air masses; whereas spring and fall are characterized by an abundance of both air mass types.

The relationship between the status of a given day (wet or dry) and minimum temperature is different than with maximum temperature. Cloud cover associated with rainy days acts to keep minimum temperatures near or above normal on wet days. This occurs because the earth radiates heat back into the atmosphere at night, and clouds prevent much of this heat from escaping. Therefore, the land loses heat more rapidly on clear nights than on cloudy nights.

Minimum temperatures are generally warmer in the months from April to June during dry years; and warmer in other months during wet years. An explanation may be that the effect of cool air associated with cold fronts from April to June overshadows the warming effect of cloud cover during this time. Conversely, cloud cover may play a more dominant role in other months, thereby causing wet days to be warmer at night.

CONSUMPTIVE USE CALCULATIONS

METHODS

Two different scenarios were used to calculate differences in consumptive use (evapotranspiration) and water deficits between modern and Last Glacial Maximum (LGM) conditions. Both scenarios defined modern conditions using observed temperature and precipitation data from the Beatty station. Modern temperatures were based on 1941-1970 norms taken from a National Weather Service (NWS) climatological summary (Table 56). This NWS summary estimates values for much of the missing temperature data that occurred during this period. Precipitation values were based on data from the period 1918-1986 (see Table 3).

Table 56. Mean (Average of Maximum and Minimum) Monthly Temperatures (in °F) for Beatty from NWS Climatological Summary.

Month	Temp	Month	Temp
Dec	43.2	Jun	74.1
Jan	41.3	Jul	81.1
Feb	45.4	Aug	79.4
Mar	49.7	Sep	72.7
Apr	57.8	Oct	61.8
May	66.3	Nov	50.1

LGM conditions for scenario one were based on Spaulding's (1983) packrat midden study (see Table 22). A temperature decrease of 11 °F was applied to each month. Precipitation increased 40 percent on an annual basis; a 70 percent increase applied for the months from November to April; a 40 percent decrease applied to the months of June through September; and no change for the transition months of May and October. LGM conditions for scenario two were based on temperature differences between the wettest (1/3) years and entire period of record (see table 57) at Beatty, and precipitation values for the wettest (1/3) years at Beatty. Temperatures in Table 57 were subtracted or added to "modern" values given in Table 56. The annual average temperature drop under this scenario is 1 °F.

Table 57. Temperature Differences (in °F) Between the Wettest (1/3) Years and Entire Period of Record at Beatty. Values calculated as Wettest (1/3) Temp - Entire Period of Record Temp.

Dec	-0.5	Jun	-2.5
Jan	+0.9	Jul	-1.9
Feb	+0.9	Aug	-1.2
Mar	-2.6	Sep	-0.9
Apr	-2.5	Oct	+1.2
May	-1.1	Nov	-0.4

Calculations of potential evapotranspiration were made using the Blaney-Criddle method (from Jensen, 1973). The Blaney-Criddle formula is given by:

$$U = KF = \sum_{i=1}^{12} k_i f_i$$

where U = estimated evapotranspiration (consumptive use) inches,

K = empirical consumptive use coefficient,

F = sum of monthly consumptive use factors (f),

k = monthly consumptive use coefficient,

f = tp/100; where t= mean monthly temperature and p= mean monthly percentage of annual daylight hours.

Data for p were based on values for 37 ^{o} North latitude (from Jensen, 1973). Monthly consumptive use coefficients, k, were assumed to be 1.0 for the following reasons: 1) no data concerning k values were available for the study area; 2) the primary concern of these calculations was to determine differences between LGM and modern evapotranspiration, so values of k make no difference in the final results provided that k remains constant between modern and LGM conditions. The Blaney-Criddle formula was used to obtain monthly potential evapotranspiration values, from which monthly precipitation was subtracted to give a monthly water deficit. The formula is as follows:

monthly PET (inches) - monthly PPT (inches) = monthly water deficit (inches)

where PET = potential evapotranspiration and PPT = precipitation. Monthly water deficit calculations were made for modern and LGM conditions for both scenarios. The final step was to subtract LGM monthly deficits from modern monthly deficits as follows:

Modern monthly water deficit - LGM monthly water deficit = X (inches)

where X represents the monthly amount of additional water needed under modern conditions of temperature and precipitation to obtain a LGM water budget. Values for modern monthly water deficit, LGM monthly water deficit, and X are given in Table 58 for scenario one and in Table 59 for scenario two.

RESULTS AND DISCUSSION

X values are greater for scenario one due to the larger temperature difference (-11 to -1 ^{o}F) between modern and LGM conditions. On an annual basis, there is a 13 inch difference for scenario one compared to only three and a half inches for scenario two. These two scenarios provide water deficit estimates for two possible sets of LGM conditions.

These calculations can be used to design a monthly irrigation schedule to simulate LGM water budgets on test plots near Yucca Mountain. The response of plants and changes in soil moisture conditions, induced by LGM climatic conditions, can be simulated to provide estimates of the effect of wetter climatic conditions upon infiltration and recharge.

Table 58. Monthly Differences (X) Between Modern Monthly Water Deficits and Last Glacial Maximum (LGM) Monthly Water Deficits for Scenario One.

Month	Modern Monthly Deficit (Inches)	LGM Monthly Deficit (Inches)	X (Inches)
Dec	2.42	1.32	1.10
Jan	2.23	1.03	1.20
Feb	2.34	1.06	1.28
Mar	3.54	2.21	1.33
Apr	4.71	3.44	1.27
May	6.25	5.17	1.08
Jun	7.18	6.15	1.03
Jul	7.95	6.93	1.02
Aug	7.23	6.30	0.93
Sep	5.79	4.99	0.80
Oct	4.56	3.70	0.86
Nov	3.02	1.96	1.06
Total	57.22	44.26	12.96

Table 59. Monthly Differences (X) Between Modern Monthly Water Deficits and Last Glacial Maximum (LGM) Monthly Water Deficits for Scenario Two.

Month	Modern Monthly Deficit (Inches)	LGM Monthly Deficit (Inches)	X (Inches)
Dec	2.42	2.23	0.19
Jan	2.23	1.86	0.37
Feb	2.34	2.06	0.28
Mar	3.54	2.89	0.65
Apr	4.71	4.20	0.51
May	6.25	5.99	0.26
Jun	7.18	6.85	0.33
Jul	7.95	7.70	0.25
Aug	7.23	6.97	0.26
Sep	5.79	5.54	0.25
Oct	4.56	4.63	-0.07
Nov	3.02	2.76	0.26
Total	57.22	53.68	3.54

SUMMARY AND CONCLUSIONS

The climate of the southern Great Basin is complex due to various atmospheric and geographical factors. Climate in this region is a function of three distinct storm types: Pacific fronts, continental cyclones, and convection thunderstorms; which vary both geographically and seasonally.

Under present climatic conditions the western portion of the southern Great Basin is characterized by a winter (Pacific front) dominated precipitation regime. Beatty, located most centrally and nearest to Yucca Mountain, has a slightly less winter dominated regime due to an increased continental component. Extreme northern, eastern, and southern portions of the study area receive a more uniform seasonal distribution of precipitation due to important contributions from all three storm types. Overall, there is a trend from west to east in which the dominance of winter precipitation gradually decreases until a relatively uniform seasonal distribution occurs.

The seasonal distribution of precipitation during the wettest (1/3) years indicates some shifts from the "present" (i.e. entire period of record) distribution depending upon location. The western stations (Bishop and Haiwee) and Las Vegas have large increases in winter season precipitation. Adaven and Caliente have approximately the same increases in all seasons. Beatty has a large increase in spring precipitation, and Tonopah's largest increase occurs in summer. In general, precipitation during wet years increases most in each station's season of maximum precipitation under "present" conditions. The only exception occurs at Beatty, which has a winter maximum under "present" conditions but has its largest increase in spring season precipitation during the wettest (1/3) years. Overall, precipitation during wet years increases most from January to March in the study area.

Daily precipitation data were analyzed within a seasonal framework. Sequences of wet and dry days were modeled using Markov chains. A first-order Markov chain was used to model the distribution of wet day sequences; whereas a third-order Markov chain was best for simulating the observed distribution of dry day sequences. The observed distributions of daily storm depths were modeled using three different distributions: exponential, gamma, and Weibull. Chi-square goodness of fit tests indicate that the Weibull distribution was best able to model the observed data.

Statistical models were also applied to data sets representing the wettest (1/3) and middle (1/3) years at each station. Goodness of fit tests indicate that good results were obtained even with the smaller data sets. Statistical modeling of daily precipitation data provides a method of generating synthetic data for different climatic conditions. The importance of this result is explained in the following section.

Some relationships between temperature and precipitation data were established. On an annual basis, wet years have lower mean maximum temperatures than dry years. Mean minimum temperatures show insignificant differences between wet and dry years.

On a monthly and daily basis, wet days in a given month have significantly cooler maximum temperatures than dry days. The difference between wet- and dry-day maximum temperatures varies approximately from 3 to 15 ^oF depending on the month and station. Overall, the greatest differences between wet and dry day maximum temperatures occur from April to June.

Minimum temperatures may be cooler or warmer on dry days (compared to wet days) depending on the month and station. This observation is probably due to the complicating effect of increased cloud cover on wet days, which keep heat from escaping at night.

Consumptive use calculations were made for modern and LGM conditions and combined with precipitation data to determine monthly differences between modern and LGM water deficits. Results indicate that approximately 13 inches of water must be added to modern conditions of temperature and precipitation to simulate a LGM water deficit under scenario one, and three and a half inches under scenario two. This information will be useful in designing an irrigation schedule for experimental plots near Yucca Mountain to determine plant response and changes in soil moisture conditions caused by "pluvial" climatic conditions.

APPLICATION OF RESULTS AND FUTURE RESEARCH

A primary objective of this study is to provide climatic input data for a water balance model to determine the effect of climatic variability upon recharge in southern Nevada. In order to obtain a reasonably accurate water budget, calculations must be made on a daily basis. Therefore, this study has focused on the daily occurrence of precipitation events, in addition to monthly and seasonal variability.

Statistical modeling of wet day sequences, dry day sequences, and daily storm depths was designed to provide a means of generating synthetic precipitation data. The fitted distributions and appropriate parameters can be input to a computer program which would randomly generate a sequence of precipitation events. If the fitted distributions accurately model observed data, the computer generated (synthetic) data should have characteristics similar to the observed data. Therefore, one would be able to generate as many years of precipitation data as necessary.

Furthermore, this study has examined differences between wet, average, and dry years. If it is presumed that wet years in the historical record are representative of average years under a wetter climatic regime; the statistical characteristics of "average" years in a pluvial climate can be determined. Therefore, the observed data from wet years (defined as the wettest 33 percent of the total record) were also fit to model distributions and their parameters were estimated. In most cases, the observed data from wet years were fit to distributions as accurately as observed data from the entire period of record.

The purpose of fitting distributions and the appropriate parameters to different sets of observed data is to provide a means of generating lengthy synthetic precipitation sequences to represent current and pluvial climates. However, it must be noted that the simulated pluvial climate would not include the extremes of a pluvial regime, but only the characteristics of the "average" years in a pluvial climatic regime. Nonetheless, the different sets of precipitation data that can be generated in this manner will be very useful as input data to a water balance model to determine the effect of different climatic regimes upon recharge.

In light of the results found in this study, the following procedure is recommended for generating and inputting climate data into a water balance model: 1) construct a computer program to generate synthetic precipitation sequences using model distributions and appropriate parameters; 2) after the computer determines the wet or dry status of a given day, a temperature value is assigned conditional upon the precipitation status; 3) the climatic state of the given day is then input to a water balance model to calculate evapotranspiration, soil moisture, and net infiltration. The flow chart, given in Figure 19, outlines the computer code necessary for generation of synthetic climate data.

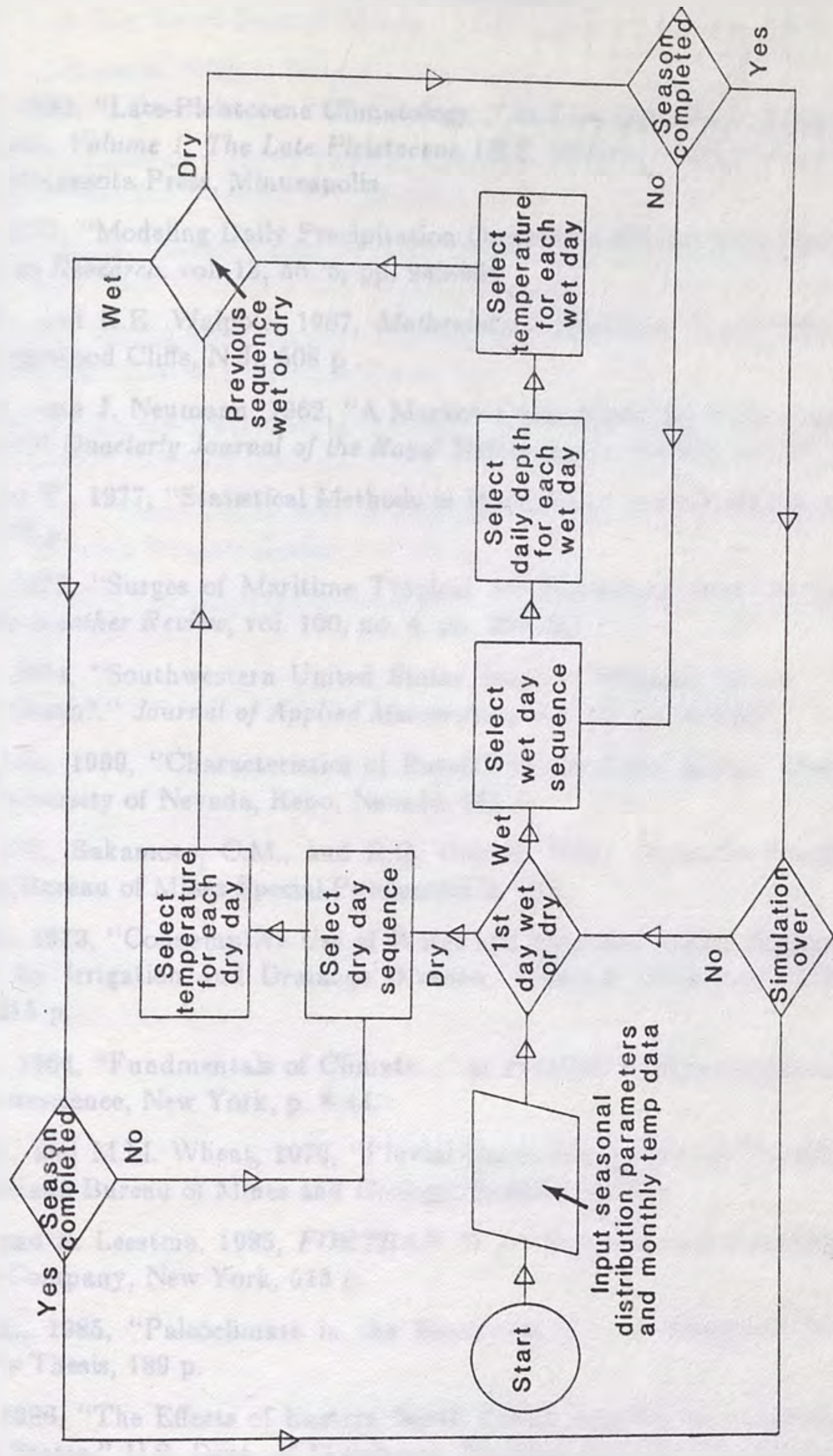


Figure 19. Flow Chart for Computer Model to Generate Synthetic Climate Data.

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APPENDIX A

The equation used to calculate the probability of a wet spell of length n is given by:

$$p(n)=P(d|w)P(w|w)^{(n-1)}$$

where $p(n)$=probability of a wet spell of length n,

$P(d|w)$=probability of a dry day given a wet day,

$P(w|w)$=probability of a wet day given a wet day.

This is a first-order Markov chain model as given by Weiss (1964). The expected values given in Tables A-1 to A-21 were calculated by multiplying p(n) times the total number of observed sequences.

The null hypothesis was tested using the chi-square goodness of fit test. The null hypothesis states that the observed distribution of wet day sequences is given by a first-order Markov chain. The test statistic being used is given by:

$$x^2=\sum_{i=1}^{k}(o_i-e_i)^2/e_i$$

where o_i = observed frequencies, e_i = expected frequencies, and x^2 is the value of a random variable X^2 whose sampling distribution is approximated by the chi-square distribution. The level of significance for all tests was α=.05. Table A-22 shows the results of the chi-square goodness of fit tests run on wet day sequences. Table A-23 gives values for $P(d|w)$ calculated from observed data sets for each station. $P(w|w)$ is equal to $1 - P(d|w)$.

Table A-1. Adaven Wet Day Sequences (1929-78): Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	249	244	233	221	185	187	144	147	805	794
2	94	94	75	83	71	70	55	48	293	294
3	31	37	23	31	27	26	12	16	92	109
4	13	14	12	12	12	10	7	5	44	41
5	6	6	2	4	3	4	1	2	13	15
6	4	2	7	2	1	1	0	1	11	6
7	1	1	1	1	0	1	0	0	4	2
8	0	0	0	0	0	0	0	0	0	1
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0

Table A-2. Beatty Wet Day Sequences (1918-86): Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	185	182	183	180	123	125	111	113	597	594
2	64	63	59	59	32	29	38	35	191	187
3	13	22	15	20	7	7	8	11	46	59
4	9	7	6	7	1	2	6	3	22	19
5	5	3	3	2	0	0	0	1	8	6
6	1	1	1	1	0	0	0	0	2	2
7	0	0	0	0	0	0	0	0	0	1
8	0	0	1	0	0	0	0	0	1	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0

Table A-3. Bishop Wet Day Sequences (1949-86): Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	115	122	124	135	101	102	94	97	431	457
2	71	53	63	45	32	31	42	35	207	169
3	15	23	11	15	10	10	9	13	45	62
4	9	10	3	5	3	3	5	5	20	23
5	3	5	0	2	1	1	1	2	6	9
6	2	2	0	1	0	0	1	1	3	3
7	0	1	1	0	0	0	0	0	1	1
8	1	0	0	0	0	0	0	0	1	0
9	1	0	0	0	0	0	0	0	1	0
10	0	0	0	0	0	0	0	0	0	0

Table A-4. Caliente Wet Day Sequences (1929-84): Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	205	211	191	183	180	175	138	139	709	705
2	101	85	70	78	66	72	57	55	291	289
3	22	34	36	33	31	30	22	22	113	118
4	14	14	11	14	9	12	8	9	42	48
5	6	6	6	6	8	5	4	4	25	20
6	4	2	2	3	0	2	2	1	8	8
7	0	1	1	1	3	1	0	1	4	3
8	0	0	1	1	0	0	0	0	1	1
9	0	0	0	0	0	0	0	0	0	1
10	0	0	0	0	0	0	0	0	0	0

Note: One 13-day sequence occurred during spring.

Table A-5. Haiwee Wet Day Sequences (1930-86): Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	183	185	174	174	91	90	81	91	523	531
2	90	78	53	53	24	25	49	35	216	193
3	22	33	15	16	8	7	12	13	59	70
4	17	14	4	5	1	2	4	5	24	26
5	1	6	3	2	0	1	1	2	5	9
6	1	2	0	0	1	0	0	1	2	3
7	4	1	0	0	0	0	0	0	4	1
8	1	0	0	0	0	0	0	0	2	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0

Table A-6. Las Vegas Wet Day Sequences (1931-86): Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	162	165	147	147	147	144	137	141	585	589
2	65	60	38	37	32	37	43	35	179	173
3	20	22	8	9	10	9	6	9	46	51
4	10	8	4	2	3	2	2	2	19	15
5	3	3	0	1	1	1	0	1	4	4
6	0	1	0	0	0	0	0	0	0	1
7	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0

Table A-7. Tonopah Wet Day Sequences (1955-86): Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	120	120	150	154	117	118	93	96	471	480
2	48	44	58	49	45	42	42	36	190	170
3	14	16	12	16	12	15	10	13	51	60
4	2	6	4	5	6	5	6	5	18	21
5	2	2	2	2	2	2	1	2	7	8
6	3	1	0	1	1	1	0	1	5	3
7	0	0	0	0	0	0	1	0	1	1
8	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0

Table A-8. Adaven Wet Day Sequences for the Middle (1/3) Years: Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	75	73	74	66	44	50	43	42	236	230
2	29	29	14	25	27	21	13	13	81	88
3	8	11	10	9	11	9	2	4	31	34
4	4	4	4	3	4	4	3	1	16	13
5	2	2	0	1	1	2	0	0	3	5
6	2	1	3	1	0	1	0	0	5	2
7	0	0	0	0	0	0	0	0	0	1
8	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0

Table A-9. Adaven Wet Day Sequences for the Wettest (1/3) Years: Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	103	100	82	79	79	78	57	58	315	311
2	34	40	36	34	25	29	23	20	120	123
3	19	16	7	15	14	11	5	7	45	50
4	6	6	8	7	6	4	4	2	23	19
5	3	3	2	3	1	2	0	1	7	8
6	0	1	3	1	0	1	0	0	2	3
7	1	0	1	1	0	0	0	0	3	1
8	0	0	0	0	0	0	0	0	0	1
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0

Table A-10. Beatty Wet Day Sequences for the Middle (1/3) Years: Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	76	78	62	60	54	54	42	42	234	234
2	20	17	16	18	12	13	16	14	64	63
3	2	4	4	6	5	3	2	5	13	17
4	1	1	3	2	0	1	4	2	8	5
5	0	0	1	1	0	0	0	1	1	1
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0

Table A-11. Beatty Wet Day Sequences for the Wettest (1/3) Years: Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	65	64	69	69	39	41	46	45	219	215
2	30	28	31	28	12	9	12	14	85	82
3	6	12	10	12	2	2	6	5	24	31
4	6	5	3	5	0	1	2	2	11	12
5	4	2	2	2	0	0	0	1	6	5
6	1	1	1	1	0	0	0	0	2	2
7	0	0	0	0	0	0	0	0	0	1
8	0	0	1	0	0	0	0	0	1	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0

Table A-12. Bishop Wet Day Sequences for the Middle (1/3) Years: Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	42	41	37	41	36	36	29	32	143	148
2	19	18	24	16	11	11	19	14	72	60
3	6	8	5	6	3	3	3	6	18	24
4	3	3	1	3	0	1	5	3	9	10
5	1	2	0	1	1	0	0	1	2	4
6	1	1	0	0	0	0	1	1	2	2
7	0	0	1	0	0	0	0	0	1	1
8	1	0	0	0	0	0	0	0	1	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0

Table A-13. Bishop Wet Day Sequences for the Wettest (1/3) Years: Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	30	39	47	52	29	30	34	34	138	150
2	35	20	25	17	11	11	12	12	83	62
3	6	11	4	6	5	4	5	4	19	26
4	6	6	2	2	2	1	0	1	10	11
5	2	3	0	1	0	1	1	1	4	4
6	1	2	0	0	0	0	0	0	1	2
7	0	1	0	0	0	0	0	0	0	1
8	0	0	0	0	0	0	0	0	0	0
9	1	0	0	0	0	0	0	0	1	0
10	0	0	0	0	0	0	0	0	0	0

Table A-14. Caliente Wet Day Sequences for the Middle (1/3) Years: Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	69	71	56	54	55	59	51	52	229	233
2	33	27	28	28	28	25	21	20	111	100
3	6	10	16	14	13	10	8	8	43	43
4	4	4	4	7	2	4	1	3	11	18
5	2	2	1	4	3	2	3	1	9	8
6	1	1	2	2	0	1	0	0	3	3
7	0	0	1	1	0	0	0	0	1	1
8	0	0	1	1	0	0	0	0	1	1
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0

Note: One 13-day sequence occurred during spring.

Table A-15. Caliente Wet Day Sequences for the Wettest (1/3) Years: Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	74	78	71	70	62	57	41	42	246	245
2	43	34	30	30	22	26	21	20	113	109
3	9	15	9	13	9	11	10	9	38	48
4	7	7	7	5	3	5	5	4	22	21
5	2	3	5	2	4	2	1	2	13	10
6	3	1	0	1	0	1	2	1	5	4
7	0	1	0	0	3	1	0	1	3	2
8	0	0	0	0	0	0	0	0	0	1
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0

Table A-16. Haiwee Wet Day Sequences for the Middle (1/3) Years: Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	59	64	56	56	27	29	29	30	171	176
2	37	27	17	17	11	8	13	11	78	65
3	9	11	6	6	2	2	4	4	21	24
4	2	5	1	2	0	1	1	2	4	9
5	1	2	1	1	0	0	1	1	3	3
6	0	1	0	0	0	0	0	0	0	1
7	2	0	0	0	0	0	0	0	2	0
8	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0

Table A-17. Haiwee Wet Day Sequences for the Wettest (1/3) Years: Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	65	63	67	69	41	38	30	36	202	202
2	30	31	28	24	7	12	22	15	86	84
3	11	15	7	8	5	4	6	6	30	35
4	14	8	2	3	1	1	3	3	20	15
5	0	4	2	1	0	0	0	1	2	6
6	1	2	0	0	1	0	0	1	2	3
7	2	1	0	0	0	0	0	0	2	1
8	1	1	0	0	0	0	0	0	1	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0

Table A-18. Las Vegas Wet Day Sequences for the Middle (1/3) Years: Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	57	60	67	67	44	43	54	55	216	220
2	28	22	14	15	11	11	14	13	70	63
3	6	8	4	3	1	3	4	3	15	18
4	3	3	1	1	1	1	0	1	5	5
5	1	1	0	0	1	0	0	0	2	2
6	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0

Table A-19. Las Vegas Wet Day Sequences for the Wettest (1/3) Years: Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	61	61	45	44	54	54	47	50	205	206
2	24	25	12	14	14	16	20	14	68	70
3	9	10	4	4	8	5	2	4	25	24
4	6	4	3	1	1	2	1	1	11	8
5	2	2	0	0	0	1	0	0	2	3
6	0	1	0	0	0	0	0	0	0	1
7	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0

Table A-20. Tonopah Wet Day Sequences for the Middle (1/3) Years: Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	45	45	48	48	27	30	28	28	146	150
2	15	14	18	17	17	12	13	12	61	54
3	4	4	3	6	3	5	2	5	14	20
4	0	1	3	2	3	2	4	2	10	7
5	0	0	1	1	0	1	1	1	2	3
6	1	0	0	0	0	0	0	0	1	1
7	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0

Table A-21. Tonopah Wet Day Sequences for the Wettest (1/3) Years: Observed and Expected Values Using a First Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	36	38	51	56	45	44	38	38	168	172
2	20	17	26	19	16	18	16	15	76	68
3	7	7	6	6	7	7	7	6	27	27
4	2	3	0	2	2	3	2	3	6	11
5	1	1	1	1	2	1	0	1	4	4
6	1	1	0	0	1	1	0	0	3	2
7	0	0	0	0	0	0	1	0	1	1
8	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0

Table A-22. Chi-Square Goodness of Fit Test Results for Wet Day Sequences. Level of Significance $\alpha = .05$; R = Reject Null Hypothesis; F = Fail to Reject Null Hypothesis.

Station	Season	Entire Record	Middle (1/3)	Wettest (1/3)
Adaven	Winter	F	F	F
	Spring	F	R	F
	Summer	F	F	F
	Fall	F	F	F
	Annual	F	F	F
Beatty	Winter	F	F	F
	Spring	F	F	F
	Summer	F	F	F
	Fall	F	F	F
	Annual	F	F	F
Bishop	Winter	R	F	R
	Spring	R	R	R
	Summer	F	F	F
	Fall	F	F	F
	Annual	R	F	R
Caliente	Winter	F	F	F
	Spring	F	F	F
	Summer	F	F	F
	Fall	F	F	F
	Annual	F	F	F
Haiwee	Winter	F	F	F
	Spring	F	F	F
	Summer	F	F	F
	Fall	R	F	F
	Annual	F	F	F
Las Vegas	Winter	F	F	F
	Spring	F	F	F
	Summer	F	F	F
	Fall	F	F	R
	Annual	F	F	F
Tonopah	Winter	F	F	F
	Spring	F	F	R
	Summer	F	F	F
	Fall	F	F	F
	Annual	F	F	F

Table A-23. Values for P(d|w) Calculated from Observed Data Sets for Each Station.

Station	Season	Entire Record	Middle (1/3)	Wettest (1/3)
Adaven	Winter	.6130	.6094	.6000
	Spring	.6255	.6258	.5654
	Summer	.6261	.5724	.6231
	Fall	.6719	.6941	.6538
	Annual	.6293	.6187	.6040
Beatty	Winter	.6553	.7857	.5691
	Spring	.6700	.6967	.5918
	Summer	.7689	.7634	.7681
	Fall	.6907	.6598	.6809
	Annual	.6846	.7306	.6184
Bishop	Winter	.5623	.5625	.4756
	Spring	.6667	.6091	.6638
	Summer	.6934	.7083	.6351
	Fall	.6395	.5545	.6579
	Annual	.6306	.5981	.5853
Caliente	Winter	.5990	.6196	.5625
	Spring	.5730	.4908	.5742
	Summer	.5884	.5814	.5514
	Fall	.6016	.6148	.5302
	Annual	.5905	.5714	.5564
Haiwee	Winter	.5810	.5838	.5042
	Spring	.6969	.6870	.6522
	Summer	.7209	.7273	.6835
	Fall	.6164	.6164	.5825
	Annual	.6362	.6319	.5843
Las Vegas	Winter	.6334	.6345	.5928
	Spring	.7471	.7727	.6882
	Summer	.7471	.7436	.6972
	Fall	.7520	.7609	.7188
	Annual	.7070	.7133	.6610
Tonopah	Winter	.6354	.6957	.5664
	Spring	.6822	.6509	.6613
	Summer	.6441	.6049	.5984
	Fall	.6266	.5926	.5962
	Annual	.6466	.6393	.6047

APPENDIX B

The equations used to calculate the marginal probability of a dry spell of length n are as follows:

$p(n)=P(w)P(d|w)P(w|d,w)$ for $n=1$

$p(n)=P(w)P(d|w)P(d|d,w)P(w|d,d,w)$ for $n=2$

$p(n)=P(w)P(d|w)P(d|d,w)P(d|d,d,w)P(d|d,d,d)^{n-3}P(w|d,d,d)$ for $n=3,4,...$

where $p(n)$=marginal probability of a dry spell of length n,

$P(w)$=marginal probability of a day being wet,

$P(d|w)$=conditional probability of a dry day following a wet day,

$P(d|d,w)$=conditional probability of a dry day following a dry day preceded by a wet day,

$P(w|d,d,w)$=conditional probability of a wet day following two dry days preceded by a wet day,

$P(d|d,d,d)$=conditional probability of a dry day following three dry days.

This is a third-order Markov chain model as given by Chin (1977). The expected values, E(n), given in Tables B-1 to B-21 were calculated by the equation:

$$E(n)=[p(n)/\sum_{n=1}^{k}p(n)] \text{ [total number of observed sequences]}.$$

The null hypothesis was tested using the chi-square goodness of fit test. The null hypothesis states that the observed distribution of dry day sequences is given by a third-order Markov chain. The goodness of fit test was applied as described in Appendix A. The level of significance for all tests was α=.05. Table B-22 shows the results of chi-square goodness of fit tests run on dry day sequences. Tables B-23 and B-24 give values for the probabilities calculated from observed data sets for each station.

Table B-1. Adaven Dry Day Sequences (1929-78): Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	69	72	64	62	48	47	20	23	188	189
2	60	58	42	39	40	42	25	23	153	153
3	39	32	29	24	19	18	20	11	101	75
4	37	28	32	22	23	17	12	11	91	69
5	20	25	23	20	13	16	10	10	58	64
6	31	23	17	18	25	14	8	9	71	59
7	12	20	9	17	11	13	10	9	42	54
8	17	18	14	15	11	12	9	8	52	50
9	21	16	12	14	17	11	5	8	47	46
10	17	14	14	13	10	11	5	8	39	42
11	11	13	12	12	8	10	4	7	31	39
12	15	12	15	11	10	9	9	7	44	36
13	7	10	6	10	12	9	7	6	29	33
14	6	9	7	9	8	8	8	6	28	30
15	4	8	9	8	10	7	8	6	26	28
16	7	7	9	7	7	7	4	5	26	26
17	6	7	4	7	4	6	5	5	15	24
18	6	6	5	6	3	6	7	5	22	22
19	5	5	8	6	8	5	4	5	23	20
20	8	5	5	5	2	5	5	4	20	19
21-30	18	26	27	32	25	34	32	32	98	122
31-40	7	9	10	13	10	16	15	19	39	53
41-50	3	3	3	5	7	8	8	11	24	24
51-60	1	1	1	2	3	4	7	6	14	10
61-70	0	0	0	1	1	2	3	4	7	5
71-80	0	0	0	0	0	1	0	2	4	2
81-92	0	0	1	0	1	0	0	1	2	1
93-									0	0

Table B-2. Beatty Dry Day Sequences (1918-86): Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	35	35	33	29	18	19	16	15	91	88
2	35	33	27	28	13	17	10	7	79	76
3	21	15	15	13	6	6	10	7	45	33
4	18	14	14	13	12	6	11	7	43	32
5	14	13	26	12	7	6	9	6	46	30
6	15	12	13	11	10	5	4	6	30	29
7	19	12	10	11	8	5	5	6	33	28
8	8	11	13	10	6	5	5	6	28	26
9	12	10	10	10	3	5	5	6	26	25
10	10	10	11	9	9	5	4	5	26	24
11	6	9	11	9	2	5	6	5	20	23
12	7	9	5	8	9	4	8	5	26	22
13	7	8	6	8	3	4	3	5	10	21
14	5	8	7	7	3	4	5	5	19	20
15	6	7	10	7	4	4	3	5	23	19
16	11	7	6	7	3	4	6	4	24	18
17	11	6	2	6	6	4	3	4	17	18
18	2	6	4	6	5	4	9	4	19	17
19	5	6	6	6	2	4	4	4	17	16
20	2	5	4	5	4	3	4	4	13	15
21-30	26	39	40	40	26	29	26	31	91	121
31-40	28	21	15	23	14	21	16	22	70	77
41-50	7	12	3	13	11	15	16	15	26	49
51-60	5	7	9	8	14	11	10	11	30	31
61-70	3	4	1	5	2	8	6	7	24	20
71-80	0	2	3	3	4	6	2	5	10	13
81-92	1	1	3	2	8	5	4	4	6	9
93-									21	13

Table B-3. Bishop Dry Day Sequences (1949-86): Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	43	41	28	30	17	19	17	18	96	94
2	29	27	15	16	16	20	11	8	70	64
3	13	10	17	11	9	6	12	8	41	29
4	12	10	18	10	9	6	10	7	46	28
5	12	9	7	10	9	5	9	7	30	27
6	9	9	9	9	2	5	8	7	25	25
7	13	8	14	9	9	5	8	6	32	24
8	10	8	7	8	4	5	7	6	23	23
9	7	7	13	8	6	5	4	6	25	22
10	2	7	3	7	2	4	6	5	12	21
11	6	6	6	7	7	4	2	5	10	20
12	4	6	7	6	3	4	7	5	16	19
13	3	6	6	6	2	4	5	5	13	18
14	9	5	5	6	6	4	4	4	19	17
15	3	5	3	5	4	4	5	4	15	16
16	4	5	5	5	3	3	3	4	14	15
17	1	4	5	5	4	3	4	4	10	14
18	5	4	2	4	2	3	5	4	12	14
19	6	4	4	4	0	3	2	4	9	13
20	2	4	3	4	2	3	4	3	9	12
21-30	22	27	29	28	25	24	21	26	87	93
31-40	18	15	9	16	21	16	6	16	48	56
41-50	6	8	6	9	12	10	7	10	25	33
51-60	3	5	4	5	5	7	7	6	23	20
61-70	2	3	5	3	2	5	9	4	18	12
71-80	0	1	0	1	1	3	1	2	8	7
81-92	0	1	0	1	0	2	0	2	3	5
93-									5	5

Table B-4. Caliente Dry Day Sequences (1929-84): Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	62	57	50	48	54	54	33	34	182	179
2	43	40	36	37	38	34	23	25	125	124
3	40	28	31	22	26	18	20	12	106	72
4	26	25	27	20	32	17	11	11	86	67
5	25	23	19	19	13	16	9	11	60	61
6	20	21	24	17	17	14	14	10	65	57
7	12	19	13	16	14	13	13	10	43	52
8	18	17	15	14	15	12	3	9	52	48
9	16	15	14	13	8	11	4	8	37	44
10	16	14	12	12	13	11	9	8	44	41
11	12	12	11	11	9	10	11	8	38	38
12	8	11	6	10	8	9	12	7	27	35
13	9	10	8	9	2	8	6	7	25	32
14	9	9	8	9	6	8	6	6	25	30
15	3	8	5	8	3	7	6	6	13	27
16	6	7	3	7	4	7	9	6	19	25
17	10	7	3	7	4	6	5	5	21	23
18	4	6	8	6	6	6	3	5	19	21
19	3	5	9	6	6	5	6	5	25	20
20	6	5	1	5	7	5	6	4	23	18
21-30	18	29	29	32	25	33	27	32	98	120
31-40	10	10	11	13	10	16	14	18	52	53
41-50	5	4	4	6	6	7	12	10	18	24
51-60	2	1	0	2	4	3	1	5	12	11
61-70	0	1	3	1	2	2	2	3	6	5
71-80	0	0	0	0	0	1	1	2	5	2
81-92	0	0	0	0	1	0	0	1	0	1
93-									3	0

Table B-5. Haiwee Dry Day Sequences (1930-86): Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	45	43	25	24	15	22	15	15	92	88
2	40	41	29	26	9	8	6	7	74	76
3	26	19	23	12	7	4	11	6	59	30
4	27	18	17	11	6	4	9	6	53	29
5	22	16	17	11	5	4	5	5	45	28
6	16	15	10	10	3	4	5	5	26	26
7	14	14	13	10	10	4	7	5	36	25
8	11	13	7	9	4	3	2	5	18	24
9	18	12	6	9	3	3	5	5	30	23
10	9	12	6	8	3	3	3	5	18	22
11	5	11	10	8	1	3	7	5	19	21
12	8	10	9	7	3	3	8	4	19	20
13	10	9	4	7	1	3	6	4	18	20
14	8	9	4	7	3	3	3	4	15	18
15	7	8	3	6	4	3	4	4	11	18
16	8	8	6	6	4	3	4	4	19	17
17	6	7	3	6	3	3	6	4	15	17
18	5	7	6	6	6	3	6	4	18	16
19	5	6	9	5	3	3	2	4	12	15
20	6	6	4	5	1	3	3	3	13	15
21-30	28	39	30	38	19	22	24	28	82	116
31-40	21	19	18	23	14	18	17	19	67	75
41-50	12	10	9	14	15	14	12	15	32	49
51-60	2	5	9	9	10	11	7	11	18	32
61-70	1	2	6	5	2	9	8	8	19	21
71-80	0	1	1	3	6	7	5	6	19	14
81-92	0	1	2	2	12	6	5	5	8	10
93-									24	14

Table B-6. Las Vegas Dry Day Sequences (1931-86): Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	44	47	21	22	32	39	20	23	113	115
2	22	19	25	24	17	15	19	19	68	67
3	19	14	16	8	12	8	11	8	49	32
4	14	14	11	8	13	7	13	8	49	31
5	19	13	10	7	19	7	16	8	55	29
6	13	12	4	7	9	7	12	7	30	28
7	15	11	12	7	4	7	5	7	27	27
8	11	11	7	6	8	6	2	7	23	26
9	10	10	6	6	6	6	8	6	23	24
10	8	9	5	6	3	6	5	6	16	23
11	4	9	5	6	4	6	10	6	18	22
12	9	8	6	5	4	5	4	6	21	21
13	9	8	5	5	5	5	2	5	12	20
14	10	7	2	5	4	5	6	5	24	19
15	9	7	6	5	13	5	6	5	28	18
16	6	6	2	5	4	4	4	5	15	17
17	5	6	2	4	3	4	5	4	14	17
18	4	6	2	4	0	4	3	4	10	16
19	6	5	4	4	3	4	1	4	10	15
20	5	5	3	4	4	4	1	4	9	14
21-30	22	35	29	31	23	30	33	31	94	111
31-40	18	18	20	20	15	20	17	20	58	69
41-50	8	10	11	13	12	13	10	13	35	43
51-60	7	5	12	9	9	8	4	8	18	26
61-70	1	3	2	6	7	6	6	5	19	16
71-80	0	1	0	4	2	4	4	3	13	10
81-92	0	1	3	3	1	3	1	3	11	7
93-									11	9

Table B-7. Tonopah Dry Day Sequences (1955-86): Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	35	36	29	27	34	39	17	16	108	105
2	21	19	35	34	20	19	17	20	83	81
3	12	9	24	14	10	9	14	8	52	35
4	6	9	12	13	15	8	10	7	34	33
5	13	8	16	12	8	8	9	7	39	31
6	10	8	14	11	9	7	14	7	43	29
7	9	7	9	10	6	7	6	6	25	28
8	8	7	14	9	12	7	7	6	34	26
9	6	7	6	9	8	6	3	6	18	24
10	3	6	10	8	11	6	4	5	22	23
11	4	6	3	7	7	6	6	5	18	21
12	6	5	3	7	8	5	1	5	15	20
13	4	5	6	6	3	5	7	5	16	19
14	5	5	4	6	4	5	3	4	14	18
15	2	5	5	5	3	4	2	4	10	17
16	6	4	5	5	2	4	5	4	18	16
17	2	4	6	5	6	4	4	4	16	15
18	6	4	2	4	2	4	3	3	15	14
19	3	4	4	4	2	3	4	3	10	13
20	8	3	2	4	1	3	3	3	15	12
21-30	23	24	15	25	14	24	18	23	67	88
31-40	11	13	8	12	12	13	5	13	38	47
41-50	3	7	6	5	6	7	11	8	25	25
51-60	2	4	3	2	4	4	4	5	16	13
61-70	3	2	2	1	1	2	1	3	5	7
71-80	0	1	0	1	3	1	2	2	7	4
81-92	0	1	1	0	0	1	1	1	2	2
93-									4	2

Table B-8. Adaven Dry Day Sequences for the Middle (1/3) Years: Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	20	21	17	18	11	9	5	6	50	51
2	16	16	10	9	11	10	5	4	38	38
3	17	10	9	7	4	6	4	3	32	22
4	10	9	8	7	5	5	1	3	18	21
5	5	8	7	6	5	5	3	3	15	19
6	12	7	6	6	7	5	2	3	27	18
7	3	6	5	5	5	4	4	2	19	16
8	3	6	3	5	4	4	3	2	14	15
9	8	5	2	4	8	4	2	2	16	14
10	5	5	3	4	2	3	0	2	8	13
11	3	4	3	4	4	3	1	2	10	12
12	3	4	6	3	1	3	5	2	15	11
13	3	3	0	3	7	3	2	2	10	10
14	2	3	1	3	1	3	2	2	6	9
15	2	3	4	3	3	2	1	2	9	9
16	2	2	6	2	1	2	2	2	11	8
17	2	2	2	2	1	2	0	2	3	7
18	0	2	2	2	1	2	1	1	3	7
19	2	2	3	2	4	2	0	1	8	6
20	2	2	1	2	0	2	3	1	7	6
21-30	6	9	11	10	5	10	13	10	33	39
31-40	3	3	2	4	4	5	6	6	15	18
41-50	2	1	2	2	4	3	1	4	9	8
51-60	0	0	0	1	1	1	3	2	3	4
61-70	0	0	0	0	0	1	1	1	2	2
71-80	0	0	0	0	0	0	0	1	2	1
81-92	0	0	0	0	0	0	0	1	1	0
93-									0	0

Table B-9. Adaven Dry Day Sequences for the Wettest (1/3) Years: Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	32	31	26	28	24	25	11	12	91	90
2	30	28	24	24	20	21	13	11	80	80
3	16	16	12	9	8	8	9	5	41	34
4	21	14	12	8	11	7	4	5	44	30
5	10	12	11	7	4	7	5	4	29	28
6	8	10	8	7	10	6	3	4	25	25
7	5	9	2	6	4	6	4	4	13	23
8	9	8	5	5	3	5	4	3	22	21
9	6	7	3	5	4	5	2	3	14	19
10	8	6	6	4	5	4	1	3	16	17
11	5	5	3	4	3	4	1	3	10	15
12	6	4	5	4	7	4	3	3	18	14
13	3	4	3	3	0	3	2	3	8	13
14	1	3	2	3	5	3	4	2	13	11
15	1	3	3	3	6	3	2	2	11	10
16	1	2	1	2	6	2	1	2	9	9
17	1	2	1	2	1	2	2	2	5	8
18	3	2	1	2	1	2	3	2	9	8
19	2	1	2	2	3	2	4	2	10	7
20	3	1	3	2	1	2	0	2	7	6
21-30	4	6	7	10	7	11	11	11	27	38
31-40	1	1	2	3	1	4	2	6	10	14
41-50	0	0	0	1	2	2	4	3	5	5
51-60	0	0	1	0	1	1	3	1	6	2
61-70	0	0	0	0	0	0	0	1	0	1
71-80	0	0	0	0	0	0	0	0	1	0
81-92	0	0	1	0	0	0	0	0	1	0
93-									0	0

Table B-10. Beatty Dry Day Sequences for the Middle (1/3) Years: Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	12	11	11	12	7	8	7	6	35	31
2	13	10	5	5	7	8	5	4	26	24
3	6	6	8	4	2	3	6	3	20	14
4	3	5	3	4	7	3	4	3	11	13
5	4	5	11	4	3	3	3	3	19	12
6	9	5	4	4	4	3	0	3	12	12
7	8	5	3	4	3	3	4	3	13	11
8	5	4	4	3	2	3	4	3	13	11
9	6	4	1	3	2	2	3	2	11	10
10	4	4	4	3	3	2	0	2	8	10
11	2	4	5	3	0	2	2	2	6	9
12	3	3	1	3	5	2	6	2	12	9
13	5	3	1	3	2	2	1	2	4	8
14	1	3	2	3	2	2	1	2	6	8
15	2	3	4	2	2	2	0	2	9	8
16	6	3	0	2	2	2	1	2	7	7
17	3	2	1	2	3	2	1	2	6	7
18	0	2	2	2	4	2	3	2	9	7
19	2	2	1	2	0	2	0	2	3	6
20	0	2	2	2	2	2	2	2	7	6
21-30	9	15	17	13	12	12	12	12	40	45
31-40	7	8	4	8	1	8	5	8	19	28
41-50	3	4	0	5	6	5	7	5	12	17
51-60	1	2	4	3	4	3	2	3	9	11
61-70	2	1	1	2	0	2	1	2	10	6
71-80	0	1	0	1	1	1	1	1	3	4
81-92	0	0	2	1	2	1	1	1	1	3
93-									6	3

Table B-11. Beatty Dry Day Sequences for the Wettest (1/3) Years: Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	16	18	18	16	8	9	8	8	43	44
2	14	16	19	20	4	6	5	3	41	40
3	12	7	4	6	3	2	2	3	18	15
4	11	6	7	6	3	2	5	3	22	14
5	6	6	9	5	3	2	5	3	21	13
6	3	6	9	5	0	2	3	3	12	12
7	5	5	5	5	3	2	1	3	11	12
8	3	5	8	4	2	2	1	2	12	11
9	3	4	6	4	1	2	2	2	10	11
10	4	4	4	4	5	2	2	2	9	10
11	2	4	2	4	0	1	3	2	8	9
12	4	3	2	3	2	1	1	2	7	9
13	2	3	0	3	1	1	1	2	3	8
14	3	3	2	3	0	1	3	2	9	8
15	2	3	4	3	1	1	0	2	5	8
16	4	3	1	3	0	1	4	2	10	7
17	5	2	1	2	2	1	0	2	7	7
18	2	2	0	2	1	1	4	2	7	6
19	1	2	1	2	1	1	3	2	7	6
20	2	2	0	2	1	1	2	1	4	6
21-30	9	12	13	13	9	9	9	11	31	43
31-40	9	5	8	7	8	7	5	7	29	25
41-50	2	2	2	3	1	5	5	5	10	15
51-60	0	1	2	2	6	3	3	3	10	9
61-70	0	1	0	1	1	3	2	2	7	5
71-80	0	0	0	0	1	2	0	1	2	3
81-92	0	0	0	0	2	1	0	1	2	2
93-									2	2

Table B-12. Bishop Dry Day Sequences for the Middle (1/3) Years: Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	13	12	10	9	6	8	6	7	30	32
2	11	9	4	5	9	11	6	5	30	27
3	5	4	6	3	3	2	3	3	13	10
4	3	4	6	3	2	2	5	3	16	9
5	5	3	3	3	3	2	4	3	12	9
6	3	3	2	3	0	2	2	2	8	9
7	5	3	4	3	1	1	3	2	10	8
8	4	3	1	3	2	1	1	2	4	8
9	3	3	2	2	5	1	2	2	10	7
10	1	2	1	2	0	1	2	2	3	7
11	2	2	2	2	0	1	1	2	3	7
12	1	2	1	2	1	1	3	2	4	6
13	1	2	4	2	0	1	3	2	7	6
14	2	2	0	2	2	1	1	2	4	6
15	0	2	2	2	1	1	2	2	5	5
16	2	2	3	2	1	1	1	1	6	5
17	0	2	1	2	2	1	1	1	2	5
18	1	2	0	2	1	1	2	1	3	5
19	3	1	0	1	0	1	0	1	4	4
20	1	1	2	1	0	1	2	1	5	4
21-30	9	10	14	10	7	7	9	9	36	32
31-40	5	5	3	6	11	5	3	6	19	20
41-50	1	3	2	3	4	4	1	4	9	12
51-60	1	2	2	2	1	2	1	2	4	7
61-70	2	1	1	1	0	2	4	1	6	4
71-80	0	1	0	1	1	1	0	1	4	3
81-92	0	0	0	0	0	1	0	1	1	2
93-									1	2

Table B-13. Bishop Dry Day Sequences for the Wettest (1/3) Years: Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	19	19	13	15	8	9	5	5	43	43
2	11	12	5	6	5	7	2	3	23	24
3	7	4	4	5	1	2	7	3	16	11
4	5	3	5	4	3	2	3	3	14	10
5	2	3	3	4	2	2	1	2	7	10
6	4	3	3	4	1	2	3	2	10	9
7	2	3	7	3	4	2	3	2	11	9
8	2	3	4	3	1	1	4	2	11	8
9	4	2	10	3	1	1	2	2	14	8
10	0	2	2	3	1	1	2	2	5	7
11	2	2	3	3	3	1	1	2	4	7
12	2	2	4	2	0	1	3	2	8	7
13	1	2	2	2	1	1	0	2	3	6
14	7	2	2	2	2	1	3	2	13	6
15	1	2	0	2	1	1	2	2	4	6
16	0	2	0	2	2	1	1	1	3	5
17	0	1	1	2	0	1	0	1	1	5
18	2	1	1	2	0	1	1	1	4	5
19	1	1	1	1	0	1	0	1	1	4
20	0	1	1	1	1	1	2	1	3	4
21-30	7	8	8	9	10	7	6	9	26	31
31-40	4	4	3	5	5	5	1	5	11	18
41-50	3	2	2	2	4	3	3	3	8	10
51-60	1	1	2	1	3	2	4	2	11	6
61-70	0	1	0	1	0	2	2	1	6	3
71-80	0	0	0	0	0	1	0	1	1	2
81-92	0	0	0	0	0	1	0	0	0	1
93-									2	1

Table B-14. Caliente Dry Day Sequences for the Middle (1/3) Years: Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	20	20	24	23	18	15	13	12	65	65
2	12	10	10	9	17	14	9	10	41	40
3	16	9	10	8	10	6	7	5	39	24
4	7	8	10	7	11	6	3	4	29	22
5	9	7	9	6	3	5	3	4	22	21
6	8	7	7	6	4	5	8	4	24	19
7	4	6	4	5	7	4	3	4	16	18
8	7	6	4	5	4	4	0	3	16	16
9	3	5	6	4	3	4	2	3	12	15
10	7	5	4	4	2	4	2	3	10	14
11	3	4	2	4	1	3	3	3	9	13
12	3	4	1	3	4	3	4	3	9	12
13	4	3	1	3	1	3	2	3	7	11
14	5	3	3	3	2	3	1	2	11	10
15	0	3	2	3	3	3	3	2	7	9
16	1	3	2	2	2	2	5	2	9	9
17	2	2	1	2	1	2	4	2	9	8
18	1	2	2	2	1	2	1	2	4	7
19	1	2	4	2	3	2	2	2	12	7
20	1	2	0	2	1	2	3	2	4	6
21-30	6	11	9	11	6	12	13	11	34	42
31-40	4	4	4	4	4	6	0	6	14	19
41-50	2	2	2	2	3	3	5	3	6	9
51-60	2	1	0	1	1	1	0	2	7	4
61-70	0	0	1	0	1	1	1	1	3	2
71-80	0	0	0	0	0	0	0	1	2	1
81-92	0	0	0	0	1	0	0	0	0	0
93-									1	0

Table B-15. Caliente Dry Day Sequences for the Wettest (1/3) Years: Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	25	24	17	17	24	26	10	12	74	74
2	19	19	19	19	11	8	9	9	53	53
3	17	13	15	9	11	6	6	5	43	29
4	12	12	8	8	9	6	4	4	30	27
5	10	10	9	7	2	5	5	4	23	24
6	9	9	7	7	7	5	4	4	25	22
7	6	8	4	6	2	5	3	3	13	20
8	9	7	4	5	6	4	3	3	22	18
9	7	6	6	5	4	4	2	3	17	17
10	4	5	3	4	9	4	4	3	20	15
11	3	5	5	4	4	3	4	3	13	14
12	4	4	4	4	2	3	1	3	7	13
13	1	3	3	3	0	3	4	2	9	11
14	2	3	5	3	0	3	3	2	8	10
15	2	3	1	3	0	2	2	2	4	9
16	3	2	1	2	1	2	3	2	6	9
17	3	2	1	2	0	2	1	2	5	8
18	2	2	1	2	2	2	2	2	7	7
19	2	2	2	2	2	2	2	2	7	7
20	1	1	1	2	4	2	2	2	11	6
21-30	5	7	9	9	8	11	8	11	29	37
31-40	1	2	2	3	3	5	5	5	13	14
41-50	1	0	2	1	2	2	3	3	7	6
51-60	0	0	0	0	2	1	1	1	5	2
61-70	0	0	0	0	0	0	0	1	0	1
71-80	0	0	0	0	0	0	0	0	1	0
81-92	0	0	0	0	0	0	0	0	0	0
93-									0	0

Table B-16. Haiwee Dry Day Sequences for the Middle (1/3) Years: Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	13	11	8	10	2	3	4	3	25	22
2	16	18	11	11	5	3	1	2	28	29
3	12	7	9	3	3	1	4	2	24	10
4	6	6	6	3	0	1	3	2	12	9
5	7	6	5	3	2	1	3	2	17	9
6	7	5	3	3	0	1	1	2	7	9
7	5	5	4	3	2	1	0	2	9	8
8	1	5	0	3	0	1	2	2	1	8
9	6	4	1	3	2	1	1	2	9	8
10	4	4	3	3	1	1	2	2	9	7
11	2	4	4	2	0	1	1	2	7	7
12	3	4	1	2	3	1	3	1	6	7
13	6	3	1	2	0	1	2	1	8	6
14	2	3	1	2	2	1	2	1	6	6
15	1	3	1	2	0	1	0	1	1	6
16	3	3	3	2	1	1	1	1	5	6
17	2	3	1	2	0	1	2	1	3	5
18	1	2	3	2	3	1	1	1	7	5
19	3	2	1	2	2	1	0	1	4	5
20	3	2	0	2	0	1	3	1	6	5
21-30	12	14	12	12	4	8	10	10	30	39
31-40	7	7	5	8	8	6	5	7	22	26
41-50	4	3	6	5	8	5	2	5	14	17
51-60	0	2	4	3	2	4	2	4	6	11
61-70	0	1	2	2	0	3	3	3	8	8
71-80	0	0	0	1	3	3	2	2	7	5
81-92	0	0	0	1	3	2	3	2	3	4
93-									7	5

Table B-17. Haiwee Dry Day Sequences for the Wettest (1/3) Years: Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	21	24	13	11	10	13	9	9	50	50
2	18	17	11	8	3	3	4	4	32	33
3	9	8	10	6	2	2	6	3	25	15
4	14	7	8	6	4	2	4	2	26	14
5	6	7	7	5	3	2	1	2	17	13
6	6	6	4	5	2	2	3	2	13	12
7	3	6	5	5	4	2	6	2	17	12
8	6	5	5	4	3	2	0	2	11	11
9	9	5	3	4	1	2	1	2	14	11
10	3	4	2	4	2	2	0	2	7	10
11	1	4	3	4	1	2	2	2	5	9
12	3	4	3	3	0	1	2	2	6	9
13	2	3	3	3	0	1	3	2	7	9
14	4	3	2	3	0	1	1	2	6	8
15	4	3	2	3	4	1	2	2	6	8
16	1	3	2	3	3	1	1	2	6	7
17	2	2	1	2	2	1	2	2	6	7
18	4	2	2	2	1	1	3	1	7	6
19	1	2	3	2	0	1	0	1	5	6
20	1	2	2	2	1	1	0	1	4	6
21-30	9	12	10	14	9	9	8	11	31	43
31-40	4	5	9	7	3	7	9	7	25	25
41-50	3	2	1	4	3	5	6	5	9	15
51-60	0	1	3	2	5	3	1	3	6	9
61-70	1	0	0	1	1	2	1	2	5	5
71-80	0	0	0	1	2	2	1	1	6	3
81-92	0	0	0	0	2	1	1	1	2	2
93-									4	2

Table B-18. Las Vegas Dry Day Sequences for the Middle (1/3) Years: Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	14	15	13	13	9	12	7	9	42	44
2	8	8	13	14	3	3	9	11	30	32
3	7	6	7	4	3	2	4	3	17	12
4	3	5	8	3	8	2	5	3	22	12
5	11	5	6	3	1	2	5	3	22	11
6	5	5	0	3	5	2	7	3	12	10
7	5	4	5	3	2	2	2	3	10	10
8	3	4	2	3	1	2	1	2	7	9
9	4	4	1	3	2	2	2	2	8	9
10	4	4	2	2	2	2	2	2	8	9
11	2	3	1	2	1	2	3	2	3	8
12	2	3	2	2	0	2	2	2	6	8
13	3	3	4	2	1	2	0	2	4	7
14	5	3	1	2	1	1	4	2	10	7
15	3	3	3	2	5	1	3	2	10	7
16	1	2	0	2	2	1	1	2	4	6
17	2	2	2	2	2	1	2	2	8	6
18	2	2	1	2	0	1	1	2	5	6
19	1	2	1	2	0	1	0	1	2	5
20	1	2	1	2	2	1	0	1	2	5
21-30	12	12	9	11	6	10	9	11	33	39
31-40	7	6	9	7	4	7	6	7	24	24
41-50	2	3	1	4	3	5	5	4	13	14
51-60	1	1	2	3	3	3	0	3	2	9
61-70	0	1	1	2	3	2	3	2	6	5
71-80	0	0	0	1	2	2	1	1	5	3
81-92	0	0	2	1	1	1	0	1	2	2
93-									4	2

Table B-19. Las Vegas Dry Day Sequences for the Wettest (1/3) Years: Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	18	21	5	5	12	15	10	11	43	45
2	11	8	7	6	12	12	8	6	32	29
3	7	6	4	3	4	3	6	3	17	13
4	9	6	2	3	4	3	5	3	21	13
5	8	5	3	3	10	3	7	3	24	12
6	5	5	2	2	4	3	4	3	14	11
7	4	5	4	2	1	3	2	3	11	11
8	6	4	3	2	4	3	0	3	11	10
9	2	4	4	2	1	2	4	2	9	10
10	3	4	2	2	1	2	2	2	5	9
11	1	3	3	2	1	2	5	2	10	9
12	5	3	2	2	2	2	1	2	9	8
13	2	3	1	2	2	2	0	2	4	8
14	3	3	1	2	2	2	1	2	7	7
15	4	3	1	2	4	2	0	2	9	7
16	3	2	1	2	1	2	3	2	7	7
17	3	2	0	2	0	2	1	2	4	6
18	0	2	1	1	0	2	2	2	3	6
19	3	2	1	1	2	1	0	2	4	6
20	3	2	1	1	1	1	1	1	4	5
21-30	5	11	10	10	9	11	6	11	23	39
31-40	3	5	8	7	5	6	7	7	20	23
41-50	3	2	3	4	4	4	2	4	9	13
51-60	1	1	5	3	5	2	2	3	6	7
61-70	1	1	0	2	0	1	1	2	8	4
71-80	0	0	0	1	0	1	3	1	2	3
81-92	0	0	0	1	0	1	0	1	6	2
93-									2	1

Table B-20. Tonopah Dry Day Sequences for the Middle (1/3) Years: Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	15	15	7	8	7	8	6	7	35	34
2	8	5	11	11	2	1	4	4	22	19
3	6	3	6	5	4	3	3	3	18	12
4	1	3	6	4	6	3	4	2	14	11
5	5	3	7	4	1	2	4	2	14	10
6	4	3	5	4	2	2	6	2	17	10
7	3	3	2	3	1	2	1	2	5	9
8	2	2	6	3	6	2	3	2	12	9
9	3	2	1	3	2	2	0	2	4	8
10	0	2	4	3	4	2	1	2	7	8
11	4	2	2	2	2	2	2	2	8	7
12	2	2	0	2	2	2	1	2	6	7
13	0	2	1	2	1	2	4	1	7	6
14	2	2	2	2	4	1	2	1	5	6
15	0	2	1	2	0	1	0	1	1	5
16	1	1	1	2	0	1	0	1	4	5
17	0	1	0	1	1	1	0	1	2	5
18	2	1	1	1	1	1	0	1	4	5
19	0	1	0	1	0	1	0	1	2	4
20	1	1	2	1	0	1	2	1	5	4
21-30	5	8	8	7	3	8	7	7	19	28
31-40	5	4	2	3	5	4	3	4	15	15
41-50	1	2	2	1	1	2	2	2	5	8
51-60	0	1	1	1	1	1	0	1	3	4
61-70	2	1	0	0	0	1	1	1	3	2
71-80	0	0	0	0	2	0	0	1	2	1
81-92	0	0	0	0	0	0	1	0	0	1
93-									3	0

Table B-21. Tonopah Dry Day Sequences for the Wettest (1/3) Years: Observed and Expected Values Using a Third Order Markov Chain.

Sequence Length (Days)	Winter		Spring		Summmer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
1	12	13	9	8	15	16	8	7	41	40
2	9	9	17	17	12	12	8	10	42	43
3	4	3	10	5	6	4	9	4	24	14
4	2	3	5	5	3	3	4	4	12	13
5	7	3	3	4	4	3	4	3	17	12
6	3	3	7	4	4	3	5	3	17	12
7	3	3	3	4	1	3	3	3	8	11
8	2	2	7	3	3	3	4	3	15	10
9	0	2	1	3	5	2	3	3	7	9
10	0	2	2	3	5	2	2	2	6	9
11	0	2	0	3	3	2	1	2	6	8
12	3	2	1	2	4	2	0	2	6	8
13	2	2	2	2	1	2	1	2	4	7
14	2	2	1	2	0	2	0	2	5	7
15	2	2	2	2	3	2	1	2	6	6
16	4	1	3	2	2	2	3	2	11	6
17	2	1	3	2	1	1	1	1	7	5
18	3	1	0	2	1	1	0	1	4	5
19	1	1	2	1	0	1	1	1	3	5
20	1	1	0	1	0	1	1	1	2	4
21-30	6	8	4	9	4	8	6	8	20	30
31-40	3	4	2	4	2	4	1	4	9	15
41-50	1	2	3	2	2	2	5	2	9	7
51-60	1	1	1	1	1	1	1	1	5	4
61-70	1	1	1	0	1	1	0	1	2	2
71-80	0	0	0	0	1	0	1	0	3	1
81-92	0	0	0	0	0	0	0	0	2	1
93-									0	0

Table B-22. Chi-Square Goodness of Fit Test Results for Dry Day Sequences. Level of Significance $\alpha = .05$; R = Reject Null Hypothesis; F = Fail to Reject Null Hypothesis.

Station	Season	Entire Record	Middle (1/3)	Wettest (1/3)
Adaven	Winter	F	R	F
	Spring	F	F	F
	Summer	F	F	F
	Fall	F	F	F
	Annual	F	F	F
Beatty	Winter	F	F	F
	Spring	F	F	F
	Summer	F	F	F
	Fall	F	F	F
	Annual	R	F	F
Bishop	Winter	F	F	F
	Spring	F	F	R
	Summer	R	R	F
	Fall	F	F	F
	Annual	F	F	R
Caliente	Winter	F	F	F
	Spring	F	F	F
	Summer	R	F	R
	Fall	F	R	F
	Annual	R	R	F
Haiwee	Winter	F	F	F
	Spring	F	R	F
	Summer	R	F	R
	Fall	F	F	F
	Annual	R	R	F
Las Vegas	Winter	F	F	F
	Spring	F	R	F
	Summer	R	R	R
	Fall	R	R	R
	Annual	R	R	R
Tonopah	Winter	F	F	R
	Spring	F	F	F
	Summer	F	R	R
	Fall	F	R	R
	Annual	R	F	F

Table B-23. Values for P(w) and P(d|d,w) Calculated from Observed Data Sets for Each Station.

Station	Season	Entire Record	Middle (1/3)	Wettest (1/3)
Adaven	Winter	.1620 / .8325	.1544 / .8376	.2027 / .8210
	Spring	.1381 / .8363	.1289 / .8416	.1754 / .8060
	Summer	.1178 / .8610	.1180 / .9070	.1449 / .8197
	Fall	.0807 / .9104	.0683 / .9153	.0982 / .8810
	Annual	.1246 / .8542	.1173 / .8676	.1552 / .8294
Beatty	Winter	.0893 / .8914	.0777 / .9091	.1257 / .8585
	Spring	.0834 / .9053	.0743 / .8824	.1260 / .8783
	Summer	.0443 / .9125	.0562 / .9143	.0441 / .8824
	Fall	.0497 / .9295	.0586 / .9344	.0606 / .9048
	Annual	.0666 / .9035	.0666 / .9085	.0894 / .8768
Bishop	Winter	.1144 / .8317	.1098 / .8551	.1543 / .7821
	Spring	.0887 / .8693	.0928 / .8788	.1060 / .8312
	Summer	.0623 / .8973	.0602 / .8824	.0670 / .8478
	Fall	.0701 / .9048	.0862 / .8929	.0714 / .9200
	Annual	.0838 / .8732	.0872 / .8785	.0995 / .8386
Caliente	Winter	.1501 / .8504	.1368 / .8407	.1919 / .8358
	Spring	.1398 / .8617	.1601 / .8095	.1638 / .8667
	Summer	.1269 / .8390	.1254 / .8687	.1444 / .7745
	Fall	.0976 / .8717	.0996 / .8780	.1177 / .8734
	Annual	.1286 / .8545	.1305 / .8452	.1544 / .8360
Haiwee	Winter	.1159 / .8806	.1150 / .9167	.1578 / .8250
	Spring	.0744 / .9180	.0707 / .8987	.1036 / .9038
	Summer	.0362 / .8862	.0332 / .9500	.0512 / .8302
	Fall	.0499 / .9291	.0464 / .9556	.0672 / .8814
	Annual	.0689 / .8998	.0661 / .9231	.0947 / .8592
Las Vegas	Winter	.0980 / .8419	.1026 / .8571	.1254 / .8182
	Spring	.0621 / .9072	.0754 / .8706	.0674 / .9365
	Summer	.0610 / .8377	.0530 / .8448	.0797 / .8421
	Fall	.0595 / .9022	.0646 / .9000	.0711 / .8696
	Annual	.0701 / .8685	.0738 / .8627	.0858 / .8613
Tonopah	Winter	.1018 / .8306	.1032 / .7969	.1168 / .8281
	Spring	.1114 / .8899	.1196 / .8986	.1245 / .9135
	Summer	.0961 / .8167	.0891 / .8571	.1206 / .8056
	Fall	.0834 / .9122	.0890 / .8750	.1059 / .9000
	Annual	.0982 / .8631	.1002 / .8590	.1170 / .8648

Table B-24. Values for P(w|d,d,w) and P(d|d,d,d) Calculated from Observed Data Sets for Each Station.

Station	Season	Entire Record	Middle (1/3)	Wettest (1/3)
Adaven	Winter	.1635 / .8930	.1443 / .8958	.1923 / .8587
	Spring	.1232 / .9129	.0941 / .9158	.2037 / .9030
	Summer	.1434 / .9275	.1067 / .9286	.1900 / .9118
	Fall	.0995 / .9463	.0566 / .9529	.1233 / .9373
	Annual	.1383 / .9210	.1125 / .9247	.1825 / .9057
Beatty	Winter	.1149 / .9422	.0920 / .9397	.1522 / .9233
	Spring	.1008 / .9468	.0541 / .9480	.1782 / .9328
	Summer	.0822 / .9679	.0938 / .9586	.0889 / .9689
	Fall	.0355 / .9647	.0545 / .9585	.0364 / .9573
	Annual	.0918 / .9560	.0769 / .9520	.1279 / .9471
Bishop	Winter	.1337 / .9417	.1207 / .9411	.1803 / .9361
	Spring	.0814 / .9416	.0690 / .9453	.0781 / .9302
	Summer	.1221 / .9598	.2000 / .9647	.1282 / .9615
	Fall	.0465 / .9535	.0833 / .9511	.0435 / .9504
	Annual	.0990 / .9498	.1163 / .9508	.1080 / .9458
Caliente	Winter	.1228 / .9023	.0957 / .9086	.1532 / .8721
	Spring	.1231 / .9157	.0941 / .9160	.1731 / .9017
	Summer	.1198 / .9266	.1429 / .9310	.0897 / .9231
	Fall	.1077 / .9419	.1127 / .9392	.1176 / .9362
	Annual	.1183 / .9221	.1108 / .9234	.1393 / .9102
Haiwee	Winter	.1292 / .9318	.1515 / .9316	.1546 / .9176
	Spring	.0991 / .9513	.1268 / .9553	.0753 / .9352
	Summer	.0467 / .9764	.0541 / .9783	.0465 / .9671
	Fall	.0385 / .9684	.0233 / .9698	.0588 / .9611
	Annual	.0953 / .9582	.1071 / .9600	.1058/.9470
Las Vegas	Winter	.0762 / .9379	.0909 / .9306	.0875 / .9245
	Spring	.1105 / .9582	.1644 / .9511	.0862 / .9567
	Summer	.0759 / .9585	.0417 / .9638	.1563 / .9512
	Fall	.0915 / .9569	.1429 / .9545	.0847 / .9527
	Annual	.0877 / .9532	.1136 / .9508	.1053 / .9463
Tonopah	Winter	.1060 / .9404	.0800 / .9389	.1509 / .9386
	Spring	.1563 / .9260	.1613 / .9176	.2027 / .9224
	Summer	.1103 / .9421	.0238 / .9444	.1754 / .9341
	Fall	.1194 / .9473	.0732 / .9466	.1441 / .9333
	Annual	.1226 / .9392	.0900 / .9377	.1687 / .9322

APPENDIX C

The equation describing the Weibull distribution is given by:

$$p(x)=\alpha x^{\alpha-1}\beta^{-\alpha}\exp[-(x/\beta)^{\alpha}]$$

where α , $\beta > 0$; $x \geq 0$. The probability for each value of x was calculated, and the sum of all values of p(x) equals 1.

Estimation of values for α and β was accomplished using the method of moments. The specific iterative scheme used for solving the moment equations is shown below:

$$\mu=\beta\Gamma(1+\frac{1}{\alpha}) \tag{1}$$

rearranging (1) yields,

$$\beta=\mu/\Gamma(1+\frac{1}{\alpha}) \tag{2}$$

squaring (2) yields,

$$\beta^2=\mu^2/\Gamma^2(1+\frac{1}{\alpha}) \tag{3}$$

$$\mathrm{var}=\beta^2[\Gamma(1+2/\alpha)-\Gamma^2(1+1/\alpha)] \tag{4}$$

rearranging (4) yields,

$$\beta^2=\mathrm{var}/[\Gamma(1+2/\alpha)-\Gamma^2(1+1/\alpha)] \tag{5}$$

equating (3) and (5) yields,

$$\mu^2/\Gamma^2(1+1/\alpha)=\mathrm{var}/[\Gamma(1+2/\alpha)-\Gamma^2(1+1/\alpha)] \tag{6}$$

rearranging (6) yields,

$$var/\mu^2=[\Gamma(1+2/\alpha)-\Gamma^2(1+1/\alpha)]/\Gamma^2(1+1/\alpha) \quad (7)$$

rearranging (7) yields,

$$var/\mu^2=[\Gamma(1+2/\alpha)/\Gamma^2(1+1/\alpha)]-1 \quad (8)$$

and rearranging (8) yields,

$$[\Gamma(1+2/\alpha)/\Gamma^2(1+1/\alpha)]=(var/\mu^2)+1 \quad (9)$$

where μ = mean of observed data, and var = variance of observed data, and Γ= gamma function. The mean and variance are calculated from observed data and α is estimated from equation (9) on a trial and error basis. A known value of α can then be substituted back into equation (2) to obtain the value of β.

Data were grouped into .05 inch blocks as follows: .01 - .05 , .06 - .10, .11 - .15, etc. The probability of each .05 inch block was calculated and multiplied by the total number of observations to obtain expected values shown in Tables C-1 to C-21.

The null hypothesis was tested using the chi-square goodness of fit test. The null hypothesis states that the observed distribution of daily storm depths is given by the Weibull distribution. The goodness of fit test was applied as described in Appendix A. The level of significance for all tests was α = .05. Table C-22 shows results of chi-square goodness of fit tests run on daily storm depths. Tables C-23 and C-24 give mean, variance, and parameter (α and β) estimates calculated from observed data sets for each station.

Table C-1. Distribution of Daily Storm Depths for Adaven (1929-1978).

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	108	105	106	101	103	108	49	47	366	365
.06-.10	108	85	102	80	85	70	39	38	334	276
.11-.15	64	71	60	65	61	53	34	32	219	221
.16-.20	60	59	50	53	49	41	41	28	200	181
.21-.25	41	50	37	44	26	33	20	24	124	149
.26-.30	41	42	30	36	18	27	21	20	110	124
.31-.35	22	35	29	30	21	22	9	18	81	104
.36-.40	36	30	24	25	19	18	10	15	89	87
.41-.45	20	25	16	21	13	15	9	13	58	74
.46-.50	22	21	21	17	11	13	18	11	72	62
.51-.55	28	18	14	14	8	11	10	10	60	53
.56-.60	13	15	8	12	13	9	9	9	43	45
.61-.65	14	13	14	10	9	8	3	7	40	38
.66-.70	10	11	6	8	6	7	6	6	28	32
.71-.75	3	9	6	7	6	6	4	6	19	27
.76-.80	10	8	2	6	3	5	4	5	19	23
.81-.85	6	7	7	5	1	4	7	4	21	20
.86-.90	2	6	7	4	3	4	2	4	14	17
.91-.95	4	5	1	3	4	3	4	3	13	15
.96-1.00	3	4	5	3	1	3	2	3	11	13
1.01-	28	24	14	14	17	18	22	19	81	77

Table C-2. Distribution of Daily Storm Depths for Beatty (1918-1986).

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	121	109	149	125	85	72	73	59	428	366
.06-.10	70	68	63	72	36	38	32	38	201	214
.11-.15	51	49	49	49	24	25	16	28	140	150
.16-.20	23	37	27	35	17	17	14	21	81	110
.21-.25	32	29	20	26	13	13	21	16	86	84
.26-.30	18	23	25	20	6	10	19	13	68	65
.31-.35	23	18	16	15	5	7	16	10	60	51
.36-.40	10	15	12	12	2	6	9	8	33	41
.41-.45	14	12	5	9	5	5	8	7	32	33
.46-.50	12	10	6	7	5	4	9	6	32	26
.51-.55	10	8	4	6	1	3	3	5	18	21
.56-.60	5	7	5	5	2	2	1	4	13	17
.61-.65	5	6	3	4	1	2	1	3	10	14
.66-.70	4	5	1	3	2	2	1	3	8	12
.71-.75	3	4	4	2	3	1	1	2	11	10
.76-.80	4	3	1	2	0	1	4	2	9	8
.81-.85	4	3	1	2	1	1	0	2	6	7
.86-.90	0	2	1	1	0	1	0	1	1	6
.91-.95	3	2	1	1	0	1	0	1	4	5
.96-1.00	0	2	2	1	2	1	1	1	5	4
1.01-	7	10	4	4	2	3	6	5	19	22

Table C-3. Distribution of Daily Storm Depths for Bishop (1949-1986).

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	139	106	162	126	129	107	107	86	537	426
.06-.10	44	53	48	53	34	42	36	42	162	179
.11-.15	40	37	24	32	13	22	25	27	102	112
.16-.20	20	28	13	21	13	13	16	18	62	78
.21-.25	20	22	8	15	9	9	11	13	48	58
.26-.30	13	17	7	11	3	6	9	10	32	45
.31-.35	11	14	8	8	1	4	3	8	23	35
.36-.40	7	12	8	6	3	3	4	6	22	28
.41-.45	11	10	5	5	2	2	2	5	20	23
.46-.50	12	9	2	4	1	1	4	4	19	19
.51-.55	8	8	4	3	1	1	3	3	16	16
.56-.60	7	7	3	3	0	1	3	2	13	14
.61-.65	2	6	0	2	1	1	0	2	3	12
.66-.70	5	5	1	2	1	0	1	2	8	10
.71-.75	3	5	1	1	0	0	1	1	5	9
.76-.80	4	4	0	1	0	0	1	1	5	7
.81-.85	3	4	0	1	1	0	1	1	5	7
.86-.90	3	3	1	1	0	0	4	1	8	6
.91-.95	1	3	2	1	0	0	3	1	6	5
.96-1.00	1	3	0	1	0	0	1	1	2	4
1.01-	28	27	5	4	0	0	1	3	34	39

Table C-4. Distribution of Daily Storm Depths for Caliente (1929-1984).

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	167	166	199	171	185	149	126	98	677	592
.06-.10	118	108	86	103	77	85	47	60	328	352
.11-.15	71	77	75	71	50	59	44	43	240	245
.16-.20	58	56	43	51	29	43	27	33	157	180
.21-.25	44	42	36	37	32	33	17	26	129	135
.26-.30	32	31	31	28	24	25	22	20	109	104
.31-.35	19	24	17	21	21	20	15	17	72	81
.36-.40	15	18	17	16	19	16	13	13	64	63
.41-.45	15	14	13	12	12	13	12	11	52	50
.46-.50	15	11	9	9	12	10	8	9	44	40
.51-.55	7	8	5	7	5	8	8	8	25	32
.56-.60	4	6	4	6	3	7	9	6	20	26
.61-.65	5	5	3	4	2	6	5	5	15	21
.66-.70	1	4	3	3	5	5	7	5	16	17
.71-.75	2	3	1	3	4	4	4	4	11	14
.76-.80	3	2	3	2	4	3	1	3	11	11
.81-.85	1	2	1	2	5	3	3	3	10	9
.86-.90	3	1	2	1	3	2	1	2	9	8
.91-.95	0	1	1	1	2	2	2	2	5	6
.96-1.00	2	1	0	1	3	2	4	2	9	5
1.01-	1	3	4	3	5	9	7	11	17	26

Table C-5. Distribution of Daily Storm Depths for Haiwee (1930-1986).

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	133	107	140	108	70	57	80	68	423	337
.06-.10	77	71	55	56	27	30	38	37	197	193
.11-.15	60	54	28	38	13	20	35	25	136	138
.16-.20	33	44	25	28	17	14	7	19	82	105
.21-.25	23	36	17	21	10	11	13	15	63	83
.26-.30	30	30	15	17	7	8	6	12	58	67
.31-.35	16	25	6	13	10	6	9	9	41	55
.36-.40	16	22	7	11	3	5	6	8	32	45
.41-.45	22	19	5	9	1	4	6	6	34	38
.46-.50	16	16	8	8	3	3	4	5	31	32
.51-.55	10	14	7	6	0	3	3	4	20	27
.56-.60	8	12	7	5	0	2	2	4	17	23
.61-.65	10	11	2	5	1	2	3	3	16	20
.66-.70	7	9	7	4	2	1	2	3	18	17
.71-.75	13	8	3	3	2	1	3	2	21	15
.76-.80	4	7	1	3	1	1	4	2	10	13
.81-.85	6	6	2	3	1	1	2	2	11	11
.86-.90	6	6	1	2	0	1	2	2	9	10
.91-.95	2	5	5	2	2	1	1	1	10	9
.96-1.00	5	4	2	2	0	0	2	1	9	8
1.01-	47	38	13	14	3	3	8	9	71	63

Table C-6. Distribution of Daily Storm Depths for Las Vegas (1931-1986): Observed and Expected Values Using the Weibull Distribution.

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	147	113	113	92	117	92	106	85	483	394
.06-.10	53	74	50	50	38	42	43	43	184	205
.11-.15	51	53	26	32	22	27	22	28	121	135
.16-.20	31	39	15	22	14	19	16	20	76	96
.21-.25	30	29	11	16	12	14	14	15	67	71
.26-.30	20	22	8	12	4	11	8	11	40	54
.31-.35	20	17	12	9	9	9	4	9	45	42
.36-.40	7	13	5	7	9	7	4	7	25	33
.41-.45	10	10	3	5	8	6	6	6	27	26
.46-.50	9	8	0	4	2	5	2	4	13	21
.51-.55	7	6	6	3	3	4	2	4	18	17
.56-.60	3	5	4	2	2	3	1	3	10	14
.61-.65	3	4	1	2	1	3	3	2	8	11
.66-.70	4	3	3	1	1	2	3	2	11	9
.71-.75	4	2	2	1	3	2	2	2	11	8
.76-.80	1	2	2	1	0	2	0	1	3	6
.81-.85	1	1	0	1	1	2	1	1	3	5
.86-.90	0	1	0	1	1	1	3	1	4	5
.91-.95	4	1	0	1	0	1	1	1	5	4
.96-1.00	1	1	2	0	1	1	1	1	5	3
1.01-	1	3	0	2	10	8	7	4	18	19

Table C-7. Distribution of Daily Storm Depths for Tonopah (1955-1986).

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	145	124	164	125	101	94	96	72	506	417
.06-.10	39	57	49	65	59	49	31	42	178	210
.11-.15	34	34	24	41	37	32	16	29	111	135
.16-.20	31	22	19	27	15	23	30	21	95	93
.21-.25	18	15	13	19	18	17	12	16	61	67
.26-.30	8	11	19	13	5	13	12	12	44	50
.31-.35	3	8	10	10	6	10	11	10	30	37
.36-.40	4	6	12	7	10	8	5	8	31	29
.41-.45	2	4	7	5	5	6	5	6	19	22
.46-.50	2	3	2	4	3	5	2	5	9	17
.51-.55	3	2	1	3	1	4	3	4	8	14
.56-.60	2	2	1	2	6	3	2	3	11	11
.61-.65	1	1	0	2	2	3	3	3	6	9
.66-.70	0	1	0	1	2	2	3	2	5	7
.71-.75	0	1	4	1	0	2	4	2	8	6
.76-.80	0	1	1	1	2	2	0	1	3	5
.81-.85	0	0	0	1	1	1	0	1	1	4
.86-.90	0	0	0	0	1	1	1	1	2	3
.91-.95	0	0	1	0	1	1	1	1	3	2
.96-1.00	0	0	1	0	1	1	3	1	5	2
1.01-	2	1	0	1	7	5	3	3	12	10

Table C-8. Distribution of Daily Storm Depths for the Middle (1/3) Years at Adaven.

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	33	27	32	31	34	37	17	12	116	109
.06-.10	26	24	30	24	33	22	6	11	95	81
.11-.15	16	21	19	19	17	16	6	9	58	65
.16-.20	20	18	15	16	10	12	14	8	59	53
.21-.25	11	15	8	13	5	10	5	7	29	44
.26-.30	14	13	13	11	9	8	9	6	45	37
.31-.35	7	11	6	9	7	6	4	5	24	31
.36-.40	14	10	9	7	5	5	4	4	32	26
.41-.45	6	8	1	6	3	4	1	4	11	22
.46-.50	9	7	9	5	4	4	4	3	26	19
.51-.55	9	6	3	4	2	3	1	3	15	16
.56-.60	2	5	3	3	5	3	2	2	12	14
.61-.65	5	4	7	3	2	2	2	2	16	12
.66-.70	4	4	1	2	1	2	0	2	6	10
.71-.75	0	3	0	2	3	2	2	1	5	9
.76-.80	5	3	0	2	1	2	0	1	6	7
.81-.85	4	2	1	1	0	1	2	1	7	6
.86-.90	0	2	4	1	1	1	0	1	5	5
.91-.95	0	2	0	1	2	1	2	1	4	5
.96-1.00	2	1	1	1	1	1	0	1	4	4
1.01-	8	8	4	5	7	9	6	4	25	26

Table C-9. Distribution of Daily Storm Depths for the Wettest (1/3) Years at Adaven.

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	49	46	36	34	38	38	19	17	142	135
.06-.10	45	36	37	30	28	29	17	14	127	109
.11-.15	27	29	26	26	27	23	14	13	94	91
.16-.20	22	24	20	23	22	19	14	11	78	76
.21-.25	22	20	23	19	15	15	6	10	66	64
.26-.30	15	17	13	17	7	13	8	8	43	55
.31-.35	5	14	13	14	11	10	1	7	30	46
.36-.40	13	12	9	12	12	9	3	7	37	39
.41-.45	11	10	5	10	6	7	5	6	27	34
.46-.50	5	9	7	9	4	6	8	5	24	29
.51-.55	16	8	9	7	3	5	7	4	35	24
.56-.60	8	7	5	6	5	4	4	4	22	21
.61-.65	4	6	7	5	6	4	1	3	18	18
.66-.70	4	5	5	5	3	3	4	3	16	15
.71-.75	2	4	4	4	3	2	2	3	11	13
.76-.80	4	4	2	3	2	2	1	2	9	11
.81-.85	2	3	6	3	0	2	4	2	12	10
.86-.90	2	3	2	2	1	1	2	2	7	8
.91-.95	2	2	1	2	1	1	2	2	6	7
.96-1.00	1	2	3	2	0	1	1	1	5	6
1.00-	15	13	9	9	6	6	11	10	41	38

Table C-10. Distribution of Daily Storm Depths for the Middle (1/3) Years at Beatty.

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	36	35	45	40	44	33	26	22	151	134
.06-.10	22	19	22	23	17	19	14	15	75	73
.11-.15	18	14	12	15	5	12	7	11	42	50
.16-.20	6	10	11	11	6	8	3	9	26	37
.21-.25	8	8	6	8	6	6	10	7	30	28
.26-.30	5	6	9	6	4	4	9	6	27	21
.31-.35	6	5	4	4	2	3	8	5	20	17
.36-.40	2	4	6	3	1	2	1	4	10	13
.41-.45	2	3	1	3	0	2	3	3	6	11
.46-.50	5	3	3	2	4	1	5	3	17	9
.51-.55	4	2	1	2	1	1	2	2	8	7
.56-.60	2	2	1	1	1	1	1	2	5	6
.61-.65	2	2	1	1	1	0	0	1	4	5
.66-.70	1	2	0	1	1	0	1	1	3	4
.71-.75	0	1	0	1	0	0	1	1	1	3
.76-.80	1	1	0	0	0	0	3	1	4	3
.81-.85	0	1	0	0	0	0	0	1	0	2
.86-.90	0	1	0	0	0	0	0	1	0	2
.91-.95	3	1	0	0	0	0	0	1	3	2
.96-1.00	0	1	0	0	0	0	0	0	0	1
1.00-	3	5	1	1	0	0	2	2	6	9

Table C-11. Distribution of Daily Storm Depths for the Wettest (1/3) Years at Beatty: Observed and Expected Values Using the Weibull Distribution.

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	57	46	66	53	19	18	28	23	170	140
.06-.10	27	31	27	33	9	11	12	15	75	89
.11-.15	21	23	27	24	14	8	4	11	66	65
.16-.20	13	18	12	18	7	6	10	8	42	50
.21-.25	14	14	9	14	2	5	7	7	32	39
.26-.30	11	11	15	11	1	4	6	5	33	31
.31-.35	9	9	9	8	2	3	7	4	27	25
.36-.40	6	7	6	7	1	2	6	4	19	20
.41-.45	8	6	3	5	5	2	5	3	21	16
.46-.50	5	5	2	4	1	2	4	2	12	13
.51-.55	5	4	3	3	0	1	1	2	9	11
.56-.60	1	3	4	3	1	1	0	2	6	9
.61-.65	3	3	2	2	0	1	0	1	5	7
.66-.70	2	2	1	2	0	1	0	1	3	6
.71-.75	0	2	4	2	2	1	0	1	6	5
.76-.80	3	2	1	1	0	1	1	1	5	4
.81-.85	4	1	1	1	1	1	0	1	6	4
.86-.90	0	1	0	1	0	0	0	1	0	3
.91-.95	0	1	1	1	0	0	0	1	1	3
.96-1.00	0	1	1	1	2	0	1	0	4	2
1.00-	4	4	3	3	2	2	4	3	13	12

Table C-12. Distribution of Daily Storm Depths for the Middle (1/3) Years at Bishop: Observed and Expected Values Using the Weibull Distribution.

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	50	35	70	55	42	35	45	34	207	154
.06-.10	17	21	14	20	10	14	13	17	54	73
.11-.15	14	15	6	11	5	8	8	11	33	46
.16-.20	4	11	6	7	6	5	10	8	26	32
.21-.25	7	9	3	5	4	3	3	6	17	23
.26-.30	4	7	2	3	1	2	5	5	12	17
.31-.35	6	5	2	2	0	1	2	4	10	13
.36-.40	3	4	4	2	2	1	3	3	12	10
.41-.45	4	4	1	1	1	1	0	2	6	8
.46-.50	3	3	0	1	0	1	2	2	5	6
.51-.55	3	2	2	1	0	0	2	2	7	5
.56-.60	4	2	0	1	0	0	2	1	6	4
.61-.65	1	2	0	1	0	0	0	1	1	3
.66-.70	2	1	0	0	0	0	0	1	2	3
.71-.75	0	1	0	0	0	0	0	1	0	2
.76-.80	3	1	0	0	0	0	0	1	3	2
.81-.85	0	1	0	0	1	0	0	1	1	2
.86-.90	0	1	0	0	0	0	3	0	3	1
.91-.95	1	1	0	0	0	0	2	0	3	1
.96-1.00	1	0	0	0	0	0	1	0	2	1
1.00-	2	3	1	1	0	0	1	2	4	6

Table C-13. Distribution of Daily Storm Depths for the Wettest (1/3) Years at Bishop: Observed and Expected Values Using the Weibull Distribution.

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	49	33	49	40	45	37	38	32	181	140
.06-.10	15	19	23	19	14	14	13	14	65	63
.11-.15	16	15	12	13	3	8	9	9	40	42
.16-.20	10	12	4	9	4	5	6	6	24	30
.21-.25	8	10	3	7	2	3	2	4	15	23
.26-.30	6	8	3	5	2	2	3	3	14	18
.31-.35	5	7	4	4	1	1	0	2	10	15
.36-.40	2	6	3	3	0	1	1	2	6	12
.41-.45	5	5	3	3	0	1	1	1	9	10
.46-.50	7	5	1	2	1	0	1	1	10	9
.51-.55	3	4	2	2	1	0	0	1	6	8
.56-.60	2	4	2	1	0	0	0	1	4	7
.61-.65	1	3	0	1	0	0	0	0	1	6
.66-.70	3	3	1	1	1	0	1	0	6	5
.71-.75	3	3	1	1	0	0	1	0	5	4
.76-.80	1	2	0	1	0	0	1	0	2	4
.81-.85	3	2	0	1	0	0	0	0	3	4
.86-.90	3	2	1	1	0	0	0	0	4	3
.91-.95	0	2	1	0	0	0	1	0	2	3
.96-1.00	0	2	0	0	0	0	0	0	0	3
1.01-	25	21	4	3	0	0	0	1	29	27

Table C-14. Distribution of Daily Storm Depths for the Middle (1/3) Years at Caliente: Observed and Expected Values Using the Weibull Distribution.

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	59	53	80	63	63	50	45	33	247	203
.06-.10	38	35	24	43	29	30	17	21	108	127
.11-.15	22	25	40	31	14	21	13	15	89	90
.16-.20	12	18	19	22	13	16	11	12	55	66
.21-.25	17	13	13	16	7	12	4	9	41	50
.26-.30	8	10	12	12	10	9	7	8	37	38
.31-.35	4	7	6	9	10	7	6	6	26	29
.36-.40	7	6	8	7	7	6	3	5	25	23
.41-.45	2	4	5	5	4	4	5	4	16	18
.46-.50	6	3	4	4	5	3	5	3	20	14
.51-.55	2	2	3	3	3	3	3	3	11	11
.56-.60	2	2	1	2	1	2	3	2	7	9
.61-.65	2	1	2	2	0	2	3	2	7	7
.66-.70	1	1	0	1	1	1	2	2	4	6
.71-.75	0	1	0	1	1	1	2	1	3	5
.76-.80	1	1	2	1	0	1	0	1	3	4
.81-.85	0	0	1	0	2	1	2	1	5	3
.86-.90	1	0	1	0	2	1	1	1	5	2
.91-.95	0	0	0	0	0	1	1	1	1	2
.96-1.00	1	0	0	0	0	0	1	1	2	2
1.01-	0	1	0	1	1	2	2	4	3	7

Table C-15. Distribution of Daily Storm Depths for the Wettest (1/3) Years at Caliente: Observed and Expected Values Using the Weibull Distribution.

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	56	58	64	56	62	48	45	35	227	208
.06-.10	49	45	40	37	20	29	17	22	126	131
.11-.15	38	35	22	27	22	21	17	17	99	95
.16-.20	26	26	17	20	11	16	9	13	63	71
.21-.25	17	20	15	15	14	13	7	10	53	55
.26-.30	19	15	10	12	12	10	11	8	52	43
.31-.35	9	11	8	9	6	8	6	7	29	34
.36-.40	5	8	9	7	8	7	9	6	31	27
.41-.45	7	6	8	6	4	5	4	5	23	22
.46-.50	5	5	3	4	6	5	3	4	17	18
.51-.55	2	3	2	3	1	4	4	3	9	15
.56-.60	2	3	3	3	1	3	4	3	10	12
.61-.65	2	2	1	2	1	3	1	2	5	10
.66-.70	0	1	3	2	2	2	3	2	8	8
.71-.75	1	1	0	1	2	2	1	2	4	7
.76-.80	2	1	1	1	3	2	1	1	7	6
.81-.85	1	1	0	1	2	1	1	1	4	5
.86-.90	2	0	1	1	1	1	0	1	4	4
.91-.95	0	0	1	1	2	1	1	1	4	3
.96-1.00	0	0	0	0	2	1	2	1	4	3
1.01-	0	1	3	2	4	6	4	5	11	14

Table C-16. Distribution of Daily Storm Depths for the Middle (1/3) Years at Haiwee: Observed and Expected Values Using the Weibull Distribution.

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	47	38	50	40	30	21	21	19	148	116
.06-.10	30	26	21	20	6	9	16	11	73	67
.11-.15	21	20	9	13	4	6	8	8	42	48
.16-.20	12	16	9	9	2	4	2	6	25	36
.21-.25	8	13	7	7	4	3	5	5	24	28
.26-.30	6	11	2	5	2	2	3	4	13	22
.31-.35	6	9	2	4	1	2	1	3	10	18
.36-.40	6	8	1	3	2	1	1	3	10	15
.41-.45	6	6	0	3	0	1	4	2	10	12
.46-.50	9	5	1	2	1	1	2	2	13	10
.51-.55	5	5	3	2	0	1	3	2	11	9
.56-.60	4	4	2	1	0	1	1	1	7	7
.61-.65	3	3	0	1	0	0	1	1	4	6
.66-.70	2	3	3	1	0	0	0	1	5	5
.71-.75	6	3	2	1	0	0	1	1	9	5
.76-.80	1	2	0	1	1	0	1	1	3	4
.81-.85	1	2	0	1	0	0	0	1	1	3
.86-.90	1	2	0	1	0	0	1	1	2	3
.91-.95	0	1	1	0	1	0	0	1	2	3
.96-1.00	1	1	1	0	0	0	2	0	4	2
1.01-	12	9	3	3	1	1	3	3	19	16

Table C-17. Distribution of Daily Storm Depths for the Wettest (1/3) Years at Haiwee: Observed and Expected Values Using the Weibull Distribution.

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	48	36	55	40	29	25	35	28	167	126
.06-.10	24	26	21	23	14	14	14	15	73	78
.11-.15	26	22	11	16	6	9	17	11	60	59
.16-.20	15	18	12	13	9	7	2	8	38	46
.21-.25	9	16	8	10	4	5	7	6	28	38
.26-.30	16	14	9	8	3	4	3	5	31	31
.31-.35	9	12	3	7	6	3	4	4	22	26
.36-.40	7	10	5	6	1	2	2	3	15	22
.41-.45	13	9	4	5	0	2	2	3	19	19
.46-.50	7	8	7	4	2	2	1	2	17	16
.51-.55	2	7	2	4	0	1	0	2	4	14
.56-.60	3	6	4	3	0	1	1	2	8	12
.61-.65	6	6	1	3	0	1	2	2	9	11
.66-.70	5	5	2	2	2	1	1	1	10	9
.71-.75	6	5	1	2	1	1	2	1	10	8
.76-.80	3	4	1	2	0	0	3	1	7	7
.81-.85	3	4	1	2	0	0	2	1	6	7
.86-.90	3	3	0	1	0	0	1	1	4	6
.91-.95	1	3	4	1	1	0	0	1	6	5
.96-1.00	4	3	1	1	0	0	0	1	5	5
1.01-	32	26	10	10	2	1	5	5	49	41

Table C-18. Distribution of Daily Storm Depths for the Middle (1/3) Years at Las Vegas: Observed and Expected Values Using the Weibull Distribution.

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	51	38	48	37	39	33	44	36	182	151
.06-.10	24	28	20	21	11	12	14	17	69	77
.11-.15	17	21	8	14	8	7	9	11	42	50
.16-.20	7	15	9	10	2	5	7	7	25	35
.21-.25	10	11	5	7	4	4	7	5	26	25
.26-.30	8	9	4	5	2	3	3	4	17	19
.31-.35	12	6	5	4	1	2	2	3	20	15
.36-.40	0	5	2	3	2	2	2	2	6	11
.41-.45	6	4	1	2	4	1	0	2	11	9
.46-.50	5	3	0	2	0	1	0	1	5	7
.51-.55	4	2	3	1	3	1	1	1	11	6
.56-.60	1	2	1	1	0	1	0	1	2	5
.61-.65	0	1	1	1	0	1	1	1	2	4
.66-.70	0	1	1	1	0	1	1	1	2	3
.71-.75	2	1	1	1	0	1	0	0	3	2
.76-.80	0	1	1	0	0	0	0	0	1	2
.81-.85	0	0	0	0	0	0	0	0	0	2
.86-.90	0	0	0	0	1	0	0	0	1	1
.91-.95	1	0	0	0	0	0	1	0	2	1
.96-1.00	0	0	1	0	0	0	0	0	1	1
1.01-	0	1	0	1	1	2	2	1	3	5

Table C-19. Distribution of Daily Storm Depths for the Wettest (1/3) Years at Las Vegas: Observed and Expected Values Using the Weibull Distribution.

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	52	37	33	30	40	32	38	25	163	126
.06-.10	15	28	22	17	14	17	14	15	65	77
.11-.15	23	21	12	12	10	12	6	11	51	55
.16-.20	15	17	2	8	12	9	7	8	36	41
.21-.25	15	13	6	6	6	7	4	6	31	32
.26-.30	10	11	0	5	1	5	3	5	14	25
.31-.35	8	8	6	3	5	4	2	4	21	20
.36-.40	7	7	2	3	7	4	1	3	17	16
.41-.45	3	5	2	2	2	3	5	3	12	13
.46-.50	4	4	0	2	1	2	2	2	7	11
.51-.55	2	3	3	1	0	2	0	2	5	9
.56-.60	1	3	1	1	1	2	1	2	4	7
.61-.65	3	2	0	1	1	1	2	1	6	6
.66-.70	3	2	2	1	0	1	2	1	7	5
.71-.75	2	1	1	0	3	1	2	1	8	4
.76-.80	1	1	0	0	0	1	0	1	1	4
.81-.85	1	1	0	0	0	1	0	1	1	3
.86-.90	0	1	0	0	0	1	2	1	2	2
.91-.95	3	1	0	0	0	1	0	1	3	2
.96-1.00	1	1	1	0	0	1	1	0	3	2
1.01-	1	2	0	1	7	4	5	3	13	10

Table C-20. Distribution of Daily Storm Depths for the Middle (1/3) Years at Tonopah: Observed and Expected Values Using the Weibull Distribution.

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	42	35	56	44	29	29	28	21	155	131
.06-.10	15	21	18	22	18	15	11	14	62	70
.11-.15	9	13	10	13	16	10	4	10	39	46
.16-.20	12	8	6	9	3	7	9	8	30	31
.21-.25	7	5	2	6	4	5	6	6	19	22
.26-.30	3	3	4	4	3	4	6	5	16	16
.31-.35	1	2	3	3	1	3	5	4	10	12
.36-.40	1	1	6	2	1	2	2	3	10	9
.41-.45	1	1	2	2	1	2	2	2	6	7
.46-.50	0	1	0	1	1	1	0	2	1	5
.51-.55	1	0	0	1	0	1	1	1	2	4
.56-.60	1	0	1	1	2	1	0	1	4	3
.61-.65	0	0	0	1	1	1	2	1	3	2
.66-.70	0	0	0	0	0	0	2	1	2	2
.71-.75	0	0	1	0	0	0	1	1	2	1
.76-.80	0	0	0	0	0	0	0	0	0	1
.81-.85	0	0	0	0	1	0	0	0	1	1
.86-.90	0	0	0	0	0	0	0	0	0	1
.91-.95	0	0	0	0	0	0	1	0	1	1
.96-1.00	0	0	1	0	0	0	1	0	2	0
1.01-	0	0	0	0	1	1	0	1	1	2

Table C-21. Distribution of Daily Storm Depths for the Wettest (1/3) Years at Tonopah: Observed and Expected Values Using the Weibull Distribution.

Daily Depth (Inches)	Winter		Spring		Summer		Fall		Annual	
	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt	Obsv	Expt
.01-.05	52	46	58	40	49	35	40	30	199	152
.06-.10	15	21	14	24	17	19	11	18	57	81
.11-.15	17	13	10	16	11	13	10	13	48	54
.16-.20	11	9	4	12	4	10	17	9	36	39
.21-.25	8	6	7	8	11	8	3	7	29	29
.26-.30	2	5	12	6	1	6	4	6	19	22
.31-.35	2	3	5	5	2	5	5	4	14	17
.36-.40	1	3	5	4	6	4	1	3	13	14
.41-.45	1	2	4	3	1	3	2	3	8	11
.46-.50	1	2	2	2	2	3	2	2	7	9
.51-.55	2	1	1	2	1	2	1	2	5	7
.56-.60	1	1	0	1	4	2	2	1	7	6
.61-.65	1	1	0	1	0	2	0	1	1	5
.66-.70	0	1	0	1	2	1	1	1	3	4
.71-.75	0	1	2	1	0	1	3	1	5	3
.76-.80	0	0	1	0	2	1	0	1	3	3
.81-.85	0	0	0	0	0	1	0	1	0	2
.86-.90	0	0	0	0	1	1	0	0	1	2
.91-.95	0	0	1	0	1	1	0	0	2	2
.96-1.00	0	0	0	0	1	1	1	0	2	1
1.01-	2	1	0	1	6	4	3	2	11	8

Table C-22. Chi-Square Goodness of Fit Test Results for Daily Storm Depths. Level of Significance $\alpha = .05$; R = Reject Null Hypothesis; F = Fail to Reject Null Hypothesis.

Station	Season	Entire Record	Middle (1/3)	Wettest (1/3)
Adaven	Winter	R	F	F
	Spring	F	F	F
	Summer	F	F	F
	Fall	F	F	F
	Annual	R	R	F
Beatty	Winter	F	F	F
	Spring	F	F	F
	Summer	F	F	F
	Fall	R	F	R
	Annual	R	F	F
Bishop	Winter	F	F	F
	Spring	R	R	F
	Summer	R	F	F
	Fall	F	F	F
	Annual	R	R	R
Caliente	Winter	F	F	F
	Spring	F	R	F
	Summer	R	F	F
	Fall	F	F	F
	Annual	R	F	F
Haiwee	Winter	R	F	F
	Spring	R	F	F
	Summer	F	F	F
	Fall	F	F	F
	Annual	R	R	R
Las Vegas	Winter	R	R	F
	Spring	F	F	F
	Summer	R	F	F
	Fall	F	F	R
	Annual	R	R	R
Tonopah	Winter	R	F	F
	Spring	R	F	R
	Summer	F	F	R
	Fall	R	F	R
	Annual	R	F	R

Table C-23. Values for α / β Calculated from Observed Data Sets for Each Station.

Station	Season	Entire Record	Middle (1/3)	Wettest (1/3)
Adaven	Winter	.97 / 29.35	1.03 / 32.01	.93 / 29.82
	Spring	.97 / 26.17	.95 / 25.86	1.03 / 31.51
	Summer	.83 / 23.62	.74 / 23.69	.94 / 25.93
	Fall	.96 / 34.03	.99 / 32.83	.99 / 38.61
	Annual	.92 / 27.60	.91 / 28.29	.96 / 30.66
Beatty	Winter	.82 / 19.60	.73 / 19.46	.87 / 20.99
	Spring	.81 / 15.17	.82 / 13.98	.85 / 18.27
	Summer	.75 / 13.78	.84 / 12.10	.78 / 20.69
	Fall	.84 / 20.31	.87 / 22.42	.83 / 22.30
	Annual	.80 / 17.18	.76 / 16.32	.84 / 20.18
Bishop	Winter	.64 / 21.49	.82 / 18.62	.71 / 35.91
	Spring	.64 / 9.64	.60 / 6.60	.69 / 14.41
	Summer	.71 / 6.77	.71 / 7.26	.70 / 6.70
	Fall	.71 / 12.42	.72 / 14.94	.70 / 9.84
	Annual	.59 / 12.05	.70 / 12.04	.59 / 16.86
Caliente	Winter	.90 / 16.17	.92 / 15.74	1.03 / 17.82
	Spring	.86 / 14.90	.95 / 15.53	.89 / 17.70
	Summer	.79 / 16.74	.83 / 16.55	.80 / 20.57
	Fall	.80 / 20.40	.83 / 21.87	.82 / 23.00
	Annual	.82 / 16.56	.86 / 16.81	.84 / 18.95
Haiwee	Winter	.81 / 29.47	.84 / 26.64	.87 / 39.20
	Spring	.69 / 17.44	.70 / 14.31	.72 / 23.54
	Summer	.75 / 14.57	.65 / 11.12	.76 / 15.61
	Fall	.72 / 18.75	.77 / 22.59	.71 / 20.54
	Annual	.74 / 21.84	.76 / 20.28	.77 / 27.73
Las Vegas	Winter	.90 / 16.76	.98 / 17.12	.95 / 21.34
	Spring	.80 / 12.86	.81 / 13.62	.84 / 14.53
	Summer	.63 / 13.39	.54 / 9.26	.72 / 18.59
	Fall	.72 / 14.11	.71 / 11.35	.79 / 20.55
	Annual	.74 / 14.30	.74 / 13.21	.81 / 18.99
Tonopah	Winter	.75 / 9.57	.97 / 10.75	.69 / 10.80
	Spring	.81 / 11.26	.77 / 10.33	.87 / 14.42
	Summer	.73 / 14.50	.78 / 12.56	.73 / 18.56
	Fall	.81 / 16.32	.90 / 18.39	.81 / 17.44
	Annual	.75 / 12.40	.81 / 12.42	.75 / 15.02

Table C-24. Values for μ / var Calculated from Observed Data Sets for Each Station.

Station	Season	Entire Record	Middle (1/3)	Wettest (1/3)
Adaven	Winter	29.73 / 935.27	31.62 / 946.61	30.92 / 1106.27
	Spring	26.51 / 749.19	26.43 / 780.34	31.13 / 912.96
	Summer	26.03 / 998.79	28.50 / 1518.40	26.63 / 806.04
	Fall	34.77 / 1320.69	32.97 / 1105.29	38.77 / 1541.22
	Annual	28.76 / 968.44	29.59 / 1069.00	31.21 / 1059.24
Beatty	Winter	21.83 / 718.11	23.70 / 1096.76	22.52 / 667.24
	Spring	16.99 / 449.63	15.58 / 366.71	19.92 / 552.37
	Summer	16.37 / 497.80	13.26 / 250.67	23.86 / 967.45
	Fall	22.26 / 721.49	24.05 / 764.01	24.57 / 883.34
	Annual	19.47 / 602.57	19.28 / 657.16	22.12 / 700.09
Bishop	Winter	29.83 / 2391.03	20.74 / 654.79	44.89 / 4231.77
	Spring	13.39 / 478.25	9.96 / 311.87	18.50 / 753.48
	Summer	8.46 / 149.09	9.07 / 170.77	8.49 / 152.28
	Fall	15.53 / 497.17	18.43 / 672.82	12.46 / 336.69
	Annual	18.46 / 1134.95	15.25 / 506.00	25.83 / 2138.11
Caliente	Winter	17.01 / 355.78	16.39 / 312.12	17.60 / 289.16
	Spring	16.08 / 351.33	15.87 / 277.95	18.71 / 445.64
	Summer	19.19 / 594.01	18.24 / 486.55	23.30 / 858.37
	Fall	23.11 / 852.15	24.10 / 858.44	25.63 / 1005.90
	Annual	18.45 / 513.20	18.14 / 454.74	20.76 / 608.74
Haiwee	Winter	33.01 / 1677.31	29.19 / 1213.21	42.06 / 2340.96
	Spring	22.40 / 1125.59	18.13 / 700.49	29.04 / 1695.99
	Summer	17.31 / 546.13	15.22 / 580.14	18.44 / 605.79
	Fall	23.14 / 1079.53	26.37 / 1199.44	25.67 / 1364.92
	Annual	26.27 / 1302.91	23.96 / 1018.30	32.36 / 1823.49
Las Vegas	Winter	17.64 / 384.84	17.28 / 311.17	21.81 / 527.26
	Spring	14.57 / 335.38	15.25 / 359.97	15.92 / 360.24
	Summer	19.00 / 973.05	16.19 / 1052.37	22.95 / 1061.83
	Fall	17.41 / 603.66	14.19 / 421.77	23.55 / 904.60
	Annual	17.20 / 549.87	15.89 / 479.54	21.27 / 700.10
Tonopah	Winter	11.36 / 237.25	10.89 / 126.88	13.87 / 423.61
	Spring	12.61 / 250.38	12.05 / 253.26	15.48 / 319.02
	Summer	17.66 / 598.34	14.48 / 355.24	22.61 / 1010.24
	Fall	18.28 / 514.77	19.35 / 464.53	19.54 / 593.07
	Annual	14.74 / 396.69	13.92 / 298.25	17.85 / 594.27

Table D-1. Bishop, Daily Frequency of Precipitation for the Middle (1/3) Years. Table Values Represent Number of Days with Precipitation Depths at or Above Given Threshold.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	2.54	1.23	0.77	0.38	0.08
Jan	4.08	2.08	1.00	0.46	0.00
Feb	3.31	1.69	1.16	0.54	0.08
Mar	2.62	0.54	0.23	0.16	0.08
Apr	2.62	0.69	0.38	0.00	0.00
May	3.31	0.92	0.38	0.08	0.00
Jun	0.54	0.23	0.00	0.00	0.00
Jul	3.54	1.08	0.31	0.08	0.00
Aug	1.46	0.46	0.08	0.00	0.00
Sep	2.62	0.46	0.31	0.00	0.00
Oct	2.08	1.08	0.31	0.08	0.00
Nov	3.15	1.92	1.16	0.85	0.08
Win	9.93	5.00	2.93	1.38	0.16
Spg	8.55	2.15	0.99	0.24	0.08
Sum	5.54	1.77	0.39	0.08	0.00
Fal	7.85	3.46	1.78	0.93	0.08
Year	31.87	12.38	6.09	2.63	0.32

Table D-2. Bishop, Daily Frequency of Precipitation for the Wettest (1/3) Years. Table Values Represent Number of Days with Precipitation Depths at or Above Given Threshold.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	3.58	2.50	1.67	1.17	0.67
Jan	5.58	3.25	2.17	1.58	1.00
Feb	4.75	2.92	2.00	1.08	0.42
Mar	4.83	1.92	1.33	0.58	0.17
Apr	2.92	1.50	0.75	0.50	0.17
May	2.00	0.75	0.25	0.00	0.00
Jun	2.17	0.58	0.25	0.17	0.00
Jul	1.83	0.42	0.17	0.00	0.00
Aug	2.17	0.58	0.17	0.00	0.00
Sep	2.17	1.08	0.25	0.08	0.00
Oct	1.67	0.42	0.08	0.00	0.00
Nov	2.67	0.92	0.50	0.25	0.00
Win	13.91	8.67	5.84	3.83	2.09
Spg	9.75	4.17	2.33	1.08	0.34
Sum	6.17	1.58	0.59	0.17	0.00
Fal	6.51	2.42	0.83	0.33	0.00
Year	36.34	16.84	9.59	5.41	2.43

Table D-3. Haiwee, Daily Frequency of Precipitation for the Middle (1/3) Years. Table Values Represent Number of Days with Precipitation Depths at or Above Given Threshold.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	2.78	2.06	1.22	0.61	0.17
Jan	3.39	1.83	1.11	0.56	0.22
Feb	4.22	2.33	1.56	0.89	0.28
Mar	3.94	1.89	0.78	0.50	0.06
Apr	1.22	0.39	0.22	0.17	0.06
May	1.33	0.44	0.28	0.17	0.06
Jun	0.56	0.22	0.17	0.06	0.00
Jul	1.39	0.50	0.11	0.00	0.00
Aug	1.11	0.39	0.22	0.17	0.06
Sep	1.28	0.67	0.28	0.11	0.00
Oct	1.11	0.44	0.28	0.11	0.00
Nov	1.83	1.17	0.78	0.50	0.17
Win	10.39	6.22	3.89	2.06	0.67
Spg	6.49	2.72	1.28	0.84	0.18
Sum	3.06	1.11	0.50	0.23	0.06
Fal	4.22	2.28	1.34	0.72	0.17
Year	24.16	12.33	7.01	3.85	1.08

Table D-4. Haiwee, Daily Frequency of Precipitation for the Wettest (1/3) Years. Table Values Represent Number of Days with Precipitation Depths at or Above Given Threshold.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	3.71	2.65	1.59	1.00	0.59
Jan	5.29	3.59	2.47	1.35	0.53
Feb	5.24	4.18	3.12	1.71	0.76
Mar	5.18	3.06	2.00	1.35	0.41
Apr	3.00	1.59	0.88	0.24	0.18
May	1.35	0.71	0.35	0.12	0.00
Jun	0.88	0.41	0.18	0.06	0.00
Jul	1.76	0.94	0.24	0.00	0.00
Aug	2.06	0.88	0.65	0.29	0.12
Sep	2.00	1.06	0.71	0.29	0.06
Oct	1.53	0.59	0.35	0.18	0.00
Nov	2.59	1.76	0.71	0.53	0.24
Win	14.24	10.42	7.18	4.06	1.88
Spg	9.53	5.36	3.23	1.71	0.59
Sum	4.70	2.23	1.07	0.35	0.12
Fal	6.12	3.41	1.77	1.00	0.30
Year	34.59	21.42	13.25	7.12	2.89

Table D-5. Adaven, Daily Frequency of Precipitation for the Middle (1/3) Years. Table Values Represent Number of Days with Precipitation Depths at or Above Given Threshold.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	2.79	1.71	1.14	0.64	0.21
Jan	5.43	4.07	2.57	1.22	0.14
Feb	5.71	4.71	2.93	1.21	0.21
Mar	4.00	2.64	1.50	0.57	0.14
Apr	3.64	2.72	1.57	0.93	0.21
May	4.21	3.00	1.57	0.50	0.00
Jun	2.07	1.00	0.71	0.29	0.00
Jul	3.57	2.21	1.22	0.50	0.14
Aug	5.21	3.29	2.00	1.07	0.36
Sep	2.14	1.63	0.79	0.29	0.14
Oct	2.14	1.43	1.00	0.43	0.07
Nov	1.93	1.64	1.00	0.57	0.21
Win	13.93	10.49	6.64	3.07	0.56
Spg	11.85	8.36	4.64	2.00	0.35
Sum	10.85	6.50	3.93	1.86	0.50
Fal	6.21	4.70	2.79	1.29	0.42
Year	42.84	30.05	18.00	8.22	1.83

Table D-6. Adaven, Daily Frequency of Precipitation for the Wettest (1/3) Years. Table Values Represent Number of Days with Precipitation Depths at or Above Given Threshold.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	5.47	3.73	2.33	1.20	0.13
Jan	6.20	4.53	2.47	1.40	0.40
Feb	6.60	4.80	3.00	1.47	0.47
Mar	7.27	5.87	3.53	2.00	0.40
Apr	5.53	3.93	2.33	1.40	0.27
May	3.33	2.13	1.27	0.27	0.07
Jun	2.53	2.00	1.13	0.60	0.00
Jul	5.33	3.73	1.67	0.73	0.20
Aug	5.47	3.73	2.07	0.73	0.20
Sep	2.67	1.87	1.20	0.93	0.20
Oct	2.67	2.13	1.40	0.87	0.27
Nov	3.60	2.67	1.80	1.20	0.27
Win	18.27	13.06	7.80	4.07	1.00
Spg	16.13	11.93	7.13	3.67	0.74
Sum	13.33	9.46	4.87	2.06	0.40
Fal	8.94	6.67	4.40	3.00	0.74
Year	56.67	41.12	24.20	12.80	2.88

Table D-7. Caliente, Daily Frequency of Precipitation for the Middle (1/3) Years. Table Values Represent Number of Days with Precipitation Depths at or Above Given Threshold.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	4.73	2.47	0.93	0.33	0.00
Jan	3.93	2.20	1.07	0.47	0.00
Feb	3.67	1.93	0.73	0.07	0.00
Mar	5.40	3.20	1.27	0.20	0.00
Apr	5.00	2.47	1.27	0.33	0.00
May	4.33	2.67	0.73	0.20	0.00
Jun	1.47	0.40	0.20	0.07	0.00
Jul	4.60	2.07	1.07	0.13	0.00
Aug	5.47	3.27	2.07	0.60	0.07
Sep	1.60	0.93	0.93	0.33	0.00
Oct	3.53	1.80	0.93	0.27	0.07
Nov	3.93	2.40	1.27	0.73	0.07
Win	12.33	6.60	2.73	0.87	0.00
Spg	14.73	8.34	3.27	0.73	0.00
Sum	11.54	5.74	3.34	0.80	0.07
Fal	9.06	5.13	3.13	1.33	0.14
Year	47.66	25.81	12.47	3.73	0.21

Table D-8. Caliente, Daily Frequency of Precipitation for the Wettest (1/3) Years. Table Values Represent Number of Days with Precipitation Depths at or Above Given Threshold.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	4.57	3.00	1.22	0.29	0.00
Jan	6.14	3.79	1.43	0.36	0.00
Feb	6.64	3.86	1.43	0.43	0.00
Mar	6.36	3.71	2.00	0.64	0.07
Apr	4.93	2.72	1.36	0.43	0.14
May	3.79	1.79	0.78	0.21	0.00
Jun	2.43	1.29	0.79	0.29	0.00
Jul	5.29	3.07	1.79	0.64	0.21
Aug	5.57	3.21	1.79	0.57	0.14
Sep	3.43	2.14	1.14	0.50	0.00
Oct	4.79	2.72	1.64	0.71	0.21
Nov	2.50	1.79	1.36	0.36	0.07
Win	17.35	10.65	4.08	1.08	0.00
Spg	15.08	8.22	4.14	1.28	0.21
Sum	13.29	7.57	4.37	1.50	0.35
Fal	10.72	6.65	4.14	1.57	0.28
Year	56.44	33.09	16.73	5.43	0.84

Table D-9. Beatty, Daily Frequency of Precipitation for the Middle (1/3) Years. Table Values Represent Number of Days with Precipitation Depths at or Above Given Threshold.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	2.39	1.33	0.61	0.28	0.06
Jan	2.44	1.50	0.72	0.33	0.00
Feb	2.17	1.33	0.83	0.39	0.11
Mar	3.11	1.44	0.72	0.11	0.00
Apr	1.89	1.00	0.50	0.17	0.06
May	1.83	1.06	0.33	0.06	0.00
Jun	1.00	0.56	0.33	0.06	0.00
Jul	1.89	0.78	0.22	0.06	0.00
Aug	2.78	0.78	0.44	0.22	0.00
Sep	1.00	0.67	0.39	0.22	0.00
Oct	1.72	1.33	0.83	0.11	0.06
Nov	2.61	1.33	0.89	0.28	0.06
Win	7.00	4.16	2.16	1.00	0.17
Spg	6.83	3.50	1.55	0.34	0.06
Sum	5.67	2.12	0.99	0.34	0.00
Fal	5.33	3.33	2.11	0.61	0.12
Year	24.83	13.11	6.81	2.29	0.35

Table D-10. Beatty, Daily Frequency of Precipitation for the Wettest (1/3) Years. Table Values Represent Number of Days with Precipitation Depths at or Above Given Threshold.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	2.82	1.53	0.76	0.29	0.00
Jan	4.47	2.53	1.29	0.41	0.06
Feb	4.06	2.76	1.59	0.71	0.18
Mar	5.35	2.88	1.53	0.65	0.12
Apr	3.12	2.12	1.00	0.29	0.06
May	3.12	1.47	0.88	0.29	0.06
Jun	1.06	0.65	0.24	0.12	0.06
Jul	1.29	0.76	0.35	0.12	0.00
Aug	1.71	1.00	0.47	0.29	0.18
Sep	1.82	1.06	0.59	0.18	0.12
Oct	1.71	0.82	0.59	0.12	0.00
Nov	2.12	1.53	1.00	0.18	0.18
Win	11.35	6.82	3.64	1.41	0.24
Spg	11.59	6.47	3.41	1.23	0.24
Sum	4.06	2.41	1.06	0.53	0.24
Fal	5.65	3.41	2.18	0.48	0.30
Year	32.65	19.11	10.29	3.65	1.02

Table D-11. Las Vegas, Daily Frequency of Precipitation for the Middle (1/3) Years. Table Values Represent Number of Days with Precipitation Depths at or Above Given Threshold.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	2.00	1.25	0.81	0.12	0.00
Jan	3.56	1.69	0.81	0.19	0.00
Feb	3.71	2.14	1.19	0.31	0.00
Mar	3.75	1.75	0.69	0.38	0.06
Apr	1.88	0.88	0.44	0.13	0.00
May	1.31	0.56	0.31	0.06	0.00
Jun	0.31	0.19	0.00	0.00	0.00
Jul	1.44	0.63	0.25	0.06	0.00
Aug	3.12	1.19	0.75	0.25	0.06
Sep	1.94	1.06	0.38	0.19	0.13
Oct	2.12	0.87	0.25	0.06	0.00
Nov	1.81	0.81	0.31	0.13	0.00
Win	9.27	5.08	2.81	0.62	0.00
Spg	6.94	3.19	1.44	0.57	0.06
Sum	4.87	2.01	1.00	0.31	0.06
Fal	5.87	2.74	0.94	0.38	0.13
Year	26.95	13.02	6.19	1.88	0.25

Table D-12. Las Vegas, Daily Frequency of Precipitation for the Wettest (1/3) Years. Table Values Represent Number of Days with Precipitation Depths at or Above Given Threshold.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	3.53	1.93	0.80	0.33	0.00
Jan	4.33	2.93	1.53	0.27	0.00
Feb	3.46	2.40	1.33	0.80	0.07
Mar	2.33	1.00	0.53	0.33	0.00
Apr	2.60	1.07	0.47	0.13	0.00
May	1.27	0.73	0.40	0.07	0.00
Jun	1.13	0.60	0.20	0.07	0.00
Jul	3.00	1.60	0.87	0.40	0.27
Aug	3.20	1.67	0.93	0.33	0.20
Sep	2.40	1.33	0.73	0.33	0.13
Oct	1.60	0.60	0.40	0.20	0.00
Nov	2.47	1.20	0.80	0.53	0.20
Win	11.32	7.26	3.66	1.40	0.07
Spg	6.20	2.80	1.40	0.53	0.00
Sum	7.33	3.87	2.00	0.80	0.47
Fal	6.47	3.13	1.93	1.06	0.33
Year	31.32	17.06	8.99	3.79	0.87

Table D-13. Tonopah, Daily Frequency of Precipitation for the Middle (1/3) Years. Table Values Represent Number of Days with Precipitation Depths at or Above Given Threshold.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	2.10	0.90	0.00	0.00	0.00
Jan	3.90	1.50	0.20	0.00	0.00
Feb	3.30	1.50	0.60	0.20	0.00
Mar	4.20	1.40	0.40	0.00	0.00
Apr	2.30	0.70	0.30	0.10	0.00
May	4.50	1.80	1.10	0.20	0.00
Jun	3.00	1.60	0.70	0.30	0.00
Jul	2.30	1.30	0.10	0.10	0.00
Aug	2.90	0.90	0.50	0.20	0.10
Sep	2.30	0.90	0.60	0.10	0.00
Oct	2.90	1.90	0.90	0.50	0.00
Nov	2.90	1.60	1.00	0.20	0.00
Win	9.30	3.90	0.80	0.20	0.00
Spg	11.00	3.90	1.80	0.30	0.00
Sum	8.20	3.80	1.30	0.60	0.10
Fal	8.10	4.40	2.50	0.80	0.00
Year	36.60	16.00	6.40	1.90	0.10

Table D-14. Tonopah, Daily Frequency of Precipitation for the Wettest (1/3) Years. Table Values Represent Number of Days with Precipitation Depths at or Above Given Threshold.

	0.01 in.	0.10 in.	0.25 in.	0.50 in.	1.00 in.
Dec	2.55	1.45	0.27	0.09	0.00
Jan	4.45	1.73	0.46	0.00	0.00
Feb	3.55	1.64	0.82	0.46	0.18
Mar	5.18	2.18	1.45	0.18	0.00
Apr	3.64	1.55	0.64	0.09	0.00
May	2.64	1.45	1.00	0.18	0.00
Jun	2.00	0.91	0.46	0.18	0.00
Jul	4.45	2.27	1.27	0.91	0.46
Aug	4.64	2.36	1.18	0.55	0.09
Sep	4.27	2.09	0.91	0.46	0.09
Oct	1.91	1.36	0.82	0.36	0.00
Nov	3.46	1.73	0.64	0.27	0.18
Win	10.55	4.82	1.55	0.55	0.18
Spg	11.46	5.18	3.09	0.45	0.00
Sum	11.09	5.54	2.91	1.64	0.55
Fal	9.64	5.18	2.37	1.09	0.27
Year	42.74	20.72	9.92	3.73	1.00

Table D-15. Average Daily Storm Depths (in.) for the Middle (1/3) Years.

	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Dec	0.33	0.22	0.22	0.16	0.30	0.19	0.09
Jan	0.31	0.19	0.18	0.19	0.28	0.15	0.09
Feb	0.32	0.31	0.23	0.14	0.29	0.18	0.14
Mar	0.26	0.14	0.11	0.17	0.18	0.16	0.09
Apr	0.30	0.20	0.08	0.16	0.18	0.14	0.13
May	0.24	0.14	0.10	0.14	0.19	0.14	0.14
Jun	0.21	0.17	0.10	0.12	0.16	0.12	0.17
Jul	0.28	0.12	0.09	0.14	0.10	0.13	0.11
Aug	0.32	0.13	0.09	0.23	0.21	0.18	0.15
Sep	0.28	0.28	0.08	0.33	0.17	0.20	0.15
Oct	0.32	0.28	0.15	0.21	0.18	0.10	0.24
Nov	0.40	0.20	0.30	0.24	0.38	0.13	0.19
Win	0.32	0.24	0.21	0.16	0.29	0.17	0.11
Spg	0.26	0.16	0.10	0.16	0.18	0.15	0.12
Sum	0.29	0.13	0.09	0.18	0.15	0.16	0.14
Fal	0.33	0.24	0.18	0.24	0.26	0.14	0.19
Year	0.30	0.19	0.15	0.18	0.24	0.16	0.14

Table D-16. Average Daily Storm Depths (in.) for the Wettest (1/3) Years.

	Adaven	Beatty	Bishop	Caliente	Haiwee	Las Vegas	Tonopah
Dec	0.28	0.19	0.53	0.18	0.42	0.18	0.13
Jan	0.31	0.20	0.44	0.18	0.39	0.19	0.10
Feb	0.33	0.28	0.39	0.17	0.45	0.29	0.19
Mar	0.35	0.21	0.19	0.22	0.35	0.18	0.15
Apr	0.31	0.20	0.23	0.18	0.24	0.13	0.13
May	0.24	0.18	0.10	0.14	0.18	0.18	0.21
Jun	0.30	0.23	0.10	0.22	0.17	0.15	0.15
Jul	0.25	0.21	0.08	0.25	0.13	0.25	0.27
Aug	0.26	0.28	0.07	0.22	0.24	0.24	0.21
Sep	0.38	0.26	0.12	0.21	0.24	0.22	0.18
Oct	0.41	0.18	0.08	0.25	0.17	0.18	0.25
Nov	0.38	0.29	0.16	0.32	0.32	0.29	0.19
Win	0.31	0.23	0.45	0.18	0.42	0.22	0.14
Spg	0.31	0.20	0.19	0.19	0.29	0.16	0.15
Sum	0.27	0.24	0.09	0.23	0.18	0.23	0.23
Fal	0.39	0.25	0.12	0.26	0.26	0.24	0.20
Year	0.31	0.22	0.26	0.21	0.32	0.21	0.18

Table E-1. Mean Maximum (Max), Mean Minimum (Min), and Average of Max and Min (Avg) Temperatures in °F for the Wettest 1/3, Middle 1/3, and Driest 1/3 Years in the Period of Record.

Station	Season	Wettest 1/3			Middle 1/3			Driest 1/3		
		Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Adaven	Winter	43.6	20.7	32.2	42.6	18.8	30.7	45.2	21.0	33.1
	Spring	58.6	30.8	44.7	60.8	31.0	45.9	62.1	32.0	47.0
	Summer	83.0	50.7	66.8	85.1	51.2	68.1	84.6	51.1	67.8
	Fall	65.4	36.8	51.1	65.5	35.7	50.6	65.8	36.4	51.1
	Annual	62.7	34.8	48.8	63.6	34.3	48.9	64.5	35.2	49.8
Beatty	Winter	55.8	30.0	42.9	52.6	27.9	40.2	59.3	29.9	44.6
	Spring	69.5	39.8	54.7	72.2	41.6	56.9	75.0	42.1	58.6
	Summer	93.5	57.5	75.5	95.0	59.3	77.1	97.7	61.1	79.4
	Fall	77.1	44.0	60.6	75.7	43.6	59.6	78.6	44.6	61.6
	Annual	74.0	42.9	58.5	74.0	43.2	58.6	77.7	44.5	61.1
Bishop	Winter	55.1	23.9	39.5	55.4	22.3	38.8	55.9	23.1	39.5
	Spring	70.5	36.1	53.3	72.6	36.9	54.8	71.9	36.1	54.0
	Summer	93.3	52.9	73.1	94.8	53.5	74.1	95.0	54.5	74.8
	Fall	76.0	37.3	56.7	76.0	37.8	56.9	75.6	36.7	56.2
	Annual	73.8	37.6	55.7	74.8	37.7	56.2	74.7	37.7	56.2
Caliente	Winter	47.0	18.9	33.0	50.1	19.0	34.5	49.7	18.7	34.2
	Spring	68.6	34.8	51.7	68.2	33.5	50.8	71.8	34.1	52.9
	Summer	91.4	53.5	72.4	92.7	52.7	72.7	93.2	53.7	73.5
	Fall	71.5	35.9	53.7	72.9	34.7	53.8	74.2	35.7	54.9
	Annual	69.7	35.9	52.8	71.1	35.1	53.1	72.3	35.6	54.0
Haiwee	Winter	53.9	31.4	42.6	52.8	29.5	41.2	52.4	29.6	41.0
	Spring	69.5	43.3	56.4	69.4	42.2	55.8	70.0	43.6	56.8
	Summer	92.6	62.6	77.6	92.5	62.4	77.5	92.2	63.9	78.0
	Fall	74.3	47.1	60.7	74.1	45.8	59.9	73.6	46.7	60.1
	Annual	72.7	46.1	59.4	72.3	45.1	58.7	72.1	46.0	59.1
Las Vegas	Winter	57.8	34.6	46.2	58.8	35.4	47.1	58.9	34.6	46.7
	Spring	78.1	50.7	64.4	77.1	51.1	64.1	78.8	50.5	64.7
	Summer	101.2	72.0	86.6	101.3	73.4	87.4	102.1	73.2	87.6
	Fall	81.2	53.6	67.4	79.7	53.7	66.7	80.8	53.0	66.9
	Annual	79.7	52.8	66.2	79.4	53.5	66.4	80.2	52.9	66.6
Tonopah	Winter	46.4	20.9	33.7	43.9	18.8	31.4	47.5	21.2	34.3
	Spring	63.0	33.9	48.5	62.3	33.5	47.9	64.6	33.6	49.1
	Summer	87.3	53.7	70.5	86.9	53.2	70.1	89.2	54.3	71.1
	Fall	66.7	36.9	51.8	66.7	36.6	51.7	67.5	35.8	51.7
	Annual	65.9	36.4	51.2	65.1	35.6	50.3	67.3	36.3	51.8

Table E-2. Adaven, Dry-Day and Wet-Day Temperatures in ^{o}F for the Wettest 1/3, Middle 1/3, and Driest 1/3 Years in the Period of Record.

Month	Day	Wettest 1/3			Middle 1/3			Driest 1/3		
		Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Dec	Dry	45.8	20.7	33.2	44.3	18.6	31.4	46.4	21.6	34.0
	Wet	39.2	24.8	32.0	37.3	20.1	28.7	35.2	20.3	27.7
Jan	Dry	44.2	19.9	32.1	41.0	16.0	28.5	44.6	18.3	31.5
	Wet	37.1	22.6	29.9	33.8	15.6	24.7	36.6	20.3	28.4
Feb	Dry	45.0	20.2	32.6	44.6	19.5	32.0	48.1	23.0	35.5
	Wet	37.4	20.7	29.0	39.6	23.5	31.6	40.3	24.1	32.2
Mar	Dry	50.1	23.3	36.7	52.0	22.8	37.4	54.7	26.6	40.7
	Wet	42.7	25.0	33.9	41.6	20.0	30.8	41.0	22.0	31.5
Apr	Dry	60.3	30.4	45.3	63.4	31.7	47.6	62.9	31.6	47.3
	Wet	47.1	27.8	37.4	50.1	27.3	38.7	52.1	30.1	41.1
May	Dry	70.7	39.4	55.1	71.2	38.8	55.0	73.2	39.8	56.5
	Wet	58.4	34.3	46.4	59.6	34.4	47.0	67.6	38.5	53.0
Jun	Dry	78.6	45.6	62.1	81.8	46.7	64.3	82.2	47.6	64.9
	Wet	66.2	41.7	54.0	67.8	40.4	54.1	69.0	42.4	55.7
Jul	Dry	87.2	53.2	70.2	88.8	53.9	71.3	88.5	54.4	71.4
	Wet	82.9	54.4	68.6	83.5	55.1	69.3	82.6	54.4	68.5
Aug	Dry	85.6	53.2	69.4	85.6	51.3	68.4	85.4	52.4	68.9
	Wet	81.2	53.3	67.2	81.1	51.6	66.4	83.4	54.6	69.0
Sep	Dry	76.7	45.2	61.0	78.7	45.4	62.0	78.2	45.4	61.9
	Wet	69.6	48.0	58.8	70.7	47.1	58.9	72.6	49.2	60.9
Oct	Dry	67.2	37.5	52.4	66.7	35.6	51.1	67.6	37.2	52.4
	Wet	57.4	37.1	47.2	57.3	33.8	45.6	54.2	34.6	44.4
Nov	Dry	54.9	27.4	41.1	54.4	26.1	40.2	53.0	26.6	39.8
	Wet	44.2	27.3	35.8	43.4	25.1	34.3	42.5	24.5	33.5

Table E-3. Beatty, Dry-Day and Wet-Day Temperatures in °F for the Wettest 1/3, Middle 1/3, and Driest 1/3 Years in the Period of Record.

Month	Day	Wettest 1/3			Middle 1/3			Driest 1/3		
		Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Dec	Dry	56.3	28.0	42.1	54.3	27.7	41.0	60.5	30.3	45.4
	Wet	51.3	33.3	42.3	45.0	30.2	37.6	51.2	35.2	43.2
Jan	Dry	54.5	28.0	41.3	49.3	25.7	37.5	58.2	28.9	43.6
	Wet	48.7	34.2	41.4	40.6	27.9	34.2	50.3	32.7	41.6
Feb	Dry	60.0	31.8	45.9	57.1	29.3	43.2	60.8	30.0	45.4
	Wet	50.7	36.9	43.8	53.6	35.1	44.4	51.8	31.1	41.4
Mar	Dry	61.3	32.4	46.9	65.0	35.4	50.2	67.9	34.5	51.2
	Wet	53.0	35.6	44.3	55.7	36.3	46.0	55.9	35.6	45.7
Apr	Dry	70.7	38.9	54.8	73.0	40.7	56.9	77.1	43.0	60.1
	Wet	61.0	41.9	51.5	61.4	41.5	51.4	65.3	42.8	54.0
May	Dry	80.8	47.3	64.0	82.5	48.9	65.7	81.7	48.6	65.1
	Wet	68.7	44.5	56.6	67.7	46.2	56.9	72.7	52.7	62.7
Jun	Dry	89.8	54.0	71.9	92.8	56.4	74.6	95.0	58.2	76.6
	Wet	80.3	53.3	66.8	80.4	54.2	67.3	88.5	53.5	71.0
Jul	Dry	97.1	58.9	78.0	97.3	61.3	79.3	100.8	64.6	82.7
	Wet	92.6	65.4	79.0	91.7	65.2	78.4	95.0	67.3	81.1
Aug	Dry	94.4	58.6	76.5	95.7	59.5	77.6	97.4	60.0	78.7
	Wet	87.3	66.2	76.7	91.8	65.0	78.4	96.7	63.7	80.2
Sep	Dry	87.9	53.4	70.6	89.2	53.2	71.2	91.2	54.6	72.9
	Wet	78.4	58.1	68.3	76.7	54.0	65.3	87.1	62.6	74.9
Oct	Dry	80.2	44.8	62.5	76.7	43.9	60.3	78.5	44.4	61.4
	Wet	71.2	47.4	59.3	62.9	42.2	52.5	63.7	47.8	55.8
Nov	Dry	64.6	33.4	49.0	63.8	33.4	48.6	67.2	34.6	50.9
	Wet	54.2	35.7	44.9	50.7	37.5	44.1	54.8	33.0	43.9

Table E-4. Bishop, Dry-Day and Wet-Day Temperatures in °F for the Wettest 1/3, Middle 1/3, and Driest 1/3 Years in the Period of Record.

Month	Day	Wettest 1/3			Middle 1/3			Driest 1/3		
		Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Dec	Dry	55.7	22.4	39.0	57.0	21.6	39.3	54.8	21.4	38.1
	Wet	47.4	28.6	38.0	48.1	28.1	38.1	44.2	23.2	33.7
Jan	Dry	54.8	21.3	38.1	52.9	19.5	36.2	55.4	21.9	38.6
	Wet	45.8	27.2	36.5	42.3	20.5	31.4	45.0	25.0	35.0
Feb	Dry	59.1	25.6	42.3	59.4	24.7	42.1	60.3	25.5	42.9
	Wet	50.7	31.4	41.1	52.2	30.3	41.3	51.4	31.2	41.3
Mar	Dry	62.1	28.7	45.4	66.1	30.6	48.4	64.7	28.8	46.8
	Wet	52.6	31.8	42.2	53.9	32.6	43.3	56.6	30.8	43.7
Apr	Dry	70.5	35.4	53.0	73.8	36.1	55.0	72.5	35.9	54.2
	Wet	57.0	36.1	46.6	59.9	34.5	47.2	66.0	38.5	52.3
May	Dry	82.3	43.6	63.0	81.8	44.0	62.9	80.5	43.5	62.0
	Wet	72.3	45.3	58.8	68.9	42.5	55.7	64.9	40.3	52.6
Jun	Dry	89.4	49.7	69.5	91.8	51.0	71.4	91.9	51.8	71.9
	Wet	77.3	49.7	63.5	80.4	50.1	65.3	85.3	52.5	68.9
Jul	Dry	96.2	54.7	75.4	98.0	55.6	76.8	98.6	57.0	77.8
	Wet	93.2	61.0	77.1	95.0	61.1	78.1	93.2	60.9	77.0
Aug	Dry	95.8	53.3	74.5	95.4	52.9	74.1	95.5	54.2	74.8
	Wet	87.9	61.2	74.5	88.7	58.3	73.5	89.6	59.1	74.4
Sep	Dry	87.7	46.3	67.0	88.4	47.1	67.7	88.5	46.2	67.3
	Wet	77.7	52.4	65.0	78.8	49.8	64.3	79.6	49.4	64.5
Oct	Dry	77.8	37.2	57.5	76.7	37.0	56.8	77.0	36.7	56.8
	Wet	69.0	43.4	56.2	64.3	41.0	52.6	63.8	39.5	51.7
Nov	Dry	64.7	27.2	45.9	66.1	28.2	47.2	63.0	26.8	44.9
	Wet	53.7	31.5	42.6	52.8	33.4	43.1	52.2	30.9	41.5

Table E-5. Caliente, Dry-Day and Wet-Day Temperatures in °F for the Wettest 1/3, Middle 1/3, and Driest 1/3 Years in the Period of Record.

Month	Day	Wettest 1/3			Middle 1/3			Driest 1/3		
		Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Dec	Dry	47.7	16.5	32.1	49.8	18.2	34.0	51.2	18.5	34.9
	Wet	43.0	26.0	34.5	44.0	25.8	34.9	44.2	27.4	35.8
Jan	Dry	44.7	14.7	29.7	48.8	16.1	32.4	46.8	14.0	30.4
	Wet	40.0	21.0	30.5	43.3	23.7	33.5	42.1	21.3	31.7
Feb	Dry	51.3	20.9	36.1	53.4	20.0	36.7	54.8	20.2	37.5
	Wet	46.9	30.1	38.5	47.2	29.0	38.1	50.1	30.7	40.4
Mar	Dry	61.6	27.6	44.6	61.6	26.2	43.9	64.1	25.5	44.8
	Wet	51.1	31.3	41.2	51.3	29.2	40.3	55.2	30.2	42.7
Apr	Dry	70.9	33.8	52.3	70.7	33.8	52.2	73.6	33.5	53.6
	Wet	56.9	34.0	45.4	57.3	34.9	46.1	63.5	35.9	49.7
May	Dry	80.3	42.5	61.4	79.1	40.3	59.7	80.7	41.8	61.3
	Wet	68.8	42.2	55.5	67.2	38.3	52.7	70.4	40.3	55.3
Jun	Dry	88.9	49.2	69.0	88.8	47.4	68.1	89.8	49.2	69.5
	Wet	76.6	48.5	62.6	75.8	48.9	62.4	81.6	49.9	65.8
Jul	Dry	95.7	55.2	75.5	96.2	54.4	75.3	96.4	56.2	76.3
	Wet	92.3	60.7	76.5	93.3	61.7	77.5	93.1	60.6	76.8
Aug	Dry	92.7	53.8	73.3	94.0	54.4	74.2	94.1	54.5	74.3
	Wet	88.0	60.3	74.1	89.3	58.2	73.8	92.0	59.2	75.6
Sep	Dry	87.2	45.5	66.3	85.6	44.2	64.9	86.7	45.3	66.0
	Wet	76.8	50.3	63.6	76.3	52.1	64.2	81.6	52.9	67.3
Oct	Dry	72.7	34.4	53.6	75.7	34.6	55.1	77.3	35.5	56.4
	Wet	62.8	40.5	51.6	65.7	42.8	54.2	61.0	38.2	49.6
Nov	Dry	61.1	25.0	43.0	59.1	22.8	41.0	61.3	24.3	42.8
	Wet	50.0	33.6	41.8	52.4	33.3	42.9	51.0	29.4	40.2

Table E-6. Haiwee, Dry-Day and Wet-Day Temperatures in ^{o}F for the Wettest 1/3, Middle 1/3, and Driest 1/3 Years in the Period of Record.

Month	Day	Wettest 1/3			Middle 1/3			Driest 1/3		
		Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Dec	Dry	54.6	30.6	42.6	52.2	28.4	40.3	51.9	29.5	40.7
	Wet	49.5	33.6	41.5	49.0	31.5	40.2	44.4	29.7	37.0
Jan	Dry	52.7	29.7	41.2	50.8	28.0	39.4	50.2	27.8	39.0
	Wet	49.4	33.8	41.6	46.3	31.0	38.6	44.3	27.6	35.9
Feb	Dry	56.9	32.4	44.7	57.6	31.6	44.6	56.9	31.6	44.3
	Wet	51.1	34.7	42.9	49.7	32.7	41.2	52.1	33.7	42.9
Mar	Dry	63.0	37.6	50.3	61.0	34.2	47.6	64.1	37.3	50.7
	Wet	52.5	35.0	43.7	53.9	33.0	43.4	57.3	34.0	45.7
Apr	Dry	69.1	42.5	55.8	69.8	42.2	56.0	71.0	44.5	57.7
	Wet	58.0	37.3	47.7	58.7	39.3	49.0	61.5	39.9	50.7
May	Dry	80.0	50.9	65.4	79.7	50.9	65.3	76.6	50.1	63.3
	Wet	71.9	48.2	60.0	70.0	45.0	57.5	64.6	42.0	53.3
Jun	Dry	89.9	59.6	74.7	89.7	59.8	74.8	89.1	60.7	74.9
	Wet	78.2	53.8	66.0	75.2	51.6	63.4	77.0	53.0	65.0
Jul	Dry	94.7	64.3	79.5	95.5	64.9	80.2	95.8	67.3	81.5
	Wet	92.2	65.3	78.7	91.0	64.6	77.8	89.2	64.3	76.7
Aug	Dry	94.0	63.6	78.8	92.9	62.6	77.8	92.1	63.9	78.0
	Wet	87.4	65.2	76.3	86.6	63.0	74.8	89.5	64.3	76.9
Sep	Dry	87.0	57.7	72.4	86.6	56.1	71.4	86.7	57.6	72.1
	Wet	79.5	57.7	68.6	76.7	57.4	67.1	82.0	60.8	71.4
Oct	Dry	75.1	47.0	61.1	75.1	45.8	60.5	73.6	46.5	60.0
	Wet	63.2	45.0	54.1	66.8	46.9	56.9	65.9	44.8	55.4
Nov	Dry	62.6	36.7	49.7	61.6	35.1	48.4	61.7	36.1	48.9
	Wet	54.1	36.2	45.1	58.3	38.2	48.3	50.6	35.0	42.8

Table E-7. Las Vegas, Dry-Day and Wet-Day Temperatures in ^oF for the Wettest 1/3, Middle 1/3, and Driest 1/3 Years in the Period of Record.

Month	Day	Wettest 1/3			Middle 1/3			Driest 1/3		
		Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Dec	Dry	57.8	33.6	45.7	57.7	33.2	45.5	57.2	33.6	45.4
	Wet	55.6	41.0	48.3	51.9	39.0	45.4	51.0	38.5	44.7
Jan	Dry	55.9	32.7	44.3	56.4	33.0	44.7	58.1	33.5	45.8
	Wet	49.5	35.6	42.5	52.4	38.3	45.4	56.0	41.1	48.5
Feb	Dry	62.3	36.4	49.4	63.6	39.3	51.5	62.6	36.6	49.6
	Wet	56.8	41.2	49.0	56.6	42.4	49.5	58.1	42.5	50.3
Mar	Dry	70.9	43.8	57.4	68.0	43.0	55.5	70.1	42.0	56.0
	Wet	61.7	44.6	53.1	58.9	42.1	50.5	63.1	44.3	53.7
Apr	Dry	77.9	49.8	63.9	76.2	49.9	63.1	80.4	51.4	65.9
	Wet	64.3	46.6	55.5	61.6	45.8	53.7	67.9	47.7	57.8
May	Dry	88.4	59.1	73.8	89.2	61.0	75.1	86.9	58.6	72.7
	Wet	73.6	53.5	63.5	74.2	55.7	65.0	70.5	51.0	60.8
Jun	Dry	98.2	68.2	83.2	98.8	69.7	84.2	99.9	69.6	84.8
	Wet	91.8	65.6	78.7	87.0	64.4	75.7	93.2	66.2	79.7
Jul	Dry	105.1	75.6	90.3	104.3	76.1	90.2	104.8	76.5	90.6
	Wet	96.6	73.0	84.8	98.2	74.8	86.5	99.7	74.8	87.3
Aug	Dry	102.3	72.6	87.4	102.4	74.6	88.5	102.3	74.2	88.3
	Wet	94.6	71.5	83.1	95.8	73.3	84.5	100.6	75.2	87.9
Sep	Dry	94.8	65.4	80.1	94.6	66.4	80.5	94.0	64.8	79.4
	Wet	88.5	68.2	78.4	87.4	66.8	77.1	85.0	64.7	74.8
Oct	Dry	82.2	53.5	67.8	79.7	53.1	66.4	81.8	53.0	67.4
	Wet	71.5	54.1	62.8	71.8	53.9	62.8	70.9	51.8	61.3
Nov	Dry	68.1	41.6	54.8	65.9	41.5	53.7	66.9	41.0	53.9
	Wet	59.2	45.4	52.3	57.7	43.1	50.4	58.1	43.0	50.6

Table E-8. Tonopah, Dry-Day and Wet-Day Temperatures in °F for the Wettest 1/3, Middle 1/3, and Driest 1/3 Years in the Period of Record.

Month	Day	Wettest 1/3			Middle 1/3			Driest 1/3		
		Max	Min	Avg	Max	Min	Avg	Max	Min	Avg
Dec	Dry	45.4	19.8	32.6	44.0	17.8	30.9	48.1	20.4	34.2
	Wet	41.0	24.5	32.8	39.0	24.5	31.7	39.3	23.9	31.6
Jan	Dry	45.8	18.9	32.3	41.4	14.9	28.1	46.5	19.4	33.0
	Wet	37.5	22.4	30.0	35.8	19.8	27.8	42.9	26.1	34.5
Feb	Dry	51.0	23.2	37.1	48.7	22.6	35.7	49.4	22.5	35.9
	Wet	42.2	25.6	33.9	41.2	25.9	33.5	45.4	28.7	37.1
Mar	Dry	55.6	27.4	41.5	54.9	26.8	40.8	57.3	26.4	41.9
	Wet	45.8	29.0	37.4	43.6	27.3	35.5	48.0	29.7	38.9
Apr	Dry	63.4	32.4	47.9	62.1	32.3	47.2	65.2	32.9	49.0
	Wet	51.4	31.8	41.6	47.4	28.7	38.0	55.4	32.5	44.0
May	Dry	74.1	41.7	57.9	74.0	41.8	57.9	74.2	41.7	57.9
	Wet	62.6	41.0	51.8	63.4	40.9	52.1	62.1	38.6	50.4
Jun	Dry	84.3	50.3	67.3	83.3	50.4	66.8	86.2	51.1	68.7
	Wet	77.4	51.2	64.3	70.2	48.1	59.1	72.6	46.1	59.3
Jul	Dry	91.5	55.9	73.7	90.3	55.3	72.8	92.0	56.1	74.1
	Wet	85.5	59.0	72.2	88.2	58.9	73.6	90.1	59.7	74.9
Aug	Dry	88.0	53.8	70.9	88.7	53.5	71.1	90.2	55.0	72.6
	Wet	82.5	56.6	69.5	84.0	57.8	70.9	87.0	59.5	73.2
Sep	Dry	80.2	47.4	63.8	81.1	46.6	63.9	80.1	45.7	62.9
	Wet	72.4	49.6	61.0	74.9	50.7	62.8	70.7	45.5	58.1
Oct	Dry	68.7	36.6	52.7	67.8	36.4	52.1	69.0	36.4	52.7
	Wet	57.0	37.9	47.5	59.6	39.5	49.5	56.3	38.0	47.2
Nov	Dry	54.6	26.5	40.5	53.5	25.8	39.6	55.2	25.0	40.1
	Wet	41.6	24.8	33.2	43.2	29.9	36.5	45.3	29.3	37.3

Table E-9. Adaven, Differences in Temperatures (°F) Between Wettest (1/3) and Middle (1/3) Years, and Wettest (1/3) and Driest (1/3) Years.

Month	Day	Wettest (1/3) - Middle (1/3)			Wettest (1/3) - Driest (1/3)		
		Max	Min	Avg	Max	Min	Avg
Dec	Dry	1.5	2.1	1.8	-0.6	-0.9	-0.8
	Wet	1.9	4.7	3.3	4.0	4.5	4.3
Jan	Dry	3.2	3.9	3.6	-0.4	1.6	0.6
	Wet	3.3	7.0	5.2	0.5	2.3	1.5
Feb	Dry	0.4	0.7	0.6	-3.1	-2.8	-2.9
	Wet	-2.2	-2.8	-2.6	-2.9	-3.4	-3.2
Mar	Dry	-1.9	0.5	-0.7	-4.6	-3.3	-4.0
	Wet	1.1	5.0	3.1	1.7	3.0	2.4
Apr	Dry	-3.1	-1.3	-2.3	-2.6	-1.2	-2.0
	Wet	-3.0	0.5	-1.3	-5.0	-2.3	-3.7
May	Dry	-0.5	0.6	0.1	-2.5	-0.4	-1.4
	Wet	-1.2	-0.1	-0.6	-9.2	-4.2	-6.6
Jun	Dry	-3.2	-1.1	-2.2	-3.6	-2.0	-2.8
	Wet	-1.6	1.3	-0.1	-2.8	-0.7	-1.7
Jul	Dry	-1.6	-0.7	-1.1	-1.3	-1.2	-1.2
	Wet	-0.6	-0.7	-0.7	0.3	0.0	0.1
Aug	Dry	0.0	1.9	1.0	0.2	0.8	0.5
	Wet	0.1	1.7	0.8	-2.2	-1.3	-1.8
Sep	Dry	-2.0	-0.2	-1.0	-1.5	-0.2	-0.9
	Wet	-1.1	0.9	-0.1	-3.0	-1.2	-2.1
Oct	Dry	0.5	1.9	1.3	-0.4	0.3	0.0
	Wet	0.1	3.3	1.6	3.2	2.5	2.8
Nov	Dry	0.5	1.3	0.9	1.9	0.8	1.3
	Wet	0.8	2.2	1.5	1.7	2.8	2.3

Table E-10. Beatty, Differences in Temperatures (°F) Between Wettest (1/3) and Middle (1/3) Years, and Wettest (1/3) and Driest (1/3) Years.

Month	Day	Wettest (1/3) - Middle (1/3)			Wettest (1/3) - Driest (1/3)		
		Max	Min	Avg	Max	Min	Avg
Dec	Dry	2.0	0.3	1.1	-4.2	-2.3	-3.3
	Wet	6.3	3.1	4.7	0.1	-1.9	-0.9
Jan	Dry	5.2	2.3	3.8	-3.7	-0.9	-2.3
	Wet	8.1	6.3	7.2	-1.6	1.5	-0.2
Feb	Dry	2.9	2.5	2.7	-0.8	1.8	0.5
	Wet	-2.9	1.8	-0.6	-1.1	5.8	2.4
Mar	Dry	-3.7	-3.0	-3.3	-6.6	-2.1	-4.3
	Wet	-2.7	-0.7	-1.7	-2.9	0.0	-1.4
Apr	Dry	-2.3	-1.8	-2.1	-6.4	-4.1	-5.3
	Wet	-0.4	0.4	0.1	-4.3	-0.9	-2.5
May	Dry	-1.7	-1.6	-1.7	-0.9	-1.3	-1.1
	Wet	1.0	-1.7	-0.3	-4.0	-8.2	-6.1
Jun	Dry	-3.0	-2.4	-2.7	-5.2	-4.2	-4.7
	Wet	-0.1	-0.9	-0.5	-8.2	-0.2	-4.2
Jul	Dry	-0.2	-2.4	-1.3	-3.7	-5.7	-4.7
	Wet	0.9	0.2	0.6	-2.4	-1.9	-2.1
Aug	Dry	-1.3	-0.9	-1.1	-3.0	-1.4	-2.2
	Wet	-4.5	1.2	-1.7	-9.4	2.5	-3.5
Sep	Dry	-1.3	0.2	-0.6	-3.3	-1.2	-2.3
	Wet	1.7	4.1	3.0	-8.7	-4.5	-6.6
Oct	Dry	3.5	0.9	2.2	1.7	0.4	1.1
	Wet	8.3	5.2	6.8	7.5	-0.4	3.5
Nov	Dry	0.8	0.0	0.4	-2.6	-1.2	-1.9
	Wet	3.5	-1.8	0.8	-0.6	2.7	1.0

Table E-11. Bishop, Differences in Temperatures (°F) Between Wettest (1/3) and Middle (1/3) Years, and Wettest (1/3) and Driest (1/3) Years.

Month	Day	Wettest (1/3) - Middle (1/3)			Wettest (1/3) - Driest (1/3)		
		Max	Min	Avg	Max	Min	Avg
Dec	Dry	-1.3	0.8	-0.3	0.9	1.0	0.9
	Wet	-0.7	0.5	-0.1	3.2	5.4	4.3
Jan	Dry	1.9	1.8	1.9	-0.6	-0.6	-0.5
	Wet	3.5	6.7	5.1	0.8	2.2	1.5
Feb	Dry	-0.3	0.9	0.2	-1.2	0.1	-0.6
	Wet	-1.5	1.1	-0.2	-0.7	0.2	-0.2
Mar	Dry	-4.0	-1.9	-3.0	-2.6	-0.1	-1.4
	Wet	-1.3	-0.8	-1.1	-4.0	1.0	-1.5
Apr	Dry	-3.3	-0.7	-2.0	-2.0	-0.5	-1.2
	Wet	-2.9	1.6	-0.6	-9.0	-2.4	-5.7
May	Dry	0.5	-0.4	0.1	1.8	0.1	1.0
	Wet	3.4	2.8	3.1	7.4	5.0	6.2
Jun	Dry	-2.4	-1.3	-1.9	-2.5	-2.1	-2.4
	Wet	-3.1	-0.4	-1.8	-8.0	-2.8	-5.4
Jul	Dry	-1.8	-0.9	-1.4	-2.4	-2.3	-2.4
	Wet	-1.8	-0.1	-1.0	0.0	0.1	0.1
Aug	Dry	0.4	0.4	0.4	0.3	-0.9	-0.3
	Wet	-0.8	2.9	1.0	-1.7	2.1	0.1
Sep	Dry	-0.7	-0.8	-0.7	-0.8	0.1	-0.3
	Wet	-1.1	2.6	0.7	-1.9	3.0	0.5
Oct	Dry	1.1	0.2	0.7	0.8	0.5	0.7
	Wet	4.7	2.4	3.6	5.2	3.9	4.5
Nov	Dry	-1.4	-1.0	-1.3	1.7	0.4	1.0
	Wet	0.9	-1.9	-0.5	1.5	0.6	1.1

Table E-12. Caliente, Differences in Temperatures (°F) Between Wettest (1/3) and Middle (1/3) Years, and Wettest (1/3) and Driest (1/3) Years.

Month	Day	Wettest (1/3) - Middle (1/3)			Wettest (1/3) - Driest (1/3)		
		Max	Min	Avg	Max	Min	Avg
Dec	Dry	-2.1	-1.7	-1.9	-3.5	-2.0	-2.8
	Wet	-1.0	0.2	-0.4	-1.2	-1.4	-1.3
Jan	Dry	-4.1	-1.4	-2.7	-2.1	0.7	-0.7
	Wet	-3.3	-2.7	-3.0	-2.1	-0.3	-1.2
Feb	Dry	-2.1	0.9	-0.6	-3.5	0.7	-1.4
	Wet	-0.3	1.1	0.4	-3.2	-0.6	-1.9
Mar	Dry	0.0	1.4	0.7	-2.5	2.1	-0.2
	Wet	-0.2	2.1	0.9	-4.1	1.1	-1.5
Apr	Dry	0.2	0.0	0.1	-2.7	0.3	-1.3
	Wet	-0.4	-0.9	-0.7	-6.6	-1.9	-4.3
May	Dry	1.2	2.2	1.7	-0.4	0.7	0.1
	Wet	1.6	3.9	2.8	-1.6	1.9	0.2
Jun	Dry	0.1	1.8	0.9	-0.9	0.0	-0.5
	Wet	0.8	-0.4	0.2	-5.0	-1.4	-3.2
Jul	Dry	-0.5	0.8	0.2	-0.7	-1.0	-0.8
	Wet	-1.0	-1.0	-1.0	-0.8	0.1	-0.3
Aug	Dry	-1.3	-0.6	-0.9	-1.4	-0.7	-1.0
	Wet	-1.3	2.1	0.3	-4.0	1.1	-1.5
Sep	Dry	1.6	1.3	1.4	0.5	0.2	0.3
	Wet	0.5	-1.8	-0.6	-4.8	-2.6	-3.7
Oct	Dry	-3.0	-0.2	-1.5	-4.6	-1.1	-2.8
	Wet	-2.9	-2.3	-2.6	1.8	2.3	2.0
Nov	Dry	2.0	2.2	2.0	-0.2	0.7	0.2
	Wet	-2.4	0.3	-1.1	-1.0	4.2	1.6

Table E-13. Haiwee, Differences in Temperatures (°F) Between Wettest (1/3) and Middle (1/3) Years, and Wettest (1/3) and Driest (1/3) Years.

Month	Day	Wettest (1/3) - Middle (1/3)			Wettest (1/3) - Driest (1/3)		
		Max	Min	Avg	Max	Min	Avg
Dec	Dry	2.4	2.2	2.3	2.7	1.1	1.9
	Wet	0.5	2.1	1.3	5.1	3.9	4.5
Jan	Dry	1.9	1.7	1.8	2.5	1.9	2.2
	Wet	3.1	2.8	3.0	5.1	6.2	5.7
Feb	Dry	-0.7	0.8	0.1	0.0	0.8	0.4
	Wet	1.4	2.0	1.7	-1.0	1.0	0.0
Mar	Dry	2.0	3.4	2.7	-1.1	0.3	-0.4
	Wet	-1.4	2.0	0.3	-4.8	1.0	-2.0
Apr	Dry	-0.7	0.3	-0.2	-1.9	-2.0	-1.9
	Wet	-0.7	-2.0	-1.3	-3.5	-2.6	-3.0
May	Dry	0.3	0.0	0.1	3.4	0.8	2.1
	Wet	1.9	3.2	2.5	7.3	6.2	6.7
Jun	Dry	0.2	-0.2	-0.1	0.8	-1.1	-0.2
	Wet	3.0	2.2	2.6	1.2	0.8	1.0
Jul	Dry	-0.8	-0.6	-0.7	-1.1	-3.0	-2.0
	Wet	1.2	0.7	0.9	3.0	1.0	2.0
Aug	Dry	1.1	1.0	1.0	1.9	-0.3	0.8
	Wet	0.8	2.2	1.5	-2.1	0.9	-0.6
Sep	Dry	0.4	1.6	1.0	0.3	0.1	0.3
	Wet	2.8	0.3	1.5	-2.5	-3.1	-2.8
Oct	Dry	0.0	1.2	0.6	1.5	0.5	1.1
	Wet	-3.6	-1.9	-2.8	-2.7	0.2	-1.3
Nov	Dry	1.0	1.6	1.3	0.9	0.6	0.8
	Wet	-4.2	-2.0	-3.2	3.5	1.2	2.3

Table E-14. Las Vegas, Differences in Temperatures (°F) Between Wettest (1/3) and Middle (1/3) Years, and Wettest (1/3) and Driest (1/3) Years.

Month	Day	Wettest (1/3) - Middle (1/3)			Wettest (1/3) - Driest (1/3)		
		Max	Min	Avg	Max	Min	Avg
Dec	Dry	0.1	0.4	0.2	0.6	0.0	0.3
	Wet	3.7	2.0	2.9	4.6	2.5	3.6
Jan	Dry	-0.5	-0.3	-0.4	-2.2	-0.8	-1.5
	Wet	-2.9	-2.7	-2.9	-6.5	-5.5	-6.0
Feb	Dry	-1.3	-2.9	-2.1	-0.3	-0.2	-0.2
	Wet	0.2	-1.2	-0.5	-1.3	-1.3	-1.3
Mar	Dry	2.9	0.8	1.9	0.8	1.8	1.4
	Wet	2.8	2.5	2.6	-1.4	0.3	-0.6
Apr	Dry	1.7	-0.1	0.8	-2.5	-1.6	-2.0
	Wet	2.7	0.8	1.8	-3.6	-1.1	-2.3
May	Dry	-0.8	-1.9	-1.3	1.5	0.5	1.1
	Wet	-0.6	-2.2	-1.5	3.1	2.5	2.7
Jun	Dry	-0.6	-1.5	-1.0	-1.7	-1.4	-1.6
	Wet	4.8	1.2	3.0	-1.4	-0.6	-1.0
Jul	Dry	0.8	-0.5	0.1	0.3	-0.9	-0.3
	Wet	-1.6	-1.8	-1.7	-3.1	-1.8	-2.5
Aug	Dry	-0.1	-2.0	-1.1	0.0	-1.6	-0.9
	Wet	-1.2	-1.8	-1.4	-6.0	-3.7	-4.8
Sep	Dry	0.2	-1.0	-0.4	0.8	0.6	0.7
	Wet	1.1	1.4	1.3	3.5	3.5	3.6
Oct	Dry	2.5	0.4	1.4	0.4	0.5	0.4
	Wet	-0.3	0.2	0.0	0.6	2.3	1.5
Nov	Dry	2.2	0.1	1.1	1.2	0.6	0.9
	Wet	1.5	2.3	1.9	1.1	2.4	1.7

Table E-15. Tonopah, Differences in Temperatures (°F) Between Wettest (1/3) and Middle (1/3) Years, and Wettest (1/3) and Driest (1/3) Years.

Month	Day	Wettest (1/3) - Middle (1/3)			Wettest (1/3) - Driest (1/3)		
		Max	Min	Avg	Max	Min	Avg
Dec	Dry	1.4	2.0	1.7	-2.7	-0.6	-1.6
	Wet	2.0	0.0	1.1	1.7	0.6	1.2
Jan	Dry	4.4	4.0	4.2	-0.7	-0.5	-0.7
	Wet	1.7	2.6	2.2	-5.4	-3.7	-4.5
Feb	Dry	2.3	0.6	1.4	1.6	0.7	1.2
	Wet	1.0	-0.3	0.4	-3.2	-3.1	-3.2
Mar	Dry	0.7	0.6	0.7	-1.7	1.0	-0.4
	Wet	2.2	1.7	1.9	-2.2	-0.7	-1.5
Apr	Dry	1.3	0.1	0.7	-1.8	-0.5	-1.1
	Wet	4.0	3.1	3.6	-4.0	-0.7	-2.4
May	Dry	0.1	-0.1	0.0	-0.1	0.0	0.0
	Wet	-0.8	0.1	-0.3	0.5	2.4	1.4
Jun	Dry	1.0	-0.1	0.5	-1.9	-0.8	-1.4
	Wet	7.2	3.1	5.2	4.8	5.1	5.0
Jul	Dry	1.2	0.6	0.9	-0.5	-0.2	-0.4
	Wet	-2.7	0.1	-1.4	-4.6	-0.7	-2.7
Aug	Dry	-0.7	0.3	-0.2	-2.2	-1.2	-1.7
	Wet	-1.5	-1.2	-1.4	-4.5	-2.9	-3.7
Sep	Dry	-0.9	0.8	-0.1	0.1	1.7	0.9
	Wet	-2.5	-1.1	-1.8	1.7	4.1	2.9
Oct	Dry	0.9	0.2	0.6	-0.3	0.2	0.0
	Wet	-2.6	-1.6	-2.0	0.7	-0.1	0.3
Nov	Dry	1.1	0.7	0.9	-0.6	1.5	0.4
	Wet	-1.6	-5.1	-3.3	-3.7	-4.5	-4.1