TWENTIETH CENTURY PRECIPITATION PATTERNS AND TRENDS THROUGHOUT THE STATE OF TEXAS

Thesis

Presented to the Graduate Council of
Texas State University-San Marcos
in Partial Fulfillment
of the Requirements

for the Degree

Master of SCIENCE

by

Susan E. Street, B.A.

San Marcos, Texas
May 2010

ACKNOWLEDGEMENTS

This thesis would not have been possible without the help of my advisor, Dr. Richard W. Dixon; my committee members, Dr. Denise Blanchard and Dr. Donald Huebner; and Dr. Pamela Showalter, without whose counsel, I would have been lost. Each have answered endless questions and been supportive throughout the process.

Many thanks to my parents, Carene Goodman and the late E.F. Goodman; the late Elizabeth Burton (Aunt Liz), for her encouragement and positive attitude; my cousin, Elise L. Moore, who, like her mother, is infinitely positive and generous in spirit; and the late Alfred Goodman (Uncle Bob) whose life-long travels made geography seem "touchable", and for his financial support. To Dr. C. Allen Williams of Sam Houston State University, Department of Geography, I thank you for your early support and inspiration, and to my geographically inclined friends, who include Debbie Leahy, Frank Ingram and Jacqueline King; I want to thank you for your technical expertise, wise counsel and midnight consultations.

How does one thank a spouse for their tireless support, understanding and tending to the mundane chores of life while I work on my degree? To James, my husband and best friend, I will love you forever.

This manuscript was submitted on March 30, 2010.

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CHAPTER I

INTRODUCTION

1.1 Texas characteristics

Is Texas getting dryer? Or has it gotten wetter? Depending on where a person lives in Texas, they might answer "yes" to either of those questions. Determining where those changes are occurring is important to the localities and the state. Texas is the second largest state, in area, in the contiguous United States, covering over 692,244 km^2 (267,277 mi^2), with 254 counties and a population of over 24 million (Ramos 2002). There are four physiographic regions, ten vegetation zones, eight USDA Hardiness zones, and three basic climate zones by means of the Koppen Climate Classification System: the humid subtropical (Koppen Cfa), the temperate semi-arid steppe (Koppen BSk), and the subtropical steppe (Koppen BSh) (Ramos 2002). This classification system was originally constructed in order to designate local climates a climate type and show the spatial distribution of these types for a specific reference period (Beck et al. 2006). Physical influences on climate include being located (1) downwind from mountain ranges to the west, (2) adjacent to the Gulf of Mexico and the southern Great Plains, (3) west of the center of the Bermuda high pressure cell, (4) at a relatively low latitude, and by (5) the changes in land elevation from the high plains and mountains to the coastal plains (Larkin and Bomar, 1983).

1.2 Precipitation

Precipitation is a major component in the determination of climate and is defined as water that falls to the ground, in solid or liquid form, including rain, snow, sleet, and hail. All precipitation is measured in its liquid water equivalent. Texas receives all of the above forms of precipitation, depending on the season, and sometimes to the extreme. Snow has fallen in South Texas, a place that rarely has a freeze, and Far West Texas has experienced flash flooding, though the annual average rainfall is usually less than 10 inches.

Considering the size of the state, one would expect diversity in precipitation, and rainfall amounts are wide-ranging, graduating longitudinally (east to west) from an annual average of over 148 cm (58 in) in Orange to less than 22 cm (8.8 in) in El Paso (Ramos 2002). This unequal distribution in precipitation influences fresh water resources for a steadily growing population.

1.3 Purpose of this study

The U.S. Census Bureau (2009) projects a 59% growth rate by the year 2030, or an additional 12.4 million people. The question is not only where and how much rain falls, but when it falls that matters. Knowing if these amounts are changing is of particular importance in terms of water supply, hydro-electric power generation, economic activities and ecosystems. Current population centers will need to evaluate future water availability in relation to attracting business, agriculture and population growth. Therefore, the purpose of this study is to collect, investigate and analyze precipitation data from eight regions that encompass the whole of Texas, looking for patterns and degree of change in precipitation rates, to determine if change has occurred over the last century, and generate a prototype for future study. There are a few published long-term regional studies of precipitation in Texas (Mishra et al. 2009) and other large states, including Alaska (Stafford et al. 2000) and California (Mo and Higgins 1998), but most are interested in a smaller, more specific area (Cavazos 1999, Simpson et al. 2007). The general aspects of this study will allow a broader use of its findings and may lead to further research that will aid policy makers in determining regional water needs and limitations.

CHAPTER II

STUDY AREA/HYPOTHESIS

2.1 General

The study area is the state of Texas, divided into eight regions and a single city or town from each region as the case study (Table 1).

Table 1. Texas Regions and Cities

Texas Regions and Cities				
Region Number	Region Name	City Name	Years with Data	Number of Years
1	West Central	Albany	1901-2002	102
2	Far West	Balmorhea	1923-2002	80
3	South Central	Boerne	1897-2002	106
4	South East	Danevang	1897-2002	105*
5	East	Greenville	1900-2002	102*
6	Panhandle and Plains	Plainview	1908-2002	95
7	South	Rio Grande City	1897-2002	85*
8	North Central	Temple	1897-2002	105*

* Adjustments have been made to totals for missing years

The regions are spatially dispersed (Figure 1) areas of interest with quantifiable data that span the years to be investigated, and are roughly correlated to those used by the U.S.

Census Bureau and the National Climate Data Center (NCDC) to report aggregated climate data.

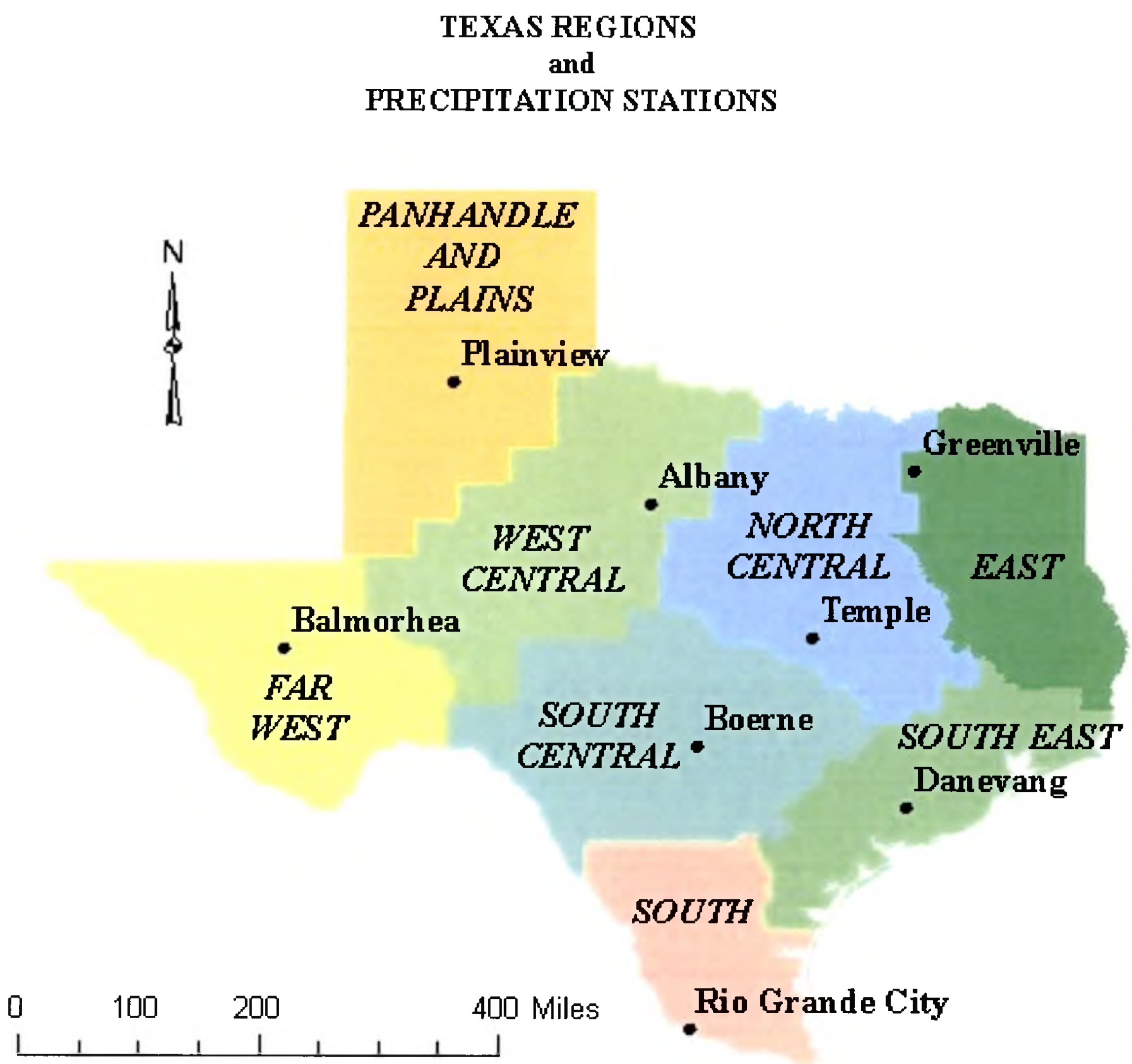

Figure 1. Texas Regions and Precipitation Stations.

2.2 Description of Areas

A brief geographic description of each data station is below.

2.2.1 Albany

Albany is the county seat of Shackelford County, located in the rolling to hilly portion of West Central Texas at latitude 32° 43' 23.001"N, longitude 99° 17' 48"W. The area's main economy is based on oil and ranching and average annual rainfall is 28.6 inches (Ramos 2002, 257).

2.2.2 Balmorhea

Balmorhea is located in the rolling plains of Reeves County in Far West Texas at latitude 30° 59' 3"N, longitude 103° 44' 37"W. The area's main economy includes agribusiness, feedlots and tourism. The average annual rainfall is 14.3 inches (Ramos 2002, 98,250).

2.2 3 Boerne

Boerne, the county seat of Kendall County, is located in the Hill Country of South Central Texas at latitude 29° 47' 39"N, longitude 98° 43' 52"W. The area's main economy is based on government offices and the service industry. The average annual rainfall is 34.2 inches (Ramos 2002, 211).

2.2.4 Danevang

Danevang is located in the coastal prairie of South East Texas at latitude 29° 3' 25"N, longitude 96° 12' 24"W. The area's main economy includes oil and agribusiness. The average annual rainfall is 42.3 inches (Ramos 2002, 99,278).

2.2.5 Greenville

Greenville is the county seat of Hunt County, located in the rolling country of East Texas at latitude 33° 8' 22"N, longitude 96° 6' 24"W. The area's main economy is education and manufacturing. The average annual rainfall is 41.6 inches (Ramos 2002, 211).

2.2.6 Plainview

Plainview is the county seat of Hale County, located in the high plains of the Panhandle of Texas at latitude 34° 11' 4"N, longitude 101° 42' 23"W. The area's main economy is agribusiness and food-processing plants. The average annual rainfall is 19.8 inches (Ramos 2002, 189).

2.2.7 Rio Grande City

Rio Grande City, county seat of Starr County, is located in the rolling hills of South Texas at latitude 26° 22' 45"N, longitude 98° 49' 10"W. The area's main economy is vegetable packing and as a gateway to Mexico, across the Rio Grande River. The average annual rainfall is 22.3 inches (Ramos 2002, 260).

2.2.8 Temple

Temple is located in the Blackland prairie of Bell County in North Central Texas at latitude 31° 5' 52"N, longitude 97° 20' 31"W. The area's main economy is based on Fort Hood and manufacturing. The average annual rainfall is 34.9 inches (Ramos 2002, 260).

2.3 Hypothesis

The research question for this study asks if there has been a statistically significant change in regional precipitation in Texas in the last century, and if so, during what months and how much. The null hypothesis for this study states that there has been no change in regional precipitation patterns in Texas over the past century. The use of one city in each region makes this study a "proof of concept" or "pilot" research, meaning the test of an idea made by building a prototype of the application. If the data of this investigation show significant trends, development of a larger study using multiple stations per region should be undertaken.

CHAPTER III

LITERATURE REVIEW

3.1 Global

Worldwide, climate change has become a topic of heated debate for scientists, politicians, the media and the general population over the past several decades. The speed of change is also uncertain and depending on the scale of the study, various model simulations have been used to depict past, present and future climate scenarios (Labraga and Villalba 2009). These simulations are compared to actual conditions experienced in order to correlate results, lending credence to future climate model results (Tapiador and Sanchez 2008; Crochet 2007).

The variability of contributing forces on individual climate regions can affect weather patterns. A change in circulation on one side of the Earth can affect precipitation 8,000 miles away. The El Nino Southern Oscillation (ENSO) is a naturally occurring cycle that affects weather patterns across the United States.

> The development of the El Nino phenomenon has its origins in the western tropical Pacific Ocean. Easterly trade winds relax and a westerly wind anomaly develops, exciting eastward propagating Kelvin waves along the equator. These waves suppress the thermocline, deepening the surface mixed layer. As the result, warm sea surface temperature (SST) anomalies develop and spread eastward to

the South American coast. Teleconnection links the tropical Pacific and higher latitudes and shift mid-latitude synoptic weather patterns. (Green, et al. 1997)

The Intergovernmental Panel on Climate Change (IPCC) has been gathering information and generating assessment reports on worldwide climate since 1988 (Pachauri and Reisinger 2007). Its assessments, combining research from various scientific arenas, have concluded that there is worldwide climate change occurring (Ruiz-Barradas and Nigam 2006), specifically a global temperature increase of 0.74°C in the 100-year linear trend from 1906-2005, and the projection that many regions will experience increased precipitation, particularly from more intense storms. These findings invite those scientists with differing research results to make comment. Because of the variety of opinions and ongoing studies, a consensus has yet to be reached that satisfies everyone.

Global analysis of precipitation trends are more focused on retrospective analysis (or reanalysis) formats and judging the bias of particular models when looking at different aspects of precipitation (Bosilovich et al. 2008). Reanalysis systems have improved but the accuracy in some locations is not comparable to the observed data. Ruiz-Barradas and Nigam (2006) explain that understanding regional climate is needed before making forecasts about climate change. Extreme weather and climate events are seen as evidence of global warming by the media and general population, but are not necessarily indicative of future events. A long-term global analysis of daily precipitation from gauge-based datasets has begun (Chen et al. 2002); including 17,000 stations from the Global Historical Climatology Network (GHCN) and the Climate Anomaly Monitoring System (CAMS), and the daily data will be continuously updated.

3.2 United States

Climate studies examining the United States explore the topic from several different angles. Previous ENSO events were analyzed (Changnon 1999) and used to forecast and mitigate damages from storms and weather related impacts ensuing from the predicted 1997-98 El Nino, and assess the economic benefits/damages of that particular event. Changnon also discusses the positive/negative outcomes of being able to forecast nationwide weather events. Schubert et al. (2008) used models to compare winter precipitation variability as it relates to ENSO events for 1948-1998 and found that the time between intense storms decreased during sustained El Nino conditions. Schubert's model simulations show a close connection and similarity to actual observations in many parts of the US, but he points out that some regions will have different results due to inherent modeling characteristics.

Using the Climate Extremes Index (CEI) makes it possible to quantify observed changes in the fraction of areas in the United States that experience extremes in temperature, precipitation and drought. Gleason et al. (2008) reviewed warm seasons from 1950-present and found increasing trends of heavy daily precipitation. Using a modified form of Thornthwaite's moisture index (the index of the supply of water in an area [precipitation] relative to the climatic demand for water [potential evapotranspiration]) (American Meteorological Society 2009), Grundstein (2008) found a shift to the west of the Humid region as the eastern half of the country had become wetter. Karl and Knight (1998) determined that precipitation across the U.S. had increased by approximately 10%, primarily due to increased frequency of rain days and the number of days with heavy or intense precipitation. Higgins et al. (2007) also found an increase in precipitation frequency and intensity leading to an increase in total precipitation, but that the increase was not uniform. He attributed the changes not only to ENSO but the Pacific Decadal Oscillation (PDO) and the Arctic Oscillation (AO) where the PDO affected the western and southern US and the AO affected the southeastern US.

US precipitation changes are not only attributed to offshore circulation patterns, as in ENSO and PDO. Portmann et al. (2009) explains that precipitation can be linked to temperature trends which are affected by latitudinal location, specifically 30-40° N in the warm season (May-June), and possibly by variable aerosols related to vegetation changes.

3.3 Regional

Regional precipitation studies tend to include daily datasets that are ultimately used to verify model simulations for climate prediction at larger scales using regional climate models (Lopez-Moreno and Beniston 2009). These regional studies also examine extremes in precipitation as possible explanations for positive trends (Nastos and Zerefos 2008).

Spatial and temporal variability in regional precipitation is the subject of many analyses, with some including a century (Banfield and Jacobs 1998; Henderson and Shields 2006; Boe and Terray 2008; Krishnakumar et al. 2009; Millett et al. 2009; Strong et al. 2009), some 50-60 years (Wan et al. 2005; Feidas et al. 2007; Zhang et al. 2009) and others only 20-30 years (DeLiberty 2000; Carvalho et al. 2004). Each of these studies used gauge-based data as the baseline for their analysis. Krishnakumar et al. (2009) was concerned about the spatial and temporal circumstances of the precipitation in

Kerala, India with respect to hydro-electric power generation and the monsoonal adjustment. Zhang et al. (2009) and Wan et al. (2005) looked at the precipitation variations in China to pinpoint extremes and establish norms for watershed management, respectively. Carvalho et al. (2004), Boe and Terray (2008), Banfield and Jacobs (1998) and Henderson and Shields (2006) linked seasonal variability and extremes to global circulation patterns.

3.4 Texas

The number of studies exploring precipitation in Texas have been minimal. Simpson et al. (2007) examined a 24-year record of precipitation and the effect of drought on pronghorn populations in the Trans-Pecos region, incorporating the Palmer Drought Severity Index (PDSI), which uses temperature and rainfall information in a formula to determine dryness. Mishra et al. (2009) investigated variability trends, examining ten climate divisions and 43 stations from 1925-2005 and is the only study currently discovered to include the entire state of Texas.

In light of recent IPCC reports and various studies mentioned here, it is important for policy makers at all levels in the state to be aware of changes that may be occurring in Texas precipitation. Because of the size of the state and variability of the landscape, regional precipitation would be affected differently, depending on location, and the spatial element of latitude and longitude coupled with temporal (seasonal) aspects of precipitation would be factored into each region's expectations for water usage. Proximity to the Gulf of Mexico or the dryer Great Plains will affect the amount of available moisture that is needed to generate rainfall on a consistent basis. Available moisture is also important when considering precipitation intensity, or how much rain or snow falls over a given period of time. Regions nearer the Gulf of Mexico have a greater chance of being affected by tropical storms, which would increase daily/monthly intensity figures.

Agricultural interests are very dependent on local water sources, both surface reservoirs and underground aquifers. Replenishment timetables of the Edwards Aquifer may be vital for South Central Texas farmers, while East Texas is dependent on Lake Livingston or the Trinity River for irrigation needs, so steady rainfall events in that watershed are required.

Awareness of ENSO patterns and their past effect on a particular region may help regional planners and agricultural extension agents anticipate future scenarios and assist with mitigation. Being aware of future precipitation trends may assist in planning for expansion or budgeting new water sources, so information regarding trends will assist those in decision-making positions regarding anomalies versus norms. This study will establish parameters to provide for future precipitation scenarios.

CHAPTER IV

DATA AND METHODS

4.1 Data

Precipitation data were obtained from the National Climate Data Center (NCDC), using the gauge network of the U.S. Historical Climatology Network (USHCN) for years between 1897 and 2002. This network was developed over the years at the National Oceanic and Atmospheric Administration's (NOAA) NCDC to assist in the detection of regional climate change (USHCN, 2009). Not all years are available for each location and adjustments to the total number of years to be studied has been made. One city in each region has been chosen based on completeness of the precipitation record and the percentage of missing data is less than ten percent for each site and month (Table 2). A narrower study is included, focusing on the years 1950 through 2002, in order to view statistics that reflect the severe drought of the 1950s.

Table 2. Percentage of Missing Data (in Months)

Months Location	J	F	M	A	M	J	J	A	S	O	N	D	# of Months Missing/ Incomplete	Years	Total # of Years	Total # of Months (Total # of Years x 12)	% Missing
Albany	6*	4	6	6	6	5	4	5	4	6	5	10	67	1901-2002	102	1224	5.4
Balmorhea	6	2	2	4	2	4	3	3	3	1	2	3	35	1923-2002	80	960	3.6
Boerne[1]	2	2	3	2	2	2	2	2	2	6	5	3	33	1897-2002	105	1272	2.5
Danevang[2]	4	2	1	0	1	3	4	2	5	4	7	3	36	1897-2002	105	1260	2.8
Greenville[3]	9	7	3	4	5	6	5	4	2	3	5	4	57	1900-2002	102	1224	4.6
Plainview	3	3	5	3	3	3	4	2	2	1	2	3	34	1908-2002	95	1140	2.9
Rio Grande City[4]	4	2	4	8	5	10	8	6	9	9	7	5	77	1897-2002	85	1020	7.5
Temple[5]	3	5	8	6	5	4	4	3	7	5	6	5	61	1897-2002	105	1260	4.8
# of Months Missing/Incomplete	37	27	32	33	29	37	34	27	34	35	39	36			779		
Total # of Months (Sum of years for all Locations = 780	779	779	779	779	779	779	779	779	779	779	779	779					
% Missing	4.7	3.5	4.1	4.2	3.7	4.7	4.4	3.5	4.4	4.5	5.0	4.6					

Boerne[1] - all months of 1899 missing; Danevang[2] – all months of 1899 missing; Greenville[3] - all months of 1945 missing; Rio Grande City[4] - all months of 1888, 1889, 1907-1914, 1917-1927 (21 years) missing; Temple[5] - all months of 1899 missing.

*- refers to the number of months missing, not a percentage.

4.2 Methods

To determine patterns and trends of precipitation during the past century in the state, each of the eight regional stations' daily precipitation data (Table 1), or approximately 780 years worth of daily precipitation values obtained from the NCDC, were entered into a Microsoft Excel spreadsheet and organized under the following measures: 1) total monthly precipitation; 2) number of days of precipitation per month; and 3) monthly precipitation intensity (total monthly rainfall/number of days with rainfall). These were analyzed in order of progression using SPSS software. That is, descriptive statistics (e.g., mean, median, deciles, maximum, minimum, and coefficient of variation) were first developed to give a basic understanding of precipitation levels in the eight regions. After testing the null hypothesis at the 0.1 level of significance, trend analysis (linear regression) or line of best fit (Caldwell 2007) will demonstrate the relationships between monthly precipitation totals over time, effects of monthly intensity on annual averages, and how these trends relate to current seasonal and annual norms for each of the eight regions, as well as, for the state as a whole.

CHAPTER V

RESULTS

The results of this study are divided into sections by variable: precipitation, number of days of precipitation, and precipitation intensity. Results are further divided by data site and by the period of years considered.

5.1 Precipitation

Precipitation in this study includes all forms (rain, snow, sleet and hail), though not differentiated or specifically noted by the data site collections. Each data site is discussed using raw data values (descriptives) and statistical analysis using linear regressions to determine current trends for the periods of available data. These periods vary at each site, with the starting year ranging from 1897 to 1923, and are sub-divided into a secondary study period of 1950-2002 in order to narrow the scope and include the effects of the severe drought during the 1950s. In an aggregate table (Table 3) of all statistically significant precipitation trends, only Balmorhea and Temple showed no annual trend, while all other station data calculations produced positive annual trends. Annual minimums, maximums and means were affected by missing or incomplete data, but all available data was used to maximize the weight of monthly data. Medians were used to lessen the effect of extreme or missing values.

Table 3. Occurrence of Statistically Significant P-values for Monthly Precipitation

PRECIPITATION	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Albany			↑										↑
Balmorhea										↓			
Boerne				↓		↑							↑
Danevang				↓	↑	↑	↓		↑				↑
Greenville		↑	↑							↑			↑
Plainview													↑
Rio Grande City							↓			↑			↑
Temple		↑		↓									

↓ – negative trend (Coefficient B); ↑ - positive trend (Coefficient B)

<u>*5.1.1 Albany*</u>

5.1.1.1 Period 1901-2002

Albany station for the period 1901-2002 (102 years) shows statistically significant data with positive trends for March and the Annual precipitation calculations (Table 4). Annual precipitation shows (p=0.014) and b=0.073 (Figure 2). All other months are within the 90% level of confidence, and do not show a significant trend (Appendix 1). Median monthly values (Appendix 2) show the wet season as April, May, June and September with > 2.0 inches and the dry season as November, December, January and February with < 1.25 inches (Figure 3).

5.1.1.2 Period 1950-2002

Albany station for the period 1950-2002 (53 years) shows statistically significant data with positive trends for March, June and December precipitation calculations (Table 4). Annual precipitation shows (p=0.363) and b=0.068 (Figure 4). All other months are within the 90% level of confidence, and show no significant trend (Appendix 3). Median monthly values (Appendix 4) show the wet season as April, May, June, September and October with > 2.0 inches and the dry season as November, December, January and February with < 1.25 inches (Figure 5).

Table 4. Statistically Significant Precipitation Data - Albany

	Month	Coefficient - B	Significance (P-value)	R squared
1901-2002				
Albany	Mar	.008	.085	.031
	Annual	.073	.014	.059
1950-2002				
Albany	Mar	.041	.000	.269
	Jun	.042	.058	.070
	Dec	.025	.070	.071

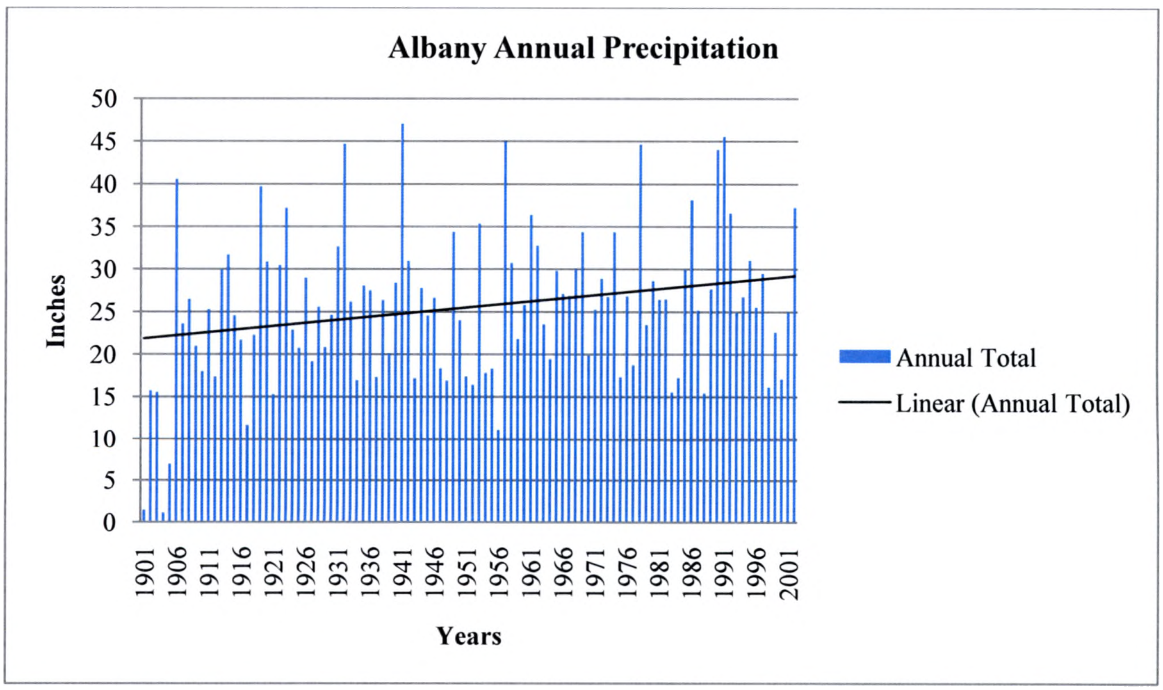

Figure 2. Albany Annual Precipitation for the Period 1901-2002. Trend is significant (p = 0.014), b = 0.073.

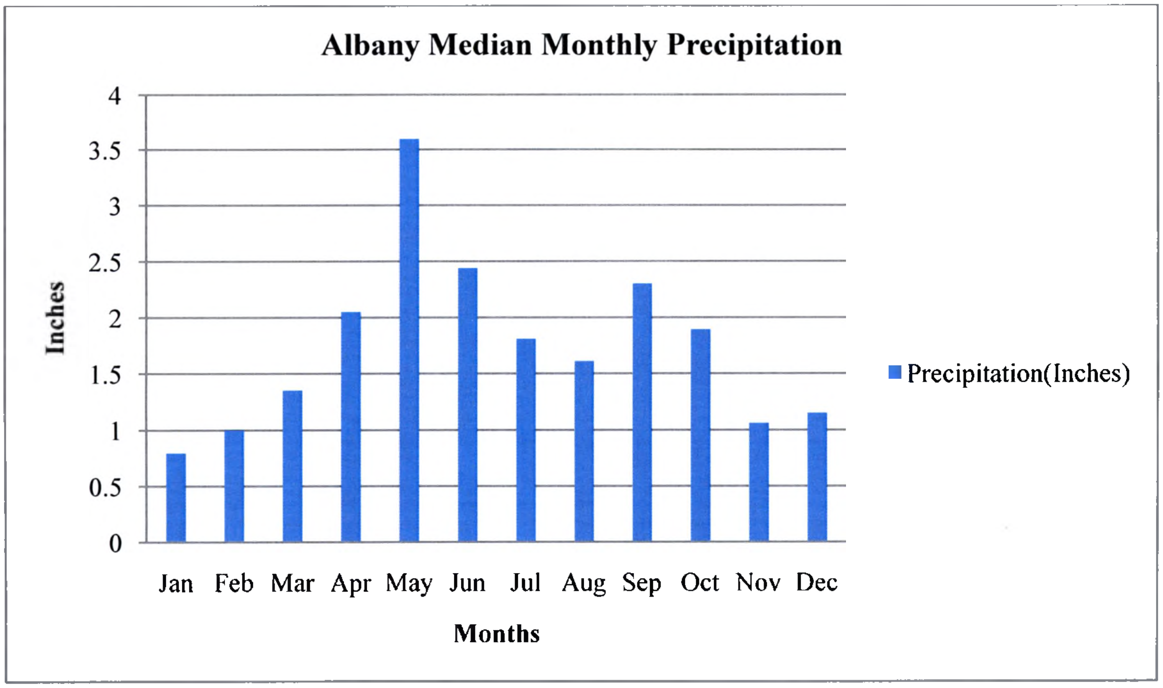

Figure 3. Albany Median Monthly Precipitation for the Period 1901-2002.

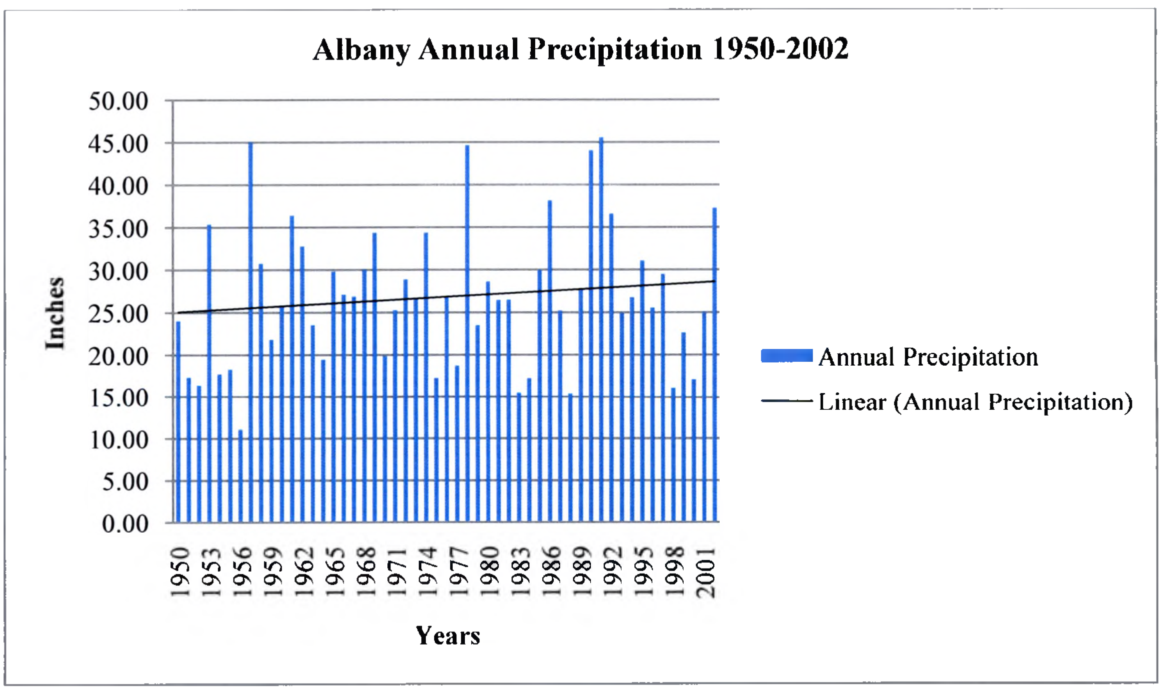

Figure 4. Albany Annual Precipitation for the Period 1950-2002. Trend is not significant ($p = 0.363$), $b = 0.068$.

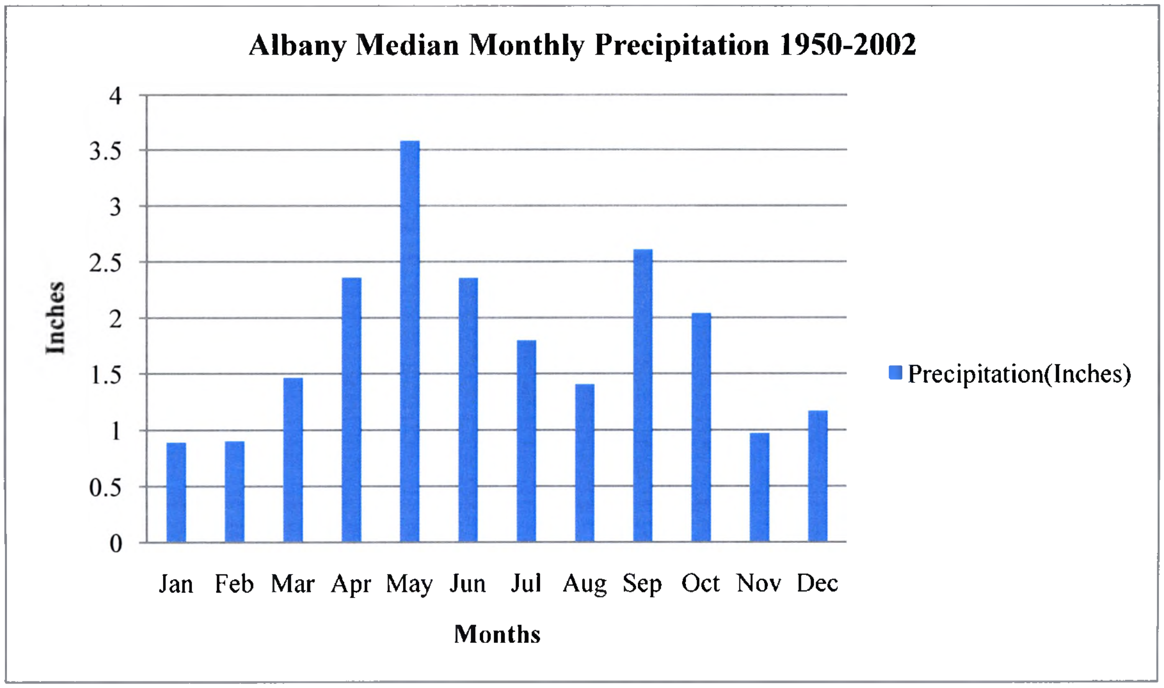

Figure 5. Albany Median Monthly Precipitation for the Period 1950-2002.

5.1.2 Balmorhea

5.1.2.1 Period 1923-2002

Balmorhea station for the period 1923-2002 (80 years) shows no statistically significant precipitation data. Annual precipitation shows ($p = 0.960$) and $b = -0.001$ (Figure 6). All months are within the 90% level of confidence, and show no significant trend (Appendix 5). Median monthly values (Appendix 6) show the wet season as July, August, September and October with precipitation > 1.0 inch and the dry season as January, February, March, April, November and December, with < 0.5 inches per month (Figure 7).

5.1.2.2 Period 1950-2002

Balmorhea station for the period 1950-2002 (53 years) shows no statistically significant precipitation data. Annual precipitation shows p = 0.423 and b = 0.041 (Figure 8). All months are within the 90% level of confidence, and show no significant trend (Appendix 7). Median monthly values (Appendix 8) show the wet season as July, August and September with precipitation > 1.0 inch and the dry season as January, February, March, April, November and December, with < 0.5 inches per month (Figure 9).

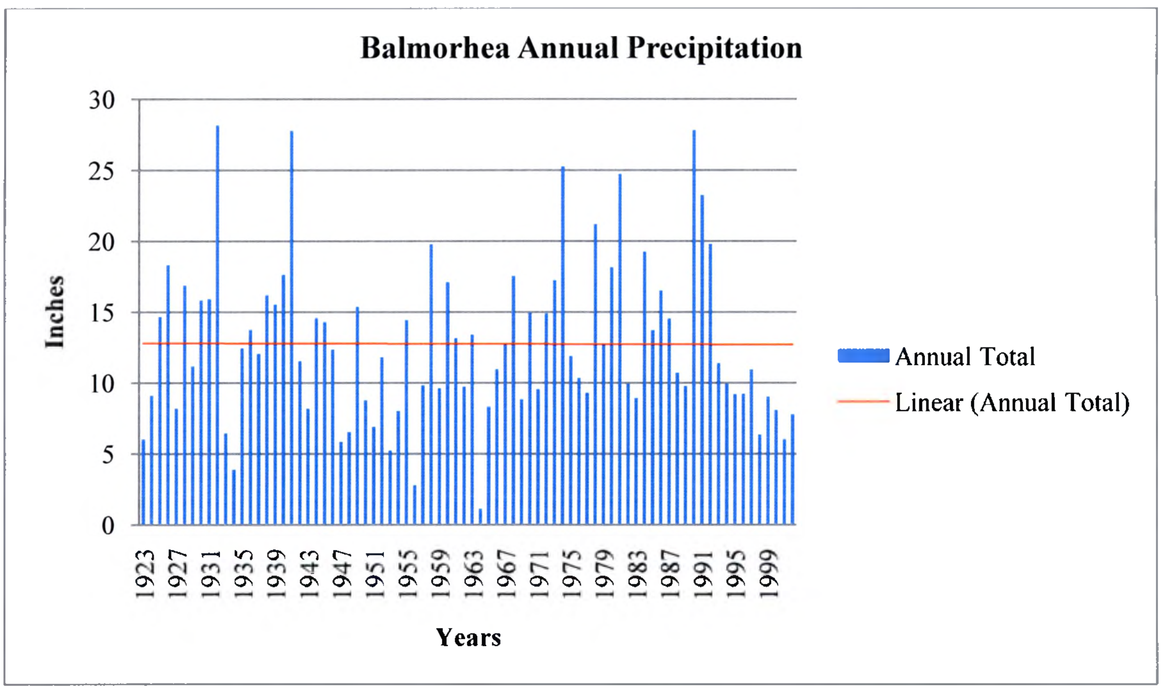

Figure 6. Balmorhea Annual Precipitation for the Period 1923-2002. Trend is not significant (p = 0.960), b = -0.001.

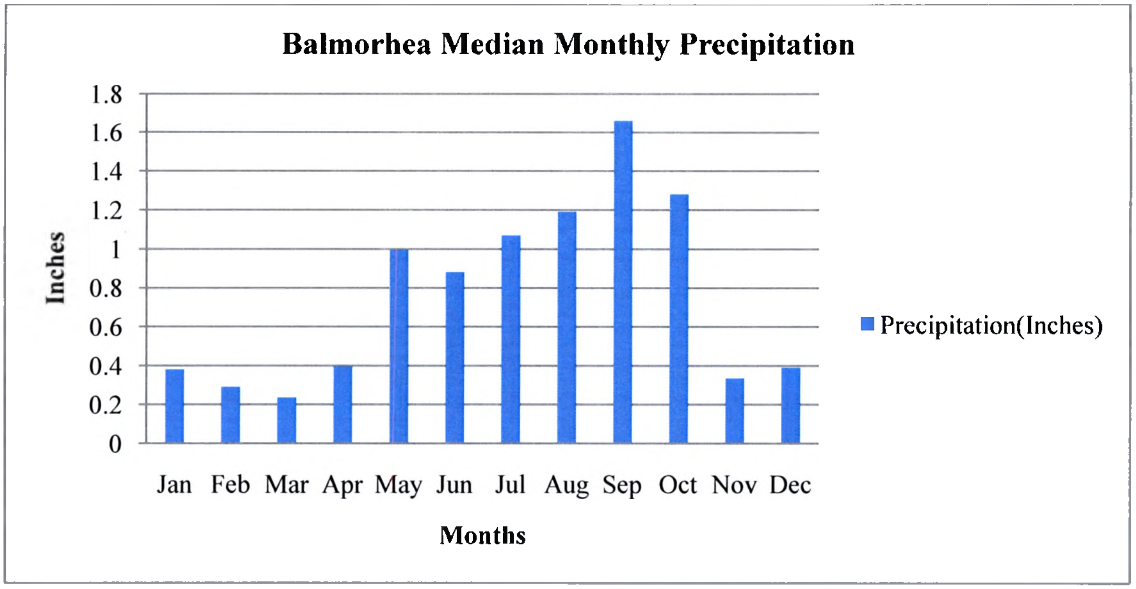

Figure 7. Balmorhea Median Monthly Precipitation for the Period 1923-2002.

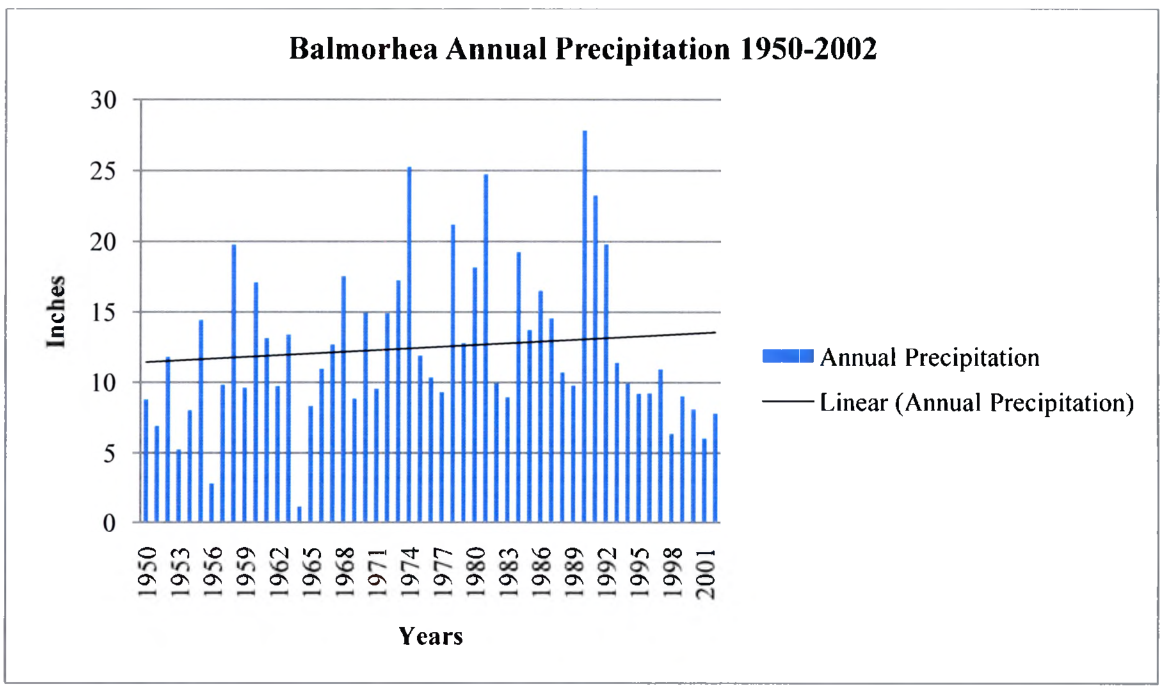

Figure 8. Balmorhea Annual Precipitation for the Period 1950-2002. Trend is not significant ($p = 0.423$), $b = 0.041$.

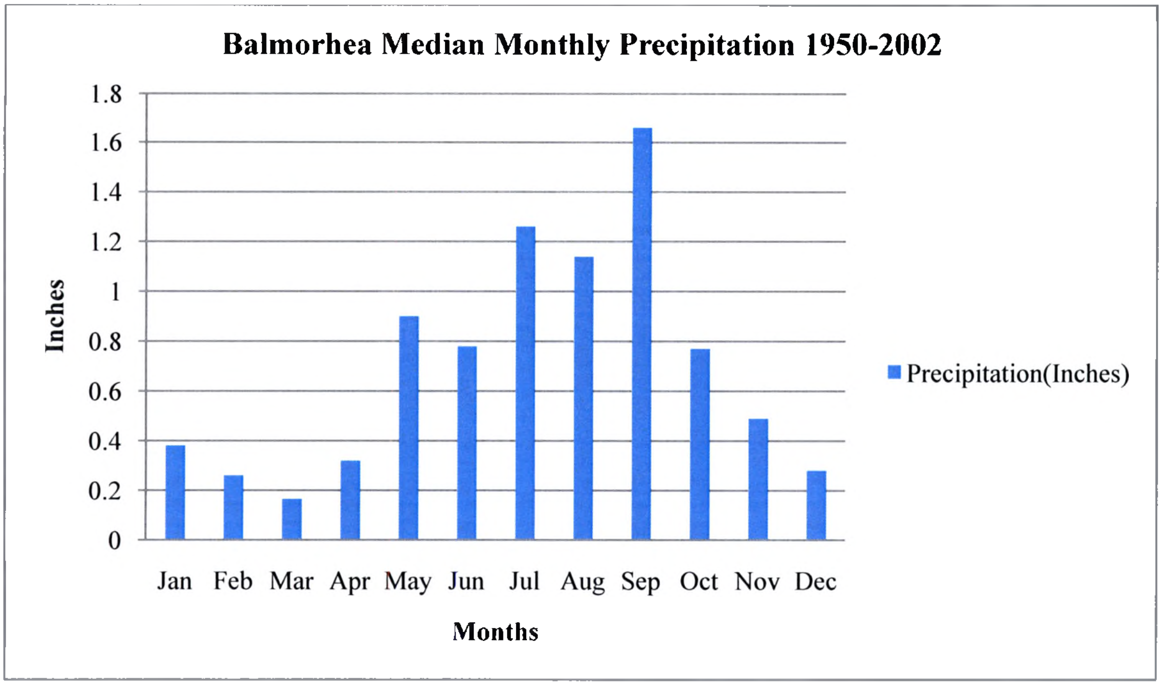

Figure 9. Balmorhea Median Monthly Precipitation for the Period 1950-2002.

5.1.3 Boerne

5.1.3.1 Period 1897-2002

Boerne station for the period 1897-2002 (105 years) shows statistically significant precipitation data with a negative trend for April and positive trends for June and Annual figures (Table 5). Annual precipitation shows (p = 0.016) and b = 0.088 (Figure 10). All other months are within the 90% level of confidence, and show no significant trend (Appendix 9). Median monthly values (Appendix 10) show the wet season as May, June, September and October with precipitation > 2.5 inches and the dry season as January, July, August and November, with < 1.75 inches per month (Figure 11).

5.1.3.2 Period 1950-2002

Boerne station for the period 1950-2002 (53 years) shows statistically significant data with positive trends for March, June, July, October, November and Annual precipitation calculations (Table 5). Annual precipitation shows ($p = 0.001$) and $b = 0.330$ (Figure 12). All other months are within the 90% level of confidence, and show no significant trend (Appendix 11). Median monthly values (Appendix 12) show the wet season as May, June, September and October with precipitation > 2.5 inches and the dry season as January, July and December with < 1.75 inches per month (Figure 13).

Table 5. Statistically Significant Precipitation Data – Boerne

	Month	Coefficient - B	Significance (P-value)	R squared
1897-2002				
Boerne	Apr	-.018	.022	.051
	Jun	.024	.007	.069
	Annual	.088	.016	.055
1950-2002				
Boerne	Mar	.042	.007	.136
	Jun	.060	.037	.083
	Jul	.069	.081	.059
	Oct	.048	.073	.063
	Nov	.048	.010	.124
	Annual	.330	.001	.184

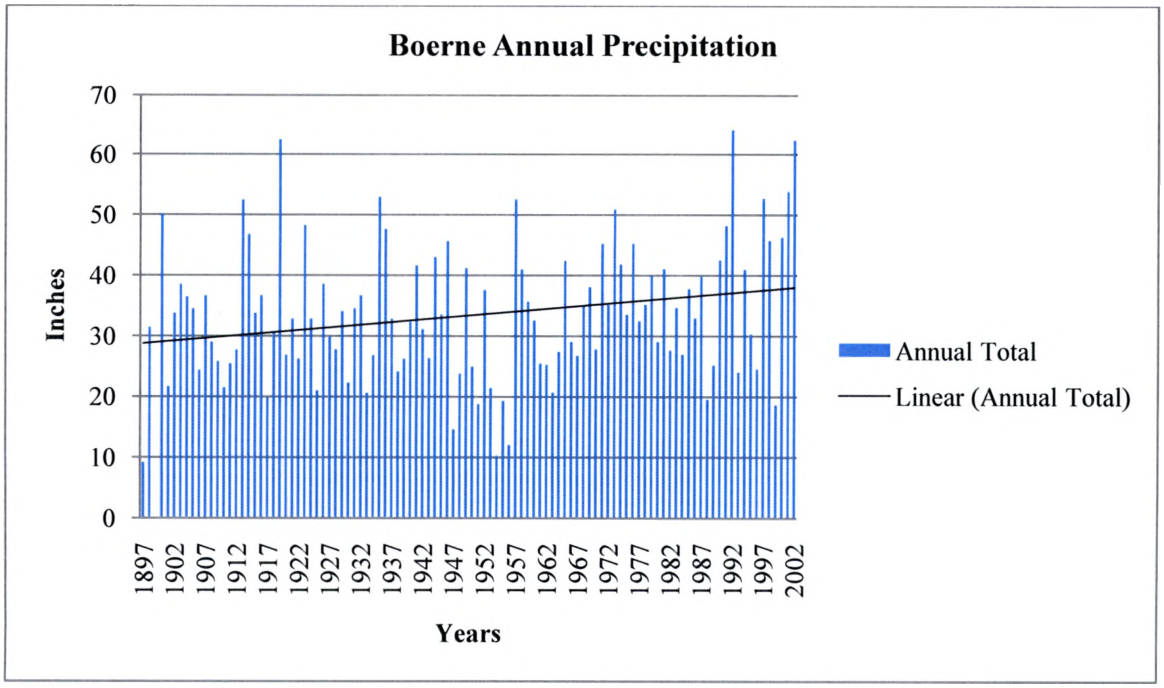

Figure 10. Boerne Annual Precipitation for the Period 1897-2002. Trend is significant ($p = 0.016$), $b = 0.088$.

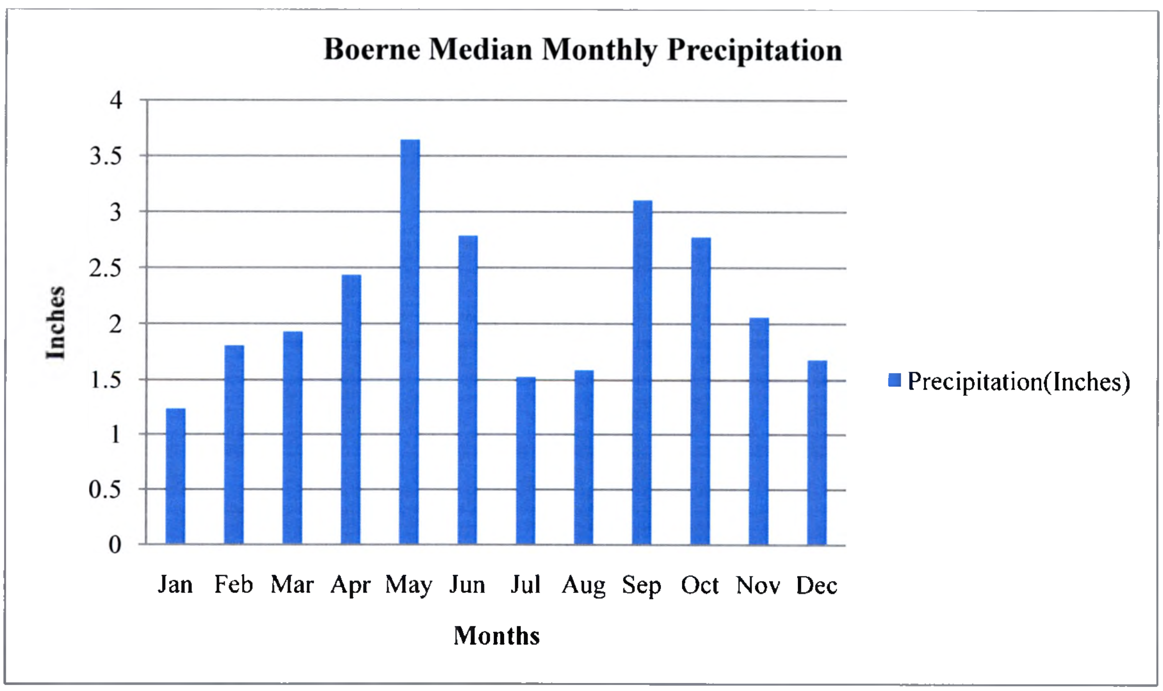

Figure 11. Boerne Median Monthly Precipitation for the Period 1897-2002.

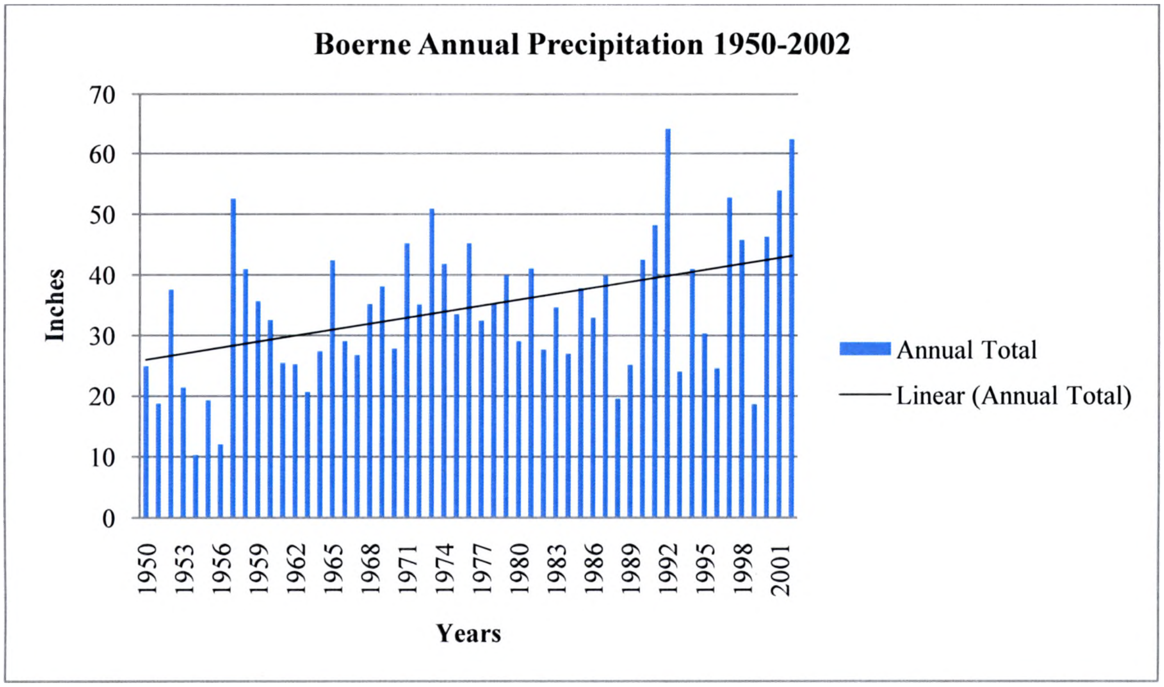

Figure 12. Boerne Annual Precipitation for the Period 1897-2002. Trend is significant (p = 0.001), b = 0.330.

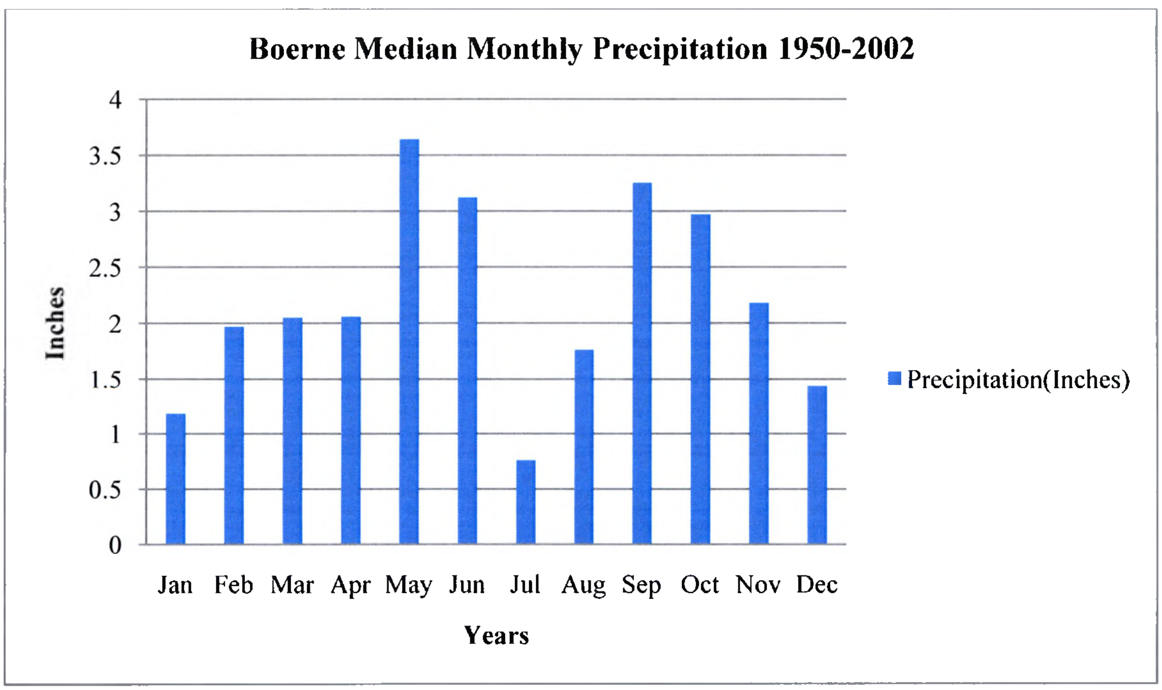

Figure 13. Boerne Median Monthly Precipitation for the Period 1950-2002.

5.1.4 Danevang

5.1.4.1 Period 1897-2002

Danevang station for the period 1897-2002 (105 years) shows statistically significant precipitation data with a negative trend for April, and positive trends for May, June, September and Annual figures (Table 6). Annual precipitation shows ($p = 0.009$) and $b = 0.101$ (Figure 14). All other months are within the 90% level of confidence, and show no significant trend (Appendix 13). Median monthly values (Appendix 14) show the wet season as May, June and September with precipitation > 3.5 inches and the dry season as February, March and April with < 2.5 inches per month (Figure 15).

5.1.4.2 Period 1950-2002

Danevang station for the period 1950-2002 (53 years) shows statistically significant data with positive trends for January, March, October, November and Annual precipitation calculations, only (Table 6). Annual precipitation shows ($p = 0.012$) and $b = 0.263$ (Figure 16). All other months are within the 90% level of confidence, and show no significant trend (Appendix 15). Median monthly values (Appendix 16) show the wet season as May, June and September with precipitation > 3.5 inches and the dry season as February, March, April and July with < 2.5 inches per month (Figure 17).

Table 6. Statistically Significant Precipitation Data - Danevang

	Month	Coefficient - B	Significance (P-value)	R squared
1897-2002				
Danevang	Apr	-.013	.069	.032
	May	.018	.088	.028
	Jun	.020	.054	.036
	Sep	.023	.036	.043
	Annual	.101	.009	.063
1950-2002				
Danevang	Jan	.034	.030	.089
	Mar	.044	.026	.094
	Oct	.054	.071	.063
	Nov	.045	.038	.081
	Annual	.263	.012	.118

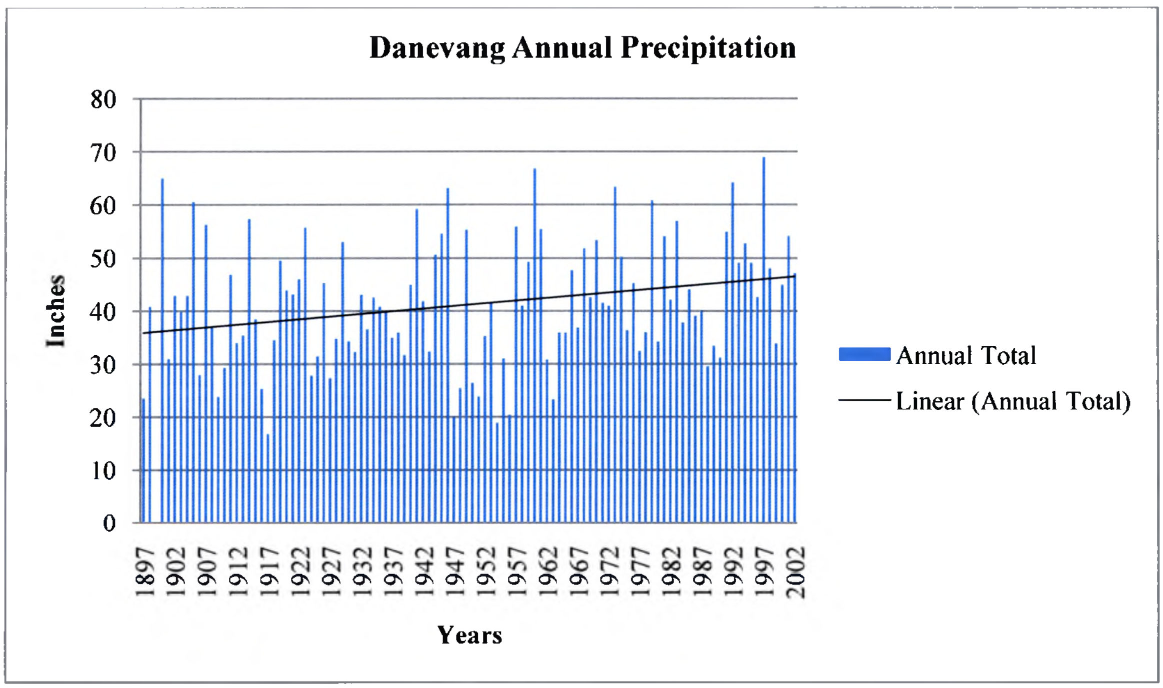

Figure 14. Danevang Annual Precipitation for the Period 1897-2002. Trend is significant ($p = 0.009$), $b = 0.101$.

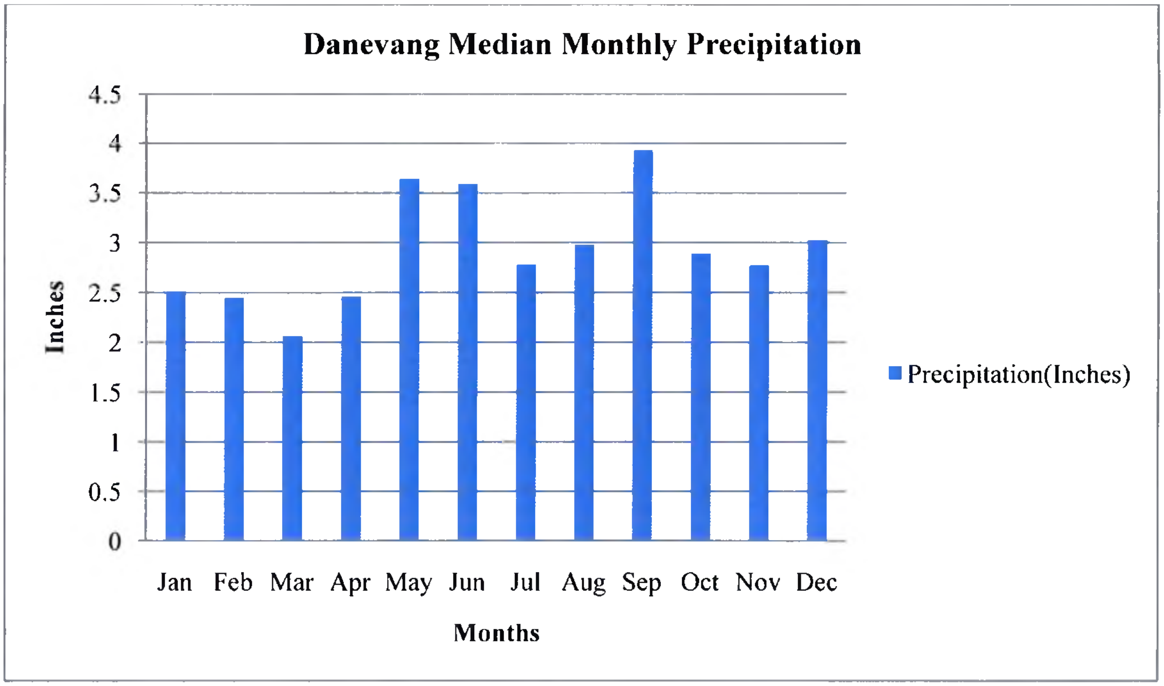

Figure 15. Danevang Median Monthly Precipitation for the Period 1897-2002.

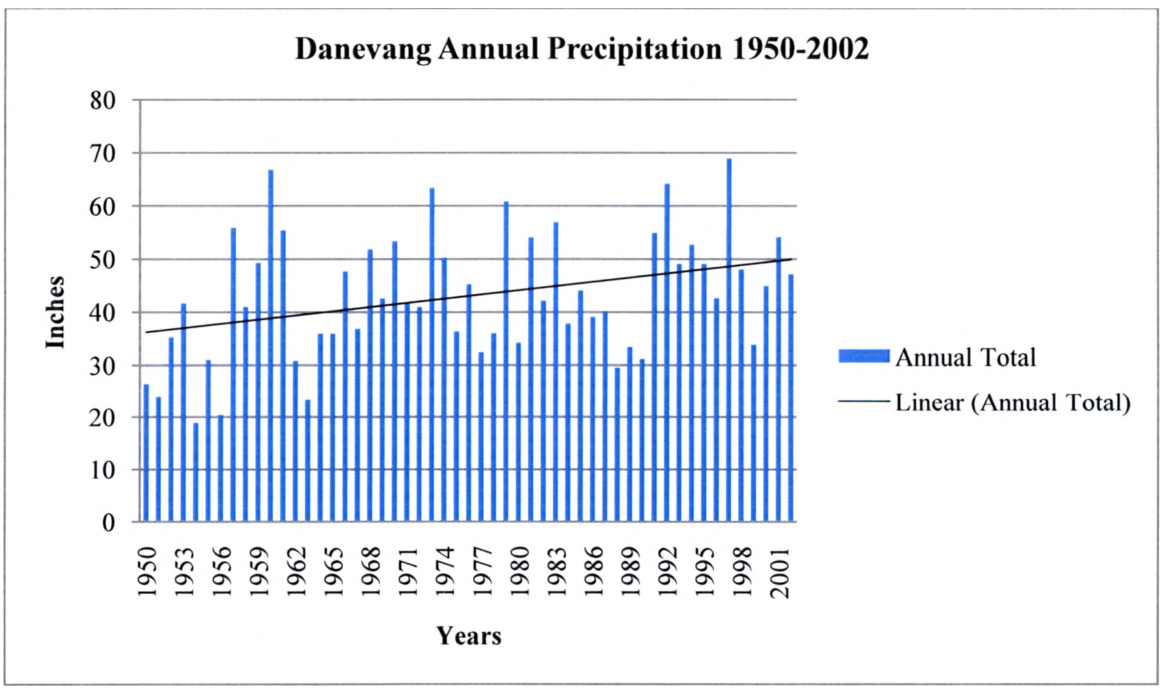

Figure 16. Danevang Annual Precipitation for the Period 1950-2002. Trend is significant ($p = 0.012$), $b = 0.263$.

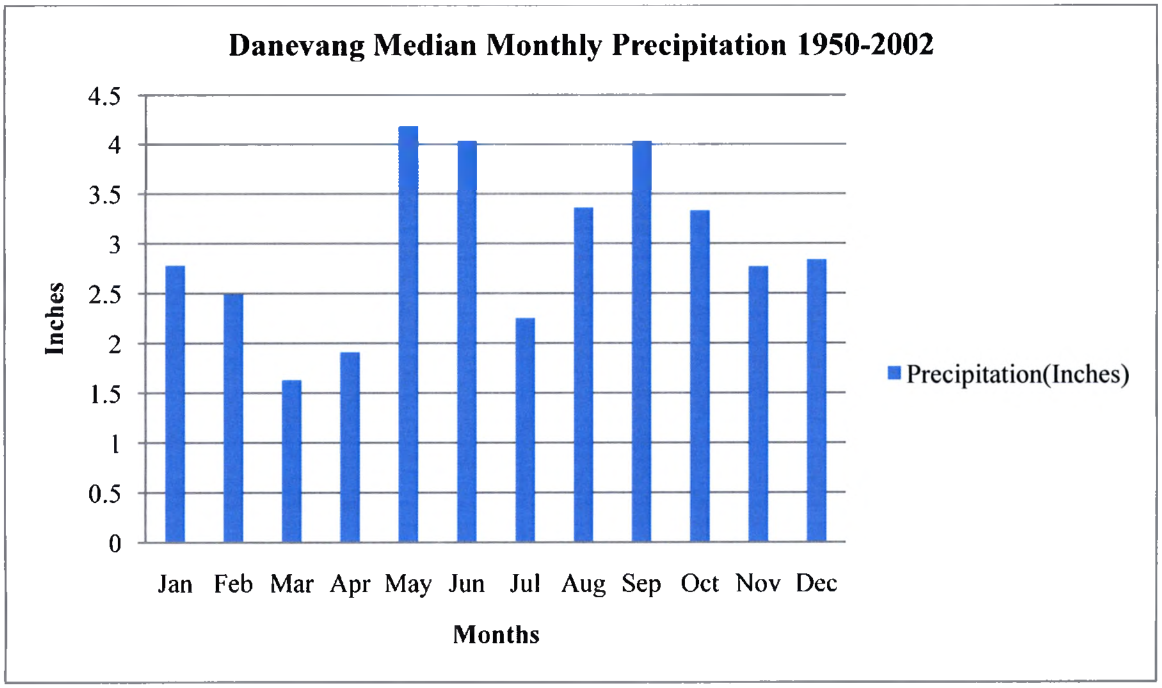

Figure 17. Danevang Median Monthly Precipitation for the Period 1950-2002.

5.1.5 Greenville

5.1.5.1 Period 1900-2002

Greenville station for the period 1900-2002 (102 years) shows statistically significant precipitation data with positive trends for February, March, October and Annual figures (Table 7). Annual precipitation shows $p = 0.011$ and $b = 0.089$ (Figure 18). All other months are within the 90% level of confidence, and show no significant trend (Appendix 17). Median monthly values (Appendix 18) show the wet season as April and May with precipitation > 3.5 inches and the dry season as January, July and August with < 2.5 inches per month (Figure 19).

5.1.5.2 Period 1950-2002

Greenville station for the period 1950-2002 (53 years) shows statistically significant data with positive trends for March and December (Table 7). Annual precipitation calculations are not statistically significant (p = 0.399), b = 0.071 (Figure 20). All other months are within the 90% level of confidence, and show no significant trend (Appendix 19). Median monthly values (Appendix 20) show the wet season as April and May with precipitation > 3.5 inches and the dry season as January and August with < 2.5 inches per month (Figure 21).

Table 7. Statistically Significant Precipitation Data - Greenville

	Month	Coefficient - B	Significance (P-value)	R squared
1900-2002				
Greenville	Feb	.013	.034	.046
	Mar	.016	.009	.069
	Oct	.024	.018	.056
	Annual	.089	.011	.063
1950-2002				
Greenville	Mar	.035	.067	.067
	Dec	.051	.010	.125

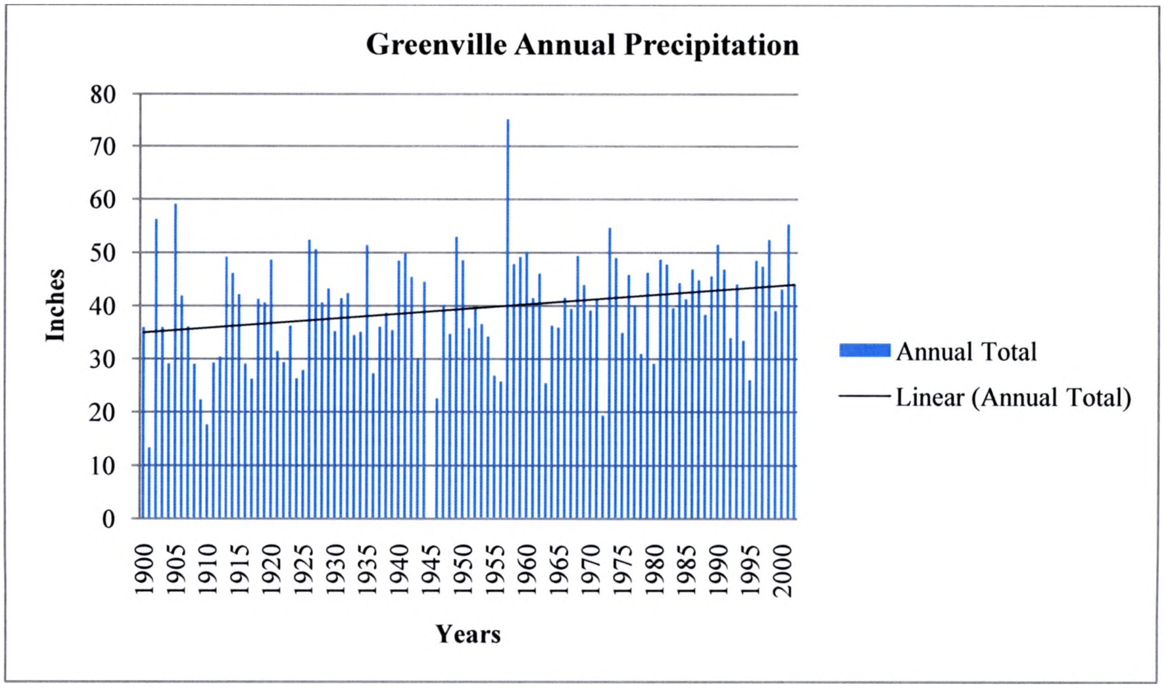

Figure 18. Greenville Annual Precipitation for the Period 1900-2002. Trend is significant ($p = 0.011$), $b = 0.089$.

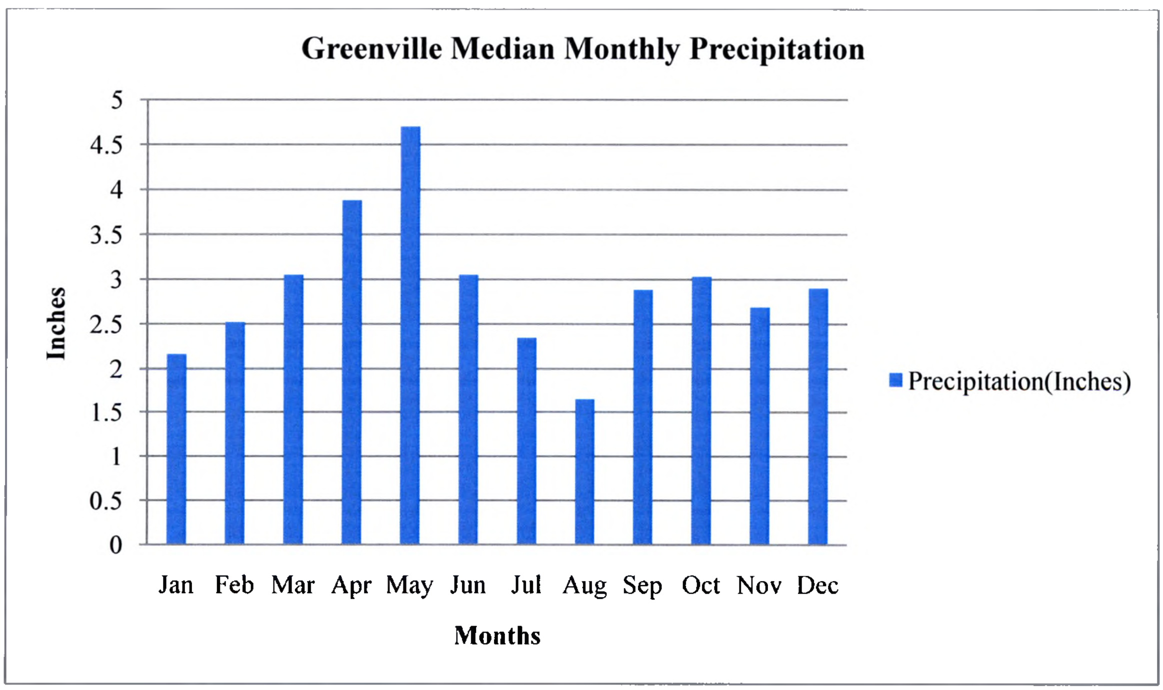

Figure 19. Greenville Median Monthly Precipitation for the Period 1900-2002.

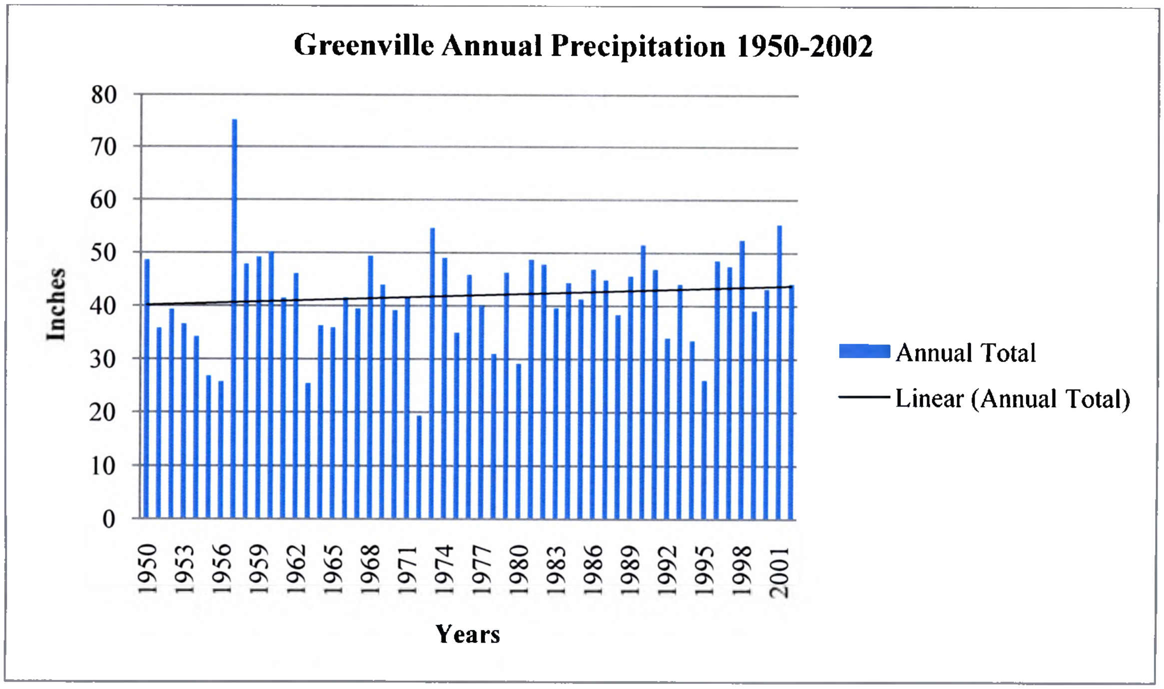

Figure 20. Greenville Annual Precipitation for the Period 1950-2002. Trend is not significant ($p = 0.399$), $b = 0.071$.

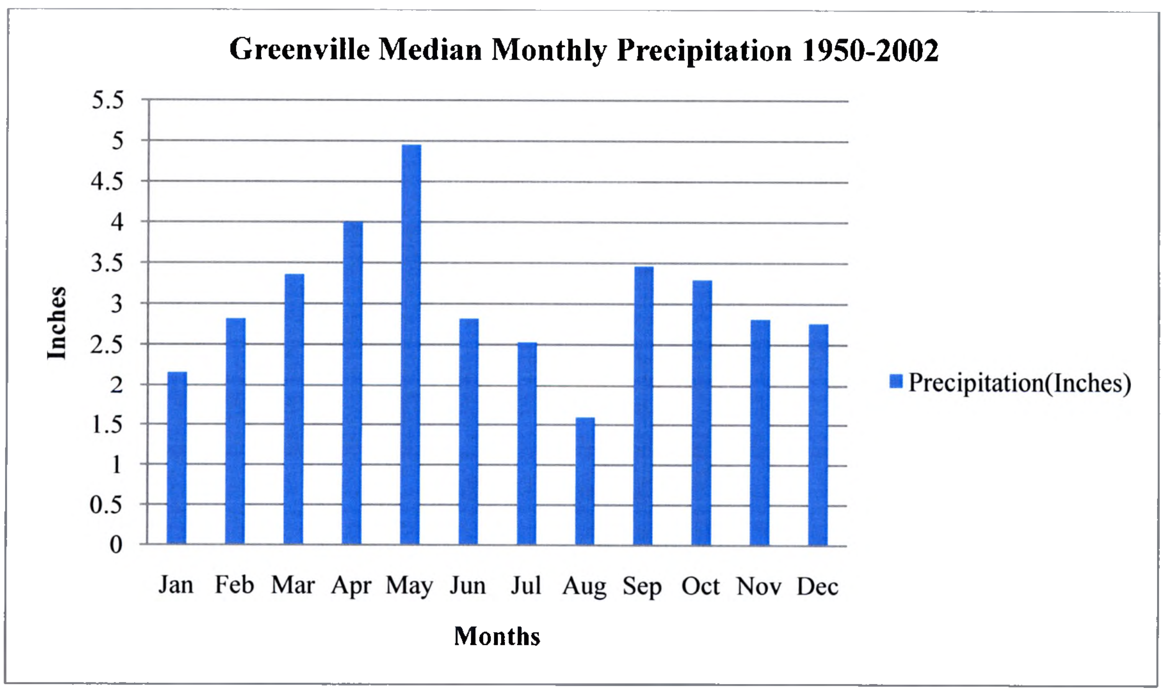

Figure 21. Greenville Median Monthly Precipitation for the Period 1950-2002.

5.1.6 Plainview

5.1.6.1 Period 1908-2002

Plainview station for the period 1908-2002 (95 years) shows no statistically significant precipitation data. Annual precipitation shows $p = 0.831$ and $b = -0.005$ (Figure 22). All months are within the 90% level of confidence, and show no significant trend (Appendix 21). Median monthly values (Appendix 22) show the wet season as May and June with precipitation > 2.0 inches and the dry season as January, February, March, April, November and December with < 1.0 inches per month (Figure 23).

5.1.6.2 Period 1950-2002

Plainview station for the period 1950-2002 (53 years) shows statistically significant data with positive trends for March, November and December, only (Table 8). Annual precipitation calculations are not statistically significant ($p = 0.435$) and $b = 0.040$ (Figure 24). All other months are within the 90% level of confidence, and show no significant trend (Appendix 23). Median monthly values (Appendix 24) show the wet season as May, June, July and August with precipitation > 2.0 inches and the dry season as January, February, March, November and December with < 1.0 inches per month (Figure 25).

Table 8. Statistically Significant Precipitation Data - Plainview

	Month	Coefficient - B	Significance (P-value)	R squared
1950-2002				
Plainview	Mar	.013	.083	.060
	Nov	.013	.034	.088
	Dec	.010	.085	.058

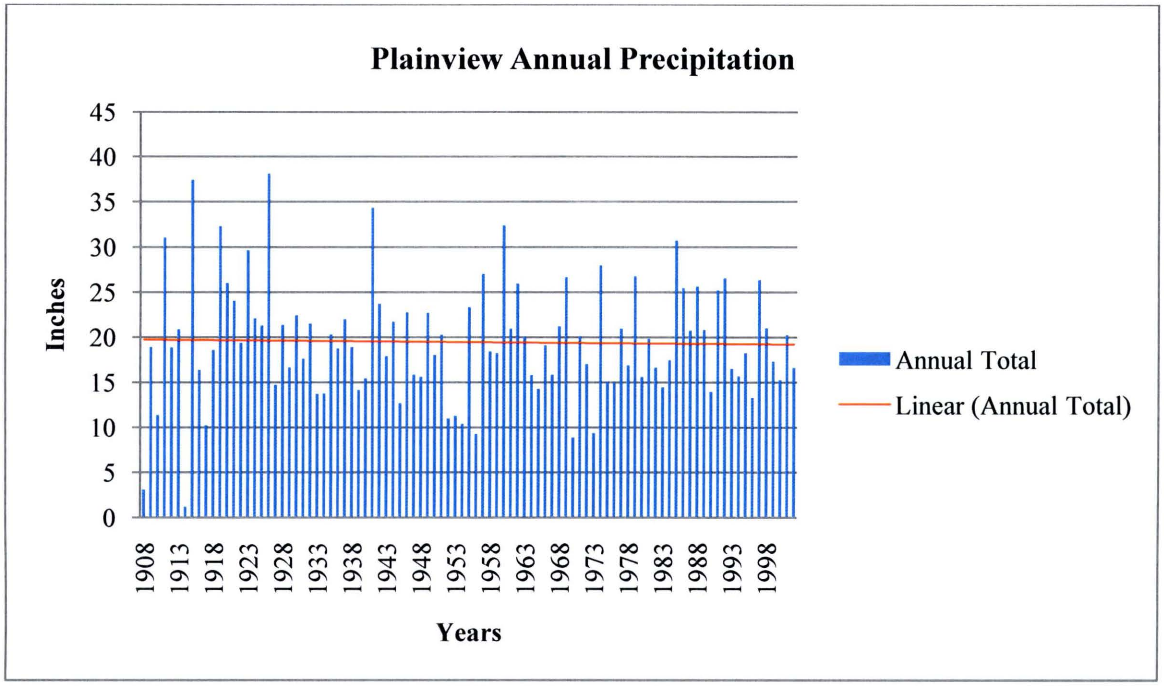

Figure 22. Plainview Annual Precipitation for the Period 1908-2002. Trend is not significant ($p = 0.831$), $b = -0.005$.

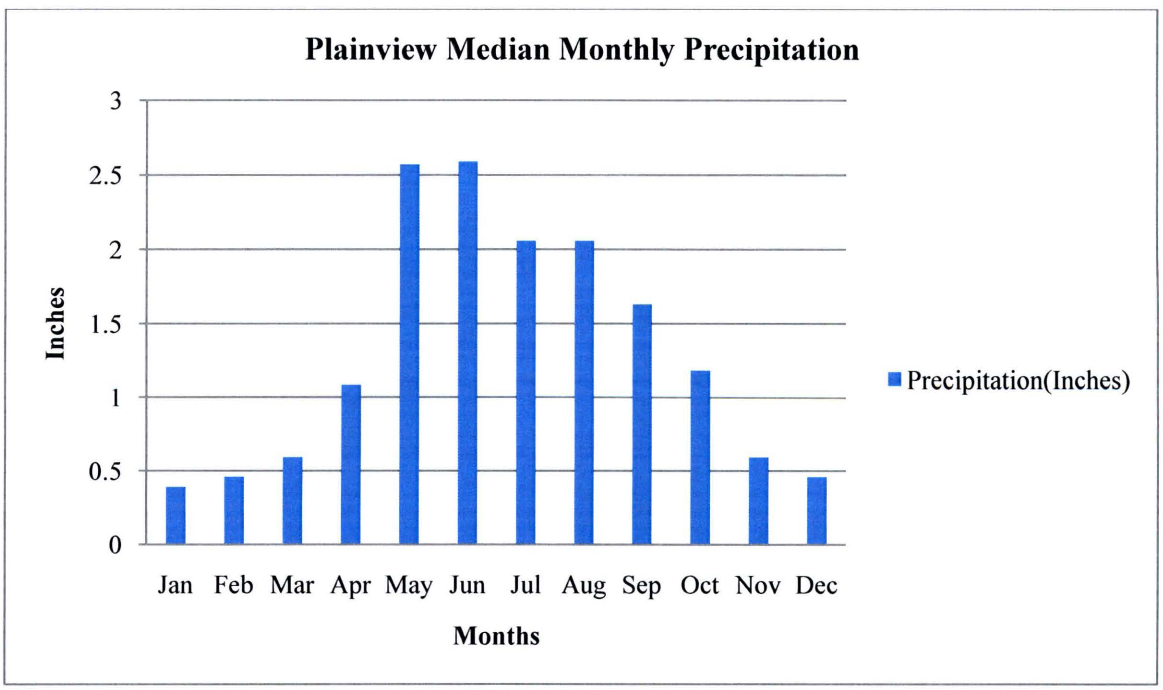

Figure 23. Plainview Median Monthly Precipitation for the Period 1908-2002.

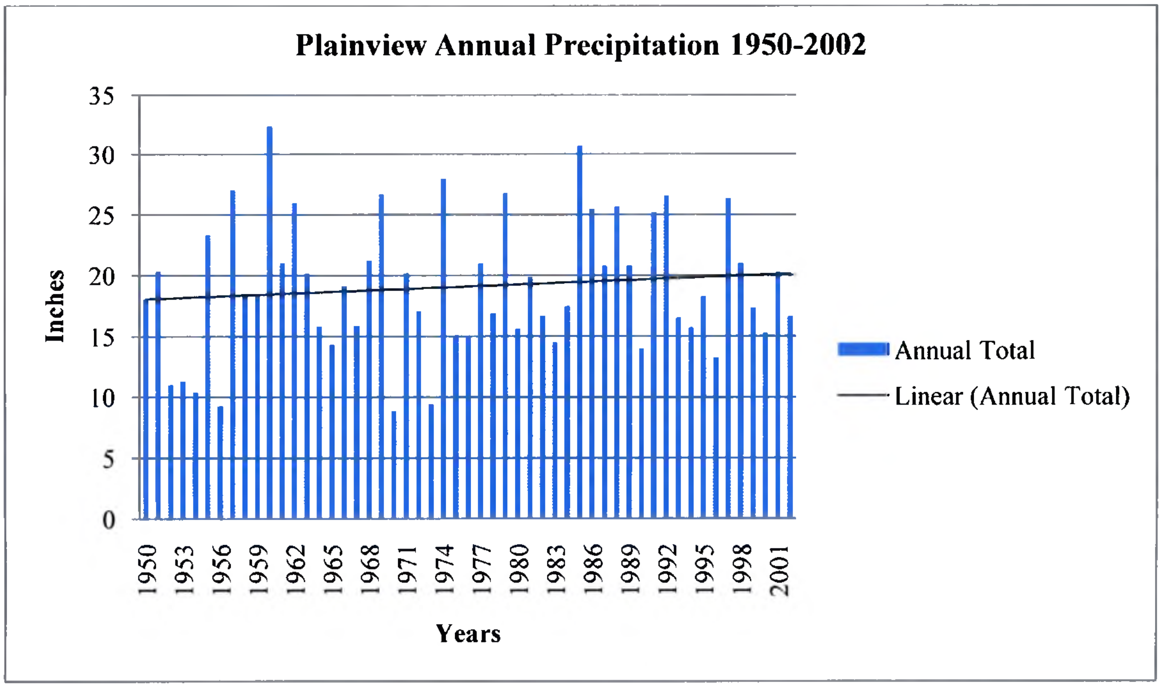

Figure 24. Plainview Annual Precipitation for the Period 1950-2002. Trend is not significant ($p = 0.435$), $b = 0.040$.

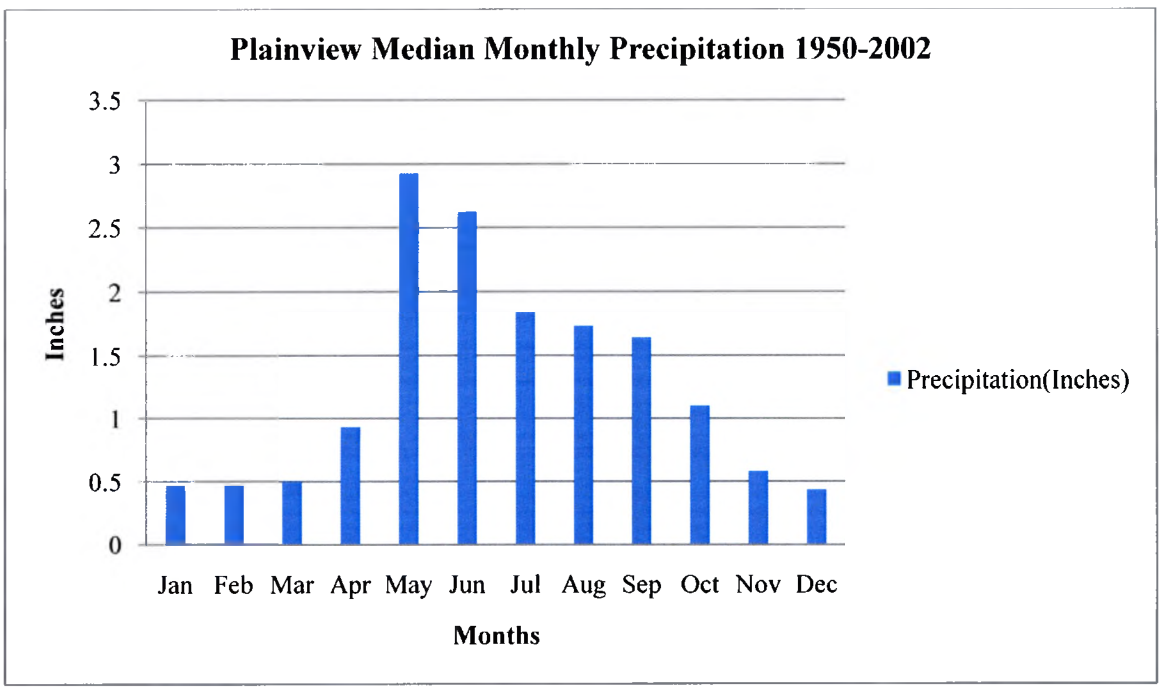

Figure 25. Plainview Median Monthly Precipitation for the Period 1950-2002.

5.1.7 Rio Grande City

5.1.7.1 Period 1897-2002

Rio Grande City station for the period 1897-2002 (85 years) shows statistically significant precipitation data with a negative trend for July and positive trends for October and Annual figures (Table 9). Annual precipitation shows ($p = 0.002$) and $b = 0.095$ (Figure 26). All other months are within the 90% level of confidence, and show no significant trend (Appendix 25). Median monthly values (Appendix 26) show the wet season as May, June and September with precipitation > 1.5 inches and the dry season as January, February, March, November and December with < 0.75 inches per month (Figure 27).

5.1.7.2 Period 1950-2002

Rio Grande City station for the period 1950-2002 (53 years) shows no statistically significant precipitation data. Annual precipitation calculations show ($p=0.264$) and $b=0.083$ (Figure 28). All months are within the 90% level of confidence, and show no significant trend (Appendix 27). Median monthly values (Appendix 28) show the wet season as May, June, August, September and October with precipitation > 1.5 inches and the dry season as January, February, March, November and December with < 0.75 inches per month (Figure 29).

Table 9. Statistically Significant Precipitation Data – Rio Grande City

	Month	Coefficient - B	Significance (P-value)	R squared
1897-2002				
Rio Grande City	Jul	**-.013**	**.065**	**.044**
	Oct	**.019**	**.014**	**.076**
	Annual	**.095**	**.002**	**.107**

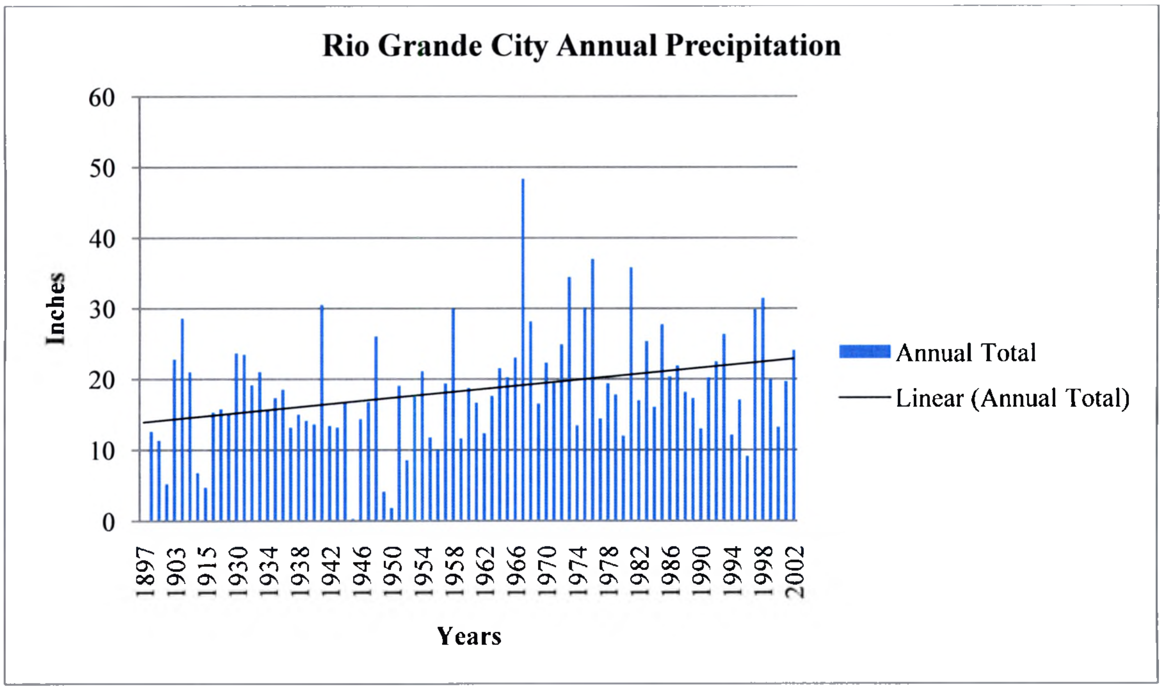

Figure 26. Rio Grande City Annual Precipitation for the Period 1897-2002. Trend is significant (p = 0.002), b = 0.095.

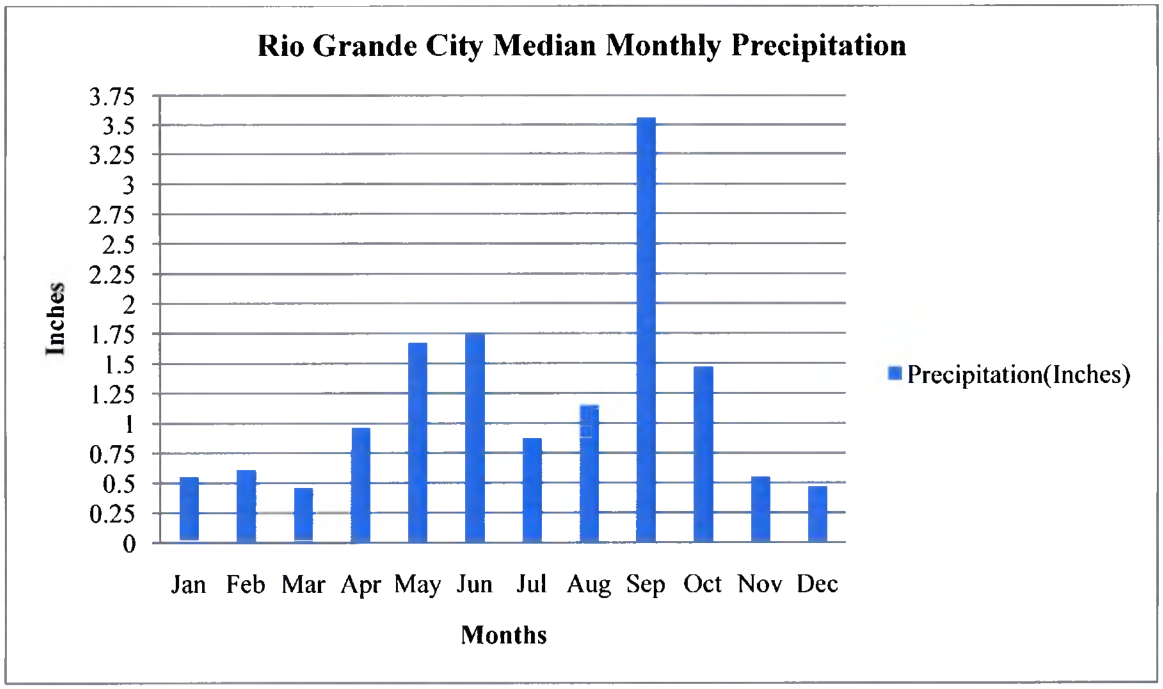

Figure 27. Rio Grande City Median Monthly Precipitation for the Period 1897-2002.

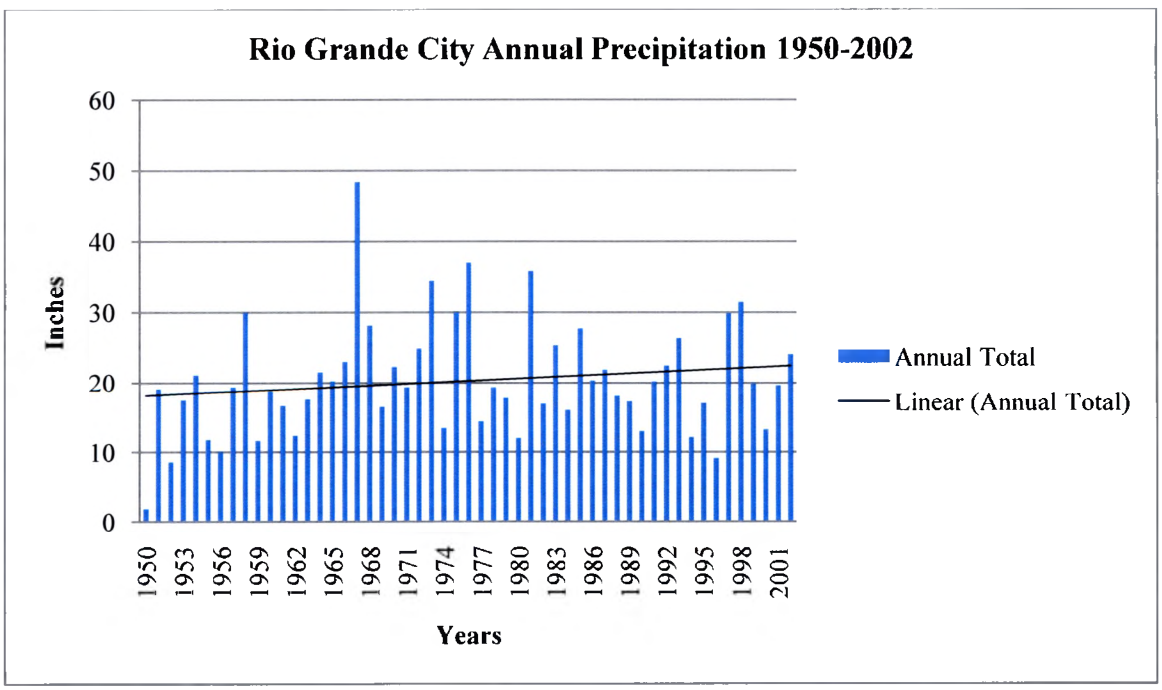

Figure 28. Rio Grande City Annual Precipitation for the Period 1950-2002. Trend is not significant (p = 0.264), b = 0.083.

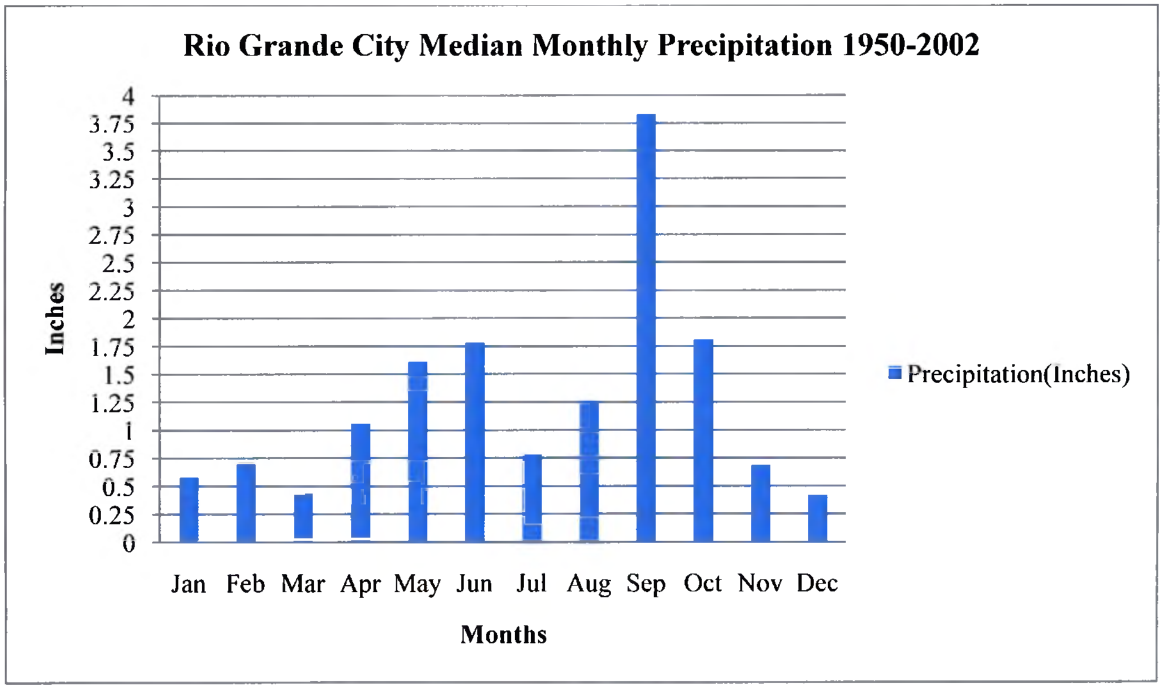

Figure 29. Rio Grande City Median Monthly Precipitation for the Period 1950-2002.

5.1.8 Temple

5.1.8.1 Period 1897-2002

Temple station for the period 1897-2002 (105 years) shows statistically significant precipitation data with a positive trend for February and a statistically significant negative trend for April (Table 10). Annual precipitation is not statistically significant and shows ($p = 0.808$) and $b = 0.008$ (Figure 30). All other months are within the 90% level of confidence, and show no significant trend (Appendix 29). Median monthly values (Appendix 30) show the wet season as February, May, June, September and October with precipitation > 2.5 inches and the dry season as January, July and August with < 1.5 inches per month (Figure 31).

5.1.8.2 Period 1950-2002

Temple station for the period 1950-2002 (53 years) shows statistically significant data with positive trends for March, only (Table 10). Annual precipitation calculations are not statistically significant at p = 0.165 and b = 0.128 (Figure 32). All other months are within the 90% level of confidence, and show no significant trend (Appendix 31). Median monthly values (Appendix 32) show the wet season as April, May, June and September with precipitation > 2.5 inches and the dry season as July and August with < 1.5 inches per month (Figure 33).

Table 10. Statistically Significant Precipitation Data - Temple

	Month	Coefficient - B	Significance (P-value)	R squared
1897-2002				
Temple	Feb	.009	.091	.028
	Apr	-.023	.004	.079
1950-2002				
Temple	Mar	.031	.032	.093

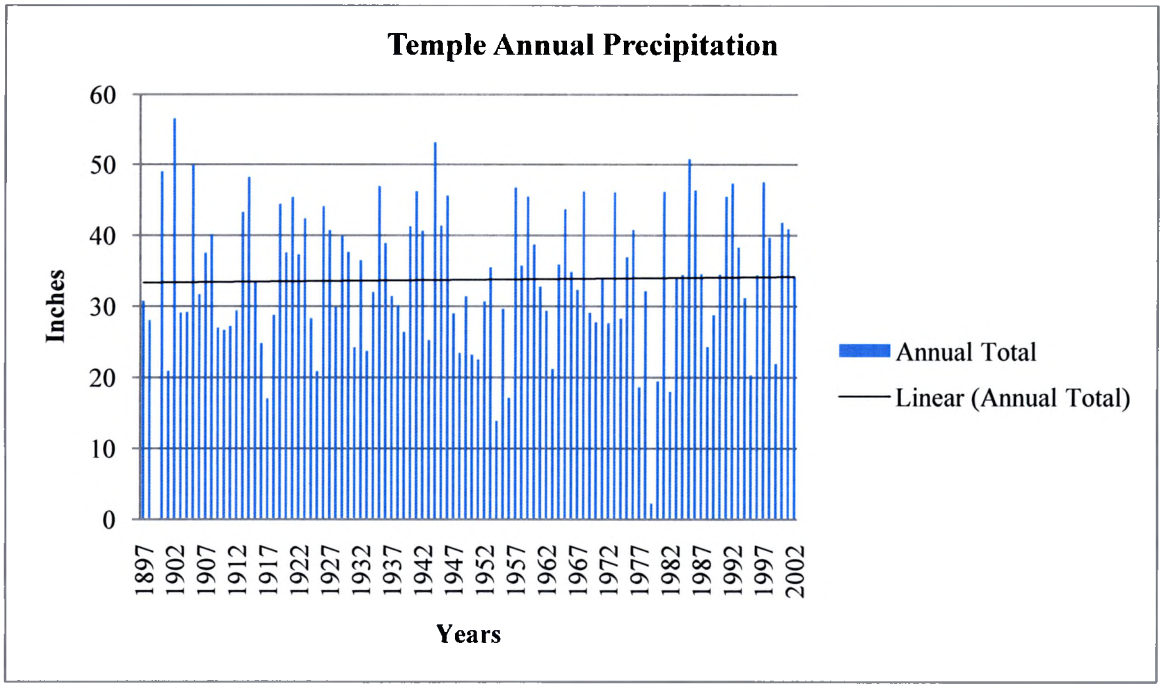

Figure 30. Temple Annual Precipitation for the Period 1897-2002. Trend is not significant ($p = 0.808$), $b = 0.008$.

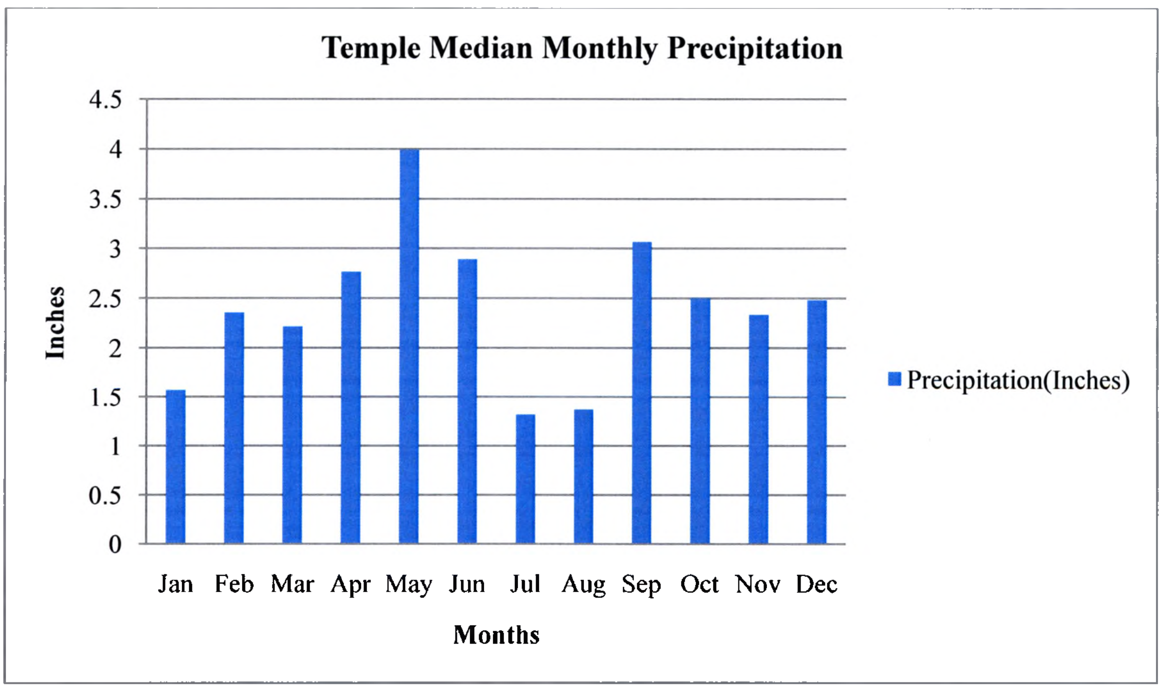

Figure 31. Temple Median Monthly Precipitation for the Period 1897-2002.

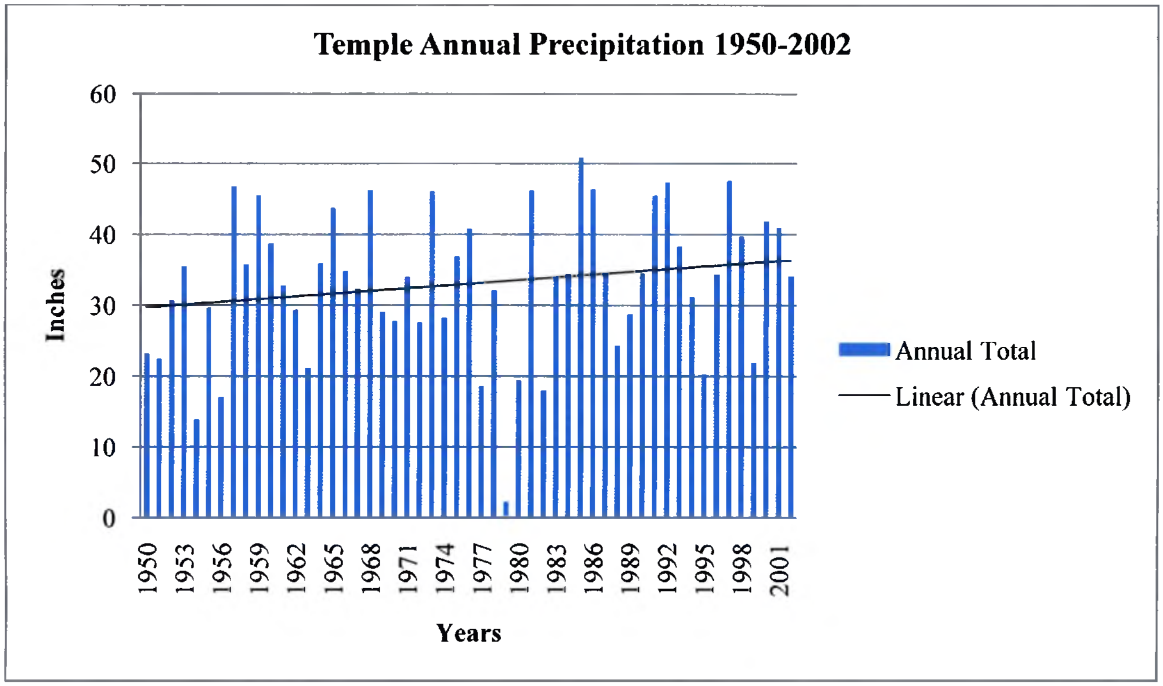

Figure 32. Temple Annual Precipitation for the Period 1950-2002. Trend is not significant ($p = 0.165$), $b = 0.128$.

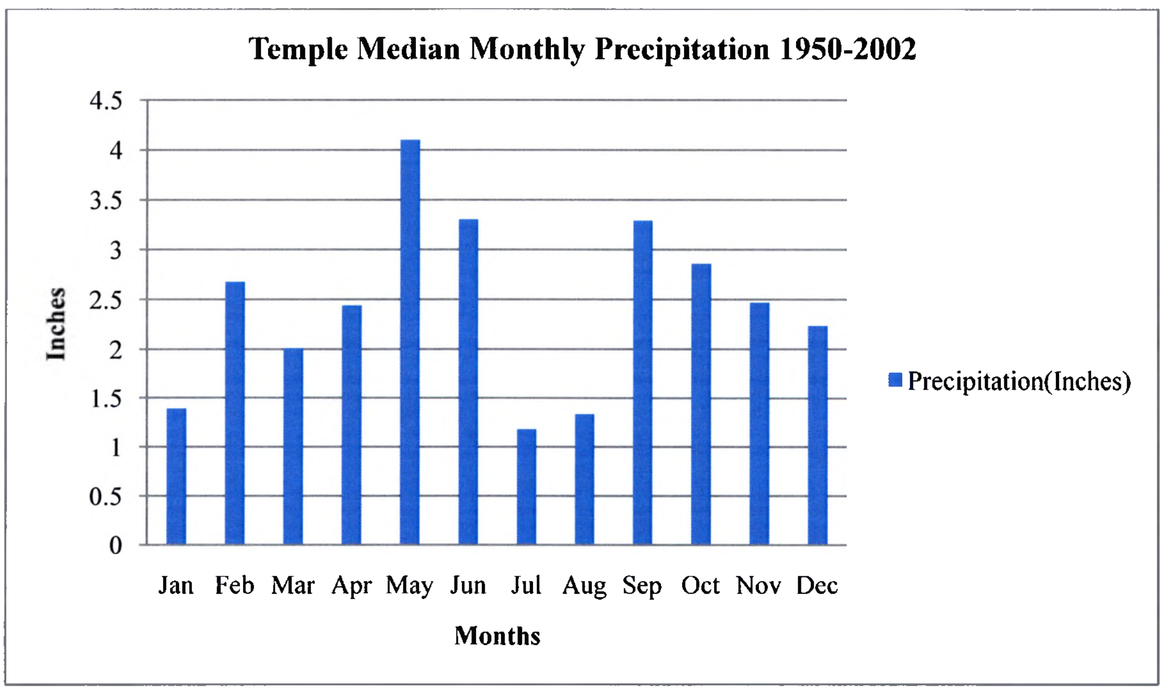

Figure 33. Temple Median Monthly Precipitation for the Period 1950-2002.

5.2 Number of Days with Precipitation

The number of days of precipitation per month is simply that and will be referred to as "Days" through the rest of this section. Each data site is discussed using raw data values (descriptives) and statistical analysis using linear regressions to determine current trends for the periods of available data. These periods vary at each site, with the starting year ranging from 1897 to 1923, and are sub-divided into a secondary study period of 1950-2002 in order to narrow the scope and include the effects of the severe drought during the 1950s. In an aggregate table (Table 11) of all statistically significant "number of days" trends, all station data calculations produced positive annual trends, indicating an overall increase in days of rainfall. Annual minimums, maximums and means were affected by missing or incomplete data, but all available data was used to maximize the weight of monthly data. Medians were used to lessen the effect of extreme or missing values.

Table 11. Occurrence of Statistically Significant P-values for Monthly Number of Days of Precipitation

NUMBER of DAYS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Albany		↑	↑			↑						↑	↑
Balmorhea		↓	↓	↓	↓			↓		↓		↓	↑
Boerne	↑		↑		↑		↓		↑	↑	↑		↑
Danevang	↑	↑	↑		↑	↑		↑	↑	↑		↑	↑
Greenville	↑		↑		↑	↑			↑	↑	↑		↑
Plainview	↑	↑	↑									↑	↑
Rio Grande City	↑	↑		↑							↑	↑	↑
Temple	↑					↑			↑				↑

↓ – negative trend (Coefficient B); ↑ - positive trend (Coefficient B)

5.2.1 Albany

5.2.1.1 Period 1901-2002

Albany station for the period 1901-2002 (102 years) shows statistically significant data with positive trends for February, March, June, December and the Annual Days calculations (Table 12). Annual Days shows (p=0.001) and b=0.191 (Figure 34). All other months are within the 90% level of confidence, and show no significant trend (Appendix 1). Median monthly values (Appendix 2) show the highest frequency of occurrence as only May with > 5 days of precipitation (Figure 35).

5.2.1.2 Period 1950-2002

Albany station for the period 1950-2002 (53 years) shows statistically significant data with negative trends for April, May, September and the Annual Days calculations (Table 12). Annual Days shows (p = 0.026) and b = -0.264 (Figure 36). All other months are within the 90% level of confidence, and show no significant trend (Appendix 3). Median monthly values (Appendix 4) show the highest frequency of occurrence as May, June, and September with > 5 days of precipitation (Figure 37).

Table 12. Statistically Significant Number of Days Data - Albany

	Month	Coefficient - B	Significance (P-value)	R squared
1901-2002				
Albany	Feb	.019	.063	.036
	Mar	.024	.009	.069
	Jun	.016	.110	.027
	Dec	.023	.030	.051
	Annual	.191	.001	.114
1950-2002				
Albany	Apr	-.051	.021	.105
	May	-.060	.040	.080
	Sep	-.024	.052	.072
	Annual	-.264	.026	.093

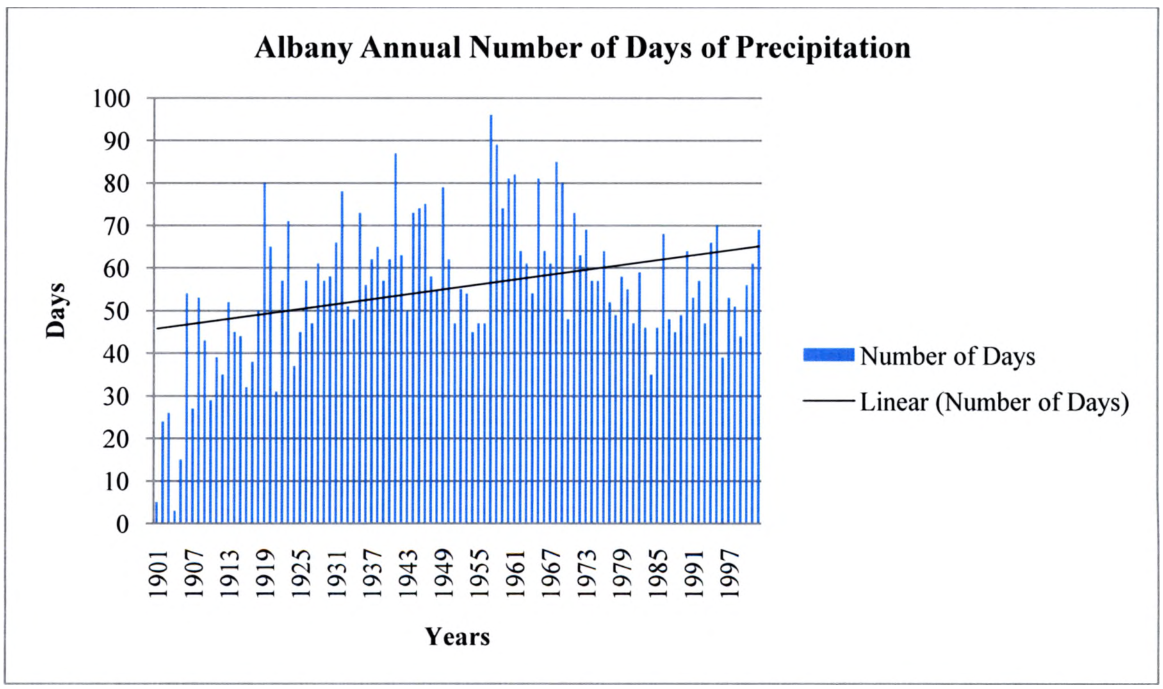

Figure 34. Albany Annual Number of Days of Precipitation for the Period 1901-2002. Trend is significant (p = 0.001), b = 0.191.

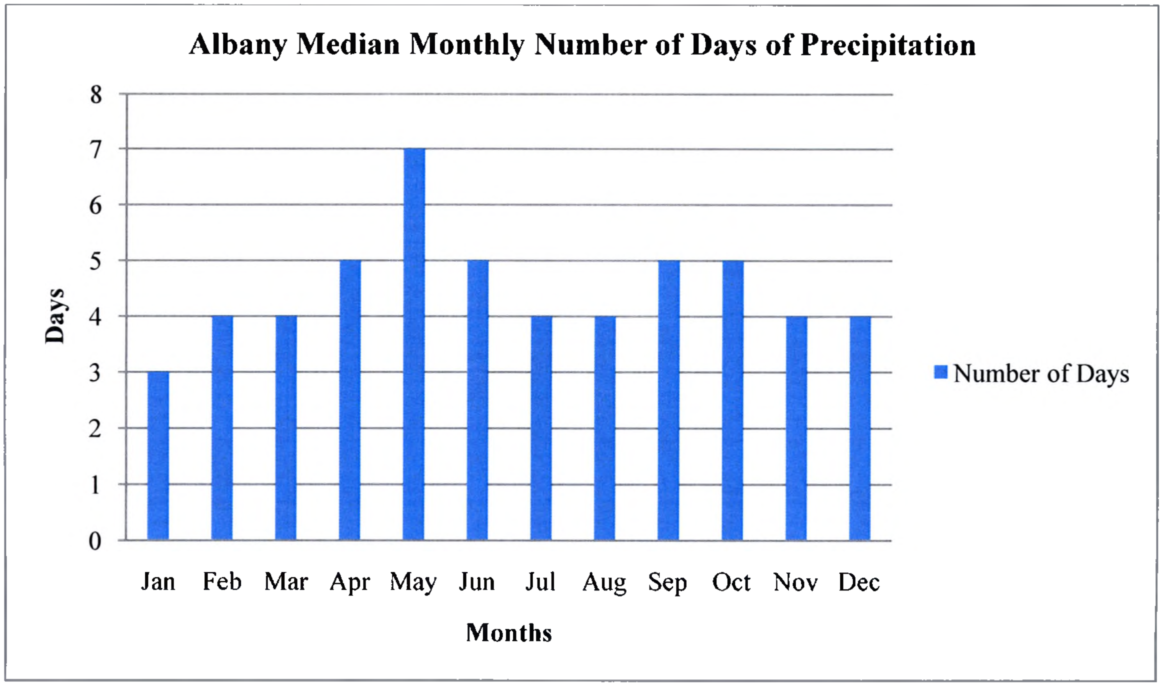

Figure 35. Albany Median Monthly Number of Days of Precipitation for the Period 1901-2002.

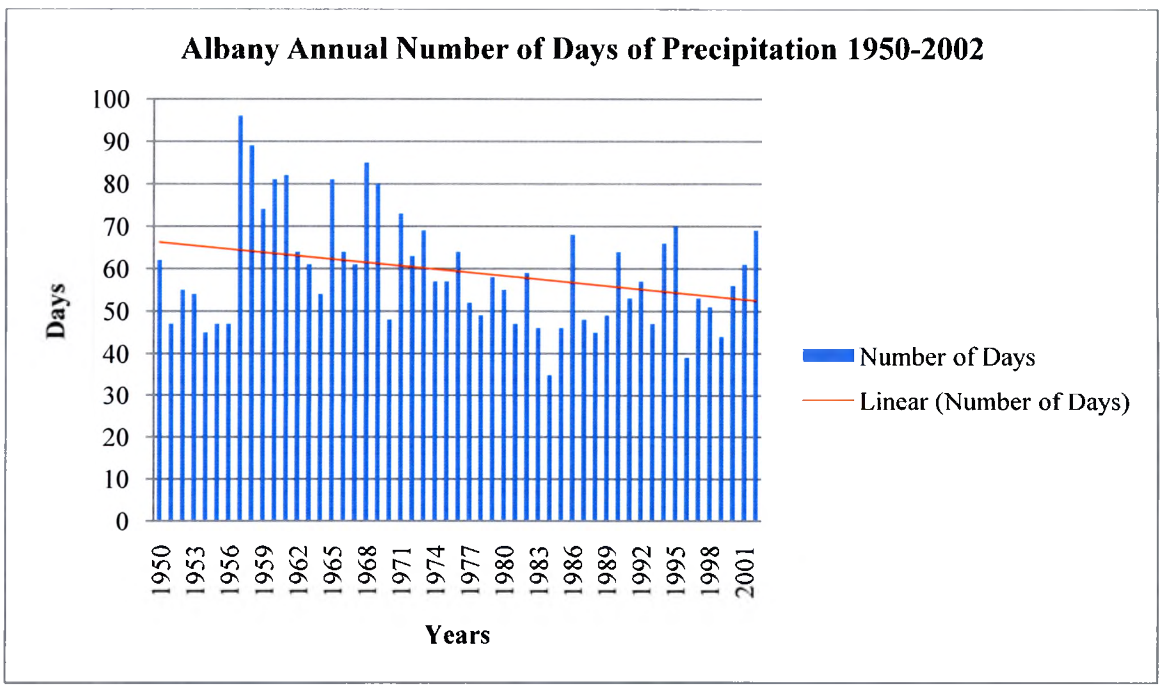

Figure 36. Albany Annual Number of Days of Precipitation for the Period 1950-2002. Trend is significant ($p = 0.026$), $b = -0.264$.

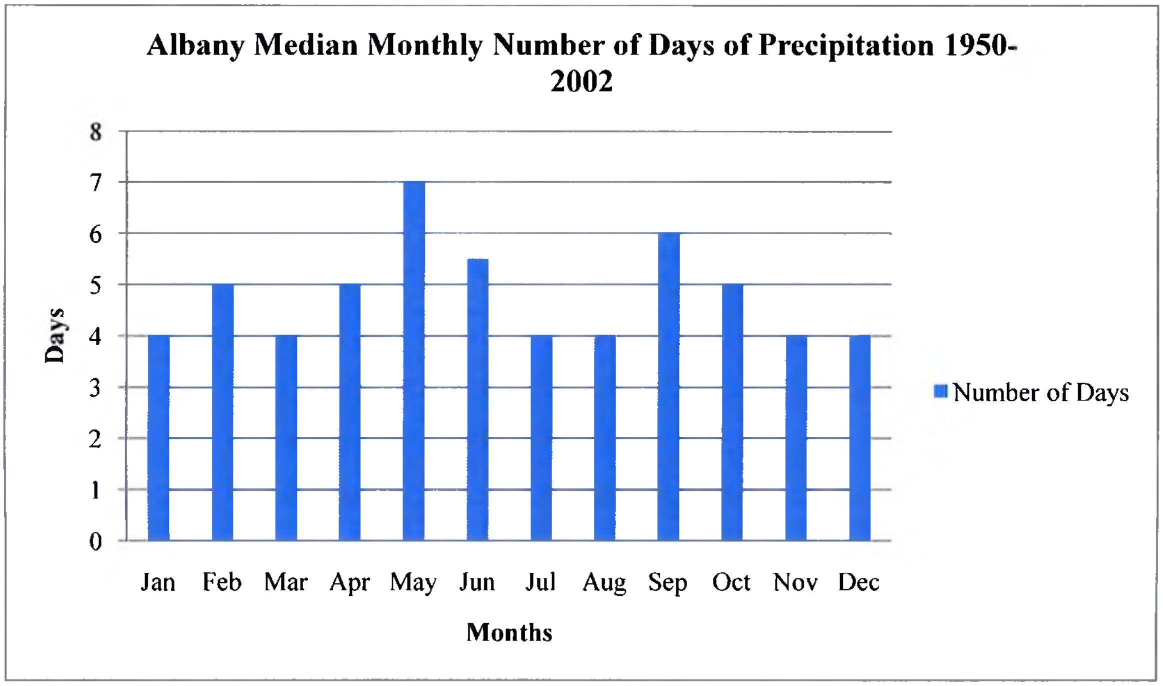

Figure 37. Albany Median Monthly Number of Days of Precipitation for the Period 1950-2002.

5.2.2 Balmorhea

5.2.2.1 Period 1923-2002

Balmorhea station for the period 1923-2002 (80 years) shows statistically significant data with negative trends for February, March, April, May, August, October, December and the Annual Days calculations (Table 13). Annual Days shows ($p = 0.000$) and $b = -0.259$ (Figure 38). All other months are within the 90% level of confidence, and show no significant trend (Appendix 5). Median monthly values (Appendix 6) show the highest frequency of occurrence as only July with > 5 days of precipitation (Figure 39).

5.2.2.2 Period 1950-2002

Balmorhea station for the period 1950-2002 (53 years) shows statistically significant data with negative trends for the Annual Days calculations, only (Table 13). Annual Days shows ($p = 0.073$) and $b = -0.211$ (Figure 40). All other months are within the 90% level of confidence, and show no significant trend (Appendix 7). Median monthly values (Appendix 8) show no months with a frequency of occurrence > 5 days of precipitation (Figure 41).

Table 13. Statistically Significant Number of Days Data - Balmorhea

	Month	Coefficient - B	Significance (P-value)	R squared
1923-2002				
Balmorhea	Feb	-.022	.039	.054
	Mar	-.020	.025	.064
	Apr	-.021	.057	.048
	May	-.035	.014	.077
	Aug	-.027	.068	.044
	Oct	-.046	.002	.117
	Dec	-.043	.000	.152
	Annual	-.259	.000	.146
1950-2002				
Balmorhea	Annual	-.211	.073	.062

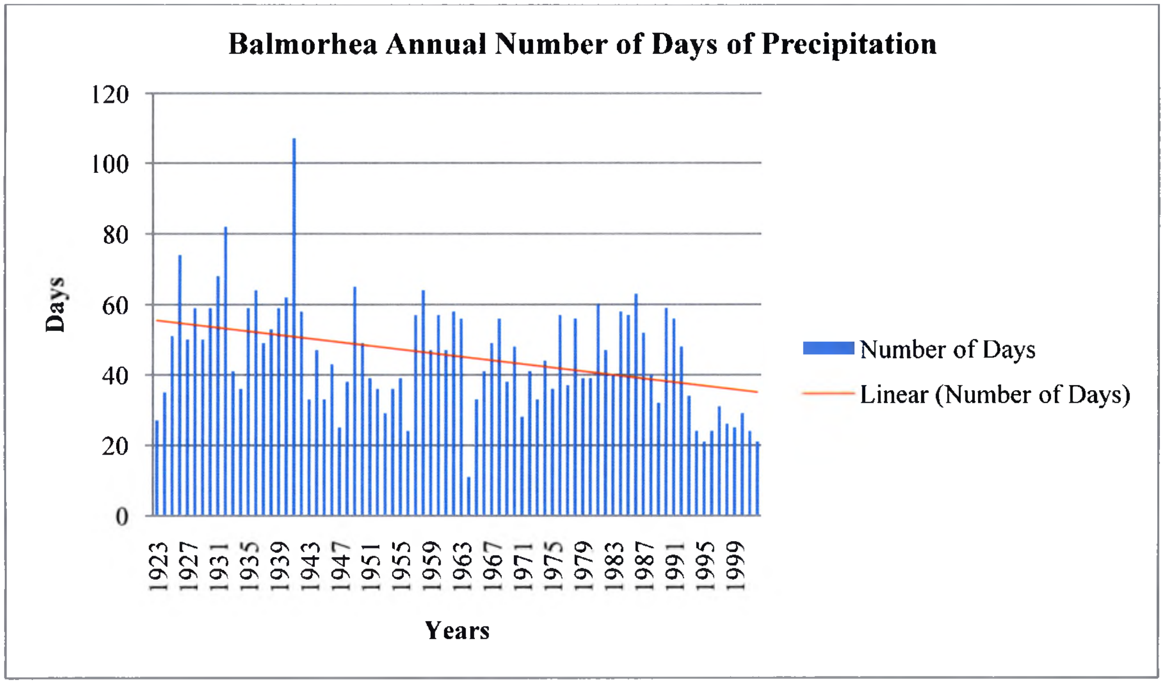

Figure 38. Balmorhea Annual Number of Days of Precipitation for the Period 1923-2002. Trend is significant ($p = 0.000$), $b = -0.259$.

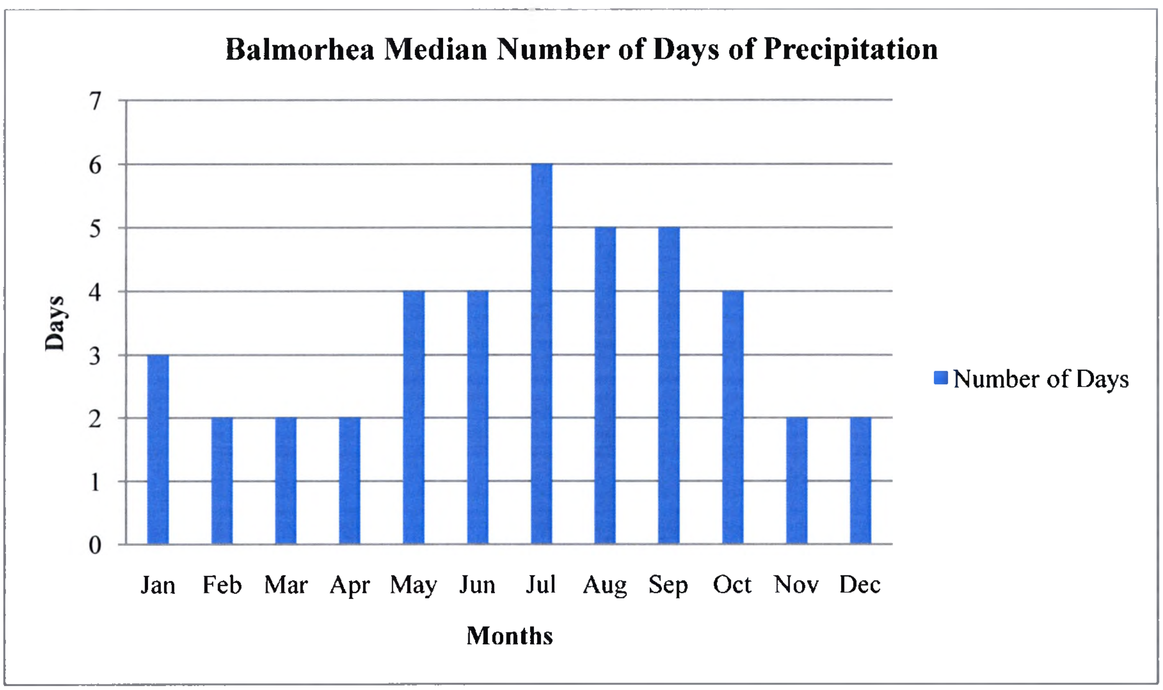

Figure 39. Balmorhea Median Monthly Number of Days of Precipitation for the Period 1923-2002.

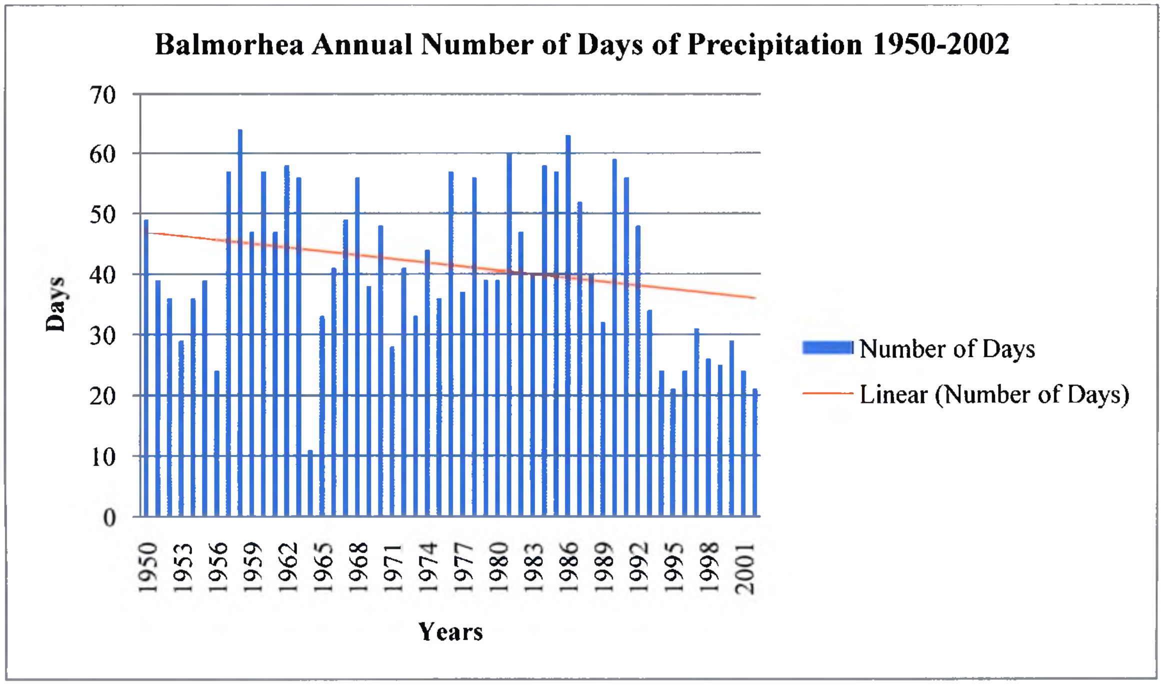

Figure 40. Balmorhea Annual Number of Days of Precipitation for the Period 1950-2002. Trend is significant ($p = 0.073$), $b = - 0.211$.

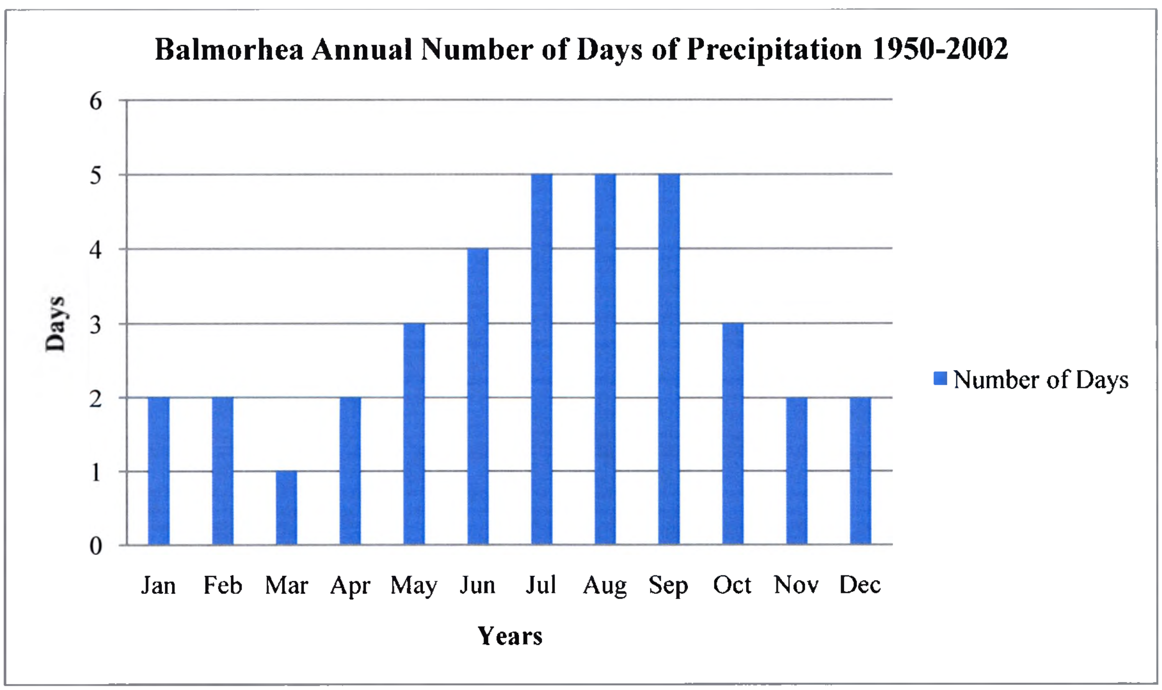

Figure 41. Balmorhea Median Monthly Number of Days of Precipitation for the Period 1950-2002.

5.2.3 Boerne

5.2.3.1 Period 1897-2002

Boerne station for the period 1897-2002 (105 years) shows statistically significant data with positive trends for January, March, May, July, September, October, November and the Annual Days calculations (Table 14). Annual Days shows ($p = 0.000$) and $b = 0.250$ (Figure 42). All other months are within the 90% level of confidence, and show no significant trend (Appendix 9). Median monthly values (Appendix 10) show the highest frequency of occurrence as January, February, March, April, May, September, November, and December with > 5 days of precipitation (Figure 43).

5.2.3.2 Period 1950-2002

Boerne station for the period 1950-2002 (53 years) shows statistically significant data with negative trends for April calculations, only (Table 14). Annual Days calculations are not statistically significant and show ($p = 0.693$) and $b = 0.060$ (Figure 44). All other months are within the 90% level of confidence, and show no significant trend (Appendix 11). Median monthly values (Appendix 12) show the highest frequency of occurrence as January, February, March, April, May, June, September, October, November and December with > 5 days of precipitation (Figure 45).

Table 14. Statistically Significant Number of Days Data - Boerne

	Month	Coefficient - B	Significance (P-value)	R squared
1897-2002				
Boerne	Jan	.027	.014	.040
	Mar	.035	.001	.102
	May	.023	.063	.033
	Jul	-.016	.103	.026
	Sep	.018	.107	.025
	Oct	.035	.005	.079
	Nov	.020	.066	.034
	Annual	.250	.000	.128
1950-2002				
Boerne	Apr	-.056	.088	.056

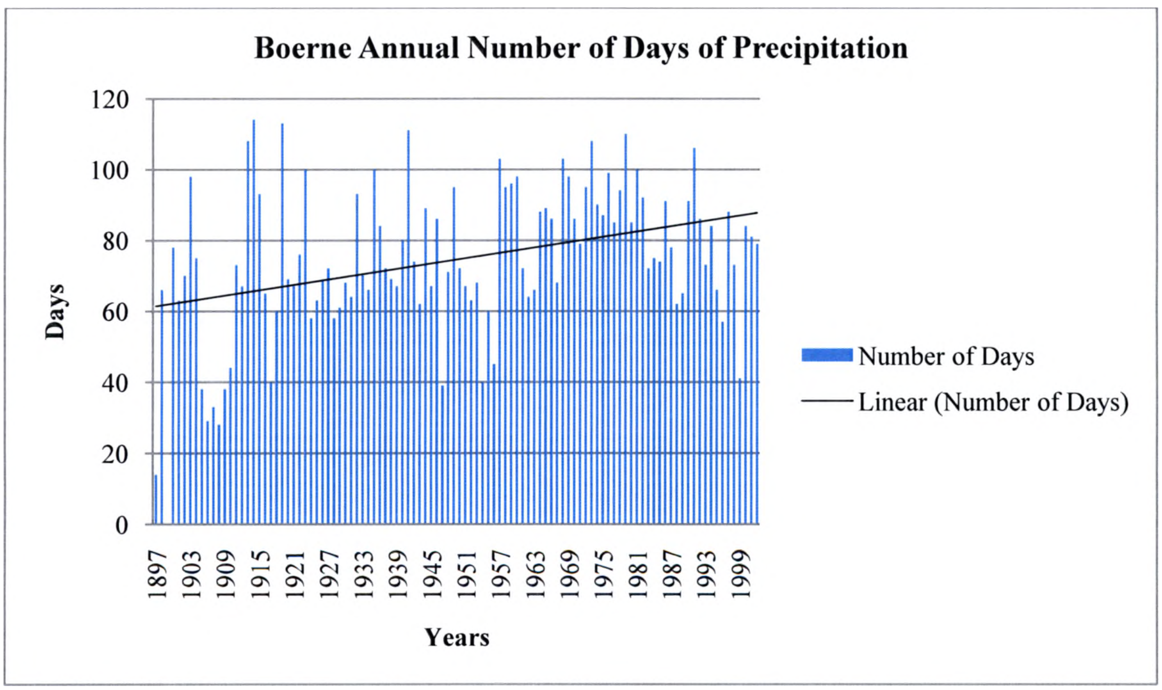

Figure 42. Boerne Annual Number of Days of Precipitation for the Period 1897-2002. Trend is significant (p = 0.000), b = 0.250.

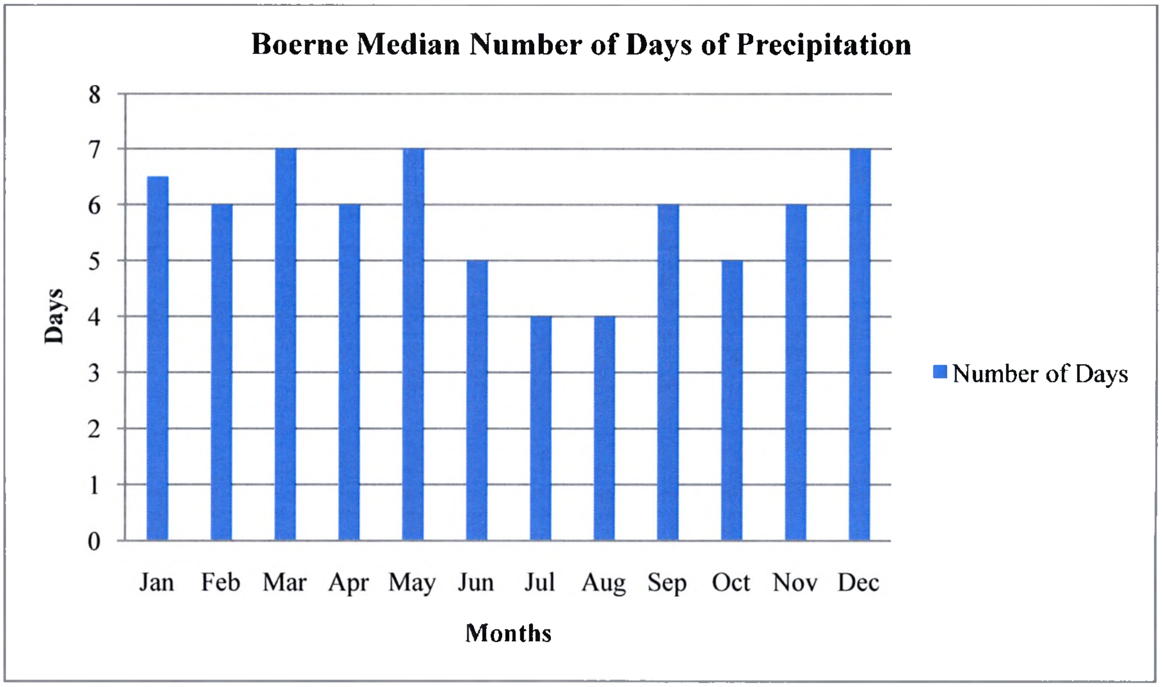

Figure 43. Boerne Median Monthly Number of Days of Precipitation for the Period 1897-2002.

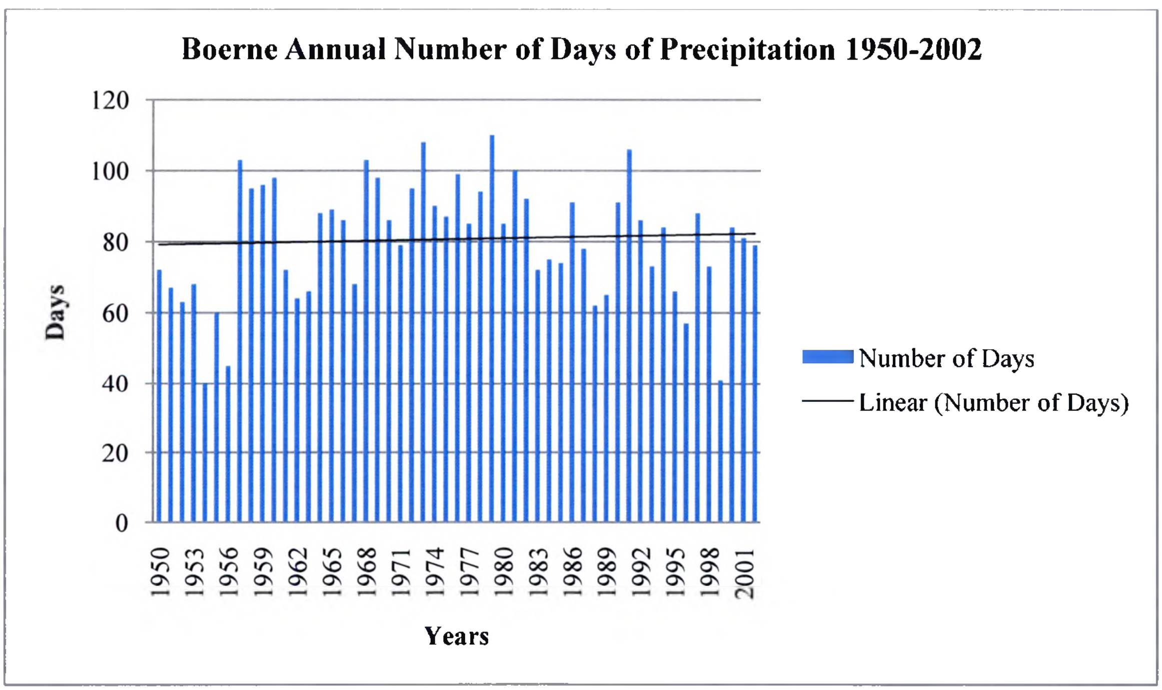

Figure 44. Boerne Annual Number of Days of Precipitation for the Period 1950-2002. Trend is not significant ($p = 0.693$), $b = 0.060$.

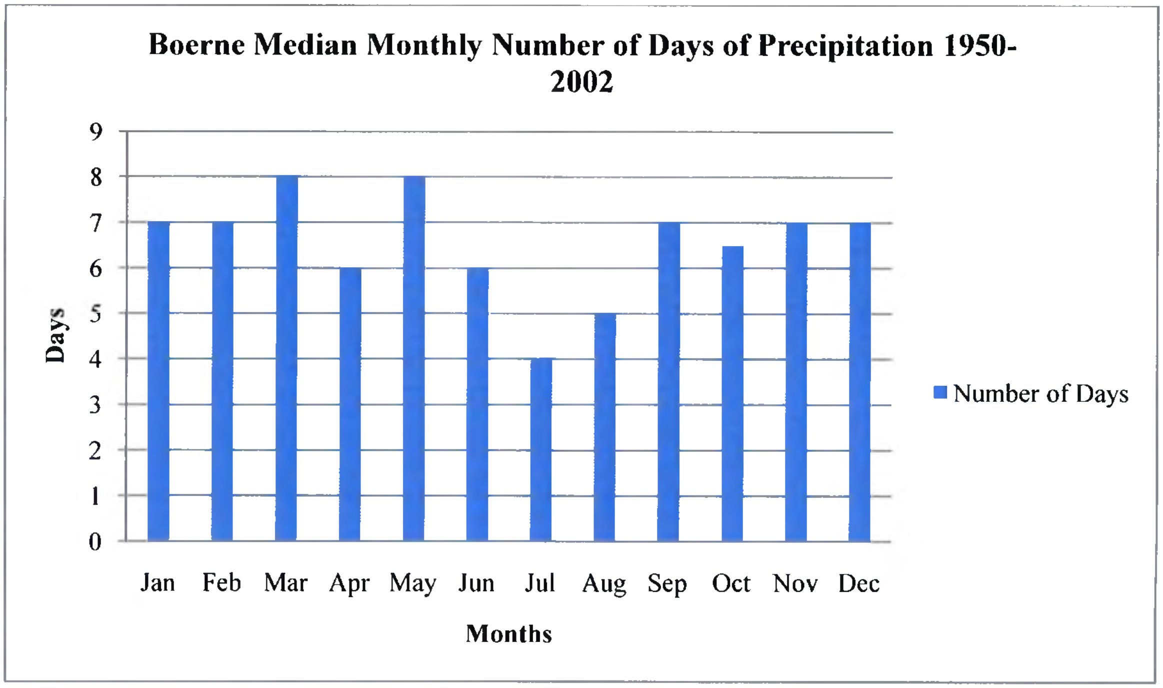

Figure 45. Boerne Median Monthly Number of Days of Precipitation for the Period 1950-2002.

5.2.4 Danevang

5.2.4.1 Period 1897-2002

Danevang station for the period 1897-2002 (105 years) shows statistically significant data with positive trends for January, February, March, May, June, August, September, October, December and the Annual Days calculations (Table 15). Annual Days shows ($p = 0.000$) and $b = 0.250$ (Figure 46). All other months are within the 90% level of confidence, and show no significant trend (Appendix 13). Median monthly values (Appendix 14) show the highest frequency of occurrence in January, February, March, May, June, July, August, September, November, and December with > 5 days of precipitation (Figure 47).

5.2.4.2 Period 1950-2002

Danevang station for the period 1950-2002 (53 years) shows statistically significant data with negative trends for April and the Annual Days calculations (Table 15). Annual Days shows (p = 0.058) and b = -0.222 (Figure 48). All other months are within the 90% level of confidence, and show no significant trend (Appendix 15). Median monthly values (Appendix 16) show the highest frequency of occurrence in all months with > 5 days of precipitation. Extreme frequencies of over 8 days occur in January, August and September (Figure 49).

Table 15. Statistically Significant Number of Days Data - Danevang

	Month	Coefficient - B	Significance (P-value)	R squared
1897-2002				
Danevang	Jan	.051	.000	.134
	Feb	.032	.004	.079
	Mar	.021	.024	.049
	May	.026	.010	.063
	Jun	.042	.000	.127
	Aug	.032	.011	.063
	Sep	.022	.061	.035
	Oct	.027	.038	.042
	Dec	.021	.047	.039
	Annual	.363	.000	.220
1950-2002				
Danevang	Apr	-.073	.003	.162
	Annual	-.222	.058	.069

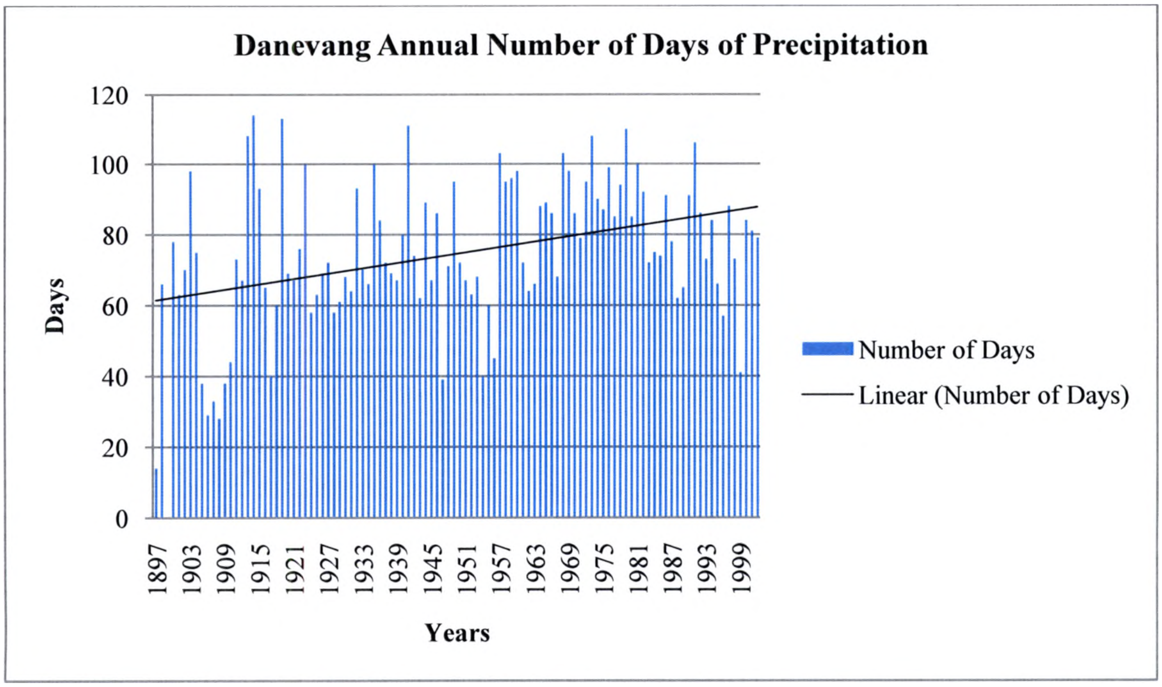

Figure 46. Danevang Annual Number of Days of Precipitation for the Period 1897-2002. Trend is significant ($p = 0.000$), $b = 0.250$.

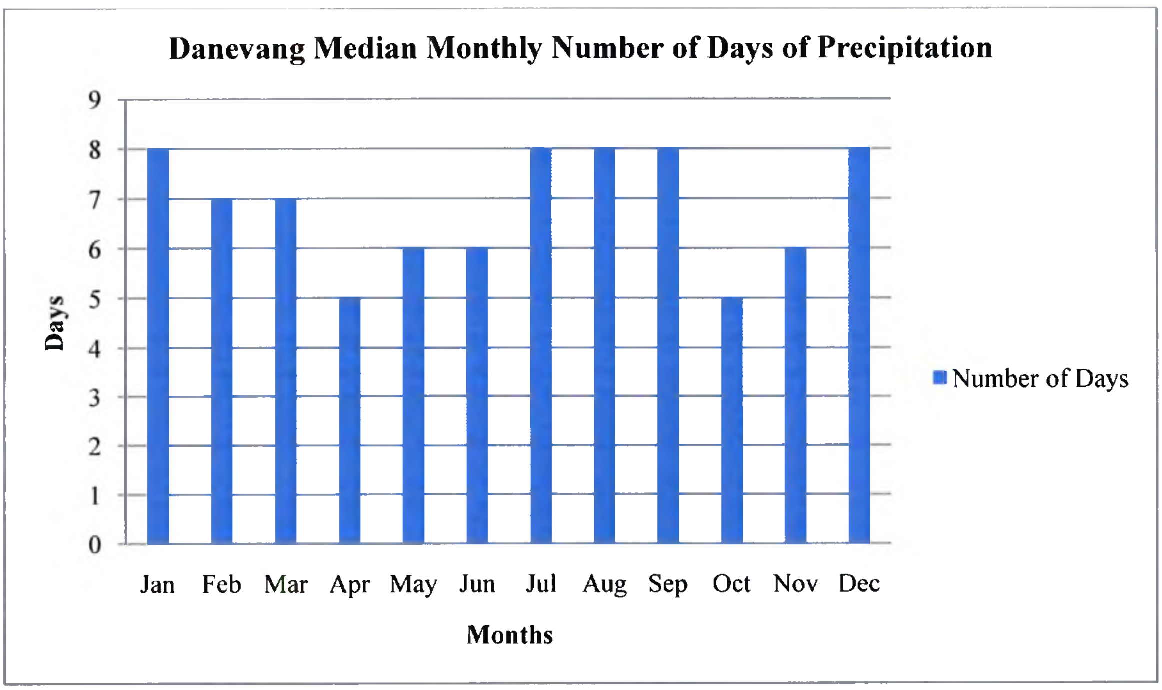

Figure 47. Danevang Median Monthly Number of Days of Precipitation for the Period 1897-2002.

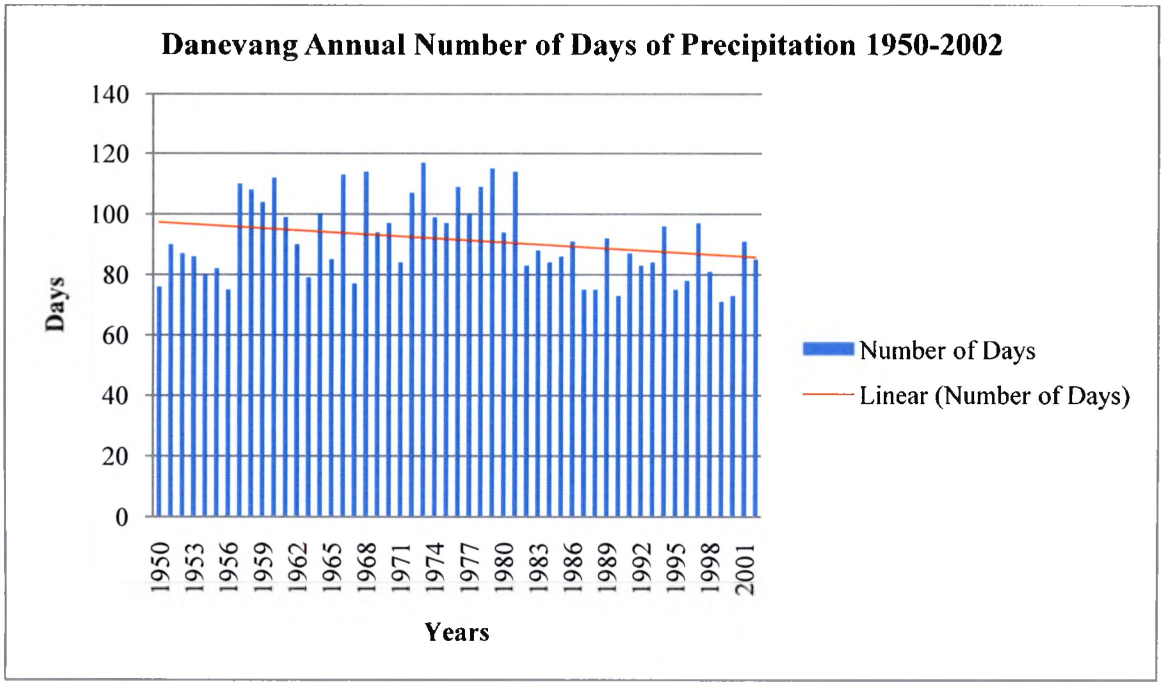

Figure 48. Danevang Annual Number of Days of Precipitation for the Period 1950-2002. Trend is significant ($p = 0.058$), $b = -0.222$.

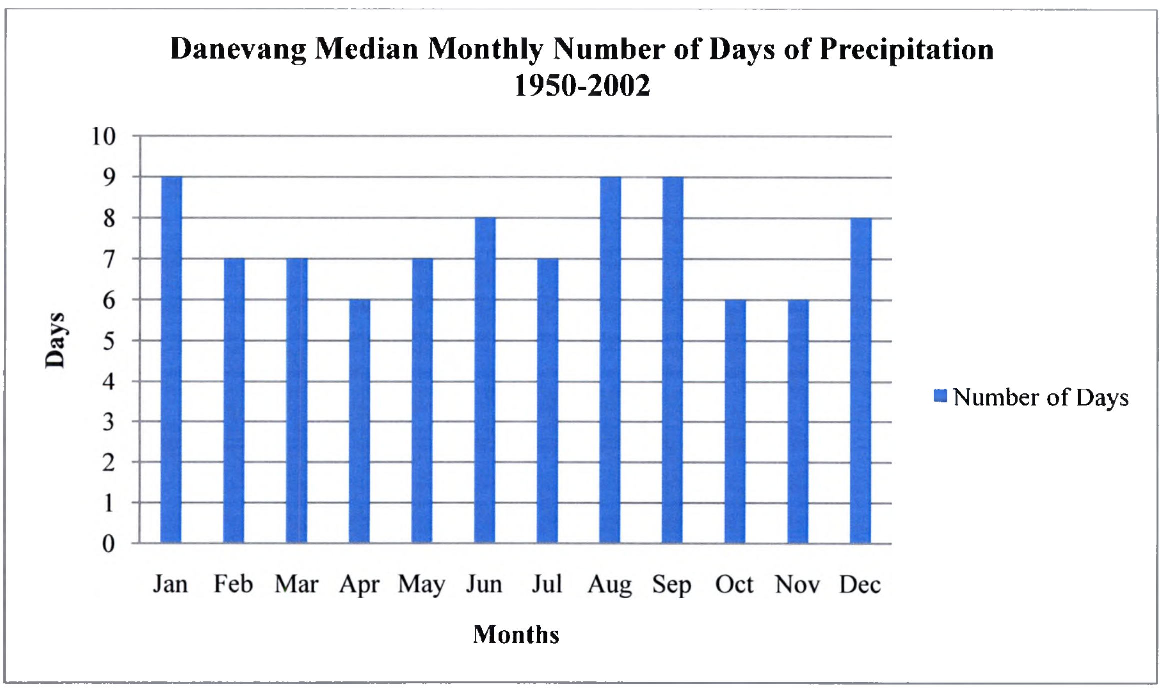

Figure 49. Danevang Median Monthly Number of Days of Precipitation for the Period 1950-2002.

5.2.5 Greenville

5.2.5.1 Period 1900-2002

Greenville station for the period 1900-2002 (102 years) shows statistically significant data with positive trends for January, March, May, June, September, October, November and the Annual Days calculations (Table 16). Annual Days shows ($p=0.001$) and $b=0.218$ (Figure 50). All other months are within the 90% level of confidence, and show no significant trend (Appendix 17). Median monthly values (Appendix 18) show the highest frequency of occurrence as January, February, March, April, May, June, September, October, November and December with > 5 days of precipitation (Figure 51).

5.2.5.2 Period 1950-2002

Greenville station for the period 1950-2002 (53 years) shows statistically significant data with negative trends for February, April, July and the Annual Days calculations (Table 16). Annual Days shows ($p = 0.012$) and $b = -0.337$ (Figure 52). All other months are within the 90% level of confidence, and show no significant trend (Appendix 19). Median monthly values (Appendix 20) show the highest frequency of occurrence as January, February, March, April, May, June, September, October, November and December with > 5 days of precipitation (Figure 53). An extreme frequency of over 8 days occurred in May.

Table 16. Statistically Significant Number of Days Data - Greenville

	Month	Coefficient - B	Significance (P-value)	R squared
1900-2002				
Greenville	Jan	.029	.018	.057
	Mar	.040	.000	.163
	May	.019	.093	.029
	Jun	.022	.038	.044
	Sep	.028	.006	.075
	Oct	.030	.006	.074
	Nov	.025	.026	.050
	Annual	.218	.001	.104
1950-2002				
Greenville	Feb	-.053	.043	.079
	Apr	-.066	.012	.121
	Jul	-.058	.026	.098
	Annual	-.337	.012	.117

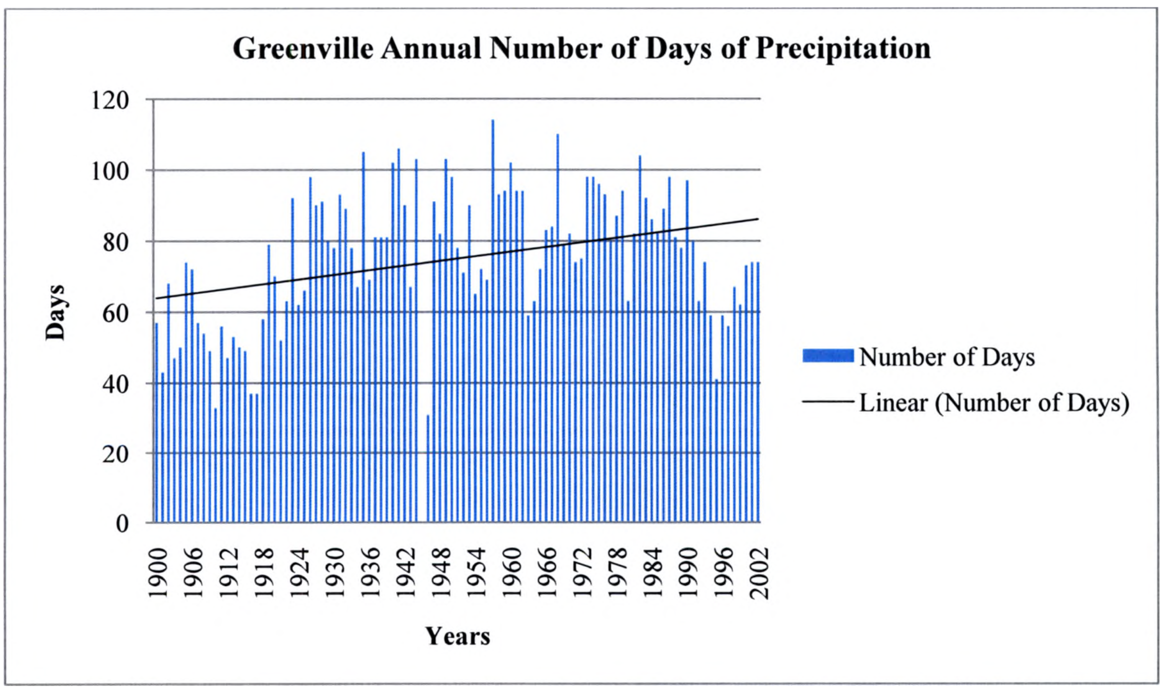

Figure 50. Greenville Annual Number of Days of Precipitation for the Period 1900-2002. Trend is significant (p = 0.001), b = 0.218.

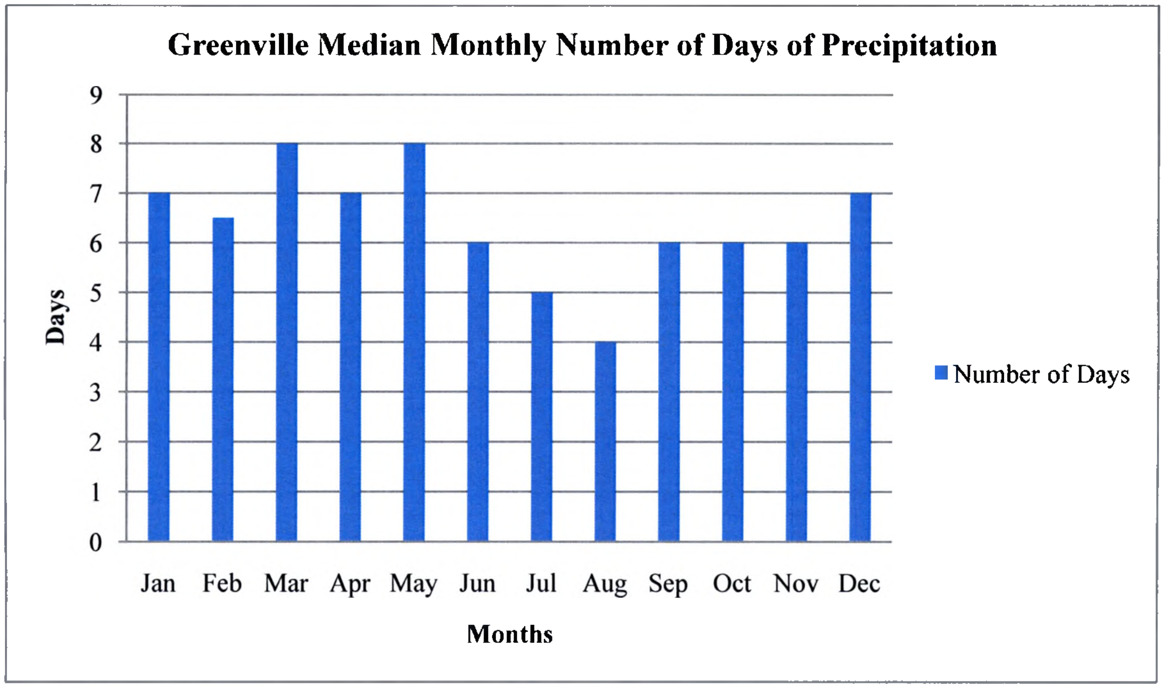

Figure 51. Greenville Median Monthly Number of Days of Precipitation for the Period 1900-2002.

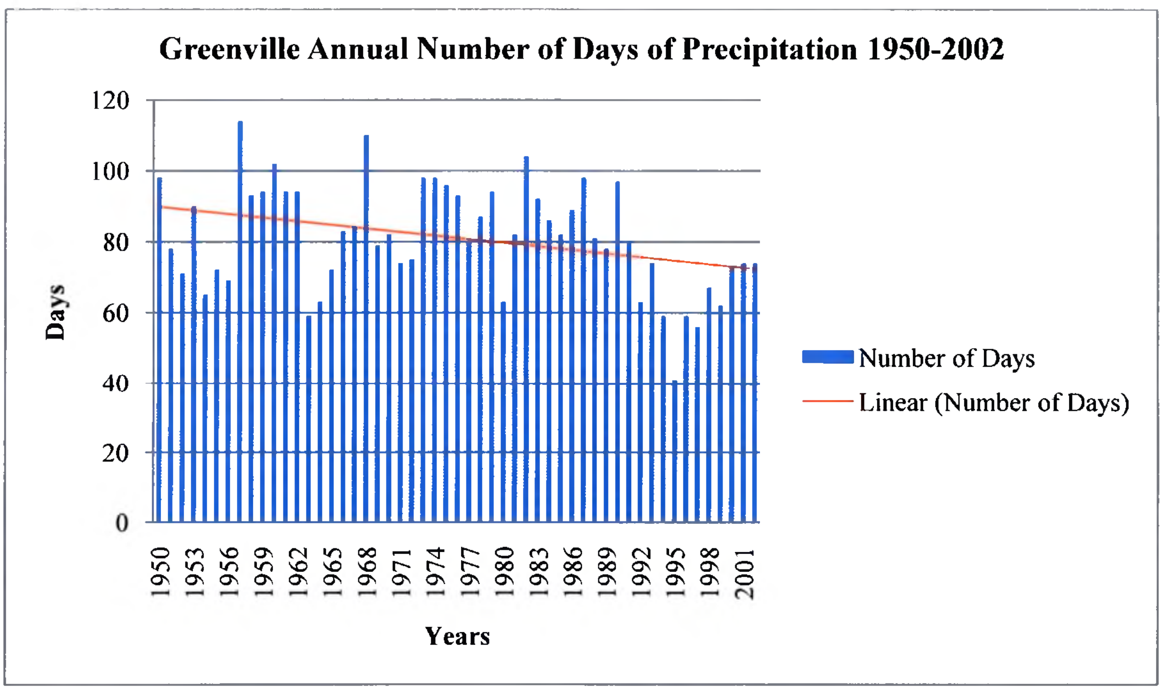

Figure 52. Greenville Annual Number of Days of Precipitation for the Period 1950-2002. Trend is significant ($p = 0.012$), $b = -0.337$.

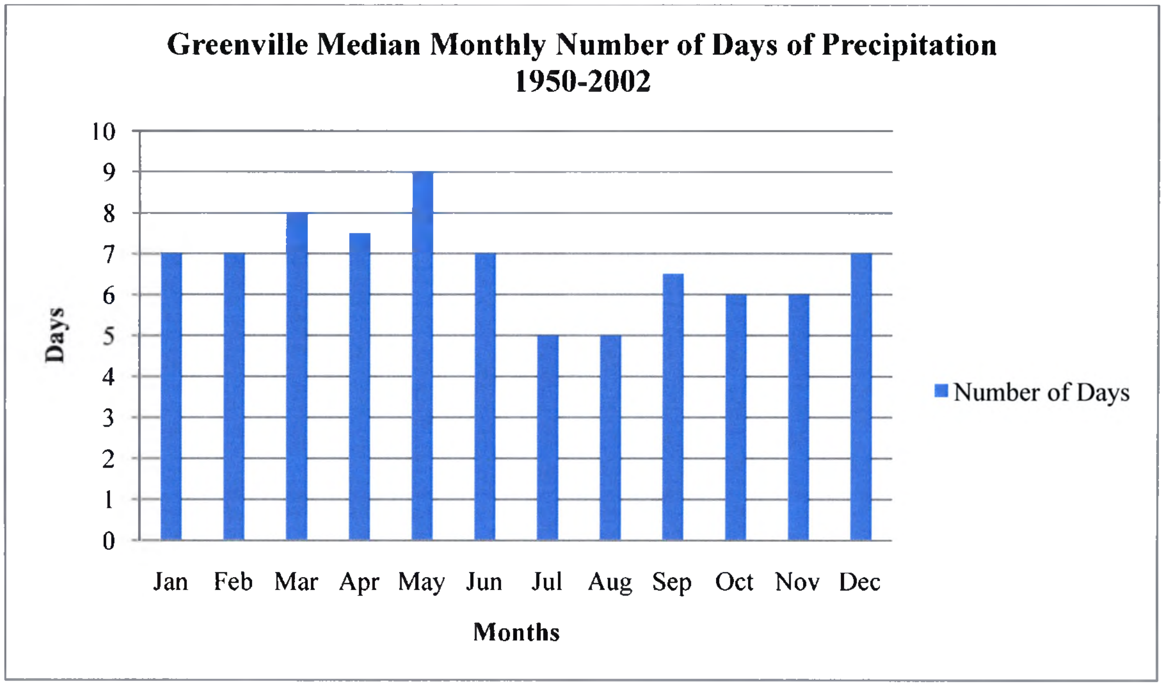

Figure 53. Greenville Median Monthly Number of Days of Precipitation for the Period 1950-2002.

5.2.6 Plainview

5.2.6.1 Period 1908-2002

Plainview station for the period 1908-2002 (95 years) shows statistically significant data with positive trends for January, February, March, December and the Annual Days calculations (Table 17). Annual Days shows ($p = 0.000$) and $b = 0.190$ (Figure 54). All other months are within the 90% level of confidence, and show no significant trend (Appendix 21). Median monthly values (Appendix 22) show the highest frequency of occurrence as May, June, July, August and September with > 5 days of precipitation (Figure 55).

5.2.6.2 Period 1950-2002

Plainview station for the period 1950-2002 (53 years) shows statistically significant data with a negative trend for July, only (Table 17). Annual Days shows ($p = 0.290$) and $b = 0.127$ (Figure 56). All other months are within the 90% level of confidence, and show no significant trend (Appendix 23). Median monthly values (Appendix 24) show the highest frequency of occurrence as May, June, July and August with > 5 days of precipitation (Figure 57).

Table 17. Statistically Significant Number of Days Data - Plainview

	Month	Coefficient - B	Significance (P-value)	R squared
1908-2002				
Plainview	Jan	.018	.048	.042
	Feb	.022	.034	.048
	Mar	.021	.029	.052
	Dec	.016	.093	.030
	Annual	.190	.000	.124
1950-2002				
Plainview	Jul	-.045	.065	.068

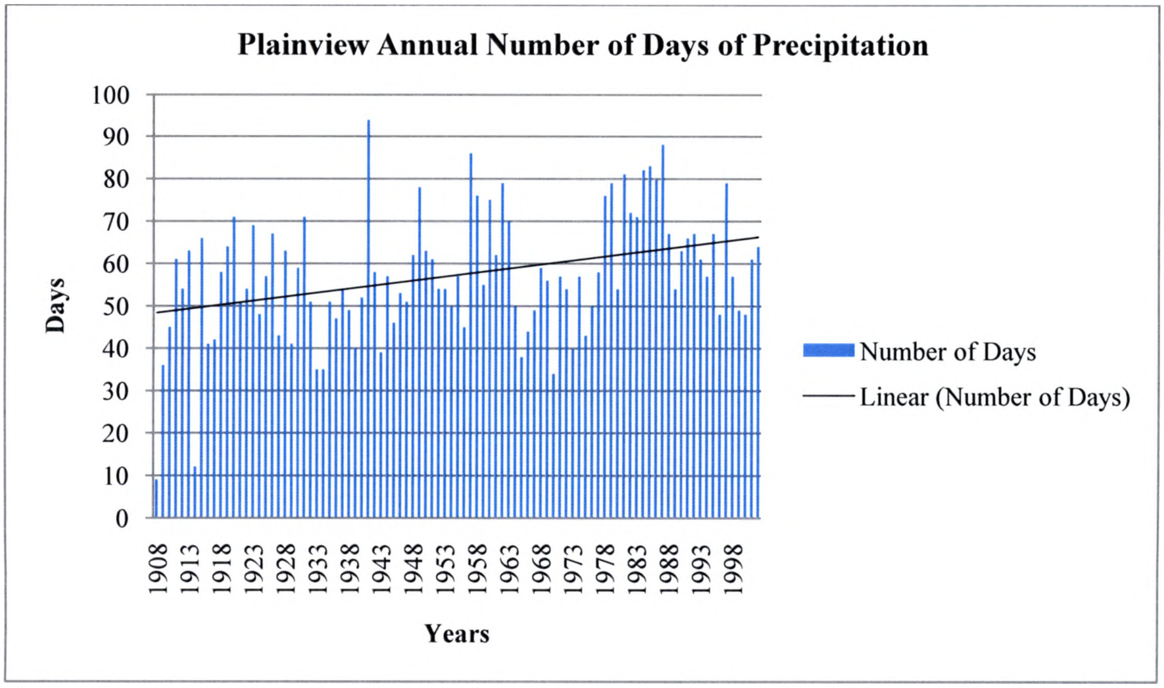

Figure 54. Plainview Annual Number of Days of Precipitation for the Period 1908-2002. Trend is significant (p = 0.000), b = 0.190.

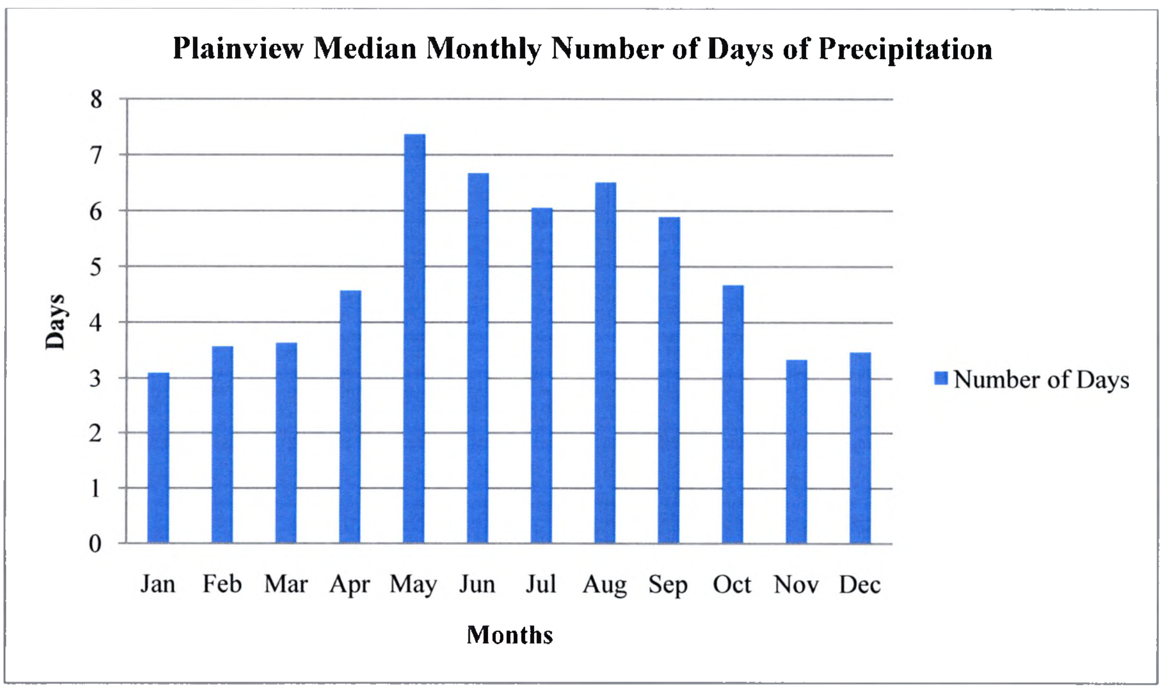

Figure 55. Plainview Median Monthly Number of Days of Precipitation for the Period 1950-2002.

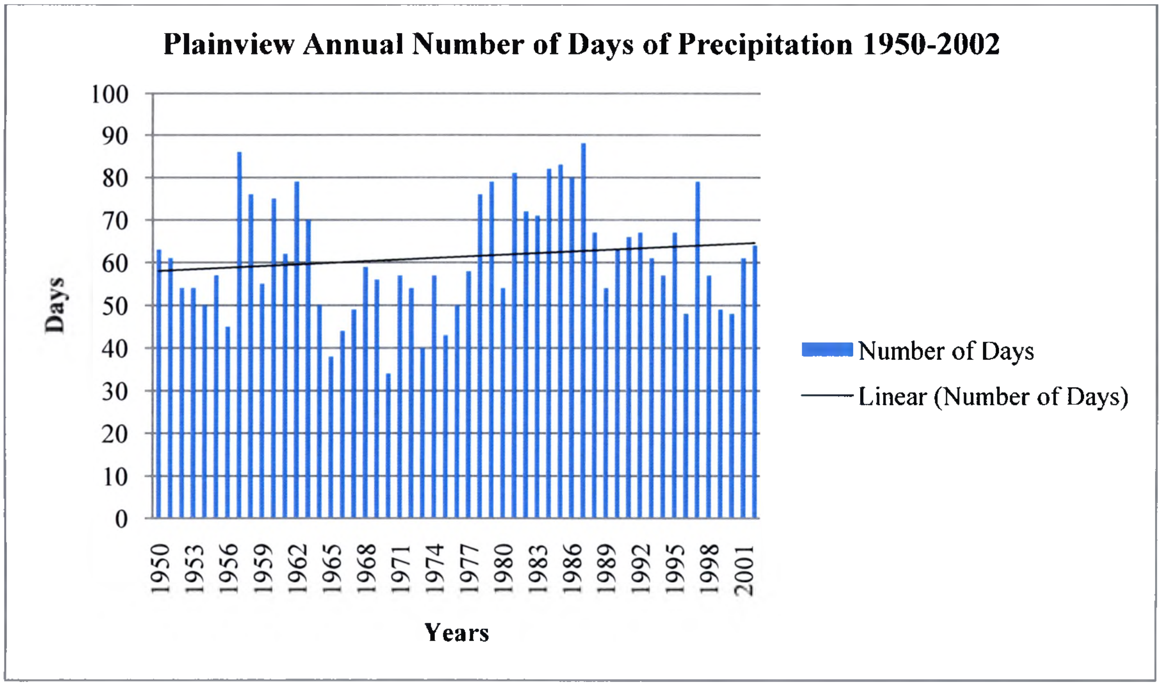

Figure 56. Plainview Annual Number of Days of Precipitation for the Period 1950-2002. Trend is not significant ($p = 0.290$), $b = 0.127$.

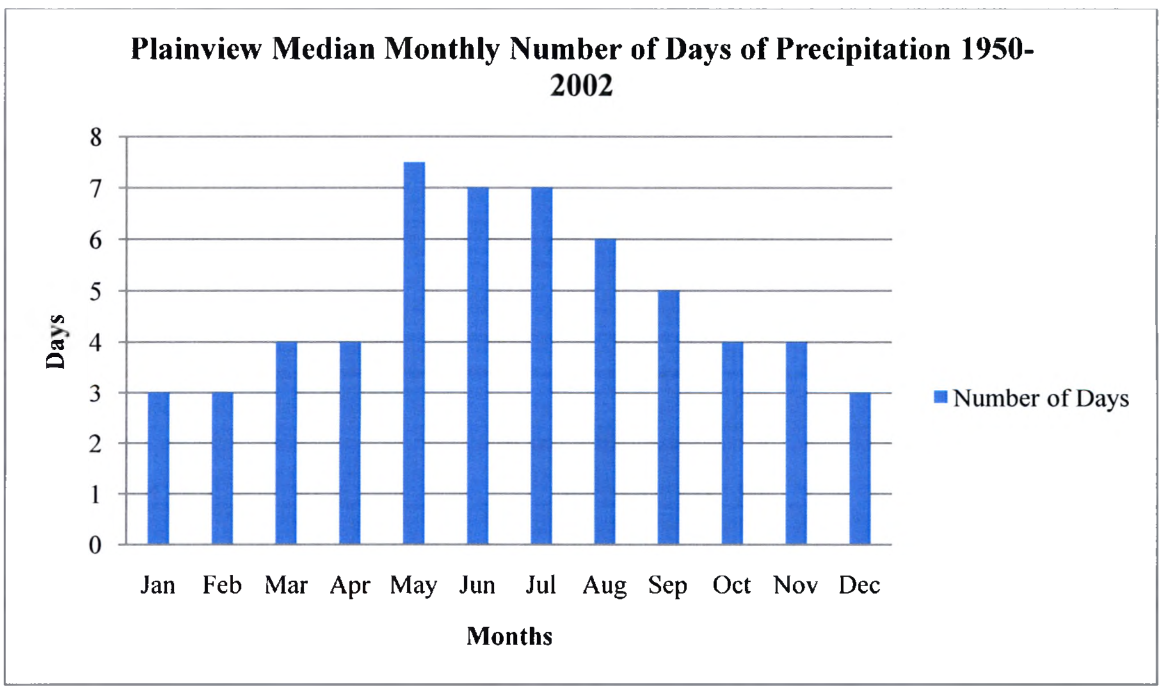

Figure 57. Plainview Median Monthly Number of Days of Precipitation for the Period 1950-2002.

5.2.7 Rio Grande City

5.2.7 1 Period 1897-2002

Rio Grande City station for the period 1897-2002 (85 years) shows statistically significant data with positive trends for January, February, April, November, December and the Annual Days calculations (Table 18). Annual Days shows ($p = 0.000$) and $b = 0.337$ (Figure 58). All other months are within the 90% level of confidence, and show no significant trend (Appendix 25). Median monthly values (Appendix 26) show the highest frequency of occurrence as January and September with > 5 days of precipitation (Figure 59).

5.2 7.2 Period 1950-2002

Rio Grande City station for the period 1950-2002 (53 years) shows statistically significant data with positive trends for November, December and the Annual Days calculations (Table 18). Annual Days shows ($p = 0.010$) and $b = 0.355$ (Figure 60). All other months are within the 90% level of confidence, and show no significant trend (Appendix 27). Median monthly values (Appendix 28) show the highest frequency of occurrence as January and September with > 5 days of precipitation (Figure 61).

Table 18. Statistically Significant Number of Days Data – Rio Grande City

	Month	Coefficient - B	Significance (P-value)	R squared
1897-2002				
Rio Grande City	Jan	.047	.008	.084
	Feb	.033	.006	.089
	Apr	.030	.005	.095
	Nov	.027	.020	.067
	Dec	.038	.017	.069
	Annual	.337	.000	.230
1950-2002				
Rio Grande City	Nov	.046	.080	.060
	Dec	.065	.073	.063
	Annual	.355	.010	.124

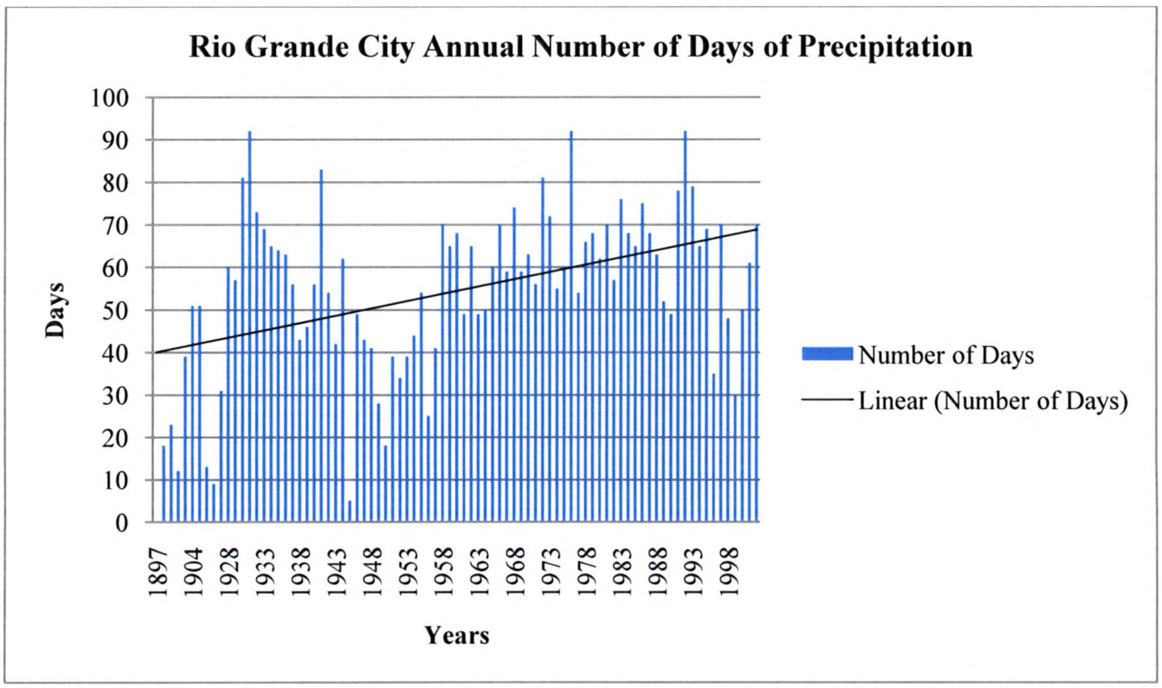

Figure 58. Rio Grande City Annual Number of Days of Precipitation for the Period 1897-2002. Trend is significant (p = 0.000), b = 0.337.

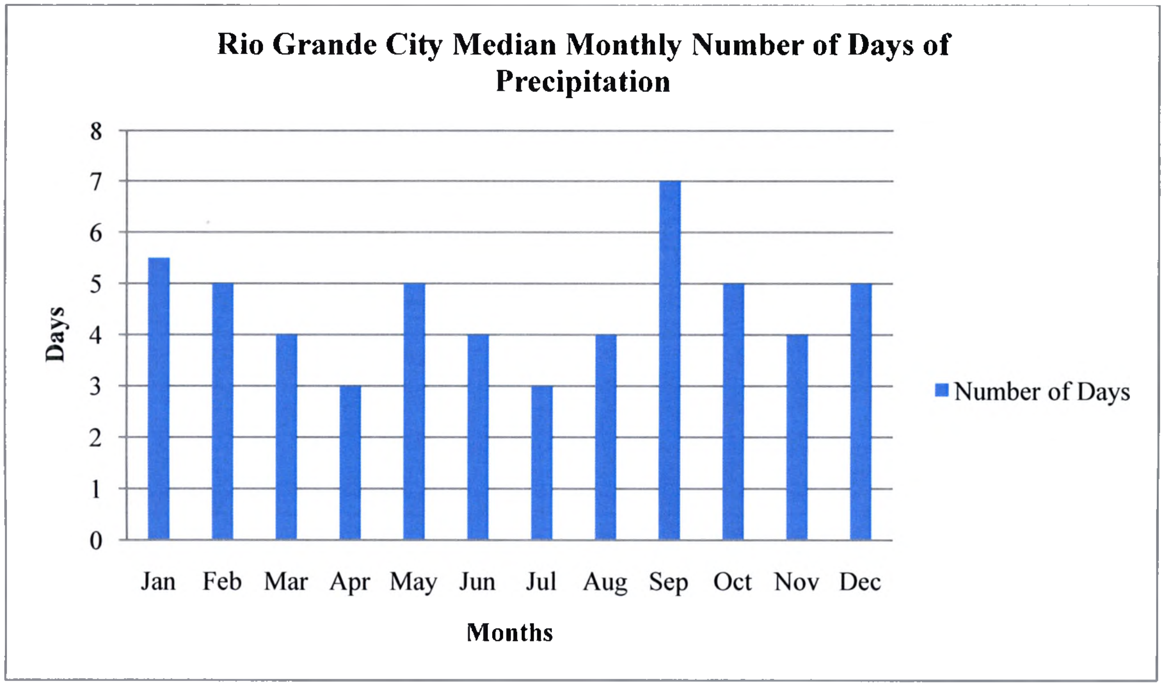

Figure 59. Rio Grande City Median Monthly Number of Days of Precipitation for the Period 1897-2002.

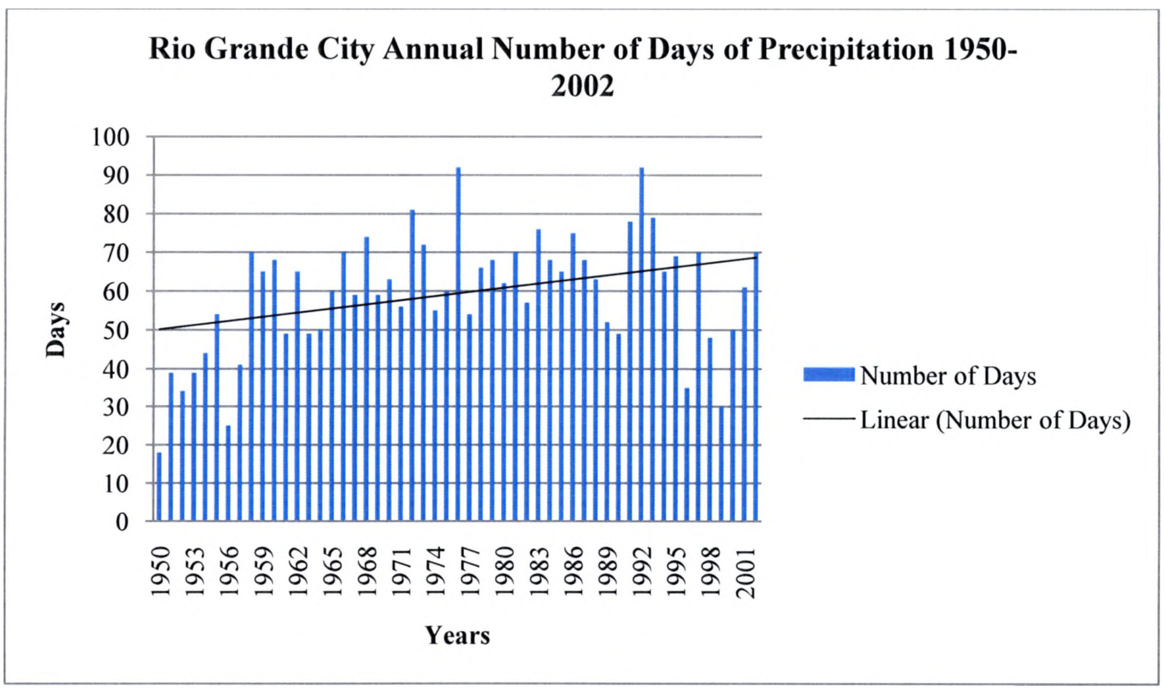

Figure 60. Rio Grande City Annual Number of Days of Precipitation for the Period 1950-2002. Trend is significant ($p = 0.010$), $b = 0.355$.

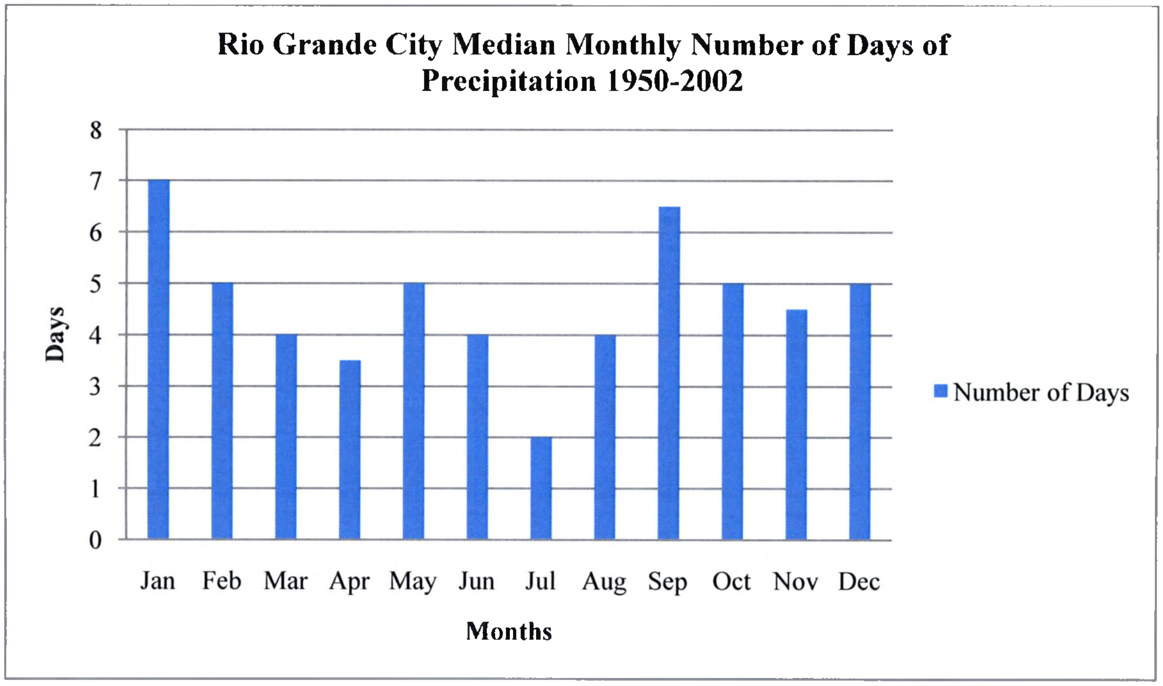

Figure 61. Rio Grande City Median Monthly Number of Days of Precipitation for the Period 1950-2002.

5.2.8 Temple

5.2.8.1 Period 1897-2002

Temple station for the period 1897-2002 (105 years) shows statistically significant data with positive trends for January, June, September and the Annual Days calculations (Table 19). Annual Days shows ($p = 0.081$) and $b = 0.105$ (Figure 62). All other months are within the 90% level of confidence, and show no significant trend (Appendix 29). Median monthly values (Appendix 30) show the highest frequency of occurrence as January, February, March, April, May, June, November and December with > 5 days of precipitation (Figure 63).

5.2.8.2 Period 1950-2002

Temple station for the period 1950-2002 (53 years) shows statistically significant data with only positive trends for April calculations (Table 19). Annual Days shows ($p = 0.983$) and $b = 0.004$ (Figure 64). All other months are within the 90% level of confidence, and show no significant trend (Appendix 31). Median monthly values (Appendix 32) show the highest frequency of occurrence as January, February, March, April, May, June, September, November and December with > 5 days of precipitation (Figure 65).

Table 19. Statistically Significant Number of Days Data – Temple

	Month	Coefficient - B	Significance (P-value)	R squared
1897-2002				
Temple	Jan	.023	.055	.035
	Jun	.019	.065	.033
	Sep	.020	.060	.035
	Annual	.105	.081	.29
1950-2002				
Temple	Apr	-.069	.013	.121

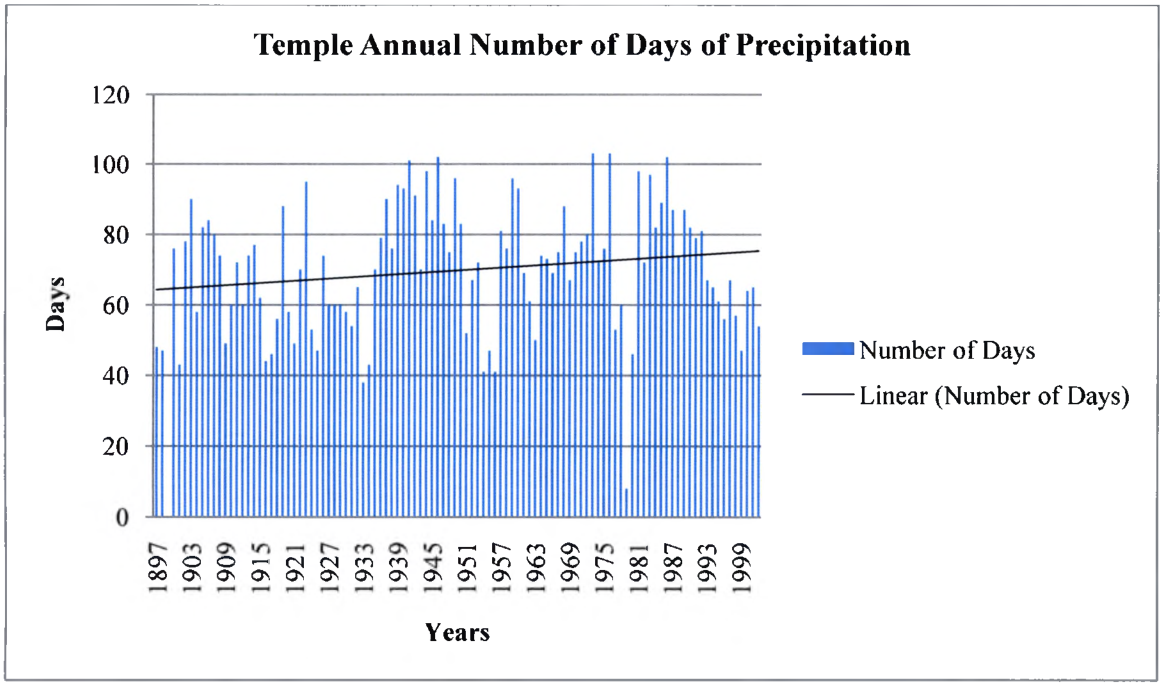

Figure 62. Temple Annual Number of Days of Precipitation for the Period 1897-2002. Trend is significant (p = 0.081), b = 0.105.

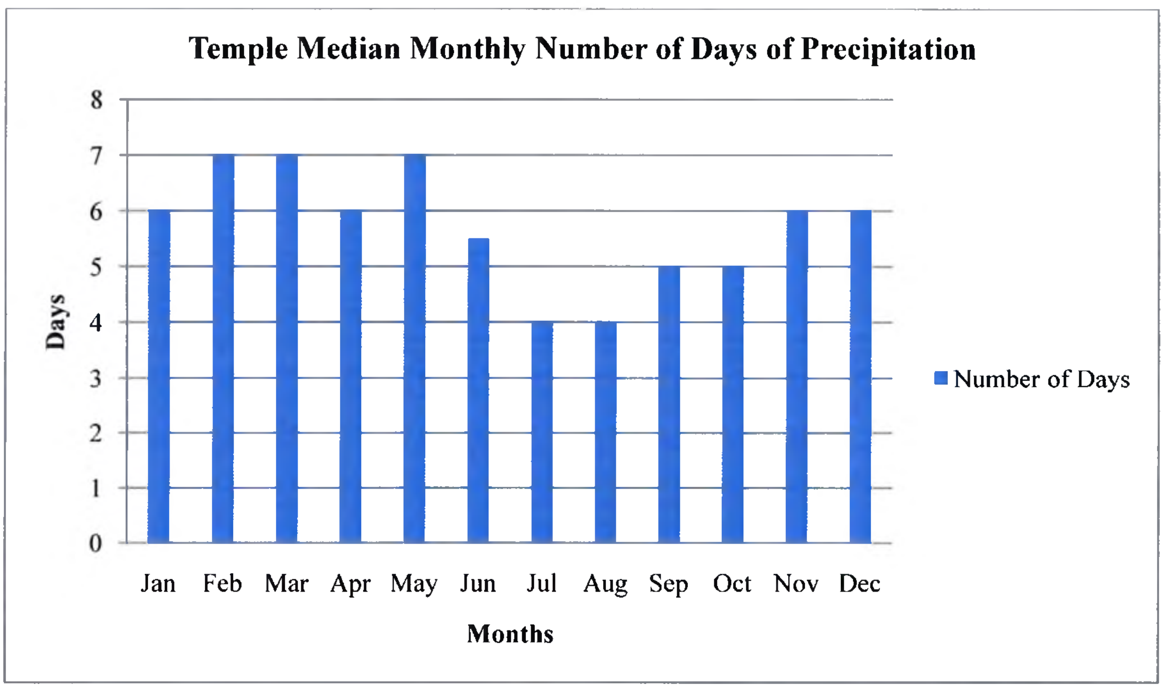

Figure 63. Temple Median Monthly Number of Days of Precipitation for the Period 1897-2002.

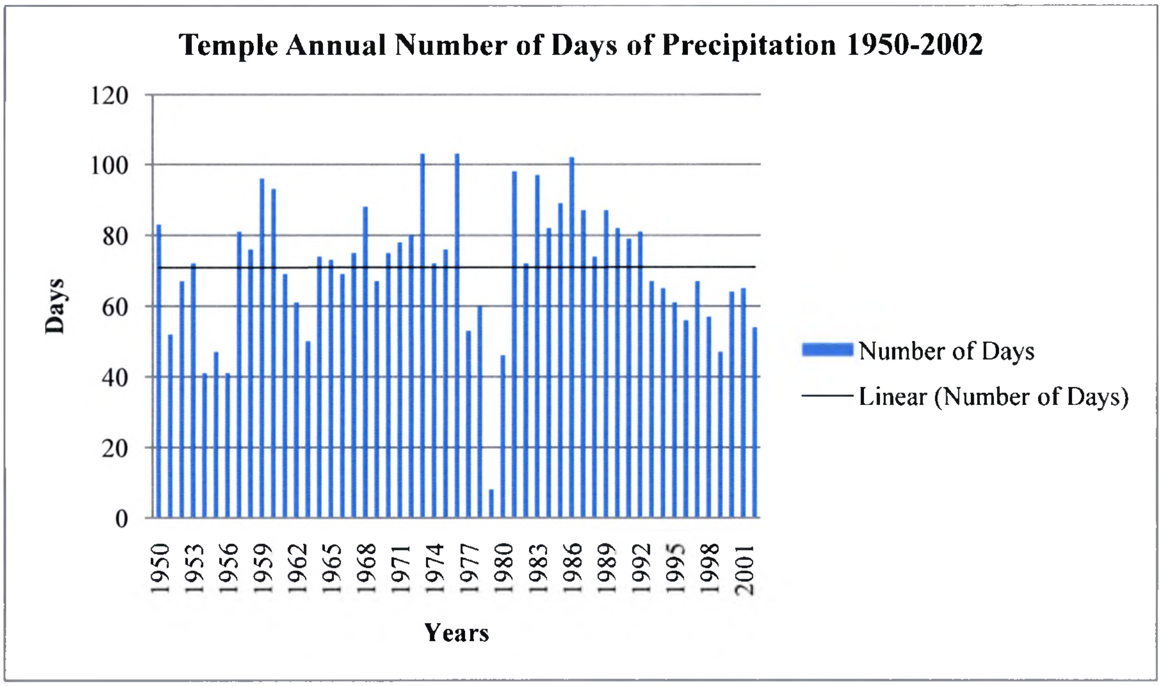

Figure 64. Temple Annual Number of Days of Precipitation for the Period 1950-2002. Trend is not significant ($p = 0.983$), $b = 0.004$.

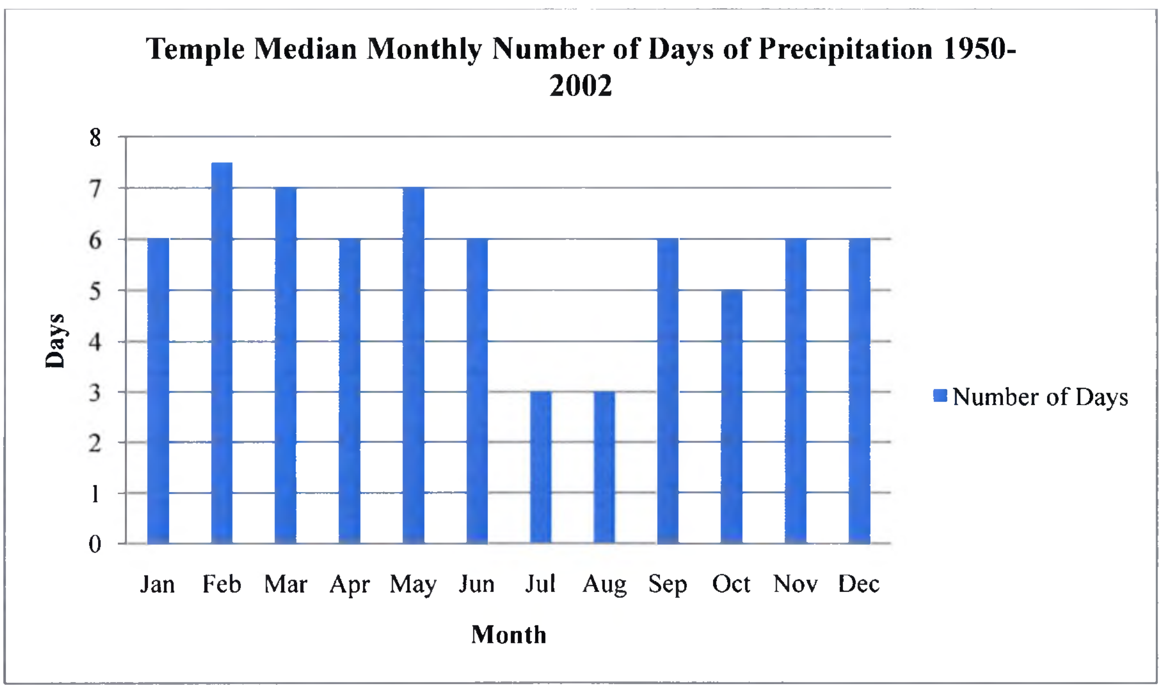

Figure 65. Temple Median Monthly Number of Days of Precipitation for the Period 1950-2002.

5.3 Intensity

Precipitation intensity was calculated by dividing the total monthly precipitation by the number of days with precipitation for each month in order to express a value that indicates the strength of precipitation occurrence. Intensity is a variable that will be related in monthly values, only (Table 20). No annual or cumulative totals should be used to express the concept, except as a single mean or median value, and a single value would not suggest a trend.

Each data site is discussed using raw data values (descriptives) and statistical analysis using linear regressions to determine current trends for the periods of available data. These periods vary at each site, with the starting year ranging from 1897 to 1923, and are sub-divided into a secondary study period of 1950-2002 in order to narrow the scope and include the effects of the severe drought during the 1950s. Annual minimums, maximums and means were affected by missing or incomplete data, but all available data was used to maximize the weight of monthly data. Medians were used to lessen the effect of extreme or missing values.

Table 20. Occurrence of Statistically Significant P-values for Monthly Precipitation Intensity for the Period covering 1897-2002

INTENSITY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Albany												
Balmorhea		↑						↑	↑			↑
Boerne			↓	↓			↓			↓		
Danevang	↓	↓	↓	↓			↓				↓	↓
Greenville				↓								
Plainview		↓		↓			↓	↓		↓		
Rio Grande City			↓	↓	↓		↓					
Temple				↓				↑			↓	

↓ – negative trend (Coefficient B); ↑ - positive trend (Coefficient B)

5.3.1 Albany

5.3.1.1 Period 1901-2002

Albany station for the period 1901-2002 (102 years) shows no statistically significant data (Table 21). All months are within the 90% level of confidence, and show no significant trend (Appendix 1). Median monthly values (Appendix 2) show the greatest intensity for April, May, June, July, September and October with > 0.4 inches per occurrence (Figure 66).

5.3.1.2 Period 1950-2002

Albany station for the period 1950-2002 (53 years) shows statistically significant data with positive trends for January, February, March, October and November calculations (Table 21). All other months are within the 90% level of confidence, and show no significant trend (Appendix 3). Median monthly values (Appendix 4) show the greatest intensity for April, May, June, July, September and October with > 0.4 inches per occurrence (Figure 67).

Table 21. Statistically Significant Intensity Data - Albany

	Month	Coefficient - B	Significance (P-value)	R squared
1950-2002				
Albany	Jan	.004	.049	.080
	Feb	.005	.016	.113
	Mar	.008	.000	.296
	Oct	.005	.084	.060
	Nov	.005	.092	.057

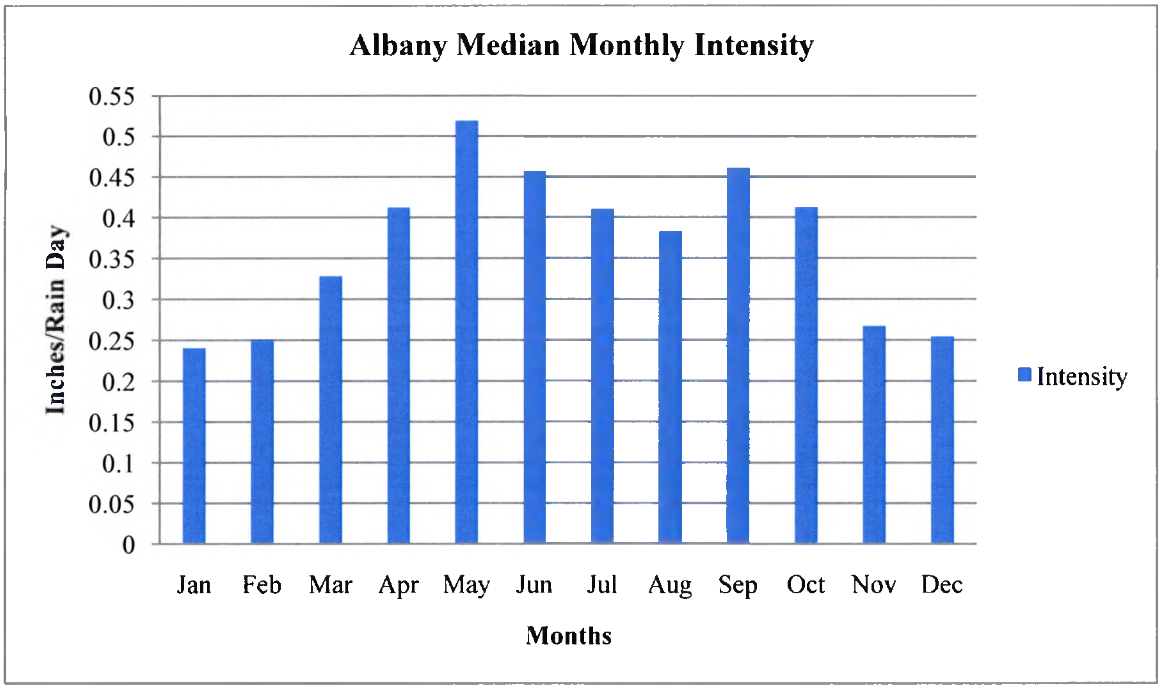

Figure 66. Albany Median Monthly Intensity for the Period 1901-2002.

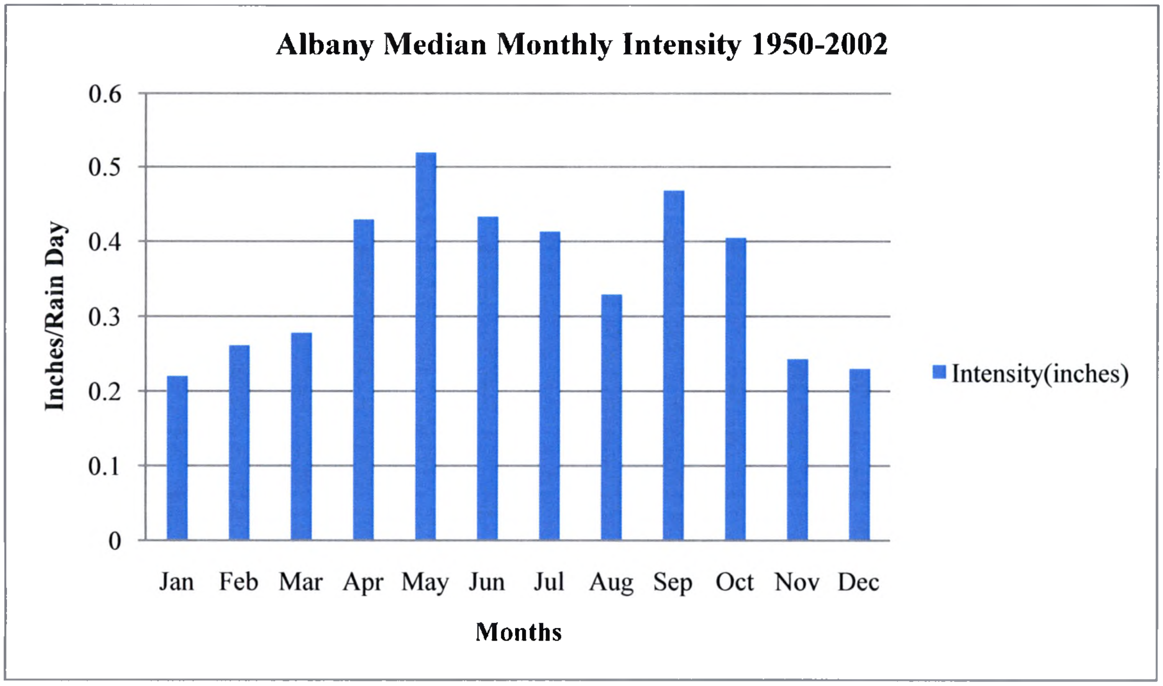

Figure 67. Albany Median Monthly Intensity for the Period 1901-2002.

5.3.2 Balmorhea

5.3.2.1 Period 1923-2002

Balmorhea station for the period 1923-2002 (80 years) shows statistically significant data with positive trends for February, August, September and December calculations (Table 22). All other months are within the 90% level of confidence, and show no significant trend (Appendix 5). Median monthly values (Appendix 6) show no months with intensity values > 0.4 inches of precipitation (Figure 68).

5.3.2.2 Period 1950-2002

Balmorhea station for the period 1950-2002 (53 years) shows statistically significant data with positive trends for August, September and December calculations (Table 22). All other months are within the 90% level of confidence, and show no significant trend (Appendix 7). Median monthly values (Appendix 8) show no months with intensity values > 0.4 inches of precipitation (Figure 69).

Table 22. Statistically Significant Intensity Data - Balmorhea

	Month	Coefficient - B	Significance (P-value)	R squared
1923-2002				
Balmorhea	Feb	.002	.034	.057
	Aug	.002	.005	.102
	Sep	.003	.024	.066
	Dec	.002	.032	.060
	Annual	.033	.000	.522
1950-2002				
Balmorhea	Aug	.006	.000	.248
	Sep	.004	.090	.057
	Dec	.006	.013	.119
	Annual	.019	.024	.096

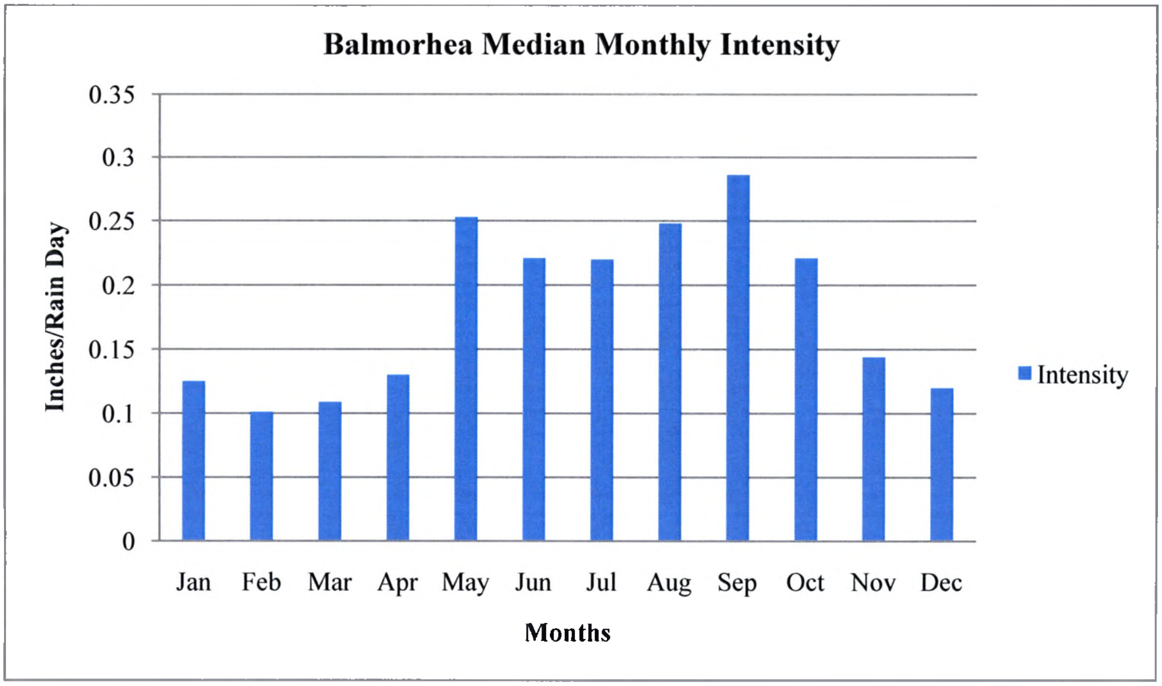

Figure 68. Balmorhea Median Monthly Intensity for the Period 1923-2002.

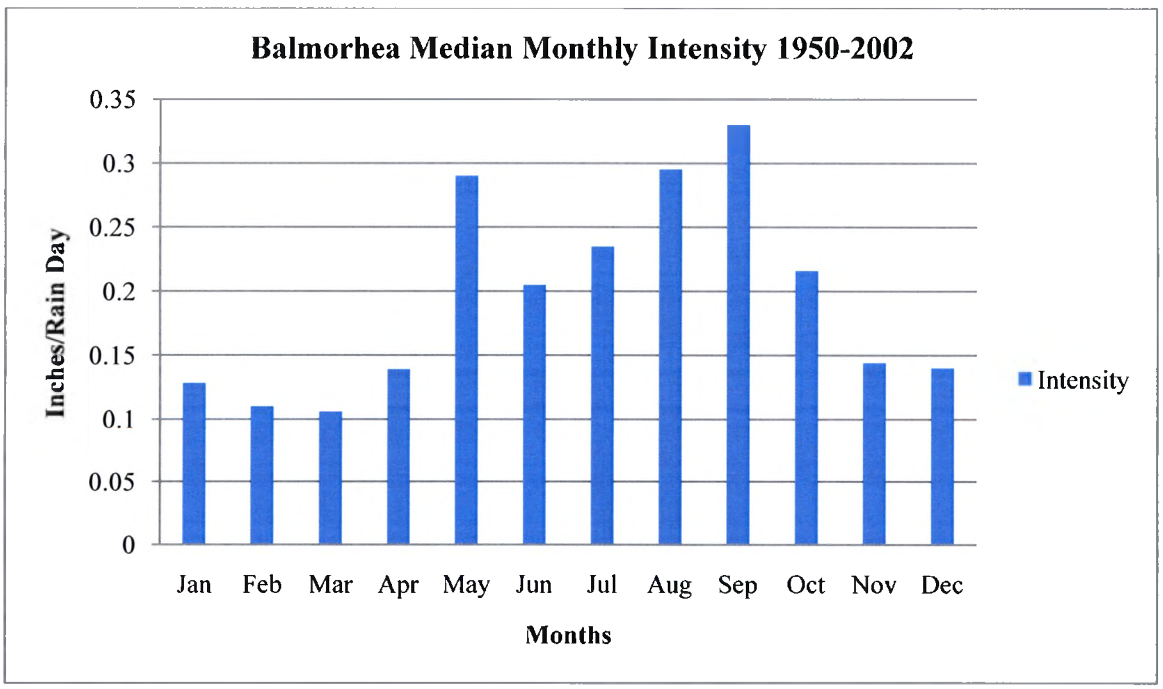

Figure 69. Balmorhea Median Monthly Intensity for the Period 1950-2002.

5.3.3 Boerne

5.3.3.1 Period 1897-2002

Boerne station for the period 1897-2002 (106 years) shows statistically significant data with negative trends for March, April, July and October calculations (Table 23). All other months are within the 90% level of confidence, and show no significant trend (Appendix 9). Median monthly values (Appendix 10) show the greatest intensity for April, May, June, September and October with > 0.4 inches per occurrence (Figure 70).

5.3.3.2 Period 1950-2002

Boerne station for the period 1950-2002 (53 years) shows statistically significant data with positive trends for March, June and November calculations (Table 23). All other months are within the 90% level of confidence, and show no significant trend (Appendix 11). Median monthly values (Appendix 12) show the greatest intensity for May, June, September and October with > 0.4 inches per occurrence (Figure 71).

Table 23. Statistically Significant Intensity Data - Boerne

	Month	Coefficient - B	Significance (P-value)	R squared
1897-2002				
Boerne	Mar	-.002	.018	.055
	Apr	-.003	.001	.105
	Jul	-.003	.085	.029
	Oct	-.003	.060	.036
	Annual	-.010	.090	.027
1950-2002				
Boerne	Mar	.004	.008	.134
	Jun	.005	.060	.068
	Nov	.004	.027	.092
	Annual	.038	.001	.190

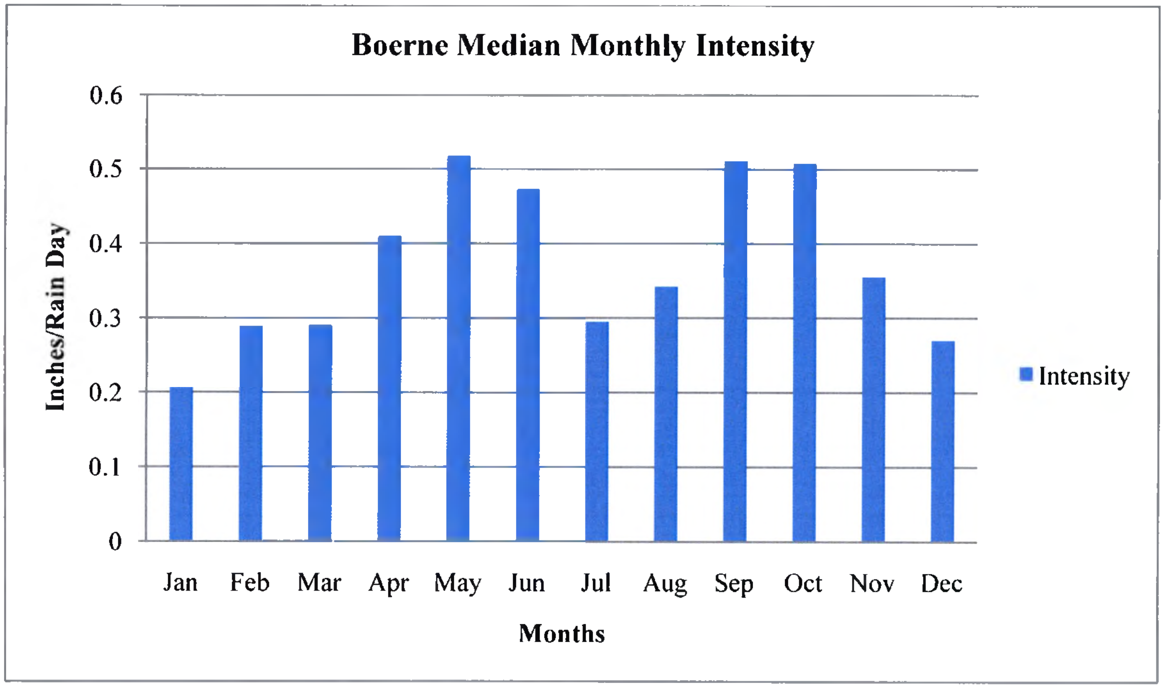

Figure 70. Boerne Median Monthly Intensity for the Period 1897-2002.

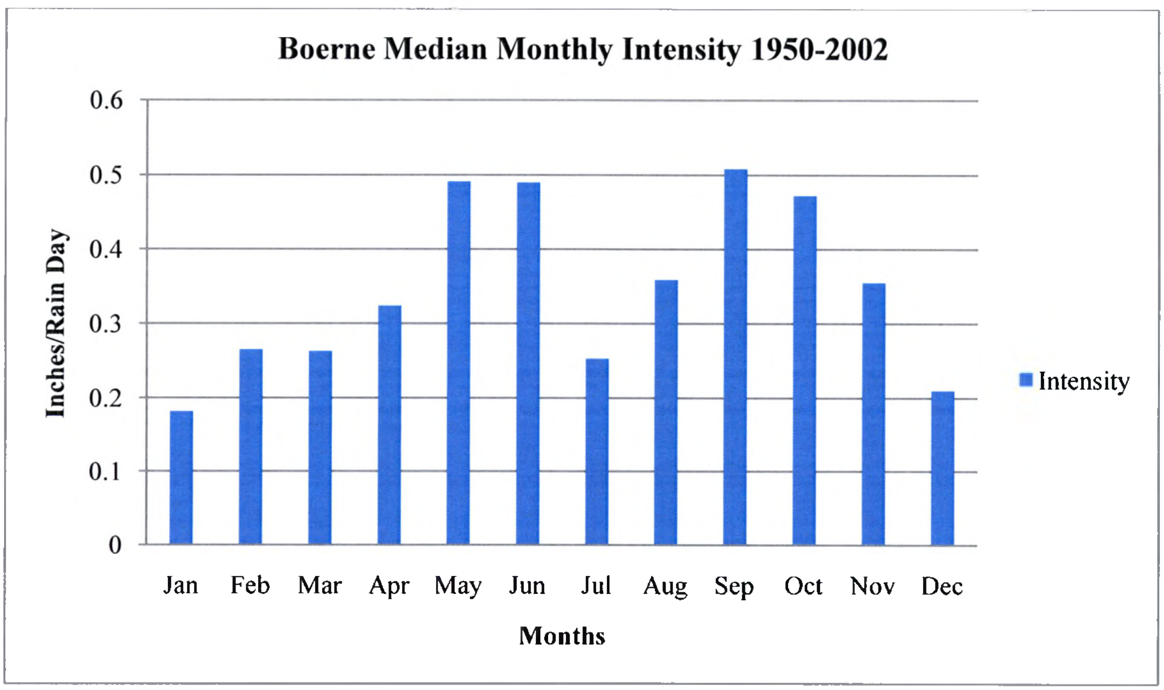

Figure 71. Boerne Median Monthly Intensity for the Period 1950-2002.

5.3.4 Danevang

5.3.4.1 Period 1897-2002

Danevang station for the period 1897-2002 (105 years) shows statistically significant data with negative trends for January, February, March, April, July, November and December calculations (Table 24). All other months are within the 90% level of confidence, and show no significant trend (Appendix 13). Median monthly values (Appendix 14) show the greatest intensity for April, May, June, July, September and October with > 0.4 inches per occurrence (Figure 72).

5.3.4.2 Period 1950-2002

Danevang station for the period 1950-2002 (53 years) shows statistically significant data with positive trends for January, March, April, July, October, November and December calculations (Table 24). All other months are within the 90% level of confidence, and show no significant trend (Appendix 15). Median monthly values (Appendix 16) show the greatest intensity for May, June, September, October and November with > 0.4 inches per occurrence (Figure 73).

Table 24. Statistically Significant Intensity Data - Danevang

	Month	Coefficient - B	Significance (P-value)	R squared
1897-2002				
Danevang	Jan	-.002	.020	.052
	Feb	-.004	.001	.111
	Mar	-.002	.087	.028
	Apr	-.004	.014	.058
	Jul	-.002	.034	.044
	Nov	-.004	.014	.061
	Dec	-.004	.000	.180
	Annual	-.015	.042	.039
1950-2002				
Danevang	Jan	.004	.013	.115
	Mar	.009	.001	.207
	Apr	.006	.060	.068
	Jul	.005	.021	.102
	Oct	.013	.005	.146
	Nov	.007	.004	.148
	Dec	.004	.044	.077
	Annual	.051	.001	.210

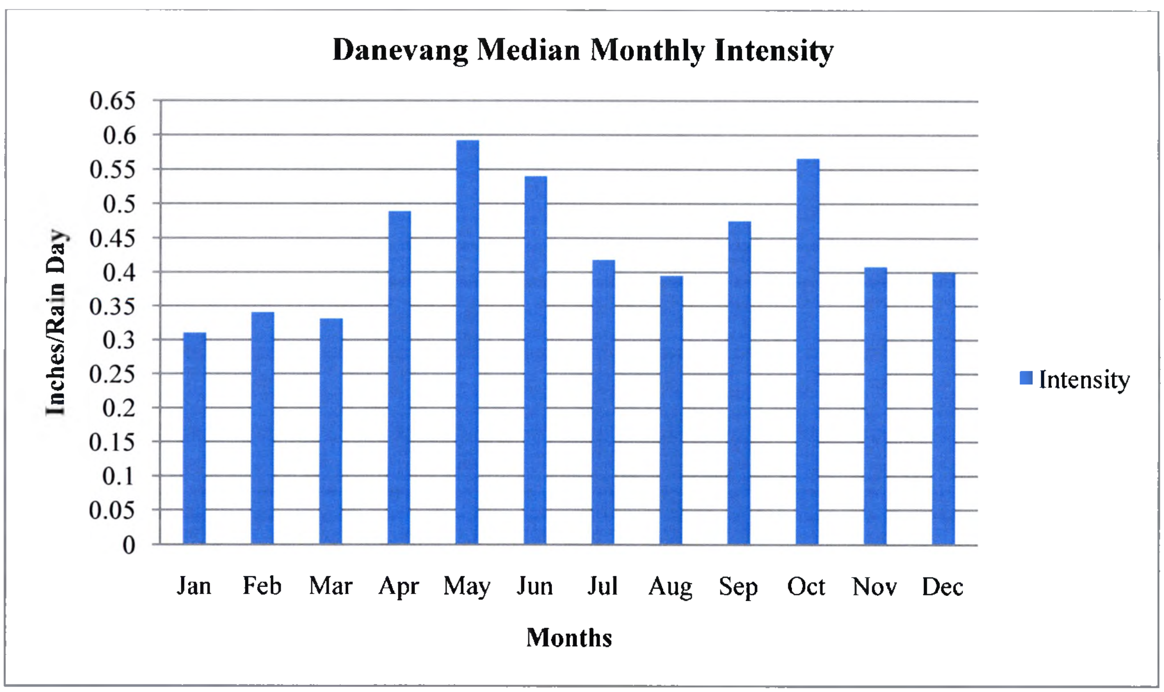

Figure 72. Danevang Median Monthly Intensity for the Period 1897-2002.

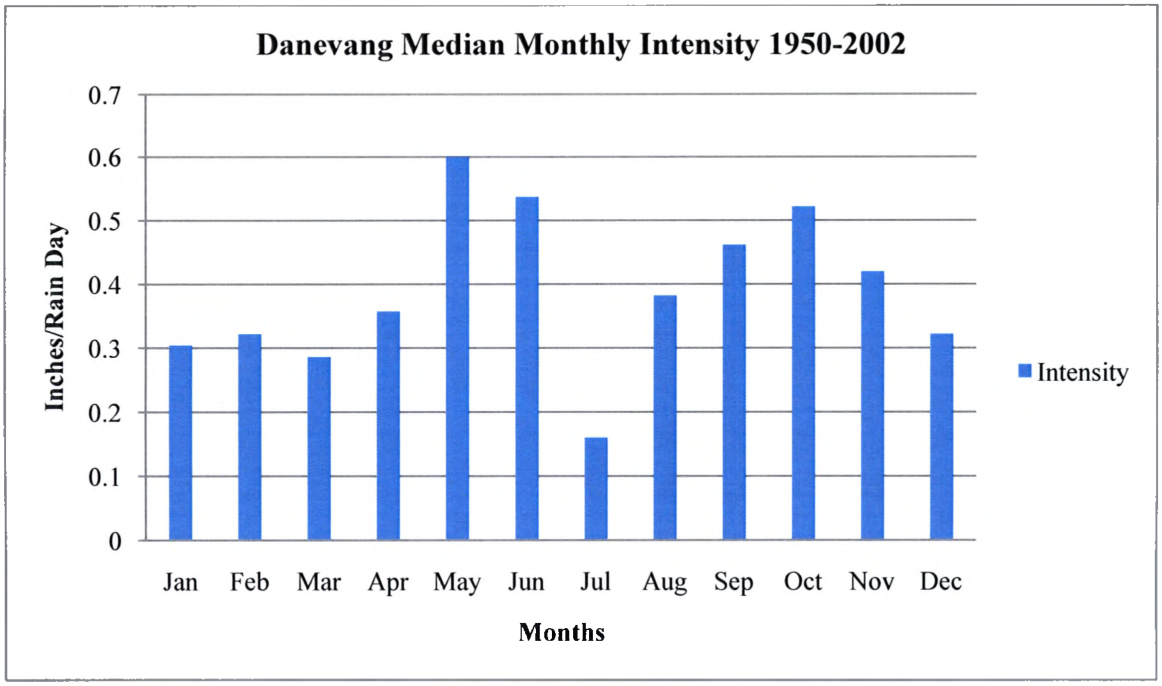

Figure 73. Danevang Median Monthly Intensity for the Period 1950-2002.

5.3.5 Greenville

5.3.5.1 Period 1900-2002

Greenville station for the period 1900-2002 (102 years) shows statistically significant data with a negative trend for April calculations, only (Table 25). All other months are within the 90% level of confidence, and show no significant trend (Appendix 17). Median monthly values (Appendix 18) show the greatest intensity for March, April, May, June, July, September, October, November and December with > 0.4 inches per occurrence (Figure 74).

5.3.5.2 Period 1950-2002

Greenville station for the period 1950-2002 (53 years) shows statistically significant data with positive trends for January, February, August, October and December calculations (Table 25). All other months are within the 90% level of confidence, and show no significant trend (Appendix 19). Median monthly values (Appendix 20) show the greatest intensity for March, April, May, June, July, September, October and November with > 0.4 inches per occurrence (Figure 75).

Table 25. Statistically Significant Intensity Data - Greenville

	Month	Coefficient - B	Significance (P-value)	R squared
1900-2002				
Greenville	Apr	-.002	.085	.030
1950-2002				
Greenville	Jan	.004	.025	.096
	Feb	.012	.017	.110
	Aug	.005	.031	.090
	Oct	.010	.012	.119
	Dec	.010	.001	.193
	Annual	.039	.004	.152

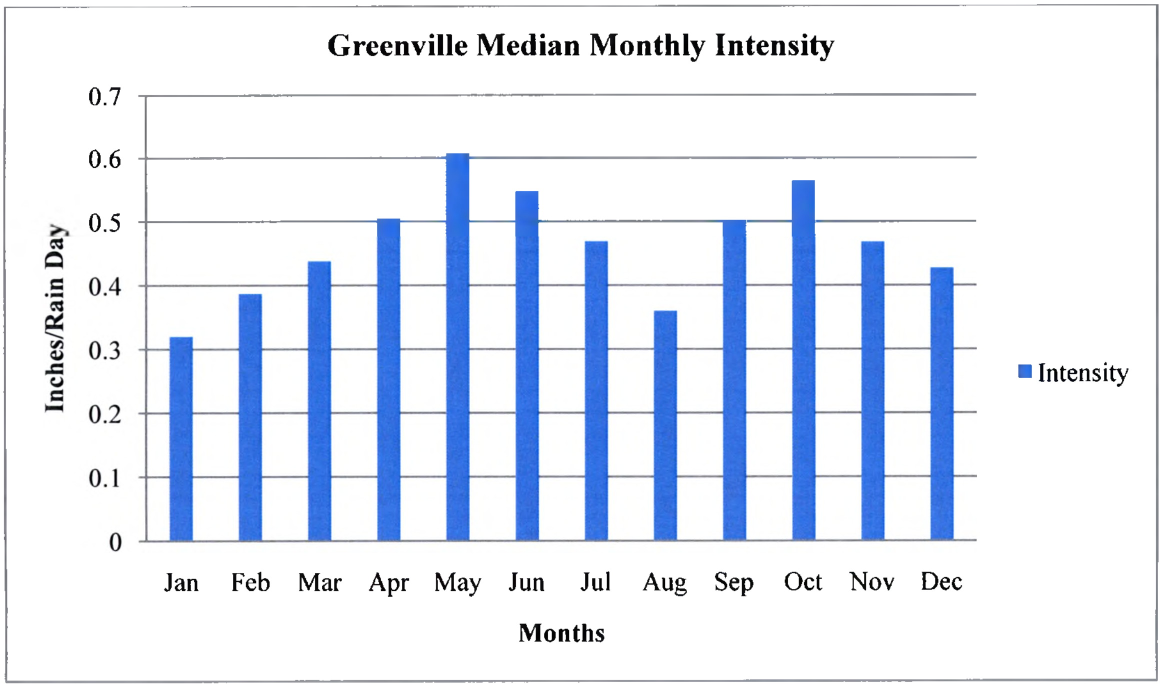

Figure 74. Greenville Median Monthly Intensity for the Period 1900-2002.

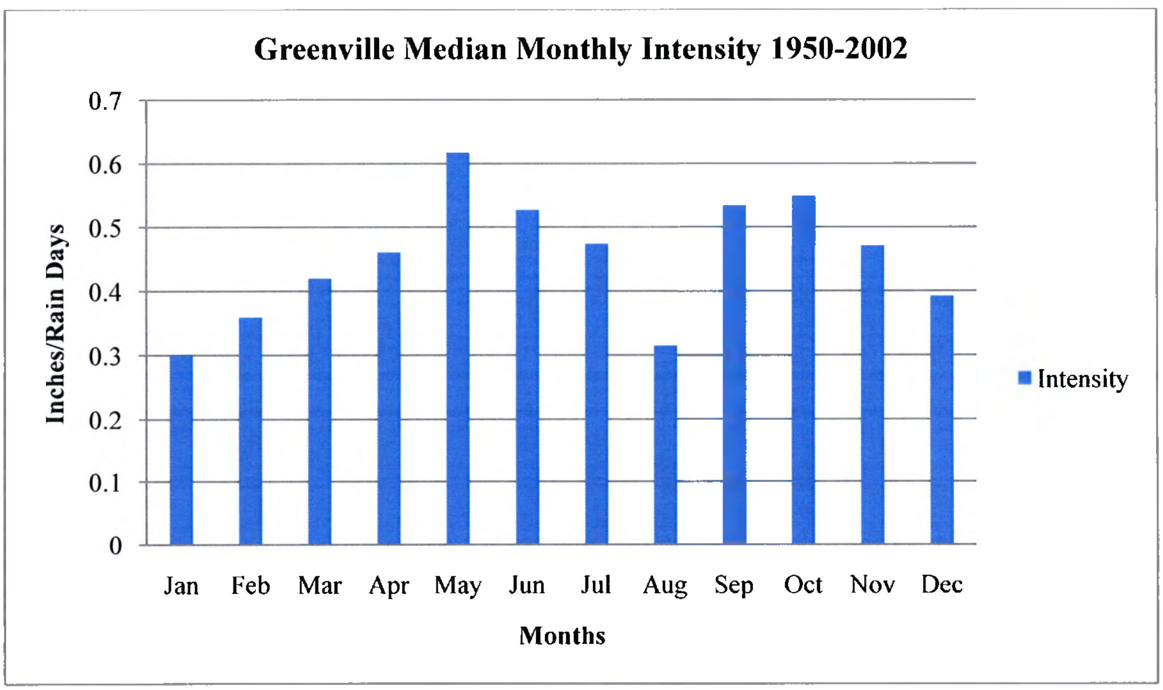

Figure 75. Greenville Median Monthly Intensity for the Period 1950-2002.

5.3.6 Plainview

5.3.6.1 Period 1908-2002

Plainview station for the period 1908-2002 (95 years) shows statistically significant data with negative trends for February, April, July, August and October calculations (Table 26). All other months are within the 90% level of confidence, and show no significant trend (Appendix 21). Median monthly values (Appendix 22) show the greatest intensity for only June with > 0.4 inches per occurrence (Figure 76).

5.3.6.2 Period 1950-2002

Plainview station for the period 1950-2002 (53 years) shows no statistically significant data (Table 26). All months are within the 90% level of confidence, and show no significant trend (Appendix 23). Median monthly values (Appendix 24) show no months with intensity values > 0.4 inches of precipitation (Figure 77).

Table 26. Statistically Significant Intensity Data – Plainview

	Month	Coefficient - B	Significance (P-value)	R squared
1908-2002				
Plainview	Feb	-.001	.026	.053
	Apr	-.001	.059	.039
	Jul	-.002	.026	.054
	Aug	-.002	.048	.042
	Oct	-.002	.029	.051
	Annual	-.011	.006	.079

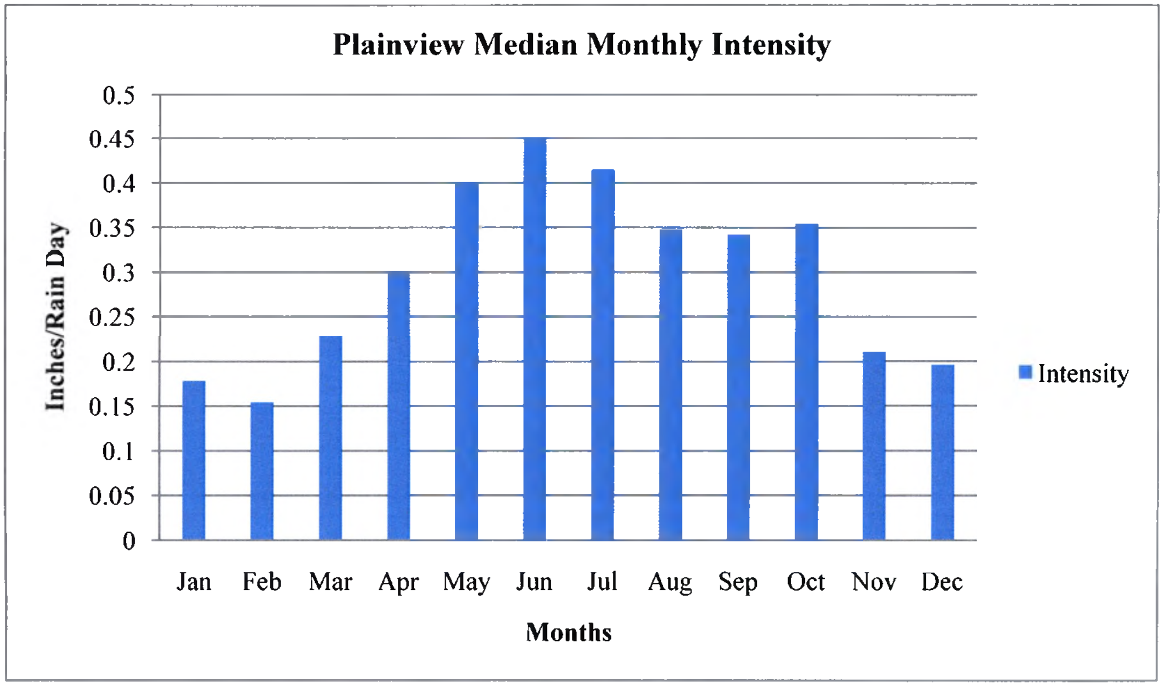

Figure 76. Plainview Median Monthly Intensity for the Period 1908-2002.

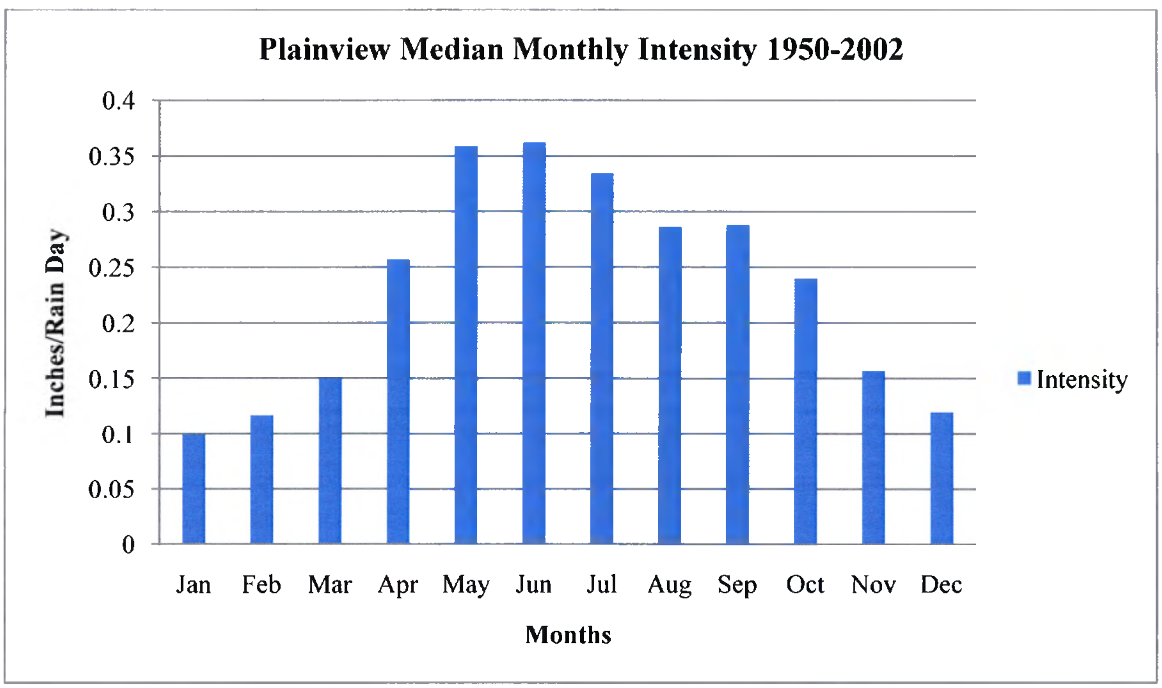

Figure 77. Plainview Median Monthly Intensity for the Period 1950-2002.

5.3.7 Rio Grande City

5.3.7.1 Period 1897-2002

Rio Grande City station for the period 1897-2002 (85 years) shows statistically significant data with negative trends for March, April, May and July calculations (Table 27). All other months are within the 90% level of confidence, and show no significant trend (Appendix 25). Median monthly values (Appendix 26) show the greatest intensity for only June and September with > 0.4 inches per occurrence (Figure 78).

5.3.7.2 Period 1950-2002

Rio Grande City station for the period 1950-2002 (53 years) shows statistically significant data with only positive trends for December calculations (Table 27). All other months are within the 90% level of confidence, and show no significant trend (Appendix 27). Median monthly values (Appendix 28) show the greatest intensity for June and September with > 0.4 inches per occurrence (Figure 79).

Table 27. Statistically Significant Intensity Data – Rio Grande City

	Month	Coefficient - B	Significance (P-value)	R squared
1897-2002				
Rio Grande City	Mar	-.002	.090	.036
	Apr	-.004	.053	.047
	May	-.003	.054	.046
	Jul	-.004	.084	.039
1950-2002				
Rio Grande City	Dec	.004	.064	.067

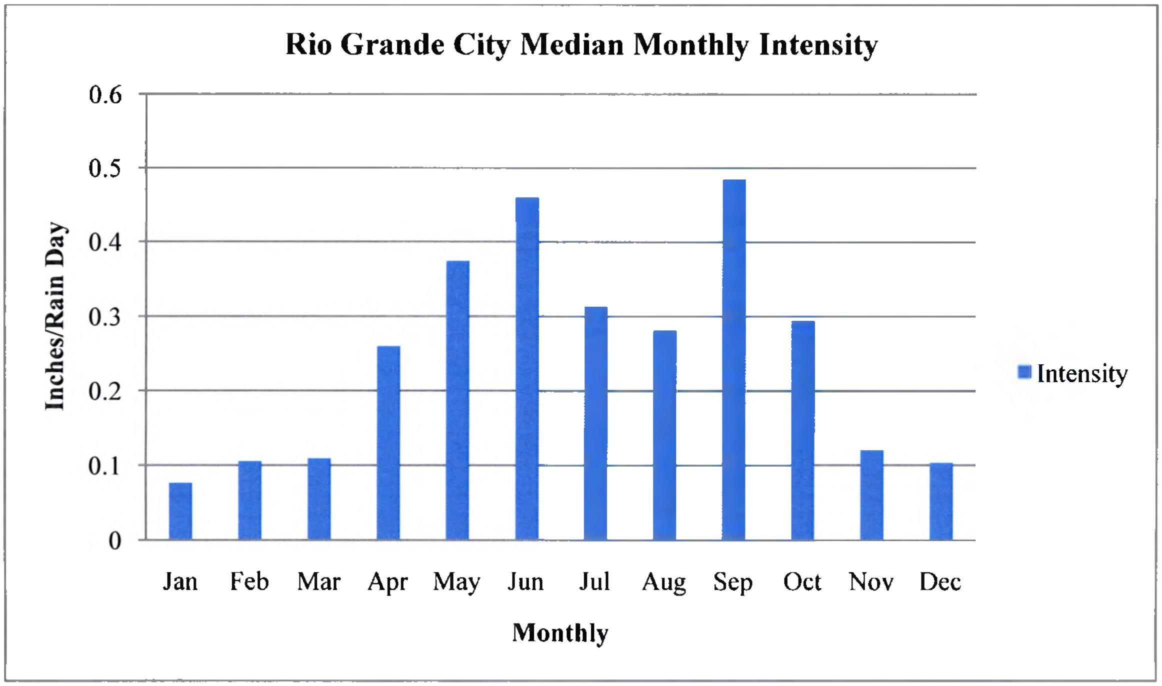

Figure 78. Rio Grande City Median Monthly Intensity for the Period 1897-2002.

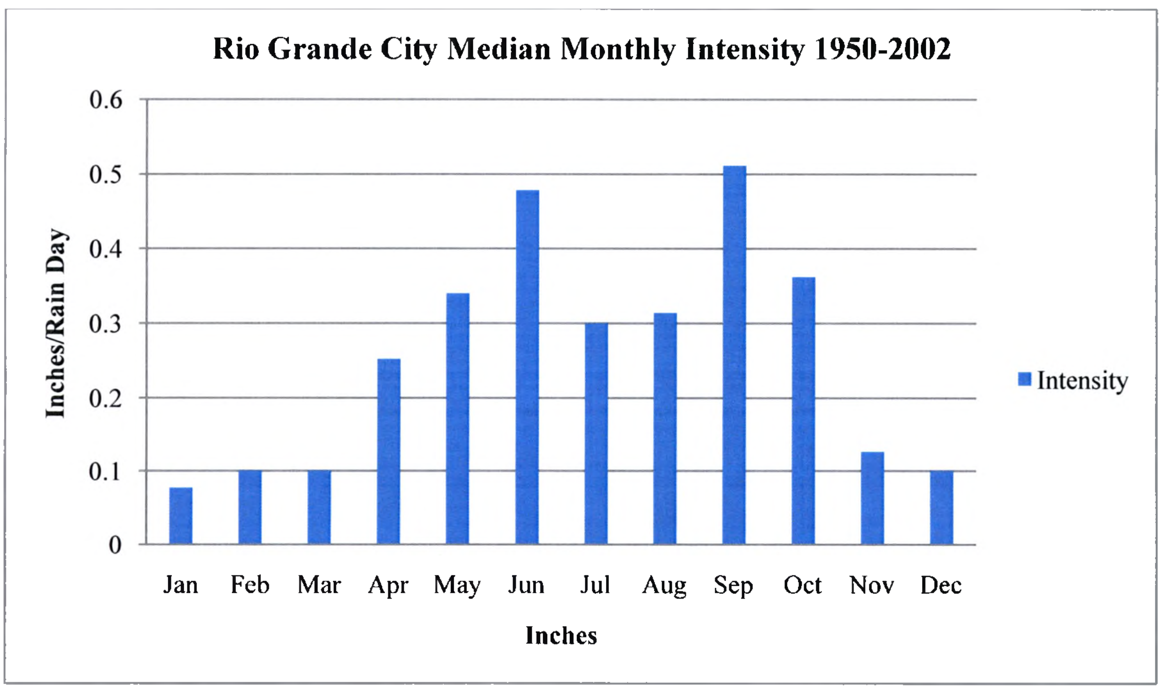

Figure 79. Rio Grande City Median Monthly Intensity for the Period 1950-2002.

5.3.8 Temple

5.3.8.1 Period 1897-2002

Temple station for the period 1897-2002 (105 years) shows statistically significant data with negative trends for April and November, and a positive trend for August calculations (Table 28). All other months are within the 90% level of confidence, and show no significant trend (Appendix 29). Median monthly values (Appendix 30) show the greatest intensity for April, May, June, August, September, October and November with > 0.4 inches per occurrence (Figure 80).

5.3.8.2 Period 1950-2002

Temple station for the period 1950-2002 (53 years) shows statistically significant data with positive trends for March and August calculations, only (Table 28). All other months are within the 90% level of confidence, and show no significant trend (Appendix 31). Median monthly values (Appendix 32) show the greatest intensity for May, June, August, September and October with > 0.4 inches per occurrence (Figure 81).

Table 28. Statistically Significant Intensity Data – Temple

	Month	Coefficient - B	Significance (P-value)	R squared
1897-2002				
Temple	Apr	-.002	.044	.040
	Aug	.002	.089	.028
	Nov	-.002	.079	.031
1950-2002				
Temple	Mar	.003	.083	.061
	Aug	.009	.011	.126
	Annual	.031	.035	.085

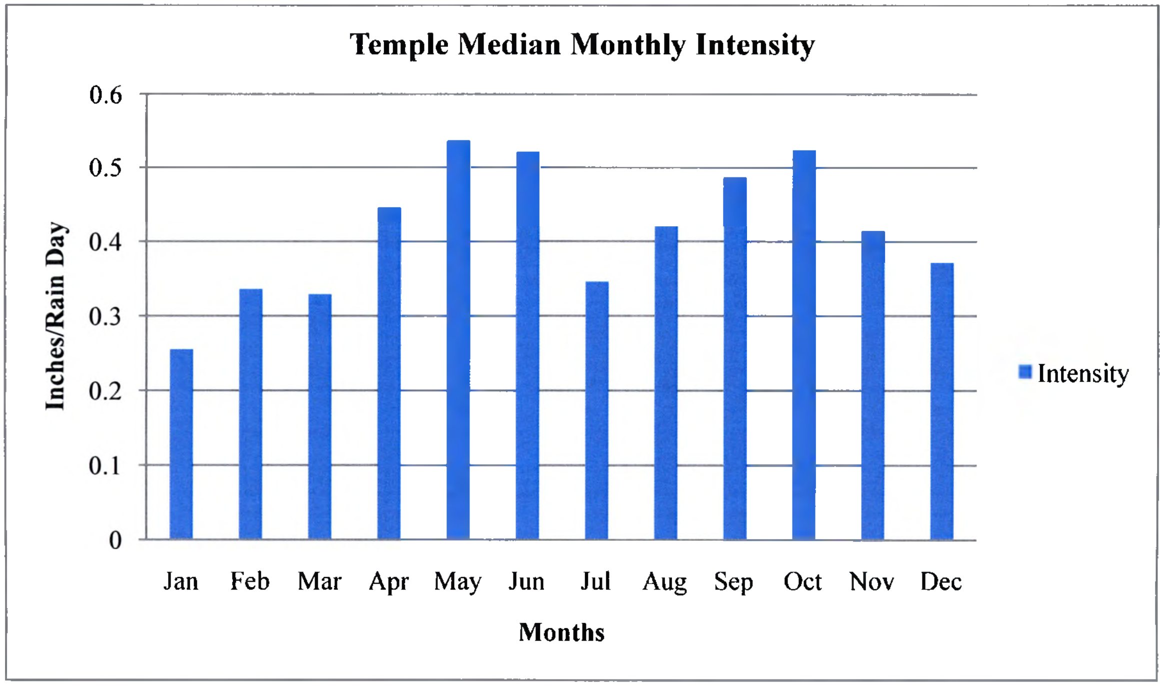

Figure 80. Temple Median Monthly Intensity for the Period 1897-2002.

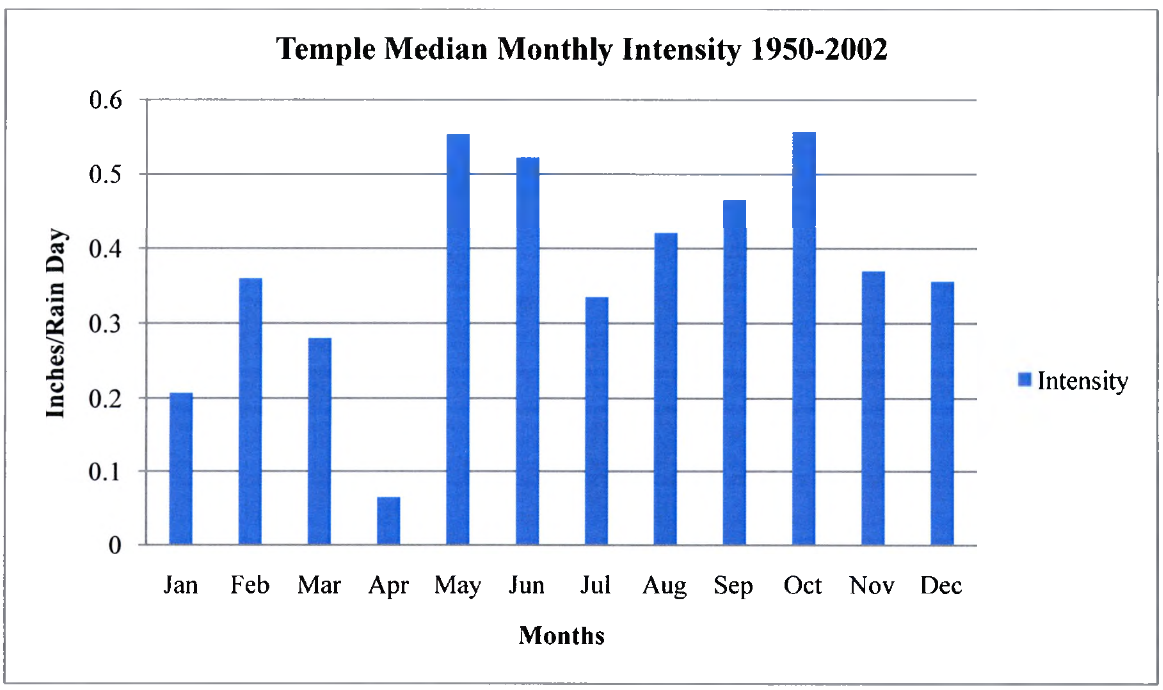

Figure 81. Temple Median Monthly Intensity for the Period 1950-2002.

CHAPTER VI

CONCLUSIONS

6.1 Precipitation

To answer the original question of "Is it raining more?", in general, yes, the combined statistics for 1897-2002 and 1950-2002 (Table 29) indicated that there was a positive trend across the state, with the exception of Balmorhea, in Far West Texas. All stations, except for Balmorhea and Temple, indicated a positive annual trend, and all months except April reported at least one positive trend at each station. April indicated a predominantly negative trend for Boerne, Danevang and Temple. When looking only at 1950-2002 annual statistics, there were no statistically significant negative trends. All stations were relatively unchanged or reported a positive trend.

Table 29. Occurrence of Statistically Significant P-values for Monthly Precipitation for the Periods 1897-2002 (x-positive, y-negative) and 1950-2002 (↑)

PRECIPITATION	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Albany			x↑			↑						↑	x
Balmorhea										y			
Boerne			↑	y		x↑	↑			↑	↑		↑
Danevang	↑		↑	y	x	x	y		x	↑	↑		x↑
Greenville		x	x↑							x		↑	x
Plainview			↑								↑	↑	x
Rio Grande City							y			x			x
Temple		x	↑	y									

↓ – negative trend (Coefficient B); ↑ - positive trend (Coefficient B)

When looking at the 1897-2002 annual graphs, the Dust Bowl years during the 1930s did not stand out as expected. There were some extremely low years, but 1932 reads above the trend line in five of the eight stations. Only Balmorhea, Danevang and Greenville are below. The drought of the 1950s stood out with extremely low totals that would affect the means and 1957 indicated a break in the drought at all stations except Rio Grande City. It took five more years before there was a steady increase of precipitation in South Texas.

6.2 Number of Days of Precipitation

Statistically significant annual data values for the period 1897-2002 indicated that all stations had positive trends with the exception of Balmorhea in Far West Texas, which reported all negative trends. For the period 1950-2002, this trend was reversed for all stations except Rio Grande City in South Texas, which reported positive trends. Use of the shorter time frame gave a more succinct indication of current negative trends. When looking at both time periods (Table 30), with the exception of annual values, there was only one statistically significant value that overlapped the two periods (Rio Grande City, December). The fact that all but one of the negative trends in the 1950-2002 period occurred in months that had no statistically significant trend in the longer data period could implicate the earlier drought years as a tipping factor for the 1897-2002 trend lines.

Table 30. Occurrence of Statistically Significant P-values for monthly Number of Days of Precipitation for the Periods 1897-2002 (x-positive, y-negative) and 1950-2002 (↑)

NUMBER of DAYS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Albany		x	x	↓	↓	x			↓			x	x↓
Balmorhea		y	y	y	y			y		y		y	y↓
Boerne	x		x	↓	x		y		x	x	x		x
Danevang	x	x	x	↓	x	x		x	x	x		x	x↓
Greenville	x	↓	x	↓	x	x	↓		x	x	x		x
Plainview	x	x	x				↓					x	x
Rio Grande City	x	x		x							x	x↑	x↑
Temple	x			↓		x			x				x

↓ – negative trend (Coefficient B); ↑ - positive trend (Coefficient B)

Precipitation totals may be trending upwards, but in general, the precipitation was falling in fewer days, which would suggest an increase in precipitation intensity.

6.3 Intensity

Statistically significant annual data values for the period 1897-2002 indicated all negative trends with the exception of Balmorhea in Far West Texas. For the period 1950-2002, this annual trend was reversed for all stations, reporting positive values for all statistically significant findings. Not all stations showed statistically significant values, but the only month not showing any positive trend for any time period was May (Table 31).

Table 31. Occurrence of Statistically Significant P-values for monthly Precipitation Intensity for the Periods 1897-2002 (x-positive, y-negative) and 1950-2002 (↑)

INTENSITY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Albany	↑	↑	↑							↑	↑	
Balmorhea		x						x↑	x↑			x↑
Boerne			y↑	y		↑	y			y	↑	
Danevang	y↑	y	y↑	y↑			y↑			↑	y↑	y↑
Greenville	↑	↑		y				↑		↑		↑
Plainview		y		y			y	y		y		
Rio Grande City			y	y	y		y					↑
Temple			↑	y				x↑			y	

↓ – negative trend (Coefficient B); ↑ - positive trend (Coefficient B)

As the change in the number of days of precipitation would indicate, these data indicate that more precipitation is falling over a shorter period of time. Increased volume of precipitation could lead to localized flooding, flash flooding, road hazards due to ponding on streets and highways and difficulties for agribusiness. However, these issues are beyond the scope of this paper, and further research is called for regarding the impact of an increased trend in precipitation.

6.4 Seasonal Findings

Because precipitation does not fall uniformly in Texas, either spatially or temporally, determining when one might expect to receive precipitation is part science and part speculation. Using precipitation data to establish when it has rained in the past is not an absolute in determining future rain events. Texas has wet seasons and dry seasons, generally. Late spring, specifically May, is usually the wettest month (Albany, Boerne, Danevang, Greenville, Plainview and Temple), followed by April, but this study's data (Table 3) indicates a negative precipitation trend during April in Boerne, Danevang and Temple. West Texas is the exception to a late spring wet season. The higher elevations in the western part of the state tend to generate summer thunderstorms that produce the bulk of their precipitation (Bomar 1995). Balmorhea posts higher values of precipitation in the hottest months of July, August and September (Figure 9) and intensity shows an increase during August and September.

In the other regions of Texas, a secondary wet season usually occurs in early fall during September and October. Danevang, Greenville, and Rio Grande City reflect positive trends at this time of the year and these trends may be linked to increased tropical storm activity as well as proximity to the Gulf of Mexico.

The driest part of the year is usually mid-summer (July) and mid-winter (December, January). Median precipitation values show similar findings. Low summer medians occur in Albany, Boerne, Greenville, Rio Grande City and Temple. Low winter medians occur in Albany, Balmorhea, Boerne, Plainview, Rio Grande City and Temple, reinforcing the normal expectations for each region.

This pilot study was designed to discover if there were long-term trends in regional precipitation in Texas and if further study was warranted. Because all statistically significant annual trends in precipitation were positive, an expanded study is indicated to broaden the scope of data and pinpoint locations in each region that may not fit the current area profile. Increasing the number of data stations would enhance regional coverage and provide data that may indicate an adjustment to the shape and size of a region. The study could be amplified to include other climatic variables that may affect precipitation, such as regional physical features, seasonal or annual wind patterns or temperature variations. Data trends from an expanded study could be used to identify local patterns of precipitation for use by city planners, flood plain managers and agricultural interests.

APPENDIX

TABLES

ALBANY

BALMORHEA

BOERNE

DANEVANG

GREENVILLE

1. ALBANY DATA ANALYSIS 1901-2002

ALBANY	Month	Coefficient - B	Significance (P-value)	R squared
Number of Days	Jan	.010	.316	.011
	Feb	**.019**	**.063**	**.036**
	Mar	**.024**	**.009**	**.069**
	Apr	-.001	.870	.000
	May	.005	.688	.002
	Jun	.016	.110	.027
	Jul	-.005	.589	.003
	Aug	-.002	.802	.001
	Sep	.009	.365	.009
	Oct	.011	.309	.011
	Nov	.012	.226	.015
	Dec	**.023**	**.030**	**.051**
	Annual	**.191**	**.001**	**.114**
Intensity	Jan	.000	.366	.009
	Feb	.000	.699	.002
	Mar	.000	.929	.000
	Apr	.000	.708	.002
	May	.000	.771	.001
	Jun	.000	.726	.001
	Jul	.000	.555	.004
	Aug	.000	.945	.000
	Sep	.000	.673	.002
	Oct	.000	.838	.000
	Nov	.000	.418	.007
	Dec	.000	.703	.002
	Annual	.005	.320	.010
Precipitation	Jan	.003	.562	.004
	Feb	.007	.146	.022
	Mar	**.008**	**.085**	**.031**
	Apr	-.002	.800	.001
	May	.001	.873	.000
	Jun	.010	.232	.015
	Jul	-.006	.398	.007
	Aug	.000	.952	.000
	Sep	.009	.319	.010
	Oct	.000	.959	.000
	Nov	.000	.904	.000
	Dec	.003	.544	.004
	Annual	**.073**	**.014**	**.059**

Statistically significant (< 0.1) values in **bold**.

2. ALBANY DESCRIPTIVE DATA 1901-2002

ALBANY	Month	Min	Max	10%	90%	Mean	Median
Number of Days	Jan	0	12	1.0	7.0	3.88	3.0
	Feb	0	12	1.0	8	4.31	4
	Mar	0	11	1.7	9	4.56	4
	Apr	0	13	3	9	5.25	5
	May	1	15	3.7	11.3	7.05	7
	Jun	0	12	2	10	5.48	5
	Jul	0	12	2	9	4.65	4
	Aug	0	12	2	8	4.56	4
	Sep	0	13	2	9.1	5.11	5
	Oct	0	13	1.7	10	5.24	5
	Nov	0	14	.8	8	4.26	4
	Dec	0	11	1	9	4.34	4
	Annual	3	96	35	78.7	55.48	56
Intensity	Jan	0	.787	.029	.647	.276	.24
	Feb	0	1.14	.065	.694	.322	.25
	Mar	0	1.3	.116	722	.363	.328
	Apr	0	1.61	.154	.862	.472	.412
	May	.108	1.90	.256	.884	.552	.519
	Jun	0	1.88	.102	1.02	.514	.457
	Jul	0	1.45	.088	.922	.432	.41
	Aug	0	5.20	.097	.868	.477	.383
	Sep	0	1.78	.12	1.03	.522	.461
	Oct	0	1.62	.127	1.08	.491	.412
	Nov	0	1.345	.02	.871	.361	.267
	Dec	0	1.73	.049	.726	.333	.254
	Annual	.568	9.670	3.212	6.573	4.838	4.658
Precipitation	Jan	0	8.13	.047	3.033	1.168	.795
	Feb	0	6.55	.127	3.394	1.451	1.0
	Mar	0	7.08	.331	3.67	1.621	1.35
	Apr	0	10.2	.517	5.721	2.58	2.05
	May	.25	10.53	1.184	7.387	3.871	3.595
	Jun	0	9.46	.282	6.172	2.903	2.44
	Jul	0	11.57	.2	4.713	2.195	1.81
	Aug	0	31.19	.188	5.418	2.476	1.61
	Sep	0	13.48	.229	6.145	2.894	2.3
	Oct	0	12.27	.234	6.181	2.742	1.895
	Nov	0	6.77	.04	3.888	1.648	1.06
	Dec	0	8.65	.052	2.767	1.436	1.15
	Annual	1.1	47.01	15.853	37.223	25.537	25.54

3. ALBANY DATA ANALYSIS 1950-2002

ALBANY	Month	Coefficient - B	Significance (P-value)	R squared
Number of Days	Jan	-.025	.354	.018
	Feb	-.038	.124	.148
	Mar	.029	.248	.028
	Apr	**-.051**	**.021**	**.105**
	May	**-.060**	**.040**	**.080**
	Jun	.015	.555	.007
	Jul	-.027	.305	.021
	Aug	-.024	.224	.029
	Sep	**-.024**	**.052**	**.072**
	Oct	-.013	.653	.004
	Nov	-.005	.860	.001
	Dec	.026	.357	.019
	Annual	**-.264**	**.026**	**.093**
Intensity	**Jan**	**.004**	**.049**	**.080**
	Feb	**.005**	**.016**	**.113**
	Mar	**.008**	**.000**	**.296**
	Apr	.005	.101	.054
	May	.004	.129	.045
	Jun	.004	.157	.040
	Jul	-.002	.448	.011
	Aug	.003	.698	.003
	Sep	.000	.991	.000
	Oct	**.005**	**.084**	**.060**
	Nov	**.005**	**.092**	**.057**
	Dec	.005	.118	.054
	Annual	**.042**	**.003**	**.163**
Precipitation	Jan	.002	.874	.001
	Feb	.018	.199	.033
	Mar	**.041**	**.000**	**.269**
	Apr	-.012	.526	.008
	May	-.010	.661	.004
	Jun	**.042**	**.058**	**.070**
	Jul	-.028	.149	.040
	Aug	.004	.916	.000
	Sep	-.023	.349	.017
	Oct	.012	.575	.006
	Nov	.014	.334	.019
	Dec	**.025**	**.070**	**.071**
	Annual	.068	.363	.016

Statistically significant (< 0.1) values in **bold**.

4. ALBANY DESCRIPTIVE DATA 1950-2002

ALBANY	Month	Min	Max	10%	90%	Mean	Median
Number of Days	Jan	0	12	1	8	3.96	4
	Feb	0	11	1	8	4.71	5
	Mar	1	11	2	9.9	5.06	4
	Apr	0	12	3	9	5.33	5
	May	2	15	3	12	7.21	7
	Jun	1	12	2	10	5.75	5.5
	Jul	0	12	1	9	4.62	4
	Aug	0	11	2	7	4.58	4
	Sep	0	13	2	9.6	5.51	6
	Oct	0	12	1.2	10	5.51	5
	Nov	0	14	1	9.8	4.59	4
	Dec	0	10	1	9	4.62	4
	Annual	35	96	45.4	81	59.38	57
Intensity	Jan	0	.74	.010	.667	.251	.220
	Feb	0	1.14	.097	.679	.331	.261
	Mar	.040	.980	.113	.695	.339	.278
	Apr	0	1.60	.146	.866	.475	.429
	May	.108	1.898	.191	.878	.541	.519
	Jun	.040	1.577	.120	1.0	.497	.433
	Jul	0	1.44	.067	.894	.436	.413
	Aug	0	5.198	.092	.842	.474	.329
	Sep	0	1.378	.107	1.044	.524	.468
	Oct	0	1.343	.125	.999	.468	.405
	Nov	0	1.345	.029	.843	.342	.243
	Dec	0	1.730	.065	.580	.311	.230
	Annual	2.858	9.667	3.122	7.170	4.84	4.338
Precipitation	Jan	0	8.13	.01	3.34	1.222	.89
	Feb	0	6.55	.266	3.906	1.568	.9
	Mar	.08	4.36	.356	3.653	1.684	1.465
	Apr	0	10.2	.598	5.63	2.644	2.36
	May	.25	10.53	.912	7.68	3.811	3.58
	Jun	.08	9.46	.4	7.279	2.994	2.355
	Jul	0	11.57	.146	4.986	2.241	1.8
	Aug	0	31.19	.338	5.402	2.452	1.405
	Sep	0	13.48	.2	6.616	3.269	2.61
	Oct	0	11.03	.242	6.316	2.675	2.04
	Nov	0	6.09	.05	3.826	1.659	.97
	Dec	0	8.65	.072	2.818	1.382	1.17
	Annual	11.07	45.54	16.66	37.766	26.837	26.49

5. BALMORHEA DATA ANALYSIS 1923-2002

BALMORHEA	Month	Coefficient - B	Significance (P-value)	R squared
Number of Days	Jan	-.007	.604	.004
	Feb	**-.022**	**.039**	**.054**
	Mar	**-.020**	**.025**	**.064**
	Apr	**-.021**	**.057**	**.048**
	May	**-.035**	**.014**	**.077**
	Jun	-.012	.399	.010
	Jul	-.026	.132	.030
	Aug	**-.027**	**.068**	**.044**
	Sep	-.025	.191	.023
	Oct	**-.046**	**.002**	**.117**
	Nov	-.011	.366	.011
	Dec	**-.043**	**.000**	**.152**
	Annual	**-.259**	**.000**	**.146**
Intensity	Jan	.001	.205	.022
	Feb	**.002**	**.034**	**.057**
	Mar	.000	.646	.003
	Apr	.000	.724	.002
	May	.001	.321	.013
	Jun	.000	.713	.002
	Jul	.000	.740	.001
	Aug	**.002**	**.005**	**.102**
	Sep	**.003**	**.024**	**.066**
	Oct	.000	.577	.004
	Nov	.001	.256	.017
	Dec	**.002**	**.032**	**.060**
	Annual	**.013**	**.001**	**.123**
Precipitation	Jan	.000	.949	.000
	Feb	.001	.757	.001
	Mar	-.003	.237	.018
	Apr	-.003	.548	.005
	May	.000	.981	.000
	Jun	-.003	.653	.003
	Jul	-.002	.874	.001
	Aug	.005	.463	.007
	Sep	.007	.569	.004
	Oct	-.010	.109	.033
	Nov	.001	.787	.001
	Dec	-.003	.426	.008
	Annual	-.001	.960	.000

Statistically significant (< 0.1) values in **bold**.

6. BALMORHEA DESCRIPTIVE DATA 1923-2002

BALMORHEA	Month	Min	Max	10%	90%	Mean	Median
Number of Days	Jan	0	14	0	7.0	3.13	3.0
	Feb	0	8	0	6.0	2.53	2.0
	Mar	0	10	0	4.0	1.91	2.0
	Apr	0	9	0	6.0	2.63	2
	May	0	14	1	8.1	4.45	4
	Jun	0	12	1	9.0	4.63	4
	Jul	0	15	2	11.0	5.78	6
	Aug	1	14	2	10.0	5.81	5
	Sep	1	17	2	11.2	6	5
	Oct	0	13	1	9.0	4.45	4
	Nov	0	12	0	6.0	2.54	2
	Dec	0	9	0	7.0	2.92	2
	Annual	11	107	25	62.9	45.28	45.5
Intensity	Jan	0	.52	0	.329	.142	.125
	Feb	0	.91	0	.474	.167	.101
	Mar	0	1.0	0	.327	.144	.109
	Apr	0	1.193	0	.431	.192	.13
	May	0	1.147	.076	.563	.293	.253
	Jun	0	1.02	.071	.571	.278	.221
	Jul	0	1.6	.086	.524	.281	.22
	Aug	.054	.733	.081	.553	.304	.248
	Sep	.035	1.346	.078	.659	.334	.286
	Oct	0	1.335	.030	.53	.270	.221
	Nov	0	1.08	0	.33	.168	.144
	Dec	0	1.005	0	.363	.183	.12
	Annual	.386	4.73	1.54	4.089	2.669	2.62
Precipitation	Jan	0	4.05	0	1.47	.58	.38
	Feb	0	3.79	0	1.68	.559	.29
	Mar	0	2.0	0	1.071	.369	.235
	Apr	0	4.81	0	2.037	.645	.395
	May	0	5.86	.22	3.154	1.372	.995
	Jun	0	4.87	.15	3.76	1.33	.88
	Jul	0	11.31	.258	4.13	1.675	1.07
	Aug	.15	6.4	.324	4.042	1.84	1.19
	Sep	.07	12.11	.158	5.32	2.365	1.66
	Oct	0	6.47	.03	2.67	1.319	1.28
	Nov	0	3.45	0	1.388	.558	.335
	Dec	0	2.25	0	1.766	.598	.39
	Annual	1.13	28.15	6.349	19.797	12.758	11.85

7. BALMORHEA DATA ANALYSIS 1950-2002

BALMORHEA	Month	Coefficient - B	Significance (P-value)	R squared
Number of Days	Jan	.007	.707	.003
	Feb	-.018	.274	.023
	Mar	-.013	.359	.017
	Apr	-.010	.607	.006
	May	-.034	.164	.038
	Jun	-.032	.191	.035
	Jul	-.036	.272	.024
	Aug	-.022	.417	.013
	Sep	.006	.859	.001
	Oct	-.026	.316	.020
	Nov	-.021	.365	.016
	Dec	-.030	.178	.037
	Annual	**-.211**	**.073**	**.062**
Intensity	Jan	.001	.529	.008
	Feb	.003	.137	.043
	Mar	.001	.333	.019
	Apr	.000	.859	.001
	May	-.002	.358	.017
	Jun	.002	.350	.018
	Jul	.000	.899	.000
	Aug	**.006**	**.000**	**.248**
	Sep	**.004**	**.090**	**.057**
	Oct	.000	.689	.003
	Nov	.000	.927	.000
	Dec	**.006**	**.013**	**.119**
	Annual	**.019**	**.024**	**.096**
Precipitation	Jan	.004	.451	.012
	Feb	.007	.283	.023
	Mar	-.002	.645	.004
	Apr	.000	.934	.000
	May	-.010	.418	.013
	Jun	.001	.965	.000
	Jul	-.005	.780	.002
	Aug	.023	.110	.050
	Sep	.021	.410	.014
	Oct	-.004	.697	.003
	Nov	.000	.964	.000
	Dec	.007	.213	.031
	Annual	.041	.423	.013

Statistically significant (< 0.1) values in **bold**.

8. BALMORHEA DESCRIPTIVE DATA 1950-2002

BALMORHEA	Month	Min	Max	10%	90%	Mean	Median
Number of	Jan	0	8	0	5.8	2.78	2
Days	Feb	0	6	0	5.6	2.21	2
	Mar	0	7	0	3.7	1.65	1
	Apr	0	9	0	5	2.3	2
	May	0	13	1	8	3.98	3
	Jun	0	12	1	7.8	4.51	4
	Jul	0	15	1	10.7	5.5	5
	Aug	1	13	2	9.7	5.48	5
	Sep	1	14	2	11	5.53	5
	Oct	0	13	0	8	3.81	3
	Nov	0	12	0	5.7	2.44	2
	Dec	0	9	0	5	2.27	2
	Annual	11	64	24	58	41.42	40
Intensity	Jan	0	.52	0	.356	.147	.128
	Feb	0	.90	0	.579	.193	.110
	Mar	0	.73	0	.341	.143	.106
	Apr	0	1.193	0	.421	.187	.139
	May	0	1.147	.059	.669	.324	.29
	Jun	0	1.02	.066	.601	.272	.205
	Jul	0	1.60	.063	.527	.291	.235
	Aug	.054	.733	.079	.561	.317	.295
	Sep	.035	1.346	.07	.707	.364	.330
	Oct	0	1.335	0	.483	.261	.216
	Nov	0	1.08	0	.464	.190	.144
	Dec	0	1.0	0	.585	.195	.140
	Annual	.386	4.73	1.664	4.345	2.817	2.723
Precipitation	Jan	0	2.39	0	1.364	.501	.38
	Feb	0	2.96	0	1.716	.558	.26
	Mar	0	1.74	0	1.077	.333	.165
	Apr	0	4.81	0	1.933	.607	.32
	May	0	5.86	.15	3.769	.142	.9
	Jun	0	4.78	.128	3.55	1.249	.78
	Jul	0	11.31	.212	3.748	1.651	1.26
	Aug	.15	6.4	.293	4.148	11.836	1.14
	Sep	.07	12.11	.156	6.432	2.417	1.66
	Oct	0	6.47	0	2.554	1.143	.77
	Nov	0	3.45	0	1.108	.578	.49
	Dec	0	2.11	0	1.718	.517	.28
	Annual	1.13	27.81	6.564	20.628	12.494	10.94

9. BOERNE DATA ANALYSIS 1897-2002

BOERNE	Month	Coefficient - B	Significance (P-value)	R squared
Number of Days	Jan	-.007	.604	.004
	Feb	**-.022**	**.039**	**.054**
	Mar	**-.020**	**.025**	**.064**
	Apr	**-.021**	**.057**	**.048**
	May	**-.035**	**.014**	**.077**
	Jun	-.012	.399	.010
	Jul	-.026	.132	.030
	Aug	**-.027**	**.068**	**.044**
	Sep	-.025	.191	.023
	Oct	**-.046**	**.002**	**.117**
	Nov	-.011	.366	.011
	Dec	**-.043**	**.000**	**.152**
	Annual	**-.259**	**.000**	**.146**
Intensity	Jan	.001	.205	.022
	Feb	**.002**	**.034**	**.057**
	Mar	.000	.646	.003
	Apr	.000	.724	.002
	May	.001	.321	.013
	Jun	.000	.713	.002
	Jul	.000	.740	.001
	Aug	**.002**	**.005**	**.102**
	Sep	**.003**	**.024**	**.066**
	Oct	.000	.577	.004
	Nov	.001	.256	.017
	Dec	**.002**	**.032**	**.060**
	Annual	**.013**	**.001**	**.123**
Precipitation	Jan	.000	.949	.000
	Feb	.001	.757	.001
	Mar	-.003	.237	.018
	Apr	-.003	.548	.005
	May	.000	.981	.000
	Jun	-.003	.653	.003
	Jul	-.002	.874	.001
	Aug	.005	.463	.007
	Sep	.007	.569	.004
	Oct	-.010	.109	.033
	Nov	.001	.787	.001
	Dec	-.003	.426	.008
	Annual	-.001	.960	.000

Statistically significant (< 0.1) values in **bold**.

10. BOERNE DESCRIPTIVE DATA 1897-2002

BOERNE	Month	Min	Max	10%	90%	Mean	Median
Number of	Jan	0	20	2	12.5	7.18	6.5
Days	Feb	0	19	2	11	6.54	6
	Mar	0	17	2.4	11	6.7	7
	Apr	0	18	3	13	7.02	6
	May	1	18	3	13	7.89	7
	Jun	0	16	2	12	5.86	5
	Jul	0	14	1	9	4.77	4
	Aug	0	13	1	9	4.82	4
	Sep	1	15	2	11	6.71	6
	Oct	0	119	2	11	6.0	5
	Nov	0	16	2	11	6.1	6
	Dec	0	18	2	12	6.9	7
	Annual	14	114	42.8	100.0	75.28	73
Intensity	Jan	0	.885	.062	.477	.241	.206
	Feb	0	1.183	.11	.636	.332	.289
	Mar	0	2.0	.098	.631	.343	.29
	Apr	0	1.55	.189	.736	.45	.41
	May	.03	3.8	.184	.98	.58	.517
	Jun	0	3.65	.154	1.027	.568	.473
	Jul	0	3.45	.089	1.043	.485	.295
	Aug	0	2.093	.085	.989	.473	.342
	Sep	.08	3.408	.181	.991	.614	.511
	Oct	0	2.65	.098	1.177	.6	.507
	Nov	0	1.92	.104	.812	.413	.355
	Dec	0	1.17	.075	.648	.32	.27
	Annual	2.479	11.986	3.641	7.342	5.336	4.961
Precipitation	Jan	0	6.5	.23	4.285	1.812	1.23
	Feb	0	8.7	.265	4.52	2.205	1.805
	Mar	0	6.97	.414	3.928	2.14	1.93
	Apr	0	12.36	1.02	6.76	3.202	2.435
	May	.12	15.65	1.055	8.16	4.322	3.645
	Jun	0	16.56	.445	6.765	3.257	2.785
	Jul	0	28.43	.152	6.65	2.631	1.53
	Aug	0	15.46	.14	6.155	2.515	1.59
	Sep	.1	13.9	.725	8.905	3.94	3.105
	Oct	0	16.37	.396	7.216	3.443	2.775
	Nov	0	10.4	.396	4.976	2.514	2.06
	Dec	0	16.96	.274	4.364	2.236	1.68
	Annual	9.14	64.17	20.628	49.014	33.677	32.81

11. BOERNE DATA ANALYSIS 1950-2002

BOERNE	Month	Coefficient - B	Significance (P-value)	R squared
Number of Days	Jan	-.015	.655	.004
	Feb	-.029	.291	.022
	Mar	.048	.115	.049
	Apr	**-.056**	**.088**	**.056**
	May	.011	.743	.002
	Jun	.041	.168	.037
	Jul	.004	.893	.000
	Aug	-.016	.568	.006
	Sep	-.014	.652	.004
	Oct	.043	.200	.033
	Nov	.033	.235	.028
	Dec	.022	.498	.009
	Annual	.060	.693	.003
Intensity	Jan	.002	.141	.042
	Feb	.002	.223	.029
	Mar	**.004**	**.008**	**.134**
	Apr	.002	.300	.021
	May	.003	.229	.028
	Jun	**.005**	**.060**	**.068**
	Jul	.006	.115	.048
	Aug	.003	.388	.015
	Sep	-.003	.499	.009
	Oct	.005	.104	.052
	Nov	**.004**	**.027**	**.092**
	Dec	.003	.130	.044
	Annual	**.038**	**.001**	**.190**
Precipitation	Jan	.018	.192	.033
	Feb	.008	.631	.005
	Mar	**.042**	**.007**	**.136**
	Apr	-.013	.537	.008
	May	.029	.257	.025
	Jun	**.060**	**.037**	**.083**
	Jul	**.069**	**.081**	**.059**
	Aug	.018	.565	.007
	Sep	-.027	.310	.020
	Oct	**.048**	**.073**	**.063**
	Nov	**.048**	**.010**	**.124**
	Dec	.035	.129	.045
	Annual	**.330**	**.001**	**.184**

Statistically significant (< 0.1) values in **bold**.

12. BOERNE DESCRIPTIVE DATA 1950-2002

BOERNE	Month	Min	Max	10%	90%	Mean	Median
Number of	Jan	1	16	2.4	12.6	7.68	7
Days	Feb	0	15	2.4	11	6.81	7
	Mar	1	17	3	11	7.52	8
	Apr	0	16	3.4	13	7.15	6
	May	1	17	4	14	8.47	8
	Jun	1	13	2.4	12	6.15	6
	Jul	0	14	1	8	4.26	4
	Aug	0	13	2	10	5.15	5
	Sep	2	15	3	12	7.3	7
	Oct	0	17	2.3	12	6.83	6.5
	Nov	0	14	2	11	6.66	7
	Dec	0	18	2.4	11	6.98	7
	Annual	40	110	60.8	101.8	84.7	84
Intensity	Jan	.017	.698	.052	.396	.218	.182
	Feb	0	1.008	.091	.566	.317	.265
	Mar	.026	.988	.092	.499	.276	.263
	Apr	0	.751	.075	.693	.369	.324
	May	.03	1.428	.156	.905	.521	.491
	Jun	.04	1.5	.164	1.023	.57	.49
	Jul	0	2.369	.048	1.029	.369	.253
	Aug	0	2.09	.071	.946	.485	.359
	Sep	.1	3.408	.194	.846	.58	.508
	Oct	0	1.4	.1	1.078	.52	.472
	Nov	0	.97	.109	.720	.382	.355
	Dec	0	1.17	.05	.646	.283	.210
	Annual	2.716	9.47	3.457	6.918	4.88	4.63
Precipitation	Jan	.03	6.5	.228	4.49	1.705	1.18
	Feb	0	7.81	.284	4.8	2.29	1.97
	Mar	.08	6.97	.312	4.725	2.196	2.05
	Apr	0	11.11	.384	5.756	2.8	2.06
	May	.12	12.61	.934	7.98	4.28	3.64
	Jun	.04	16.56	.642	8.544	3.72	3.12
	Jul	0	28.43	.068	4.792	2.23	.76
	Aug	0	15.46	.19	6.376	2.846	1.76
	Sep	.22	13.63	.722	8.54	4.04	3.25
	Oct	0	15.16	.35	7.64	3.706	2.97
	Nov	0	9.7	.354	5.926	2.714	2.18
	Dec	0	16.96	.238	4.19	2.133	1.44
	Annual	10.29	64.17	19.378	51.902	34.57	34.6

13. DANEVANG DATA ANALYSIS 1897-2002

DANEVANG	Month	Coefficient - B	Significance (P-value)	R squared
Number of	**Jan**	**.051**	**.000**	**.134**
Days	**Feb**	**.032**	**.004**	**.079**
	Mar	**.021**	**.024**	**.049**
	Apr	.009	.299	.010
	May	**.026**	**.010**	**.063**
	Jun	**.042**	**.000**	**.127**
	Jul	-.010	.393	.007
	Aug	**.032**	**.011**	**.063**
	Sep	**.022**	**.061**	**.035**
	Oct	**.027**	**.038**	**.042**
	Nov	.015	.177	.019
	Dec	**.021**	**.047**	**.039**
	Annual	**.363**	**.000**	**.220**
Intensity	**Jan**	**-.002**	**.020**	**.052**
	Feb	**-.004**	**.001**	**.111**
	Mar	**-.002**	**.087**	**.028**
	Apr	**-.004**	**.014**	**.058**
	May	.000	.917	.000
	Jun	.000	.702	.001
	Jul	**-.002**	**.034**	**.044**
	Aug	.000	.554	.003
	Sep	.001	.682	.002
	Oct	.000	.826	.000
	Nov	**-.004**	**.014**	**.061**
	Dec	**-.004**	**.000**	**.180**
	Annual	**-.015**	**.042**	**.039**
Precipitation	Jan	.009	.183	.018
	Feb	.002	.701	.001
	Mar	.000	.977	.000
	Apr	**-.013**	**.069**	**.032**
	May	**.018**	**.088**	**.028**
	Jun	**.020**	**.054**	**.036**
	Jul	-.015	.101	.026
	Aug	.009	.397	.007
	Sep	**.023**	**.036**	**.043**
	Oct	.015	.209	.016
	Nov	.000	.962	.000
	Dec	-.010	.158	.020
	Annual	**.101**	**.009**	**.063**

Statistically significant (< 0.1) values in **bold**.

14. DANEVANG DESCRIPTIVE DATA 1897-2002

DANEVANG	Month	Min	Max	10%	90%	Mean	Median
Number of Days	Jan	0	22	2	13.6	8.01	8
	Feb	0	17	2	11	6.95	7
	Mar	0	14	3	10	6.48	7
	Apr	1	13	2	10	5.54	5
	May	1	15	2	10	6.36	6
	Jun	0	16	2.5	12	6.8	6
	Jul	0	17	3	13	7.7	8
	Aug	0	22	3.4	14	8.02	8
	Sep	0	18	4	13	8.38	8
	Oct	0	20	1.3	12.7	6.23	5
	Nov	1	16	3	11	6.59	6
	Dec	1	17	3.3	12	7.79	8
	Annual	0	117	47	111.3	82.46	86
Intensity	Jan	0	1.48	.084	.73	.385	.31
	Feb	0	2.83	.101	.809	.42	.34
	Mar	0	2.25	.088	.909	.446	.331
	Apr	.02	3.2	.153	1.095	.585	.489
	May	.02	5.0	.128	1.323	.705	.592
	Jun	0	3.296	.183	1.085	.609	.54
	Jul	0	1.772	.154	.808	.464	.418
	Aug	0	1.6	.183	.823	.448	.395
	Sep	0	2.623	.244	1.156	.59	.475
	Oct	0	2.85	.12	1.26	.664	.566
	Nov	.041	4.25	.152	1.325	.577	.408
	Dec	.025	1.55	.188	.929	.477	.4
	Annual	0	14.193	3.851	9.828	6.199	5.583
Precipitation	Jan	0	9.24	.7	5.252	2.771	2.51
	Feb	0	8.45	.515	5.045	2.683	2.445
	Mar	0	11.12	.518	6.102	2.662	2.06
	Apr	.04	9.6	.506	6.732	3.018	2.46
	May	.04	15.87	.512	8.664	4.22	3.64
	Jun	0	19.78	.775	8.77	4.153	3.585
	Jul	0	12.3	.698	8.492	3.631	2.78
	Aug	0	24.01	.892	7.324	3.775	2.98
	Sep	0	15.74	1.229	9.928	4.757	3.925
	Oct	0	22.66	.441	9.201	4.026	2.89
	Nov	.2	14.12	.69	6.44	3.322	2.77
	Dec	.2	14.1	.904	5.966	3.377	3.02
	Annual	0	68.89	25.399	57.042	41.209	40.98

15. DANEVANG DATA ANALYSIS 1950-2002

DANEVANG	Month	Coefficient - B	Significance (P-value)	R squared
Number of Days	Jan	-.020	.505	.009
	Feb	-.042	.112	.049
	Mar	-.015	.517	.008
	Apr	**-.073**	**.003**	**.162**
	May	.004	.886	.000
	Jun	.030	.361	.016
	Jul	-.040	.211	.031
	Aug	-.002	.959	.000
	Sep	-.035	.271	.024
	Oct	.001	.973	.000
	Nov	-.008	.773	.002
	Dec	-.016	.509	.009
	Annual	**-.222**	**.058**	**.069**
Intensity	**Jan**	**.004**	**.013**	**.115**
	Feb	.000	.832	.001
	Mar	**.009**	**.001**	**.207**
	Apr	**.006**	**.060**	**.068**
	May	.004	.496	.009
	Jun	-.001	.770	.002
	Jul	**.005**	**.021**	**.102**
	Aug	-.001	.587	.006
	Sep	.003	.480	.010
	Oct	**.013**	**.005**	**.146**
	Nov	**.007**	**.004**	**.148**
	Dec	**.004**	**.044**	**.077**
	Annual	**.051**	**.001**	**.210**
Precipitation	**Jan**	**.034**	**.030**	**.089**
	Feb	-.014	.414	.013
	Mar	**.044**	**.026**	**.094**
	Apr	-.012	.526	.008
	May	.038	.229	.028
	Jun	.017	.605	.005
	Jul	.021	.374	.016
	Aug	-.006	.815	.001
	Sep	.025	.492	.009
	Oct	**.054**	**.071**	**.063**
	Nov	**.045**	**.038**	**.081**
	Dec	.021	.205	.031
	Annual	**.263**	**.012**	**.118**

Statistically significant (< 0.1) values in **bold**.

16. DANEVANG DESCRIPTIVE DATA 1950-2002

DANEVANG	Month	Min	Max	10%	90%	Mean	Median
Number of	Jan	3	17	4	13.6	9.15	9
Days	Feb	2	17	4	11	7.68	7
	Mar	2	12	4	10.6	6.96	7
	Apr	1	11	2	10	6.11	6
	May	1	14	2	10.6	6.94	7
	Jun	1	16	3	13	7.89	8
	Jul	0	17	3	11.7	7.21	7
	Aug	3	22	4	14	8.98	9
	Sep	3	18	5	13.6	9	9
	Oct	0	20	2	13	6.87	6
	Nov	1	14	3	11.6	6.81	6
	Dec	3	15	5	11.6	8.06	8
	Annual	71	117	75	112.6	91.53	90
Intensity	Jan	.007	1.0	.068	.552	.324	.304
	Feb	.027	.819	.097	.631	.342	.322
	Mar	.023	1.589	.066	.782	.355	.286
	Apr	.02	2.22	.109	.851	.460	.357
	May	.05	5	.174	1.312	.725	.6
	Jun	.02	3.296	.158	1.119	.63	.537
	Jul	0	1.16	.084	.745	.379	.16
	Aug	.1	1.039	.202	.871	.438	.382
	Sep	.162	2.62	.244	1.201	.6	.462
	Oct	0	2.85	.12	1.21	.644	.522
	Nov	.041	1.37	.136	.798	.468	.42
	Dec	.068	.938	.11	.733	.370	.322
	Annual	2.878	11.192	3.749	8.196	5.734	5.437
Precipitation	Jan	.26	9.24	.676	5.076	2.83	2.78
	Feb	.08	8.45	.538	5.05	2.82	2.49
	Mar	.07	11.12	.444	4.856	2.436	1.63
	Apr	.04	8.2	.362	6.322	2.745	1.91
	May	.05	15.55	.778	9.212	4.669	4.18
	Jun	.02	19.78	.83	10.908	4.854	4.03
	Jul	0	11.6	.367	5.894	2.96	2.25
	Aug	.3	11.43	1.288	8.584	4.01	3.36
	Sep	.68	15.74	1.258	12.148	5.37	4.03
	Oct	0	12.73	.538	9.708	4.119	3.33
	Nov	.22	9.92	.672	6.686	3.31	2.77
	Dec	.4	8.38	.803	5.68	2.982	2.84
	Annual	18.85	68.89	27.68	59.244	43.062	42.11

17. GREENVILLE DATA ANALYSIS 1900-2002

GREENVILLE	Month	Coefficient - B	Significance (P-value)	R squared
Number of	**Jan**	**.029**	**.018**	**.057**
Days	Feb	.007	.558	.004
	Mar	**.040**	**.000**	**.163**
	Apr	.006	.555	.004
	May	**.019**	**.093**	**.029**
	Jun	**.022**	**.038**	**.044**
	Jul	-.005	.615	.003
	Aug	.006	.523	.004
	Sep	**.028**	**.006**	**.075**
	Oct	**.030**	**.006**	**.074**
	Nov	**.025**	**.026**	**.050**
	Dec	.016	.153	.021
	Annual	**.218**	**.001**	**.104**
Intensity	Jan	-.001	.119	.025
	Feb	.002	.125	.024
	Mar	-.001	.178	.019
	Apr	**-.002**	**.085**	**.030**
	May	.000	.641	.002
	Jun	.000	.664	.002
	Jul	.000	.761	.001
	Aug	-.001	.266	.013
	Sep	.000	.701	.002
	Oct	.001	.697	.002
	Nov	.000	.705	.001
	Dec	.002	.145	.022
	Annual	-.002	.699	.001
Precipitation	Jan	.003	.598	.003
	Feb	**.013**	**.034**	**.046**
	Mar	**.016**	**.009**	**.069**
	Apr	-.008	.458	.006
	May	.011	.256	.013
	Jun	.011	.220	.015
	Jul	-.007	.432	.006
	Aug	-.004	.542	.004
	Sep	.012	.180	.018
	Oct	**.024**	**.018**	**.056**
	Nov	.012	.199	.017
	Dec	.009	.253	.013
	Annual	**.089**	**.011**	**.063**

Statistically significant (< 0.1) values in **bold**.

18. GREENVILLE DESCRIPTIVE DATA 1900-2002

GREENVILLE	Month	Min	Max	10%	90%	Mean	Median
Number of	Jan	1	17	2.8	12	6.81	7
Days	Feb	1	16	2	11	6.72	6.5
	Mar	2	15	3	11	7.51	8
	Apr	1	17	4	12	7.74	7
	May	2	18	4	13	8.47	8
	Jun	0	13	2	11	6.28	6
	Jul	0	14	2	10	5.43	5
	Aug	0	13	2	8	4.9	4
	Sep	0	15	2	10	5.72	6
	Oct	0	16	2	10	5.87	6
	Nov	0	15	2	10	5.95	6
	Dec	0	14	2	11	6.76	7
	Annual	0	114	49	98	75.01	78
Intensity	Jan	.03	1.4	.15	.793	.398	.32
	Feb	.04	4.0	.173	.833	.482	.387
	Mar	.06	1.2	.186	.76	.465	.438
	Apr	.079	2.15	.241	1.036	.586	.505
	May	.112	1.465	.274	1.001	.618	.607
	Jun	0	1.345	.193	.929	.559	.547
	Jul	0	2.27	.129	1.052	.559	.469
	Aug	0	2.488	.08	.844	.425	.36
	Sep	0	1.9	.170	1.016	.576	.501
	Oct	0	1.978	.13	1.323	.634	.564
	Nov	0	1.855	.193	1.033	.548	.468
	Dec	0	1.551	.17	.907	.49	.427
	Annual	0	10.459	4.346	8.59	6.092	5.923
Precipitation	Jan	.03	9.13	.54	4.89	2.534	2.16
	Feb	.04	9.34	.761	5.576	2.899	2.52
	Mar	.12	9.02	1.23	5.75	3.368	3.05
	Apr	.23	18.75	1.371	7.982	4.457	3.88
	May	.54	14.19	1.64	9.23	5.218	4.7
	Jun	0	11.94	.67	8.07	3.618	3.05
	Jul	0	11.96	.288	7.536	3.061	2.345
	Aug	0	10.15	.11	5.0	2.261	1.65
	Sep	0	11.9	.381	7.351	3.422	2.885
	Oct	0	12.32	.38	8.29	3.752	3.03
	Nov	0	14.33	.58	6.87	3.295	2.69
	Dec	0	10.86	.82	6.23	3.221	2.9
	Annual	0	75.24	26.258	51.06	39.483	40.61

19. GREENVILLE DATA ANALYSIS 1950-2002

GREENVILLE	Month	Coefficient - B	Significance (P-value)	R squared
Number of	Jan	-.028	.391	.015
Days	**Feb**	**-.053**	**.043**	**.079**
	Mar	.026	.324	.020
	Apr	**-.066**	**.012**	**.121**
	May	-.008	.799	.001
	Jun	-.021	.465	.011
	Jul	**-.058**	**.026**	**.098**
	Aug	-.036	.152	.041
	Sep	-.023	.397	.014
	Oct	.024	.411	.014
	Nov	.005	.871	.001
	Dec	-.005	.871	.001
	Annual	**-.337**	**.012**	**.117**
Intensity	**Jan**	**.004**	**.025**	**.096**
	Feb	**.012**	**.017**	**.110**
	Mar	.002	.269	.025
	Apr	.001	.710	.003
	May	.000	.907	.000
	Jun	.003	.169	.038
	Jul	.000	.929	.000
	Aug	**.005**	**.031**	**.090**
	Sep	-.002	.461	.011
	Oct	**.010**	**.012**	**.119**
	Nov	.002	.419	.013
	Dec	**.010**	**.001**	**.193**
	Annual	**.039**	**.004**	**.152**
Precipitation	Jan	.016	.206	.032
	Feb	.024	.192	.034
	Mar	**.035**	**.067**	**.067**
	Apr	-.042	.153	.040
	May	-.010	.705	.003
	Jun	.003	.901	.000
	Jul	-.016	.439	.013
	Aug	.011	.460	.011
	Sep	-.024	.321	.020
	Oct	.049	.103	.052
	Nov	.026	.274	.024
	Dec	**.051**	**.010**	**.125**
	Annual	.071	.399	.014

Statistically significant (< 0.1) values in **bold**.

20. GREENVILLE DESCRIPTIVE DATA 1950-2002

GREENVILLE	Month	Min	Max	10%	90%	Mean	Median
Number of	Jan	1	17	3	12	7.29	7
Days	Feb	1	13	3.3	11	6.77	7
	Mar	3	15	4.2	12	8.37	8
	Apr	1	17	5	12	8.06	7.5
	May	2	18	5	13	8.9	9
	Jun	2	13	3	12	6.88	7
	Jul	1	14	2	9	5.52	5
	Aug	0	13	2	8	5.06	5
	Sep	1	15	2.3	10	6.62	6.5
	Oct	1	16	2	10	6.48	6
	Nov	0	15	3	11.7	6.5	6
	Dec	1	13	3	11	6.83	7
	Annual	41	114	60.2	98	81.04	81
Intensity	Jan	.3	1.135	.185	.565	.349	.3
	Feb	.04	4	.175	.849	.523	.359
	Mar	.124	1.44	.18	.745	.442	.42
	Apr	.079	1.52	.217	1.006	.539	.461
	May	.112	1.465	.32	.999	.635	.617
	Jun	.055	1.327	.193	.866	.536	.527
	Jul	.057	2.27	.13	1.14	.568	.474
	Aug	0	1	.073	.75	.376	.315
	Sep	.04	1.288	.272	1.068	.6	.534
	Oct	.027	1.755	.115	1.3	.646	.549
	Nov	0	1.588	.188	.958	.528	.471
	Dec	.063	1.55	.164	1.141	.509	.392
	Annual	2.818	10.383	4.244	8.937	6.07	5.929
Precipitation	Jan	.03	5.5	.576	4.474	2.422	2.16
	Feb	.04	9.34	.814	6.46	3.144	2.82
	Mar	.55	9.02	1.14	6.958	3.67	3.36
	Apr	.27	18.75	1.296	7.772	4.435	4.0
	May	.56	14.19	2.09	9.158	5.534	4.95
	Jun	.11	11.94	1.03	8.468	3.852	2.82
	Jul	.012	8.81	.313	7.496	3.02	2.53
	Aug	0	6.2	1.54	4.567	2.074	1.59
	Sep	.04	11.9	.956	7.431	4.003	3.46
	Oct	.07	12.32	2.96	9.218	4.287	3.295
	Nov	0	12.7	5.89	7.738	3.489	2.815
	Dec	.13	10.86	.965	6.170	3.175	2.765
	Annual	19.38	75.24	27.778	50.974	41.942	43.142

21. PLAINVIEW DATA ANALYSIS 1908-2002

PLAINVIEW	Month	Coefficient - B	Significance (P-value)	R squared
Number of	**Jan**	**.018**	**.048**	**.042**
Days	**Feb**	**.022**	**.034**	**.048**
	Mar	**.021**	**.029**	**.052**
	Apr	.006	.563	.004
	May	.013	.263	.014
	Jun	.016	.186	.019
	Jul	.000	.998	.000
	Aug	.007	.546	.004
	Sep	.008	.540	.004
	Oct	.013	.287	.012
	Nov	.014	.124	.026
	Dec	**.016**	**.093**	**.030**
	Annual	**.190**	**.000**	**.124**
Intensity	Jan	.000	.982	.000
	Feb	**-.001**	**.026**	**.053**
	Mar	-.001	.193	.019
	Apr	**-.001**	**.059**	**.039**
	May	.000	.916	.000
	Jun	.000	.519	.005
	Jul	**-.002**	**.026**	**.054**
	Aug	**-.002**	**.048**	**.042**
	Sep	.000	.320	.011
	Oct	**-.002**	**.029**	**.051**
	Nov	-.001	.146	.23
	Dec	.000	.260	.014
	Annual	**.011**	**.006**	**.079**
Precipitation	Jan	.003	.336	.010
	Feb	-.003	.356	.009
	Mar	.001	.782	.001
	Apr	-.005	.363	.009
	May	.006	.435	.007
	Jun	.000	.958	.000
	Jul	-.009	.265	.014
	Aug	-.004	.532	.004
	Sep	-.005	.463	.006
	Oct	-.004	.568	.004
	Nov	-.001	.684	.002
	Dec	.000	.871	.000
	Annual	-.005	.831	.000

Statistically significant (< 0.1) values in **bold**.

22. PLAINVIEW DESCRIPTIVE DATA 1908-2002

PLAINVIEW	Month	Min	Max	10%	90%	Mean	Median
Number of Days	Jan	0	11	.40	7	3.10	3
	Feb	0	14	0	7.6	3.57	3
	Mar	0	12	1	7	3.63	3
	Apr	0	13	1	8	4.57	4
	May	2	15	4	11.7	7.37	7
	Jun	1	15	3	10.7	6.67	6.5
	Jul	1	15	3	9	6.05	6
	Aug	0	13	3	10.6	6.51	6
	Sep	0	14	1.4	10.6	5.89	5
	Oct	0	13	1	10	4.67	4
	Nov	0	11	0	7	3.34	3
	Dec	0	14	1	7	3.47	3
	Annual	0	94	34.3	78.7	53.4	55.5
Intensity	Jan	0	.837	.006	.415	.178	.140
	Feb	0	.972	0	.291	.154	.135
	Mar	0	1.107	.023	.498	.229	.18
	Apr	0	.96	.060	.576	.299	.271
	May	.073	1.347	.138	.707	.399	.359
	Jun	.03	1.3	.122	.818	.451	.375
	Jul	.03	1.468	.098	.725	.415	.357
	Aug	0	1.137	.106	.674	.348	.33
	Sep	0	1.103	.054	.686	.342	.31
	Oct	0	1.19	.061	.78	.354	.297
	Nov	0	1.507	0	.47	.211	.162
	Dec	0	1.43	.02	.41	.196	.140
	Annual	0	6.328	1.64	4.915	3.249	3.399
Precipitation	Jan	0	3.89	.008	1.55	.613	.39
	Feb	0	5.83	0	1.392	.656	.46
	Mar	0	3.32	.04	2.29	.874	.59
	Apr	0	6.46	.114	3.6	1.519	1.09
	May	.19	11.11	.801	6.002	2.988	2.57
	Jun	.03	10.42	.503	5.928	2.996	2.59
	Jul	.07	11.74	.338	4.914	2.554	2.06
	Aug	0	8.02	.46	4.06	2.254	2.06
	Sep	0	8.17	.132	4.852	2.241	1.63
	Oct	0	6.84	.120	4.74	1.789	1.185
	Nov	0	4.52	0	1.876	.800	.59
	Dec	0	2.82	.02	2.05	.728	.46
	Annual	0	38.1	9	26.954	18.15	18.51

23. PLAINVIEW DATA ANALYSIS 1950-2002

PLAINVIEW	Month	Coefficient - B	Significance (P-value)	R squared
Number of Days	Jan	.017	.470	.010
	Feb	.013	.640	.004
	Mar	.037	.148	.042
	Apr	.009	.717	.003
	May	-.011	.670	.004
	Jun	-.004	.894	.000
	Jul	**-.045**	**.065**	**.068**
	Aug	.008	.773	.002
	Sep	.005	.870	.001
	Oct	.006	.846	.001
	Nov	.034	.150	.042
	Dec	.036	.163	.038
	Annual	.127	.290	.022
Intensity	Jan	.001	.550	.007
	Feb	.000	.858	.001
	Mar	.002	.300	.022
	Apr	.001	.443	.012
	May	.000	.818	.001
	Jun	.000	.908	.000
	Jul	.000	.877	.000
	Aug	.001	.472	.010
	Sep	.000	.856	.001
	Oct	.000	.846	.001
	Nov	.002	.132	.046
	Dec	.001	.506	.009
	Annual	.009	.238	.027
Precipitation	Jan	.006	.320	.020
	Feb	-.001	.842	.001
	Mar	**.013**	**.083**	**.060**
	Apr	.010	.426	.012
	May	-.006	.754	.002
	Jun	-.004	.831	.001
	Jul	-.018	.385	.015
	Aug	.012	.415	.013
	Sep	-.003	.866	.001
	Oct	.002	.882	.000
	Nov	**.013**	**.034**	**.088**
	Dec	**.010**	**.085**	**.058**
	Annual	.040	.435	.012

Statistically significant (< 0.1) values in **bold**.

24. PLAINVIEW DESCRIPTIVE DATA 1950-2002

PLAINVIEW	Month	Min	Max	10%	90%	Mean	Median
Number of Days	Jan	0	9	0	7	3.35	3
	Feb	0	14	1	8.7	4	3
	Mar	0	12	1	8	4.06	4
	Apr	0	11	1.4	8	4.74	4
	May	2	14	4	12	7.63	7.5
	Jun	2	15	4	12	7.21	7
	Jul	1	15	3	9.8	6.29	7
	Aug	0	13	3	11	6.66	6
	Sep	0	14	2	12	6.17	5
	Oct	0	12	1	10.6	4.98	4
	Nov	0	11	0	7	3.61	4
	Dec	0	14	1	8	3.75	3
	Annual	34	88	44.4	80.6	61.32	59
Intensity	Jan	0	.837	0	.425	.163	.099
	Feb	0	.331	.01	.265	.125	.117
	Mar	0	1	.023	.376	.191	.15
	Apr	0	.632	.034	.514	.254	.257
	May	.073	1.347	.127	.731	.404	.359
	Jun	.083	1.178	.135	.818	.427	.362
	Jul	.03	1.468	.067	.697	.370	.334
	Aug	0	1.01	.082	.513	.305	.286
	Sep	0	1.103	.047	.568	.312	.288
	Oct	0	.929	.026	.630	.294	.240
	Nov	0	.88	0	.385	.180	.157
	Dec	0	.57	.023	.322	.162	.120
	Annual	1.60	4.908	2.018	4.214	3.136	3.05
Precipitation	Jan	0	2.64	0	1.391	.589	.47
	Feb	0	2.32	.01	1.377	.611	.47
	Mar	0	3.01	.04	2.172	.839	.5
	Apr	0	5.69	.076	3.222	1.384	.93
	May	.19	11.11	.796	6.44	3.11	2.925
	Jun	.33	10.03	.847	6.215	3.067	2.625
	Jul	.12	11.74	.24	5.272	2.514	1.84
	Aug	0	8.02	.442	4.434	2.135	1.73
	Sep	0	5.5	.129	4.771	2.134	1.64
	Oct	0	6.5	.044	.632	1.674	1.1
	Nov	0	2.71	0	1.8	.742	.58
	Dec	0	2.57	.023	1.69	.635	.435
	Annual	8.88	32.39	11.122	26.752	19.094	18.27

25. RIO GRANDE CITY DATA ANALYSIS 1897-2002

RIO GRANDE CITY	Month	Coefficient - B	Significance (P-value)	R squared
Number of Days	**Jan**	**.047**	**.008**	**.084**
	Feb	**.033**	**.006**	**.089**
	Mar	.013	.184	.022
	Apr	**.030**	**.005**	**.095**
	May	.014	.237	.018
	Jun	.016	.235	.018
	Jul	-.015	.252	.017
	Aug	.017	.185	.023
	Sep	.008	.569	.004
	Oct	.021	.140	.028
	Nov	**.027**	**.020**	**.067**
	Dec	**.038**	**.017**	**.069**
	Annual	**.337**	**.000**	**.230**
Intensity	Jan	.000	.672	.002
	Feb	-.001	.207	.020
	Mar	**-.002**	**.090**	**.036**
	Apr	**-.004**	**.053**	**.047**
	May	**-.003**	**.054**	**.046**
	Jun	.002	.254	.017
	Jul	**-.004**	**.084**	**.039**
	Aug	.001	.478	.007
	Sep	.001	.581	.004
	Oct	.002	.139	.028
	Nov	.001	.251	.017
	Dec	.000	.950	.000
	Annual	.002	.733	.001
Precipitation	Jan	.003	.449	.007
	Feb	.005	.263	.015
	Mar	-.003	.339	.011
	Apr	.002	.651	.003
	May	-.003	.733	.001
	Jun	.015	.122	.031
	Jul	**-.013**	**.065**	**.044**
	Aug	.007	.367	.011
	Sep	.020	.224	.019
	Oct	**.019**	**.014**	**.076**
	Nov	.006	.119	.031
	Dec	.003	.426	.008
	Annual	**.095**	**.002**	**.107**

Statistically significant (< 0.1) values in **bold**.

26. RIO GRANDE CITY DESCRIPTIVE DATA 1897-2002

RIO GRANDE CITY	Month	Min	Max	10%	90%	Mean	Median
Number of	Jan	0	17	1	12.7	5.96	5.5
Days	Feb	0	11	1	9	4.99	5
	Mar	0	11	1	7	3.72	4
	Apr	0	12	.2	8	3.72	3
	May	0	13	1.2	9.8	5.0	5
	Jun	0	7	1	9	4.44	4
	Jul	0	15	0	8.1	3.53	3
	Aug	0	11	0	9	4.29	4
	Sep	0	16	3	12.1	7.13	7
	Oct	0	16	1	10	5.2	5
	Nov	0	11	1	8.9	4.15	4
	Dec	0	17	1	11.7	5.5	5
*	Annual	0	92	0	74.3	43.68	51
Intensity	Jan	0	1.93	.012	.293	.145	.076
	Feb	0	1.9	.025	.389	.187	.105
	Mar	0	1.44	.01	.646	.214	.109
	Apr	0	2.5	.002	.822	.368	.26
	May	0	1.83	.101	.987	.473	.374
	Jun	0	1.4	.09	.98	.481	.46
	Jul	0	4.32	0	.836	.429	.313
	Aug	0	1.5	0	.74	.333	.281
	Sep	0	2.896	.35	1.162	.580	.484
	Oct	0	2.5	.099	.773	.381	.294
	Nov	0	1.4	.01	.457	.197	.12
	Dec	0	1.5	.02	.302	.147	.103
*	Annual	0	8.347	0	4.965	2.96	3.2
Precipitation	Jan	0	4.59	.013	2.354	.876	.55
	Feb	0	5.29	.044	2.388	.94	.61
	Mar	0	3.04	.01	2.161	.778	.455
	Apr	0	5.97	.002	3.03	1.277	.96
	May	0	10.3	.196	5.256	2.396	1.67
	Jun	0	13.26	.14	5.61	2.337	1.74
	Jul	0	7.5	0	4.342	1.528	.875
	Aug	0	10.5	0	4.17	1.752	1.15
	Sep	0	26.06	.636	7.832	4.101	3.56
	Oct	0	949	1.9	4.66	1.96	1.47
	Nov	0	4.25	.01	2.264	.89	.55
	Dec	0	4.71	.05	1.974	.793	.47
*	Annual	0	48.35	0	28.244	14.762	15.9

* Annual values adjusted for missing years (1888, 1889, 1907-1914, 1917-1927)

27. RIO GRANDE CITY DATA ANALYSIS 1950-2002

RIO GRANDE CITY	Month	Coefficient - B	Significance (P-value)	R squared
Number of	Jan	.051	.237	.027
Days	Feb	.031	.254	.025
	Mar	.021	.320	.020
	Apr	.027	.287	.023
	May	.013	.648	.004
	Jun	.011	.734	.002
	Jul	.038	.161	.040
	Aug	.014	.600	.006
	Sep	.027	.388	.015
	Oct	.005	.864	.001
	Nov	**.046**	**.080**	**.060**
	Dec	**.065**	**.073**	**.063**
	Annual	**.355**	**.010**	**.124**
Intensity	Jan	.003	.216	.030
	Feb	.002	.330	.019
	Mar	.001	.645	.004
	Apr	-.005	.142	.024
	May	.000	.902	.000
	Jun	.003	.457	.011
	Jul	-.001	.644	.004
	Aug	-.002	.457	.011
	Sep	-.002	.591	.006
	Oct	.000	.982	.000
	Nov	.003	.132	.045
	Dec	**.004**	**.064**	**.067**
	Annual	.005	.663	.004
Precipitation	Jan	.005	.623	.005
	Feb	.006	.521	.008
	Mar	.005	.454	.011
	Apr	-.008	.535	.008
	May	.006	.777	.002
	Jun	.026	.279	.024
	Jul	.021	.436	.012
	Aug	-.008	.684	.003
	Sep	.006	.875	.000
	Oct	.003	.856	.001
	Nov	.010	.234	.028
	Dec	.011	.198	.033
	Annual	.083	.264	.024

Statistically significant (< 0.1) values in **bold**.

28. RIO GRANDE CITY DESCRIPTIVE DATA 1950-2002

RIO GRANDE CITY	Month	Min	Max	10%	90%	Mean	Median
Number of Days	Jan	0	17	.4	14	6.43	7
	Feb	0	11	1.4	9.6	5.45	5
	Mar	0	9	1	7	3.87	4
	Apr	0	12	1	9	4.27	3.5
	May	0	13	1.4	10	5.17	5
	Jun	0	17	1	8.8	4.59	4
	Jul	0	11	0	7.8	3.04	2
	Aug	0	11	.3	9	4.46	4
	Sep	0	16	3	12.7	7.1	6.5
	Oct	0	16	1	10	5.58	5
	Nov	0	11	1	9	4.56	4.5
	Dec	0	17	1	11.7	5.78	5
	Annual	18	92	36.6	77.2	59.45	62
Intensity	Jan	0	1.93	.004	.274	.143	.077
	Feb	0	1.04	.016	.374	.167	.1
	Mar	0	1.44	.02	.354	.171	.1
	Apr	0	1.76	.033	.807	.241	.252
	May	0	1.3	.092	.948	.412	.34
	Jun	0	1.4	.089	.997	.509	.478
	Jul	0	1.223	0	.831	.362	.3
	Aug	0	1.5	.003	.747	.35	.314
	Sep	.048	2.896	.198	1.192	.638	.511
	Oct	0	2.5	.105	.786	.424	.362
	Nov	0	1.4	.01	.424	.206	.126
	Dec	0	1.5	.024	.301	.139	.1
	Annual	.563	8.374	2.13	4.971	3.8	3.956
Precipitation	Jan	0	4.59	.004	2.13	.893	.58
	Feb	0	5.29	.028	2.724	1.023	.71
	Mar	0	2.94	.02	1.778	.686	.44
	Apr	0	5.97	.049	3.361	1.382	1.06
	May	0	10.3	.178	5.498	2.3	1.61
	Jun	0	13.26	.18	6.34	2.534	1.78
	Jul	0	6.27	0	3.71	1.263	.79
	Aug	0	10.5	.003	4.152	1.878	1.255
	Sep	.17	26.06	.822	7.74	4.538	3.83
	Oct	0	9.49	.238	5.502	2.328	1.81
	Nov	0	3.32	.01	2.291	1.003	.685
	Dec	0	4.71	.053	2.045	.797	.415
	Annual	1.85	48.35	11.648	30.898	20.3	19.34

29. TEMPLE DATA ANALYSIS 1897-2002

TEMPLE	Month	Coefficient - B	Significance (P-value)	R squared
Number of	**Jan**	**.023**	**.055**	**.035**
Days	Feb	.016	.153	.020
	Mar	.016	.116	.024
	Apr	-.010	.313	.010
	May	.004	.678	.002
	Jun	**.019**	**.065**	**.033**
	Jul	-.014	.117	.024
	Aug	-.004	.632	.002
	Sep	**.020**	**.060**	**.035**
	Oct	.015	.182	.018
	Nov	.015	.166	.020
	Dec	.001	.927	.000
	Annual	**.105**	**.081**	**.29**
Intensity	Jan	.000	.889	.000
	Feb	.000	.728	.001
	Mar	-.001	.113	.025
	Apr	**-.002**	**.044**	**.040**
	May	.000	.715	.001
	Jun	.000	.650	.002
	Jul	.000	.786	.001
	Aug	**.002**	**.089**	**.028**
	Sep	.000	.811	.001
	Oct	.000	.781	.001
	Nov	**-.002**	**.079**	**.031**
	Dec	.000	.354	.009
	Annual	-.003	.591	.003
Precipitation	Jan	.004	.433	.006
	Feb	**.009**	**.091**	**.028**
	Mar	-.002	.674	.002
	Apr	**-.023**	**.004**	**.079**
	May	.000	.941	.000
	Jun	.007	.417	.006
	Jul	-.012	.124	.024
	Aug	.004	.628	.002
	Sep	.013	.125	.023
	Oct	.012	.169	.019
	Nov	-.001	.878	.000
	Dec	-.005	.460	.005
	Annual	.008	.808	.001

Statistically significant (< 0.1) values in **bold**.

30. TEMPLE DESCRIPTIVE DATA 1897-2002

TEMPLE	Month	Min	Max	10%	90%	Mean	Median
Number of	Jan	0	20	2.6	12	6.63	6
Days	Feb	0	16	3	12	6.82	7
	Mar	0	15	3	11	6.72	7
	Apr	1	17	3	11.7	6.78	6
	May	1	15	4	10.2	7.57	7
	Jun	0	14	2	10.5	5.57	5.5
	Jul	0	13	1	8	4.27	4
	Aug	0	13	1	8	4.18	4
	Sep	0	14	3	10	5.73	5
	Oct	0	19	2	11	5.8	5
	Nov	0	15	2	11	5.96	6
	Dec	0	15	3	11.7	6.54	6
	Annual	0	103	46.7	95.3	69.7	72
Intensity	Jan	0	1.475	.111	.548	.315	.255
	Feb	0	1.29	.110	.632	.374	.336
	Mar	0	.833	.113	.726	.369	.329
	Apr	.023	1.453	.206	1.024	.547	.446
	May	.12	2.79	.538	1.042	.624	.536
	Jun	0	1.86	.116	.933	.533	.521
	Jul	0	2.6	.081	1.012	.464	.346
	Aug	0	1.577	.078	.916	.46	.421
	Sep	0	2.95	.153	1.131	.601	.487
	Oct	0	2.118	.157	.999	.573	.523
	Nov	0	2.475	.153	.999	.532	.415
	Dec	0	1.71	.126	.729	.442	.371
	Annual	0	11.029	3.664	7.695	5.633	5.577
Precipitation	Jan	0	7.54	.372	4.58	2.053	1.57
	Feb	0	7.4	.433	4.632	2.472	2.355
	Mar	0	6.76	.443	4.553	2.454	2.215
	Apr	.16	11.63	.942	7.348	3.608	2.765
	May	.24	14.51	1.264	7.462	4.688	3.99
	Jun	0	13.62	.375	6.56	3.17	2.89
	Jul	0	19.79	.209	4.504	2.023	1.32
	Aug	0	11.61	.158	5.078	2.13	1.37
	Sep	0	11.94	.439	7.32	3.37	3.065
	Oct	0	13.54	.388	8.192	3.245	2.5
	Nov	0	13.11	.64	6.321	2.99	2.335
	Dec	0	11.16	.253	5.147	2.764	2.48
	Annual	0	56.54	20.9	46.467	33.748	34.025

31. TEMPLE DATA ANALYSIS 1950-2002

TEMPLE	Month	Coefficient - B	Significance (P-value)	R squared
Number of Days	Jan	.014	.657	.004
	Feb	-.026	.398	.015
	Mar	.036	.247	.028
	Apr	-.069	.013	.121
	May	-.014	.623	.005
	Jun	.041	.170	.037
	Jul	-.005	.864	.001
	Aug	-.021	.428	.013
	Sep	-.026	.428	.013
	Oct	.029	.412	.014
	Nov	.020	.517	.009
	Dec	.004	.902	.000
	Annual	.004	.983	.000
Intensity	Jan	.001	.587	.006
	Feb	-.001	.568	.007
	Mar	**.003**	**.083**	**.061**
	Apr	.002	.357	.018
	May	.005	.185	.036
	Jun	.002	.368	.016
	Jul	.001	.888	.000
	Aug	**.009**	**.011**	**.126**
	Sep	.005	.229	.030
	Oct	.000	.904	.000
	Nov	.002	.508	.009
	Dec	.003	.275	.024
	Annual	**.031**	**.035**	**.085**
Precipitation	Jan	.010	.480	.010
	Feb	-.007	.671	.004
	Mar	**.031**	**.032**	**.093**
	Apr	-.032	.112	.052
	May	.005	.847	.001
	Jun	.024	.274	.024
	Jul	.009	.566	.007
	Aug	.007	.771	.002
	Sep	.024	.310	.021
	Oct	.012	.666	.004
	Nov	.022	.202	.014
	Dec	.023	.156	.040
	Annual	.128	.165	.037

Statistically significant (< 0.1) values in **bold**.

32. TEMPLE DESCRIPTIVE DATA 1950-2002

TEMPLE	Month	Min	Max	10%	90%	Mean	Median
Number of Days	Jan	1	16	3	12	6.29	6.0
	Feb	0	16	3	11.9	7.18	7.5
	Mar	2	15	3	11.9	7.06	7
	Apr	1	14	2.1	11	6.6	6
	May	2	15	4	11.8	7.63	7
	Jun	0	14	2	11	5.85	6
	Jul	0	13	1	8	3.8	3
	Aug	0	13	1	8	4.02	3
	Sep	0	14	2.1	11.9	6.52	6
	Oct	0	19	2	11	5.84	5
	Nov	0	15	1	11	6.31	6
	Dec	0	15	3	11.7	6.35	6
	Annual	8	103	47	96.6	70.98	72
Intensity	Jan	.025	1.475	.091	.518	.298	.207
	Feb	0	1.29	.11	.734	.398	.360
	Mar	.02	.833	.096	.632	.318	.280
	Apr	.23	1.453	.15	.931	.475	.065
	May	.12	2.79	.225	.976	.627	.554
	Jun	0	1.523	.115	.894	.524	.522
	Jul	0	2.6	.22	1.082	.45	.335
	Aug	0	1.577	.031	1.02	.494	.421
	Sep	0	2.52	.154	1.313	.600	.465
	Oct	0	1.92	.153	1.013	.605	.557
	Nov	0	1.255	.158	.82	.454	.37
	Dec	0	1.71	.078	.744	.419	.356
	Annual	.281	9.23	3.486	7.704	5.421	5.353
Precipitation	Jan	.05	7.54	.296	4.56	1.97	1.39
	Feb	0	7.4	.449	4.956	2.748	2.675
	Mar	.08	6.53	.441	4.353	2.252	2.01
	Apr	.16	10.7	.711	5.687	2.961	2.44
	May	.24	11.26	1.32	8.31	4.617	4.1
	Jun	0	13.62	.281	6.033	3.275	3.305
	Jul	0	5.47	.032	4.364	1.705	1.18
	Aug	0	11.61	.036	6.152	2.261	1.33
	Sep	0	10.25	.514	7.297	3.721	3.29
	Oct	0	13.54	.37	8.55	3.677	2.86
	Nov	0	8.08	.77	6.14	2.88	2.47
	Dec	0	8.98	.472	5.186	2.522	2.235
	Annual	2.25	50.75	18.96	46.282	33.07	34.12

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VITA

Susan Eileen Street was born on December 18, 1958 in Houston, Texas to Elstun F. Goodman and Carene G. Goodman, graduates of Miami University at Oxford, Ohio and Watts School of Nursing at Chapel Hill, North Carolina, respectively. After graduating from Alief Hastings High School in 1976, Susan attended Texas A&M University for two years and was a member of the Corps of Cadets. She worked in private industry until 1986 when she entered Sam Houston State University and earned a Bachelor of Arts-Teaching degree in 1990, and taught Sixth Grade Social Studies in Houston. Upon being introduced to Photogrammetry in 1993, she worked for 15 years as a Stereo Photogrammetry Technician in San Antonio, Texas until returning to school at Texas State University-San Marcos in 2008 to pursue a Master's Degree in Geography.