



NOAA Technical Memorandum NWS WR-212

**PRELIMINARY ANALYSIS OF THE SAN FRANCISCO
RAINFALL RECORD: 1849-1990**

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Preliminary Analysis of the San Francisco Rainfall Record: 1849-1990

I. INTRODUCTION

Background

During the 1980s, the State of California had experienced a wide swing from too little to too much water and back again. To plan for and mitigate such events Federal, state, and local officials need to have sufficient data to base their risk management decisions upon. In addition to meteorological forecasts, an analysis of detailed climatological data is necessary to examine past events and plan for mitigation of future ones.

Currently, no comprehensive analysis of rainfall data and its variability for California, in general, or San Francisco, in particular, exists. The data that are available are either incomplete or not synthesized in a manner that is generally useful to the decision maker.

Objectives

The overall objective of this study is to establish an in-depth analysis of the San Francisco rainfall record. The manner in which it will be accomplished is as follows:

- First, it is necessary to collect and determine the veracity of the existing data for the site in question. Monthly and seasonal rainfall data for San Francisco is readily available, however it has never undergone rigorous statistical testing to determine if it is homogeneous. If the data are found not to be valid, then adjustments will have to be made to make it representative.
- The second step of the analysis process will be to delineate the basic data set in a concise and meaningful manner. The various statistical parameters that describe the San Francisco rainfall record will also be developed.
- Next the existing record will be used to calculate the return periods for various dry (drought) and wet (flood) events. This type of frequency analysis is especially useful to persons making risk management decisions such as water managers and flood control engineers.
- Finally, a time series will be analyzed for trends and to attempt to determine if there have been periods of greater variability.

II. SAN FRANCISCO RAINFALL RECORD

Climate and Geographical Description

The location of San Francisco, in the middle latitudes on the west coast of the continent, places it in a Mediterranean type climate, which is a Köppen type Cs (Ahrens, 1988). This type of climate is characterized by moist, mild winters and dry summers.

This climate is also modified by the fact that the city of San Francisco is on the northern end of a peninsula (Fig. 1), surrounded on three sides by the relatively cool waters of the Pacific Ocean and San Francisco Bay.

San Francisco is generally in the shape of a square measuring approximately seven miles on a side, and is bisected by a portion of the Coast Range that extends from north to south. The highest elevations in the city are along this bisector and approach 1000 feet above sea level, sloping gradually westward to the Pacific Ocean. The terrain east of this divide is more varied with a number of hills that range to 300 feet above sea level.

Selection Criteria

San Francisco has been chosen for this study for several reasons. Foremost, it represents the oldest continuous rainfall record in California. Because it is centrally located, it is generally representative of other sites in northern and central California, and is specifically representative of those in the San Francisco Bay Area.

It was also chosen because it has been a National Weather Service site in a large urban area and consequently monitored closely throughout its period of record. The assumption that the record is homogeneous will be tested as part of this research.

Because there is a natural break in California rainfall during the dry summer months, the data for this research are based upon a "rainfall season" from July 1 to June 30. This methodology has been adopted by many researchers of west coast climates, including Granger (1976, 1979) and Quintana (1986). This differs only slightly from the "water year" used by hydrologists that runs from October 1 to September 30.

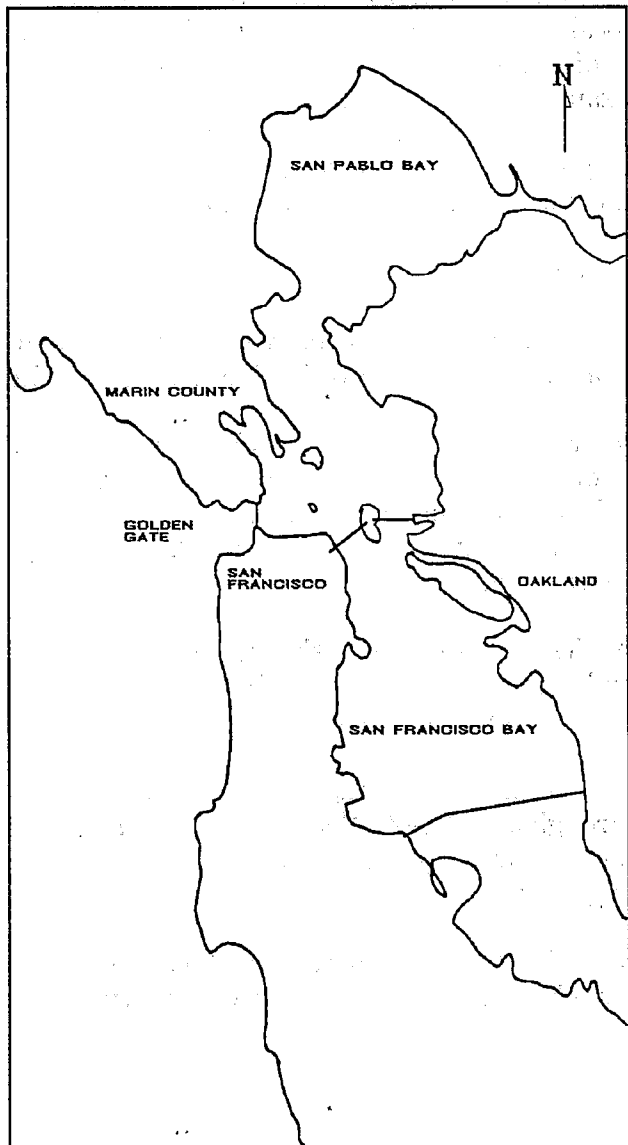


Fig. 1.

Historical Review

The rainfall record for San Francisco is the oldest continuous record of weather observations in California, dating back to the Gold Rush. Between 1849 and present, the site has been at 13 different locations, all located in the northwestern quadrant of the city (Fig. 2).

The first observations began at the San Francisco Presidio in 1847 and continued intermittently until 1849. On August 14, 1849, Thomas Tennet began the continuous San Francisco record and continued through 1871 (Pericht, 1988). Tennet's observations were at six different sites confined to a small area in the Nob Hill and Telegraph Hill area (Appendix A).

Tennet, a maker of nautical and mathematical instruments, supplied his data to local newspapers, and eventually published it in Tennet's Nautical Almanac beginning in 1868. It has been used as the "official" early record despite the fact that several other individuals were compiling weather data simultaneously.

On February 2, 1871, the U.S. Army Signal Corps took over as the official weather observer for San Francisco. From that time to present, the U. S. Government has taken the observations; first the U. S. Weather Bureau, later renamed the National Weather Service. During the period from 1871 to present, the observation site was moved another six times, but still remained in the northwestern portion of the city.

The observation site at the Mills Building was destroyed by the earthquake and fire on April 18, 1906, and observations were taken at a private residence about 2 miles to the west until October 1, 1906. There is a discrepancy in the records (Null, 1978; Pericht 1988) as to whether observations were taken between April 18 and May 1, 1906; though McAdie (1906) indicates rainfall for San Francisco on several dates during that period. This corresponds to data available at several other nearby sites during the same period.

It was discovered that there was a "minor malfunction" in the rain gauge on the Federal Office Building from January 1973 to April 1982 (Pericht, 1988). The record was corrected by substituting data from KGO Television, which was only 2 blocks away, and was found to be representative.

The latest location is at Mission Dolores, where it was moved in April 18, 1983. This site is the southernmost of the 13 locations, yet it is within a 2-mile diameter circle that encompasses all of the aforementioned sites.

San Francisco Data Set

Monthly data for San Francisco were compiled by Null (1978) from data archived by the National Weather Service at San Francisco Airport (Appendix B). These data were from original hand-written records as well as from the National Climatic Data Center (NCDC). It was later updated by Pericht (1988).

Initial error checking of the data was accomplished by comparing the sums of the monthly amounts with published seasonal totals. Subsequently, the monthly and seasonal amounts were cross-checked against data from Rowntree (1990), with discrepancies resolved by comparison to original daily records.

Data for 15 surrounding sites (1889-1989) was used in the homogeneity testing (Goodridge, 1990), and has not been rigorously scrutinized. These data, which came from a hydrologic database maintained by Goodridge, are for the "water year" which is widely used by hydrologists, and is for the period of October 1 to September 30. A seasonal mean for these stations was calculated to generate a regional average or "index".

Fig. 2



III. HOMOGENEITY OF DATA

Definitions

Because climate (and consequently climatic data) can be highly variable, it is often difficult to differentiate between fluctuations occurring randomly and those that result from other sources. It is therefore necessary with any climatic time series to determine if the data are homogeneous. Conrad and Pollack (1950) offer the following definition: *A numerical series representing the variations of a climatological element is called "homogeneous" if the variations are caused only by variations of weather and climate.*

Since it is impossible, due to naturally occurring variations, to tell if a climatological time series is "absolutely homogeneous", systematic errors caused by other than natural reasons must be deduced by examining surrounding sites. This methodology is defined by Conrad and Pollack (1950) as follows: *A climatological series is relatively homogeneous with respect to a synchronous series at another place if the differences (or ratios) of pairs of homologous average constitute a series of random numbers that satisfies the law of errors.*

Most discontinuities in rainfall records result from changes in the location of the gauge, instrument malfunctions or in changes in the gauge's exposure. Factors that can affect the exposure of a site include nearby construction, vegetation growing or being cut down, or height changes.

These discontinuities take either of two forms. The first results in a distinct break in the time series, and is usually the result of a relocation of the gauge to a different microclimate. The second, more subtle, type of change is caused by gradual changes near the gauge, such as the growth of vegetation or by nearby construction.

Methods of Testing for Homogeneity

Tests of homogeneity of a rainfall record take the form of the null hypothesis (H_0) that the series exhibits the characteristics of a random series. Therefore, by using statistical tests that reject the null hypothesis, it can be determined whether or not the rainfall record is indeed not random.

Two widely used tests for testing the homogeneity of a rainfall record are a double-mass analysis (Linsley, Kohler & Paulus, 1949) and the Kendall tau correlation test (Thom, 1981). These are both relatively simple nonparametric tests that have no specific requirement to know the Gaussian (normal) distribution of the data.

Double-mass analysis is a graphical technique that is an objective means of determining breaks in a time series. The accumulated sums of a dependent variable is plotted versus the accumulated sum of the average of the independent variables. A "best fit" line is drawn and by using nearby stations, a nearly linear plot is generated, with changes in the slope of the plot indicating a possible discontinuity in the data. These "break points" should then be examined to determine the source of the change. Corrections can be made to the record by adjusting the dependent variable using the ratios of the change in the slope.

Double-mass plots do have the disadvantage of not being sensitive to breaks near either end of the record, and are also only useful for those periods that stations have overlapping records. Furthermore they cannot distinguish the cause of break.

The Kendall tau (τ) rank correlation is a robust non-parametric test of the statistical alternative to trend (i.e., randomness). It takes the form:

$$\tau = \frac{S}{\frac{1}{2}N(N-1)}$$

where N = the number of pairs and
 S = the ordered ranking of the pairs.

The statistical significance is then tested by calculating a z-score using:

$$z = \frac{\tau}{\sqrt{\frac{2(2N+5)}{9N(N-1)}}}$$

Results of Homogeneity Testing

The seasonal rainfall record for San Francisco (1889 to 1989) was converted to "water year" to facilitate homogeneity testing with the Goodridge 15 station water year data set. [While it would have been ideal to use the "rainfall season" throughout this study, the only comparable records were by water year. The slight shift, from July 1 to October 1, should have no effect upon the homogeneity testing, as this is a dry time of year with less than 3% of the seasonal average. Once the homogeneity of the San Francisco record can be verified, the record can be used as either rainfall season or water year].

The data were tested using both the double-mass graphical analysis and the Kendall rank correlation statistic. All calculations were done using GB-Stat (1990), a commercial statistics package, after importing the data from Quattro Professional 2.0 (1990).

The double-mass plot (Fig. 3) is constructed by plotting the accumulated sum of rainfall at San Francisco along the abscissa and the accumulated sum of the average of 15 other stations in the region along the ordinate.

Analysis of the double-mass plot yielded a change in slope which corresponded to the period in 1906 when the rain gauge was moved several times following the San Francisco Earthquake. Immediately after the quake was a period of growth for the area, a trend which

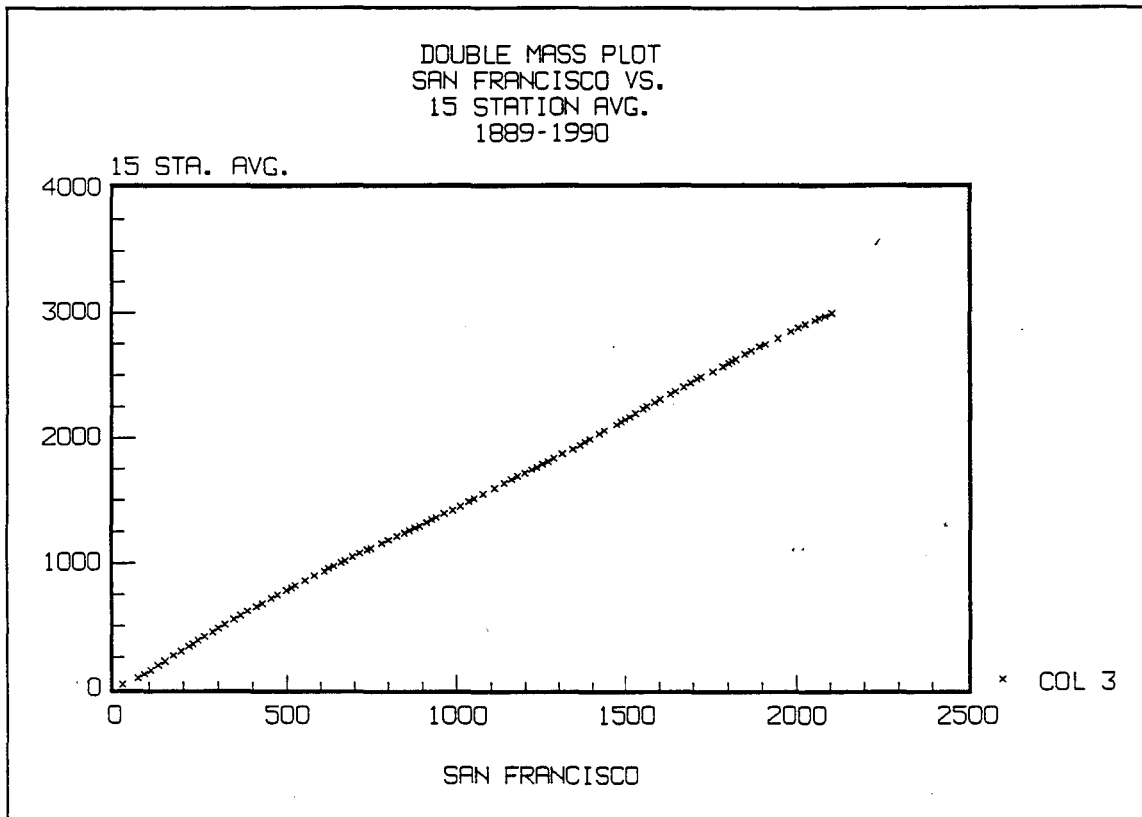


Fig. 3. Double Mass Plot of San Francisco vs. 15 Station Average

continues. While this type of analysis does not specify the reason for any changes, it can be surmised from the station record that the 1906 moves resulted in a change in the slope of the plot.

The Kendall rank correlation statistic was $\tau = 1.00$, with a resulting z-score of 14.81, which has a significance of $<.0001$. (The z-score expresses a specific value in terms of the number of standard deviations it is from the mean).

Because of the break in the double-mass plot and that the Kendall rank correlation was so robust, then the null hypothesis that "changes to the time series are random" must be rejected.

Further research using the San Francisco rainfall data set should address the break in the record. This can be done by adjusting the slope of the curve on either side of the break to match the other. It is problematical as to which side is adjusted, depending if it's desired to have the "old" record match "new" or vice-versa.

This can also be seen by analyzing the linear trend of the time series from 1849 to 1990 (Fig. 4); and then comparing it to the trend lines for 1849 to 1905 segment and (Fig. 5), and the 1907 to 1990 segment (Fig. 6). It can be seen that the downward trend seen in the overall record is in fact biased by the first 56 years of record.

Therefore, users of the San Francisco data set should be aware of this change in slope of the data, and make appropriate adjustments as suggested by Linsley, Kohler, and Paulus (1949).

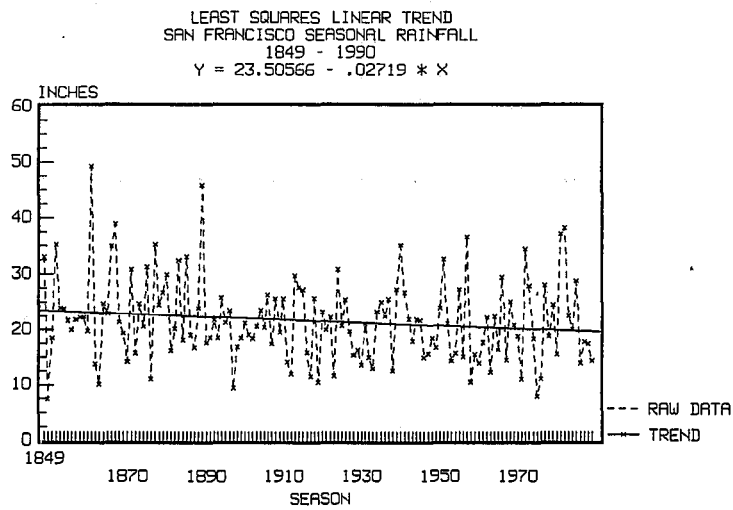


Fig. 4.

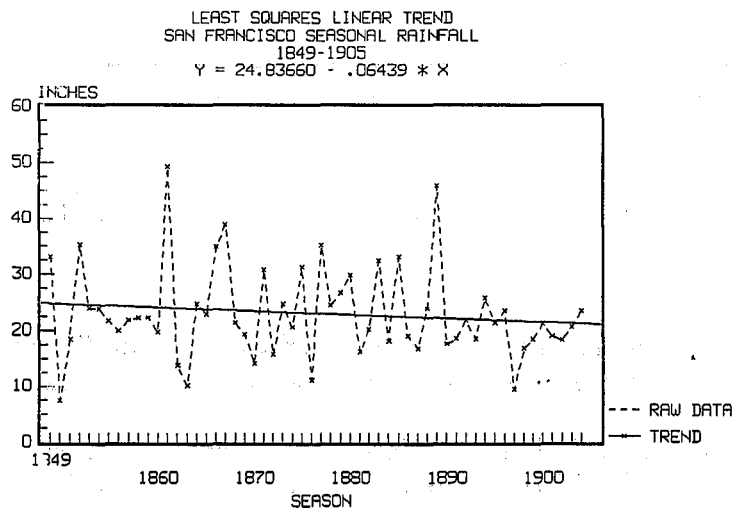


Fig. 5.

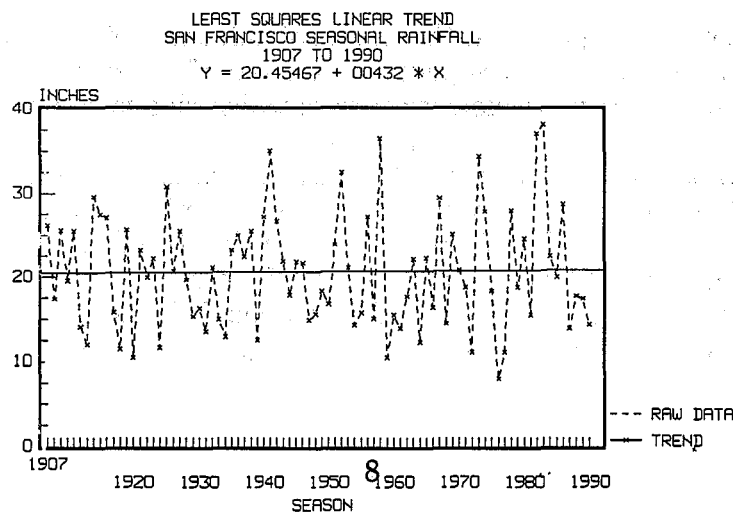


Fig. 6.

IV. STATISTICAL ANALYSIS

Methodology and Definitions

In this section, the objective is to subject the San Francisco rainfall record to a variety of statistical tests, in an effort to make the data meaningful.

A wide array of statistical terms can be used to describe climatological data and its distribution. These include many common statistical terms as well as some unique to climatology. The following functions are those that will be used in defining the rainfall of San Francisco.

The mean is the arithmetic average of rainfall over time and represents the central tendency of the data.

$$\bar{X} = \frac{\sum X}{N}$$

A rainfall normal is merely the mean over a given period of time. The accepted normal period used by the National Weather Service is 30 years.

The standard deviation (S) and coefficient of variation (CV) are both measures of the dispersion of the data from the mean. The standard deviation has the same units as the mean, while the coefficient of variation is dimensionless.

$$S = \sqrt{\frac{\sum (x)^2}{n-1}}$$

$$CV = \frac{S}{\bar{X}}$$

The coefficient of skew (g) is another dimensionless number that is a measure of the lack of symmetry of the data set. Rainfall data are bounded by zero on one end and unbounded on the other; it is usually skewed positively.

$$g = \frac{N \sum x^3}{(N-1)(N-2) S^3}$$

Wet and Dry Period Return Periods

The frequency that a rainfall event will occur is best defined by assigning the distribution model that best fits the data. Wu and Goodridge (1976) determined that long-term California rainfall (i.e., one year or more) is best described by a gamma (Pearson Type III) type distribution. The frequency that a given event will exceed a certain threshold is then defined by the relationship of the gamma distribution and the coefficient of skew. A multiplier for each exceedence factor corresponding to a particular coefficient of skew is

derived from the Pearson Type III table. The standard deviation is multiplied by this factor, and the resulting product is added to the mean,

$$R_E = (\Gamma *) + \bar{x}$$

where R_E is the exceedence rainfall and Γ is the multiplier from the gamma distribution.

Using the following statistical parameters from the entire 141 year period of record, return periods were calculated for both dry and wet events for San Francisco:

Period of Record	=	141 Seasons
Mean (\bar{x})	=	21.58 inches
Standard Deviation (S)	=	7.46 inches
Coefficient of Skewness (g)	=	.832

Return Periods of Less than Normal Rainfall

<u>Exceedence Freq.</u>	<u>Return Period</u>	<u>Amount</u>
.0001	10000 Years	5.28 inches
.0005	2000	5.97
.0010	1000	6.48
.0050	200	7.76
.0100	100	8.65
.0200	50	9.60
.0250	40	9.95
.0400	25	10.78
.0500	20	11.22
.1000	10	12.88
.2000	5	15.19

Return Periods of Greater than Normal Rainfall

<u>Exceedence Freq.</u>	<u>Return Period</u>	<u>Amount</u>
.8000	5 Years	27.40 inches
.9000	10	31.58
.9500	20	35.31
.9600	25	36.43
.9750	40	38.81
.9800	50	39.86
.9900	100	43.14
.9910	200	46.27
.9990	1000	53.21
.9995	2000	56.12
.9999	10000	62.61

Variations with Time

Examining the time series for the entire period of record shows that the seasonal rainfall has fluctuated with time. Since the most common "normal" period used is 30 years, running 30-year means and standard deviations were calculated and plotted (Fig. 7). This was accomplished for each 30-year period, beginning with the period of 1849-1878 and continuing for each of the 30-year periods through 1960-1989.

From Fig. 7, it can be seen that there are maxima in both the 30-year mean and standard deviations between 1890 and 1900, while there are minima from about 1920 to 1950. Since 1950, the standard deviation has gradually been rising. Further investigation, beyond the scope of this research, should be done to establish if the peaks are statistically significant.

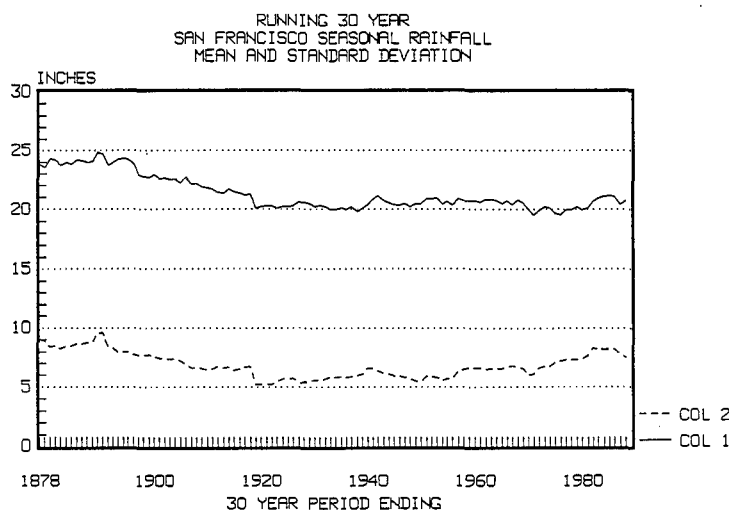


Fig. 7.

Subperiod Rainfall

The data were also analyzed for five, ten and fifteen year periods (Appendix C). The decade and 30-year means and standard deviations are summarized below (Table 1).

TABLE 1. Subperiod Rainfall

<u>Period</u>	<u>10 yr Mean</u>	<u>Std. Dev.</u>	<u>30 yr Mean</u>	<u>Std. Dev.</u>
1850-1859	22.75	7.28		
1860-1869	25.79	11.29		
1870-1879	22.70	7.59	23.75	9.02
1880-1889	23.60	6.27	24.03	8.72
1890-1899	21.88	9.03	22.73	7.72
1900-1909	21.05	2.92	22.17	6.62
1910-1919	20.81	6.66	21.24	6.71
1920-1929	19.91	5.87	20.59	5.42
1930-1939	18.73	4.93	19.82	5.93
1940-1949	22.08	5.84	20.25	5.74
1950-1959	21.35	8.10	20.72	6.59
1960-1969	18.91	5.28	20.78	6.66
1970-1979	19.68	7.99	19.98	7.32
1980-1989	23.55	8.17	20.71	7.55

The data were also sorted by accumulated seasonal rainfall for one, two, three, four and five year periods (Appendix D).

V. SUMMARY AND CONCLUSIONS

The analysis of the San Francisco rainfall record shows a total of thirteen changes in the location of the official observation during the 141 seasons of record. This has resulted in a "break" in the record about 1906, despite a very strong Kendall rank correlation with 15 surrounding stations from 1889 to 1990. Because of the 1906 break, the original hypotheses that the record would be homogeneous has not been proved.

If the entire long-term record is used in further research, an adjustment to compensate for the changes due to the break will have to be made. Shorter periods of analysis (i.e., those that do not cross the 1906 season) would not have to make adjustments, as there appears to be homogeneity from 1889 to 1905 and again from 1907 to 1990.

The second hypothesis, that the data set would show periods of greater variability, has been substantiated by examination of the both the 30 year mean and standard deviation.

Finally, this research should be the cornerstone of an even more exhaustive examination of the San Francisco rainfall record. This would include analysis of monthly and daily data sets, as well as performing correlations of various subperiods.

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APPENDIX A.

STATION LOCATIONS

<u>Map #</u>	<u>Location</u>	<u>Began</u>	<u>Ended</u>	<u>Elev. ASL</u>
1	NE Corner Union & Dupont St	08/14/1849	07/01/1851	125'
2	Corner of Stockton & California	07/02/1851	7/1862	175'
3	Powell St between Pacific & Broadway	7/1862	Summer 1863	120'
4	Sacramento St between Taylor & Jones	Summer 1863	7/1864	330'
5	Leavenworth between Pine & California	7/1864	7/1866	260'
6	Battery St between Washington & Jackson	7/1866	02/01/1871	14'
7	Merchants Exchange Bldg Sacramento & Leideadorff	02/02/1871	09/03/1890	15'
8	Phelan Bldg Market, Grant & O'Farrell	09/04/1890	10/31/1892	41'
9	Mills Bldg 220 Montgomery St	11/01/1892	04/18/1906	25'
10	Residence 3018 Clay St	05/01/1906	09/30/1906	257'
11	Merchant's Exchange Bldg 465 California St	10/01/1906	05/12/1936	17'
12	Federal Office Bldg 50 Fulton St	05/13/1936	04/18/1983	52'
13	Mission Dolores 16th & Mission St	04/18/1983	Present	75'

APPENDIX B.

SAN FRANCISCO MONTHLY PRECIPITATION DATA (1849-1990)

SEASON	MONTH	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	SEASON	SEASON
1849 -1850	0.00	0.00	0.00	3.14	8.66	6.20	8.34	1.77	4.53	0.46	0.00	0.00	0.00	1849 -1850	33.10
1850 -1851	0.00	0.00	0.33	0.00	0.92	1.05	0.72	0.54	1.94	1.23	0.67	0.02	0.02	1850 -1851	7.42
1851 -1852	0.00	0.02	1.03	0.21	2.12	7.10	0.58	0.14	6.68	0.26	0.32	0.00	0.00	1851 -1852	18.46
1852 -1853	0.00	0.00	0.00	0.80	5.31	13.20	3.92	1.42	4.86	5.37	0.38	0.00	0.00	1852 -1853	35.26
1853 -1854	0.00	0.04	0.46	0.12	2.28	2.32	3.88	8.04	3.51	3.12	0.02	0.08	0.08	1853 -1854	23.87
1854 -1855	0.00	0.00	0.15	2.43	0.34	0.87	3.67	4.77	4.64	4.99	1.88	0.08	0.08	1854 -1855	23.83
1855 -1856	0.00	0.00	0.00	0.00	0.67	5.76	9.40	0.50	1.60	2.94	0.76	0.03	0.03	1855 -1856	21.66
1856 -1857	0.02	0.00	0.07	0.45	2.79	3.75	2.45	8.59	1.62	0.00	0.05	0.12	0.12	1856 -1857	19.91
1857 -1858	0.00	0.00	0.00	0.93	3.01	4.14	4.36	1.83	5.55	1.55	0.34	0.05	0.05	1857 -1858	21.81
1858 -1859	0.05	0.16	0.00	2.74	0.69	6.14	1.28	6.32	3.02	0.27	1.55	0.00	0.00	1858 -1859	22.22
1859 -1860	0.00	0.02	0.03	0.05	7.28	1.57	1.64	1.60	3.99	3.14	2.86	0.09	0.09	1859 -1860	22.27
1860 -1861	0.21	0.00	0.00	0.91	0.58	6.16	2.47	3.72	4.08	0.51	1.00	0.08	0.08	1860 -1861	19.72
1861 -1862	0.00	0.00	0.02	0.00	4.10	9.54	24.36	7.53	2.20	0.73	0.74	0.05	0.05	1861 -1862	49.27
1862 -1863	0.00	0.00	0.00	0.52	0.15	2.35	3.63	3.19	2.06	1.61	0.23	0.00	0.00	1862 -1863	13.74
1863 -1864	0.00	0.00	0.03	0.00	2.55	1.80	1.83	0.00	1.52	1.57	0.78	0.00	0.00	1863 -1864	10.08
1864 -1865	0.00	0.21	0.01	0.13	6.68	8.91	5.14	1.34	0.74	0.94	0.63	0.00	0.00	1864 -1865	24.73
1865 -1866	0.00	0.00	0.24	0.26	4.19	0.58	10.88	2.12	3.04	0.12	1.46	0.04	0.04	1865 -1866	22.93
1866 -1867	0.00	0.00	0.11	0.00	3.35	15.16	5.16	7.20	1.58	2.36	0.00	0.00	0.00	1866 -1867	34.92
1867 -1868	0.00	0.00	0.04	0.20	3.41	10.69	9.50	6.13	6.30	2.31	0.03	0.23	0.23	1867 -1868	38.84
1868 -1869	0.00	0.00	0.00	0.15	1.18	4.34	6.35	3.90	3.14	2.19	0.08	0.02	0.02	1868 -1869	21.35
1869 -1870	0.00	0.00	0.12	1.29	1.19	4.31	3.89	4.78	2.00	1.53	0.20	0.00	0.00	1869 -1870	19.31
1870 -1871	0.00	0.00	0.03	0.00	0.43	3.38	3.07	3.76	1.31	1.89	0.23	0.01	0.01	1870 -1871	14.11
1871 -1872	0.00	0.02	0.00	0.07	2.81	14.36	4.00	6.90	1.59	0.81	0.18	0.04	0.04	1871 -1872	30.78
1872 -1873	0.01	0.00	0.04	0.11	2.79	5.95	1.58	3.94	0.79	0.43	0.00	0.02	0.02	1872 -1873	15.66
1873 -1874	0.01	0.08	0.00	0.83	1.16	9.72	5.66	2.21	3.36	0.90	0.66	0.14	0.14	1873 -1874	24.73
1874 -1875	0.00	0.09	0.02	2.69	6.55	0.33	8.01	0.32	1.30	0.10	0.22	1.02	1.02	1874 -1875	20.56
1875 -1876	0.00	0.00	0.00	0.24	7.27	4.15	7.55	4.92	5.49	1.29	0.24	0.04	0.04	1875 -1876	31.19
1876 -1877	0.01	0.01	0.38	3.36	0.25	0.00	4.32	1.18	1.08	0.26	0.18	0.01	0.01	1876 -1877	11.04
1877 -1878	0.02	0.00	0.00	0.65	1.57	2.66	11.97	12.52	4.56	1.06	0.16	0.01	0.01	1877 -1878	35.18
1878 -1879	0.01	0.00	0.55	1.27	0.57	0.58	3.52	4.90	8.75	1.89	2.35	0.05	0.05	1878 -1879	24.44
1879 -1880	0.01	0.02	0.00	0.78	4.03	4.46	2.23	1.87	2.08	10.06	1.12	0.00	0.00	1879 -1880	26.66
1880 -1881	0.00	0.00	0.00	0.05	0.33	12.33	8.69	4.65	0.90	2.00	0.22	0.69	0.69	1880 -1881	29.86
1881 -1882	0.00	0.00	0.25	0.54	1.94	3.85	1.68	2.96	3.45	1.22	0.21	0.04	0.04	1881 -1882	16.14
1882 -1883	0.00	0.00	0.26	2.66	4.18	2.01	1.92	1.04	3.01	1.51	3.52	0.01	0.01	1882 -1883	20.12
1883 -1884	0.00	0.00	0.42	1.48	1.60	0.92	3.94	6.65	8.24	6.33	0.23	2.57	2.57	1883 -1884	32.38
1884 -1885	0.00	0.04	0.33	2.55	0.26	7.68	2.53	0.30	1.01	3.17	0.04	0.19	0.19	1884 -1885	18.10
1885 -1886	0.06	0.00	0.11	0.72	11.78	4.99	7.42	0.24	2.07	5.28	0.37	0.01	0.01	1885 -1886	33.05
1886 -1887	0.23	0.00	0.01	1.48	0.84	2.07	1.90	9.24	0.84	2.30	0.06	0.07	0.07	1886 -1887	19.04
1887 -1888	0.00	0.01	0.29	0.00	0.99	3.34	6.81	0.94	3.60	0.11	0.38	0.27	0.27	1887 -1888	16.74
1888 -1889	0.01	0.01	0.98	0.13	3.99	5.80	1.28	0.72	7.78	0.96	2.17	0.03	0.03	1888 -1889	23.86
1889 -1890	0.01	0.00	0.00	7.28	2.90	13.81	9.61	5.16	4.73	1.18	1.07	0.10	0.10	1889 -1890	45.85
1890 -1891	0.02	0.00	0.31	0.00	0.00	3.25	0.98	7.26	1.96	2.44	1.25	0.11	0.11	1890 -1891	17.58
1891 -1892	0.10	0.02	0.77	0.04	0.56	5.62	2.42	2.90	2.85	1.39	1.86	0.00	0.00	1891 -1892	18.53
1892 -1893	0.00	0.00	0.02	1.65	3.91	5.08	3.05	2.75	4.08	1.03	0.15	0.03	0.03	1892 -1893	21.75
1893 -1894	0.02	0.00	0.21	0.16	4.18	2.25	5.99	2.69	0.60	0.50	1.31	0.56	0.56	1893 -1894	18.47
1894 -1895	0.00	0.00	1.05	1.73	0.88	9.01	6.99	2.31	1.89	1.24	0.60	0.00	0.00	1894 -1895	25.70
1895 -1896	0.01	0.00	0.77	0.11	1.78	1.43	8.14	0.28	2.85	5.16	0.72	0.00	0.00	1895 -1896	21.25
1896 -1897	0.04	0.09	0.52	1.55	4.56	4.34	2.26	4.41	4.56	0.27	0.61	0.22	0.22	1896 -1897	23.43
1897 -1898	0.00	0.00	0.10	1.70	1.05	1.22	1.12	2.13	0.24	0.19	1.44	0.19	0.19	1897 -1898	9.38
1898 -1899	0.00	0.00	1.06	0.86	0.46	1.62	3.67	0.10	7.61	0.62	0.86	0.01	0.01	1898 -1899	16.87
1899 -1900	0.00	0.00	0.00	3.92	3.79	2.65	4.11	0.64	1.91	1.08	0.32	0.05	0.05	1899 -1900	18.47
1900 -1901	0.00	0.09	0.46	1.48	3.91	1.37	5.79	5.03	0.80	1.64	0.69	0.00	0.00	1900 -1901	21.17
1901 -1902	0.00	0.00	0.78	0.64	3.48	0.90	1.23	7.27	2.65	0.98	1.05	0.00	0.00	1901 -1902	18.98
1902 -1903	0.00	0.00	0.00	1.70	1.98	2.32	3.73	1.76	6.23	0.56	0.00	0.00	0.00	1902 -1903	18.28
1903 -1904	0.00	0.00	0.00	0.17	4.25	1.63	1.05	5.89	6.01	1.29	0.30	0.00	0.00	1903 -1904	20.59
1904 -1905	0.02	0.06	5.07	2.37	1.07	1.59	4.04	2.70	3.15	1.33	2.05	0.00	0.00	1904 -1905	23.45
1905 -1906	0.00	0.00	0.00	0.00	0.92	2.05	3.90	4.30	5.02	0.92	2.75	0.56	0.56	1905 -1906	20.42
1906 -1907	0.08	0.11	0.18	0.03	1.59	6.90	4.41	3.02	8.42	0.11	0.04	1.28	1.28	1906 -1907	26.17
1907 -1908	0.00	0.00	0.11	1.36	0.04	3.66	4.88	5.39	0.90	0.22	0.76	0.01	0.01	1907 -1908	17.35
1908 -1909	0.02	0.01	0.13	0.61	1.34	2.15	10.51	7.53	3.27	0.00	0.00	0.00	0.00	1908 -1909	25.57
1909 -1910	0.00	0.00	0.80	1.23	2.43	5.59	3.24	2.09	3.78	0.31	0.03	0.02	0.02	1909 -1910	19.52
1910 -1911	0.00	0.00	0.05	0.65	0.48	1.73	13.79	3.02	4.57	0.89	0.28	0.03	0.03	1910 -1911	25.49
1911 -1912	0.00	0.00	0.00	0.28	0.60	2.54	2.47	0.41	4.10	1.38	1.47	0.81	0.81	1911 -1912	14.06
1912 -1913	0.00	0.00	1.25	0.49	1.94	1.30	3.84	0.43	1.47	0.60	0.63	0.02	0.02	1912 -1913	11.97

1913 -1914	0.07	0.01	0.00	0.35	6.22	5.41	9.76	5.04	1.09	0.99	0.37	0.29	1913 -1914	29.60
1914 -1915	0.02	0.00	0.00	0.29	0.70	5.49	6.74	7.36	3.02	0.62	3.17	0.00	1914 -1915	27.41
1915 -1916	0.01	0.00	0.00	0.01	0.92	6.42	14.59	3.77	1.33	0.00	0.07	0.00	1915 -1916	27.12
1916 -1917	0.03	0.29	1.20	0.52	1.50	4.79	1.83	3.81	1.42	0.33	0.06	0.00	1916 -1917	15.78
1917 -1918	0.00	0.00	0.02	0.00	0.81	0.72	0.81	5.79	2.73	0.60	0.00	0.00	1917 -1918	11.48
1918 -1919	0.00	0.00	2.53	0.17	5.60	2.62	2.57	9.31	2.74	0.10	0.00	0.00	1918 -1919	25.64
1919 -1920	0.01	0.00	0.39	0.27	0.44	3.21	0.26	1.23	3.25	1.36	0.00	0.04	1919 -1920	10.46
1920 -1921	0.00	0.00	0.13	1.83	2.70	7.48	6.30	1.38	2.28	0.54	0.52	0.00	1920 -1921	23.16
1921 -1922	0.00	0.00	0.35	0.52	1.43	6.39	2.41	5.15	2.38	0.47	0.55	0.26	1921 -1922	19.91
1922 -1923	0.00	0.00	0.00	2.95	3.77	7.77	2.84	0.77	0.03	3.92	0.06	0.06	1922 -1923	22.17
1923 -1924	0.00	0.01	0.44	0.46	0.49	1.91	2.75	3.30	1.96	0.30	0.00	0.00	1923 -1924	11.62
1924 -1925	0.00	0.01	0.00	2.98	1.50	7.37	1.62	7.90	2.63	2.73	4.02	0.05	1924 -1925	30.81
1925 -1926	0.06	0.00	0.45	0.31	2.32	1.01	5.48	5.40	0.25	5.26	0.15	0.00	1925 -1926	20.69
1926 -1927	0.00	0.04	0.00	1.90	7.21	1.04	3.77	6.85	2.19	1.95	0.10	0.38	1926 -1927	25.43
1927 -1928	0.00	0.00	0.00	1.93	3.18	3.94	2.40	1.97	4.65	1.31	0.26	0.00	1927 -1928	19.64
1928 -1929	0.00	0.00	0.03	0.13	3.35	4.89	1.32	2.14	1.56	1.01	0.01	0.86	1928 -1929	15.30
1929 -1930	0.00	0.00	0.00	0.01	0.00	3.09	4.99	2.94	3.53	1.56	0.16	0.00	1929 -1930	16.28
1930 -1931	0.00	0.00	0.10	0.89	1.56	0.98	5.50	1.10	1.68	0.31	1.10	0.32	1930 -1931	13.54
1931 -1932	0.00	0.00	0.00	0.68	2.93	9.24	3.23	3.00	0.86	0.47	0.65	0.03	1931 -1932	21.09
1932 -1933	0.00	0.00	0.00	0.01	1.00	2.75	5.68	1.13	2.93	0.06	1.36	0.01	1932 -1933	14.93
1933 -1934	0.00	0.00	0.14	1.49	0.00	4.19	1.03	4.68	0.07	0.51	0.12	0.68	1933 -1934	12.91
1934 -1935	0.01	0.00	0.13	0.88	3.76	4.06	6.23	2.38	2.31	3.45	0.01	0.00	1934 -1935	23.22
1935 -1936	0.00	0.25	0.08	1.44	1.24	3.25	5.77	10.06	1.01	1.09	0.49	0.28	1935 -1936	24.96
1936 -1937	0.03	0.02	0.00	0.69	0.01	2.94	5.26	4.88	7.05	0.86	0.06	0.59	1936 -1937	22.39
1937 -1938	0.00	0.00	0.00	0.90	2.46	3.73	2.65	8.49	5.73	1.52	0.00	0.00	1937 -1938	25.48
1938 -1939	0.01	0.00	0.15	1.33	0.88	1.48	3.07	1.94	2.62	0.42	0.63	0.00	1938 -1939	12.53
1939 -1940	0.00	0.00	1.06	0.17	0.20	1.05	9.98	7.81	5.32	0.94	0.63	0.01	1939 -1940	27.17
1940 -1941	0.00	0.00	0.59	1.05	2.22	6.25	8.24	6.71	4.75	4.05	1.18	0.01	1940 -1941	35.05
1941 -1942	0.01	0.03	0.00	0.93	1.99	7.29	4.76	4.27	2.62	3.65	1.11	0.00	1941 -1942	26.66
1942 -1943	0.01	0.00	0.18	0.95	4.45	2.87	6.15	1.95	3.18	1.88	0.13	0.13	1942 -1943	21.88
1943 -1944	0.00	0.00	0.02	0.74	0.80	2.69	4.31	5.34	0.83	2.07	0.94	0.12	1943 -1944	17.86
1944 -1945	0.01	0.02	0.00	1.70	6.24	3.97	1.33	3.43	4.15	0.32	0.64	0.01	1944 -1945	21.82
1945 -1946	0.00	0.00	0.04	1.95	3.24	9.84	1.76	2.03	2.34	0.05	0.37	0.02	1945 -1946	21.64
1946 -1947	0.06	0.00	0.06	0.15	2.73	2.77	1.35	2.65	3.64	0.17	0.67	0.64	1946 -1947	14.89
1947 -1948	0.00	0.00	0.00	2.09	1.39	1.84	1.00	2.32	3.36	3.04	0.54	0.01	1947 -1948	15.59
1948 -1949	0.02	0.02	0.09	0.20	1.18	4.75	2.20	3.04	5.85	0.00	0.93	0.00	1948 -1949	18.28
1949 -1950	0.06	0.04	0.00	0.08	1.18	2.77	7.40	2.33	1.65	0.87	0.37	0.03	1949 -1950	16.78
1950 -1951	0.00	0.00	0.00	2.72	4.96	6.01	4.41	3.00	1.32	0.89	0.65	0.04	1950 -1951	23.90
1951 -1952	0.01	0.43	0.08	0.81	3.33	7.92	10.69	2.62	4.90	1.08	0.30	0.39	1951 -1952	32.56
1952 -1953	0.00	0.01	0.00	0.07	2.42	9.06	3.26	0.04	1.83	3.42	0.38	0.61	1952 -1953	21.10
1953 -1954	0.00	0.00	0.00	0.34	1.88	0.82	3.11	2.42	4.56	0.82	0.11	0.14	1953 -1954	14.27
1954 -1955	0.03	0.21	0.00	0.24	2.55	5.67	4.05	1.18	0.29	1.49	0.04	0.00	1954 -1955	15.74
1955 -1956	0.02	0.00	0.02	0.03	2.38	11.47	8.72	2.03	0.12	1.68	0.68	0.02	1955 -1956	27.17
1956 -1957	0.00	0.01	0.33	1.14	0.04	0.37	2.84	3.58	2.39	1.09	3.19	0.06	1956 -1957	15.04
1957 -1958	0.01	0.00	1.46	3.46	1.13	3.60	4.38	7.78	8.22	5.47	0.88	0.09	1957 -1958	36.48
1958 -1959	0.05	0.00	0.04	0.12	0.09	1.48	3.96	4.04	0.30	0.36	0.02	0.00	1958 -1959	10.46
1959 -1960	0.00	0.02	2.06	0.00	0.00	1.71	4.04	3.57	2.06	1.16	0.85	0.00	1959 -1960	15.47
1960 -1961	0.00	0.00	0.00	0.48	3.35	2.31	2.79	0.96	2.27	0.79	0.88	0.04	1960 -1961	13.87
1961 -1962	0.00	0.02	0.22	0.09	4.44	2.13	1.08	6.58	2.74	0.36	0.00	0.00	1961 -1962	17.66
1962 -1963	0.00	0.07	0.22	5.51	0.60	2.81	3.35	1.92	3.87	3.35	0.45	0.00	1962 -1963	22.15
1963 -1964	0.00	0.00	0.06	1.39	3.52	0.87	3.37	0.19	2.12	0.01	0.22	0.57	1963 -1964	12.32
1964 -1965	0.00	0.01	0.00	1.90	3.99	5.35	3.97	0.94	2.92	3.21	0.00	0.00	1964 -1965	22.29
1965 -1966	0.02	0.49	0.00	0.01	4.79	3.51	3.27	2.72	0.80	0.36	0.19	0.17	1965 -1966	16.33
1966 -1967	0.06	0.10	0.10	0.01	4.80	3.87	9.49	0.22	4.35	4.90	0.09	1.42	1966 -1967	29.41
1967 -1968	0.00	0.00	0.04	0.53	1.10	2.12	4.54	2.28	3.15	0.48	0.22	0.00	1967 -1968	14.46
1968 -1969	0.00	0.03	0.06	0.62	2.67	3.91	7.74	7.26	1.01	1.74	0.00	0.05	1968 -1969	25.09
1969 -1970	0.00	0.00	0.01	2.61	0.45	6.15	7.81	1.56	1.55	0.06	0.03	0.57	1969 -1970	20.80
1970 -1971	0.00	0.00	0.00	0.84	6.44	5.39	2.04	0.26	2.91	0.72	0.19	0.00	1970 -1971	18.79
1971 -1972	0.01	0.01	0.22	0.11	1.92	3.93	1.32	2.13	0.23	1.07	0.00	0.11	1971 -1972	11.06
1972 -1973	0.01	0.04	0.54	5.41	6.40	3.53	9.38	6.32	2.63	0.02	0.08	0.00	1972 -1973	34.36
1973 -1974	0.01	0.04	0.33	1.81	8.64	4.21	3.46	1.54	5.27	2.37	0.00	0.10	1973 -1974	27.78
1974 -1975	0.73	0.00	0.00	0.91	0.40	1.83	2.85	4.30	5.97	1.30	0.02	0.04	1974 -1975	18.35
1975 -1976	0.20	0.02	0.00	2.75	0.43	0.50	0.31	1.96	1.04	0.70	0.01	0.03	1975 -1976	7.95
1976 -1977	0.00	0.78	0.51	0.38	1.18	2.53	1.85	0.90	2.31	0.05	0.57	0.00	1976 -1977	11.06
1977 -1978	0.00	0.03	0.96	0.17	2.22	3.30	6.94	4.14	5.90	4.21	0.00	0.00	1977 -1978	27.87
1978 -1979	0.00	0.00	0.20	0.00	1.67	0.89	7.43	5.58	1.95	0.87	0.15	0.00	1978 -1979	18.74
1979 -1980	0.07	0.00	0.01	1.94	3.69	4.12	4.63	6.79	1.73	1.29	0.23	0.02	1979 -1980	24.52
1980 -1981	0.04	0.00	0.00	0.00	0.28	3.09	4.97	2.09	4.72	0.17	0.12	0.00	1980 -1981	15.48
1981 -1982	0.00	0.00	0.22	2.00	5.30	5.41	9.48	3.78	7.81	3.03	0.00	0.06	1981 -1982	37.09

1982 -1983	0.00	0.00	0.72	2.79	5.62	2.22	5.77	8.06	9.04	3.48	0.47	0.00	1982 -1983	38.17
1983 -1984	0.01	0.03	0.68	0.26	8.20	7.72	0.50	2.34	1.32	0.92	0.16	0.30	1983 -1984	22.47
1984 -1985	0.00	0.24	0.10	2.94	7.45	2.10	0.59	1.98	3.94	0.27	0.09	0.31	1984 -1985	20.01
1985 -1986	0.00	0.00	0.38	0.80	4.83	2.47	4.77	8.29	6.25	0.76	0.13	0.00	1985 -1986	28.68
1986 -1987	0.03	0.01	1.32	0.11	0.20	1.64	4.26	3.77	2.31	0.14	0.06	0.01	1986 -1987	13.86
1987 -1988	0.00	0.00	0.00	1.07	3.09	5.09	4.93	0.40	0.07	1.73	0.66	0.70	1987 -1988	17.74
1988 -1989	0.00	0.00	0.00	0.64	3.70	4.23	1.26	1.49	5.28	0.70	0.06	0.07	1988 -1989	17.43
1989 -1990	0.00	0.00	0.98	1.18	1.33	0.00	4.02	2.45	1.34	0.58	2.38	0.01	1989 -1990	14.32
1990 -1991	0.00	0.00	0.12	0.20	0.52									
Avg	0.02	0.03	0.28	1.03	2.60	4.16	4.59	3.56	3.09	1.49	0.59	0.15		21.58
Std D	0.07	0.10	0.58	1.20	2.23	3.08	3.36	2.59	2.07	1.56	0.77	0.32		7.46
Max	0.73	0.78	5.07	7.28	11.78	15.16	24.36	12.52	9.04	10.06	4.02	2.57		49.27
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.03	0.00	0.00	0.00		7.42

APPENDIX C.

SAN FRANCISCO PRECIPITATION (1849-1990)

SEASON	30YR AVG	30YR STD	30YR CV	10YR AVG	10YR DEV	5YR AVG	5YR DEV	15YR AVG	15YR DEV	
1849 -1850	33.10									
1850 -1851	7.42									
1851 -1852	18.46									
1852 -1853	35.26									
1853 -1854	23.87					23.62	10.14			
1854 -1855	23.83					21.77	9.03			
1855 -1856	21.66					24.62	5.68			
1856 -1857	19.91					24.91	5.38			
1857 -1858	21.81					22.22	1.49			
1858 -1859	22.22			22.75	7.28	21.89	1.25			
1859 -1860	22.27			21.67	6.41	21.57	0.86			
1860 -1861	19.72			22.90	4.44	21.19	1.13			
1861 -1862	49.27			25.98	8.82	27.06	11.15	15YR AVG	15YR DEV	
1862 -1863	13.74			23.83	8.92	25.44	12.31			
1863 -1864	10.08			22.45	9.82	23.02	13.81	22.84	9.95	
1864 -1865	24.73			22.54	9.84	23.51	13.82	22.28	9.58	
1865 -1866	22.93			22.67	9.84	24.15	13.71	23.32	8.72	
1866 -1867	34.92			24.17	10.43	21.28	8.75	24.41	9.07	
1867 -1868	38.84			25.87	11.26	26.30	10.08	24.65	9.39	
1868 -1869	21.35			25.79	11.29	28.55	6.99	24.49	9.43	
1869 -1870	19.31			25.49	11.42	27.47	7.87	24.18	9.52	
1870 -1871	14.11			24.93	11.82	25.71	9.51	23.68	9.83	
1871 -1872	30.78			23.08	8.97	24.88	8.82	24.41	9.93	
1872 -1873	15.66			23.27	8.79	20.24	5.86	24.00	10.15	
1873 -1874	24.73			24.74	7.61	20.92	6.14	24.16	10.14	
1874 -1875	20.56			24.32	7.71	21.17	6.09	24.05	10.17	
1875 -1876	31.19			25.15	7.95	24.58	5.96	24.81	10.25	
1876 -1877	11.04	30YR AVG	30YR STD	30Yr CV	22.76	8.24	20.64	7.00	22.26	8.44
1877 -1878	35.18				22.39	7.57	24.54	8.43	23.69	8.69
1878 -1879	24.44	23.75	9.02	0.38	22.70	7.59	24.48	8.43	24.65	7.89
1879 -1880	26.66	23.53	8.87	0.38	23.44	7.58	25.70	8.22	24.78	7.91
1880 -1881	29.86	24.28	8.42	0.35	25.01	7.10	25.44	8.05	25.24	7.99
1881 -1882	16.14	24.20	8.48	0.35	23.55	7.27	26.46	6.30	23.99	7.84
1882 -1883	20.12	23.70	8.26	0.35	23.99	6.90	23.44	4.84	22.74	6.80
1883 -1884	32.38	23.98	8.40	0.35	24.76	7.34	25.03	6.05	23.48	7.20
1884 -1885	18.10	23.79	8.47	0.36	24.51	7.52	23.32	6.54	23.40	7.25
1885 -1886	33.05	24.17	8.62	0.36	24.70	7.70	23.96	7.26	24.66	7.17
1886 -1887	19.04	24.14	8.63	0.36	25.50	6.58	24.54	6.71	23.88	7.10
1887 -1888	16.74	23.97	8.73	0.36	23.65	6.18	23.86	7.27	23.95	7.02
1888 -1889	23.86	24.03	8.72	0.36	23.60	6.17	22.16	5.95	23.89	7.02
1889 -1890	45.85	24.81	9.55	0.38	25.51	9.11	27.71	10.66	25.58	8.82
1890 -1891	17.58	24.74	9.60	0.39	24.29	9.27	24.61	10.90	24.67	8.90
1891 -1892	18.53	23.72	8.50	0.36	24.53	9.08	24.51	10.95	25.17	8.31
1892 -1893	21.75	23.98	8.31	0.35	24.69	9.02	25.51	10.41	24.27	7.90
1893 -1894	18.47	24.26	7.97	0.33	23.30	8.79	24.44	10.80	23.88	8.03
1894 -1895	25.70	24.30	7.97	0.33	24.06	8.64	20.41	3.00	23.81	8.01
1895 -1896	21.25	24.24	7.99	0.33	22.88	8.12	21.14	2.65	23.24	7.86
1896 -1897	23.43	23.86	7.74	0.32	23.32	8.02	22.12	2.40	23.72	7.63
1897 -1898	9.38	22.87	7.64	0.33	22.58	8.88	19.65	5.66	23.01	8.40
1898 -1899	16.87	22.73	7.72	0.34	21.88	9.03	19.33	5.76	21.97	8.13
1899 -1900	18.47	22.70	7.73	0.34	19.14	4.20	17.88	4.81	22.00	8.12
1900 -1901	21.17	22.93	7.57	0.33	19.50	4.21	17.86	4.80	21.21	7.56
1901 -1902	18.98	22.54	7.46	0.33	19.55	4.20	16.97	4.04	21.20	7.57
1902 -1903	18.28	22.63	7.39	0.33	19.20	4.15	18.75	1.40	21.30	7.51
1903 -1904	20.59	22.49	7.39	0.33	19.41	4.16	19.50	1.17	21.09	7.49
1904 -1905	23.45	22.59	7.38	0.33	19.19	3.86	20.49	1.81	19.59	3.65
1905 -1906	20.42	22.23	7.22	0.32	19.10	3.83	20.34	1.78	19.78	3.61
1906 -1907	26.17	22.73	6.94	0.31	19.38	4.21	21.78	2.74	20.29	3.92
1907 -1908	17.35	22.14	6.60	0.30	20.18	2.73	21.60	2.99	20.00	3.97
1908 -1909	25.57	22.17	6.62	0.30	21.05	2.92	22.59	3.30	20.47	4.17
1909 -1910	19.52	21.94	6.58	0.30	21.15	2.84	21.81	3.47	20.06	3.94
1910 -1911	25.49	21.79	6.45	0.30	21.58	3.13	22.82	3.65	20.34	4.16
1911 -1912	14.06	21.72	6.52	0.30	21.09	3.81	20.40	4.54	19.72	4.35
1912 -1913	11.97	21.45	6.75	0.31	20.46	4.65	19.32	5.64	19.89	3.97

1913 -1914	29.60	21.36	6.62	0.31	21.36	5.40	20.13	6.67	20.74	4.55
1914 -1915	27.41	21.67	6.68	0.31	21.76	5.68	21.71	7.24	21.34	4.79
1915 -1916	27.12	21.47	6.42	0.30	22.43	5.88	22.03	7.44	21.73	5.00
1916 -1917	15.78	21.36	6.49	0.30	21.39	6.04	22.38	7.10	21.52	5.18
1917 -1918	11.48	21.19	6.68	0.32	20.80	6.66	22.28	7.24	21.07	5.71
1918 -1919	25.64	21.24	6.71	0.32	20.81	6.66	21.49	6.58	21.40	5.82
1919 -1920	10.46	20.06	5.23	0.26	19.90	7.35	18.10	7.01	20.54	6.39
1920 -1921	23.16	20.25	5.23	0.26	19.67	7.21	17.30	6.11	20.72	6.43
1921 -1922	19.91	20.30	5.22	0.26	20.25	6.96	18.13	6.13	20.30	6.26
1922 -1923	22.17	20.31	5.23	0.26	21.27	6.40	20.27	5.24	20.62	6.22
1923 -1924	11.62	20.08	5.45	0.27	19.48	6.33	17.46	5.36	19.69	6.45
1924 -1925	30.81	20.25	5.70	0.28	19.82	6.82	21.53	6.16	20.45	7.02
1925 -1926	20.69	20.23	5.69	0.28	19.17	6.39	21.04	6.11	20.13	6.89
1926 -1927	25.43	20.30	5.74	0.28	20.14	6.53	22.14	6.31	20.88	6.81
1927 -1928	19.64	20.64	5.37	0.26	20.95	5.88	21.64	6.38	21.39	6.40
1928 -1929	15.30	20.59	5.42	0.26	19.92	5.87	22.37	5.31	20.44	6.16
1929 -1930	16.28	20.52	5.46	0.27	20.50	5.15	19.47	3.59	19.70	5.95
1930 -1931	13.54	20.26	5.60	0.28	19.54	5.45	18.04	4.20	18.79	5.78
1931 -1932	21.09	20.33	5.60	0.28	19.66	5.47	17.17	2.79	19.15	5.75
1932 -1933	14.93	20.22	5.67	0.28	18.93	5.57	16.23	2.59	19.38	5.50
1933 -1934	12.91	19.97	5.82	0.29	19.06	5.41	15.75	2.91	18.53	5.45
1934 -1935	23.22	19.96	5.81	0.29	18.30	4.08	17.14	4.20	19.38	5.11
1935 -1936	24.96	20.11	5.88	0.29	18.73	4.51	19.42	4.70	19.50	5.21
1936 -1937	22.39	19.98	5.79	0.29	18.43	4.13	19.68	4.82	19.67	5.26
1937 -1938	25.48	20.25	5.85	0.29	19.01	4.64	21.79	4.58	19.89	5.43
1938 -1939	12.53	19.82	5.93	0.30	18.73	4.93	21.72	4.73	19.95	5.34
1939 -1940	27.17	20.07	6.07	0.30	19.82	5.45	22.51	5.22	19.70	4.91
1940 -1941	35.05	20.39	6.58	0.32	21.97	6.65	24.52	7.31	20.66	6.23
1941 -1942	26.66	20.81	6.56	0.32	22.53	6.79	25.38	7.26	20.74	6.30
1942 -1943	21.88	21.14	6.35	0.30	23.23	6.31	24.66	7.39	20.89	6.30
1943 -1944	17.86	20.75	6.18	0.30	23.72	5.64	25.72	5.77	21.06	6.18
1944 -1945	21.82	20.57	6.06	0.29	23.58	5.67	24.65	5.90	21.43	6.05
1945 -1946	21.64	20.38	5.94	0.29	23.25	5.68	21.97	2.79	21.97	5.67
1946 -1947	14.89	20.35	5.96	0.29	22.50	6.21	19.62	2.81	21.56	5.94
1947 -1948	15.59	20.49	5.80	0.28	21.51	6.44	18.36	2.92	21.60	5.89
1948 -1949	18.28	20.25	5.74	0.28	22.08	5.84	18.44	2.91	21.96	5.50
1949 -1950	16.78	20.46	5.48	0.27	21.05	5.77	17.44	2.40	21.53	5.63
1950 -1951	23.90	20.48	5.50	0.27	19.93	3.64	17.89	3.22	21.46	5.60
1951 -1952	32.56	20.90	5.91	0.28	20.52	4.93	21.42	6.26	22.14	6.25
1952 -1953	21.10	20.87	5.90	0.28	20.44	4.92	22.52	5.58	21.85	6.19
1953 -1954	14.27	20.96	5.78	0.28	20.08	5.21	21.72	6.36	21.96	6.02
1954 -1955	15.74	20.45	5.55	0.27	19.48	5.33	21.51	6.54	21.20	6.04
1955 -1956	27.17	20.67	5.68	0.28	20.03	5.79	22.17	6.90	20.68	5.08
1956 -1957	15.04	20.32	5.70	0.28	20.04	5.78	18.66	4.88	19.90	4.99
1957 -1958	36.48	20.88	6.39	0.31	22.13	7.35	21.74	8.76	20.87	6.48
1958 -1959	10.46	20.72	6.59	0.32	21.35	8.10	20.98	9.51	20.38	6.96
1959 -1960	15.47	20.70	6.61	0.32	21.22	8.18	20.92	9.54	19.96	7.05
1960 -1961	13.87	20.71	6.60	0.32	20.22	8.40	18.26	9.28	19.44	7.19
1961 -1962	17.66	20.59	6.62	0.32	18.73	7.34	18.79	9.15	19.62	7.11
1962 -1963	22.15	20.83	6.54	0.31	18.83	7.38	15.92	3.90	20.06	7.05
1963 -1964	12.32	20.81	6.56	0.32	18.64	7.52	16.29	3.42	19.66	7.30
1964 -1965	22.29	20.78	6.56	0.32	19.29	7.52	17.66	4.11	20.03	7.29
1965 -1966	16.33	20.49	6.56	0.32	18.21	7.08	18.15	3.76	19.53	7.26
1966 -1967	29.41	20.73	6.74	0.33	19.64	7.72	20.50	5.82	19.32	6.92
1967 -1968	14.46	20.36	6.77	0.33	17.44	5.39	18.96	6.19	18.87	7.00
1968 -1969	25.09	20.78	6.66	0.32	18.91	5.28	21.52	5.52	19.60	7.05
1969 -1970	20.80	20.57	6.56	0.32	19.44	5.18	21.22	5.51	19.93	6.98
1970 -1971	18.79	20.03	5.98	0.30	19.93	4.85	21.71	5.15	19.37	6.71
1971 -1972	11.06	19.51	6.06	0.31	19.27	5.52	18.04	4.89	19.11	6.95
1972 -1973	34.36	19.92	6.61	0.33	20.49	7.13	22.02	7.66	18.97	6.60
1973 -1974	27.78	20.25	6.75	0.33	22.04	6.86	22.56	7.95	20.12	6.53
1974 -1975	18.35	20.14	6.75	0.34	21.64	6.95	22.07	8.12	20.31	6.43
1975 -1976	7.95	19.68	7.09	0.36	20.81	7.97	19.90	9.95	19.92	6.97
1976 -1977	11.06	19.55	7.21	0.37	18.97	7.89	19.90	9.95	19.48	7.30
1977 -1978	27.87	19.96	7.32	0.37	20.31	8.15	18.60	8.25	19.86	7.58
1978 -1979	18.74	19.98	7.32	0.37	19.68	7.99	16.79	6.93	20.29	7.32
1979 -1980	24.52	20.24	7.33	0.36	20.05	8.12	18.03	7.61	20.44	7.38
1980 -1981	15.48	19.95	7.35	0.37	19.72	8.23	19.53	6.05	20.38	7.41
1981 -1982	37.09	20.11	7.65	0.38	22.32	9.15	24.74	7.54	20.89	8.24

1982 -1983	38.17	20.67	8.31	0.40	22.70	9.71	26.80	9.31	22.47	9.08
1983 -1984	22.47	20.95	8.23	0.39	22.17	9.56	27.55	8.77	22.30	9.06
1984 -1985	20.01	21.09	8.17	0.39	22.34	9.50	26.64	9.25	22.25	9.07
1985 -1986	28.68	21.14	8.21	0.39	24.41	8.33	29.28	7.39	22.91	9.15
1986 -1987	13.86	21.10	8.25	0.39	24.69	7.91	24.64	8.27	23.09	8.93
1987 -1988	17.74	20.48	7.75	0.38	23.68	8.09	20.55	4.95	21.98	8.49
1988 -1989	17.43	20.71	7.55	0.36	23.55	8.17	19.54	4.97	21.29	8.41
1989 -1990	14.32	20.67	7.58	0.37	22.53	8.61	18.41	5.37	21.03	8.56

APPENDIX D.

SAN FRANCISCO CITY OFFICE 1849-1990
 SORTED CUMULATIVE RAINFALL TOTALS
 (RAINFALL SEASON JULY 1 TO JUN 30)

SEASON	1 YEAR	2 YEAR	3 YEAR	4 YEAR	5 YEAR				
1850 -1851	7.42	1975 -1977	19.01	1974 -1977	37.36	1958 -1962	57.46	1929 -1934	78.75
1975 -1976	7.95	1862 -1864	23.82	1958 -1961	39.80	1930 -1934	62.47	1958 -1963	79.61
1897 -1898	9.38	1850 -1852	25.88	1897 -1900	44.72	1986 -1990	63.35	1928 -1933	81.14
1863 -1864	10.08	1958 -1960	25.93	1928 -1931	45.12	1916 -1920	63.36	1959 -1964	81.47
1958 -1959	10.46	1911 -1913	26.03	1975 -1978	46.88	1927 -1931	64.76	1974 -1979	83.97
1919 -1920	10.46	1897 -1899	26.25	1959 -1962	47.00	1973 -1977	65.14	1897 -1902	84.87
1876 -1877	11.04	1974 -1976	26.30	1917 -1920	47.58	1974 -1978	65.23	1930 -1935	85.69
1976 -1977	11.06	1916 -1918	27.26	1862 -1865	48.55	1946 -1950	65.54	1927 -1932	85.85
1971 -1972	11.06	1932 -1934	27.84	1946 -1949	48.76	1975 -1979	65.62	1916 -1921	86.52
1917 -1918	11.48	1959 -1961	29.34	1931 -1934	48.93	1929 -1933	65.84	1945 -1950	87.18
1923 -1924	11.62	1929 -1931	29.82	1986 -1899	49.03	1897 -1901	65.89	1919 -1924	87.32
1912 -1913	11.97	1970 -1972	29.85	1987 -1990	49.49	1960 -1964	66.00	1960 -1965	88.29
1963 -1964	12.32	1953 -1955	30.01	1930 -1933	49.56	1928 -1932	66.21	1896 -1901	89.32
1938 -1939	12.53	1946 -1948	30.48	1896 -1899	49.68	1896 -1900	68.15	1895 -1900	89.40
1933 -1934	12.91	1960 -1962	31.53	1969 -1972	50.65	1959 -1963	69.15	1946 -1951	89.44
1930 -1931	13.54	1928 -1930	31.58	1947 -1950	50.65	1945 -1949	70.40	1975 -1980	90.14
1862 -1863	13.74	1986 -1988	31.60	1929 -1932	50.91	1917 -1921	70.74	1926 -1931	90.19
1986 -1987	13.86	1988 -1990	31.75	1963 -1966	50.94	1895 -1899	70.93	1967 -1972	90.20
1960 -1961	13.87	1896 -1898	32.81	1932 -1935	51.06	1909 -1913	71.04	1915 -1920	90.48
1911 -1912	14.06	1869 -1871	33.42	1952 -1955	51.11	1862 -1866	71.48	1917 -1922	90.65
1870 -1871	14.11	1919 -1921	33.62	1927 -1930	51.22	1931 -1935	72.15	1961 -1966	90.75
1953 -1954	14.27	1922 -1924	33.79	1910 -1913	51.52	1953 -1957	72.22	1956 -1961	91.32
1989 -1990	14.32	1947 -1949	33.87	1945 -1948	52.12	1962 -1966	73.09	1943 -1948	91.80
1967 -1968	14.46	1962 -1964	34.47	1961 -1964	52.13	1944 -1948	73.94	1985 -1990	92.03
1946 -1947	14.89	1963 -1965	34.61	1916 -1919	52.90	1961 -1965	74.42	1944 -1949	92.22
1932 -1933	14.93	1930 -1932	34.63	1919 -1922	53.53	1947 -1951	74.55	1973 -1978	93.01
1956 -1957	15.04	1863 -1865	34.81	1960 -1963	53.68	1898 -1902	75.49	1952 -1957	93.32
1928 -1929	15.30	1927 -1929	34.94	1921 -1924	53.70	1919 -1923	75.70	1898 -1903	93.77
1959 -1960	15.47	1948 -1950	35.06	1895 -1898	54.06	1968 -1972	75.74	1957 -1962	93.94
1980 -1981	15.48	1987 -1989	35.17	1973 -1976	54.08	1932 -1936	76.02	1963 -1968	94.81
1947 -1948	15.59	1898 -1900	35.34	1915 -1918	54.38	1943 -1947	76.21	1908 -1913	96.61
1872 -1873	15.66	1952 -1954	35.37	1868 -1871	54.77	1957 -1961	76.28	1894 -1899	96.63
1954 -1955	15.74	1886 -1888	35.78	1911 -1914	55.63	1890 -1894	76.33	1931 -1936	97.11
1916 -1917	15.78	1931 -1933	36.02	1898 -1901	56.51	1926 -1930	76.65	1925 -1930	97.34
1881 -1882	16.14	1918 -1920	36.10	1962 -1965	56.76	1920 -1924	76.86	1899 -1904	97.49
1929 -1930	16.28	1890 -1892	36.11	1953 -1956	57.18	1899 -1903	76.90	1976 -1981	97.67
1965 -1966	16.33	1933 -1935	36.13	1976 -1979	57.67	1956 -1960	77.45	1984 -1989	97.72
1887 -1888	16.74	1881 -1883	36.26	1863 -1866	57.74	1985 -1989	77.71	1942 -1947	98.09
1949 -1950	16.78	1945 -1947	36.53	1901 -1904	57.85	1952 -1956	78.28	1893 -1898	98.23
1898 -1899	16.87	1917 -1919	37.12	1890 -1893	57.86	1900 -1904	79.02	1932 -1937	98.41
1907 -1908	17.35	1901 -1903	37.26	1954 -1957	57.95	1967 -1971	79.14	1972 -1977	99.50
1988 -1989	17.43	1937 -1939	38.01	1944 -1947	58.35	1918 -1922	79.17	1971 -1976	99.50
1890 -1891	17.58	1964 -1966	38.62	1900 -1903	58.43	1894 -1898	79.76	1909 -1914	100.64
1961 -1962	17.66	1902 -1904	38.87	1899 -1902	58.62	1869 -1873	79.86	1868 -1873	101.21
1987 -1988	17.74	1976 -1978	38.93	1978 -1981	58.74	1915 -1919	80.02	1918 -1923	101.34
1943 -1944	17.86	1967 -1969	39.55	1891 -1894	58.75	1984 -1988	80.29	1901 -1906	101.72
1884 -1885	18.10	1910 -1912	39.55	1948 -1951	58.96	1963 -1967	80.35	1907 -1912	101.99
1948 -1949	18.28	1969 -1971	39.59	1849 -1852	58.98	1925 -1929	81.06	1890 -1895	102.03
1902 -1903	18.28	1899 -1901	39.64	1909 -1912	59.07	1910 -1914	81.12	1900 -1905	102.47
1974 -1975	18.35	1943 -1945	39.68	1918 -1921	59.26	1901 -1905	81.30	1962 -1967	102.50
1851 -1852	18.46	1938 -1940	39.70	1886 -1889	59.64	1914 -1918	81.79	1983 -1988	102.76
1899 -1900	18.47	1942 -1944	39.74	1965 -1968	60.20	1976 -1980	82.19	1872 -1877	103.18
1893 -1894	18.47	1961 -1963	39.81	1985 -1988	60.28	1964 -1968	82.49	1869 -1874	104.59
1891 -1892	18.53	1979 -1981	40.00	1967 -1970	60.35	1902 -1906	82.74	1955 -1960	104.62
1978 -1979	18.74	1900 -1902	40.15	1926 -1929	60.37	1911 -1915	83.04	1954 -1959	104.89
1970 -1971	18.79	1892 -1894	40.22	1936 -1939	60.40	1942 -1946	83.20	1921 -1926	105.20
1901 -1902	18.98	1891 -1893	40.28	1870 -1873	60.55	1933 -1937	83.48	1891 -1896	105.70
1886 -1887	19.04	1872 -1874	40.39	1872 -1875	60.95	1951 -1955	83.67	1870 -1875	105.84
1869 -1870	19.31	1849 -1851	40.52	1933 -1936	61.09	1891 -1895	84.45	1856 -1861	105.93
1909 -1910	19.52	1887 -1889	40.60	1850 -1853	61.14	1921 -1925	84.51	1965 -1970	106.09
1927 -1928	19.64	1868 -1870	40.66	1943 -1946	61.32	1908 -1912	84.64	1862 -1867	106.40
1860 -1861	19.72	1949 -1951	40.68	1942 -1945	61.56	1969 -1973	85.01	1947 -1952	107.11
1921 -1922	19.91	1912 -1914	41.57	1956 -1959	61.98	1850 -1854	85.01	1914 -1919	107.43

1856 -1857	19.91	1855 -1857	41.57	1902 -1905	62.32	1983 -1987	85.02	1950 -1955	107.57
1984 -1985	20.01	1856 -1858	41.72	1957 -1960	62.41	1870 -1874	85.28	1964 -1969	107.58
1882 -1883	20.12	1859 -1861	41.99	1907 -1910	62.44	1965 -1969	85.29	1920 -1925	107.67
1905 -1906	20.42	1921 -1923	42.08	1984 -1987	62.55	1922 -1926	85.29	1855 -1860	107.87
1874 -1875	20.56	1955 -1957	42.21	1874 -1877	62.79	1935 -1939	85.36	1903 -1908	107.98
1903 -1904	20.59	1875 -1877	42.23	1923 -1926	63.12	1868 -1872	85.55	1923 -1928	108.19
1925 -1926	20.69	1923 -1925	42.43	1855 -1858	63.38	1855 -1859	85.60	1910 -1915	108.53
1969 -1970	20.80	1983 -1985	42.48	1856 -1859	63.94	1857 -1861	86.02	1966 -1971	108.55
1931 -1932	21.09	1985 -1987	42.54	1905 -1908	63.94	1856 -1860	86.21	1934 -1939	108.58
1952 -1953	21.10	1915 -1917	42.90	1869 -1872	64.20	1977 -1981	86.61	1949 -1954	108.61
1900 -1901	21.17	1954 -1956	42.91	1970 -1973	64.21	1881 -1885	86.74	1953 -1958	108.70
1895 -1896	21.25	1907 -1909	42.92	1858 -1861	64.21	1884 -1888	86.93	1850 -1855	108.84
1868 -1869	21.35	1920 -1922	43.07	1903 -1906	64.46	1892 -1896	87.17	1902 -1907	108.91
1945 -1946	21.64	1978 -1980	43.26	1922 -1925	64.60	1854 -1858	87.21	1933 -1938	108.96
1855 -1856	21.66	1944 -1946	43.46	1968 -1971	64.68	1904 -1908	87.39	1905 -1910	109.03
1892 -1893	21.75	1906 -1908	43.52	1937 -1940	65.18	1873 -1877	87.52	1854 -1859	109.43
1857 -1858	21.81	1904 -1906	43.87	1920 -1923	65.24	1936 -1940	87.57	1941 -1946	109.86
1944 -1945	21.82	1966 -1968	43.87	1854 -1857	65.40	1907 -1911	87.93	1968 -1973	110.10
1942 -1943	21.88	1857 -1859	44.03	1893 -1896	65.42	1941 -1945	88.22	1911 -1916	110.16
1962 -1963	22.15	1903 -1905	44.04	1925 -1928	65.76	1972 -1976	88.44	1970 -1975	110.34
1922 -1923	22.17	1893 -1895	44.17	1892 -1895	65.92	1923 -1927	88.55	1892 -1897	110.60
1858 -1859	22.22	1858 -1860	44.49	1880 -1883	66.12	1906 -1910	88.61	1922 -1927	110.72
1859 -1860	22.27	1895 -1897	44.68	1857 -1860	66.30	1893 -1897	88.85	1884 -1889	110.79
1964 -1965	22.29	1870 -1872	44.89	1941 -1944	66.40	1955 -1959	89.15	1951 -1956	110.84
1936 -1937	22.39	1909 -1911	45.01	1951 -1954	67.93	1853 -1857	89.27	1853 -1858	111.08
1983 -1984	22.47	1926 -1928	45.07	1964 -1967	68.03	1905 -1909	89.51	1913 -1918	111.39
1865 -1866	22.93	1908 -1910	45.09	1881 -1884	68.64	1966 -1970	89.76	1924 -1929	111.87
1920 -1921	23.16	1873 -1875	45.29	1885 -1888	68.83	1903 -1907	90.63	1912 -1917	111.88
1934 -1935	23.22	1971 -1973	45.42	1966 -1969	68.96	1948 -1952	91.52	1935 -1940	112.53
1896 -1897	23.43	1854 -1856	45.49	1912 -1915	68.98	1971 -1975	91.55	1948 -1953	112.62
1904 -1905	23.45	1965 -1967	45.74	1906 -1909	69.09	1871 -1875	91.73	1969 -1974	112.79
1854 -1855	23.83	1968 -1970	45.89	1853 -1856	69.36	1950 -1954	91.83	1904 -1909	112.96
1888 -1889	23.86	1880 -1882	46.00	1904 -1907	70.04	1970 -1974	91.99	1906 -1911	114.10
1853 -1854	23.87	1925 -1927	46.12	1884 -1887	70.19	1872 -1876	92.14	1859 -1864	115.08
1950 -1951	23.90	1973 -1975	46.13	1914 -1917	70.31	1863 -1867	92.66	1880 -1885	116.60
1878 -1879	24.44	1876 -1878	46.22	1894 -1897	70.38	1885 -1889	92.69	1878 -1883	117.22
1979 -1980	24.52	1871 -1873	46.44	1934 -1937	70.57	1879 -1883	92.78	1860 -1865	117.54
1873 -1874	24.73	1905 -1907	46.59	1908 -1911	70.58	1860 -1864	92.81	1849 -1854	118.11
1864 -1865	24.73	1977 -1979	46.61	1882 -1885	70.60	1867 -1871	93.61	1883 -1888	119.31
1935 -1936	24.96	1957 -1959	46.94	1876 -1879	70.66	1849 -1853	94.24	1881 -1886	119.79
1968 -1969	25.09	1894 -1896	46.95	1977 -1980	71.13	1949 -1953	94.34	1861 -1866	120.75
1926 -1927	25.43	1935 -1937	47.35	1983 -1986	71.16	1954 -1958	94.43	1889 -1894	122.18
1937 -1938	25.48	1864 -1866	47.66	1871 -1874	71.17	1978 -1982	95.83	1874 -1879	122.41
1910 -1911	25.49	1853 -1855	47.70	1879 -1882	72.66	1934 -1938	96.05	1887 -1892	122.56
1908 -1909	25.57	1936 -1938	47.87	1935 -1938	72.83	1912 -1916	96.10	1936 -1941	122.62
1918 -1919	25.64	1934 -1936	48.18	1861 -1864	73.09	1924 -1928	96.57	1882 -1887	122.69
1894 -1895	25.70	1941 -1943	48.54	1971 -1974	73.20	1878 -1882	97.10	1873 -1878	122.70
1906 -1907	26.17	1984 -1986	48.69	1949 -1952	73.24	1876 -1880	97.32	1871 -1876	122.92
1941 -1942	26.66	1883 -1885	50.48	1938 -1941	74.75	1861 -1865	97.82	1886 -1891	123.07
1879 -1880	26.66	1878 -1880	51.10	1873 -1876	76.48	1874 -1878	97.97	1851 -1856	123.08
1915 -1916	27.12	1884 -1886	51.15	1924 -1927	76.93	1880 -1884	98.50	1982 -1987	123.19
1955 -1956	27.17	1924 -1926	51.50	1979 -1982	77.09	1913 -1917	99.91	1940 -1945	123.27
1939 -1940	27.17	1956 -1958	51.52	1875 -1878	77.41	1937 -1941	100.23	1938 -1943	123.29
1914 -1915	27.41	1874 -1876	51.75	1950 -1953	77.56	1938 -1942	101.41	1977 -1982	123.70
1973 -1974	27.78	1885 -1887	52.09	1851 -1854	77.59	1851 -1855	101.42	1867 -1872	124.39
1977 -1978	27.87	1882 -1884	52.50	1955 -1958	78.69	1940 -1944	101.45	1852 -1857	124.53
1985 -1986	28.68	1980 -1982	52.57	1867 -1870	79.50	1875 -1879	101.85	1879 -1884	125.16
1966 -1967	29.41	1951 -1953	53.66	1972 -1975	80.49	1883 -1887	102.57	1937 -1942	126.89
1913 -1914	29.60	1851 -1853	53.72	1982 -1985	80.65	1882 -1886	103.65	1876 -1881	127.18
1880 -1881	29.86	1914 -1916	54.53	1878 -1881	80.96	1889 -1893	103.71	1858 -1863	127.22
1871 -1872	30.78	1950 -1952	56.46	1889 -1892	81.96	1887 -1891	104.03	1888 -1893	127.57
1924 -1925	30.81	1879 -1881	56.52	1864 -1867	82.58	1852 -1856	104.62	1875 -1880	128.51
1875 -1876	31.19	1913 -1915	57.01	1860 -1863	82.73	1859 -1863	105.00	1866 -1871	128.53
1883 -1884	32.38	1865 -1867	57.85	1852 -1855	82.96	1886 -1890	105.49	1939 -1944	128.62
1951 -1952	32.56	1852 -1854	59.13	1883 -1886	83.53	1888 -1892	105.82	1863 -1868	131.50
1885 -1886	33.05	1877 -1879	59.62	1940 -1943	83.59	1982 -1986	109.33	1877 -1882	132.28
1849 -1850	33.10	1867 -1869	60.19	1913 -1916	84.13	1939 -1943	110.76	1980 -1985	133.22
1972 -1973	34.36	1982 -1984	60.64	1877 -1880	86.28	1980 -1984	113.21	1978 -1983	134.00
1866 -1867	34.92	1940 -1942	61.71	1887 -1890	86.45	1858 -1862	113.48	1857 -1862	135.29

1940 -1941	35.05	1972 -1974	62.14	1888 -1891	87.29	1866 -1870	114.42	1865 -1870	137.35
1877 -1878	35.18	1939 -1941	62.22	1939 -1942	88.88	1979 -1983	115.26	1979 -1984	137.73
1852 -1853	35.26	1861 -1863	63.01	1980 -1983	90.74	1877 -1881	116.14	1885 -1890	138.54
1957 -1958	36.48	1889 -1891	63.43	1859 -1862	91.26	1981 -1985	117.74	1864 -1869	142.77
1981 -1982	37.09	1860 -1862	68.99	1866 -1869	95.11	1865 -1869	118.04	1981 -1986	146.42
1982 -1983	38.17	1888 -1890	69.71	1865 -1868	96.69	1864 -1868	121.42		
1867 -1868	38.84	1866 -1868	73.76	1981 -1984	97.73				
1889 -1890	45.85	1981 -1983	75.26						
1861 -1862	49.27								

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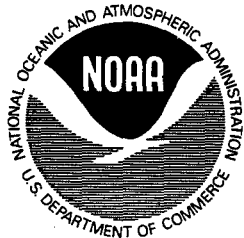
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