Development of Baseline Time Series for the St. Marks River Rise Minimum Flows Evaluation

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1 Introduction and Objectives

The Northwest Florida Water Management District (District) is developing minimum flows for the St. Marks River Rise (Rise). The minimum flows will address protection of water resources affected by reduced spring flows, including those in the downstream freshwater and estuarine reaches of the St. Marks River. This current document provides the results of a series of Tasks, part of Task Order (TO) #4, directed at developing a baseline flow time series for the Rise for use in minimum flow scenario evaluation. The Tasks performed were as follows:

- QA/QC evaluation of existing rainfall, flow, evapotranspiration, and Floridan aquifer level to ensure confidence in the data used for baseline flow development;
- Trend tests on long-term flow data from the St. Marks River at Newport USGS gage, rainfall data from nearby monitoring sites, available evapotranspiration data, and Floridan aquifer levels with sufficient periods of record;
- Development of technically sound and defensible relationships between flows at the long-term Newport USGS gage just downstream of the Rise and shorter-term flows from just upstream of the St. Marks River swallet, and spring discharge from the Rise;
- Development of a long-term flow record for the Rise spring discharge utilizing data collected by the District and USGS and the relationships developed between flows above the swallet and flows at the Rise; and
- Assessment of potential groundwater withdrawal impacts on the Rise spring discharge using water budget information and results from the trend and time series analyses, with the assessment results used to adjust the long-term flow record to remove withdrawal effects, if present, and create a long-term baseline (unimpacted) flow record of Rise spring discharge.

2 Data QA/QC Evaluation

The data to be used in the development of the baseline unimpacted spring flow record include rainfall, groundwater levels, evapotranspiration, and river flow. The datasets compiled for this effort have been evaluated, including developing time-series plots for each site and data type. The time series plots are provided as Attachment 1, and the finalized datasets are provided as Excel files or CSV files in the accompanying directory. Brief summaries of each dataset are provided in the following.

The available data are sufficient to complete the goal of developing the long-term unimpacted spring flow timeseries. Additional data evaluation follows in the next section with the discussion of the trend tests.

NWS Rainfall Monthly Data in file ***"NWS_NWFWMD_MonthlyRain.xlsx"***

Station USC00091463, Name CAIRO, GA US: 1940 - 2016

Significant period of missing data as follows (not counting single months scattered throughout the record)

missing JUL73 - MAY88

Station USC00091500, Name CAMILLA 3 SE, GA US: 1940 - 2016

Significant period of missing data as follows (not counting single months scattered throughout the record)

missing NOV40 - MAY41

Station USC00085880, Name MONTICELLO 10 SW, FL US: 2007 - 2016

Significant period of missing data as follows (not counting single months scattered throughout the record)

missing JAN07 - JUL07
FEB16 - DEC16

Station USC00096087, Name MOULTRIE 2 ESE, GA US: 1940 - 2016

Significant period of missing data as follows (not counting single months scattered throughout the record)

missing MAR05 - JUL05
FEB16 - JUL16

Station USC00087025, Name PERRY, FL US: 1940 - 2016

Significant period of missing data as follows (not counting single months scattered throughout the record)

missing JAN49 - DEC56

Station USC00097276, Name QUITMAN 2 NW, GA US: 1940 - 2010

Significant periods of missing data as follows (not counting single months scattered throughout the record)

missing NOV74 - MAY75
AUG75 - DEC75

Station USC00087869, Name ST MARKS NWR, FL US: 2002 - 2016

Significant periods of missing data as follows (not counting single months scattered throughout the record)

missing JAN42 - JUL42
JAN43 - DEC45

Station USC00093805, Name TALLAHASSEE REGIONAL AIRPORT, FL US: 1942 - 2016

Significant periods of missing data as follows (not counting single months scattered throughout the record)

missing JAN02-JUN02, OCT03, JUN04, JUL08, MAY11, AUG11, OCT11-FEB12, MAR13, JUN13-JUL13, JUN14-JUL14, MAY15-JAN16, MAR16-APR16, JUN16-SEP16, DEC16

Station US1GATH0004, Name THOMASVILLE 5.1 ESE, GA US: 2009 - 2016

No significant periods of missing data

Station USC00098703, Name TIFTON, GA US: 1940 - 2016

No significant periods of missing data

District Rainfall 5-Minute Data in file ***"District_5min_rainfall.csv"*** (very large)

Station 602 (sensor 11285): 01JAN88:00:00 - 30APR17:23:55

missing 02DEC88:09:55 - 03DEC88:09:40
02JUN00:09:50 - 05JUL00:10:00

Station 605 (sensor 11288): 01JAN88:00:00 - 30APR17:23:55

missing 05FEB09:09:55
05FEB91:10:00
21MAR06:14:40
23MAR12:08:00
02APR12:09:30 - 02APR12:09:45

Station 606 (sensor 11289): 03APR87:17:00 - 30APR17:23:55

missing 23JUL87:09:30 - 23JUL87:09:55
08JAN88:15:05 - 08JAN89:15:25
14AUG89:12:40 - 15AUG89:12:35
06JAN90:23:25 - 08JAN90:10:55
06AUG90:15:50 - 13AUG90:10:55

05JUL94:23:10 - 03JAN00:11:55
27DEC00:06:10 - 31DEC00:23:55
03MAR01:08:50 - 07MAR01:11:10
27JUL02:10:00 - 13AUG02:15:30
for period 29OCT02:13:55 - 01OCT14:12:55, data were collected every 10 minutes

Station 610 (sensor 11293): 01JAN87:14:45 -30APR17:23:55
missing 03DEC87:15:10 - 03DEC87:15:30

Station 613 (sensor 11296): 03FEB87:14:25 - 30APR17:23:55
missing 02DEC87:15:55 - 03DEC87:12:50
16DEC11:15:35 - 16DEC11:15:40
22DEC11:12:35

Station 616 (sensor 11299): 30MAR87:12:00 - 30APR17:23:55
missing 30JUL87:14:35 - 21AUG87:12:55
19FEB88:08:50 - 22FEB88:14:55
13MAY88:12:25 - 09JUN88:15:55
21JUN88:13:25 - 18AUG88:14:55
04FEB92:12:40
03NOV92:13:15
03NOV92:13:15
05APR05:19:00 - 14APR05:09:25
20JUN10:11:15 - 27JUN10:02:00
12DEC11:12:20 - 19DEC11:05:10
10DEC11:20:40 - 26DEC11:15:00
09AUG13:02:45 - 09AUG13:13:05

Evapotranspiration Daily Data from IFAS FAWN Monticello in file***"ET_IFAS_Monticello.xlsx"***
23APR03 - 30AUG17
missing 10JUL03 -29JUL03
27DEC03 - 06JAN04
12JAN04 - 03FEB04
28FEB04 - 26APR04
29MAY04 - 03JUN04
05JUN04 - 29JUL04
02AUG04 - 10JUN05
11AUG05 - 15AUG05
17MAR06 - 26MAR06
09JUN07 - 12JUN07

Groundwater Elevation all data in ***"NWFWMD Groundwater Elevation Data.xlsx"***
NWFWMD Site 671: JUN61 - MAY17
NWFWMD Site 2136: JUN81 - JUN91
NWFWMD Site 2536: JUN85 - JUN91
NWFWMD Site 3861: JAN60 - MAY90
NWFWMD Site 7498: FEB00 - FEB17
NWFWMD Site 7498 Continuous (15-minute): 14AUG14:12:30 - 11JUL17:10:30
NWFWMD Site 8419: MAY03 - MAY17
St. Marks Newport daily: 03OCT56 - 10AUG17
SRWMD SRPinckneyHill: FEB88 - FEB12 Monthly, MAR12 - JUL17 Daily

Flows
District Grabs above the Swallet: 09APR03 - 25FEB14 ***"Q_District_Grab_above_Swallet.xlsx"***
USGS 02326885 Daily St. Marks above the Swallet: 04JUN15 - 30JUL17
"Q_USGS_above_Swallet.xlswx"
USGS 02326900 Daily at St. Marks at Newport: 01OCT56 - 10AUG17
"FlowStMarksNewport.xlsx"

3 Trend Tests of Data to be Used for Spring Flow Time Series Development

As part of the work effort to develop the unimpacted spring flow record for use in modeling evaluation of reduced flow scenarios in aid of minimum flows development, an evaluation of time series trends in rainfall, groundwater levels, evapotranspiration, and river flow was completed. The sites evaluated are provided in Figure 1. This section provides a synthesis of results from application of the Seasonal Kendall Tau trend test (SKT: Hirsch and Slack, 1984). The trend tests were conducted to characterize the period of record of empirical data collections within the St. Marks region with respect to identifying any monotonic trends in the timeseries over time.

3.1 Methods

Trend analysis and associated exploratory data analysis serve to investigate and potentially account for the relative contributions of anthropogenic and climatic (i.e., rainfall) factors to changes as reflected in observed time series. The first step in the trend analysis was examination of the data to be used. The data (data listing provided in Section 2 above) employed in the trend analyses were visually examined by producing time series plots of all variables of interest at each site, as provided in Attachment 1. Trend analyses were completed using the nonparametric SKT test. For these analyses, the null hypotheses for each test was that there was no trend, so that the alternative to the null hypotheses was that there was a trend, either increasing or decreasing. Seasons were defined as the twelve months of the year. The SKT procedure computes a tau statistic and a p-value and slope for each station/parameter combination. When the p-value is <0.05, the slope is considered statistically significant for the parameter being tested. A positive slope indicates an increasing monotonic trend, while a negative slope indicates a decreasing monotonic trend (assuming the p-value indicates statistical significance). The SKT was implemented using the open source software R package RKT (Marchetto, 2015; R Core Team, 2013). Missing data are allowed in the time series. Significance of the trend test is determined by comparing the p-value reported after adjustment for serial autocorrelation (termed "Correction for inter-block covariance") to an alpha level of 0.05. A minimum of ten years of data is required to evaluate serial autocorrelation.

For rainfall analysis the monthly total rainfall reported in inches was evaluated, while for streamflow, evapotranspiration, and groundwater levels, the monthly median values were evaluated. The entire available period of record was considered for trend testing. Descriptive statistics and graphics were generated for each station evaluated and are provided in the attachments associated with each data type (Attachments 2-8). This information includes: 1) detailed sampling frequency tables, 2) time series plots, 3) seasonal (i.e. monthly) boxplots to assess seasonality, 4) univariate statistics for the data distribution including histograms and cumulative distribution function (CDF) plots, and 5) correlograms to evaluate the potential serial correlation among observations through time going back 15 months.

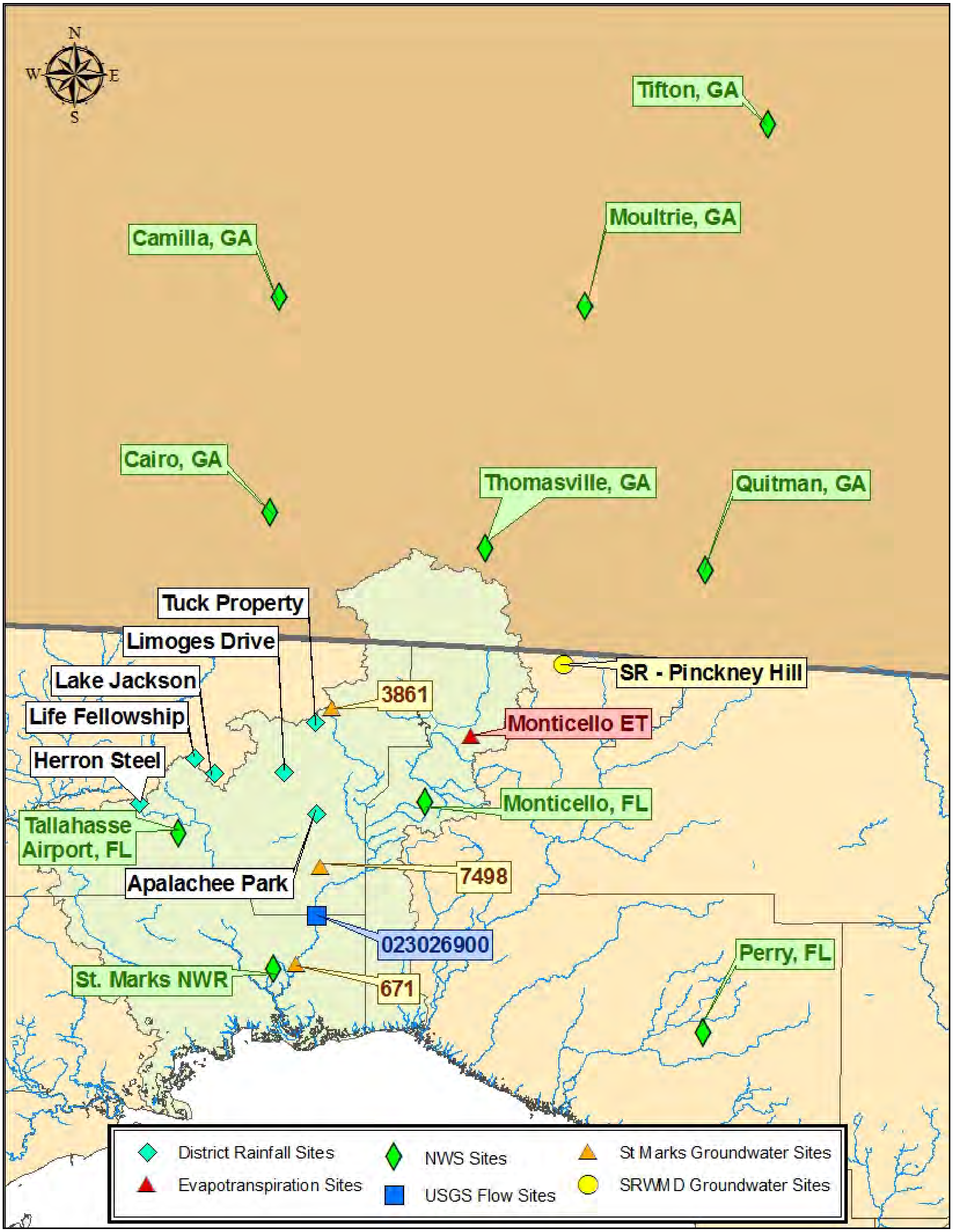

Figure 1. **Locations of data collection sites used in trend test evaluations.**

3.2 Results

3.2.1 Streamflow Trends

The only streamflow site with a long-term time series (i.e. 1956 – present) available for trend testing was the St. Marks River near Newport gage (USGS 02326900) (Figure 2). The daily time series is complete except for a data gap beginning in November 1994 and ending in July 1996, and a smaller gap between October 2004 and May 2005. The median discharge value over the timeseries was 611 cfs, with a maximum value of 5,820 cfs, as illustrated in the descriptive plots of the univariate daily data provided in Figure 3. Seasonal boxplots illustrate the seasonality in flows with tendency for higher flows in the spring (March and April) and in late summer (August and September) (Figure 4). After calculating the monthly median flow, a correlogram of the monthly data was generated (Figure 5) which suggested that the monthly data were highly correlated up to six months. Results of SKT trend testing on the monthly data indicated no significant trends in the long-term time series (p-value = 0.76; Figure 6). Detailed descriptive results are provided in Attachment 2.

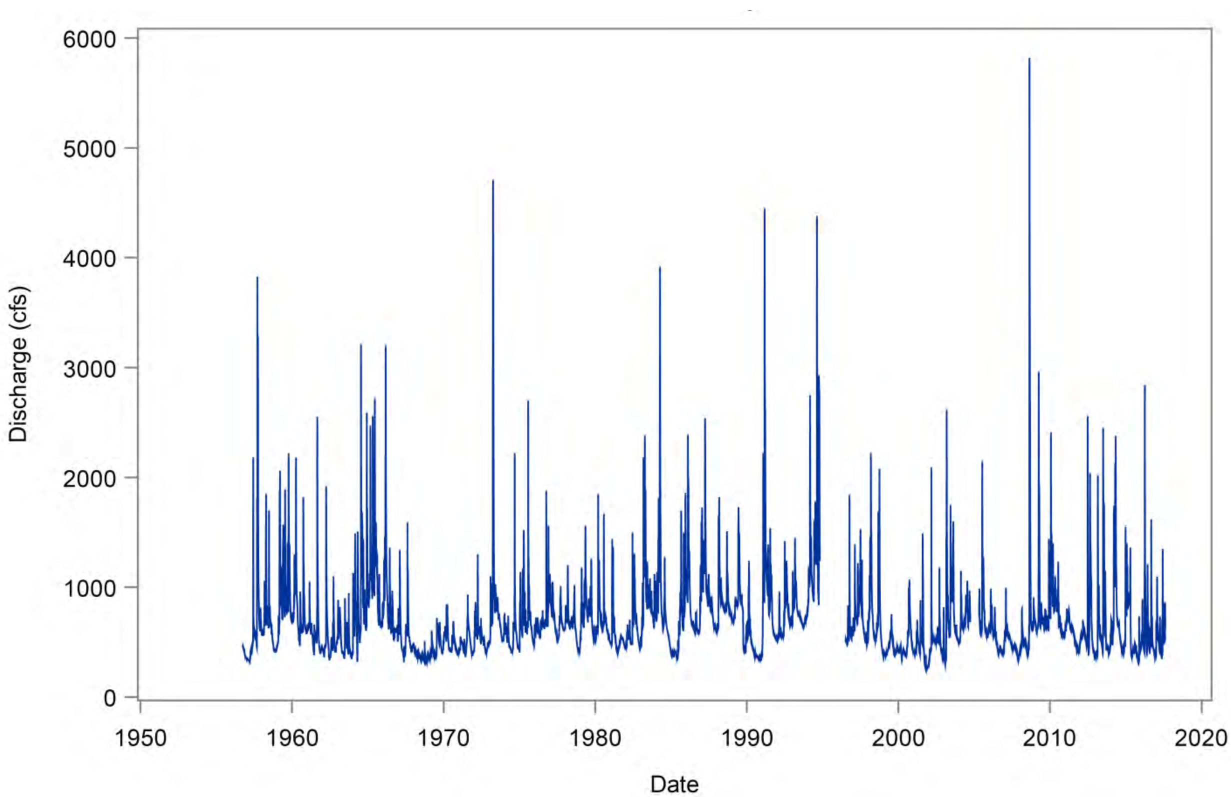

Figure 2. **Time series of daily flows (cfs) between 1956 and 2017 at the St. Marks River near Newport site (USGS 02326900).**

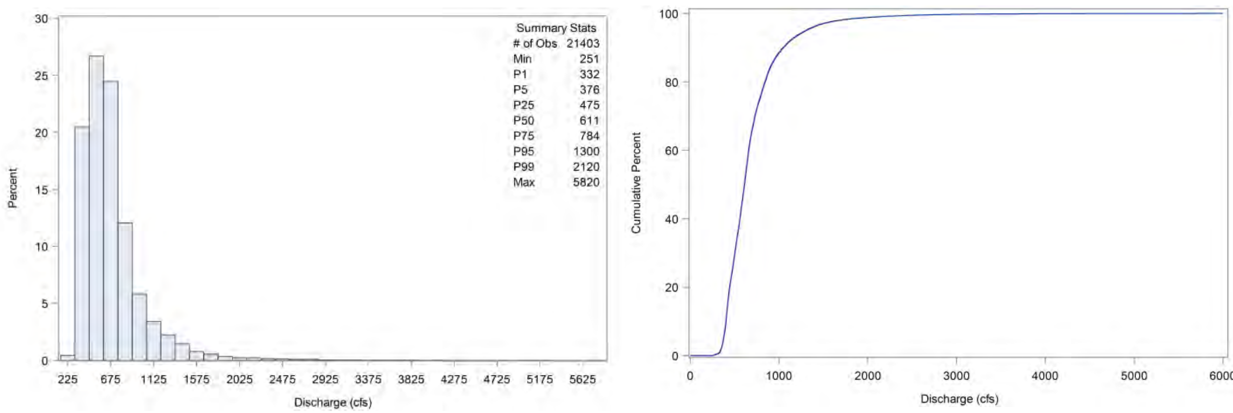

Figure 3. **Univariate statistics for daily discharge at St. Marks River near Newport site (USGS gage 02326900).**

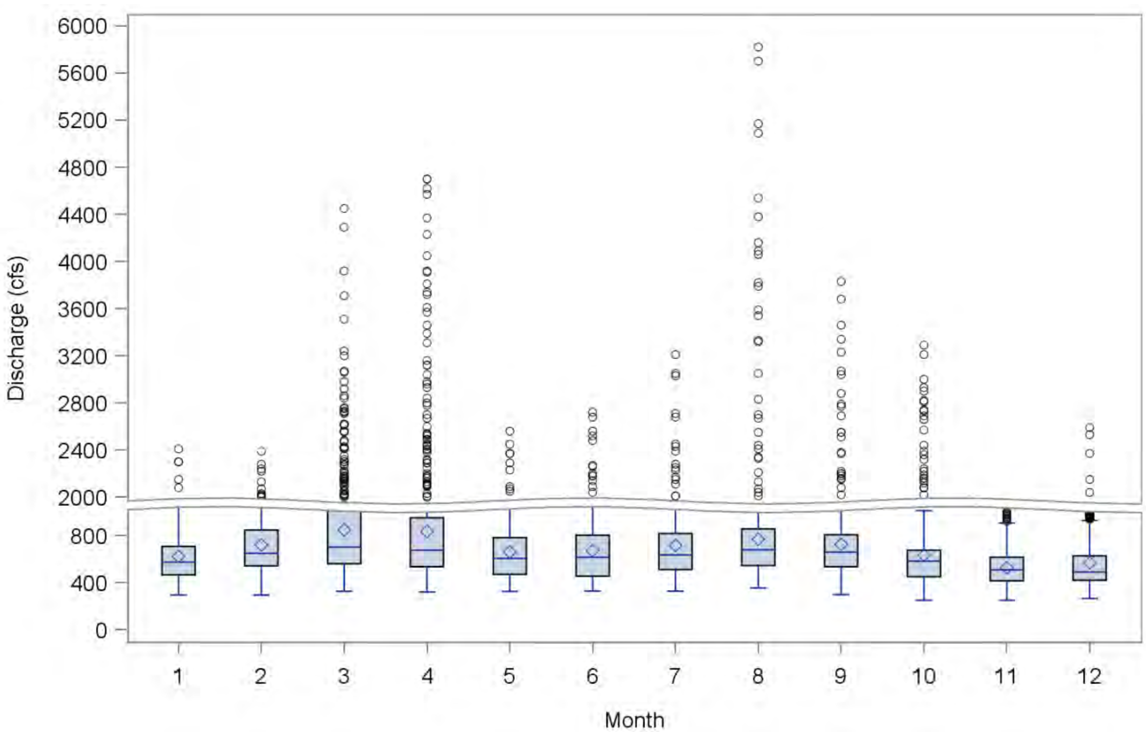

Figure 4. **Seasonal boxplots of daily discharge at St. Marks River near Newport site (USGS gage 02326900).**

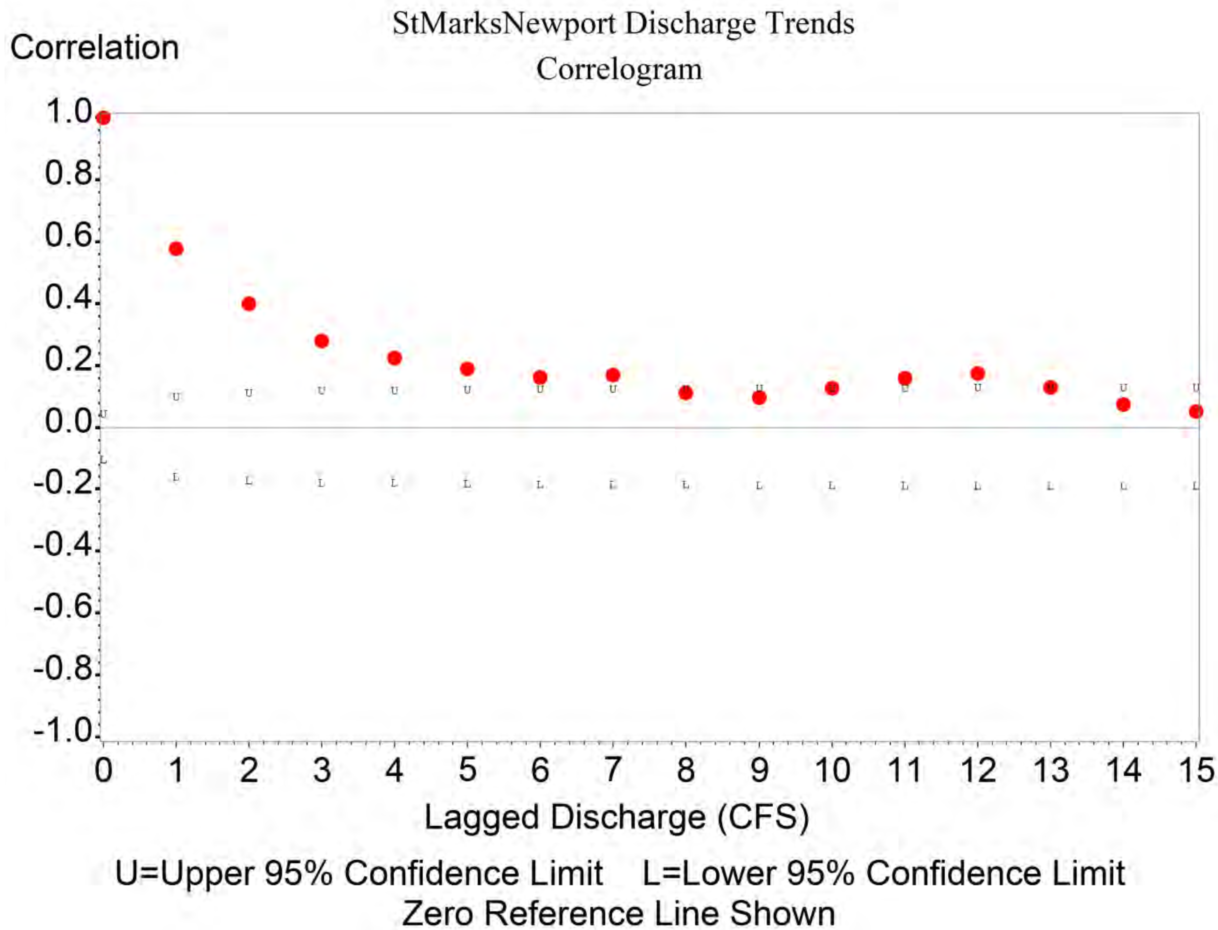

Figure 5. **Correlogram of monthly median discharge measurements at the St. Marks River near Newport site (USGS gage 02326900) between October 1956 and August 2017.**

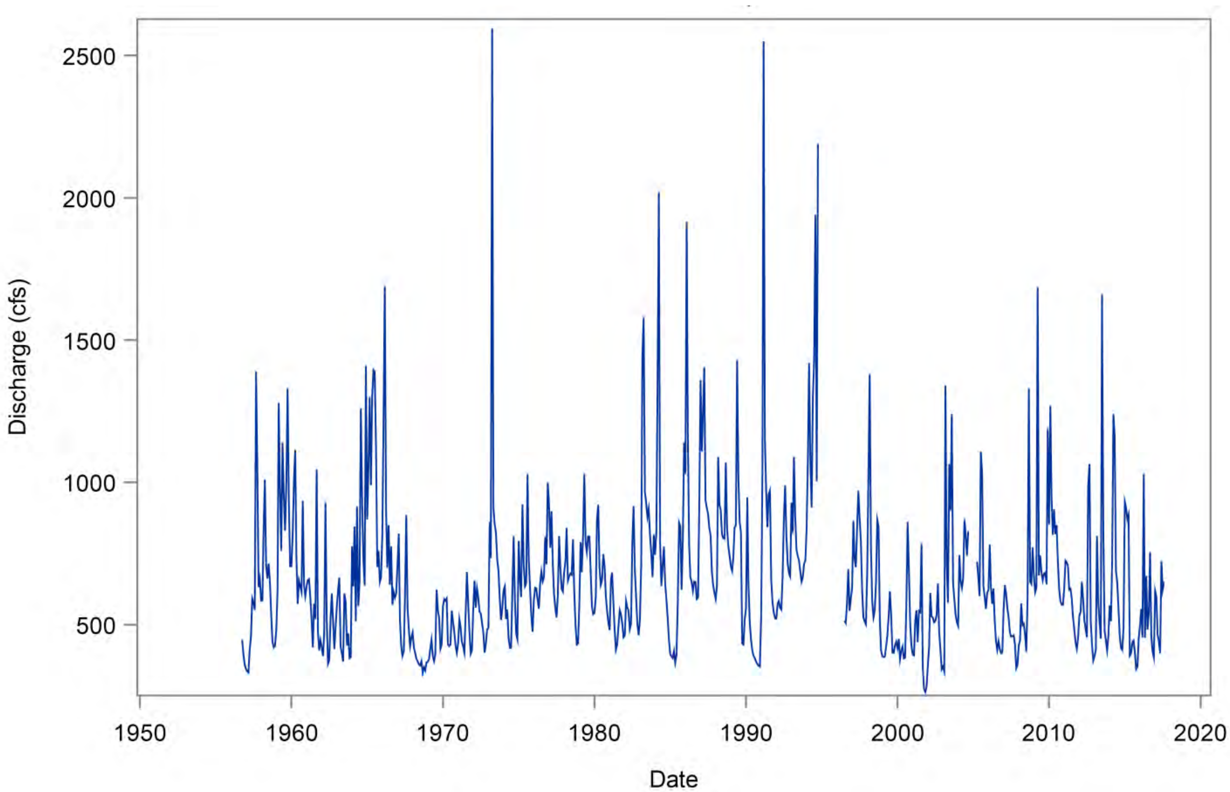

Figure 6. **Time series of monthly median discharge at St. Marks River near Newport with SKT trend test results.**

3.2.2 Evapotranspiration

Evapotranspiration data used for trend testing were daily values calculated from measured meteorological data collected by the University of Florida Institute of Food and Agricultural Science (IFAS) Florida Automated Weather Network (FAWN) Monticello site. The time series is relatively complete between 2003 and 2017 other than some missing daily values between 2003 and 2005. Evapotranspiration rates ranged from 0.02 to 0.23 inches per day with a median value of 0.1 inch as illustrated in the descriptive plots of the univariate daily data (Figure 7). Seasonal boxplots illustrate heavily seasonal evapotranspiration rates as expected with evapotranspiration rates peaking during June and July (Figure 8). After calculating the monthly median evapotranspiration, a correlogram of the monthly data was generated (Figure 9) which suggested that the monthly data were highly correlated with negative correlation at 6 months and positive correlation at 12 months, reiterating the strong seasonal signal in evapotranspiration. Results of SKT trend testing on the monthly data suggested no significant trend in the time series (p-value = 0.432: Figure 10). Detailed descriptive results are provided in Attachment 3.

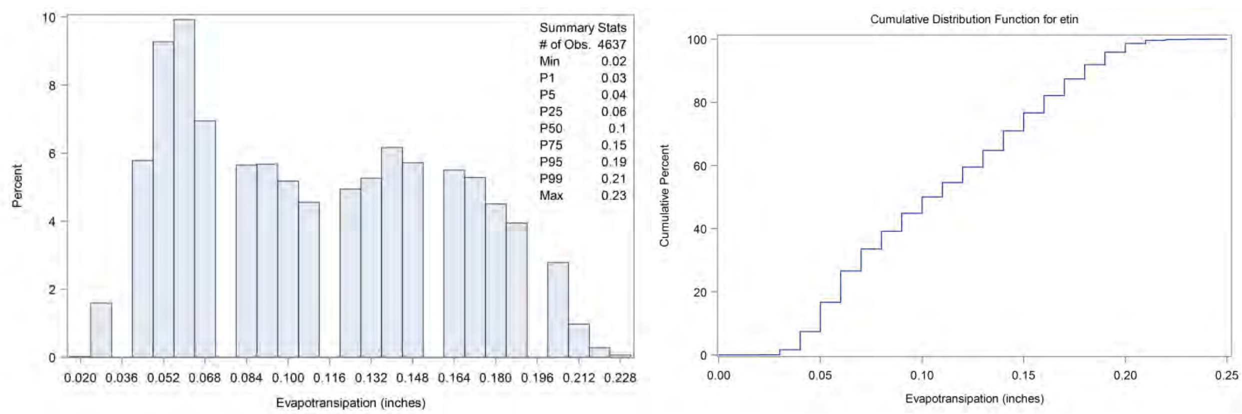

Figure 7. **Univariate statistics for daily evapotranspiration at Monticello.**

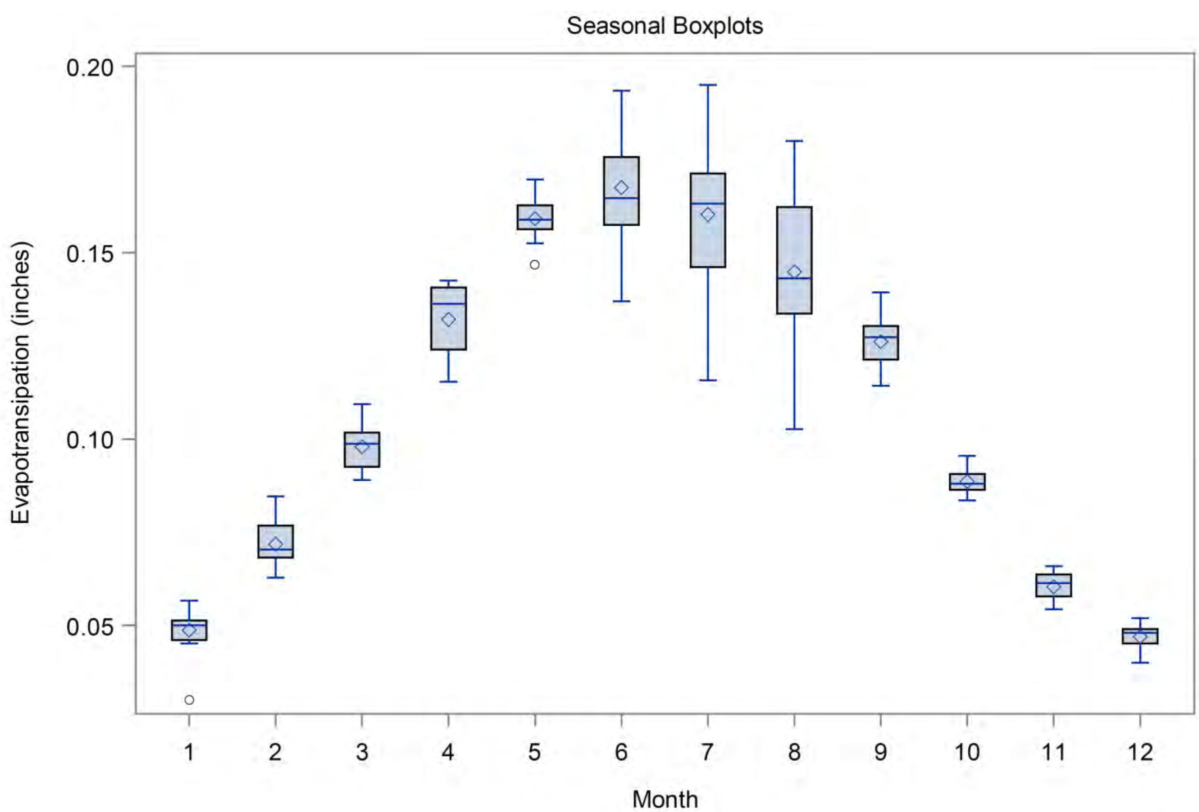

Figure 8. **Seasonal boxplots of daily evapotranspiration at Monticello.**

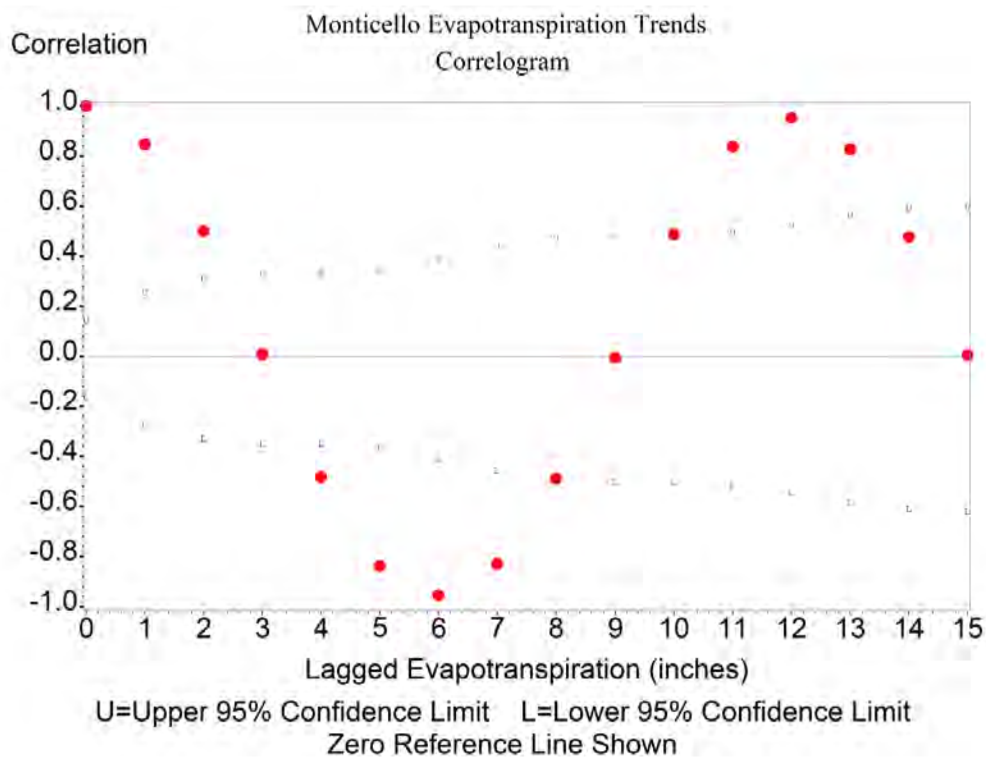

Figure 9. **Correlogram of monthly median evapotranspiration measurements over the period of record.**

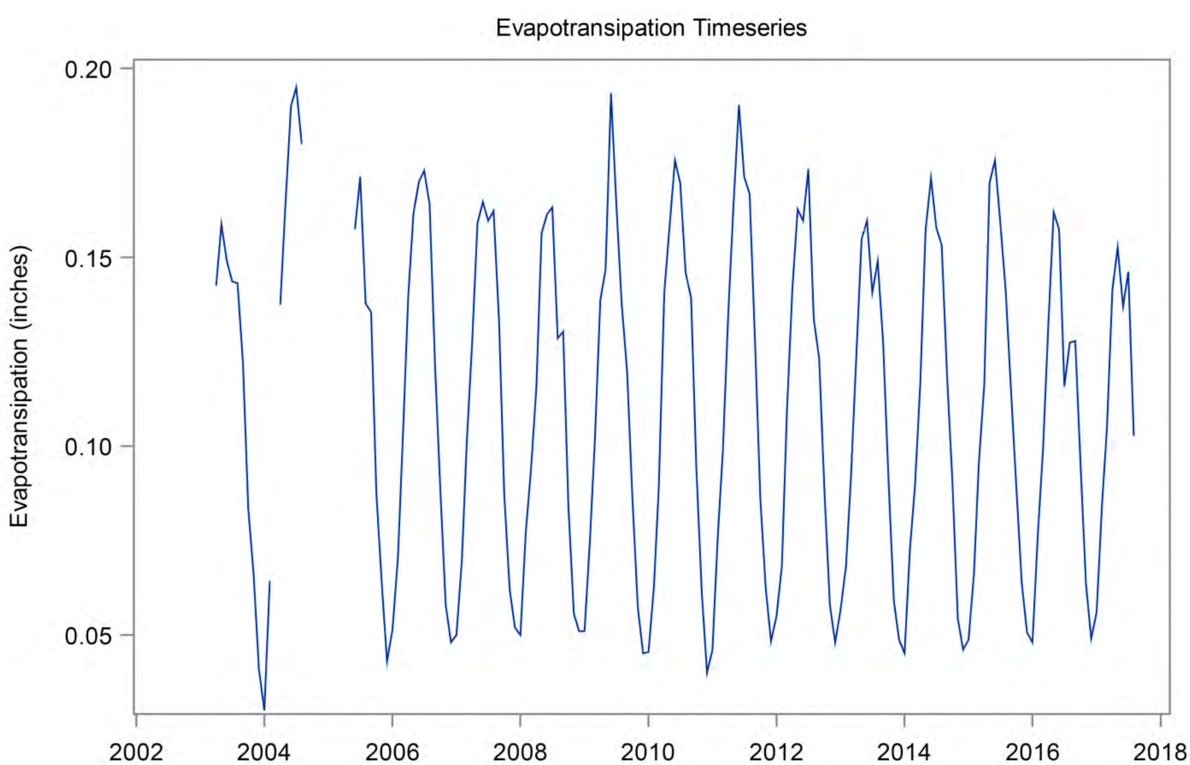

Figure 10. **Time series of monthly median evapotranspiration at Monticello with SKT trend test results.**

3.2.3 Rainfall

Rainfall trends were evaluated for both National Weather Service (NWS) and District gages.

District Gages

A total of six District-maintained rainfall gauges were analyzed for trends (Table 1). The period of record for each District gage is presented in Table 1 along with the number of monthly observations (i.e. "Nobs"). A timeseries plot of the monthly values is provided along with the results of the trend test in Figure 11. There were no statiscally significant trends in the District rainfall time series. Descriptive statistics and plots for each of the 6 District rain gages are provided in Attachment 4.

Table 1. Period of record and number of observations for District rain gages.

Obs	station	Nobs	mindate	maxdate
1	Herron Steel 11285	352	01/01/1988	04/01/2017
2	Life Fellowship 11288	352	01/01/1988	04/01/2017
3	Lake Jackson 11289	362	03/01/1987	04/01/2017
4	Tuck Property 11293	364	01/01/1987	04/01/2017
5	Limoges Dr 11296	363	02/01/1987	04/01/2017
6	Apalachee Park 11299	361	03/01/1987	04/01/2017

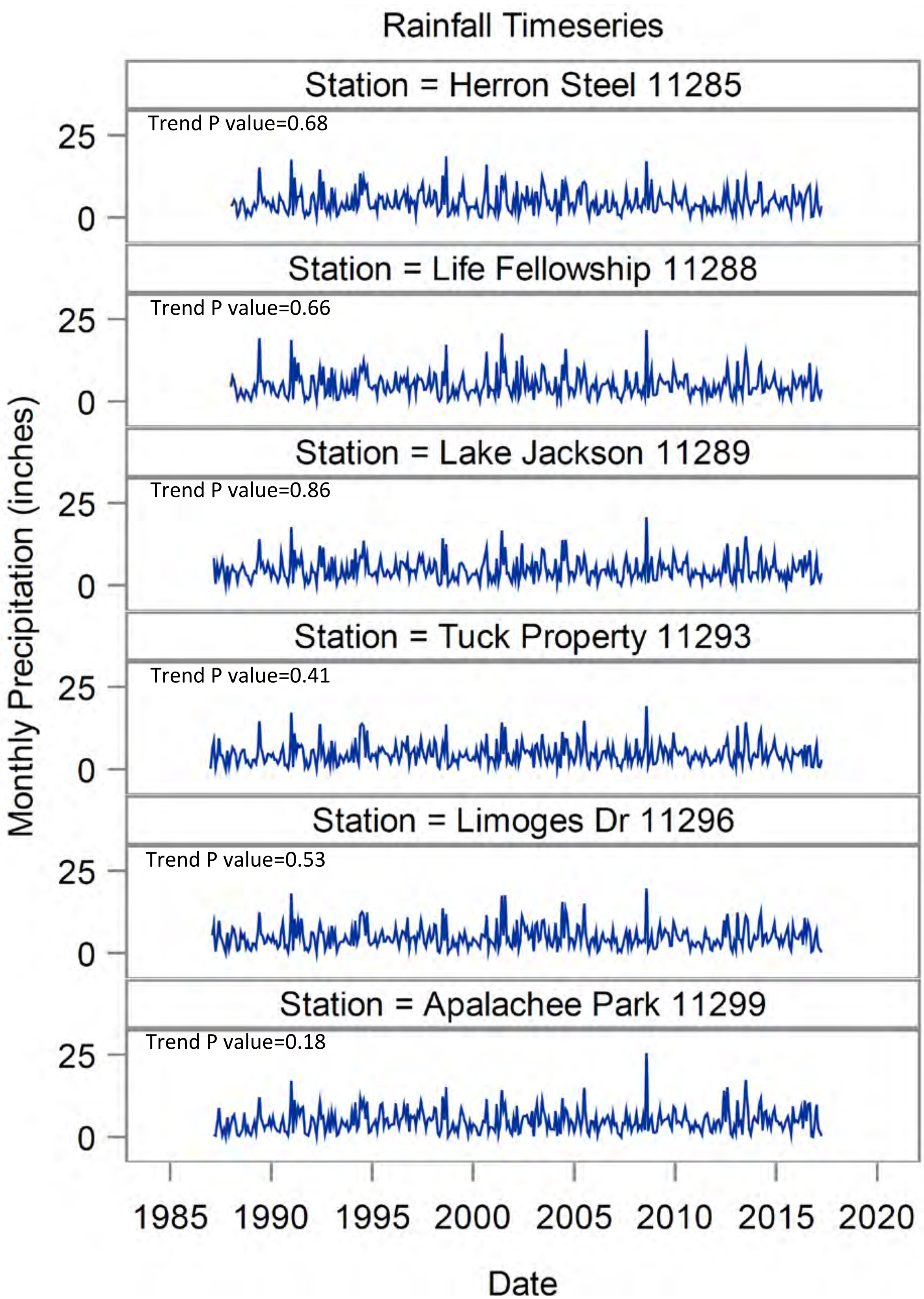

Figure 11. **Results of SKT trend test for District rain gages.**

NWS Gages

A total of 10 National Weather Service (NWS) rain gages were investigated for trends. Two stations (US1GATH004 and USC00085880) contained data records of length less than 10 years which precluded trend analysis (Table 2). The period of record for the monthly rainfall at each NWS gage is presented in Table 2 along with the number of observations (i.e. "Nobs"). Descriptive statistics and plots for each of the NWS rain gages are provided in Attachment 5. The results of the SKT test suggested a single rain gage (USC000870025, Perry, FL) had a significant declining trend in rainfall between 1940 and 2016 with a very small slope, suggesting an approximate 1 inch decrease in rainfall over 100 years. There were no statiscally significant trends in the remaining NWS rainfall time series (Figure 12).

Table 2. Period of record and number of observations for NWS rain gages.

Obs	station	name	Nobs	mindate	maxdate
1	US1GATH0004	THOMASVILLE 5.1 ESE, GA US	96	01/01/2009	12/01/2016
2	USC00085880	MONTICELLO 10 SW, FL US	120	01/01/2007	12/01/2016
3	USC00087025	PERRY, FL US	924	01/01/1940	12/01/2016
4	USC00087869	ST MARKS NWR, FL US	180	01/01/2002	12/01/2016
5	USC00091463	CAIRO, GA US	924	01/01/1940	12/01/2016
6	USC00091500	CAMILLA 3 SE, GA US	924	01/01/1940	12/01/2016
7	USC00096087	MOULTRIE 2 ESE, GA US	924	01/01/1940	12/01/2016
8	USC00097276	QUITMAN 2 NW, GA US	852	01/01/1940	12/01/2010
9	USC00098703	TIFTON, GA US	924	01/01/1940	12/01/2016
10	USW00093805	TALLAHASSEE REGIONAL AIRPORT, FL US	900	01/01/1942	12/01/2016

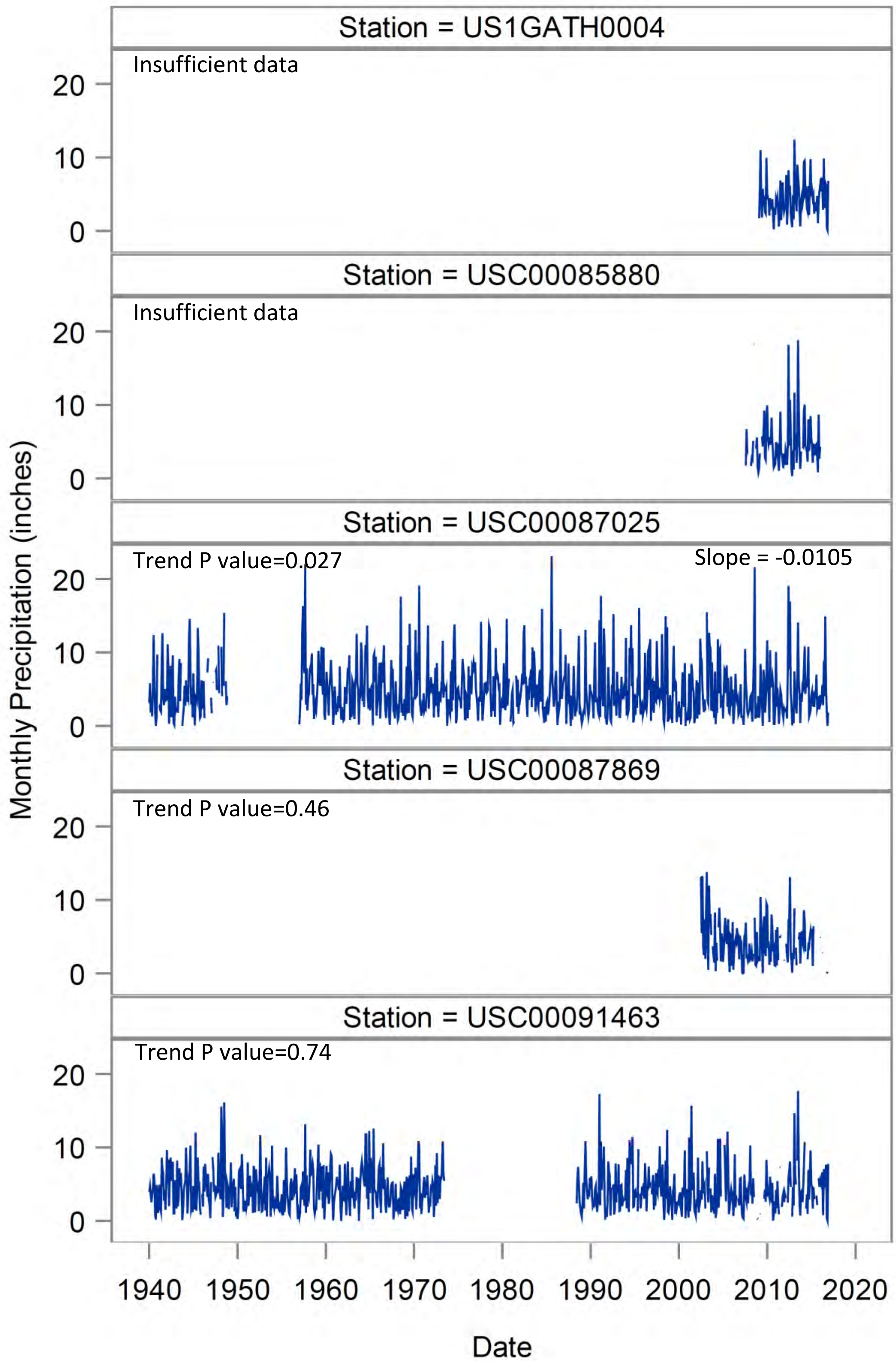

Figure 12. **NWS rainfall trend results for gages located near/within the District.**

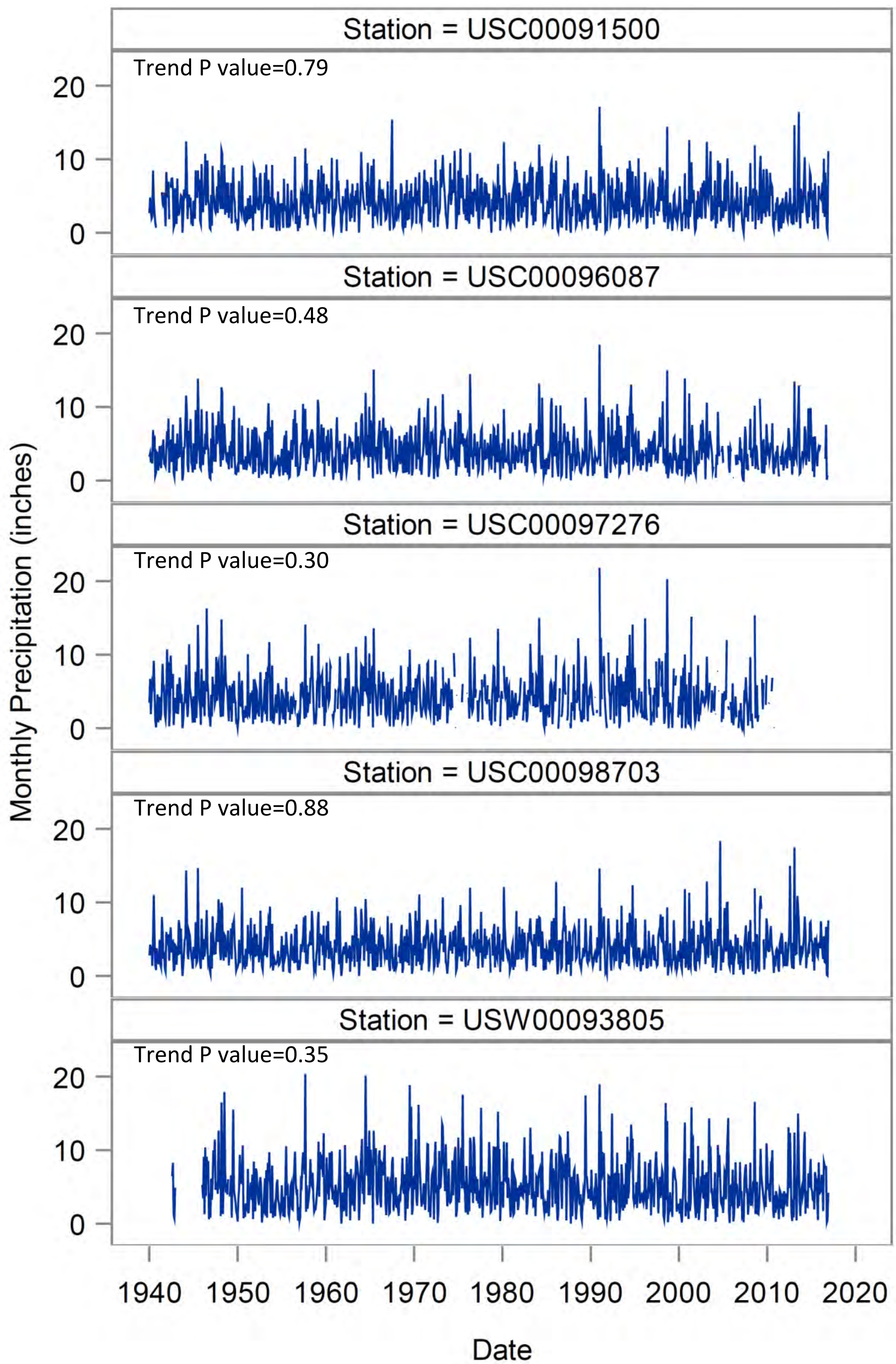

Figure 12 (cont). **NWS rainfall trend results for gages located near/within the District.**

3.2.4 Groundwater

There were four gages with sufficient period of record for trend testing groundwater elevations. Two gages (3861 and 671) have measurements dating back to the early 1960s while the Pinckney Hill gage and site 7481 have more recent start dates (Table 3; Figure 13). The number of observations (i.e. "Nobs") was quite sporadic among gages. For example, Pinkney Hill had relatively stable monthly measures until 2002 when daily measurements began while other stations had a mix of monthly and seasonal measurements over time. Descriptive statistics (including the sampling frequency by year and month for each site) and plots for the groundwater sites are provided in Attachment 6. Monthly median values were calculated where more than one measure was taken within a month. Results of trend testing indicated no trends at two wells and significantly declining trends in groundwater levels over time for two stations: Pinkney Hill, located in SRWMD northeast of the Rise (Figure 1), (slope of -0.182 feet per year), and Site 671, Newport Recreation Well, located near the St. Marks River and US Hwy 98 (slope of -0.013 feet per year).

Table 3. Period of record and number of observations for Groundwater Stations.

Obs	station	Nobs	mindate	maxdate
1	3861	324	01/05/1960	05/15/1990
2	671	171	06/30/1961	05/22/2017
3	7498	70	02/17/2000	02/07/2017
4	SRPinckneyHill	2246	02/22/1988	07/17/2017

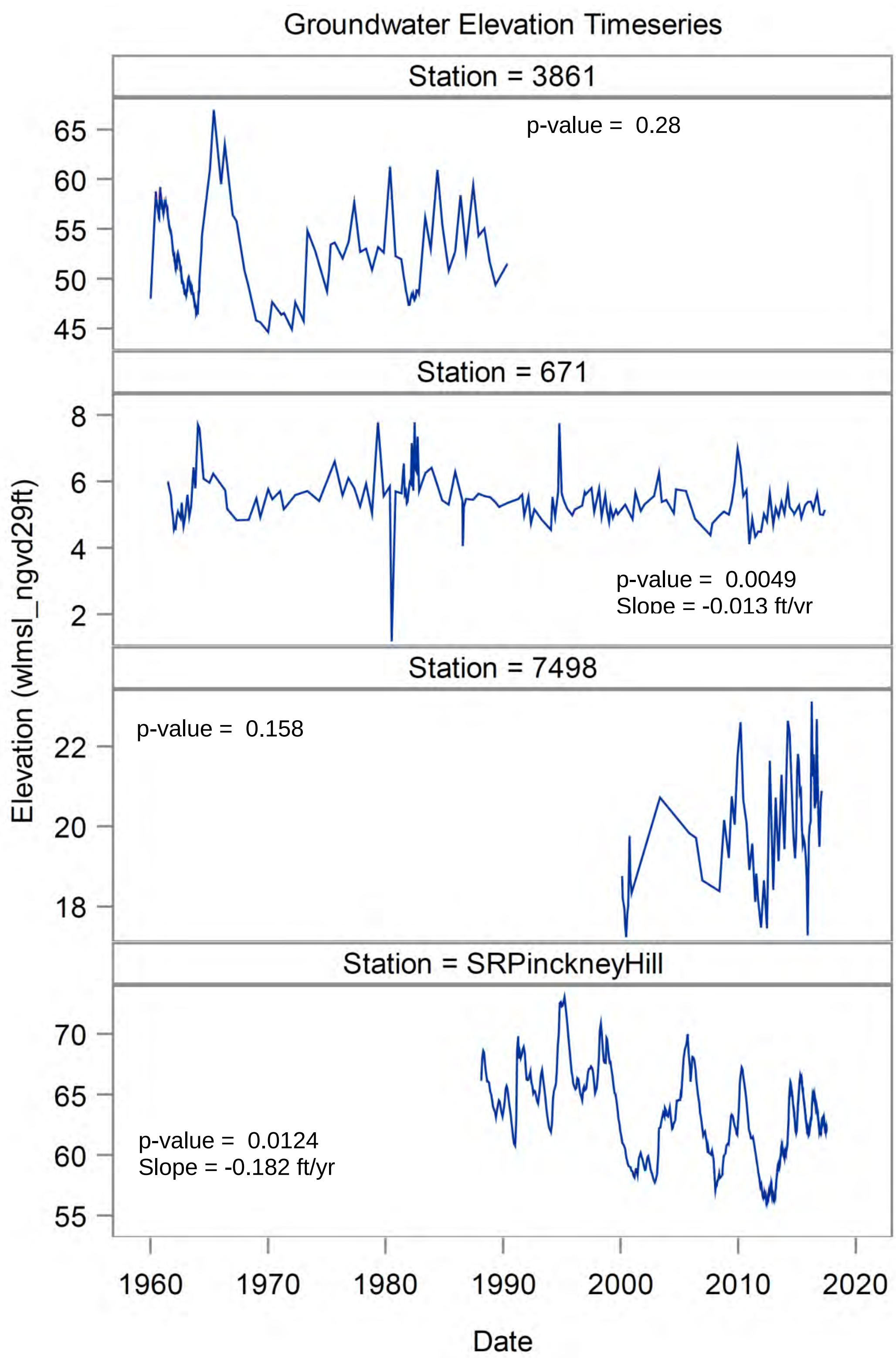

Figure 13. **Time series trend test results for groundwater stations.**

3.2.5 Summary of Trend Tests Results

In summary, the results of the trend tests were as follows:

- Streamflow: St. Marks River near Newport - No significant trend.
- Evapotranspiration: Monticello - No significant trend.
- Rainfall:
  - Six District gages - No significant trends.
  - Ten NWS gages - Eight with sufficient period of record for trend testing. Only significant trend was for Perry, FL (USC00087025), with significant declining trend of ~1 inch over 100 years.
- Groundwater Elevations: Four gages with sufficient period of record for trend testing - Significant declining trends at Pinkney Hill in SRWMD northeast of the Rise (-0.182 ft/yr), and at Newport Recreation Well near St. Marks River and US Hwy 98 (-0.013 ft/yr).

4 Long-Term Time Series of Spring Discharge at St. Marks River Rise

This section describes the development of a long-term spring flow record for the Rise for use in modeling evaluation of reduced flow scenarios in aid of the development of minimum flows. This is a necessary step in developing the long-term unimpacted spring flow record to be used in minimum flow evaluation. The data considered in the development of the long-term spring flow record include rainfall, groundwater levels, evapotranspiration, and river flow. This section provides a synthesis of methods and results from application of exploratory data analysis and time series regression modeling to generate a long-term time series of spring flow estimates for the Rise as part of an effort to provide technical support to the establishment of a minimum flow for the Rise.

Empirical data include the long-term USGS daily discharge measurements near Newport (USGS 02326900 St. Marks River near Newport, FL) which is located approximately 2,000 feet below the Rise, and a gage near Woodville (USGS 02326885 St. Marks River Swallet near Woodville, FL) that has been in operation since June 2015 and is located just upstream of the swallet, where the flow goes below ground. There are no direct flow measurements at the Rise but no known significant additional surface water inputs between the Rise and the location of USGS station 02326900 exist. The Rise spring discharge is estimated as the flow at the USGS St. Marks River Newport (02326900) less the upstream river flow that discharges into the swallet as measured at the USGS Woodville gage (02326885). There is a limited period of record of USGS Woodville flows, from June 2015 to July 2017 and continuing to present day. The District has requested the development of empirically-derived, statistically-based models to estimate a long term historical time series of flows for Woodville which can then be used to calculate an estimated long term spring flow time series at the Rise.

The overall objective of this effort was to develop the long-term time series of the spring flow discharge at the Rise using statistical modeling. An “unimpacted” spring flow time series is developed as described in the next section of this report, accounting for any estimated quantity of groundwater extraction that has occurred over the time period. Importantly, it is not explicity necessary, although it may be desirable, to know the source water contributions of the Rise discharge in order to evaluate the potential pumping effect or the un-impacted condition. However, we used exploratory regression modeling to determine if there were additional covariates that could be included to account for variability in the Rise flows that was not explained by the flows measured at Newport and Woodville. In addition to the available discharge data, the District provided daily rainfall, aquifer levels, and daily lake stage data to be used to evaluate potential contributions to the spring discharge. The location of empirical data collection stations in the vicinity of the lower St. Marks River is provided in Figure 14. Efforts to include these potential covariates are described below.

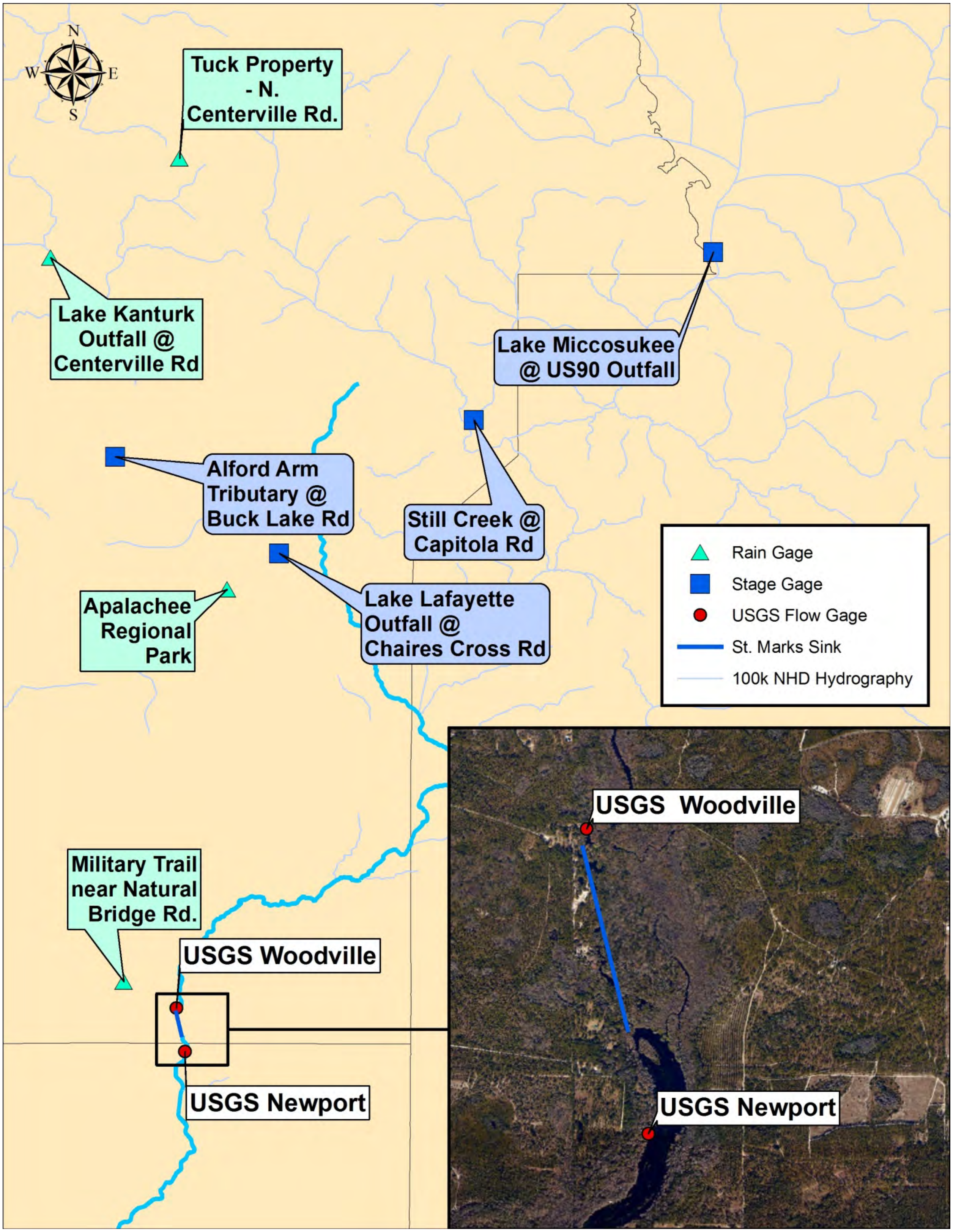

Figure 14. **Rainfall and lake stage sampling locations near the St. Marks River gauging stations.**

4.1 Methods

4.1.1 Data Handling

The relationship between the two USGS discharge measurements over time is displayed in the time series plots of Figure 15. It is clear by examining these plots that: 1) the two independent measures of discharge in the lower river appear to be highly correlated; 2) the magnitude of the Newport flows is substantially larger than those at Woodville; and 3) the Woodville gage included small periods where data were missing which seemed to be associated with times of peak flows.

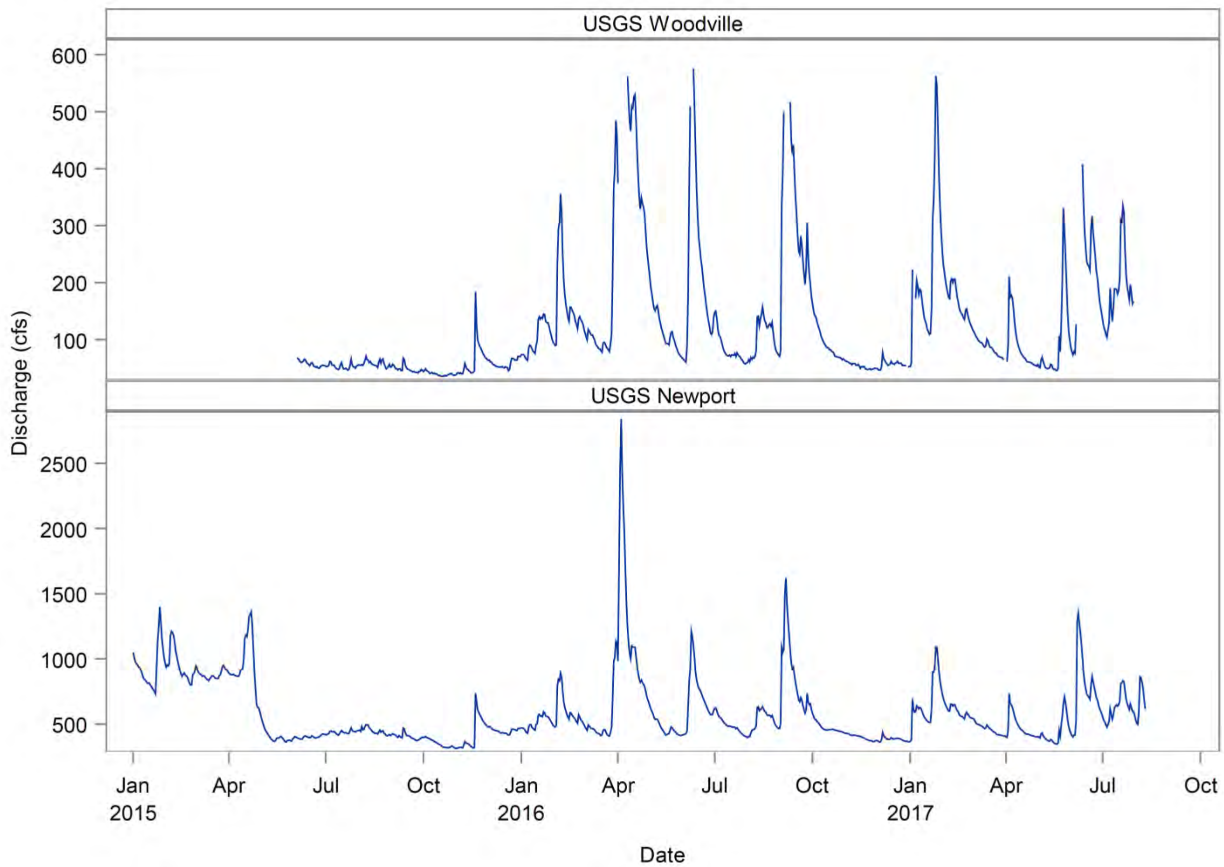

Figure 15. Discharge at USGS Woodville (02326885) and USGS Newport (02326900) over period of coincident measurements. Note y-axis scale diference.

This time series of daily flows at Newport is the only long term flow record in the watershed and is nearly complete except for a data gap beginning in November 1994 and ending in July 1996, and a smaller gap between October 2004 and May 2005. The median flow over the period of record is 611 cfs with flows typically ranging between 475 cfs and 784 cfs. The Woodville time series period of record is June 2015 through July 2017 with 23 missing daily values within that daily time series. The median flow over the period of record was 79 cfs with typical range between 55 cfs and 145 cfs. The missing daily flows were imputed (filled) using nonlinear regression as described in more detail below.

The periods of record for the daily rainfall data is provided in Table 4. The daily records are almost entirely complete within the period of record and any missing values within the record were assumed to be zero. Details of the sampling frequency and distribution of daily rainfall are provided in Attachment 7.

Table 4. Periods of record for District daily rainfall data collected in the Lower St Marks watershed.

Obs	Site Name	Station	Date	Date
1	Apalachee Regional Park	NWFID_11299_prcp_in	03/30/1987	09/12/2017
2	Lake Kanturk Outfall @ Centerville Rd	NWFID_11301_prcp_in	11/09/1989	05/02/2017
3	Military Tr Near Natual Bridge Rd	NWFID_11370_prcp_in	08/03/2004	09/12/2017
4	Tuck Property, N. Centerville Rd	NWFID_1293_prcp_in	01/28/1987	09/12/2017

Cumulative sums of rainfall for the four daily rainfall stations were calculated for 7, 14, 30, 60, 90, and 120 days prior to the day of interest for inclusion as potential covariates in regression modeling. In addition, lag average stage heights for the four lake outfalls were calculated for 7, 14, 30, 60, and 90 days prior to the date of interest. The periods of record for these data is provided in Table 5 and descriptive statistics for these data are provided in Attachment 8.

Table 5. Periods of record for District Stage data collected in the Lower St Marks watershed.

Obs	Site	Date	Date
1	Alford Arm Tributary at Buck Lake Rd	01/29/1987	09/15/2017
2	Lake Lafayette Outfall	11/18/1987	08/01/2017
3	Lake Miccosukee Outfall	06/04/2012	09/13/2017
4	Still Creek at Capitola Rd	04/01/2009	09/14/2017

4.1.2 Statistical Methods

The need for long-term daily estimates of the spring discharge at the Rise necessitates a special class of statistical methods to account for the serial correlation that exists in daily flow time series data. Ordinary least squares regression (OLS, standard linear regression) assumes independence between samples. That is, the OLS error correlation matrix is given by:

$$OLS\,cor(\varepsilon_t, \varepsilon_{t-1}) \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Violation of this assumption can have critical effects on hypothesis testing such as testing for significance of potential covariates in explaining the variation in flows because correlated error structures inflate the false positive rates of the statistical test by underestimating the true standard errors.

Generalized Least Squares (GLS) regression allows for the estimation of the correlation between successive observations taken in time by modeling the error covariance matrix. For example, a model with first order correlated errors (AR1) would be given by:

$$AR1\,cor(\varepsilon_t, \varepsilon_{t-1}) \begin{bmatrix} 1 & \rho & \rho^2 & \rho^3 \\ \rho & 1 & \rho & \rho^2 \\ \rho^2 & \rho & 1 & \rho \\ \rho^3 & \rho^2 & \rho & 1 \end{bmatrix}$$

where $\rho^{|t_2 - t_1|}$ is the correlation between successive observations in time and decomposes with observations taken farther apart in time.

The autoregressive moving average (ARMA) model and the ARIMA (I = integrated) model structure are further generalizations to describe correlations among successive observations in time as well as the moving average component of correlation in the error term. With these models, the variable of interest is actually regressed on its own prior values and therefore dependent on both the independent terms as well as prior values of the dependent variable. Often the response time series needs to be differenced in order to meet the assumption of stationarity (e.g. constant mean and variance) and so the difference between the value and the value one step previous in time is used as the response variable of interest. This is the “Integrated” component of the “ARIMA” model (Box et. al., 1994).

The analyses used in this task explored several statistical modeling strategies to develop a time series of long-term spring flow at the Rise. The process involved creating a long-term time series of average daily flows at the Woodville gage (e.g. flow into swallet) and then subtracting these flows from flows measured at the Newport gage to create a long-term time series of spring discharge. Statistical modeling strategies included: (1) OLS regression; (2) GLS regression; (3) nonparametric and nonlinear locally weighted regression (LOESS); and (4) ARIMA modeling. The techniques were employed using Statistical Analysis Systems (SAS Institute, Inc., 2015) for OLS regression (SAS Proc

GLMSelect), GLS regression (Proc Mixed), and the nonparametric and nonlinear locally weighted regression (Proc LOESS) analysis. We used the open source statistical software R (R Core Development Team, 2015) for GLS (NMLE package) and ARIMA modeling (forecast package). The forecast package, created by Rob Hyndman http://pkg.robjhyndman.com/forecast/, is extremely flexible to accommodate a wide range of time series error structures including both seasonal and serial differencing to remove autocorrelation effects. An important attribute of this work that makes it different from typical time series modeling is the need to "hindcast" or predict backwards in time all covariates. This required reversing the order of the time series for all variables in the model. Reversing the time series is reported to have no effect on the ARIMA model estimation process. For further details see information provided by the creator of the forecast package at http://robjhyndman.com/hyndsight/backcasting/. Residual analysis included the use of the autocorrelation function (ACF), partial autocorrelation function (PACF), and Box Ljung test to test model adequacy with respect to the residuals.

The modeling strategy applied to this exploratory data analysis is summarized in the bullet points below:

1) Use LOESS regression to impute (i.e. fill) missing values in existing Woodville time series based on a relationship with flows measured at the Newport gage. This was necessary for later ARIMA modeling efforts. This also provides an additional estimate of a long-term time series of predicted Woodville flows using a simple nonlinear model.
2) Model Newport flows as a function of Woodville flows using GLS regression. This is the most internally consistent formulation of the hypothesis we wished to test in that the Woodville gage is upstream of the Newport gage. The GLS model was used in an attempt to account for serial autocorrelation and generate residuals, after accounting for serial correlation, which were then evaluated in the next step to identify potential covariates.
3) The residuals of the GLS regression were then used to evaluate the potential for additional empirical data to explain variation in flows that could be attributed to the Rise flows.
4) Reformulate the model structure and develop ARIMA models that include the additional covariates identified in step 3 to generate a long-term time series of Woodville flows based on Newport flows and the additional covariates.
5) Compare results from the methods applied to determine the most appropriate long-term time series of flows at Woodville to subtract from the Newport flows and generate the long-term Rise spring flow record.

Each of these steps is further detailed in the results section below.

4.2 Results

The Woodville time series is critical to the objectives of this task and the first effort of the analysis was to impute (fill) the 23 missing dates within the Woodville time series in order to have a complete time series within the two year period of record of daily flows. Since the length of missing data periods did not exceed 8 days, LOESS regression was used to impute those missing values, using the Newport time series to estimate the Woodville flows on missing Woodville days.

The regression relationship is displayed in Figure 16 where Newport flows are on the X-axis and Woodville flows are on the Y-axis and the solid line represents the LOESS-predicted values. The fit suggests a slower rate of change in Woodville flows when Newport flows are below 500 cfs and an increased rate of change when Newport flows are above 500 cfs. The plot provided in Figure 17 displays the imputed values (red dots) and indicated that the majority of missing values occurred during high flow periods.

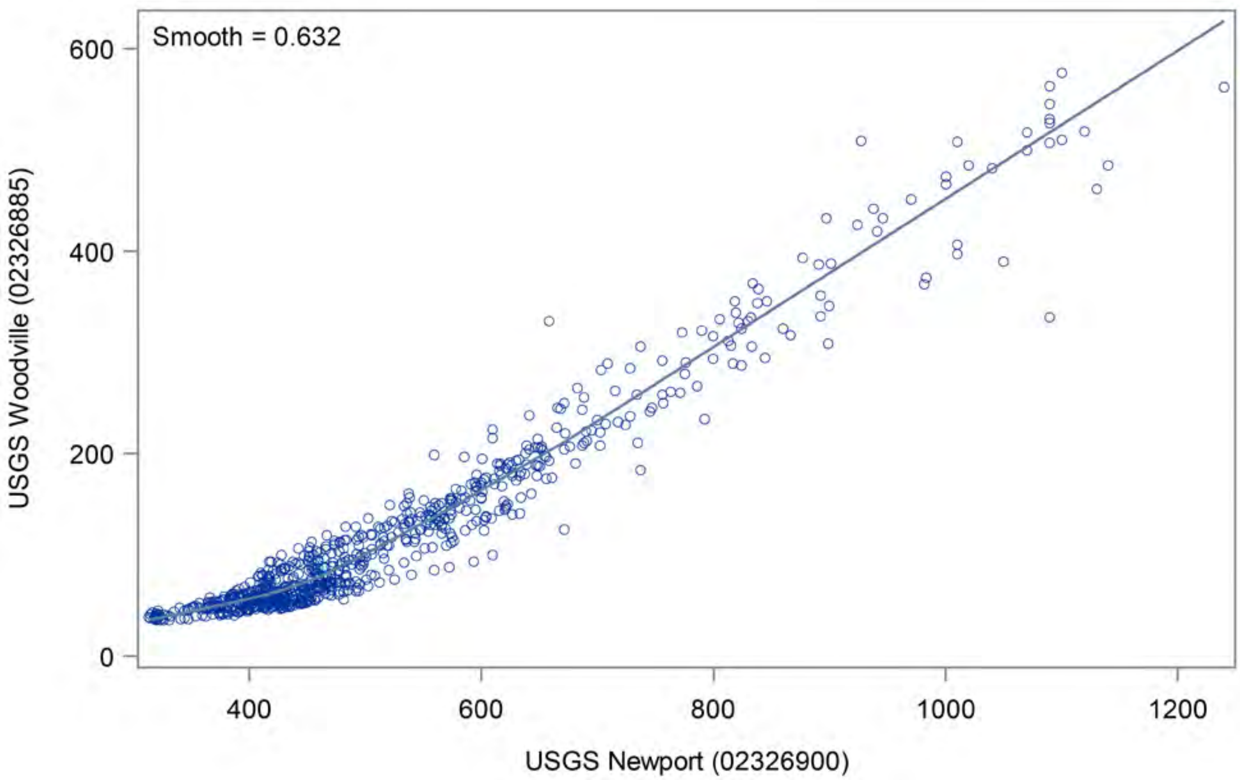

Figure 16. Relationship between the flows at USGS Newport (02326900) and flows at USGS Woodville (02326885) based on daily measurements between June 2015 and July 2017.

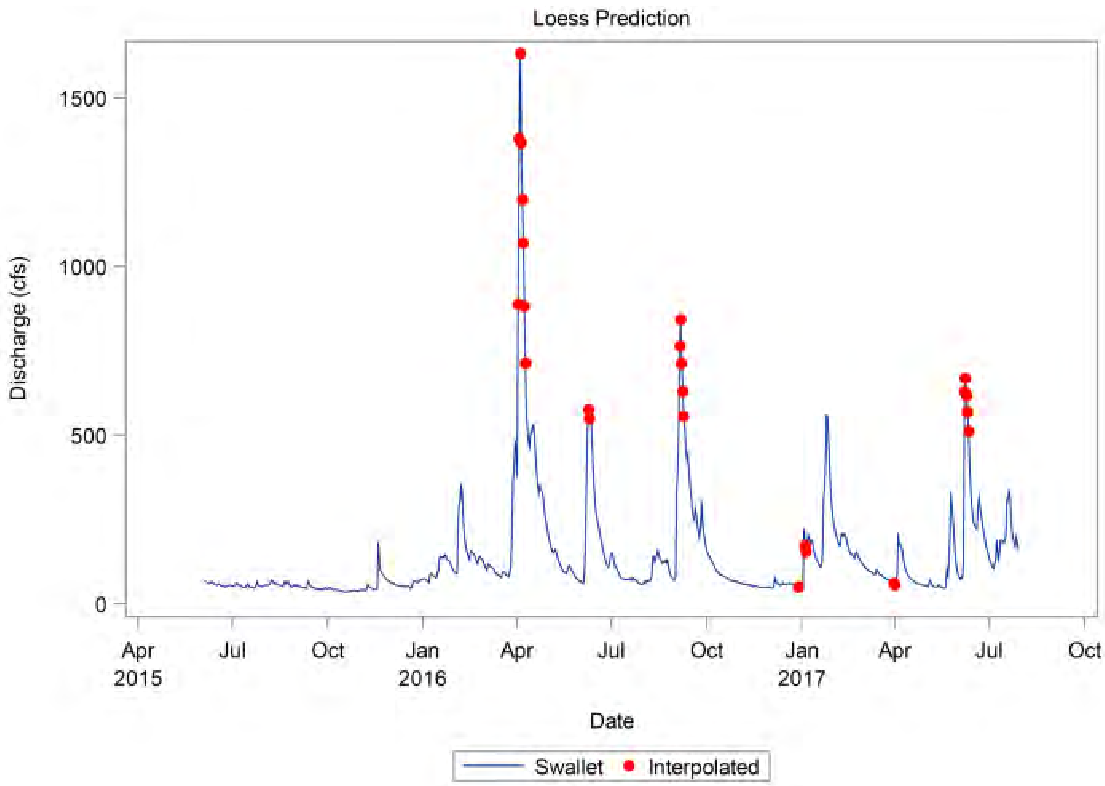

Figure 17. **Results of LOESS regression model used for imputing Woodville flows on missing days.**

Locally weighted regression (LOESS: Cleveland. 1979) was implemented using the SAS LOESS procedure (SAS Institute, Inc., 2015). The LOESS method is nonparametric and uses weighted least squares to fit linear functions of the predictors at the centers of neighborhoods. The radius of each neighborhood is chosen so that the neighborhood contains a specified percentage of the data points. The fraction of the data, called the *smoothing parameter,* in each local neighborhood controls the smoothness of the estimated surface. Data points in a given local neighborhood are weighted by a smooth decreasing function of their distance from the center of the neighborhood. To relate Newport and Woodville discharge measures, automated selection criteria were used to provide the best fit to the data while maximizing the predictive capacity of the model. This included using the AICC function to select the smoothing parameter, and using iteratively reweighted least squares to perform robust fitting in the presence of outliers in the data as described in the SAS procedure documentation (PROC LOESS: SAS Institute, Inc. 2015).

Initially, as referenced above, LOESS regression was utilized in an effort to fill in missing values in the timeseries of observed Woodville discharge measurements between 2015 and 2017 (breaks in the line plot, Figure 15). The filled timeseries was then used in exploratory data analysis to predict a long term timeseries of Woodville flows that could be used to develop an estimate of the spring flow from the Rise.

The principal explanatory variable used to predict Woodville flows was the flow record downstream at the Newport gage. In addition to this gage, the District requested consideration of the inclusion of additional covariates including antecedent rainfall, groundwater levels and other potential covariates to explain variation in the Woodville flows after accounting for the relationship between the flows at Woodville and Newport. Autoregressive integrated moving average (ARIMA) timeseries regression analysis was used to evaluate the potential of these covariates to explain additional variation in Woodville flows after accounting for the Newport flows (see further discussion below). ARIMA modeling was selected for hypothesis testing of these additional covariates due to the serial correlation present in the daily timeseries of flows. The results of that effort are detailed below and suggest that, after accounting for the relationship between Newport and Woodville, there is little improvement to the models by including additional covariates. This was due to the high degree of correspondence between these two independent measures of discharge over the same time period. For example, a simple linear regression model predicting Woodville flows using Newport flows resulted in an R^2 value of 0.97. The serial autocorrelation present in the timeseries resulted in the choice for ARIMA modeling to conduct hypothesis testing for potential additional explanatory terms to relate these measurements, but in the end there was little improvement in the model by the inclusion of additional covariates.

The flow duration curves of the observed and predicted Woodville flows (Figure 18) suggest extremely good agreement between the observed and predicted values. The timeseries plot of the observed and predicted values (Figure 19) also reveals a tight correspondence between the observed and predicted values. Finally, the residual diagnostics (Figure 20) suggest that the residuals are approximately normally distributed and fit well across the range of observed values. The long-term time series of LOESS predictions of Woodville flows is provided in Figure 21 along with the observed Newport time series used as the explanatory term in the model.

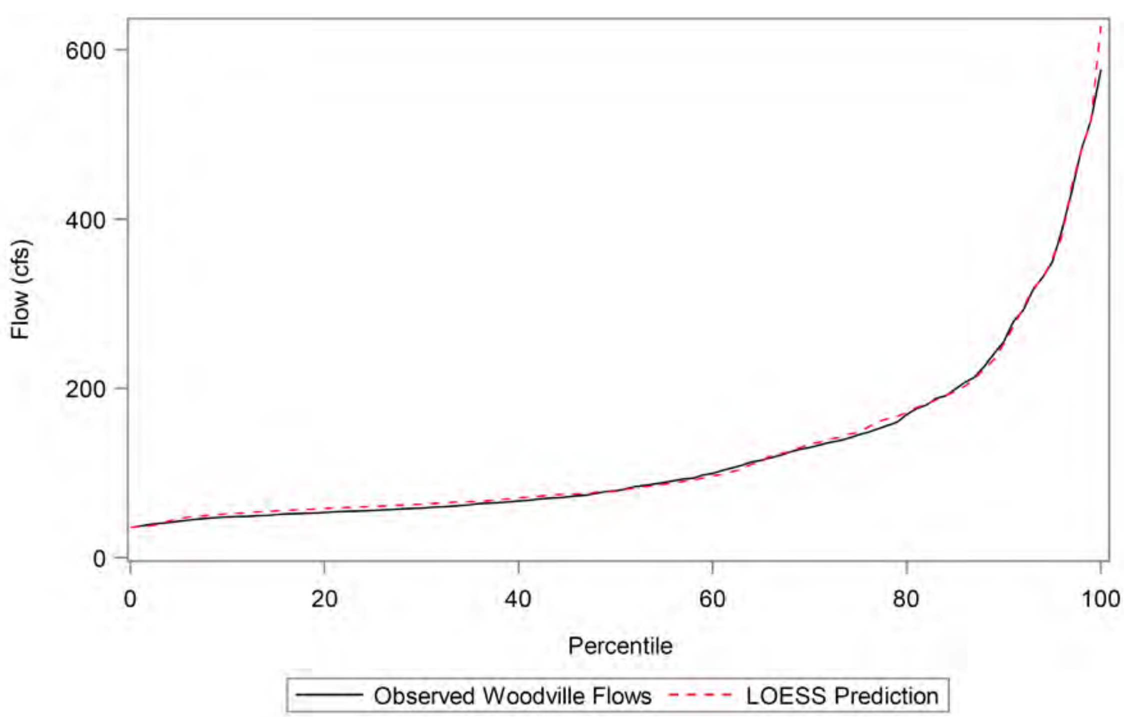

Figure 18. **Flow duration curves for observed and predicted flows at USGS Woodville (02326885).**

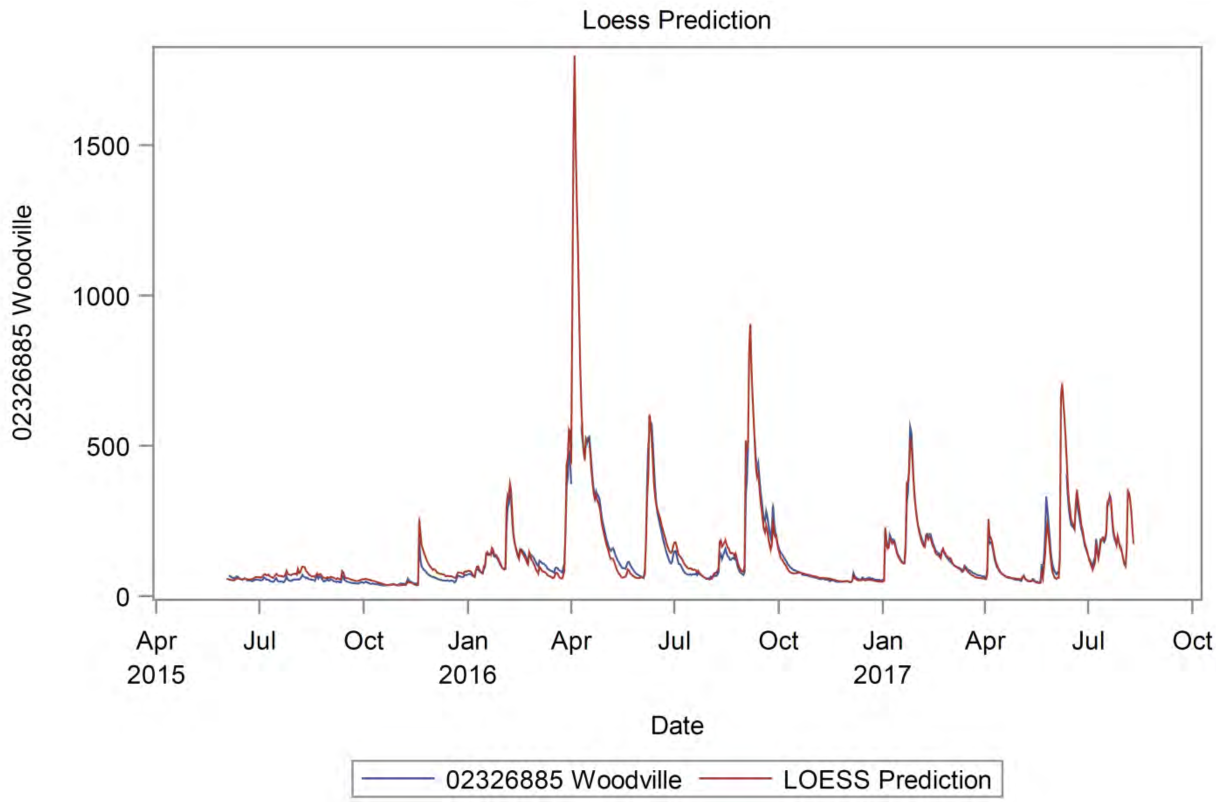

Figure 19. **Timeseries of observed and predicted flows at USGS Woodville (02326885) between June 2015 and July 2017.**

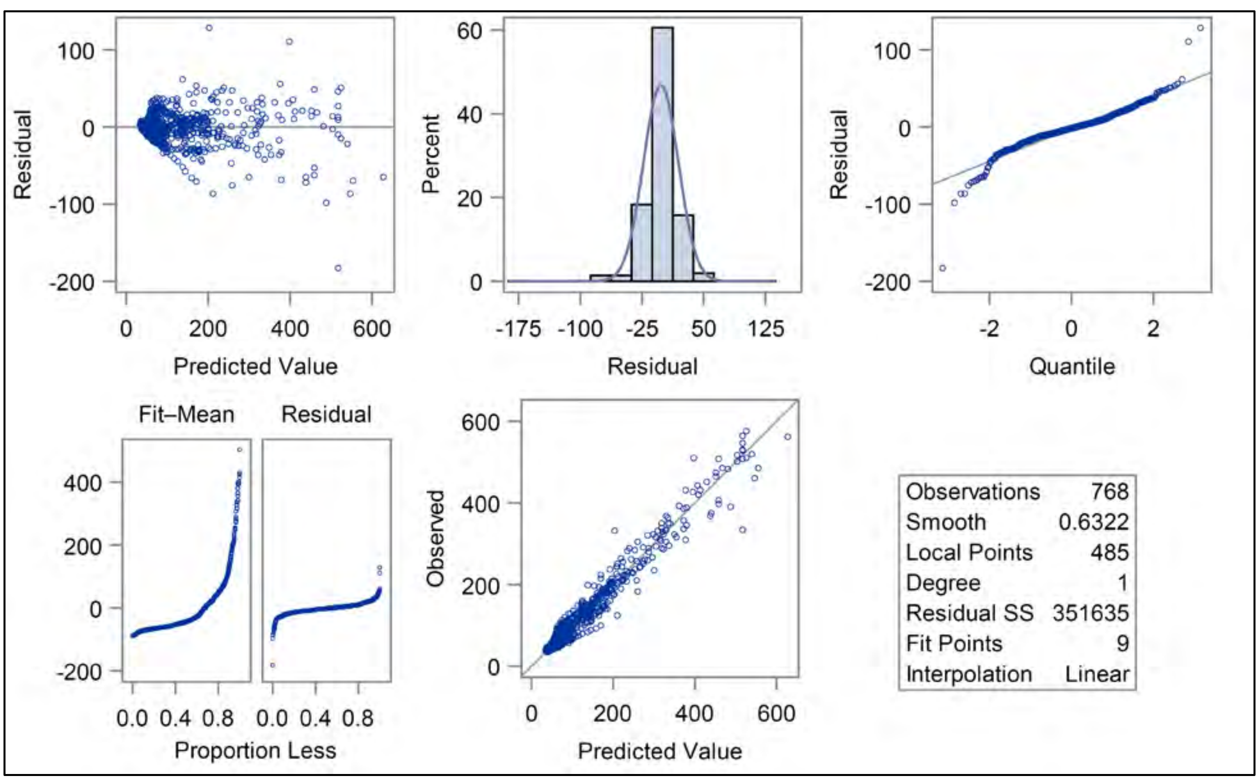

Figure 20. **Residual diagnostics of LOESS fit of USGS Newport to USGS Woodville.**

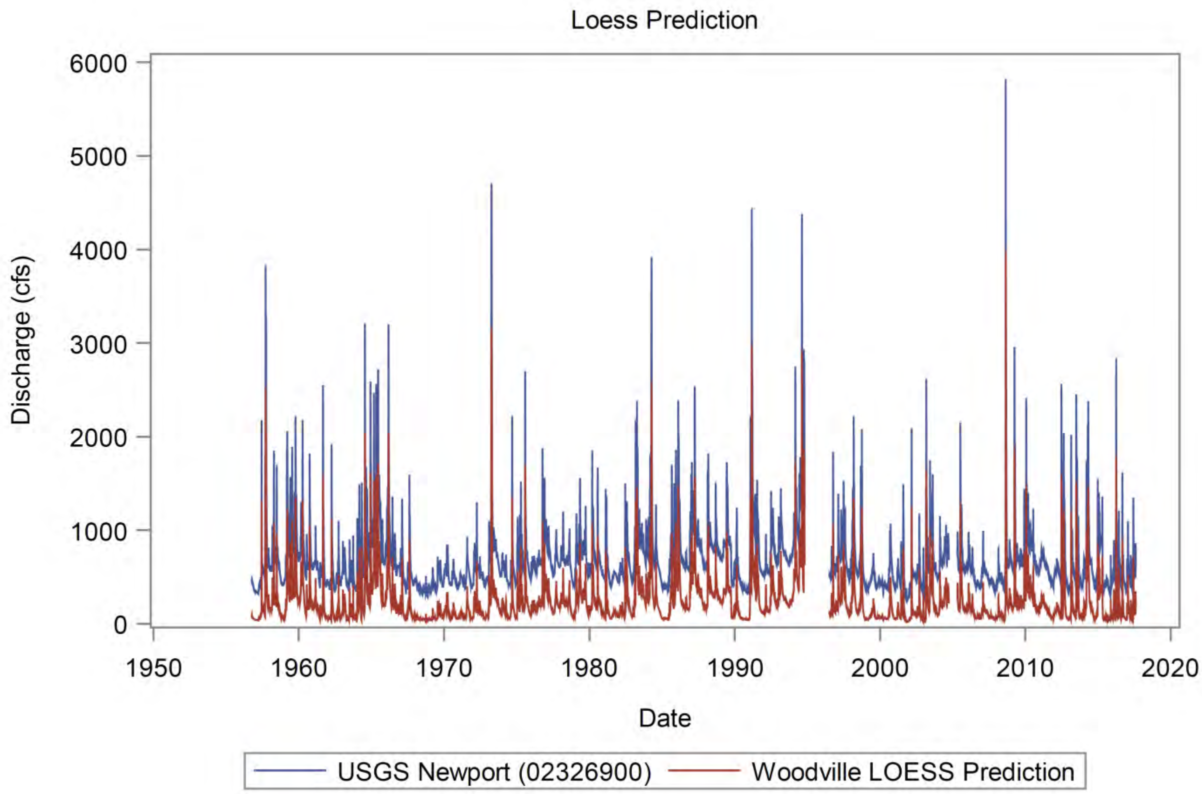

Figure 21. **Time series of Woodville predictions based on LOESS model (red line) and time series of observed Newport discharge (blue line) for long term period of record.**

Once the data gaps were filled using the LOESS methodology, the next analytical step was to address the question: are there covariates in addition to the Newport flows that contribute to the variation in Woodville flows that can be identified using existing data? The most straightforward statistical approach to identify potential covariates describing the composition of discharge at the Woodville was to formulate a GLS regression model to evaluate discharge at Newport as a function of discharge at Woodville and use the residuals of that regression to evaluate the potential for covariates to explain additional contribution to the flows at Newport, after accounting for the flows at Woodville. In this way the correlation among the residuals could be accounted for in a statistically appropriate manner and the covariates could be evaluated against the residuals using automated variable entry selection procedures for the 48 potential covariates requested for inclusion in the model (i.e. cumulative rainfall for varying aggregation periods and lagged average lake stage). There are no known variable selection routines for time series regression models in either SAS or R, thus variable selection was performed manually. Therefore, the SAS Proc Mixed procedure was first used to develop a ARMA (1,1) model to estimate the relationship between Woodville and Newport flows. The resulting model was highly statistically significant (Figure 22) and estimated that when flows at Woodville were 0, flows at Newport would be 330 cfs and for each 1 cfs increase in Woodville flows, the Newport flows would increase by 1.5372 cfs. The residual diagnostic plots for this regression are provided in Figure 22.

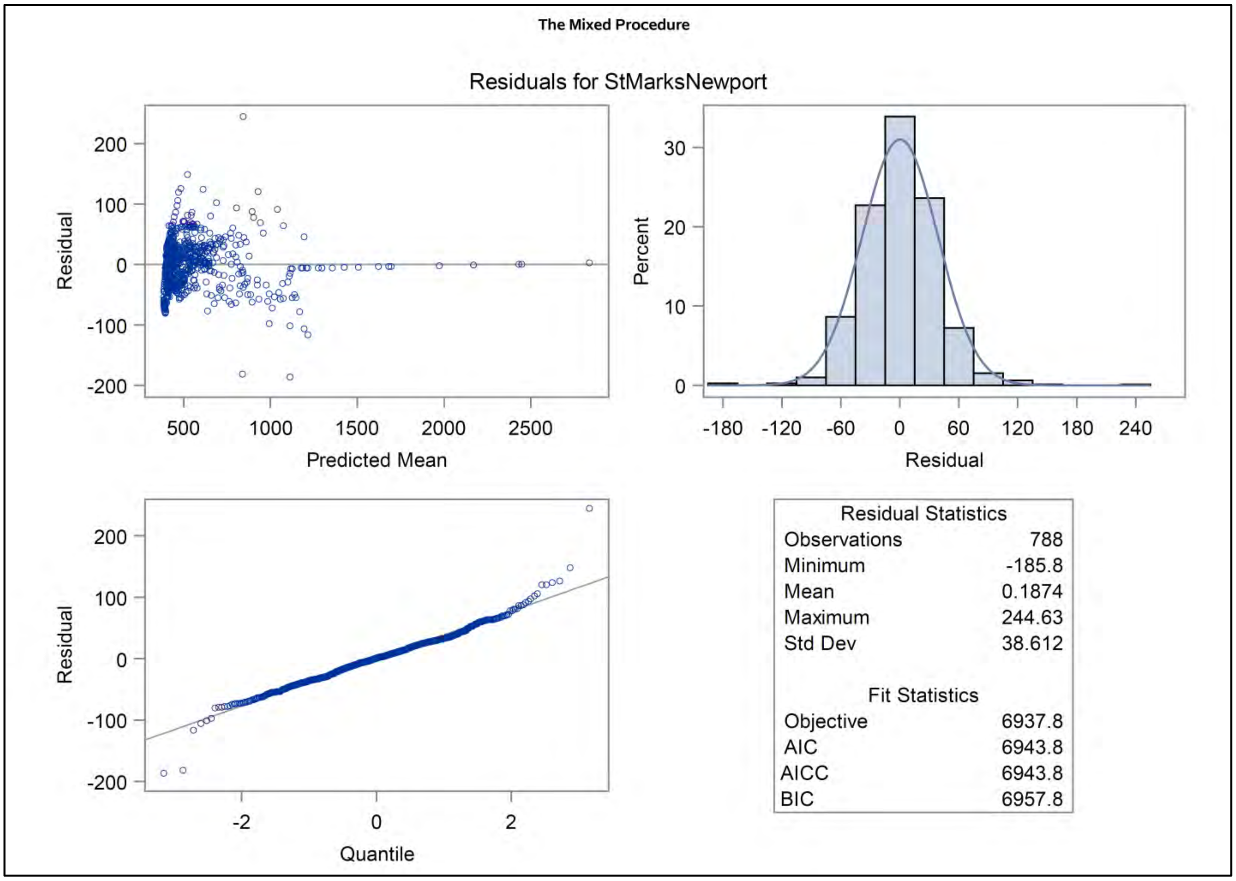

Figure 22. Results of ARMA (1,1) regression analysis to predict Newport flows from Woodville flows between June 2015 and July 2017.

The daily residuals of this regression were then used as the dependent variable to address the question regarding the potential for additional covariates to explain variation in Newport flows after accounting for the Woodville flows. The SAS Proc GLMSelect procedure was used to assess the potential contribution of the antecedent rainfall and stage data including all the lagged average stage and cumulative rainfall sum data. All 48 variables were included as potential effects as a saturated model and the Lasso and Mallows Cp options were used for variable selection. In addition, the data were partitioned such that 60% of the data were selected at random to fit the model, 20% were used for model validation, and 20% were used for testing. This was done 1) to account for any remaining serial correlation in the residuals and 2) to ensure that the variables selected were externally validated as having predictive capacity to the empirical data. The results of this analysis suggested that the 30-day cumulative rainfall at Lake Kanturk Outfall (NWFID 11301) and the 30-day sum rainfall at Military Trail near Natural Bridge (NWFID 11370) were the best predictors of variation in Newport residual flows after accounting for the Woodville flows.

Figure 23 displays the results of variable selection and shows that after the two most significant variables were accounted for, the Mallow's Cp criterion suggested no further improvement in the model by any additional variables. The Coefficient of Determination (R^2) of this fit was 0.154 indicting that these data explained only an additional 15% of the variation in residual flows after accounting for flows at the Woodville station. By comparison, a simple linear regression model of total flows at Newport using flows at Woodville results in an R^2 of 0.97 though the R^2 is inflated due to serial autocorrelation. An example plot of the relationship between the residuals and the cumulative rainfall data for Lake Kanturk is provided in Figure 24 and illustrates the noise in the relationship between the residuals and rainfall for the various cumulative rainfall sums.

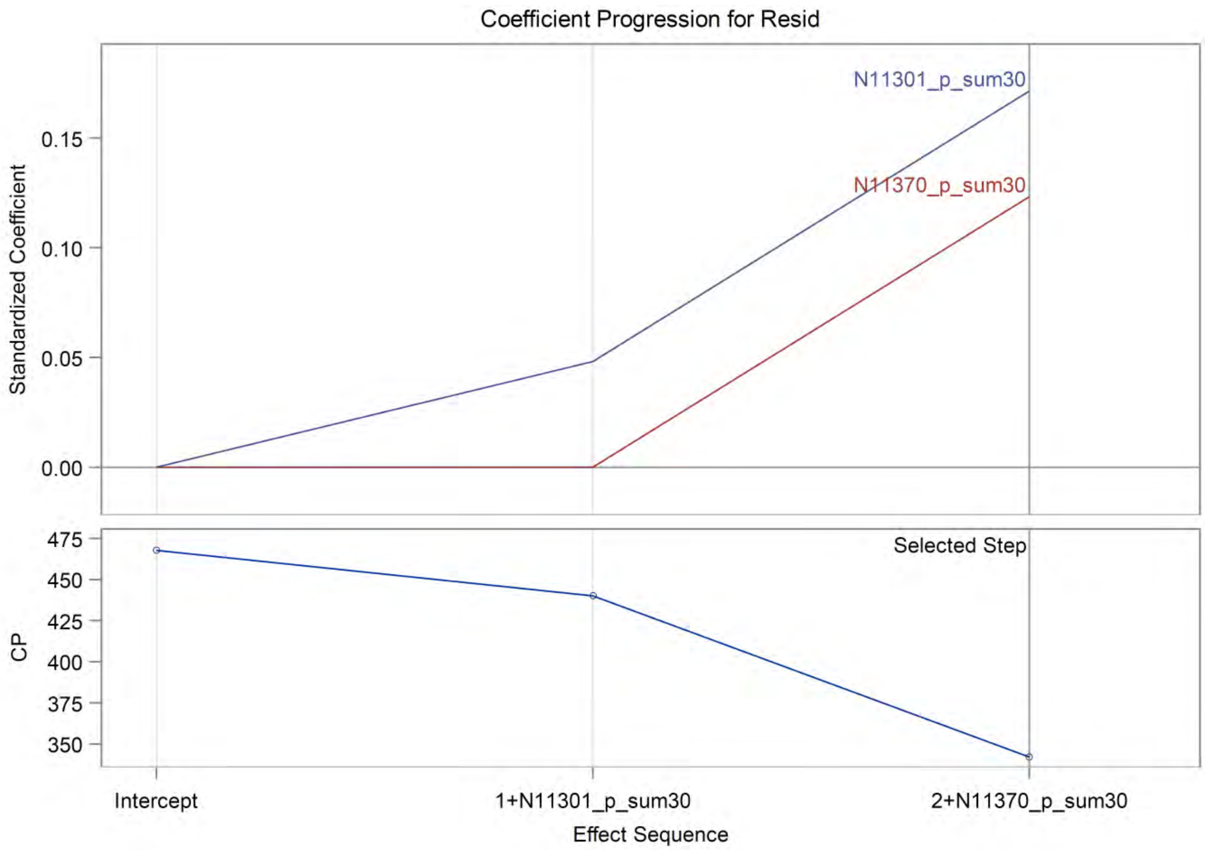

Figure 23. **Effect sequence from variable selection procedure indicating the standardized coefficients for signficiant effects and the step where the Mallows Cp criterion terminated the routine.**

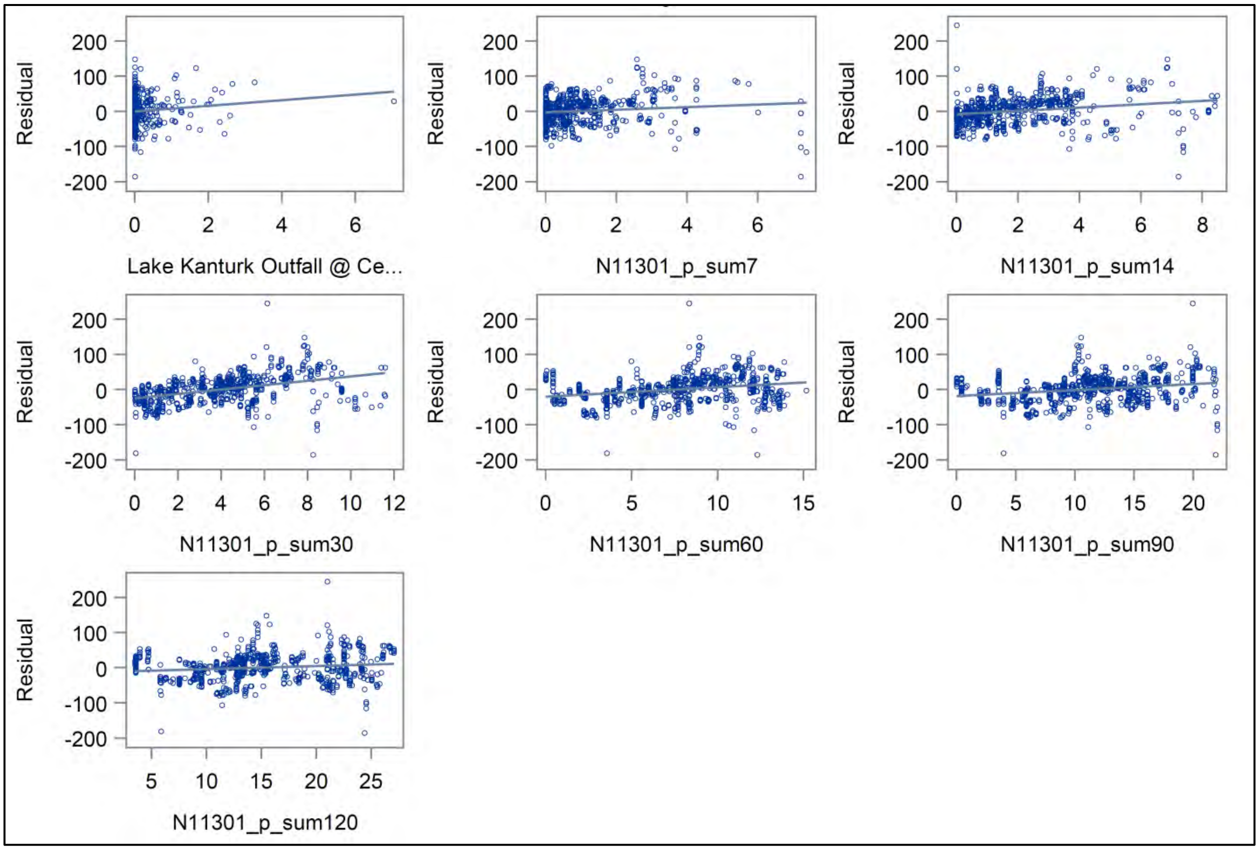

Figure 24. Scatter plot of residual flows at Newport against various cumulative sums of rainfall at Lake Kanturk outfall.

Once the principal covariates were identified, the R forecast package was used to model the time series and generate long-term hindcasts of the Woodville flows. The first step was to identify the most appropriate time series regression structure. For example, while the ARMA (1,1) model was used to evaluate the potential covariates of Newport flow residuals after accounting for the effect of Woodville flows, there was evidence that the residuals remained correlated through examination of the autocorrelation plots (Figure 25) where the needle lines extend beyond the blue broken lines of statistical significance in both the ACF plots used for the AR component and the P (partial) ACF plot used for the MA component. SAS Proc Mixed does not allow for more complex ARMA structure. As a result, we performed the next step of the regression modeling using the R forecast package.

While the previous effort was used to evaluate the principal covariates effecting flows at Newport, the ultimate goal of this effort was the need to develop a long-term time series of flows at Woodville that could be subsequently used to generate a long-term time series prediction for the Rise flows. Therefore, the independent and dependent terms in the previous model were switched. That is, Woodville flows were predicted as a function of Newport flows and other independent terms identified in the previous step. This would allow for a long-term prediction time series for Woodville and incorporate additional covariates identified from the variable selection procedure above to evaluate their benefit to the model. The ACF, PACF plots and Box Ljung test were used to test for model adequacy with respect to the correlation of the residuals and AICC was used to assess improvement of the model through the inclusion of the covariates. Once the optimal model structure was identified, the values for the independent terms in the model could be used to predict a long term time series prediction for Woodville flows

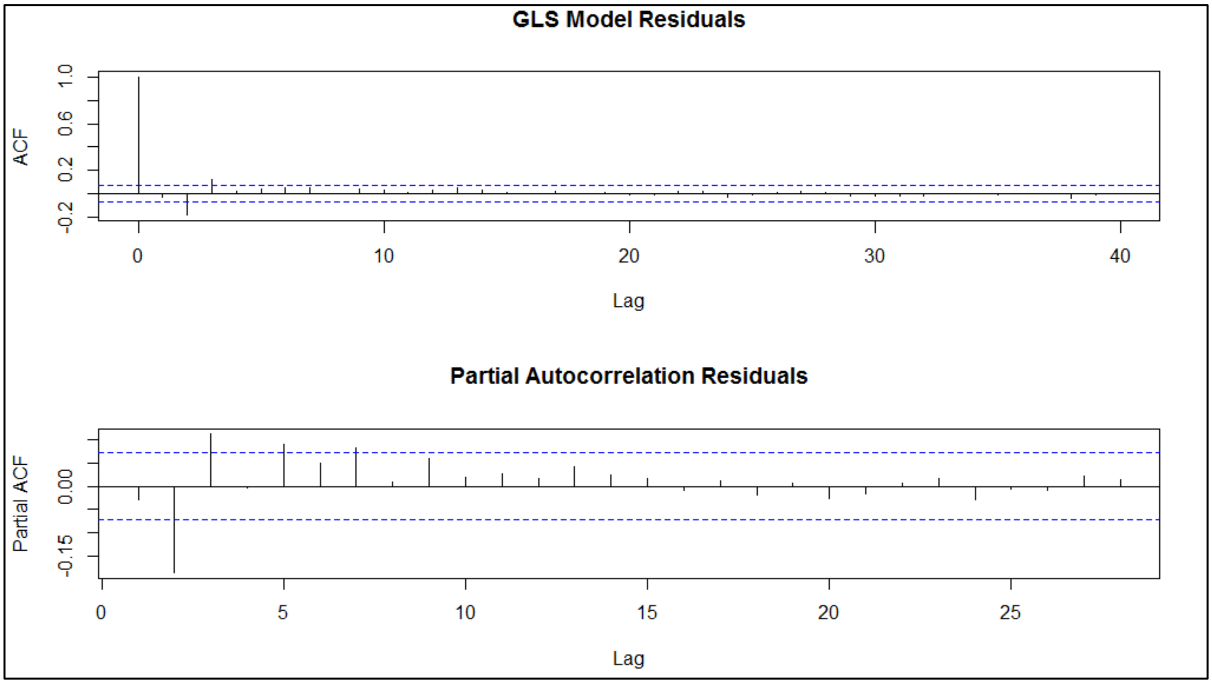

Figure 25. Autocorrelation and partial autocorrelation plots of ARMA 1,1 model on the regression predicting Newport flows using Woodville flows.

Several forms of ARMA and ARIMA models of Woodville daily flows were derived as candidate models. The best model as chosen by the smallest AICC criterion was a differenced ARMA1,3 model, equivalent to an ARIMA (1,1,3) model with AICC value of 5721.97 (Figure 26). The ACF and PACF plots indicate non-significant correlation at all lags and the results of the Box Ljung test resulted in a non-significant p value of 0.66 indicating that the model effectively accounted for serial correlation in the timeseries.

Including the 30-day summed rainfall at Lake Kanturk improved the AICC slightly to 5712.55 and adding additional covariates after that did not improve the model fit according to the AICC criterion. Therefore a final ARIMA model predicted the Woodville flows using Newport flows and the 30 day sum rainfall at Lake Kanturk. Because the Lake Kanturk time series only goes back to November 1989, the time series of predicted Woodville flows using this model is restricted to this time period. To provide an option for a longer prediction time series, the model with only Newport flows was also output for comparison which allows for hindcast predictions back to 1956. These two models are referred to as “covariate” and “univariate” ARIMA models, respectively.

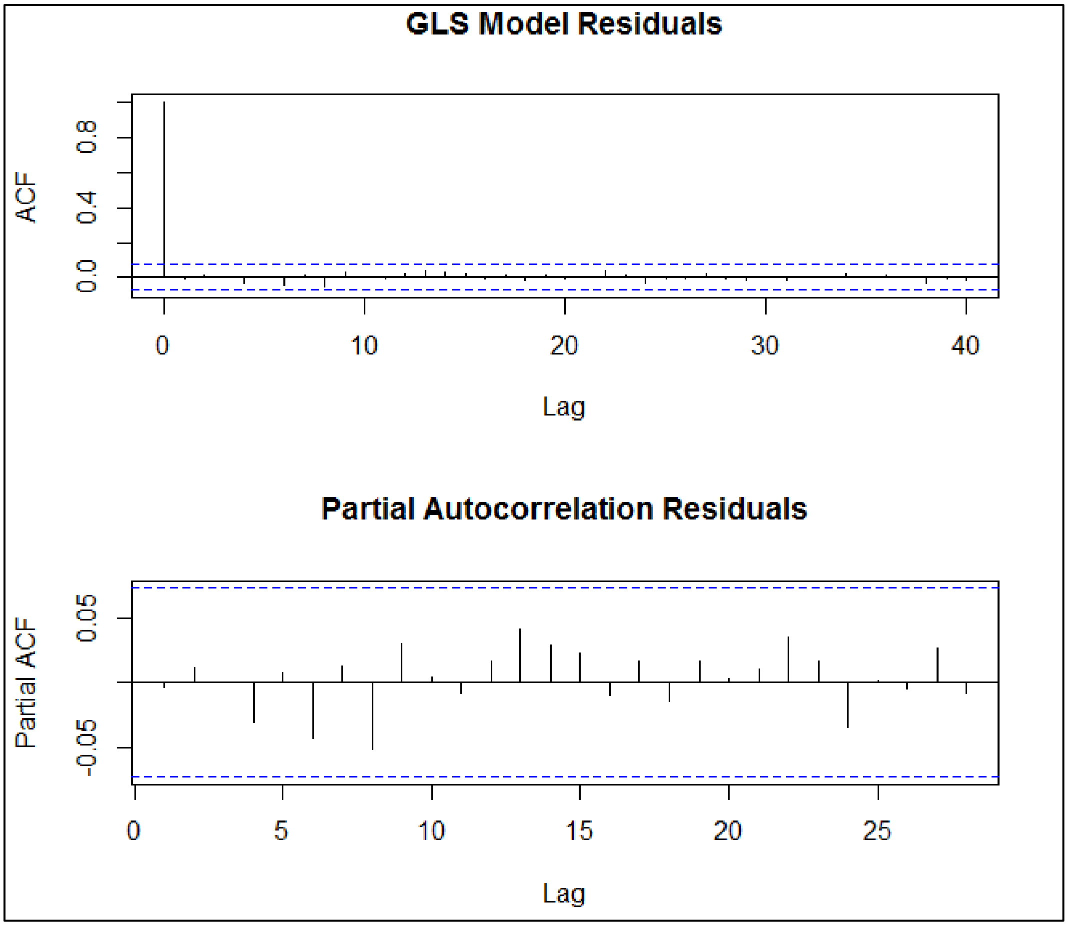

Figure 26. **Autocorrelation and partial autocorrelation plots of a differenced (ARIMA 1,1,3) model on the regression predicting Newport flows using Woodville flows**

In addition, it was observed that the ARIMA models could result in negative discharge predictions in a small number of predictions which is implausible. While typically these predictions might be set to zero (or the minimum observed value), the LOESS regression model provided nearly identical fit to the ARIMA model predictions and provided a better fit to the data when Woodville flows were near their minimum values.

4.2.1 Summary

Calibration statistics for the period of record of Woodville flows suggest that either the ARIMA model without additional covariates or the model with the Lake Kanturk 30-day summed rainfall covariate had nearly identical calibration statistics (Table 6) with respect to the intercept and slope of the predicted versus actual Woodville data. The GLS model performed the worst. The simple LOESS model used for interpolation also performed well but results in slight over-prediction bias as evidenced by the larger intercept and calibration statistics. The LOESS model, however, did not predict negative values whereas the other two models did in rare cases. It should be noted that Woodville flows were never zero during the available period of record.

Table 6. **Calibration statistics for the three models developed for predicting a long term time series of flows at the Rise**.

Model	Nobs	Intercept	Slope	_RMSE_	_RSQ_
Arima_Pred	797	1.157	0.992	12.031	0.994
Covar_Pred	726	1.679	0.989	12.029	0.994
GLS_pred	797	8.640	0.939	23.562	0.976
LOESS_pred	797	2.558	0.983	20.351	0.983

A comparison of three of the candidate models (i.e. LOESS, Univariate, Covariate) is provided in the time series plot of Figure 27. All three models had similar prediction trends which makes it difficult to distinguish the different predictions in the figure below. Therefore, the difference between the three best models is plotted for a hypothetical six-year time series in Figure 28. This period could serve as a reference period for development of the estuarine hydrodynamic models described in later sections (1996-2002).

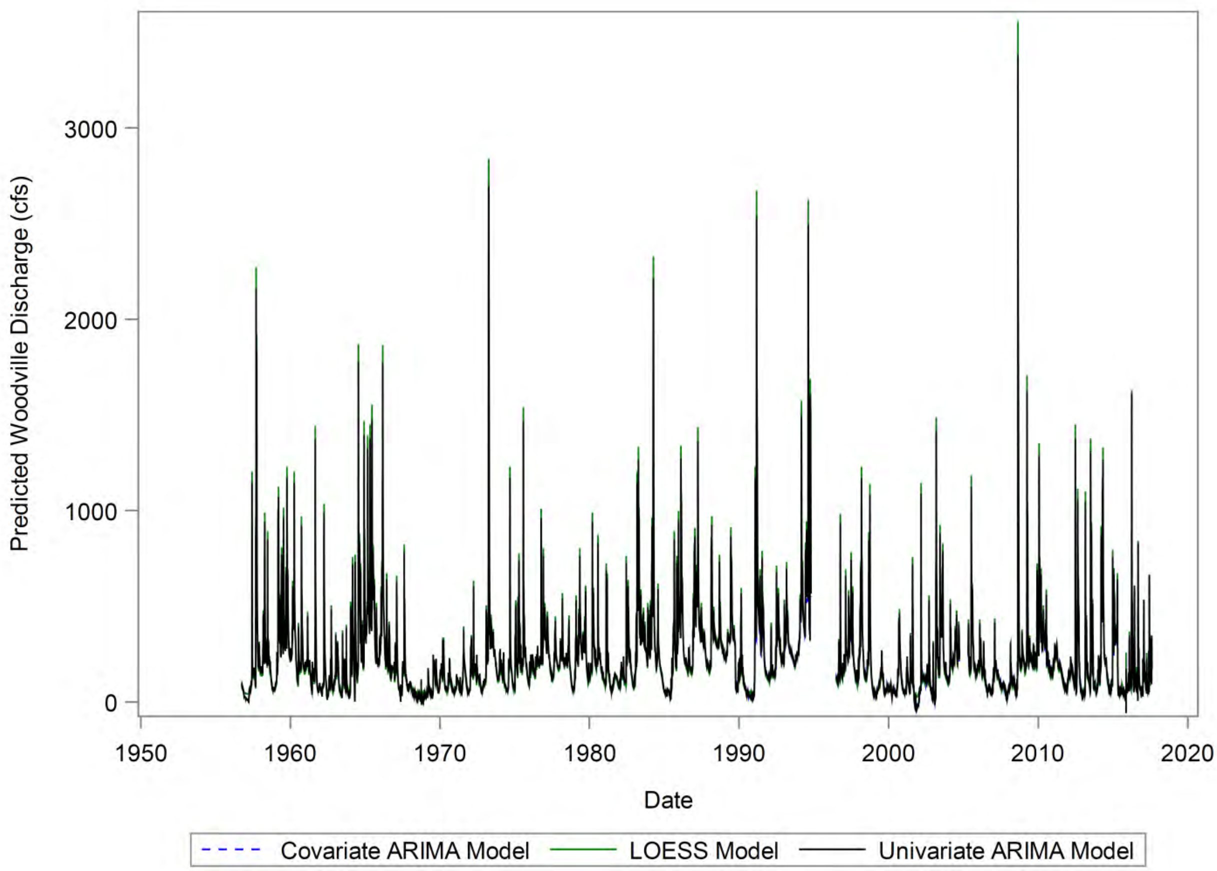

Figure 27. Time series of predictions for three candidate models to predict a long term time series of Woodville flows.

The plot provided in Figure 28 suggests that the two ARIMA models have very similar predictions over the time series with differences typically less than 20 cfs. LOESS model predictions were more variable and tended to predict higher peak flows at Woodville relative to either the univariate or covariate model when flows at Newport were higher over the period of record (the black solid line in the upper third of the figure is the square root of the Newport flows for reference to an observed time series). The covariate model appeared to predict lower flows than either the univariate ARIMA model or the LOESS model during times of peak flows.

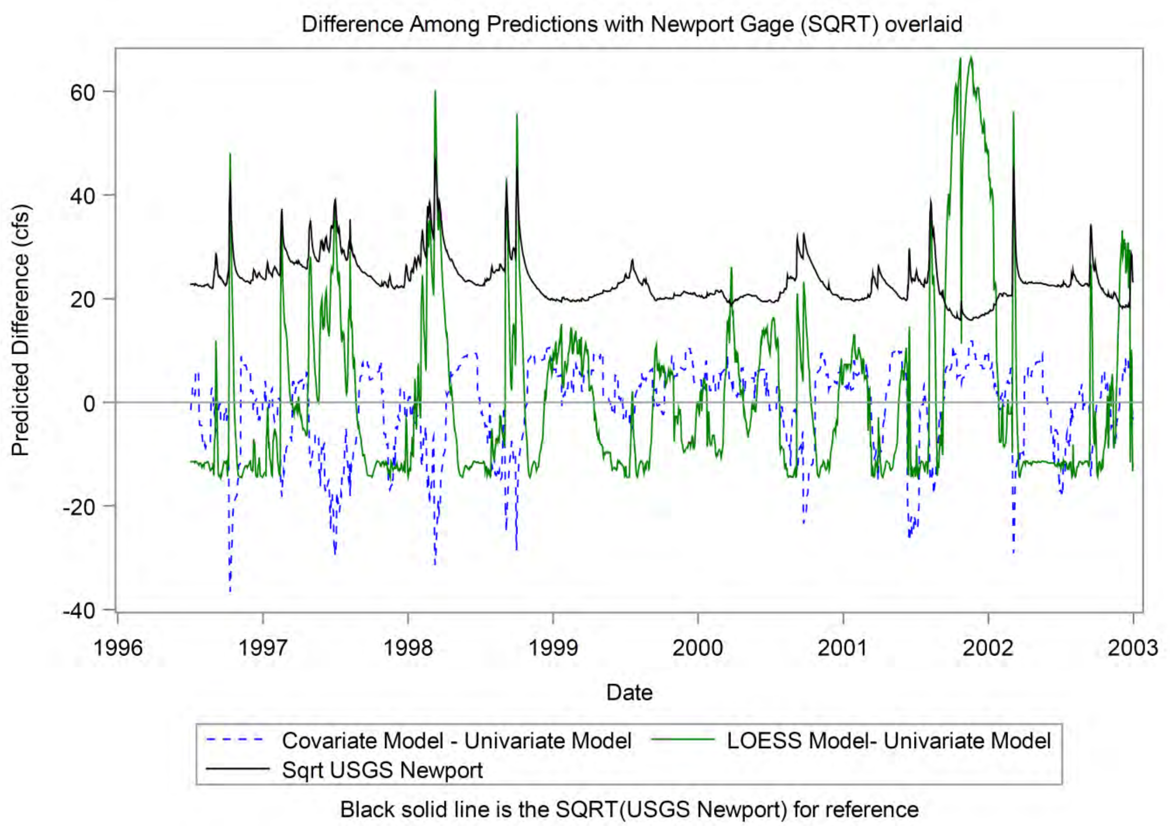

Figure 28. Time series of differences between the LOESS and Covariate models and the univariate ARIMA model for the 1996-2002 time period.

In summary, several regression models have been developed to predict Woodville flows from Newport flows in an effort to derive a long-term time series of spring flows from the Rise. These models are summarized below:

LOESS – A simple LOESS model to predict Woodville as a function of Newport flows. The model fits well and is capable of predicting a time series back to 1956 with only the Newport flows as independent variable. Advantages of the LOESS model are that it is nonlinear and does not predict zero or negative flows at Woodville. The disadvantage of the LOESS model is that it is not a time series model and therefore does not account for the serial memory in the flow time series inherent in the data. The model predictions may therefore be less precise in some instances than the ARIMA model predictions though they are more precise at extreme low flows when the ARIMA models predict zero or negative values.

Univariate ARIMA – A univariate ARIMA model (univariate meaning one independent variable – i.e. USGS Newport). This model had the highest agreement with the empirical Woodville data as estimated by the intercept and slope of the calibration comparison for data when both Woodville and Newport data were available. Advantages of the model are that it allows for predictions back to 1956 which would be advantageous if, for example, pumping data were available that suggested little pumping effect until the 1970s. A potential disadvantage of this model would be that it can result in zero or negative predictions for Woodville flows which occurred in slightly more than 1% of the daily values. These values could be set to zero or to a minimum observed value if the timeseries were to be used for future evaluations.

ARIMA with Covariate – A multiple parameter ARIMA regression model including both flows at Newport and the 30 day cumulative sum rainfall at Lake Kanturk. This model had very similar calibration statistics to the univariate model and included a covariate describing empirical antecedent rainfall data. The AICC criterion suggests a very modest increase in predictive capacity over the time period when all three data records were available relative to the univariate model. Advantages of this model are that it includes additional information collected along with the two flow records. The disadvantage of this model is it restricts the hindcasting time period to 1989, the available period of record for the rainfall dataset.

GLMSelect - At the request of the District, an additional model was developed to model the difference between observed Woodville and Newport flows as a function of the Newport flows and the rainfall and stage data described above. The resulting GLMSelect model indicated that the 30-day and 60-day sum rainfall at Lake Kanturk, and the 30-day sum rainfall at Military Trail, were significant predictors in addition to the Newport flows. with an R^2 value of 0.91. After accounting for serial autocorrelation using an ARMA(1,1) model, only the Newport flows remained significant, indicating that additional covariates did not improve the model once serial correlation was accounted for. Therefore, this model provides no improvement over the other models developed for this project which adhere more strictly to statistical assumptions of the regression modeling framework.

Outcomes of this modeling effort have resulted in the conclusion that if a long term time series (i.e. back to 1956) of Woodville flows is necessary, then either the univariate ARIMA model or LOESS model could be used to develop the St. Marks River Rise spring flow time series by subtracting the Woodville predictions from the Newport time series. If a shorter period of record is sufficient, than either the univariate or covariate ARIMA model predictions will serve equally to estimate the St. Marks River Rise spring flow time series in the absence of other information. Negative predictions could be set to zero or the minimum observed value for Woodville for future assessments. The differences among these models are small and likely within the uncertainty of any of the individual models.

In consultation with District staff, it was decided that the LOESS model provided the best tool for use in developing the long term un-impacted Rise flow time series. The LOESS model fit the observed data well and is fully capable of predicting a daily time series of Woodville flows back to 1956 using only the Newport flows as independent variable. The prediction timeseries was very similar to the ARIMA modeling effort described above but did not yield negative predictions like the ARIMA models. The only disadvantage of the LOESS model relative to the ARIMA models is that it is not a time series model and therefore does not account for serial memory in the flow time series inherent in the data; however, this artifact is primarily important for hypothesis testing (i.e. detecting the statistical significance of covariates in the model). Since this model is univariate, with only Newport flows as the explanatory variable, the benefits of ARIMA modeling are much less consequential in this regard.

5 Baseline Flow Record for St. Marks River Rise Unimpacted Condition

This section describes the development of an unimpacted spring flow record for use in modeling evaluation of reduced flow scenarios in aid of minimum flows development. Section 4 above described the development of a synthetic long-term flow time series of spring discharge at the St. Marks River Rise (Rise). Minimum flows and minimum water level (MFL) determinations require that the system in question be evaluated under conditions representing a baseline (unimpacted) condition which is then used for comparison to conditions under various flow reduction scenarios to arrive at a technically defensible, scientifically supportable minimum flows. This section describes the use of the long-term flow record developed for the Rise described in Section 4 as the starting point to developing a baseline flow record that is unimpacted by consumptive use (e.g. groundwater and surface water withdrawals). This section provides a synthesis of methods and results to generate a long-term time series of baseline spring flow estimates for the Rise as part of the effort to provide technical support to the establishment of minimum flows for spring discharge at the Rise.

The baseline time series will serve as a reference condition in which the impact from groundwater withdrawals is negligible. Review of the conceptual groundwater model conducted by Interflow Engineering (2015) indicates that the primary anthropogenic stressors on the Rise are pumping and irrigation. The effects of these two activities will be manifested primarily as the net effect of the consumptive use in the Rise spring discharge. Per Table 4.7.1 of Interflow Engineering (2015), pumping and irrigation comprised approximately 4.9% and 3.3%, respectively, of the St. Marks River long term baseflow. These components are a relatively small portion of the water budget for the Rise groundwater contribution area.

The evaluation described in Section 4 above resulted in the conclusion that the LOESS regression model should be used to develop the daily timeseries of Rise spring discharge by subtracting the estimated daily Woodville flows from the Newport time series. The results of subtracting the Woodville flows as predicted by the LOESS regression model from USGS Newport station flows is shown in Figure 29. This time series represents the best estimate of daily spring discharge from the Rise. Figure 30 presents the cumulative residuals for spring flow for the periods Water Year (WY) 1957-2016. In this case, residuals are defined as each value's departure from the long-term average annual spring discharge at the Rise (451.8 cfs).

Temporal patterns in the Rise flow record were evaluated through box-and-whisker plots and a series of flow duration curves. Box-and-whisker plots were made for the WY periods 1957-2016, 1957-1986, 1987-2016, 1957-1965, 1966-1975, 1976-1985, 1986-1994, 1997-2004, and 2006-2017. The period of record (ignoring gaps) encompassed approximately 60 years. It was divided into two equal 30-yr periods and 6 equal periods of approximately 10 years each. Figure 31 presents these box-and-whisker plots. As compared to the box-and-whisker diagram for the full period of record, WY 1957-1965 and WY 1986-1994 reflect periods of higher than average flows.

The figure indicates that WY1976-1985 reflects an average period while the remaining periods reflect times of generally lower than average spring flows.

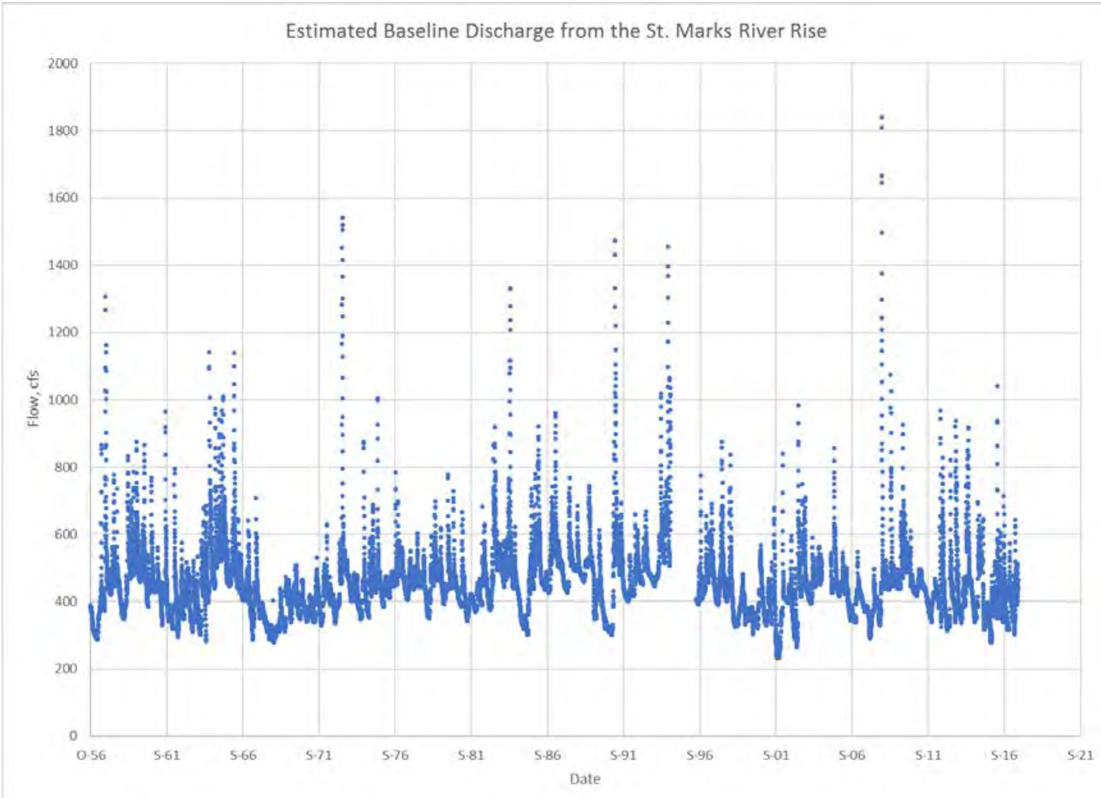

Figure 29. **Time series of Rise spring flows.**

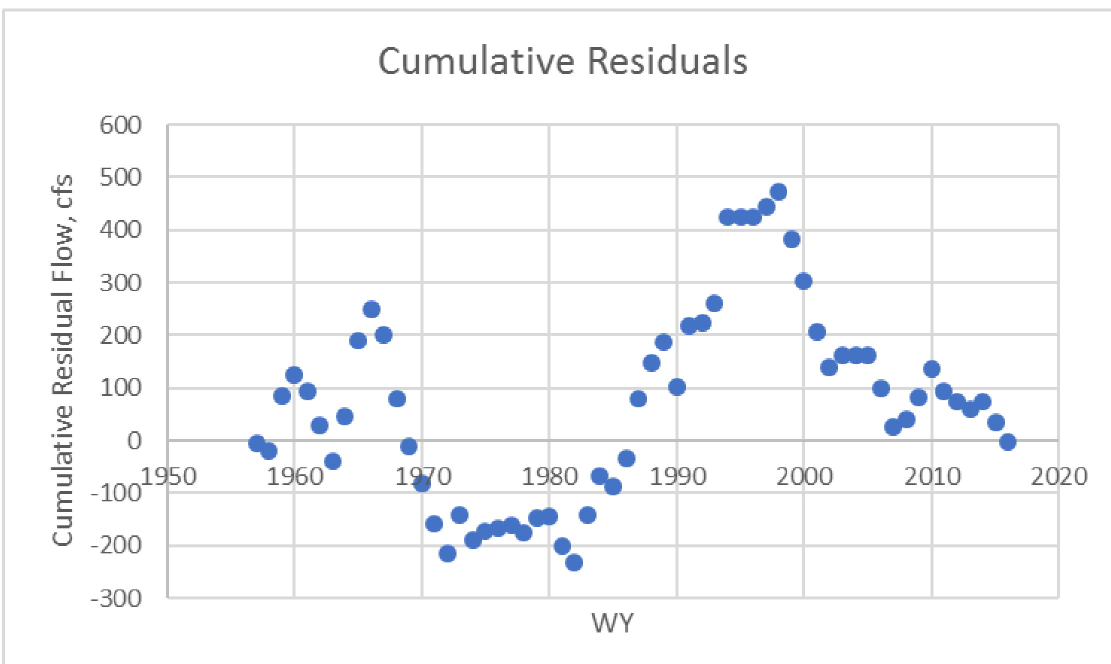

Figure 30. **Cumulative residuals of average annual spring flows at the Rise.**

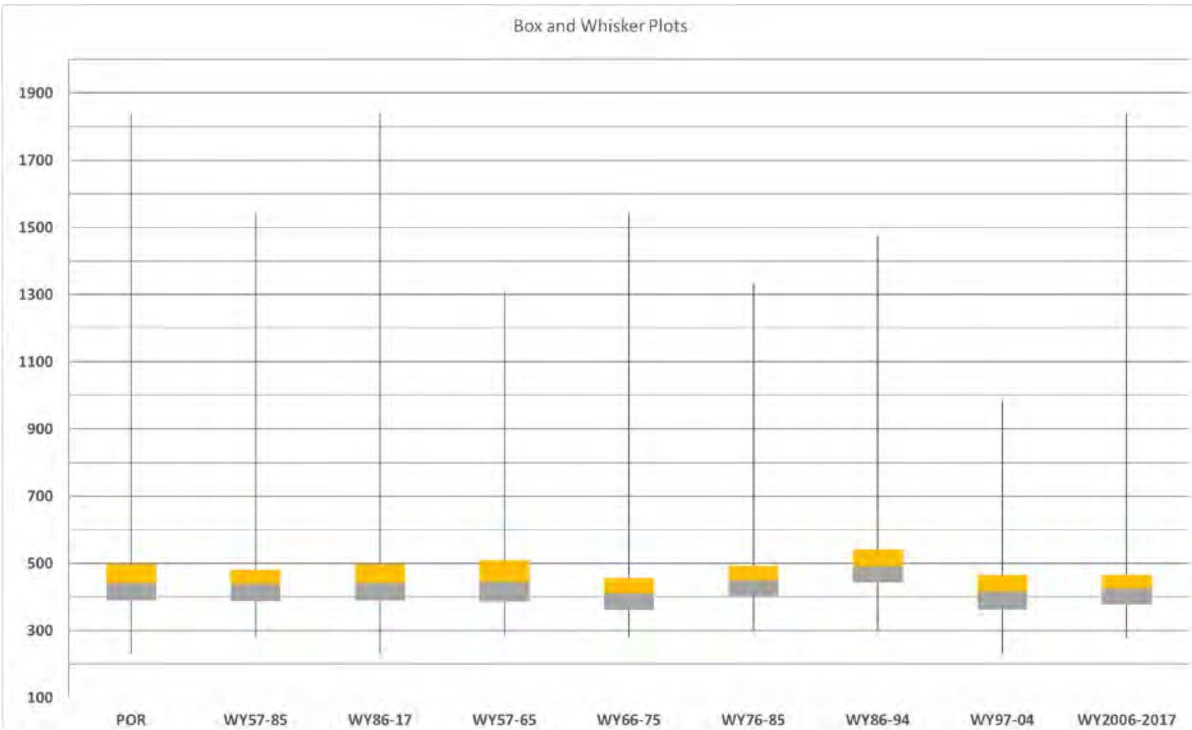

Figure 31. Box-and -whisker plots of Rise spring flows.

To understand the dynamic nature of climate pattern and its effect on hydrology, it is useful to characterize current conditions in the context of long-term historical conditions. Figures 32-34 present flow duration curves of estimated spring flows at the Rise for the same time periods as for the box-and-whisker plots. Figure 32 presents the flow duration curves for the 1957-2016, 1957-1986, and 1987-2016 periods. Inspection of the plot reveals that the differences between the three curves appear to be negligible. Table 7 presents a comparison of flow percentiles for the three periods. Figure 33 presents flow duration curves for WY periods 1957-2016, 1957-1965, 1966-1975, and 1976-1985. Figure 34 presents flow duration curves the WY periods 1957-2016, 1986-1994, 1997-2004, and 2006-2017. Larger differences between the long term pattern and the flow duration curves for the various decades are apparent and are not unexpected.

Table 7. Comparison of flows (cfs) at specified percentiles for three record periods.

	Period-of-Record	WY 57-85	WY 86-2017
Max	1841	1541	1841
95	629	621	637
90	562	551	570
75	490	482	498
50	440	438	441
25	388	387	389
10	345	346	345
5	325	323	328
Min	230	279	230

Trends and relationships between observed hydrologic and meteorological variables are important in minimum flow determinations to assist with identifying a baseline flow record and for distinguishing between anthropogenic and climatic influences on flow. A baseline flow record is one that reflects unimpacted or minimally-impacted historical conditions over representative long-term hydrometeorological cycles. It was concluded in Section 4 that the rainfall record at the Lake Kanturk Outfall at Centerville Road provided the best correlation of rainfall with flows at St. Marks River. The Lake Kanturk time series period of record is November 1989 to present.

Figure 35 presents the annual rainfall as recorded at the Lake Kanturk gage, which displays no trends in annual rainfall during 1990-2016. This is consistent with the findings in presented in Section 3 above. Figure 36 presents the cumulative residuals of the Lake Kanturk Outfall rainfall. Residuals are defined as each annual value's departure from the long-term average annual rainfall. Cumulative residuals can provide greater resolution and make any trends in the data more apparent. A rainfall surplus occurred for the period 1990-1998. The remainder of the record (1999-2016) reflected a below-average to average rainfall period. A similar trend in spring flow is evident at the Rise (Figures 37, 38, and 39).

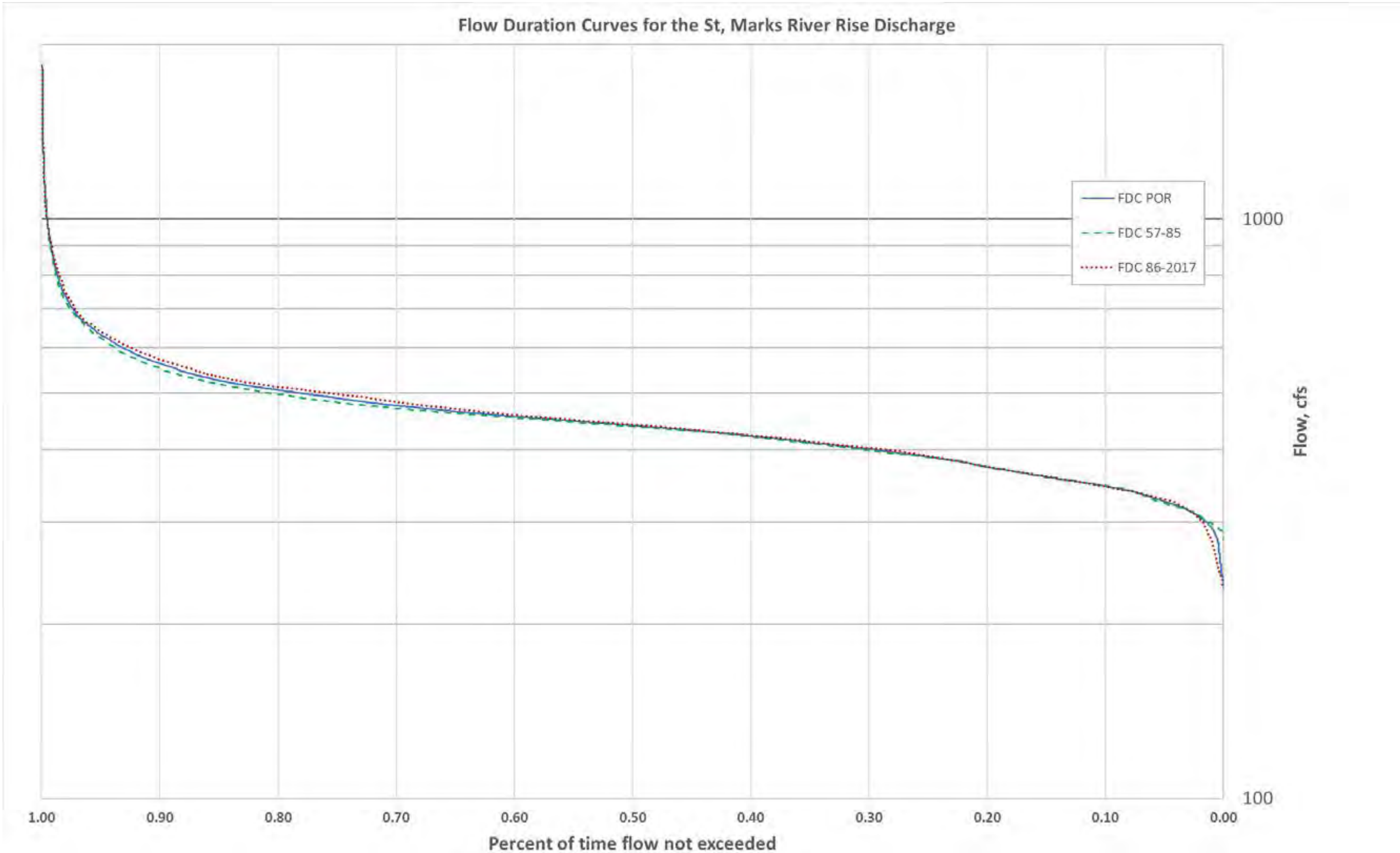

Figure 32. Flow duration curves of Rise spring flows for entire period of record (POR, WY1957-2017), 1957-1986, and 1987-2017.

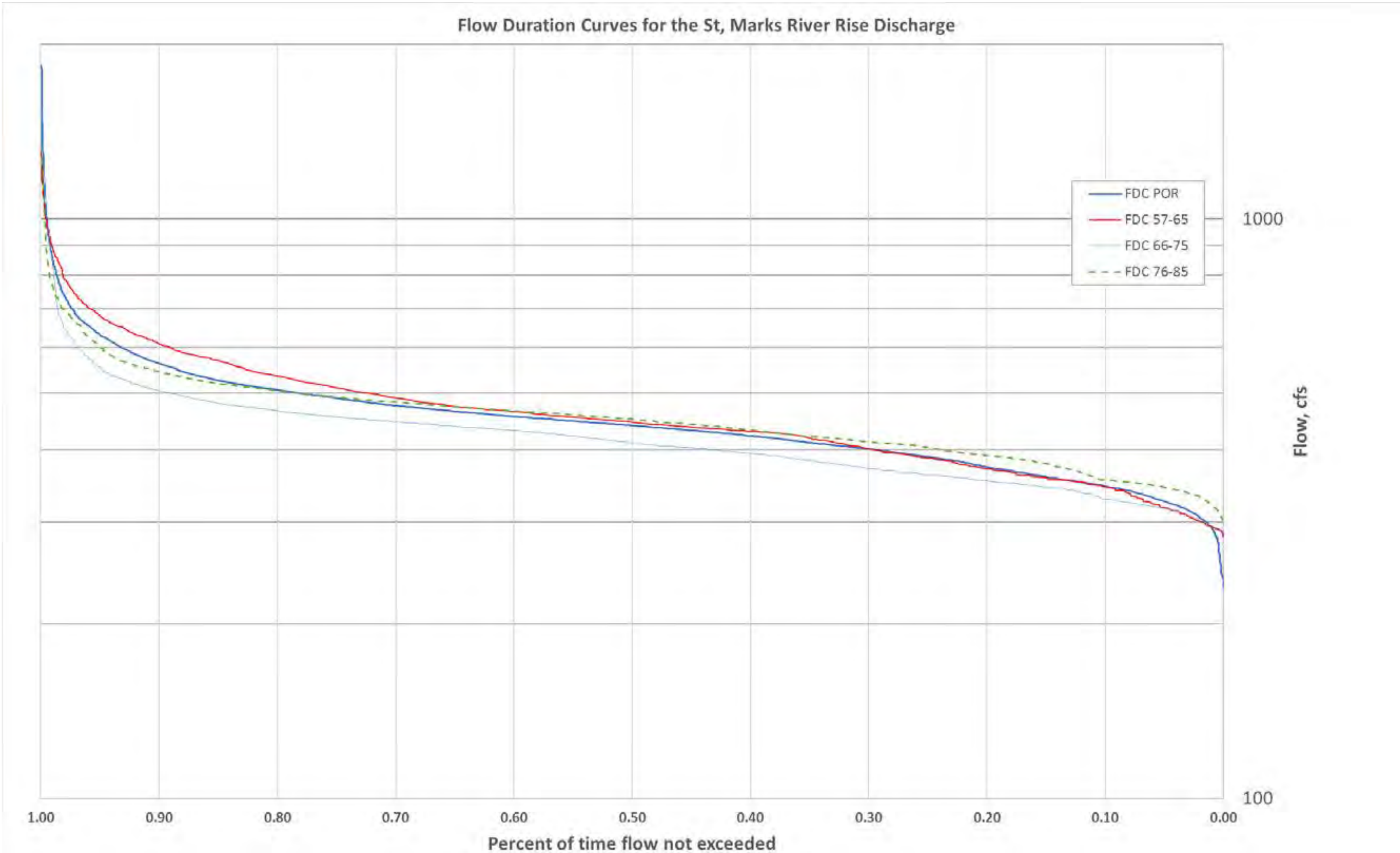

Figure 33. Flow duration curves of Rise spring flows for entire period of record (POR, WY1957-2017), 1957-1965, 1966-1975, and 1976-1985.

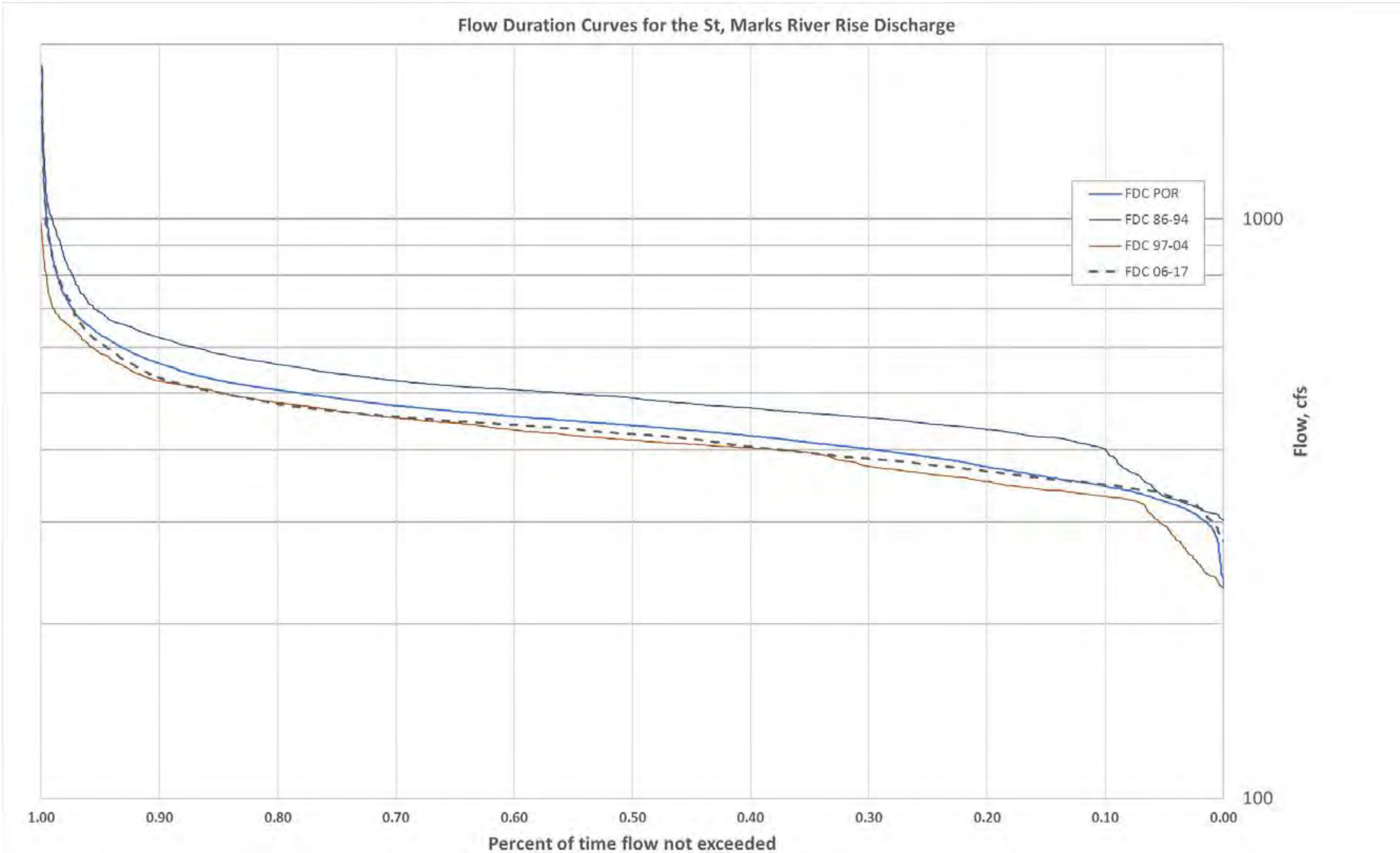

Figure 34. Flow duration curves of Rise spring flows for entire period of record (POR, WY1957-2017), 1986-1994, 1997-2004, and 2006-2017.

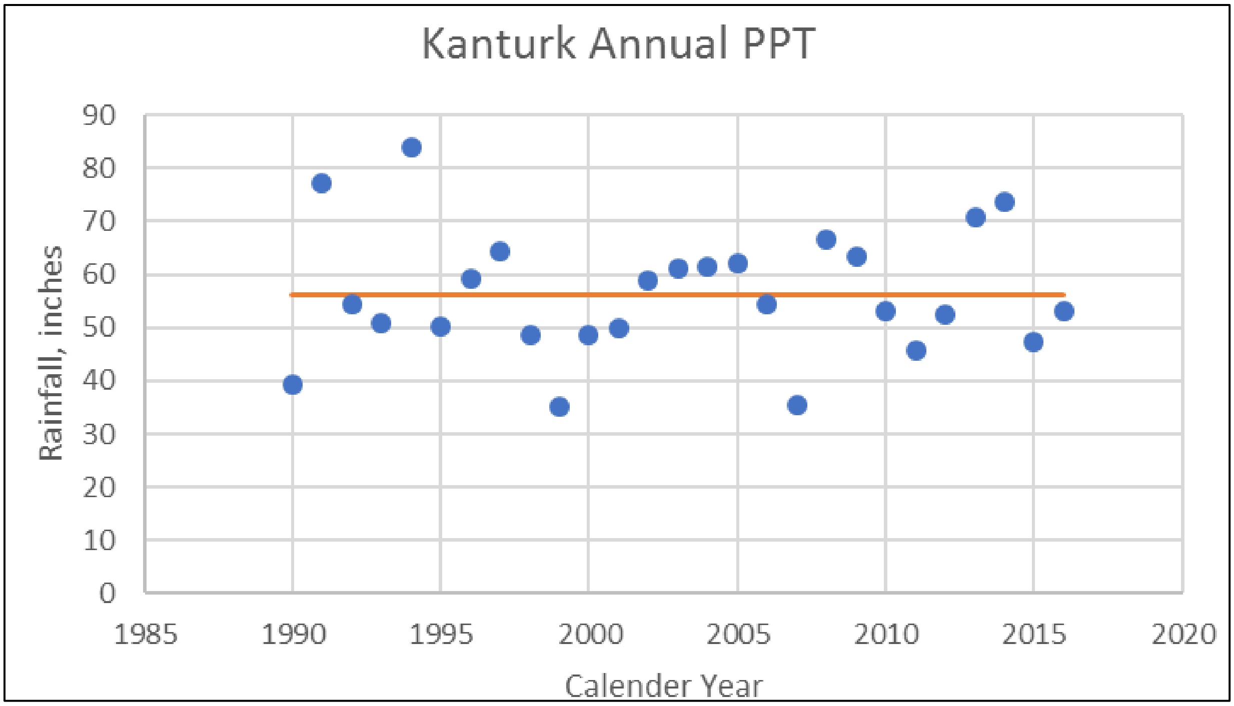

Figure 35. **Time series of annual rainfall at Lake Kanturk Outfall.**

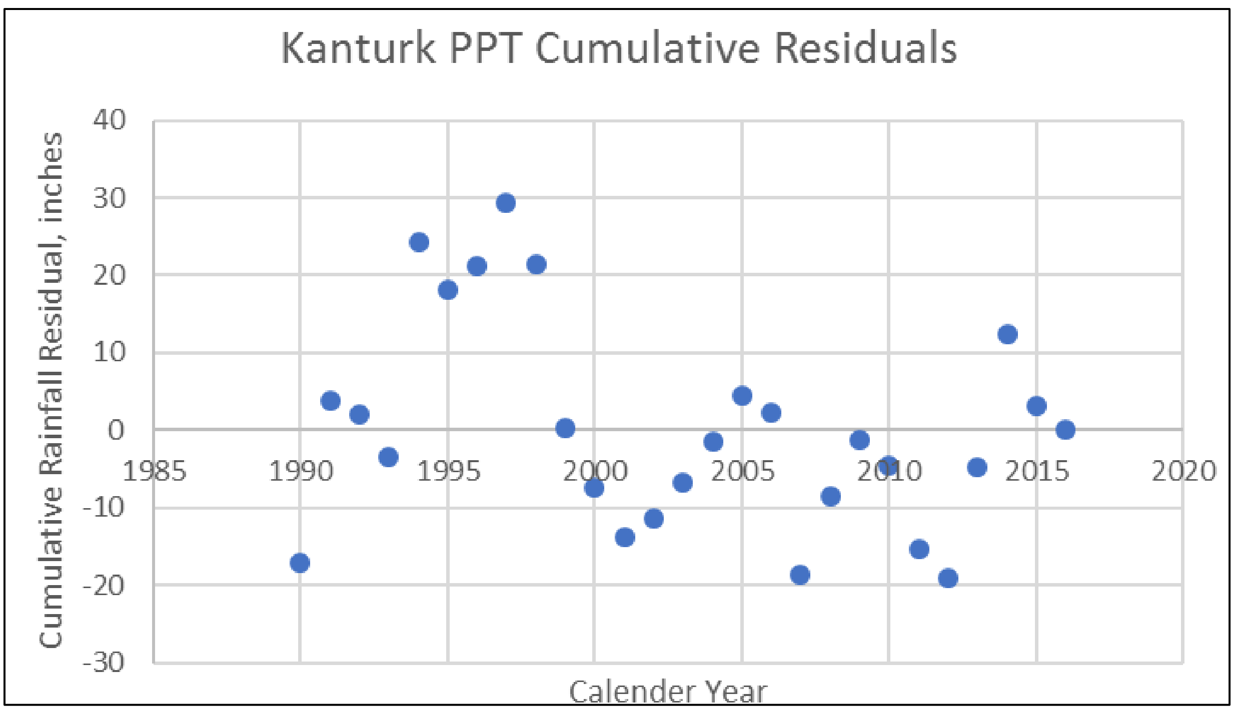

Figure 36. **Cumulative Residuals as compared to the period-of-record average of Lake Kanturk Outfall. Residuals are defined as each annual value's departure from the long-term average annual rainfall.**

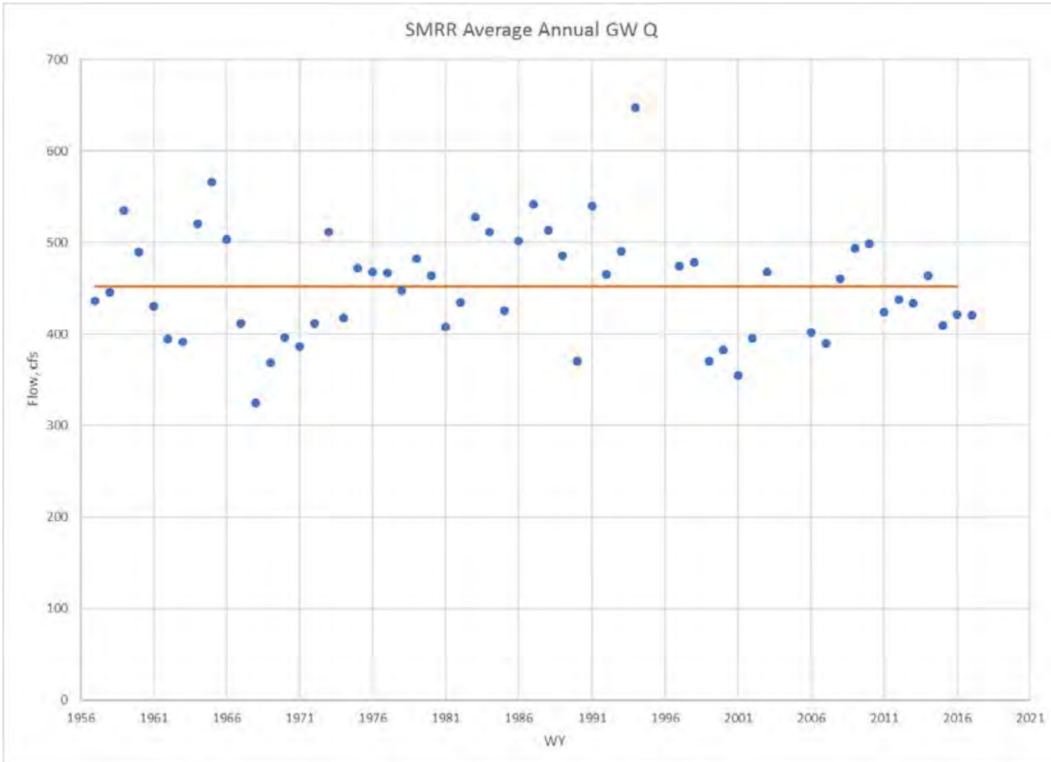

Figure 37. **Residuals as compared to the period-of-record average of the Rise flows (451.8 cfs.) Residuals are defined as each annual value's departure from the long-term average annual spring flow.**

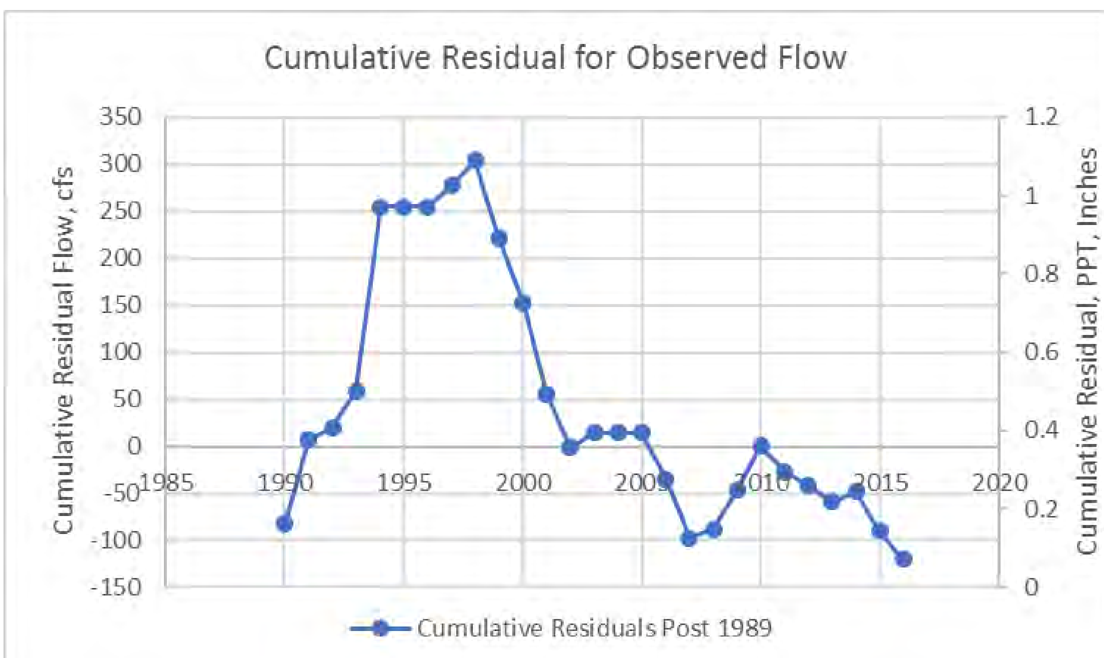

Figure 38. **Cumulative residuals (WY 1990-2016) as compared to the period-of-record average of the flows (451.8 cfs). Residuals are defined as each annual value's departure from the long-term average annual spring flow.**

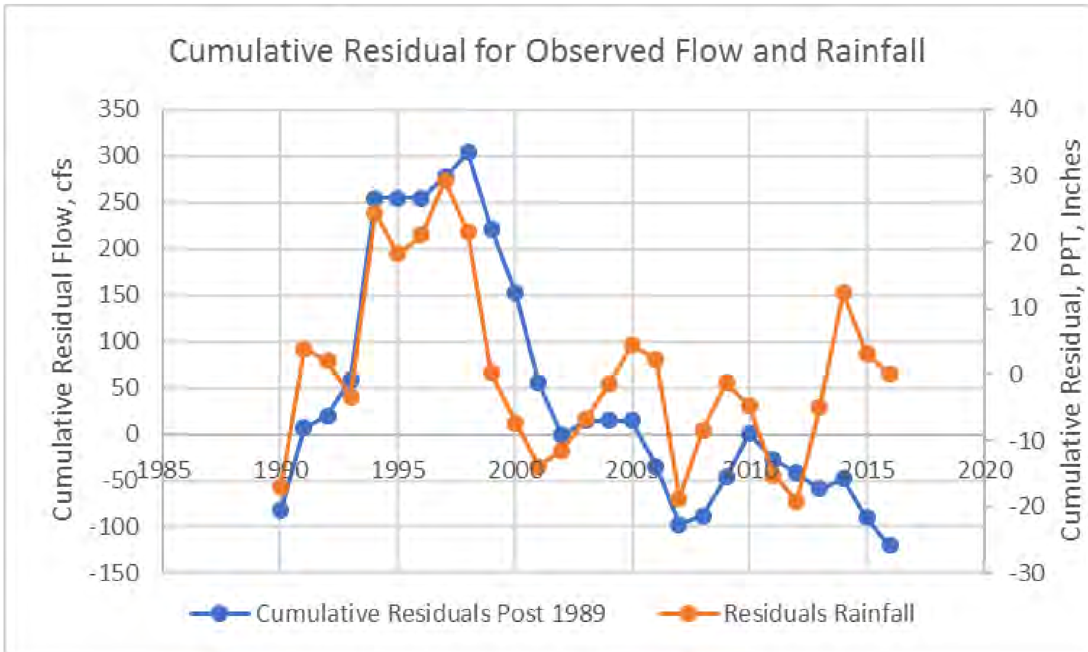

Figure 39. Cumulative residuals (WY 1990-2016) as compared to the period-of-record average of the Rise spring flows.

Double mass curves can be used to check the consistency of hydrologic records. The double mass curve can be used to study trends or possible changes in precipitation-runoff relationships (Searcy and Hardison, 1960). Using double mass curves, further analysis was performed to determine if a change in spring flow can be discerned that is not explained by precipitation or other climatological variables. The period of record for the Rise and the Lake Kanturk Outfall rainfall were analyzed to determine if the precipitation-runoff relationship may have changed over time and, if so, to try to quantify the magnitude of the changes over the period of interest. A precipitation-runoff relationship was developed and then compared to observed, or measured, runoff to see if changes in the precipitation-runoff relationship has changed.

A linear association between the annual flow and rainfall is given by:

Q = b0+ b1*Ri + b2*Ri-1 in which
Q is the estimated annual average flow at the Rise, in cfs;
Ri = rainfall in the current (i) WY, in inches;
Ri-1 = rainfall in the preceding (i-1) WY;
b0, b1, and b2 are fitting parameters.

Using the Regression module in Excel and period of record data (i.e., 1990–2016), associations between Lake Kanturk precipitation and spring flow at the Rise were developed. Initial efforts indicated that the previous year's precipitation did not significantly improve the regression result. A regression using the current year's precipitation provided good agreement between predicted and measured flows (i.e., R^2 value of 0.655). Table 8 presents the results of the regression.

Table 8. Summary output of the regression between annual flow and rainfall.

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.809441564							
R Square	0.655195645							
Adjusted R Square	0.62071521							
Standard Error	50.19812721							
Observations	12							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	47882.11108	47882.11108	19.0019539	0.001423103			
Residual	10	25198.51975	2519.851975					
Total	11	73080.63083						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	176.5138031	65.97244643	2.675568554	0.023269057	29.51803202	323.5095741	29.51803202	323.5095741
Kanturk PPT (Annual)	4.94137284	1.133570391	4.359123066	0.001423103	2.41562061	7.467125071	2.41562061	7.467125071

Figure 40 presents a comparison of the "observed" annual spring flow at the Rise and the annual spring flows as predicted by the above regression.

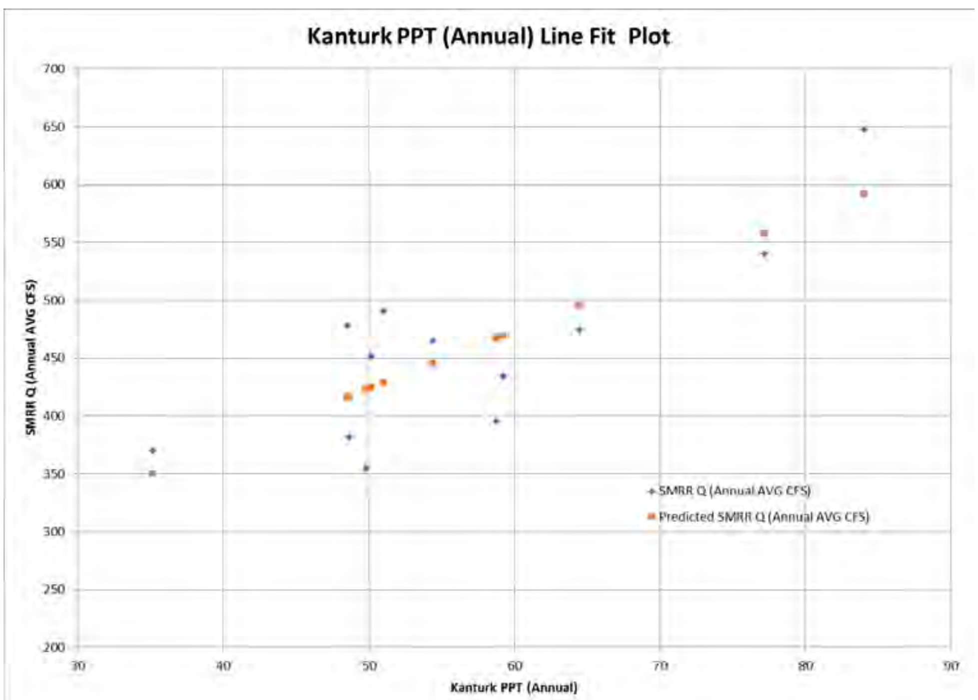

Figure 40. Comparison of the "observed" annual spring flow at the Rise and the annual spring flow as predicted by the regression summarized in Table 8.

The double mass curve of the Rise spring flow as estimated by the statistical model developed in Section 4 and the flow computed by the above regression is presented in Figure 41. There is no primary point of inflection in the double mass curve of the cumulative predicted flow versus cumulative measured flow after which the curve continues to depart from the 1:1 reference line (Figure 41). At 2014, it does appear that the curve may be beginning to diverge from the 1:1 line at that point, with observed flows appearing slightly higher than computed flows.

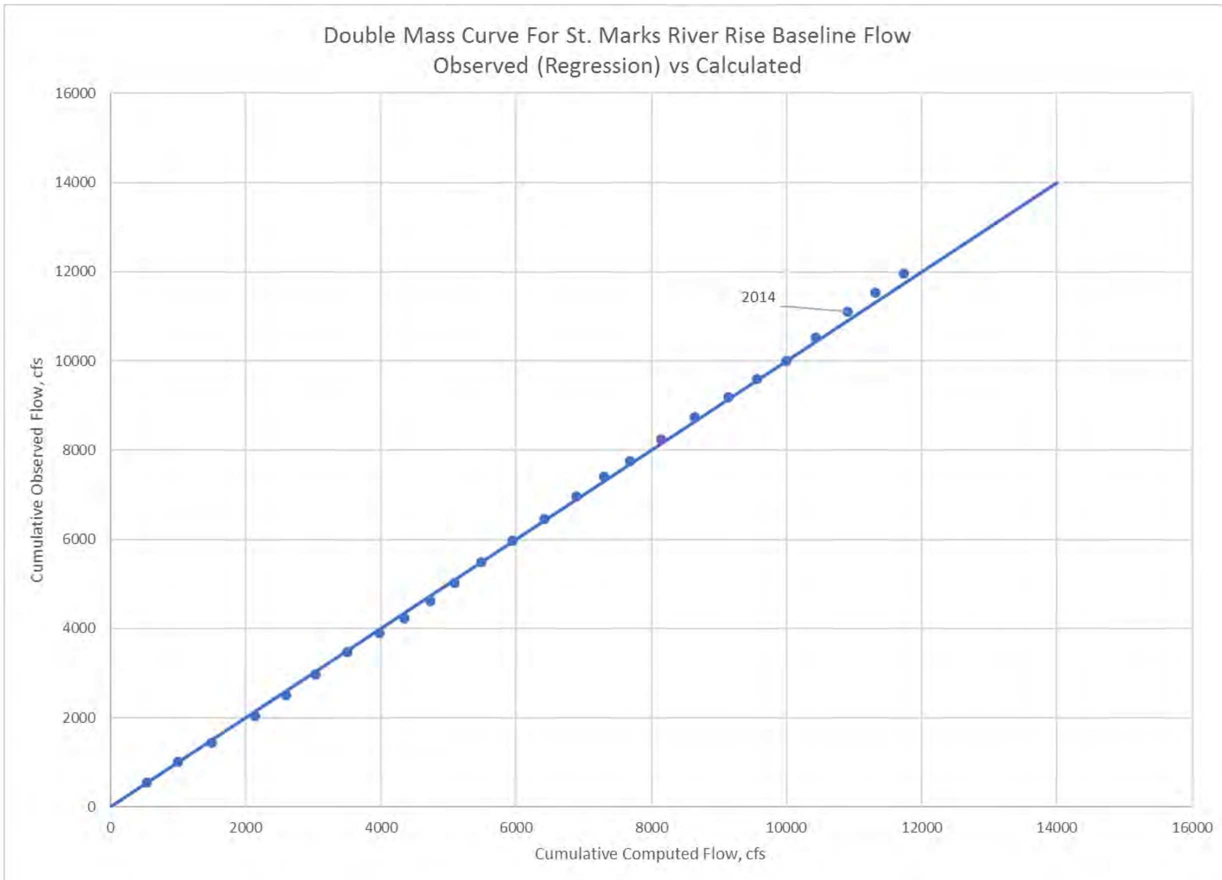

Figure 41. **Double mass curve (WY 1991-2016) of the Rise annual spring flows and computed flows using regression.**

Variations in the double mass relationship are magnified by plotting the cumulative residuals (i.e., Rise Annual Flows [Section 4 LOESS regression model] minus computed spring flows) versus time (Figure 42). This relationship more clearly shows the consistent prediction of annual runoff up to WY 2014. Figure 43 presents the cumulative residuals for the computed flows using the regression of annual spring flows at the Rise and Lake Kanturk Outfall rainfall. The figure shows a consistent prediction of annual flow and annual rainfall up to around 2014 at which point the annual runoff prediction begins to deviate. It is possible that this deviation is due to some anthropogenic influence. However, it is noted that following 2014, the expected rainfall-flow relationship appears to return, which indicates the deviation is a short-term event. The interpretation of this apparent divergence, if it continues, will become more apparent as the flow record gets longer and subject to less error.

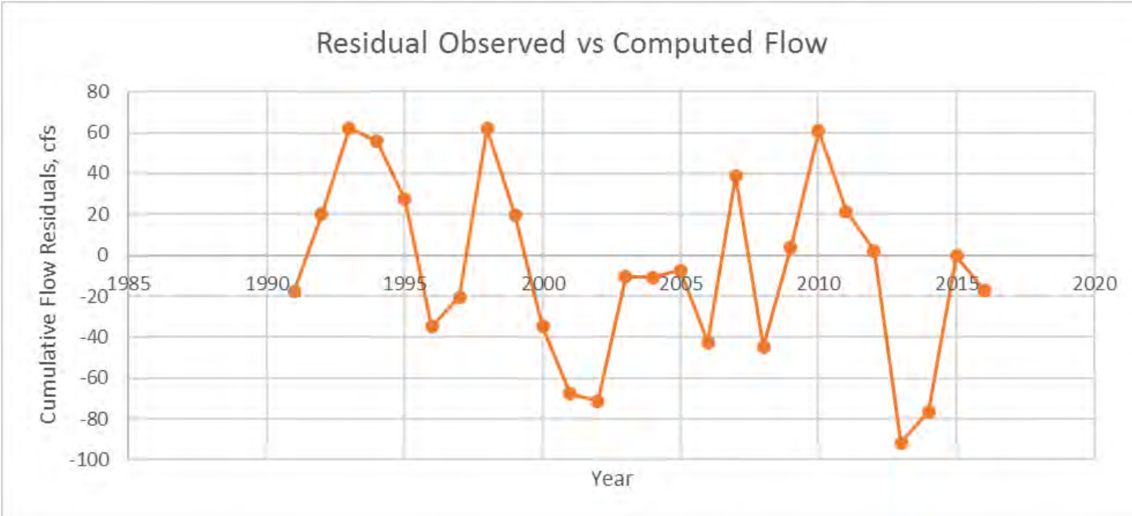

Figure 42. **Cumulative residuals (WY 1991-2016) of the Rise annual spring flows (Section 4 statistical model) and computed flows using regression.**

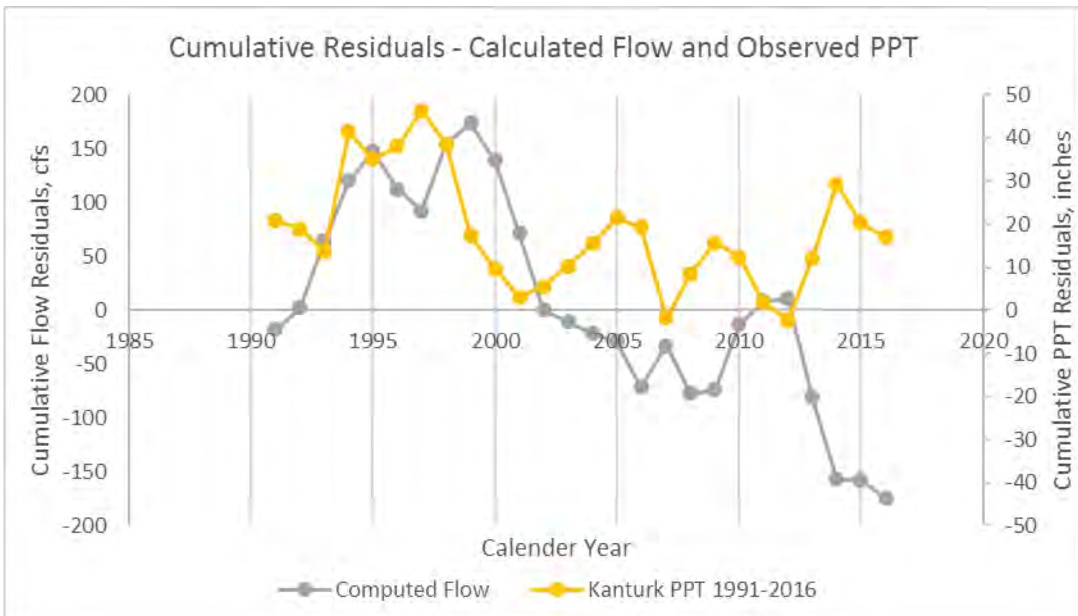

Figure 43. **Cumulative residuals (WY 1991-2016) of the Rise computed annual spring flows using regression and the Lake Kanturk Rainfall.**

Table 9 presents a comparison of the estimated pumping in the Rise groundwater contributing area (Interflow Engineering, 2015) and the annual average flow as estimated at the Rise. Pumping was estimated to total approximately 0.6 inches over the groundwater contribution area or 11.2 mgd on average for the period 2008–2013. In comparison, rainfall comprised 54.7 inches, evapotranspiration comprised 37.6 inches and St. Marks River flow comprised 13.7 inches. In general, the effect of the pumping will be greatly attenuated as you move from the outer edges of the groundwater contributing area toward the Rise. The relationship between groundwater pumpage and spring flow reductions is not a one-to-one relationship as demonstrated in other MFL studies. Pumping is a very small portion of the Rise spring flow. As demonstrated by the trend and double mass curve analyses, pumpage effects are not discernable in the spring discharge time series.

Table 9. Comparison of the estimated pumping in the St. Marks River Rise groundwater contributing area (Interflow Engineering, 2015).

Year	St. Marks River Rise Groundwater Contributing Area - Fl (mgd)	St. Marks River Rise Groundwater Contributing Area - Ga (mgd)	Total Estimated Pumpage (mgd)	Total Estimated Pumpage (cfs)	Annual Average Flow at the Rise (cfs)
2008	0.65	11	11.65	18.02	476
2009	0.86	11.1	11.96	18.50	504
2010	1.13	11.2	12.33	19.07	513
2011	1.32	11.3	12.62	19.52	419
2012	1.16	11.4	12.56	19.43	444
2013	1.13	11.5	12.63	19.54	445
Avg.	1.04	11.2	12.24	18.94	467

Based on available water use data and the analysis performed here, there is no evidence of persistent groundwater withdrawal impacts on the spring discharge at the Rise (WY 1990-2016). Therefore, the baseline time series for the Rise spring flows, as presented in Figure 29, represents a minimally-impacted flow time series. The time series was developed by subtracting the Woodville daily flows as estimated by the LOESS regression model (described in Section 4) from the Newport time series of daily flows.

6 Flow Record Subset Selection

This section describes the selection of a subset of the unimpacted spring flow record for use in modeling evaluation of reduced flow scenarios in aid of minimum flow development for the St. Marks River Rise. Section 4 provided a synthetic long-term flow time series of spring discharge at the Rise. The results of a rigorous statistical analysis of available flow data and identified relationships defined during that work were detailed in Section 4. Minimum flow determinations require that the system in question be evaluated under conditions representing a baseline (unimpacted or minimally-impacted) condition which is then used for comparison to conditions under various flow reduction scenarios to arrive at a technically defensible, scientifically supportable minimum flow. Section 5 describes how the long-term flow record developed for the Rise was used as the starting point to develop a baseline flow record that is unimpacted by consumptive use (e.g. groundwater and surface water withdrawals). As described in Section 5, results indicated that groundwater withdrawals have not measurably affected the spring flow at the Rise and that the full time period of the Rise can be utilized as the baseline flow record. This Section provides a synthesis of methods and results of the flow duration analysis to select a time period recommended for use in subsequent modeling scenarios to establish minimum flows for spring discharge at the Rise.

To evaluate the effects of reductions in the Rise spring discharge on stage and salinity regimes in the lower St. Marks River, it is important to select a period for model application that includes, to the greatest extent possible, a distribution of flows similar to that over the long-term record. This is necessary as utilizing the full period of record (1957-2017) is not computationally feasible within the model applications being utilized for minimum flow evaluations. The goal of this exercise was to select a roughly two-year representative period for model evaluations. This allows the impacts of spring flow reductions to be evaluated over the entire range of flows experienced in the river utilizing only a relatively small portion of the available flow record.

Constraining the selection of a baseline period for use in model evaluations are the length of the period to be evaluated (a function of model run time) and the availability of boundary condition data during the selected period. Evaluation of the historic flow record against various shorter periods was done by comparing flow duration curves for the historical flow record and various shorter flow periods to identify the optimal time period of the model scenarios. Additionally, it is helpful if a time period can be selected when boundary forcing conditions are available from the previously completed Gulf Coast Shelf Model (GCSM) runs for 1995-2002. These model runs provide offshore conditions for salinity, temperature, and water surface elevation which can serve as boundaries for the St. Marks/Wakulla EFDC hydrodynamic model.

A comparison of the distribution of the baseline time series of flows and the distribution of flows during the period for which GCSM output exists was performed to identify a subset of the baseline time series that possesses, to the greatest extent possible, a similar range of flows for use in the EFDC model, and potentially, HEC-RAS model scenarios. The selection of the time period will ensure that there is not a bias (e.g. relatively higher or lower flows) associated with climatic conditions.

The Rise flow record extends from October 1, 1956 to August 10, 2017, and contains the following gaps in the flow record: October 26, 1994 - June 30, 1996, and September 30, 2004 - April 29, 2005. Due to the gaps in the flow record, the overlapping period of the Rise flow record with the GCSM model output is July 1, 1996 - December 31, 2002. This was the period of the Rise flow record that was examined further to determine the most appropriate modeling period. Figure 44 presents the Rise flow time series for this time period.

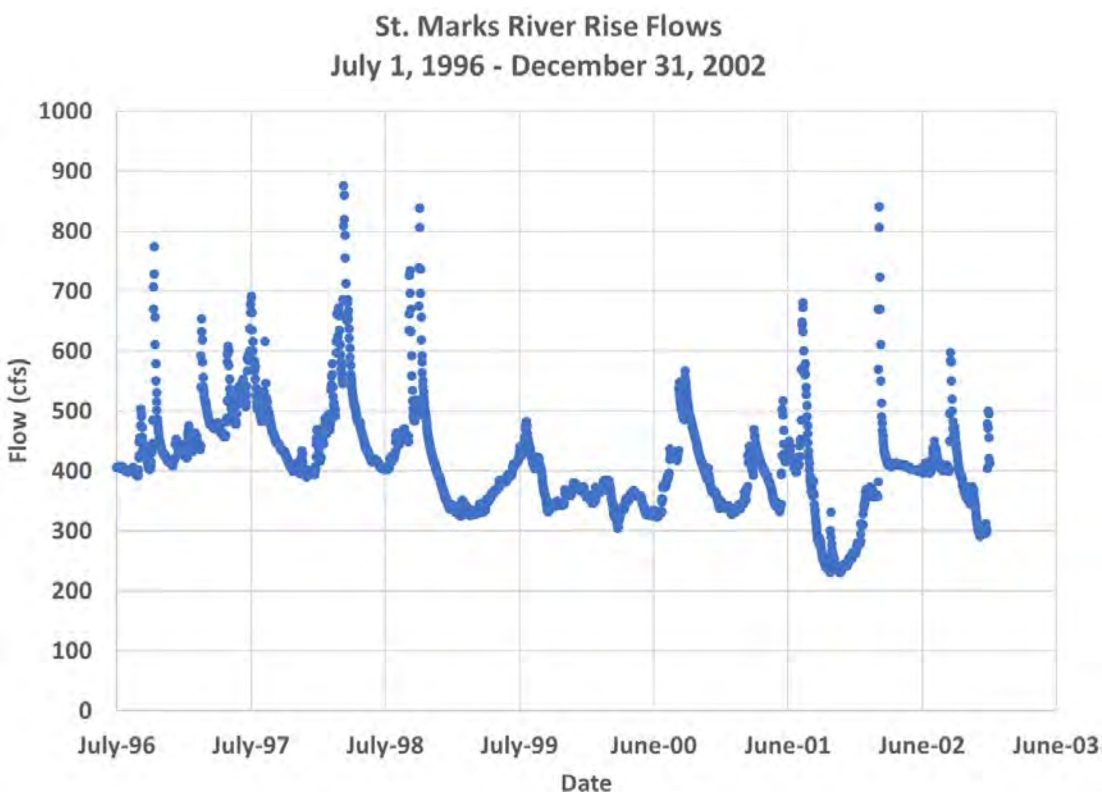

Figure 44. St. Marks River Rise flow time series for the period July 1, 1996 - December 31, 2002.

A comparison of the distribution of the baseline daily flows (October 1, 1956 – August 10, 2017) and the distribution of flows during the shorter period for which GCSM output existed indicated that the flow distribution for the period May 1, 1997 – May 31, 1999, is representative of the period of record flows. Figure 45 provides a graphical display of the distributions of flows for the May 1, 1997 – May 31, 1999 period and flows for the complete period of record, and Table 10 provides comparison of the flow distribution statistics for the period of record to those for the 25-month period (May 1, 1997 – May 31, 1999). Both Figure 45 and Table 10 show that the modeling period of May 1, 1997 - May 31-1999 is representative of the exceedance curve and percentile flows of the full period of record.

Based on this analysis, it is recommended to use the daily flows at the Rise from May 1, 1997- May 31, 1999 to represent baseline conditions for modeling purposes. This time series will also be utilized to evaluate the impacts of spring flow reduction scenarios on water resource values for the St. Marks River.

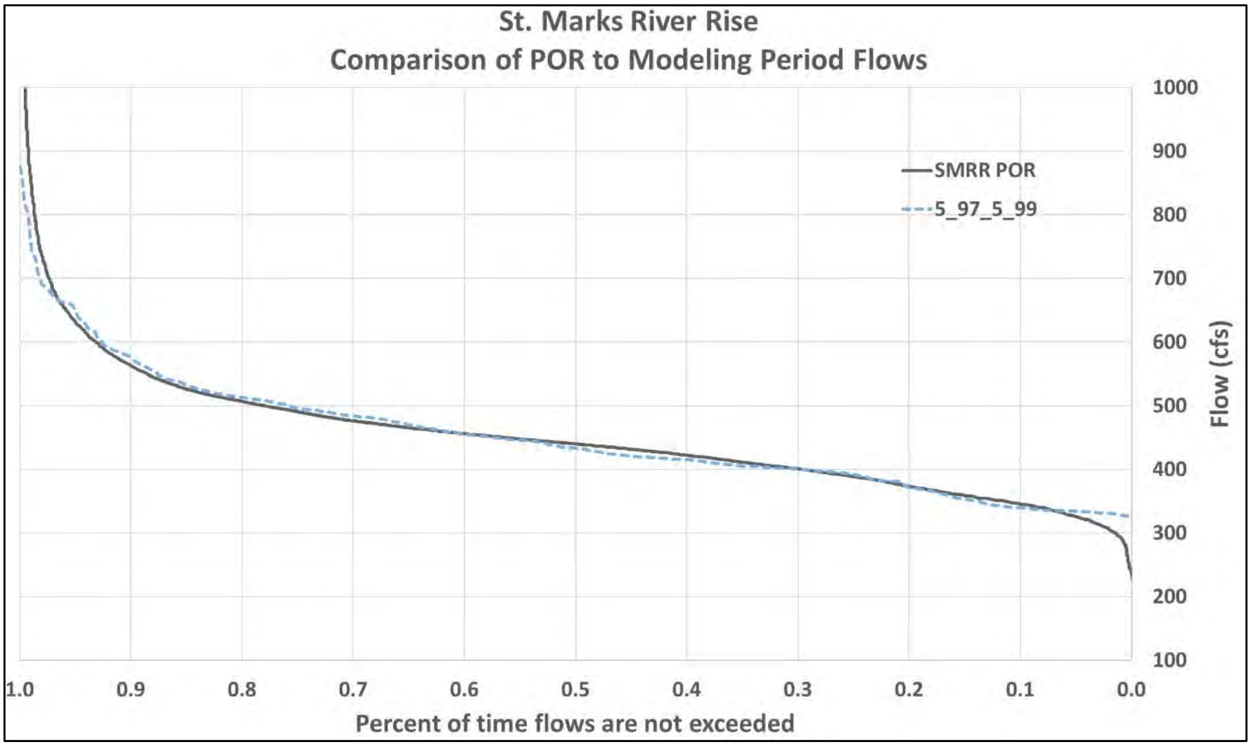

Figure 45. **Comparison of flow distributions for period of record (October 1, 1956 – August 10, 2017) and the selected 25-month baseline period (May 1, 1997 – May 31, 1999).**

Table 10. **Comparison of flow distribution statistics for the period-of-record (October 1, 1956 – August 10, 2017) and 25-month modeling period (May 1, 1997 – May 31, 1999).**

Flow percentile	Baseline Flow (cfs)	Modeling Period Flow (cfs)
5th	325	334
10th	345	340
25th	388	391
50th (median)	440	433
75th	490	496
90th	562	575
95th	629	653
Mean	451.8	450.9

7 References

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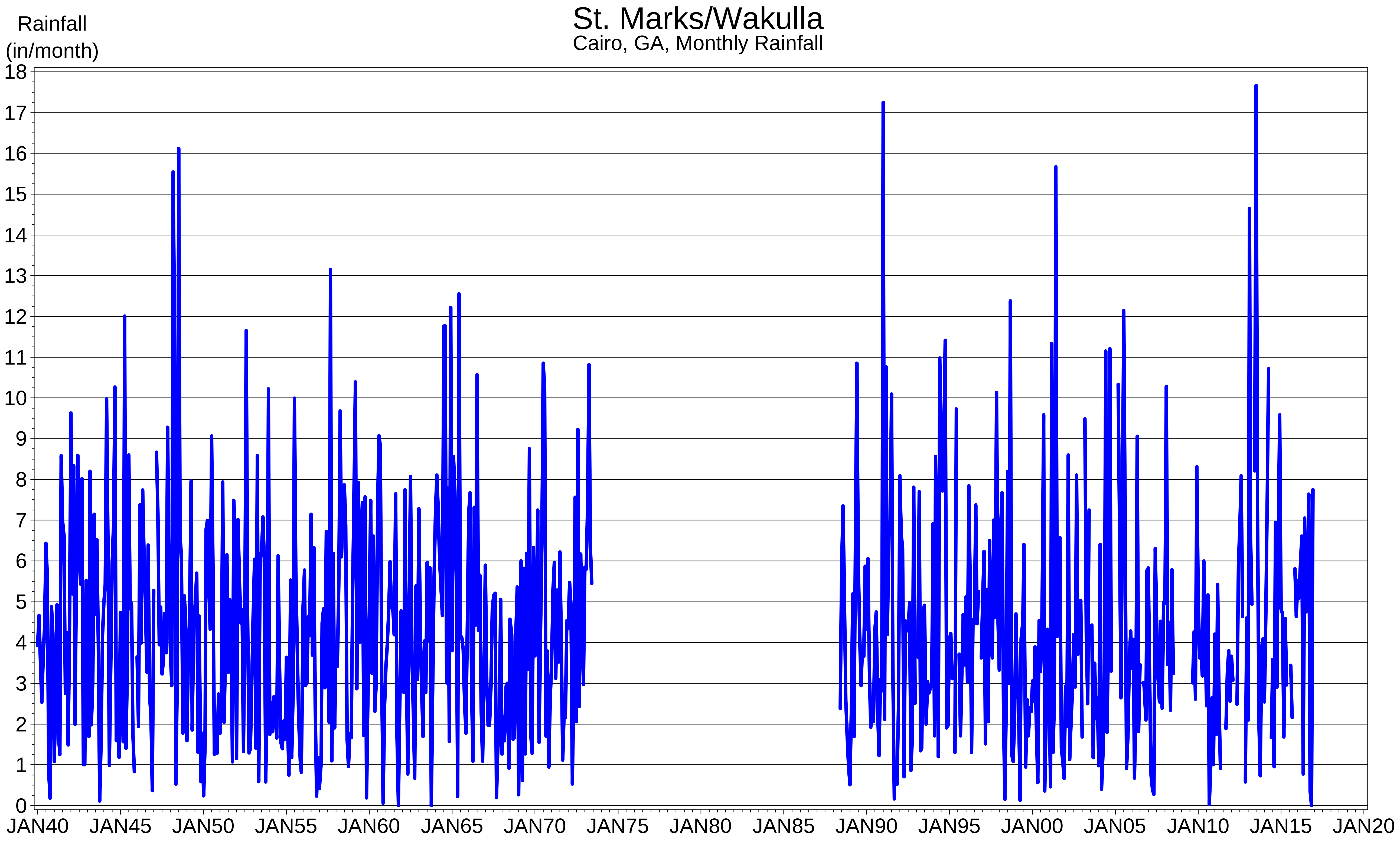
ATTACHMENT 1:
PLOTS OF AVAILABLE DATA


St. Marks/Wakulla
Cairo, GA, Monthly Rainfall
Rainfall
(in/month)
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
JAN40
JAN45
JAN50
JAN55
JAN60
JAN65
JAN70
JAN75
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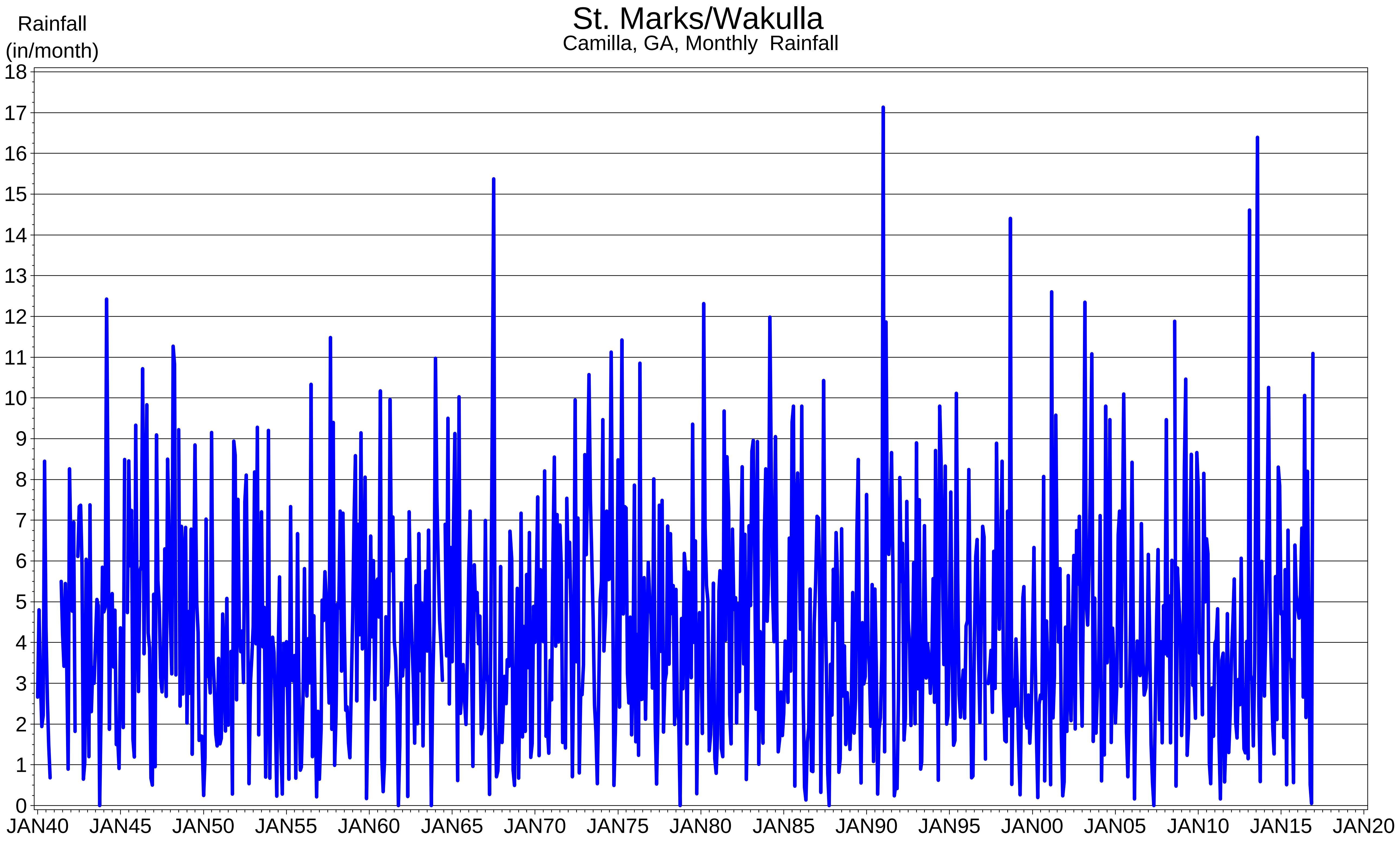
JAN15
JAN20


St. Marks/Wakulla
Camilla, GA, Monthly Rainfall
Rainfall
(in/month)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
JAN40
JAN45
JAN50
JAN55
JAN60
JAN65
JAN70
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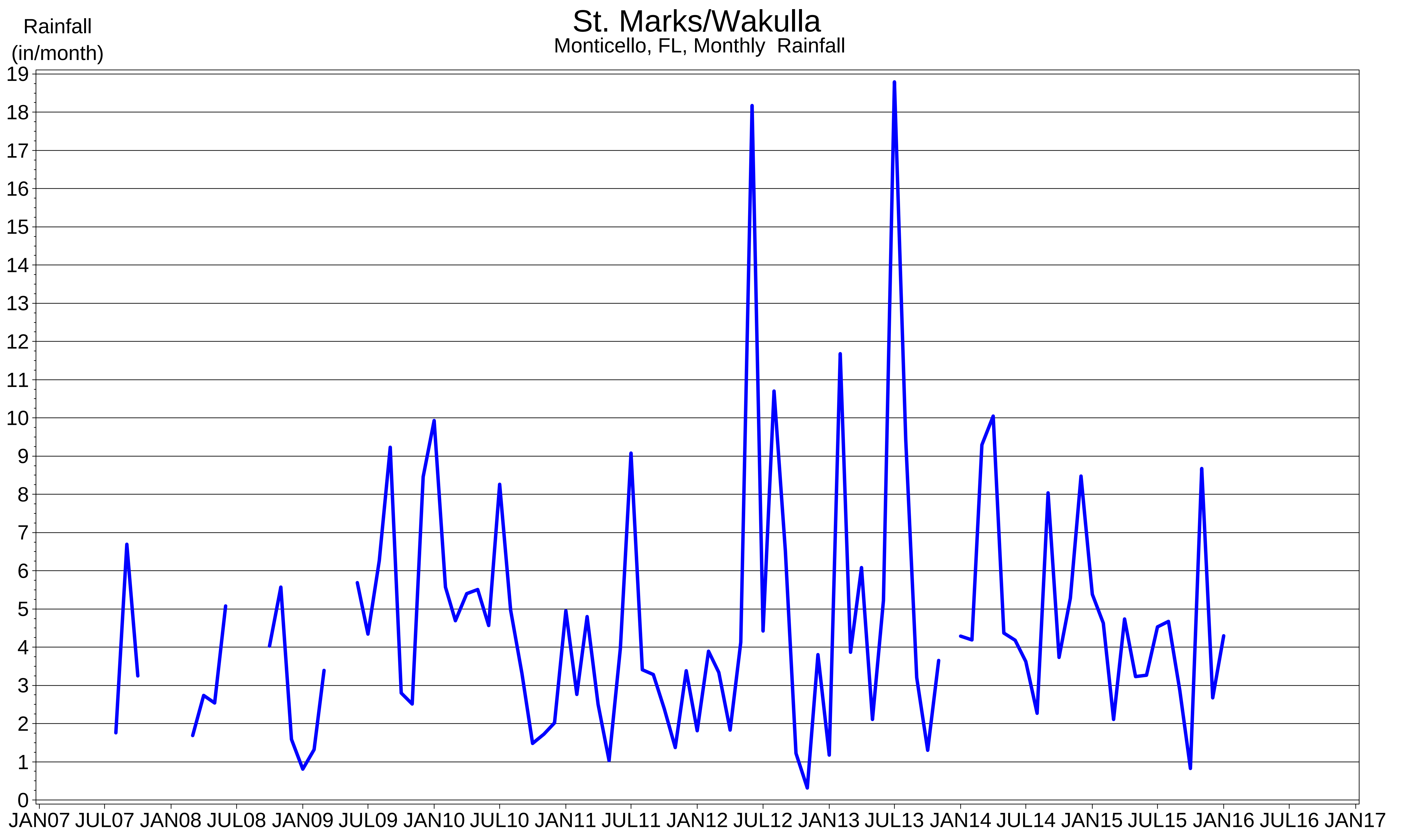
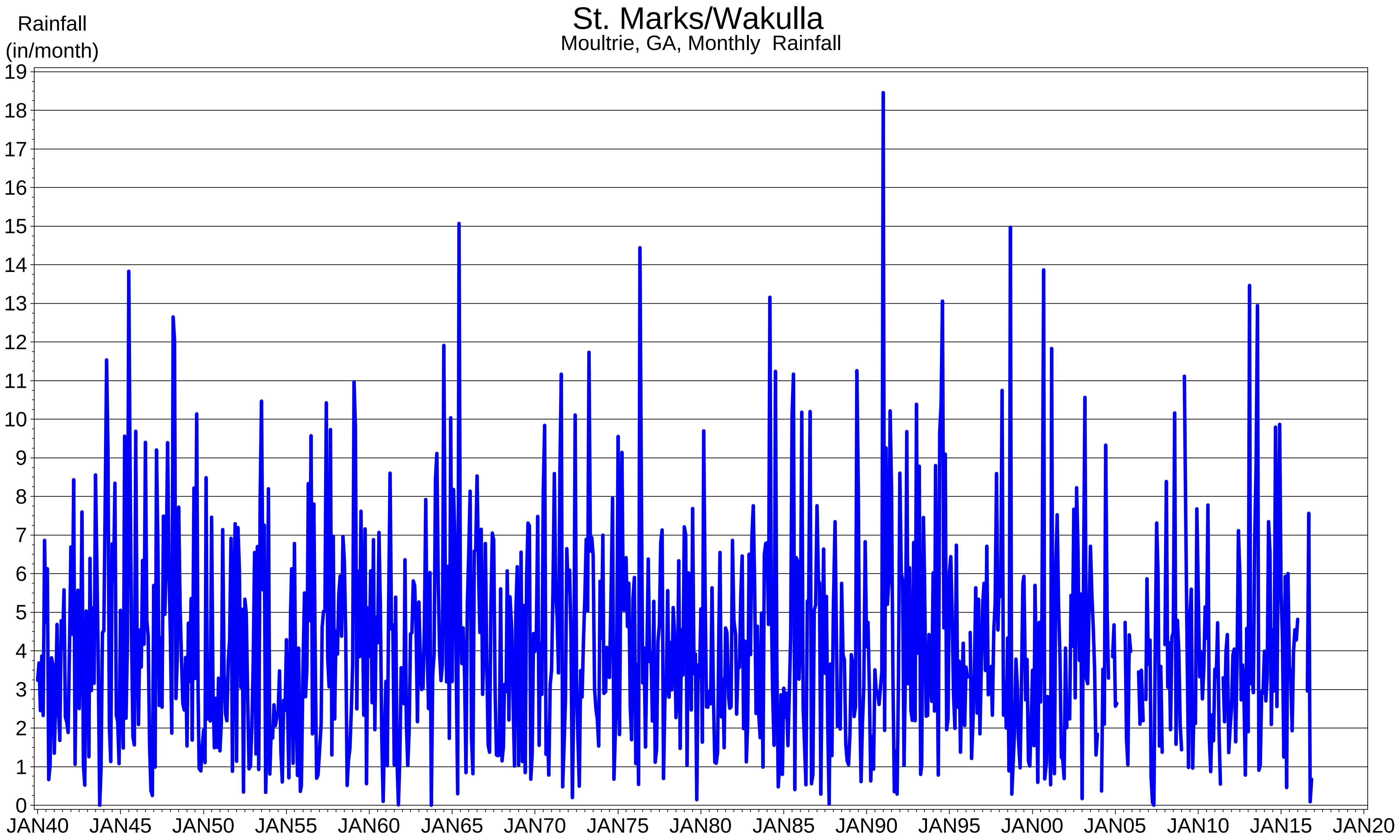
JAN20


St. Marks/Wakulla
Monticello, FL, Monthly Rainfall
Rainfall
(in/month)
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
JAN07 JUL07 JAN08 JUL08 JAN09 JUL09 JAN10 JUL10 JAN11 JUL11 JAN12 JUL12 JAN13 JUL13 JAN14 JUL14 JAN15 JUL15 JAN16 JUL16 JAN17



St. Marks/Wakulla
Moultrie, GA, Monthly Rainfall
Rainfall
(in/month)
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
JAN40
JAN45
JAN50
JAN55
JAN60
JAN65
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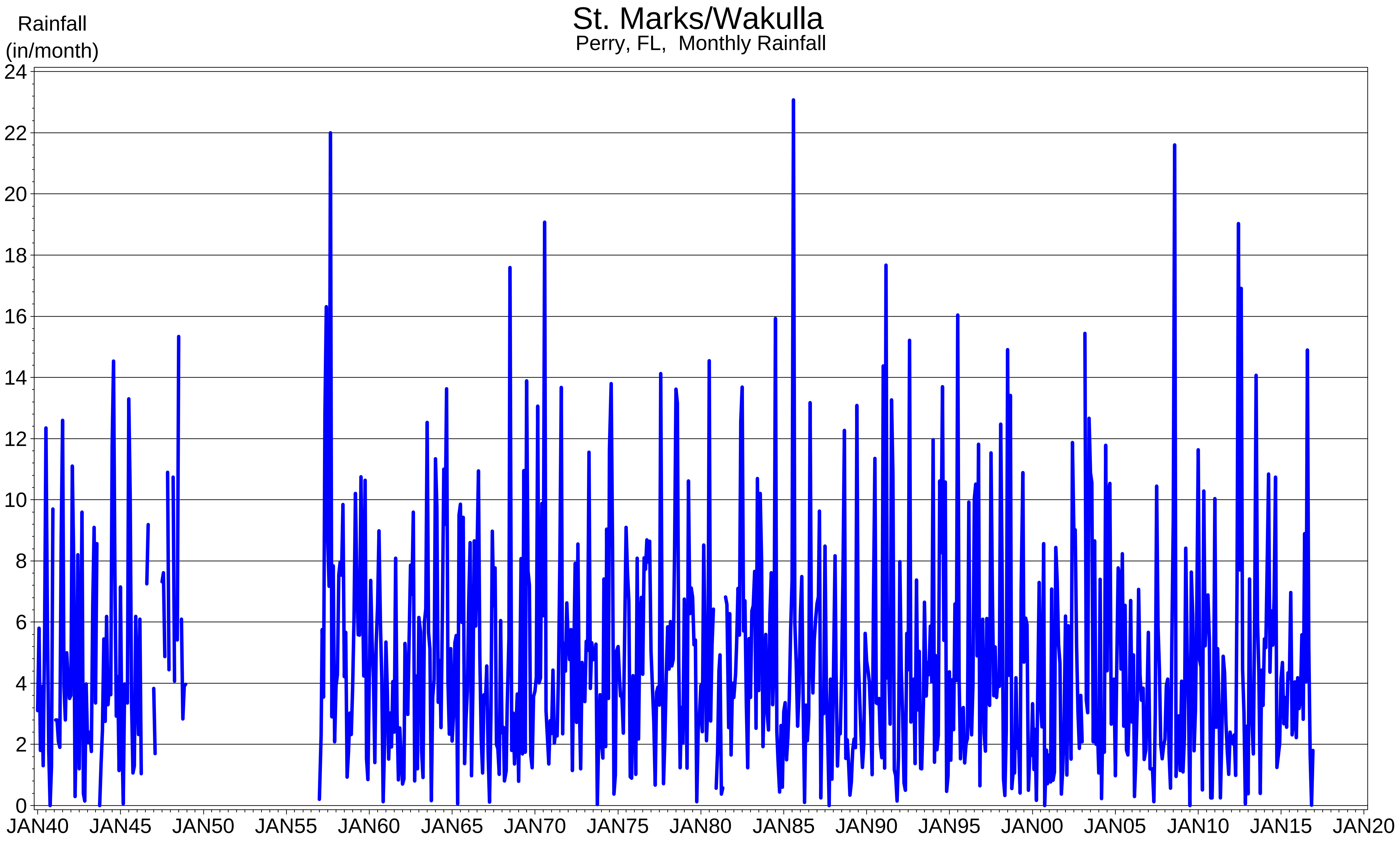
JAN20


St. Marks/Wakulla
Perry, FL, Monthly Rainfall
Rainfall
(in/month)
24
22
20
18
16
14
12
10
8
6
4
2
0
JAN40
JAN45
JAN50
JAN55
JAN60
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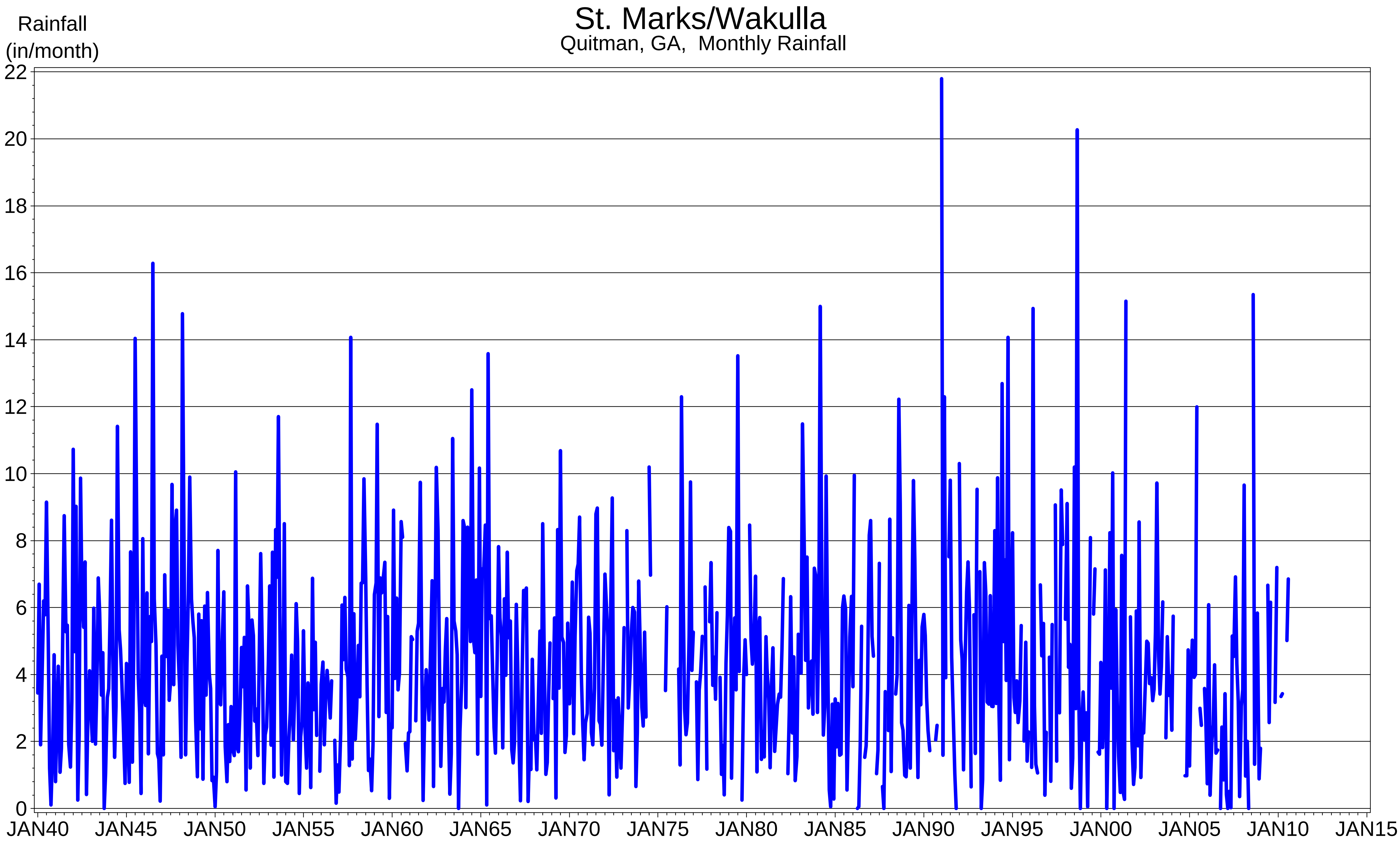
JAN20


St. Marks/Wakulla
Quitman, GA, Monthly Rainfall
Rainfall
(in/month)
0
2
4
6
8
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12
14
16
18
20
22
JAN40
JAN45
JAN50
JAN55
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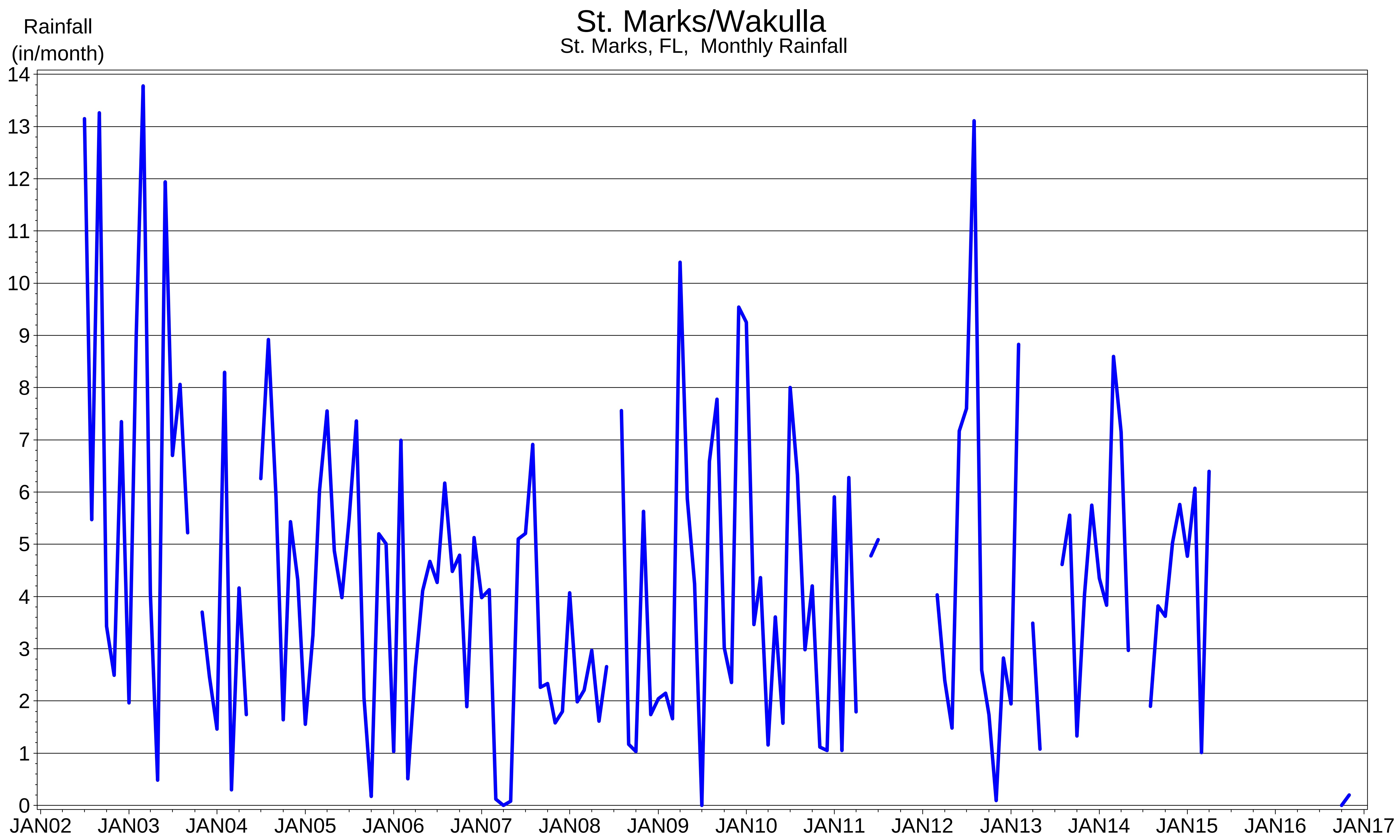
JAN05
JAN10
JAN15


St. Marks/Wakulla
St. Marks, FL, Monthly Rainfall
Rainfall
(in/month)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
JAN02
JAN03
JAN04
JAN05
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JAN15
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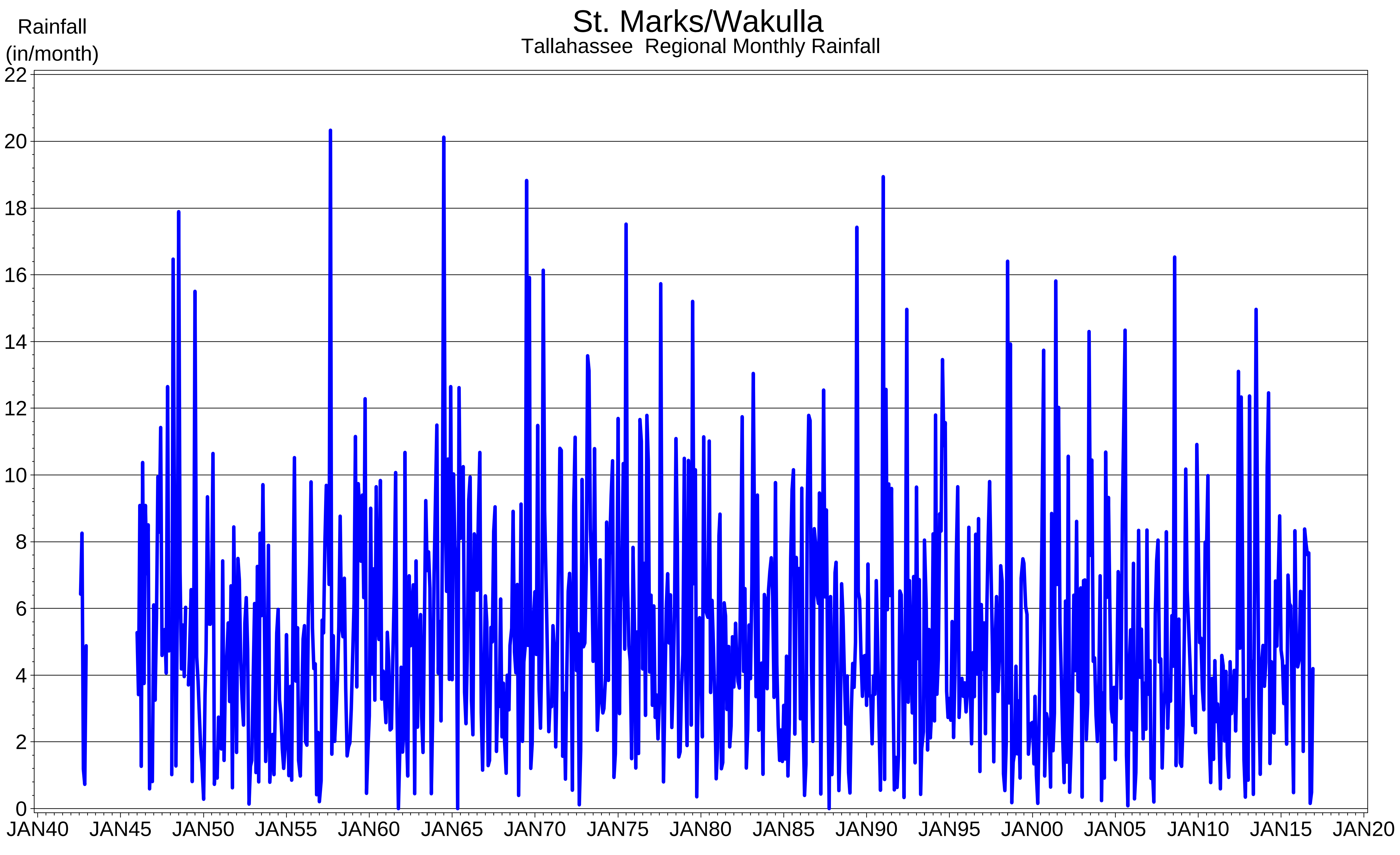
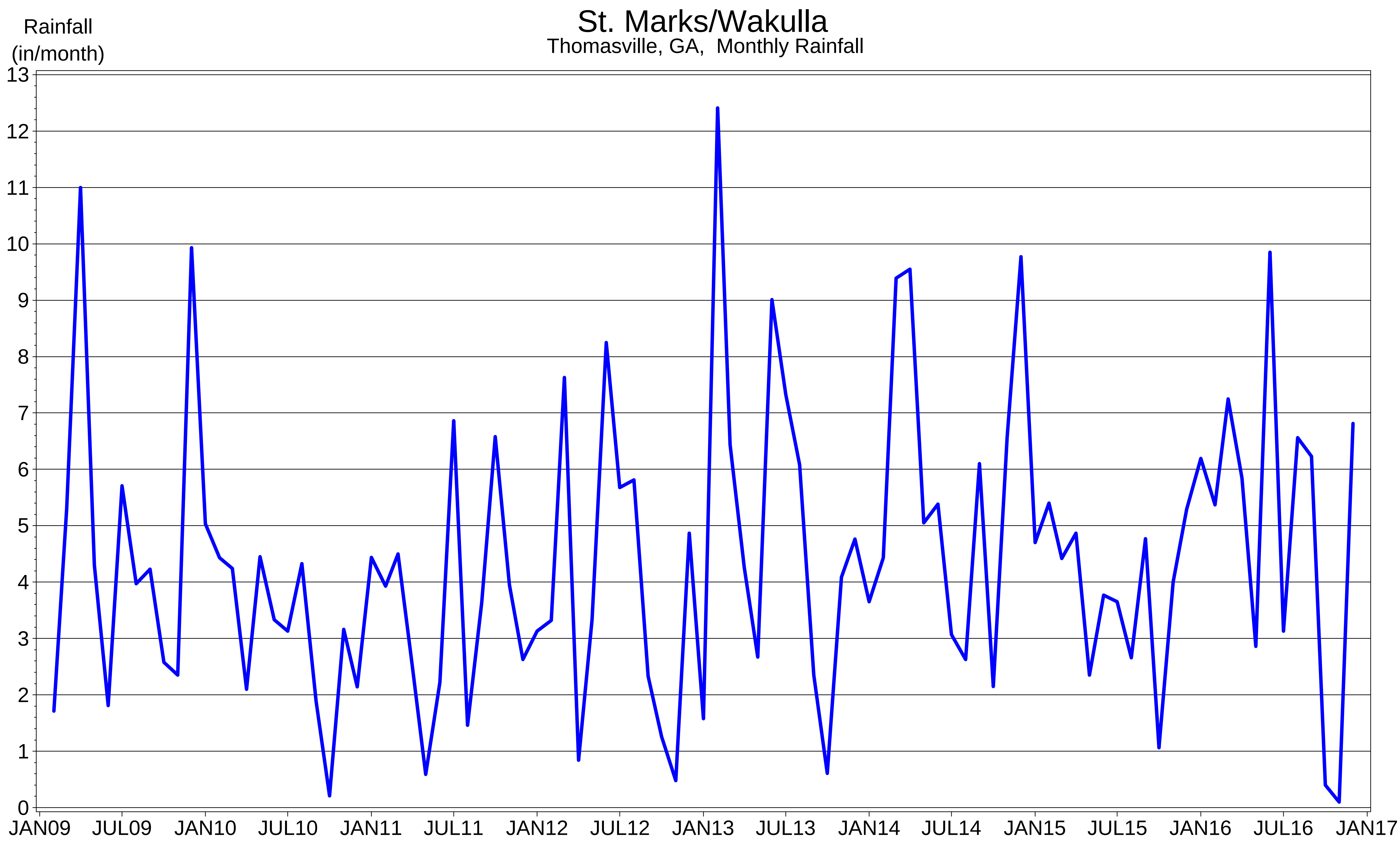
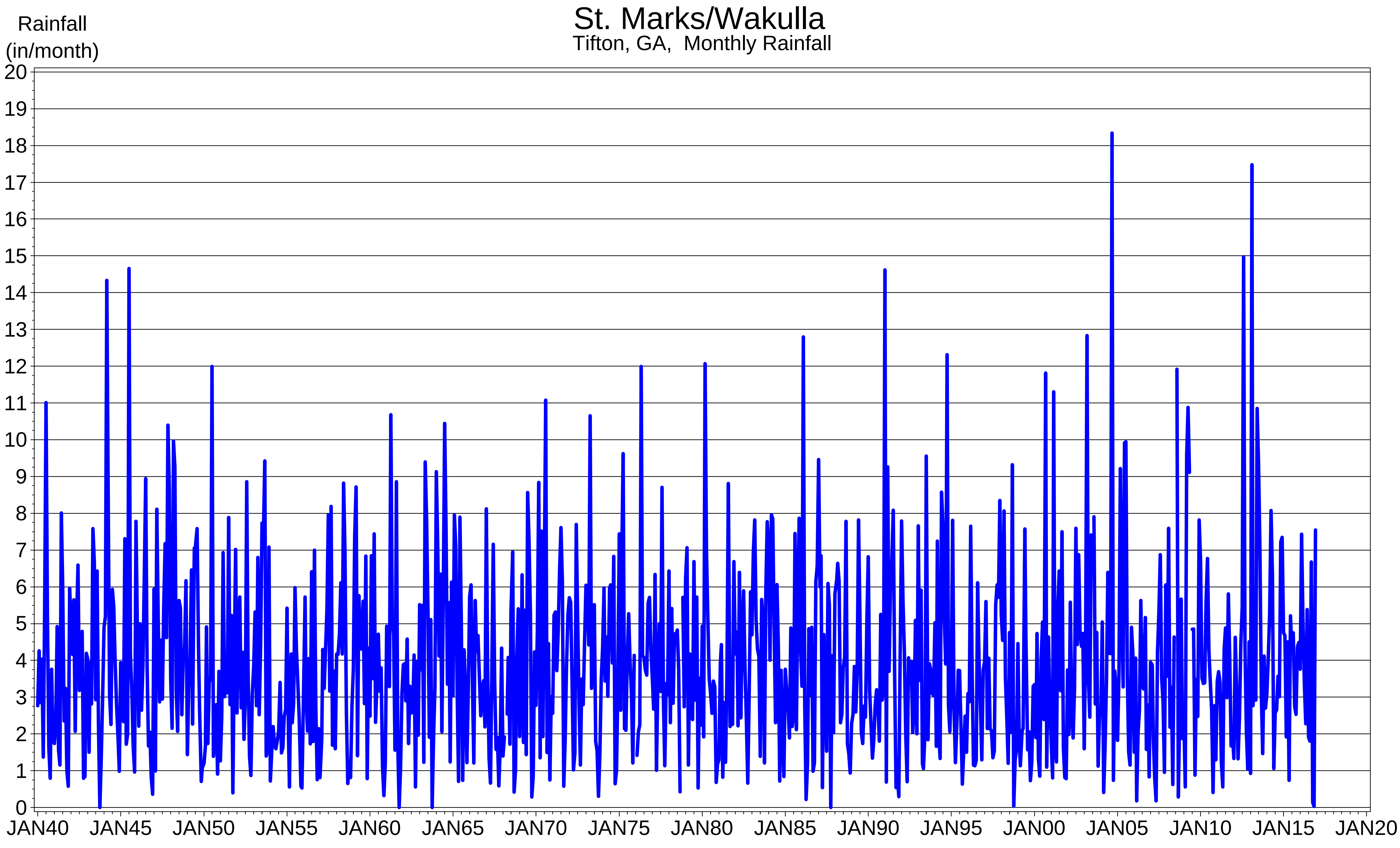
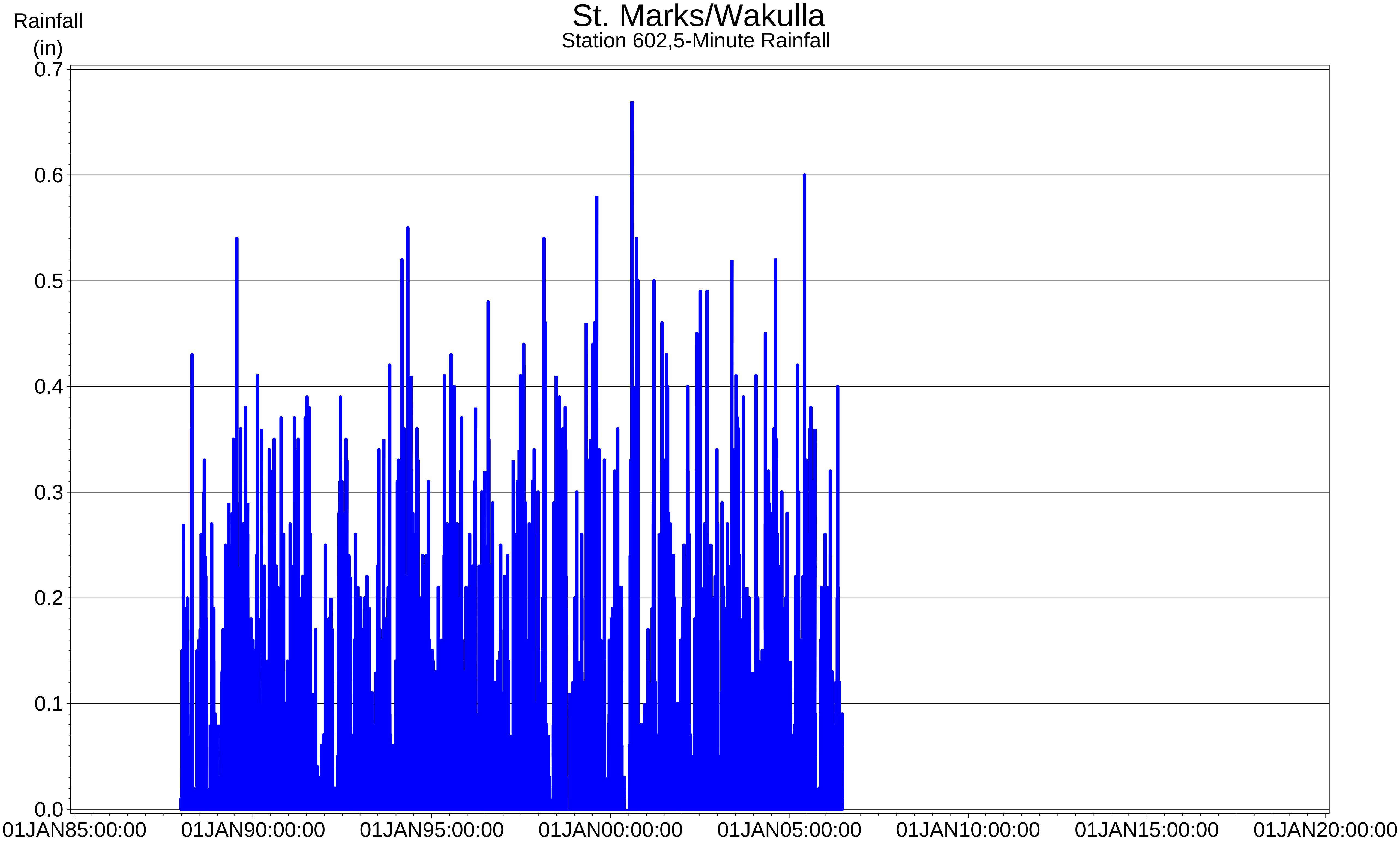
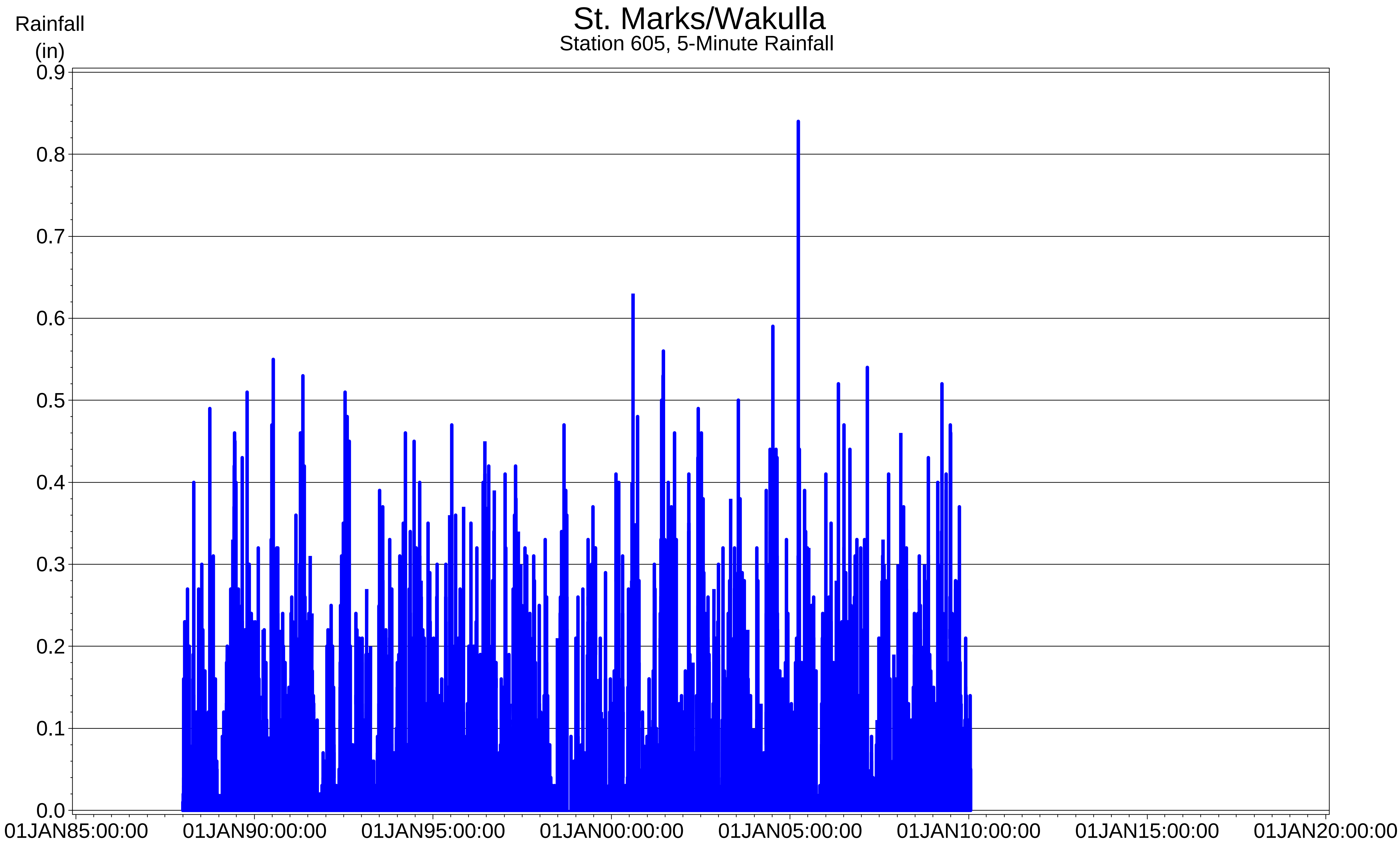

St. Marks/Wakulla
Tallahassee Regional Monthly Rainfall
Rainfall
(in/month)
22
20
18
16
14
12
10
8
6
4
2
0
JAN40
JAN45
JAN50
JAN55
JAN60
JAN65
JAN70
JAN75
JAN80
JAN85
JAN90
JAN95
JAN00
JAN05
JAN10
JAN15
JAN20



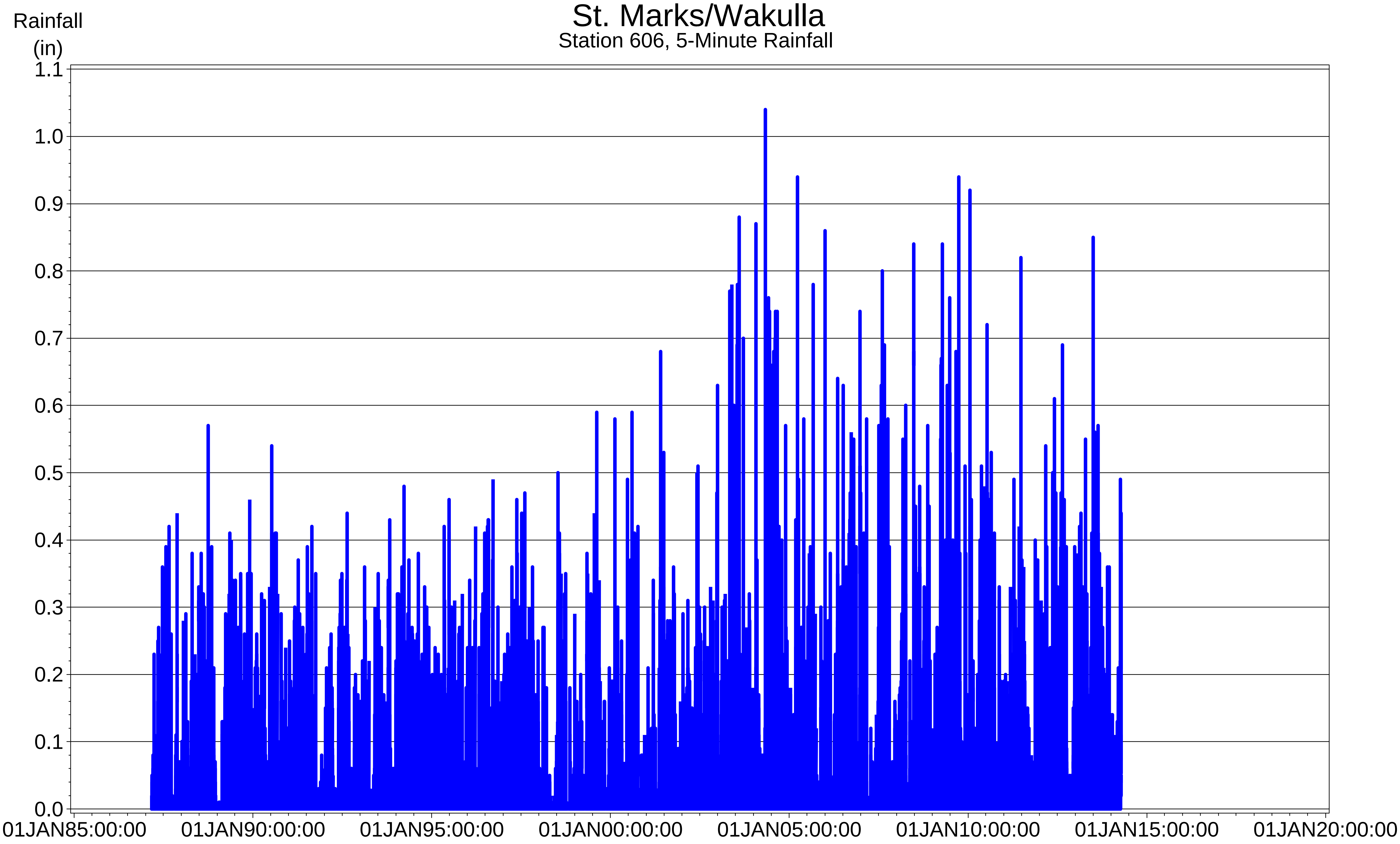
St. Marks/Wakulla
Thomasville, GA, Monthly Rainfall
Rainfall
(in/month)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
JAN09
JUL09
JAN10
JUL10
JAN11
JUL11
JAN12
JUL12
JAN13
JUL13
JAN14
JUL14
JAN15
JUL15
JAN16
JUL16
JAN17

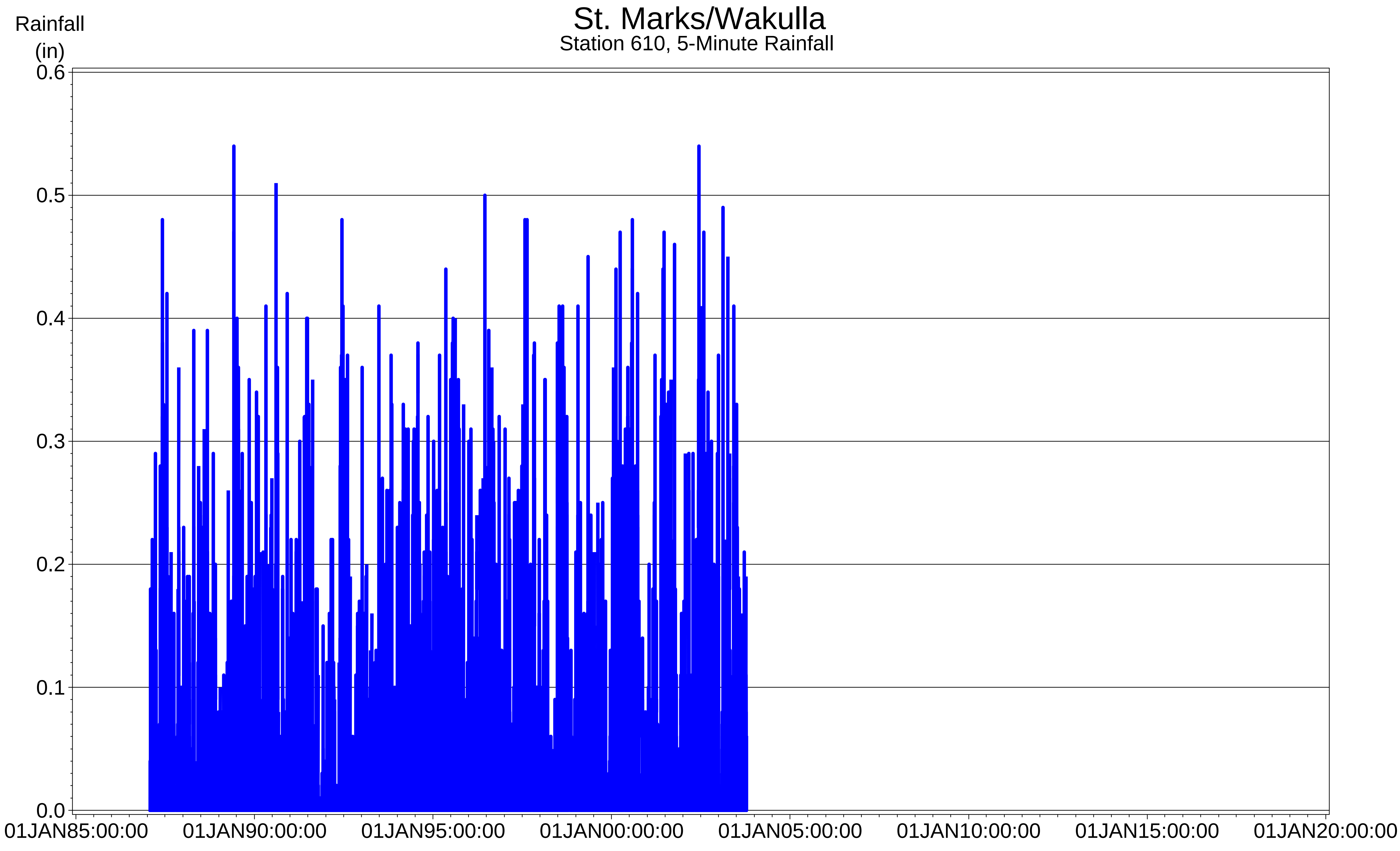

St. Marks/Wakulla
Tifton, GA, Monthly Rainfall
Rainfall
(in/month)
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
JAN40
JAN45
JAN50
JAN55
JAN60
JAN65
JAN70
JAN75
JAN80
JAN85
JAN90
JAN95
JAN00
JAN05
JAN10
JAN15
JAN20


St. Marks/Wakulla
Station 602,5-Minute Rainfall
Rainfall (in)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
01JAN85:00:00
01JAN90:00:00
01JAN95:00:00
01JAN00:00:00
01JAN05:00:00
01JAN10:00:00
01JAN15:00:00
01JAN20:00:00

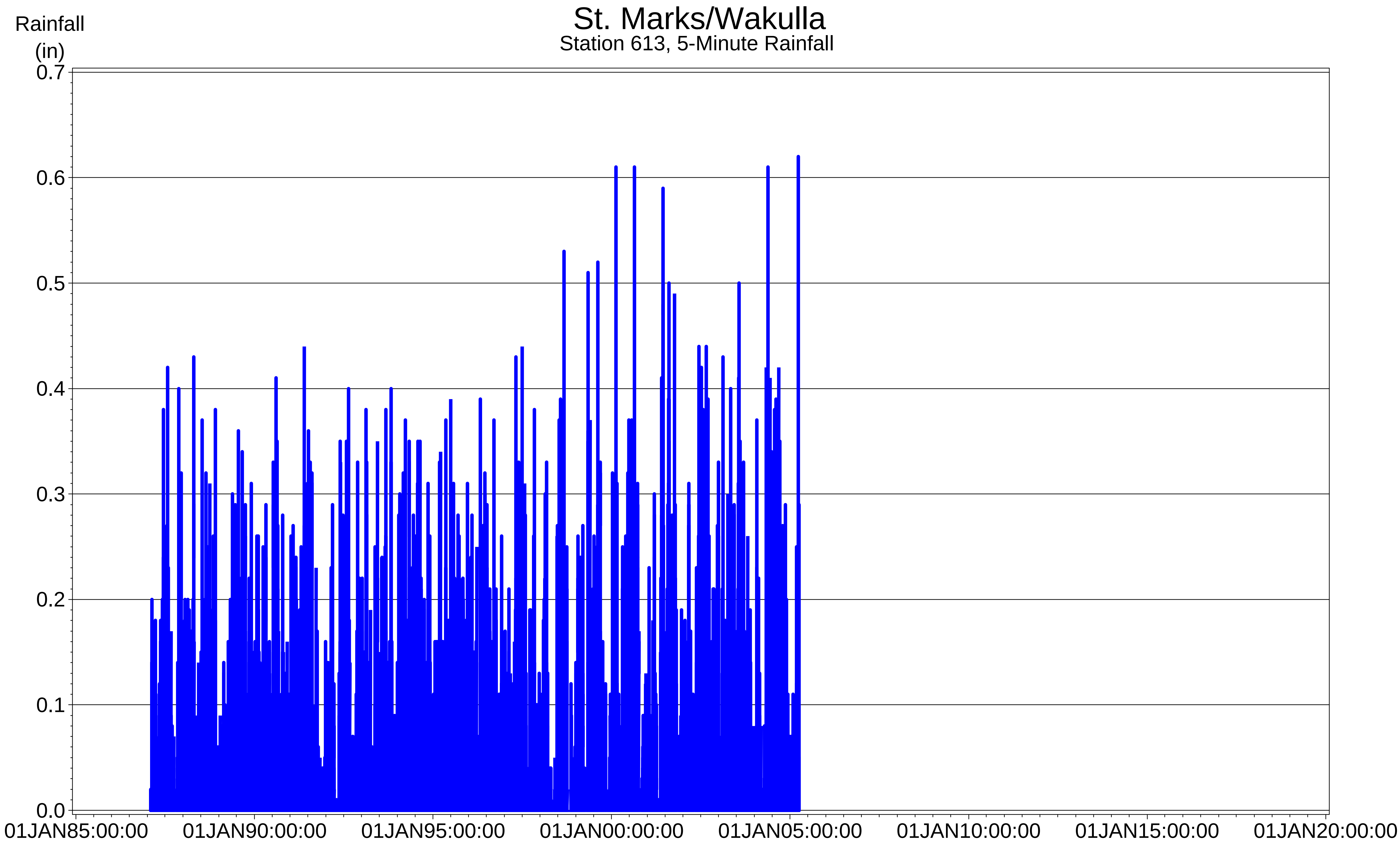


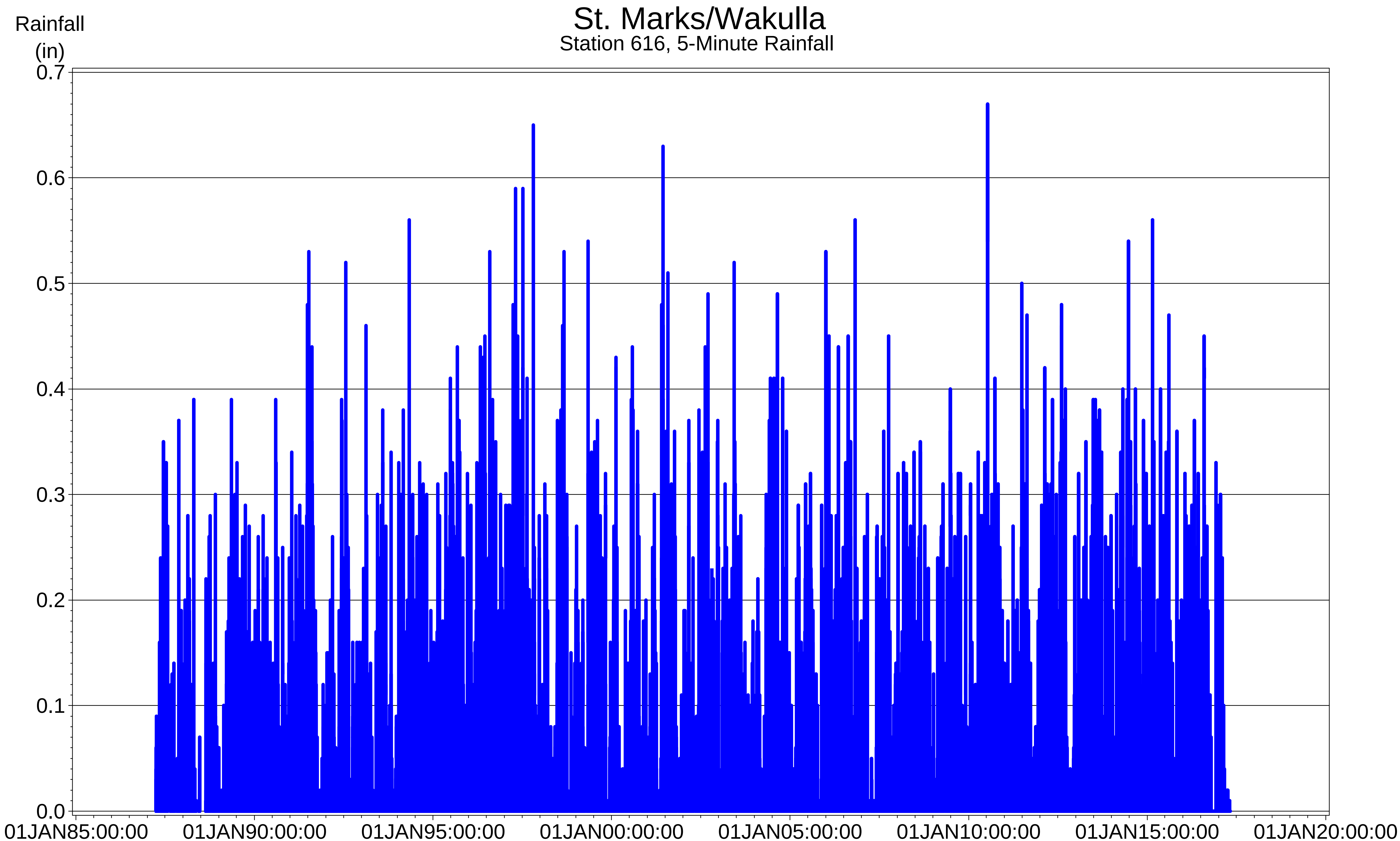
St. Marks/Wakulla
Station 605, 5-Minute Rainfall
Rainfall (in)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
01JAN85:00:00
01JAN90:00:00
01JAN95:00:00
01JAN00:00:00
01JAN05:00:00
01JAN10:00:00
01JAN15:00:00
01JAN20:00:00

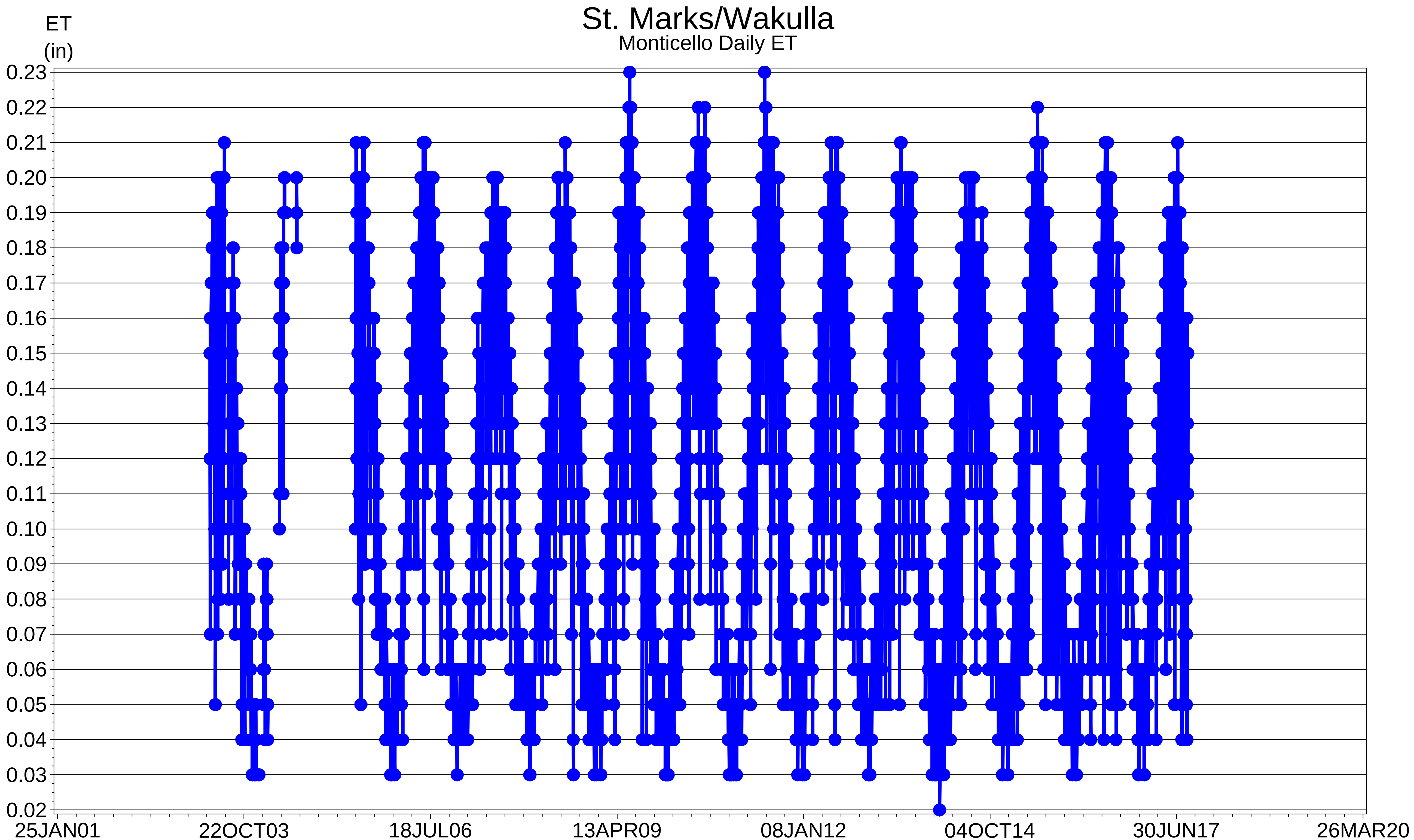

St. Marks/Wakulla
Station 606, 5-Minute Rainfall
Rainfall
(in)
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
01JAN85:00:00
01JAN90:00:00
01JAN95:00:00
01JAN00:00:00
01JAN05:00:00
01JAN10:00:00
01JAN15:00:00
01JAN20:00:00

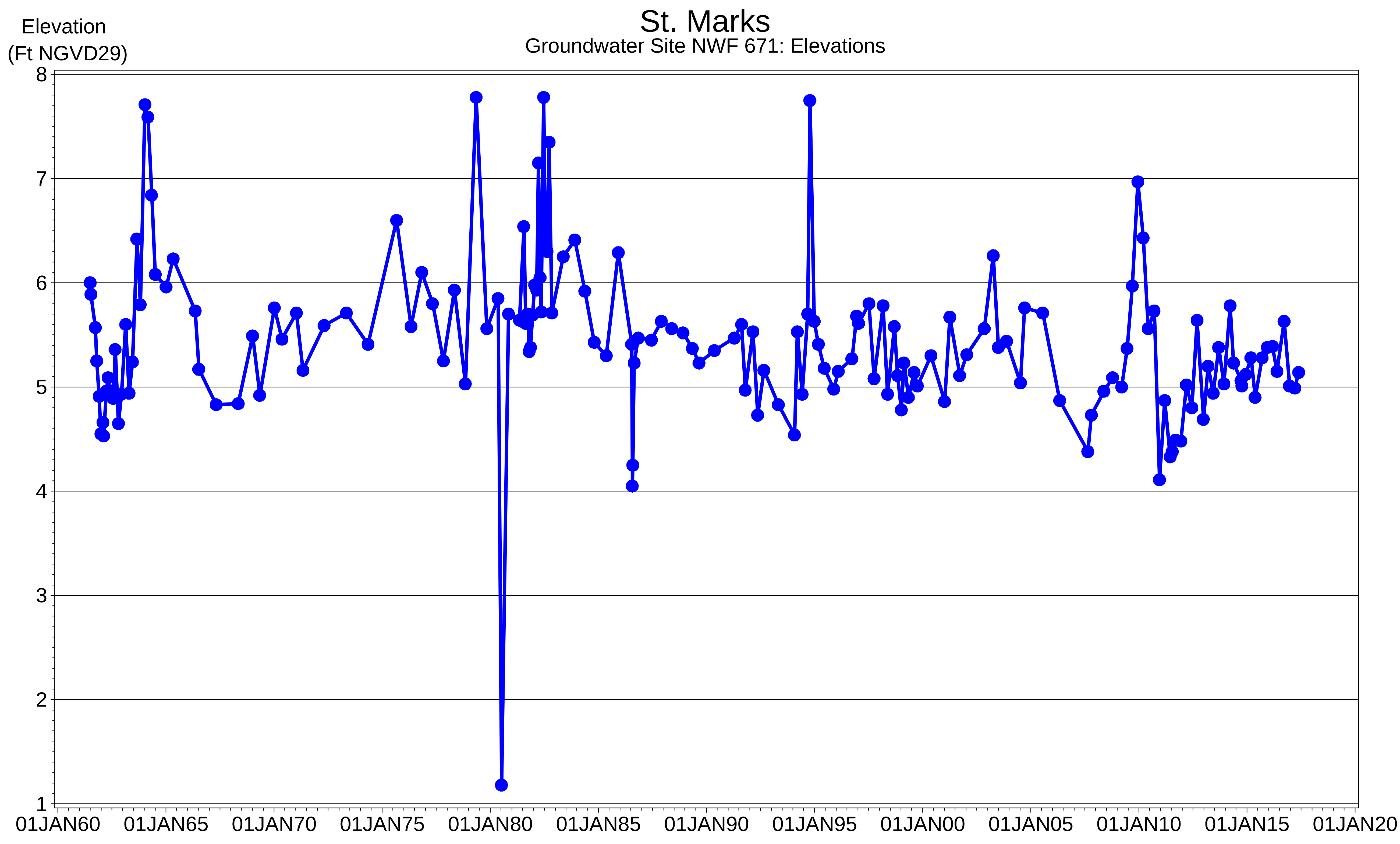


St. Marks/Wakulla
Station 610, 5-Minute Rainfall
Rainfall (in)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
01JAN85:00:00
01JAN90:00:00
01JAN95:00:00
01JAN00:00:00
01JAN05:00:00
01JAN10:00:00
01JAN15:00:00
01JAN20:00:00

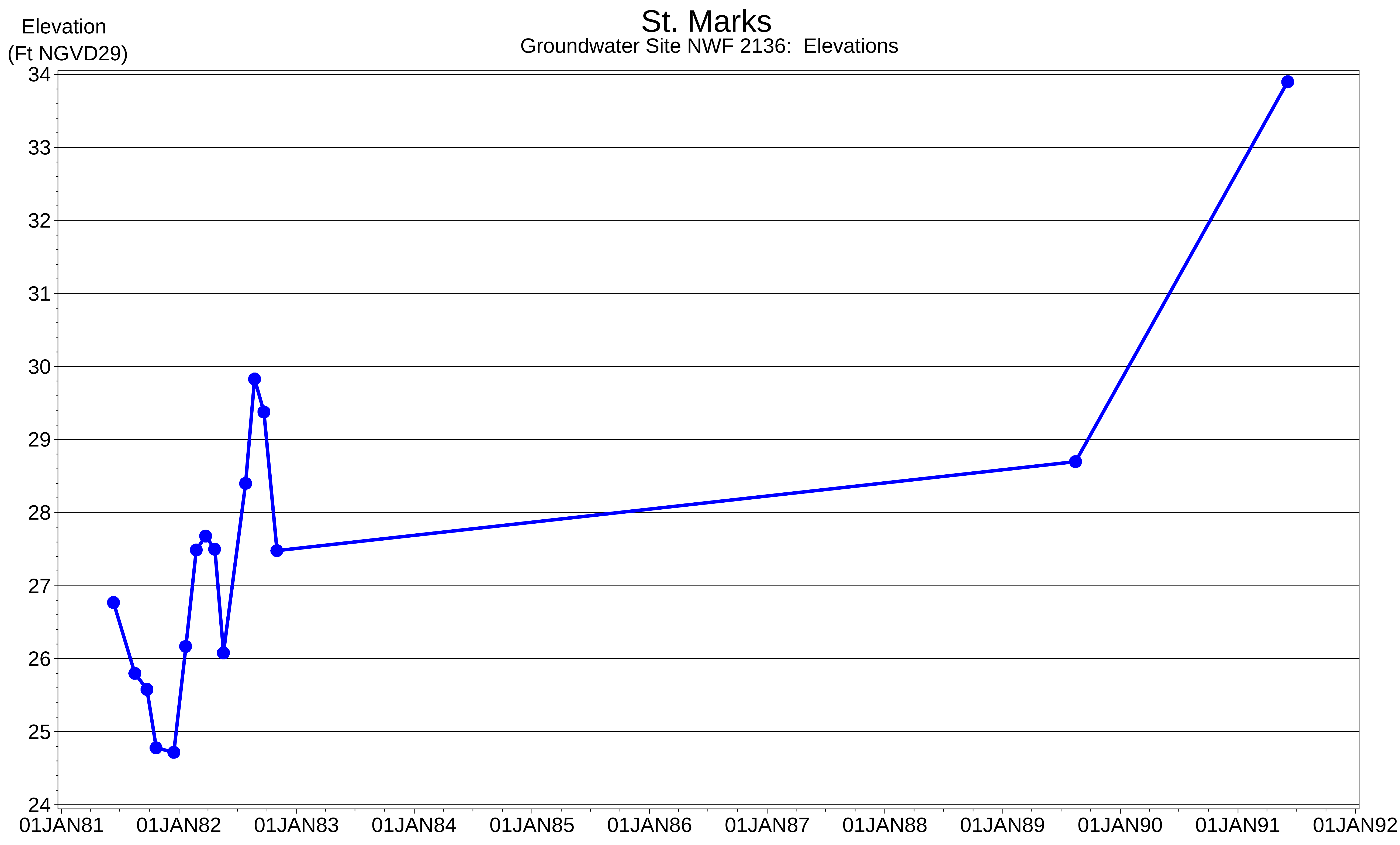

St. Marks/Wakulla
Station 613, 5-Minute Rainfall
Rainfall
(in)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
01JAN85:00:00
01JAN90:00:00
01JAN95:00:00
01JAN00:00:00
01JAN05:00:00
01JAN10:00:00
01JAN15:00:00
01JAN20:00:00


St. Marks/Wakulla
Station 616, 5-Minute Rainfall
Rainfall (in)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
01JAN85:00:00
01JAN90:00:00
01JAN95:00:00
01JAN00:00:00
01JAN05:00:00
01JAN10:00:00
01JAN15:00:00
01JAN20:00:00

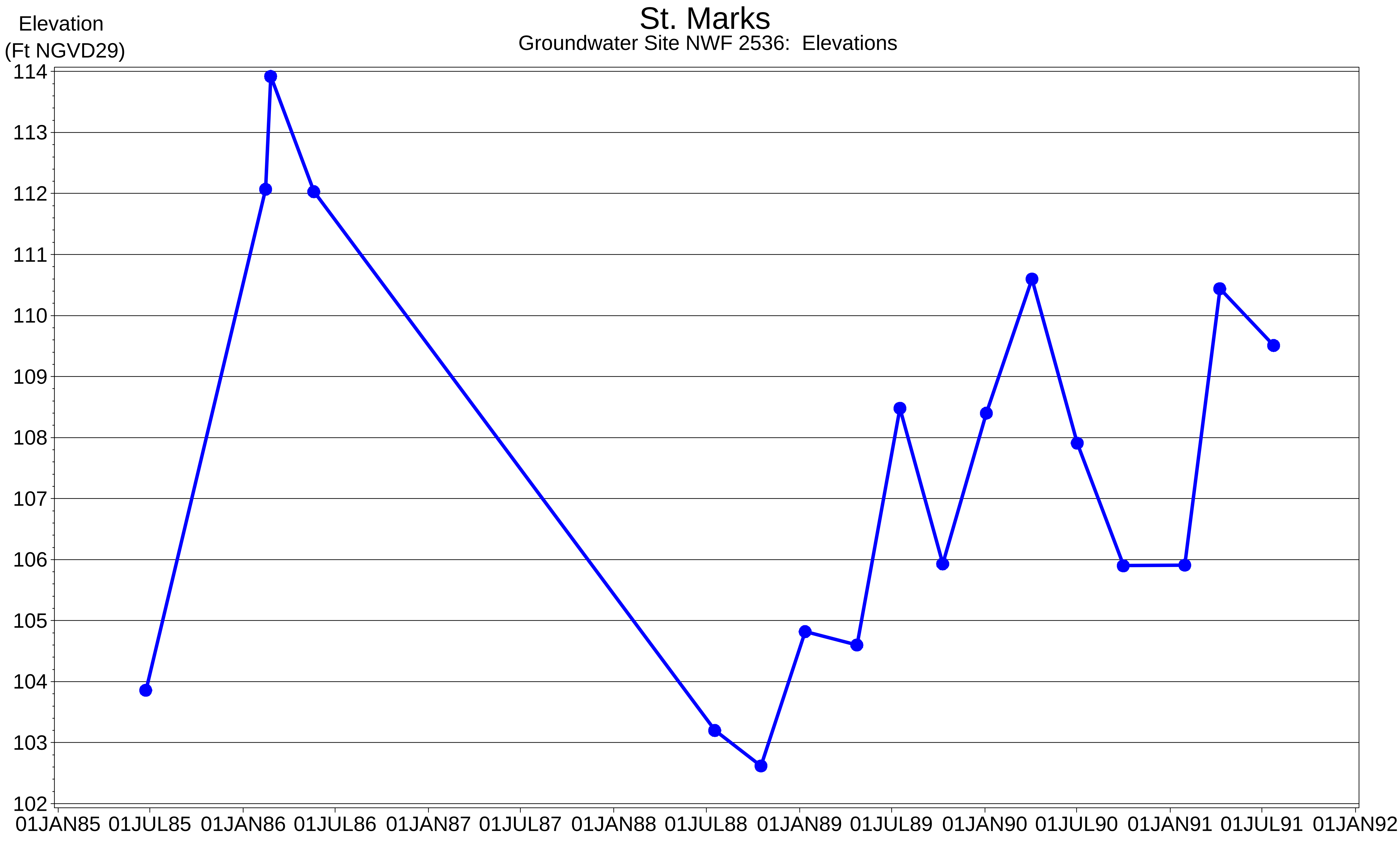

St. Marks/Wakulla
Monticello Daily ET
ET
(in)
0.23
0.22
0.21
0.20
0.19
0.18
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
25JAN01
22OCT03
18JUL06
13APR09
08JAN12
04OCT14
30JUN17
26MAR20



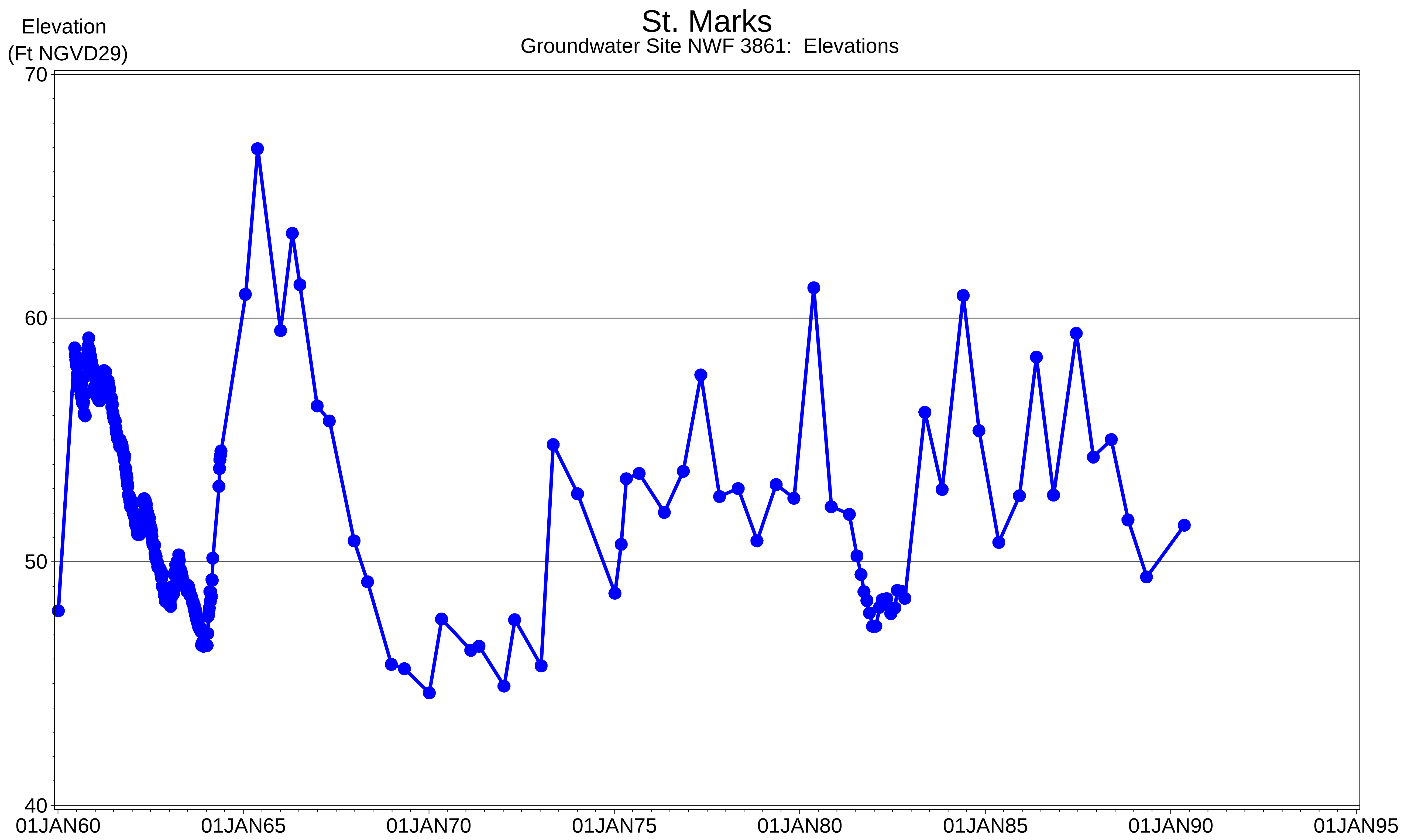
St. Marks
Groundwater Site NWF 671: Elevations
Elevation
(Ft NGVD29)
8
7
6
5
4
3
2
1
01JAN60
01JAN65
01JAN70
01JAN75
01JAN80
01JAN85
01JAN90
01JAN95
01JAN00
01JAN05
01JAN10
01JAN15
01JAN20



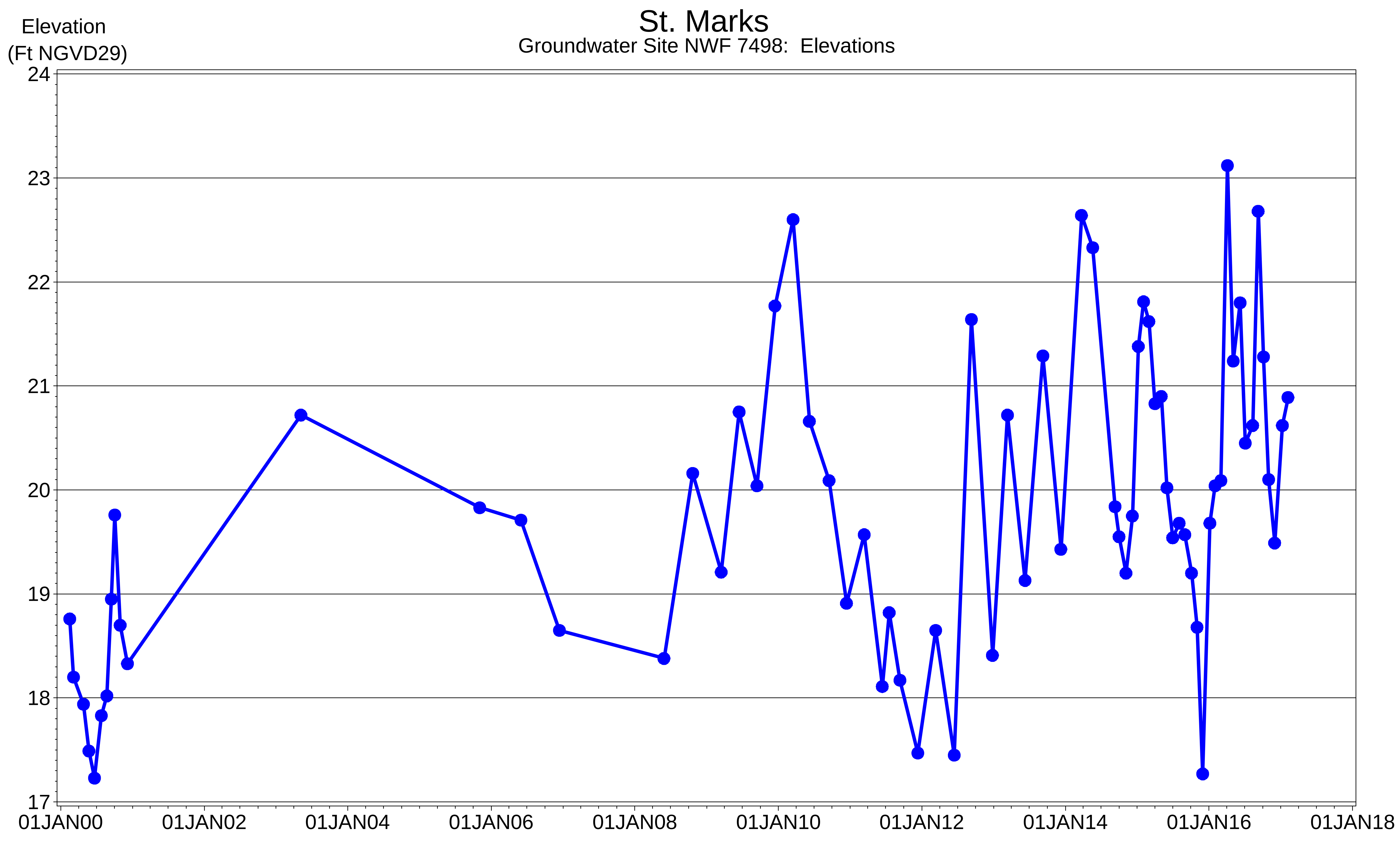
St. Marks
Groundwater Site NWF 2136: Elevations
Elevation
(Ft NGVD29)
34
33
32
31
30
29
28
27
26
25
24
01JAN81
01JAN82
01JAN83
01JAN84
01JAN85
01JAN86
01JAN87
01JAN88
01JAN89
01JAN90
01JAN91
01JAN92

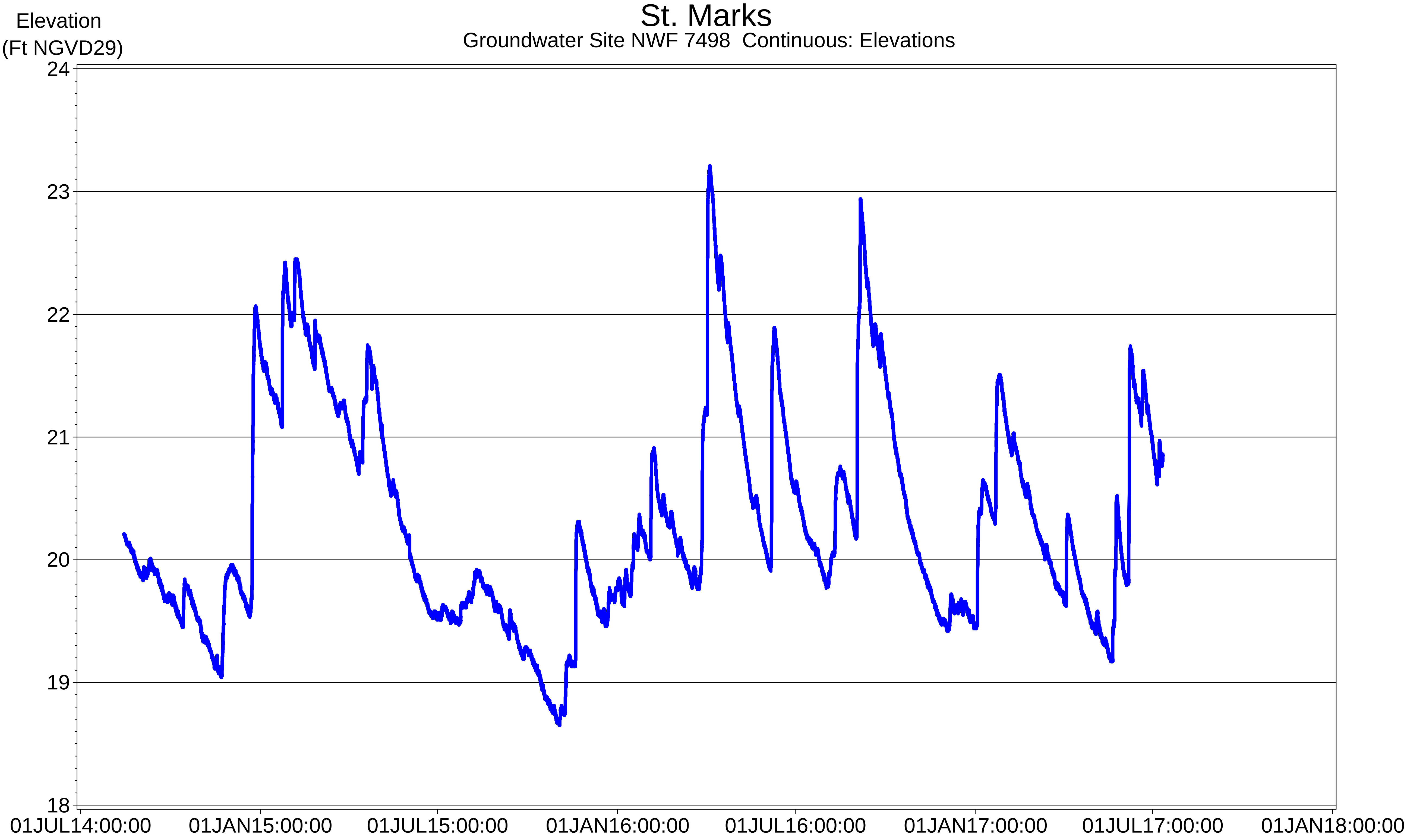


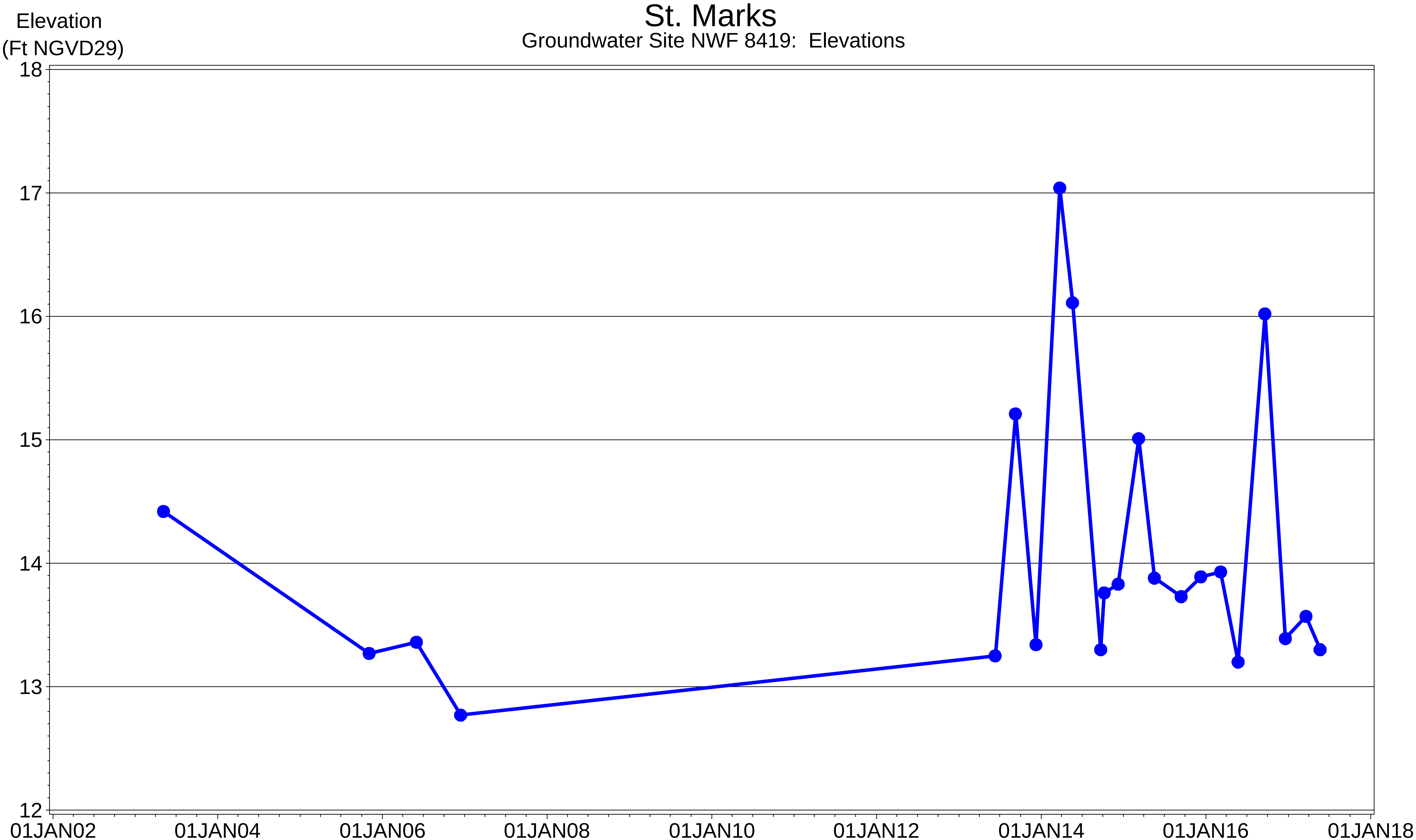
Elevation
(Ft NGVD29)
St. Marks
Groundwater Site NWF 2536: Elevations
114
113
112
111
110
109
108
107
106
105
104
103
102
01JAN85
01JUL85
01JAN86
01JUL86
01JAN87
01JUL87
01JAN88
01JUL88
01JAN89
01JUL89
01JAN90
01JUL90
01JAN91
01JUL91
01JAN92



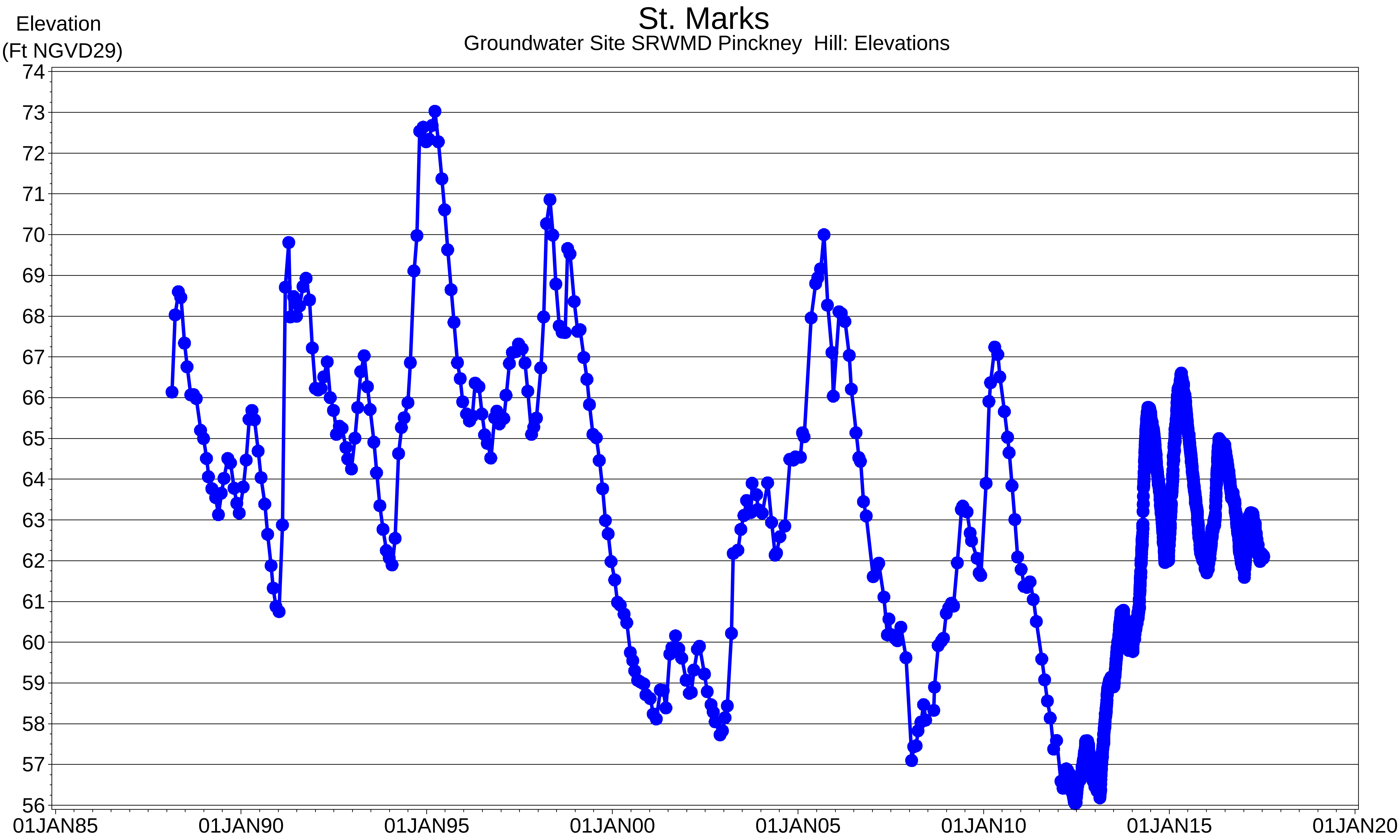
St. Marks
Groundwater Site NWF 3861: Elevations
Elevation
(Ft NGVD29)
70
60
50
40
01JAN60
01JAN65
01JAN70
01JAN75
01JAN80
01JAN85
01JAN90
01JAN95


St. Marks
Groundwater Site NWF 7498: Elevations
Elevation
(Ft NGVD29)
24
23
22
21
20
19
18
17
01JAN00
01JAN02
01JAN04
01JAN06
01JAN08
01JAN10
01JAN12
01JAN14
01JAN16
01JAN18

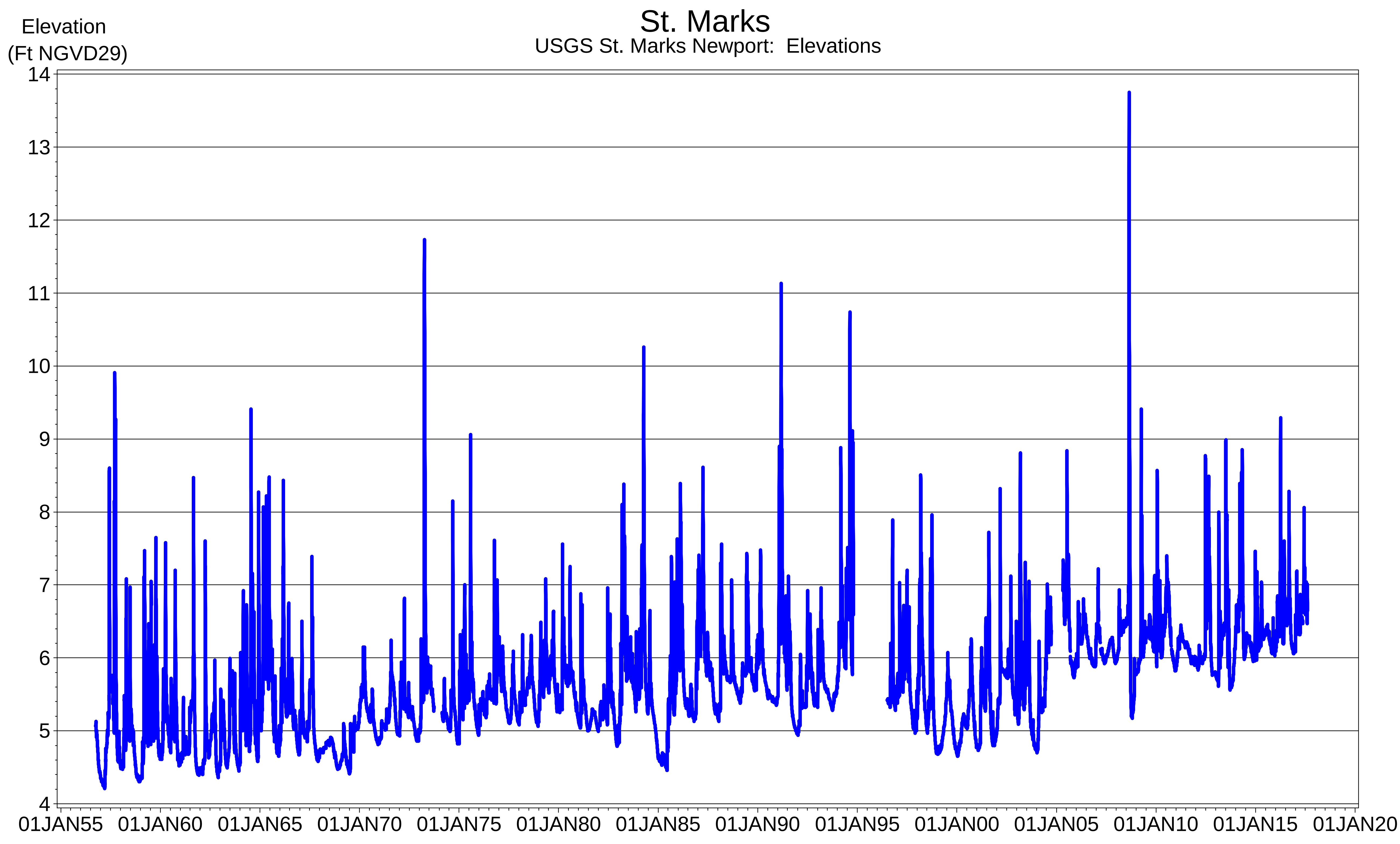

St. Marks
Groundwater Site NWF 7498 Continuous: Elevations
Elevation
(Ft NGVD29)
24
23
22
21
20
19
18
01JUL14:00:00
01JAN15:00:00
01JUL15:00:00
01JAN16:00:00
01JUL16:00:00
01JAN17:00:00
01JUL17:00:00
01JAN18:00:00



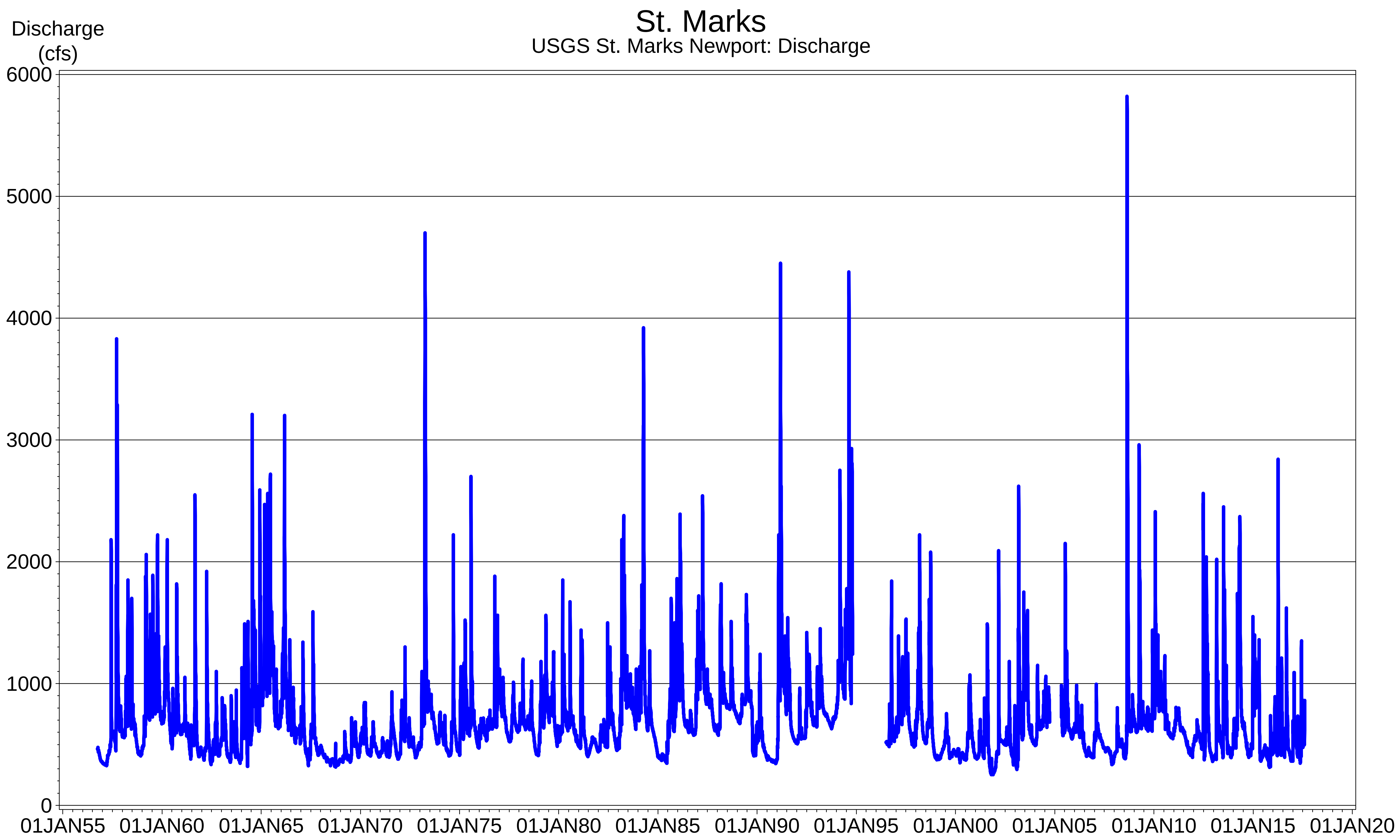
St. Marks
Groundwater Site NWF 8419: Elevations
Elevation
(Ft NGVD29)
18
17
16
15
14
13
12
01JAN02
01JAN04
01JAN06
01JAN08
01JAN10
01JAN12
01JAN14
01JAN16
01JAN18

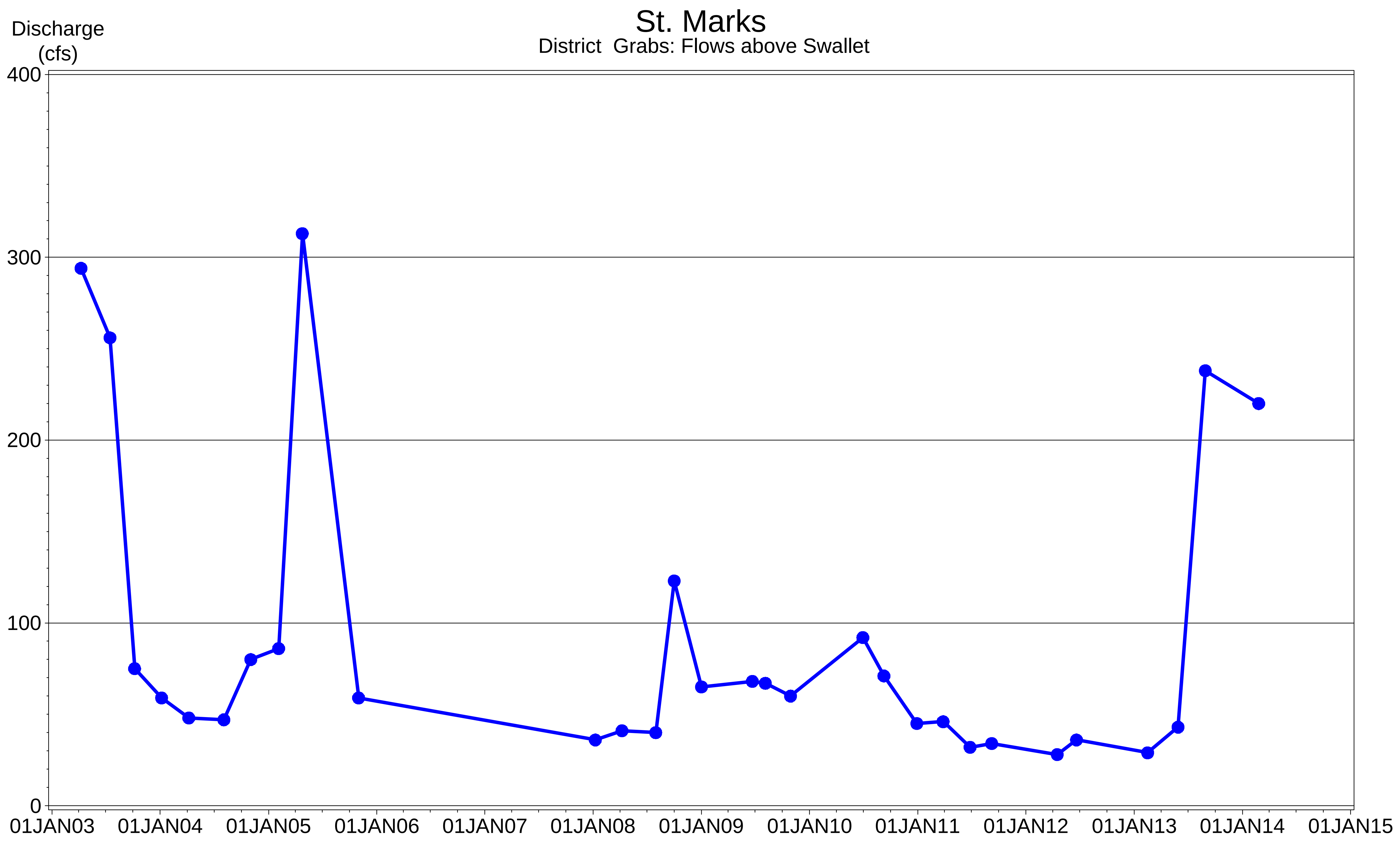


St. Marks
Groundwater Site SRWMD Pinckney Hill: Elevations
Elevation
(Ft NGVD29)
74
73
72
71
70
69
68
67
66
65
64
63
62
61
60
59
58
57
56
01JAN85
01JAN90
01JAN95
01JAN00
01JAN05
01JAN10
01JAN15
01JAN20

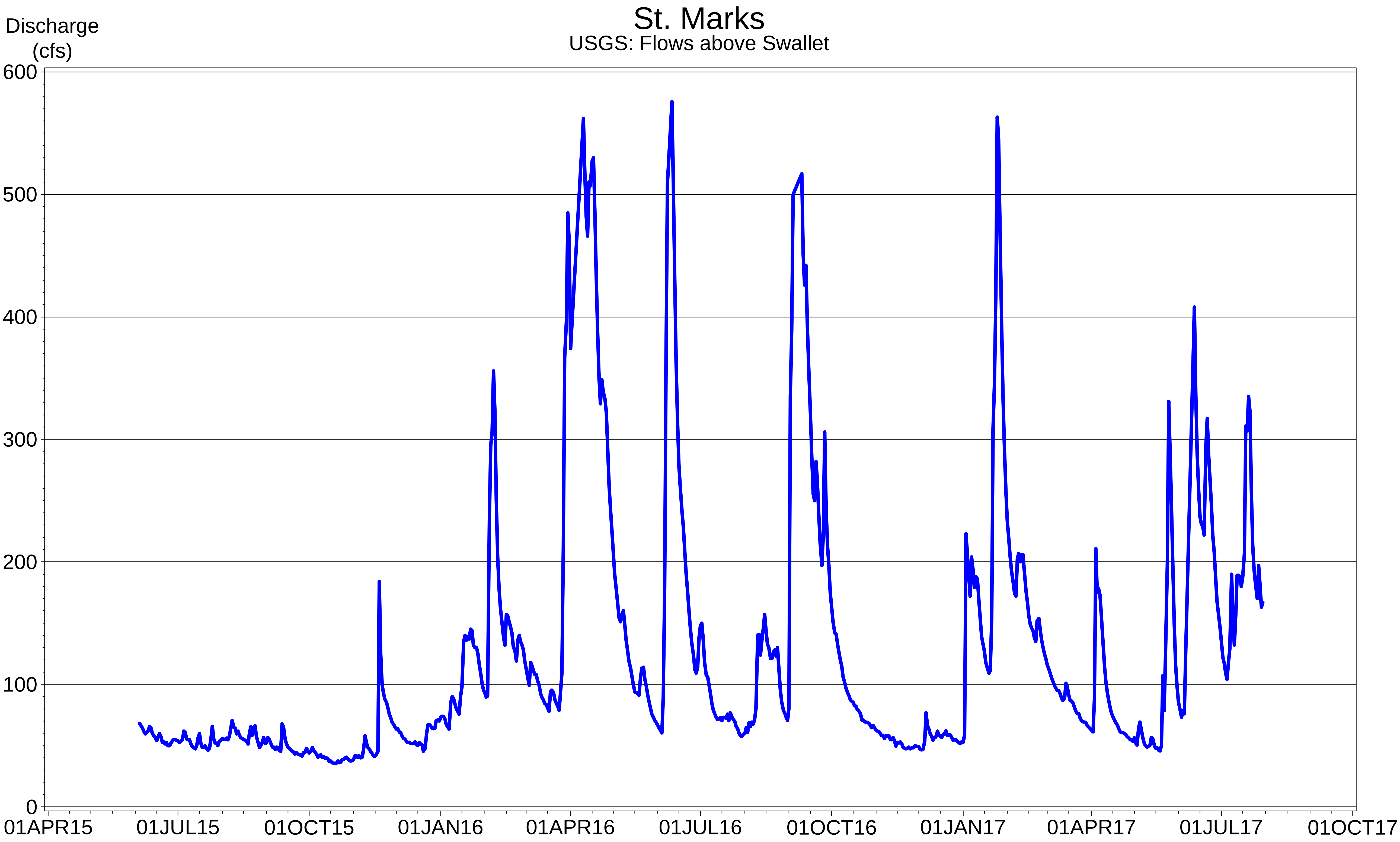


St. Marks
USGS St. Marks Newport: Elevations
Elevation
(Ft NGVD29)
14
13
12
11
10
9
8
7
6
5
4
01JAN55
01JAN60
01JAN65
01JAN70
01JAN75
01JAN80
01JAN85
01JAN90
01JAN95
01JAN00
01JAN05
01JAN10
01JAN15
01JAN20

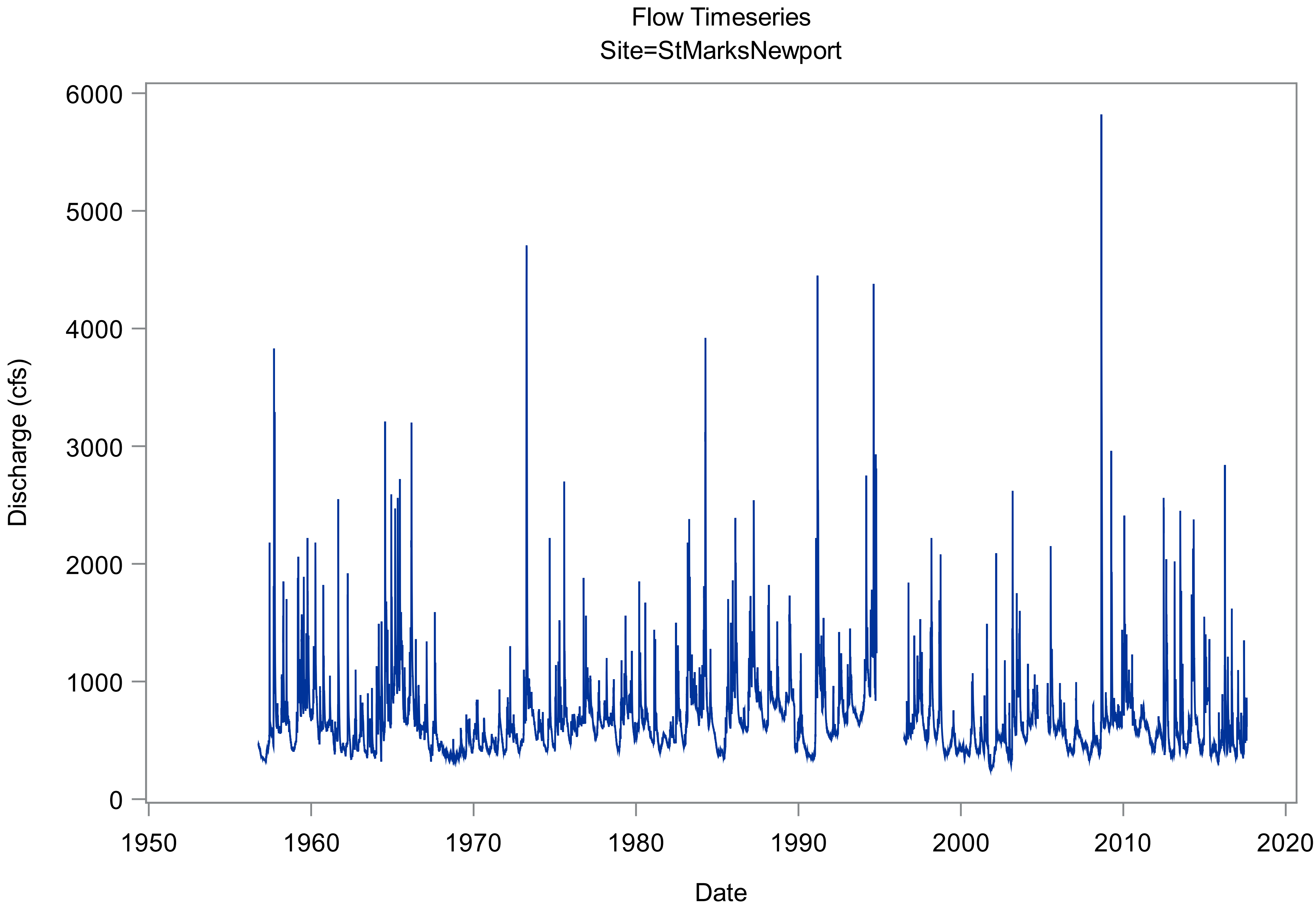

St. Marks
USGS St. Marks Newport: Discharge
Discharge
(cfs)
6000
5000
4000
3000
2000
1000
0
01JAN55
01JAN60
01JAN65
01JAN70
01JAN75
01JAN80
01JAN85
01JAN90
01JAN95
01JAN00
01JAN05
01JAN10
01JAN15
01JAN20



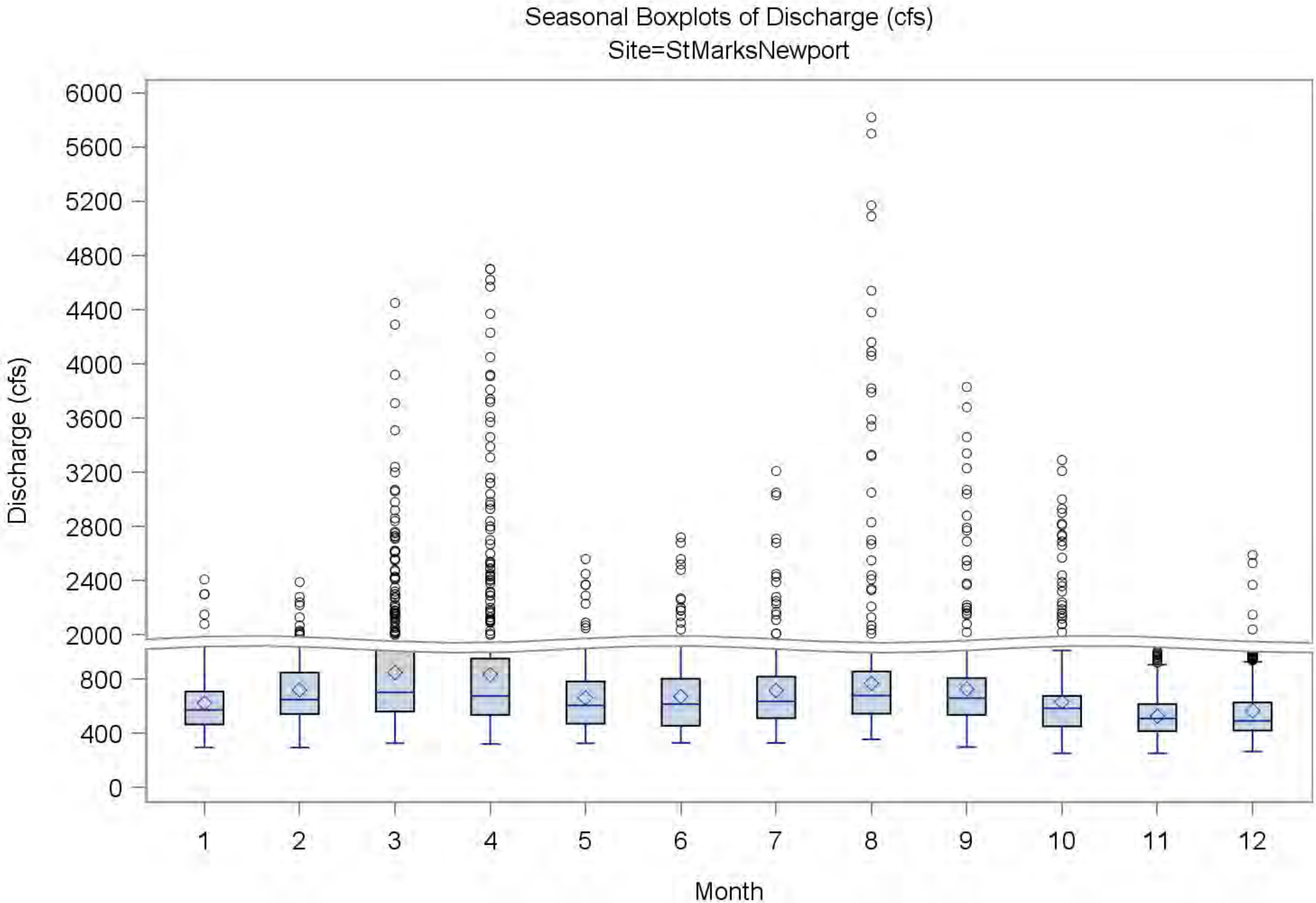
St. Marks
District Grabs: Flows above Swallet
Discharge
(cfs)
400
300
200
100
0
01JAN03
01JAN04
01JAN05
01JAN06
01JAN07
01JAN08
01JAN09
01JAN10
01JAN11
01JAN12
01JAN13
01JAN14
01JAN15


St. Marks
USGS: Flows above Swallet
Discharge
(cfs)
600
500
400
300
200
100
0
01APR15
01JUL15
01OCT15
01JAN16
01APR16
01JUL16
01OCT16
01JAN17
01APR17
01JUL17
01OCT17

ATTACHMENT 2
STREAMFLOW
DESCRIPTIVE STATISTICS AND PLOTS



Flow Timeseries
Site=StMarksNewport
Discharge (cfs)
0
1000
2000
3000
4000
5000
6000
1950
1960
1970
1980
1990
2000
2010
2020
Date



Seasonal Boxplots of Discharge (cfs)
Site=StMarksNewport
Discharge (cfs)
6000
5600
5200
4800
4400
4000
3600
3200
2800
2400
2000
800
400
0
1
2
3
4
5
6
7
8
9
10
11
12
Month

Beginning and End Dates for Discharge Stations

Obs	site	_TYPE_	_FREQ_	mindate	maxdate
1	StMarksNewport	0	22229	10/01/1956	08/10/2017

Check for Data Gaps in Discharge Timeseries

Site=StMarksNewport

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1956	.	.	.	.	.	.	.	.	.	31	30	31
1957	31	28	31	30	31	30	31	31	30	31	30	31
1958	31	28	31	30	31	30	31	31	30	31	30	31
1959	31	28	31	30	31	30	31	31	30	31	30	31
1960	31	29	31	30	31	30	31	31	30	31	30	31
1961	31	28	31	30	31	30	31	31	30	31	30	31
1962	31	28	31	30	31	30	31	31	30	31	30	31
1963	31	28	31	30	31	30	31	31	30	31	30	31
1964	31	29	31	30	31	30	31	31	30	31	30	31
1965	31	28	31	30	31	30	31	31	30	31	30	31
1966	31	28	31	30	31	30	31	31	30	31	30	31
1967	31	28	31	30	31	30	31	31	30	31	30	31
1968	31	29	31	30	31	30	31	31	30	31	30	31
1969	31	28	31	30	31	30	31	31	30	31	30	31
1970	31	28	31	30	31	30	31	31	30	31	30	31
1971	31	28	31	30	31	30	31	31	30	31	30	31
1972	31	29	31	30	31	30	31	31	30	31	30	31
1973	31	28	31	30	31	30	31	31	30	31	30	31
1974	31	28	31	30	31	30	31	31	30	31	30	31
1975	31	28	31	30	31	30	31	31	30	31	30	31
1976	31	29	31	30	31	30	31	31	30	31	30	31
1977	31	28	31	30	31	30	31	31	30	31	30	31
1978	31	28	31	30	31	30	31	31	30	31	30	31
1979	31	28	31	30	31	30	31	31	30	31	30	31

(Continued)

Check for Data Gaps in Discharge Timeseries

Site=StMarksNewport

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1980	31	29	31	30	31	30	31	31	30	31	30	31
1981	31	28	31	30	31	30	31	31	30	31	30	31
1982	31	28	31	30	31	30	31	31	30	31	30	31
1983	31	28	31	30	31	30	31	31	30	31	30	31
1984	31	29	31	30	31	30	31	31	30	31	30	31
1985	31	28	31	30	31	30	31	31	30	31	30	31
1986	31	28	31	30	31	30	31	31	30	31	30	31
1987	31	28	31	30	31	30	31	31	30	31	30	31
1988	31	29	31	30	31	30	31	31	30	31	30	31
1989	31	28	31	30	31	30	31	31	30	31	30	31
1990	31	28	31	30	31	30	31	31	30	31	30	31
1991	31	28	31	30	31	30	31	31	30	31	30	31
1992	31	29	31	30	31	30	31	31	30	31	30	31
1993	31	28	31	30	31	30	31	31	30	31	30	31
1994	31	28	31	30	31	30	31	31	30	25	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	31	31	30	31	30	31
1997	31	28	31	30	31	30	31	31	30	31	30	31
1998	31	28	31	30	31	30	31	31	30	31	30	31
1999	31	28	31	30	31	30	31	31	30	31	30	31
2000	31	29	31	30	31	30	31	31	30	31	30	31
2001	31	28	31	30	31	30	31	31	30	31	30	31
2002	31	28	31	30	31	30	31	31	30	31	30	31
2003	31	28	31	30	31	30	31	31	30	31	30	31

(Continued)

Check for Data Gaps in Discharge Timeseries

Site=StMarksNewport

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
2004	31	29	31	30	31	30	31	31	29	0	0	0
2005	0	0	0	1	31	30	31	31	30	31	30	31
2006	31	28	31	30	31	30	31	31	30	31	30	31
2007	31	28	31	30	31	30	31	31	30	31	30	31
2008	31	29	31	30	31	30	31	31	30	31	30	31
2009	31	28	31	30	31	30	31	31	30	31	30	31
2010	31	28	31	30	31	30	31	31	30	31	30	31
2011	31	28	31	30	31	30	31	31	30	31	30	31
2012	31	29	31	30	31	30	31	31	30	31	30	31
2013	31	28	31	30	31	30	31	31	30	31	30	31
2014	31	28	31	30	31	30	31	31	30	31	30	31
2015	31	28	31	30	31	30	31	31	30	31	30	31
2016	31	29	31	30	31	30	31	31	30	31	30	31
2017	31	28	31	30	31	30	31	10	.	.	.	.

Descriptive Statistics for Northwest Discharge Stations

The UNIVARIATE Procedure
Variable: qcfs (Discharge (cfs))

Site=StMarksNewport

Moments			
N	21403	**Sum Weights**	21403
Mean	690.059992	**Sum Observations**	14769354
Std Deviation	355.188876	**Variance**	126159.138
Skewness	3.68157328	**Kurtosis**	24.9388311
Uncorrected SS	1.28918E10	**Corrected SS**	2700057871
Coeff Variation	51.4721736	**Std Error Mean**	2.427851

Basic Statistical Measures			
Location		**Variability**	
Mean	690.0600	**Std Deviation**	355.18888
Median	611.0000	**Variance**	126159
Mode	415.0000	**Range**	5569
		Interquartile Range	309.00000

Note: The mode displayed is the smallest of 2 modes with a count of 120.

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	284.2267	**Pr > |t|**	<.0001
Sign	**M**	10701.5	**Pr >= |M|**	<.0001
Signed Rank	**S**	1.1453E8	**Pr >= |S|**	<.0001

Descriptive Statistics for Northwest Discharge Stations

The UNIVARIATE Procedure
Variable: qcfs (Discharge (cfs))

Site=StMarksNewport

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	5820
99%	2120
95%	1300
90%	1050
75% Q3	784
50% Median	611
25% Q1	475
10%	403
5%	376
1%	332
0% Min	251

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
251	16486	4700	6033
251	16485	5090	18956
251	16459	5170	18959
252	16484	5700	18958
252	16458	5820	18957

Descriptive Statistics for Northwest Discharge Stations

The UNIVARIATE Procedure
Variable: qcfs (Discharge (cfs))

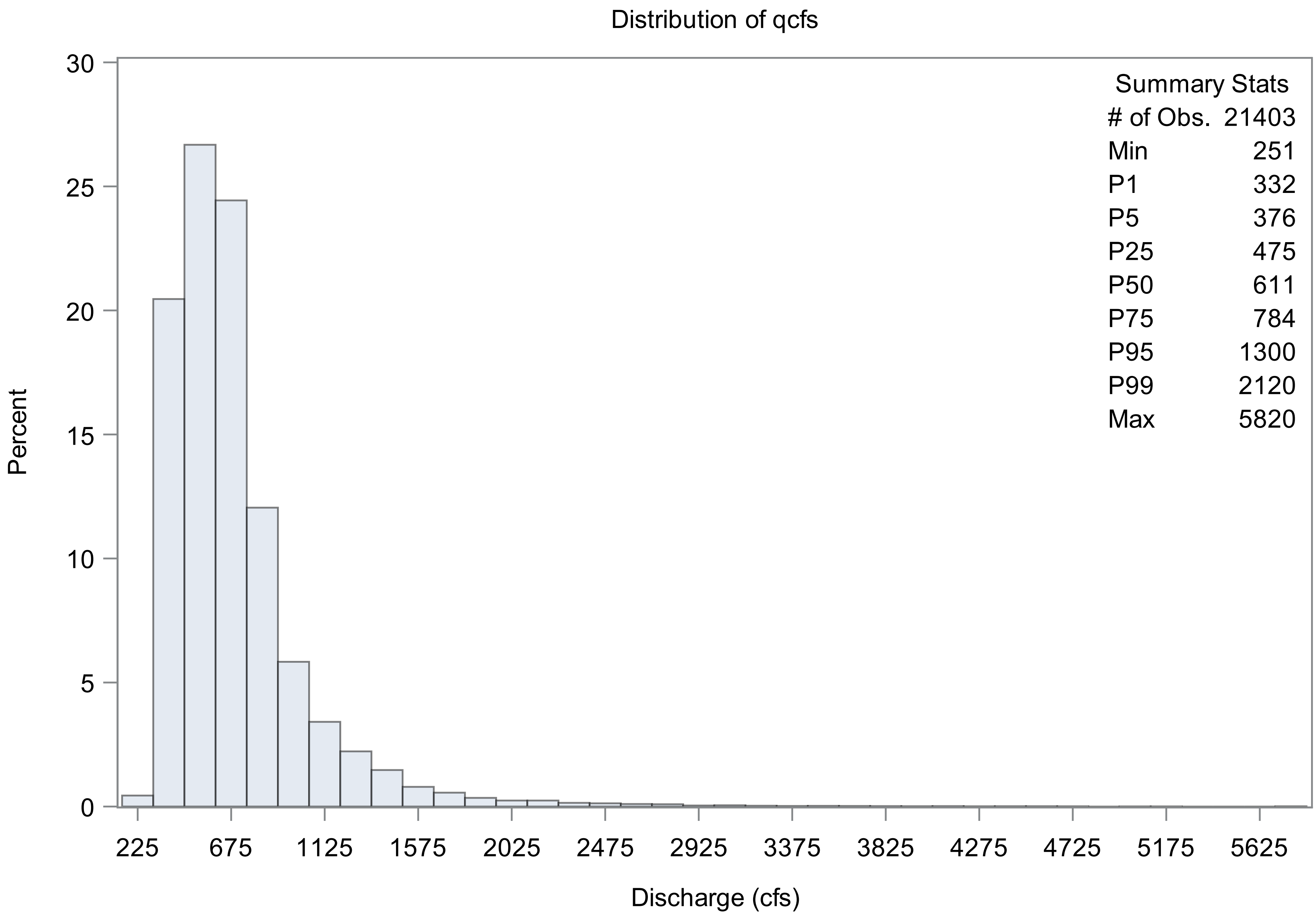
Site=StMarksNewport

Missing Values			
		Percent Of	
Missing Value	Count	All Obs	Missing Obs
.	826	3.72	100.00

Descriptive Statistics for Northwest Discharge Stations

The UNIVARIATE Procedure

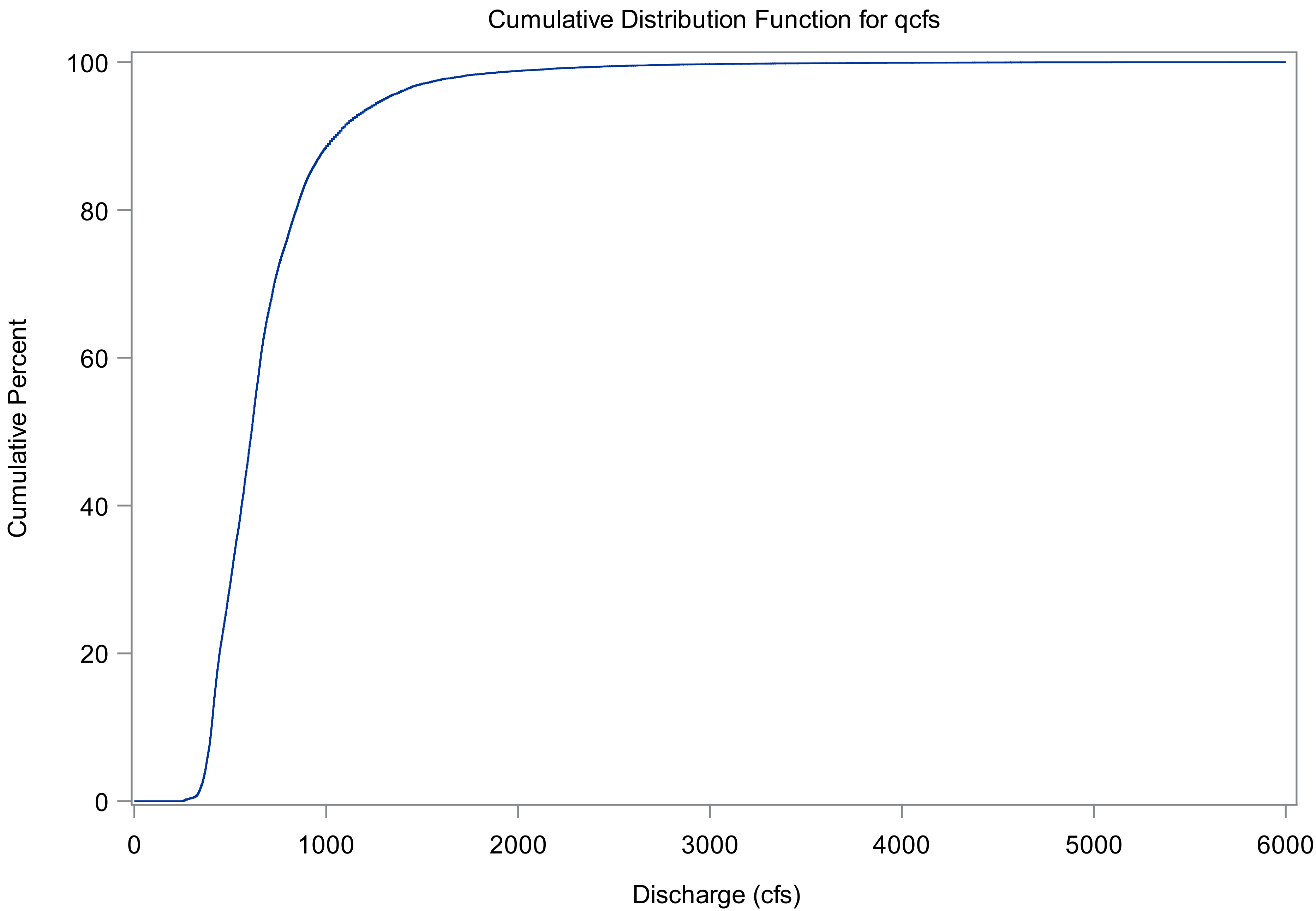
Site=StMarksNewport

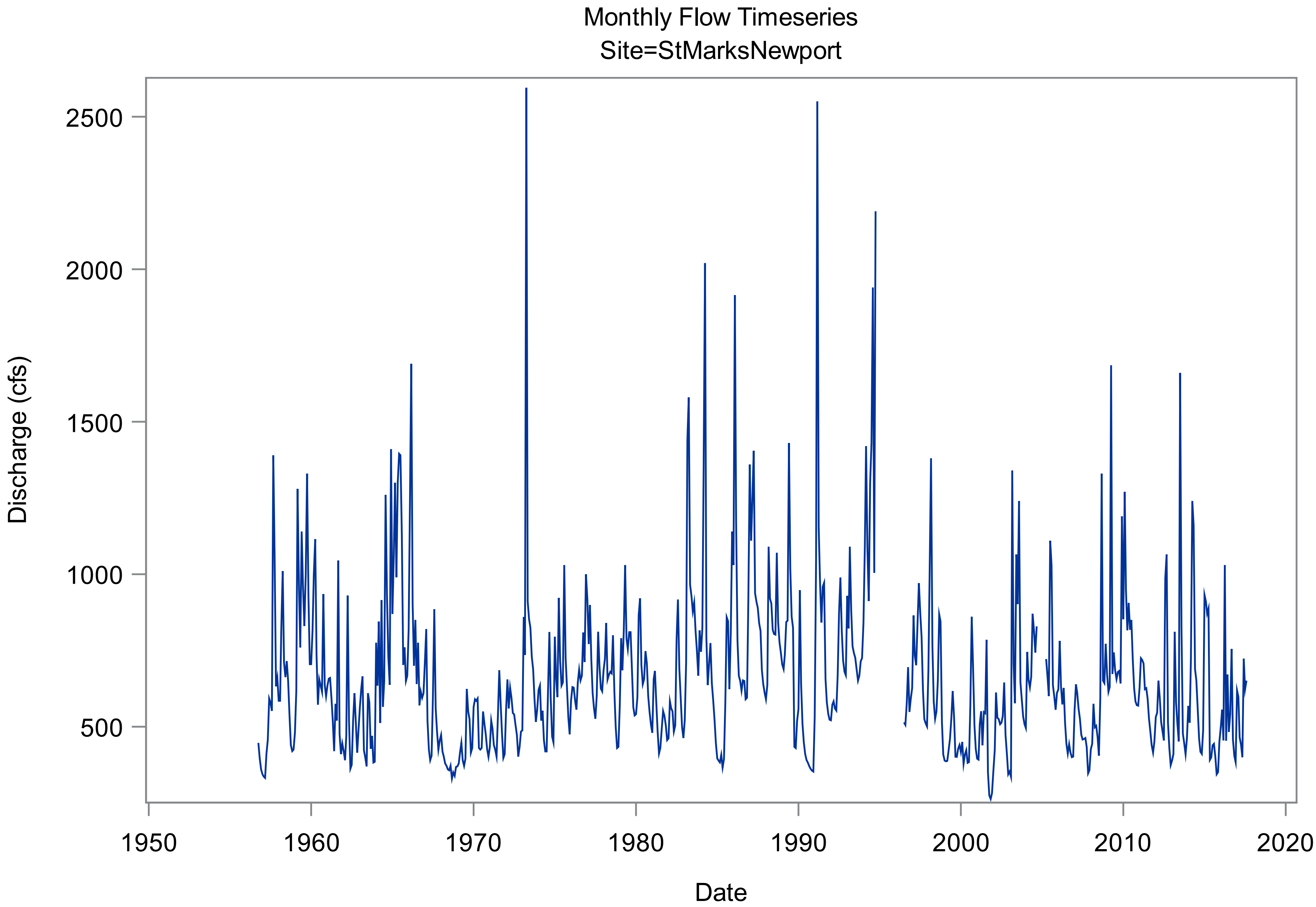


Descriptive Statistics for Northwest Discharge Stations

The UNIVARIATE Procedure

Site=StMarksNewport

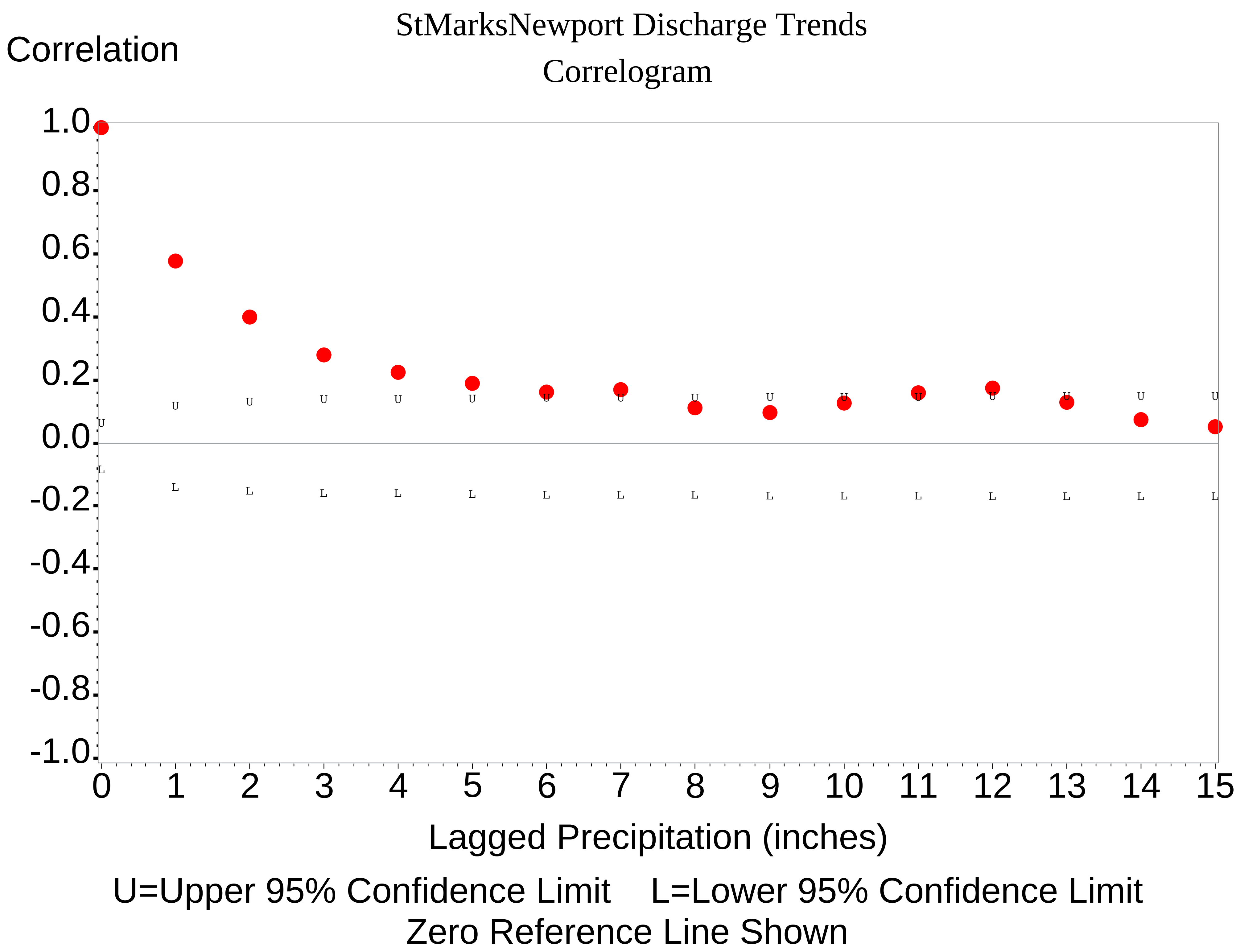



Monthly Flow Timeseries
Site=StMarksNewport
Discharge (cfs)
2500
2000
1500
1000
500
1950
1960
1970
1980
1990
2000
2010
2020
Date

StMarksNewport Discharge Trends

Autocorrelation Statistics

Lagged Precipitation (inches)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.037	0.074	-0.074
1	0.576	0.064	0.128	-0.128
2	0.398	0.071	0.142	-0.142
3	0.279	0.074	0.148	-0.148
4	0.224	0.075	0.150	-0.150
5	0.188	0.076	0.152	-0.152
6	0.162	0.077	0.154	-0.154
7	0.170	0.077	0.154	-0.154
8	0.111	0.078	0.155	-0.155
9	0.097	0.078	0.156	-0.156
10	0.127	0.078	0.156	-0.156
11	0.158	0.078	0.157	-0.157
12	0.173	0.079	0.158	-0.158
13	0.129	0.079	0.159	-0.159
14	0.073	0.080	0.159	-0.159
15	0.052	0.080	0.159	-0.159


StMarksNewport Discharge Trends
Correlogram
Correlation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Lagged Precipitation (inches)
U=Upper 95% Confidence Limit L=Lower 95% Confidence Limit
Zero Reference Line Shown

ATTACHMENT 3
EVAPOTRANSPIRATION
DESCRIPTIVE STATISTICS AND PLOTS

Beginning and End Dates for Evapotranspiration Station

Obs	station	_TYPE_	_FREQ_	mindate	maxdate
1	Monticello	0	5241	04/23/2003	08/30/2017

Check for Data Gaps in ET Timeseries

Station=Monticello

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
2003	.	.	.	8	30	30	11	29	25	28	27	22
2004	2	21	0	4	28	1	2	1	0	0	0	0
2005	0	0	0	0	0	20	31	26	29	29	30	30
2006	29	27	21	29	30	27	31	30	30	28	28	31
2007	30	28	31	30	31	26	31	31	30	31	30	31
2008	30	26	28	28	30	29	28	28	29	30	30	30
2009	29	21	30	29	31	29	31	31	29	31	30	31
2010	31	28	31	30	31	30	31	31	30	31	30	31
2011	31	28	31	30	31	30	31	31	30	31	30	31
2012	31	29	31	30	26	29	30	30	29	31	30	30
2013	30	28	31	30	31	30	31	28	26	30	30	31
2014	31	28	31	30	31	30	28	31	30	31	30	31
2015	31	28	31	30	31	30	31	31	30	31	30	31
2016	31	29	31	30	31	30	31	31	28	31	30	31
2017	30	28	31	30	31	30	31	30	.	.	.	.

Descriptive Statistics for Daily Northwest Evapotranspiration

The UNIVARIATE Procedure
Variable: etin (Evapotransipation (inches))

Station=Monticello

Moments			
N	4637	**Sum Weights**	4637
Mean	0.10978434	**Sum Observations**	509.07
Std Deviation	0.04998918	**Variance**	0.00249892
Skewness	0.23341377	**Kurtosis**	-1.1723976
Uncorrected SS	67.4729	**Corrected SS**	11.5849843
Coeff Variation	45.5339791	**Std Error Mean**	0.0007341

Basic Statistical Measures			
Location		**Variability**	
Mean	0.109784	**Std Deviation**	0.04999
Median	0.100000	**Variance**	0.00250
Mode	0.060000	**Range**	0.21000
		Interquartile Range	0.09000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	149.5488	**Pr > |t|**	<.0001
Sign	**M**	2318.5	**Pr >= |M|**	<.0001
Signed Rank	**S**	5376602	**Pr >= |S|**	<.0001

Descriptive Statistics for Daily Northwest Evapotranspiration

The UNIVARIATE Procedure
Variable: etin (Evapotransipation (inches))

Station=Monticello

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	0.23
99%	0.21
95%	0.19
90%	0.18
75% Q3	0.15
50% Median	0.10
25% Q1	0.06
10%	0.05
5%	0.04
1%	0.03
0% Min	0.02

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
0.02	3910	0.22	2982
0.03	5008	0.22	4435
0.03	5007	0.23	2252
0.03	4978	0.23	2974
0.03	4977	0.23	2975

Descriptive Statistics for Daily Northwest Evapotranspiration

The UNIVARIATE Procedure
Variable: etin (Evapotransipation (inches))

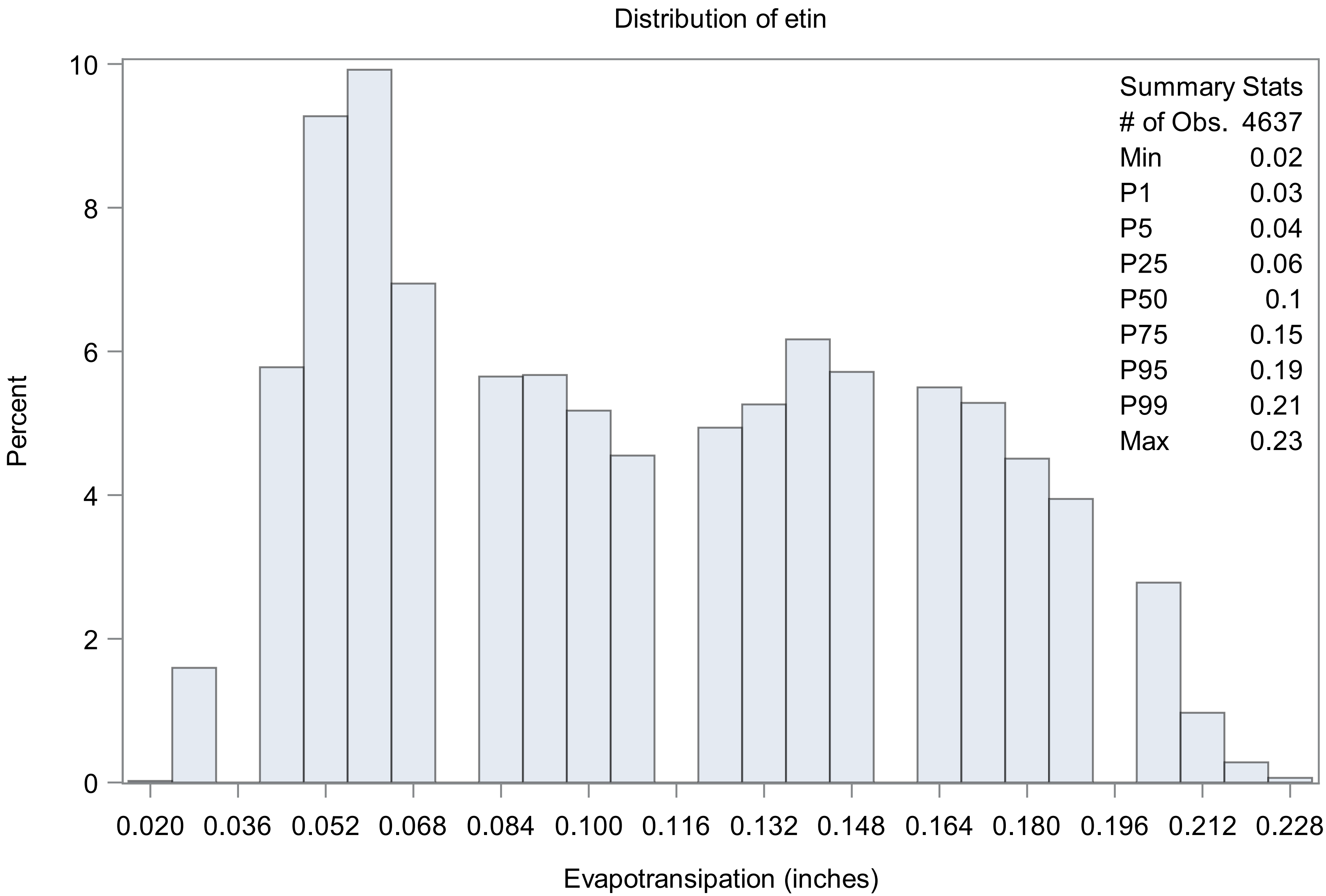
Station=Monticello

Missing Values			
		Percent Of	
Missing Value	Count	All Obs	Missing Obs
.	604	11.52	100.00

Descriptive Statistics for Daily Northwest Evapotranspiration

The UNIVARIATE Procedure

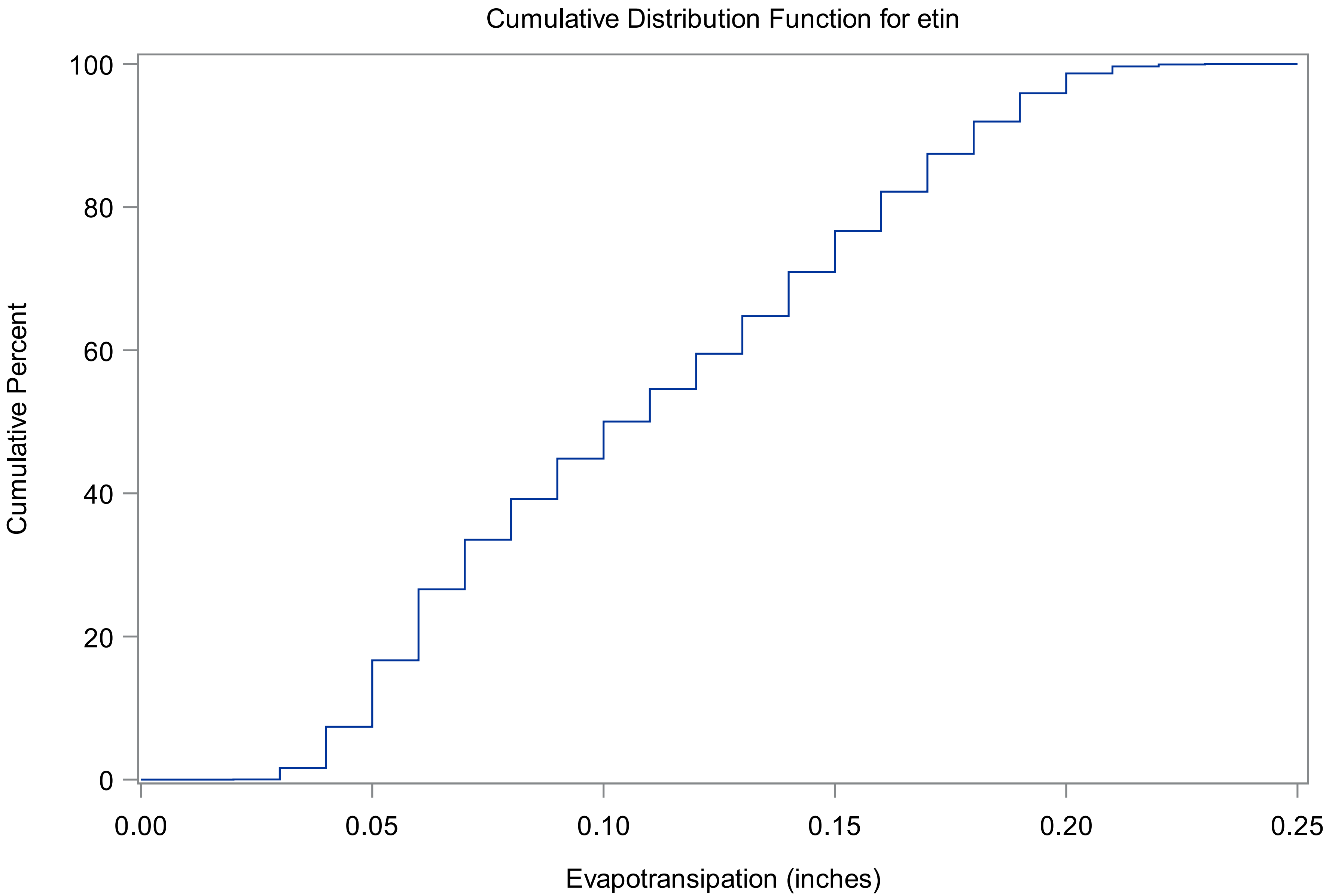
Station=Monticello

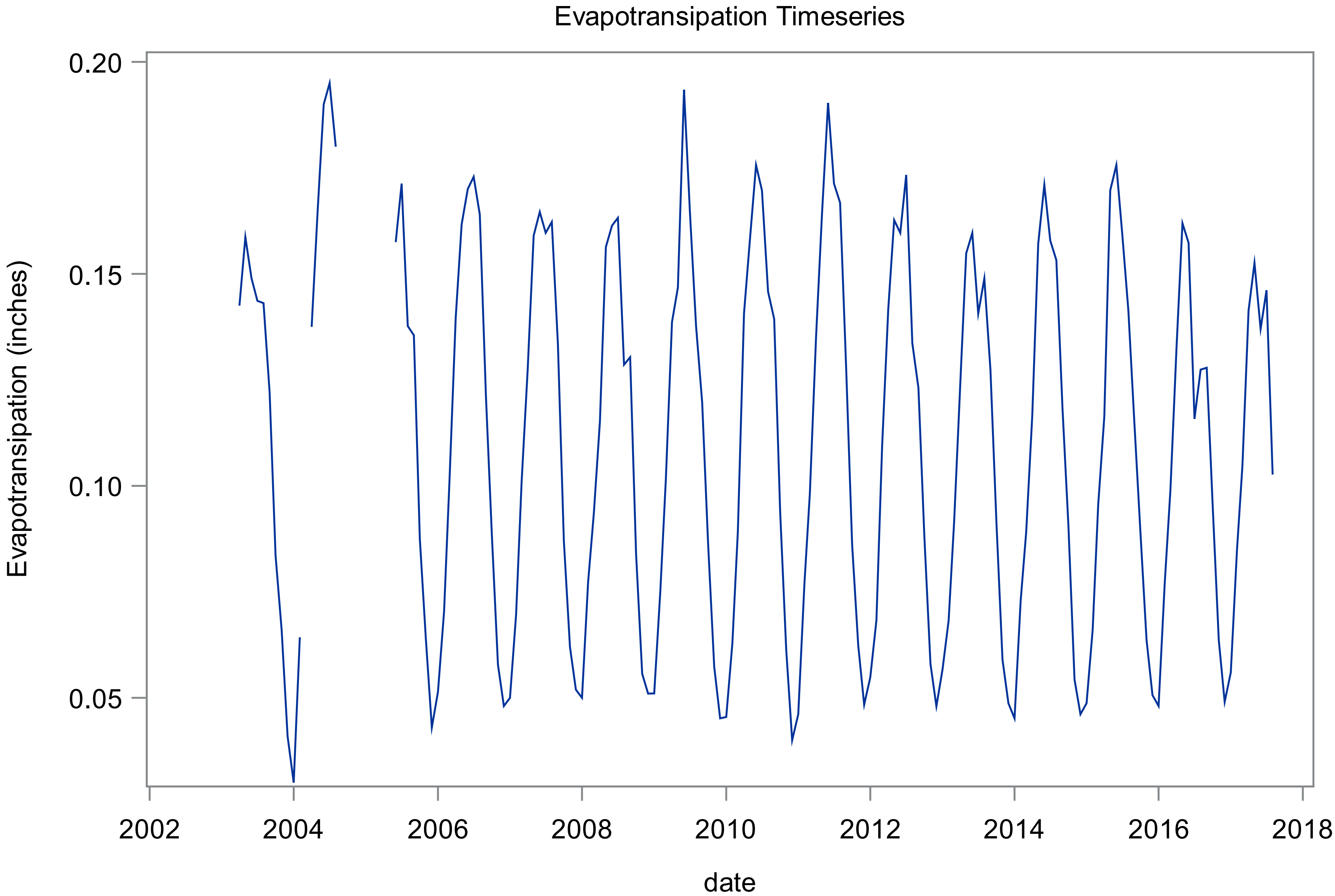


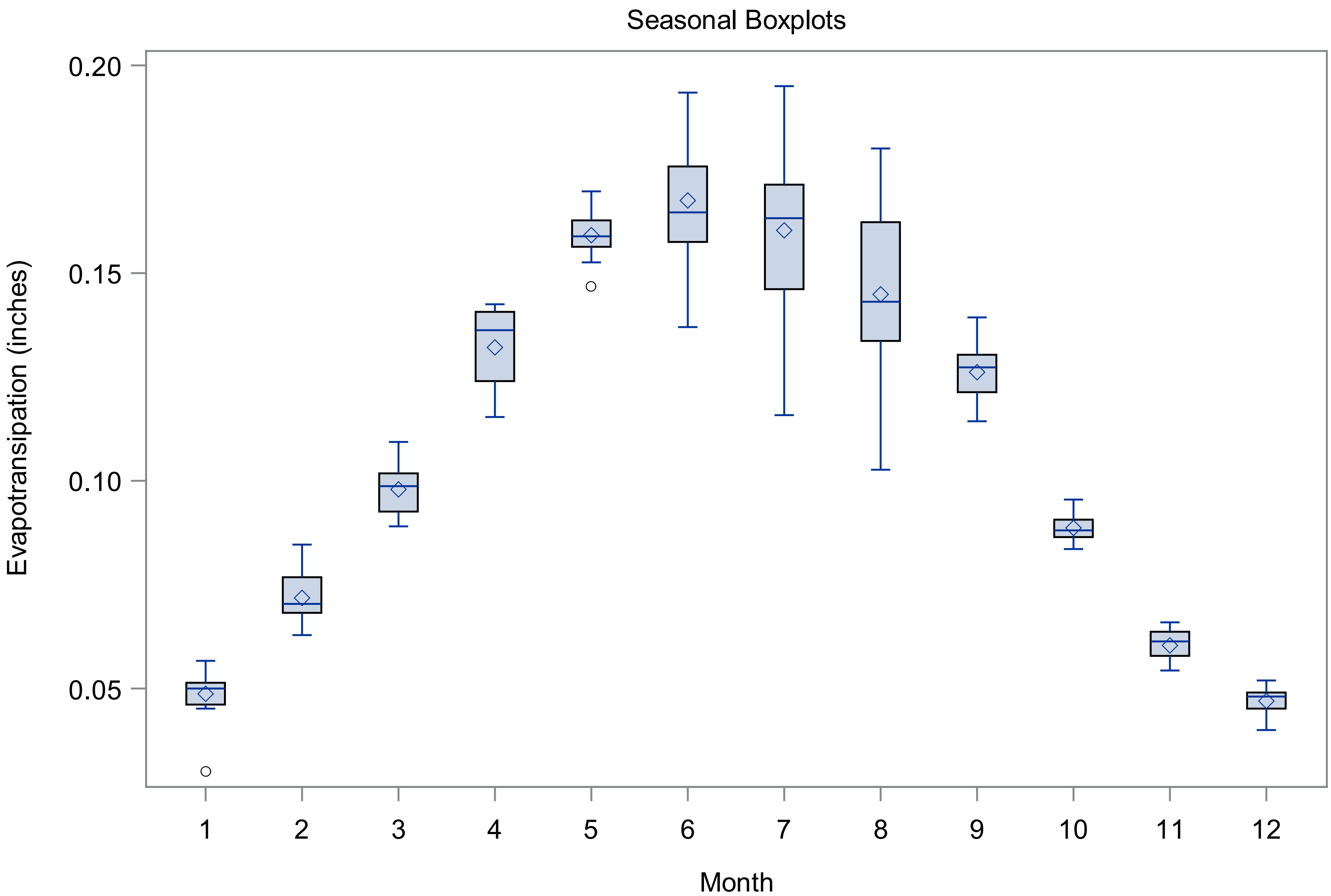
Descriptive Statistics for Daily Northwest Evapotranspiration

The UNIVARIATE Procedure

Station=Monticello



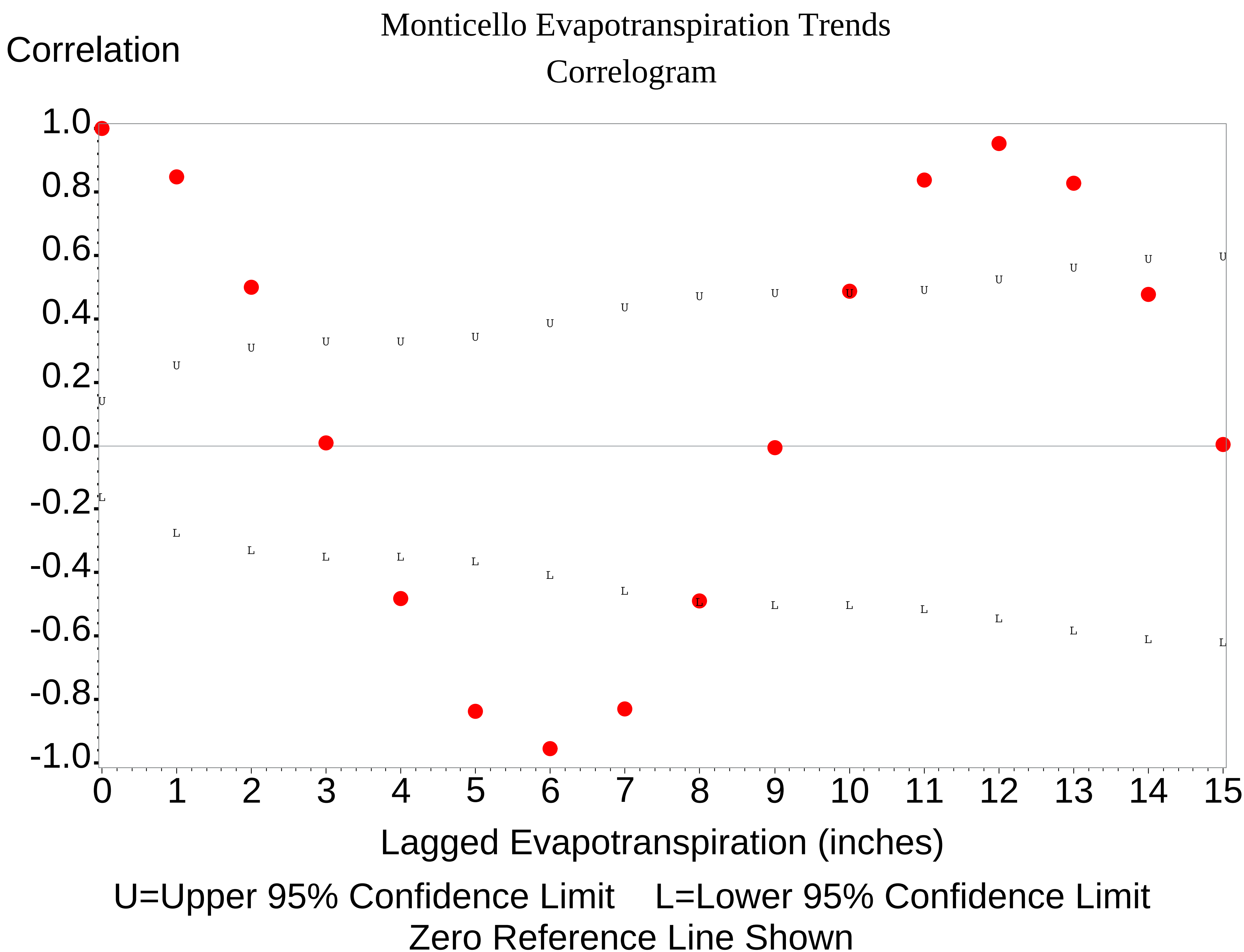

Evapotransipation Timeseries
Evapotransipation (inches)
0.20
0.15
0.10
0.05
2002
2004
2006
2008
2010
2012
2014
2016
2018
date


Seasonal Boxplots
Evapotransipation (inches)
0.20
0.15
0.10
0.05
1
2
3
4
5
6
7
8
9
10
11
12
Month

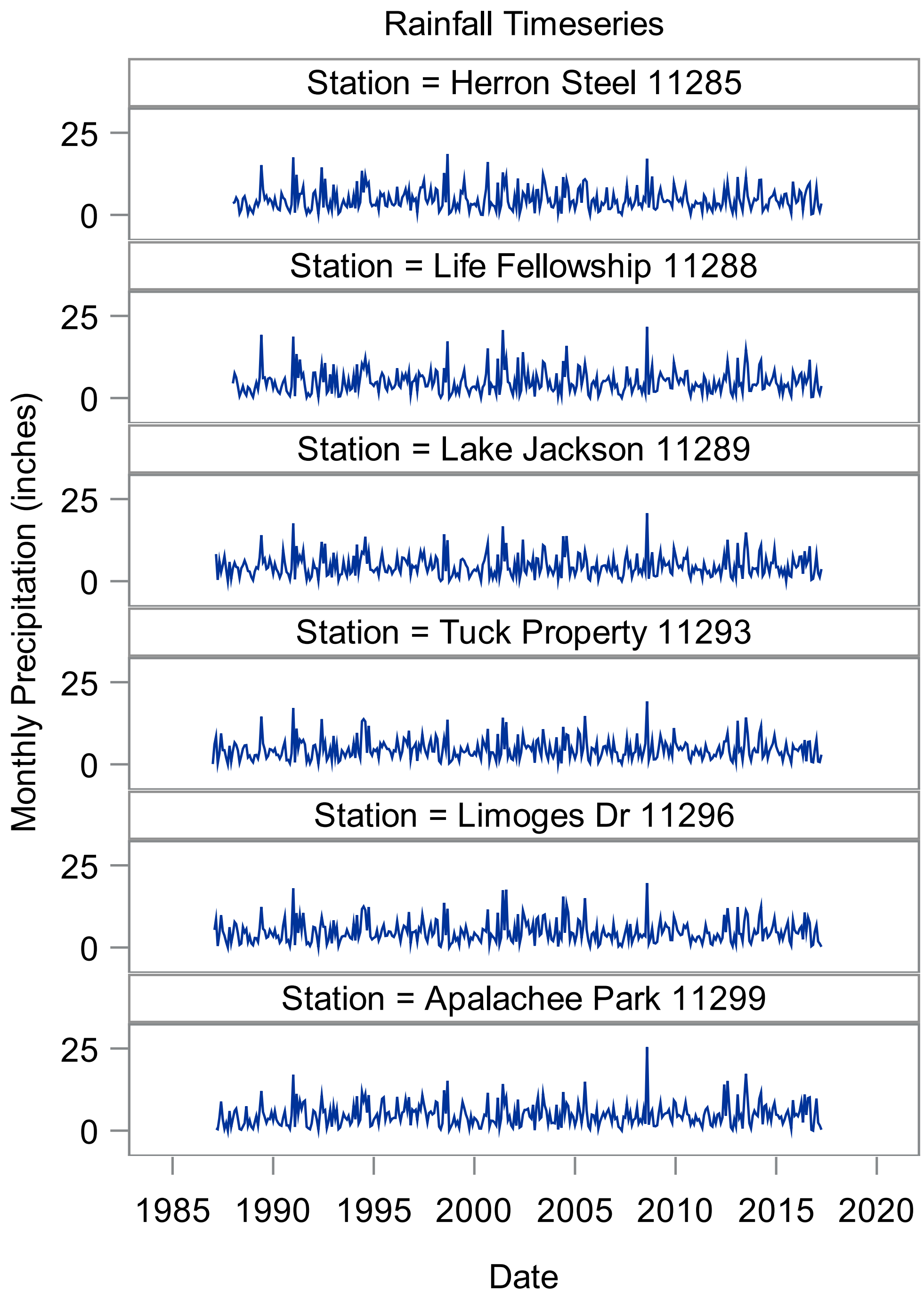
Monticello Evapotranspiration Trends

Autocorrelation Statistics

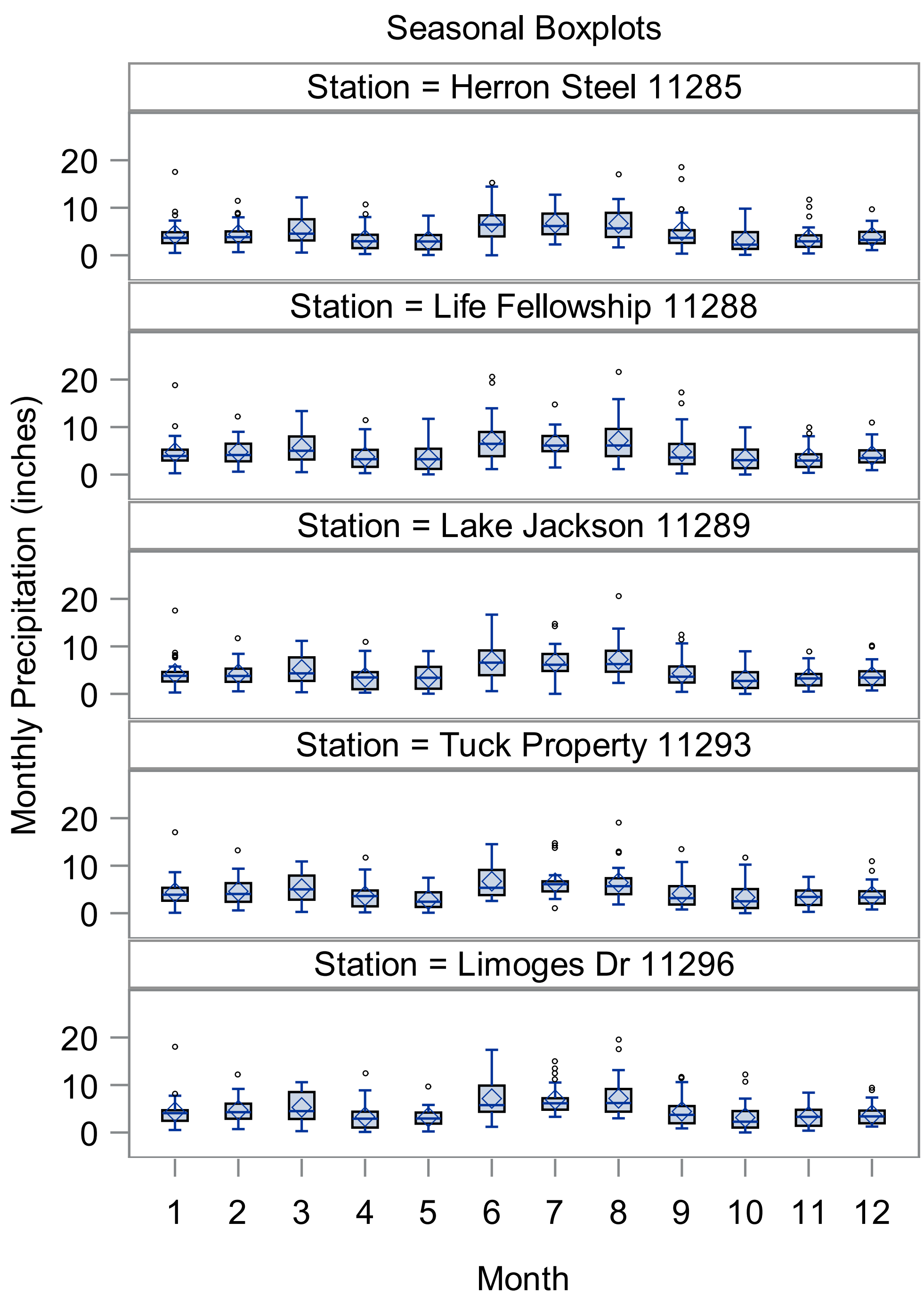
Lagged Evapotranspiration (inches)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.076	0.152	-0.152
1	0.846	0.132	0.263	-0.263
2	0.499	0.160	0.320	-0.320
3	0.010	0.169	0.338	-0.338
4	-0.482	0.169	0.338	-0.338
5	-0.837	0.177	0.353	-0.353
6	-0.955	0.198	0.396	-0.396
7	-0.829	0.223	0.446	-0.446
8	-0.489	0.240	0.481	-0.481
9	-0.005	0.246	0.492	-0.492
10	0.486	0.246	0.492	-0.492
11	0.837	0.252	0.503	-0.503
12	0.951	0.267	0.534	-0.534
13	0.827	0.286	0.572	-0.572
14	0.476	0.300	0.599	-0.599
15	0.003	0.304	0.608	-0.608


Monticello Evapotranspiration Trends
Correlogram
Correlation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Lagged Evapotranspiration (inches)
U=Upper 95% Confidence Limit
L=Lower 95% Confidence Limit
Zero Reference Line Shown

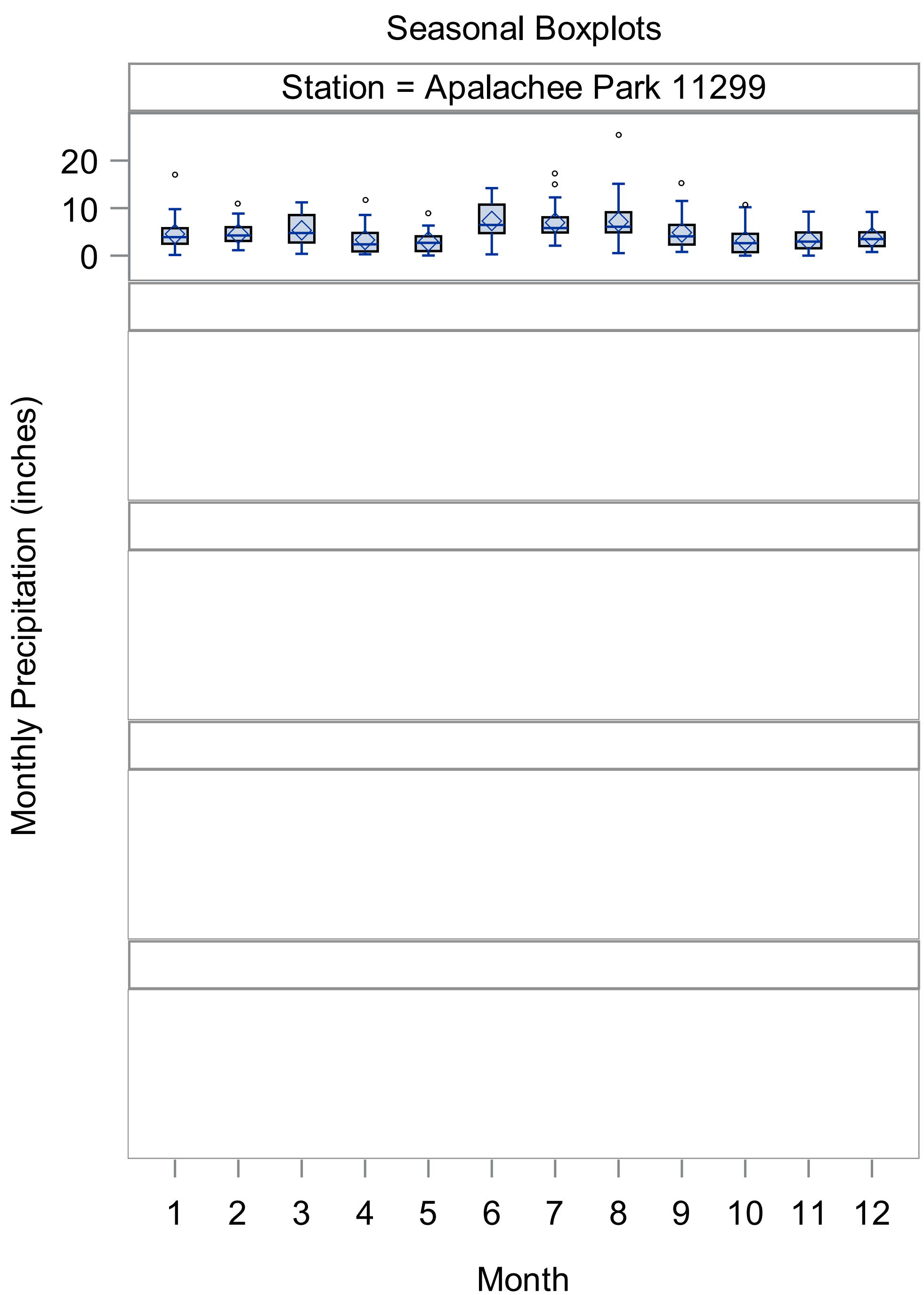
ATTACHMENT 4
DISTRICT RAINFALL
DESCRIPTIVE STATISTICS AND PLOTS



Rainfall Timeseries
Station = Herron Steel 11285
Station = Life Fellowship 11288
Station = Lake Jackson 11289
Station = Tuck Property 11293
Station = Limoges Dr 11296
Station = Apalachee Park 11299
Monthly Precipitation (inches)
25
0
1985
1990
1995
2000
2005
2010
2015
2020
Date


Seasonal Boxplots
Station = Herron Steel 11285
Station = Life Fellowship 11288
Station = Lake Jackson 11289
Station = Tuck Property 11293
Station = Limoges Dr 11296
Monthly Precipitation (inches)
0
10
20
1
2
3
4
5
6
7
8
9
10
11
12
Month

Seasonal Boxplots


Seasonal Boxplots
Station = Apalachee Park 11299
20
10
0
Monthly Precipitation (inches)
1
2
3
4
5
6
7
8
9
10
11
12
Month

Beginning and End Dates for Rainfall Stations

Obs	station	Nobs	mindate	maxdate
1	Herron Steel 11285	352	01/01/1988	04/01/2017
2	Life Fellowship 11288	352	01/01/1988	04/01/2017
3	Lake Jackson 11289	362	03/01/1987	04/01/2017
4	Tuck Property 11293	364	01/01/1987	04/01/2017
5	Limoges Dr 11296	363	02/01/1987	04/01/2017
6	Apalachee Park 11299	361	03/01/1987	04/01/2017

Check for Data Gaps in Rainfall Timeseries

Station=Herron Steel 11285

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1988	1	1	1	1	1	1	1	1	1	1	1	1
1989	1	1	1	1	1	1	1	1	1	1	1	1
1990	1	1	1	1	1	1	1	1	1	1	1	1
1991	1	1	1	1	1	1	1	1	1	1	1	1
1992	1	1	1	1	1	1	1	1	1	1	1	1
1993	1	1	1	1	1	1	1	1	1	1	1	1
1994	1	1	1	1	1	1	1	1	1	1	1	1
1995	1	1	1	1	1	1	1	1	1	1	1	1
1996	1	1	1	1	1	1	1	1	1	1	1	1
1997	1	1	1	1	1	1	1	1	1	1	1	1
1998	1	1	1	1	1	1	1	1	1	1	1	1
1999	1	1	1	1	1	1	1	1	1	1	1	1
2000	1	1	1	1	1	1	1	1	1	1	1	1
2001	1	1	1	1	1	1	1	1	1	1	1	1
2002	1	1	1	1	1	1	1	1	1	1	1	1
2003	1	1	1	1	1	1	1	1	1	1	1	1
2004	1	1	1	1	1	1	1	1	1	1	1	1
2005	1	1	1	1	1	1	1	1	1	1	1	1
2006	1	1	1	1	1	1	1	1	1	1	1	1
2007	1	1	1	1	1	1	1	1	1	1	1	1
2008	1	1	1	1	1	1	1	1	1	1	1	1
2009	1	1	1	1	1	1	1	1	1	1	1	1

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=Herron Steel 11285

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
2010	1	1	1	1	1	1	1	1	1	1	1	1
2011	1	1	1	1	1	1	1	1	1	1	1	1
2012	1	1	1	1	1	1	1	1	1	1	1	1
2013	1	1	1	1	1	1	1	1	1	1	1	1
2014	1	1	1	1	1	1	1	1	1	1	1	1
2015	1	1	1	1	1	1	1	1	1	1	1	1
2016	1	1	1	1	1	1	1	1	1	1	1	1
2017	1	1	1	1	.	.	.	.	.	.	.	.

Check for Data Gaps in Rainfall Timeseries

Station=Life Fellowship 11288

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1988	1	1	1	1	1	1	1	1	1	1	1	1
1989	1	1	1	1	1	1	1	1	1	1	1	1
1990	1	1	1	1	1	1	1	1	1	1	1	1
1991	1	1	1	1	1	1	1	1	1	1	1	1
1992	1	1	1	1	1	1	1	1	1	1	1	1
1993	1	1	1	1	1	1	1	1	1	1	1	1
1994	1	1	1	1	1	1	1	1	1	1	1	1
1995	1	1	1	1	1	1	1	1	1	1	1	1
1996	1	1	1	1	1	1	1	1	1	1	1	1
1997	1	1	1	1	1	1	1	1	1	1	1	1
1998	1	1	1	1	1	1	1	1	1	1	1	1
1999	1	1	1	1	1	1	1	1	1	1	1	1
2000	1	1	1	1	1	1	1	1	1	1	1	1
2001	1	1	1	1	1	1	1	1	1	1	1	1
2002	1	1	1	1	1	1	1	1	1	1	1	1
2003	1	1	1	1	1	1	1	1	1	1	1	1
2004	1	1	1	1	1	1	1	1	1	1	1	1
2005	1	1	1	1	1	1	1	1	1	1	1	1
2006	1	1	1	1	1	1	1	1	1	1	1	1
2007	1	1	1	1	1	1	1	1	1	1	1	1
2008	1	1	1	1	1	1	1	1	1	1	1	1
2009	1	1	1	1	1	1	1	1	1	1	1	1

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=Life Fellowship 11288

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
2010	1	1	1	1	1	1	1	1	1	1	1	1
2011	1	1	1	1	1	1	1	1	1	1	1	1
2012	1	1	1	1	1	1	1	1	1	1	1	1
2013	1	1	1	1	1	1	1	1	1	1	1	1
2014	1	1	1	1	1	1	1	1	1	1	1	1
2015	1	1	1	1	1	1	1	1	1	1	1	1
2016	1	1	1	1	1	1	1	1	1	1	1	1
2017	1	1	1	1	.	.	.	.	.	.	.	.

Check for Data Gaps in Rainfall Timeseries

Station=Lake Jackson 11289

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1987	.	.	1	1	1	1	1	1	1	1	1	1
1988	1	1	1	1	1	1	1	1	1	1	1	1
1989	1	1	1	1	1	1	1	1	1	1	1	1
1990	1	1	1	1	1	1	1	1	1	1	1	1
1991	1	1	1	1	1	1	1	1	1	1	1	1
1992	1	1	1	1	1	1	1	1	1	1	1	1
1993	1	1	1	1	1	1	1	1	1	1	1	1
1994	1	1	1	1	1	1	1	1	1	1	1	1
1995	1	1	1	1	1	1	1	1	1	1	1	1
1996	1	1	1	1	1	1	1	1	1	1	1	1
1997	1	1	1	1	1	1	1	1	1	1	1	1
1998	1	1	1	1	1	1	1	1	1	1	1	1
1999	1	1	1	1	1	1	1	1	1	1	1	1
2000	1	1	1	1	1	1	1	1	1	1	1	1
2001	1	1	1	1	1	1	1	1	1	1	1	1
2002	1	1	1	1	1	1	1	1	1	1	1	1
2003	1	1	1	1	1	1	1	1	1	1	1	1
2004	1	1	1	1	1	1	1	1	1	1	1	1
2005	1	1	1	1	1	1	1	1	1	1	1	1
2006	1	1	1	1	1	1	1	1	1	1	1	1
2007	1	1	1	1	1	1	1	1	1	1	1	1
2008	1	1	1	1	1	1	1	1	1	1	1	1

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=Lake Jackson 11289

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
2009	1	1	1	1	1	1	1	1	1	1	1	1
2010	1	1	1	1	1	1	1	1	1	1	1	1
2011	1	1	1	1	1	1	1	1	1	1	1	1
2012	1	1	1	1	1	1	1	1	1	1	1	1
2013	1	1	1	1	1	1	1	1	1	1	1	1
2014	1	1	1	1	1	1	1	1	1	1	1	1
2015	1	1	1	1	1	1	1	1	1	1	1	1
2016	1	1	1	1	1	1	1	1	1	1	1	1
2017	1	1	1	1	.	.	.	.	.	.	.	.

Check for Data Gaps in Rainfall Timeseries

Station=Tuck Property 11293

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1987	1	1	1	1	1	1	1	1	1	1	1	1
1988	1	1	1	1	1	1	1	1	1	1	1	1
1989	1	1	1	1	1	1	1	1	1	1	1	1
1990	1	1	1	1	1	1	1	1	1	1	1	1
1991	1	1	1	1	1	1	1	1	1	1	1	1
1992	1	1	1	1	1	1	1	1	1	1	1	1
1993	1	1	1	1	1	1	1	1	1	1	1	1
1994	1	1	1	1	1	1	1	1	1	1	1	1
1995	1	1	1	1	1	1	1	1	1	1	1	1
1996	1	1	1	1	1	1	1	1	1	1	1	1
1997	1	1	1	1	1	1	1	1	1	1	1	1
1998	1	1	1	1	1	1	1	1	1	1	1	1
1999	1	1	1	1	1	1	1	1	1	1	1	1
2000	1	1	1	1	1	1	1	1	1	1	1	1
2001	1	1	1	1	1	1	1	1	1	1	1	1
2002	1	1	1	1	1	1	1	1	1	1	1	1
2003	1	1	1	1	1	1	1	1	1	1	1	1
2004	1	1	1	1	1	1	1	1	1	1	1	1
2005	1	1	1	1	1	1	1	1	1	1	1	1
2006	1	1	1	1	1	1	1	1	1	1	1	1
2007	1	1	1	1	1	1	1	1	1	1	1	1
2008	1	1	1	1	1	1	1	1	1	1	1	1

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=Tuck Property 11293

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
2009	1	1	1	1	1	1	1	1	1	1	1	1
2010	1	1	1	1	1	1	1	1	1	1	1	1
2011	1	1	1	1	1	1	1	1	1	1	1	1
2012	1	1	1	1	1	1	1	1	1	1	1	1
2013	1	1	1	1	1	1	1	1	1	1	1	1
2014	1	1	1	1	1	1	1	1	1	1	1	1
2015	1	1	1	1	1	1	1	1	1	1	1	1
2016	1	1	1	1	1	1	1	1	1	1	1	1
2017	1	1	1	1	.	.	.	.	.	.	.	.

Check for Data Gaps in Rainfall Timeseries

Station=Limoges Dr 11296

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1987	.	1	1	1	1	1	1	1	1	1	1	1
1988	1	1	1	1	1	1	1	1	1	1	1	1
1989	1	1	1	1	1	1	1	1	1	1	1	1
1990	1	1	1	1	1	1	1	1	1	1	1	1
1991	1	1	1	1	1	1	1	1	1	1	1	1
1992	1	1	1	1	1	1	1	1	1	1	1	1
1993	1	1	1	1	1	1	1	1	1	1	1	1
1994	1	1	1	1	1	1	1	1	1	1	1	1
1995	1	1	1	1	1	1	1	1	1	1	1	1
1996	1	1	1	1	1	1	1	1	1	1	1	1
1997	1	1	1	1	1	1	1	1	1	1	1	1
1998	1	1	1	1	1	1	1	1	1	1	1	1
1999	1	1	1	1	1	1	1	1	1	1	1	1
2000	1	1	1	1	1	1	1	1	1	1	1	1
2001	1	1	1	1	1	1	1	1	1	1	1	1
2002	1	1	1	1	1	1	1	1	1	1	1	1
2003	1	1	1	1	1	1	1	1	1	1	1	1
2004	1	1	1	1	1	1	1	1	1	1	1	1
2005	1	1	1	1	1	1	1	1	1	1	1	1
2006	1	1	1	1	1	1	1	1	1	1	1	1
2007	1	1	1	1	1	1	1	1	1	1	1	1
2008	1	1	1	1	1	1	1	1	1	1	1	1

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=Limoges Dr 11296

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
2009	1	1	1	1	1	1	1	1	1	1	1	1
2010	1	1	1	1	1	1	1	1	1	1	1	1
2011	1	1	1	1	1	1	1	1	1	1	1	1
2012	1	1	1	1	1	1	1	1	1	1	1	1
2013	1	1	1	1	1	1	1	1	1	1	1	1
2014	1	1	1	1	1	1	1	1	1	1	1	1
2015	1	1	1	1	1	1	1	1	1	1	1	1
2016	1	1	1	1	1	1	1	1	1	1	1	1
2017	1	1	1	1	.	.	.	.	.	.	.	.

Check for Data Gaps in Rainfall Timeseries

Station=Apalachee Park 11299

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1987	.	.	1	1	1	1	1	1	1	1	1	1
1988	1	1	1	1	1	1	.	1	1	1	1	1
1989	1	1	1	1	1	1	1	1	1	1	1	1
1990	1	1	1	1	1	1	1	1	1	1	1	1
1991	1	1	1	1	1	1	1	1	1	1	1	1
1992	1	1	1	1	1	1	1	1	1	1	1	1
1993	1	1	1	1	1	1	1	1	1	1	1	1
1994	1	1	1	1	1	1	1	1	1	1	1	1
1995	1	1	1	1	1	1	1	1	1	1	1	1
1996	1	1	1	1	1	1	1	1	1	1	1	1
1997	1	1	1	1	1	1	1	1	1	1	1	1
1998	1	1	1	1	1	1	1	1	1	1	1	1
1999	1	1	1	1	1	1	1	1	1	1	1	1
2000	1	1	1	1	1	1	1	1	1	1	1	1
2001	1	1	1	1	1	1	1	1	1	1	1	1
2002	1	1	1	1	1	1	1	1	1	1	1	1
2003	1	1	1	1	1	1	1	1	1	1	1	1
2004	1	1	1	1	1	1	1	1	1	1	1	1
2005	1	1	1	1	1	1	1	1	1	1	1	1
2006	1	1	1	1	1	1	1	1	1	1	1	1
2007	1	1	1	1	1	1	1	1	1	1	1	1
2008	1	1	1	1	1	1	1	1	1	1	1	1

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=Apalachee Park 11299

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
2009	1	1	1	1	1	1	1	1	1	1	1	1
2010	1	1	1	1	1	1	1	1	1	1	1	1
2011	1	1	1	1	1	1	1	1	1	1	1	1
2012	1	1	1	1	1	1	1	1	1	1	1	1
2013	1	1	1	1	1	1	1	1	1	1	1	1
2014	1	1	1	1	1	1	1	1	1	1	1	1
2015	1	1	1	1	1	1	1	1	1	1	1	1
2016	1	1	1	1	1	1	1	1	1	1	1	1
2017	1	1	1	1	.	.	.	.	.	.	.	.

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=Herron Steel 11285

Moments			
N	352	Sum Weights	352
Mean	4.68877841	Sum Observations	1650.45
Std Deviation	3.31708062	Variance	11.0030239
Skewness	1.23398439	Kurtosis	1.80504554
Uncorrected SS	11600.6557	Corrected SS	3862.06137
Coeff Variation	70.7450925	Std Error Mean	0.17680099

Basic Statistical Measures			
Location		Variability	
Mean	4.688778	Std Deviation	3.31708
Median	3.905000	Variance	11.00302
Mode	0.390000	Range	18.55000
		Interquartile Range	3.89000

Note: The mode displayed is the smallest of 3 modes with a count of 2.

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	26.52009	Pr > |t|	<.0001
Sign	M	175.5	Pr >= |M|	<.0001
Signed Rank	S	30888	Pr >= |S|	<.0001

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=Herron Steel 11285

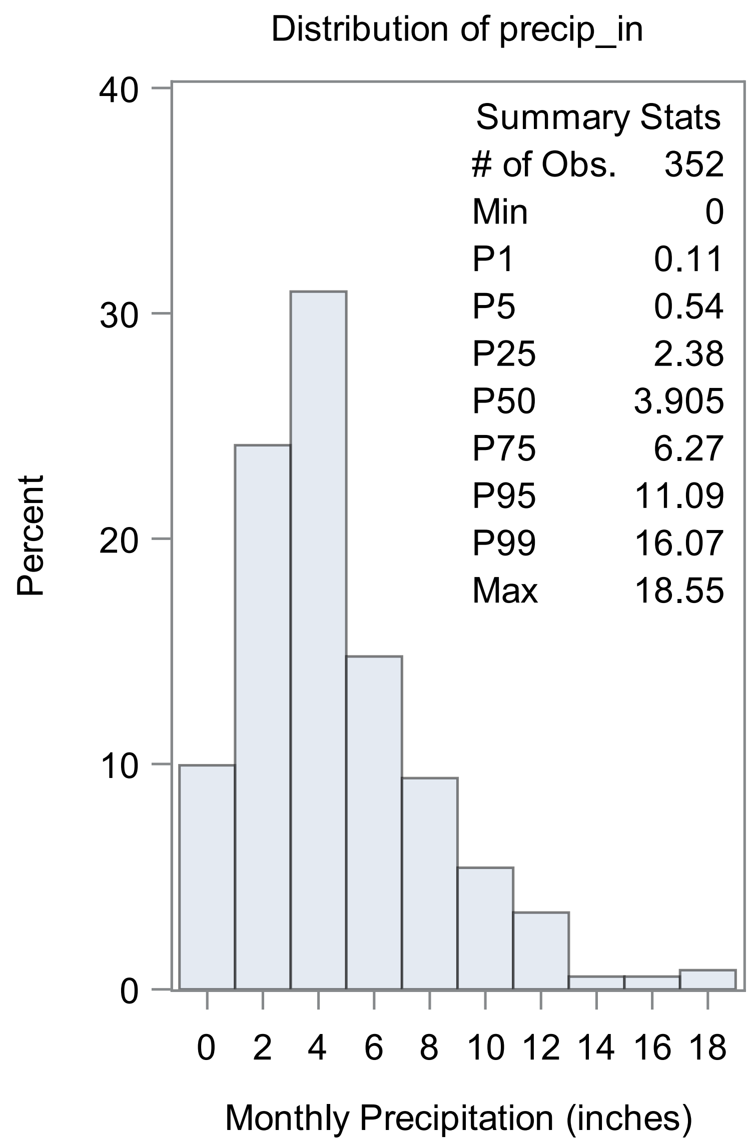
Quantiles (Definition 5)	
Level	**Quantile**
100% Max	18.550
99%	16.070
95%	11.090
90%	9.640
75% Q3	6.270
50% Median	3.905
25% Q1	2.380
10%	1.070
5%	0.540
1%	0.110
0% Min	0.000

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
0.00	150	15.16	18
0.05	149	16.07	153
0.09	214	17.13	248
0.11	233	17.49	37
0.16	274	18.55	129

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

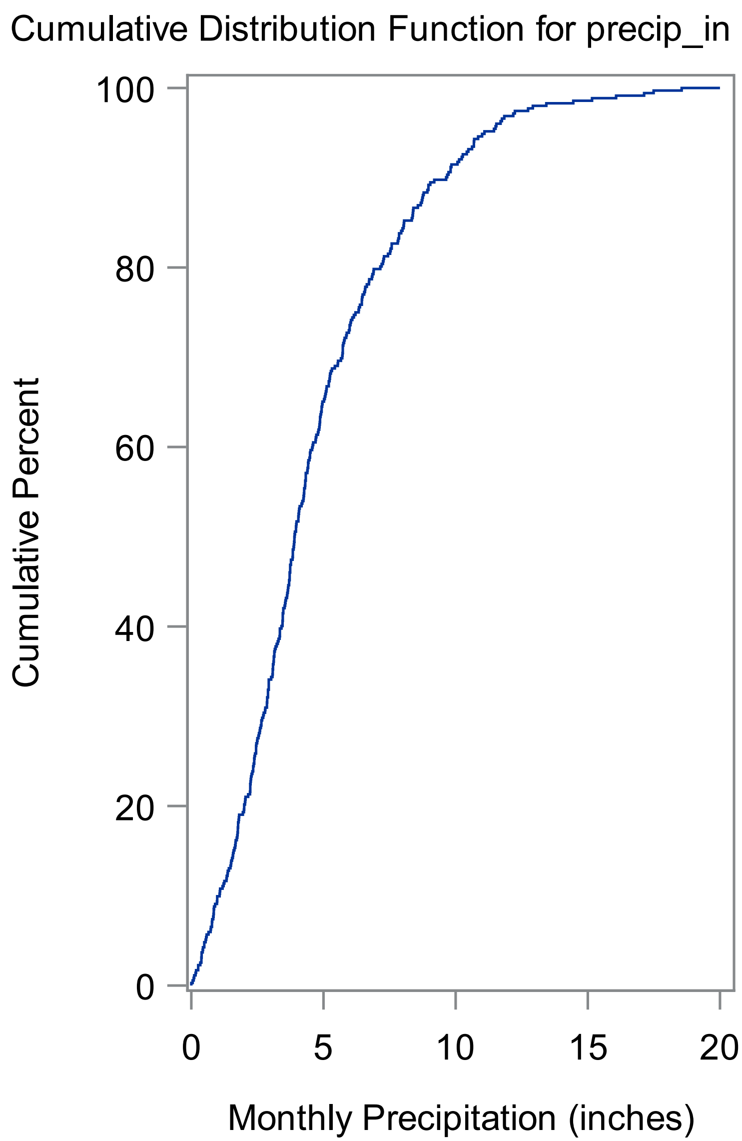
Station=Herron Steel 11285



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

Station=Herron Steel 11285



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=Life Fellowship 11288

Moments			
N	352	**Sum Weights**	352
Mean	4.89767045	**Sum Observations**	1723.98
Std Deviation	3.52770972	**Variance**	12.4447359
Skewness	1.49706414	**Kurtosis**	3.50708956
Uncorrected SS	12811.5882	**Corrected SS**	4368.10229
Coeff Variation	72.0283195	**Std Error Mean**	0.18802756

Basic Statistical Measures			
Location		**Variability**	
Mean	4.897670	**Std Deviation**	3.52771
Median	4.225000	**Variance**	12.44474
Mode	0.510000	**Range**	21.67000
		Interquartile Range	4.04000

Note: The mode displayed is the smallest of 3 modes with a count of 2.

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	26.04762	**Pr > |t|**	<.0001
Sign	**M**	176	**Pr >= |M|**	<.0001
Signed Rank	**S**	31064	**Pr >= |S|**	<.0001

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=Life Fellowship 11288

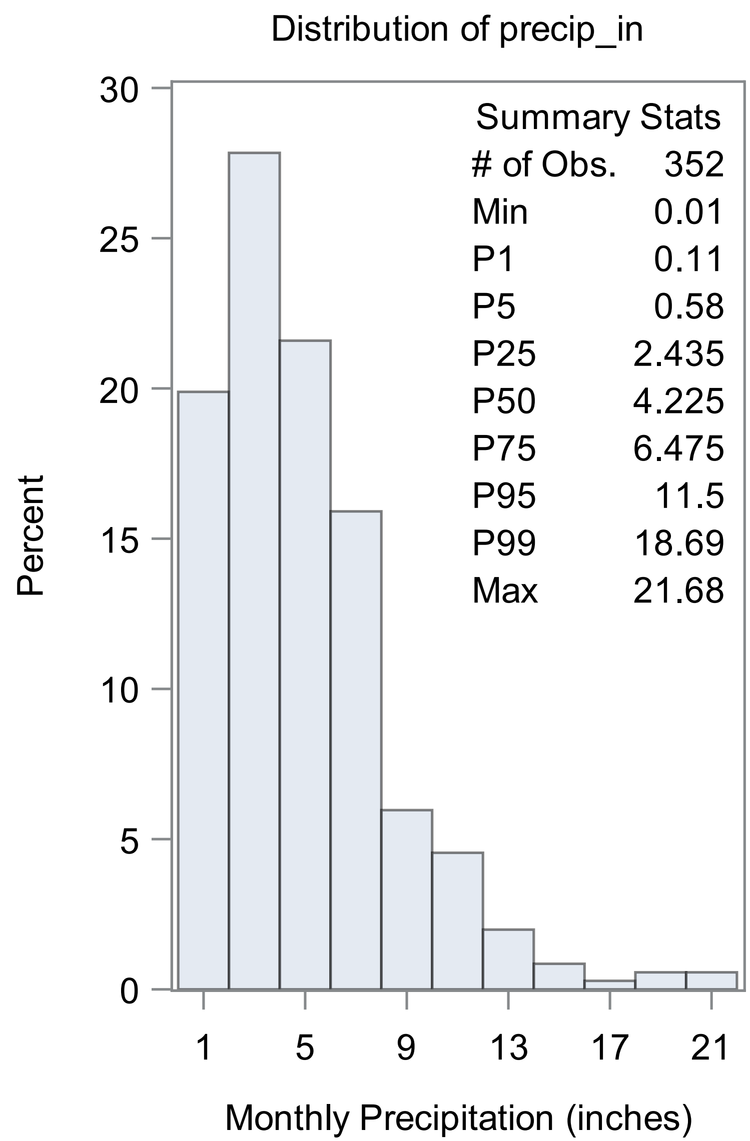
Quantiles (Definition 5)	
Level	**Quantile**
100% Max	21.680
99%	18.690
95%	11.500
90%	9.550
75% Q3	6.475
50% Median	4.225
25% Q1	2.435
10%	1.140
5%	0.580
1%	0.110
0% Min	0.010

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
0.01	482	17.23	481
0.04	585	18.69	389
0.06	566	19.22	370
0.11	501	20.65	514
0.16	477	21.68	600

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

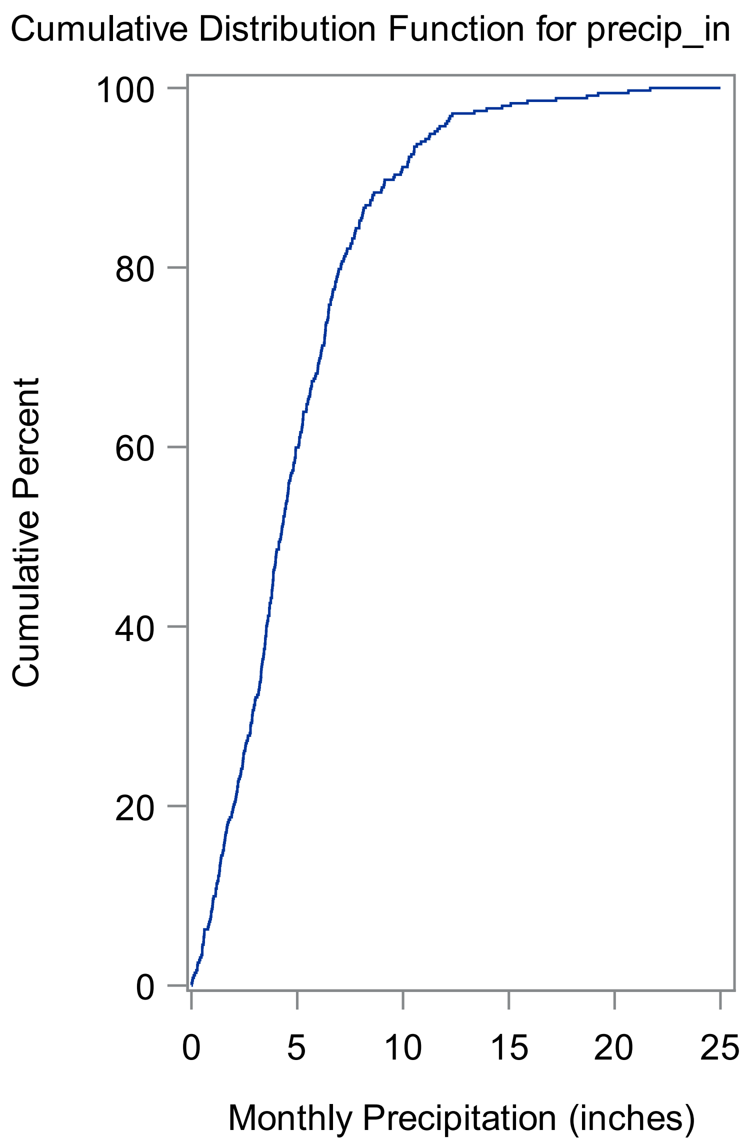
Station=Life Fellowship 11288



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

Station=Life Fellowship 11288



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=Lake Jackson 11289

Moments			
N	362	**Sum Weights**	362
Mean	4.6593453	**Sum Observations**	1686.683
Std Deviation	3.28249179	**Variance**	10.7747523
Skewness	1.26611185	**Kurtosis**	2.37896269
Uncorrected SS	11748.5241	**Corrected SS**	3889.68559
Coeff Variation	70.4496356	**Std Error Mean**	0.17252394

Basic Statistical Measures			
Location		**Variability**	
Mean	4.659345	**Std Deviation**	3.28249
Median	4.035000	**Variance**	10.77475
Mode	0.260000	**Range**	20.70000
		Interquartile Range	3.92000

Note: The mode displayed is the smallest of 5 modes with a count of 2.

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	27.00695	**Pr > |t|**	<.0001
Sign	**M**	180.5	**Pr >= |M|**	<.0001
Signed Rank	**S**	32670.5	**Pr >= |S|**	<.0001

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=Lake Jackson 11289

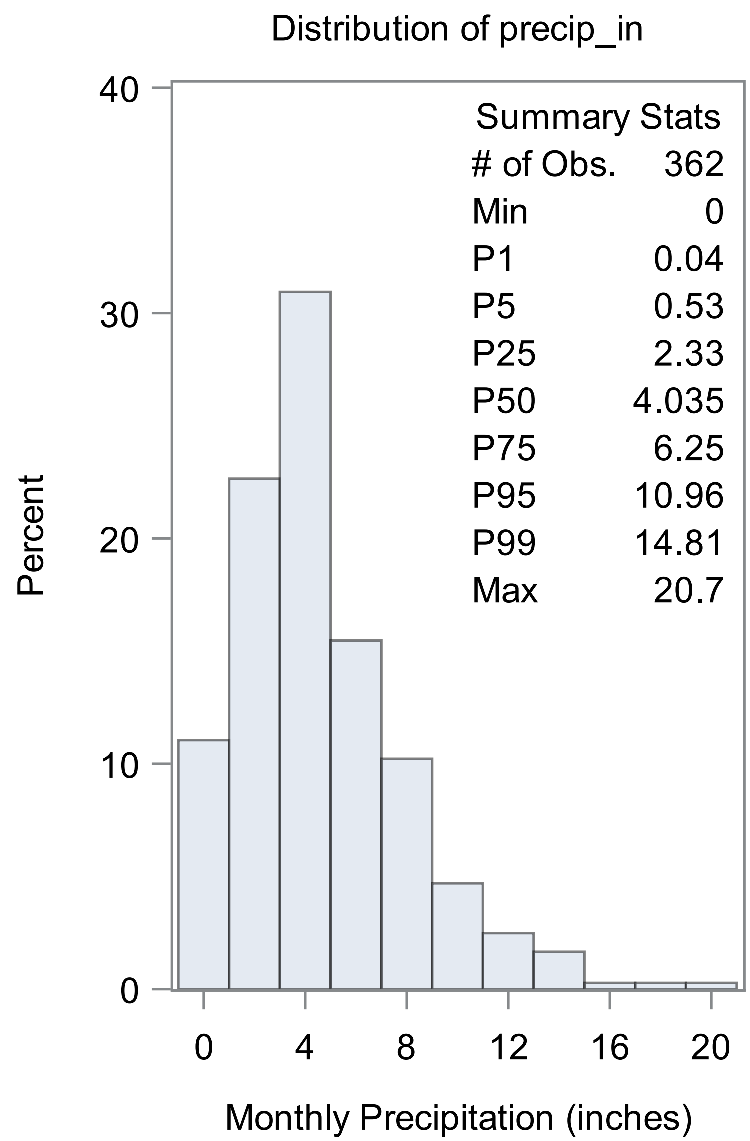
Quantiles (Definition 5)	
Level	**Quantile**
100% Max	20.700
99%	14.810
95%	10.960
90%	8.930
75% Q3	6.250
50% Median	4.035
25% Q1	2.330
10%	0.960
5%	0.530
1%	0.040
0% Min	0.000

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
0.00	712	14.29	841
0.01	1045	14.81	1021
0.03	844	16.68	876
0.04	947	17.62	751
0.06	839	20.70	962

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

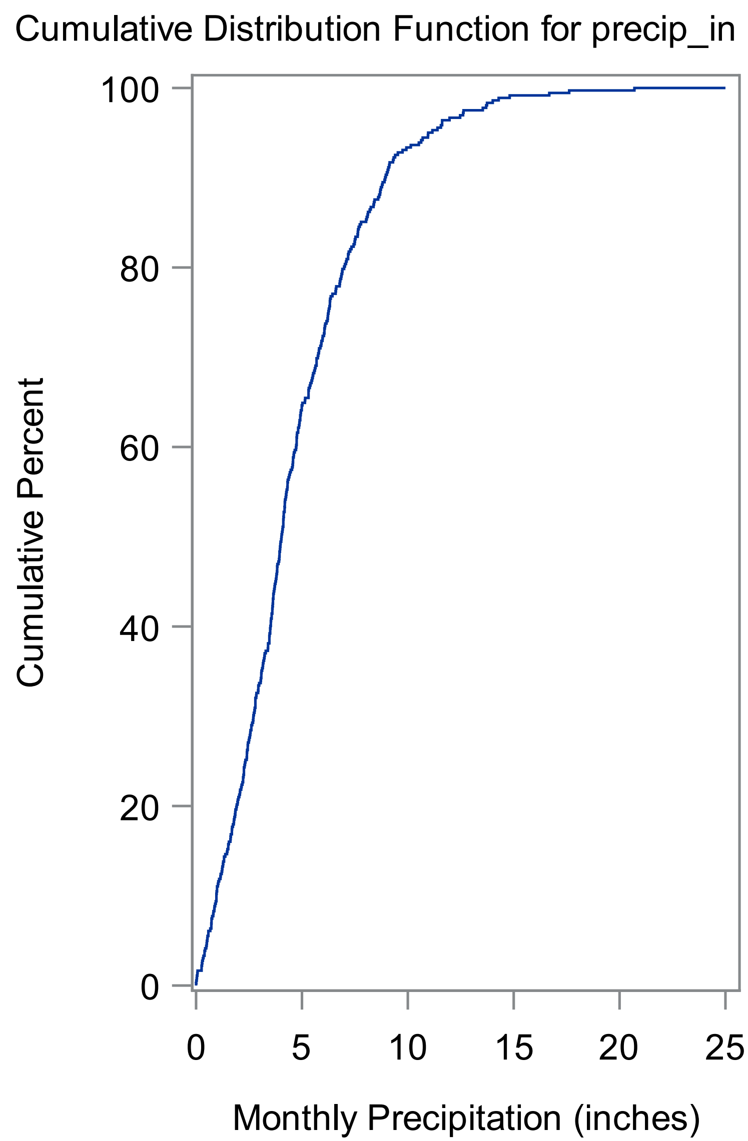
Station=Lake Jackson 11289



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

Station=Lake Jackson 11289



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=Tuck Property 11293

Moments			
N	364	**Sum Weights**	364
Mean	4.54925824	**Sum Observations**	1655.93
Std Deviation	3.1453311	**Variance**	9.89310771
Skewness	1.31499768	**Kurtosis**	2.43174823
Uncorrected SS	11124.4513	**Corrected SS**	3591.1981
Coeff Variation	69.1394274	**Std Error Mean**	0.16486014

Basic Statistical Measures			
Location		Variability	
Mean	4.549258	**Std Deviation**	3.14533
Median	4.000000	**Variance**	9.89311
Mode	0.320000	**Range**	19.16000
		Interquartile Range	3.57000

Note: The mode displayed is the smallest of 7 modes with a count of 2.

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	27.59465	Pr > |t|	<.0001
Sign	M	182	Pr >= |M|	<.0001
Signed Rank	S	33215	Pr >= |S|	<.0001

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=Tuck Property 11293

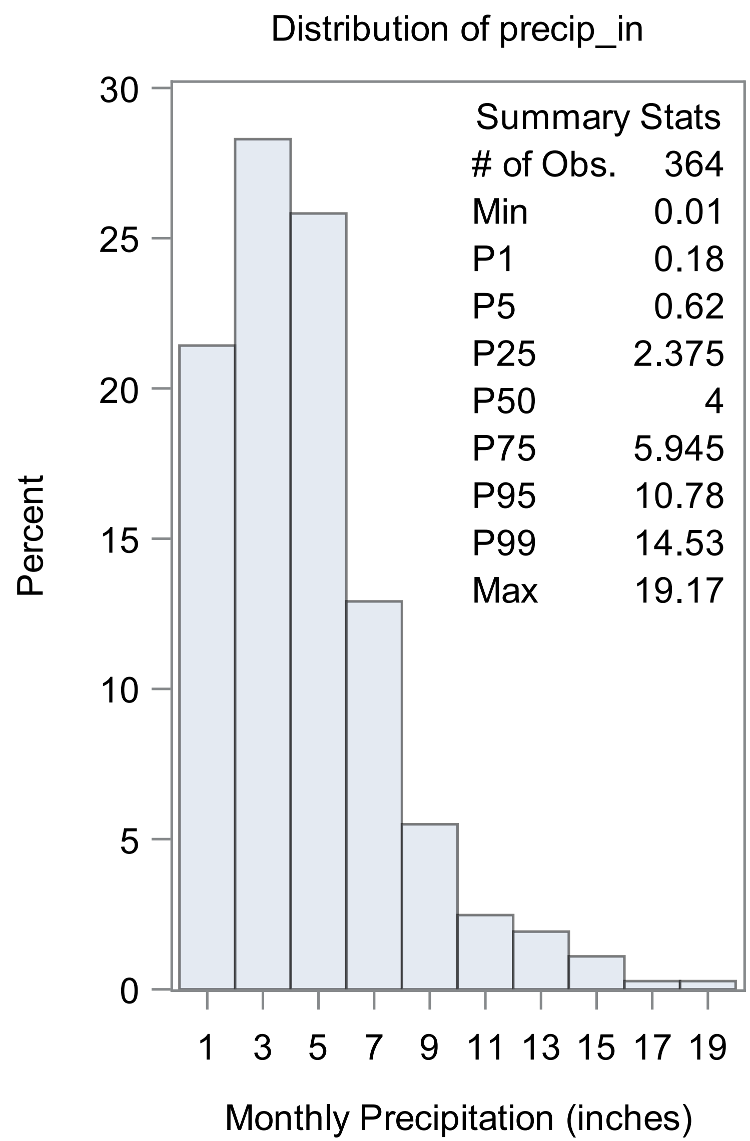
Quantiles (Definition 5)	
Level	**Quantile**
100% Max	19.170
99%	14.530
95%	10.780
90%	8.830
75% Q3	5.945
50% Median	4.000
25% Q1	2.375
10%	1.030
5%	0.620
1%	0.180
0% Min	0.010

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
0.01	1076	14.24	1385
0.09	1067	14.53	1096
0.10	1311	14.69	1289
0.18	1130	17.14	1115
0.27	1273	19.17	1326

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

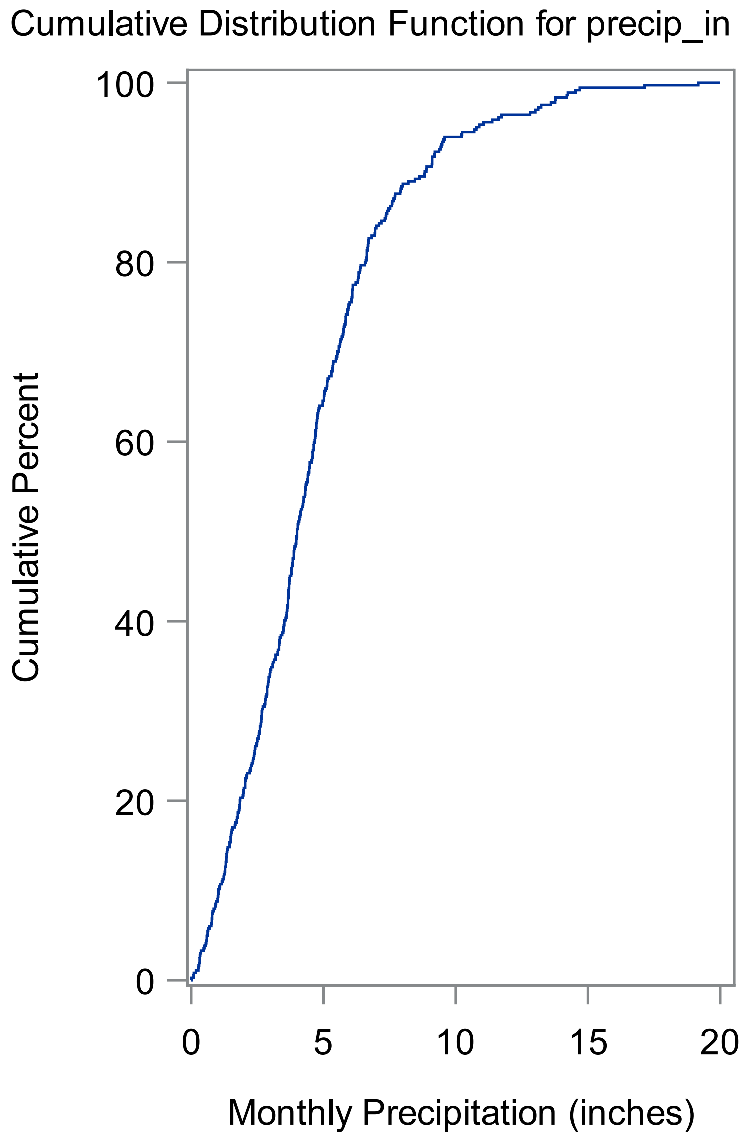
Station=Tuck Property 11293



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

Station=Tuck Property 11293



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=Limoges Dr 11296

Moments			
N	363	Sum Weights	363
Mean	4.73622589	Sum Observations	1719.25
Std Deviation	3.33539396	Variance	11.1248528
Skewness	1.3266839	Kurtosis	2.37821989
Uncorrected SS	12169.9531	Corrected SS	4027.19673
Coeff Variation	70.4230337	Std Error Mean	0.17506278

Basic Statistical Measures			
Location		Variability	
Mean	4.736226	Std Deviation	3.33539
Median	4.130000	Variance	11.12485
Mode	1.070000	Range	19.59000
		Interquartile Range	3.87000

Note: The mode displayed is the smallest of 8 modes with a count of 2.

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	27.05444	Pr > |t|	<.0001
Sign	M	181.5	Pr >= |M|	<.0001
Signed Rank	S	33033	Pr >= |S|	<.0001

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=Limoges Dr 11296

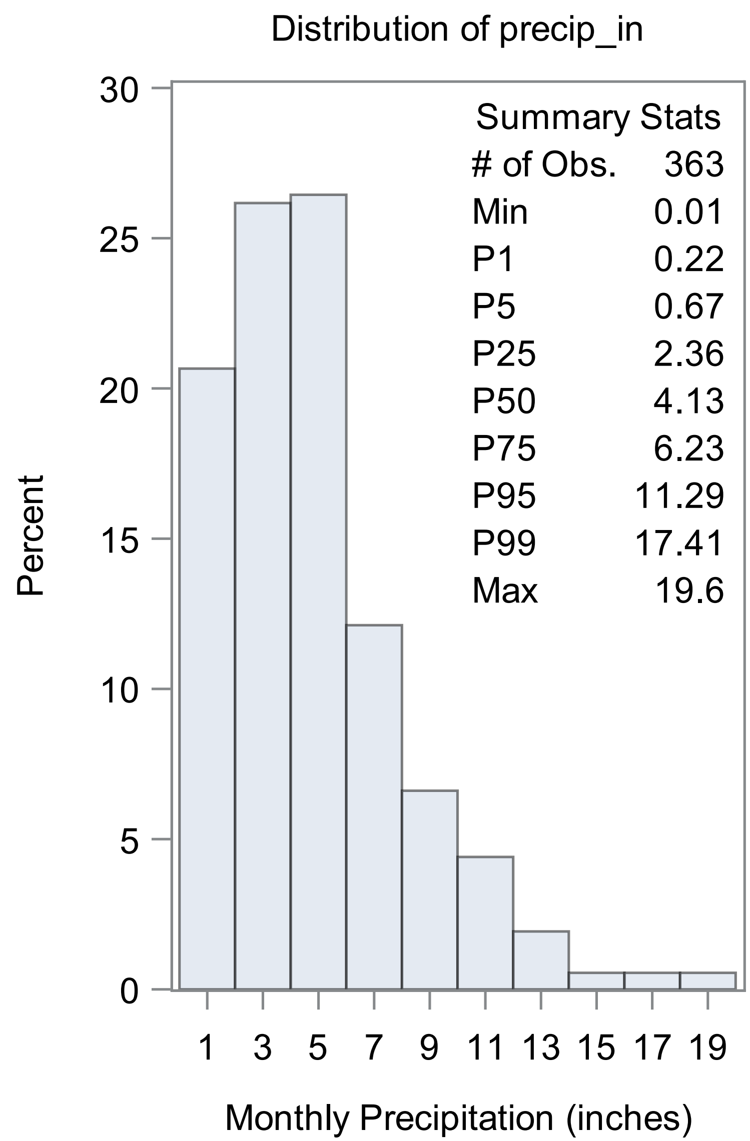
Quantiles (Definition 5)	
Level	**Quantile**
100% Max	19.60
99%	17.41
95%	11.29
90%	9.47
75% Q3	6.23
50% Median	4.13
25% Q1	2.36
10%	1.08
5%	0.67
1%	0.22
0% Min	0.01

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
0.01	1439	15.51	1639
0.06	1571	17.41	1603
0.12	1493	17.60	1605
0.22	1793	18.04	1478
0.22	1566	19.60	1689

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

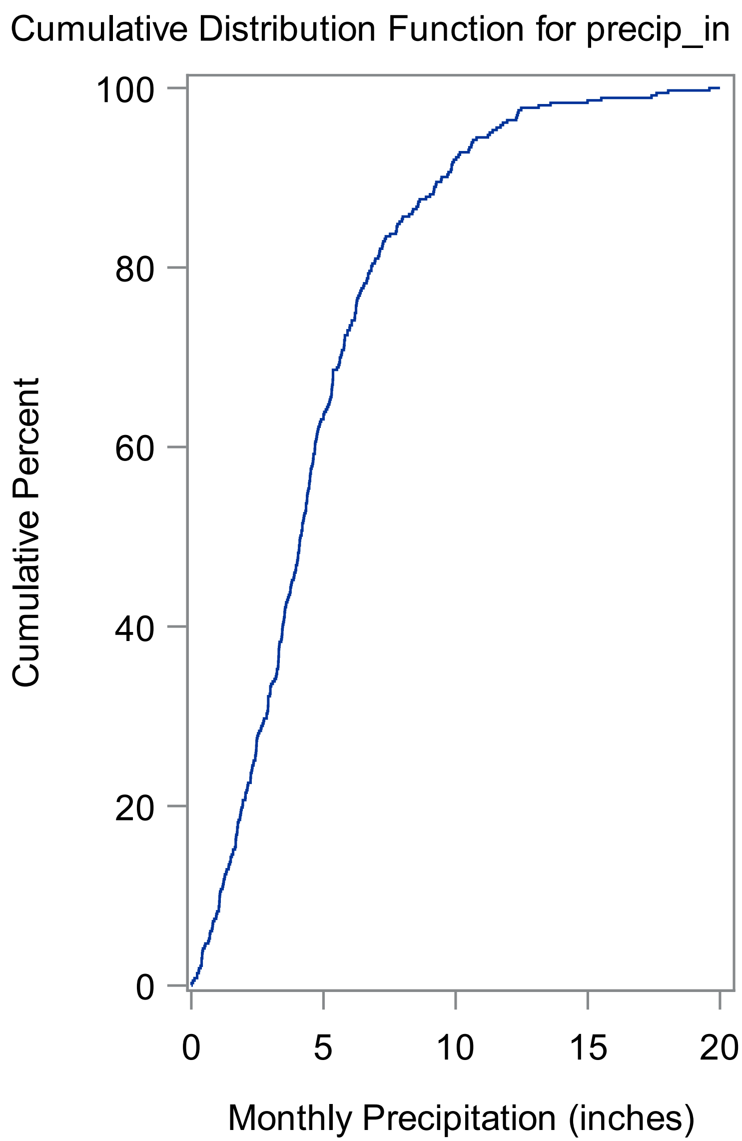
Station=Limoges Dr 11296



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

Station=Limoges Dr 11296



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=Apalachee Park 11299

Moments			
N	361	Sum Weights	361
Mean	4.76077562	Sum Observations	1718.64
Std Deviation	3.42292142	Variance	11.7163911
Skewness	1.42500945	Kurtosis	4.02842619
Uncorrected SS	12399.9602	Corrected SS	4217.90078
Coeff Variation	71.8983984	Std Error Mean	0.18015376

Basic Statistical Measures			
Location		Variability	
Mean	4.760776	Std Deviation	3.42292
Median	4.280000	Variance	11.71639
Mode	0.000000	Range	25.44000
		Interquartile Range	3.97000

Note: The mode displayed is the smallest of 6 modes with a count of 2.

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	26.42618	Pr > |t|	<.0001
Sign	M	179.5	Pr >= |M|	<.0001
Signed Rank	S	32310	Pr >= |S|	<.0001

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=Apalachee Park 11299

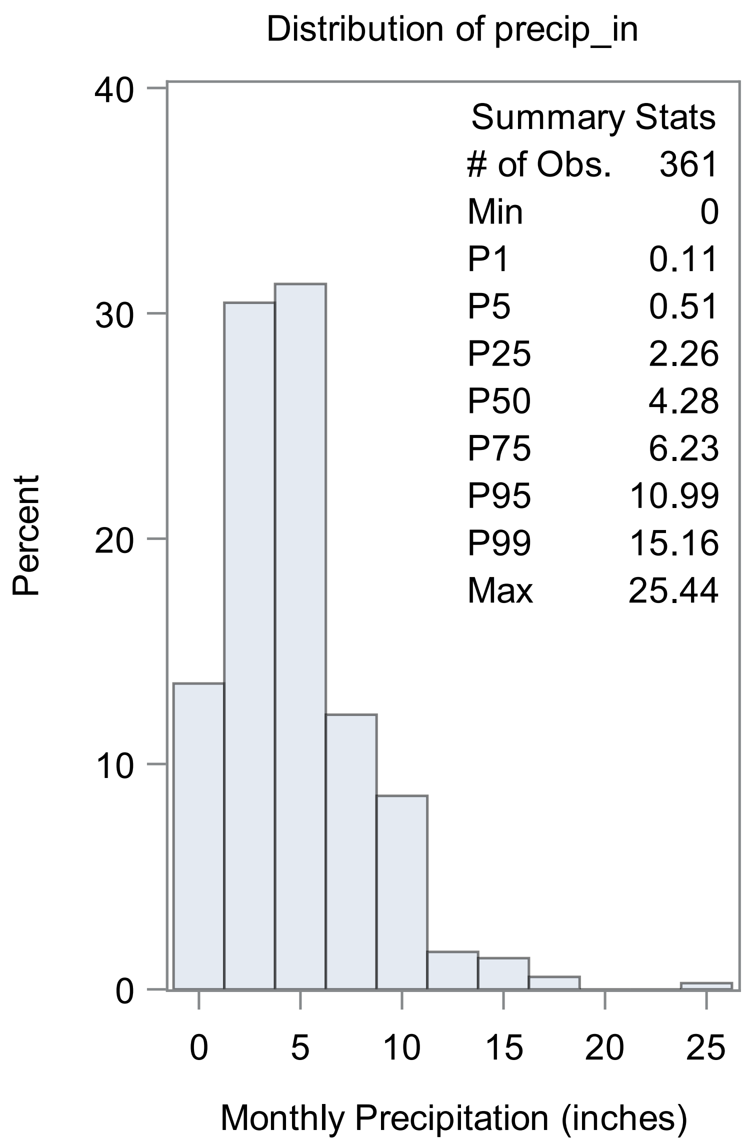
Quantiles (Definition 5)	
Level	**Quantile**
100% Max	25.44
99%	15.16
95%	10.99
90%	9.55
75% Q3	6.23
50% Median	4.28
25% Q1	2.26
10%	0.94
5%	0.51
1%	0.11
0% Min	0.00

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
0.00	2149	15.12	2098
0.00	1801	15.16	1931
0.02	2035	17.04	1839
0.11	1932	17.29	2109
0.14	1983	25.44	2050

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

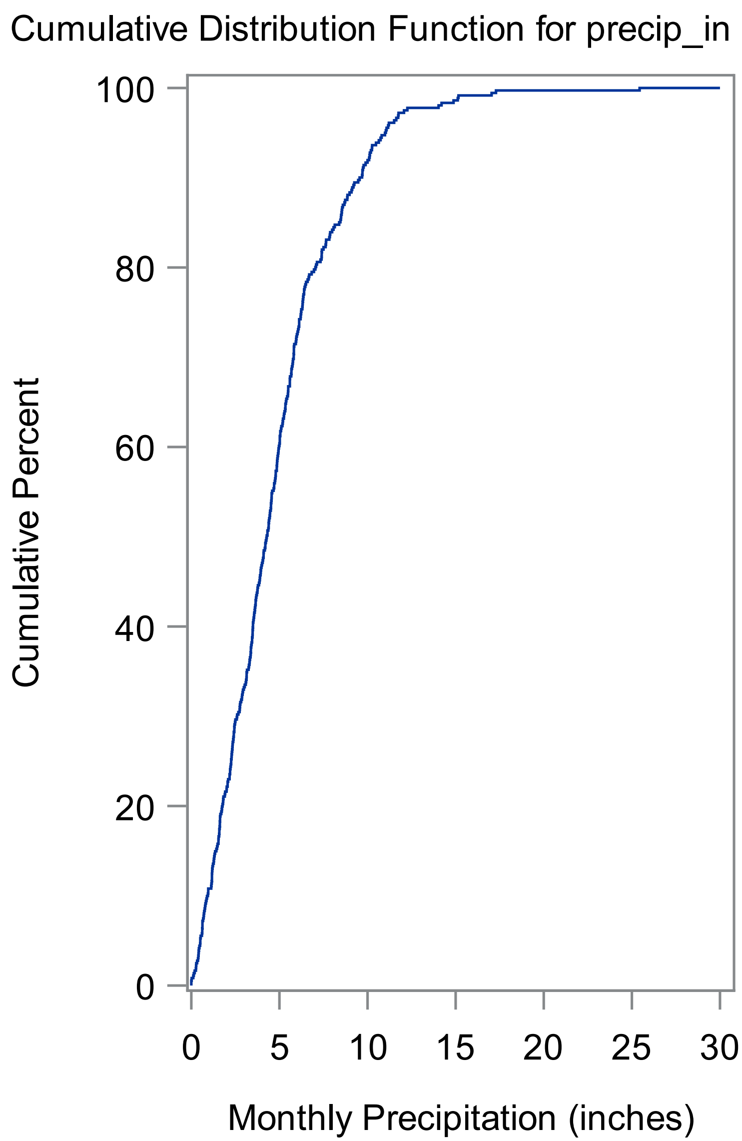
Station=Apalachee Park 11299



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

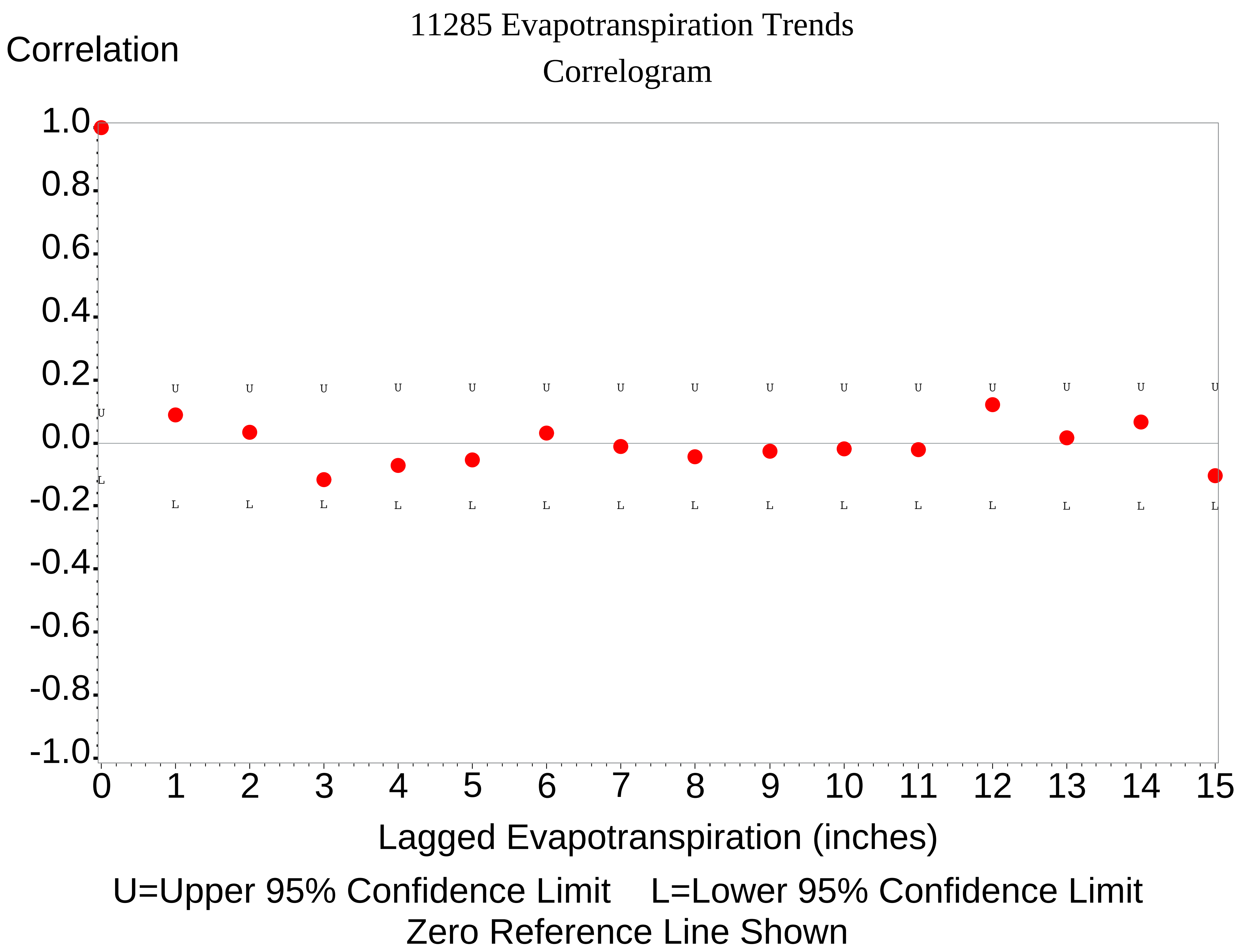
Station=Apalachee Park 11299



11285 Evapotranspiration Trends

Autocorrelation Statistics

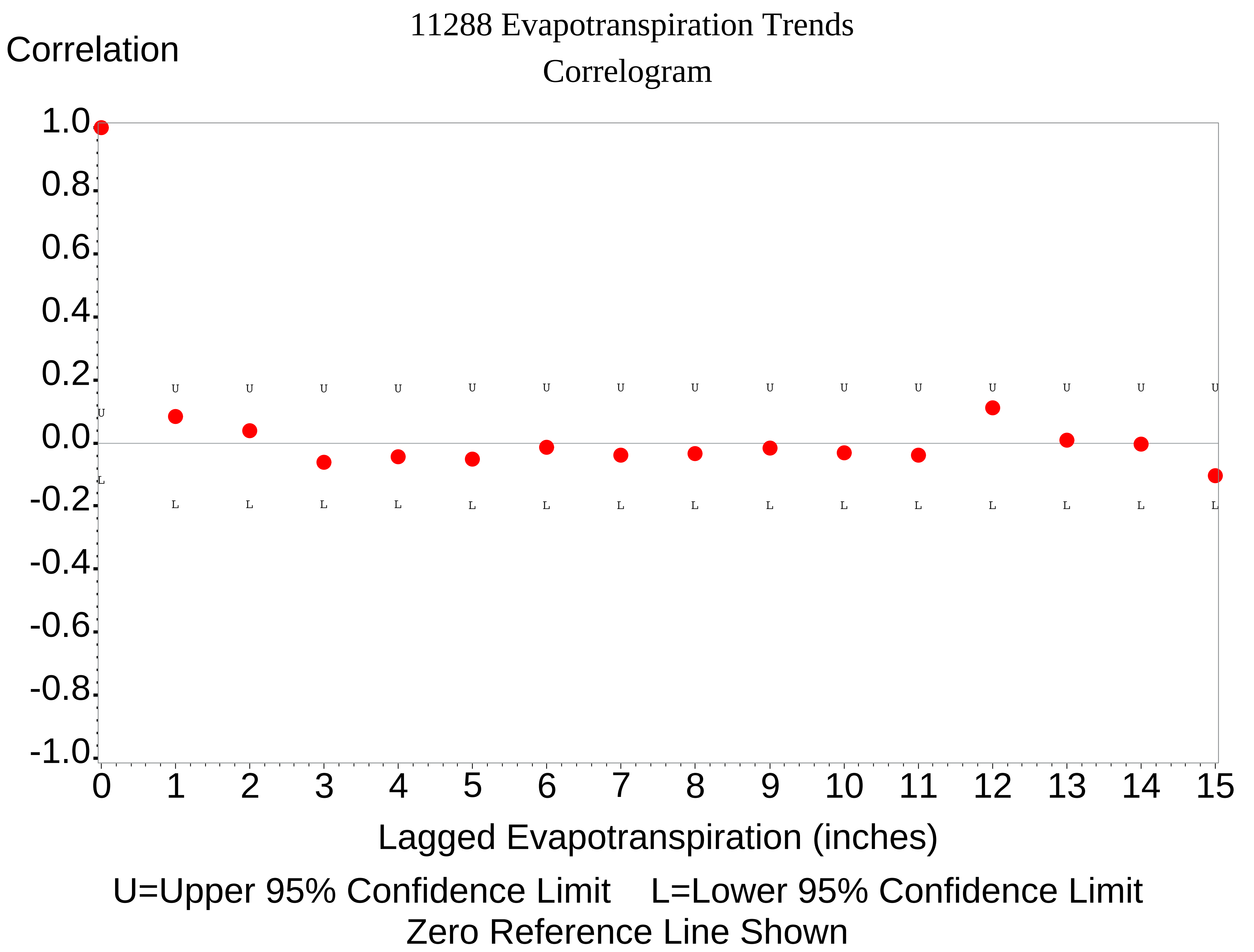
Lagged Evapotranspiration (inches)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.053	0.107	-0.107
1	0.089	0.092	0.185	-0.185
2	0.034	0.093	0.185	-0.185
3	-0.117	0.093	0.185	-0.185
4	-0.070	0.093	0.186	-0.186
5	-0.054	0.093	0.186	-0.186
6	0.032	0.093	0.187	-0.187
7	-0.011	0.093	0.187	-0.187
8	-0.044	0.093	0.187	-0.187
9	-0.026	0.093	0.187	-0.187
10	-0.019	0.093	0.187	-0.187
11	-0.022	0.093	0.187	-0.187
12	0.121	0.093	0.187	-0.187
13	0.016	0.094	0.188	-0.188
14	0.067	0.094	0.188	-0.188
15	-0.104	0.094	0.188	-0.188


11285 Evapotranspiration Trends
Correlogram
Correlation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Lagged Evapotranspiration (inches)
U=Upper 95% Confidence Limit L=Lower 95% Confidence Limit
Zero Reference Line Shown

11288 Evapotranspiration Trends

Autocorrelation Statistics

Lagged Evapotranspiration (inches)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.053	0.107	-0.107
1	0.084	0.092	0.185	-0.185
2	0.039	0.093	0.185	-0.185
3	-0.062	0.093	0.185	-0.185
4	-0.044	0.093	0.185	-0.185
5	-0.050	0.093	0.186	-0.186
6	-0.014	0.093	0.186	-0.186
7	-0.039	0.093	0.186	-0.186
8	-0.034	0.093	0.186	-0.186
9	-0.017	0.093	0.186	-0.186
10	-0.030	0.093	0.186	-0.186
11	-0.038	0.093	0.186	-0.186
12	0.111	0.093	0.186	-0.186
13	0.008	0.093	0.187	-0.187
14	-0.004	0.093	0.187	-0.187
15	-0.103	0.093	0.187	-0.187



11288 Evapotranspiration Trends
Correlogram
Correlation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Lagged Evapotranspiration (inches)
U=Upper 95% Confidence Limit
L=Lower 95% Confidence Limit
Zero Reference Line Shown

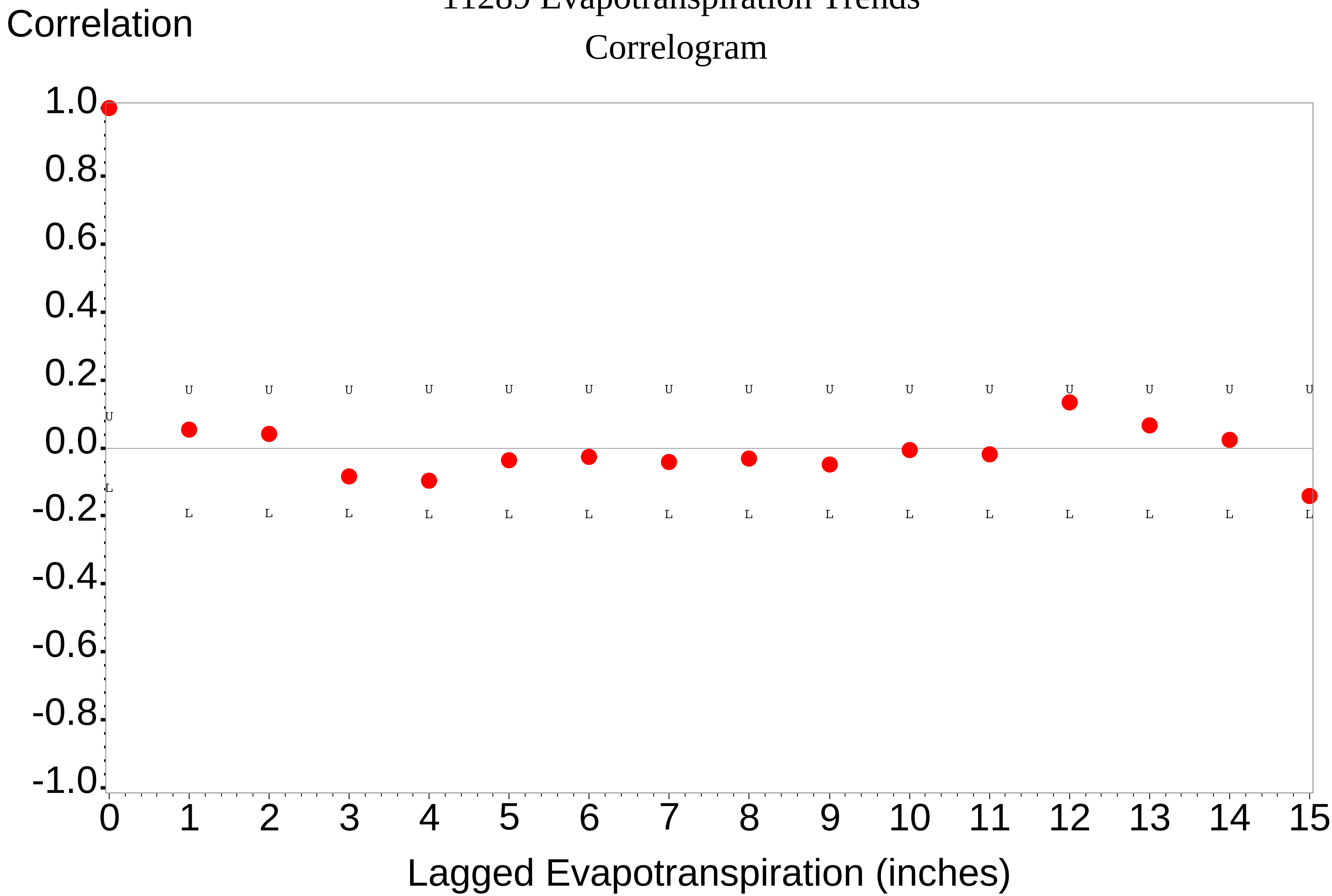
11289 Evapotranspiration Trends

Autocorrelation Statistics

Lagged Evapotranspiration (inches)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.053	0.105	-0.105
1	0.054	0.091	0.182	-0.182
2	0.041	0.091	0.182	-0.182
3	-0.083	0.091	0.182	-0.182
4	-0.095	0.091	0.183	-0.183
5	-0.035	0.092	0.183	-0.183
6	-0.027	0.092	0.183	-0.183
7	-0.040	0.092	0.183	-0.183
8	-0.032	0.092	0.184	-0.184
9	-0.049	0.092	0.184	-0.184
10	-0.006	0.092	0.184	-0.184
11	-0.019	0.092	0.184	-0.184
12	0.134	0.092	0.184	-0.184
13	0.066	0.092	0.185	-0.185
14	0.024	0.093	0.185	-0.185
15	-0.142	0.093	0.185	-0.185

11289 Evapotranspiration Trends

Correlogram



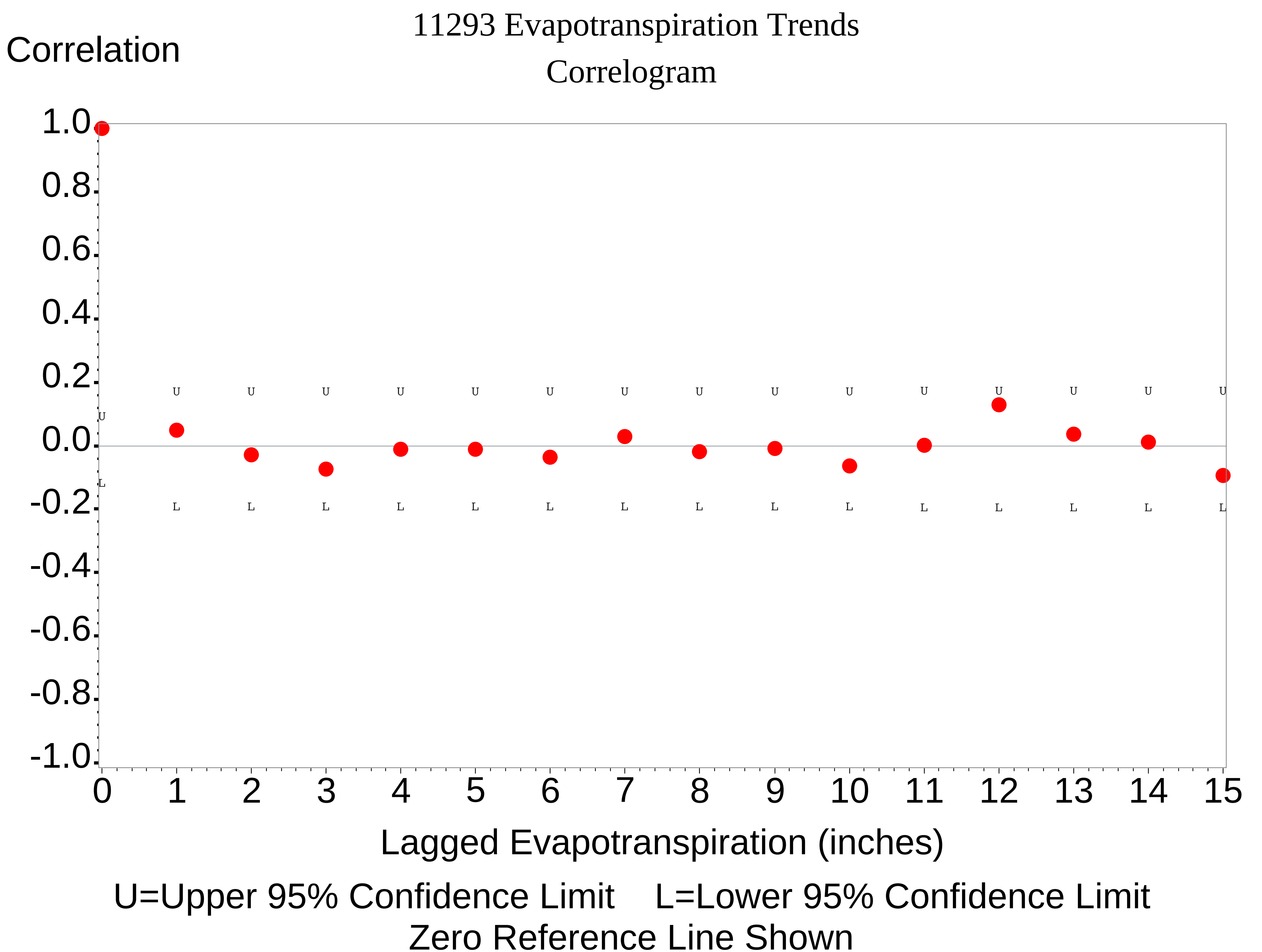
U=Upper 95% Confidence Limit L=Lower 95% Confidence Limit

Zero Reference Line Shown

11293 Evapotranspiration Trends

Autocorrelation Statistics

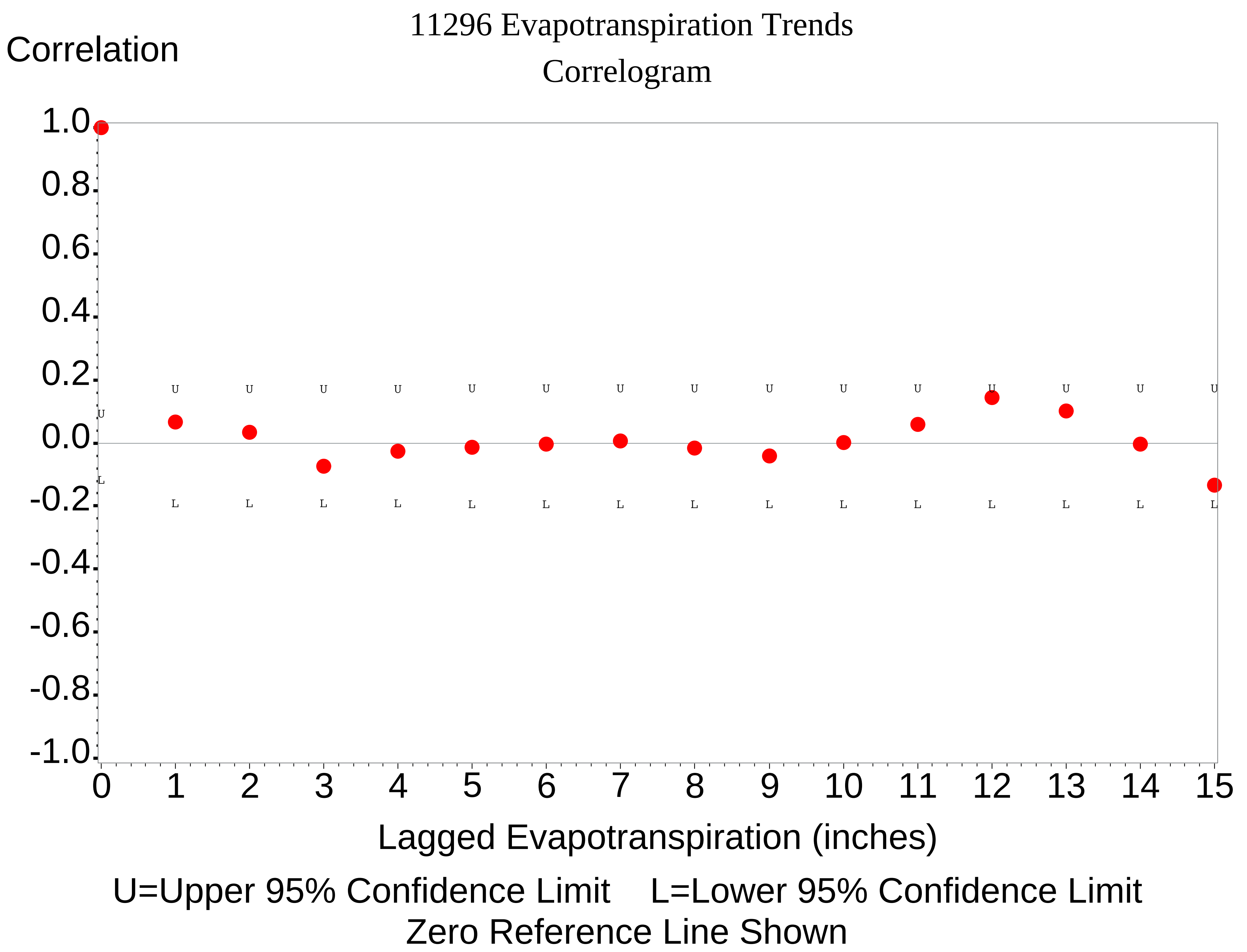
Lagged Evapotranspiration (inches)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.052	0.105	-0.105
1	0.050	0.091	0.182	-0.182
2	-0.029	0.091	0.182	-0.182
3	-0.073	0.091	0.182	-0.182
4	-0.012	0.091	0.182	-0.182
5	-0.010	0.091	0.182	-0.182
6	-0.036	0.091	0.182	-0.182
7	0.030	0.091	0.182	-0.182
8	-0.019	0.091	0.182	-0.182
9	-0.008	0.091	0.182	-0.182
10	-0.064	0.091	0.182	-0.182
11	0.002	0.091	0.183	-0.183
12	0.129	0.091	0.183	-0.183
13	0.036	0.092	0.184	-0.184
14	0.012	0.092	0.184	-0.184
15	-0.094	0.092	0.184	-0.184


11293 Evapotranspiration Trends
Correlogram
Correlation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Lagged Evapotranspiration (inches)
U=Upper 95% Confidence Limit L=Lower 95% Confidence Limit
Zero Reference Line Shown

11296 Evapotranspiration Trends

Autocorrelation Statistics

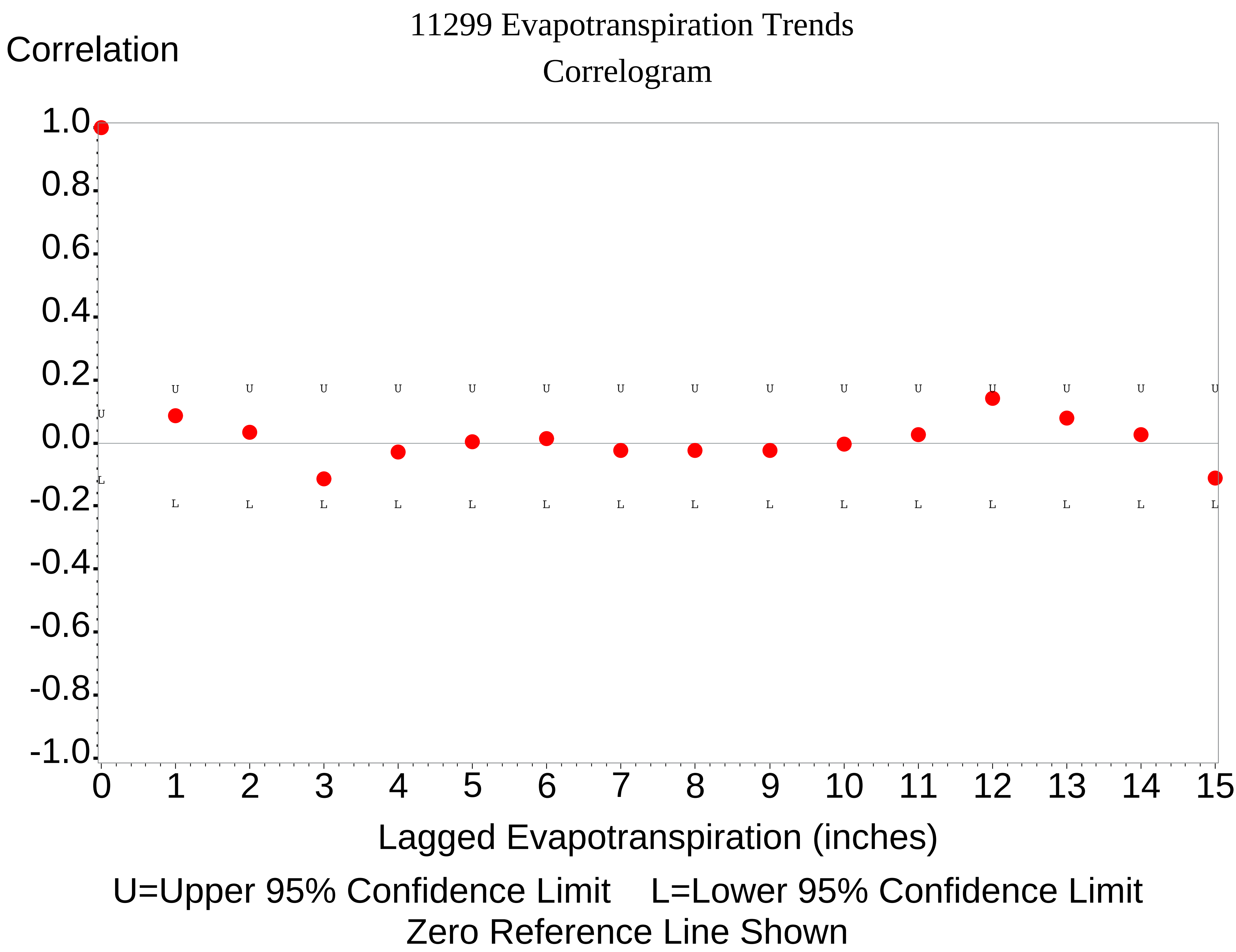
Lagged Evapotranspiration (inches)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.052	0.105	-0.105
1	0.067	0.091	0.182	-0.182
2	0.033	0.091	0.182	-0.182
3	-0.074	0.091	0.182	-0.182
4	-0.026	0.091	0.182	-0.182
5	-0.013	0.091	0.183	-0.183
6	-0.003	0.091	0.183	-0.183
7	0.006	0.091	0.183	-0.183
8	-0.016	0.091	0.183	-0.183
9	-0.040	0.091	0.183	-0.183
10	0.002	0.091	0.183	-0.183
11	0.059	0.091	0.183	-0.183
12	0.143	0.091	0.183	-0.183
13	0.101	0.092	0.184	-0.184
14	-0.004	0.092	0.185	-0.185
15	-0.135	0.092	0.185	-0.185


11296 Evapotranspiration Trends
Correlogram
Correlation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Lagged Evapotranspiration (inches)
U=Upper 95% Confidence Limit L=Lower 95% Confidence Limit
Zero Reference Line Shown

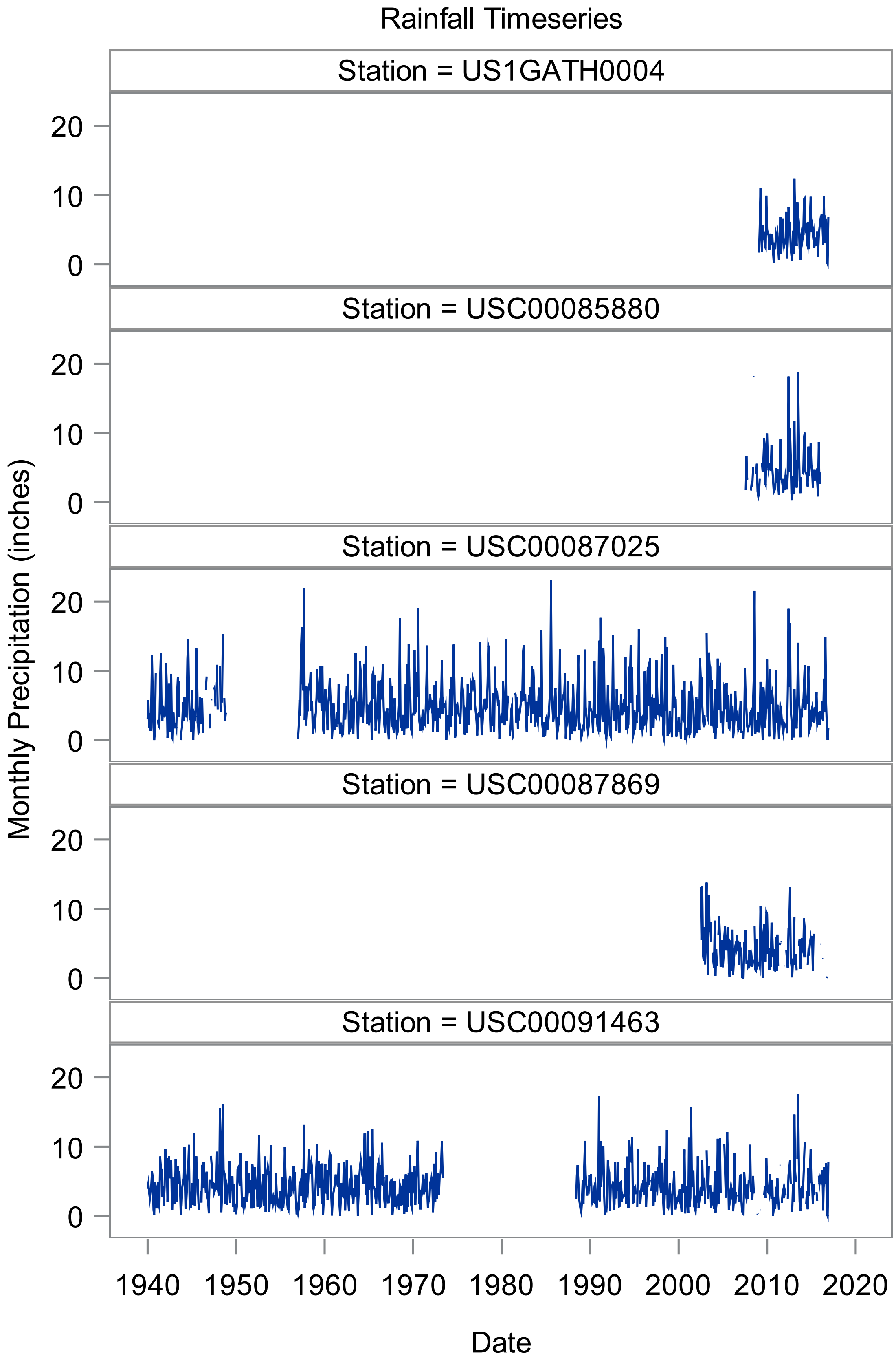
11299 Evapotranspiration Trends

Autocorrelation Statistics

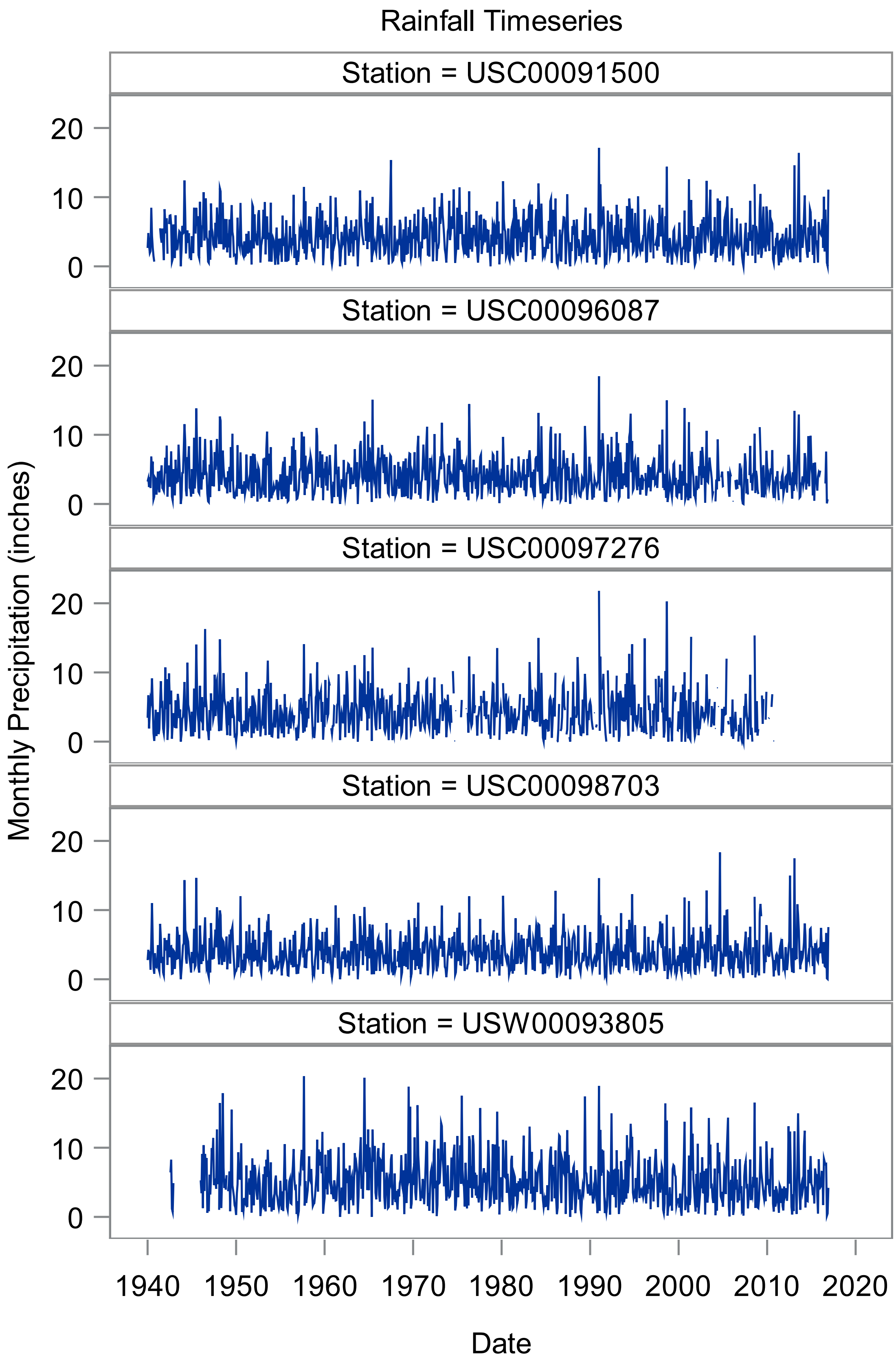
Lagged Evapotranspiration (inches)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.053	0.105	-0.105
1	0.086	0.091	0.182	-0.182
2	0.034	0.091	0.183	-0.183
3	-0.114	0.091	0.183	-0.183
4	-0.028	0.092	0.184	-0.184
5	0.004	0.092	0.184	-0.184
6	0.015	0.092	0.184	-0.184
7	-0.023	0.092	0.184	-0.184
8	-0.023	0.092	0.184	-0.184
9	-0.024	0.092	0.184	-0.184
10	-0.004	0.092	0.184	-0.184
11	0.027	0.092	0.184	-0.184
12	0.142	0.092	0.184	-0.184
13	0.079	0.093	0.185	-0.185
14	0.026	0.093	0.185	-0.185
15	-0.110	0.093	0.185	-0.185

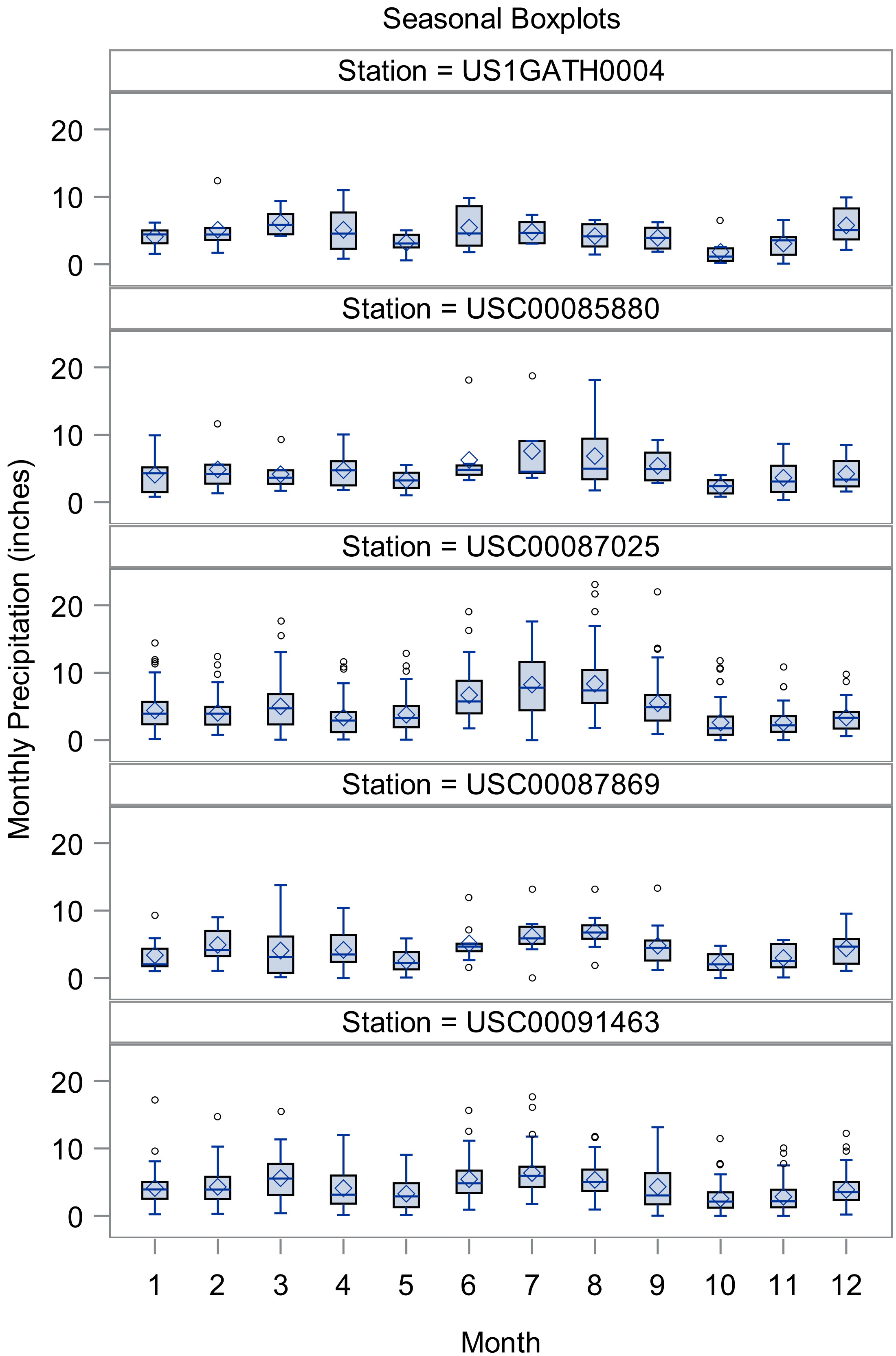

11299 Evapotranspiration Trends
Correlogram
Correlation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Lagged Evapotranspiration (inches)
U=Upper 95% Confidence Limit L=Lower 95% Confidence Limit
Zero Reference Line Shown

ATTACHMENT 5
NATIONAL WEATHER SERVICE RAINFALL DESCRIPTIVE STATISTICS AND PLOTS

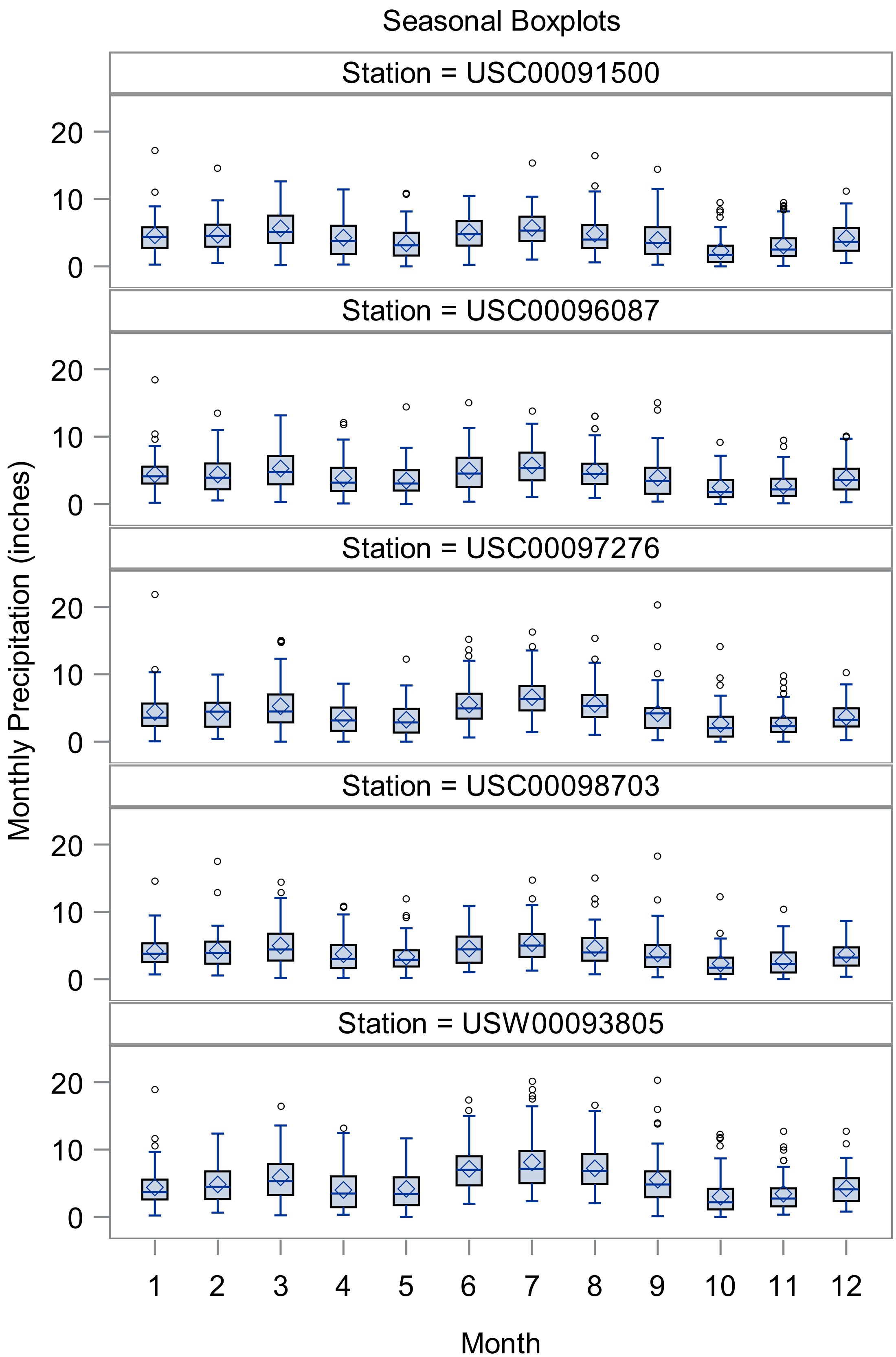

Rainfall Timeseries
Station = US1GATH0004
Station = USC00085880
Station = USC00087025
Station = USC00087869
Station = USC00091463
Monthly Precipitation (inches)
0
10
20
1940
1950
1960
1970
1980
1990
2000
2010
2020
Date

Rainfall Timeseries




Seasonal Boxplots
Station = US1GATH0004
Station = USC00085880
Station = USC00087025
Station = USC00087869
Station = USC00091463
Monthly Precipitation (inches)
0
10
20
1
2
3
4
5
6
7
8
9
10
11
12
Month

Seasonal Boxplots



Beginning and End Dates for Rainfall Stations

Obs	station	name	Nobs	mindate	maxdate
1	US1GATH0004	THOMASVILLE 5.1 ESE, GA US	96	01/01/2009	12/01/2016
2	USC00085880	MONTICELLO 10 SW, FL US	120	01/01/2007	12/01/2016
3	USC00087025	PERRY, FL US	924	01/01/1940	12/01/2016
4	USC00087869	ST MARKS NWR, FL US	180	01/01/2002	12/01/2016
5	USC00091463	CAIRO, GA US	924	01/01/1940	12/01/2016
6	USC00091500	CAMILLA 3 SE, GA US	924	01/01/1940	12/01/2016
7	USC00096087	MOULTRIE 2 ESE, GA US	924	01/01/1940	12/01/2016
8	USC00097276	QUITMAN 2 NW, GA US	852	01/01/1940	12/01/2010
9	USC00098703	TIFTON, GA US	924	01/01/1940	12/01/2016
10	USW00093805	TALLAHASSEE REGIONAL AIRPORT, FL US	900	01/01/1942	12/01/2016

Check for Data Gaps in Rainfall Timeseries

Station=US1GATH0004 name=THOMASVILLE 5.1 ESE, GA US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
2009	0	1	1	1	1	1	1	1	1	1	1	1
2010	1	1	1	1	1	1	1	1	1	1	1	1
2011	1	1	1	1	1	1	1	1	1	1	1	1
2012	1	1	1	1	1	1	1	1	1	1	1	1
2013	1	1	1	1	1	1	1	1	1	1	1	1
2014	1	1	1	1	1	1	1	1	1	1	1	1
2015	1	1	1	1	1	1	1	1	1	1	1	1
2016	1	1	1	1	1	1	1	1	1	1	1	1

Check for Data Gaps in Rainfall Timeseries

Station=USC00085880 name=MONTICELLO 10 SW, FL US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
2007	0	0	0	0	0	0	0	1	1	1	0	1
2008	0	0	1	1	1	1	0	1	0	1	1	1
2009	1	1	1	0	0	1	1	1	1	1	1	1
2010	1	1	1	1	1	1	1	1	1	1	1	1
2011	1	1	1	1	1	1	1	1	1	1	1	1
2012	1	1	1	1	1	1	1	1	1	1	1	1
2013	1	1	1	1	1	1	1	1	1	1	1	0
2014	1	1	1	1	1	1	1	1	1	1	1	1
2015	1	1	1	1	1	1	1	1	1	1	1	1
2016	1	0	0	0	0	0	0	0	0	0	0	0

Check for Data Gaps in Rainfall Timeseries

Station=USC00087025 name=PERRY, FL US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1940	1	1	1	1	1	1	1	1	1	1	1	1
1941	0	1	1	1	1	1	1	1	1	1	1	1
1942	1	1	1	1	1	1	1	1	1	1	1	1
1943	1	1	1	1	1	1	1	1	0	1	1	1
1944	1	1	1	1	1	1	1	1	1	1	1	1
1945	1	1	1	1	1	1	1	1	1	1	1	1
1946	1	1	1	1	0	0	0	1	1	0	0	0
1947	1	1	0	0	1	0	1	1	1	0	1	1
1948	0	0	1	1	0	1	1	0	1	1	1	1
1949	0	0	0	0	0	0	0	0	0	0	0	0
1950	0	0	0	0	0	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0	0	0	0	0	0
1957	1	1	1	1	1	1	1	1	1	1	1	1
1958	1	1	1	1	1	1	1	1	1	1	1	1
1959	1	1	1	1	1	1	1	1	1	1	1	1
1960	1	1	1	1	1	1	1	1	1	1	1	1
1961	1	1	1	1	1	1	1	1	1	1	1	1
1962	1	1	1	1	1	1	1	1	1	1	1	1
1963	1	1	1	1	1	1	1	1	1	1	1	1
1964	1	1	1	1	1	1	1	1	1	1	1	1
1965	1	1	1	1	1	1	1	1	1	1	1	1
1966	1	1	1	1	1	1	1	1	1	1	1	1
1967	1	1	1	1	1	1	1	1	1	1	1	1
1968	1	1	1	1	1	1	1	1	1	1	1	1
1969	1	1	1	1	1	1	1	1	1	1	1	1
1970	1	1	1	1	1	1	1	1	1	1	1	1
1971	1	1	1	1	1	1	1	1	1	1	1	1
1972	1	1	1	1	1	1	1	1	1	1	1	1
1973	1	1	1	1	1	1	1	1	1	1	1	1

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=USC00087025 name=PERRY, FL US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1974	1	1	1	1	1	1	1	1	1	1	1	1
1975	1	1	1	1	1	1	1	1	1	1	1	1
1976	1	1	1	1	1	1	1	1	1	1	1	1
1977	1	1	1	1	1	1	1	1	1	1	1	1
1978	1	1	1	1	1	1	1	1	1	1	1	1
1979	1	1	1	1	1	1	1	1	1	1	1	1
1980	1	1	1	1	1	1	1	1	1	1	0	1
1981	1	1	1	1	1	0	1	1	1	1	1	1
1982	1	1	1	1	1	1	1	1	1	1	1	1
1983	1	1	1	1	1	1	1	1	1	1	1	1
1984	1	1	1	1	1	1	1	1	1	1	1	1
1985	1	1	1	1	1	1	1	1	1	1	1	1
1986	1	1	1	1	1	1	1	1	1	1	1	1
1987	1	1	1	1	1	1	1	1	1	1	1	1
1988	1	1	1	1	1	1	1	1	1	1	1	1
1989	1	1	1	1	1	1	1	1	1	1	1	1
1990	1	1	1	1	1	1	1	1	1	1	1	1
1991	1	1	1	1	1	1	1	1	1	1	1	1
1992	1	1	1	1	1	1	1	1	1	1	1	1
1993	1	1	1	1	1	1	1	1	1	1	1	1
1994	1	1	1	1	1	1	1	1	1	1	1	1
1995	1	1	1	1	1	1	1	1	1	1	1	1
1996	1	1	1	1	1	1	1	1	1	1	1	1
1997	1	1	1	1	1	1	1	1	1	1	1	1
1998	1	1	1	1	1	1	1	1	1	1	1	1
1999	1	1	1	1	1	1	1	1	1	1	1	1
2000	1	1	1	1	1	1	1	1	1	1	1	1
2001	1	1	1	1	1	1	1	1	1	1	1	1
2002	1	1	1	1	1	1	1	1	1	1	1	1
2003	1	0	1	1	1	1	1	1	1	1	1	1
2004	1	1	1	1	1	1	1	1	1	1	1	1
2005	1	1	1	1	1	1	1	1	1	1	1	1
2006	1	1	1	1	1	1	1	1	1	1	1	1
2007	1	1	1	1	1	1	1	1	1	1	1	1

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=USC00087025 name=PERRY, FL US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
2008	1	1	1	1	1	1	1	1	1	1	1	1
2009	1	1	1	1	1	1	1	1	1	1	1	1
2010	1	1	1	1	1	1	1	1	1	1	1	1
2011	1	1	1	1	1	1	1	1	1	1	1	1
2012	1	1	1	1	1	1	1	1	1	1	1	1
2013	1	1	1	1	1	1	1	1	1	1	1	1
2014	1	1	1	1	1	1	1	1	1	1	1	1
2015	1	1	1	1	1	1	1	1	1	1	1	1
2016	1	1	1	1	1	1	1	1	1	1	1	1

Check for Data Gaps in Rainfall Timeseries

Station=USC00087869 name=ST MARKS NWR, FL US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
2002	0	0	0	0	0	0	1	1	1	1	1	1
2003	1	1	1	1	1	1	1	1	1	0	1	1
2004	1	1	1	1	1	0	1	1	1	1	1	1
2005	1	1	1	1	1	1	1	1	1	1	1	1
2006	1	1	1	1	1	1	1	1	1	1	1	1
2007	1	1	1	1	1	1	1	1	1	1	1	1
2008	1	1	1	1	1	1	0	1	1	1	1	1
2009	1	1	1	1	1	1	1	1	1	1	1	1
2010	1	1	1	1	1	1	1	1	1	1	1	1
2011	1	1	1	1	0	1	1	0	1	0	0	0
2012	1	0	1	1	1	1	1	1	1	1	1	1
2013	1	1	0	1	1	0	0	1	1	1	1	1
2014	1	1	1	1	1	0	0	1	1	1	1	1
2015	1	1	1	1	0	0	0	0	0	0	0	0
2016	0	1	0	0	1	0	0	0	0	1	1	0

Check for Data Gaps in Rainfall Timeseries

Station=USC00091463 name=CAIRO, GA US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1940	1	1	1	1	1	1	1	1	1	1	1	1
1941	1	1	1	1	1	1	1	1	1	1	1	1
1942	1	1	1	1	1	1	1	1	1	1	1	1
1943	1	1	1	1	1	1	1	1	1	1	1	1
1944	1	1	1	1	1	1	1	1	1	1	1	1
1945	1	1	1	1	1	1	1	1	1	1	1	0
1946	1	1	1	1	1	1	1	1	1	1	1	1
1947	1	0	1	1	1	1	1	1	1	1	1	1
1948	1	1	1	1	1	1	1	1	1	1	1	1
1949	1	1	1	1	1	1	1	1	1	1	1	1
1950	1	1	1	1	1	1	1	1	1	1	1	1
1951	1	1	1	1	1	1	1	1	1	1	1	1
1952	1	1	1	1	1	1	1	1	1	1	1	1
1953	1	1	1	1	1	1	1	1	1	1	1	1
1954	1	1	1	1	1	1	1	1	1	1	1	1
1955	1	1	1	1	1	1	1	1	1	1	1	1
1956	1	1	1	1	1	1	1	1	1	1	1	1
1957	1	1	1	1	1	1	1	1	1	1	1	1
1958	1	1	1	1	1	1	1	1	1	1	1	1
1959	1	1	1	1	1	1	1	1	1	1	1	1
1960	1	1	1	1	1	1	1	1	1	1	1	1
1961	1	1	1	1	1	1	1	1	1	1	1	1
1962	1	1	1	1	1	1	1	1	1	1	1	1
1963	1	1	1	1	1	1	1	1	1	1	1	1
1964	1	1	1	1	1	1	1	1	1	1	1	1
1965	1	1	1	1	1	1	1	1	1	1	1	1
1966	1	1	1	1	1	1	1	1	1	1	1	1
1967	1	1	1	1	1	1	1	1	1	1	1	1
1968	1	1	1	1	1	1	1	1	1	1	1	1
1969	1	1	1	1	1	1	1	1	1	1	1	1
1970	1	1	1	1	1	1	1	1	1	1	1	1
1971	1	1	1	1	1	1	1	1	1	1	1	1
1972	1	1	1	1	1	1	1	1	1	1	1	1
1973	1	1	1	1	1	1	0	0	0	0	0	0

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=USC00091463 name=CAIRO, GA US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1974	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	1	1	1	1	1	1	1
1989	1	1	1	1	1	1	1	1	1	1	1	1
1990	1	1	1	1	1	1	1	1	1	1	1	1
1991	1	1	1	1	1	1	1	1	1	0	1	1
1992	1	1	1	1	1	0	1	1	1	1	1	1
1993	0	1	1	1	1	1	1	1	1	1	1	1
1994	1	1	1	1	1	1	1	1	1	1	1	1
1995	1	1	1	0	1	1	0	1	1	1	1	1
1996	1	1	1	1	1	1	1	1	1	1	0	1
1997	1	1	1	1	1	1	1	1	1	1	1	1
1998	1	1	1	1	1	1	1	1	1	1	1	1
1999	1	1	1	1	1	1	1	1	1	1	1	1
2000	1	1	1	1	1	1	1	1	1	1	1	1
2001	1	1	1	1	1	1	1	1	1	1	1	1
2002	1	1	1	1	1	1	1	1	1	1	1	1
2003	1	0	1	1	1	1	0	1	1	1	1	1
2004	1	1	1	1	1	1	1	1	1	1	0	0
2005	0	0	1	1	1	1	1	1	1	1	1	1
2006	1	1	1	1	1	1	1	0	1	1	1	1
2007	1	1	1	1	1	1	1	1	1	1	1	1

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=USC00091463 name=CAIRO, GA US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
2008	1	1	1	1	1	1	1	0	0	0	0	1
2009	0	1	0	1	0	0	0	0	1	1	1	1
2010	1	1	1	1	1	1	1	1	1	1	1	1
2011	1	1	1	1	1	0	1	0	1	1	1	1
2012	1	1	0	0	1	1	1	1	1	0	1	1
2013	1	1	1	1	0	1	1	1	1	1	1	1
2014	1	1	1	1	0	1	1	1	1	1	1	1
2015	1	1	1	1	1	0	0	1	1	0	1	1
2016	1	1	1	1	1	1	1	1	1	1	1	1

Check for Data Gaps in Rainfall Timeseries

Station=USC00091500 name=CAMILLA 3 SE, GA US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1940	1	1	1	1	1	1	1	1	1	1	0	0
1941	0	0	0	0	0	1	1	1	1	1	1	1
1942	1	1	1	1	0	1	1	1	1	1	1	1
1943	1	1	1	1	1	1	1	1	1	1	1	1
1944	1	1	1	1	1	1	1	1	1	1	1	1
1945	1	1	1	1	0	1	1	1	1	1	1	1
1946	1	1	1	1	1	1	1	1	1	1	1	1
1947	1	1	1	1	1	1	1	1	1	1	1	1
1948	1	1	1	1	1	0	1	1	1	1	1	1
1949	1	1	1	1	1	1	1	1	1	1	1	1
1950	1	1	1	1	1	1	1	1	1	1	1	1
1951	1	1	1	1	1	1	1	0	1	1	1	1
1952	1	1	1	1	1	1	1	1	1	1	1	1
1953	1	1	1	1	1	1	1	1	1	1	1	1
1954	1	1	1	1	1	1	1	1	1	1	1	1
1955	1	1	1	1	1	1	1	1	1	1	1	1
1956	1	1	1	1	1	1	1	1	1	1	1	1
1957	1	1	1	1	1	1	1	1	1	1	1	1
1958	1	1	1	1	1	1	1	1	1	1	1	1
1959	1	1	1	1	1	1	1	1	1	1	1	1
1960	1	1	1	1	1	1	1	1	1	1	1	1
1961	1	1	1	1	1	1	1	1	1	1	1	1
1962	1	1	1	1	1	1	1	1	1	1	1	1
1963	1	1	1	1	1	1	1	1	1	1	1	1
1964	1	1	1	1	1	1	0	1	1	1	1	1
1965	1	1	1	1	1	1	1	1	1	1	1	1
1966	1	1	1	1	1	1	1	1	1	1	1	1
1967	1	1	1	1	1	1	1	1	1	1	1	1
1968	1	1	1	1	1	1	1	1	1	1	1	1
1969	1	1	1	1	1	1	1	1	1	1	1	1
1970	1	1	1	1	1	1	1	1	1	1	1	1
1971	1	1	1	1	1	1	1	1	1	1	1	1
1972	1	1	1	1	1	1	1	1	1	1	1	1
1973	1	1	1	1	1	1	1	1	1	1	1	1

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=USC00091500 name=CAMILLA 3 SE, GA US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1974	1	1	1	1	1	1	1	1	1	1	1	1
1975	1	1	1	1	1	1	1	1	1	1	1	1
1976	1	1	1	1	1	1	1	1	1	1	1	1
1977	1	1	1	1	1	1	1	1	1	1	1	1
1978	1	1	1	1	1	1	1	1	1	1	1	1
1979	1	1	1	1	1	1	1	1	1	1	1	1
1980	1	1	1	1	1	1	1	1	1	1	1	1
1981	1	1	1	1	1	1	1	1	1	1	1	1
1982	1	1	1	1	1	1	1	1	1	1	1	1
1983	1	1	1	1	1	1	1	1	1	1	1	1
1984	1	1	1	1	1	1	1	1	1	1	1	1
1985	1	1	1	1	1	1	1	1	1	1	1	1
1986	1	1	1	1	1	1	1	1	1	1	1	1
1987	1	1	1	1	1	1	1	1	1	1	1	1
1988	1	1	1	1	1	1	1	1	1	1	1	1
1989	1	1	1	1	1	1	1	1	1	1	1	1
1990	1	1	1	1	1	1	1	1	1	1	1	1
1991	1	1	1	1	1	1	1	1	1	1	1	1
1992	1	1	1	1	1	1	1	1	1	1	1	1
1993	1	1	1	1	1	1	1	1	1	1	1	1
1994	1	1	1	1	1	1	1	1	1	1	1	1
1995	1	1	1	1	1	1	1	1	1	1	1	1
1996	1	1	1	1	1	1	1	1	1	1	1	1
1997	1	1	1	0	1	1	1	1	1	1	1	1
1998	1	1	1	1	1	1	1	1	1	1	1	1
1999	1	1	1	1	1	1	1	1	1	1	1	1
2000	1	1	1	1	1	1	1	1	1	1	1	1
2001	1	1	1	1	1	1	1	1	1	1	1	1
2002	1	1	1	1	1	1	1	1	1	1	1	1
2003	1	1	1	1	1	1	1	1	1	1	1	1
2004	1	1	1	1	1	1	1	1	1	1	1	1
2005	1	1	1	1	1	1	1	1	1	1	1	1
2006	1	1	1	1	1	1	1	1	1	1	1	1
2007	1	1	1	1	1	1	1	1	1	1	1	1

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=USC00091500 name=CAMILLA 3 SE, GA US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
2008	1	1	1	1	1	1	0	1	1	1	1	1
2009	1	1	1	1	1	1	1	1	1	1	1	1
2010	1	1	1	1	1	1	1	1	1	1	1	1
2011	1	1	1	1	1	1	1	1	1	1	1	1
2012	1	1	1	1	1	1	1	1	1	1	1	1
2013	1	1	1	1	1	1	1	1	1	1	1	1
2014	1	1	1	1	1	1	1	1	1	1	1	1
2015	1	1	1	1	1	1	1	1	1	1	1	1
2016	1	1	1	1	1	1	1	1	1	1	1	1

Check for Data Gaps in Rainfall Timeseries

Station=USC00096087 name=MOULTRIE 2 ESE, GA US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1940	1	1	1	1	1	1	1	1	1	1	1	1
1941	1	1	1	1	1	1	1	1	1	1	1	1
1942	1	1	1	1	1	1	1	1	1	1	1	1
1943	1	1	1	1	1	1	1	1	1	1	1	1
1944	1	1	1	1	1	1	1	1	1	1	1	1
1945	1	1	1	1	1	1	1	1	1	1	1	1
1946	1	1	1	1	1	1	1	1	1	1	1	1
1947	1	1	1	1	1	1	1	1	1	1	1	1
1948	1	1	1	1	1	1	1	1	1	1	1	1
1949	1	1	1	1	1	1	1	1	1	1	1	1
1950	1	1	1	1	1	1	1	1	1	1	1	1
1951	1	1	1	1	1	1	1	1	1	1	1	1
1952	1	1	1	1	1	1	1	1	1	1	1	1
1953	1	1	1	1	1	1	1	1	1	1	1	1
1954	1	1	1	1	1	1	1	1	1	1	1	1
1955	1	1	1	1	1	1	1	1	1	1	1	1
1956	1	1	1	1	1	1	1	1	1	1	1	1
1957	1	1	1	1	1	1	1	1	1	1	1	1
1958	1	1	1	1	1	1	1	1	1	1	1	1
1959	1	1	1	1	1	1	1	1	1	1	1	1
1960	1	1	1	1	1	1	1	1	1	1	1	1
1961	1	1	1	1	1	1	1	1	1	1	1	1
1962	1	1	1	1	1	1	1	1	1	1	1	1
1963	1	1	1	1	1	1	1	1	1	1	1	1
1964	1	1	1	1	1	1	1	1	1	1	1	1
1965	1	1	1	1	1	1	1	1	1	1	1	1
1966	1	1	1	1	1	1	1	1	1	1	1	1
1967	1	1	1	1	1	1	1	1	1	1	1	1
1968	1	1	1	1	1	1	1	1	1	1	1	1
1969	1	1	1	1	1	1	1	1	1	1	1	1
1970	1	1	1	1	1	1	1	1	1	1	1	1
1971	1	1	1	1	1	1	1	1	1	1	1	1
1972	1	1	1	1	1	1	1	1	1	1	1	1
1973	1	1	1	1	1	1	1	1	1	1	1	1

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=USC00096087 name=MOULTRIE 2 ESE, GA US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1974	1	1	1	1	1	1	1	1	1	1	1	1
1975	1	1	1	1	1	1	1	1	1	1	1	1
1976	1	1	1	1	1	1	1	1	1	1	1	1
1977	1	1	1	1	1	1	1	1	1	1	1	1
1978	1	1	1	1	1	1	1	1	1	1	1	1
1979	1	1	1	1	1	1	1	1	1	1	1	1
1980	1	1	1	1	1	1	1	1	1	1	1	1
1981	1	1	1	1	1	1	1	1	1	1	1	1
1982	1	1	1	1	1	1	1	1	1	1	1	1
1983	1	1	1	1	1	1	1	1	1	1	1	1
1984	1	1	1	1	1	1	1	1	1	1	1	1
1985	1	1	1	1	1	1	1	1	1	1	1	1
1986	1	1	1	1	1	1	1	1	1	1	1	1
1987	1	1	1	1	1	1	1	1	1	1	1	1
1988	1	1	1	1	1	1	1	1	1	1	1	1
1989	1	1	1	1	1	1	1	1	1	1	1	1
1990	1	1	1	1	1	1	1	1	1	1	1	1
1991	1	1	1	1	1	1	1	1	1	1	1	1
1992	1	1	1	1	1	1	1	1	1	1	1	1
1993	1	1	1	1	1	1	1	1	1	1	1	1
1994	1	1	1	1	1	1	1	1	1	1	1	1
1995	1	1	1	1	1	1	1	1	1	1	1	1
1996	1	1	0	1	1	1	1	1	1	1	1	1
1997	1	1	1	1	1	1	1	1	1	1	1	1
1998	1	1	1	1	1	1	1	1	1	1	1	1
1999	1	1	1	1	1	1	1	1	1	1	1	1
2000	1	1	1	1	1	1	1	1	1	1	1	1
2001	1	1	1	1	1	1	1	1	1	1	1	1
2002	1	1	0	1	1	1	1	1	1	1	1	1
2003	1	1	1	1	1	1	1	1	1	1	1	1
2004	0	0	1	1	1	1	1	1	0	0	1	1
2005	1	1	0	0	0	0	0	1	1	1	1	1
2006	0	0	1	0	0	1	1	1	1	0	1	1
2007	1	1	1	1	1	1	1	1	1	1	1	0

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=USC00096087 name=MOULTRIE 2 ESE, GA US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
2008	1	1	1	1	1	1	1	1	1	1	1	1
2009	1	0	1	1	1	1	1	1	1	1	1	1
2010	1	1	1	1	1	1	1	1	1	1	1	1
2011	1	1	1	1	1	0	1	1	1	1	1	1
2012	1	1	1	1	1	1	1	1	1	1	1	1
2013	1	1	1	1	1	1	1	1	1	1	1	1
2014	1	1	1	1	1	1	1	1	1	1	1	1
2015	1	1	1	1	1	1	1	1	1	1	1	1
2016	1	0	0	0	0	0	0	1	1	1	1	0

Check for Data Gaps in Rainfall Timeseries

Station=USC00097276 name=QUITMAN 2 NW, GA US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1940	1	1	1	1	1	1	1	1	1	1	1	1
1941	1	1	1	1	1	1	1	1	1	1	1	1
1942	1	1	1	1	1	1	1	1	1	1	1	1
1943	1	1	1	1	1	1	1	1	1	1	1	1
1944	1	1	1	1	1	1	1	1	1	1	1	1
1945	1	1	1	1	1	1	1	1	1	1	1	1
1946	1	1	1	1	1	1	1	1	1	1	1	1
1947	1	1	1	1	1	1	1	1	1	1	1	1
1948	1	1	1	1	1	1	1	1	1	1	1	1
1949	1	1	1	1	1	1	1	1	1	1	1	1
1950	1	1	1	1	1	1	1	1	1	1	1	1
1951	1	1	1	1	1	1	1	1	1	1	1	1
1952	1	1	1	1	1	1	1	1	1	1	1	1
1953	1	1	1	1	1	1	1	1	1	1	1	1
1954	1	1	1	1	1	1	1	1	1	1	1	1
1955	1	1	1	1	1	1	1	1	1	1	0	1
1956	1	1	1	1	1	1	1	1	0	1	1	1
1957	1	1	1	1	1	1	1	1	1	1	1	1
1958	1	1	1	1	1	1	1	1	1	1	1	1
1959	1	1	1	1	1	1	1	1	1	1	1	1
1960	1	1	1	1	1	1	1	1	0	1	1	1
1961	1	1	1	0	1	1	1	1	1	1	1	1
1962	1	1	1	1	1	1	1	1	1	1	1	1
1963	1	1	1	1	1	1	1	1	1	1	1	1
1964	1	1	1	1	1	1	1	1	1	1	1	1
1965	1	1	1	1	1	1	1	1	1	1	1	1
1966	1	1	1	1	1	1	1	1	1	1	1	1
1967	1	1	1	1	1	1	1	1	1	1	1	1
1968	1	1	1	1	1	1	1	1	1	1	1	1
1969	0	1	1	1	1	1	1	1	1	1	1	1
1970	1	1	1	1	1	1	1	1	1	1	1	1
1971	1	1	1	1	1	1	1	1	1	1	1	1
1972	1	1	1	1	1	1	1	1	1	1	1	1
1973	1	1	0	1	1	1	1	1	1	1	1	1

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=USC00097276 name=QUITMAN 2 NW, GA US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1974	1	1	1	1	1	0	1	1	0	1	0	1
1975	0	0	0	0	0	1	1	0	0	0	0	0
1976	1	0	1	1	1	1	1	1	1	1	1	1
1977	1	0	1	1	1	1	1	0	1	1	0	1
1978	1	1	1	1	1	0	1	1	1	1	1	1
1979	1	1	1	1	1	1	1	1	0	1	1	1
1980	1	0	1	1	1	1	1	1	1	1	1	1
1981	1	1	1	1	1	1	1	1	1	1	1	1
1982	1	1	0	0	1	1	1	1	1	1	1	1
1983	1	1	1	1	1	1	1	1	1	1	1	1
1984	1	1	1	1	1	1	1	1	1	1	1	1
1985	1	1	1	1	1	1	1	1	1	1	1	1
1986	1	1	0	1	1	1	1	0	1	1	1	1
1987	1	1	1	0	1	1	1	0	1	1	1	0
1988	1	1	1	1	0	1	1	1	1	1	1	1
1989	1	1	1	1	1	1	1	1	1	1	1	1
1990	1	1	1	1	1	0	1	0	1	1	0	0
1991	1	1	1	1	0	1	1	1	1	1	1	0
1992	1	1	1	1	1	1	1	1	1	0	1	1
1993	1	0	1	1	1	1	1	1	1	1	1	1
1994	1	1	1	1	1	1	1	1	1	1	1	1
1995	1	1	1	1	1	1	1	0	1	1	1	1
1996	0	1	1	1	1	1	0	1	1	1	1	1
1997	0	1	1	1	0	1	1	0	1	1	1	0
1998	1	1	1	1	1	1	1	1	1	1	1	1
1999	1	1	1	1	1	1	0	1	1	0	1	1
2000	1	1	1	1	1	1	1	1	1	1	1	1
2001	1	1	1	1	1	1	0	0	1	1	1	1
2002	1	1	1	1	1	1	1	1	1	1	1	1
2003	1	1	1	1	1	1	1	0	1	1	1	1
2004	1	1	0	1	0	1	0	1	0	1	1	1
2005	1	1	1	1	1	1	0	1	1	0	1	1
2006	1	1	1	1	1	1	1	1	0	1	1	1
2007	1	1	1	1	1	1	1	1	1	1	1	1

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=USC00097276 name=QUITMAN 2 NW, GA US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
2008	1	1	1	1	1	0	0	1	1	1	1	1
2009	1	0	0	0	0	1	1	1	0	0	1	1
2010	0	0	1	1	0	0	1	1	0	1	0	0

Check for Data Gaps in Rainfall Timeseries

Station=USC00098703 name=TIFTON, GA US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1940	1	1	1	1	1	1	1	1	1	1	1	1
1941	1	1	1	1	1	1	1	1	1	1	1	1
1942	1	1	1	1	1	1	1	1	1	1	1	1
1943	1	1	1	1	1	1	1	1	1	1	1	1
1944	1	1	1	1	1	1	1	1	1	1	1	1
1945	1	1	1	1	1	1	1	1	1	1	1	1
1946	1	1	1	1	1	1	1	1	1	1	1	1
1947	1	1	1	1	1	1	1	1	1	1	1	1
1948	1	1	1	1	1	1	1	1	1	1	1	1
1949	1	1	1	1	1	1	1	1	1	1	1	1
1950	1	1	1	1	1	1	1	1	1	1	1	1
1951	1	1	1	1	1	1	1	1	1	1	1	1
1952	1	1	1	1	1	1	1	1	1	1	1	1
1953	1	1	1	1	1	1	1	1	1	1	1	1
1954	1	1	1	1	1	1	1	1	1	1	1	1
1955	1	1	1	1	1	1	1	1	1	1	1	1
1956	1	1	1	1	1	1	1	1	1	1	1	1
1957	1	1	1	1	1	1	1	1	1	1	1	1
1958	1	1	1	1	1	1	1	1	1	1	1	1
1959	1	1	1	1	1	1	1	1	1	1	1	1
1960	1	1	1	1	1	1	1	1	1	1	1	1
1961	1	1	1	1	1	1	1	1	1	1	1	1
1962	1	1	1	1	1	1	1	1	1	1	1	1
1963	1	1	1	1	1	1	1	1	1	1	1	1
1964	1	1	1	1	1	1	1	1	1	1	1	1
1965	1	1	1	1	1	1	1	1	1	1	1	1
1966	1	1	1	1	1	1	1	1	1	1	1	1
1967	1	1	1	1	1	1	1	1	1	1	1	1
1968	1	1	0	1	1	1	1	1	1	1	1	1
1969	1	1	1	1	1	1	1	1	1	1	1	1
1970	1	1	1	1	1	1	1	1	1	1	1	1
1971	1	1	1	1	1	1	1	1	1	1	1	1
1972	1	1	1	1	1	1	1	1	1	1	1	1
1973	1	1	1	1	1	1	1	1	1	1	1	1

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=USC00098703 name=TIFTON, GA US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1974	1	1	1	1	1	1	1	1	1	1	1	1
1975	1	1	1	1	1	1	1	1	1	1	1	1
1976	0	1	1	1	1	1	1	1	1	1	1	1
1977	1	1	1	1	1	1	1	1	1	1	1	1
1978	1	1	1	1	1	1	1	1	1	0	1	1
1979	1	1	1	1	1	1	1	1	1	1	1	1
1980	1	1	1	1	1	1	1	1	1	1	1	1
1981	1	1	1	1	1	1	1	1	1	1	1	1
1982	1	1	1	1	1	1	1	1	1	1	1	1
1983	1	1	1	1	1	1	1	1	1	1	1	1
1984	1	1	1	1	1	1	1	1	1	1	1	1
1985	1	1	1	1	1	1	1	1	1	1	1	1
1986	1	1	1	1	1	1	1	1	1	1	1	1
1987	1	1	1	1	1	1	1	1	1	1	1	1
1988	1	1	1	1	1	1	1	1	1	1	1	1
1989	1	1	1	1	1	1	1	1	1	1	1	1
1990	1	1	1	1	1	1	1	1	1	1	1	1
1991	1	1	1	1	1	1	1	1	1	1	1	1
1992	1	1	1	1	1	1	1	1	1	1	1	1
1993	1	1	1	1	1	1	1	1	1	1	1	1
1994	1	1	1	1	1	1	1	1	1	1	1	1
1995	1	1	1	1	1	1	1	1	1	1	1	1
1996	1	1	1	1	1	1	1	1	1	1	1	1
1997	1	1	1	1	1	1	1	1	1	1	1	1
1998	1	1	1	1	1	1	1	1	1	1	1	1
1999	1	1	1	1	1	1	1	1	1	1	1	1
2000	1	1	1	1	1	1	1	1	1	1	1	1
2001	1	1	1	1	1	1	1	1	1	1	1	1
2002	1	1	1	1	1	1	1	1	1	1	1	1
2003	1	1	1	1	1	1	0	1	1	1	1	1
2004	1	1	1	1	1	1	1	1	1	1	1	1
2005	1	1	1	1	1	1	1	1	1	1	1	1
2006	1	1	1	1	1	1	1	1	1	1	1	1
2007	1	1	1	1	1	1	1	1	1	1	1	1

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=USC00098703 name=TIFTON, GA US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
2008	1	1	1	1	1	1	0	1	1	1	1	1
2009	1	1	1	1	1	0	1	1	1	1	1	1
2010	1	1	1	1	1	1	1	1	1	1	1	1
2011	1	1	1	1	1	1	1	1	1	1	1	1
2012	1	1	1	1	1	1	1	1	1	1	1	1
2013	1	1	1	1	1	1	1	1	1	1	1	1
2014	1	1	1	1	1	1	1	1	1	1	1	1
2015	1	1	1	1	1	1	1	1	1	1	1	1
2016	1	1	1	1	1	1	1	1	1	1	1	1

Check for Data Gaps in Rainfall Timeseries

Station=USW00093805 name=TALLAHASSEE REGIONAL AIRPORT, FL US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1942	0	0	0	0	0	0	0	1	1	1	1	1
1943	0	0	0	0	0	0	0	0	0	0	0	0
1944	0	0	0	0	0	0	0	0	0	0	0	0
1945	0	0	0	0	0	0	0	0	0	0	0	0
1946	1	1	1	1	1	1	1	1	1	1	1	1
1947	1	1	1	1	1	1	1	1	1	1	1	1
1948	0	1	1	1	1	1	1	1	1	1	1	1
1949	0	1	1	1	1	1	1	1	1	1	1	1
1950	1	1	1	1	1	1	1	1	1	1	1	1
1951	1	1	1	1	1	1	1	1	1	1	1	1
1952	1	1	1	1	1	1	1	1	1	1	1	1
1953	1	1	1	1	1	1	1	1	1	1	1	1
1954	1	1	1	1	1	1	1	1	1	1	1	1
1955	1	1	1	1	1	1	1	1	1	1	1	1
1956	1	1	1	1	1	1	1	1	1	1	1	1
1957	1	1	1	1	1	1	1	1	1	1	1	1
1958	1	1	1	1	1	1	1	1	1	1	1	1
1959	1	1	1	1	1	1	1	1	1	1	1	1
1960	1	1	1	1	1	1	1	1	1	1	1	1
1961	1	1	1	1	1	1	1	1	1	1	1	1
1962	1	1	1	1	1	1	1	1	1	1	1	1
1963	1	1	1	1	1	1	1	1	1	1	1	1
1964	1	1	1	1	1	1	1	1	1	1	1	1
1965	1	1	1	1	1	1	1	1	1	1	1	1
1966	1	1	1	1	1	1	1	1	1	1	1	1
1967	1	1	1	1	1	1	1	1	1	1	1	1
1968	1	1	1	1	1	1	1	1	1	1	1	1
1969	1	1	1	1	1	1	1	1	1	1	1	1
1970	1	1	1	1	1	1	1	1	1	1	1	1
1971	1	1	1	1	1	1	1	1	1	1	1	1
1972	1	1	1	1	1	1	1	1	1	1	1	1
1973	1	1	1	1	1	1	1	1	1	1	1	1
1974	1	1	1	1	1	1	1	1	1	1	1	1
1975	1	1	1	1	1	1	1	1	1	1	1	1

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=USW00093805 name=TALLAHASSEE REGIONAL AIRPORT, FL US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
1976	1	1	1	1	1	1	1	1	1	1	1	1
1977	1	1	1	1	1	1	1	1	1	1	1	1
1978	1	1	1	1	1	1	1	1	1	1	1	1
1979	1	1	1	1	1	1	1	1	1	1	1	1
1980	1	1	1	1	1	1	1	1	1	1	1	1
1981	1	1	1	1	1	1	1	1	1	1	1	1
1982	1	1	1	1	1	1	1	1	1	1	1	1
1983	1	1	1	1	1	1	1	1	1	1	1	1
1984	1	1	1	1	1	1	1	1	1	1	1	1
1985	1	1	1	1	1	1	1	1	1	1	1	1
1986	1	1	1	1	1	1	1	1	1	1	1	1
1987	1	1	1	1	1	1	1	1	1	1	1	1
1988	1	1	1	1	1	1	1	1	1	1	1	1
1989	1	1	1	1	1	1	1	1	1	1	1	1
1990	1	1	1	1	1	1	1	1	1	1	1	1
1991	1	1	1	1	1	1	1	1	1	1	1	1
1992	1	1	1	1	1	1	1	1	1	1	1	1
1993	1	1	1	1	1	1	1	1	1	1	1	1
1994	1	1	1	1	1	1	1	1	1	1	1	1
1995	1	1	1	1	1	1	1	1	1	1	1	1
1996	1	1	1	1	1	1	1	1	1	1	1	1
1997	1	1	1	1	1	1	1	1	1	1	1	1
1998	1	1	1	1	1	1	1	1	1	1	1	1
1999	1	1	1	1	1	1	1	1	1	1	1	1
2000	1	1	1	1	1	1	1	1	1	1	1	1
2001	1	1	1	1	1	1	1	1	1	1	1	1
2002	1	1	1	1	1	1	1	1	1	1	1	1
2003	1	1	1	1	1	1	1	1	1	1	1	1
2004	1	1	1	1	1	1	1	1	1	1	1	1
2005	1	1	1	1	1	1	1	1	1	1	1	1
2006	1	1	1	1	1	1	1	1	1	1	1	1
2007	1	1	1	1	1	1	1	1	1	1	1	1
2008	1	1	1	1	1	1	1	1	1	1	1	1
2009	1	1	1	1	1	1	1	1	1	1	1	1

(Continued)

Check for Data Gaps in Rainfall Timeseries

Station=USW00093805 name=TALLAHASSEE REGIONAL AIRPORT, FL US

	month											
	1	2	3	4	5	6	7	8	9	10	11	12
year												
2010	1	1	1	1	1	1	1	1	1	1	1	1
2011	1	1	1	1	1	1	1	1	1	1	1	1
2012	1	1	1	1	1	1	1	1	1	1	1	1
2013	1	1	1	1	1	1	1	1	1	1	1	1
2014	1	1	1	1	1	1	1	1	1	1	1	1
2015	1	1	1	1	1	1	1	1	1	1	1	1
2016	1	1	1	1	1	1	1	1	1	1	1	1

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=US1GATH0004 name=THOMASVILLE 5.1 ESE, GA US

Moments			
N	95	**Sum Weights**	95
Mean	4.40473684	**Sum Observations**	418.45
Std Deviation	2.54221249	**Variance**	6.46284434
Skewness	0.75827355	**Kurtosis**	0.58603891
Uncorrected SS	2450.6695	**Corrected SS**	607.507368
Coeff Variation	57.7154228	**Std Error Mean**	0.2608255

Basic Statistical Measures			
Location		**Variability**	
Mean	4.404737	**Std Deviation**	2.54221
Median	4.240000	**Variance**	6.46284
Mode	2.350000	**Range**	12.31000
		Interquartile Range	3.23000

Note: The mode displayed is the smallest of 2 modes with a count of 3.

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	16.88768	**Pr > |t|**	<.0001
Sign	**M**	47.5	**Pr >= |M|**	<.0001
Signed Rank	**S**	2280	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	12.41
99%	12.41
95%	9.77
90%	7.63
75% Q3	5.81
50% Median	4.24
25% Q1	2.58
10%	1.46
5%	0.59
1%	0.10
0% Min	0.10

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=US1GATH0004 name=THOMASVILLE 5.1 ESE, GA US

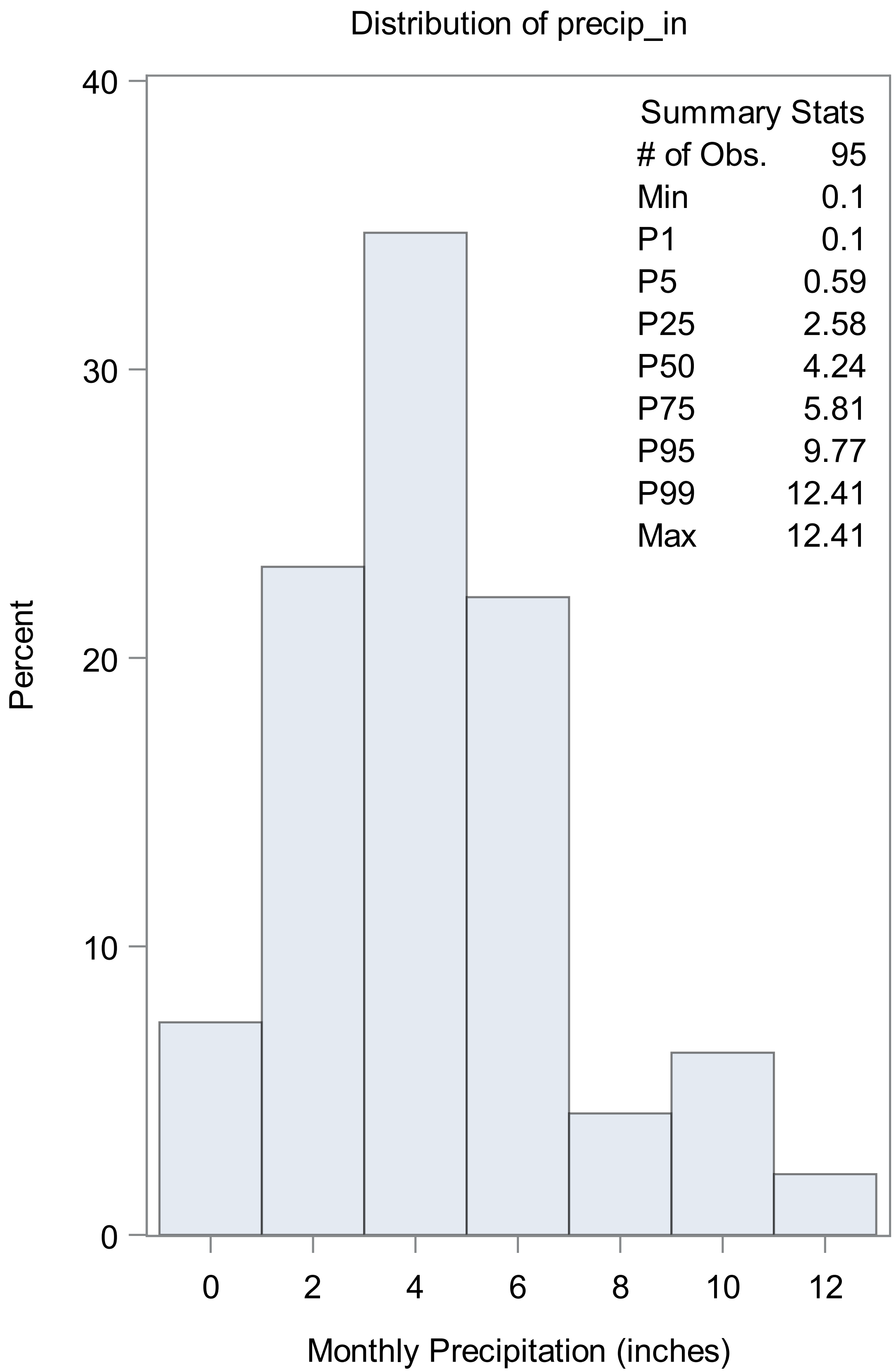
Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
0.10	95	9.77	72
0.21	22	9.85	90
0.40	94	9.93	12
0.48	47	11.00	4
0.59	29	12.41	50

Missing Values			
		Percent Of	
Missing Value	Count	All Obs	Missing Obs
.	1	1.04	100.00

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

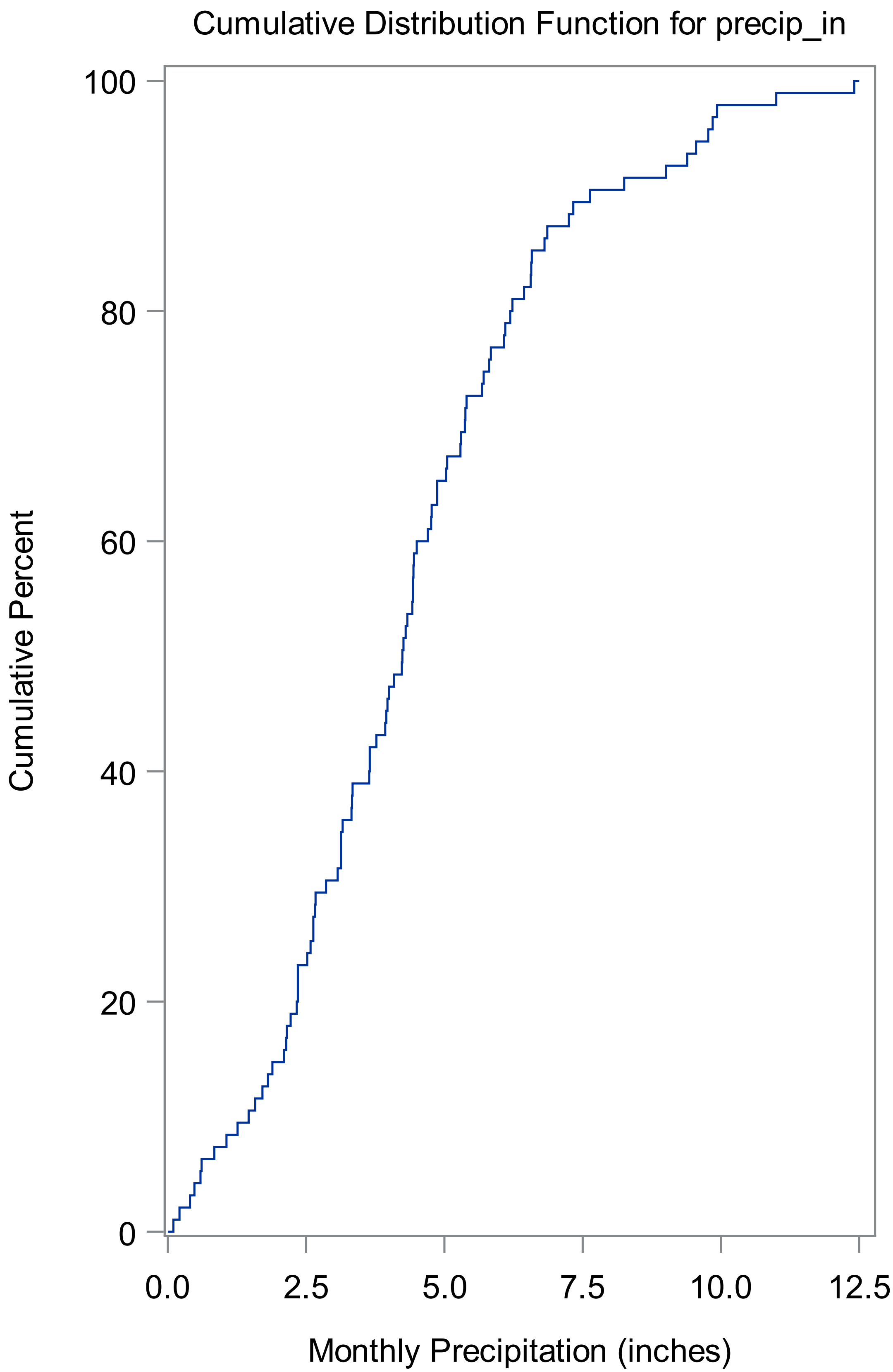
Station=US1GATH0004 name=THOMASVILLE 5.1 ESE, GA US



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

Station=US1GATH0004 name=THOMASVILLE 5.1 ESE, GA US



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=USC00085880 name=MONTICELLO 10 SW, FL US

Moments			
N	94	**Sum Weights**	94
Mean	4.765	**Sum Observations**	447.91
Std Deviation	3.51158107	**Variance**	12.3312016
Skewness	2.05926452	**Kurtosis**	5.44179745
Uncorrected SS	3281.0929	**Corrected SS**	1146.80175
Coeff Variation	73.6953005	**Std Error Mean**	0.36219193

Basic Statistical Measures			
Location		**Variability**	
Mean	4.765000	**Std Deviation**	3.51158
Median	4.000000	**Variance**	12.33120
Mode	2.110000	**Range**	18.48000
		Interquartile Range	2.97000

Note: The mode displayed is the smallest of 2 modes with a count of 2.

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	13.15601	**Pr > |t|**	<.0001
Sign	**M**	47	**Pr >= |M|**	<.0001
Signed Rank	**S**	2232.5	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	18.79
99%	18.79
95%	10.70
90%	9.23
75% Q3	5.51
50% Median	4.00
25% Q1	2.54
10%	1.48
5%	1.18
1%	0.31
0% Min	0.31

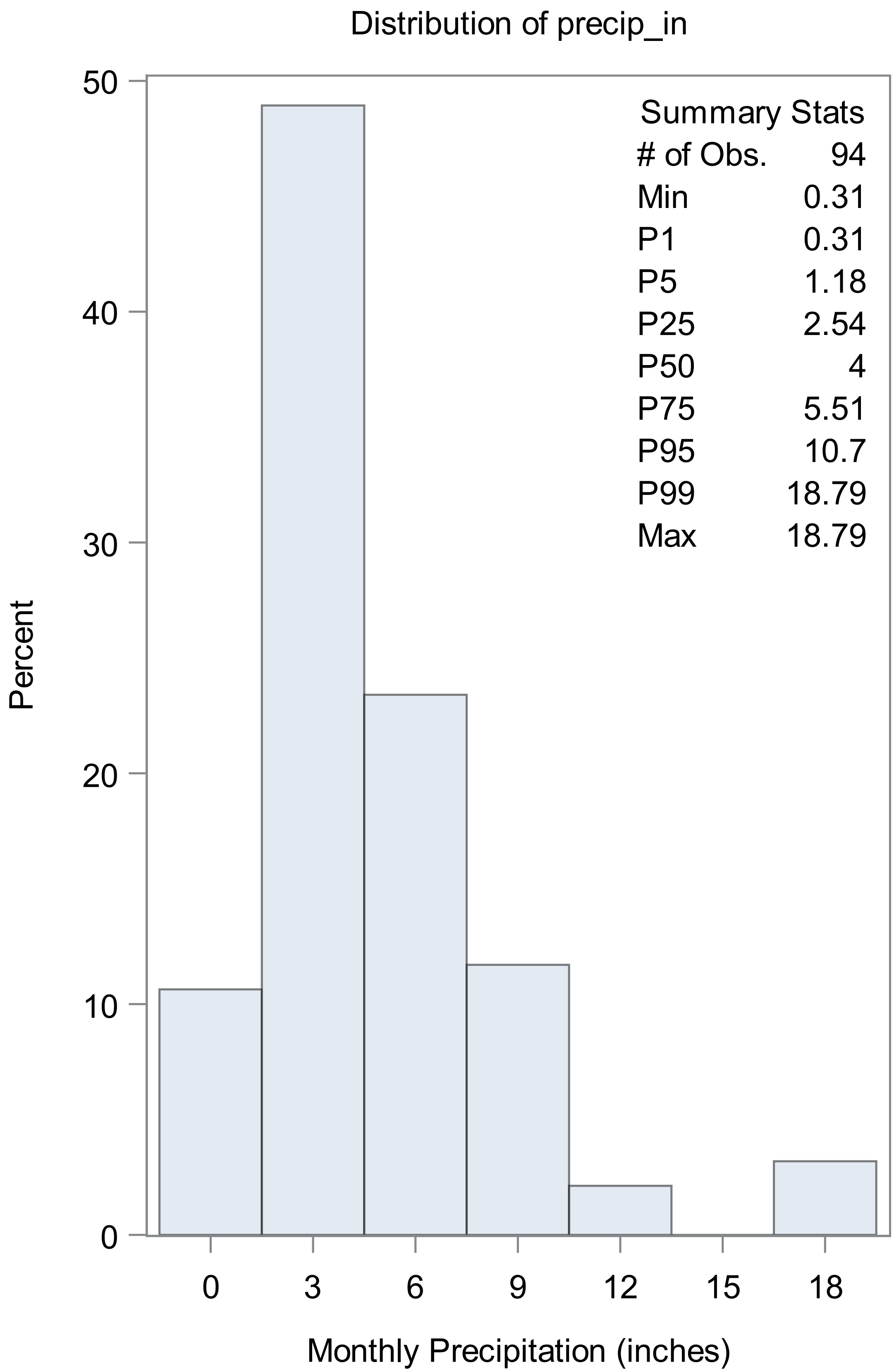
Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=USC00085880 name=MONTICELLO 10 SW, FL US

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
0.31	167	10.70	164
0.81	121	11.68	170
0.83	202	18.12	116
1.03	149	18.17	162
1.18	169	18.79	175

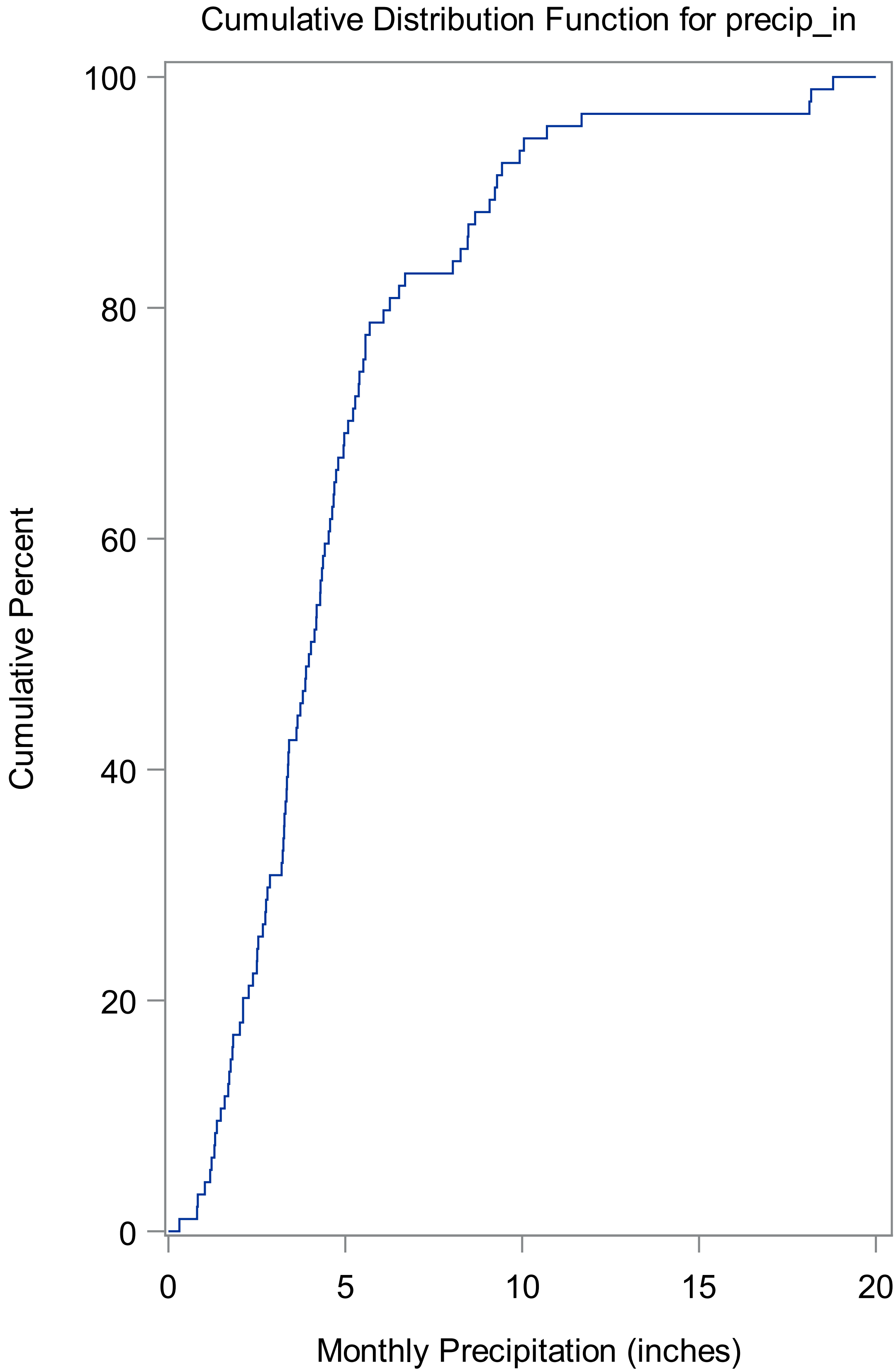
Missing Values			
		Percent Of	
Missing Value	Count	All Obs	Missing Obs
.	26	21.67	100.00


Distribution of precip_in
Summary Stats
# of Obs. 94
Min 0.31
P1 0.31
P5 1.18
P25 2.54
P50 4
P75 5.51
P95 10.7
P99 18.79
Max 18.79
Percent
0
10
20
30
40
50
0
3
6
9
12
15
18
Monthly Precipitation (inches)

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

Station=USC00085880 name=MONTICELLO 10 SW, FL US



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=USC00087025 name=PERRY, FL US

Moments			
N	809	**Sum Weights**	809
Mean	4.82154512	**Sum Observations**	3900.63
Std Deviation	3.6770423	**Variance**	13.5206401
Skewness	1.39792462	**Kurtosis**	2.49091666
Uncorrected SS	29731.7407	**Corrected SS**	10924.6772
Coeff Variation	76.2627375	**Std Error Mean**	0.12927792

Basic Statistical Measures			
Location		Variability	
Mean	4.821545	**Std Deviation**	3.67704
Median	4.010000	**Variance**	13.52064
Mode	1.200000	**Range**	23.08000
		Interquartile Range	4.35000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	37.29597	**Pr > |t|**	<.0001
Sign	**M**	402	**Pr >= |M|**	<.0001
Signed Rank	**S**	161805	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	23.08
99%	16.31
95%	12.47
90%	10.05
75% Q3	6.52
50% Median	4.01
25% Q1	2.17
10%	1.06
5%	0.51
1%	0.06
0% Min	0.00

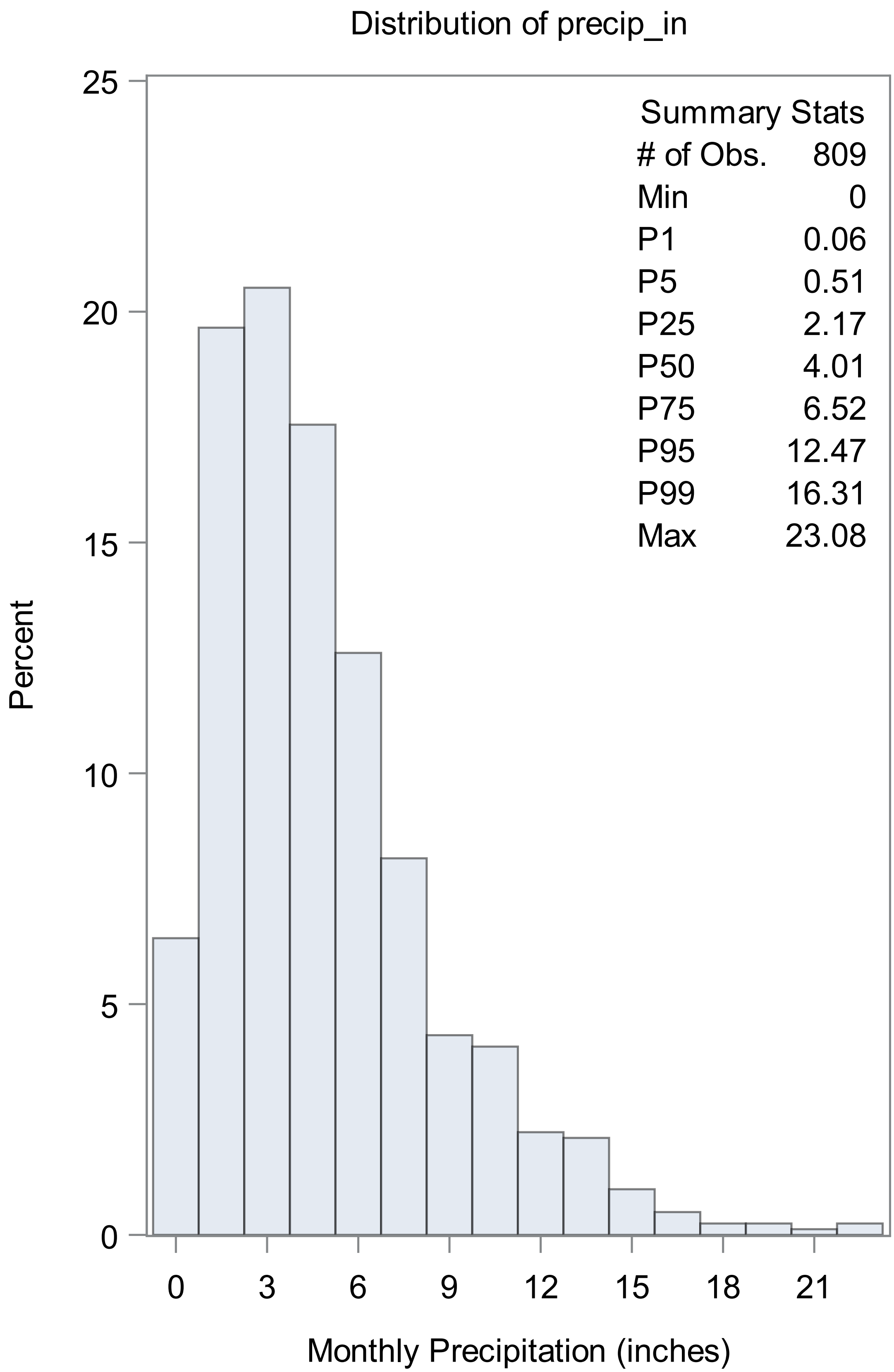
Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=USC00087025 name=PERRY, FL US

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
0	1051	19.03	1086
0	946	19.08	584
0	790	21.60	1040
0	262	22.00	429
0	226	23.08	764

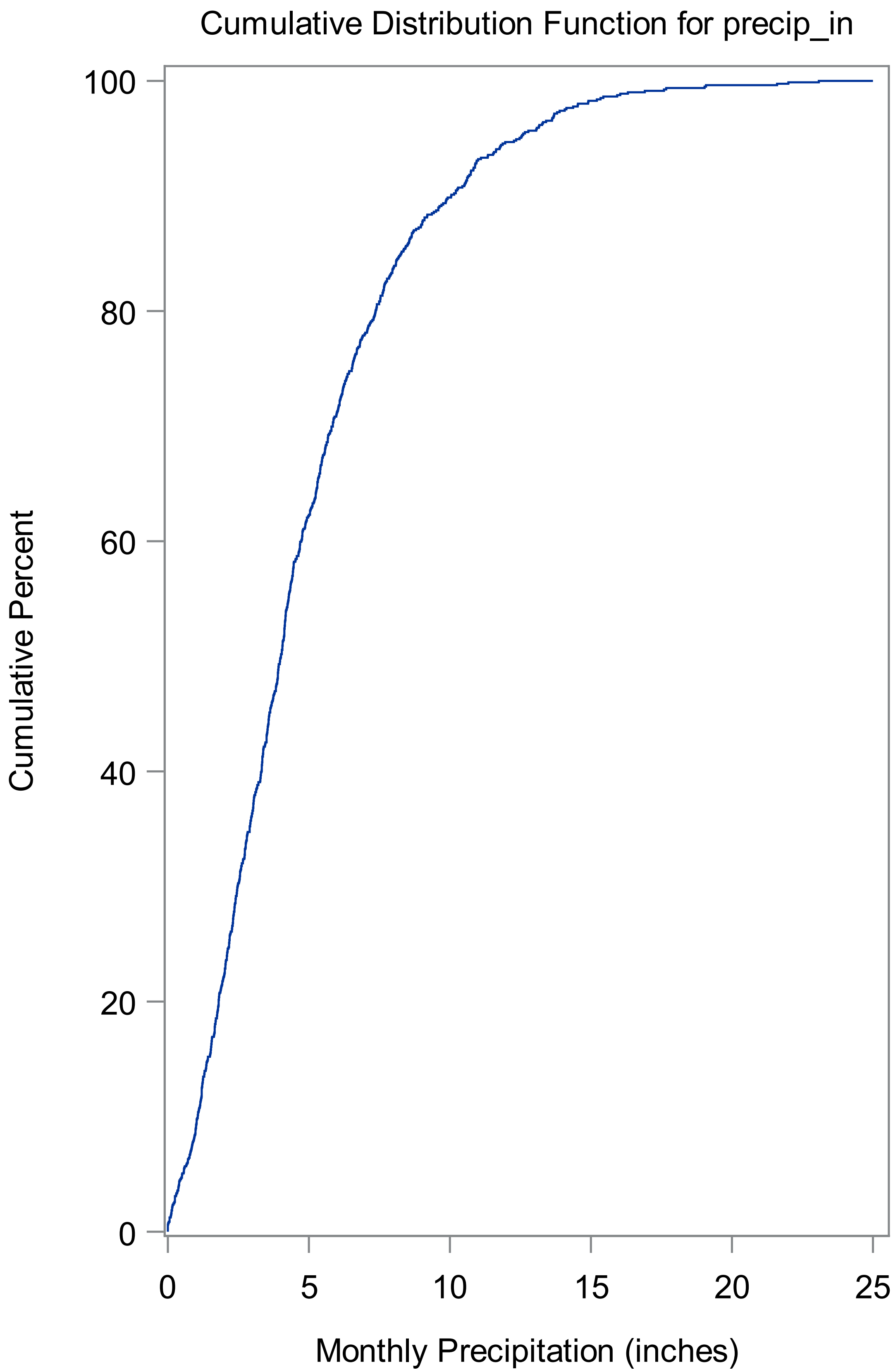
Missing Values			
		Percent Of	
Missing Value	Count	All Obs	Missing Obs
.	115	12.45	100.00


Distribution of precip_in
Summary Stats
# of Obs. 809
Min 0
P1 0.06
P5 0.51
P25 2.17
P50 4.01
P75 6.52
P95 12.47
P99 16.31
Max 23.08
Percent
0
5
10
15
20
25
0
3
6
9
12
15
18
21
Monthly Precipitation (inches)

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

Station=USC00087025 name=PERRY, FL US



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=USC00087869 name=ST MARKS NWR, FL US

Moments			
N	144	Sum Weights	144
Mean	4.26	Sum Observations	613.44
Std Deviation	2.94439731	Variance	8.66947552
Skewness	0.95158375	Kurtosis	1.02555519
Uncorrected SS	3852.9894	Corrected SS	1239.735
Coeff Variation	69.1173078	Std Error Mean	0.24536644

Basic Statistical Measures			
Location		Variability	
Mean	4.260000	Std Deviation	2.94440
Median	4.045000	Variance	8.66948
Mode	0.000000	Range	13.78000
		Interquartile Range	3.99500

Note: The mode displayed is the smallest of 2 modes with a count of 3.

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	17.36179	Pr > |t|	<.0001
Sign	M	70.5	Pr >= |M|	<.0001
Signed Rank	S	5005.5	Pr >= |S|	<.0001

Quantiles (Definition 5)	
Level	Quantile
100% Max	13.780
99%	13.260
95%	9.250
90%	8.000
75% Q3	5.890
50% Median	4.045
25% Q1	1.895
10%	1.050
5%	0.200
1%	0.000
0% Min	0.000

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=USC00087869 name=ST MARKS NWR, FL US

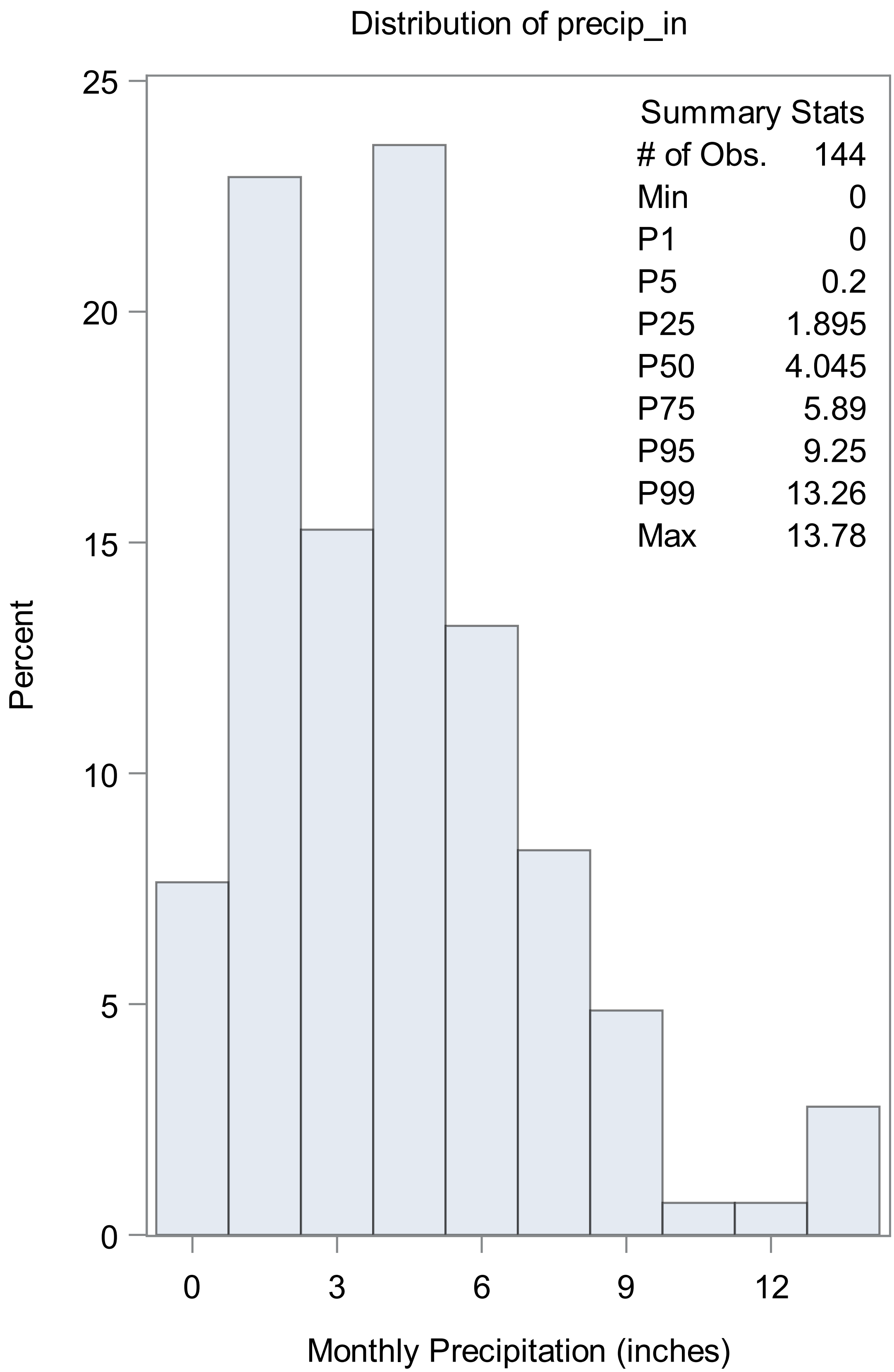
Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
0.00	1318	11.94	1158
0.00	1231	13.11	1268
0.00	1204	13.15	1147
0.08	1205	13.26	1149
0.09	1271	13.78	1155

Missing Values			
		Percent Of	
Missing Value	Count	All Obs	Missing Obs
.	36	20.00	100.00

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

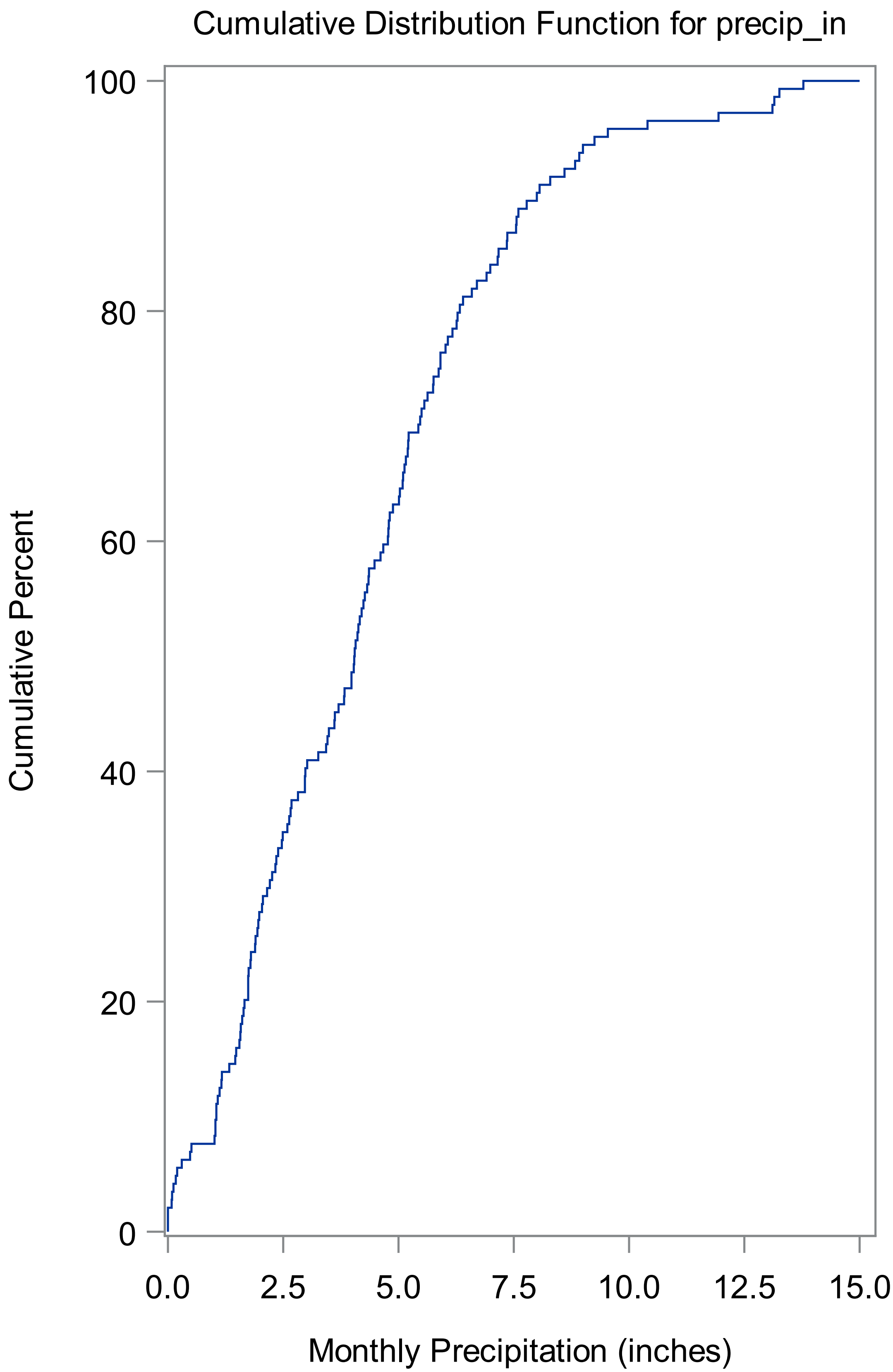
Station=USC00087869 name=ST MARKS NWR, FL US



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

Station=USC00087869 name=ST MARKS NWR, FL US



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=USC00091463 name=CAIRO, GA US

Moments			
N	710	Sum Weights	710
Mean	4.35040845	Sum Observations	3088.79
Std Deviation	2.89384907	Variance	8.37436246
Skewness	1.08439819	Kurtosis	1.73545232
Uncorrected SS	19374.9211	Corrected SS	5937.42298
Coeff Variation	66.5190201	Std Error Mean	0.10860422

Basic Statistical Measures			
Location		Variability	
Mean	4.350408	Std Deviation	2.89385
Median	3.975000	Variance	8.37436
Mode	2.300000	Range	17.67000
		Interquartile Range	3.87000

Note: The mode displayed is the smallest of 2 modes with a count of 5.

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	40.05745	Pr > |t|	<.0001
Sign	M	353.5	Pr >= |M|	<.0001
Signed Rank	S	125139	Pr >= |S|	<.0001

Quantiles (Definition 5)	
Level	Quantile
100% Max	17.670
99%	12.550
95%	9.990
90%	7.990
75% Q3	5.970
50% Median	3.975
25% Q1	2.100
10%	1.095
5%	0.610
1%	0.150
0% Min	0.000

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=USC00091463 name=CAIRO, GA US

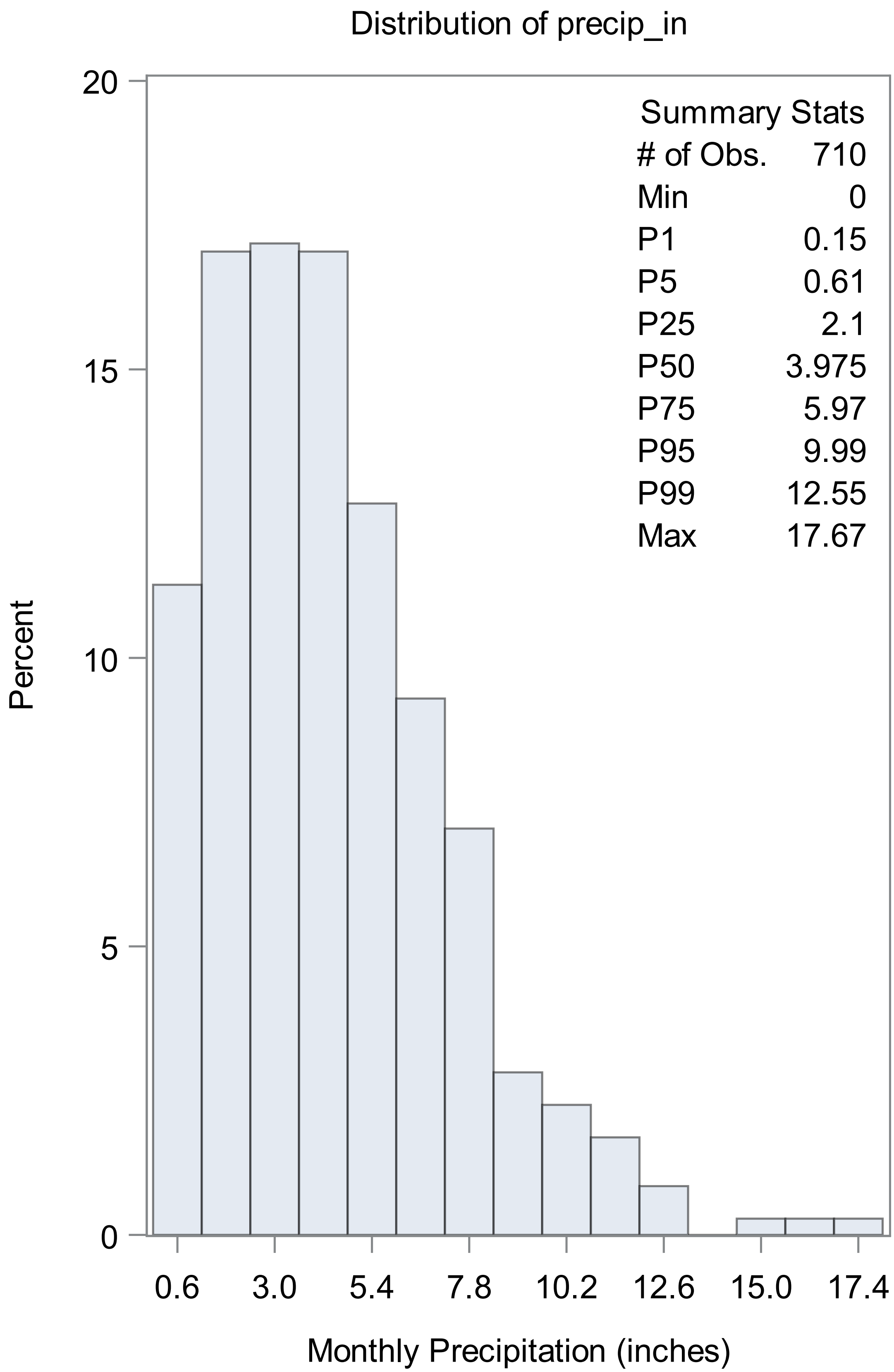
Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
0.00	2243	15.54	1419
0.00	1606	15.67	2058
0.00	1582	16.12	1423
0.03	2169	17.25	1933
0.06	1571	17.67	2203

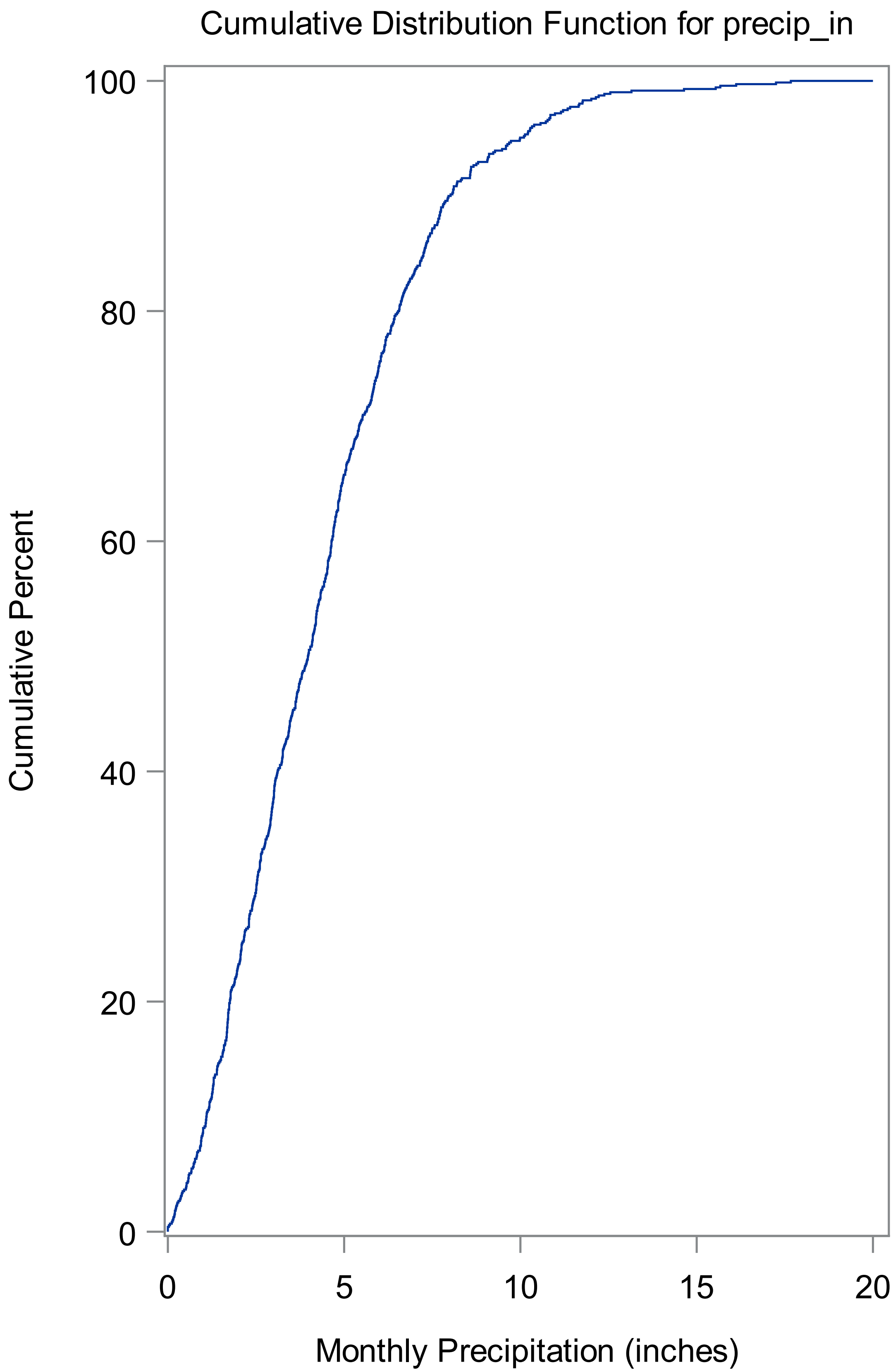
Missing Values			
		Percent Of	
Missing Value	Count	All Obs	Missing Obs
.	214	23.16	100.00

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

Station=USC00091463 name=CAIRO, GA US




Cumulative Distribution Function for precip_in
Cumulative Percent
0
20
40
60
80
100
0
5
10
15
20
Monthly Precipitation (inches)

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=USC00091500 name=CAMILLA 3 SE, GA US

Moments			
N	910	**Sum Weights**	910
Mean	4.30568132	**Sum Observations**	3918.17
Std Deviation	2.7723382	**Variance**	7.68585911
Skewness	0.89276005	**Kurtosis**	0.96551854
Uncorrected SS	23856.8373	**Corrected SS**	6986.44593
Coeff Variation	64.3879098	**Std Error Mean**	0.09190212

Basic Statistical Measures			
Location		**Variability**	
Mean	4.305681	**Std Deviation**	2.77234
Median	3.785000	**Variance**	7.68586
Mode	0.000000	**Range**	17.13000
		Interquartile Range	3.77000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	46.85073	**Pr > |t|**	<.0001
Sign	**M**	452	**Pr >= |M|**	<.0001
Signed Rank	**S**	204530	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	17.130
99%	11.980
95%	9.470
90%	8.225
75% Q3	5.960
50% Median	3.785
25% Q1	2.190
10%	1.150
5%	0.580
1%	0.160
0% Min	0.000

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=USC00091500 name=CAMILLA 3 SE, GA US

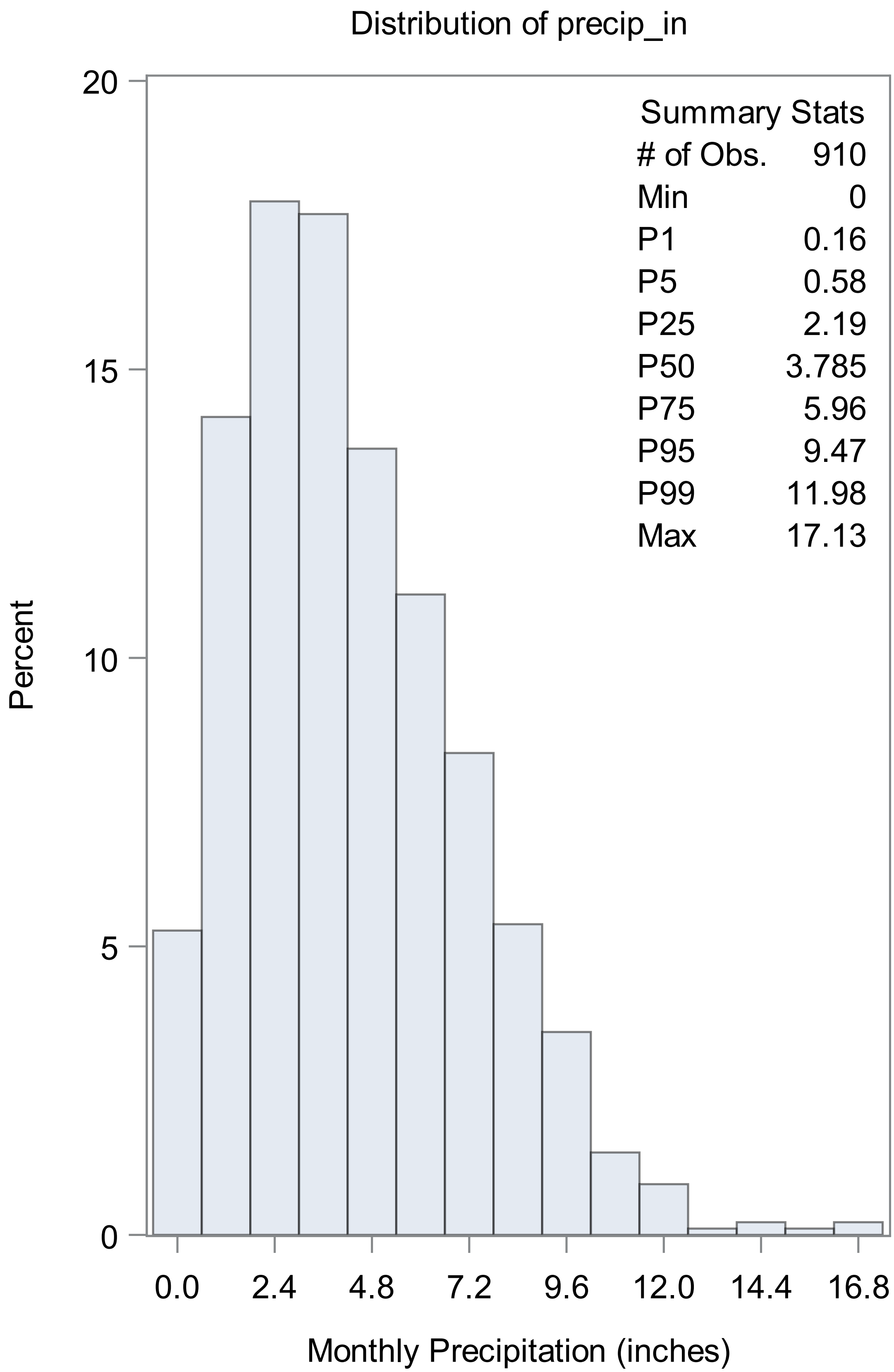
Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
0	3053	14.40	2949
0	2818	14.61	3122
0	2710	15.37	2575
0	2530	16.39	3128
0	2506	17.13	2857

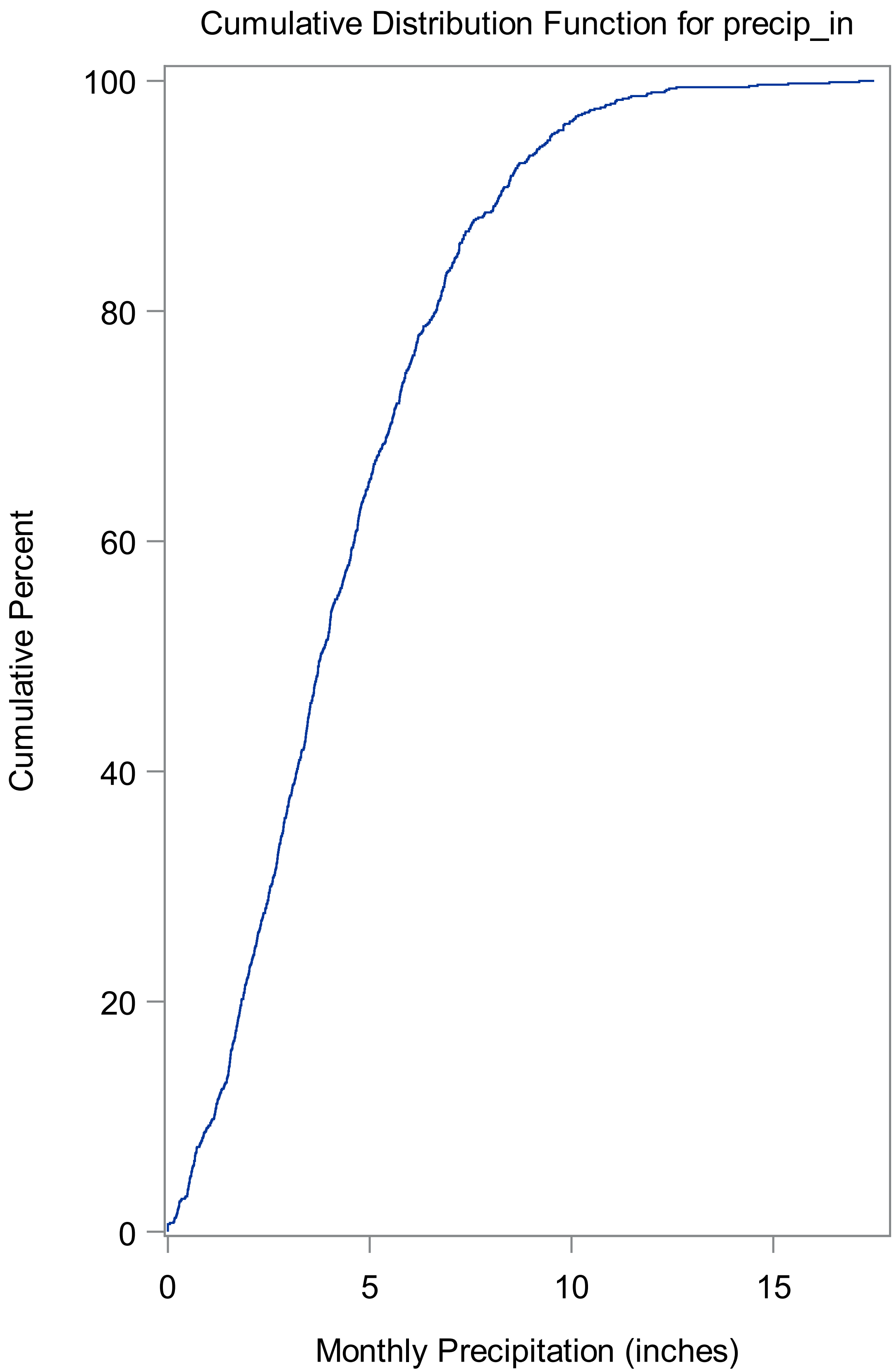
Missing Values			
		Percent Of	
Missing Value	Count	All Obs	Missing Obs
.	14	1.52	100.00

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

Station=USC00091500 name=CAMILLA 3 SE, GA US




Cumulative Distribution Function for precip_in
Cumulative Percent
100
80
60
40
20
0
0
5
10
15
Monthly Precipitation (inches)

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=USC00096087 name=MOULTRIE 2 ESE, GA US

Moments			
N	898	**Sum Weights**	898
Mean	4.15339644	**Sum Observations**	3729.75
Std Deviation	2.7533987	**Variance**	7.58120439
Skewness	1.09251406	**Kurtosis**	1.63440538
Uncorrected SS	22291.4707	**Corrected SS**	6800.34034
Coeff Variation	66.2927014	**Std Error Mean**	0.0918821

Basic Statistical Measures			
Location		**Variability**	
Mean	4.153396	**Std Deviation**	2.75340
Median	3.665000	**Variance**	7.58120
Mode	3.330000	**Range**	18.46000
		Interquartile Range	3.55000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	45.20354	**Pr > |t|**	<.0001
Sign	**M**	447.5	**Pr >= |M|**	<.0001
Signed Rank	**S**	200480	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	18.460
99%	13.060
95%	9.670
90%	7.760
75% Q3	5.670
50% Median	3.665
25% Q1	2.120
10%	1.040
5%	0.670
1%	0.140
0% Min	0.000

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=USC00096087 name=MOULTRIE 2 ESE, GA US

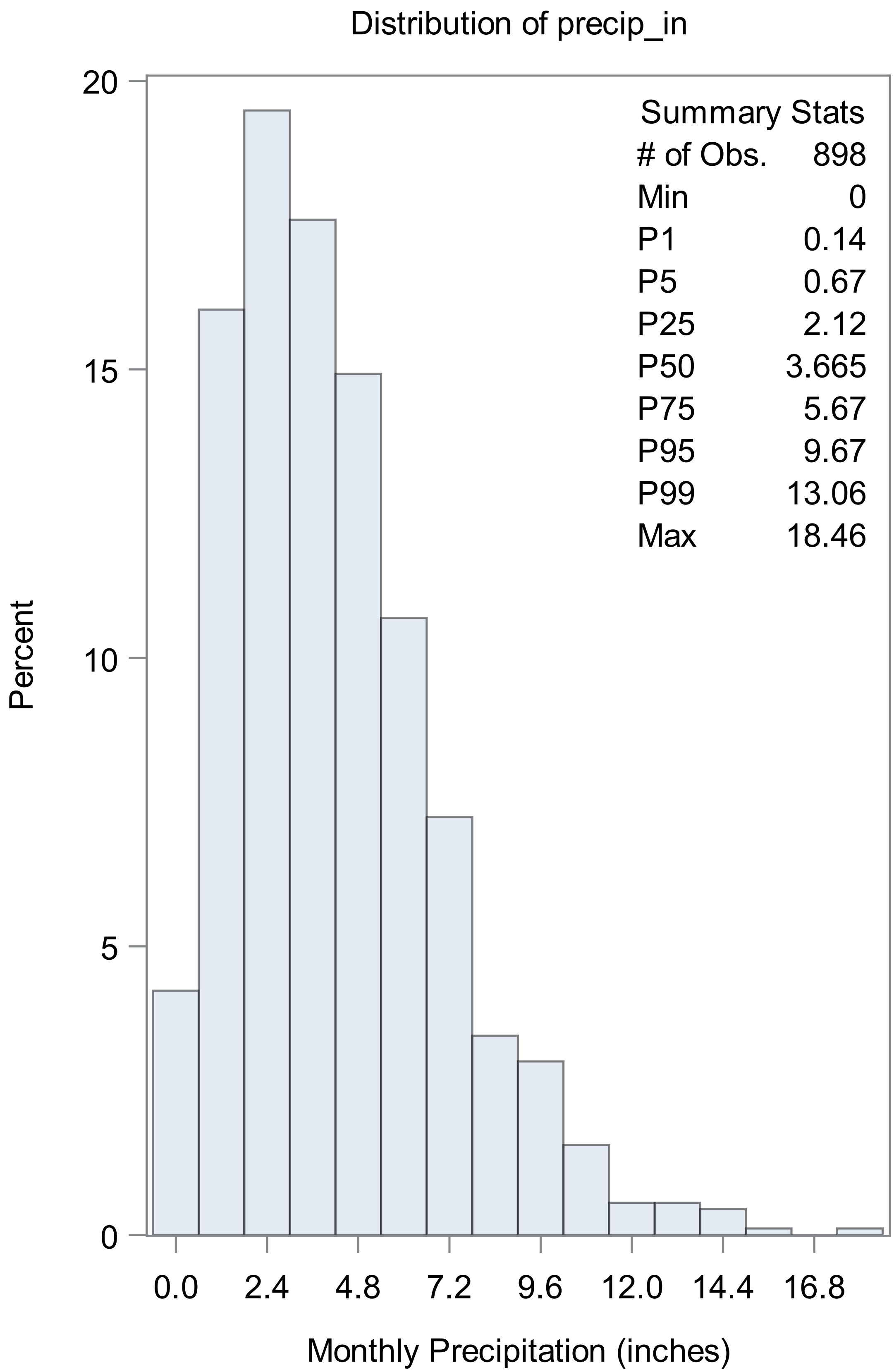
Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
0.00	3977	13.87	3897
0.00	3454	14.44	3605
0.00	3214	14.97	3873
0.01	3430	15.07	3474
0.03	3742	18.46	3781

Missing Values			
		Percent Of	
Missing Value	Count	All Obs	Missing Obs
.	26	2.81	100.00

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

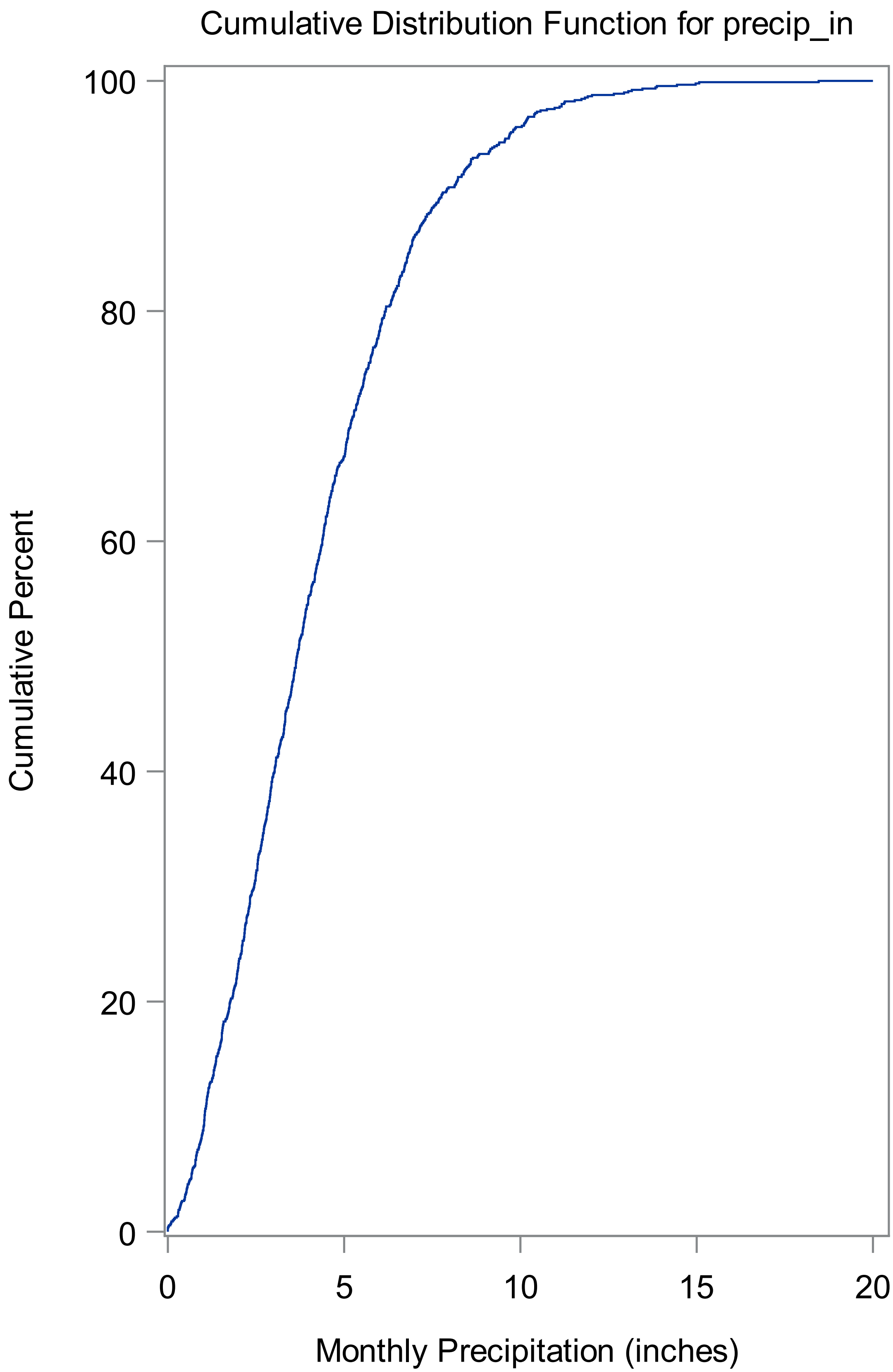
Station=USC00096087 name=MOULTRIE 2 ESE, GA US



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

Station=USC00096087 name=MOULTRIE 2 ESE, GA US



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=USC00097276 name=QUITMAN 2 NW, GA US

Moments			
N	776	Sum Weights	776
Mean	4.2968299	Sum Observations	3334.34
Std Deviation	3.03876953	Variance	9.23412026
Skewness	1.29389991	Kurtosis	3.04624565
Uncorrected SS	21483.535	Corrected SS	7156.4432
Coeff Variation	70.7211969	Std Error Mean	0.10908547

Basic Statistical Measures			
Location		Variability	
Mean	4.296830	Std Deviation	3.03877
Median	3.810000	Variance	9.23412
Mode	0.000000	Range	21.80000
		Interquartile Range	3.77500

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	39.38957	Pr > |t|	<.0001
Sign	M	381	Pr >= |M|	<.0001
Signed Rank	S	145351.5	Pr >= |S|	<.0001

Quantiles (Definition 5)	
Level	Quantile
100% Max	21.800
99%	14.780
95%	9.840
90%	8.300
75% Q3	5.805
50% Median	3.810
25% Q1	2.030
10%	0.930
5%	0.420
1%	0.000
0% Min	0.000

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=USC00097276 name=QUITMAN 2 NW, GA US

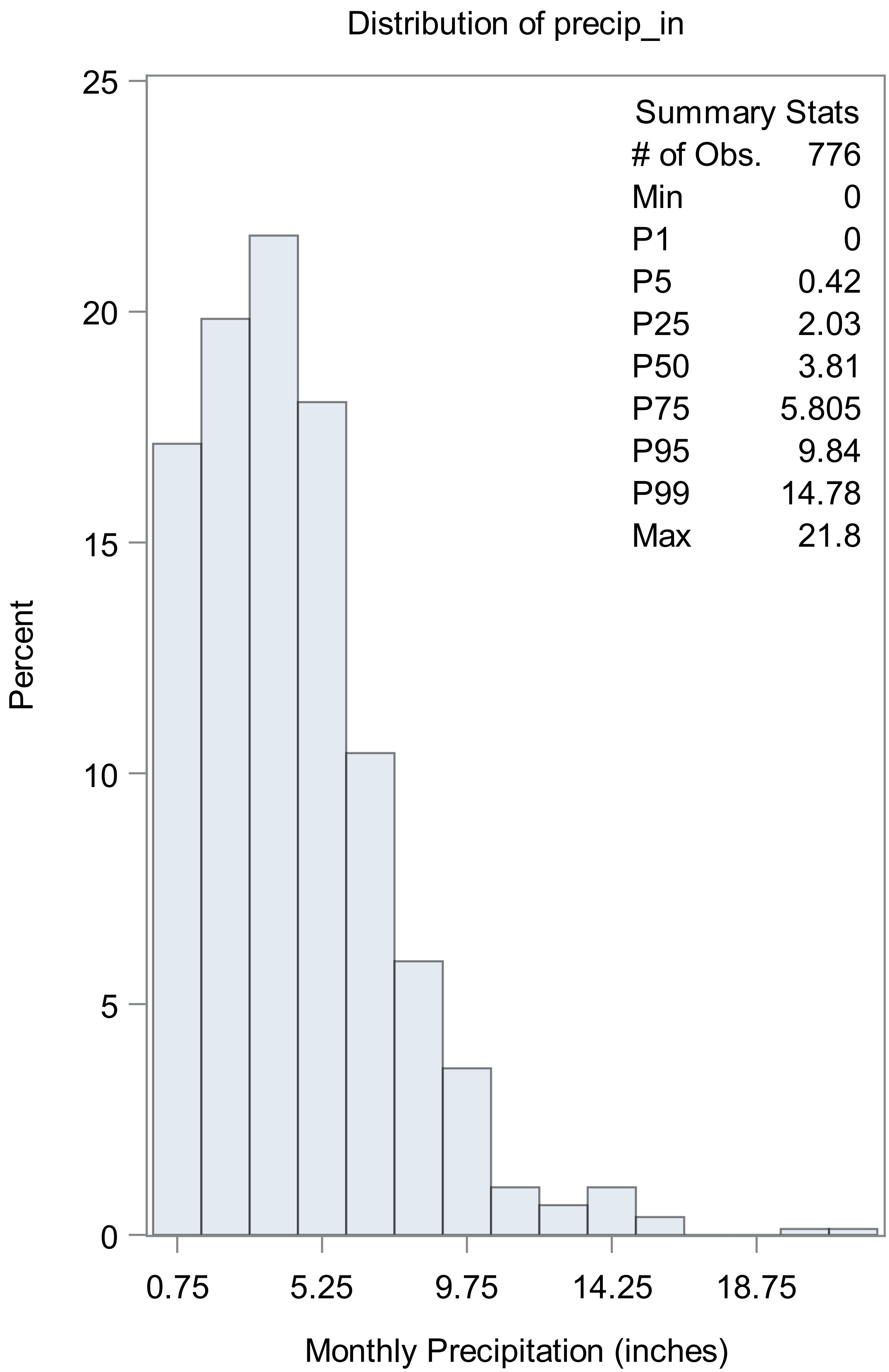
Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
0	4942	15.15	4830
0	4913	15.35	4916
0	4899	16.28	4171
0	4894	20.27	4797
0	4822	21.80	4705

Missing Values			
		Percent Of	
Missing Value	Count	All Obs	Missing Obs
.	76	8.92	100.00

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

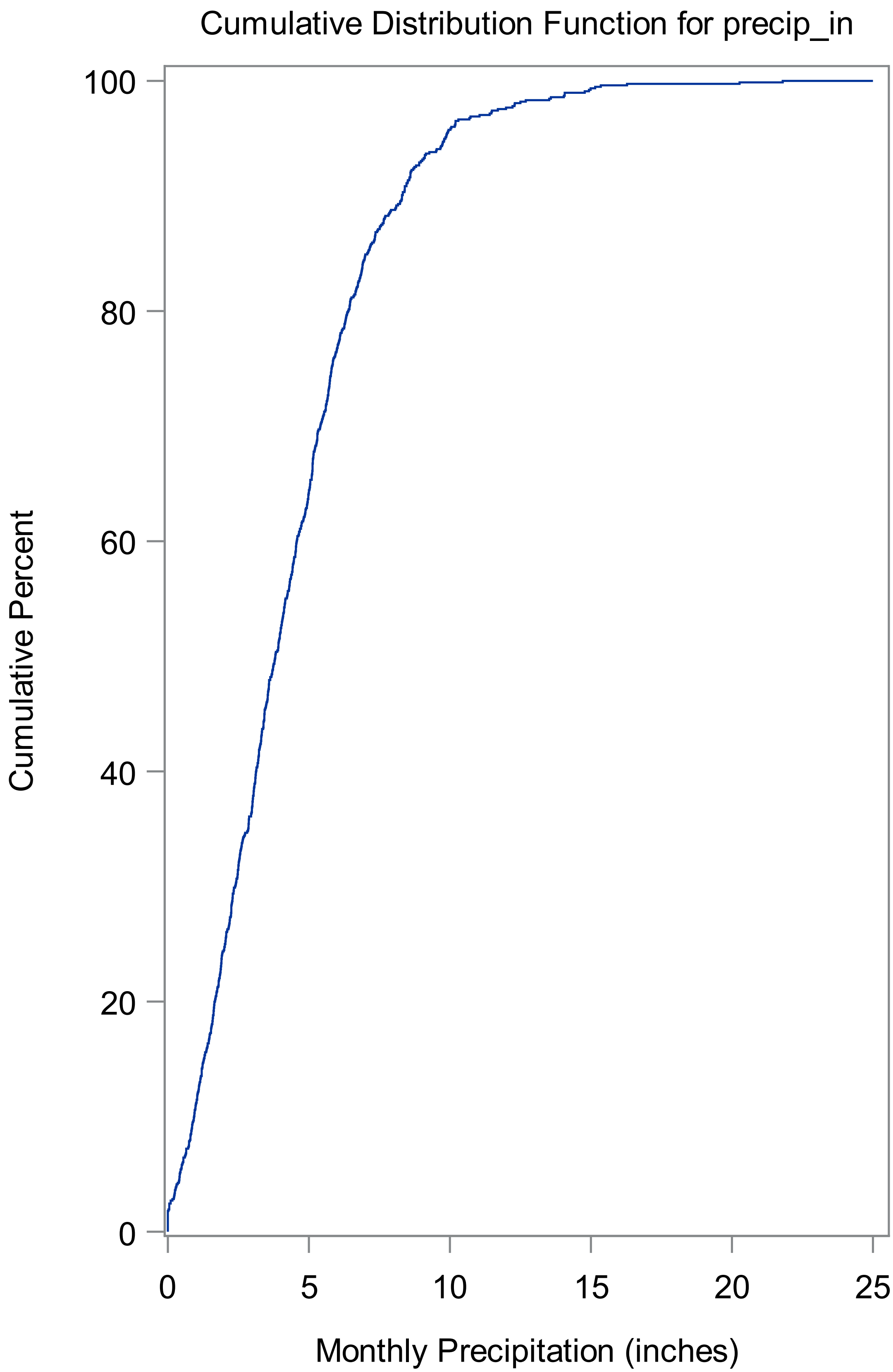
Station=USC00097276 name=QUITMAN 2 NW, GA US



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

Station=USC00097276 name=QUITMAN 2 NW, GA US



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=USC00098703 name=TIFTON, GA US

Moments			
N	918	Sum Weights	918
Mean	3.95491285	Sum Observations	3630.61
Std Deviation	2.6055678	Variance	6.78898358
Skewness	1.26149839	Kurtosis	2.69402168
Uncorrected SS	20584.2441	Corrected SS	6225.49794
Coeff Variation	65.8818007	Std Error Mean	0.08599655

Basic Statistical Measures			
Location		Variability	
Mean	3.954913	Std Deviation	2.60557
Median	3.480000	Variance	6.78898
Mode	4.170000	Range	18.34000
		Interquartile Range	3.32000

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	45.9892	Pr > |t|	<.0001
Sign	M	457	Pr >= |M|	<.0001
Signed Rank	S	209077.5	Pr >= |S|	<.0001

Quantiles (Definition 5)	
Level	Quantile
100% Max	18.34
99%	12.07
95%	8.72
90%	7.45
75% Q3	5.32
50% Median	3.48
25% Q1	2.00
10%	1.12
5%	0.72
1%	0.22
0% Min	0.00

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=USC00098703 name=TIFTON, GA US

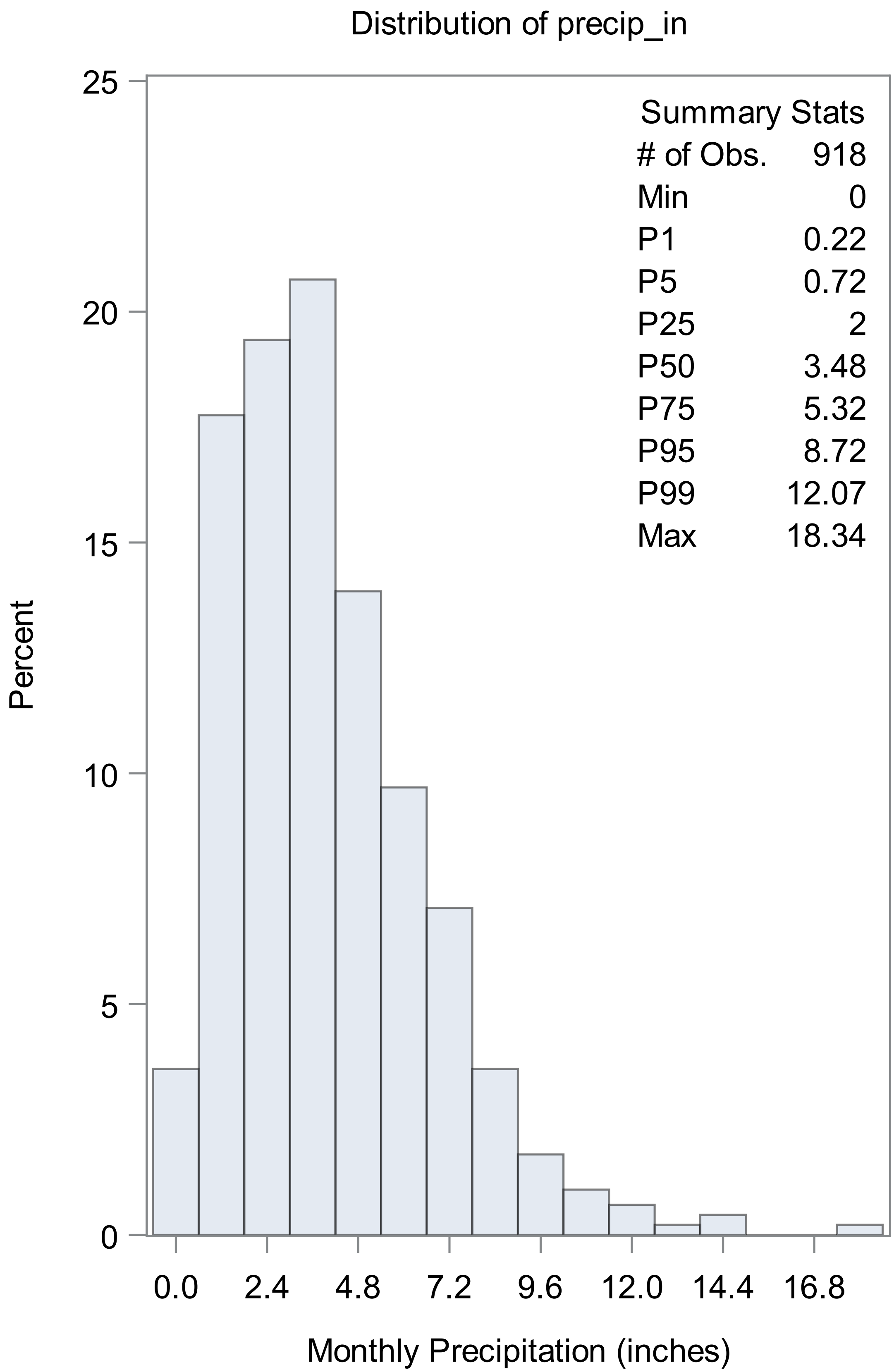
Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
0.00	5518	14.62	5557
0.00	5230	14.65	5011
0.00	5206	14.98	5816
0.00	4990	17.48	5822
0.03	5867	18.34	5721

Missing Values			
		Percent Of	
Missing Value	Count	All Obs	Missing Obs
.	6	0.65	100.00

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

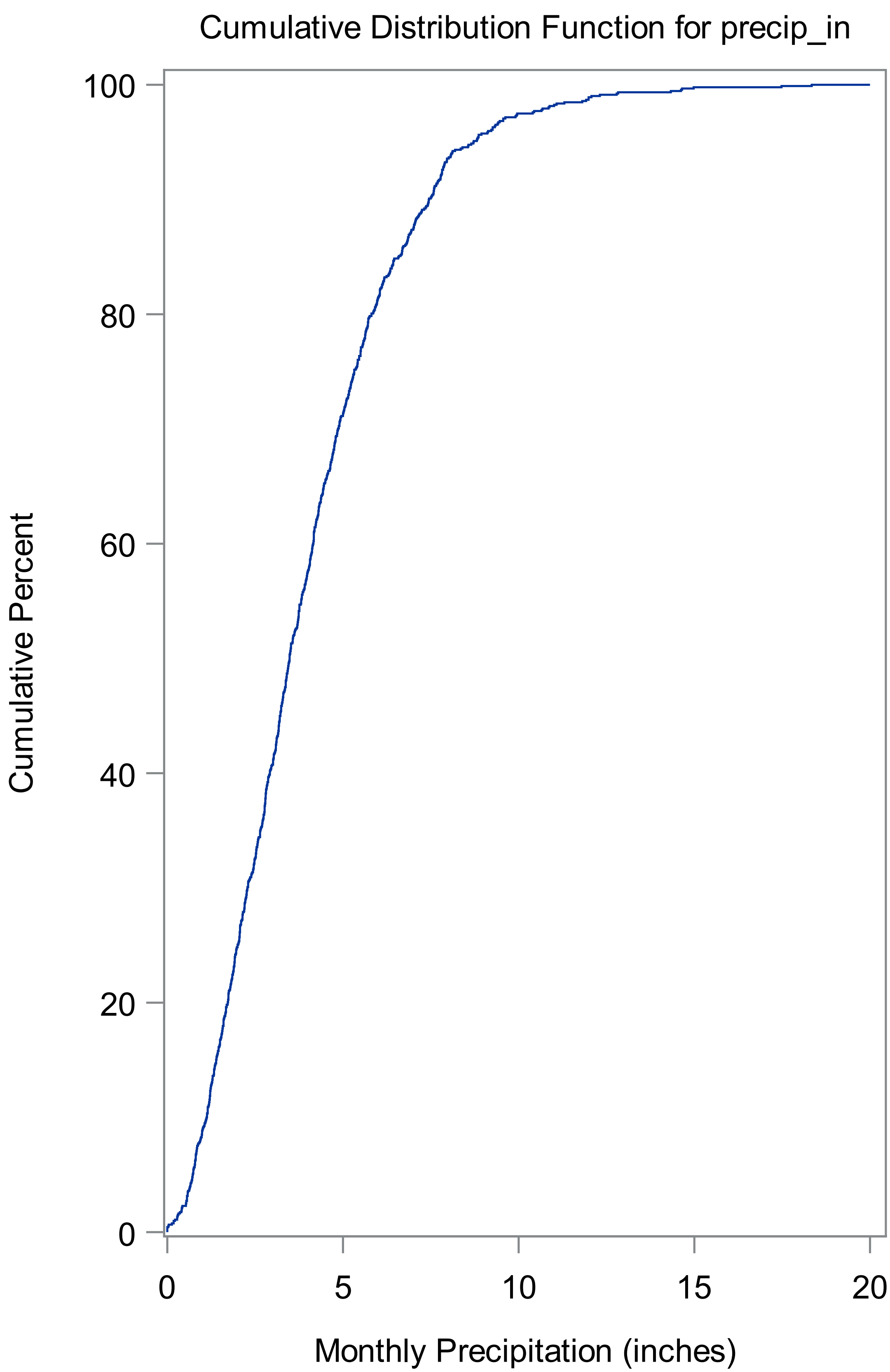
Station=USC00098703 name=TIFTON, GA US



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

Station=USC00098703 name=TIFTON, GA US



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=USW00093805 name=TALLAHASSEE REGIONAL AIRPORT, FL US

Moments			
N	855	Sum Weights	855
Mean	5.15412865	Sum Observations	4406.78
Std Deviation	3.51838213	Variance	12.3790128
Skewness	1.09819169	Kurtosis	1.5272008
Uncorrected SS	33284.788	Corrected SS	10571.6769
Coeff Variation	68.2633741	Std Error Mean	0.12032613

Basic Statistical Measures			
Location		Variability	
Mean	5.154129	Std Deviation	3.51838
Median	4.430000	Variance	12.37901
Mode	1.440000	Range	20.33000
		Interquartile Range	4.54000

Note: The mode displayed is the smallest of 2 modes with a count of 5.

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	42.83466	Pr > |t|	<.0001
Sign	M	426	Pr >= |M|	<.0001
Signed Rank	S	181689	Pr >= |S|	<.0001

Quantiles (Definition 5)	
Level	Quantile
100% Max	20.33
99%	16.47
95%	11.66
90%	9.83
75% Q3	7.04
50% Median	4.43
25% Q1	2.50
10%	1.22
5%	0.73
1%	0.18
0% Min	0.00

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: precip_in (Monthly Precipitation (inches))

Station=USW00093805 name=TALLAHASSEE REGIONAL AIRPORT, FL US

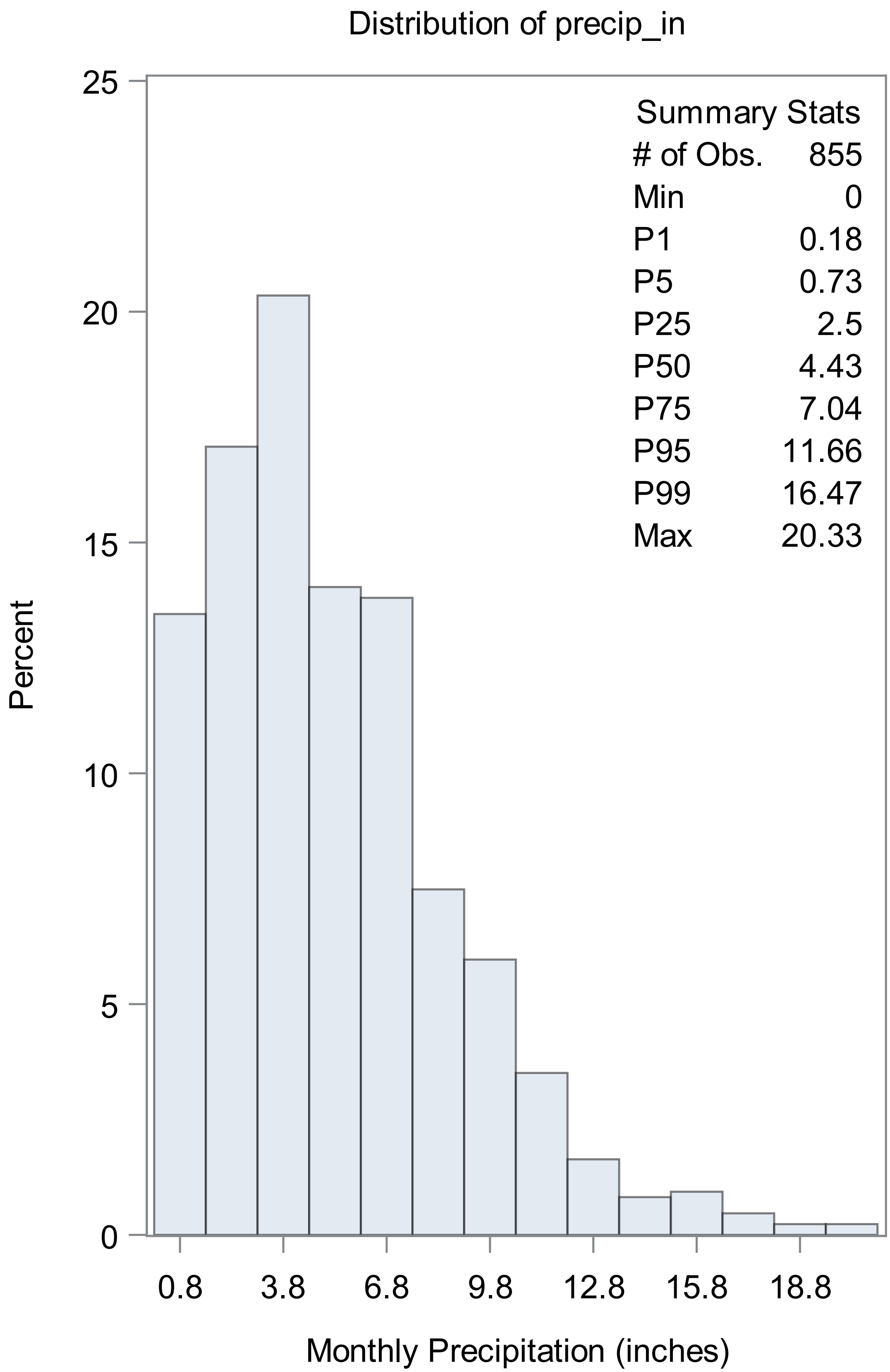
Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
0.00	6418	17.89	5947
0.00	6149	18.83	6199
0.00	6106	18.94	6457
0.08	6634	20.12	6139
0.11	6237	20.33	6057

Missing Values			
		Percent Of	
Missing Value	Count	All Obs	Missing Obs
.	45	5.00	100.00

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

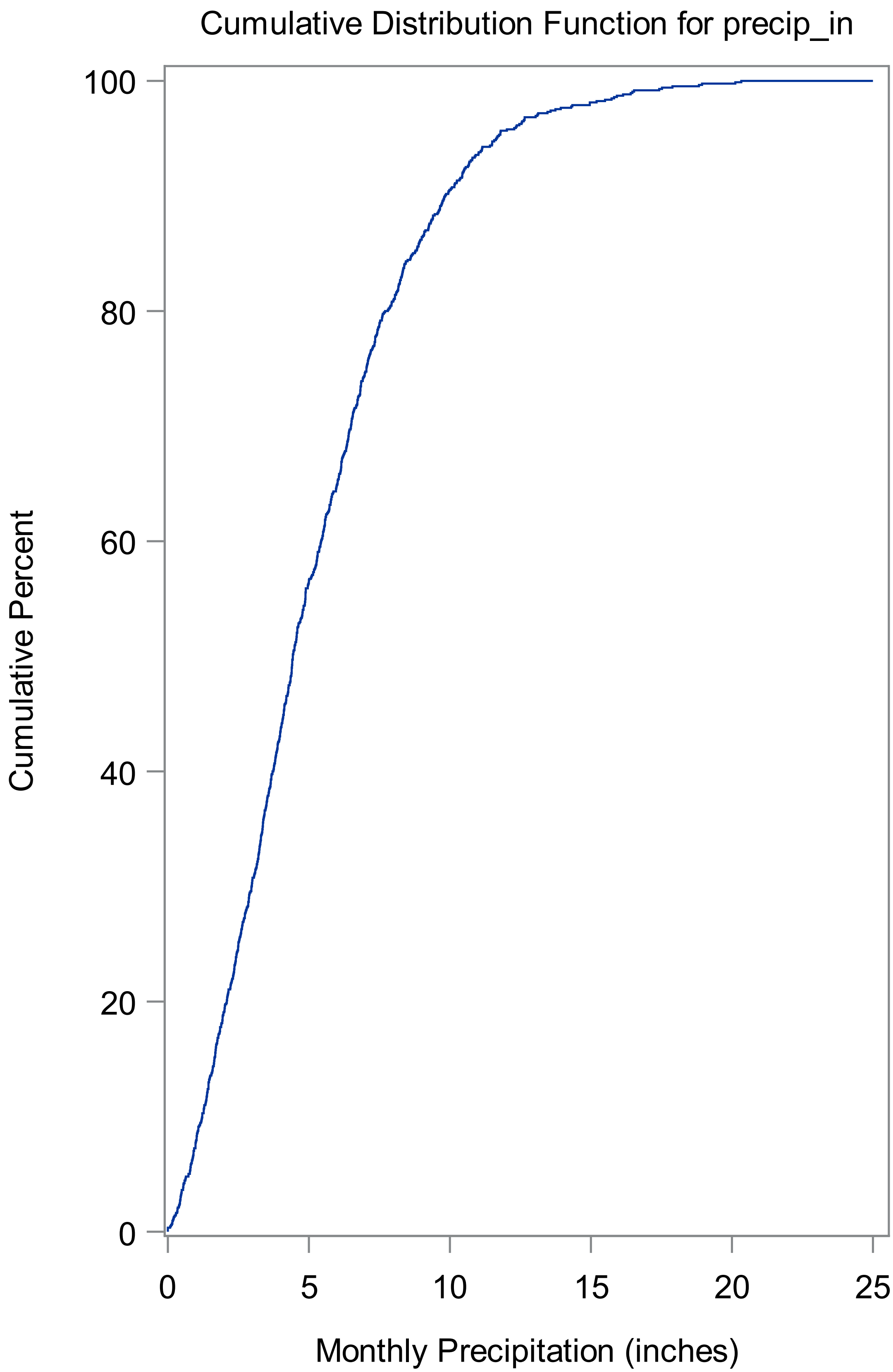
Station=USW00093805 name=TALLAHASSEE REGIONAL AIRPORT, FL US



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

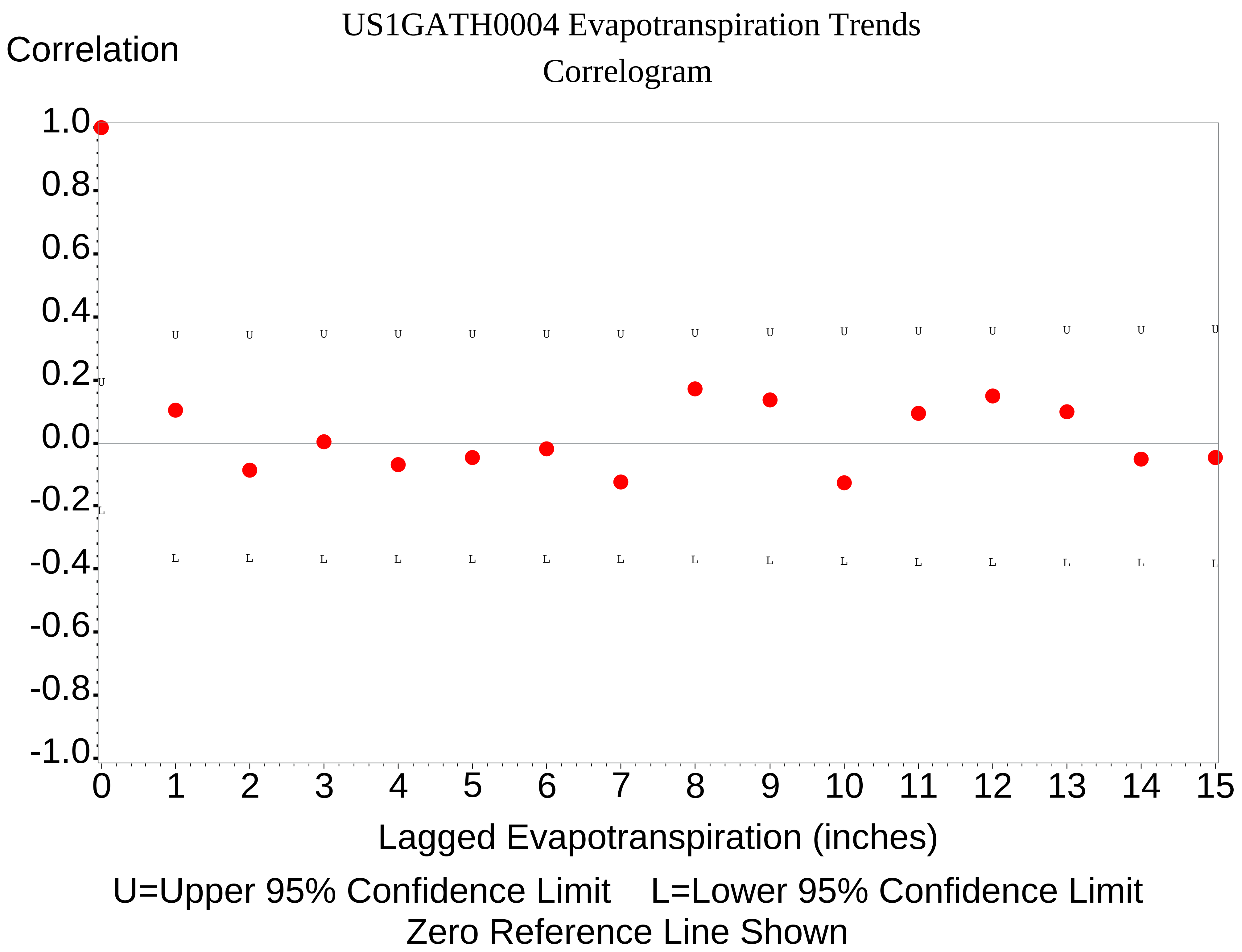
Station=USW00093805 name=TALLAHASSEE REGIONAL AIRPORT, FL US



US1GATH0004 Evapotranspiration Trends

Autocorrelation Statistics

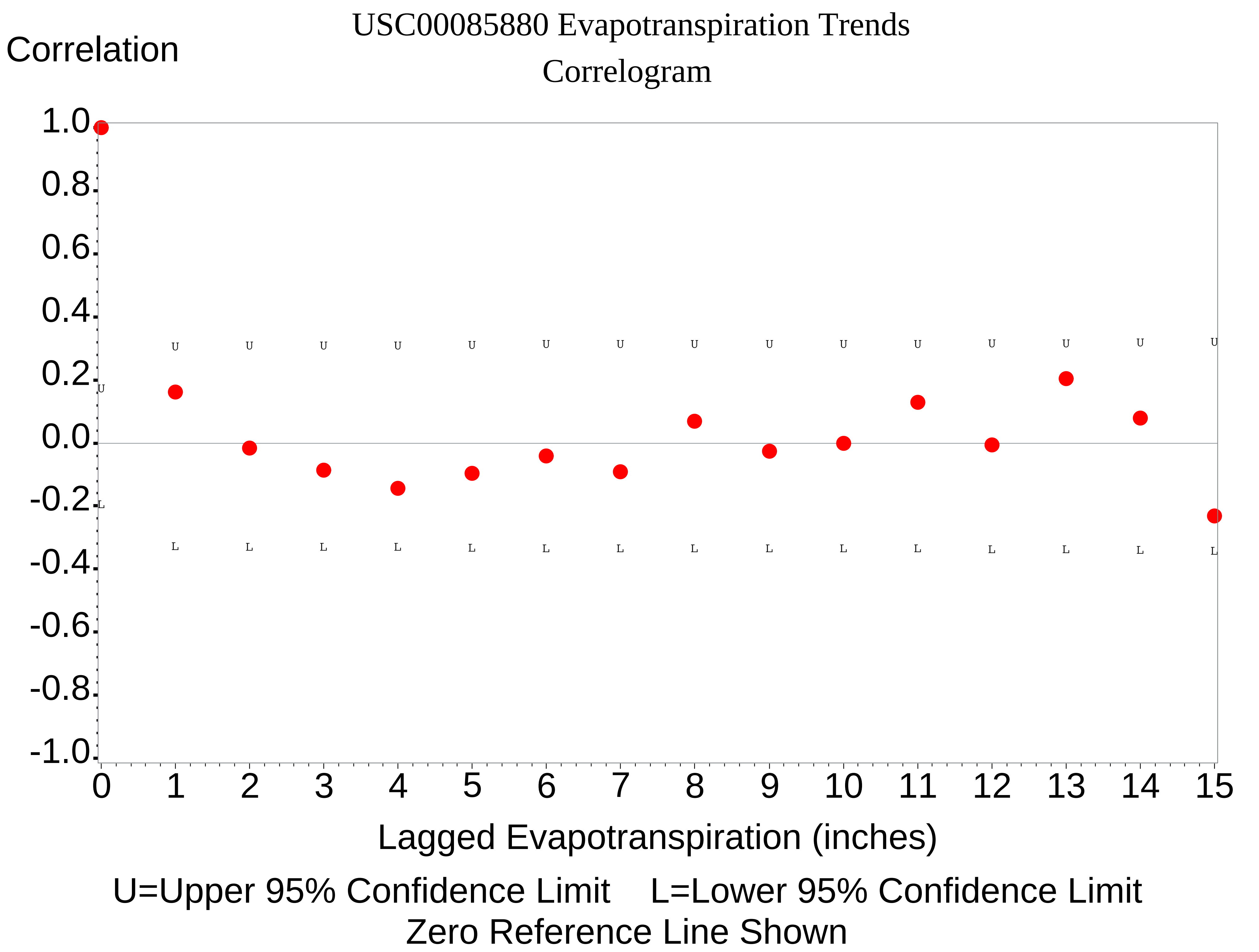
Lagged Evapotranspiration (inches)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.102	0.204	-0.204
1	0.105	0.177	0.354	-0.354
2	-0.086	0.177	0.355	-0.355
3	0.005	0.178	0.356	-0.356
4	-0.068	0.178	0.356	-0.356
5	-0.045	0.178	0.356	-0.356
6	-0.019	0.178	0.356	-0.356
7	-0.124	0.178	0.357	-0.357
8	0.172	0.179	0.358	-0.358
9	0.137	0.181	0.362	-0.362
10	-0.127	0.182	0.364	-0.364
11	0.093	0.183	0.366	-0.366
12	0.148	0.183	0.367	-0.367
13	0.100	0.185	0.369	-0.369
14	-0.051	0.185	0.370	-0.370
15	-0.047	0.185	0.371	-0.371


US1GATH0004 Evapotranspiration Trends
Correlogram
Correlation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Lagged Evapotranspiration (inches)
U=Upper 95% Confidence Limit L=Lower 95% Confidence Limit
Zero Reference Line Shown

USC00085880 Evapotranspiration Trends

Autocorrelation Statistics

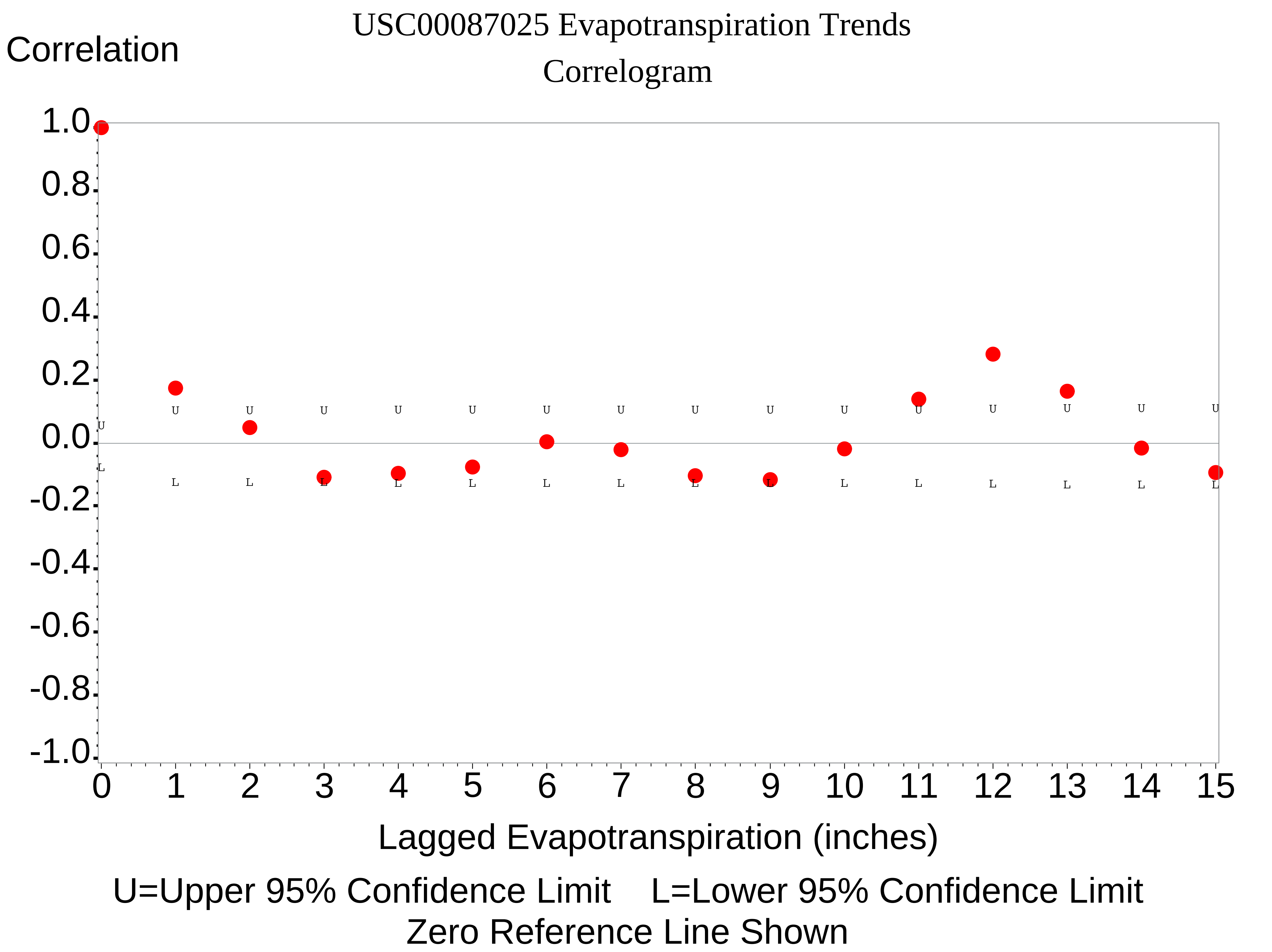
Lagged Evapotranspiration (inches)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.091	0.183	-0.183
1	0.162	0.158	0.316	-0.316
2	-0.016	0.159	0.319	-0.319
3	-0.087	0.160	0.319	-0.319
4	-0.145	0.160	0.320	-0.320
5	-0.097	0.161	0.322	-0.322
6	-0.041	0.161	0.323	-0.323
7	-0.090	0.162	0.323	-0.323
8	0.068	0.162	0.324	-0.324
9	-0.026	0.162	0.324	-0.324
10	-0.002	0.162	0.325	-0.325
11	0.129	0.162	0.325	-0.325
12	-0.005	0.163	0.326	-0.326
13	0.204	0.163	0.326	-0.326
14	0.078	0.165	0.330	-0.330
15	-0.232	0.166	0.331	-0.331


USC00085880 Evapotranspiration Trends
Correlogram
Correlation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Lagged Evapotranspiration (inches)
U=Upper 95% Confidence Limit L=Lower 95% Confidence Limit
Zero Reference Line Shown

USC00087025 Evapotranspiration Trends

Autocorrelation Statistics

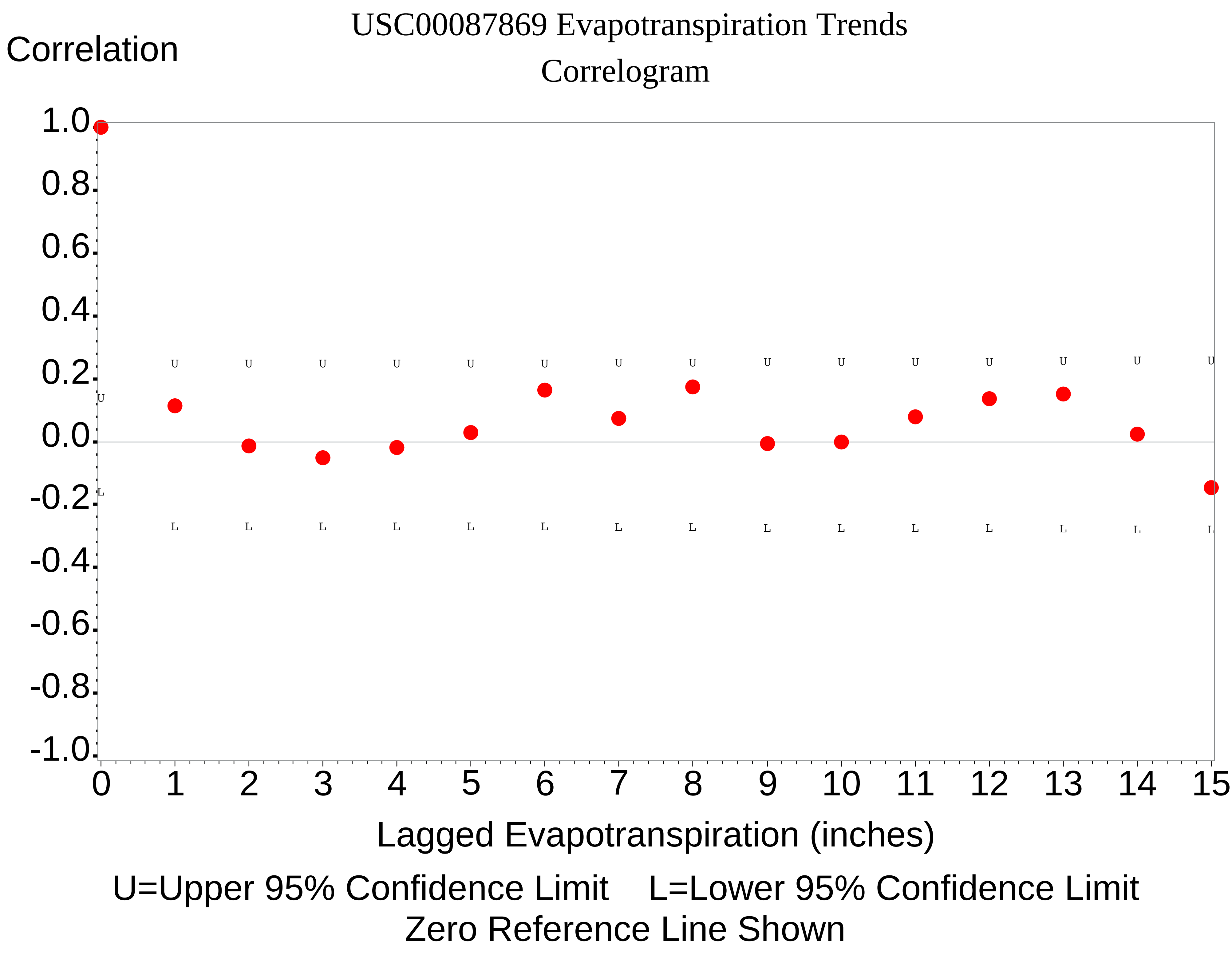
Lagged Evapotranspiration (inches)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.033	0.066	-0.066
1	0.173	0.057	0.114	-0.114
2	0.048	0.058	0.115	-0.115
3	-0.108	0.058	0.115	-0.115
4	-0.095	0.058	0.116	-0.116
5	-0.077	0.058	0.116	-0.116
6	0.005	0.058	0.116	-0.116
7	-0.022	0.058	0.116	-0.116
8	-0.104	0.058	0.116	-0.116
9	-0.117	0.058	0.117	-0.117
10	-0.018	0.059	0.117	-0.117
11	0.140	0.059	0.117	-0.117
12	0.282	0.059	0.118	-0.118
13	0.164	0.060	0.121	-0.121
14	-0.015	0.061	0.122	-0.122
15	-0.094	0.061	0.122	-0.122


USC00087025 Evapotranspiration Trends
Correlogram
Correlation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Lagged Evapotranspiration (inches)
U=Upper 95% Confidence Limit L=Lower 95% Confidence Limit
Zero Reference Line Shown

USC00087869 Evapotranspiration Trends

Autocorrelation Statistics

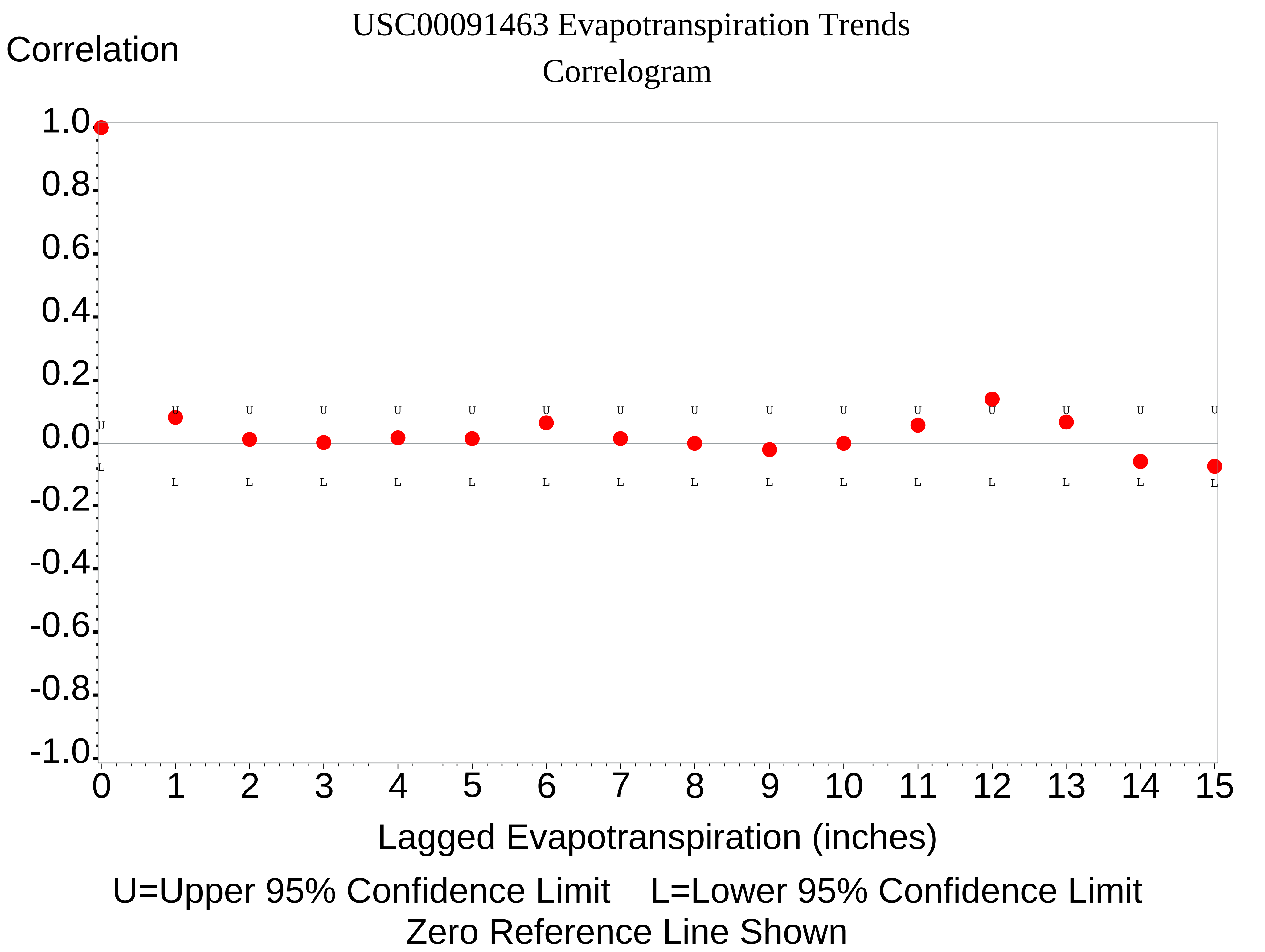
Lagged Evapotranspiration (inches)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.075	0.149	-0.149
1	0.115	0.129	0.258	-0.258
2	-0.013	0.130	0.259	-0.259
3	-0.052	0.130	0.259	-0.259
4	-0.019	0.130	0.260	-0.260
5	0.030	0.130	0.260	-0.260
6	0.165	0.130	0.260	-0.260
7	0.073	0.131	0.262	-0.262
8	0.173	0.131	0.262	-0.262
9	-0.007	0.132	0.265	-0.265
10	0.000	0.132	0.265	-0.265
11	0.078	0.132	0.265	-0.265
12	0.137	0.133	0.265	-0.265
13	0.151	0.134	0.267	-0.267
14	0.024	0.134	0.269	-0.269
15	-0.147	0.135	0.269	-0.269


USC00087869 Evapotranspiration Trends
Correlogram
Correlation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Lagged Evapotranspiration (inches)
U=Upper 95% Confidence Limit L=Lower 95% Confidence Limit
Zero Reference Line Shown

USC00091463 Evapotranspiration Trends

Autocorrelation Statistics

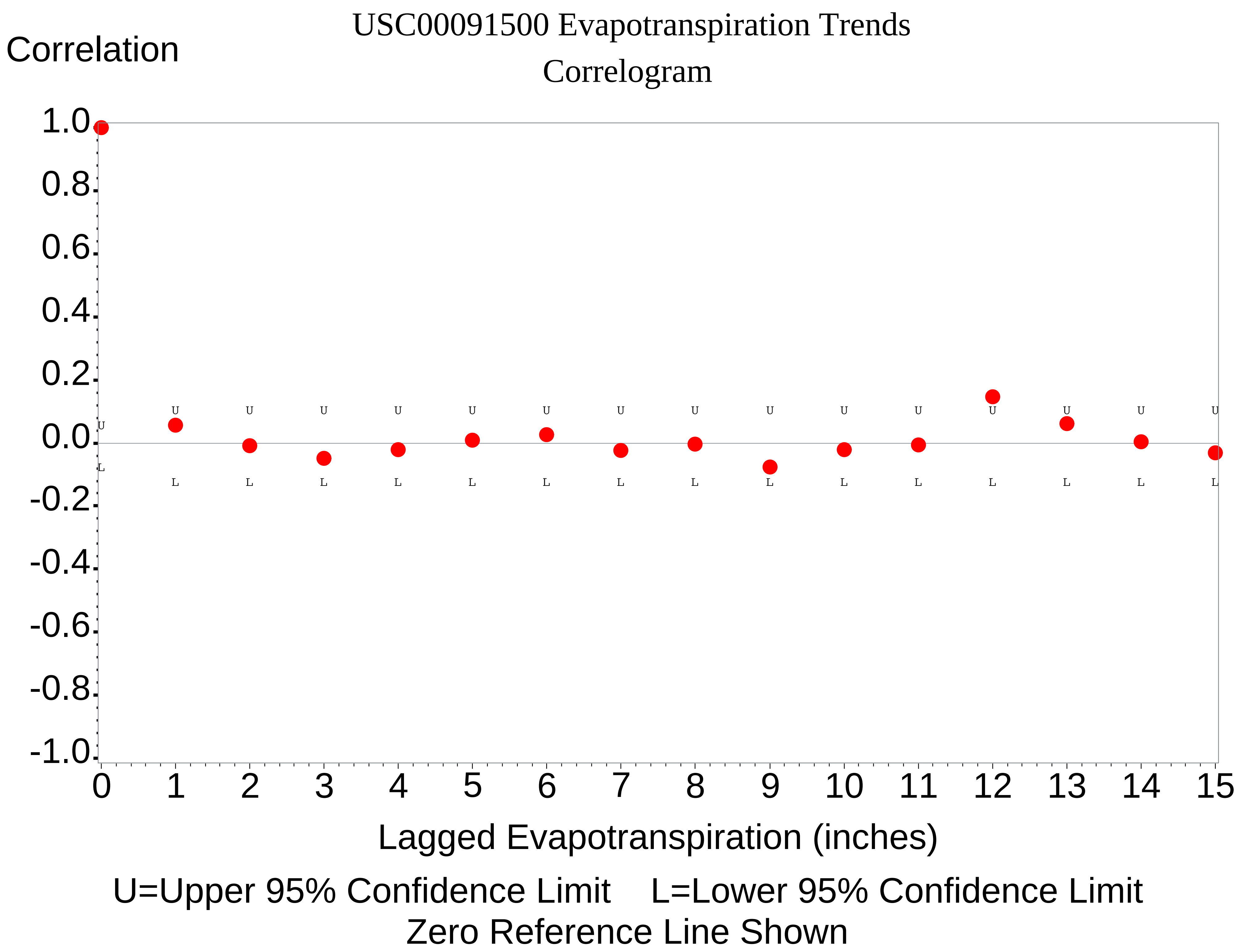
Lagged Evapotranspiration (inches)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.033	0.066	-0.066
1	0.081	0.057	0.114	-0.114
2	0.011	0.057	0.114	-0.114
3	0.002	0.057	0.114	-0.114
4	0.016	0.057	0.114	-0.114
5	0.013	0.057	0.114	-0.114
6	0.063	0.057	0.114	-0.114
7	0.013	0.057	0.114	-0.114
8	-0.002	0.057	0.114	-0.114
9	-0.020	0.057	0.114	-0.114
10	0.000	0.057	0.114	-0.114
11	0.056	0.057	0.114	-0.114
12	0.139	0.057	0.115	-0.115
13	0.067	0.058	0.115	-0.115
14	-0.058	0.058	0.115	-0.115
15	-0.073	0.058	0.116	-0.116


USC00091463 Evapotranspiration Trends
Correlogram
Correlation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Lagged Evapotranspiration (inches)
U=Upper 95% Confidence Limit L=Lower 95% Confidence Limit
Zero Reference Line Shown

USC00091500 Evapotranspiration Trends

Autocorrelation Statistics

Lagged Evapotranspiration (inches)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.033	0.066	-0.066
1	0.057	0.057	0.114	-0.114
2	-0.008	0.057	0.114	-0.114
3	-0.049	0.057	0.114	-0.114
4	-0.020	0.057	0.114	-0.114
5	0.009	0.057	0.114	-0.114
6	0.026	0.057	0.114	-0.114
7	-0.024	0.057	0.114	-0.114
8	-0.003	0.057	0.114	-0.114
9	-0.077	0.057	0.114	-0.114
10	-0.022	0.057	0.114	-0.114
11	-0.005	0.057	0.114	-0.114
12	0.146	0.057	0.114	-0.114
13	0.061	0.058	0.115	-0.115
14	0.005	0.058	0.115	-0.115
15	-0.031	0.058	0.115	-0.115



USC00091500 Evapotranspiration Trends
Correlogram
Correlation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Lagged Evapotranspiration (inches)
U=Upper 95% Confidence Limit L=Lower 95% Confidence Limit
Zero Reference Line Shown

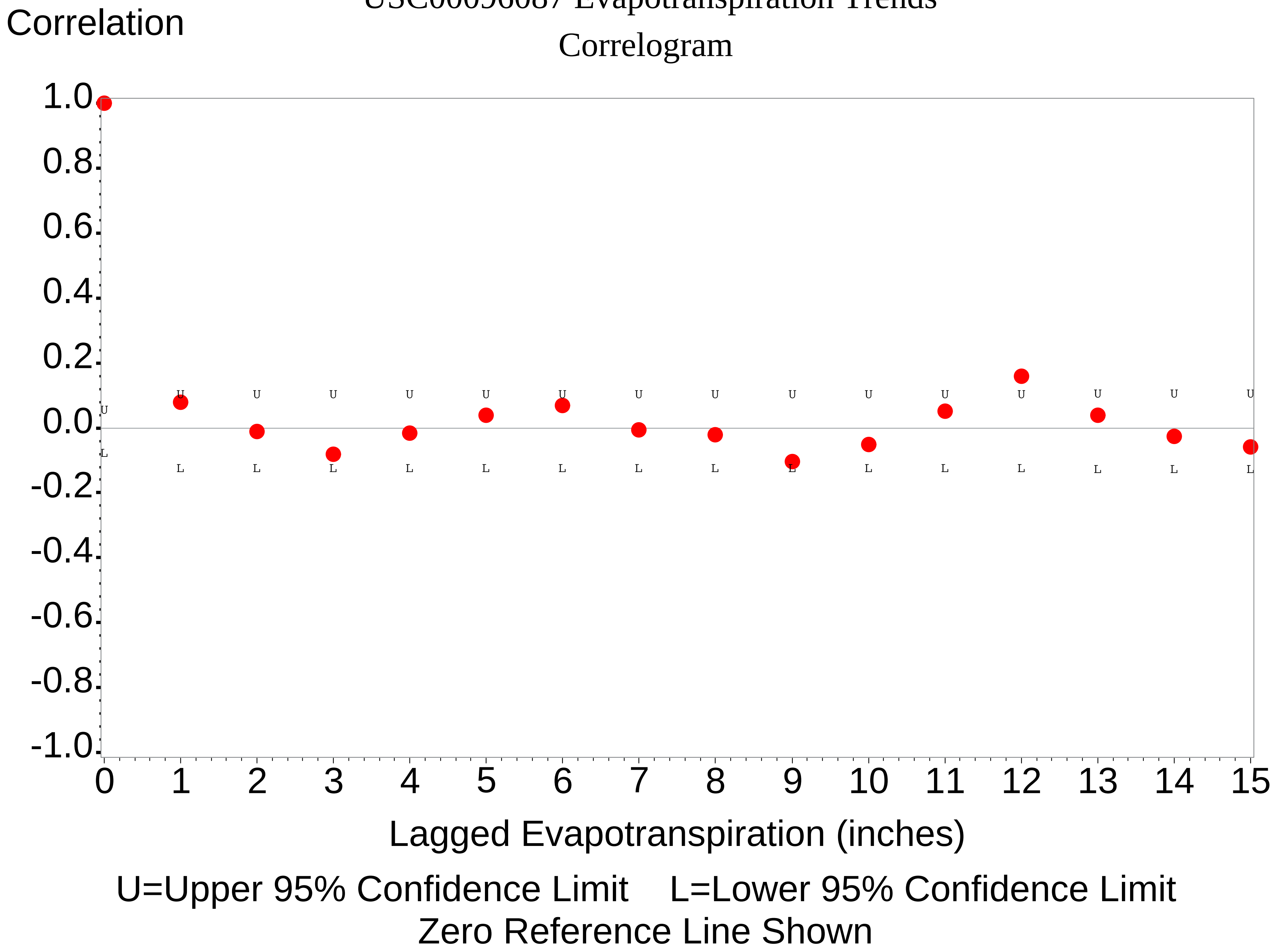
USC00096087 Evapotranspiration Trends

Autocorrelation Statistics

Lagged Evapotranspiration (inches)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.033	0.066	-0.066
1	0.080	0.057	0.114	-0.114
2	-0.011	0.057	0.114	-0.114
3	-0.080	0.057	0.114	-0.114
4	-0.015	0.057	0.114	-0.114
5	0.039	0.057	0.114	-0.114
6	0.068	0.057	0.115	-0.115
7	-0.006	0.057	0.115	-0.115
8	-0.022	0.057	0.115	-0.115
9	-0.103	0.057	0.115	-0.115
10	-0.051	0.058	0.115	-0.115
11	0.052	0.058	0.115	-0.115
12	0.160	0.058	0.115	-0.115
13	0.039	0.058	0.116	-0.116
14	-0.025	0.058	0.116	-0.116
15	-0.058	0.058	0.116	-0.116

USC00096087 Evapotranspiration Trends

Correlogram



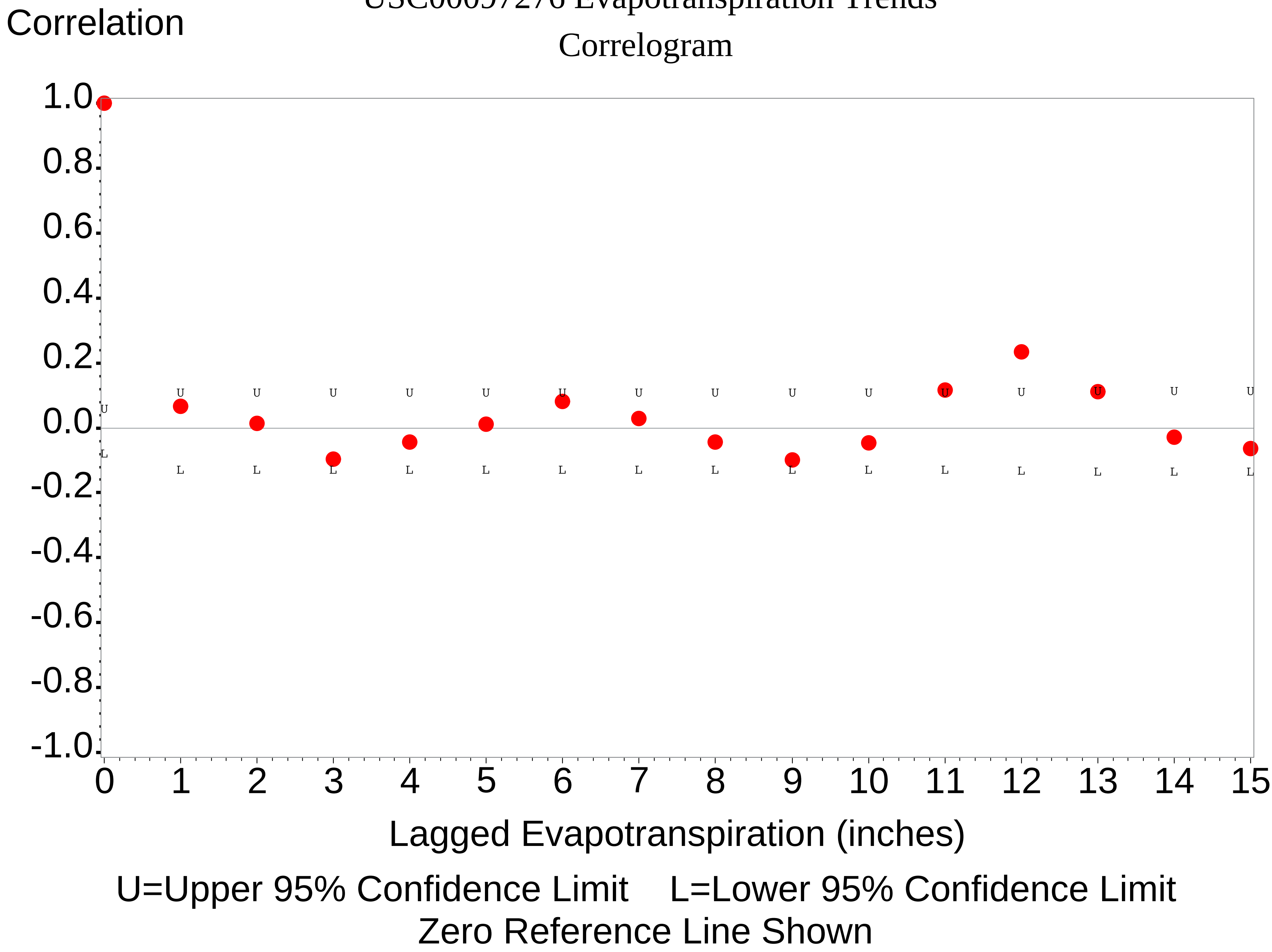
USC00097276 Evapotranspiration Trends

Autocorrelation Statistics

Lagged Evapotranspiration (inches)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.034	0.069	-0.069
1	0.067	0.059	0.119	-0.119
2	0.014	0.059	0.119	-0.119
3	-0.095	0.059	0.119	-0.119
4	-0.043	0.060	0.119	-0.119
5	0.011	0.060	0.119	-0.119
6	0.081	0.060	0.119	-0.119
7	0.029	0.060	0.120	-0.120
8	-0.044	0.060	0.120	-0.120
9	-0.098	0.060	0.120	-0.120
10	-0.047	0.060	0.120	-0.120
11	0.116	0.060	0.120	-0.120
12	0.235	0.060	0.121	-0.121
13	0.112	0.061	0.123	-0.123
14	-0.029	0.062	0.123	-0.123
15	-0.064	0.062	0.123	-0.123

USC00097276 Evapotranspiration Trends

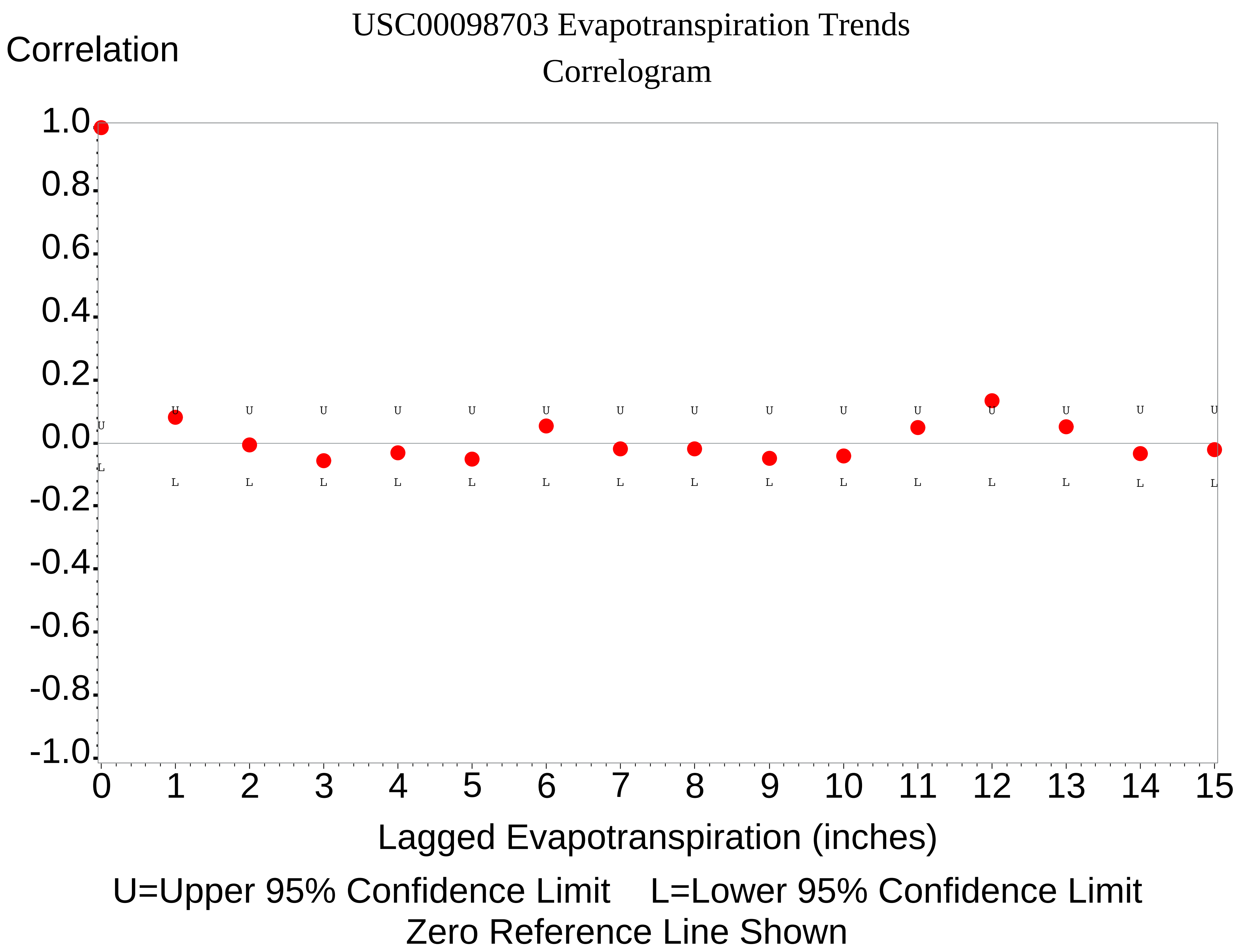
Correlogram



USC00098703 Evapotranspiration Trends

Autocorrelation Statistics

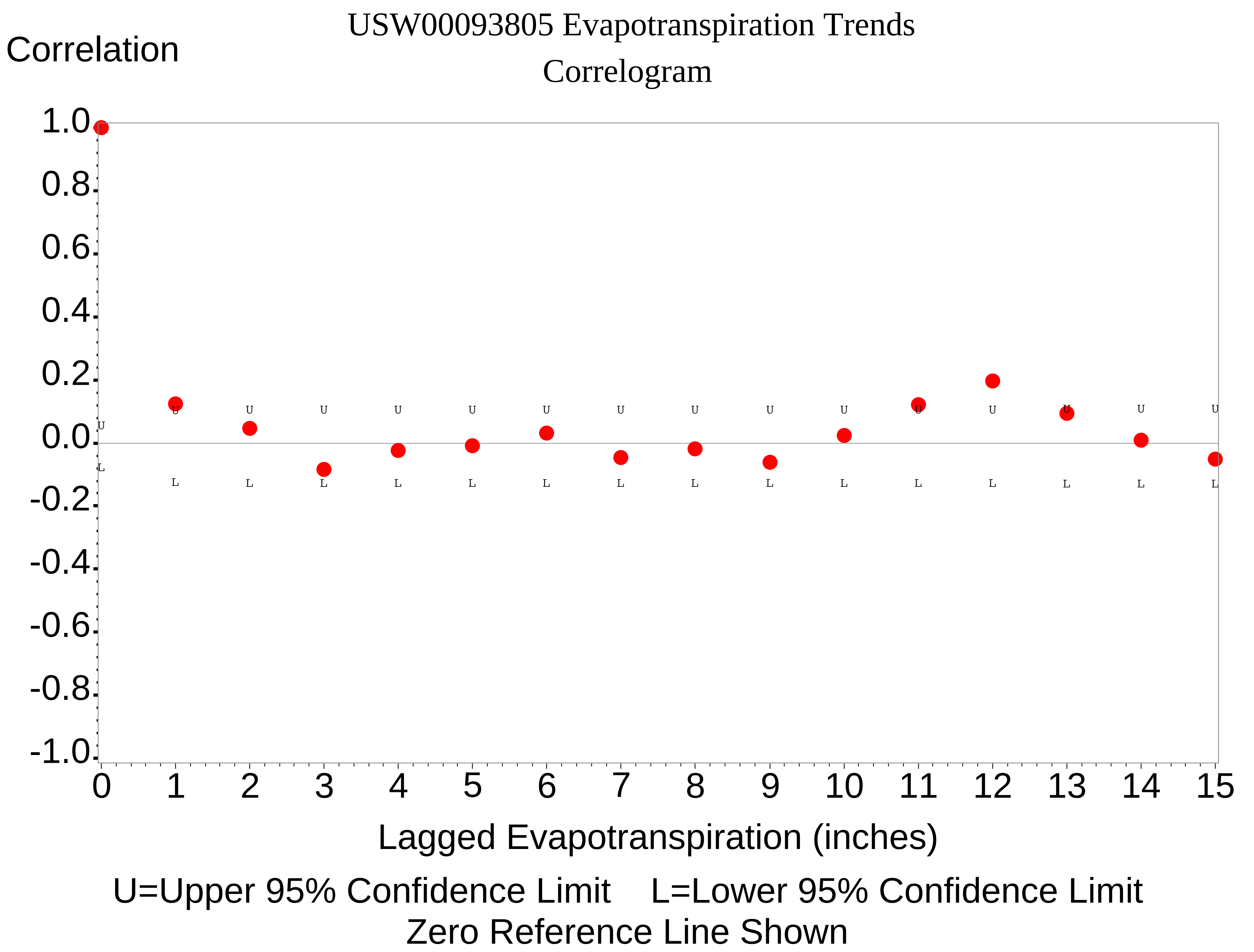
Lagged Evapotranspiration (inches)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.033	0.066	-0.066
1	0.081	0.057	0.114	-0.114
2	-0.005	0.057	0.114	-0.114
3	-0.055	0.057	0.114	-0.114
4	-0.030	0.057	0.114	-0.114
5	-0.050	0.057	0.114	-0.114
6	0.053	0.057	0.114	-0.114
7	-0.018	0.057	0.115	-0.115
8	-0.019	0.057	0.115	-0.115
9	-0.049	0.057	0.115	-0.115
10	-0.040	0.057	0.115	-0.115
11	0.049	0.057	0.115	-0.115
12	0.134	0.057	0.115	-0.115
13	0.051	0.058	0.115	-0.115
14	-0.034	0.058	0.116	-0.116
15	-0.022	0.058	0.116	-0.116


USC00098703 Evapotranspiration Trends
Correlogram
Correlation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Lagged Evapotranspiration (inches)
U=Upper 95% Confidence Limit L=Lower 95% Confidence Limit
Zero Reference Line Shown

USW00093805 Evapotranspiration Trends

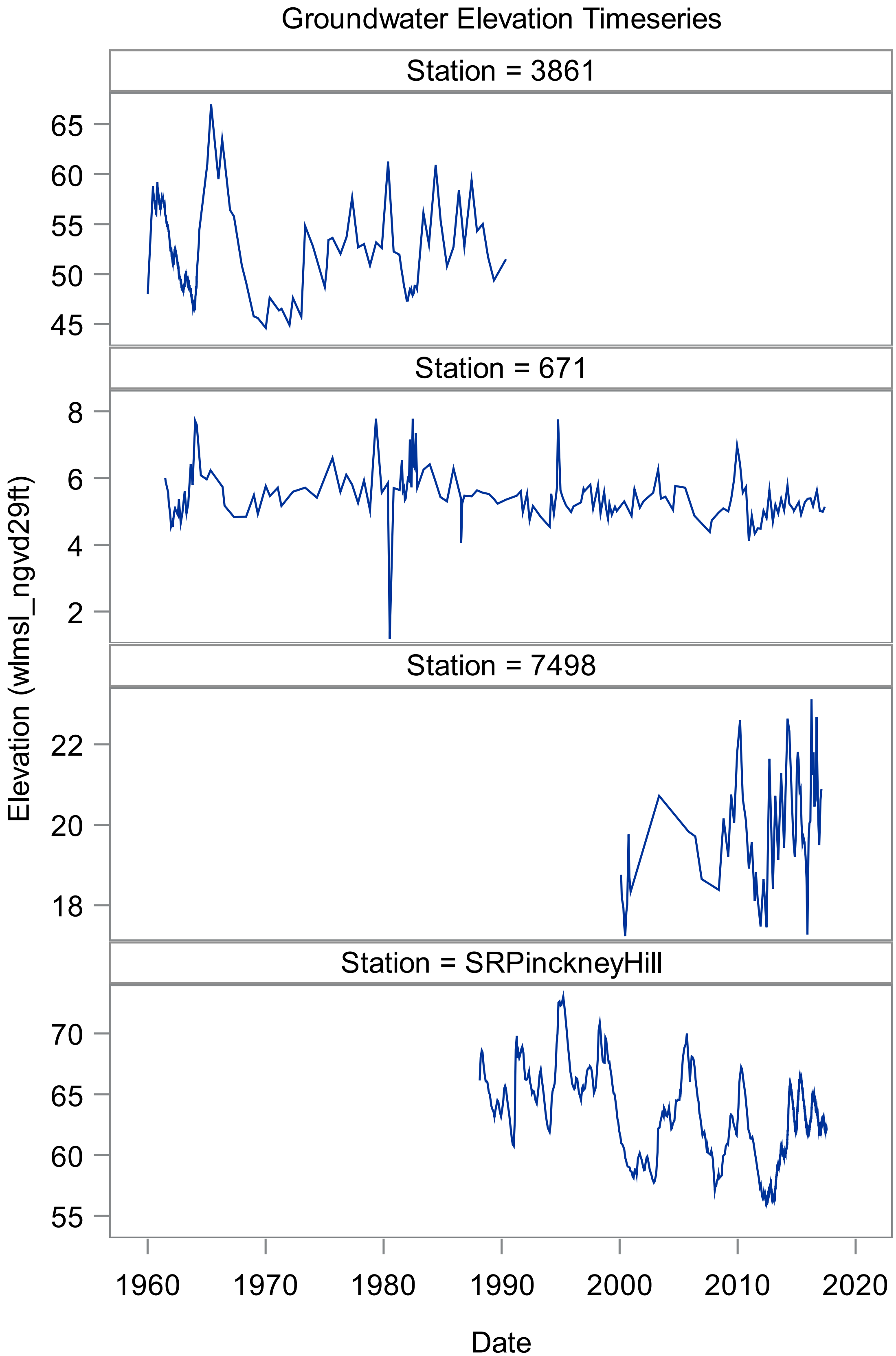
Autocorrelation Statistics

Lagged Evapotranspiration (inches)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.033	0.067	-0.067
1	0.123	0.058	0.115	-0.115
2	0.047	0.058	0.116	-0.116
3	-0.083	0.058	0.116	-0.116
4	-0.024	0.058	0.116	-0.116
5	-0.009	0.058	0.116	-0.116
6	0.032	0.058	0.116	-0.116
7	-0.045	0.058	0.116	-0.116
8	-0.018	0.058	0.117	-0.117
9	-0.062	0.058	0.117	-0.117
10	0.023	0.058	0.117	-0.117
11	0.121	0.058	0.117	-0.117
12	0.197	0.059	0.117	-0.117
13	0.093	0.059	0.119	-0.119
14	0.009	0.060	0.119	-0.119
15	-0.051	0.060	0.119	-0.119

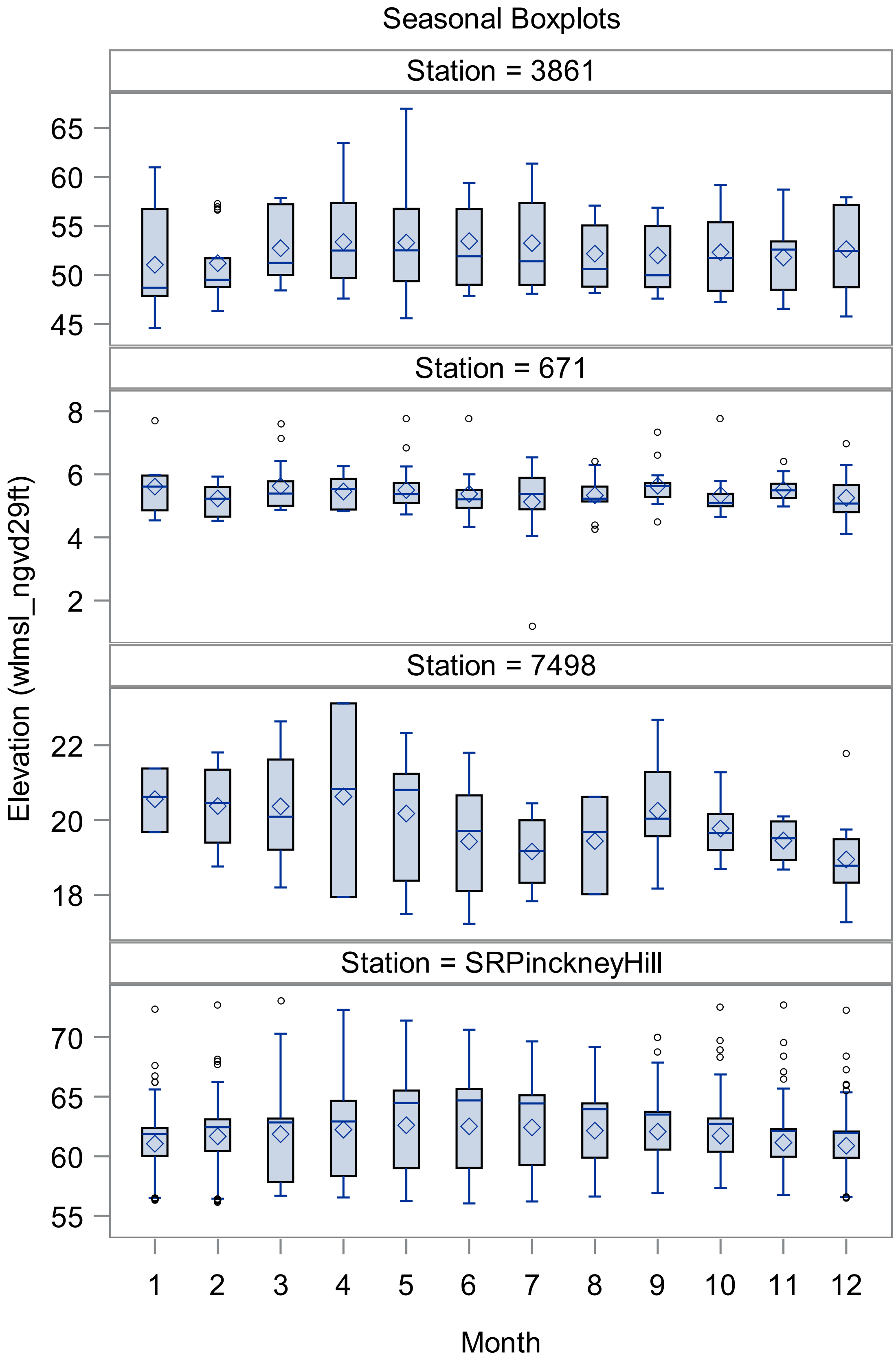


USW00093805 Evapotranspiration Trends
Correlogram
Correlation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Lagged Evapotranspiration (inches)
U=Upper 95% Confidence Limit L=Lower 95% Confidence Limit
Zero Reference Line Shown

ATTACHMENT 6
GROUNDWATER
DESCRIPTIVE STATISTICS AND PLOTS



Groundwater Elevation Timeseries
Station = 3861
65
60
55
50
45
Station = 671
8
6
4
2
Station = 7498
22
20
18
Station = SRPinckneyHill
70
65
60
55
Elevation (wlmsl_ngvd29ft)
1960
1970
1980
1990
2000
2010
2020
Date



Seasonal Boxplots
Station = 3861
65
60
55
50
45
Station = 671
8
6
4
2
Station = 7498
22
20
18
Station = SRPinckneyHill
70
65
60
55
Elevation (wlmsl_ngvd29ft)
1
2
3
4
5
6
7
8
9
10
11
12
Month

Beginning and End Dates for Groundwater Stations

Obs	station	Nobs	mindate	maxdate
1	3861	324	01/05/1960	05/15/1990
2	671	171	06/30/1961	05/22/2017
3	7498	70	02/17/2000	02/07/2017
4	SRPinckneyHill	2246	02/22/1988	07/17/2017

Check for Data Gaps in Groundwater Timeseries

Station=3861

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Year												
1960	1	.	.	.	.	4	6	5	6	6	6	6
1961	6	6	6	6	6	6	6	6	6	6	6	6
1962	5	6	5	5	6	6	6	6	6	6	5	2
1963	6	6	4	6	6	6	6	6	6	6	6	2
1964	5	6	1	.	5	.	.	.	.	.	.	.
1965	1	.	.	.	1	.	.	.	.	.	.	.
1966	1	.	.	1	.	.	1	.	.	.	.	1
1967	.	.	.	1	.	.	.	.	.	.	.	1
1968	.	.	.	.	1	.	.	.	.	.	.	1
1969	.	.	.	.	1	.	.	.	.	.	.	.
1970	1	.	.	.	1	.	.	.	.	.	.	.
1971	.	1	.	.	1	.	.	.	.	.	.	.
1972	1	.	.	1	.	.	.	.	.	.	.	.
1973	1	.	.	.	1	.	.	.	.	.	.	.
1974	1	.	.	.	.	.	.	.	.	.	.	.
1975	1	.	1	1	.	.	.	.	1	.	.	.
1976	.	.	.	.	1	.	.	.	.	.	1	.
1977	.	.	.	.	1	.	.	.	.	.	1	.
1978	.	.	.	.	1	.	.	.	.	.	1	.
1979	.	.	.	.	1	.	.	.	.	.	1	.
1980	.	.	.	.	1	.	.	.	.	.	1	.
1981	.	.	.	.	1	.	1	1	1	1	1	1
1982	1	1	1	1	1	1	1	1	1	.	1	.
1983	.	.	.	.	1	.	.	.	.	.	1	.
1984	.	.	.	.	1	.	.	.	.	1	.	.
1985	.	.	.	.	1	.	.	.	.	.	.	1
1986	.	.	.	.	1	.	.	.	.	.	1	.
1987	.	.	.	.	.	1	.	.	.	.	.	1
1988	.	.	.	.	1	.	.	.	.	.	1	.
1989	.	.	.	.	1	.	.	.	.	.	.	.
1990	.	.	.	.	1	.	.	.	.	.	.	.

Check for Data Gaps in Groundwater Timeseries

Station=671

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Year												
1961	.	.	.	.	.	1	1	.	1	1	.	2
1962	.	2	1	.	1	1	1	1	.	1	.	1
1963	.	1	.	1	.	1	.	1	.	1	.	.
1964	1	.	1	.	1	.	1	.	.	.	.	.
1965	1	.	.	.	1	.	.	.	.	.	.	.
1966	.	.	.	.	1	.	1	.	.	.	.	.
1967	.	.	.	1	.	.	.	.	.	.	.	.
1968	.	.	.	.	1	.	.	.	.	.	.	.
1969	1	.	.	.	1	.	.	.	.	.	.	.
1970	1	.	.	.	1	.	.	.	.	.	.	.
1971	1	.	.	.	1	.	.	.	.	.	.	.
1972	.	.	.	1	.	.	.	.	.	.	.	.
1973	.	.	.	.	1	.	.	.	.	.	.	.
1974	.	.	.	.	1	.	.	.	.	.	.	.
1975	.	.	.	.	.	.	.	.	1	.	.	.
1976	.	.	.	.	1	.	.	.	.	.	1	.
1977	.	.	.	.	1	.	.	.	.	.	1	.
1978	.	.	.	.	1	.	.	.	.	.	1	.
1979	.	.	.	.	1	.	.	.	.	.	1	.
1980	.	.	.	.	1	.	1	.	.	.	1	.
1981	.	.	.	.	1	.	1	1	1	1	1	1
1982	1	1	1	1	1	1	1	1	1	.	1	.
1983	.	.	.	.	1	.	.	.	.	.	1	.
1984	.	.	.	.	1	.	.	.	.	1	.	.
1985	.	.	.	.	1	.	.	.	.	.	.	1
1986	.	.	.	.	.	.	2	2	.	.	1	.
1987	.	.	.	.	.	1	.	.	.	.	.	1
1988	.	.	.	.	1	.	.	.	.	.	1	.
1989	.	.	.	.	1	.	.	1	.	.	.	.
1990	.	.	.	.	1	.	.	.	.	.	.	.
1991	.	.	.	1	.	.	.	1	.	1	.	.
1992	.	1	.	.	1	.	.	1	.	.	.	.
1993	.	.	.	1	.	.	.	.	.	.	.	.
1994	1	.	1	.	.	1	.	.	1	1	.	1

(Continued)

Check for Data Gaps in Groundwater Timeseries

Station=671

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Year												
1995	.	.	1	.	.	1	.	.	.	.	1	.
1996	.	1	.	.	.	.	.	.	1	.	.	1
1997	1	.	.	.	.	.	1	.	.	1	.	.
1998	.	.	1	.	1	.	.	.	1	.	1	.
1999	1	1	.	.	1	.	.	1	.	1	.	.
2000	.	.	.	.	1	.	.	.	.	.	.	.
2001	1	.	.	1	.	.	.	.	1	.	.	.
2002	1	.	.	.	.	.	.	.	.	.	1	.
2003	.	.	.	1	.	.	1	.	.	.	1	.
2004	.	.	.	.	.	.	2	.	1	.	.	.
2005	.	.	.	.	.	.	1	.	.	.	.	.
2006	.	.	.	.	1	.	.	.	.	.	.	.
2007	.	.	.	.	.	.	.	1	.	1	.	.
2008	.	.	.	.	1	.	.	.	.	1	.	.
2009	.	.	1	.	.	1	.	.	1	.	.	1
2010	.	.	1	.	.	1	.	.	1	.	.	1
2011	.	.	1	.	.	1	1	.	1	.	.	1
2012	.	.	1	.	.	1	.	.	1	.	.	1
2013	.	.	1	.	.	1	.	.	1	.	.	1
2014	.	.	1	.	1	.	.	.	1	1	.	1
2015	.	.	1	.	1	.	.	.	1	.	.	1
2016	.	.	1	.	1	.	.	.	1	.	.	1
2017	.	.	1	.	1	.	.	.	.	.	.	.

Check for Data Gaps in Groundwater Timeseries

Station=7498

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Year												
2000	.	1	1	1	1	1	1	1	1	2	.	1
2003	.	.	.	.	1	.	.	.	.	.	.	.
2005	.	.	.	.	.	.	.	.	.	.	1	.
2006	.	.	.	.	.	1	.	.	.	.	.	1
2008	.	.	.	.	1	.	.	.	.	1	.	.
2009	.	.	1	.	.	1	.	.	1	.	.	1
2010	.	.	1	.	.	1	.	.	1	.	.	1
2011	.	.	1	.	.	1	1	.	1	.	.	1
2012	.	.	1	.	.	1	.	.	1	.	.	1
2013	.	.	1	.	.	1	.	.	1	.	.	1
2014	.	.	1	.	1	.	.	.	1	1	1	1
2015	1	1	1	1	1	1	1	1	1	1	1	1
2016	1	1	1	1	1	1	1	1	1	1	1	1
2017	1	1	.	.	.	.	.	.	.	.	.	.

Check for Data Gaps in Groundwater Timeseries

Station=SRPinckneyHill

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Year												
1988	.	1	1	1	1	1	1	1	1	1	1	1
1989	1	1	1	1	1	1	1	1	1	1	1	1
1990	1	1	1	1	1	1	1	1	1	1	1	1
1991	1	1	1	1	1	1	2	.	1	1	1	1
1992	2	1	1	1	1	1	1	1	1	1	1	1
1993	1	1	1	1	1	1	1	1	1	1	1	1
1994	1	1	1	1	1	1	1	1	1	1	1	1
1995	1	1	1	1	1	1	1	1	1	1	1	1
1996	1	1	1	1	1	1	1	1	1	1	1	1
1997	1	1	1	1	1	1	1	1	1	1	1	1
1998	1	1	1	1	1	1	1	1	1	1	1	1
1999	1	1	1	1	1	1	1	1	1	1	1	1
2000	1	1	1	1	1	1	1	1	1	1	2	.
2001	1	1	1	1	1	1	1	1	1	1	1	1
2002	1	1	1	1	1	1	1	1	1	1	1	1
2003	1	1	1	1	1	1	1	1	1	1	1	1
2004	1	.	1	1	1	1	1	1	.	1	1	1
2005	1	1	1	.	1	1	1	1	1	1	1	1
2006	.	1	1	1	1	1	1	1	1	1	1	.
2007	1	1	1	1	1	1	1	1	1	1	1	.
2008	1	1	2	1	1	1	.	1	1	1	1	2
2009	1	1	2	1	1	1	1	1	1	1	1	1
2010	1	1	1	1	1	1	1	1	1	1	1	1
2011	1	1	1	1	1	1	1	1	1	1	1	1
2012	1	1	18	30	31	30	31	32	30	31	30	32
2013	31	28	31	31	31	30	31	32	30	32	30	31
2014	31	29	31	30	31	31	31	31	30	31	30	31
2015	31	28	31	30	31	30	31	31	30	31	30	31
2016	31	29	31	30	31	30	31	31	30	31	30	31
2017	31	28	31	30	31	30	17	.	.	.	.	.

Descriptive Statistics for Northwest NWS Groundwater Stations

The UNIVARIATE Procedure
Variable: wlmsl_ngvd29ft (Elevation (wlmsl_ngvd29ft))

Station=3861

Moments			
N	324	**Sum Weights**	324
Mean	52.4357407	**Sum Observations**	16989.18
Std Deviation	3.99028934	**Variance**	15.922409
Skewness	0.39756629	**Kurtosis**	-0.6337343
Uncorrected SS	895983.176	**Corrected SS**	5142.93812
Coeff Variation	7.6098655	**Std Error Mean**	0.22168274

Basic Statistical Measures			
Location		Variability	
Mean	52.43574	**Std Deviation**	3.99029
Median	51.86000	**Variance**	15.92241
Mode	48.44000	**Range**	22.34000
		Interquartile Range	7.29500

Note: The mode displayed is the smallest of 2 modes with a count of 3.

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	236.5351	**Pr > |t|**	<.0001
Sign	**M**	162	**Pr >= |M|**	<.0001
Signed Rank	**S**	26325	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	66.960
99%	61.250
95%	58.470
90%	57.650
75% Q3	56.250
50% Median	51.860
25% Q1	48.955
10%	47.890
5%	47.250
1%	45.730
0% Min	44.620

Descriptive Statistics for Northwest NWS Groundwater Stations

The UNIVARIATE Procedure
Variable: wlmsl_ngvd29ft (Elevation (wlmsl_ngvd29ft))

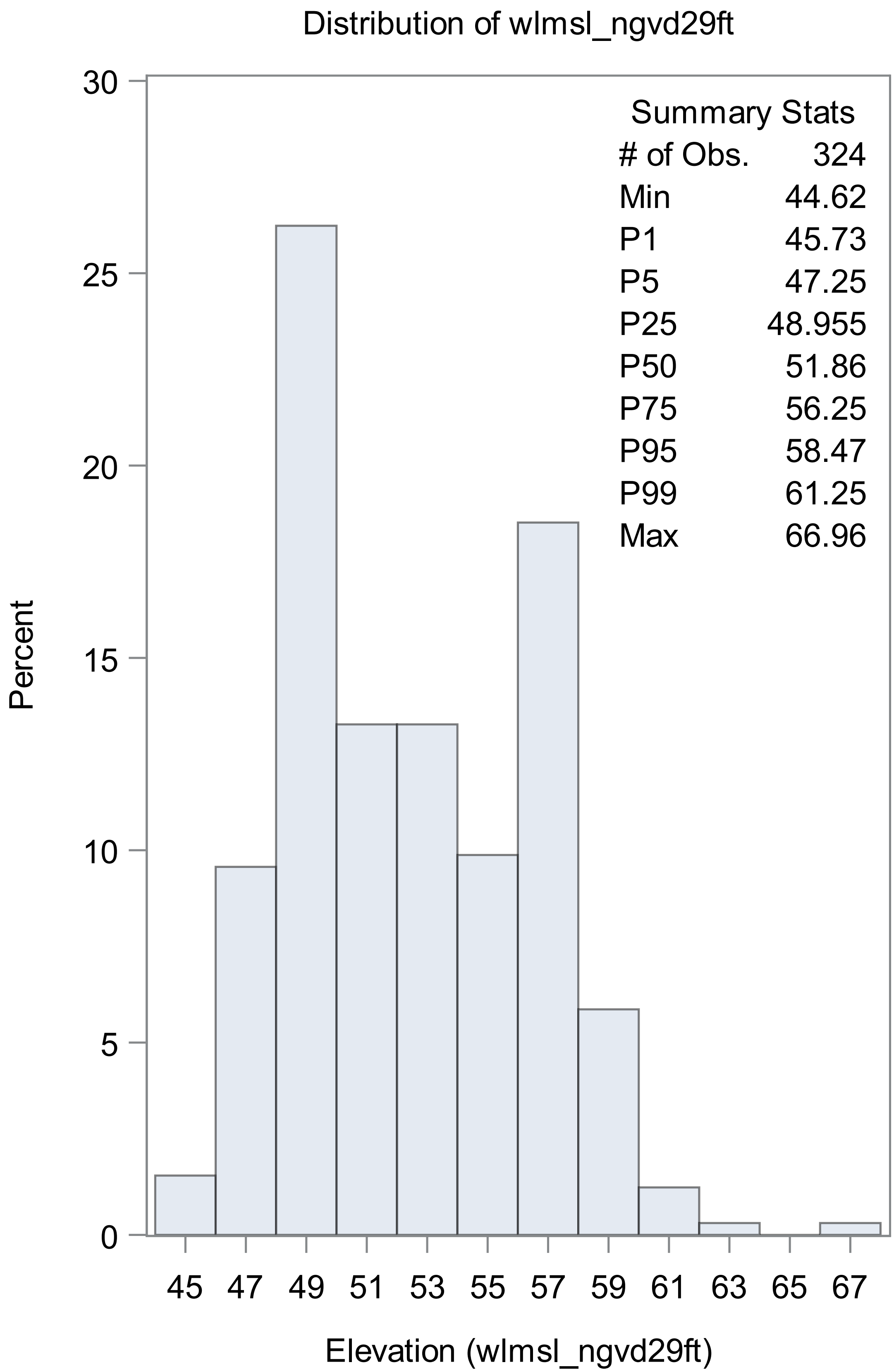
Station=3861

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
44.62	271	60.98	260
44.90	275	61.25	292
45.61	270	61.37	264
45.73	277	63.48	263
45.79	269	66.96	261

Descriptive Statistics for Northwest NWS Groundwater Stations

The UNIVARIATE Procedure

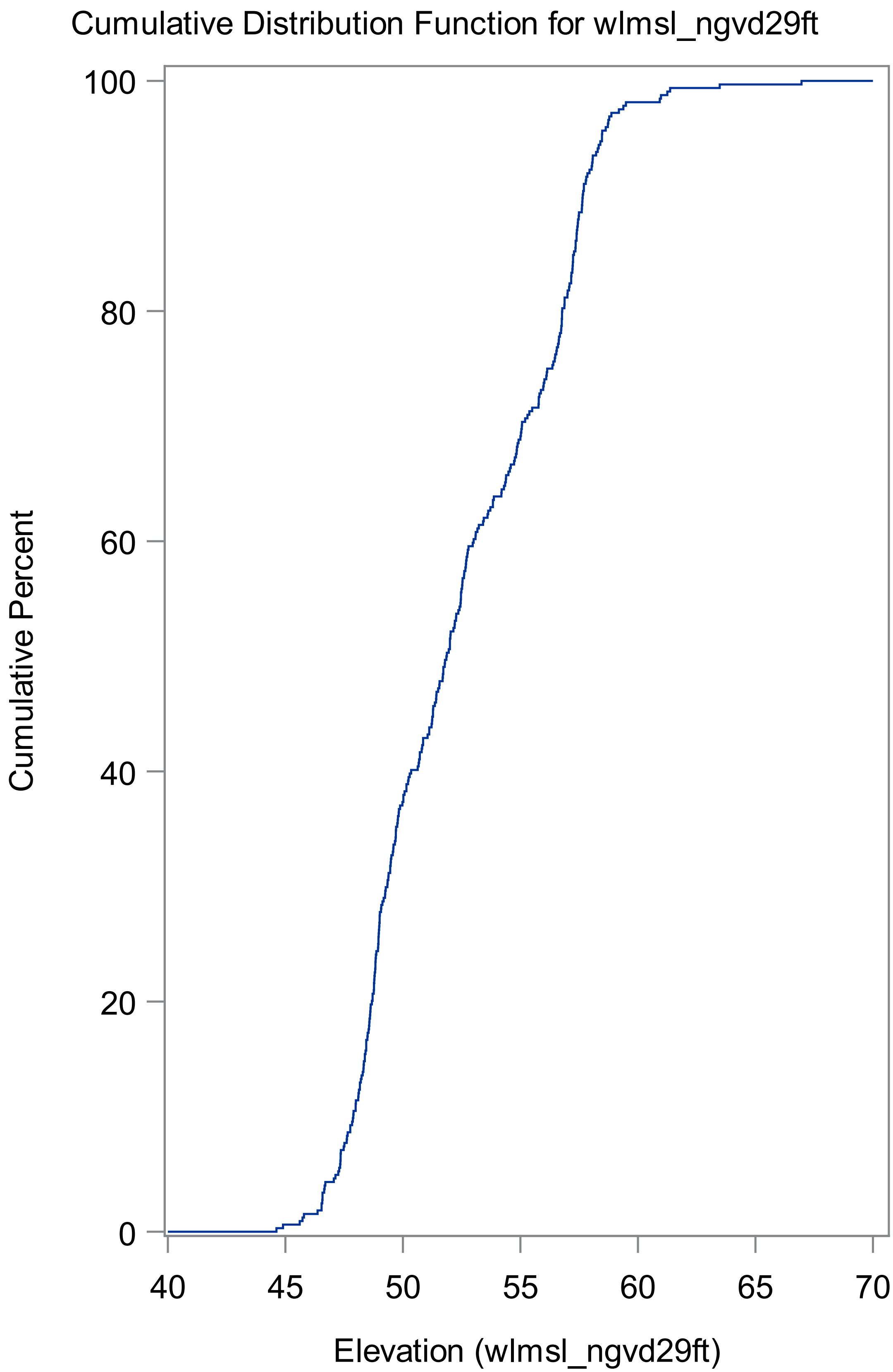
Station=3861



Descriptive Statistics for Northwest NWS Groundwater Stations

The UNIVARIATE Procedure

Station=3861



Descriptive Statistics for Northwest NWS Groundwater Stations

The UNIVARIATE Procedure
Variable: wlmsl_ngvd29ft (Elevation (wlmsl_ngvd29ft))

Station=671

Moments			
N	171	**Sum Weights**	171
Mean	5.43450292	**Sum Observations**	929.3
Std Deviation	0.75411589	**Variance**	0.56869078
Skewness	-0.1048593	**Kurtosis**	6.89055941
Uncorrected SS	5146.961	**Corrected SS**	96.6774327
Coeff Variation	13.8764466	**Std Error Mean**	0.05766868

Basic Statistical Measures			
Location		Variability	
Mean	5.434503	**Std Deviation**	0.75412
Median	5.380000	**Variance**	0.56869
Mode	5.230000	**Range**	6.60000
		Interquartile Range	0.70000

Note: The mode displayed is the smallest of 4 modes with a count of 4.

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	**t**	94.23664	**Pr > |t|**	<.0001
Sign	**M**	85.5	**Pr >= |M|**	<.0001
Signed Rank	**S**	7353	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	Quantile
100% Max	7.78
99%	7.78
95%	6.84
90%	6.26
75% Q3	5.71
50% Median	5.38
25% Q1	5.01
10%	4.78
5%	4.49
1%	4.05
0% Min	1.18

The UNIVARIATE Procedure
Variable: wlmsl_ngvd29ft (Elevation (wlmsl_ngvd29ft))

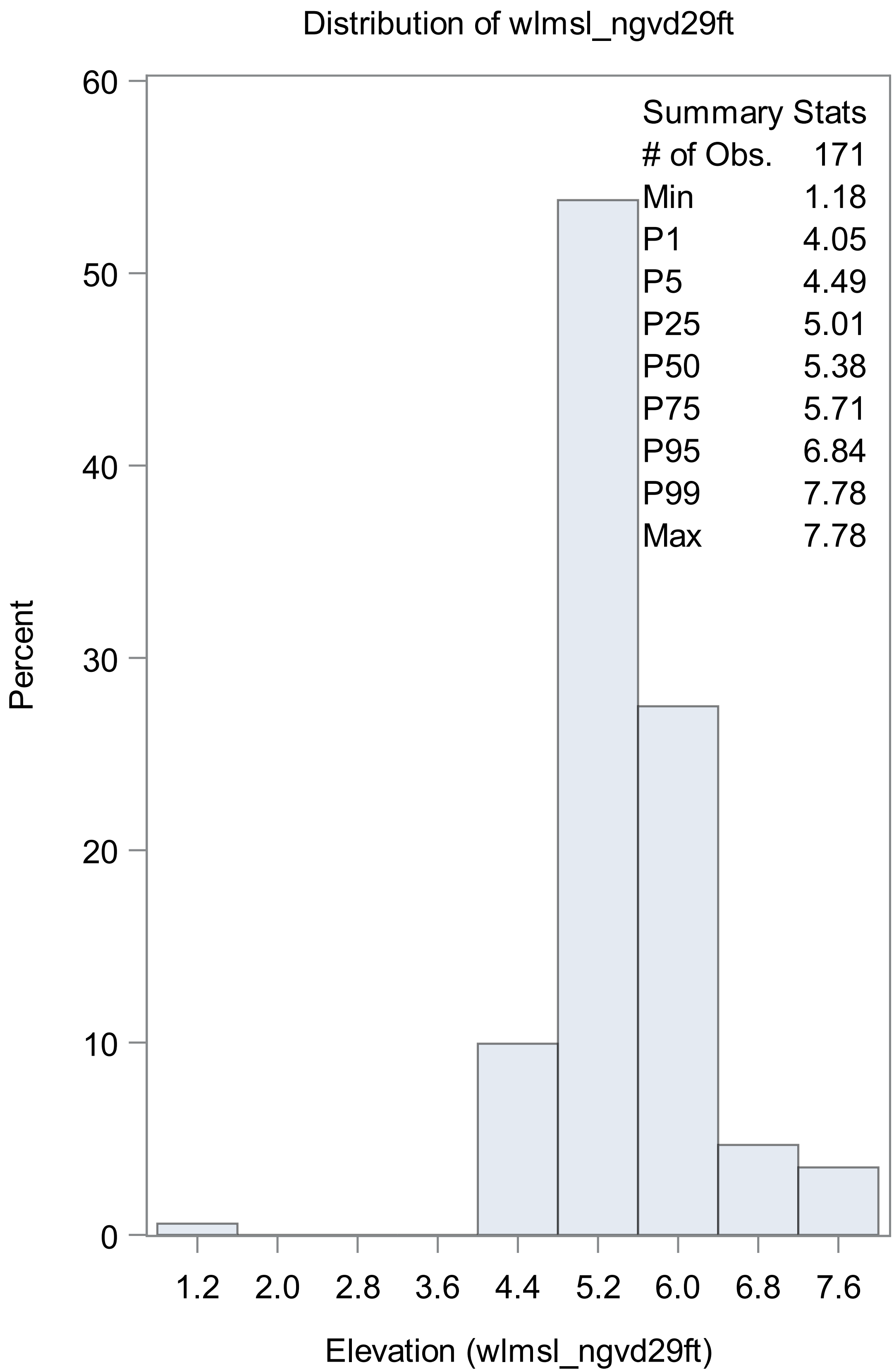
Station=671

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
1.18	374	7.59	346
4.05	400	7.71	345
4.11	467	7.75	422
4.25	401	7.78	371
4.33	469	7.78	388

Descriptive Statistics for Northwest NWS Groundwater Stations

The UNIVARIATE Procedure

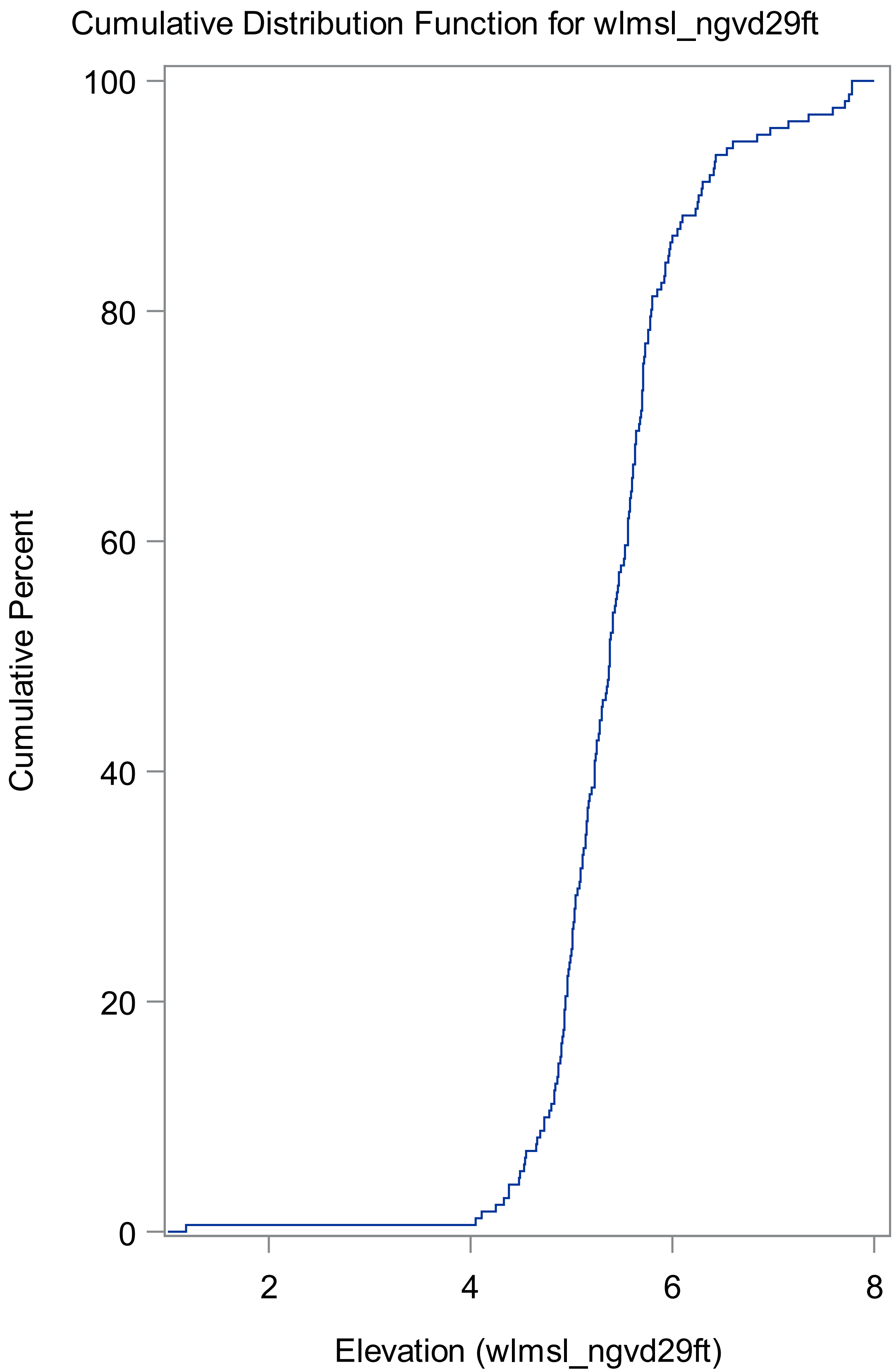
Station=671



Descriptive Statistics for Northwest NWS Groundwater Stations

The UNIVARIATE Procedure

Station=671



Descriptive Statistics for Northwest NWS Groundwater Stations

The UNIVARIATE Procedure
Variable: wlmsl_ngvd29ft (Elevation (wlmsl_ngvd29ft))

Station=7498

Moments			
N	70	**Sum Weights**	70
Mean	19.8208571	**Sum Observations**	1387.46
Std Deviation	1.43952966	**Variance**	2.07224563
Skewness	0.23673135	**Kurtosis**	-0.5349689
Uncorrected SS	27643.6314	**Corrected SS**	142.984949
Coeff Variation	7.26270134	**Std Error Mean**	0.1720567

Basic Statistical Measures			
Location		**Variability**	
Mean	19.82086	**Std Deviation**	1.43953
Median	19.73000	**Variance**	2.07225
Mode	18.65000	**Range**	5.89000
		Interquartile Range	2.05000

Note: The mode displayed is the smallest of 8 modes with a count of 2.

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	115.1996	**Pr > |t|**	<.0001
Sign	**M**	35	**Pr >= |M|**	<.0001
Signed Rank	**S**	1242.5	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	23.120
99%	23.120
95%	22.600
90%	21.785
75% Q3	20.750
50% Median	19.730
25% Q1	18.700
10%	17.980
5%	17.470
1%	17.230
0% Min	17.230

Descriptive Statistics for Northwest NWS Groundwater Stations

The UNIVARIATE Procedure
Variable: wlmsl_ngvd29ft (Elevation (wlmsl_ngvd29ft))

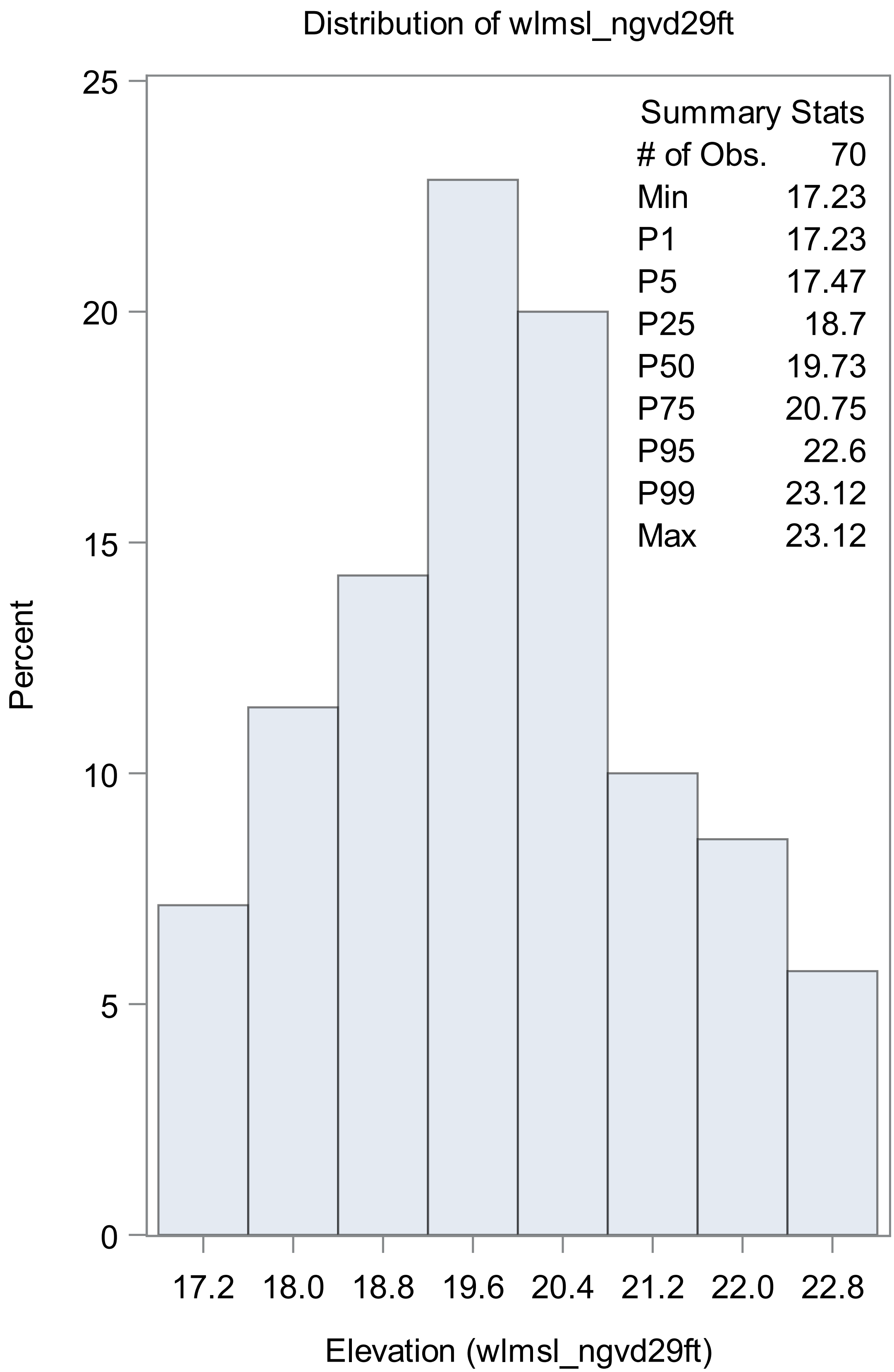
Station=7498

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
17.23	500	22.33	535
17.27	551	22.60	517
17.45	527	22.64	534
17.47	525	22.68	560
17.49	499	23.12	555

Descriptive Statistics for Northwest NWS Groundwater Stations

The UNIVARIATE Procedure

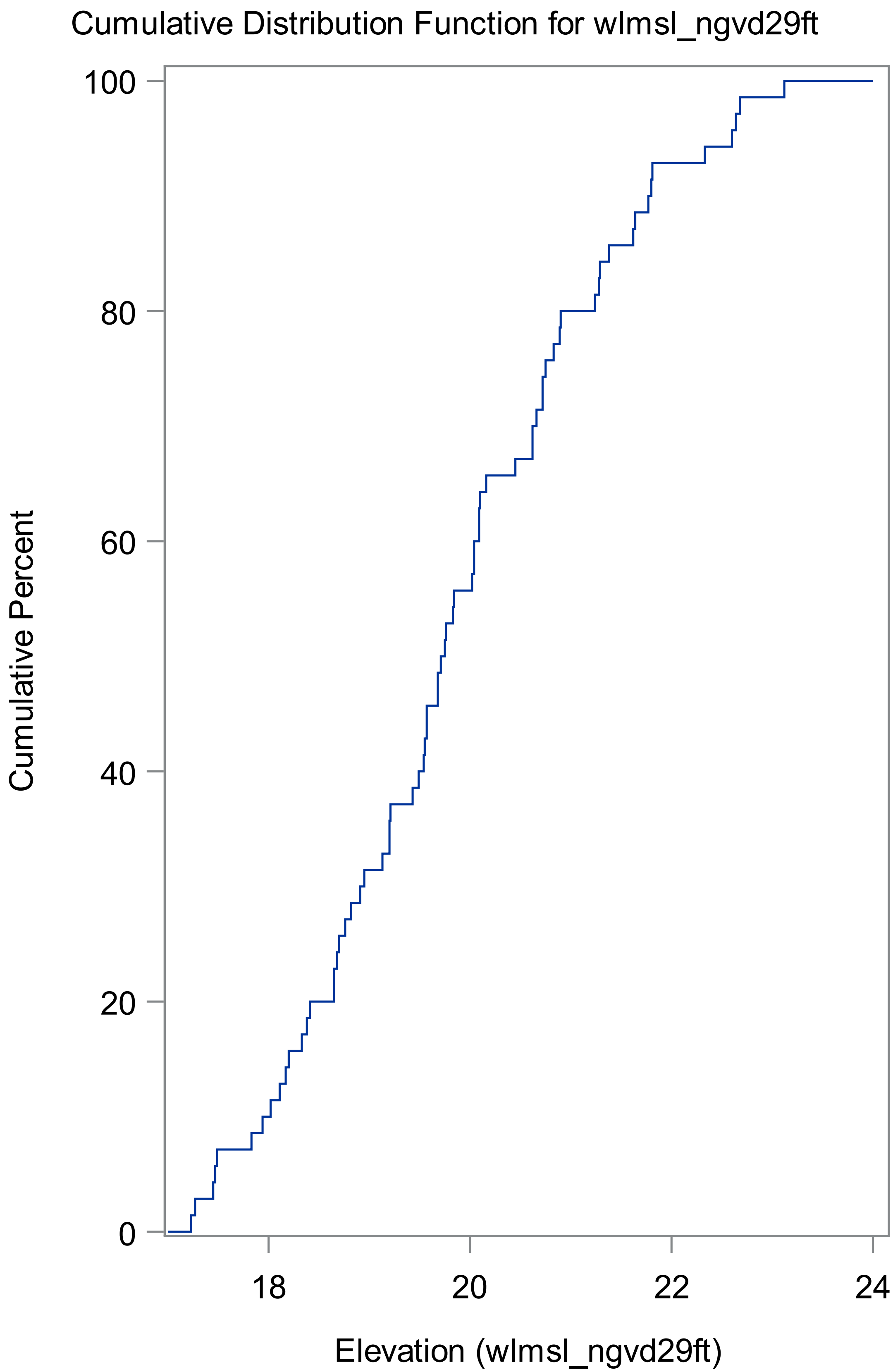
Station=7498



Descriptive Statistics for Northwest NWS Groundwater Stations

The UNIVARIATE Procedure

Station=7498



Descriptive Statistics for Northwest NWS Groundwater Stations

The UNIVARIATE Procedure
Variable: wlmsl_ngvd29ft (Elevation (wlmsl_ngvd29ft))

Station=SRPinckneyHill

Moments			
N	2245	**Sum Weights**	2245
Mean	61.8838517	**Sum Observations**	138929.247
Std Deviation	3.1917509	**Variance**	10.1872738
Skewness	-0.144714	**Kurtosis**	-0.4711951
Uncorrected SS	8620337.16	**Corrected SS**	22860.2425
Coeff Variation	5.15764746	**Std Error Mean**	0.06736291

Basic Statistical Measures			
Location		**Variability**	
Mean	61.88385	**Std Deviation**	3.19175
Median	62.27500	**Variance**	10.18727
Mode	56.75200	**Range**	16.98900
		Interquartile Range	4.43800

Note: The mode displayed is the smallest of 5 modes with a count of 4.

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	918.6636	**Pr > |t|**	<.0001
Sign	**M**	1122.5	**Pr >= |M|**	<.0001
Signed Rank	**S**	1260568	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	73.030
99%	68.800
95%	66.277
90%	65.618
75% Q3	64.252
50% Median	62.275
25% Q1	59.814
10%	56.768
5%	56.492
1%	56.184
0% Min	56.041

Descriptive Statistics for Northwest NWS Groundwater Stations

The UNIVARIATE Procedure
Variable: wlmsl_ngvd29ft (Elevation (wlmsl_ngvd29ft))

Station=SRPinckneyHill

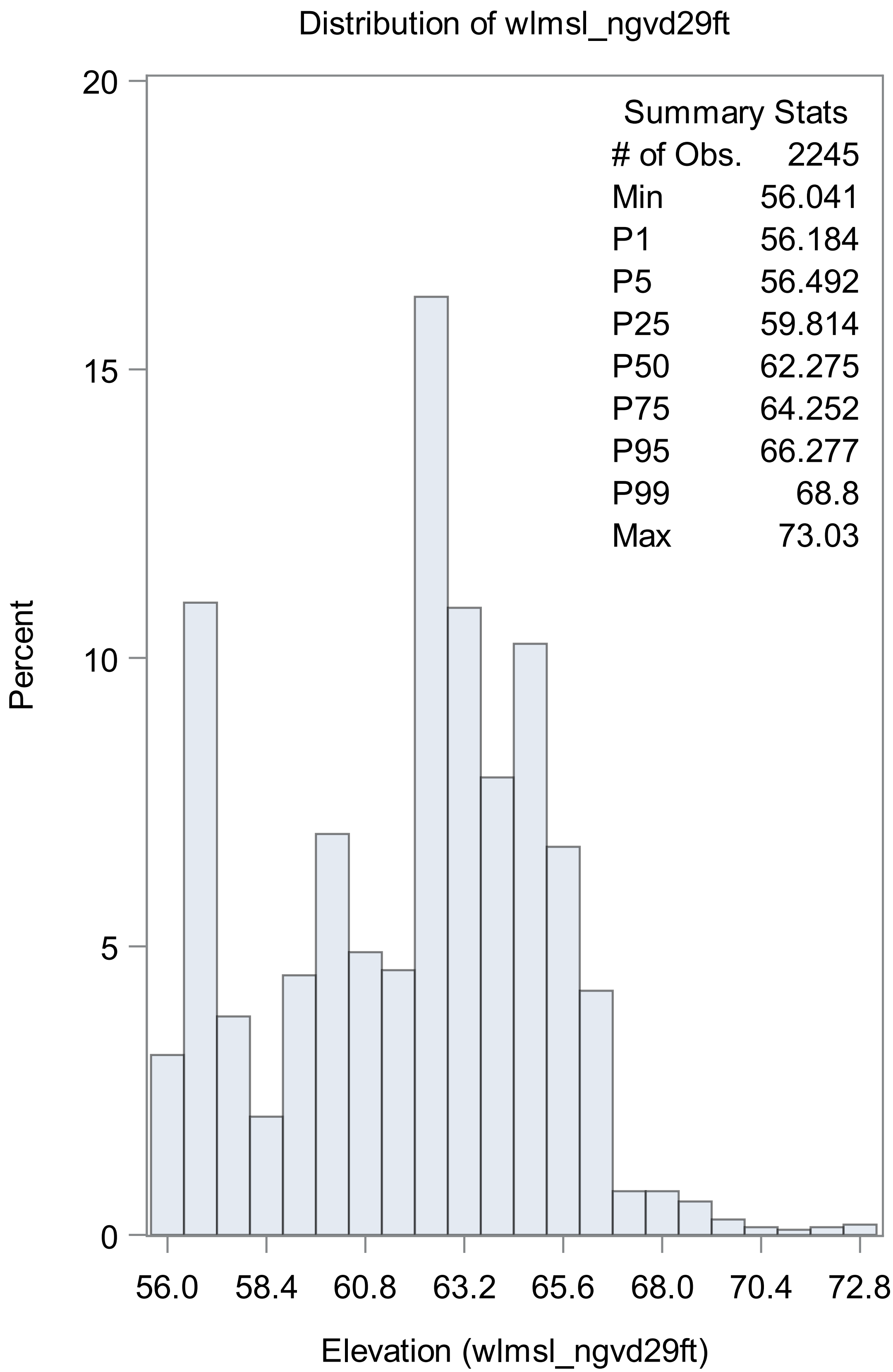
Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
56.041	950	72.34	651
56.049	951	72.54	648
56.059	958	72.64	649
56.070	959	72.68	652
56.074	947	73.03	653

Missing Values			
		Percent Of	
Missing Value	Count	All Obs	Missing Obs
.	1	0.04	100.00

Descriptive Statistics for Northwest NWS Groundwater Stations

The UNIVARIATE Procedure

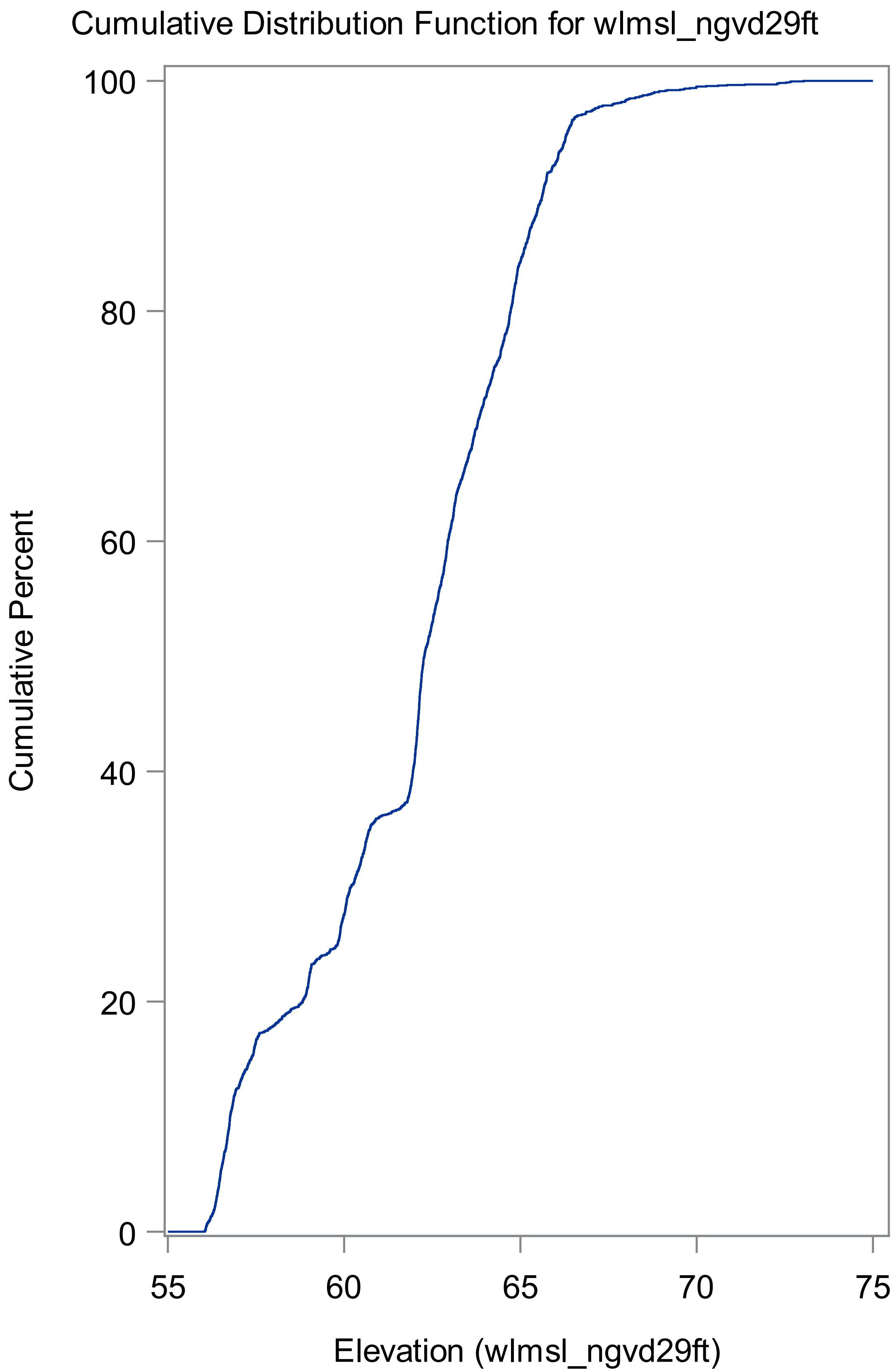
Station=SRPinckneyHill



Descriptive Statistics for Northwest NWS Groundwater Stations

The UNIVARIATE Procedure

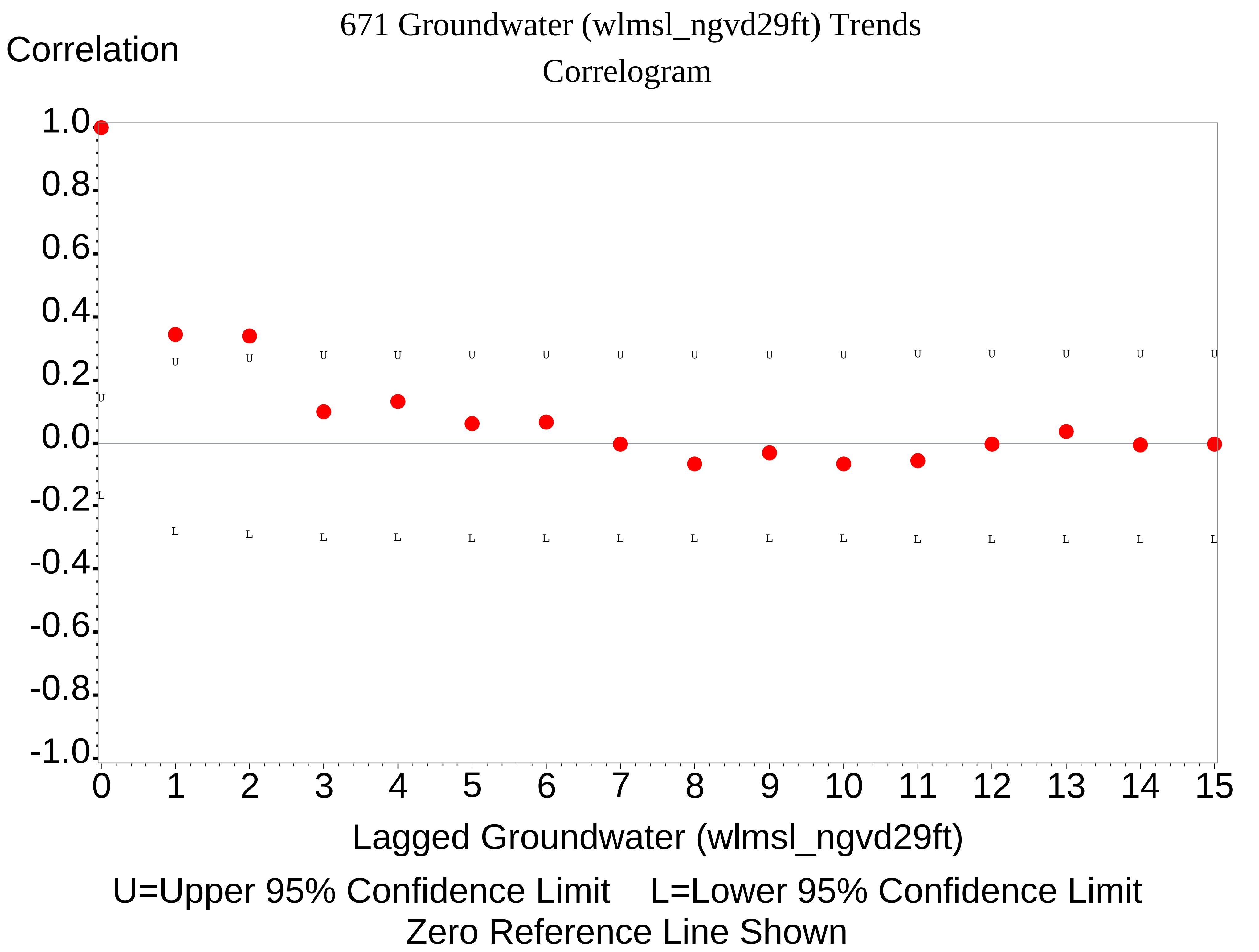
Station=SRPinckneyHill



671 Groundwater (wlmsl_ngvd29ft) Trends

Autocorrelation Statistics

Lagged Groundwater (wlmsl_ngvd29ft)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.078	0.155	-0.155
1	0.343	0.134	0.269	-0.269
2	0.340	0.140	0.279	-0.279
3	0.099	0.145	0.289	-0.289
4	0.131	0.145	0.290	-0.290
5	0.062	0.146	0.291	-0.291
6	0.067	0.146	0.292	-0.292
7	-0.004	0.146	0.292	-0.292
8	-0.066	0.146	0.292	-0.292
9	-0.030	0.146	0.292	-0.292
10	-0.065	0.146	0.292	-0.292
11	-0.055	0.146	0.293	-0.293
12	-0.004	0.146	0.293	-0.293
13	0.036	0.146	0.293	-0.293
14	-0.006	0.147	0.293	-0.293
15	-0.004	0.147	0.293	-0.293

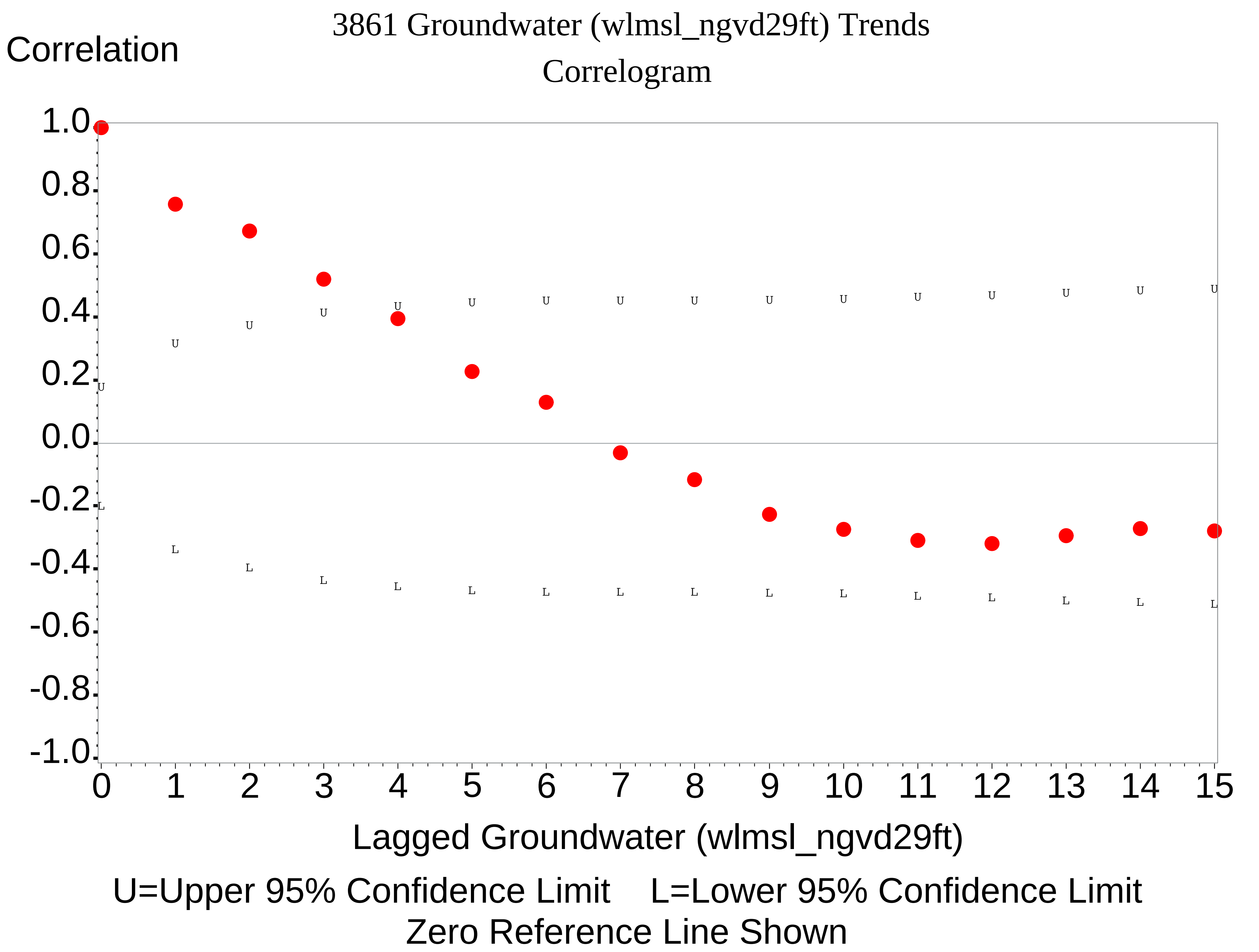


671 Groundwater (wlmsl_ngvd29ft) Trends
Correlogram
Correlation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Lagged Groundwater (wlmsl_ngvd29ft)
U=Upper 95% Confidence Limit
L=Lower 95% Confidence Limit
Zero Reference Line Shown

3861 Groundwater (wlmsl_ngvd29ft) Trends

Autocorrelation Statistics

Lagged Groundwater (wlmsl_ngvd29ft)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.094	0.188	-0.188
1	0.757	0.163	0.326	-0.326
2	0.673	0.192	0.383	-0.383
3	0.519	0.211	0.423	-0.423
4	0.393	0.222	0.445	-0.445
5	0.227	0.229	0.457	-0.457
6	0.130	0.231	0.461	-0.461
7	-0.031	0.231	0.462	-0.462
8	-0.115	0.231	0.462	-0.462
9	-0.227	0.232	0.463	-0.463
10	-0.273	0.234	0.467	-0.467
11	-0.309	0.236	0.473	-0.473
12	-0.319	0.240	0.480	-0.480
13	-0.294	0.244	0.488	-0.488
14	-0.271	0.247	0.494	-0.494
15	-0.280	0.249	0.499	-0.499


3861 Groundwater (wlmsl_ngvd29ft) Trends
Correlogram
Correlation
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Lagged Groundwater (wlmsl_ngvd29ft)
U=Upper 95% Confidence Limit L=Lower 95% Confidence Limit
Zero Reference Line Shown

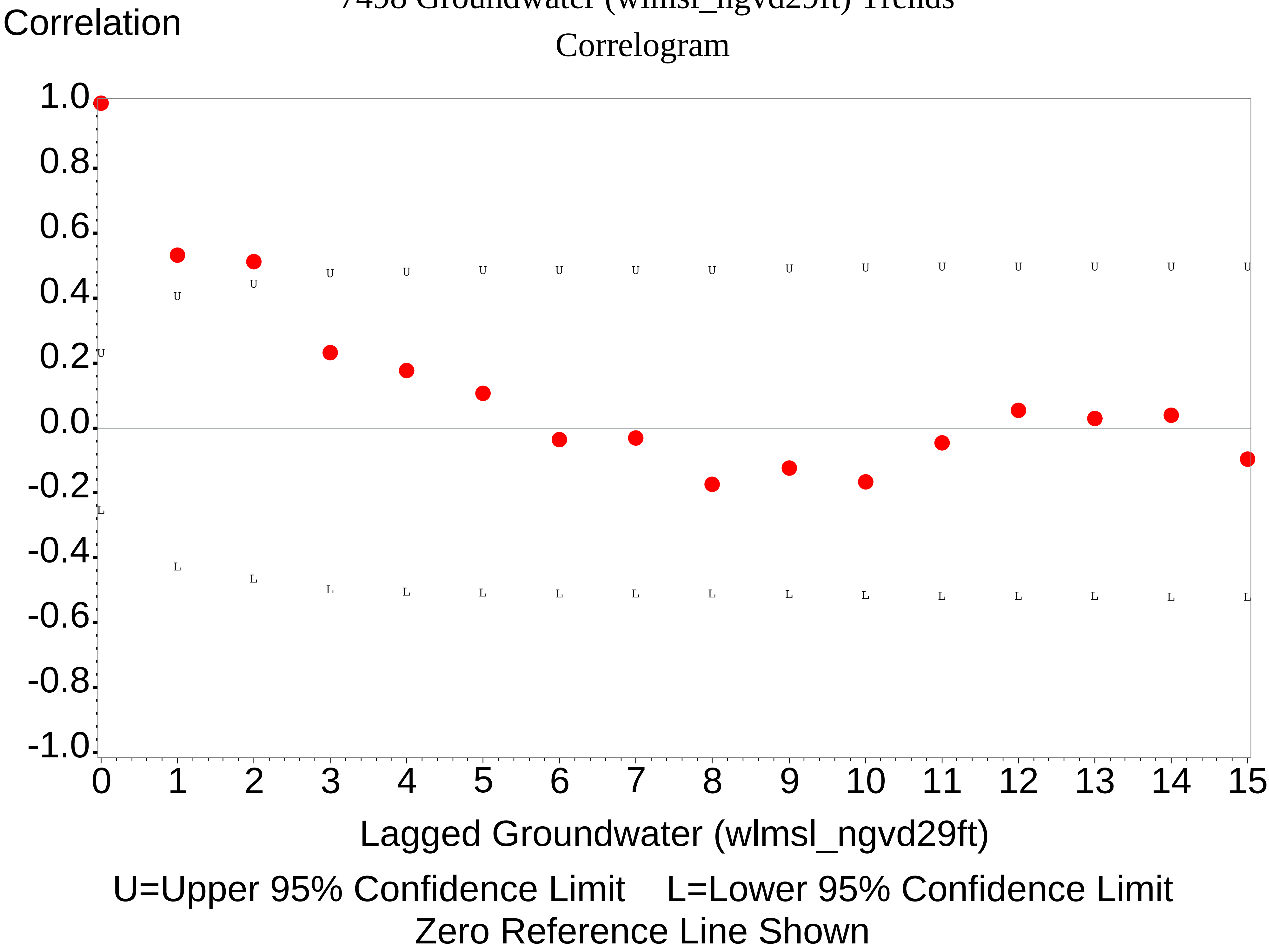
7498 Groundwater (wlmsl_ngvd29ft) Trends

Autocorrelation Statistics

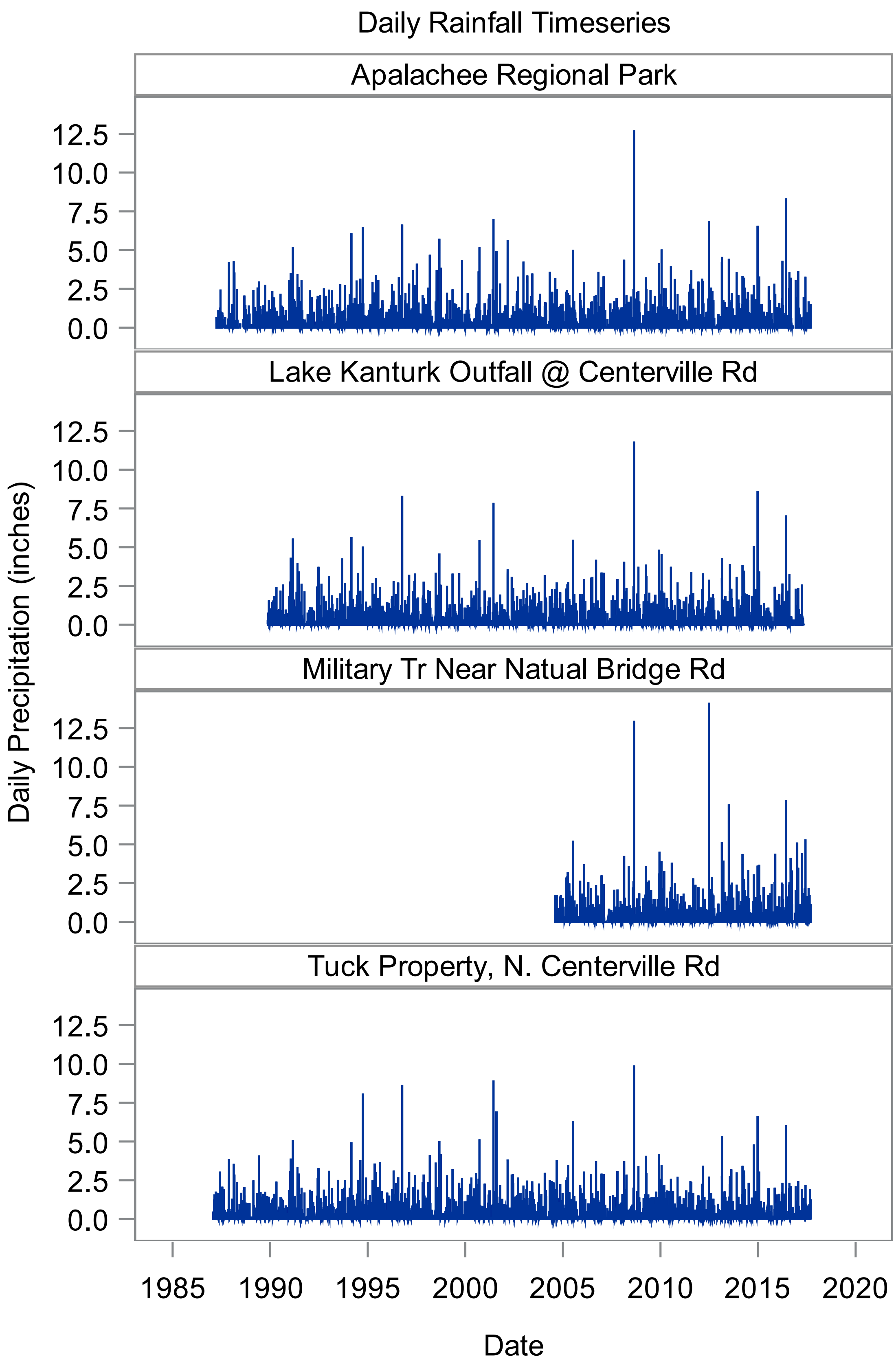
Lagged Groundwater (wlmsl_ngvd29ft)	Correlation	Standard Error	Upper Limit	Lower Limit
0	1.000	0.120	0.241	-0.241
1	0.533	0.209	0.417	-0.417
2	0.511	0.227	0.455	-0.455
3	0.231	0.243	0.487	-0.487
4	0.177	0.247	0.493	-0.493
5	0.107	0.248	0.497	-0.497
6	-0.036	0.249	0.498	-0.498
7	-0.031	0.249	0.498	-0.498
8	-0.174	0.249	0.498	-0.498
9	-0.123	0.251	0.502	-0.502
10	-0.166	0.252	0.504	-0.504
11	-0.045	0.253	0.507	-0.507
12	0.053	0.254	0.507	-0.507
13	0.028	0.254	0.507	-0.507
14	0.040	0.254	0.508	-0.508
15	-0.097	0.254	0.508	-0.508

7498 Groundwater (wlmsl_ngvd29ft) Trends

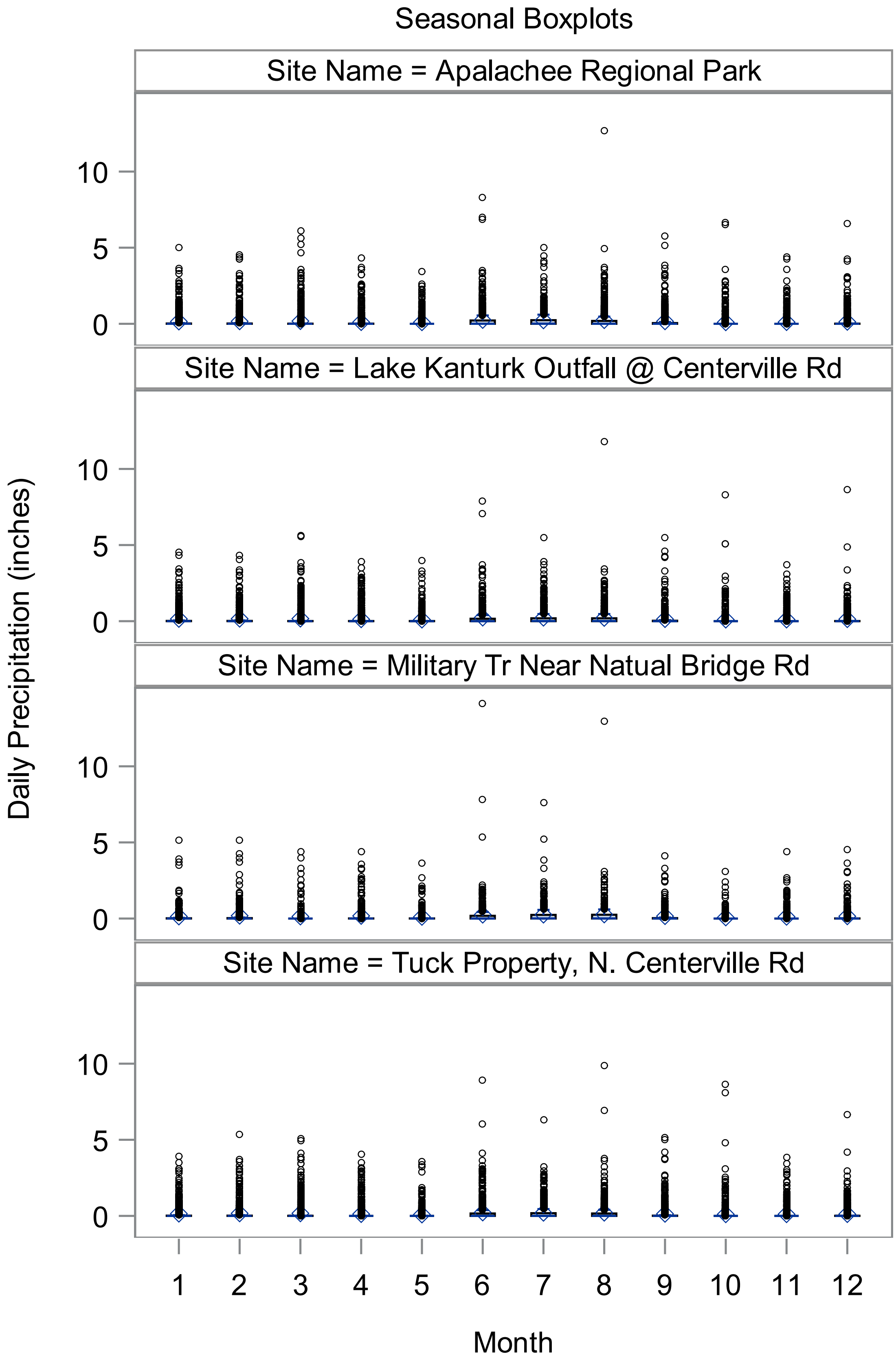
Correlogram



ATTACHMENT 7
DAILY RAINFALL
DESCRIPTIVE STATISTICS AND PLOTS



Daily Rainfall Timeseries
Apalachee Regional Park
Lake Kanturk Outfall @ Centerville Rd
Military Tr Near Natual Bridge Rd
Tuck Property, N. Centerville Rd
Daily Precipitation (inches)
12.5
10.0
7.5
5.0
2.5
0.0
1985
1990
1995
2000
2005
2010
2015
2020
Date


Seasonal Boxplots
Site Name = Apalachee Regional Park
Site Name = Lake Kanturk Outfall @ Centerville Rd
Site Name = Military Tr Near Natual Bridge Rd
Site Name = Tuck Property, N. Centerville Rd
Daily Precipitation (inches)
0
5
10
1
2
3
4
5
6
7
8
9
10
11
12
Month

Beginning and End Dates for Daily Rainfall Stations

Obs	Site Name	Station	Date	Date
1	Apalachee Regional Park	NWFID_11299_prcp_in	03/30/1987	09/12/2017
2	Lake Kanturk Outfall @ Centerville Rd	NWFID_11301_prcp_in	11/09/1989	05/02/2017
3	Military Tr Near Natual Bridge Rd	NWFID_11370_prcp_in	08/03/2004	09/12/2017
4	Tuck Property, N. Centerville Rd	NWFID_1293_prcp_in	01/28/1987	09/12/2017

Check for Data Gaps in Rainfall Timeseries

Station=NWFID_11299_prcp_in Site Name=Apalachee Regional Park

	Month											
Year	1	2	3	4	5	6	7	8	9	10	11	12
1987	0	0	2	30	31	30	30	11	30	31	30	31
1988	31	27	31	30	13	13	0	14	30	31	30	31
1989	31	28	31	30	31	30	31	31	30	31	30	31
1990	31	28	31	30	31	30	31	31	30	31	30	31
1991	31	28	31	30	31	30	31	31	30	31	30	31
1992	31	29	31	30	31	30	31	31	30	31	30	31
1993	31	28	31	30	31	30	31	31	30	31	30	31
1994	31	28	31	30	31	30	31	31	30	31	30	31
1995	31	28	31	30	31	30	31	31	30	31	30	31
1996	31	29	31	30	31	30	31	31	30	31	30	31
1997	31	28	31	30	31	30	31	31	30	31	30	31
1998	31	28	31	30	31	30	31	31	30	31	30	31
1999	31	28	31	30	31	30	31	31	30	31	30	31
2000	31	29	31	30	31	30	31	31	30	31	30	31
2001	31	28	31	30	31	30	31	31	30	31	30	31
2002	31	28	31	30	31	30	31	31	30	31	30	31
2003	31	28	31	30	31	30	31	31	30	31	30	31
2004	31	29	31	30	31	30	31	31	30	31	30	31
2005	31	28	31	22	31	30	31	31	30	31	30	31
2006	31	28	31	30	31	30	31	31	30	31	30	31
2007	31	28	31	30	31	30	31	31	30	31	30	31
2008	31	29	31	30	31	30	31	31	30	31	30	31
2009	31	28	31	30	31	30	31	31	30	31	30	31
2010	31	28	31	30	31	24	31	31	30	31	30	31
2011	31	28	31	30	31	30	31	31	30	31	30	19
2012	31	29	31	30	31	30	31	31	30	31	30	31
2013	31	28	31	30	31	30	31	31	30	31	30	31
2014	31	28	31	30	31	30	31	31	30	31	30	31
2015	31	28	31	30	31	30	23	28	30	31	30	31
2016	31	29	31	30	31	30	31	31	30	31	9	25
2017	27	28	31	30	31	30	31	31	12	.	.	.

Check for Data Gaps in Rainfall Timeseries

Station=NWFID_11301_prcp_in Site Name=Lake Kanturk Outfall @ Centerville Rd

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Year												
1987	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	22	31
1990	31	28	31	30	31	30	31	31	30	31	30	31
1991	31	28	31	30	31	30	31	31	30	31	30	31
1992	31	29	31	30	31	30	31	31	30	31	30	31
1993	31	28	31	30	31	30	31	31	30	31	30	31
1994	31	28	31	30	31	30	31	31	30	31	30	31
1995	31	28	31	30	31	30	31	31	30	31	30	31
1996	31	29	31	30	31	30	31	31	30	31	30	31
1997	31	28	31	30	31	30	31	31	30	31	30	31
1998	31	28	31	30	31	30	31	31	30	31	30	31
1999	31	28	31	30	31	30	31	31	30	31	30	31
2000	31	29	31	30	31	30	31	31	30	31	30	31
2001	31	28	31	30	31	30	31	27	30	31	30	31
2002	31	28	31	30	31	30	31	31	30	31	30	31
2003	31	28	31	30	31	30	31	31	30	31	30	31
2004	31	29	31	30	31	30	31	31	30	31	30	31
2005	31	28	31	30	31	30	31	31	30	31	30	31
2006	31	28	31	30	31	30	31	31	30	31	30	31
2007	31	28	31	30	31	30	31	31	30	31	30	31
2008	31	29	31	30	31	30	31	31	30	31	30	31
2009	31	28	31	30	31	30	31	31	30	31	30	31
2010	31	28	31	30	31	30	31	31	30	31	30	31
2011	31	28	31	30	31	30	31	31	30	31	30	31
2012	31	29	31	30	31	30	31	31	30	31	30	31
2013	31	28	31	30	31	30	31	31	30	31	30	31
2014	31	28	31	30	31	30	31	31	30	31	30	31
2015	31	28	31	30	31	30	31	31	30	31	30	31
2016	31	29	31	30	31	30	31	26	22	29	28	17
2017	26	28	24	29	2	0	0	0	0	.	.	.

Check for Data Gaps in Rainfall Timeseries

Station=NWFID_11370_prcp_in Site Name=Military Tr Near Natual Bridge Rd

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Year												
1987	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	29	30	31	30	31
2005	31	28	31	30	31	30	31	31	30	31	30	31
2006	31	28	31	30	31	30	31	31	30	31	30	31
2007	31	20	30	28	31	28	31	31	30	31	30	31
2008	31	29	31	30	31	30	31	31	30	31	30	31
2009	31	28	31	30	31	30	31	31	30	31	30	31
2010	31	28	31	30	31	30	31	31	30	31	30	31
2011	31	28	31	30	31	30	31	31	30	31	30	31
2012	31	29	31	30	31	30	31	31	30	31	30	31
2013	31	28	31	30	31	30	31	31	30	31	30	31
2014	31	28	31	30	31	30	31	31	30	31	30	31
2015	31	28	31	30	31	30	31	31	30	31	30	31
2016	31	29	31	30	31	30	31	31	30	31	30	31
2017	31	28	31	30	31	30	31	31	12	.	.	.

Check for Data Gaps in Rainfall Timeseries

Station=NWFID_1293_prcp_in Site Name=Tuck Property, N. Centerville Rd

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Year												
1987	4	28	31	30	31	30	31	31	30	31	30	31
1988	31	29	31	30	31	30	31	31	30	31	30	31
1989	31	28	31	30	31	30	31	31	30	31	30	31
1990	31	28	31	30	31	30	31	31	30	31	30	31
1991	31	28	31	30	31	30	31	31	30	31	30	31
1992	31	29	31	30	31	30	31	31	30	31	30	31
1993	31	28	31	30	31	30	31	31	30	31	30	31
1994	31	28	31	30	31	30	31	31	30	31	30	31
1995	31	28	31	30	31	30	31	31	30	31	30	31
1996	31	29	31	30	31	30	31	31	30	31	30	31
1997	31	28	31	30	31	30	31	31	30	31	30	31
1998	31	28	31	30	31	30	31	31	30	31	30	31
1999	31	28	31	30	31	30	31	31	30	31	30	31
2000	31	29	31	30	31	30	31	31	30	31	30	31
2001	31	28	31	30	31	30	31	31	30	31	30	31
2002	31	28	31	30	31	30	31	31	30	31	30	31
2003	31	28	31	30	31	30	31	31	30	31	30	31
2004	31	29	31	30	31	30	31	31	30	31	30	31
2005	31	28	31	30	31	30	31	31	30	31	30	31
2006	31	28	31	30	31	30	31	31	30	31	30	31
2007	31	28	31	30	31	30	31	31	30	31	30	31
2008	31	29	31	30	31	30	31	31	30	31	30	31
2009	31	28	31	30	31	30	31	31	30	31	30	31
2010	31	28	31	30	31	30	31	31	30	31	30	31
2011	31	28	31	30	31	30	31	31	30	31	30	31
2012	31	29	31	30	31	30	31	31	30	31	30	31
2013	31	28	31	30	31	30	31	31	30	31	30	31
2014	31	28	31	30	31	30	31	31	30	31	30	31
2015	31	28	31	30	31	30	31	31	30	31	30	31
2016	31	29	31	30	31	30	9	31	30	31	30	31
2017	31	12	28	30	31	30	31	21	12	.	.	.

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: prcp_in (Daily Precipitation (inches))

Station=NWFID_11299_prcp_in Site Name=Apalachee Regional Park

Moments			
N	10951	Sum Weights	10951
Mean	0.15977719	Sum Observations	1749.72
Std Deviation	0.49902331	Variance	0.24902426
Skewness	6.76886739	Kurtosis	80.0353645
Uncorrected SS	3006.381	Corrected SS	2726.81566
Coeff Variation	312.3245	Std Error Mean	0.00476863

Basic Statistical Measures			
Location		Variability	
Mean	0.159777	Std Deviation	0.49902
Median	0.000000	Variance	0.24902
Mode	0.000000	Range	12.72000
		Interquartile Range	0.04000

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	33.50587	Pr > |t|	<.0001
Sign	M	1861.5	Pr >= |M|	<.0001
Signed Rank	S	3466113	Pr >= |S|	<.0001

Quantiles (Definition 5)	
Level	Quantile
100% Max	12.72
99%	2.43
95%	0.97
90%	0.49
75% Q3	0.04
50% Median	0.00
25% Q1	0.00
10%	0.00
5%	0.00
1%	0.00
0% Min	0.00

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: prcp_in (Daily Precipitation (inches))

Station=NWFID_11299_prcp_in Site Name=Apalachee Regional Park

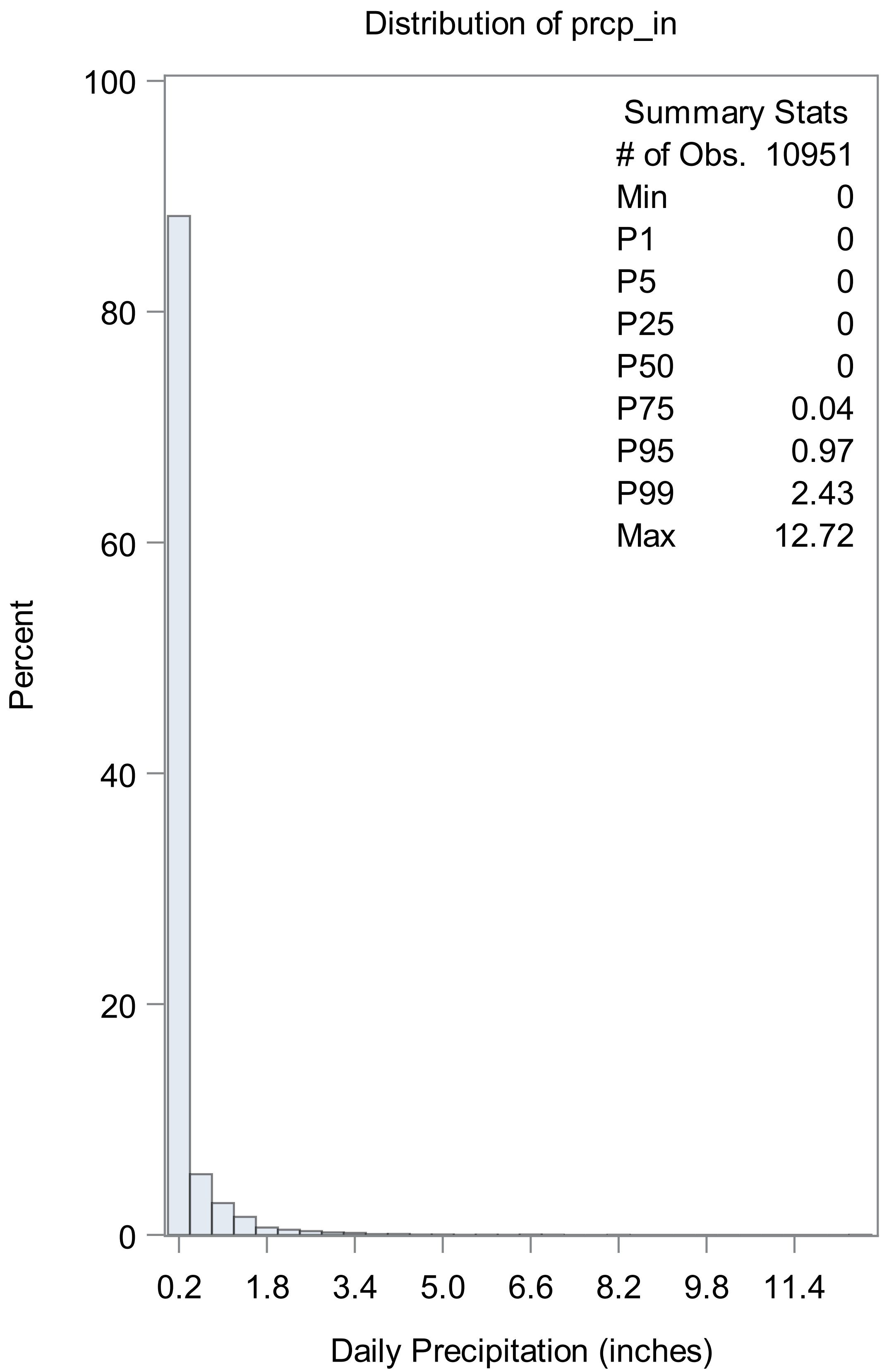
Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
0	11186	6.65	3541
0	11183	6.88	9281
0	11182	7.01	5249
0	11181	8.33	10723
0	11179	12.72	7879

Missing Values			
		Percent Of	
Missing Value	Count	All Obs	Missing Obs
.	235	2.10	100.00

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

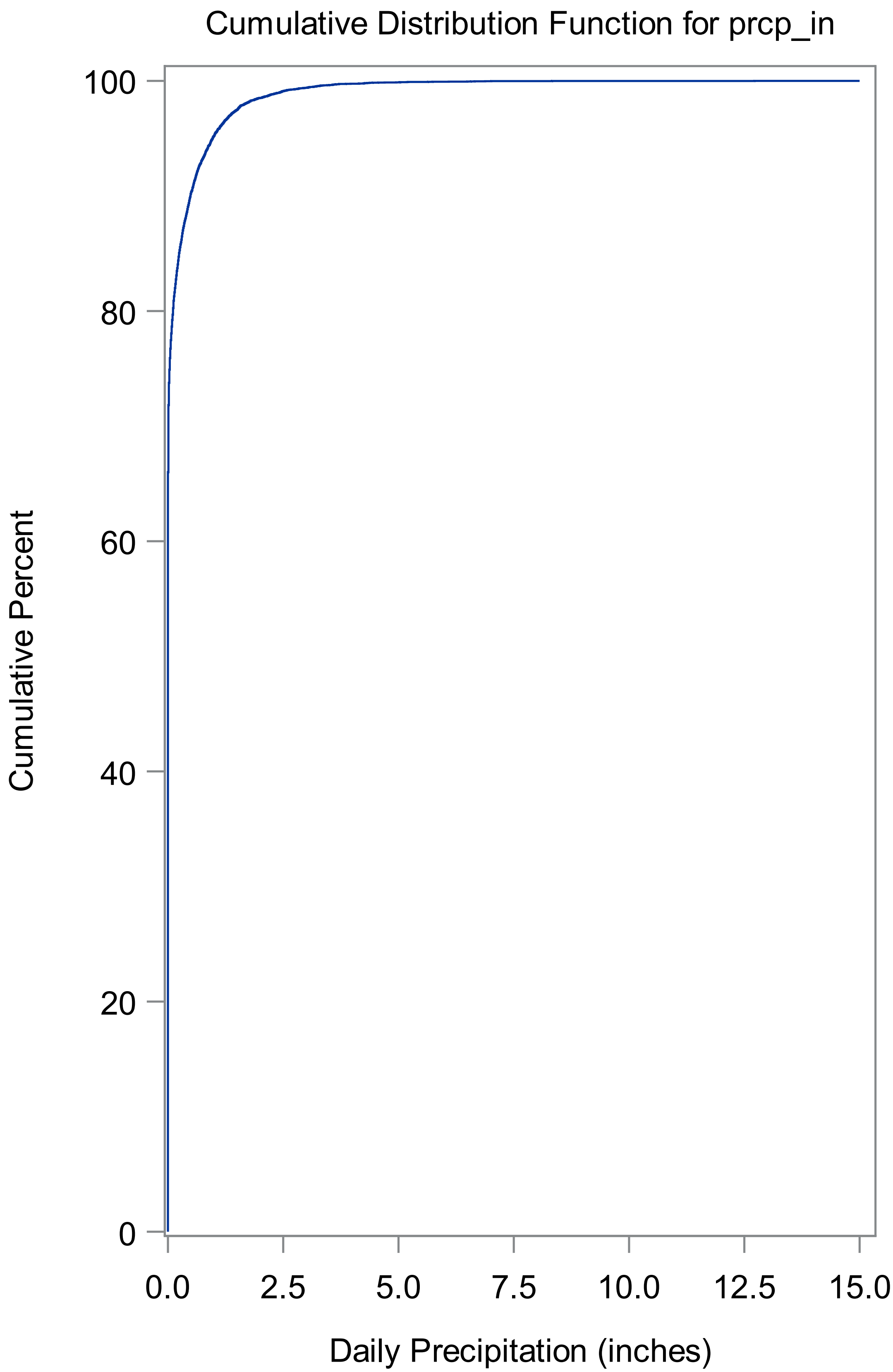
Station=NWFID_11299_prcp_in Site Name=Apalachee Regional Park



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

Station=NWFID_11299_prcp_in Site Name=Apalachee Regional Park



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: prcp_in (Daily Precipitation (inches))

Station=NWFID_11301_prcp_in Site Name=Lake Kanturk Outfall @ Centerville Rd

Moments			
N	9989	Sum Weights	9989
Mean	0.15401942	Sum Observations	1538.5
Std Deviation	0.48682715	Variance	0.23700067
Skewness	6.89518613	Kurtosis	83.0227524
Uncorrected SS	2604.1216	Corrected SS	2367.16272
Coeff Variation	316.081663	Std Error Mean	0.00487095

Basic Statistical Measures			
Location		Variability	
Mean	0.154019	Std Deviation	0.48683
Median	0.000000	Variance	0.23700
Mode	0.000000	Range	11.81000
		Interquartile Range	0.03000

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	31.61999	Pr > |t|	<.0001
Sign	M	1702	Pr >= |M|	<.0001
Signed Rank	S	2897655	Pr >= |S|	<.0001

Quantiles (Definition 5)	
Level	Quantile
100% Max	11.81
99%	2.29
95%	0.95
90%	0.46
75% Q3	0.03
50% Median	0.00
25% Q1	0.00
10%	0.00
5%	0.00
1%	0.00
0% Min	0.00

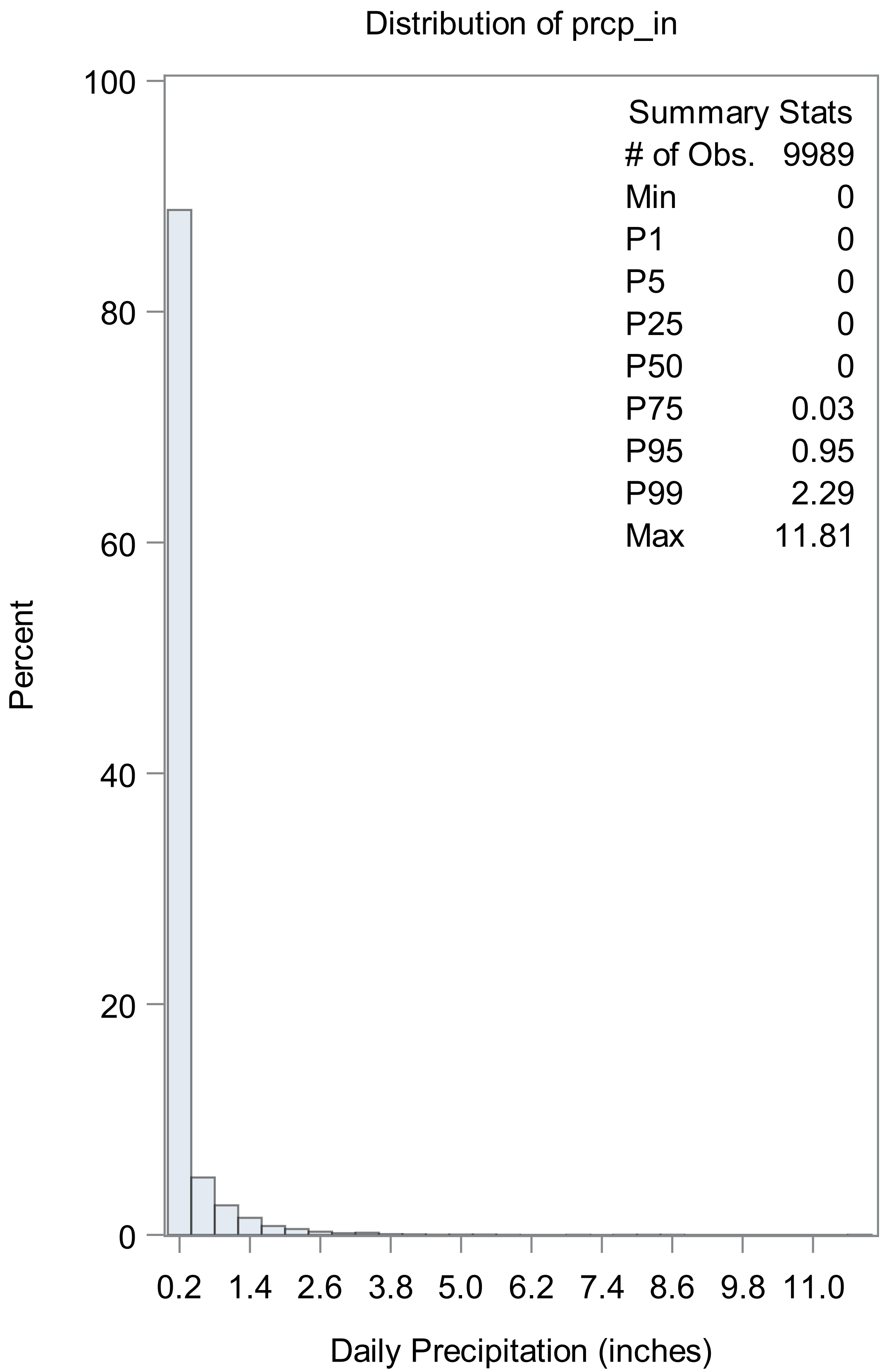
Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: prcp_in (Daily Precipitation (inches))

Station=NWFID_11301_prcp_in Site Name=Lake Kanturk Outfall @ Centerville Rd

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
0	22239	7.05	21909
0	22237	7.86	16435
0	22236	8.31	14727
0	22235	8.64	21378
0	22234	11.81	19065

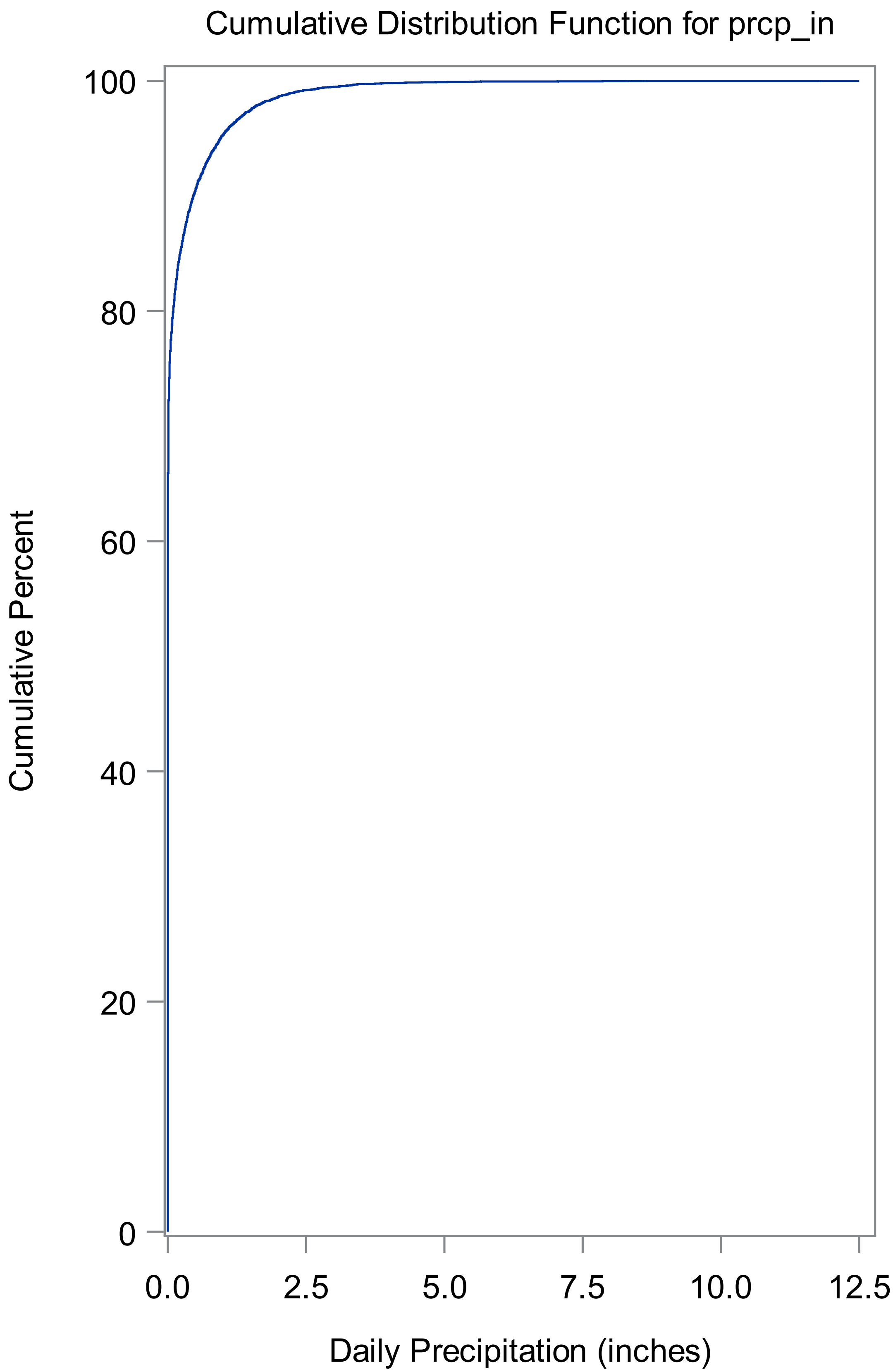
Missing Values			
		Percent Of	
Missing Value	Count	All Obs	Missing Obs
.	1197	10.70	100.00


Distribution of prcp_in
Summary Stats
# of Obs. 9989
Min 0
P1 0
P5 0
P25 0
P50 0
P75 0.03
P95 0.95
P99 2.29
Max 11.81
Percent
100
80
60
40
20
0
0.2
1.4
2.6
3.8
5.0
6.2
7.4
8.6
9.8
11.0
Daily Precipitation (inches)

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

Station=NWFID_11301_prcp_in Site Name=Lake Kanturk Outfall @ Centerville Rd



Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: prcp_in (Daily Precipitation (inches))

Station=NWFID_11370_prcp_in Site Name=Military Tr Near Natual Bridge Rd

Moments			
N	4776	Sum Weights	4776
Mean	0.16686348	Sum Observations	796.939998
Std Deviation	0.56953667	Variance	0.32437202
Skewness	9.34671412	Kurtosis	156.39078
Uncorrected SS	1681.85659	Corrected SS	1548.87641
Coeff Variation	341.31894	Std Error Mean	0.00824118

Basic Statistical Measures			
Location		Variability	
Mean	0.166863	Std Deviation	0.56954
Median	0.000000	Variance	0.32437
Mode	0.000000	Range	14.13000
		Interquartile Range	0.04000

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	20.24752	Pr > |t|	<.0001
Sign	M	823	Pr >= |M|	<.0001
Signed Rank	S	677740.5	Pr >= |S|	<.0001

Quantiles (Definition 5)	
Level	Quantile
100% Max	14.13
99%	2.55
95%	0.96
90%	0.47
75% Q3	0.04
50% Median	0.00
25% Q1	0.00
10%	0.00
5%	0.00
1%	0.00
0% Min	0.00

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: prcp_in (Daily Precipitation (inches))

Station=NWFID_11370_prcp_in Site Name=Military Tr Near Natual Bridge Rd

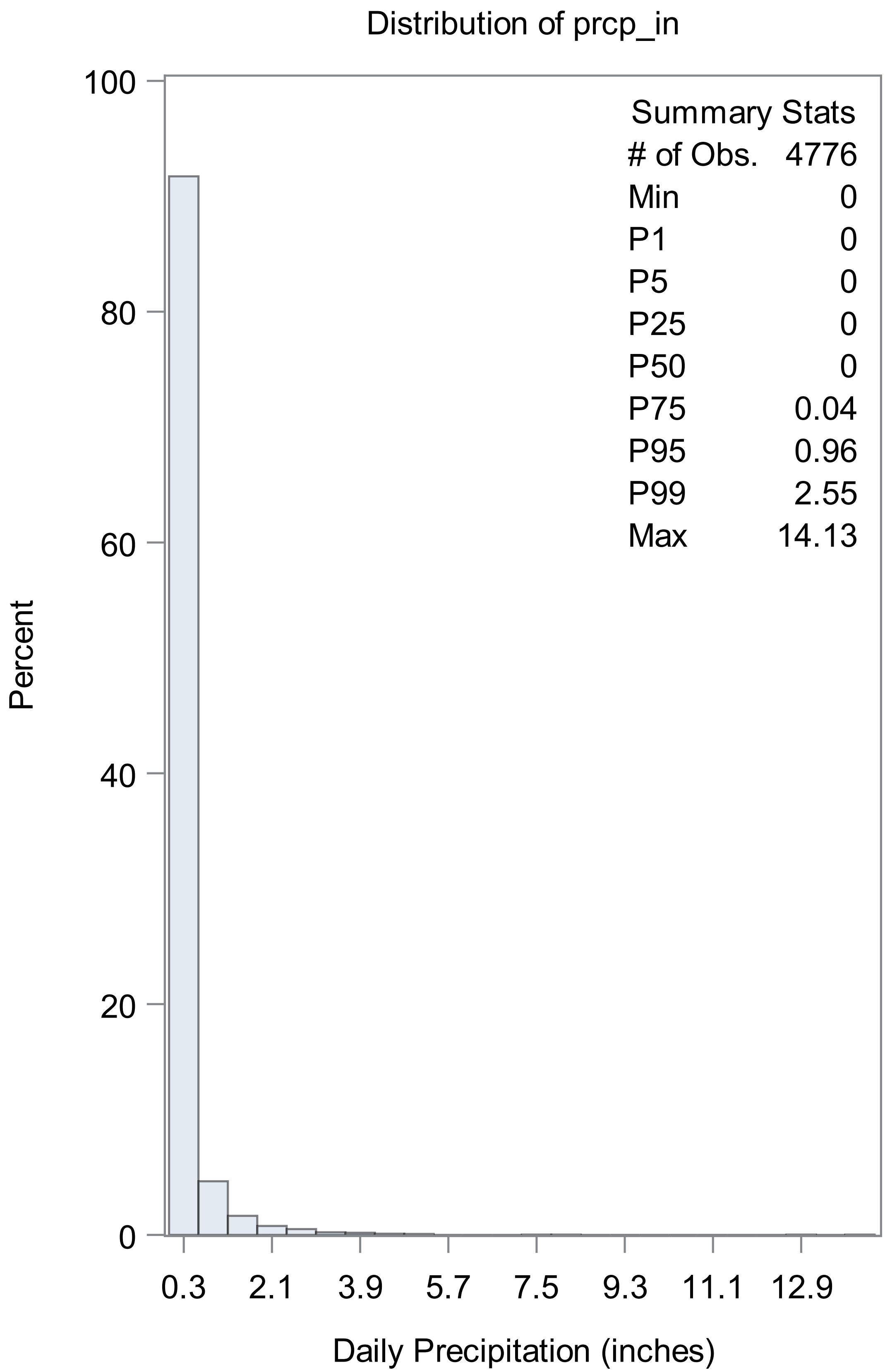
Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
0	33558	5.32	33460
0	33555	7.58	32025
0	33554	7.85	33095
0	33553	12.97	30251
0	33551	14.13	31653

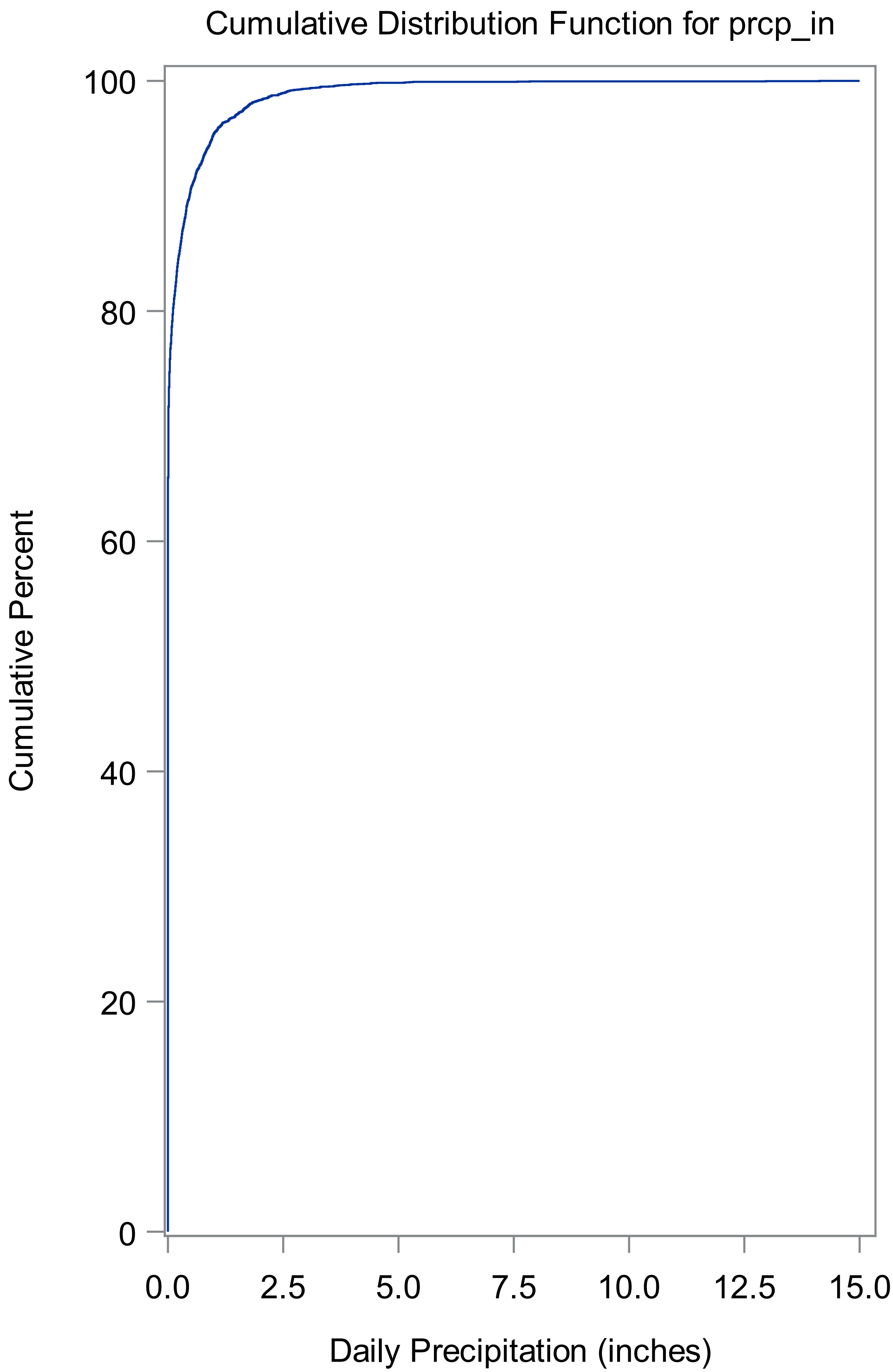
Missing Values			
		Percent Of	
Missing Value	Count	All Obs	Missing Obs
.	6410	57.30	100.00

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

Station=NWFID_11370_prcp_in Site Name=Military Tr Near Natual Bridge Rd




Cumulative Distribution Function for prcp_in
100
80
60
40
20
0
Cumulative Percent
0.0
2.5
5.0
7.5
10.0
12.5
15.0
Daily Precipitation (inches)

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: prcp_in (Daily Precipitation (inches))

Station=NWFID_1293_prcp_in Site Name=Tuck Property, N. Centerville Rd

Moments			
N	11135	Sum Weights	11135
Mean	0.15045263	Sum Observations	1675.29
Std Deviation	0.47865748	Variance	0.22911298
Skewness	6.63187691	Kurtosis	71.8716282
Uncorrected SS	2802.9957	Corrected SS	2550.94392
Coeff Variation	318.144978	Std Error Mean	0.00453607

Basic Statistical Measures			
Location		Variability	
Mean	0.150453	Std Deviation	0.47866
Median	0.000000	Variance	0.22911
Mode	0.000000	Range	9.90000
		Interquartile Range	0.03000

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	33.16806	Pr > |t|	<.0001
Sign	M	1813.5	Pr >= |M|	<.0001
Signed Rank	S	3289689	Pr >= |S|	<.0001

Quantiles (Definition 5)	
Level	Quantile
100% Max	9.90
99%	2.33
95%	0.93
90%	0.45
75% Q3	0.03
50% Median	0.00
25% Q1	0.00
10%	0.00
5%	0.00
1%	0.00
0% Min	0.00

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure
Variable: prcp_in (Daily Precipitation (inches))

Station=NWFID_1293_prcp_in Site Name=Tuck Property, N. Centerville Rd

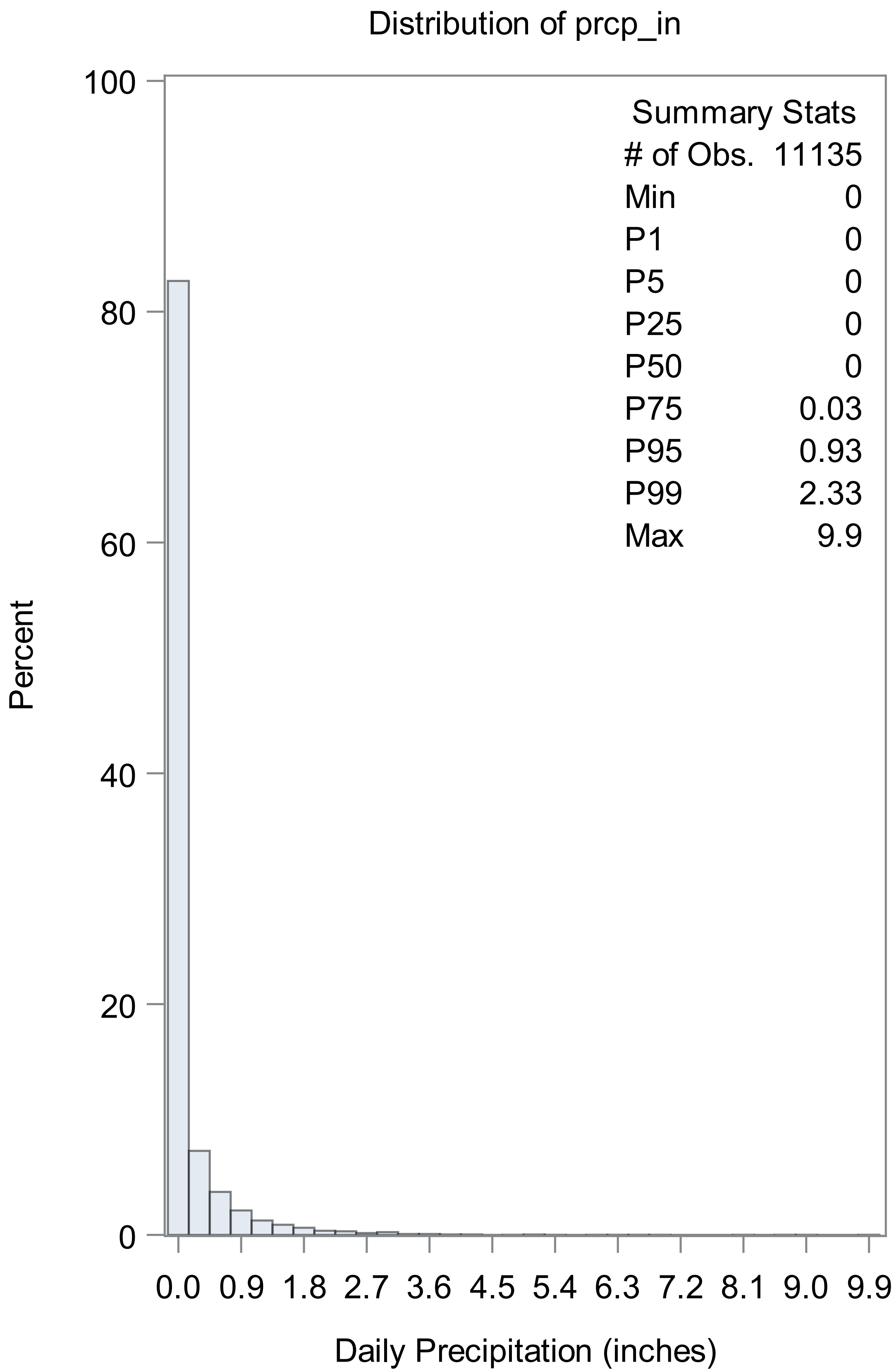
Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
0	44741	6.94	38863
0	44740	8.10	36363
0	44739	8.65	37099
0	44737	8.94	38807
0	44735	9.90	41437

Missing Values			
		Percent Of	
Missing Value	Count	All Obs	Missing Obs
.	51	0.46	100.00

Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

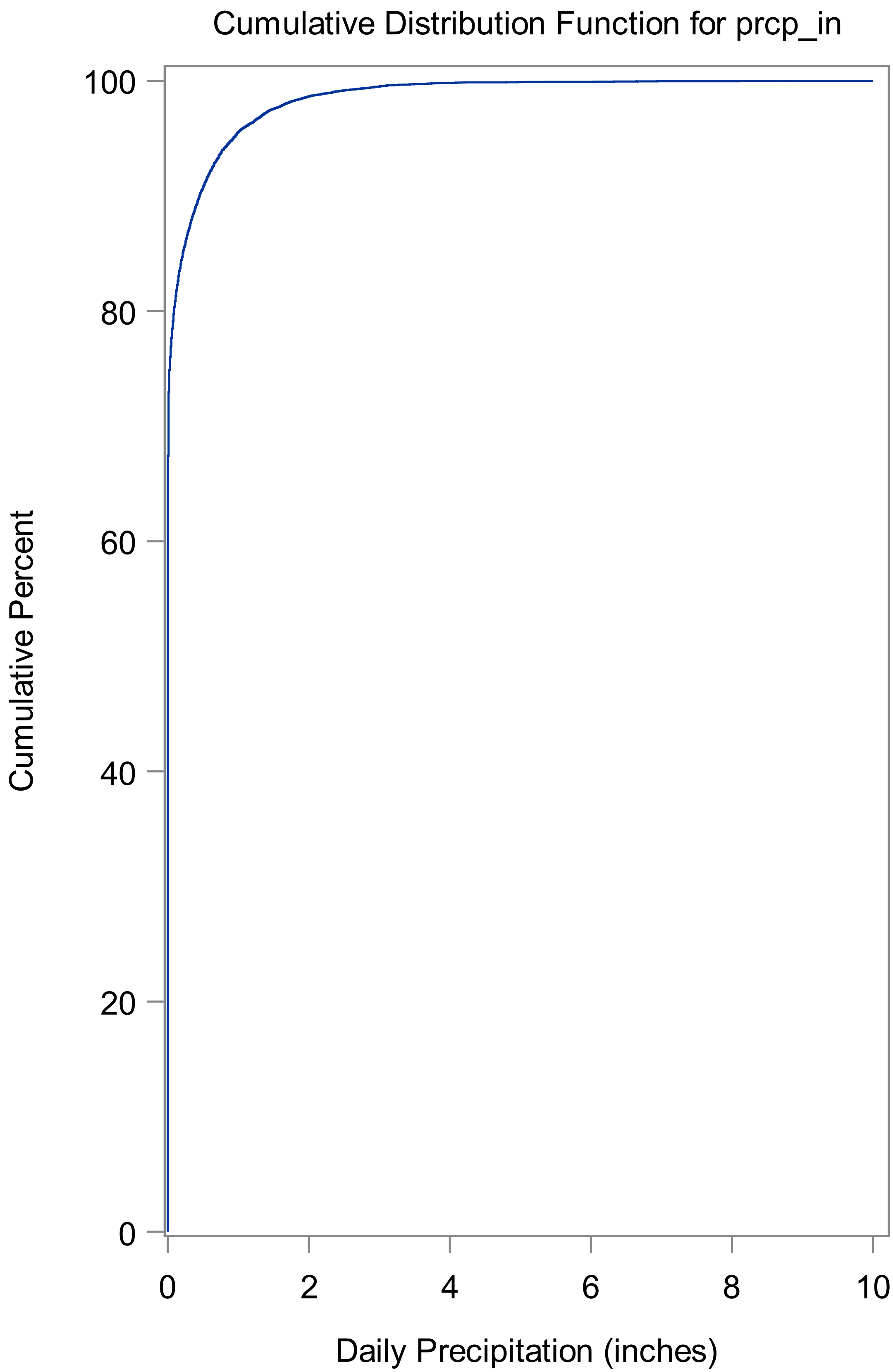
Station=NWFID_1293_prcp_in Site Name=Tuck Property, N. Centerville Rd



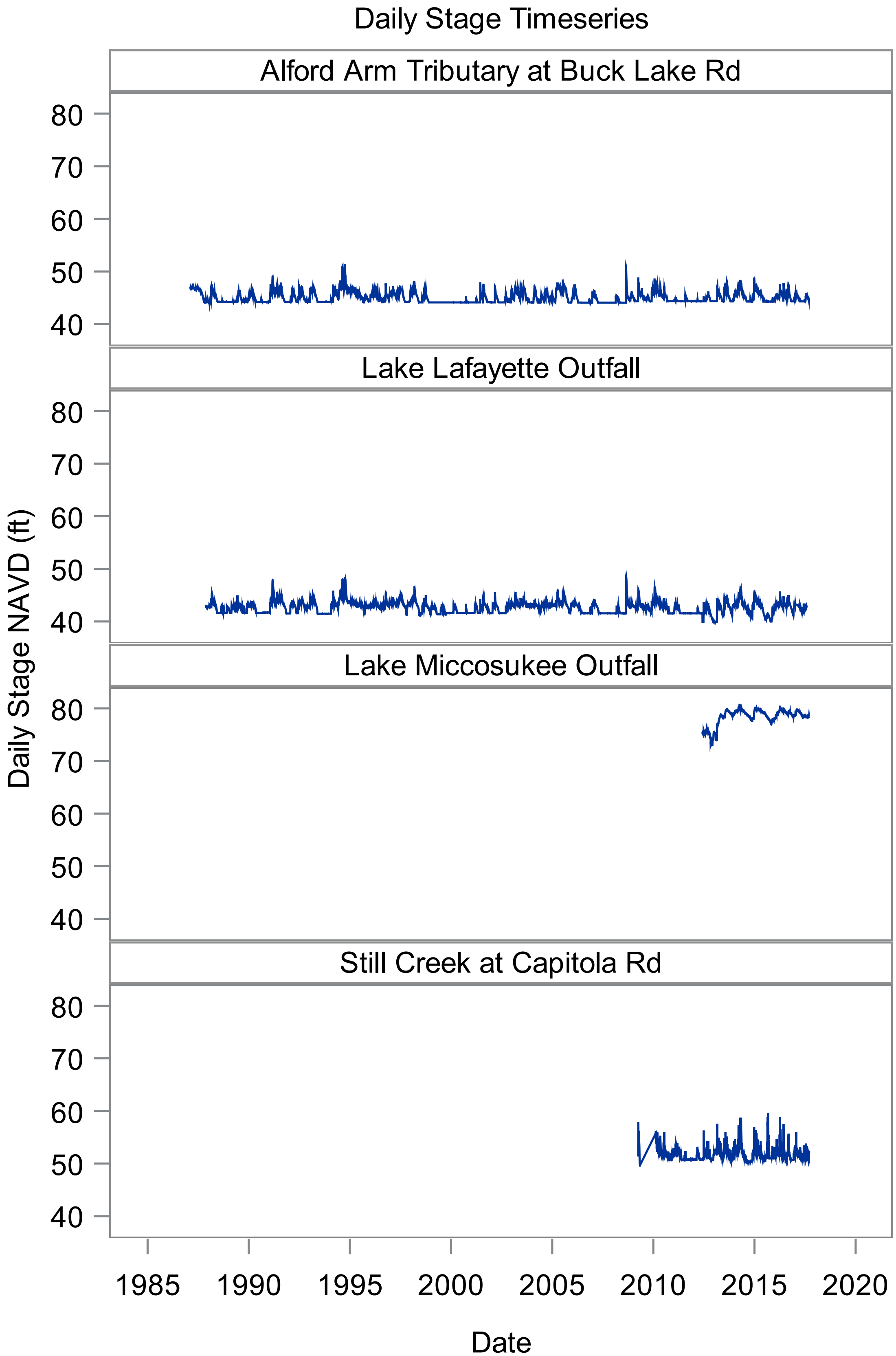
Descriptive Statistics for Northwest NWS Rainfall Stations

The UNIVARIATE Procedure

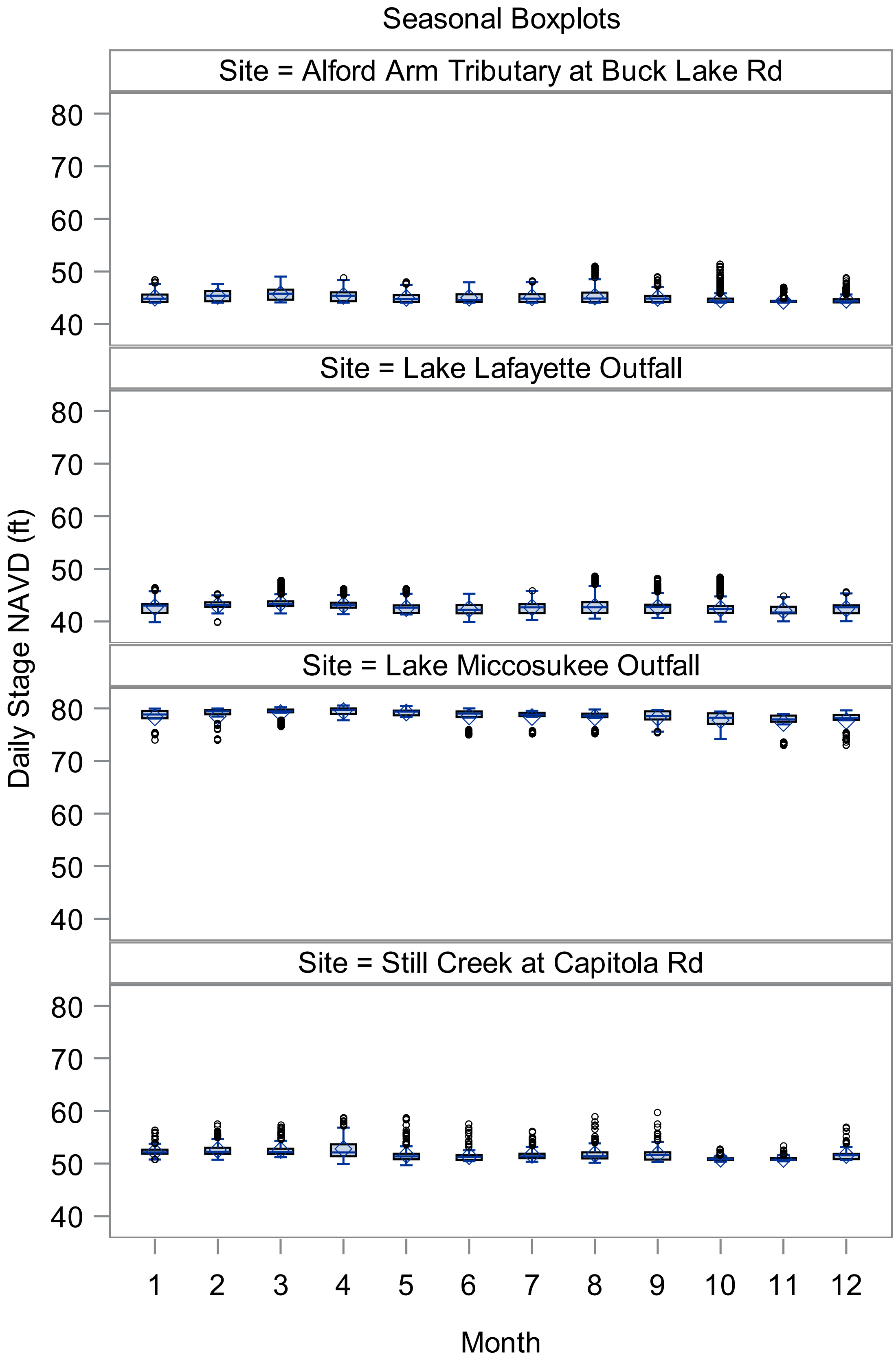
Station=NWFID_1293_prcp_in Site Name=Tuck Property, N. Centerville Rd



ATTACHMENT 8
DAILY STAGE
DESCRIPTIVE STATISTICS AND PLOTS



Daily Stage Timeseries
Alford Arm Tributary at Buck Lake Rd
Lake Lafayette Outfall
Lake Miccosukee Outfall
Still Creek at Capitola Rd
Daily Stage NAVD (ft)
80
70
60
50
40
1985
1990
1995
2000
2005
2010
2015
2020
Date


Seasonal Boxplots
Site = Alford Arm Tributary at Buck Lake Rd
Site = Lake Lafayette Outfall
Site = Lake Miccosukee Outfall
Site = Still Creek at Capitola Rd
Daily Stage NAVD (ft)
80
70
60
50
40
1
2
3
4
5
6
7
8
9
10
11
12
Month

Beginning and End Dates for Daily Stage Stations

Obs	Site	Date	Date
1	Alford Arm Tributary at Buck Lake Rd	01/29/1987	09/15/2017
2	Lake Lafayette Outfall	11/18/1987	08/01/2017
3	Lake Miccosukee Outfall	06/04/2012	09/13/2017
4	Still Creek at Capitola Rd	04/01/2009	09/14/2017

Check for Data Gaps in Stage Timeseries

Site=Alford Arm Tributary at Buck Lake Rd Station=NWFID_8460

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Year												
1987	3	28	31	30	31	30	31	31	30	31	30	31
1988	31	29	31	30	31	30	31	31	30	31	30	31
1989	31	28	31	30	31	30	31	31	30	30	30	31
1990	31	28	31	30	31	30	31	31	30	31	30	31
1991	31	28	31	30	31	30	31	31	30	31	30	31
1992	31	29	31	30	31	30	31	31	30	31	30	31
1993	31	28	31	30	31	30	31	31	30	31	30	31
1994	31	28	31	30	31	30	31	31	30	31	30	31
1995	31	28	31	30	31	30	31	31	30	31	30	9
1996	27	29	31	30	31	30	31	31	30	31	30	31
1997	31	28	31	30	31	30	6	25	30	31	30	31
1998	31	28	31	30	31	30	31	31	30	31	30	31
1999	31	28	31	30	31	30	31	31	30	31	30	31
2000	31	29	31	30	31	30	31	31	30	31	30	31
2001	31	28	31	30	31	30	31	31	30	31	30	31
2002	31	28	31	30	31	30	31	31	30	31	30	31
2003	31	28	31	30	31	30	31	31	30	31	30	31
2004	31	29	31	30	31	30	31	31	30	31	30	31
2005	31	28	31	30	31	30	31	31	30	31	30	31
2006	31	28	31	30	31	30	31	31	30	31	30	31
2007	31	28	31	30	31	30	31	31	30	31	30	31
2008	31	29	31	30	31	30	31	31	30	31	30	31
2009	31	28	31	30	31	30	31	31	30	31	30	31
2010	31	28	31	30	31	30	31	31	30	31	30	31
2011	31	28	31	30	31	30	31	31	30	31	30	31
2012	31	29	31	30	31	30	31	31	30	31	30	31
2013	31	28	31	30	31	30	31	31	30	31	30	31
2014	31	28	31	30	31	30	31	31	30	31	30	31
2015	31	28	31	30	31	30	31	31	30	31	30	31
2016	31	29	31	30	31	30	31	31	30	31	30	31
2017	31	28	31	30	31	21	31	31	15	.	.	.

Check for Data Gaps in Stage Timeseries

Site=Lake Lafayette Outfall Station=NWFID_8471

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Year												
1987	.	.	.	.	.	.	.	.	.	.	13	31
1988	31	29	31	30	31	30	27	30	30	31	30	31
1989	31	28	31	30	31	30	31	31	30	31	30	31
1990	31	28	31	30	31	30	31	31	30	31	30	31
1991	31	28	31	30	31	30	31	31	30	31	30	31
1992	31	29	31	30	31	30	31	31	30	31	30	31
1993	31	28	31	30	31	30	31	31	30	31	30	31
1994	31	28	31	30	31	30	31	31	30	31	30	31
1995	31	28	31	30	31	30	31	31	30	31	30	31
1996	31	29	31	30	31	30	31	31	30	31	30	31
1997	31	28	31	30	31	30	31	31	30	31	14	29
1998	31	28	31	30	31	30	31	31	30	31	30	31
1999	31	28	31	30	31	30	31	31	30	31	30	31
2000	31	29	31	30	31	30	31	31	30	31	30	31
2001	31	28	31	30	31	30	31	31	30	31	30	31
2002	31	28	31	30	31	30	31	31	30	31	30	31
2003	31	28	31	30	31	30	31	31	30	31	30	31
2004	31	29	31	30	31	30	31	31	30	31	30	31
2005	31	28	31	30	31	30	31	31	30	31	30	31
2006	31	28	31	30	31	30	31	31	30	31	30	31
2007	31	28	31	30	31	30	31	31	30	31	30	31
2008	31	29	31	30	31	30	31	31	30	31	30	31
2009	31	28	31	30	31	30	31	31	30	31	30	31
2010	31	28	31	30	31	30	31	31	30	31	30	31
2011	31	28	31	30	31	30	31	31	30	31	30	31
2012	31	29	31	30	31	30	31	31	30	31	30	31
2013	31	28	31	30	31	30	31	31	30	31	30	31
2014	31	28	31	30	31	30	31	31	30	31	30	31
2015	31	28	31	30	31	30	31	31	30	31	30	31
2016	31	29	31	23	31	30	31	30	18	.	12	31
2017	16	9	31	30	31	30	31	1	.	.	.	.

Check for Data Gaps in Stage Timeseries

Site=Lake Miccosukee Outfall Station=NWFID_11355

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Year												
2012	.	.	.	.	.	27	31	31	30	31	30	31
2013	31	28	31	30	31	30	31	31	30	31	30	31
2014	31	28	31	30	31	30	31	31	30	31	30	31
2015	31	28	31	30	31	30	31	31	30	31	30	31
2016	31	29	31	30	31	30	31	31	30	31	30	31
2017	31	28	31	30	31	30	31	31	13	.	.	.

Check for Data Gaps in Stage Timeseries

Site=Still Creek at Capitola Rd Station=NWFID_11359

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Year												
2009	.	.	.	30	9	.	.	.	.	.	.	.
2010	.	20	31	29	17	14	31	18	16	31	30	31
2011	31	28	31	30	31	30	31	31	30	31	30	31
2012	31	29	31	30	31	30	31	17	30	31	30	31
2013	31	28	31	30	31	30	31	31	30	31	30	31
2014	31	28	31	30	31	30	31	31	30	31	30	31
2015	31	28	31	30	31	30	31	31	30	31	30	31
2016	31	29	31	30	31	30	31	21	24	31	30	31
2017	31	28	31	30	31	30	31	31	14	.	.	.

Descriptive Statistics for Stage Stations

The UNIVARIATE Procedure
Variable: Stage_ft (Daily Stage NAVD (ft))

Site=Alford Arm Tributary at Buck Lake Rd Station=NWFID_8460

Moments			
N	11121	Sum Weights	11121
Mean	45.0397024	Sum Observations	500886.53
Std Deviation	1.01912826	Variance	1.0386224
Skewness	1.21835842	Kurtosis	1.57620287
Uncorrected SS	22571329.7	Corrected SS	11549.4811
Coeff Variation	2.26273311	Std Error Mean	0.009664

Basic Statistical Measures			
Location		Variability	
Mean	45.03970	Std Deviation	1.01913
Median	44.66000	Variance	1.03862
Mode	44.12000	Range	7.28000
		Interquartile Range	1.47000

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	4660.565	Pr > |t|	<.0001
Sign	M	5560.5	Pr >= |M|	<.0001
Signed Rank	S	30921941	Pr >= |S|	<.0001

Quantiles (Definition 5)	
Level	Quantile
100% Max	51.36
99%	47.69
95%	46.95
90%	46.66
75% Q3	45.65
50% Median	44.66
25% Q1	44.18
10%	44.12
5%	44.09
1%	44.09
0% Min	44.08

Descriptive Statistics for Stage Stations

The UNIVARIATE Procedure
Variable: Stage_ft (Daily Stage NAVD (ft))

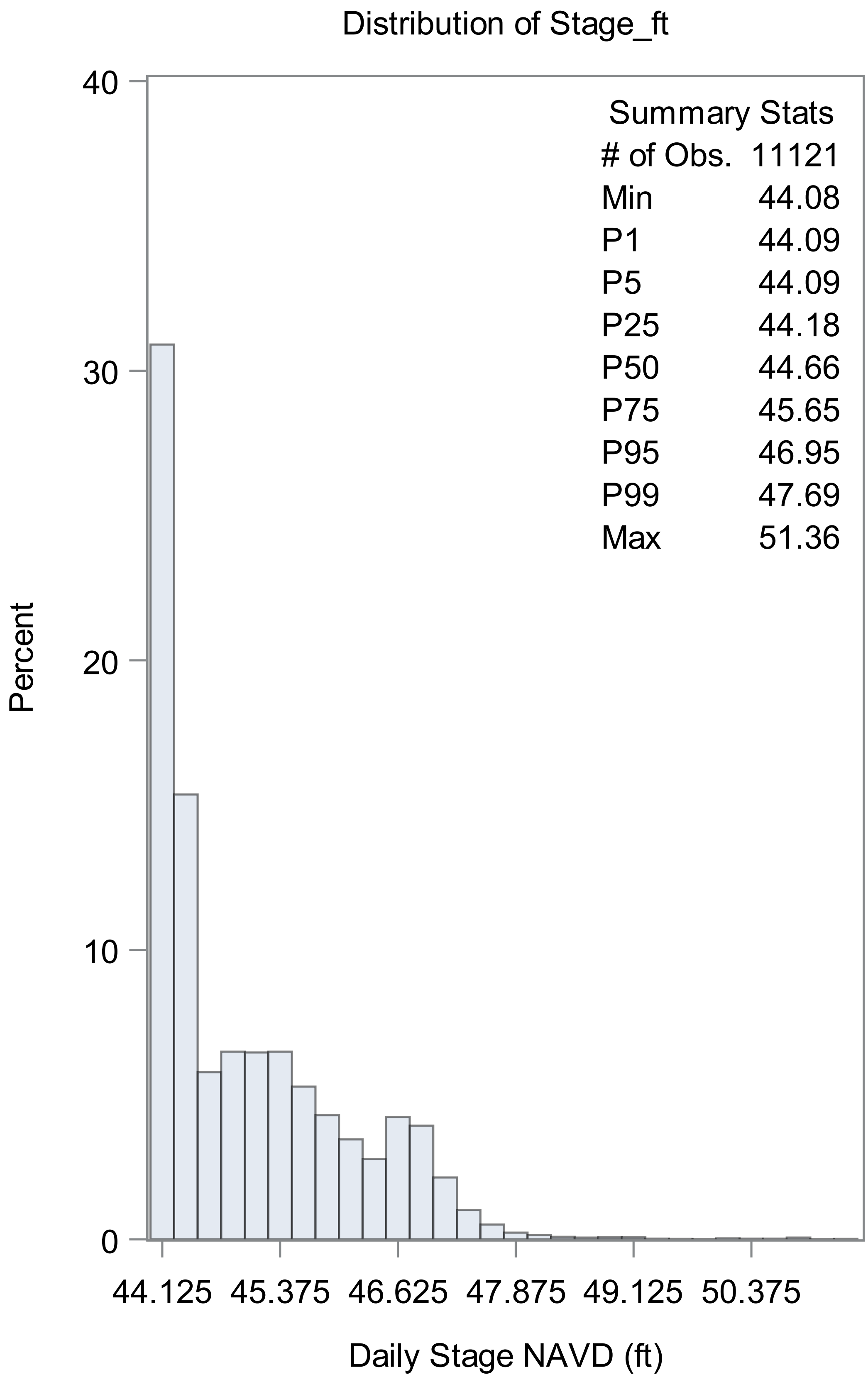
Site=Alford Arm Tributary at Buck Lake Rd Station=NWFID_8460

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
44.08	7819	50.94	2760
44.08	7818	50.97	2761
44.08	7817	51.05	2806
44.08	7816	51.28	2805
44.08	7815	51.36	2804

Descriptive Statistics for Stage Stations

The UNIVARIATE Procedure

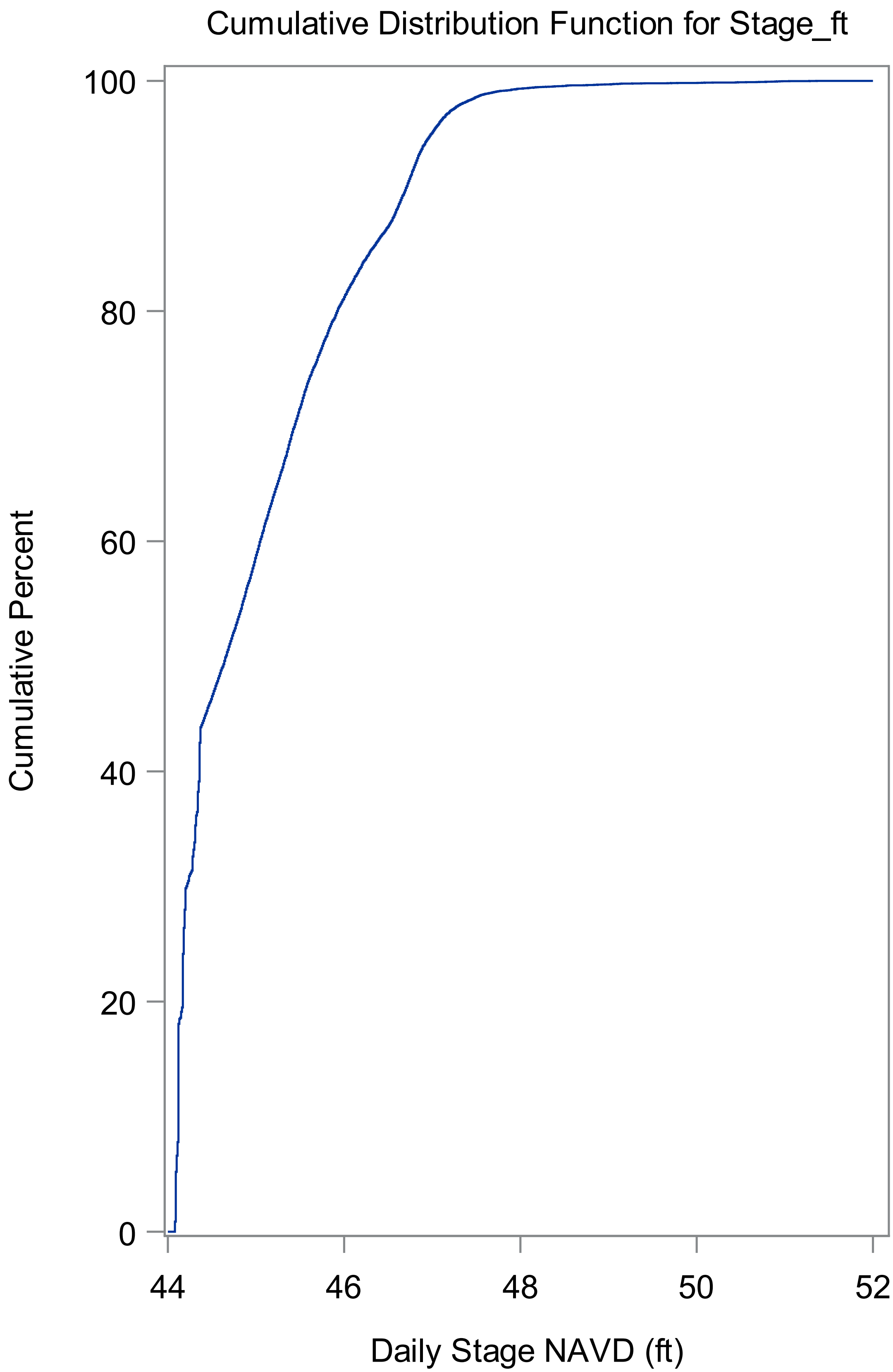
Site=Alford Arm Tributary at Buck Lake Rd Station=NWFID_8460



Descriptive Statistics for Stage Stations

The UNIVARIATE Procedure

Site=Alford Arm Tributary at Buck Lake Rd Station=NWFID_8460



Descriptive Statistics for Stage Stations

The UNIVARIATE Procedure
Variable: Stage_ft (Daily Stage NAVD (ft))

Site=Lake Lafayette Outfall Station=NWFID_8471

Moments			
N	10724	**Sum Weights**	10724
Mean	42.701423	**Sum Observations**	457930.06
Std Deviation	1.10250591	**Variance**	1.21551928
Skewness	0.7175172	**Kurtosis**	2.05930989
Uncorrected SS	19567299.2	**Corrected SS**	13034.0133
Coeff Variation	2.58189502	**Std Error Mean**	0.01064639

Basic Statistical Measures			
Location		Variability	
Mean	42.70142	**Std Deviation**	1.10251
Median	42.81000	**Variance**	1.21552
Mode	41.55000	**Range**	8.76000
		Interquartile Range	1.65000

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	**t**	4010.881	**Pr > |t|**	<.0001
Sign	**M**	5362	**Pr >= |M|**	<.0001
Signed Rank	**S**	28753725	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	48.62
99%	45.92
95%	44.49
90%	43.96
75% Q3	43.27
50% Median	42.81
25% Q1	41.62
10%	41.54
5%	41.44
1%	40.13
0% Min	39.86

Descriptive Statistics for Stage Stations

The UNIVARIATE Procedure
Variable: Stage_ft (Daily Stage NAVD (ft))

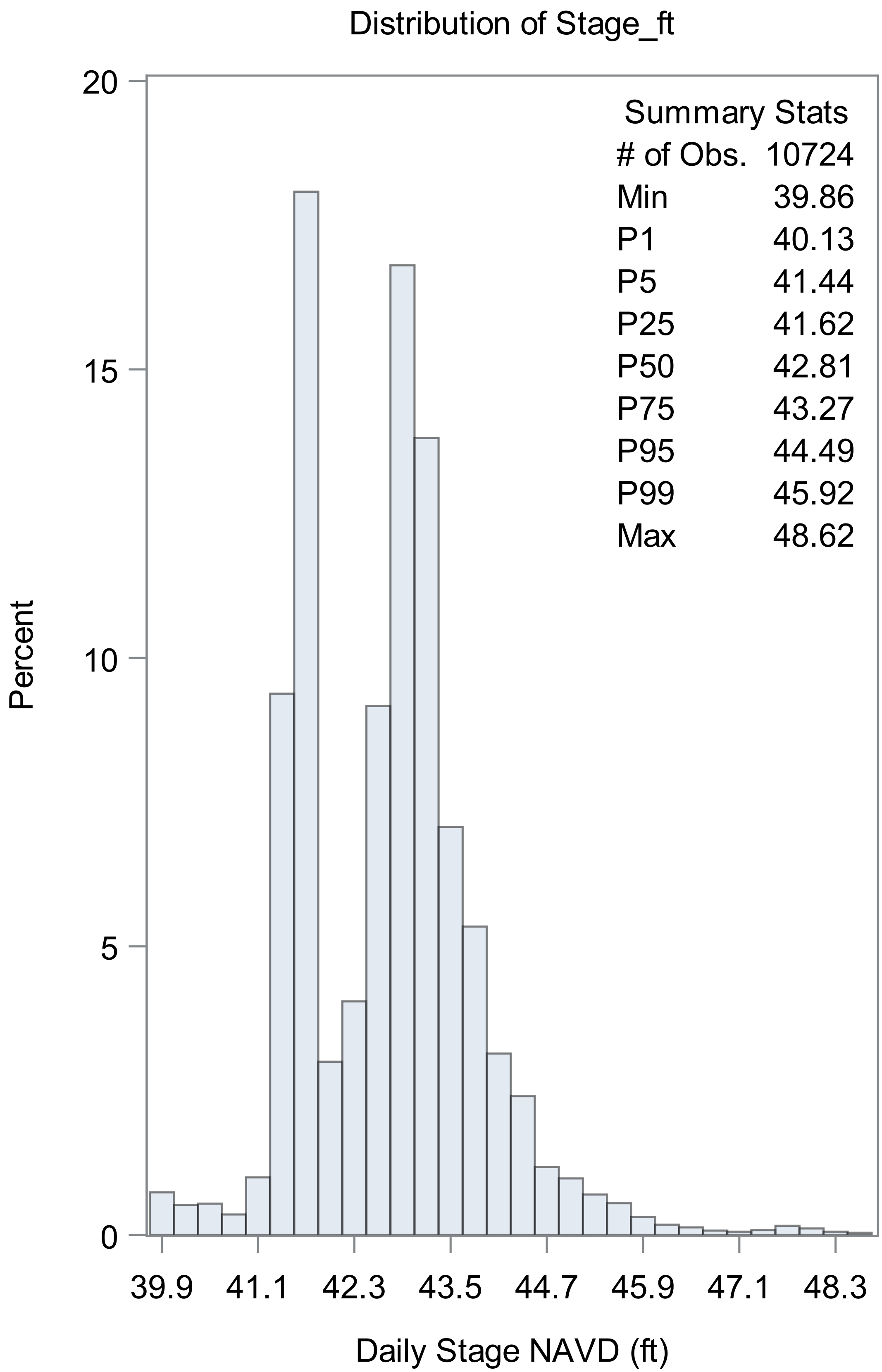
Site=Lake Lafayette Outfall Station=NWFID_8471

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
39.86	20294	48.44	13630
39.89	20293	48.48	18689
39.90	20323	48.55	18686
39.90	20322	48.56	18688
39.90	20297	48.62	18687

Descriptive Statistics for Stage Stations

The UNIVARIATE Procedure

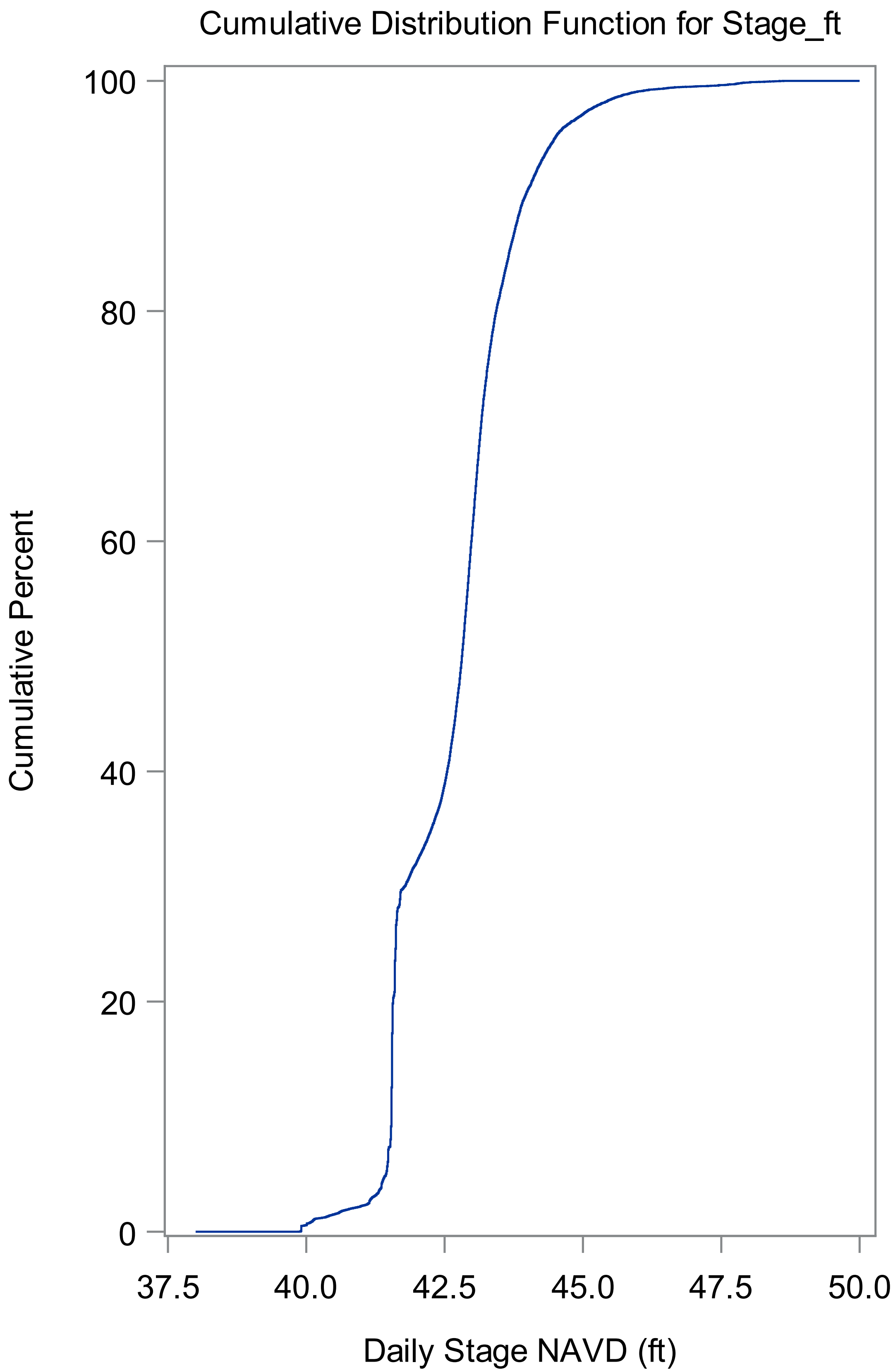
Site=Lake Lafayette Outfall Station=NWFID_8471



Descriptive Statistics for Stage Stations

The UNIVARIATE Procedure

Site=Lake Lafayette Outfall Station=NWFID_8471



Descriptive Statistics for Stage Stations

The UNIVARIATE Procedure
Variable: Stage_ft (Daily Stage NAVD (ft))

Site=Lake Miccosukee Outfall Station=NWFID_11355

Moments			
N	1928	Sum Weights	1928
Mean	78.3674533	Sum Observations	151092.45
Std Deviation	1.57431983	Variance	2.47848292
Skewness	-1.5672546	Kurtosis	1.78702796
Uncorrected SS	11845506.6	Corrected SS	4776.0366
Coeff Variation	2.00889497	Std Error Mean	0.03585415

Basic Statistical Measures			
Location		Variability	
Mean	78.36745	Std Deviation	1.57432
Median	78.79000	Variance	2.47848
Mode	79.71000	Range	7.52000
		Interquartile Range	1.31000

Tests for Location: Mu0=0				
Test	Statistic		p Value	
Student's t	t	2185.729	Pr > |t|	<.0001
Sign	M	964	Pr >= |M|	<.0001
Signed Rank	S	929778	Pr >= |S|	<.0001

Quantiles (Definition 5)	
Level	Quantile
100% Max	80.54
99%	80.28
95%	79.89
90%	79.74
75% Q3	79.42
50% Median	78.79
25% Q1	78.11
10%	75.42
5%	75.02
1%	73.44
0% Min	73.02

Descriptive Statistics for Stage Stations

The UNIVARIATE Procedure
Variable: Stage_ft (Daily Stage NAVD (ft))

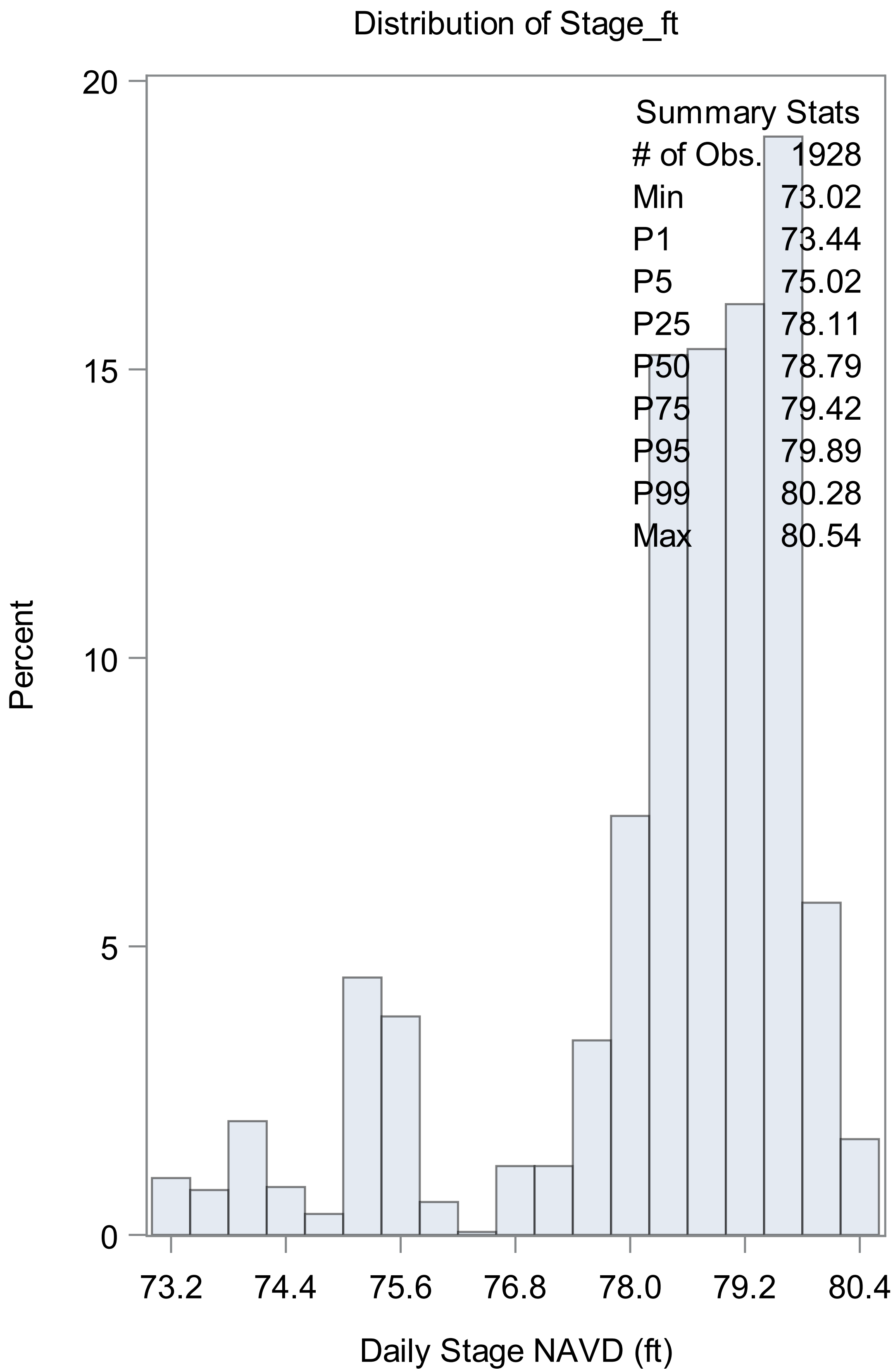
Site=Lake Miccosukee Outfall Station=NWFID_11355

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
73.02	22028	80.48	22534
73.02	22027	80.51	22533
73.02	22026	80.53	22530
73.02	22025	80.53	22532
73.02	22018	80.54	22531

Descriptive Statistics for Stage Stations

The UNIVARIATE Procedure

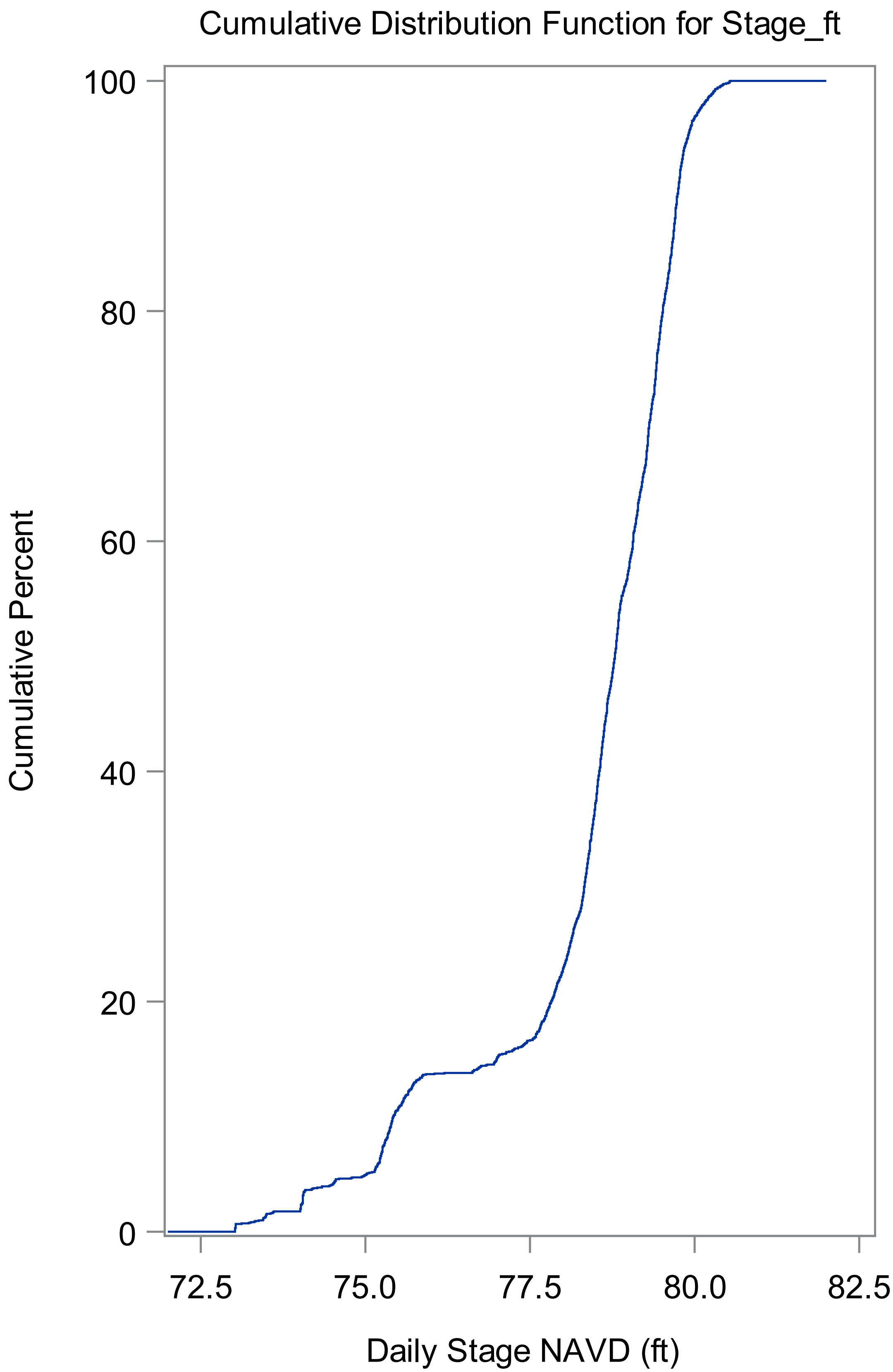
Site=Lake Miccosukee Outfall Station=NWFID_11355



Descriptive Statistics for Stage Stations

The UNIVARIATE Procedure

Site=Lake Miccosukee Outfall Station=NWFID_11355



Descriptive Statistics for Stage Stations

The UNIVARIATE Procedure
Variable: Stage_ft (Daily Stage NAVD (ft))

Site=Still Creek at Capitola Rd Station=NWFID_11359

Moments			
N	2726	**Sum Weights**	2726
Mean	51.853584	**Sum Observations**	141352.87
Std Deviation	1.35077629	**Variance**	1.82459658
Skewness	1.97490245	**Kurtosis**	4.86434679
Uncorrected SS	7334624.94	**Corrected SS**	4972.02568
Coeff Variation	2.60498153	**Std Error Mean**	0.02587143

Basic Statistical Measures			
Location		**Variability**	
Mean	51.85358	**Std Deviation**	1.35078
Median	51.59000	**Variance**	1.82460
Mode	50.72000	**Range**	9.98000
		Interquartile Range	1.37000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	2004.279	**Pr > |t|**	<.0001
Sign	**M**	1363	**Pr >= |M|**	<.0001
Signed Rank	**S**	1858451	**Pr >= |S|**	<.0001

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	59.67
99%	56.99
95%	54.87
90%	53.48
75% Q3	52.20
50% Median	51.59
25% Q1	50.83
10%	50.71
5%	50.49
1%	50.38
0% Min	49.69

Descriptive Statistics for Stage Stations

The UNIVARIATE Procedure
Variable: Stage_ft (Daily Stage NAVD (ft))

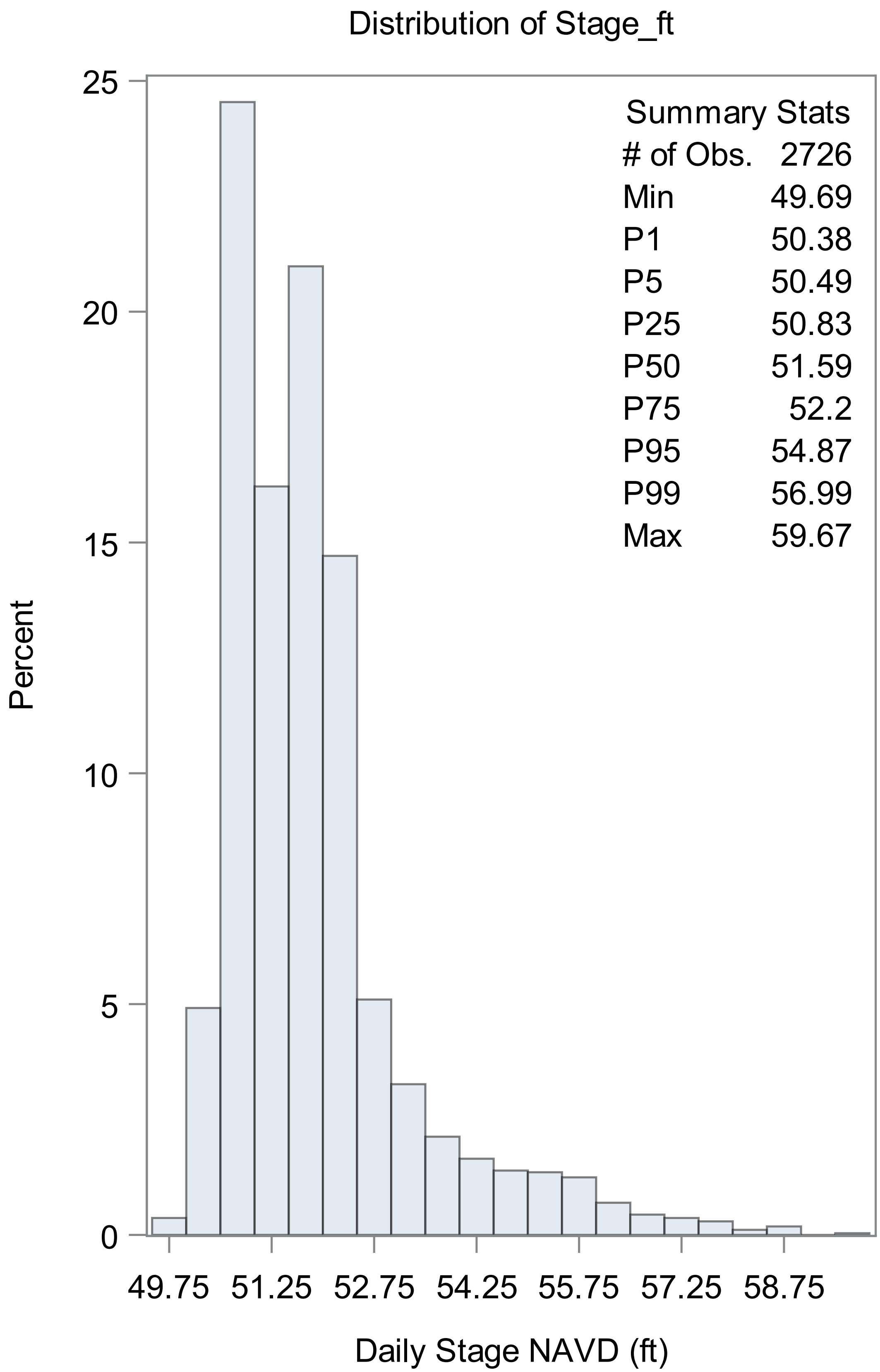
Site=Still Creek at Capitola Rd Station=NWFID_11359

Extreme Observations			
Lowest		Highest	
Value	Obs	Value	Obs
49.69	23807	58.74	25285
49.70	23808	58.75	25273
49.73	23806	58.79	25987
49.77	23812	58.82	25764
49.77	23805	59.67	25774

Descriptive Statistics for Stage Stations

The UNIVARIATE Procedure

Site=Still Creek at Capitola Rd Station=NWFID_11359



Descriptive Statistics for Stage Stations

The UNIVARIATE Procedure

Site=Still Creek at Capitola Rd Station=NWFID_11359