

Chesapeake Bay Maryland NERR Meteorological Metadata
July-December 2003
Latest Update: **October 10, 2023**

I. Data Set and Research Descriptors

1) Principal investigators and contact persons:

Contact Person:

Julie Bortz-Research Coordinator

jbortz@dnr.state.md.us

410-260-8989 phone

Mailing Address:

Chesapeake Bay National Estuarine Research Reserve Maryland

Maryland Department of Natural Resources

580 Taylor Ave. Bldg E-2

Annapolis, Maryland 21401

Principal Investigators:

Julie Bortz-Research Coordinator

jbortz@dnr.state.md.us

410-250-8989 phone

John Zimmerelli-Technician

jzimmerelli@dnr.state.md.us

410-263-3369

Chris Trumbauer-Technician

ctrumbauer@dnr.state.md.us

410-263-3369

2) Entry verification:

a) Data input procedures:

The meteorological information is sampled every 5 seconds from each instrument on the weather station and stored on a Campbell Scientific CR10X data logger. Data are output to a file in three arrays: array 15 stores 15 minute average, max and min data; array 60 stores hourly average, max and min data; and array 144 stores daily average, max and min data. The CDMO Data Logger Program (NERR_4.CSI) was loaded into the CR10X and controls the sensors. The CR10X then interfaces with the PC208W software supplied by Campbell Scientific.

Data are uploaded from the CR10X data logger or storage module to a Personal Computer (IBM compatible). Files are exported from PC208W or LoggerNet in a comma-delimited format (.DAT) and opened in Microsoft Excel for pre-processing with the EQWin format macro that was developed by the CDMO to reformat the header columns, insert station codes, insert a date column (mm/dd/yyyy), correct the time column format and reformat the data to the appropriate number of decimal places. The Advance Date

Macro developed by the CDMO was also run on the data to advance the 00:00 hour to the next day. The pre-processed file is then ready to be copied into the EQWin weather.eqi file where the data are QA/QC checked and archived in a database. EQWin queries, reports and graphs are used to discover data set outliers (values which fall outside the range that the instrument is designed to measure) and large changes in the data. EQWin is also used to generate statistics, view graphs, create customized queries and reports of the data, cross query the water, weather and nutrient data and finally export the data to the CDMO. Pre-processing, data verification, and data upload to the CDMO server was performed by John Zimmerelli.

Data are retrieved from the CR10X using two methods. First, the data from the CR10X is radio-telemetered to a PC at the Jug Bay component, specifically the Jug Bay Wetlands Sanctuary. Managers at the Sanctuary routinely download data from the weather station and store it on the hard drive of the office computer. Secondly, NERR technicians perform manual monthly downloads of the data directly from the CR10X using a laptop and PC208W software. This data are saved on the laptop as a raw file. This data are then transferred to a disk at the field office for archiving. Data are both archived on site at the Jug Bay Wetlands Sanctuary as well as on the Maryland Department of Natural Resources network, and a disk.

The Centralized Data Management Office converted all SWMP weather data collected with CR10X program versions prior to version 4.0 which was distributed in October 2003. This was necessary in order to merge the old data format (12 array output) with the new data format found in version 4.0 (3 array output). The new format produces averages, maximums and minimums every fifteen minutes (array 15), every hour (array 60) and every day (array 144) for any sensors hooked up to the CR10X. Specifically, the 150 and 151 fifteen minute data were converted to the new 15 array; the hourly 101, 102, 105 and 106 data were converted to the new 60 array; and the daily 241, 242, 243, 244, 245 and 246 data were converted to the new 144 array. With the new format, the use of 55555's to code for deleted data and 11111's to code for missing data has been abandoned. Hence, all 55555's or 11111's contained in the SWMP weather data collected prior to Version 4.0 of the CR10X program were removed and left blank.

b) Data collection schedule:

- i) 15-minute data are collected instantaneously for Air Temperature (C), Relative Humidity (%), Barometric Pressure (mb), Wind Speed (m/s), and Wind Direction (degrees). 15-minute Precipitation (mm) and PAR (mmol/m²) data are totaled from 5-second readings, prior to NERR_4.CSI
- ii) 15-minute average, maximum and minimum data are averages of 5-second readings for Air Temperature (oC), Relative Humidity (%), Barometric Pressure (mb) and Wind Speed (m/s).
- iii) Hourly average, maximum, and minimum data are averages of 5-second readings for Air Temperature (oC), Relative Humidity (%), Barometric Pressure (mb), Wind Speed (m/s), and Wind Direction (degrees). Hourly totals for PAR (mmol/m²) and Precipitation (mm) are totals of 15-minute readings.

iv) Daily average, maximum and minimum data are averages of 5-second readings for Air Temperature (°C), Relative Humidity (%), Barometric Pressure (mb), Wind Speed (m/s), and Wind Direction (degrees). Daily totals for PAR (mmol/m²) and Precipitation (mm) are totals of 15-minute readings.

Data were stored on a Campbell Scientific storage module (SM192 or SM4M), which was retrieved monthly. The data were downloaded and pre-processed as described in Section 2. QA/QC of the data was conducted using either the WDMP or EQWin. WDMP error reports and EQWin queries were based on the following anomalous data criteria:

c) Error/anomalous data criteria:

Air Temp:

- 15 min sample not greater than max for the day
- 15 min sample not less than the min for the day
- 15 min sample not greater than 3.0 C from the previous 15 minutes (WDMP only)
- Max and min temp recorded for the day (WDMP only)
- 1-hour average not greater than 10% above the greatest 15 min sample recorded in the hour (WDMP only)
- Sample not greater than 50 C or less than -30 C (EQWin only)

Relative Humidity:

- Not changed by more than 25% from the previous 15 minutes (WDMP only)
- Max and min humidity recorded for the day (WDMP only)
- 1-hour average not greater than 10% above the greatest 15 min sample recorded in the hour (WDMP only)
- Sample not greater than 100% or less than 0% (EQWin only)

Pressure:

- Pressure not greater than 1040 mb or less than 980 mb (WDMP only)
- Pressure changes greater than 5 mb per hour (WDMP only)
- Maximum and minimum values recorded for the day (WDMP only)
- 1-hour average not greater than 10% above the greatest 15 min sample recorded in the hour (WDMP only)
- Sample not greater than 1060 mb or less than 900 mb (EQWin only)

Wind Speed:

- Wind speed not greater than 65 m/s or less than 0.5 m/s (WDMP only)
- Wind speed not greater than 30 m/s (EQWin only)
- Wind speed not less than 0.5 m/s for 12 consecutive hours (EQWin only)

Wind Direction:

- Wind direction not greater than 360 degrees or less than 0 degrees

Rainfall:

- Precipitation not greater than 5 mm in 15 min

- No precipitation for the month (WDMP only)

Photosynthetically Active Radiation (PAR):

- Sample not greater than 5000 mmol/m² or less than -0.5 mmol/m²

Time:

- 15-minute interval recorded

For all data:

- No duplicate data

3) Research objectives:

The principal objectives are to record meteorological information for the Chesapeake Bay National Estuarine Research Reserve in Maryland in support of the National Estuarine Research Reserve's (NERR) System Wide Monitoring Program (SWMP). This information is available for the following: 1) to track and record atmospheric and meteorological conditions useful to help understand and explain additional data collected concurrently 2) to create a database capable of detecting long-term changes in weather patterns 3) to record and identify the impact of storms, hurricanes, heavy rain and other episodic weather events capable of influencing other environmental conditions such as water quality (as monitored by the SWMP effort) and to collect ancillary data in support of other research efforts.

4) Research methods:

The Campbell Scientific weather station samples every 5 seconds continuously throughout the year. Data are used by the CR10X to produce 15 minute averages, maximum and minimums (array 15), hourly averages, maximums and minimums (array 60) and daily averages, maximums and minimums (array 144) of air temperature, relative humidity, barometric pressure, rainfall, wind speed, and wind direction. Data are radio telemetered to a desktop PC at the Jug Bay Wetlands Sanctuary where it is stored until uploaded to a laptop or copied to disk. Typically, data are transferred or uploaded once monthly throughout the year. All collected data are quality checked after the monthly downloads using EQWin, EQWinFormat macro and Advance Date macro. The reports, graphs and queries of meteorological data are reviewed and any errors or anomalous data are further investigated and the data are either corrected or deleted (if necessary) or commented on and left unchanged.

A minimum of monthly maintenance is conducted on the sensors, probes and weather station in accordance with NERR guidelines. At this time, sensors on the weather station are inspected for damage, debris, and or fouling and cleaned as needed. Monthly maintenance log sheets are also completed and sensors are checked with a handheld Kestrel 4000 to ensure comparative readings. Additional checks are often done weekly and bi-weekly specifically to check the rain gauge and Li-COR sensors for fouling. The rain gauge frequently tends to collect debris and is therefore checked as often as possible, with suggested checks prior to onset of storm events. Simultaneous rain data are also recorded by the Jug Bay Wetlands Sanctuary daily and therefore provides supplemental rain data. Sensors were removed and replaced with new sensors in July 2003. Old sensors will be sent back to Campbell Scientific for calibration and rotated every 2 years to maintain current calibration requirements.

5) Site location and character:

The Chesapeake Bay National Estuarine Research Reserve in Maryland consists of three components; Otter Point Creek on the Bush River along the upper western shore of the Chesapeake Bay, Jug Bay along the Patuxent River in the middle Bay and Monie Bay on the lower eastern shore of the Chesapeake Bay. The weather station is located at the Jug Bay Component of the Reserve, specifically at the Jug Bay Wetlands Sanctuary. The station is situated on the north end of the Jug Bay marsh, along a tidal creek that feeds the Patuxent River. The weather station is situated at 38-46-50.6N and 76-42-29.1W. The station is housed in a small outdoor building situated at the end of a boardwalk in the Jug Bay marsh. The boardwalk extends about 50m from an elevated old railroad track out into the marsh. The CR10x is in a weather proof box situated on the inside of the building, while the probes are fixed to the roof of the building so as not to be impacted by the structure. The probes are approximately 5m above mean water and are not shaded. Wind speed may be slightly altered at the site due to proximity of the old railroad bridge that splits the marsh. The old railroad bridge is on an elevated berm that sits about 2-2.5m above mean water. The berm runs east to west and the boardwalk that houses the weather station runs perpendicular to the berm in the north/south direction. From 1995-2002, the weather station was also the site of a YSI datalogger that recorded water quality at the site. Due to problems with the shallow nature of the site, the water quality component was moved in 2003, approximately 500m westward, from the tidal creek to the mainstem of the Patuxent River.

An additional weather station is targeted for the Otter Point Creek component of the reserve in 2004.

6) Data collection period:

Data collection for this period began on January 1, 2003 at 00:00 and continued throughout the year, ending on 23:45 December 31, 2003. Data collected from January 1, 2003 through 13:45 on July 22, 2003 was collected, but is not reported due to concerns with the calibration of the probes and problems with the time coding. This data should be treated as suspect; however, the data can be made available. Any person interested in this data should contact Julie Bortz, the Research Coordinator for the Reserve. On July 22, 2003, all probes, except the tipping rain gauge, were replaced with calibrated new probes. On October 29, 2003 the CR10x program was upgraded to NERR_4.CSI to affix a time/date stamp to the data and output the data in three arrays rather than twelve.

7) Distribution:

NOAA/ERD retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The PI retains the right to be fully credited for having collected and processed the data. Following academic courtesy standards, the PI and NERR site where the data were collected will be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. Manuscripts resulting from this NOAA/OCRM supported research that are produced for publication in open literature, including refereed scientific journals, will acknowledge that the research was conducted under an award from the Estuarine Reserves Division, Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration. The data set enclosed within this package/transmission is only as good as the quality assurance

and quality control procedures outlined by the enclosed metadata reporting statement. The user bears all responsibility for its subsequent use/misuse in any further analyses or comparisons. The Federal government does not assume liability to the Recipient or third persons, nor will the Federal government reimburse or indemnify the Recipient for its liability due to any losses resulting in any way from the use of this data.

NERR weather data and metadata can be obtained from the Research Coordinator at the individual NERR site (please see Section 1 Principal investigators and contact persons), from the Data Manager at the Centralized Data Management Office (please see personnel directory under the general information link on the CDMO home page) and online at the CDMO home page <http://cdmo.baruch.sc.edu/>. Data are available in text format and Access data tables.

8) Associated researchers and projects:

Data are most commonly used in support of the System Wide Monitoring Program (SWMP) and to help explain the relationships between water quality and meteorological conditions. Three of the four SWMP water quality sites are located at the Jug Bay component of the Reserve and therefore the collection of meteorological data provides additional information helpful for analyzing and detecting trends in water quality data. For more information about the SWMP water quality monitoring effort, refer to the Chesapeake Bay Maryland Reserve water quality data on the CDMO website <http://cdmo.baruch.sc.edu/>.

Additional research and data that is available at the Jug Bay component of the Reserve is sediment erosion data and water quality data collected by Jug Bay Wetlands Sanctuary staff. Various sediment erosion tables (SET) are installed and monitored at the site annually to track changes in sedimentation levels. Dr. Marta Ceroni is one of the lead PI's on the sediment effort while Chris Swarth is the lead PI for supplemental water quality monitoring efforts. Additional information, to include their contact information, can be obtained through the Research Coordinator.

Efforts are underway to install another weather station at the Otter Point Creek component of the Reserve as well as install vented tide gauges at both the Otter Point Creek and Jug Bay components. Additionally, efforts to telemeter the data real-time from both weather stations and respective water quality stations are projected for 2004.

II. Physical Structure Descriptors

9) Sensor specifications:

The weather station records temperature, relative humidity, barometric pressure, wind speed, wind direction, light as measured by a LI-COR Quantum Sensor, and precipitation. The following is a list of the above parameters along with a parameter description, units, sensor type, model number, range of measurement, accuracy, and date of the last calibration for each sensor. Similar information for the storage module and CR10x is also listed below.

Parameter: Temperature

Units: Celsius

Sensor type: Platinum resistance temperature detector (PRT)

Model #: HMP45C Temperature and Relative Humidity Probe

Operating Temperature: -40°C to +60°C
Range: -40°C to +60°C
Accuracy: ± 0.2 °C @ 20°C
Date of Last calibration: 03/11/2003

Parameter: Relative Humidity
Units: Percent
Sensor type: Vaisala HUMICAP© 180 capacitive relative humidity sensor
Model #: HMP45C Temperature and Relative Humidity Probe
Range: 0-100% non-condensing
Accuracy at 20°C: $\pm 2\%$ RH (0-90%) and $\pm 3\%$ (90-100%)
Temperature dependence of RH measurement: $\pm 0.05\%$ RH/°C
Date of Last calibration: 03/11/2003

Parameter: Barometric Sensor
Units: millibars (mb)
Sensor type: Vaisala Barocap © silicon capacitive pressure sensor
Model #: CS-105
Operating Range: Pressure: 600 to 1060 mb; Temperature: -40°C to +60°C;
Humidity: non-condensing
Accuracy: ± 0.5 mb @ 20°C; ± 2 mb @ 0°C to 40°C; ± 4 mb @ -20°C to 45°C; ± 6 mb @ -40°C to 60°C
Stability: ± 0.1 mb per year
Date of Last calibration: 02/18/2003

Parameter: Wind speed
Units: meter per second (m/s)
Sensor type: 18 cm diameter 4-blade helicoids propeller molded of polypropylene
Model #: R.M. Young 05103 Wind Monitor
Range: 0-60 m/s (130 mph); gust survival 100 m/s (220 mph)
Accuracy: $\pm 2\%$
Date of last calibration: Unknown (new in July 2003)

Parameter: Wind direction
Units: degrees
Sensor type: balanced vane, 38 cm turning radius
Model #: R.M. Young 05103 Wind Monitor
Range: 360° mechanical, 355° electrical (5° open)
Accuracy: $\pm 5\%$
Date of last calibration: unknown (new in July 2003)

Parameter: LI-COR Quantum Sensor
Units: mmoles m⁻² (total flux)
Sensor type: High stability silicon photovoltaic detector (blue enhanced)
Model #: LI190SB
Light spectrum waveband: 400 to 700 nm
Temperature dependence: 0.15% per °C maximum
Stability: $<\pm 2\%$ change over 1 yr

Operating Temperature: -40°C to 65°C; Humidity: 0 to 100%

Sensitivity: typically 5 μA per 1000 $\mu\text{moles s}^{-1} \text{ m}^{-2}$

Date of last calibration: 09/18/2002

Parameter: Precipitation (specify if heated rain gauge)

Units: millimeters (mm)

Sensor type: Tipping Bucket Rain Gauge

Model #: TE525

Rainfall per tip: 0.01 inch

Operating range: Temperature: 0° to +/- 50°C; Humidity: 0 to 100%

Accuracy: +/- 1.0% up to 1 in./hr; +0, -3% from 1 to 2 in./hr; +0, -5% from 2 to 3 in./hr

Date of Last calibration: Unknown (needs to be done)

Storage Module

Model #: SM4M

Storage capacity: 2 million low-resolution data values

Program storage: stores up to 8 programs with a total capacity of 128 KB

Processor: Hitachi H8S

Operating system: 64 KB, flash memory based, user downloadable

Operating range: Temperature: -35° to +65°C

Baud rates: 9600, 76800

Memory type: user selectable for either ring style (default) or fill and drop.

Power requirements: 5 +/-0.3 VDC @ 100 mA

10) Coded variable definition:

cbm – Chesapeake Bay Maryland, JB - jug bay, met – meteorological, Atemp – AirTemperature(C), AvgVol - Average Battery Voltage(volts), BP - Barometric Pressure(mb), IRR0_N - Incident Irradiance($\mu\text{mol}/\text{m}^2/\text{s}$), MaxTemp - Maximum Air Temperature(C), MaxTempT -Maximum Air Temperature Time, MaxBP - Maximum Pressure(mb), MaxBPT - Maximum Pressure Time, MaxRH - Maximum Relative Humidity(%), MaxRHT - Maximum Relative Humidity Time, MaxWSpd - Maximum Wind Speed(m/s), MaxWSpdT - Maximum Wind Speed Time(m/s), MinTemp - Minimum Air Temperature(C), MinTempT - Minimum Air Temperature Time, MinBP - Minimum Pressure(mb), MinBP - Minimum Pressure Time, MinRH - Minimum Relative Humidity(%), MinRHT - Minimum Relative Humidity Time, MinWSpd - Minimum Wind Speed(m/s), MinWSpdT - Minimum Wind Speed Time, RH - Relative Humidity(%), WdirWind -Direction(deg), WINDIR - Wind Direction, WSpd - Wind Speed(m/s), WINSPD - Wind Speed.

11) Anomalous/suspect data:

Arrays:

During 2022 all pre-2007 weather data were revisited by the CDMO. Historically those datasets included 15 minute, hourly (60), and daily data arrays (144). As directed by the NERRS Data Management Committee, the CDMO removed the hourly and daily data arrays leaving only the 15 minute data to make the entire NERRS SWMP weather dataset consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should be aware that they are largely no longer relevant. The updated

datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout the fall of 2022.

It is believed that all sensors were functioning properly from July 22, 2003 to December 31, 2003 and that there is no suspect or anomalous data.

12) Deleted data:

Arrays:

During 2022 all pre-2007 weather data were revisited by the CDMO. Historically those datasets included 15 minute, hourly (60), and daily data arrays (144). As directed by the NERRS Data Management Committee, the CDMO removed the hourly and daily data arrays leaving only the 15 minute data to make the entire NERRS SWMP weather dataset consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should be aware that they are largely no longer relevant. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout the fall of 2022.

New sensors installed system powered down and restarted at 14:30 on 7/22/2003, hence hourly averages and daily averages off.

cbmjbmet	6007/22/2003	203	15:00
cbmjbmet	14407/23/2003	204	00:00

New program uploaded to CR10X, deleted 15min averages (mins. and maxs.) at 15:30, and hourly and daily averages.

cbmjbmet	15 10/29/2003	302	15:30
cbmjbmet	60 10/29/2003	302	16:00
cbmjbmet	144 10/30/2003	303	00:00

13) Missing data:

Arrays:

During 2022 all pre-2007 weather data were revisited by the CDMO. Historically those datasets included 15 minute, hourly (60), and daily data arrays (144). As directed by the NERRS Data Management Committee, the CDMO removed the hourly and daily data arrays leaving only the 15 minute data to make the entire NERRS SWMP weather dataset consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should be aware that they are largely no longer relevant. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout the fall of 2022.

Data from January 1, 2003 to July 22, 2003 are missing due to equipment problems associated with the maintenance and calibration of probes. Data collected during this period is available, but should be considered suspect. If additional information on missing data are needed, or

missing data are requested, please contact the Research Coordinator at the reserve submitting the data.

Data from October 27, 2003 at 13:15 to October 29, 2003 at 15:30 are missing due to user error. Last set of data not downloaded prior to the upload of new CR10X program and data was lost.

14) Other remarks/notes:

On 10/10/2023 this dataset was updated to include embedded QAQC flags for anomalous/suspect data. System-wide monitoring data beginning in 2007 were processed to allow for QAQC flags and codes to be embedded in the data files rather than detailed in the metadata alone (as in the anomalous/suspect, deleted, and missing data sections above). Prior to 2007, rejected data were deleted from the dataset so they are unavailable to be used at all, but suspect data were only noted in the metadata document. Suspect data flags <1> were embedded retroactively in order to allow suspect data to be easily identified and filtered from the dataset if desired for analysis and reporting purposes. No other flags or codes were embedded in the dataset and users should still refer to the detailed explanations above for more information.

Arrays:

During 2022 all pre-2007 weather data were revisited by the CDMO. Historically those datasets included 15 minute, hourly (60), and daily data arrays (144). As directed by the NERRS Data Management Committee, the CDMO removed the hourly and daily data arrays leaving only the 15 minute data to make the entire NERRS SWMP weather dataset consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should be aware that they are largely no longer relevant. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsddata.org/get/landing.cfm throughout the fall of 2022.

Precipitation:

During the initial years of NERRS SWMP weather data collection the CR10X programming was inconsistent in how precipitation values were recorded. For most reserves, zeros were not recorded when rainfall had not occurred between 2001-2003, instead no rainfall was represented by a blank cell. The CDMO verified which datasets were impacted by this issue for the 2001-2006 datasets and inserted zeros when the metadata indicated that no precipitation occurred and data were not missing for other reasons. In some cases, zero values for precipitation data were evaluated and removed where the metadata confirmed that no rainfall should have been in the dataset. The pre-2007 data did not go through a thorough QAQC process again at that time (in addition to previous QAQC); however, if discrepancies were noticed between what was documented in the metadata and what was in the dataset, additional updates may have been made. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsddata.org/get/landing.cfm throughout early 2023.

Additional weather data for the Jug Bay component of the Reserve is available. Staff from the Jug Bay Wetlands Sanctuary collected the data independently. Interested persons should contact the Research Coordinator listed in section 1 for the appropriate contact information. It should also be noted that in 2003 Maryland logged one of the wettest years on record in this region. Data collected may not be representative of a “normal” year. Additionally, the entire

Chesapeake Bay region was strongly impacted by Hurricane Isabel, which came onshore in the Chesapeake Bay Region on September 17, 2003. The storm brought high winds, strong rainfall, and especially high tidal surges and was followed by an additionally large rain event on September 20, 2003, which exacerbated conditions. These two events, coupled with an unusually wet year, should be noted.

LiCor:

Prior to the installation of the new NERR_4.CSI program, all values less than 0 were altered in the raw data to read 0. These values may indicate an incorrect multiplier, calibration problems, or a sensor malfunction. Because these values are changed in the raw data, we cannot confirm that they are all valid data points.

Relative Humidity:

Prior to the installation of the new NERR_4.CSI program, all values over 100% were altered in the raw data to read 100%. These values may indicate super saturated air, calibration problems, or a sensor malfunction. Because these values are changed in the raw data, we cannot confirm that they are all valid data points.

EQWin Rainfall Data:

Daily Precip Totals (mm)

7/24/2003	1.3
7/25/2003	0.5
7/29/2003	25.9
7/30/2003	0.5
7/31/2003	0.5

Monthly Total (mm)

8/2/2003	6.6
8/3/2003	0.3
8/4/2003	8.9
8/6/2003	14.5
8/7/2003	0.3
8/8/2003	0.5
8/10/2003	13.5
8/11/2003	0.3
8/12/2003	11.7
8/13/2003	0.3
8/17/2003	23.6
8/18/2003	5.1
8/23/2003	0.3
8/27/2003	22.4
8/28/2003	13
8/29/2003	0.3
8/30/2003	8.4
8/31/2003	6.6

Monthly Total (mm)

136.6

9/2/2003	6.6
9/3/2003	2.8
9/4/2003	13.5
9/5/2003	5.1
9/8/2003	0.3
9/13/2003	20.8
9/14/2003	8.9
9/19/2003	38.6
9/20/2003	1
9/23/2003	2.3
9/24/2003	40.1
9/26/2003	0.3
9/29/2003	0.8
Monthly Total (mm)	141.1
10/1/2003	0.3
10/10/2003	0.3
10/11/2003	0.3
10/12/2003	0.3
10/15/2003	30.5
10/16/2003	0.3
10/23/2003	0.8
10/27/2003	3.3
10/31/2003	0.3
Monthly Total (mm)	36.4
11/6/2003	11.9
11/7/2003	15
11/8/2003	2
11/13/2003	16.8
11/17/2003	1
11/19/2003	0.3
11/20/2003	27.9
11/25/2003	6.6
11/29/2003	13
Monthly Total (mm)	94.5
12/6/2003	23.1
12/7/2003	0.3
12/9/2003	3
12/11/2003	7.9
12/12/2003	23.9
12/15/2003	25.4
12/18/2003	22.1
12/24/2003	0.5
12/25/2003	21.8
12/30/2003	0.3

12/31/2003	0.8
Monthly Total (mm)	129.1
Annual Total (mm)	566.4