

**North Carolina (NOC) National Estuarine Research Reserve
Research Creek Meteorological Metadata Report**

January - December 2003

Latest Update: **February 13, 2023**

I. Data Set and Research Descriptors

1. Principal investigator(s) and contact persons

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2. Entry verification

The 15-minute data, one-hour average, maximum and minimum data, and 24-hour average, totals, maximum and minimum data were downloaded from each instrument on the weather station to a Campbell Scientific CR10X datalogger. The CDMO datalogger program was loaded into the CR10X and controls the sensors and data collection schedule. The CR10X then interfaced with the PC208W software supplied by Campbell Scientific. This software was located on a computer at the NOC NERR lab, to which the data were uploaded every hour via telemetry. The data were saved in two separate areas on the computer and the Real Time Data Display software (provided by Campbell), displayed the near real time data in graphs and charts.

The data were saved as monthly raw data files (comma-delimited format) on another computer and backed up on zip discs. Data files were 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 pre-processed file is then ready to be copied into the EQWin weather.eqi file where the data were QA/QC checked and archived in a database. EQWin queries, reports and graphs are used to discover data set outliers (values that 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. Any anomalous data were investigated and noted below in the Anomalous/Suspect Data Section. Any data corrections that were

performed are noted in the Deleted Data Section below. The most common reported errors/anomalies in 2003 were precipitation differences greater than 5mm in 15 minutes. All errors of these types were double checked with other data that could support such "anomalous" weather changes and were noted in the sections that follow.

Raw data files and EQWin databases were saved on multiple computers, archived on Zip discs and/or compact discs, and backed-up on the CDMO server. Paula May was responsible for error checking and compiling 2003 weather data.

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.

3. Research Objectives

The principal objectives are to establish long-term monitoring of the weather in the vicinity of Masonboro Island, to obtain better data on storms and to be able to correlate the weather, water quality, chlorophyll and nutrient data. In addition, the weather data collected will be used in support of other ongoing projects within the Reserve and nearby area.

4. Research methods

The Campbell Scientific weather station samples every 5 seconds continuously throughout the year. These 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 stored in a storage module connected to the CR10X and also downloaded hourly to a PC located in the NOCNERR lab via telemetry using the PC208W software package. Data are periodically compared to values recorded by other local weather stations to verify accuracy. Data are also quality checked using EQWin. The reports, graphs and queries of meteorological data are printed and reviewed. Anomalous data and errors are further investigated and data are corrected, deleted (if necessary) or left unchanged and noted in the metadata report.

The weather station and sensors are inspected monthly for cleaning and/or repair. Sensors are replaced and/or calibrated according to the manufacturer's guidelines (annually or biannually).

5. Site location and character

The components of North Carolina's National Estuarine Research Reserve (from north to south) are: the Northern Sites component, Rachel Carson, Masonboro Island, Zeke's Island, and the Southern Sites component. They are located along the southeastern coast of the United States in the Atlantic Ocean. Currently, only data from Masonboro Island and Zeke's Island components are transferred to the CDMO. The four water quality sites and meteorological station are:

a) Research Creek, Masonboro Island

The first Masonboro Island site (formerly called Masonboro Island (MS)) is 0.72 km north east from the mouth of Whiskey Creek, and east of the Intracoastal Waterway (ICW), in a small navigable channel called Research Creek at 34°09'21.7" latitude and 77° 50'59.9" longitude. The site has a salinity range from 18-35 ppt and a tidal range that averages 1.7 meters. The creek bottom is characterized by sand and detritus based sediment with areas of soft mud with a depth ranging from 0.34 to 2.45 m. The sole source of freshwater is rain. *Spartina* spp. marsh and dunes surround the site, which is relatively unimpacted by manmade perturbations and it is not accessible to road traffic. The site does experience minimal boat traffic.

b) Loosin Creek, Masonboro Island

The second Masonboro Island site (added in 2002) is 1.2 km east of the ICW, and 2.5 km south west of Masonboro Inlet, in a small navigable channel called Loosin Creek at 34° 10'20.0" latitude and 77° 49'58.1" longitude. The site has a salinity range from 18-35 ppt and a tidal range that averages 1.7 meters. The creek bottom is characterized by sand and detritus based sediment with areas of soft mud with a depth ranging from 0.1 to 2.5 m. The sole source of freshwater is rain. *Spartina* spp. marsh and dunes surround the site, which is relatively unimpacted by manmade perturbations and it is not accessible to road traffic. The site does experience minimal boat traffic.

c) East Cribbings, Zeke's Island

The first Zeke's Island site (formerly called Zeke's Island (ZI)) is located 1.8 km south of Federal Point boat launch in a tidal basin estuary at 33° 56'23.5" latitude and 77° 56'28.1" longitude. This site receives minimal freshwater input from leakage of the Cape Fear River through the 5.6 km rock jetty that separates the two bodies of water. The site has a salinity range from 15-35 ppt and a tidal range that averages 2 meters. Depth varies, but typically it can be found to range from 0.11 to 2.30 meters. Bottom type substratum consists of large rocks (the cribbings) with sand and detritus based sediment. There are no pollutants from land. Marsh and dunes surround the site; not accessible to road traffic and minimal boat traffic.

d) Zeke's Basin, Zeke's Island

The second Zeke's Island site (added in 2002) is located 0.8 km south east of the Federal Point boat launch in a tidal basin estuary at 33° 57'17.0" latitude and 77° 56'6.0" longitude. This site receives minimal freshwater input from leakage of the Cape Fear River through the 5.6 km rock jetty that separates the two bodies of water. The site has a salinity range from 11-35 ppt and a tidal range that averages 2 meters. Depth varies, but typically it can be found to range from 0.1 to 2 meters. Bottom type substratum consists of sand and detritus based sediment with a layer of soft sulfuric mud. There are no pollutants from land. Marsh and dunes surround the site; not accessible to road traffic and minimal boat traffic.

e) Research Creek Meteorological Station

The meteorological site is located on Masonboro Island, 2.09 km from the NOC NERR lab, and approximately 76.2 m from the Masonboro Island water quality deployment site. The weather station is located on an inactive dredge spoil island next to Research Creek east of the Intracoastal Waterway. It is directly across the Intracoastal Waterway from Whiskey Creek, at 34° 9.328'N, 77° 51.054'W. The station sits at an elevation of approximately 4.88 m above sea level, slightly offset from the highest point of the spoil, which has a maximum elevation of approximately 5.8 m. The site has scrub surrounding the periphery, and grassy cover in the central areas. The weather station consists of a 3-meter aluminum tower that holds the wind sensor (wind speed and direction) at a height of 3.68 m and the Li-COR sensor at a height of 3.66 m. The temperature and relative humidity sensor is mounted on the tower at 2.39 m and the barometric pressure, which is inside of the CR10X housing, is mounted at a height of 1.75 m. The rain gauge is located on a separate platform 7.62 m east south east of the tower and is mounted at a height of 1.79 m. The sensors were wired to the CR10X (Campbell datalogger) according to the protocol in the Meteorological Monitoring SOP.

6. Data collection period

Collection of meteorological data began on 15 March 1997 and continues through the present. Instruments were deployed prior to this date; however, data were for initial testing and verification of functions, and have since been discarded.

7. Distribution

According to the Ocean and Coastal Resource Management (OCRM) Data Dissemination Policy for the NERRS System Wide Monitoring Program (SWMP),

National Oceanic and Atmospheric Administration (NOAA)/Estuarine Reserves Division (ERD) retains the right to analyze, synthesize and publish summaries of the NERRS SWMP 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 publication in which any part of the data are

used. Manuscripts resulting from the 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 ERD, OCRM, National Ocean Service (NOS), NOAA. The data enclosed within the package/transmission are only as good as the quality assurance/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 of 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 (see section I. 1. Principal investigators and contact persons), from the Data Manager at the Centralized Data Management Office (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

Meteorological data will be used to augment other research components of the System Wide Monitoring Program (SWMP) that currently include water quality, chlorophyll and nutrient monitoring. The principal objective of the water quality monitoring is to record long-term water quality data in order to observe and document any physical and chemical changes or trends in water quality over time. The objective of the chlorophyll and nutrient monitoring study is to ascertain the annual and tidal fluctuations in nutrient and chlorophyll a levels surrounding the four water quality sites.

Additional projects are ongoing and continually changing. Check with the Research Coordinator or other contact person for an updated list of research (see section I.1.).

II. Physical Structure Descriptors

9. Sensor specifications

Ecoharmony tipping bucket rain gauge

Model # TB4.

Range: 0 to 600 mm/hr

Accuracy: 0.01 inches per bucket tip; +/- 3% for intensities from 25-600 mm/hr

Date of last calibration: 10/30/02

Campbell Scientific Temperature and Relative Humidity

Model # HMP35C (deployed from 01/01/03 to 11/3/03)

Range: -35 to +50°C; 0 to 100%

Accuracy: +/- 0.4°C; @ 20°C +/- 2% RH (0 - 90% RH), +/- 3% RH (90 - 100% RH)

Date of last calibration: 10/05/01 (installed 10/01/02)

Campbell Scientific Temperature and Relative Humidity

Model # HMP45ASP (deployed from 11/03/03 to 12/31/03)

Range of -40 to 60°C; 0 to 100% non-condensing

Accuracy is +/- 0.2°C @ 20°C; @ 20°C +/- 2% RH (0 - 90% RH), +/- 3% RH (90 - 100% RH)

Date of last calibration: 03/06/03 (installed new on 11/03/03)

LiCor Pyranometer Quantum Sensor.

Model # LI190SZ

Range: 1% up to 10,000 $\mu\text{moles s}^{-1}\text{m}^{-2}$, 400-700 nm

Accuracy: 5 μA per 1000 $\mu\text{moles s}^{-1}\text{m}^{-2}$, with a stability of <+/- 2% change per year

Date of last calibration: 11/08/01 (installed on 11/03/03)

Vaisala Ultrasonic Wind Sensor

Model # 425

Range: 0 to 65 m/s (0 to 144 mph, 0 to 125 knots); 0 to 360°

Accuracy: ± 0.135 m/s (± 0.3 mph, ± 0.26 knots) or 3% of reading, whichever is greater;

$\pm 2^\circ$

Date of last calibration: N/A (no calibration needed) installed new on 07/15/02

Vaisala Barometric Pressure

Model # PTB101B

Range: 600 to 1060 mb

Accuracy: +/- 0.45 mb

Date of last calibration: 10/25/01 (installed on 11/03/03)

Storage Module

Model#: SM192

Storage capacity: 192,896 bytes

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

Processor: Hitachi 6303

Baud rates: 300, 1200, 9600, 76800

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

Power requirements: 5 +/- 0.4 VDC @ 100mA

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°C 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 @ 100mA

Campbell Scientific CR10X Wiring Panel has 128K of flash memory (EEPROM), in which it stores the operating system and it's program (that it uses to run the weather station). Additionally, there are 128K of SRAM, which it uses to run the program and store its measurements and for final data storage.

10. Coded variable definitions

NOC - North Carolina	rel hum - relative humidity
RC - Research Creek	°C - degrees Celsius
temp - temperature	mb - millibars
m/s - meters per second	V - volt
par - photosynthetic active radiation	ppt - parts per thousand
µA - microamps	µmoles - micromoles

Sampling station:	Sampling site code:	Station code:
Research Creek	RC	nocrcmet

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.

15 minute sample rainfall amount differences of over 5 mm in 15 minutes can occur during storms and indicate intense precipitation bursts during thunderstorms or frontal passages.

The following precipitation data appear to be correct:

STNCODE	SMPLDATE	USRCODES	SMPLTIME	CLASS	TotPrcp
nocrcmet	02/07/2003	38	02:15	15	06.3
nocrcmet	03/11/2003	70	14:15	15	05.8
nocrcmet	03/20/2003	79	13:15	15	07.4
nocrcmet	03/20/2003	79	13:30	15	06.3
nocrcmet	04/07/2003	97	15:30	15	07.4
nocrcmet	04/09/2003	99	06:00	15	05.6
nocrcmet	04/10/2003	100	03:00	15	06.6
nocrcmet	04/25/2003	115	14:00	15	11.2
nocrcmet	04/25/2003	115	15:15	15	10.4
nocrcmet	04/25/2003	115	15:30	15	05.3

nocrcmet	05/03/2003	123	23:00	15	11.2
nocrcmet	05/23/2003	143	05:45	15	05.6
nocrcmet	05/23/2003	143	06:00	15	05.1
nocrcmet	05/23/2003	143	06:15	15	07.4
nocrcmet	05/23/2003	143	07:45	15	07.9
nocrcmet	05/27/2003	147	17:00	15	06.9
nocrcmet	06/15/2003	166	07:30	15	05.8
nocrcmet	07/09/2003	190	22:45	15	06.9
nocrcmet	07/23/2003	204	18:15	15	09.7
nocrcmet	08/03/2003	215	12:00	15	09.9
nocrcmet	08/04/2003	216	10:00	15	12.4
nocrcmet	08/07/2003	219	05:45	15	06.6
nocrcmet	08/08/2003	220	05:45	15	11.9
nocrcmet	08/10/2003	222	21:45	15	05.3
nocrcmet	08/23/2003	235	16:45	15	09.9
nocrcmet	08/23/2003	235	17:00	15	05.3
nocrcmet	09/22/2003	265	16:15	15	05.1
nocrcmet	09/22/2003	265	17:30	15	06.6
nocrcmet	10/08/2003	281	03:15	15	06.6
nocrcmet	10/08/2003	281	03:30	15	06.9
nocrcmet	10/08/2003	281	03:45	15	07.9
nocrcmet	10/08/2003	281	04:30	15	06.9
nocrcmet	10/08/2003	281	05:30	15	09.7
nocrcmet	10/08/2003	281	15:30	15	09.4
nocrcmet	10/08/2003	281	19:15	15	05.6
nocrcmet	10/29/2003	302	02:30	15	09.1
nocrcmet	10/29/2003	302	02:45	15	07.9
nocrcmet	12/10/2003	344	17:30	15	05.6
nocrcmet	12/10/2003	344	21:30	15	05.3

Beginning on 24 September, the value of -99999 was recorded by the CR10X for wind speed periodically throughout the data set for unknown reasons. The values were not removed, but should be noted as erroneous.

After the Licor sensor was replaced on 3 November, slightly negative values for PAR data were recorded for numerous periods of time when no light was present. These data were corrected by changing the values to zero.

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.

Inaccurate precipitation data were collected due to testing and/or cleaning of the rain gauge. Precipitation data for the following dates and times were removed:

Array	Date	Time
15	02/03/03	14:30
60	02/03/03	15:00
144	02/03/03	00:00
15	03/19/03	12:45
60	03/19/03	13:00
144	03/19/03	00:00
15	05/22/03	15:30
60	05/22/03	16:00
144	05/22/03	00:00
15	06/13/03	16:30
60	06/13/03	17:00
144	06/13/03	00:00

When the CR10X is powered down for maintenance or other causes or the program reloaded, all temporary 5 second data for that calendar date are lost at the moment of power down. When the CR10X is powered again the 5 second data from that point on for that date are again stored in the daily temporary file for that calendar date. Consequently, the daily averages, maximums and minimums for all parameters, which are calculated for the calendar date using the 5 second data file, will be incorrect for the calendar date because only a portion of the day's data will be used for calculation. The same applies to the hourly and 15 minute averages, maximums and minimums for the time period immediately following a power down event. Current protocol is to delete the daily data for these dates as well as any hourly and 15 minute averages so affected.

All data for the following dates and times were deleted due to power downs and/or program reloads:

Array	Date	Time
144	06/13/03	00:00
60	11/03/03	17:00
144	11/04/03	00:00
15	11/05/03	15:15-15:30
60	11/05/03	16:00
144	11/06/03	00:00
15	11/12/03	15:15
60	11/12/03	16:00
144	11/13/04	00:00
15	11/13/03	16:15
60	11/13/03	17:00
144	11/14/03	00:00

All data for the following dates and times were deleted due to failure of the external battery to hold a charge at night and during the early hours of morning when the battery was not charged by the solar panel:

Array	Date	Time
60	09/07/03	08:00
144	09/07/03	00:00
60	09/08/03	07:00
144	09/08/03	00:00
144	09/09/03	00:00

Wind speed and wind direction data were deleted for the following dates and times due to erroneous values recorded for unknown reasons:

Array	Date	Time
15	07/22/03	09:15
15	07/22/03	16:15
15	10/29/03	05:15

An erroneous value for wind speed was deleted for array 60 at 06:00 on 10/29/03.

All wind data were deleted from 16:45 on 11/03/03 through 16:00 on 11/13/03 due to errors in the CR10X program causing erroneous values to be recorded.

An erroneous value of 447 was recorded periodically throughout the data set from April through December for wind speeds, wind speed maximums, and wind speed minimums for unknown reasons. These values were deleted from the data set.

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 are missing due to equipment or associated specific probes not being deployed, equipment failure, time of maintenance or calibration of equipment, or repair/replacement of a sampling station platform. For more details on deleted data, see the Deleted Data Section (12). If additional information on missing data is needed, contact the Research Coordinator at the reserve submitting the data.

All data for the following dates and times are missing due to power downs and/or program reloads:

Array	Date	Time
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15	06/13/03	15:15-16:00
60	06/13/03	16:00
15	11/03/03	11:15-16:30
60	11/03/03	12:00-16:00

All data for the following dates and times are missing due to failure of the external battery to hold a charge at night and during the early hours of morning when the battery was not charged by the solar panel:

Array	Date	Time
15	09/06/03-09/07/03	22:45-07:30
60	09/06/03-09/07/03	23:00-07:00
144	09/06/03	00:00
15	09/08/03	01:30-06:45
60	09/08/03	02:00-06:00
15	09/09/03	06:00-07:00
60	09/09/03	06:00-07:00

14. Other remarks/notes

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.

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.nerrsdata.org/get/landing.cfm throughout early 2023.

Hurricane Isabel passed over the area on 18 September 2003.

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.

Rain Events:

January

Date	Daily Precipitation Totals (mm)
01/01/2003	23.9
01/16/2003	0.5
01/17/2003	0.5
01/21/2003	3.3
01/22/2003	0.8
01/29/2003	0.5
01/30/2003	3.8

Monthly Total (mm) 33.3

February

Date	Daily Precipitation Totals (mm)
02/01/2003	0.3
02/04/2003	8.4
02/06/2003	4.8
02/07/2003	17.8
02/10/2003	11.7
02/16/2003	26.7
02/17/2003	4.3
02/21/2003	0.3
02/22/2003	4.6
02/26/2003	2.5
02/27/2003	10.9

Monthly Total (mm) 92.3

March

Date	Daily Precipitation Totals (mm)
03/01/2003	2.0
03/02/2003	5.8
03/04/2003	0.3
03/05/2003	0.8
03/06/2003	5.1
03/07/2003	14.5

03/09/2003	0.5
03/11/2003	15.0
03/12/2003	0.3
03/15/2003	12.7
03/16/2003	0.8
03/17/2003	6.1
03/18/2003	0.5
03/20/2003	51.6
03/21/2003	1.5
03/24/2003	0.5
03/30/2003	7.6

Monthly Total (mm) 125.6

April

Date	Daily Precipitation Totals (mm)
04/06/2003	2.8
04/07/2003	21.8
04/08/2003	8.4
04/09/2003	35.8
04/10/2003	26.4
04/11/2003	8.4
04/17/2003	0.3
04/25/2003	48.3
04/26/2003	4.1
04/30/2003	0.5

Monthly Total (mm) 156.8

May

Date	Daily Precipitation Totals (mm)
05/01/2003	1.8
05/02/2003	1.5
05/03/2003	16.3
05/04/2003	2.5
05/06/2003	1.3
05/08/2003	4.1
05/15/2003	4.1
05/19/2003	2.8
05/22/2003	8.1
05/23/2003	70.6
05/26/2003	0.3
05/27/2003	15.5
05/29/2003	2.0
05/31/2003	14.0

Monthly Total (mm) 144.9

June

Date	Daily Precipitation Totals (mm)
06/03/2003	6.6
06/04/2003	7.4
06/07/2003	0.5
06/08/2003	6.6
06/14/2003	6.9
06/15/2003	10.7
06/16/2003	1.8
06/18/2003	0.3
06/19/2003	7.9
06/20/2003	1.5

Monthly Total (mm) 50.2

July

Date	Daily Precipitation Totals (mm)
07/01/2003	0.8
07/02/2003	8.1
07/07/2003	0.3
07/09/2003	13.7
07/10/2003	1.0
07/11/2003	5.3
07/12/2003	13.5
07/13/2003	0.3
07/14/2003	19.1
07/19/2003	6.9
07/23/2003	17.0
07/24/2003	1.3
07/25/2003	7.4
07/26/2003	0.3
07/28/2003	0.3
07/31/2003	4.1

Monthly Total (mm) 99.4

August

Date	Daily Precipitation Totals (mm)
08/02/2003	0.8
08/03/2003	14.7
08/04/2003	19.6
08/05/2003	3.6
08/06/2003	15.2
08/07/2003	17.5
08/08/2003	20.1
08/09/2003	14.2
08/10/2003	10.4
08/11/2003	4.6

08/18/2003	5.6
08/23/2003	16.8

Monthly Total (mm) 143.1

September

Date	Daily Precipitation Totals (mm)
09/03/2003	2.0
09/04/2003	9.4
09/05/2003	2.0
09/06/2003	5.3
09/10/2003	25.9
09/18/2003	49.5
09/22/2003	23.1
09/23/2003	2.5
09/24/2003	0.3
09/28/2003	0.5

Monthly Total (mm) 120.5

October

Date	Daily Precipitation Totals (mm)
10/02/2003	0.3
10/07/2003	6.6
10/08/2003	112.5
10/09/2003	31.8
10/10/2003	3.3
10/11/2003	0.8
10/14/2003	10.2
10/18/2003	0.3
10/21/2003	0.3
10/25/2003	3.3
10/26/2003	1.0
10/27/2003	7.1
10/28/2003	42.9
10/29/2003	37.1
10/30/2003	0.3

Monthly Total (mm) 257.8

November

Date	Daily Precipitation Totals (mm)
11/05/2003	0.3
11/07/2003	3.8
11/19/2003	1.5
11/20/2003	30.7
11/21/2003	0.3
11/24/2003	0.3

11/26/2003	0.3
11/29/2003	1.3

Monthly Total (mm)	38.5
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December

Date	Daily Precipitation Totals (mm)
12/05/2003	12.7
12/11/2003	39.4
12/15/2003	42.2
12/18/2003	2.8
12/24/2003	14.0
12/25/2003	9.4
12/31/2003	0.3

Monthly Total (mm)	120.8
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Annual Total (mm)	1383.2
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