Chesapeake Bay Virginia (CBV) NERR Meteorological Metadata
January 2005 - December 2005
Latest update: **October 16, 2023**

I. Data Set & Research Descriptors

1) Principal investigator & contact persons:

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2) Entry verification

a) Data Input Procedures:

The 15-minute, 1-hour average, and 24-hour data were downloaded from each instrument on the weather station to a Campbell Scientific CR10X datalogger. The CDMO Data Logger Program (nerr.csi) was loaded into the CR10X and controls the sensors and data collection schedule (see 2b of the Entry Verification section for the data collection schedule). The CR10X interfaced with the PC208W software supplied by Campbell Scientific. This software was located on a laptop computer to which the data were downloaded manually in the field. Data were downloaded monthly or biweekly from a storage module located within the weather station. Data were formatted in Excel using the weather macro provided by CDMO.

The Centralized Data Management Office converted all SWMP weather data collected with CR10X program versions prior to version 4.0. 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 connected 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.

Gretchen Arnold was responsible for the QA/QC of the 2004 Weather data. Chris Clapp and Scott Lerberg were responsible for the QA/QC of the 2005 Weather data.

For data collection, the CR10X datalogger was programmed to collect data in the following formats:

i) 15-minute average, maximum and minimum data are averages of 5-second readings for Air Temperature (degrees C), Relative Humidity (%), Barometric Pressure (mb) and Wind Speed (m/s). 15-minute Precipitation (mm) and PAR (mmol/m^2) data are totaled from 5-second readings.

ii) Hourly average, maximum, and minimum data are averages of 5-second readings for Air Temperature (degrees C), Relative Humidity (%), Barometric Pressure (mb), Wind Speed (m/s), and Wind Direction (degrees). Hourly totals for PAR (mmol/m^2) 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 (degrees C), Relative Humidity (%), Barometric Pressure (mb), Wind Speed (m/s), and Wind Direction (degrees). Daily totals for PAR (mmol/m^2) and Precipitation (mm) are totals of 15-minute readings.

Data were stored on a Campbell Scientific storage module (SM192 or SM4M). The data were downloaded and pre-processed as described in Section 2. QA/QC of the data was conducted using EQWin. Data were investigated as recommended in the CDMO NERR SWMP Data Management Manual Version 5.1, and included the use of queries, graphs, and reports. Any anomalous or missing data were investigated and are noted below in the corresponding section. Any data corrections that were performed are noted in the Data Correction section below. Additionally, basic EQWin queries were conducted based on the following anomalous data criteria:

Air Temp:
-Sample not greater than 40 C or less than –20 C
-15 minute averages not greater than the max for the day
-15 minute averages not greater than the min for the day

Relative Humidity:
-Sample not greater than 100% or less than 0%
-15 minute averages not greater than the max for the day
-15 minute averages not greater than the min for the day

Pressure:
-Pressure not greater than 1040 mb or less than 980 mb
-15 minute averages not greater than the max for the day
-15 minute averages not greater than the min for the day

Wind Speed:
-Wind speed not greater than 30 m/s and not less than 0
-Sample not less than 0.5 m/s for 12 hours consecutively

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

Rainfall:
- Precipitation not greater than 5 mm in 15 minutes

Photosynthetically Active Radiation (PAR):
-15 min. total not greater than 5000 mmol/m^2 or less than –2.214 mmol/m^2.
-60 min. total not greater than 20000 mmol/m^2 or less than –8.856 mmol/m^2
-24 hour total not greater than 480,000 mmol/m^2 or less than –212.544 mmol/m^2

Time:
-15 minute interval recorded

For all data:
-No duplicate data

Additional queries were performed as necessary.

3) Research objectives:

The principal objective is to record long-term meteorological data within the York River watershed in order to observe any environmental changes or trends over time. Data may also be used for watershed research. Samples were taken every 5 seconds and 15 minutes over roughly two-week collecting intervals.

4) Research methods:

The Campbell Scientific weather station samples every 5 seconds to produce 15 minute, hourly and daily averages of those measurements of air temperature, relative humidity, barometric pressure, rainfall, wind speed and wind direction. A one-month to biweekly sampling interval was chosen so that the storage module would not run out of room and overwrite data. Periodically, sensors on the weather station are inspected for damage or debris. If any is found, it is repaired and/or cleaned. Sensors are scheduled to be removed and sent back to Campbell Scientific for calibration at minimum of every two years. However, it should be noted that the following sensors were either calibrated or replaced in 2005: Temperature/RH, Barometric Pressure, LiCor Quantum Sensor (PAR) and Rain Gauge (Precipitation). The calibration and installation dates (and history) are noted in Section 9 of this document.

5) Site location and character:

Taskinas Creek (TC) Component:

The Chesapeake Bay National Estuarine Research Reserve in Virginia (CBNERRVA) is located on the York River, a tributary of the Chesapeake Bay. CBNERRVA maintains a long-term water quality-monitoring program and stream gauge station at Taskinas Creek, a tributary of the York River that is located in the transitional zone of the York River State Park. The Taskinas Creek weather station is also located within York River State Park. The park is located on the mainstem of the York River, which is 50 km long, 38 kilometers from the mouth of the river, and 2.25 kilometer wide near the weather station. The weather station in located (37°24' 50.79850" N, 76°42' 44.51934" W) on a bluff (11m elevation) 60m from the York River in a manicured lawn area of the park. No trees or other major structures are within a 35m radius of weather station. The stream gauge is located 2km NW (288 degrees of weather station and the water quality station is located 200m (298 degrees) of weather station. The weather station has a landscape fence around it to deter park visitors from tampering with it. All the instruments are located on the approximately 3.5 m aluminum tower following the descriptions outlined in the CDMO Manual V 4.0. The Tipping Bucket Rain gauge is located within 2m of the tower. The sensors were wired to the CR10X following the protocol in the CDMO Manual.

6) Data collection period:

Weather data has been collected at the Taskinas Creek since 1996. The current weather station has been operational since 1996. Data was collected for the entire year in 2005.

7) Distribution

According to the Ocean and Coastal Resource Management Data Dissemination Policy for the NERRS System-wide Monitoring Program, 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 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 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/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:

The Taskinas Creek watershed is a site of limited impact due to development or recreational use. There is a water quality station and a stream gauge station at this site. This site is being developed as a control site for watershed work in the area.

II. Physical Structure Descriptors

9) Sensor specifications, operating range, accuracy, date of last calibration

CSI LiCor Quantum Sensor
Model # LI190SB
Stability: <±2% change over 1 yr
Operating Temperature: -40 to 65°C
Sensitivity: typically 5 µA per 1000µmoles s-1 m-2
Light spectrum wavelength: 400 to 700 nm
Multiplier: 1.346
LICOR Sensor History

Sensor ID	Model	Date Installed	Date Calibrated	Date Next Calibration
(N/A)	LI190	Jan-01	Aug-00	Aug-02
Q23182	LI190	Mar-03	Aug-02	Aug-04
Q22440	LI190	Jul-05	Mar-05	Mar-07

R.M. Young Wind Monitor
Model # 05103-5
WIND SPEED SUMMARY:
Range: 0-60 m/s; gust survival 100 m/s
WIND DIRECTION (AZIMUTH) SUMMARY:
Range: 360° mechanical, 355° electrical

Last Calibration 3/2004
Wind Monitor History

Sensor ID	Model	Date Installed	Date Calibrated	Date Next Calibration
(N/A)	Wind Sentry	Jan-01	Dec-00	Dec-02
(N/A)	Wind Sentry	Mar-03	(N/A)	(N/A)
60365	Wind Monitor	Jun-04	Mar-04	Mar-06

CSI Temperature and Relative Humidity
Model #: HM45C
Operating Temperature: -40-+60°C
Temperature Measurement Range: -40-+60°C
Temperature Accuracy: ± 0.2 °C @ 20°C
Relative Humidity Measurement Range: 0-100% non-condensing
RH Accuracy: +/-2% RH (0-90%) and +/-3%(90-100%)
Uncertainty of calibration: ± 1.2% RH
Date of Last calibration: 7/13/2005. Date installed 7/13/2005.
TEMP/Relative Humidity Sensor History

Sensor ID	Model	Date Installed	Date Calibrated	Date Next Calibration
(N/A)	(N/A)	(N/A)	Oct-00	Oct-02
W1060077	HMP45	(N/A)	May-01	May-03
Z4020058	HMP45	Jul-05	Oct-04	Oct-06

CSI Barometric Sensor
Model #PTB101B
Operating Range: Pressure - 600-1060 mb
Temperature: -40-+60C
Humidity: non-condensing
Accuracy: ±0.5 to 6.0 mb (+20-60C)
Stability: ± 0.1 mb per year
Date of Last calibration: 7/14/2005 installed 7/14/2005
Barometric Pressure Sensor History

Sensor ID	Model	Date Installed	Date Calibrated	Date Next Calibration
(N/A)		Jan-01	Jul-00	Jul-02
S4450003		Mar-03	(N/A)	(N/A)
R1630018		Jul-05	Mar-05	Mar-07

Fluid Isolation Technology Tipping Bucket Rain Gauge
Model #: RG-2000-C
Range: 0.1 mm
Accuracy: 1.0% at <14"/hr
Date of Last calibration: 2/22/2005
Rain Gauge History

Sensor ID	Model	Date Installed	Date Calibrated	Date Next Calibrate
(N/A)	AMJ Fluid Tech	(N/A)	Jan-01	(N/A)
(N/A)	AMJ Fluid Tech	(N/A)	(N/A)	(N/A)
(N/A)	AMJ Fluid Tech	(N/A)	Feb-05	(N/A)

The Campbell Scientific CR10X Wiring Panel has 128K of flash memory (EEPROM) in

which it stores the operating system and its 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 indicator and variable code definitions:

Sampling station:	Sampling site code:	Station code:
Taskinas Creek	TC	cbvtcmet

11) Data anomalies/Data corrections:

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.

- The following are records which have been identified as being "suspect" as they fall outside of the range of measurement specifications for the sensors (the ranges were identified in Section 2) within the 2005 Taskinas Creek Weather Station Dataset. This data has been deleted, but just "flagged" as being suspect as should be treated with caution.

- Numerous Relative Humidity readings of 101, 102, and 103 were cross-checked with a nearby station and found to be reasonable, and as this is within the range of error in the sensor, these records were left unchanged.

- For Total Precipitation – there were a few records where the total precipitation during a 15 minute sampling period exceeded 5 millimeters (the threshold defined by CDMO). These events were cross-checked with precipitation records for nearby weather monitoring stations during those same dates and times. It has been determined that although these values appear high, there were also rain events at those other stations during this time, and thus this data most likely reflects real rain events. The date, time, and measurement for these "suspect" events are as follows:

    - 5/15/05 at 1600 (7.9)
    - 6/07/05 at 0330 (8.6)
    - 7/17/05 at 1730 (5.6)
    - 7/29/05 at 0230 (6.6)
    - 8/06/05 at 1630 (9.4)
    - 8/06/05 at 1645 (6.4)
    - 8/15/05 at 2215 (7.4)
    - 8/15/05 at 2315 (11.7)
    - 8/15/05 at 2330 (7.1)
    - 8/16/05 at 1845 (15.5)
    - 9/20/05 at 1845 (5.6)

- For Wind Speed – there was only one sampling period where the wind speed was less than 0.5 meters per second for a 12 hour period. This occurred during the time period from 1/22/05 (16:30) to 1/24/05 (11:30). This may very well be real data (and usually calm conditions), so it has not been deleted.

- For Barometric Pressure. There were two brief periods where the barometric pressure exceeds (only reaching 1041 and 1042 millibars) the data criteria (set in Section 2) for this sensor of 1040 millibars. This was from 1/28/05 (from 07:30 to 21:00) and on 12/08/05 (from 09:00 to 12:00). These values are within the accuracy range of the sensor, and have been left intact within the dataset.

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.

- For PAR – there were a number of records which were lower than the 15 minute total threshold of -2.214 mmol/m^2 and 60-minute threshold of -8.856 mmol/m^2. These records occurred during January 8th, 2005 and April 4th, 2005. From April 5th, 2005 to December 31, 2005, there were no further instances of PAR data being lower than these thresholds.

- In addition, there appears to be a period of time where the pressure sensor was not functioning properly (and was eventually replaced on 07/14/05 at 8:20 AM). Barometric pressure readings were deleted starting at 6/6/05 at 12:15 (when the readings started to start drifting – compared with other weather stations) until 7/14/05 at 9:00 AM. The barometric pressure sensor was replaced on 7/14/2005 at 8:19 AM on 7/14/2005.

- In addition, there are a few readings on both 7/13/05, 7/14/05, and 9/2/05 when there was maintenance being done on the weather station (either changing out sensors or updating the programs) which resulted in some erroneous 15-minute readings which were well outside the acceptable thresholds and were an obvious result of the maintenance being conducted on the weather stations. These values were deleted and included the following records. In addition, at 13:45 on 9/05/05, the data for minimum temperature and minimum relative humidity were inconsistent (and outliers) compared to adjacent records within the dataset (and records from other weather stations). So, these data were eliminated from the 15 (13:45), 60 (14:00), and 144 (24:00) minute readings on this date.

7/13/05 1115 (15 min) PAR
7/13/05 1130 (15 min) Air Temp, Max Temp, Min Temp, RH, Max RH, Min RH, and PAR.
7/13/05 1200 (60 min) Air Temp, Max Temp, Min Temp, RH, Max RH, Min RH, and PAR.

7/13/05 2400 (144 min) Air Temp, Max Temp, Min Temp, RH, Max RH, Min RH, and PAR.
7/14/05 2400 (144 min) BP, Max BAP, Min BP (due to BP sensor replaced at 8:19 AM)
9/02/05 1745 (15 min) Max RH, Max Temp, Min RH, Min Temp, PAR
9/02/05 1900 (15 min) Air Temp, Max Temp, Min Temp, RH, Max RH, Min RH
9/02/05 1900 (60 min) Air Temp, Max Temp, Min Temp, RH, Max RH, Min RH
9/02/05 2400 (144 min) Air Temp, Max Temp, Min Temp, RH, Max RH, Min RH
9/05/05 1345 (15 min) Min Temp, Min RH
9/05/05 1400 (60 min) Min Temp, Min RH
9/05/05 2400 (144 min) Min Temp, Min RH

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.

02/22/05 (1430) to 02/22/05 (1545). This was due to work being done at the weather station including erasing an existing program and installing new updated programs as well as recalibrating the rain gauge).

On 6/28/05 at (08:45). This particular 15 minute reading was lost, possibly due to the reading being taken during the same time data was being downloaded from the station (during a field visit).

On 8/9/2005 at (09:00). This particular 15 minute reading was lost, possibly due to the reading being taken during the same time data was being downloaded from the station (during a field visit).

09/02/05 (1800) to 09/02/05 (1845). This was during a time when maintenance was done on the weather station causing loss of those records.

11/14/05 (1115) to 11/28/05 (1100). There were problems resulting from the installation of a new satellite transmitter and data recorded during this time period was overwritten (and subsequently lost). There is still a possibility this data could be retrieved from the HADS system.

12/08/05 (1600) to 12/19/05 (1000). There were problems resulting from the installation of a new satellite transmitter and data recorded during this time period was overwritten (and subsequently lost). There is still a possibility this data could be retrieved from the HADS system.

14) Other Remarks/notes

On 10/16/2023 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.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.

During the revisit of the precipitation data mentioned above, it was noted in the 2004 metadata comments that all precipitation data had been deleted from August 2004 through the end of the year due to a malfunctioning rain gauge. There was no mention of repairs to the rain gauge in the 2005 metadata and only zeros were recorded until shortly after the sensor was calibrated on 02/22/2005. Zero precipitation values that had been included in the dataset 01/01/2005 00:00 – 02/22/2005 14:15 were determined to actually be missing data and were removed.

As part of the NERRs Telemetry Pilot Program a Campbell Scientific TX312 Satellite transmitter was installed in November of 2005. At that time the SM4M Storage Module was removed because it was believed it would interfere with the transmitter. Therefore, there are some small gaps in the data around this time. The storage module has since been reinstalled.