**Old Woman Creek (OWC) NERR Meteorological Metadata**

January- December 2005

Latest Update: **October 17, 2023**

I. DATA SET AND RESEARCH DESCRIPTORS

1. Principal investigator and Contact Person

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1. Entry Verification
   1. Data Input Procedures:

The 15 minute data, 1 hour average data, and the 24 hour data are downloaded from each instrument at the weather station to a Campbell Scientific CR10X datalogger (the CDMO Data Logger Program was loaded into the CR10X and controls the sensors and data collection schedule (See Part B of this section for the data collection schedule). The CR10X is then interfaced with the Loggernet software supplied by Campbell Scientific. The data are collected in a storage module and retrieved monthly and then downloaded into a computer containing the Loggernet software. The data are also saved as a monthly raw data file (month01.dat) onto a CD read/write disc drive. Files are exported from 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 pre-processed file is then 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.

Anomalous or suspect data which is highlighted by the EQW in program are noted in the metadata (Section 11). These data are also manually checked in the dataset.

* 1. Data Collection Schedules

The Campbell Scientific weather station samples every 5 seconds continuously throughout the sampling period. These data are used by the CR10X to produce 15 minute averages, maximums 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, wind speed, and direction. Total amounts of rainfall and PAR are also collected every 15 minutes (array 15), hourly (array 60), and daily (array 144).

* 1. Error/Anomalous Data Criteria

**Air Temperature**:

- 15-minute average not greater than maximum for the day

- 15-minute average not less than minimum for the day

- Sample not greater than 50 degrees Celsius (C)

- Sample not less than –40 degrees Celsius (C)

**Relative Humidity**:

- Sample not greater than 100 percent humidity (%)

* Sample not less than 0 percent humidity (%)

## Barometric Pressure

* Sample not greater than 1060 millibars (mb)
* Sample not less than 900 millibars (mb)

**Wind Speed**:

- Wind speed not greater than 30 meters per second (m/s)

- Wind speed less than 0.5 m/s for 12 hours consecutively

**Wind Direction**:

- Wind direction not greater than 3600

* Wind direction not less than 00

**Precipitation**:

- Precipitation not greater than 5 cm in 15-minute period

**Photosynthetic Active Radiation (PAR)**

* Sample not greater than 5000 millimoles per meter squared (mmol/m2)
* Sample not less than 0 millimoles per meter squared (mmol/m2)

**Time**:

- 15-minute interval recorded

**For all data**:

- Duplicate interval data

1. Research Objectives

The objective of this work is to record weather data over a long time period for Old Woman Creek to look at long term trends and seasonal variability in weather conditions. An added function is to provide the weather data so that researchers can examine the impact of changing weather conditions on the ecology of the estuary. Since this estuary is a storm driven system and the source of water in the estuary is a function of both storm activity in the watershed and on the lake proper, weather information is critical when studying the estuary.

1. Research Methods (Campbell Weather Station)

The Campbell weather station samples every 5 seconds to produce both hourly and daily averages of air temperature, relative humidity, barometric pressure, rainfall, wind speed and direction, and PAR. The data is stored onsite in a SM4M storage module. The modules are swapped at monthly intervals and the data is then downloaded into a computer for processing. (see data input section 2). When the storage module is changed, usually once a month, the sensors on the weather station are inspected for damage and cleaned, if necessary. All sensors except the rainfall collector are sent to Campbell Scientific for recalibration at least every two years. When the storage module is changed, a handheld Kestrel 4000 is run to provide a general check of the sensors.

1. Site Location and Character

The Old Woman Creek State Nature Preserve and National Estuarine Research Reserve are located on the southern shore of Lake Erie east of the City of Huron, Ohio. The reserve lies within the Lake Erie Biogeographic Region. Old Woman Creek drains a primarily row-crop agricultural watershed, with corn, soybeans, and winter wheat being the most important crops. The weather station is located within the boundaries of the reserve, due east of the parking lot at the Ohio Center for Coastal Research in a field that is maintained in early succession. This ensures that there is no tall vegetation that will interfere with the weather station. The tower is located within a fenced (6 foot chain link fencing) enclosure about 5 meters square. The enclosure has a gravel base. The coordinates of the station are 410 22’40” N and 820 30’ 29”W. The site is approximately 180 meters above sea level. Wind speed and wind direction sensors are atop a 10 meter tower, while the PAR sensor is located off of the south-west edge of the tower at approximately 3 meters in height following the descriptions outlined in the CDMO Manual V 4.0. The tipping rain gauge is located about 3 meters southeast of the tower. The sensors are wired to the CR10X following the protocol in the CDMO Manual. The weather station is within 1 mile of three of the four water quality stations (sites WM, OL, SU) and is within 3 miles of the last station, site BR.

1. Data Collection Period

Weather data was collected from 1 January though the end of December, 2005.

1. Distribution

NOAA/ERD retains the right to analyze, synthesize, and publish summaries of the NERRS System-wide Monitoring Program data. The OWC Research Coordinator (RC) retains the right to be fully credited for having collected and processed the data. Following academic courtesy standard, the RC and the 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.

The data set enclosed within this package/transmission is only as good as the quality assurance and quality control procedures outlined in the enclosed metadata reporting statement. The user bears all responsibility for its subsequent use/misuse in any further analyses or comparisons. The Federal government and the State of Ohio do not assume liability to the Recipient or third persons, nor will the Federal government or the State of Ohio reimburse or indemnify the Recipient for its liability due to any losses resulting in any way from the use of this data.

NERR water quality 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 general information link on CDMO homepage) an online at the CDMO homepage http://cdmo.baruch.sc.edu/. Data are available in text tab-delimited format.

1. Associated Research and Monitoring Project

The four SWMP data loggers are located within 1 and ½ kilometers of this weather station. The two sites were established to determine the role of the estuary in mitigating storm flow though the system and the impact of Lake Erie on the estuary. Samples for nutrient analysis are also collected at these sites when the data loggers are swapped out.

1. Sensor specifications, operating range, accuracy, date of last calibration

Parameter: PAR (Photosynthetic Active Radiation)

Units: mmoles m-2 (total flux)

Sensor type: High stability silicon photovoltaic detector (blue enhanced)

Model LiCor Quantum Sensor#LI190SB

Light spectrum waveband: 400 to 700 nm

Temperature dependence: 0.15% per 0C maximum

Stability: <+2% change over 1 year

Operating Temperature: -400 to +650 C

Sensitivity: typically 5 microA per 1000 micromoles/second/meter2

Light Spectrum Wavelength: 400 to 700 nm

Date of Last Calibration: 16 October, 2002

Parameter: Wind speed

Units: meters per second (ms-1)

Sensor type: 12 cm diameter cup wheel assembly, 40 mm diameter hemispherical cups

Model RM Young Wind Sentry #03001

Range: 0-50 m/s; gust survival 60 m/s

Accuracy: + 0.5ms-1

Date of Last Calibration: 28 February, 2003

From 4 April, 2005 onward

Sensor type: 18 cm diameter 4-blade helicoids propeller molded of polypropylene

Model: R.M. Young Model #05103 Wind Monitor

Range: 0-60 m/s (130 mph); gust survival 100 m/s (220 mph)

Accuracy: + 2%

Date of last calibration: 22 December 2004

Parameter: Wind direction

Units: degrees

Sensor type: balanced vane, 16 cm turning radius

Model RM Young Wind Sentry #03001

Range: 3600 mechanical, 3550 electrical (50 open)

Accuracy: + 5%

Date of Last Calibration: 28 February, 2003

From 4 April, 2005 onward

Sensor type: balanced vane, 38 cm turning radius

Model: R.M. Young Model #05103 Wind Monitor

Range: 3600 mechanical, 3550 electrical (50 open)

Accuracy: + 5%

Date of last calibration: 22 December, 2004

Parameter: Temperature

Units: degrees Celsius

Sensor type: Platinum resistance temperature detector (PRT)

Model: Vaisala HMP45C Temperature and Relative Humidity Probe

Operating Temperature: -400C to +600C

Accuracy: + 0.20C at 200C

Date of Last Calibration: 4 February, 2004; from 4 April, 2005 onward: 14 September, 2004

Parameter: Relative Humidity

Units Percent

Sensor type: Vaisala HUMICAP© capacitive relative humidity sensor

Model: Vaisala HMP45C Temperature and Relative Humidity Probe

Range: 0-100% non-condensing

Accuracy: +/- 2% RH (0-90%) and +/- 3% RH (90-100%)

Temperature dependence of RH measurement: + 0.05% RH/0C

Date of Last Calibration: 4 February, 2004; from 4 April, 2005 onward: 14 September, 2004

Parameter: Barometric Pressure

Units: millibars (mb)

Sensor type Vaisala Barocap© silicon capacitive pressure sensor

Model #Vaisala PTB 101B (Campbell Scientific #CS-105

Operating Range: Pressure 600-1060 mb

Temperature Range: -400 to + 600C

Humidity: non-condensing

Accuracy: + 0.5mb at 200C; + 2mb at 00C to 400C; + 4mb at –200C to 450C; + 6mb at –400C to 600C

Stability: + 0.1 mb per year

Date of Last Calibration: 4 February, 2004

Parameter: Precipitation (heated rain gauge)

Units: millimeters (mm)

Sensor Tipping Bucket Rain Gauge

Model#: Met One Model 385Heated Rain Gauge

Sensitivity: 0.2mm

Accuracy: +1% at 25 to 76 mm per hour at 210C

Date of Last Calibration: Checked and calibrated on 6 May, 2004; recalibrated 6 August, 2005

Storage Module

Model #: SM4M

Storage capacity: 2 million low-resolution data values

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

Processor: Hitachi H8S

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

Operating range : temperature: -350C to +650C

Baud rates: 9600, 76800

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

Power requirements: 5 + 0.3 VDC at 100 mA

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

Coded variable indicator and variable code definitions: owcowmet is the code given to the weather station site, OWC=Old Woman Creek, OW=Old Woman Sampling Station, MET=Meteorological Data Set. Data files from this station will be coded with this 8 letter code followed by the dates of the data in the particular file.

1. Data Anomalies/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](http://www.nerrsdata.org/get/landing.cfm) throughout the fall of 2022.

Note: the negative numbers sometimes reported in the PAR data is within the error of the sensor and should be considered as zero

**January 2005:**  weather readings running about 1 hour slow

**February 2005:** weather readings running about 1 hour slow

**Wind speed during the period Feb 10-Feb 12 may be questionable due to freezing of the sensor, as during this period there was a small amount of precipitation and temperatures were below freezing**

**March 2005:** weather readings running about 1 hour slow

**April 2005:** weather readings before 4/14/2005 (09:45:00) running about 1 hour slow

**May 2005:**

**June 2005:**

**July 2005:**

**August 2005:**

**September 2005:**

**October 2005:** rain gauge did not record rainfall from 8 October, 2005 through the end of the month

**November 2005:** rain gauge did not record rainfall during the month

**December 2005**: rain gauge did not record rainfall during the month

**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](http://www.nerrsdata.org/get/landing.cfm) throughout the fall of 2022.

**January 2005**:

**February 2005**:

**March 2005**:

**April 2005**: On 4/14/2005 both 15 minute and 60 minute data deleted at 11:00:000 24 hour data for 4/4/2005 also deleted.

**May 2005**:

**June 2005**:

**July 2005**:

**August 2005**:

**September 2005**:

**October 2005**:

**November 2005**:

**December 2005**:

**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](http://www.nerrsdata.org/get/landing.cfm) throughout the fall of 2022.

**January 2005**:

**February 2005**:

**March 2005**:

**April 2005**: All data on 4/14/2005 (10:00:00-through 10:45:00) is missing due to servicing the weather station

**May 2005**:

**June 2005**:

**July 2005**: All data on 07/01/2005 (10:15:00) is missing due to servicing the weather station

**August 2005**:

**September 2005**:

**October 2005**:

**November 2005**:

**December 2005**:

1. **Other remarks:**

**On 10/17/2023 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](http://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](http://www.nerrsdata.org/get/landing.cfm) throughout early 2023.