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

**January – September 2021**

**Latest Update:** 11/28/2023

**I. Data Set and Research Descriptors**

1. **Principal investigator(s) and contact persons –**

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**2) Entry verification –**

Data are uploaded from the CR1000X data logger to a personal computer with a Windows 7 or newer operating system. (Microsoft Windows 10). Files are exported from LoggerNet in a comma-delimited format and uploaded to the CDMO where they undergo automated primary QAQC and become part of the CDMO’s online provisional database. During primary QAQC, data are flagged if they are missing or out of sensor range. The edited file is then returned to the Reserve where it is opened in Microsoft Excel and processed using the CDMO’s NERRQAQC Excel macro. The macro inserts station codes, creates metadata worksheets for flagged data and summary statistics, and graphs the data for review. It allows the user to apply QAQC flags and codes to the data, append files, and export the resulting data file to the CDMO for tertiary QAQC and assimilation into the CDMO’s authoritative online database. For more information on QAQC flags and QAQC codes, see Sections 11 and 12.

Sebastian Mejia is responsible for data management.

**3) Research objectives –**

The objective of this work is to record weather data over a long period of time for Old Woman Creek to capture long-term trends and seasonal variability in weather conditions. Weather conditions can be related to long-term trends and seasonal variability in estuary water quality. 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. Weather information is critical when studying the estuary because the 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.

**4) Research methods –**

Campbell Scientific data telemetry equipment (TX-325 transmitter) was installed at the Old Woman Creek station on 05/25/2021, which transmits data to the NOAA GOES satellite, NESDIS ID #3B017310. The transmissions are scheduled hourly at 0:00:00 and contain four (4) data sets reflecting fifteen-minute data sampling intervals. The time zone for Local Standard Time is Eastern Standard Time. Upon receipt by the CDMO, the data undergo the same automated primary QAQC process detailed in Section 2 above. The “real-time” telemetry data become part of the provisional dataset until undergoing secondary and tertiary QAQC and assimilation in the CDMO’s authoritative online database. Provisional and authoritative data are available at https://cdmo.baruch.sc.edu.

The Wind Sentry, temperature and relative humidity sensor, barometric pressure sensor and the PAR sensor are located on a 10-meter tower following the descriptions outlined in the CDMO Manual V 4.0. The tipping bucket rain gauge is located about 2-3 meters southeast of the tower. The sensors are wired to the CR1000X following the protocol in the CDMO Manual. Old Woman Creek is 604 feet above sea level and the barometric pressure offset value is 522.

Data collection information:

The 15-minute Data are collected in the following formats for the **CR1000X**:

Averages from 5-second data:

Air Temperature (°C), Relative Humidity (%), Barometric Pressure (mb), Wind Speed (m/s), Wind Direction (degrees), Battery Voltage (volts)

Maximum and Minimum Air Temperature (°C) and their times from 5-second data (these data are available from the Reserve)

Maximum Wind Speed (m/s) and time from 5-second data

Wind Direction Standard Deviation (degrees)

Totals:

Precipitation (mm), PAR (millimoles/m2), and Cumulative Precipitation (mm) (Cumulative precipitation is no longer available via export from the CDMO. Please contact the Reserve or the CDMO for more information or to obtain these data.)

Calibration information:

Once a month, the sensors on the weather station are inspected for damage and cleaned, if necessary.

Calibration frequency is as follows:

- Temperature/Humidity- yearly recalibration

- Rain Gauge- yearly recalibration

- Wind Speed/Direction- every 2 years

- Barometric Pressure- every 2 years recalibration

- PAR- every 2 years recalibration

- CR1000X-every 5 years (required beginning 2014)

Data quality checks:

Ongoing checks of data quality include comparing data from nearby weather stations with OWC weather data approximately weekly. Precipitation data are also compared to data collected by a manual (OH-ER-49) and digital gauge on site and other local rain gauge monitors (OH-ER-11, OH-ER-18) through [CoCoRaHs](https://www.cocorahs.org/ViewData/StationPrecipSummary.aspx). When the data are downloaded monthly, a handheld Kestrel 5000 is used to provide a general check of the sensors.

**5) Site location and character –**

The Old Woman Creek State Nature Preserve and National Estuarine Research Reserve is 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 predominant crops. The weather station is located within the boundaries of the reserve, due east of the parking lot at the Michael Dewine Center for Coastal Research in a field that is maintained in early succession. This ensures that no tall vegetation will interfere with the weather station. The tower is located within an approximately 5-m square fenced (6-foot chain link fencing) enclosure with a gravel base. The coordinates of the station are 41˚ 22’40” N and 82˚ 30’ 29”W. 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. The temperature/ RH sensor is located off the north-east edge of the tower at approximately 2.3 meters in height. The barometric pressure sensor is located within the instrument box on the tower at approximately 2 meters in height. The sensor is vented to the outside through a hole in the bottom of the instrument box. The heated tipping rain gauge is located about 2-3 meters southeast of the tower on a platform about 1 meter above the ground. The weather station is located within 1 kilometer of three of the SWMP water quality data logger sites (WM, OL, and DR) and within 5 kilometers of the fourth water quality data logger site (BR). The site is 604 feet above sea level.

SWMP Station Timeline

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Station Code | SWMP Status | Station Name | Location | Active Dates | Reason Decommissioned | Notes |
| OW | P | Old Woman Creek | 41˚ 22’40” N  82˚ 30’ 29”W | 2002- present | NA | NA |

**6) Data collection period –**

Weather data were collected starting 02 December 2020 through 03 January 2022; reported data begin 1 January (00:00 EST) 2021 and end 31 December (23:45 EST) 2021.

|  |  |  |
| --- | --- | --- |
| File Start Date and Time | File End Date and time | Upload Date |
| \*12/02/2020 14:45 | 01/04/2021 11:45 | 01/04/2021 |
| \*01/04/2021 12:00 | 02/01/2021 17:15 | 02/08/2021 |
| \*02/01/2021 17:30 | 03/01/2021 13:00 | 03/02/2021 |
| \*03/01/2021 13:15 | 03/06/2021 08:45 | 04/01/2021 |
| 06/01/2021 12:30 | 07/01/2021 09:30 | 07/01/2021 |
| 07/01/2021 09:45 | 08/02/2021 10:15 | 08/02/2021 |
| 08/02/2021 10:30 | 09/01/2021 13:30 | 09/13/2021 |
| 08/06/2021 15:15 | 09/01/2021 13:00 | 09/13/2021 |
| 09/01/2021 13:15 | 10/01/2021 13:30 | 10/04/2021 |
| 10/01/2021 13:15 | 11/02/2021 09:00 | 11/05/2021 |
| 11/02/2021 09:15 | 11/30/2021 13:30 | 11/30/2021 |
| 11/30/2021 13:45 | 01/03/2022 13:30 | 01/05/2022 |

\* Intermittent gaps of missing data due to CR1000 and TX312 malfunctioning.

**7) Distribution –**

NOAA retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data.  The OWC Research Coordinator (RC) and the NERRS retain the right to be fully credited for having collected and processed the data.  Following academic courtesy standards, the RC or Manager at the NERR site where the data were collected should 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 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 and the State of Ohio do not assume liability to the Recipient or third persons, nor will the Federal government or 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.

Requested citation format:

NOAA National Estuarine Research Reserve System (NERRS). System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: <http://www.nerrsdata.org/>; *accessed* 12 October 2021.

NERR meteorological data and metadata can be obtained from the Research Coordinator at the individual NERR site (please see 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 [www.nerrsdata.org](http://www.nerrsdata.org).  Data are available in comma delimited format.

**8) Associated researchers and projects –**

As part of the SWMP long-term monitoring program, OWC NERR also collects 15-minute water quality data along with monthly grab samples and diel sampling for nutrient data at four stations within the estuary. 15-minute water level data are collected at the DR water quality station and adjacent to the WM water quality station. These data may be correlated with this meteorological dataset. Three of the four current SWMP water quality stations (WM, OL, DR) and one former station (SU) are located within 1 kilometer of this weather station; the fourth current station (BR) is located within 5 kilometers and has a USGS water gauge adjacent to it. The four sites were established to determine the role of the estuary in mitigating storm flow through the system and the impact of Lake Erie on the estuary. These data are available at [www.nerrsdata.org](http://www.nerrsdata.org). Periodic vegetation and habitat data and maps also exist and are available from the reserve.

**II. Physical Structure Descriptors**

**9) Sensor specifications –**

Parameter: Temperature

Sensor type: PT100 RTD, Class A, with calibrated signal conditioning

Model: EE181 Temperature and Relative Humidity Probe

Operating Temperature: -40°C to +60°C

Range: -40°C to +60°C

Accuracy: ±0.2°C at 23°C

Serial Number 20021600052164

Date of Last Calibration: 01/16/2020

Dates of Sensor Use: 06/25/2020 (10:45) – 05/25/2021 (13:45)

Serial Number 201816000716C

Date of Last Calibration: 05/06/2020

Dates of Sensor Use: 06/01/2021 (12:30) – Current as of 12/31/2021

Parameter: Relative Humidity

Units: Percent

Sensor type: HC101

Model #: EE181 Temperature and Relative Humidity Probe

Range: 0-100% non-condensing

Accuracy: –15 to 40 °C: ≤90% RH ± (1.3 + 0.003 • RH reading) % RH

–15 to 40 °C: >90% RH ± 2.3% RH

–25 to 60 °C: ± (1.4 + 0.01 • RH reading) % RH

–40 to 60 °C: ± (1.5 + 0.015 • RH reading) % RH

Temperature dependence of RH measurement: typically, 0.03% RH/°C

***Note:*** This sensor caps relative humidity values at 100%, measured values >100% are altered to 100%

Serial Number 20021600052164

Date of Last Calibration: 01/16/2020

Dates of Sensor Use: 06/25/2020 (10:45) – 05/25/2021 (13:45)

Serial Number 201816000716C

Date of Last Calibration: 05/06/2020

Dates of Sensor Use: 06/01/2021 (12:30) – Current as of 12/31/2021

Parameter: Barometric Pressure

Units: millibars (mb)

Sensor type Vaisala Barocap© silicon capacitive pressure sensor

Model # Vaisala PTB110 Barometer (PTB110 1B0CA)

Operating Range: Pressure: 500 to 1100 mb; Temperature: -40°C to +60°C;

Humidity: non-condensing

Accuracy: + 0.3 mb at 20°C; + 0.6mb at 0°C to 40°C; + 1mb at –20°C to 45°C; + 1.5mb at –40°C to 60°C

Stability: + 0.1 mb per year

Serial Number J2060017

Date of Last Calibration: 08/21/2020

Dates of Sensor Use: 06/01/2021 (12:30) – Current as of 12/31/2021

Serial Number G4870077

Date of Last Calibration: 05/29/2019

Dates of Sensor Use: 07/01/2019 (16:15) – 05/25/2021(13:45)

Parameter: Wind speed

Units: meters per second (m/s)

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 (134 mph); gust survival 100 m/s (220 mph)

Accuracy: +/- 0.3 m/s

Serial Number WM75736

Date of last calibration: 06/25/2020 (serviced nose cone installed)

Dates of sensor use: 11/02/2006 – current as of 12/31/2021

Parameter: Wind direction

Units: degrees

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%

Serial Number WM75736

Date of last calibration: 06/25/2020 (serviced nose cone installed)

Dates of sensor use: 11/02/2006 – current as of 12/31/2021

Parameter: PAR (Photosynthetically Active Radiation)

Units: mmoles m-2 (total flux)

Sensor type: anodized aluminum with cast acrylic diffuser

Model #SQ110 Apogee Quantum Sensor

Light spectrum waveband: 410 to 655 nm

Temperature dependence: 0.06+/-0.06% per °C

Stability: <±2% change over 1 yr

Operating Temperature: -40°C to 70°C; Humidity 0 to 100%

Cosine Response: 45° zenith angle: +/- 2%; 75° zenith angle: +/- 5%

Sensitivity: 0.2mV per µmol s-1 m-2

Multiplier: 0.025

Serial Number: 20021600052164

Date of Last Calibration:05/25/2021

Dates of Sensor Use: 06/01/2021 (12:30) – Current as of 12/31/2021

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 ˚C maximum

Stability: <+2% change over 1 year

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

Sensitivity: typically, 5 µA per 1000 µmoles s-1 m-2

Serial Number Q49472 (Retired)

Multipliers: 1.1997

Date of Last Calibration: 03/10/2016

Dates of Sensor Use: 09/13/2017 (16:15) – 11/26/2019 (11:45)

Serial Number Q46576 (Retired)

Multipliers: 1.7996

Date of Last Calibration: 12/13/2017

Dates of Sensor Use: 11/26/2019 (12:15) – 05/25/2021 (13:45)

Parameter: Precipitation (heated rain gauge – not functioning)

Units: millimeters (mm)

Sensor Tipping Bucket Rain Gauge

Model: Met One Model 385Heated Rain Gauge

Sensitivity: 0.2mm

Rainfall per tip: 0.01 inch

Operating range: Temperature: -20° to 50°C; Humidity: 0 to 100%

Accuracy: + 0.5% < 0.5 in./hr rate; + 2.0% < 3 in./hr rate

Serial Number: A11740

Date of Last Calibration: 10/01/2021

Date of Sensor Use: 10/01/2021 – current as of 12/31/2021

Serial Number: A1415 (was misidentified as F5714 since at least 2013)

Date of Last Calibration: 01/15/2020

Dates of Sensor Use: pre 04/01/2007 – 10/01/2021

CR1000:

The CR1000 has 2 MB of Flash EEPROM that is used to store the Operating System. Another 128 K Flash is used to store configuration settings. A minimum of 2 MB SRAM is (4 MB optional upgrade) available for program storage (16K), operating system use, and data storage. Additional storage is available by using a compact flash card in the optional CFM100 Compact Flash Module.

CR1000 Serial Number 58337 (mislabeled as 57851 from 2013 – 2017), (Retired)

Date installed: 09/05/2013

Date calibrated: 08/22/2013

Date removed: 09/12/2018 14:45

CR1000 Serial Number 72109 (Retired)

Date installed: 09/12/2018 15:45

Date calibrated: 07/23/2018

Date removed: 10/18/2018 15:15

CR1000 Serial Number 58337 (Retired)

Date installed: 10/19/2018 08:30

Date calibrated: 09/28/2018

Date Removed: 05/25/2021

CR1000 Firmware Version (s): OS 26, updated when purchased but went back to OS26 on 11/28/2018; OS 32.05 as of 06/25/2020

CR1000 Program Version(s):

12/18/2017 (16:30) – 12/02/2019 (13:15): owcowmet\_5.5\_091317\_2.CR1

12/02/2019 (14:00) – 06/25/2020 (08:30): owcowmet\_5.5\_120219.CR1 (updated with new PAR multiplier)

06/25/2020 (10:45) – 11/09/2020 (10:15): owcowmet\_6.1.2\_062520.CR1

11/09/2020 (14:00) – 05/25/2021 13:30: owcowmet\_6.1.2\_062520.110920.CR1

CR1000X:

The CR1000X has a total onboard memory of 128 MB of flash and 4MB of battery backed SRAM. There is 8 MB of flash memory reserved for loading the operating system and 1MB of flash reserved for configuration settings. SRAM is used for the CRBasic program operating memory, communication memory, and data storage, with 72 MB of flash for extended data storage. Additional data storage expansion is available with a removable microSD flash memory card of up to 16 GB.

CR1000X Serial Number 23354

Date installed: 05/25/2021

Date Calibrated: 05/01/2021

Date Removed: Current as of present

CR1000X Firmware Version(s): 5.01, updated 06/01/2021

CR1000X Program Version(s):

05/25/2021 (13:45) – 08/05/2021 (07:30) OWCOCMET\_Cr1000x\_052521\_6.0.1.CR1X

Never deployed: OWCOCMET\_Cr1000x\_080421\_6.0.2.CR1X

Never deployed: OWCOCMET\_Cr1000x\_080421\_6.0.3.CR1X

08/06/2021 (08:45 – 08/06/2021 (15:00): OWCOCMET\_Cr1000x\_080421\_6.0.4.CR1X

08/06/2021 (15:15) – Current as of 12/31/2021: OWCOCMET\_CR1000x\_080621\_6.0.5.CR1X

GOES Transmitter:

Model Number: TX325

Serial Number: 300001673

Date Installed: 05/25/2021

**10) Coded variable definitions -**

Sampling station: Sampling site code: Station code:

Old Woman Creek OW owcowmet

**11) QAQC flag definitions –**

QAQC flags provide documentation of the data and are applied to individual data points by insertion into the parameter’s associated flag column (header preceded by an F\_). During primary automated QAQC (performed by the CDMO), -5, -4, and -2 flags are applied automatically to indicate data that are above or below sensor range, or missing. All remaining data are then flagged 0, as passing initial QAQC checks. During secondary and tertiary QAQC 1, -3, and 5 flags may be used to note data as suspect, rejected due to QAQC, or corrected.

-5 Outside High Sensor Range

-4 Outside Low Sensor Range

-3 Data Rejected due to QAQC

-2 Missing Data

-1 Optional SWMP supported parameter

0 Passed Initial QAQC Checks

1 Suspect Data

2 *Open - reserved for later flag*

3 *Open - reserved for later flag*

4 Historical Data: Pre-Auto QAQC

5 Corrected Data

**12) QAQC code definitions** –

QAQC codes are used in conjunction with QAQC flags to provide further documentation of the data and are also applied by insertion into the associated flag column. There are three (3) different code categories, general, sensor, and comment. General errors document general problems with the CR1000/CR1000X, sensor errors are sensor specific, and comment codes are used to further document conditions or a problem with the data. Only one general or sensor error and one comment code can be applied to a particular data point, but some comment codes (marked with an \* below) can be applied to the entire record in the F\_Record column.

General Errors

GIM Instrument malfunction

GIT Instrument recording error, recovered telemetry data

GMC No instrument deployed due to maintenance/calibration

GMT Instrument maintenance

GPD Power down

GPF Power failure / Low battery

GPR Program reload

GQR Data rejected due to QA/QC checks

GSM See metadata

Sensor Errors

SDG Suspect due to sensor diagnostics

SIC Incorrect calibration constant, multiplier or offset

SIW Incorrect wiring

SMT Sensor maintenance

SNV Negative value

SOC Out of calibration

SQR Data rejected due to QAQC checks

SSD Sensor drift

SSN Not a number / unknown value

SSM Sensor malfunction

SSR Sensor removed

Comments

CAF Acceptable calibration/accuracy error of sensor

CCU Cause unknown

CDF Data appear to fit conditions

CML Snow melt from previous snowfall event

CRE\* Significant rain event

CSM\* See metadata

CVT\* Possible vandalism/tampering

CWE\* Significant weather event

**13) Other remarks/notes** –

General

Data are missing due to equipment or associated specific sensors not being deployed, equipment failure, time of maintenance or calibration of equipment, or repair/replacement of a sampling station platform. Any NANs in the dataset stand for “not a number” and are the result of low power, disconnected wires, or out of range readings. If additional information on missing data is needed, contact the Research Coordinator at the reserve submitting the data.

Data recorded for all parameters (except for cumulative precipitation) at the midnight timestamp (00:00) are the 15-minute averages and totals for the 23:45-23:59 time period of the previous day. Cumulative precipitation data at the midnight timestamp (00:00) are the sum of raw (unrounded) precipitation data from 00:00 to 23:59 of the previous day. Summing each individual 15-minute total precipitation value from the same period will result in small differences from cumulative precipitation due to rounding. It is especially important to note how data at the midnight timestamp are recorded when using January 1st and December 31st data. **Note: Cumulative precipitation is no longer available via export from the CDMO. Please contact the Reserve or the CDMO for more information or to obtain these data.**

Data Loss and transmitter/logger problems:

Intermittent data losses occurred beginning in October 2020 and continuing into 2021, most likely due to a faulty TX312 transmitter and logger issues.

01/11/2021 11:00 – 01/19/2021 08:15

01/22/2021 12:00 – 01/26/2021 14:15

02/14/2021 04:00 – 02/17/2021 10:45

02/20/2021 06:00 – 02/22/2021 12:30

02/27/2021 07:00 – 03/01/2021 12:15

03/02/2021 06:00 – 03/03/2021 16:30

03/04/2021 10:00 – 03/05/2021 12:30

03/06/2021 09:00 – 06/01/2021 12:15

08/05/2021 07:45 – 08/06/2021 15:00

The F\_Record of affected timestamps with missing date, <-2> [GIM] in the parameter columns, was coded with {CSM}. The timestamps after the gaps in data were rejected, <-3> [GIM] (CSM). A new transmitter (TX321) was installed on 03/09/2021 10:45; however, data were still not transmitted, collected, or compiled. A new data logger, CR1000X, and TX-325 transmitter were installed on 05/25/2021, while the station was still not collecting or transmitting data. Air temperature/relative humidity, barometric pressure, and PAR sensors were exchanged during the maintenance on 05/25/2021. The station remained powered on but ceased to collect or transmit data until the new CR1000X began collecting data on 06/01/2021. All data on 06/01/2021 at the 12:30 timestamp were rejected due to a program upload and firmware update resulting an incomplete 15 minutes of 5-second data.

In addition, all wind and precipitation parameter values recorded from 06/01/2021 12:30 – 08/05/2021 07:30 and were rejected due to QAQC checks, <-3> [SQR] (CSM). The logger program that was uploaded after the installation of the CR1000X was missing tables, resulting in no data or inaccurate collection for those parameters. Following the program reload on 08/06/2021 15:15, wind values were again included in the dataset. Although the program was updated for the rain gauge, there were still problems with precipitation data collection. All precipitation data were rejected until the new rain gauge was installed on 10/01/2021 (see below under precipitation).

Telemetry data were used to replace missing records (precipitation data rejected) from 09/01/2021 13:15 – 10/01/2021 12:00, <5> [GIT](CSM). Due to a programing error 15 minute timestamps were reversed in the telemetry file (telemetry transmissions were sent in reverse order). The reversed records were corrected during the CDMO review process. Corrected data are considered suspect and both max wind speed time and cumulative precipitation are missing from the telemetry file. Data are missing 10/01/2021 12:15 – 12:30 for a station power down to swap the rain gauge and data are all rejected at 12:45 for a program reload. Data were recorded and collected for the remainder of the year without transmitter or logger issues.

Precipitation

Following the program upload on 06/25/2020 10:45, cumulative precipitation values were doubled due to a programming error. All cumulative precipitation values are rejected when precipitation values were >0.0 following the program upload and continuing until the 06/01/2021 12:30 program upload, <-3> (CSM). If cumulative data were recorded during maintenance, they were corrected back to 0.0 when no precipitation occurred. Cumulative precipitation data are not available for export, but are available from the reserve.

The CR1000X program uploaded on 06/01/2021 12:30 was missing the table for precipitation data collection and as a result, precipitation data were either not collected or were inaccurate until a new program was uploaded on 08/06/2021 15:15 (see above under data loss/logger problems). Precipitation data were rejected, <-3> [SQR](CSM) from the upload on 06/01/2021 through 08/05/2021 07:30 (08/05/2021 07:45 – 08/06/2021 15:00 records are missing). Although the new program was corrected to allow for precipitation data to be collected beginning 08/06/2021, there continued to be problems with the sensor. Values recorded are believed to be inaccurate and to have missed rain events from 08/06/2021 until a new MetOne rain gauge was installed on 10/01/2021. All precipitation values from 08/06/2021 15:30 – 10/01/2021 12:00 were rejected due to sensor malfunction.

A new Met One Instruments rain gauge was installed on 10/01/2021 12:15. Calibration check tips for both total and cumulative precipitation 10/01/2021 12:45 – 13:30 were corrected back 0.0, <5> [SMT] (CSM). During the rain gauge rewiring the power supply to the CR1000X was interrupted. Power was off at the station from 10/01/201 12:15 – 12:30, {CSM} <-2> [GPD]. All data at 12:45 were rejected due to an incomplete 15 minutes of 5-second data following the program upload,

<-3> [GPR] (CSM).

The tipping buckets on the rain gauge were accidentally tipped during monthly maintenance on the following dates and time: 02/01/2021 17:15 ice dislodged in bucket and funnel full of snow, data suspect and not accurate for rainfall but does represent snowmelt, <1>[SMT](CSM); 10/01/2021 12:45 - 13:30 (due to calibration check of new gauge). Total precipitation and cumulative precipitation were corrected and flagged <5>[SMT](CSM).

Snow events

Precipitation data collected with rain gauges that are not designed specifically for measuring frozen precipitation (snow/ice/hail), including heated gauges and those that use antifreeze to melt frozen precipitation, may not be measured accurately. Blowing wind, sublimation, and rate of snowfall/ice melt all affect the amount of recorded precipitation. The reserve has made attempts to accurately record dates and times when frozen precipitation and subsequent melting has occurred.

The electrical line that powers the heated precipitation gauge did not function until 10/01/2021 13:30. Precipitation data associated with snow events during these months are not likely to be accurate. Local [CoCoRaHs](https://www.cocorahs.org/ViewData/StationPrecipSummary.aspx) stations (OH-ER-18, OH-ER-11, **OH-ER-49**) were referenced for snowmelt. Snow occurred on the following dates and were coded as <0>(CSM) unless another coding took precedence:

|  |  |
| --- | --- |
| **Snowfall Date(s)\*** | **Notes\*** |
| **01/05/2021** | **Light snow** |
| **01/15/2021** | **Rain AM/Snow PM, data are missing** |
| **01/16-18/2021** | **Light snow, data are missing** |
| **01/26/2021** | **Freezing rain to rain/snow mix** |
| **01/28/2021** | **Snow flurries all day, no accumulation** |
| **1/31/2021** | **Snow (~4 cm) into overnight** |
| **2/6-9/2021** | **Snow, very cold temperatures** |
| **04/01/2021** | **Snow flurries all day (~1-2 cm), data are missing** |
| **04/20-21/2021** | **Snow PM into AM (~1 cm), data are missing** |

\*These dates reflect observed snowfall and snowmelt; however, users should be aware that snow loss due to sublimation may have occurred.

PAR

Small negative PAR values are within range of the sensor and are due to normal errors in the sensor and the CR1000 Datalogger. The Maximum signal noise error for the LI-COR sensor is +/- 2.214 mmoles/m2 over a 15-minute interval. These values are automatically flagged and coded as <1> (CAF).

Elevated nighttime PAR data are flagged as <1> CSM if values are > 0.1 and

< 2.214 mmoles/m2 and as <-3> CSM if values are >2.214 mmoles/m2.

Temperature/RH

Relative Humidity data greater than 100 are within range of the sensor accuracy of +/-3% and are flagged and coded as suspect, <1> (CAF). Values greater than 103 are rejected <-3>.

The sensor was unplugged during maintenance for closer inspection and reported NAN for air temperature. Both air temperature and relative humidity were rejected for maintenance. Timestamp 08/25/2021 14:30 was flagged and coded as

<-3>(SMT)(CSM).

Wind data

Birds of various sizes and weights (e.g., bluebird, hawk) will occasionally sit on the wind sensor. These data are not flagged or coded.

See above under Data Loss and transmitter/logger problems:

Wind data were not collected correctly following the upload of a logger program on 06/01/2021 that did not contain tables for wind and precipitation collection. All wind and precipitation values recorded from 06/01/2021 12:30 through 08/05/2021 07:30 were rejected due to QAQC checks, <-3>[SQR](CSM) (08/05/2021 07:45 – 08/06/2021 15:00 records are missing). The logger program that was uploaded after the installation of the CR1000X was missing tables, resulting in no data or inaccurate collection for those parameters. Following the program reload on 08/06/2021 15:15, wind values were again included in the dataset