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

**January – December 2022**

**Latest Update:** 07/09/2024

**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 via a RS-232 cable connected to a laptop (with a Windows 7 or newer operating system). 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.

Steven McMurray 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. Variation in weather that occurs throughout the watershed is captured by two weather stations, one located near the estuary mouth ("Old Woman"; owcowmet), and the other, a secondary SWMP site, near the Old Woman Creek headwaters (“Western Reserve”; owcwrmet). Weather conditions can be related to long-term trends and spatiotemporal 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) which transmits data to the NOAA GOES satellite, was installed at the owcowmet (NESDIS ID #3B017310) and owcwrmet (NESDIS ID #3B012DBE) stations on 05/25/2021, and 11/18/2022, respectively. Transmissions are scheduled hourly at 00:00:00 for the Old Woman site and at 00:05:30 after the hour for the Western Reserve site 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. **Secondary SWMP stations do not undergo tertiary review.** Provisional and authoritative data are available at <https://cdmo.baruch.sc.edu>.

At both the owcowmet and owcwrmet stations, the Wind Sentry, temperature and relative humidity sensor, barometric pressure sensor and the PAR sensor are located on a 10 m tower following the descriptions outlined in the CDMO Manual V 4.1. For both stations, sensors are wired to the CR1000X following the protocol in the CDMO Manual. At owcowmet, the heated tipping bucket rain gauge is located 3 m southeast of the tower. The tipping bucket rain gauge at owcwrmet is located 3 m east of the tower, but is not heated. Old Woman (OW) is 184 m above sea level, which makes the barometric pressure offset value for owcowmet equal to 522. The Western Reserve (WR) Local Schools campus is 270.3 m above sea level, which makes the barometric pressure offset value for owcwrmet equal to 532.

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 nose cone replacement

- Barometric Pressure- every 2 years recalibration

- PAR- every 2 years recalibration

- CR1000X- every 5 years

Data quality checks:

Ongoing checks of data quality include comparing data from nearby weather stations with owcowmet and owcwrmet 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. Long-term weather monitoring at the reserve began in 2002 with the construction of a weather station (owcowmet) near the Visitor Center and was expanded in 2022 with the construction of a second station (owcwrmet) near the southern extent of the Old Woman Creek watershed (Table 1).

The owcowmet weather station is located within the boundaries of the Reserve, 60 m due east of the Visitor Center 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 a 5 m square fenced (1.8 m tall fence) enclosure with a gravel base. The anemometer (wind speed and wind direction) is atop a 10 m tower, while the PAR sensor is located off the south-west edge of the tower at 3 m in height. The temperature/ relative humidity sensor is located off the north-east edge of the tower at 2.3 m in height. The barometric pressure sensor is located within the instrument box on the tower at 2 m 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 3 m southeast of the tower on a platform 1 m above the ground. The weather station is located within 1 km of three of the SWMP water quality data logger sites (WM, OL, and DR) and within 5 km of the fourth water quality data logger site (BR). The site is 184 m above sea level.

The owcwrmet weather station is located outside of the Reserve boundaries on the Western Reserve Local Schools District campus in Collins, Ohio. It is located 15.3 km south southeast of the OWC Visitor Center and is 1.5 km east of the southernmost extent of Old Woman Creek’s watershed boundary. The 10 m tall tower is adjacent to the district’s parking lot and is contained within a 10 m square fenced enclosure (1.8 m tall) with gravel base, ensuring that no vegetation will interfere with measurements made by the weather station. The air temperature/ relative humidity sensor is 1.75 m above the ground, the PAR sensor is 2.7 m above the ground, and the barometer is 0.75 m above the ground. The barometer is contained within the instrument box and is vented to the outside through a hole in the bottom of the box. The anemometer (wind speed and wind direction) is at the top of the tower, 10 m above the ground. The rain bucket is 3 m west of the tower and is 1.55 m above the ground. The weather station is SSE from the OWC Visitor Center and existing SWMP stations. Specifically, it is 12.5 km from BR (owcbrwq), 14.0 km from DR (owcdrwq), 15.3 km from the OW weather station (owcowmet), and 16.0 km from OL (owcolwq) and WM (owcwmwq). The owcwrmet station is 270.3 m above sea level.

**Table 1:** Location of meteorological stations that are part of the Old Woman Creek System-Wide Monitoring Program (SWMP). Station Code refers to seven-letter site notation used by the Centralized Data Management Office (CDMO) while Station Name is the short-hand name for each site.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Station Code** | **SWMP Status** | **Station Name** | **Location** | **Active Dates** | **Reason Decommissioned** | **Notes** |
| owcowmet | P | Old Woman | Latitude 41° 22’ 42” N, Longitude 82° 30’ 30” W | 2002 – current | NA | NA |
| owcwrmet | S | Western Reserve | Latitude 41° 14’ 48” N, Longitude 82° 27’ 12” W | 11/18/2022 13:15 – current | NA | NA |

**6) Data collection period –**

Reported weather data for owcowmet began 1 January (00:00 EST) 2022 and ended 31 December (23:45 EST) 2022 (Table 2). Reported weather data for owcwrmet began 18 November (13:15 EST) 2022 and ended 31 December (23:45 EST) 2022 (Table 2).

**Table 2:** File start and end dates for meteorological files uploaded to the Centralized Data Management Office (CDMO) for Old Woman (OW) and Western Reserve (WR) stations in 2022. Upload date refers to the day when each downloaded file was uploaded to the CDMO.

|  |  |  |  |
| --- | --- | --- | --- |
| **Site** | **File Start Date / Time** | **File End Date / Time** | **Upload Date** |
| OW | 11/30/2021 13:45 | 01/03/2022 13:30 | 01/03/2022 |
| OW | 01/03/2022 13:45 | 02/01/2022 09:45 | 02/01/2022 |
| OW | 02/01/2022 10:00 | 03/01/2022 13:15 | 03/07/2022 |
| OW | 03/01/2022 13:15 | 04/01/2022 12:30 | 04/06/2022 |
| OW | 04/01/2022 12:45 | 05/03/2022 08:15 | 07/13/2022 |
| OW | 05/03/2022 08:30 | 05/24/2022 09:15 | 05/26/2022 |
| OW | 05/24/2022 11:30 | 06/01/2022 13:15 | 06/01/2022 |
| OW | 06/01/2022 13:30 | 07/08/2022 11:00 | 07/13/2022 |
| OW | 07/08/2022 11:30 | 08/01/2022 12:00 | 08/01/2022 |
| OW | 08/01/2022 12:15 | 09/06/2022 11:45 | 09/07/2022 |
| OW | 09/06/2022 12:15 | 09/29/2022 13:30 | 09/29/2022 |
| OW | 09/29/2022 14:00 | 12/01/2022 11:30 | 12/01/2022 |
| OW | 12/01/2022 12:45 | 01/09/2023 09:00 | 01/13/2023 |
| WR | 11/18/22 13:15 | 12/01/2022 14:15 | 12/01/2022 |
| WR | 12/01/2022 14:30 | 01/09/2023 10:00 | 01/13/2023 |

**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 2022.

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 meteorological data. Three of the four current SWMP water quality stations (WM, OL, DR) and one former station (SU) are located within 1 km of owcowmet station, while the fourth water quality station (BR) is located within 5 km and is adjacent to a USGS water gauge. The owcwrmet station is located 1.5 km east of the southernmost extent of the Old Woman Creek watershed. It ranges from 12.5 km to the closest SWMP water quality station (BR), to 16.0 km to the SWMP water quality station that is furthest away (WM). The four water quality 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 201816000716C (owcowmet)

Date of Last Calibration: 05/06/2020

Dates of Sensor Use: 06/01/2021 (12:30) – 05/24/2022 (09:00)

Serial Number: 20021600052164 (owcowmet); 2218160019144B (owcwrmet)

Date of Last Calibration: 07/28/2021 (owcowmet); 5/10/2022 (owcwrmet)

Dates of Sensor Use: 05/24/2022 (09:15) – 03/20/2023 (14:30); (owcowmet); 11/18/2022 (13:15) – current as of 12/31/2022 (owcwrmet)

Serial Number 201816000716C (owcowmet)

Date of Last Calibration: 02/21/2023

Dates of Sensor Use: 03/20/2023 (14:45) – current as of 12/31/2022

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 201816000716C (owcowmet)

Date of Last Calibration: 05/06/2020

Dates of Sensor Use: 06/01/2021 (12:30) – 05/24/2022 (09:00)

Serial Number: 20021600052164 (owcowmet); 2218160019144B (owcwrmet)

Date of Last Calibration: 07/28/2021 (owcowmet); 5/10/2022 (owcwrmet)

Dates of Sensor Use: 05/24/2022 (09:15) – current as of 12/31/2022 (owcowmet); 11/18/2022 (13:15) – current as of 12/31/2022 (owcwrmet)

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 Range: -40° to + 60°C

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

Stability: + 0.1 mb per year

Serial Number J2060017 (owcowmet)

Date of Last Calibration: 08/21/2020

Dates of Sensor Use: 06/01/2021 (12:30) – 05/24/2022 (9:00)

Serial Number: G4870077 (owcowmet); U2331097 (owcwrmet)

Date of Last Calibration: 7/28/2021 (owcowmet); 6/8/2022 (owcwrmet)

Dates of Sensor Use: 5/24/2022 (09:15) – current as of 12/31/2022 (owcowmet); 11/18/2022 (13:15) – current as of 12/31/2022 (owcwrmet)

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 (owcowmet); WM186828 (owcwrmet)

Date of last calibration: 5/24/2022 (replaced nose cone; owcowmet); 09/01/2021 (owcwrmet)

Dates of sensor use: 11/02/2006 – current as of 12/31/2022 (owcowmet); 11/18/2022 – current as of 12/31/2022 (owcwrmet)

Parameter: Wind direction

Units: degrees

Sensor type: balanced vane, 38 cm turning radius

Model: R.M. Young Model 05103 Wind Monitor

Range: 360° mechanical, 355° electrical (5° open)

Accuracy: + 5%

Serial Number WM75736 (owcowmet); WM186828 (owcwrmet)

Date of last calibration: 5/24/2022 (replaced nose cone; owcowmet); 09/01/2021 (owcwrmet)

Dates of sensor use: 11/02/2006 – current as of 12/31/2022 (owcowmet); 11/18/2022 – current as of 12/31/2022 (owcwrmet)

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: 0.2 mV per µmol s-1 m-2

Multiplier: 0.025

Serial Number: 29533 (owcowmet)

Multipliers: 0.025

Date of Last Calibration: 09/03/2019

Dates of Sensor Use: 06/01/2021 (12:30) – 05/24/2022 (09:15)

Units: mmoles m-2 (total flux)

Sensor type: Quantum Sensor, High stability silicon photovoltaic detector (blue enhanced) in anodized aluminum case with acrylic diffuser

Model: #SQ-500-SS Apogee Full-Spectrum Quantum Sensors

Light spectrum waveband: 389 to 692 nm

Temperature dependence: –0.11 ± 0.04%/°C

Stability: <±2% change over 1 year

Operating Temperature: -40° to 70° C; Humidity 0 to 100%, Can be submerged up to 30m

Cosine Response: ±5% at 75° zenith angle

Sensitivity: 0.01 mV per µmoles m-2 s-1

Serial Number: 3942 (owcowmet); 4235 (owcwrmet)

Multipliers: 0.5

Date of Last Calibration: 05/11/2022 (owcowmet); 11/17/2022 (owcwrmet)

Dates of Sensor Use: 05/24/2022 (11:30) – current as of 12/31/2022 (owcowmet); 11/28/2022 (16:15) – current as of 12/31/2022 (owcwrmet)

Parameter: Precipitation

Units: millimeters (mm)

Sensor Type: Tipping bucket with electric heater (owcowmet)

Model: Met One Model 385 Heated Rain Gauge

Sensitivity: 0.2 mm

Rainfall per tip: 0.01 inch (0.254mm)

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: 9/29/2022

Date of Sensor Use: 10/01/2021 – current as of 12/31/2022

Sensor Type: Tipping bucket with magnetic reed switch (owcwrmet)

RainVUE 20 (not heated)

Rainfall per tip: 0.004 inch(0.1mm)

Operating Temperature Range: 1° to 70°C (liquid precipitation only); -40 to +70°C (including melting snow)

Accuracy: 1% at 0 to 19.7 in/hr (0 - 500mm/hr) intensity

Serial Number: 230709

Date of Last Calibration: new 2022, 02/16/2023

Date of Sensor Use: 11/18/2022 - not functional as of 12/31/2022

**Datalogger:**

**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.

**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.

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

Site: owcowmet

Date installed: 09/05/2013

Date calibrated: 08/22/2013

Date removed: 09/12/2018 14:45

CR1000 Serial Number 72109 (Retired)

Site: owcowmet

Date installed: 09/12/2018 15:45

Date calibrated: 07/23/2018

Date removed: 10/18/2018 15:15

CR1000 Serial Number 58337 (Retired)

Site: owcowmet

Date installed: 10/19/2018 08:30

Date calibrated: 09/28/2018

Date Removed: 05/25/2021

CR1000X Serial Number: 23354 (owcowmet); 43560 (owcwrmet)

Date installed: 5/25/2021 (owcowmet); 11/18/2022 (owcwrmet)

Date Calibrated: 12/16/2020 (owcowmet); 8/30/2022 (owcwrmet)

Date Removed: Current as of 12/31/2022

OW Data Loggers

CR1000 Firmware Version (s): OS 26

CR1000x Firmware Version(s):6.00 updated 07/08/2022, 6.01 updated 09/29/2022

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 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) – 05/23/2022: OWCOCMET\_CR1000x\_080621\_6.0.5.CR1X

05/23/2022 – 1/19/2023: OWCOCMET\_CR1000x\_052322\_6.0.6.CR1x

1/19/2023 – Current: OWCOCMET\_CR1000x\_011923\_6.0.6.CR1x

WR Data Loggers

CR1000x Firmware Version(s): 6.01 updated 11/18/2022

CR1000X Program Version(s):

11/18/2022 – 01/19/2023 (17:00): OWCWRMET\_CR1000x\_111622\_6.0.7.CR1x

01/19/2023 (17:00) – 06/22/2023: OWCWRMET\_CR1000x\_011923\_6.0.7.CR1x

06/22/2023 – current: OWCWRMET\_CR1000x\_061523\_6.0.8.CR1x

**GOES Transmitter OW:**

Model Number: TX325

Serial Number: 300001673

Date Installed: 05/25/2021

**GOES Transmitter WR:**

Model Number: TX325

Serial Number: 300002218

Date Installed: 11/18/2022

**10) Coded variable definitions -**

Sampling station: Sampling site code: Station code:

Old Woman OW owcowmet

Western Reserve WR owcwrmet

**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 or Monitoring 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**

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 effect the amount of recorded precipitation. The reserve has made attempts to accurately record dates and times when frozen precipitation and subsequent melting has occurred. A heated rain gauge is used at the OW site. The WR site did not have a working rain gauge for 2022.

Precipitation

Local [CoCoRaHs](https://www.cocorahs.org/ViewData/StationPrecipSummary.aspx) stations (OH-ER-18, OH-ER-11, OH-ER-49) were referenced for snowmelt and for accuracy checks.

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.

***Site specific events:***

Old Woman (OW)

Rain gauge tips on 01/03/2022 at 13:45 and 14:00 were corrected to 0.0. The tips occurred during maintenance to clear the rain gauge. Cumulative precipitation data were corrected until the end of the day.

Rain gauge tips on 05/24/2024 at 08:45 were corrected to 0.0. The tips occurred during maintenance. Cumulative precipitation data were corrected until the end of the day.

Missing data from 05/24/22 09:30–11:15 during station power down and sensor swap coded {CSM} <-2> [GPD]. Program reloaded and affected parameter timestamps coded {CSM} <-3> (GPR). Temperature/relative humidity, barometric pressure, PAR, and wind sensors were all swapped during the power down. BP sensor wired incorrectly, which affected the timestamps 05/24/22 11:45 –15:30 and was coded <-3>[SIW] (CSM) until fixed. Similarly, the PAR sensor was wired incorrectly, which affected the timestamps 05/24/22 11:45–05/26/22 09:45 and was coded <-3>[SIW] (CSM) until fixed.

Following the PAR sensor swap on 05/24/2022 negative nighttime PAR values started occurring. Those data are considered suspect, <1> (CSM).

Data are missing, {CSM} <-2> [GMT] on 07/08/2022 11:15 and rejected, {CSM} <-3>[GMT] at 11:30 due to a firmware update. The logger reset following the update resulting in missing 5-second data for the 15 minute averages and totals at 11:30.

During rain gauge monthly check on 9/6/2022, removal of the funnel led to the tipping of the bucket, which was nearly full. Affected timestamps for total at 12:15 and cumulative precipitation, at 12:15 and through the end of the day, were marked <1>[SMT] (CSM). There was measured rainfall, (0.3mm) earlier in the day and the water in the tipping bucket at 12:15 was most likely from that brief rain event.

The 09/06/2022 12:00 record was missing during data download; no other records were affected.

Rain gauge was calibrated on 9/29/2022, 12:45 –13:15 and data was corrected from 8.1 back to 0.0, <5> [SMT] (CSM)

09/29/2022 The logger was updated to OS 6.01 13:45 – 14:00, {CSM} <-2> [GMT] and {CSM} <-3> [GMT].

Data are missing due to a download error 12/01/2022 11:45 – 12:30. No other records were affected.

Western Reserve (WR)

**The CDMO does not authenticate the data from the Western Reserve station since it is a secondary site in the NERR SWMP. Only primary SWMP sites go through tertiary review by the CDMO.**

The WR weather station became operational starting 11/18/2022 at 13:15.

The PAR sensor on the station was not installed and operational until 11/28/2022 at 16:15; therefore, the timestamps 11/18/2022 13:15 – 11/28/2022 16:00 were marked <-3>[SSR](CSM).

The rain gage on the station was not operational throughout 2022; therefore, the timestamps 11/18/2022 13:15 – 12/31/2022 23:45 were marked <-3>[SSR](CSM).

Following the PAR installation on 11/28/2022 negative nighttime PAR values started occurring. Those data are considered suspect, <1> (CSM).