

**Weeks Bay National Estuarine Research Reserve (WKB NERRR) Meteorological Metadata**  
**Months and year the documentation covers: 01/2024 to 12/2024**  
**Latest Update: 08/29/2025**

**I. Data Set and Research Descriptors**

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

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**11300 Highway 98**  
**Fairhope, Al 36532**

**2) Entry verification –**

Data are uploaded from the CR1000X data logger to a personal computer 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. Scott Phipps is responsible for data management.

**3) Research objectives –**

The principle objective is to record long-term meteorological data for Weeks Bay in order to 1) observe any environmental changes or trends over time, 2) use as a reference for research projects at the reserve, and 3) give meteorological context to our fifteen minute SWMP water quality data.

**4) Research methods –**

Campbell Scientific data telemetry equipment was installed at the Weeks Bay Safe Harbor met station (wkbSHmet) on 07/31/2006 and transmits data to the NOAA GOES satellite, NESDIS ID **3B01A578**. The transmissions are scheduled hourly at 0:00:30 after the hour and contain four (4) data sets reflecting fifteen minute data sampling intervals. Upon receipt by the CDMO, the data undergoes 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 <http://cdmo.baruch.sc.edu>.

Data are collected for the entire year in Central Standard Time (CST).

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/m<sup>2</sup>), 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.)

Recommended calibration frequency for the MET station sensors:

- Temperature/Humidity- yearly recalibration
- Precipitation Gauge- yearly recalibration
- Wind Speed/Direction- yearly or every 2 years (depending on the sensor)
- Barometric Pressure- every 2 years recalibration
- PAR- every 2 years recalibration
- CR1000/CR1000X-every 5 years

## 5) Site location and character –

The Weeks Bay National Estuarine Research Reserve is located near the Gulf coast, southeast of the city of Fairhope, Alabama. Weeks Bay (30°23' N, 87°50' W) is a small, shallow, microtidal sub-estuary, located on the eastern shore of Mobile Bay in the northern Gulf of Mexico. The bay is nearly diamond shaped, and its longitudinal axis (3.4 km long) runs nearly north-south from the head, where the Fish River flows in, to the mouth, where water is exchanged with Mobile Bay. Its widest point (3.1 km) is located near the center of the estuary, where the Magnolia River discharges into eastern side of Weeks Bay. Average depth is 1.4 m, although there are two areas where depths are significantly greater. The first is in the mouth of the bay, where the average depth is 6 m; the second is about 100 m upstream of the mouth of the Fish River, where the average depth is 3.5 m. Tides are principally diurnal, and have a mean range of 0.4 m. The Fish River drainage basin encompasses 14300 hectares and contributes approximately 73% to the total incoming freshwater flow with the Magnolia River supplying the rest. Mean combined discharge is 9 cubic meters per second; although freshets up to 4 times larger occur throughout the year. These characteristics result in a freshwater residence time of 13 days under average discharge conditions, with a range from 0.5 to 100 days. Salinity in Weeks Bay varies substantially both temporally and spatially. During periods of high flow in the river, salinity in the bay may be fresh from the head to the mouth, except in the deeper holes of the estuary that are not as easily flushed. However, during periods of low flow in the river, wind velocity and tidal stage are strong factors influencing salinity structure. Salinity greater than 25 ppt is infrequently observed in Weeks Bay and is usually restricted to the southern portion of the estuary near the mouth. The weather station is located on a reserved owned property, near a restored marsh, about 700 meters from the west bank of Fish River (30°25'14.5"N 87°49'46.6"W) north of highway 98, on a property known to locals as "Safe Harbor". The wind sentry, temperature/RH sensor, and PAR sensor are mounted at the heights listed in the Station Measurements table below. The barometric pressure sensor, height listed below, is located in the datalogger mounting box. Tipping bucket rain gauge is located 6.5m south southwest from the tower.

#### Station measurements

| Tower and sensor heights      | Height ( <i>meters</i> ) | Notes                                                                 |
|-------------------------------|--------------------------|-----------------------------------------------------------------------|
| Tower                         | 6.1                      | Measurements were taken from the ground for the tower and all sensors |
| Temperature/Relative Humidity | 2.0                      |                                                                       |
| Barometric Pressure           | 1.7                      | In the enclosure mounted to the tower                                 |
| Wind                          | 5.3                      |                                                                       |
| PAR                           | 3.0                      |                                                                       |
| Precipitation gauge           | 0.6                      | 6.5m SSW from tower                                                   |

#### SWMP Station Timeline

| Station Code | SWMP Status | Station Name | Location                     | Active Dates               | Reason Decommissioned                | Notes |
|--------------|-------------|--------------|------------------------------|----------------------------|--------------------------------------|-------|
| SH           | P           | Safe Harbor  | 30°25'14.5"N<br>87°49'46.6"W | 01/02/2008 -<br>Present    | NA                                   | NA    |
| WB           |             | Weeks Bay    | 30° 24.89' N<br>87° 49.56' W | 01/01/2001 -<br>12/31/2007 | Construction of<br>buildings on site |       |

#### 6) Data collection period –

Weather data has been collected from January 2008 through December 2024 at the SH site. These metadata are applicable only to data collected from January 1, 2024 through December 31, 2024.

| File start date and time | File end date and time |
|--------------------------|------------------------|
| 12/21/2023 13:15         | 01/23/2024 09:45       |
| 01/23/2024 10:00         | 04/30/2024 14:00       |
| 04/30/2024 14:15         | 08/01/2024 12:45       |
| 08/01/2024 13:00         | 10/29/2024 08:15       |
| 10/29/2024 08:30         | 11/13/2024 14:30       |
| 11/13/2024 14:45         | 01/27/2025 09:30       |

#### 7) Distribution –

NOAA retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The NERRS retains the right to be fully credited for having collected and processed the data. Following academic courtesy standards, 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 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.

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 2024.

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, WKB NERR also collects 15-minute water quality data and monthly grab and diel samples for nutrient/pigment data which may be correlated with this meteorological dataset. These data are available at [www.nerrsdata.org](http://www.nerrsdata.org).

## II. Physical Structure Descriptors

### 9) Sensor specifications –

Parameter: Temperature

Units: Celsius

Sensor type: Pt1000 Class A

Model #: EE181 Temperature and Relative Humidity Probe

Operating Temperature: -40°C to +60°C

Range: -40°C to +60°C

Accuracy:  $\pm 0.2^\circ\text{C}$  @  $23^\circ\text{C}$

SN. 2218160022732B 05/12/2022 (new), installed 01/23/2023 – current as of 12/31/2024

Parameter: Relative Humidity

Units: Percent

Sensor type: HC101

Model #: EE181 Temperature and Relative Humidity Probe

Range: 0-100% non-condensing

Accuracy:  $-15$  to  $40^\circ\text{C}$ :  $\leq 90\% \text{ RH} \pm (1.3 + 0.003 \cdot \text{RH reading}) \% \text{ RH}$

$-15$  to  $40^\circ\text{C}$ :  $> 90\% \text{ RH} \pm 2.3\% \text{ RH}$

$-25$  to  $60^\circ\text{C}$ :  $\pm (1.4 + 0.01 \cdot \text{RH reading}) \% \text{ RH}$

$-40$  to  $60^\circ\text{C}$ :  $\pm (1.5 + 0.015 \cdot \text{RH reading}) \% \text{ RH}$

Temperature dependence of RH measurement: typically  $0.03\% \text{ RH}/^\circ\text{C}$

SN. 2218160022732B 05/12/2022 (new), installed 01/23/2023 – current as of 12/31/2024

Parameter: Barometric Pressure

Units: millibars (mb)

Sensor type: Vaisala Barocap © silicon capacitive pressure sensor

Model #: PTB-110 (CS-106)

Operating Range: Pressure: 500 to 1100 mb; Temperature:  $-40^\circ\text{C}$  to  $+60^\circ\text{C}$ ;

Humidity: non-condensing

Accuracy:  $\pm 0.3 \text{ mb}$  at  $+20^\circ\text{C}$ ,  $\pm 0.6 \text{ mb}$  at  $0^\circ\text{C}$  to  $40^\circ\text{C}$ ,  $\pm 1 \text{ mb}$  at  $-20^\circ\text{C}$  to  $+45^\circ\text{C}$ ,  $\pm 1.5 \text{ mb}$  at  $-40^\circ\text{C}$  to  $+60^\circ\text{C}$

Stability:  $\pm 0.1$  mb per year  
SN. U1430487, new 2022, in service 01/23/2023 – current as of 12/31/2024

Parameter: Wind speed  
Units: meter per second (m/s)  
Sensor type: 18 cm diameter 4-blade helicoids propeller molded of polypropylene  
Model #: R.M. Young 05108 Wind Monitor  
Range: 0 - 100 m/s (224 mph)  
Accuracy:  $\pm 0.3$  m/s  
SN. WM00170033, new 2020, in service 07/21/2020 – current as of 12/31/2024

Parameter: Wind direction  
Units: degrees  
Sensor type: balanced vane, 38 cm turning radius  
Range: 360° mechanical, 355° electrical  
Accuracy:  $\pm 3$  degrees  
SN. WM00170033, new 2020, in service 07/21/2020 – current as of 12/31/2024

Parameter: Photosynthetically Active Radiation (PAR)  
Units: moles m<sup>-2</sup> (total flux)  
Sensor type: anodized aluminum with cast acrylic diffuser  
Model: Apogee SQ110 (CS310) Quantum Sensor  
Light spectrum waveband: 410 to 655 nm  
Temperature dependence: 0.06 $\pm$ 0.06% per °C  
Stability:  $<\pm 2\%$  change over 1 yr  
Operating Temperature: -40°C to 70°C; Humidity 0 to 100%  
Cosine Response: 45° zenith angle:  $\pm 2\%$ ; 75° zenith angle:  $\pm 5\%$   
Sensitivity: 0.2mV per  $\mu\text{mol s}^{-1} \text{m}^{-2}$   
Multiplier: 0.025  
SN. 3903  
SN. 3903, New 2022, in service 01/23/2023 – current as of 12/31/2024

Parameter: Precipitation  
Units: millimeters (mm)  
Sensor type: Tipping Bucket Rain Gauge  
Model #: TR-525  
Rainfall per tip: 0.01 inch  
Operating range: Temperature: 0° to 50°C; Humidity: 0 to 100%  
Accuracy:  $\pm 1.0\%$  up to 1 in./hr;  $\pm 0, -3\%$  from 1 to 2 in./hr;  $\pm 0, -5\%$  from 2 to 3 in./hr  
SN. 79557-319, new 2020, in service 07/21/2020 – current as of 12/31/2024, calibrated 01/12/2023

#### **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.

**Serial Number:** 13926

**Date CR1000/CR1000X Installed:** 07/21/2020 – current as of 12/31/2024

**Date CR1000/CR1000X Calibrated:** 2019 (new)

**CR1000/CR1000X Firmware Version (s):** CR1000X.Std.03.02 (date of update unknown)

**CR1000/CR1000X Program Version(s):** WKBSHMET\_CR1000X\_6.0.1\_100720.CR1X

**GOES transmitter:**

Model number: TX321-G

Serial number: 2364

Date installed: 07/21/2020

#### 10) Coded variable definitions -

|                   |                     |               |
|-------------------|---------------------|---------------|
| Sampling station: | Sampling site code: | Station code: |
| Safe Harbor       | SH                  | wkbSHmet      |

#### 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 is 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 –

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.

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>.

Data recorded for all parameters (with the exception of 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 1<sup>st</sup> and December 31<sup>st</sup> 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.**

The wind sensor is considered out of calibration for the entire year for 2024. All wind parameters are suspect for the year.

Fifteen-minute rain fall totals on 04/10/2024 12:00 exceeded the upper limit for the sensor over that time interval. Total precipitation at 12:00 and cumulative precipitation from 12:00 through the end of the day are considered suspect.

On 7/10/2024 there was a rain event of normal proportions but at 16:00 the tipping bucket recorded 27.7 mm within the 15-minute recording period. It is believed that the funnel had filled during this rain event but there was an obstruction that prevented it from dropping the rainfall into the bucket. The obstruction must have self-released and dropped the entire bucket onto the tipping bucket all at once. The total rainfall for this event is probably accurate but the rate of fall and the precise start and end of the event is unclear. Total precipitation from 04:30 – 16:00 and cumulative precipitation from 04:30 through the end of the day are considered suspect.