

Reserve Name WKB NERR Meteorological Metadata
Months and year the documentation covers – 01/2019 through 12/2019
Latest Update: 09/09/2025

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 CR1000/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. These data are also converted to graphic representation and posted on the Internet at <http://cast-net.disl.org/monitoringdata/nep/index.htm> hourly with the cooperation of the Mobile Bay NEP and the Dauphin Island Sea Lab. For more information on QAQC flags and QAQC codes, see Sections 11 and 12.

Scott Phipps is responsible for all 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 Safe Harbor (WKB SH) station on 07/31/06 and transmits data to the NOAA GOES satellite, NESDIS ID **3B01A578**. The transmissions are scheduled hourly 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>.

The Campbell Scientific CR1000 datalogger uses 5-second data downloaded from the weather station sensors to calculate 15-minute data. The CR1000 stores only 15 minute data. Parameters measured are air temperature, relative humidity, barometric pressure,

rainfall, wind speed and wind direction. Precipitation (mm), PAR (millimoles/m²), and Cumulative Precipitation (mm) are collected as 15 minute totals (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.) Periodically, sensors on the weather station are inspected for damage or debris. If any are found, it is repaired and/or cleaned. Sensors are removed and calibrated on an annual or bi-annual basis. Temperature sensor, barometric pressure, anemometer were last calibrated 05/05/2017. A new PAR sensor was installed on 05/05/2017. Tipping bucket rain gauge was calibrated on 07/05/2017. There were no other analyses done on the meteorological data at present.

The 15-minute data are collected in the following formats for the CR1000/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.)

Recommended calibration frequency for the MET station sensors:

- Temperature/Humidity- yearly recalibration
- Precipitation Gauge- yearly recalibration
- Wind Speed/Direction- every 2 years
- 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.

CDMO Edits – station measurements updated September 2025. Previous versions of the metadata were not updated and measurements listed were from the original weather station site.

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 87°49'46.6"W	01/02/2008 - Present	NA	NA
WB		Weeks Bay	30° 24.89' N 87° 49.56' W	01/01/2001 - 12/31/2007	Construction of buildings on site	

6) Data collection period

Weather data has been collected from January 1, 2001 at Weeks Bay and beginning January 02, 2008 at the SH site.

These metadata are applicable only to data collected from January 1, 2019 through December 31, 2019.

File name	first	last	Notes
wkbSHmet010119	01/01/2019 @ 00:00	01/25/2019 @ 14:15	
wkbSHmet012519	01/25/2019 @ 14:30	02/27/2019 @ 09:00	
wkbSHmet022719	02/27/2019 @ 09:15	04/05/2019 @ 08:45	
wkbSHmet040519	04/05/2019 @ 09:00	04/17/2019 @ 10:30	
wkbSHmet041719	04/17/2019 @ 10:45	05/02/2019 @ 12:45	

wkbSHmet050219	05/02/2019 @ 14:00	05/22/2019 @ 09:00	Tower down, new T/RH
wkbSHmet052219	05/22/2019 @ 09:15	06/28/2019 @ 08:00	
wkbSHmet062819	06/28/2019 @ 08:15	08/16/2019 @ 09:30	
wkbSHmet081619	08/16/2019 @ 09:45	10/25/2019 @ 13:15	
wkbSHmet102519	10/25/2019 @ 13:30	11/15/2019 @ 09:30	
wkbSHmet111519	11/15/2019 @ 09:45	12/23/2019 @ 10:00	
wkbSHmet122319	12/23/2019 @ 10:15	01/22/2019 @ 09:15	

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 process 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 these 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 2019.

NERR weather 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 <http://cdmo.baruch.sc.edu/>. Data are available in comma separated format.

8) Associated researchers and projects

The Geological Survey of Alabama, in cooperation with the United States Geological Survey, maintains two rain gauges within the Weeks Bay watershed. One is located at the highway 98 Magnolia River overpass; the other is located at the highway 104 Fish River overpass.

Weeks Bay National Water Level Observation Network (WB NWLON) tide station data (Station 8732828) can be accessed at: <https://tidesandcurrents.noaa.gov/waterlevels.html?id=8732828>

As part of the SWMP long-term monitoring program, WKB NERR also monitors 15-minute water quality along with monthly grab samples and diel sampling for nutrient data which may be correlated with this meteorological dataset. These data are available at www.nerrsdata.org.

II. Physical Structure Descriptors

9) Sensor specifications

Parameter: Temperature

Units: Celsius

Sensor type: PT100 RTD, IEC 751 1/3 Class B, with calibrated signal conditioning

Model #: HC2-S3 Temperature and Relative Humidity Probe

Operating Temperature: -40°C to +60°C

Range: -40°C to +60°C

Accuracy: ± 0.1 °C @ 23°C

SN. NA date of calibration 05/05/2017. Out of service 05/02/2019

Parameter: Relative Humidity

Units: Percent

Sensor type: ROTRONIC® Hygromer IN-1

Model #: HC2-S3 Temperature and Relative Humidity Probe

Range: 0-100% non-condensing

Accuracy at 23°C: $\pm 0.8\%$ RH with standard configuration settings

Temperature dependence of RH measurement $\pm 3\%$ (-40 to 60°C)

SN. NA date of calibration 05/05/2017 Out of service 05/02/2019

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: ± 0.2 °C @ 23°C

Serial number, 18471600025123 dates of calibration purchased new 03/03/2019 but calibration certificate says it was calibrated 03/12/2018. Put into service new on 05/02/2019 - current as of 12/31/2019

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: $\leq 90\%$ RH $\pm (1.3 + 0.003 \cdot \text{RH reading}) \% \text{ RH}$

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

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

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

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, 18471600025123 dates of calibration purchased new 03/03/2019 but calibration certificate says it was calibrated 03/12/2018. Put into service new on 05/02/2019 - current as of 12/31/2019

Parameter: Barometric Pressure

Units: millibars (mb)

Sensor type: Vaisala Barocap © silicon capacitive pressure sensor

Model #: CS-106

Operating Range: Pressure: 600 to 1060 mb; Temperature: -40°C to +60°C;
Humidity: non-condensing
Accuracy: ± 0.5 mb @ 20°C; ± 2 mb @ 0°C to 40°C; ± 4 mb @ -20°C to 45°C; ± 6 mb @ -40°C to 60°C
Stability: ± 0.1 mb per year
SN. M0310163
Date of last calibration: 05/05/2017
Date of Sensor Use: 07/06/2017 - current as of 12/31/2019

Parameters: Wind Speed and Wind Direction
Units: Wind speed - meter per second (m/s); Wind direction – compass degrees
Sensor type: RM Young Wind Monitor (marine version)
Model # 5106m
Range: 0-50 m/s; 360° mechanical
SN 154738
Date of last calibration/re-furbishment: 05/05/17
Date of Sensor Use: 07/06/2017 - current as of 12/31/2019

Parameter: Photosynthetically Active Radiation (PAR)
Units: mmol 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 $\pm$ 0.06% per °C
Stability: $\leq \pm 2\%$ 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. 29466; Date of last calibration: New May 2017
Dates of Sensor Use: 07/06/2017 - current as of 12/31/2019

Parameter: Precipitation
Units: millimeters (mm)
Sensor type: Tipping Bucket Rain Gauge
Model #: TE525
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
Date of Last calibration: 05/02/2019, previous 07/05/2017

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.
Note: this datalogger was manufactured in 2006, first installed at wkbSHmet in 2007. In continuous service until 04/2017 when it was removed for calibration and replacement of motherboard battery.
SN. 5578

Date CR1000 Installed: 07/06/2017 - current as of 12/31/2019
Date CR1000 Calibrated: 05/05/2017

CR1000 Firmware Version (s): OS rev 31.03 installed May of 2017.

CR1000 Program Version(s): wkbWBmet_v5.5_070617.cri, WKBWBMET_CR10000_5.5.1_50219

10) Coded variable definitions

Sampling station:	Sampling site code:	Station code:
Weeks Bay	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.

Small negative PAR values are within range of the LI-COR 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 mmol/m² over a 15 minute interval. These values are automatically flagged and coded as <1> (CAF).

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 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.**

Air temperature and relative humidity are coded as CSM due to occasional temperature drops from 01/01/2019 – 05/02/2019. Although some of the drops could be attributed to rain events, the lower temperature values may also indicate sensor problems.

The station was powered down on 5/2/2019 13:00 – 13:45 to switch the air temperature/relative humidity sensor and to calibrate the precipitation gauge. Data at 14:00 were rejected due to the power down which may have caused an incomplete 15 minutes of 5-second data. **Note:** The EE181 sensor caps relative humidity values at 100%, measured values >100% are altered to 100%.

Cumulative precipitation data were corrected from 0.3 to 0.0 on 05/02/2019 14:00 – 5/3/2019 00:00. The rainfall that was recorded was from the gauge calibration and not from actual precipitation.

Air temperature and relative humidity values from 08/17/2019 00:15 – 10/05/2019 23:45 are considered suspect. Unlike the occasional temperature drops earlier in the year, these temperature and humidity drops were more sudden and sporadic.

Although it appears as though the PAR sensor's (SN 29466) calibration drifted over time, Apogee found no evidence of drift during calibration in 2021. Apogee did find evidence of moisture intrusion due to a leak in the cable. This leak did cause more noticeable problem with the data in 2020. All PAR data are flagged as suspect and coded with CSM, unless otherwise rejected or flagged suspect, for 2019.