

Reserve Name: WKB NERR Meteorological Metadata
Months and year the documentation covers – 01/2013 through 12/2013
Latest Update: 09/09/2025

I. Data Set and Research Descriptors

- 1) Principal investigator(s) and contact persons –**
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Address: Weeks Bay NERR
11300 Highway 98
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2) Entry verification

Data are uploaded from the CR1000 data logger to a Personal Computer (IBM compatible). 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 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 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 WKB 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, wind direction, and photosynthetically active radiation (PAR). 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 every two years.

The 15 minute Data are collected in the following formats for the **CR1000**:

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)

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-every 5 years (required beginning 2014, one year initial grace period)

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

6) Data collection period

Weather data has been collected from January 1, 2001 through December 31, 2013.

This metadata is applicable only to data collected from January 1, 2013 00:00 through December 31, 2013 23:45.

7) Distribution

NOAA/ERD retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The PI retains the right to be fully credited for having collected and processed the data. Following academic courtesy standards, the PI and NERR site where the data were collected will be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. Manuscripts resulting from this NOAA/OCRM supported research that are produced for publication in open literature, including refereed scientific journals, will acknowledge that the research was conducted under an award from the Estuarine Reserves Division, Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration. 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.

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 System-Wide Monitoring Program (SWMP) also includes 4 hydrographic stations within Weeks Bay where dataloggers collect water temperature, salinity and conductivity, pH, dissolved oxygen turbidity and depth. These data are collected every 15 minutes continuously. At the 4 hydrographic stations, nutrient data are collected once a month at low tide and at one site twelve samples are collected for nutrients over a tidal cycle (low tide to low tide). Nutrient data collected are total dissolved phosphorus, nitrate, nitrite, ammonia, and chlorophyll. Both nutrient and hydrographic (water quality) data are maintained at the CDMO.

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.

The following researchers have directly requested and received meteorological data generated from the Weeks Bay weather station for use as either primary or ancillary information significant to their respective projects.

Caffrey, Jane. University of West Florida. Modeling estuarine ecosystem trophic status using continuous nitrate and water quality data.

Canion, Andrew. University of South Alabama.

Murrah, Adam. Mississippi State University.

II. Physical Structure Descriptors

9) Sensor specifications

Parameters: Temperature and Relative Humidity

Units: Celsius for temperature and percent for relative humidity

Sensor type: Campbell Scientific

Model #: HMP45C

Operating Temperature: -40-+60°C

Temperature Measurement Range: -40 to +60°C

Temperature Accuracy: $\pm 0.2^\circ\text{C}$ @ 20°C

Relative Humidity Measurement Range: 0-100% non-condensing

RH Accuracy: at 20°C: $\pm 2\%$ RH(0-90%) and $\pm 3\%$ (90-100%)

Temperature dependence of RH measurement: $\pm 0.05\%$ RH/°C

Serial Number: unknown

Date of Last calibration: unknown

Dates of Sensor Use: 3/23/2011 - 04/04/2013

Serial Number: W1630068

Date of Last calibration: unknown

Dates of Sensor Use: 04/04/2013 – 09/09/2014

Parameter: Barometric Pressure

Units: millibars (mb)

Sensor type: Vaisala Barocap © silicon capacitive pressure sensor

Model #: CS-105

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

Serial Number: unknown

Date of last calibration: unknown

Dates of Sensor Use: 02/10/2009 - 04/12/2017

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
Serial Number: WM00071877
Date of last calibration: unknown
Dates of Sensor Use: 02/10/2009 – 04/12/2017

Parameter: Photosynthetically Active Radiation (PAR)
LI-COR Quantum Sensor
Units: mmol m⁻² (total flux)
Sensor type: High stability silicon photovoltaic detector (blue enhanced)
Model #: LI190SB
Light spectrum waveband: 400 to 700 nm
Temperature dependence: 0.15% per °C maximum
Stability: <±2% change over 1 yr
Operating Temperature: -40°C to 65°C; Humidity: 0 to 100%
Sensitivity: typically 5 µA per 1000 µmol s⁻¹ m⁻²
Serial Number: unknown
Date of last calibration: unknown
Multiplier: unknown
Dates of Sensor Use: 12/20/2009 – 04/04/2013

Serial Number: Q48342
Date of last calibration: 08/20/2012
Multiplier: 1.126278
Dates of Sensor Use: 04/04/2013 – 04/12/2017

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: +/- 1.0% up to 1 in./hr; +0, -3% from 1 to 2 in./hr; +0, -5% from 2 to 3 in./hr
Serial Number: unknown
Date of Last calibration: 04/04/2013, 12/10/2009 (previous)

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

Serial Number: 5578
Date CR1000 Installed: 2007

CR1000 Firmware Version (s): unknown

CR1000 Program Version(s): WKBWBMET_5.5_070208, WKBWBMET_5.5_040413

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 -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, 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
CDF	Data Appear to Fit Conditions
CML	Snow melt from previous snowfall event
CRE*	Significant Rain Event
CSM*	See Metadata
CCU	Cause Unknown
CVI*	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 sensor and are due to normal errors in the sensor and the CR1000 Datalogger. The Maximum signal noise error for the Licor sensor is +/- 2.214 mmoles/m2 over a 15 minute interval.

Relative Humidity data greater than 100 are within range of the sensor accuracy of +/-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.

There is some confusion over exact dates for sensor calibrations and sensor swaps that occurred during 2009 (some of these sensors were in use during 2013). By comparing the MetLog dates and dates for sensor maintenance, these are the dates that were considered to be the most accurate.

Sensor installation 02/10/2009: BP, wind, and precipitation

Sensor installation 12/20/2009: PAR

Based on the above installation dates, BP and Wind parameters are considered out of calibration for 2013.

Precipitation data are considered out of calibration from 01/01/2013 until the sensor calibration on 04/04/2013. PAR data are considered out of calibration 01/01/2013 until the sensor swap on 04/04/2013.

These data are flagged and coded as suspect and out of calibration, <1> SOC CSM.

In addition to the above out of calibration sensors, temperature and relative humidity are considered out of calibration from 03/23/2013 until the sensor swap on 04/04/2013.

The station was powered down on 04/04/2013 08:00 – 14:15 so temperature/relative humidity and PAR sensors could be replaced with more recently calibrated sensors. A new logger program was uploaded to update the PAR multiplier following the power down.

Following the temperature/relative humidity sensor swap on 04/04/2013, rh values slowly began to increase and are considered suspect until values of 101 and higher (max recorded was 120) began to be consistently recorded. With the problems this sensor experienced after 06/21/2013 we can't be certain that the sensor was measuring rh correctly when it was installed on 04/04/2013. Beginning 06/21/2013 05:15, when 101 was first recorded, rh data were rejected through the end of the year as it became obvious that sensor malfunctioned.

The PAR sensor installed on 04/04/2013 began reporting NAN (not a number) values shortly after installation, 04/05/2013. All PAR data were rejected beginning 04/04/2013 14:30 through the end of the year. The sensor installed on 04/04/2013 was not calibrated after removal and the sensor most likely degraded due to moisture intrusion as the layers on the sensor surface separated.

Total and cumulative precipitation data are rejected at 04/04/2013 14:45 due to maintenance to calibrate the rain gauge. Cumulative values are rejected through the end of the day as the 15 minute totals do not include rainfall from previously during the day.

The tower was dropped for maintenance and the station was powered down from 10/02/2013 13:45 – 10/08/2013 11:00. Data were rejected at 11:15 due to not being a full 15 minutes of 5-second data following the station power down.