

Reserve Name WKB NERR Meteorological Metadata
Months and year the documentation covers – 01/2014 through 12/2014
Latest Update: 12/18/2017

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 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 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 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
- Rain 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.

The weather station is located on over a reserve owned marsh at the head of 2 man-made canals about 300 meters from the west bank of the Fish River near the mouth of Weeks Bay (lat 30° 25' 16.40" N, long 87° 49' 42.50" W) north of highway 98, on property known to the locals as "Safe Harbor". Wind sentry, tipping bucket rain gauge, temperature/RH probe, Li-Cor quantum sensor and barometric pressure sensor are mounted along an aluminum tower

between 4.8 and 7.6 meters above mean high tide (estimated). Specific sensor heights above mean high tide are as follows: Barometric pressure is at 4.8m, Temp/RH sensor is at 5m, PAR and rain gauge are at 7.4m, and the Wind Sentry is at 7.6m. Due west of the weather station on the Fish River is a YSI datalogger deployment site for the continuous monitoring of water quality. This datalogger site is designated FR and is satellite telemetered to the CDMO.

6) Data collection period –

Weather data has been collected from January 1, 2001 through December 31, 2008. This metadata is applicable only to data collected from January 1, 2014 through December 2014.

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 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 2012.

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. Data are available in comma delimited 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: $\pm 0.05\%\text{RH}/^{\circ}\text{C}$
Serial Number: unknown,
Date of Calibration: unknown; Dates of Sensor Use: 3/23/2011-current as of 12/31/2011

Parameters: Temperature and Relative Humidity
Units: Celsius for temperature and percent for relative humidity
Sensor type: Rotronic
Model #: HC2-S3
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: $\pm 0.05\%\text{RH}/^{\circ}\text{C}$
Serial Number: 61247718
Date of Calibration: 1/21/2014; Dates of Sensor Use: 9/9/2014 - current as of 12/31/2014

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 Calibration: unknown; Dates of Sensor Use: 02/10/2009-current as of 12/31/2014

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 Calibration: unknown; Dates of Sensor Use: 02/10/2009-current as of 12/31/2014

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: $\leq \pm 2\%$ change over 1 yr

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

Sensitivity: typically 5 μ A per 1000 μ moles s⁻¹ m⁻²

Serial Number: unknown

Multiplier: unknown

Date of Calibration: unknown; Dates of Sensor Use: 12/20/2009- 04/04/2013

Serial Number:

Multiplier: unknown

Date of Calibration: unknown; Dates of Sensor Use: 04/04/2013 -current as of 12/31/2014

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

Dates of Calibration: 2/10/2009, 4/4/2013, 9/9/2014

The CR1000 has 2 MB of Flash EEPROM that is used to store the Operating System.

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

CR1000 Firmware Version (s): unknown

CR1000 Program Version(s): WKBWBMET_5.5_040413, WKBSHMET_5.5_090214

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, 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 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 mmol/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. **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.**

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 2014). By comparing the

MetLog dates and dates for sensor maintenance, these are the dates that were considered to be the most accurate.

02/10/2009: BP and Wind

Based on the above calibration dates, BP and Wind parameters are considered out of calibration from 01/01/2014 until 12/31/2014. The data are flagged and coded as suspect and out of calibration, <1> SOC CSM.

All PAR data for 2014 were rejected due to sensor malfunction, <-3> SSM CSM.

RH data from 1/1/2014 00:00 until the sensor swap on 9/9/2014 are flagged and coded as rejected, <-3> SSM CSM, due to a sensor malfunction.

Precipitation data on 3/28/2014 08:45 are flagged and coded as suspect, <1> GSM CRE, since the amount for that 15 minute time period exceeded the sensor's upper limit. Cumulative precipitation data are flagged and coded as <1> GSM CRE from 08:45 through the end of the day, 3/29/2014 00:00

On 29 April and extending well into 30 April a large rain event occurred in the Weeks Bay watershed. Nearby rain measurements (see: <http://www.mymobilebay.com/>) ranged from 450 – 500 mm (18 – 19.5 inches) during this period. The Weeks Bay weather station at Safe Harbor (wkbSHmet) recorded 343 mm (13.5 inches) and then the tipping bucket went under water at 3:15 am on 30 April as the area flooded and stopped recording. This tipping bucket is deployed on a stand that is approximately 1.5 meters above mean high tide. The tipping bucket began recording again on 1 May as the flood receded below its deployment. Total precipitation and cumulative precipitation are coded as <0> GSM CRE, for significant rain event from 4/29/2014 02:15 - 4/30/2014 03:00. Beginning at 4/30/2014 03:15 - 5/1/2014 00:15, both total and cumulative precipitation are rejected, <-3> GSM CRE due to the gauge being under water. Cumulative values are considered suspect from 5/1/2014 00:30 through the end of the day, 5/2/2014 00:00, since the 5/1/2014 00:15 data are not accurate and daily totals may be off.

On 9/9/2014 the tower was dropped, data uploaded, new program installed and a new temperature/relative humidity sensor installed. This is a HC2S3 sensor replacing the older HMP45C sensor. The tower was down from 7:30 to 8:30. The Tipping bucket rain gauge was calibrated at this time as well on the same day from 11:45 - 12:30 (see below).

The precipitation gauge was calibrated on 9/9/2014 from, 11:45 - 12:30. Data were corrected to 0.0 for both total and cumulative precipitation and flagged and coded as corrected due to maintenance, <5> SMT CSM. Cumulative precipitation data were corrected through the end of the day, 9/10/2014 00:00