Reserve Name WKB NERR Meteorological Metadata
Months and year the documentation covers – 01/09 through 12/09
Latest Update: 02/04/2015

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons –

Scott Phipps – Research Coordinator
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Address: Weeks Bay NERR
11300 Highway 98
Fairhope, Al 36532

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 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, cumulative precipitation, wind speed, wind direction, wind direction standard deviation, and photosynthetically active radiation. Maximum and minimum relative humidity and barometric pressure and minimum wind speed are no longer collected with the CR1000 program. Maximum and minimum air temperatures are collected and are available from the Reserve. 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. 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:

Averages from 5-second data:
Air Temperature (°C), Relative Humidity (%), Barometric Pressure (mb), Wind Speed (m/s), Wind Direction (degrees), Wind Direction Standard Deviation (degrees), Battery Voltage (volts)

Maximum, Minimum, and their times from 5-second data (these data are not available in the dataset, but are available from WKB NERR)**:**
Air Temperature (°C)

Maximm and times from 5-second data:
Wind Speed, (m/s)

Totals:
Precipitation (mm), PAR (millimoles/m^2), and Cumulative Precipitation (mm)

Recommended sensor calibration schedule:

- Temperature/Humidity- annual recalibration
- Rain Gauge- annual recalibration
- Wind Speed/Direction- bi-annual recalibration
- Barometric Pressure- bi-annual recalibration
- PAR- bi-annual recalibration

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 30º 25' 16.40" N, long 87º 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, 2009. This metadata is applicable only to data collected from January 1, 2009 00:00 through December 31, 2009 23:45.

7) Distribution

NOAA 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. 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:
National Estuarine Research Reserve System (NERRS). 2012. System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: http://cdmo.baruch.sc.edu/; *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 http://cdmo.baruch.sc.edu/. Data are available in comma delimited format.

8) Associated researchers and projects

The System-Wide Monitoring Profram (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.

Mintz, Molly. University of South Alabama.

Morrison, Andrew. Auburn 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: ± 0.2 °C @ 20°C
Relative Humidity Measurement Range: 0-100% non-condensing
RH Accuracy: at 20°C: +/- 2% RH(0-90%) and +/-3% (90-100%)
Temperature dependence of RH measurement: +/- 0.05%RH/°C
Date of calibration: unknown; Date Installed: 12/12/2008-02/10/2009
Date of calibration: unknown; Date Installed: 02/10/2009-3/23/2011

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
Date of Calibration: 6/8/2007; Date Installed: 06/08/2007 – 02/10/2009
Date of Calibration: unknown; Date Installed: 02/10/2009-current as of 12/31/2009

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
Date of Calibration: 3/27/08; Date Installed: 3/27/2008 – 02/10/2009
Date of Calibration: unknown; Date Installed: 02/10/2009 - current as of 12/31/2009

Parameter: PAR
Units: mmoles 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 μmoles s-1 m-2
Date of Calibration: 06/08/07; Date Installed: 06/08/2007 – 12/20/2009
Date of Calibration: unknown; Date Installed: 12/20/2009 - current as of 12/31/2009

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
Date of Calibration: 03/27/08; 02/10/2009

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 installed: 7/31/2006

10) Coded variable definitions - List the sampling station, sampling site code, and station code used in the data.

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 – This section details the secondary QAQC Code definitions used in combination with the QAQC flags above.

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 datalogger, 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
SSM	Sensor Malfunction
SSN	Not a Number / Unknown Value
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
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.

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.

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 but less than 104 are within range of the sensor accuracy of +/-3%.

The RH sensor began malfunctioning during 2009. It is difficult to pinpoint the exact date and time that the sensor began malfunctioning. Beginning with the first reading >103 on 9/14/2009 at 22:00, RH data <101 were flagged and coded as <1> SSM CSM (suspect and sensor malfunction). Data 101-103 were flagged and coded as <1> SSM CAF (suspect, sensor malfunction, within the range of the sensor). Date >103 were flagged and coded as <-3> SSM CSM (rejected and sensor malfunction). Data prior to 9/14/2009 22:00 are coded as CSM unless otherwise flagged and coded. Those data appear to be fine, but the user should be aware that the sensor did gradually begin to malfunction over time.

Throughout 2009 elevated nighttime PAR readings were recorded. Values >0 between sunset and sunrise were flagged and coded as <1> CSM. http://www.sunrisesunset.com/ was used to determine sunrise and sunset times.

There is some confusion over exact dates for sensor calibrations and sensor swaps for 2009. 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: ATemp/RH, BP, Wind, and precipitation gauge
12/20/2009: PAR (exact time is unknown so the entire day is coded as CSM).

Data were rejected on February 10, 2009 09:45-10:00. Tower was lowered and the rainfall tipping bucket and wind sensor were checked and calibrated. The ATemp/RH and BP sensors were swapped.
Data were rejected on April 20, 2009 at 08:30. Tower was lowered for maintenance.
Data were rejected on July 2, 2009 at 09:30. Tower was lowered for maintenance.
Data were rejected on November 5, 2009 at 10:30. Tower was lowered for maintenance.

Weather Events

There were no tropical storms or hurricanes this year – yearly rainfall was 62 inches which is the normal average for this area. There were some rainfall events where greater than 3 inches fell in a 24 hour period and on a couple of occasions rainfall intensity exceeded 0.5 inches in a 15 minute interval. This is not uncommon in this area.