**Apalachicola NERR Meteorological Metadata**

**January 2014 – December 2014**

**Latest Update: June 13, 2016**

**I. Data Set & Research Descriptors**

**1) Principal investigator & contact persons:**

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Apalachicola National Estuarine Research Reserve

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**2) Entry verification:**

Data download from the CR1000 datalogger occurs by monthly exchange of a compact flash memory card. A laptop (IBM compatible) running LoggerNet software is used when necessary to communicate directly with the CR1000 datalogger, for example during program uploads. A desktop personal computer running LoggerNet is used to retrieve data files from the compact flash memory card and convert the files into a comma-delimited format for upload to CDMO. At this time the files 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. Outliers, suspect, and erroneous data found during this secondary review are appropriately flagged and coded by Reserve staff using the NERRQAQC Excel macro. After secondary review by the Reserve is completed, the NERRQAQC Excel macro is used to append files and export them 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.

Lauren Levi and Jason Garwood are responsible for all Meteorological data management.

**3) Research objectives:**

Data collected from the East Bay weather station complement those data taken from the East Bay water quality station. Data are also used in the analysis of other datalogger data collected at Cat Point, Dry Bar and Pilots Cove. Weather station data will also be integrated with monitoring the Reserve is performing as a Sentinel Site for climate change. Positioning the weather station in East Bay allows the Reserve to monitor changes in rainfall, photosynthetically active radiation, temperature, and other weather parameters influencing the water quality of East Bay as well as climate change sentinel sites located in East Bay marshes. East Bay drains the Tate's Hell Swamp area, which was altered in the late 1960's and early 1970's by timber companies. An EPA grant allowed the Northwest Florida Water Management District to begin restoration of the site in 1995 to reduce non-point source runoff. East Bay is also an important nursery area for numerous fish and invertebrate species within Apalachicola Bay.

**4) Research methods:**

Data Collection (CR1000):

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)

Sensor Calibration QA/QC:

Sensors are calibrated either yearly or every 2 years according to the maintenance schedule dictated by the NERR System Wide Monitoring Program SOPs. The sensors and their wires are inspected monthly to make sure that they are clean, moving freely, and undamaged. The arm of the wind sensor is checked monthly to assure that it is aligned to true north.

Recommended calibration frequency for the MET station sensors:

- Temperature/Humidity- yearly recalibration

- Rain Gauge- yearly recalibration

- Wind Speed/Direction- every 2 years recalibration for the RM Young 5103 sensor at ANERR

- Barometric Pressure- every 2 years recalibration

- PAR- every 2 years recalibration

- CR1000-every 5 years (required beginning 2014, one year initial grace period)

Data Storage/Interface with LoggerNet:

Compact flash module cards (CFM 100) are used to interface between the CR1000 and the LoggerNet software supplied by Campbell Scientific. CFM100 cards are exchanged monthly. At the time of the exchange, a handheld Kestrel 4000 is used to measure weather conditions and compare them to the measurements of the sensors on the weather station. The CFM 100 card is downloaded with the LoggerNet software. A neighboring weather station operated by Florida Department of Environmental Protection, Division of State Lands, is used for further comparison when necessary.

Telemetry:

Campbell Scientific data telemetry equipment was installed at the East Bay weather station on 06/22/06 and transmits data to the NOAA GOES satellite, NESDIS ID #3B01C09E. 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](http://cdmo.baruch.sc.edu/).

**5) Site location and character:**

The Apalachicola National Estuarine Research Reserve is located in the northwestern part of Florida, generally called the panhandle. It is located adjacent to the City of Apalachicola, and encompasses most of the Apalachicola Bay system, including 52 miles of the lower Apalachicola River. Passes, both natural and manmade, connect Apalachicola Bay to the northeastern Gulf of Mexico. The sampling site is located in the upper reaches of East Bay. East Bay is separated from Apalachicola Bay by two bridges and a causeway and is located to the north of Apalachicola Bay proper. The bay is 8.2 km long, has an average depth of approximately 1.0 m MHW, and an average width of 1.8 km. The tides in East Bay are mixed and range from 0.3 m to 1.0 m (average 0.5 m).

The weather station is located at latitude 29o 47’ 27.24 N and longitude 84o 53’ 0.24 W. This site is less than 0.5 nautical miles west of the East Bay water quality station. The site is located near the tip of a peninsula, which separates Blount's Bay from West Bayou. The peninsula is dominated by marsh vegetation (mainly *Juncus roemerianus*). There is a cabbage palm hammock along the southeastern shoreline of the peninsula. The dominant upland habitat is primarily pineland forest to the northwest, which includes slash pine, saw palmetto, and sand pine. In accordance with NERR SWMP and CDMO requirements the wind and PAR sensors are mounted at the top of a 3-meter tower. The temperature/relative humidity sensor and barometric pressure sensor (inside the CR1000 enclosure) are mounted on the tower at 1.5 meters. The tower is mounted on a 2m platform. The tipping bucket rain gauge is mounted on a 1m platform approximately 4m from the weather station platform. There is nothing nearby to shade the tower and the nearest wind block is the edge of the pine forest about 1 kilometer north to northwest of the station.

**6) Data collection period:**

The Apalachicola weather monitoring station was erected on August 27, 1999 and began monitoring on September 3, 1999. The data submitted with this report encompasses data collected from 00:00 January 1, 2014 through 23:45 December 31, 2014.

|  |  |  |
| --- | --- | --- |
| Raw File Name | Start Date/Time | End Date/Time |

apaebmet112513 11/25/2013 09:00 01/09/2014 10:45

apaebmet010914 01/09/2014 11:00 01/23/2014 10:00

apaebmet012314 01/23/2014 12:15 01/27/2014 10:15

apaebmet012714 01/27/2017 10:30 02/07/2014 11:30

apaebmet020714 02/07/2014 11:45 02/14/2014 14:15

apaebmet021414 02/14/2014 14:45 03/04/2014 11:00

apaebmet030414 03/04/2014 11:15 03/11/2014 10:15

apaebmet031114 03/11/2014 10:30 04/23/2014 08:00

apaebmet042314 04/23/2014 08:15 05/14/2014 09:30

apaebmet051414 05/14/2014 09:45 06/20/2014 07:45

apaebmet062014 06/20/2014 08:00 07/18/2014 08:45

apaebmet071814 07/18/2014 09:00 08/22/2014 08:00

apaebmet082214 08/22/2014 08:15 09/22/2014 12:45

apaebmet092214 09/22/2014 13:00 10/22/2014 12:45

apaebmet102214 10/22/2014 13:00 11/25/2014 09:00

apaebmet112514 11/25/2015 09:15 12/17/2014 14:00

apaebmet121714 12/17/2015 14:15 01/13/2015 10:15

**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 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](http://www.nerrsdata.org).  Data are available in comma delimited format.

**8) Associated researchers and projects:**

Harper, J., Wren, K., Jones, D., Garwood, J., Garland, H., Snyder, C., Levi, L./ NERRS Sentinel Sites Program for Understanding Climate Change Impacts on Estuaries

Edmiston, H.L., Farhny, S., Lamb, M., Levi, L., Wanat, J., Avant, J., Selly, N./ Apalachicola National Estuarine Research Reserve. Tropical Storm and Hurricane Impacts on a Gulf Coast Estuary: Apalachicola Bay, Florida USA.

Garwood, J., Harper, J., Levi, L., Lamb, M., Jones, D., Garland, H.,/ Apalachicola National Estuarine Research Reserve. Distribution and density of fishes and benthic invertebrates in Apalachicola Bay.

Harper, J., Levi, L., Jones, D., Lamb, M., Garwood, J., Garland, H.,/ Apalachicola National Estuarine Research Reserve. System-Wide Monitoring Program (SWMP) for water quality, weather, nutrients & chlorophyll A, and submerged aquatic vegetation monitoring in Apalachicola Bay.

Gilhring, T./ Florida State University. The role of oligohaline marshes as a source or sink of nitrogen to the Apalachicola Bay.

Peterson, R./ Florida State University. Origin and fate of suspended particulates in the Apalachicola River: Impact on Apalachicola Bay

Putland, J./ Florida State University Department of Oceanography. NOAA Graduate Research Fellowship.

Planktonic food web variations related to salinity and nutrient patterns in Apalachicola Bay.

Wang, H., W. Huang, M. Harwell, L. Edmiston, E. Johnson, P. Hsieh, K. Milla, J. Christensen, J. Stewart, X. Liu. 2008. Modeling oyster growth rate by coupling oyster population and hydrodynamic models for Apalachicola Bay, Florida, USA. Ecological Modeling 211:77-89.

Paula Viveros, NOAA Graduate Research Fellowship, Phytoplankton composition and abundance in relation to salinity, nutrient and light gradients in the Apalachicola National Estuarine Research Reserve (ANERR)

Chris Anderson, Auburn University, School of Forestry and Wildlife Sciences

Response of coastal riverine wetlands to water allocations in an urbanizing watershed

Stacy Smith, Ph.D., Florida A&M University post-doctoral research associate, ECSC/Environmental Sciences Institute, Drought, Reduced River Flow and Sea Level Rise: Exploring Climate Impacts on Carbon and Nitrogen Cycling in the Apalachicola Bay System

Hagen, S., DeLorme, D., Walters, L., Wang, D., Weishampel, J., Yeh, G., Huang, W., Slinn, D., Morris, J. Ecological Effects of Sea Level Rise

**II. Physical Structure Descriptors**

**9) Sensor Specifications:**

Parameter: Temperature

Units: Celsius

Sensor type: 100 ohm platinum resistance temperature detector (PRT)

Model #: Rotronic HC2-S3 Temperature and Relative Humidity Probe

Operating Temperature: -40oC to +60oC

Range: -40oC to +60oC

Accuracy: +/- 0.1oC (@ 23oC)

S/N: 0061085467

Date of calibration: 03/15/2013

Dates of sensor use: 07/26/2013 – 03/14/2014

S/N: 0061212271

Date of calibration: 09/18/2013

Dates of sensor use: 03/14/2014 – current as of 12/31/2014

Parameter: Relative Humidity

Units: Percent

Sensor type: Rotronic IN1 capacitive sensor

Model #: Rotronic HC2-S3 Temperature and Relative Humidity Probe

Range: 0-100% non-condensing

Accuracy: +/- 0.8% RH (@23oC)

S/N: 0061085467

Date of calibration: 03/15/2013

Dates of sensor use: 07/26/2013 – 03/14/2014

S/N: 0061212271

Date of calibration: 09/18/2013

Dates of sensor use: 03/14/2014 – 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

S/N: R1630017

Date of calibration: 3/5/2012

Dates of sensor use: 03/22/2012 – 03/11/2014

S/N: W5040015

Date of calibration: 02/27/2014

Dates of sensor use: 03/11/2014 – current as of 12/31/2014

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 05103 Wind Monitor

Range: 0-60 m/s (134 mph); gust survival 100 m/s (220 mph)

Accuracy: +/- 0.3 m/s

S/N: WM127200

Date of calibration: 07/1/2013

Dates of sensor use: 07/26/2013 – current as of 12/31/2014

Parameter: Wind direction

Units: degrees

Sensor type: balanced vane, 38 cm turning radius

Model #: R.M. Young 05103 Wind Monitor

Range: 360° mechanical, 355° electrical (5° open)

Accuracy: +/- 3 degrees

S/N: WM127200

Date of calibration: 07/1/2013

Dates of sensor use: 07/26/2013 – current as of 12/31/2014

\*\*Note\*\* The arm of the wind sensor is checked monthly to ensure that it remains aligned to true north.

Parameter: Photosynthetically Active Radiation

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

S/N: Q46892

Date of calibration: 01/17/12

Dates of sensor use: 04/02/2012 – 01/23/2014

Multiplier: 1.228

S/N: Q50180

Date of calibration: 08/02/2013

Dates of sensor use: 01/23/2014 – current as of 12/31/2014

Multiplier: 1.277

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

S/N: 35501-405

Date of calibration: 02/04/2013

Date of calibration: 02/14/2014

Dates sensor in use: 08/19/2005 – 05/14/2014

S/N: 59238-314

Date of calibration: 05/14/2014

Dates sensor in use: 05/14/2014 - current as of 12/31/2014

Compact Flash Module

Model #: CFM100

Storage capacity: 64 MB

Operating range: Temperature: -35° to +65°C

Memory type: user selectable for either ring style (default) or fill and drop.

Power requirements: 12 V supplied through CR1000 peripheral port

In Use Dates are from 08/07/2006 – current

CR1000 Datalogger

The CR1000 has two MB Flash EEPROM that are 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) is 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

S/N: 005091

Calibration: 5/8/2006

Installed: 6/28/2006

Removed: 6/14/2013

S/N: 56121

Calibration: 5/31/2013

Installed: 6/14/2013 - current as of 12/31/2014

CR1000 Firmware Version 24 in use from 08:45 10/12/2012 – 14:15 02/14/2014

CR1000 Firmware Version 27 in use from 14:30 02/14/2014 - current as of 12/31/2014

CR1000 Program Version:

apaebmet\_5.6\_072513 in use 9:15 07/26/2013 – 12:00 01/23/2014.

Apaebmet\_5.6\_122013 in use 12:15 01/23/2014 to current as of 12/31/2014.

**10) Coded variable indicator and variable code definitions:**

Sampling station: Sampling site code: Station code:

East Bay EB apaebmet

**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.

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.**

Relative Humidity data greater than 100 are within range of the sensor accuracy of +/-3%.

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. Nighttime PAR values greater than 0.0 mmoles/m2 are commented as {<1> (CSM)}, indicating that users should be aware of possible data inconsistencies. Nighttime periods were determined on a monthly basis by using sunrise-sunset times obtained from <http://www.sunrisesunset.com>.

January 1, 2014 through March 4, 2014 at 11:15: Temperature and relative humidity data are rejected. The Temp/RH sensor in use during this time was deployed without the proper cap, although this omission was not immediately realized. A new sensor with a Teflon cap was deployed on March 4, 2014 at 11:30.

January 23, 2014 through March 11, 2014: A newly purchased PAR sensor (SN Q50180) was installed on January 23, 2014 at 10:15. The sensor cable was inadvertently cut during installation. Staff unsuccessfully attempted repair and was removed on 2/14/201414:15. The sensor was sent to Campbell Scientific for repair and re-installed on March 11, 2014 at 10:15. Data at 10:30 were rejected since they were not a full 15 minutes of 5-second data.

January 27, 2014 11:00: Barometric pressure is rejected due to abnormally low reading that does not fit conditions. Cause unknown.

March 29, 2014 12:15 and August 31, 2014 12:15 Minimum air temperature readings (not reported in dataset) were exceptionally low ( <-39°C) for unknown reasons. ATemp and RH were rejected on these dates and times due to QAQC checks.

March 13, 2014 12:15, August 17, 2014 12:15, and November 27, 2014 12:15 Maximum air temperature readings (not reported in dataset) were exceptionally high ( >75 °C) for unknown reasons. ATemp and RH were rejected on these dates and times due to QAQC checks.

May 14, 2014 08:45 - 09:30 total precipitation and May 14, 2015 08:45 - May 15, 2014 00:00 cumulative precipitation data are rejected due to maintenance to replace the gauge. Rain fall occurred later in the day on May 14 and values are recorded under total precipitation, however, cumulative totals were rejected and do not reflect actual rainfall for the day.

October 22, 2014 13:00 through November 25, 2014 09:00: Total precipitation data is flagged as suspect. Cumulative precipitation data are considered suspect through November 26, 2014 00:00 since it is a running total of the day’s precipitation. On the November 25th visit the rain gage funnel was found clogged and full of water. The screen for the funnel was laying on the ground. Three small dabs of putty were applied to hold the screen in place. When a call was placed to order a retaining ring we were informed that the manufacture does not offer a retaining ring for this model gage and our solution using putty is a common approach.

October, November, December, 2014: Due to the increased occurrence and amplitude of elevated nighttime Licor PAR readings, and the uncertain effect this may be having on daytime readings, all PAR values are commented as suspect for the fourth quarter of 2014 (9/30/2014 19:00 - 12/31/2014 23:45). A new Licor PAR sensor will be purchased and installed after the first of the year.