**Sapelo Island** (SAP) **NERR Meteorological Metadata**
**January - December 2020**
**Latest Update:** 03/23/2022

## 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 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. For more information on QAQC flags and QAQC codes, see Sections 11 and 12. Thompson Rose is responsible for all data management.

### 3) Research objectives –

The principal objectives are to record meteorological information for the Sapelo Island NERR's site that can be used 1) as a reference for meteorological data for research projects on the reserve, 2) to give meteorological context for our half hourly SWMP water quality data, and other long term environmental monitoring projects at the Reserve, 3) to observe and characterize important events such as storms, heat and cold waves, droughts, and heavy rainfalls, and 4) to detect trends and characterize climate variability over the long-term

### 4) Research methods –

Campbell Scientific data telemetry equipment was installed at the Marsh Landing station on 02/15/2007 and transmits data to the NOAA GOES satellite, NESDIS ID #3B036592. 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.

Data are reported in Eastern Standard Time(EST) for the year.

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/$m^2$), 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.)

Sensors are visually inspected on a monthly basis and are removed and recalibrated by the manufacturer on the following schedule:

- 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 site is located at N 31deg 25.068', W 081deg 17.721', about 15 feet above sea level. All sensors are mounted on a 10m-aluminum tower located in the northern corner of the Marsh Landing parking lot on the southwest corner of the island. The parking lot surface is approximately a meter above the surrounding marsh. The heights of the sensors on the tower are as follows:

| | |
|---|---|
| Temperature and relative humidity | 2m |
| Barometric pressure | 1m |
| PAR | 3m |
| Precipitation gauge | 6m |
| Wind sensor | 10m |

It is bordered with salt marsh to the north and south with transition into pine forest occurring 1/2 mi to the east. On the immediate west lie the Duplin River and the ferry dock, which is also the location of our lower Duplin and marsh Landing Water Quality sampling sites. The station is well exposed to all winds and weather with little blockage and no shading. This region is subject to multiple severe weather phenomena partially due to the proximity to the ocean. These phenomena include severe summer thunderstorms, which can cause drastic, localized drops in pressure, temperature, and heavy rains; powerful fall and winter frontal systems carrying prolonged strong winds (usually NNE), drastic and sudden drops in temperature and pressure, and long, steady rains; and finally the late summer and early fall hurricanes. It must be noted that due to the remote location and proximity to the ocean our weather patterns can vary greatly from those on the mainland, particularly temperatures which tend to moderate due to our being surrounded by water. The nearest sites for comparison is the Grays Reef

NOAA weather Buoy located about 20nm east of Sapelo Island and Glynco airport located approx. 30 mi to the SSE.

| Station Code | SWMP Status | Station Name | Location | Active Dates | Reason Decommissioned | Notes |
|---|---|---|---|---|---|---|
| ML | Active | Marsh Landing | N 31deg 25.068', W 081deg 17.721' | 02/15/2007-current | NA | NA |

**6) Data collection period –**

January 1, 2020 00:00- December 31, 2020 23:45

| File Start Date and Time | File End Date and Time |
|---|---|
| 10/01/2019 00:00 | 01/28/2020 12:45 |
| 01/01/2020 00:00 | 02/21/2020 13:30 |
| 02/21/2020 13:45 | 04/21/2020 10:15 |
| 04/01/2020 00:00 | 07/29/2020 15:00 |
| 06/01/2020 00:00 | 10/19/2020 12:00 |
| 10/19/2020 12:15 | 10/21/2020 12:15 |
| 10/21/2020 12:30 | 02/01/2021 13:30 |

**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 2020.

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 SWMP program in place on Sapelo also includes water quality and nutrient datasets collected along with this meteorological data. Sapelo Island has a long history of maintaining research. In 1953, the University of Georgia Marine Institute (UGAMI) was formed and the island became a

working laboratory for many. The research continues today with SAP NERR and UGAMI creating a unique partnership with much of the current research being done facilitated by SAP NERR and UGAMI together. Given UGAMI's long history on Sapelo, a bibliographic list of over 800 articles of current and previous research can be found on the UGAMI website: http://www.uga.edu/ugami and on the Sapelo Island NERR site: http://www.sapelonerr.org .

## II. Physical Structure Descriptors

### 9) Sensor specifications –

Parameter: Temperature
Units: Celsius
Sensor type: Platinum resistance temperature detector (PRT)
Model #: HC2S3 Temperature and Relative Humidity Probe
Operating Temperature: -40°C to +60°C
Range: -50°C to +100°C
Accuracy: ± 0. °C with standard configuration settings
Date of Last calibration: 10/10/2019
Dates of Sensor Use: 11/12/2019 – current as of 12/31/2020
SN 60780595

Parameter: Relative Humidity
Units: Percent
Sensor type: HC2S3 Temperature and Relative Humidity Probe
Range: 0-100% non-condensing
Accuracy at 23°C: +/- .8% RH
Temperature dependence of RH measurement: +/- 3% (-40 to 60C)
Date of Last calibration: 10/10/2019
Dates of Sensor Use: 11/12/2019 – current as of 12/31/2020
SN 60780595

Parameter: Barometric Pressure
Units: millibars (mb)
Sensor type: Vaisala Barocap © silicon capacitive pressure sensor
Model #: CS-106 (PTB110)
Operating Range: Pressure: 500 to 1100 mb; Temperature: -40°C to +60°C;
Humidity: non-condensing
Accuracy: ± 0.3 mb at +20°C, ± 0.6 mb at 0°C to 40°C, ± 1 mb at -20°C to +45°C, ± 1.5 mb at -40°C to +60°C
Stability: ± 0.1 mb per year
Date of Last calibration: 12/14/2016
Dates of Sensor Use: 05/08/2018 – current as of 12/31/2020
SN: M4930097

Parameter: Wind speed
Units: Meters/second (m/s)
Sensor type: 12cm dia cup wheel assembly, 40 mm dia hemispherical cups
Model #: R.M. Young 03110-5 Wind Sentry
Range: 0-50m/s (112mph) gust survival; 60m/s (134mph)
Accuracy: +/-2%
Last service: 10/06/2015
Dates of Sensor Use: 10/03/2017 – 10/21/2020

SN: unknown

Parameter: Wind direction
Units: degrees
Sensor type: balanced vane 16cm turning radius
Model #: R.M. Young 03110-5 Wind Sentry
Range: 360deg
Accuracy: +/- 5%
Last service: 10/06/2015
Dates of Sensor Use: 10/03/2017 – 10/21/2020
SN: unknown

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
Calibrated 09/05/2019
Dates of Sensor Use: 10/21/2020 – current as of 12/31/2020
*SN:171993*

Parameter: Wind direction
Units: degrees
Sensor type: balanced vane, 38 cm turning radius
Calibrated 09/05/2019
Dates of Sensor Use: 10/21/2020 – current as of 12/31/2020
*SN:171993*

Parameter: Photosynthetically Active Radiation (PAR)
Units: mmoles 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+/-0.06% per °C
Stability: <±2% change over 1 yr
Operating Temperature: -40°C to 70°C; Humidity 0 to 100%
Cosine Response: 45° zenith angle: +/- 2%; 75° zenith angle: +/- 5%
Sensitivity: 0.2mV per μmol s-1 m-2
Multiplier: 0.025
Last service: 03/03/2017
Dates of Sensor Use: 05/08/2018 – current as of 12/31/2019

Parameter: Precipitation (specify if heated rain gauge)
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 Last calibration: 03/01/2017, previous calibration: 02/02/2016
SN:50994-412

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.
Date Installed: 05/05/2015 – current as of 12/31/2020
Date Callibrated:07/14/2014 New at installation
SN: 66489

CR1000 Firmware Version (s): unknown
Currently running SAPMLMET_CR1000_6.1_101620.CR1

**10) Coded variable definitions –**

| Sampling station: | Sampling site code: | Station code: |
|---|---|---|
| Marsh Landing | ML | sapmlmet |

**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.

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.**

All wind parameters are considered suspect from 01/01/2020 00:00 – 10/21/2020 11:45 due to being collected with an out of calibration sensor, <1> [SOC] (CSM). Following the sensor swap on 10/21/2020 data are rejected due to incorrect wiring from 10/21/2020 13:15 – 10/23/2020 12:15.

Precipitation data are considered suspect from 01/01/2020 00:00 – 12/31/2020 23:45 due to being collected with an out of calibration sensor, <1> [SOC] (CSM). In addition to being out of calibration the sensor did not record data from 10/21/2020 13:15 through the end of 2020. Both total and cumulative precipitation are rejected from 10/21/2020 through the end of the year.

All parameters are considered suspect (unless rejected) due to the out of calibration CR1000. The logger is considered out of calibration as of 05/05/2020 through the end of the year, <1> [SOC] with {CSM} in the F_Record.

All parameters rejected due to maintenance 10/21/2020 12:00 - 13:00. The tower was lowered to swap wind sensors. An updated program was uploaded at 12:30.