

Sapelo Island (SAP) NERR Meteorological Metadata
January - December 2021
Latest Update: August 15, 2023

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 fifteen minute 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 at 00:04:40 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/m²), 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)

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.

SWMP Station Timeline:

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, 2021 00:00- December 31, 2021 23:45

File Start Date and Time	File End Date and Time
01/01/2021 00:00	04/29/2021 11:45
03/31/2021 00:00	07/01/2021 11:45
05/01/2021 00:00	06/01/2021 11:45
06/01/2021 00:00	07/01/2021 11:45
06/30/2021 00:00	08/06/2021 11:45
08/06/2021 00:00	09/14/2021 11:45
09/14/2021 00:00	10/21/2021 11:45
10/21/2021 0:00	01/13/2022 11:45

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 processed 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.nerrsdta.org/>; accessed 12 October 2021.

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.nerrsdta.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: -40°C to +60°C

Accuracy: ± 0.1 °C @ 23°C

Date of Last calibration: 10/10/2019

Dates of Sensor Use: 11/12/2019 – 11/08/2021

SN 60780595

Date of Last Calibration: 10/10/2019

Dates of Sensor Use: 11/08/2021- current as of 12/31/2021

SN 61115039

Parameter: Relative Humidity

Units: Percent

Sensor type: ROTRONIC® Hygromer IN-1

Model #: HC2-S3 Temperature and Relative Humidity Probe

Range: 0-100% non-condensing

Accuracy at 23°C: $\pm .8\%$ RH

Temperature dependence of RH measurement: $\pm 3\%$ (-40 to 60C)

Date of Last calibration: 10/10/2019

Dates of Sensor Use: 11/12/2019 – 11/08/2021

SN 60780595

Date of Last Calibration:

Dates of Sensor Use: 11/08/2021- current as of 12/31/2021

SN 61115039

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 $+20^{\circ}\text{C}$, ± 0.6 mb at 0°C to 40°C , ± 1 mb at -20°C to $+45^{\circ}\text{C}$, ± 1.5 mb at -40°C to $+60^{\circ}\text{C}$
Stability: ± 0.1 mb per year
Date of Last calibration: 12/14/2016
Dates of Sensor Use: 05/08/2018 – current as of 12/31/2021
SN: M4930097

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 12/31/2021
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 12/31/2021
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: $0.06 \pm 0.06\%$ per $^{\circ}\text{C}$
Stability: $< \pm 2\%$ change over 1 yr
Operating Temperature: -40°C to 70°C ; Humidity 0 to 100%
Cosine Response: 45° zenith angle: $\pm 2\%$; 75° zenith angle: $\pm 5\%$
Sensitivity: 0.2mV per $\mu\text{mol s}^{-1} \text{m}^{-2}$
Multiplier: 0.025
SN: SQ-110_22481
Last service: 03/03/2017
Dates of Sensor Use: 05/08/2018 – current as of 12/31/2021

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; $+0, -3\%$ from 1 to 2 in./hr; $+0, -5\%$ from 2 to 3 in./hr
SN:50994-412
Date of Last calibration: 03/01/2017, previous calibration: 02/02/2016

SN:70981-1016(unable to verify precipitation gauge swap on 06/25/2021)

New Precipitation Gauge Installed 06/25/2021 (no other documentation of new precipitation gauge installation)

CR1000

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 12/31/2021

Date Calibrated: 07/14/2014 New at installation

SN: 66489

CR1000 Firmware Version (s): unknown

Currently running SAPMLMET_CR1000_6.1_101620.CR1

GOES Transmitter:

Model Number: TX312

Serial Number: 1339

Date Installed: 2021

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.**

In addition to the precipitation gauge being considered out of calibration (see below), precipitation data were considered inaccurate from 01/01/2021 00:00 – 06/25/2021 12:00 due to sensor malfunction, <-3> [SSM] (CSM).

All parameters were considered suspect due to the out of calibration CR1000, <1> [SOC] with the F_Record coded as {CSM}. The logger was considered out of calibration as of 05/05/2020 through the end of 2021. Any suspect flagging below is included in the suspect flagging and coding for the out of calibration logger. Individual sensors that were out of calibration have an additional (CSM)_code added to the parameter flag column.

In addition to the out of calibration CR1000, the following sensors are also considered out of calibration during 2021.

Barometric Pressure (SN M49300097) out of calibration 05/08/2021 – 12/31/2021, <1>[SOC](CSM)
PAR (SN SQ-11022481) out of calibration 05/08/2021 – 12/31/2021, <1>[SOC](CSM)

The precipitation gauge installed from 01/01/2021 – 06/25/2021 was listed as being calibrated in – house on 06/25/2021. However, because of the lack of documentation to confirm the calibration happened and because precipitation data were submitted as rejected through 06/26/2021 12:00, all precipitation data are considered suspect through the end of 2021, <1>[SOC](CSM).

07/07/2021 19:30 rainfall total for that fifteen minute timestamp exceeded the limit of the rain gauge. Those data along with cumulative from 19:30 through the end of the day are considered suspect in addition to being considered suspect due to the out of calibration CR1000, <1> [SOC] (CSM).

Relative humidity vales were rejected on 07/07/2021 19:30 – 21:00 due to QAQC checks, <-3>[SQR](CSM). The values dropped sharply for a brief period. Air temperature values also dropped during that time period but less drastically; those

data are considered suspect, <1>[SOC](CSM). Cause for the drop in values is unknown, however, moisture intrusion from that day's rain event is a possibility.

Between 11/06/2021 13:00 and 11/15/2021 13:00 both relative humidity and air temperature began reporting NAN (not a number) values on occasion. Relative humidity NANs began 11/06/2021 13:00 and air temperature NANs began 11/07/2021 13:00. Relative humidity values were rejected through 11/15/2021 13:00 while air temperature values were rejected through 11/08/2021 11:00. The sensor was reported to have been swapped on 11/08/2021 but no time was given for maintenance that day. Although relative humidity values were rejected through 11/15/2021 13:00, air temperature values appear to be valid but are flagged as suspect until the sensor started reporting accurate RH values. Even though the sensor was replaced, both air temperature and relative humidity continued to be flagged as suspect from 11/15/2021 13:15 until the end of the year due to the out of calibration CR1000.