

Sapelo Island (SAP) NERR Meteorological Metadata
January – December 2012
Last Update on March 6, 2019

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 (IBM compatible). Files are exported from or 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. Patrick Hagan 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>.

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)

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

Temp/RH -annually

Precip-annually

Barometric pressure, PAR, and wind-every 2 years

5) Site location and character –

The site is located at 31° 25' 4.08 N, 81° 17' 43.26 W, 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 Glynnco airport located approx. 30 mi to the SSE.

6) Data collection period -

The data collection period for 2012 ran from Jan 1, 2012 @00:00 to Dec 31, 2012 @ 23:45. Data collection began at this site in September 2002.

7) Distribution

NOAA/ERD 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. Following academic courtesy standards, the PI and NERR site where the data were collected will be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. Manuscripts resulting from this NOAA/OCRM supported research that are produced for publication in open literature, including refereed scientific journals, will acknowledge that the research was conducted under an award from the Estuarine Reserves Division, Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration. 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.

NERR weather 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 separated 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>.

9) Sensor specifications Parameter:

Parameter: Temperature

Units: Celsius

Sensor type: Platinum resistance temperature detector (PRT)

Model #: HMP45C Temperature and Relative Humidity Probe

Operating Temperature: -40°C to +60°C

Range: -40°C to +60°C

Accuracy: ± 0.2 °C @ 20°C

Date of Last calibration: 11/3/2009

Dates Installed: 04/22/2010 - 10/15/2012

SN: Y0310098

Parameter: Relative Humidity

Units: Percent

Sensor type: Vaisala HUMICAP® 180 capacitive relative humidity sensor

Model #: HMP45C Temperature and Relative Humidity Probe

Range: 0-100% non-condensing

Accuracy at 20°C: $\pm 2\%$ RH (0-90%) and $\pm 3\%$ (90-100%)

Temperature dependence of RH measurement: $\pm 0.05\%$ RH/°C

Date of Last calibration: 11/3/2009

Dates Installed: 04/22/2010 - 10/15/2012

SN: Y0310098

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: ± 0.1 °C with standard configuration settings

Date of Last calibration: 5/20/2012

Dates Installed: 10/15/2012 - 08/26/2013

SN 60780595

Parameter: Relative Humidity

Units: Percent

Sensor type: HC2S3 Temperature and Relative Humidity Probe

Range: 0-100% non-condensing

Accuracy at 23°C: $\pm 0.8\%$ RH

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

Date of Last calibration: 5/20/2012

Dates Installed: 10/15/2012 - 08/26/2013

SN 60780595

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; $\pm$

6 mb @ -40°C to 60°C

Stability: ± 0.1 mb per year
Date of Last calibration: 11/14/2009
Dates Installed: 4/22/2010 - 08/06/2012
SN: unknown

Date of Last calibration: 2/24/2012
Dates Installed: 8/6/2012 - 10/08/2014
SN: H0870031

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: $\pm 2\%$
Last service: 09/09/2009
Dates Installed: 4/29/2010 - 10/15/2012
SN: unknown
Last service: 11/10/2011
Dates Installed: 10/15/2012 - 10/25/2013
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: $\pm 5\%$
Last service: 09/09/2009
Dates Installed: 4/29/2010 - 10/15/2012
SN: unknown

Last service: 11/10/2011
Dates Installed: 10/15/2012 - 10/25/2013
SN: unknown

Parameter: Photosynthetically Active Radiation
LI-COR Quantum Sensor
Units: $\mu\text{moles m}^{-2}$ (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 $^{\circ}\text{C}$ maximum
Stability: $< \pm 2\%$ change over 1 yr
Operating Temperature: -40°C to 65°C ; Humidity: 0 to 100%
Sensitivity: typically $5 \mu\text{A}$ per $1000 \mu\text{moles s}^{-1} \text{m}^{-2}$
Multiplier: 1.6
Date of last calibration: 11/10/2009
Dates Installed: 04/22/2010 - 10/15/2012
SN: unknown

Multiplier: 0.965945 as of 10/15/2012

Date of last calibration: 3/3/2012
Dates Installed: 10/15/2012 - 08/26/2013
SN: Q47437

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 Last calibration: 2/6/2012 , 10/15/2012,(previous 03/03/2011)
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 CR1000 Installed: 6/26/2006
SN: 005203

CR1000 Firmware Version (s): unknown

CR1000 Program Version(s): SAPMLMET_6.0_101512

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
SSN	Not a Number / Unknown Value
SSM	Sensor Malfunction
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
CVI*	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.

Elevated nighttime PAR values (>0) occurred during 2012, these values are considered suspect. The cause of these nighttime readings is believed to be moisture seeping into the sensor. Because of the possibility of the daytime data being affected, all PAR data, nighttime and daytime, are considered suspect and are flagged and coded as <1> CSM.

In addition to PAR data being considered suspect due to elevated nighttime values, PAR data beginning 10/15/2012 are considered suspect due to sensor drift. There were documented changes in PAR output according to the calibration certificate for the sensor that was replaced on 8/26/2013. The calibration certificate provided by Apogee from its 9/09/2014 calibration (03/06/2012 previous calibration) reported at -10.1% (-4.0% per year) post cal drift for the sensor that was installed from 10/15/2012 to 8/26/2013(Q47437). Acceptable drift is +/-2% for this sensor. Typically all PAR data 1 year prior to the sensor swap are flagged and coded for drift, but this sensor was installed for less than a year. Data from 10/15/2012 13:45 to 08/26/2013 are flagged and coded as <1> SSD CSM. If the users are comfortable assuming that the drift was linear (in a real world environment it is unlikely to be entirely linear), these data may be ‘corrected’ for assumed linear drift at the user’s discretion using manufacturer’s instructions.

Air temperature and Relative humidity data are flagged as suspect due to being out of calibration (<1> SOC CSM) from 4/22/2012 00:15 - 10/15/2012 12:30, unless otherwise rejected.

Data for all wind parameters are flagged as suspect due to being out of calibration (<1> SOC CSM) from 4/22/2012 00:15 - 10/15/2012 12:30, unless otherwise rejected.

On 5/14 @ 04:15 the station was shut down by a corroded connection. It was brought back on line at 12:30. Data are missing from 04:15 - 12:15, <-2> GIM

CSM, and rejected at 12:30, <-3> GIM CSM. During the down time the temp/Rh and BP sensors were replaced with recently calibrated sensors. It turned out they were both bad, <-3> SSM CSM. The BP was replaced with the original on 5/15 @ 10:30. All data on 5/15/2012 10:30 were rejected due to the station power down. Temp/RH data were rejected due to the malfunctioning sensor from 5/14/2012 12:45 - 5/22/2012 09:45. The temp/Rh was replaced with the original on 5/22 @ 10:00. All data were rejected at 10:00 due to the station power down.

A new barometric pressure sensor was installed on 8/6 @ 13:35. The affected data string on 8/6 @ 13:45 was flagged rejected due to a program upload. Cumulative precipitation values were also corrected from 0.0 to 0.3 from the program reload at 13:45 through the end of the day at 08/7 00:00. Cumulative amounts were reset when the program was reloaded and the corrected values reflect precipitation from early in the day.

New precip, temperature, wind dir/speed, relative humidity, and PAR sensors were installed on 10/15 from 12:45-13:00 while the station was powered down. Precipitation data at 13:45 are from the installation and were rejected; cumulative precipitation data were rejected from 13:45 through the end of the day at 10/16 00:00. The following data string at 13:15 was flagged and rejected due to a program reload.