Sapelo Island (SAP) NERR Meteorological Metadata
January – December 2009
Last Update on October 2, 2014

1) **Principal investigators and contact persons:**

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2) **Entry Verification:**

Data are uploaded from the CR1000 datalogger 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. 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

3) **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 Air Temperature (°C), Minimum Air Temperature (°C), and their times from 5-second data. (these are not included in the data, but are available from the SAP NERR)

Maximum Wind Speed (m/s) and its time from 5-second data

Wind Direction Standard Deviation (degrees) from 5-second data

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

Total Solar Radiation (kJ/m^2 and kW/m^2, available from SAP NERR)

Monthly, sensors on the weather station are inspected for damage or debris. If any is found, it is repaired and/or cleaned. Sensors are removed and sent back to Campbell Scientific for calibration either annually or every two years, depending on sensor specifications.

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 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 practically no blockage.

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 of course 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.

6) Data Collection Period:

The data collection period for 2009 ran from Jan 1, 2009 @00:00 to Dec 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 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 research

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: temperature
Units: Celsius
Sensor type: Platinum resistance temperature detector (PRT)
Model #: HMP45C temperature and relative humidity probe
Operating temperature: -40 to +60 deg C
Range Units: -40 to +60 deg C
Accuracy: +/- .2deg C @20deg C
Last calibration: 3/14/2005
Date installed: 2/19/2008

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 @20deg C: +/- 2% RH (0-90%) and +/- 3% (90-100%)

Temperature dependence of RH measurement: +/-0.05% RH/deg C
Last calibration: 3/14/2005
Date installed: 2/19/2008

Parameter: barometric sensor
Units: millibars (mb)
Sensor type: Vaisala Barocap silicon capacitive pressure sensor
Model #: CS-105
Operating range: 600-1061mb @-20 to +60deg C
Humidity: non condensing
Accuracy: +/- .5mb @20degC; +/- 2 mb @ 0-40deg C; +/- 4mb @-20 to 45deg C; +/-6mb @ 40-60deg C
Stability: +/- .1mb/ year
Last calibration: 1/14/2005
Date installed: 2/19/2008

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: 11/16/2005
Date installed: 8/12/2008

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: 11/16/2005
Date installed: 8/12/2008

Parameter: LI-COR quantum sensor
Units: mmoles m-2 (total flux)
Sensor type: high stability silicone photovoltaic detector (blue enhanced)
Model #: LI190SB
Light spectrum waveband: 400-700nm
Temperature dependence: 0.15% per deg C max
Stability: <2% change/year
Operating temperature: -40 to 65deg C; 0-100% humidity
Accuracy: typically 5 uA per 1000umoles s-1 m-2
Date installed (Q31357): 8/12/2008 (multiplier 1.04)), calibrated: 5/1/2006 (unconfirmed)

Date installed: (Q30397): 3/16/2009 (multiplier 1.06), calibrated: date not recorded

Parameter: precipitation
Units: millimeters (mm)
Sensor type: Tipping bucket rain gauge
Model#: TE525
Rainfall per tip: 0.01inch
Operating range: 32-50degC; 0-100% humidity
Accuracy: +/-1% up to 1in/hr; +0, -3% from 1-2in/hr, +0, -5% from 2-3in/hr
Last calibration: 1/5/2009

The CR1000 has two MB 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) 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.
Date CR1000 Installed: June 26, 2006

10) Coded Variable Definitions:

Sampling station: Marsh Landing
Sampling site code: ML
Station code: 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 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

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 are within range of the sensor accuracy of +/-3%.

The rain gauge was calibrated sometime between 10:00 and 14:00 on 1/5/2009. No data were rejected, even though there are no records, the rain gauge was more than likely disconnected to calibrate.

PAR data from 1/1/2009 until the sensor swap on 3/16/2009 are considered suspect and flagged and coded as <1> SIC CSM. There was a large jump in values following the sensor swap on 3/16/2009. Although it cannot be verified, it is believed that an incorrect PAR multiplier was used from 2007 until the sensor swap in 2009. PAR data on 3/16/2009 10:30-11:30 were rejected due to maintenance to swap the sensor.

Elevated nighttime PAR values (>0) occurred during 2009, 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 beginning with the PAR sensor swap on 3/16/2009.

Air temperature and relative humidity data were rejected from 11/19/2009 00:15 – 11/23/2009 10:30. The temperature readings were very low and did not match conditions. Relative humidity data were rejected because they are dependent upon air temperature readings.