

Sapelo Island (SAP) NERR Meteorological Metadata
January – December 2006
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2) Entry Verification:

Our meteorological information is sampled every 5 seconds by each instrument on the station and stored in a Campbell Scientific CR10X datalogger. The data is output in 3 arrays: array 15 stores 15min average, max, and minimum values; array 60 stores hourly average, max, and minimum values; and array 144 stores daily average, max, and minimum values. The CDMO datalogger program (NERR_4.CSI) is loaded into the CR10X and controls the sensors. This system interfaces with the Campbell Scientific PC208W software. A new CR1000 datalogger was installed on June 26, 2006. Campbell Scientific's Loggernet program is used as the primary interface mechanism with the CR1000. The CR1000 outputs only 15 minute data. Version 2 of the CDMO data logger program is used to control the sensors with the CR1000.

Data is uploaded to a PC on a weekly basis and saved on a raw data file that is backed up on a separate drive as well as the CDMO ftp site. Raw comma delimited files (.dat) produced by PC208 are pre-processed in Excel with a CDMO developed EQWin macro which is used to properly format the files with header columns, station codes, date, (mm, dd, yyyy), as well as format the data to the correct number of decimal places. The pre-processed file is then copied into the EQWin weather.eqi file where the data are QA/QC checked and archived in a database. EQWin queries, reports, and graphs are used to discover data set outliers (values falling outside the measurement capabilities of the instruments) and large changes in data. EQWin generates statistics, graphs, custom queries, and reports as well as cross referencing with water data. Finally the data are sent to the CDMO. Anomalous data is noted in the anomalous/suspect data section below. Any corrections that were performed and noted in the deleted data section below. Patrick Hagan is responsible for data management.

The most common errors/anomalies for 2006 were negative PAR readings that for the most part were kept as they were within the range of the sensors accuracy and since they were all recorded at night obviously represent a value of zero. We also had some issues when we upgraded our system to the CR1000

datalogger in the end of June that caused some gaps in the data, the program changes and their dates are outlined below.

08/30/2006 Changes made as requested by the Data Management Committee:

- fiftnmin table name changed to SWMP
- Relative humidity min/max, pressure min/max, wind speed min and time fields were dropped
- fieldnames instructions added to SWMP data table to generate consistent with cr10x/CDMO fieldnames
- RHumidity > 100 and PAR < 0 instructions dropped, over or under values will be handled post processing
- subroutine now used to generate min/max values and timestamps for both SWMP and GOESOUT tables

Additonal changes made:

- revision of variable names within program for consistency and improved readability
- Units instructions were added to enable output of parameter units in data table headers when using TOA5 long header ASCII download format

09/12/2006

- Added colon to max/min timestamps in SWMP table
- Added fieldnames instructions to GOES table (GOES field names same as SWMP with 'G_' prepended)
- Changed the HMP45C from a control port to a switched 12V port

Sensor specific changes:

- Added TotRadVariable to public table and to total_rad sensor setup
- changed li200 range from mv7_5 to mv2500 (this was setting in cr10x prog)
- changed li190sb range from mv7_5 to mv25 (setting in cr10x prog)
- changed units on par and total_rad comments to match those in cr10x prog
- Added total_Rad to fiftnmin and GOESout tables.

9/24/06

- changed wind multiplier from .98 to .75 and offset from 0 to .2
- added par and rad multipliers to the program itself

11/20/06

- changed total rad from mv2_5 to mv2500

11/21/06

- we eliminated the following parameters:

time of min/max windspeed

min/max barometric pressure and time of min/max

min/max relative humidity and time of min/max

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:

The Campbell Scientific weather station samples every 5 seconds continuously throughout the year. These data are used by the CR10X 15 minute averages, maximums, and minimums (array 15), hourly averages, maximums, and minimums (array 60), and daily averages, maximums, and minimums (array 144) of air temperature, relative humidity, barometric pressure, rainfall, wind speed, wind direction, and solar radiation. The CR1000 datalogger collects 15 minute data that are averages/totals of 5 second sampling over the period of 15 minutes. The parameters collected during each interval include: Date, Julian date, Time, Average Temperature (°C), Maximum and Minimum Temperature, Time at maximum and minimum temperature, Relative Humidity, Barometric Pressure, Wind speed, Wind Direction, Standard deviation of wind direction, Maximum Wind Speed, Time at maximum wind speed, Total Precipitation (for that interval), Total Photosynthetically Active Radiation (for that interval), and Battery Voltage. In 2006 data were downloaded on a weekly basis and promptly checked over.

Sensors on the weather station are inspected monthly for damage or debris. The rain gauge tends to collect debris and is checked more regularly, particularly before and after major rain events. Sensors are removed for calibration annually or biannually depending on the sensor. Also, data downloaded on site are checked against a Kestrel 4000 and an offshore NOAA buoy station to assure accurate readings.

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. 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 2006 ran from Jan 1, 2006 @00:15 to Dec 31, 2006 @ 23:45

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 referred scientific journals, will acknowledge that the research was conducted under an award from the Estuarine Reserved 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 section 1 Principal investigators and contact persons), from the Data Manager at the Centralized Data Management Office (please see personnel directory at 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 text tab-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: April 2005

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: April 2005

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: March 2005

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: March 2005

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: March 2005

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
Last calibration: Mar 2002

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: Nov 2001

Storage Module
Model#:Sm192
Storage capacity: 192896 bytes
Operating range: -35 to 65degC
Processor: Hitachi 6303
Baud rates: 300,1200, 9600, 76800
Memory type: user selectable for either ring style or fill and drop
Power requirements: 2 +/-0.4vdc@ 100mA

Campbell Scientific CR10X wiring panel has 128K of flash memory (EEPROM), in which it stores the operating system and its program (that it uses to run the weather station). Additionally there are 128K of SRAM, which it uses to run the program and store its measurements and for final data storage.

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.

10) Coded Variable Definitions:

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

11) Anomalous/suspect/missing data

Arrays:

During 2022 all pre-2007 weather data were revisited by the CDMO. Historically those datasets included 15 minute, hourly (60), and daily data arrays (144). As directed by the NERRS Data Management Committee, the CDMO removed the hourly and daily data arrays leaving only the 15 minute data to make the entire NERRS SWMP weather dataset consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should be aware that they are largely no longer relevant. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout the fall of 2022.

These data while being slightly out of range have been considered acceptable and were retained in the dataset. The following statements explain the various anomalies that may occur in greater detail.

- 1) 15 min sample rainfall amount differences of over 5mm in 15 min can occur during storms and indicates intense ppt bursts during thunderstorms or frontal passages.
- 2) Relative humidity differences greater than 25% on 15min are not unusual with frontal passages and wind shifts.
- 3) Air temp differences between 15 min samples greater than 3 deg are not unusual with frontal passages, thunderstorms, and wind shifts.
- 4) Relative humidity values slightly above 100% are usually within the range of the sensor and can be generally accepted as near 100% conditions
- 5) Intense extra-tropical cyclones and hurricanes that often affect the regional barometric pressure to values below 980mb are not uncommon in late summer and fall.

Anomalous and suspect data:

Licor Outliers:

CDMO Edit 10/6/2014: All PAR data for 2006 are considered suspect (unless missing or deleted). After reviewing later data (2007-2011), we believe an incorrect multiplier was used during 2006. Data from 6/22/2006-12/31/2006 were deleted from the dataset during the review of SAP's 2006 data in 2007; however, since we cannot be sure that the data from the first part of the year is correct, those data (1/1/2006-6/22/2006) are considered suspect.

Negative PAR data have been observed during the night; small negative values are within range of the sensor and are due to normal errors in the sensor and the CR10X Datalogger. The Maximum signal noise error for the Licor sensor is +/- 2.214 mmol/m² over a 15 minute interval. These data have been retained.

Total Precipitation Outliers

These are rain events that showed more than 5mm in a 15-minute interval. All samples were kept as summer and tropical storms may produce these results plus it is possible for the bucket to become clogged (bird droppings) only to unclog itself during a rain event and as a result drop a large amount of water at once. This still represents rain that fell.

<u>DATE</u>	<u>TIME</u>	<u>CLASS</u>	<u>mm</u>
01/02/2006	06:45	15	09.1
01/02/2006	07:15	15	05.8
01/02/2006	14:45	15	06.9
01/02/2006	15:30	15	11.9
02/02/2006	17:45	15	05.8
02/03/2006	21:45	15	06.6
04/08/2006	17:45	15	08.4
06/13/2006	07:15	15	13.2
06/13/2006	07:45	15	06.4
06/13/2006	08:00	15	08.9
06/13/2006	09:45	15	05.3
06/13/2006	10:00	15	09.1
06/13/2006	10:15	15	11.4
08/12/2006	16:15	15	13.7
08/31/2006	04:45	15	06.4
08/31/2006	05:00	15	07.4
08/31/2006	05:15	15	11.7
08/31/2006	05:45	15	06.1
09/01/2006	20:30	15	05.3
09/01/2006	20:45	15	09.4
09/01/2006	21:30	15	09.7
09/01/2006	21:45	15	08.1
09/06/2006	21:30	15	05.1

12) Deleted data

Arrays:

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consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should be aware that they are largely no longer relevant. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout the fall of 2022.

All total par data from 6/22 @0900 to 12/31 23:45 were rejected due to various program related problems that yielded unreliable data.

All data on 6/26 at 00:00 were rejected due to programming glitches.

All data on 6/26 at 12:15 due to the installatin of the CR1000 and program upload.

All data on 7/28 at 00:00 were rejected due to programming glitches.

All data on 7/28 at 12:45 due to program upload.

All data on 11/21 at 14:45 due to program upload.

13) Missing data

Arrays:

During 2022 all pre-2007 weather data were revisited by the CDMO. Historically those datasets included 15 minute, hourly (60), and daily data arrays (144). As directed by the NERRS Data Management Committee, the CDMO removed the hourly and daily data arrays leaving only the 15 minute data to make the entire NERRS SWMP weather dataset consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should be aware that they are largely no longer relevant. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout the fall of 2022.

Data are missing due to equipment or associated specific probes not being deployed, equipment failure, time of maintenance or calibration, or repair/replacement of equipment. For more details see section 12. If additional information relating to missing data is needed contact the research coordinator at the reserve from which the data came.

6/14 @ 13:30 to 6/26/ 12:00

-The station was taken offline on 6/14 @ 13:30 to begin upgrading to the cr1000 logger and the addition of satellite telemetry. The station officially went back online on 6/26 @12:15

7/26 @14:45 to 7/28 @ 12:30

-The station was undergoing further program modification during this time.

10/13 @10:15 to 11/21 @14:30

-A problem with the programming affected the data during this time period and we were unable to recover it.

14) Other remarks:

On 10/23/2023 this dataset was updated to include embedded QAQC flags for anomalous/suspect data. System-wide monitoring data beginning in 2007 were processed to allow for QAQC flags and codes to be embedded in the data files rather than detailed in the metadata alone (as in the anomalous/suspect, deleted, and missing data sections above). Prior to 2007, rejected data were deleted from the dataset so they are unavailable to be used at all, but suspect data were only noted in the metadata document. Suspect data flags <1> were embedded retroactively in order to allow suspect data to be easily identified and filtered from the dataset if desired for analysis and reporting purposes. No other flags or codes were embedded in the dataset and users should still refer to the detailed explanations above for more information.

Arrays:

During 2022 all pre-2007 weather data were revisited by the CDMO. Historically those datasets included 15 minute, hourly (60), and daily data arrays (144). As directed by the NERRS Data Management Committee, the CDMO removed the hourly and daily data arrays leaving only the 15 minute data to make the entire NERRS SWMP weather dataset consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should be aware that they are largely no longer relevant. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout the fall of 2022.

Precipitation:

During the initial years of NERRS SWMP weather data collection the CR10X programming was inconsistent in how precipitation values were recorded. For most reserves, zeros were not recorded when rainfall had not occurred between 2001-2003, instead no rainfall was represented by a blank cell. The CDMO verified which datasets were impacted by this issue for the 2001-2006 datasets and inserted zeros when the metadata indicated that no precipitation occurred and data were not missing for other reasons. In some cases, zero values for precipitation data were evaluated and removed where the metadata confirmed that no rainfall should have been in the dataset. The pre-2007 data did not go through a thorough QAQC process again at that time (in addition to previous QAQC); however, if discrepancies were noticed between what was documented in the metadata and what was in the dataset, additional updates may have been made. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout early 2023.

During precipitation edits mentioned above it was noted that hourly readings from 01/01/2006 01:00 – 06/14/2006 13:15 were missing with no explanation in the metadata. Those data were found in an archived original file and added back to the

dataset.

We dodged any major tropical events this year and otherwise had no major weather events. Our station upgrade created a few problems, which resulted in some gaps in the data (see section 13).