

Jobos Bay (JOB) National Estuarine Research Reserve Meteorological Metadata
January - December 2006
Latest Update: **October 23, 2023**

I. Data Set & Research Descriptors

1) Principal investigator(s) & contact persons

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2) Entry verification

The meteorological information was sampled every 5 seconds from each instrument on the weather station and data were stored on a Campbell Scientific CR10X data logger from January 1st, 2006 to July 21st, 2006. While the CR10X was in use, the CDMO Datalogger Program (NERR4.csi) was loaded into the CR10X and used to control the sensors and data collection schedule. The CR10X interfaced with the PC208W software supplied by Campbell Scientific. Data were output to a file in three arrays: array 15 stores 15 minute average, max and min data; array 60 stores hourly average, max and min data; and array 144 stores daily average, max and min data. A new CR1000 data logger was installed on 7/21/2006 as part of the SWMP update. Campbell Scientific's Loggernet program is used as the primary interface mechanism with the CR1000. The new program for CR1000 (JOBOSBAY_JOBIBMET_072006.CR1) was in use from 07/21/2006 to 10/13/2006. With the installation of the new datalogger and program, hourly and daily averages were no longer recorded. The program was updated again in 10/13/2006 and renamed (JOBOS_V2[1].0_1002200.CR1).

Data are uploaded from the CR10X and CR1000 data logger and transmitted via wired cable directly to the laboratory facilities to a Personal Computer (IBM compatible). The data was saved as a yearly raw data file (RAW0100.dat) onto a separate hard drive and backed up onto the Jobos Bay NERR server. Files are exported from PC208W/LoggerNet in a comma-delimited format (.DAT) and opened in Microsoft Excel for pre-processing with the EQWin format macro (EQWinFormat.xls) that was developed by the CDMO to reformat the header columns, insert station codes, insert a date column (mm/dd/yyyy), correct the time column format and reformat the data to the appropriate number of decimal places. The pre-processed file is then ready to be 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 which fall outside the range that the

instrument is designed to measure) and large changes in the data. EQWin is also used to generate statistics, view graphs, create customized queries and reports of the data, cross query the water, weather and nutrient data and finally export the data to the CDMO. Any anomalous data are investigated and noted below in the Anomalous Data/Suspect Data section. Any data corrections that were performed are noted in the Deleted Data section below.

Both raw data files and EQWin databases were saved to Compact Disc for archival and backed-up on the server. SWMP Technician Luis Encarnación and Research Coordinator Angel Dieppa error checked and compiled the 2006 weather data.

3) Research objectives (Campbell Weather Station):

The principal objective is to record long-term meteorological data to track changes in meteorological conditions that can be associated to changes in estuarine habitats and conditions. A secondary objective is to promote the access and use of reliable baseline information by federal and local agencies, universities, researchers, educators and local communities to enhance the process by which they make decisions regarding their daily activities. This data is also invaluable in the identification and development of future monitoring and research activities.

4) Research methods:

The Campbell Scientific weather station (CR10X) sampled every 5 seconds to produce 15 minute, hourly, and daily averages, maximums and minimums of air temperature, relative humidity, barometric pressure, wind speed and wind direction and 15 minute, hourly, and daily totals of precipitation and PAR. With the upgrade to the CR1000 and the new program(JOBOSBAY_JOB_JBMET_072006.CR1), the weather station samples every 5 seconds to produce 15 minute averages, minimums and maximums of air temperature, relative humidity, barometric pressure, wind speed and wind direction and 15 minute totals of precipitation and PAR. After a program update on 10/13/2006 (JOBOS_V2[1].0_1002200.CR1) maximum and minimum relative humidity and barometric pressure and minimum windspeed are no longer collected. The data is downloaded from the storage module to the laboratory computer by direct connection. Sensors on the weather station are inspected periodically for damage or debris. If any are found, sensors are repaired and/or cleaned. The rain gauge tends to collect the most debris and needs to be cleaned every few days. Sensors are removed and sent to Campbell Scientific for calibration at a minimum of every two years. There were no other analyses done on the meteorological data.

5) Site location and character:

The Jobos Bay National Estuarine Research Reserve (JBNERR) is located on the southern coastal plain of the island of Puerto Rico, the reserve is within the West Indies geographical area. JBNERR is formed by two major components: (1) Mar Negro, located on the western margin of the Bay, and (2) Cayos Caribe, a chain of 15 tear-shaped islets located to the southeast. The Mar Negro component comprises the bulk of the Reserve, and consists of mangrove forests and a complex system of lagoons and channels interspersed with salt and mud flats. Coral reefs and sea grass beds, with small beach deposits and upland areas fringe Cayos Caribe mangrove islands.

A description of the specific sampling station follows:

The weather station is situated in front of the JBNERR Visitor's Center, located in the community of Aguirre, Salinas, Puerto Rico. Its coordinates are latitude 17° 57' 23.34" and longitude 66° 13' 22.56".

The tower base is about 9m above sea level, approximately 110m north from Jobos Bay's southern shoreline. The station is about 5m. in front of the (across from) Visitors Center, the wind and light sensors are above the building height. At the northwest side there is a tree at 11 meters from the station with a height of 15 meters presenting a minor obstruction the the tower. In the southern region of Puerto Rico where JBNERR is located, 98% of the time, the winds comes from southeast to northeast, therefore the tree does not represent a significant obstruction for the winds. The Wind Sentry (9.75 m high), Temperature/ Humidity sensor (2.7m high), Barometric Pressure sensor (2.7 m high), and LiCor Sensor (9.60 m high) are all located on a 10m aluminum tower following the descriptions outlined in the CDMO Manual V 5.1. The Tipping Bucket Rain gauge is located to the SW side of the tower. The sensors were wired to the CR10X and since 7/21/2006 to a CR1000 following the protocol in the CDMO Manual.

The weather station is at the following distance from the stations used for Water Quality monitoring:

At 2.2 Km. from S09
 4.2 Km. from S10
 1.8 Km. from S19
 3.1 Km. from S20

6) Data collection period:

The weather station was deployed in 1999. Data has been collected since 2000 and is available from the CDMO. Data was collected for 2006 from January 1, 2006 00:15 through December 31, 2006 23:45.

7) Distribution:

According to the Ocean and Coastal Resource Management Data Dissemination Policy for the NERRS System-wide Monitoring Program,

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 is collected will be contacted and fully acknowledged in any subsequent publications in which any part of the data is used. Manuscripts resulting from the 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/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 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 format and Access data tables.

8) Associated research and projects:

Jobos Bay NERR system-wide monitoring program has four YSI's continuous sampling stations (s9,s10,s19,s20) that collect long term water quality data, every 30 minutes (15 minutes interval since

07/21/06), to track changes in water quality in the Bay. Parameters include temperature, dissolve oxygen (% saturation, mg/L), specific conductivity, salinity, depth, pH and turbidity. Stations 9 and 10 were selected to represent sites that could compare human impact gradients, being Station 9 an impacted site and station 10 the reference site. Stations 19 and 20 were established (July 2004) to compare ecosystem gradients. Station 19 was deployed over sea grass beds, *Thalassia testudinum*, in the bay and station 20 was deployed over sea grass bed communities near Cayos Caribe coral reefs and mangrove islands.

An air quality project, Conceptual Comparison Among Air Quality Prediction Models for Jobos Bay NERR, finished during 2004. Due to the complex nature of circulation in the JBNERR air basin and to the presence in its immediate vicinity of two mayor sources of air pollutants, they recommend the use of CALPUFF to model air quality in the Reserve.

II. Physical Structure Descriptors

1) Sensor specifications:

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: 02/18/2004

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: 02/18/2004

Parameter: Barometric Sensor

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; ± 6 mb @ -40°C to 60°C

Stability: ± 0.1 mb per year

Date of Last calibration: 02/18/2004

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 (130 mph); gust survival 100 m/s (220 mph)
Accuracy: +/- 2%
Date of last calibration: 02/18/2004

Parameter: Wind direction
Units: degrees
Sensor type: balanced vane, 38 cm turning radius
Model #: R.M. Young 05103 Wind Monitor
Range: 360° mechanical, 355° electrical (5° open)
Accuracy: +/- 5%
Date of last calibration: 02/18/2004

Parameter: LI-COR Quantum Sensor
Units: mmol 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 °C maximum
Stability: <±2% change over 1 yr
Operating Temperature: -40°C to 65°C; Humidity: 0 to 100%
Sensitivity: typically 5 µA per 1000 µmol s⁻¹ m⁻²
Date of last calibration: 02/18/2004

Parameter: Precipitation
Tipping Bucket Rain Gauge
Model #: RG-2000-C
Range: 0.254 mm
Accuracy: 1.0% at <14"/hr
Date of Last calibration: 02-18-04

Storage Module
Model #: SM4M
Storage capacity: 2 million low-resolution data values
Program storage: stores up to 8 programs with a total capacity of 128 KB
Processor: Hitachi H8S
Operating system: 64 KB, flash memory based, user downloadable
Operating range: Temperature: -35° to +65°C
Baud rates: 9600, 76800
Memory type: user selectable for either ring style (default) or fill and drop.
Power requirements: 5 +/-0.3 VDC @ 100 mA

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.
Dates in use: July 21, 2006 - present

10) Coded variable indicator and variable code definitions:

Sampling Station = Jobos Bay

Sampling Site Code = JB

Station code = jobjbmet

11) Data anomalies/Data corrections:

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.

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.

CDMO Edit 10/25/2012

The meteorological sensors at JOB have been installed since 2/18/2004 and have not been calibrated at the recommended frequency. ATemp, RH, and precipitation data are considered suspect from 2/18/2006 through the 12/31/2006. Recommended calibration frequencies are as follows:

- Temperature/Humidity- annual recalibration
- Rain Gauge- annual recalibration
- Wind Speed/Direction- bi-annual recalibration
- Barometric Pressure- bi-annual recalibration
- PAR- bi-annual recalibration

For the following dates and time precipitation values correspond with extensive rainfall in the area and represent valid readings:

SMPLDATE	TIME	TotPrcp
1/15/2006	2:00	5.6
1/15/2006	17:30	12.7
1/15/2006	17:45	6.4
2/5/2006	5:45	5.1
3/3/2006	15:30	6.6
3/3/2006	15:45	5.1
3/4/2006	19:00	6.4
3/4/2006	19:15	5.1
3/6/2006	17:15	5.3
5/14/2006	8:00	12.7
5/14/2006	8:15	23.6
5/14/2006	8:30	8.9
6/4/2006	1:00	6.4
6/4/2006	2:00	6.9

6/4/2006	2:15	6.6
6/4/2006	2:30	10.2
6/20/2006	17:45	10.4
7/30/2006	1:00	11.9
7/30/2006	1:15	6.9
8/5/2006	13:45	8.4
8/31/2006	16:15	29
9/25/2006	2:30	7.1
9/25/2006	2:45	6.4
10/4/2006	18:30	6.9
10/4/2006	18:45	14.5
10/5/2006	8:30	5.6
10/5/2006	10:15	17.8
10/5/2006	12:00	5.8
12/5/2006	23:15	5.6

Wind speeds <0.5m/s are often recorded during the night time hours. These are normal readings for this area.

There appears to be drift with the PAR sensor, readings after June 2006 are considered suspect.

12) Deleted 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.

July 2006

7/11/2006 13:15 All parameters readings were deleted. Missing five second data for the generation of these readings occurred as a result of the CR1000 installation.

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.

January 2006

1/1/2006 00:15-00:45

February 2006

None

March 2006

None

April 2006

None

May 2006

None

June 2006

None

July 2006

7/11/06 15:30 to 7/21/06 13:00

Change CR10X to CR1000 and installation of telemetric station

August 2006

None

September 2006

None

October 2006

10/13/06 15:45 to 10/31/06 23:45

Change program to CR1000 v3, and lost data for malfunction of Hard Drive

November 2006

None

December 2006

None

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 year 2006 thirteen (13) important rainfall events occur that had effects in the measurements of the different parameters of the weather station. These events occur:

- 1) January 15 with 43.9 mm of rainfall
- 2) March 3 to 7 with 74.17mm of rainfall
- 3) March 25 with 22.61 mm of rainfall
- 4) May 14 with 59.4 mm of rainfall
- 5) Jun 4 with 42.67 mm of rainfall
- 6) Jun 20 with 41.65 mm of rainfall
- 7) July 30 with 31.5 mm of rainfall
- 8) August 31 with 29.6 mm of rainfall
- 9) September 25 with 21.7 mm of rainfall
- 10) October 4 to 5 with 93.5 mm of rainfall
- 11) October 18 with 19.55 mm of rainfall
- 12) October 22 with 14.99 mm of rainfall
- 13) December 5 with 11.68 mm of rainfall