

Jobos Bay (JOB) National Estuarine Research Reserve Meteorological Metadata
January - December 2004
Latest Update: **October 12, 2023**

I. Data Set & Research Descriptors

1) Principal investigator(s) & contact persons

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2) Entry verification

The meteorological information is sampled every 5 seconds from each instrument on the weather station and stored on a Campbell Scientific CR10X data logger. Data are 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. The CDMO Data Logger Program (NERR_4.CSI) was loaded into the CR10X and controls the sensors. The CR10X then interfaces with the PC208W software supplied by Campbell Scientific.

Data are uploaded from the CR10X data logger or storage module to a Personal Computer (IBM compatible). The data was saved as a monthly raw data file (RAW0100.dat) onto a separate hard drive and backed up onto the Jobos Bay NERR server. Files are exported from PC208W or 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 Iris Tirado error checked and compiled the 2004 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 samples every 5 seconds to produce both hourly and daily averages of those measurements of air temperature, relative humidity, barometric pressure, rainfall, wind speed and wind direction. An instantaneous sample is taken every 15 minutes and that data is stored in array 150. 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.

The weather station is situated in front of the Visitor's Center, located in the community of Aguirre, Salinas, Puerto Rico. The Wind Sentry, Temperature and Humidity sensor, Barometric Sensor and LiCor Sensor are all located on a 10m aluminum tower following the descriptions outlined in the CDMO Manual V 4.0. The Tipping Bucket Rain gauge is located to the SW side of the tower. The sensors were wired to the CR10X following the protocol in the CDMO Manual.

A description of the specific sampling station follows:

The weather station is located in front of JBNERR Visitor's Center. Its coordinates are latitude 17° 57' 23.34"; longitude 66° 13' 22.56". The tower base is about 9m above sea level, approximately 110m north from Jobos Bay's northern shoreline.

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

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 about 8m from the station with a height of 7m. In the south of Puerto Rico where we are located 98% of the wind moves from east to west and from the southwest therefore the tree does not represent height block for the wind.

6) Data collection period:

The current weather station was deployed in 1999. Data has been collected for years 2000, 2001, 2002, 2003 and 2004. All data collected since year 2000 has been edited using the CDMO Weather Program. Data was collected for 2004 from January 1 through December 31.

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://inlet.geol.sc.edu/cdmohome.html>. 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, 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 just recently established (July 2004) to compare an ecosystem gradient. 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.

We have the 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: $\pm 2\%$

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: $\pm 5\%$

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.

10) Coded variable indicator and variable code definitions:

Site definitions: JB = Jobos Bay

Station Code: jobjbm

11) Data anomalies/Data corrections: None

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.

12) Deleted Data:

None

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.

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 2004

We have some data parameters missing from January 1 to January 22 because of the change to the new program and setup of the weather station.

February 2004

During February 18 from 07:15 AM to 12:00 PM we change sensors with new ones and give maintenance to the weather station. Data was deleted from this time as well as daily data affected by this, 2/18/2004 at 24:00 array 144.

March 2004

None

April 2004

None

May 2004

None

June 2004

None

July 2004

None

August 2004
None

September 2004
None

October 2004
None

November 2004
None

December 2004
None

14) Other remarks:

On 10/12/2023 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 2004 five (4) important rainfall events occur that had effects in the measurements of the different parameters of the weather station. These events occur:

- 1) May 23 with 32 mm of rainfall
- 2) June 9 with 45.5 mm of rainfall
- 3) September 17 with 64.5 mm of rainfall
- 4) October 24 with 64 mm of rainfall