

Reserve Name JOB NERR Meteorological Metadata
Months and year the documentation covers: 01/01/2011 to 12/31/2011
Latest Update: May 7, 2014

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons

Jobos Bay National Estuarine Research Reserve
PO Box 159
Salinas, PR 00704-0159
Ph. 787-853-4617
Fx. 787-853-4618

Angel Dieppa, Research Coordinator
Ph. 787-853-4617, ext. 1004
Email. adieppa@gmail.com, adieppa@drna.gobierno.pr

Sebastián García, SWMP Technician
Ph. 787-853-4617, ext. 1005
Email. sgarcia076@gmail.com

Enid Malavé, Chemist
Ph. 787-853-4617, ext. 1005
Email. emalave1@gmail.com,

2) Entry verification

Data are uploaded from the CR1000 data logger to a Personal Computer (IBM compatible). Files are exported from LoggerNet (or PC208W if needed) 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. Angel Dieppa is responsible for all data management.

A Campbell Sci. transmitter is used to deliver data to the NOAA GOES satellite, NESDIS ID # 3B018394 and NWS Location ID JOXP4. The transmissions are scheduled hourly and contain four (4) datasets reflecting fifteen minute data sampling intervals. The telemetry data is flagged as "Provisional" data and after going through QAQC process is considered "Authentic" dataset used for long term monitoring and study. This data can be viewed by going to <http://cdmo.baruch.sc.edu/>.

3) Research objectives

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 and regionally as well. 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.

This meteorological weather station is located at 0.40Km off the Jobos Bay coast and record data and information of the conditions affecting the estuary. The station is part of a System Wide Monitoring Program (SWMP) designed to evaluate the relative contributions of climate on coastal forcing and watershed inputs to hydrodynamics, nutrient dynamics, and other ecological processes within the estuary. Data is used as a reference of atmospheric conditions for ongoing research projects at the Reserve as a support from NERR and for other short and long-term environmental monitoring projects within the Reserve.

4) Research methods

Campbell Scientific data telemetry equipment was installed at the JOBBMET station on 07/20/06 and transmits data to the NOAA GOES satellite, NESDIS ID #3B018394. 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>.

From January 1, 2011 - December 31, 2011 the Campbell Scientific weather station (operated by the CR1000 datalogger) collected data every 15 minutes in the following format:

Air Temperature (°C), Relative Humidity (%), Barometric Pressure (mb), Wind Speed (m/s), Wind Direction (degrees), and Battery Voltage (volts) based on averages from 5-second data.

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 JOB NERR)

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

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

Precipitation (mm), Cumulative Precipitation (mm) (began collecting as a standard parameter at JOB on 6/17/2008), and Photosynthetic Active Radiation (PAR; millimoles/m²) based on totals of 5-second data.

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 Jobos Bay National Estuarine Research Reserve (JBNERR) is located on the southern coastal plain of the island of Puerto Rico, a reserve within the West Indies geographical area. JBNERR is composed of two major areas: (1) Mar Negro, located on the western margin of the Bay, and (2) Cayos Caribe (a chain of 17 tear-shaped islets located to the southeast) and Cayos Barca (a chain of 7 tear-shaped islets located to the southwest boundaries) both with a back-reef system. The Mar Negro area 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 and Cayos Barca 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 in Salinas, Puerto Rico. Its coordinates are latitude 17 57' 23.34" N and longitude 66 13' 22.56" W. The tower base is about 9m above sea level, approximately 110m north from Jobos Bay's southern shoreline. The station is installed on a 10 meter tower in front of the Main Building, the wind and PAR sensors are above the building height. At 11 meters to the northwest side of the tower there is a tree with a height of 15 meters presenting a minor obstruction the sensors. In the southern region of Puerto Rico where JBNERR is located the winds persists from southeast and northeast, therefore the tree does not represent a significant obstruction for the winds. The height of the sensors are: Wind Sentry Anemometer (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 over the ground. The top of the bucket is 35 centimeters above the ground. The sensors are wired to a CR1000 following the protocol in the CDMO Manual.

The weather station is at the following distance from SWMP stations used for water quality monitoring:

- 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 installed in 1999. On 7/20/06 a new telemetry equipment was installed. During January 1st 00:00 to December 31st, 2011 23:45 data were collected, transmitted and saved in a computer where the meteorology station is connected.

7) Distribution

NOAA 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. 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 water quality 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 researchers and projects

The Jobos Bay NERR maintains four water quality monitoring stations as part of the System Wide Monitoring Program (SWMP) to monitor variability in the estuarine environment. Meteorological station collect continuous information that support water quality data intended to address short-term variability and long-term changes in estuarine water parameters within the bay (i.e., localized impacts of seasonal storms and hurricane events, variability due to tidal circulation, seasonal and interannual differences in rainfall, magnitude and influence of major events such hurricanes, spatial extent of oceanic and tidal forcing. Data will also be of fundamental baseline for future development of a hydrodynamic model for the Jobos Bay estuary with the help of CaRICOOS.

Our water quality monitoring program is a key component of SWMP. Variables measured include Temperature, Dissolved Oxygen, Turbidity, pH, Salinity, Chl-a fluorescence, and Depth in 4 permanent stations equipped with YSI datasondes. At the same stations, nitrogen, phosphorus, and chlorophyll are measured in a monthly basis.

SWMP data has been incorporated in the Conservation Effects Assessment Project (CEAP), a collaborative study of USDA, NOAA and JBNERR that pretends to implement best management practices in agricultural lands to improve water quality within the aquifer and Jobos Bay. Also, the Caribbean Regional Association for the Caribbean Regional Integrated Coastal Ocean Observing System (CaRICOOS) integrated and monitors Real Time data from our SWMP stations.

II. Physical Structure Descriptors

9) 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: $\pm 0.2^\circ\text{C}$ @ 20°C

Date of previous calibration: 2/18/2004. Date Installed: 2/18/2004-2/11/2011

Date of last calibration: 4/25/2010 Date Installed: 2/11/2011-current

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 previous calibration: 2/18/2004. Date Installed: 2/18/2004-2/11/2011

Date of last calibration: 4/25/2010 Date Installed: 2/11/2011-current

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; ± 6 mb @ -40°C to 60°C

Stability: ± 0.1 mb per year

Date of previous calibration: 2/18/2004. Date Installed: 2/18/2004-2/11/2011

Date of last calibration: 4/23/2010 Date Installed: 2/11/2011-current

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 (134 mph); gust survival 100 m/s (220 mph)

Accuracy: ± 0.3 m/s

Date of previous calibration: 2/18/2004. Date Installed: 2/18/2004-2/15/2011

Date of last calibration: 3/31/2010 Date Installed: 2/15/2011-current

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: ± 3 degrees

Date of previous calibration: 2/18/2004. Date Installed: 2/18/2004-2/15/2011

Date of last calibration: 3/31/2010 Date Installed: 2/15/2011-current

Parameter: LI-COR Quantum Sensor
Units: mmols 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 µmoles s⁻¹ m⁻²
Date of previous calibration: 2/18/2004. Date Installed: 2/18/2004-2/15/2011
Multiplier: 1.5
Date of last calibration: 2/19/2010 Date Installed: 2/15/2011-current
Multiplier: 1.1187

Parameter: Precipitation (non heated rain gauge)
Units: millimeters (mm)
Sensor type: Tipping Bucket Rain Gauge
Model #: RG-2000-C
Rainfall per tip: 0.01 inch
Date of previous calibration: 2/18/2004. Date Installed: 2/18/2004-5/31/2011
Date of previous calibration: 5/31/2011
Date of last calibration: 9/22/2011 (this date may be inaccurate)

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.

CR1000 installed: 7/21/2006

10) Coded variable definitions

Sampling station:	Sampling site code:	Station code:
Jobos Meteorology	jb	jobjbmet

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 deployment or 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
SSD	Sensor Drift
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.

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%.

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.

As of April 1, 2008, all Reserves were required to align their wind direction sensor to True North. JOB wind sensor was aligned on March 18, 2011. All wind direction data from January 1, 2011 to March 18, 2011 07:30 are flagged as suspect. The sensor was correctly aligned as of March 18th, 2011 08:45. All wind data from 07:45-08:30 were rejected due to maintenance to properly align the sensor. There was approximately 12 degrees offset between True and Magnetic North. Please contact JOB Reserve for more information.

All parameters from 1/1/2011 00:00 through the 2011 sensor swaps (see below) are flagged as suspect and coded as SOC (sensor out of calibration). The sensors have been installed since 2/14/2004 and have not been calibrated since installation.

All sensors were swapped during 2011:

The ATemp and Rh sensor was replaced on 2/11/2013 from 15:00-15:30. Data were rejected for all parameters for those timestamps.

The BP sensor was replaced on 2/11/2011 from 15:00-15:15. Data were rejected for all parameters for those timestamps.

BP data from 2/11/2011 15:30 -12/31/2011 23:45 were corrected due to an incorrect programming after the sensor swap. The data were corrected by subtracting the old offset (600.0) and then dividing that value by the old multiplier (0.184). The new multiplier (0.240) was then applied and the new offset (500.0) was added to that value.

The wind sensor was replaced on 2/15/2011 from 09:45-13:45. Data were rejected for those timestamps.

The PAR sensor was replaced on 2/15/2011 from 09:45-13:45. Data were rejected for those timestamps. Data were corrected because of an incorrect multiplier from 2/15/2011 14:00 thru 2/22/2011 09:00. PAR data began collecting correctly at 09:45.

There was a noticeable jump in PAR values following the sensor swap on 2/15/2011. This is more than likely due to a freshly calibrated sensor being installed. PAR data following the sensor swap are coded as CSM.

Precipitation data were rejected 2/15/2011 09:45-13:45 because of maintenance being performed on the MET station.

The precipitation gauge was replaced on 5/31/2013. Total precipitation (10:15) and cumulative precipitation 10:15-6/1/2011 00:00) data had to be corrected because of erroneous readings recorded during sensor replacement.

According to the 9/7/2011 METLog, the rain gauge was calibrated on 9/22/2011 from 10:50-11:30 and 13:55-14:45. These data are marked as suspect since this was also the day that Hurricane Irene passed over Puerto Rico. There is concern that the METLog information may be incorrect and that the rain gauge was not calibrated that day.

Heavy rain events:

Date	Precipitation (mm)	
5/16/11	30.23	
5/17/11	56.13	
5/20/11	73.66	
6/6/11	38.35	
6/7/11	37.34	
7/23/11	49.02	
7/27/11	33.53	
8/3/11	48.51	
8/22/11	47.75	
8/23/11	97.53	
8/24/11	36.07	
9/8/11	22.60	
9/14/11	22.10	
9/19/11	22.86	
9/22/11	102.9*	Irene Hurricane
11/4/11	48.26	

See above not about 9/22/2011 rain gauge calibrations

Maximum and Minimum Values for 2011:

Temp (C) range from 18.1 to 35

RH ranged from 28 to 94 %

BP ranged from 984 to 1018 mb

Highest Cumulative Precipitation was 97.5

Total PAR Highest value was 2264.7 mmol m⁻²