

Jacques Cousteau (JAC) NERR Meteorological Metadata
January 1, 2012 – December 31, 2012
Latest Update: April 29, 2015

I. Data Set and Research Descriptors

1) Principal investigator and contact persons

Mike Kennish, Research Coordinator
Institute for Marine and Coastal Studies, Rutgers University
71 Dudley Road
New Brunswick, NJ 08901-8521
kennish@imcs.rutgers.edu
(732) 932-6555

Steve Evert, Field Station Manager
Steve.evert@stockton.edu
(609) 652-4486

Gina Petruzzelli, SWMP Technician
gina@marine.rutgers.edu
609-652-4486

Richard Stockton College of New Jersey (RSC)
Marine Science and Environmental Field Station
PO Box 195
Port Republic, NJ 08241

2) Entry verification

Data are uploaded from the CR1000 data logger 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, 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.

SWMP technician Gina Petruzzelli and RSC Marine Field Station manager Steven Evert collected; QA/QC checked and compiled 2012 weather data per CDMO procedures. Raw data files were collected weekly and backed up to disc and a secondary hard drive. Pre-processing macros were run on a dedicated met station computer. All data was backed up to secondary hard drive, disc and remote servers.

3) Research objectives

The principal objective is to record long-term meteorological data for the JAC NERR in order to observe any environmental changes or trends over time. A major component of the JACNERR SWMP program is the monitoring of estuarine water quality. The close coupling between meteorological conditions and estuarine water quality has necessitated the monitoring of atmospheric conditions in the system as well. The meteorological data collected at the Reserve site thus provide valuable information on the atmospheric influences on water quality in the JACNERR system.

4) Research methods

The Campbell Scientific weather station samples every 5 seconds to produce 15 minute 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. The CR1000 datalogger can store over two weeks of data before it overwrites the data. If the modem link failed and data could not be collected from the datalogger to the computer the data would be downloaded from the CR1000 to a laptop computer following procedures in Part D. Section 4.5 of the CDMO Operations Manual. 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 at a minimum of every two years, depending on sensor specifications.

Recommended calibration frequency for the MET station sensors:

- Temperature/Humidity- yearly recalibration
- Rain Gauge- yearly recalibration
- Wind Speed/Direction- yearly or every 2 years (depending on the sensor)
- Barometric Pressure- every 2 years recalibration
- PAR- every 2 years recalibration
- CR1000-every 5 years (required beginning 2014, one year initial grace period)

Campbell Scientific data telemetry equipment was installed at the Nacote Creek Meteorological station on 11/15/05 and transmits data to the NOAA GOES satellite, NESDIS ID #3B00D112. (Where 3B00D112 is the GOES ID for that particular station.) 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>.

Data Collection Schedule:

i) Data are collected in the following formats.

(1) 15 minute averages are collected every 15 minutes.

ii) 15 minute average parameters:

Date, Time, Air Temperature (c), Relative Humidity (%),

Barometric Pressure (mb), Wind Speed (m/s), Wind Direction (degrees), SDWDir (degrees)

(SDWDir began collecting as a standard parameter 11/1/2008)

iii) 15 minute minimum & maximum parameters:

Date, Time, Air Temperature (c), Time (these data are not included in the dataset, but are available from the JAC NERR)

Date, Time, Maximum Wind Speed (m/s), Time (MaxWSpd began collecting as a standard parameter 5/1/2008)

iv) 15 minute total parameters:

Date, Time, LiCor (par), Rainfall (mm), Cumulative precipitation (CumPrep began collecting as a standard parameter 4/1/2008)

5) Site location and character

The Jacques Cousteau National Estuarine Research Reserve (JCNERR) at Mullica River/Great Bay is located on the northeast coast of the United States on the Atlantic Ocean. The estuary is near Tuckerton, New Jersey about 14 kilometers north of Atlantic City. The met station is located adjacent to Nacote Creek, a tributary of the Mullica River. The site is approximately 14.3 kilometers WSW of Little Egg Inlet, the primary saltwater influence of the JC NERR. The met station is located on property owned by the RSC Marine Science and Environmental Field Station in Port Republic, NJ, approximately 1.8 kilometers south of the Chestnut Neck marina on the Mullica River and 0.4 kilometers northeast of Rt. 9 in Port Republic, NJ.

GPS coordinates: N 39 degrees, 32 minutes, 4.83 seconds
 W 74 degrees, 27 minutes, 48.74 seconds

The nearest long term water quality monitoring station is located at Chestnut Neck Marina, approximately 1.8 kilometers North of the met station. Water quality data (currently not included in the JAC NERR SWMP program) for Nacote Creek is at a site adjacent to the met station. The unit is mounted on a 13-meter tower adjacent to the Nacote Creek, approximately 20 m from the high tide line. The elevations above the marsh surface are as follows; Barometric pressure - 2.2 m, temperature and relative humidity - 2.9 m, PAR - 4.5 m, wind - 12.5 m, highest point on tower (lightning rod) - 14 m. The rain gauge is approximately 2.1 m above the surface

and 1.5 m north of the tower. The area is sparsely covered with clam shell debris and upland grasses.

Typical weather patterns for the New Jersey Coast include afternoon sea breezes (SW) and near still winds from midnight until shortly after sunrise during the summer months. Major weather events typically include 2-3 day duration periods of ENE winds and significant cold fronts from October through March. These cold fronts typically bring extended periods of increased NW winds commonly reaching 25-40 knots.

6) Data collection period

The meteorological monitoring program was started in October 2002 at the JCNERR. The Reserve has a long-standing program in the collection of water quality data and other meteorological data, which is available at the Rutgers University Marine Field Station before October 2002 by contacting the Research Coordinator listed above. The 2012 data collection interval spanned from January 1, 2012 at 00:00 to December 31, 2012 at 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: www.nerrsdata.org; *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 www.nerrsdata.org. Data are available in comma delimited format.

8) Associated researchers and projects

The meteorological data collected in the SWMP program of JACNERR are important to assess migration patterns of key species found in the Mullica River-Great Bay Estuary, Little Egg Harbor, and other contiguous waters. Included here are the seasonal movements of striped

bass (*Morone saxatilis*), bluefish (*Pomatomus saltatrix*) and summer flounder (*Paralichthys dentatus*). The meteorological data are also important for studies of the population dynamics of shellfish species, notably the hard clam (*Mercenaria mercenaria*) and blue crab (*Callinectes sapidus*). Furthermore, the data are valuable for evaluating environmental conditions that influence benthic communities, both those inhabiting soft sediments and living attached to hard surfaces (i.e., epibenthos). One of the most important areas of study for the coastal bay waters of Little Egg Harbor is dealing with submerged aquatic vegetation (*Zostera marina* and *Ruppia maritima*). A major concern is the health and vitality of the SAV, and how the beds in the bay are affected by natural factors (e.g., storms, unusual temperature conditions, reduced dissolved oxygen, etc.) and anthropogenic influences. All of the aforementioned studies are either underway or scheduled for future work. In addition to meteorological monitoring, JAC NERR also monitors water quality and nutrient data as part of SWMP. These data are available online at <http://cdmo.baruch.sc.edu/>.

II. Physical Structure Descriptors

9) Sensor specifications.

Parameter: Photosynthetically Active Radiation (PAR)

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

S/N: Q30323

Date of calibration: April 30, 2009; multiplier 1.29

Dates of sensor use: August 4, 2009-August 16, 2012

S/N: Q32195

Date of calibration: July 6, 2011; multiplier 1.51

Dates of sensor use: August 16, 2012- current as of 12/31/2012

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

S/N: WM56138

Date of calibration: April 30, 2009

Dates of sensor use: August 2, 2009-August 16, 2012

S/N: WM48915

Date of calibration: July 7, 2011

Dates of sensor use: August 16, 2012- current as of 12/31/2012

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

S/N: WM56138

Date of calibration: April 30, 2009

Dates of sensor use: August 2, 2009-August 16, 2012

S/N: WM48915

Date of calibration: July 7, 2011

Dates of sensor use: August 16, 2012- current as of 12/31/2012

Parameter: Air 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

S/N: X1130013

Date of calibration: April 30, 2009

Dates of sensor use: August 4, 2009-August 16, 2012

S/N: Y1541089

Date of calibration: July 11, 2011

Dates of sensor use: August 16, 2012- current as of 12/31/2012

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: +/- 2% RH (0-90%) and +/- 3% (90-100%)

Temperature dependence of RH measurement: +/- 0.05% RH/°C

S/N: X1130013

Date of calibration: April 30, 2009

Dates of sensor use: August 4, 2009-August 16, 2012

S/N: Y1541089

Date of calibration: July 11, 2011

Dates of sensor use: August 16, 2012- current as of 12/31/2012

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

S/N: W2540007

Date of calibration: May 6, 2009

Dates of sensor use: August 4, 2009-August 16, 2012

S/N: Y1430012

Date of calibration: July 12, 2011

Dates of sensor use: August 16, 2012- current as of 12/31/2012

Parameter: Precipitation

Units: millimeters (mm)

Sensor type: Tipping Bucket Rain Gauge

Model #: TE525

Rainfall per tip: 0.01 inch

Operating range: Temperature: 0° to 50°C; Humidity: 0 to 100%

Accuracy: $\pm 1.0\%$ up to 1 in./hr; $\pm 0, -3\%$ from 1 to 2 in./hr; $\pm 0, -5\%$ from 2 to 3 in./hr

Previous Calibration: August 26, 2011

Date of Last calibration: September 27, 2012

CR1000

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 CRM100 Compact Flash Module. The CR1000 was added on November 10, 2006.

A GOES transmitter was added on November 15, 2005. The satellite antenna is oriented to 192 degrees North magnetic and activates the transmitter at 39:50 after the hour for a 10 second period. The telemetry is “Provisional” data and not the “Authentic” Dataset used for long term monitoring and study. This data can be viewed by going to <http://cdmo.baruch.sc.edu>.

10) Coded variable definitions

Sampling station:	Sampling site code:	Station code:
Nacote Creek	NC	jacnemet

11) QAQC flag definitions – This section details the automated primary and secondary 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 – This section details the secondary QAQC Code definitions used in combination with the QAQC flags above.

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
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 mmol/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.

PAR data from **01/01/2012-08/03/2012** are flagged and coded as <1> SSD CSM (8/4/2012-8/16/2012 also were considered to have drifted, however the sensor was also out of calibration for those dates. Those data are coded as SOC instead of SSD). There were noticeable changes in PAR values following the swap to a freshly calibrated sensor (assumed to be accurate) on 08/16/2012. We do not have the calibration certificate for the sensor that was removed in 2012 (Q30323), however, based on the jump in PAR values, we believe the sensor drifted over time. Acceptable drift is +/- 2% for this sensor. All PAR data 1 year prior the sensor swap, from

8/16/2011 to 8/16/2012 are flagged and coded as <1> SSD CSM, unless otherwise flagged and coded (see below for elevated nighttime data). PAR data for the remainder of this deployment are flagged and coded <0> CSM and users should note that drift for that period may have exceeded acceptable limits as well. If users are comfortable assuming that drift was linear (in a real world environment it is unlikely to be entirely linear), these data may be 'corrected' for assumed linear drift at the user's discretion using manufacturer's instructions.

Slightly elevated nighttime PAR data occurred during 2012. It is believed that moisture seeping into the sensor may have caused these elevated readings. Values >0 to 2.214 were flagged as suspect <1> CSM unless otherwise flagged or coded. Values >2.214 were rejected <-3> CSM. <http://www.sunrisesunset.com/> was used to help determine the cutoff times for sunrise and sunset. From 1/1/2012 to 8/3/2012 all PAR data, including the elevated nighttime are flagged and coded as <1> SSD CSM, unless rejected, due to elevated nighttime values (see above) and all PAR data from 8/04/2012-8/16/2012 are flagged and coded as <1> SOC CSM due to the sensor being out of calibration.

The following sensors are considered out of calibration during 2012 and are flagged and coded as <1> SOC CSM:

ATemp/RH 01/01/2012 00:00 - 8/16/2012 09:00

BP 8/4/2012 00:00 - 8/16/2012 09:00

PAR 8/4/2012 00:00 - 8/16/2012 09:00

Wind (all parameters) 8/4/2012 00:00 - 8/16/2012 09:00

Data are missing due to unknown causes on 6/26/2012 10:30. Data at 10:45 were rejected since it is unknown whether or not a full 15 minutes of 5-second data were collected.

7/20/2012 – 7:00 Significant Rain Event confirmed with local weather station ACY. Since the upper limit for the rain gauge is 25mm over a fifteen minute period, the 7:00 total precipitation and cumulative precipitation data were flagged as suspect (1 GSM CRE). Cumulative precipitation data for the remainder of the day are also flagged as suspect.

8/16/2012 - 9:15 - 13:15 All data are missing due to maintenance to replace all sensors except the tipping bucket 8/16/2012 – 13:30 all data were rejected following a program reload after sensor replacement.

From 8/16/2012 13:45 - 12/31/2012 23:45 wind direction data are flagged as corrected. Following sensor replacement it was discovered that the sensor was off by 26 degrees (readings were -26 degrees from what they should have been). **For corrections, data were imported into R-Studio and were corrected using the following:**

```
setwd("/users/ginapetruzzelli/desktop")
```

 This is where to find the data on my desktop.

```
data <- read.csv("2012Winddir.csv", header=T, strip.white=TRUE, na.strings=c(""))
```

 str(data)

This is taking my 2012Winddir.csv file and bringing it into R.

```
length(which(is.na(data$Wdir))) # This tells us how many NA values the vector
haswhich(is.na(data$Wdir)) # This tells us which rows of this vector have NA values
data$new.wind <- (data$Wdir +26) # this makes a copy of Wdir, adds 26 to it, and makes a new
vector with 26 added to each value in Wdir. This new vector is called new.wind. Vector is a new
column data$new.wind1 <- ifelse(data$new.wind > 359, data$new.wind-360, data$new.wind) #
This is taking all values in new.wind and creating a new vector called new.wind1 in here it takes
any value that is 360 or higher and subtracting 360 to get the correct direction, and any number
that is 360 becomes 0 write.csv(data, file = paste("This_is_your_file_name_",
as.Date(Sys.time()), ".csv", sep = ""), row.names = FALSE) This outputs the new file.
```

Local weather stations were used for comparisons, but not to correct the data:

Atlantic City International Airport (METAR KACY 271254Z) - 8.21 miles SW

New Gretna (KNJNEWGR2) - 3.57 miles NW

Tuckerton (X025 Weather Flow) - 7.74 miles 7.74

For more information about these corrections, contact the JAC Reserve.

9/27/2012 – 12:30 Precipitation data were flagged and coded as <5> SMT CSM after being corrected to read 0 following maintenance to calibrate the rain gauge. Cumulative precipitation data were corrected through the end of the day.

Superstorm Sandy arrived in New Jersey on 10/28/12 @12:00pm and did not move inland until 10/30/12 around 13:00. The F_Record has been coded with {CWE} for these dates and times while the data are coded as CSM (with the exception of rejected PAR data). Cumulative precipitation data are coded as CSM thru the end of the day on 10/30/2012.

11/23/12 5:15-8:30 RH (1,CAF) Data are within the range of the sensor.

12/19/12 11:45 data are missing because of a power down for system maintenance, 12:00 data were rejected due to not being a full 15 minutes of 5-second data following the program reload.