Narragansett Bay (NAR) National Estuarine Research Reserve Meteorological Metadata

January – December 2008

Latest Update: Wednesday, December 4, 2024

I. Data Set and Research Descriptors

1) Principal Investigator & Contact Persons

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2) Entry Verification

Data are uploaded from the CR1000 to a laptop via a RS-232 serial cable connection in a comma-delimited format (DAT). 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 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 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.

Daisy Durant (Marine Research Specialist II) and Kenny Raposa (Research Coordinator) were responsible for compiling and error checking the January through December 2008 weather data.

3) Research Objectives

The principal objective is to record long-term meteorological data for Narragansett Bay in order to observe any environmental changes or trends over time. These data are also used to support ongoing water quality and biological monitoring as well as scientific research.

4) Research Methods

Campbell Scientific data telemetry equipment was installed at the Potter Cove weather station on July 31, 2006 and transmits data to the NOAA GOES satellite, NESDIS ID 3B0211F8. 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](http://cdmo.baruch.sc.edu/).

The 15 minute Data are collected in the following formats for the **CR1000**:

**Averages from 5-second data:**

Air Temperature (°C), Relative Humidity (%), Barometric Pressure (mb), Wind Speed (m/s), Wind Direction (degrees), Wind Direction Standard Deviation (degrees) (Recorded as a standard parameter beginning 10/24/2008), Battery Voltage (volts)

**Maximum, Minimum, and their times from 5-second data** (these data are not available in the dataset, but are available from NAR NERR)**:**

Air Temperature (°C)

Maximum and times from 5-second data:

Wind Speed, (m/s) (Recorded as a standard parameter beginning 5/13/2008)

**Totals:**

Precipitation (mm), PAR (millimoles/m2), and Cumulative Precipitation (mm) (Recorded as a standard parameter beginning 5/13/2008)

**5) Site Location and Character**

The NBNERR consists of 4376 acres of diverse estuarine and terrestrial habitats ranging from open estuarine water to salt marshes to forested uplands. The land holdings include 60% of Prudence Island, most of nearby Patience Island, all of Hope Island off the west shore of Prudence Island, and Dyer Island located in the East Passage of Narragansett Bay. The reserve is located close to the geographic center of Narragansett Bay in Rhode Island. The Bay has a drainage basin of 1,800 square miles.

The weather station is located on Prudence Island, approximately 389 m south of Potter Cove (41o 38.335’ N, 71o 20.362’ W). The Wind Sentry (10m) and the Temperature and Humidity (3m) sensor are located on an aluminum tower approximately 10 m in height. A large wooden platform approximately 2.4 m W x 1.8 m D x 2.1 m H) has been situated at the weather station for about the past 16 years*.* It was originally constructed by the U.S. Environmental Protection Agency (EPA) to hold atmospheric deposition equipment which is no longer in use. We secured permission from the EPA to use this platform for weather station equipment. The Campbell housing unit is situated under the platform and contains the CR1000 data logger and all associated hardware (and telemetry equipment) as well as the barometric pressure unit (1.5m from the ground). On top of the platform we placed the GPS antenna, solar panel, and Yagi antenna. The PAR meter (3M) was also relocated here to make it more accessible for cleaning than the previous location. The rain gauge (3m) is also on the platform. All sensors were located in accordance with manufacturer recommendations to avoid the possible influence of shading, wind blocks, etc.

**6) Data Collection Period**

During 2008 data was collected from 01/01/2008 at 00:00:00 AM to 12/31/2008 23:45:00 PM.

Meteorological data has been collected at the weather station on Potter Cove since 1992. However, it wasn’t until 2001 when the meteorological station was updated and became part of NERR-SWMP.

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 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 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 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 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/](http://cfcdmo.baruch.sc.edu/). Data are available in comma separated format.

8) Associated Researchers and Projects

The NBNERR System-Wide monitoring Program has water quality monitoring station located nearby at Potter’s Cove. The principal objective of the SWMP program is to record long-term water quality data for Narragansett Bay in order to observe any physical changes or trends in water quality over time. Four sites were selected; one to represent an impacted site, two in open water (at both the surface and near-bottom), and one located in a salt marsh tidal creek. The Potter’s Cove site is located on Prudence Island’s northeastern shore and is impacted by boat traffic and storm runoff from mainland urban and residential areas. Measurements are taken every 15 minutes over roughly two-week collecting periods at all water quality monitoring locations throughout the year.

A Physical Oceanographic Real-Time System (PORTS) meteorological station is housed in the NERRS weather station at Potter’s Cove and independently records wind speed, wind direction, atmospheric pressure, and air temperature. This is one of six PORTS meteorological stations in Narragansett Bay. The purpose of PORTS is to support safe and cost efficient navigation. Data are available real-time and the system is managed for quality control.

Leslie Smith, Ph.D. candidate at URI-GSO uses the daily PAR data in a primary productivity model to provide daily productivity values. She can then get real productivity values by integrating through the water column with data she collects. To get daily productivity values she integrates the areal values through time using NBNERR 15min PAR measurements. What she ends up with are daily measurements of productivity from 6 stations along the west passage for every month. After a year of collection she can then get the annual rate of productivity. This is part of the NOAA-funded CHRP project, the overall goal of which is to create a combined biological-physical model of the west passage in an effort to study/predict hypoxic events in the bay. Leslie’s research fits into this in that she provides the biological raw data for the model to be compared to.Bob Marshall of the Prudence Island Groundwater Task Force has been using the NBNERR precipitation data since 2006. These data are being used in conjunction with groundwater level and stream-flow monitoring efforts to evaluate the status of the groundwater resource on Prudence Island.

Richard Bell, Ph.D. candidate at URI-GSO is using NBNERR PAR data to examine changes in YOY winter flounder lipid content in relation to photoperiod and changes in all winter flounder distribution (in or out of the Bay) in relation to photoperiod;

Laura Windecker, Ph.D. candidate at URI-GSO is using daily PAR data to incorporate with additional basic oceanographic monitoring in RI and BI Sounds as part of the much larger RI Ocean SAMP-funded monitoring project.

II. Physical Structure Descriptors

**9) Sensor Specifications, Operating Range, Accuracy, Date of Last Calibration**

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: 04/28/06

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

Date of Last calibration: 4/28/06

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 Last calibration: 4/22/08

Parameter: **Wind Speed**

Units: meter per second (m s-1)

Model # R.M. Young 5305 L - AQ

Sensor type: 20 cm diameter 4-blade helicoid propeller carbon fiber thermoplastic

Range: 0-50 m/s (112 mph)

Accuracy: ±0.2 m/s (0.4 mph)

or

Model # R.M. Young 5103 - 5 Wind Monitor

Sensor type: 18 cm diameter 4-blade helicoids propeller molded of polypropylene

Range: 0-60 m s-1 (0-134 mph); gust survival 100 m s-1 (220 mph)

Accuracy: ± 0.3 m s-1 (± 0.6 mph)

Model # R.M. Young 5305 L - AQ

Serial Number: 75311

Date of last calibration: 10/04/06

Model #: Wind Monitor R.M. Young 05103-5

Serial Number: 83868

Date of last calibration: 01/23/08

Install on: 10/27/08

Parameter: **Wind Direction**

Units: degrees

Model # R.M. Young 5305 L – AQ

Sensor type: balanced vane, 48.3 cm turning radius

Range: 0-360° mechanical, 355° electrical (5° open)

Accuracy: ±3°

or

Model # R.M. Young 5103 -5 Wind Monitor

Sensor type: balanced vane, 38 cm turning radius

Range: 0-360° mechanical, 355° electrical (5° open)

Accuracy: ±3°

Model # R.M. Young 5305 L - AQ

Serial Number: 75311

Date of last calibration: 10/04/06

Model #: Wind Monitor R.M. Young 05103-5

Serial Number: 83868

Date of last calibration: 01/23/08

Install on: 10/27/08

Parameter: **Photosynthetically Active Radiation**

LI-COR Quantum Sensor

Units: mmoles 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

Multiplier: 1.4007010, new multiplier 1.33518479 on 12/03/08 11:00:00

Date of last calibration: 04/04/08

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: ± 1.0% up to 1 in./hr; +0, -3% from 1 to 2 in./hr; +0, -5% from 2 to 3 in./hr

Date of Last calibration: 7/31/06

The CR1000 has 2 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.

Date CR1000 installed: December 19, 2006

10) Coded Variable Definitions

Sampling station: Sampling site code: Station code:

Potter’s Cove PC narpcmet

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 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.

## 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

SIC Incorrect Calibration Constant, Multiplier or Offset

SNV Negative Value

SOC Out of Calibration

SSM Sensor Malfunction

SSN Not a Number / Unknown Value

SSR Sensor Removed

## Comments

CAF Acceptable Calibration / Accuracy Error of Sensor

CDF Data Appear to Fit Conditions

CRE Significant Rain Event

CSM See Metadata

CVT Possible Vandalism/Tampering

13) Other Remarks and 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.

Cumulative precipitation data are recorded from 00:00 to 23:59 with the daily total recorded at the midnight mark (00:00). The midnight CumPrcp value is actually the total from the previous day.

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 m-2 over a 15 minute interval.

Relative Humidity data greater than 100 are within range of the sensor accuracy of ± 3%.

**During the NAR 2023 MET review the CDMO discovered that the wind speed multiplier had not been updated in the logger program following sensor swaps. Wind speed and maximum wind speed values were corrected from 10/27/2008 10:15 through the end of the year for 2008. The R.M. Young 5305 model (SN 75311) has a multiplier of 0.1024 while the R.M. Young 5103 (SN 83868) has a multiplier of 0.0980. To make the corrections, data were divided by the incorrect multiplier, 0.1024, and that value was multiplied by correct multiplier, 0.0980. The data were flagged and coded 5 SIC CSM, unless rejected or missing. Corrected data are considered suspect.**

**During 2017 the CDMO discovered an incorrect line in the CR1000 programming.  If RHumidity>100 And RHumidity<108 Then RHumidity=100.  A decision was made by the DMC during 2006 to discontinue correcting >100 RH values to 100. This change was never made in our program and has remained in each updated version until it was removed during 2017.  By correcting all values >100 during data collection we may have missed erroneous values that could have indicated a problem with the RH sensor.  CSM coding was added to all RH data from 2007 until the programming change in 2017.**

The wind sensor was aligned to True North on 3/27/2008.

On June 26, 2007 version 4 of the Campbell Logger Net program was uploaded to the weather station. The newest version (version 5.5) of Campbell Logger Net program was uploaded on May 13, 2008.

Wind data from 10/20/2008 17:00 to 10/27/2008 09:15 are considered suspect due to a missing propeller piece.

PAR data from 12/3/2008 11:00:00 to 12/31/09 23:45:00 were corrected with new multiplier.