Delaware (DEL) NERR Meteorological Metadata
January 01, 2009 - December 31, 2009
Latest Update: May 28, 2012

I. Data Set & Research Descriptors

1) Principal investigator & contact persons:

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2) Entry verification

a) Data Input Procedures:

Data are uploaded from the CR1000 data logger to a Personal Computer (IBM compatible). Loggernet software, installed on the DNERR computer, is utilized to automatically upload data (every 15 minutes) via a short haul modem to this computer located at St. Jones Center for Estuarine Studies. The data are saved as a raw data file (SJ_RAW.dat) onto a separate hard drive and backed up onto Delaware Coastal Programs' (DCP) server. 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. Michael G. Mensinger conducts all data collection, data management, and QA/QC activities.

Common occurrences noted in the monthly queries were humidity values exceeding 100% and small negative PAR values. These two occurrences are within the range of the two sensors. All errors were double checked with other data that could support such "anomalous" weather changes. Wind speeds below the 0.5 m/s are common between 1900 and 0600 hours.

b) Data Collection Schedule:

i) Data is 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, Standard Deviation of Wind Direction (degrees)

iii) 15 minute minimum & maximum parameters:
Date, Time, Air Temperature (c), Time (these data are not included in the dataset, but are available from DEL NERR)
Date, Time, Maximum Wind Speed (m/s), Time

iv) 15 minute total parameters:
Date, Time, Photosynthetically Active Radiation (PAR) (mmols/m^2), Total Precipitation (mm), Cumulative Precipitation (mm)

3) Research objectives:

The principal objective is to record long-term meteorological data for the St. Jones component of the Delaware National Estuarine Research Reserve in order to observe any environmental changes or trends over time. The data are also used for specific research studies relating to atmospheric deposition of nutrients and pesticides, and nutrient runoff influences from encroaching urbanization on estuarine systems. The meteorological data also serves a supporting role for the SWMP water quality and nutrient data sets since meteorological conditions directly impact these projects.

4) Research methods:

The Campbell Scientific weather station sampled every 5 seconds to produce both 15 minute averages of the measurements of air temperature, relative humidity, barometric pressure, rainfall, wind speed and wind direction and 15 minute totals for photosynthetically active radiation and precipitation. The CR1000, installed on 09/18/06, contains 2 Mbytes of memory. The data is sent every 15 minutes to a computer for real-time display and storage. If the short haul modem link failed and data could not be automatically sent from the datalogger to the computer, the data would be downloaded from the CR1000 to a laptop computer following procedures in the CDMO Operations Manual. On a monthly basis, 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 the following intervals:

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

Campbell Scientific data telemetry equipment was installed at the St. Jones station on 11/16/05 and transmits data to the NOAA GOES satellite, NESDIS ID #3B00F7FE. 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.

5) Site location and character:

The Delaware National Estuarine Research Reserve is comprised of two component sites, the St. Jones River and Blackbird Creek components. Both components are located along the Delaware Bay Coast. The St. Jones River Component is located in central Kent County Delaware, east of the State capitol city, Dover. The Blackbird Creek component is located in the unincorporated area of Southern New Castle County. The meteorological station site, is located in the St. Jones DNERR component. It is located in a tidal marsh area with a wooded fringe area 100 m to the north, 75 m to east, 75 m to the west and 1+ km to south. The wooded area is of an approximate average height of 16 m.

Position: Latitude 39 degree 05' 20.05" N
Longitude 75 degree 26' 12.78" W

The unit is mounted on a 3-meter tower adjacent to the boardwalk that crosses the marsh. The elevations above the marsh surface are as follows; Barometric pressure - 2.2 m, temperature and relative humidity - 2.9 m , wind and PAR - 4.5 m, highest point on tower (lightning rod) - 4.9 m. The rain gauge is 2.4 m above the surface and 3 m south of the tower. The adjacent boardwalk is 1.1 m above the surface with a railing height of 1.0 m. A vegetative cover of spartina surrounds the area with an average height of 1 m. The tower and rain gauge are both 1 m east of the boardwalk. The weatherstation is located approximately 2 km from the water quality datasonde at Scotton Landing, approximately 4km from the water quality station at Lebanon Landing, and approximately 10km away from the water quality monitoring station at Division Street.

6) Data collection period:

The meteorological monitoring program was started in October 1997 at the DNERR and has been continuous through the present. The data collection format has followed NERRS protocol since standardized meteorological program development in November of 1998.The 2009 data set runs from January 1, 2009 (00:00 EST) through December 31, 2009 (23:45 EST).

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 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 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 separated format.

8) Associated researchers and projects:

The NERR Water Quality Monitoring Project has four stations located at the DNERR. The principal objective of this study is to record long-term water quality data for St. Jones and Blackbird watersheds in order to observe any physical changes or trends in water quality over time. The Blackbird station represents a pristine site while the the three St. Jones River stations represent impacted sites. Measurements are taken every 30 minutes over roughly two-week collecting periods.

The NERR Nutrient Monitoring Project has five stations located at the DNERR. The objective of this monitoring program is to provide baseline information on inorganic nutrient and Chla water quality status in the Delaware NERR while also contributing to baseline information nationally. Diel and grab samples are collected monthly at each of the five sites.

In addition atmospheric deposition of rainfall events was performed during years past in the DNERR watersheds to monitor and characterize the nutrient input to the estuary from differing storm events and seasonally. One sampler was once positioned in the St. Jones watershed (the additional two were decomissioned in 2003) and one was once located in the Blackbird watershed.

II. Physical Structure Descriptors

9) Sensor specifications, operating range, accuracy, date of last calibration

LiCor Quantum Sensor
Model # LI190SB
Stability: <±2% change over 1 yr
Operating Temperature: -40 to 65°C
Sensitivity: typically 5 µA per 1000µmoles s-1 m-2
Light spectrum wavelength: 400 to 700 nm
Date of last calibration: 8/15/2000 (installed new 12/20/2000)
12/19/2002: Replaced with unit (s/n Q22182, recalib 11/14/2002)
12/21/2004: Replaced with unit (s/n Q99240, recalib 09/17/2004)

01/11/2007: Replaced with unit (s/n Q22182, recalib 05/03/2005)
01/07/2008: Replaced with unit (s/n Q99240, recalib 11/14/2007) (multiplier = 1.29)
12/30/2008: Replaced with unit (s/n Q22182, recalib 10/31/2008) (multiplier = 1.51)
11/30/2009; Replaced with unit (s/n Q99240, recalib 05/22/2009) (multiplier = 1.35)

Wind Monitor
Model # 05103
Range: 0-60 m/s; 360° mechanical
Date of last calibration: 04/05/1999 (installed new 12/20/2000)
12/19/2002: Replaced with unit (s/n WM49558)
12/21/2004: Replaced with unit (s/n 35269, recalib 09/01/2004)
01/11/2007: Replaced with unit (s/n 49546, recalib 12/01/2006)
01/07/2008: Replaced with unit (s/n 35269, recalib 09/14/2007)
03/10/2010: Replaced with unit (s/n 49558, recalib 02/19/2010)

Temperature and Relative Humidity
Model #: HMP45C
Operating Temperature: -40-+60°C
Temperature Measurement Range: -40-+60°C
Temperature Accuracy: ± 0.2 °C @ 20°C
Relative Humidity Measurement Range: 0-100% non-condensing
RH Accuracy: +/-2% RH (0-90%) and +/-3%(90-100%)
Uncertainty of calibration: ± 1.2% RH
Date of Last calibration: Unit 2 unknown (installed new 12/20/2000)
Unit 1 11/27/2001 (installed new 12/19/2001)
12/19/2002: Replaced with unit #1 (s/n U1430039, recalib 10/09/2002)
12/22/2003: Replaced with unit #2 (s/n V2530002, recalib 11/03/2003)
12/21/2004: Replaced with unit #1 (s/n U1430039, recalib 09/14/2004)
12/16/2005: Replaced with unit #2 (s/n V2530002, recalib 04/12/2005)
12/29/2006: Replaced with unit #1 (s/n U1430039, recalib 06/06/2006)
01/07/2008: Replaced with unit #2 (s/n V2530002, recalib 11/14/2007)
12/30/2008: Replaced with unit (s/n X113???8, recalib 10/30/2008)
02/04/2010: Replaced with unit (s/n U1430039, recalib 12/22/2009)

Barometric Sensor
Model # CS-105
Operating Range: Pressure - 600-1060 mb
Temperature: -40-+60C
Humidity: non-condensing
Accuracy: ±0.5 to 6.0 mb (+20-60C)
Stability: ± 0.1 mb per year
Date of Last calibration: 9/12/00 (installed new 12/20/2000)
12/19/2002: Replaced with unit # (s/n R1630014, recalib 10/09/2002)
12/21/2004: Replaced with unit # (s/n V3320037, recalib 09/17/2004)
05/19/2006: Replaced with unit # (s/n R1630014, recalib 04/18/2005)
12/29/2006: Replaced with unit # (s/n V3320037, recalib 06/08/2006)
01/07/2008: Replaced with unit # (s/n R1630014, recalib 11/19/2007)
12/30/2008: Replaced with unit # (s/n V3320037, recalib 11/10/2008)
02/04/2010: Replaced with unit (s/n X0140015, recalib 12/22/2010)

Tipping Bucket Rain Gauge

Model #: TE 525
Range: 0.1 mm
Accuracy: 1.0% at <2"/hr
Date of Last calibration: field calibrated 12/20/2000, 12/19/2001, 12/19/2002, 12/22/2003, 12/22/2004, 12/16/2005, 12/29/2006, 01/07/2008, 12/30/2008, 10/05/2009

Storage Module
Model#: SM4M
Storage capacity: 4MB
Operating range: -35C to +65C
Processor: Hitachi H8S
Baud rates for data storage: 9600, 76800 baud
Baud rates for telecommunication: 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 76800, 115200
Memory type: user selectable for either ring style or fill and stop
Power requirements: 5 +/-0.3V DC @100mA (max.)
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.

CR1000 installed: 9/18/2006

10) Coded variable indicator and variable code definitions:

- DELSJMET (station code) "DEL" indicates the Delaware NERR
"SJ" indicates the St. Jones River Site
"MET" indicates meteorological sampling/data

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
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
CRE	Significant Rain Event
CSM	See Metadata
CVT	Possible Vandalism/Tampering

13) Other remarks/notes

a) 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.

b) 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.

c) Relative Humidity data ranging from 100-103% are within range of the sensor accuracy of +/- 3%. Relative humidity values exceeding 103% are outside the sensor's accuracy range and are rejected (coded with a -3) during QAQC analysis.

d) 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.

e) No new program uploads took place in 2009.