Wells (WEL) National Estuarine Research Reserve
January-December 2016
Latest Update: September 7th, 2017

I. Data Set & Research Descriptors

1) Principal investigator & contact persons:

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2) Entry verification:

a) Data Input Procedures:

The meteorological information is sampled every 5 seconds from each instrument on the weather station and stored on a Campbell Scientific CR1000 data logger. The CR1000 has two MB Flash EEPROM that is used to store the Operating System and another 128 K Flash is used to store configuration settings. A minimum of 2 MB SRAM (4 MB optional) is available for program storage (16K), operating system use, and data storage.

> Data are uploaded from the CR1000 data logger to a Personal Computer (IBM compatible). Files are exported from or 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 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. Jeremy Miller is responsible for all aspects of data management.

3) Research Objectives:

The principal objective is to record long-term meteorological data for Wells, in order to supplement SWMP water quality YSI and nutrient data and research data, and to observe any environmental changes or trends over time.

4) Research Methods:

The CR1000 datalogger samples every 5 seconds to produce 15 minute averages and totals. This data is stored within the CR1000 until it is manually downloaded through LoggerNet and uploaded to the CDMO for initial QA\QC procedures. All data are collected in Eastern Standard Time (EST).

Campbell Scientific data telemetry equipment was installed at the Laudholm Farm Weather station on 07/11/06 and transmits data to the NOAA GOES satellite, NESDIS ID #3b024184. 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.

Sensors on the weather station are inspected monthly for damage or debris. Sensors are removed and replaced with recently calibrated sensors approximately every two years, with the exception of the rain gauge and Temp/Humidity probe, which are calibrated approximately every year. Also, once a month on download day, we use regional NWS data, to run a comparative set of observations as a general check on the Campbell station sensors and hardware.

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)

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), and Battery Voltage (volts)

Maximum, Minimum, and their times from 5-second data:
Maximum and Minimum Air Temperature (°C) and their times from 5-second data (these data are available from the Reserve)
Maximum Wind Speed (m/s) and time from 5-second data

Wind Direction Standard Deviation (degrees)

Totals:
Precipitation (mm), PAR (millimoles/m^2), and Cumulative Precipitation (mm)

5) Site location and character:

The Wells National Estuarine Research Reserve (and Laudholm Farm Meteorological station) is located in York County, within the Town of Wells, on the coast of southern Maine and faces the Atlantic Ocean at an elevation of 18.62 meters above sea level. The Wells NERR is approximately 31 km (20 miles) south of Portland, Maine and 110 km (70 miles) north of Boston, Massachusetts. The Reserve encompasses 1,690 acres along the Gulf of Maine coastline of tidally flushed wetlands, riparian and transitional upland fields and forests within the Little River Estuary and the larger Webhannet River Estuary. Both estuaries arise in the sandy glacial outwash plain about eight miles inland. Both rivers empty into Wells Bay, a sandy basin stretching for approximately ten miles along the Atlantic coast. Bordering each river's inlet are double spit barrier beaches attached to the mainland. The backbarrier system is approximately 5 sq. km and is composed of large intertidal marshes (predominantly S. patens and S. alterniflora), intertidal sand and mud flats, and tidal channels. The watershed for the Webhannet River estuary covers an area of 35 sq. km and has a total of 6 streams, brooks or creeks, which enter the estuary. These tributaries flow across sand and gravel deposits near the headwaters and the impermeable sandy mud of the Presumpscot Formation in the lower reaches. The Webhannet River is connected to the ocean via Wells Inlet, which has a spring tidal prism of 28,200,000 cub. m (Ward 1993). The force and volume of tidal action affect the salinity level of both rivers. In the Wells region, the annual mean wave height is almost 20 inches. The estuarine system is dominated by semi-diurnal tides having a range of 8.5 to 9.8 feet. The volume of freshwater influx into both estuaries is moderate to low (on the order of 0.5 cubic meters/second), especially in the summer, because of the rivers' relatively small drainage areas and the presence of deep glacial deposits. The relatively low flows from these two rivers taken in with the 20 inch per year average runoff of the area surrounding the estuaries combine to form a freshwater flow that is dwarfed by tidal flushing. Twelve-foot tides dwarf the freshwater flow into the Webhannet estuary, which has a drainage area of 14.1 square miles. The Webhannet estuary, fed by both Blacksmith and Depot Brooks, is adjacent to the harbor and greatly developed land. It offers a valuable opportunity for comparison with the relatively pristine Little River estuary. The land use of the Webhannet estuary include a total of 15% for wetland, fresh water, and tidal marsh; a total of 63.7 % for woodland; and a total of 18.6% for developed land (compared to a total of 5.7% development in the Little River estuary) (WNERR RMA 1996; Holden 1997).

The following information regarding annual weather patterns in the area was supplied by Maine State Climatologist Professor Gregory A. Zielinski extracted from "Monthly Station Normals of Temperature, Precipitation, Heating and Cooling Degree Days 1971-2000", Climatography of the United States No. 81, National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC. and "Daily Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000", Climatography of the United States No. 84: "Average monthly temperatures range from 21.6F in January to 66.7F in July with daily highs averaging just below freezing in January and lows around 11F. Daily highs in July average around 76F and daily lows around 57F. The sea breeze often keeps daily highs lower during the summer than areas inland. Annual average temperature is 44.6F. Annual precipitation is 47.07 inches, including the water equivalent of snowfall, with monthly averages ranging from 3.01 inches in July to 4.77 inches in October. August receives just 3.02 inches on average. Annual snowfall is around 66 inches." According to Zielinski, "cool ocean temperatures keep down the number of afternoon showers and especially thunderstorms resulting in low summer precipitation amounts."

The weather station is located (43 deg 20’ 14.52” N, and 70 deg 32’ 58.03” W) on a 32'(9.75m) telephone pole surrounded by mowed grass. The temperature and humidity probes are located on the north side of the pole at a height of 10' (3.0m). The PAR sensor is located on the South side of the pole at a height of approx. 15’(4.6m). The Barometric pressure sensor is located within the Campbell Scientific enclosure at a height of approx. 5’(1.5m) and vented to the outside by a small length of aquarium tubing. The wind sensor is located atop the pole at approximately 33 feet (10.1m) above the ground. To the NW of the pole is the Coastal Ecology Center, a 20' (6.1m) high, 111'(33.8m)long building, at a distance of 37'(11.3m), running NE/SW. Further to the NW (153'(46.6m) from the pole) is the library, in a 25'(7.6m) high wing of the barn. The barn itself is 223'(68.0m) from the station and runs NE/SW. It is 38'(11.6m) high and is the largest obstruction in the area.

The rain gauge is located 9'(2.7m) southeast of the weather station pole and is situated on a post with the top of the funnel is 10'(3.0m) from the ground.

There are two SWMP water quality sampling sites in the Webhannet River estuary. These are located at the Webhannet River Head of Tide, at the Webhannet Inlet, at Skinner Mill on the Merriland River. The tidal range at each of these sites is 2.6-2.9 meters. The Inlet site is approximately 2.25km from our weather station and the Head of Tide site is approx. 5.37km from our weather station.

Station Code	Station Name	SWMP Status	Location	Active Dates	Reason Decommissioned	Notes
WELLFMET	Laudholm Farm	P	43° 20' 14.52 N, 70° 32' 58.03 W	01/01/2001 -	NA	NA

6) Data collection period: Data was collected for the full calendar year starting at 00:00 on 1/1/2016 through 12/31/2016 at 23:45. Minor data loss may have occurred due to station maintenance, probe failure, etc.

File Start Date and Time	File End Date and Time
12/22/2015 13:45	01/27/2016 13:45
01/27/2016 14:00	02/18/2016 09:30
02/18/2016 09:45	03/30/2016 09:00
03/30/2016 09:15	04/25/2016 14:45
04/25/2016 15:00	05/23/2016 10:15
05/23/2016 10:30	06/23/2016 12:45
06/23/2016 13:00	07/22/2016 08:30
07/22/2016 08:45	08/18/2016 13:15
08/18/2016 13:30	09/23/2016 13:15
09/23/2016 13:30	10/28/2016 12:00
10/28/2016 12:15	11/21/2016 11:15
11/21/2015 11:30	01/12/2017 10:45

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:

NOAA National Estuarine Research Reserve System (NERRS). System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: http://www.nerrsdata.org/; *accessed* 12 October 2016.

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:

WELLS NATIONAL ESTUARINE RESEARCH RESERVE RESEARCH AT THE RESERVE for 2016 (Please visit our website: www.wellsreserve.org/research.htm for further information on the Wells NERR research program):

The Research Program at the Wells NERR conducts and supports research, monitoring, workshops, and research/resource management planning of relevance at local, regional and national levels. The overall aim of our work is to produce science-based information needed to sustain or restore Gulf of Maine coastal habitats and resources, especially those found in salt marsh estuaries and watersheds. During 2016, many different studies involving scores of scientists, students, staff and volunteers focused on several related themes: 1) the quality of water resources in salt marsh estuaries and watersheds 2) land conservation strategies to protect coastal watersheds 3) factors controlling salt marsh accretion, erosion and plant community vigor 4) the value of salt marsh as habitat for fish, shellfish and birds, 5) restoration of salt marsh habitat degraded through human actions, and 6) understanding the ecology and functions of salt marsh habitat.

Estuarine Water Resource Quality

Water quality is monitored continuously at several stations with automated instruments as part of a NERRS system wide monitoring program (SWMP). Data on dissolved inorganic nutrients (Combined Nitrite/Nitrate, ammonia, orthophosphate, silica, and Chl-a) are also collected on a monthly basis at the above mentioned stations as part of the same SWMP Program. Research Staff at the Reserve also oversee a State of Maine volunteer river monitoring program (VRMP) which samples a number of locations in the adjacent watersheds for temp, bacterial contamination, and dissolved oxygen values.. Our water quality work has contributed to the designation of several Priority Watersheds in coastal Southern Maine by the Maine Department of Environmental Protection.

Seacoast Watershed Information Manager (Project S.W.I.M.)

The Seacoast Watershed Information Manager (Project S.W.I.M.) will be an online resource to help local planners and the public evaluate, conserve, and restore coastal watershed resources along the Maine and New Hampshire seacoast by developing a website that describes the region and its resources, provides access to GIS data and other relevant information, and includes a decision-support tool that examines the impact of growth and development on water resources. It will include:

- A Narrative that informs local resource planners and the public by describing development impacts, water resources, and land use.
- Socioeconomic Analysis focused on water resource use as it relates to human activities.
- Land Use Change Assessments focusing on shoreland and permeability.
- A Data Clearinghouse providing users access to key data needed for local and regional-scale resource management.

- A GIS-based Decision Support Tool to help communities manage and protect water resources by considering how water supply, water quality and land use change are affected by land use planning decisions.

The Project focuses on the coastal watersheds from the Cocheco and Salmon Falls River in New Hampshire to the Kennebunk River in Maine. These 15 watersheds include 38 municipalities and cover 1,800 square miles. The Wells National Estuarine Research Reserve is the lead partner with support from NOAA's Coastal Services Center Landscape Characterization and Restoration Program and the Great Bay National Estuarine Research Reserve.

Marine Invader Monitoring and Information Collaborative (MIMIC):

Researcher Associate at the Wells NERR act as State Coordinator for groups of citizen scientist who monitor 12 sites in coastal southern Maine for marine invasive species. Data has been being collected on the presence and absence, and general abundance of 23 priority species as identified by the Massachusetts Office of Coastal Zone Management and MIT SeaGrant.

HABITAT VALUE FOR FISH, SHELLFISH AND BIRDS

The Reserve combines long-term monitoring with periodic surveys and short-term experiments to identify species and measure trends and changes in populations of fish, crustaceans, clams and birds. We have 17 years of data on upland and shore birds with which to assess the status of resident and migratory avian populations, and several years of wading bird data that we use as a gross level indicator of salt marsh health, which appears to be stable. Our ongoing larvalfish surveys have produced the best available data for fish utilization of salt marsh estuaries in the Gulf of Maine. Since 1994 we have been conducting surveys and field experiments to look at the survival and growth of hatchery seed, juvenile and adult softshell clam with regard to habitat characteristics and predation by the invasive green crab. Benthic invertebrates have been sampled from a number of marshes from Wells to Casco Bay in hopes of gaining a better understanding of invertebrate assemblage and their value to higher trophic levels.

Since 2014, The Reserve has worked with Dr. Brain Beal of the Downeast Research Institute at the University of Maine, Machias, to investigate the impacts of predation on soft shell clam, populations by the invasive Green Crab (*Carcinus Meanas).* Research staff have been involved with the town of Wells Clam Commission for many years and are working with the local clam warden to improve the timing and efficiency of seeding efforts, as well as ways to control crab predation through exclusion via physical barriers (ie. Fences).

Salt Marsh Degradation and Restoration

Salt marsh ecosystems in the Gulf of Maine have sustained themselves in the face of sea-level rise and other natural disturbances for nearly five thousand years. Since colonial times large areas of salt marsh (up to half of the total areas) have been lost through diking, draining and filling. Today, the remaining marshland is fairly well protected from outright destruction, but during the past 100 years, and especially since the 1950's, salt marshes have been divided into fragments by roads, causeways, culverts and tide gates. Most of these fragments have severely restricted tidal flow, leading to chronic habitat degradation and greatly reduced access for fish and other marine species. Since 1991, the Wells Reserve has been studying the impact of these restrictions on salt marsh functions and values, and the response of salt marshes to tidal restoration. We have been working to promote an awareness of the damage being done and the benefits of salt marsh restoration throughout the Gulf of Maine.

Research Program Update: In addition to the Reserve-sponsored projects outlined above, numerous visiting investigators will be involved in on-site research. Topics include: the effects of land use, sea level, and climate on estuarine productivity; the relationship between soil nutrients and plant community patterns; the influence of soil salinity on plant community interactions; the effect of tidal restriction on marsh peat accretion; the comparative ecology of fringe marshes and back barrier marshes; habitat use by upland birds, impacts of the invasive green Crab on salt marsh communities, and the ecology of lyme disease.

"Sustaining Quality of Place in the Saco River Estuary through Community-Based Ecosystem Management"

This project will focus on understanding the effects of increasing coastal development on the health of the Saco River Estuary, and on ways to mitigate these effects. It will employ the methods of social sciences in understanding management and policy challenges, and in examining existing gaps in scientific knowledge required to address these challenges. It will also use the methods of the natural sciences to develop ecological indicators that reflect the extent and impacts of coastal development. This project is a first step in achieving the long-term goal of sustaining the structure and function of the Saco River Estuary, and could serve as a model for bringing scientists and stakeholders together to achieve similar goals.

Soundscapoe Ecology Project:
Since 2014 researchers and stewardship staff at the Wells NERR have been working with Dr. Brain Pijinowski and a number of scientist from Purdue University using soundboxes to collect continuous sound recordings from a number of locations around the Reserve. This is part of a larger international project called the Global Soundscape Network. The purpose is to use sound data as a tool to identify species in the area, timing of species arrivals, track both natural and anthropogenic sources of sounds and how those sounds are changing over time.

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 #: HC2-S3
Operating Temperature: -40°C to +60°C
Range: -40°C to +60°C
Accuracy: ± 0.2 °C @ 20°C
Serial Number: 0061290211
Date of Last Calibration: 02/24/2014
Dates in use: 12/19/2014 - 01/07/2016
AND
Serial Number: 61115998
Date of Last Calibration: 12/5/2015
Dates in use: 1/7/2016 – current as of 12/31/2016

Parameter: Relative Humidity
Units: Percent
Sensor type: Rotronics HC2-S humidity sensor
Model #: HC2-S3
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
Serial Number: 0061290211

Date of Last Calibration: 02/24/2014
Dates in use: 12/19/2014 through 01/07/20116
AND
Serial Number: 61115998
Date of Last Calibration: 12/5/2015
Dates in use: 1/7/2016 – current as of 12/31/2016

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
Serial Number: V4920039
Date of Last calibration: 10/16/2014
Dates in Use: 11/05/2014 – 11/21/2016
AND
Serial Number: P4910021
Date of Last calibration: 10/24/2016
Dates in Use: 11/21/2016 – current as of 12/31/2016

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
Serial Number: WM73891
Date of last calibration: 10/16/2014
Dates in Use: 11/5/2014 – 11/17/2016
AND
Serial Number: WM82868
Date of last calibration: 10/26/2016
Dates in Use: 11/17/2016 – current as of 12/31/2016

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
Serial Number: WM73891
Date of last calibration: 10/16/2014
Dates in Use: 11/5/2014– 11/17/2016
AND
Serial Number: WM82868
Date of last calibration: 10/26/2016
Dates in Use: 11/17/2016 – current as of 12/31/2016

Parameter: Apogee SQ-110 Quantum sensor PAR
Units: umoles/s/m^2
Sensor type: High stability silicon photovoltaic detector (blue enhanced)
Model #: SQ-110
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
Serial Number: 16741
Multiplier: 0.025 (multiplier never changes with this model)
Date of last calibration: 09/01/2014
Dates in use: 10/20/2016 - 11/21/2016
AND
Serial Number: 16742
Date of last Calibration: BRAND NEW SENSOR
Dates in use: 11/21/2016 – current as of 12/31/2016

Parameter: Precipitation
Units: millimeters (mm)
Sensor type: Tipping Bucket Rain Gauge
Model #: TE525
Serial Number: H12182
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
Previous calibration: 8/24/2015
AND
Date of last calibration: 8/18/2016

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.
Serial Number: 5244
Date CR1000 Installed: 07/12/06, removed 4/13/2015 for calibration
CR1000 calibrated: 04/18/2015
Dates in use: 4/22/2015 - current as of 12/31/2016

CR1000 Firmware Version (s): Firmware version 28.0 was used for all of 2016 data collection.

CR1000 Program Version(s): welfmmet_7.0_112014..CR1 was the only program used in 2016.

10) Coded variable code definitions:
Sampling Station: Laudholm Farm
Sampling site code: LF
Station code: wellfmet

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, 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
SSN	Not a Number / Unknown Value
SSM	Sensor Malfunction
SSR	Sensor Removed

Comments

CAF	Acceptable Calibration/Accuracy Error of Sensor
CCU	Cause Unknown
CDF	Data Appear to Fit Conditions
CML	Snow melt from previous snowfall event
CRE*	Significant Rain Event
CSM*	See Metadata
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. These values are automatically flagged and coded as <1> (CAF).

Relative Humidity data greater than 100 are within range of the sensor accuracy of +/-3% and are flagged and coded as suspect, <1> (CAF). Values greater than 103 are rejected <-3>.

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.

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. **Note: Cumulative precipitation is no longer available via export from the CDMO. Please contact the Reserve or the CDMO for more information or to obtain these data.**

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.

*Rapid changes in Relative Humidity and Temperature are quite common at the Wells NERR due to our close proximity to the coast and shifts in wind from the ocean to the land (and vise versa). These shifts in wind

direction can dramatically affect both the temperature of the air as well as the amount of moisture there in, causing air temperatures and Relative Humidity to rise and fall sharply.

Wind data on 2/16/2016 from 8:30-10:15 have been rejected as the sensor was visibly frozen from freezing rain that morning and not moving in the presence of a breeze.

5/18/2016 14:00 total precipitation was rejected and cumulative precipitation values were rejected, <-3> CSM, from 14:00 through 5/19/2016 00:00. Data recorded at 14:00 exceeded the sensor limit for 15 minute precipitation (25mm over 15 minutes). We do not believe that this amount of rainfall is accurate and the other parameters do not indicate a rain event.

Both BP and PAR sensors were swapped on 11/21/2016. Data for those parameters were rejected from 11:15 - 11:45, <-3> SMT CSM.

Additional statements about WEL NERR weather:
Data are not flagged and coded but we feel that this is important information to add to the metadata since this was a very warm and dry year for our area. 2016 was one of the warmest years for WEL NERR. We experienced the warmest winter on record since 1895 and had very little snowfall, only two major events in February 2016. Summer was also one of the driest and warmest with very little precipitation. Maine (all of New England) was considered to be in severe drought conditions from July to late October.