

I. Data Set & Research Descriptors

1) Principal Investigator(s) & contact persons

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2) Entry Verification

System I: CR1000, CR10X

- 1) As of July 12 2006 at 17:45, WBNERR weather station was changed from the CR10X datalogger to a CR1000 datalogger and associated software program. This upgrade in hardware was to accomplish the inter-phase with satellite communication and the instantaneous data sample reporting implemented by CDMO.
- 2) The data is downloaded once per month and set to CDMO where it undergoes an automated primary QAQC process. This dataset is then emailed back to the reserve for secondary QAQC. The reserve reviews and documents details pertaining to that dataset and returns it to CDMO on a quarterly schedule. The yearly data QAQC'd on an annual basis where the final dataset is archived at CDMO and can be uploaded at: <http://cdmo.baruch.sc.edu/>. The sensors for Air Temperature (C), Relative Humidity (%), Barometric Pressure (mb), Wind Speed, Wind Direction, Total Precipitation (mm), Total Photosynthetically Available Radiation (PAR), and Total Solar Radiation (SORad) remain the same. See section 9: Sensor specifications, operating range, accuracy, date of last calibration for sensor specifications.
- 3) From October 2003 to July 2006, a CR10X program was installed. The old program (ner30.csi) was revised (NERR_4.CSI) to standardize the program for all sites. The revision was necessary to meet new data reporting requirements of CDMO to eliminate instantaneous data sample reporting, add cumulative daily rainfall and additional sensors.

The meteorological information is sampled every 5 seconds from each instrument on the weather station and stored on a Campbell Scientific CR1000 data logger. Data are output to a file in three file formats: CR1000_A5Min.dat stores 5 minute data; CR1000_GOESout.dat stores 15 minute averages that are transmitted hourly for Satellite upload; and CR1000_SWMP.dat files stores the 15 minute average data that is submitted to CDMO on a quarterly basis for primary QAQC review. The CDMO Data Logger (NERR_4.CSI) was loaded into the CR1000 and controls the sensors. The CR1000 then interfaces with the PC208W software supplied by Campbell Scientific.

Presently, data are uploaded from the CR1000 data logger to a personal computer (IBM compatible). Files are exported from PC208W or LoggerNet in a comma-delimited format and upgraded 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

The most common reported errors/anomalies noted in the monthly error reports in 2008 were:

- Total PAR Licor data values with negative readings that ranged from -0.01 to -1.0
- Relative Humidity percentages data values above 100%.

Total PAR may have negative readings that range from -0.01 to -1.0, any values greater than a -1.0 (-1.1 and beyond) have been flagged as rejected (-3 code). All reported errors/anomalies are double checked, and where data truly appear anomalous, they are compared with other regional meteorological data for verification.

Chris Weidman, Research Coordinator and MaryKay Fox, Assistant Research Coordinator, error checked and compiled the meteorological data.

System II.

In July 2006, our meteorological station was linked to a NOAA GOES[®] satellite system, which allowed near real-time access to our meteorological data over the internet. A Sutton Sat-Link2 transmitter was installed and transmits data to the NOAA GOES satellite, NESDIS ID # 3B022462 (where 3B022462 is the GOES ID for that particular station). The transmissions are scheduled hourly and contain four (4) datasets reflecting fifteen minute data sampling intervals. A GOES satellite picks up hourly transmissions from the CR1000 datalogger and sends the real-time data to NOAA National Weather Service HADS webpage (Hydro meteorological Automated Data System; <http://www.nws.noaa.gov/oh/hads/> NESDIS ID# 3B022462) where it can be utilized by the public instantaneously. Additionally, the data is also sent to CDMO where 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 QAQC and assimilation in the CDMO’s “Authoritative” online database. This data can be viewed by going to <http://cdmo.baruch.sc.edu/> . The telemetry is “Provisional” data and not the “Authentic” Dataset used for long term monitoring and study.

All the real-time meteorological data since March 9, 2004 are archived at a CDMO server and available on the web (Note this is currently a separate database from data acquired through System I methods). This data can be viewed by going to <http://cdmo.baruch.sc.edu>.

Air Temperature (C)

- 15 minute average (over previous 15 minute period)
- Maximum (available from WQB NERR)
- Minimum (available from WQB NERR)
- Time Maximum (available from WQB NERR)
- Time Minimum (available from WQB NERR)

Relative Humidity (%)

- 15 minute average (over previous 15 minute period)

Barometric Pressure (mb)

- 15 minute average (over previous 15 minute period)

Wind Speed

- 15 minute average (over previous 15 minute period)
- Maximum

Wind Direction

- 15 minute average (over previous 15 minute period)
- Standard Deviation (over previous 15 minute period) (began collecting as a standard parameter 10/1/2008)

Total Precipitation (mm)

- previous 15 minute total

Cumulative Precipitation (mm) (This was not collected as a standard parameter in 2008)

Total Photosynthetically Available Radiation (PAR)

- previous 15 minute total (millimoles/ m2)

Total Solar Radiation (SORad) (not included in the dataset but available from WQB NERR)
- previous 15 minute total (285 to 2,800 millimicrons)

System III. SORad data.

On February 10th, 2005, a new EPLAB© Black and White Pyranometer was installed. It was mounted on the same structure as the PAR instrument approximately within one meters distance. This pyranometer is an Eppley 10-and 50-junction 180° pyrliometer originally introduced by Kimball and Hobbs in 1923. The detector is a differential thermopile with the hot-junction receivers blackened and the cold-junction receivers whitened. The element is of radial wire-wound-plated construction with the black segments coated with 3M black and the white segments with Barium Sulfate. Built in temperature compensation with thermistor circuitry is incorporated to free the instrument from the effects of ambient temperature. A precision ground optical glass hemisphere of Schott glass WG295 uniformly transmits energy from 285 to 2,800 millimicrons. This hemispherical envelope seals the instrument from the weather, but is readily removable for instrument repair. The cast aluminum case carries a circular spirit level and adjustable leveling screws. Also supplied is a desiccator, which can be inspected readily. The Pyranometer was calibrated and installed November 15th, 2005

Data from this SORad database can be obtained by contacting Chris Weidman at
Chris.Weidman@state.ma.us.

4) Research objectives

The principal objectives are to record meteorological information for the Waquoit Bay NERR's site that can be used 1) as a vital reference of atmospheric data for various research projects at the reserve -- an integral part of our general NERR mission is to provide a platform for estuarine research, 2) to give meteorological context (atmospheric-forcing) for our fifteen minute SWMP water quality data, and other long-term environmental monitoring programs at the Reserve (including nutrients and shoreline change), 3) to observe and characterize important events, such as storms, heat and cold waves, droughts and heavy rainfalls, and 4) to detect trends and characterize climate variability over the long-term.

5) Research Methods

The Campbell Scientific weather station samples every 5 seconds continuously throughout the year. These data are used by the CR1000 to produce 15 minute measurements of air temperature, relative humidity, barometric pressure, wind speed, and wind direction. Precipitation and PAR are recorded as totals for each interval. As mentioned above, we generally upload data from the CR1000 storage module about once a month or whenever maintenance, servicing or upgrading programming is required. CR1000 raw data are currently stored on one data storage module capable of storing about 3 months of data. The CR1000 is also cabled directly to a desktop PC where the instantaneous 5 sec data are displayed (in a PC208W window) and can be viewed at anytime. All collected data is quality submitted to CDMO after one week after being downloaded where automated QAQC checks are performed. The data is emailed back to the assistant research coordinator and reviewed; secondary QAQC is conducted and submitted to CDMO on a quarterly basis. Sensors on the weather station are inspected monthly for damage or debris. The heated rain gauge tends to collect debris and is cleaned out, particularly before and after major storms events. Sensors are removed and calibrated on an annual basis depending on the particular sensor, unless the real-time data stream indicates a malfunction. Also, when the data is uploaded, we run a comparative set of observations as a general check on the Campbell station sensors with a **©The Weather Channel WS-9035TWC Wireless Weather Station with Wind** by La Crosse Technology system to check on wind, temp and humidity levels. This is mounted approximately 10ft away from the tower where the humidity and wind sensors are located, which is 10meters above ground. We have a separately installed barometer inside the lab as another source to check on the Campbell system.

6) Site Location and character

The weather station is located on a 24-acre parcel of Reserve land that includes the Reserve headquarters at 41° 34.895 N, 70° 31.511' W. Wind (speed and direction), temperature and relative humidity sensors are mounted at the top of a 10-m aluminum tower next to the Carriage House, which houses our grounds

facilities, classroom and laboratory. The tower is surrounded on three sides by an open parking area; its attached probes stand approximately 2.5 m above the roof peak of the adjacent building and are separated from any trees by at least 30 m. A crushed shell parking area (bleach white in color) is located directly to the south and west of the tower, with the building and its roof peak to the northeast. The tower base is 10.39 m above sea level (NGVD), approximately 100 m north from Waquoit Bay's northern shoreline. The location is most well exposed to winds from the west and south (southeast clockwise to northwest). The LiCor (PAR) sensor and EPLAB Pyranometer are mounted about 10 m away on an extended aluminum arm at a height of 3 m above the ground level and are well exposed at all times to the sun in both winter and summer. The air pressure sensor, which is mounted next to the CR1000 in the laboratory, is approximately 1.5 meters in height above ground level. The rain gauge is located in an open field away from trees about 55 m northwest of the laboratory and tower at 41° 34.908' N, 70° 31.546' W and 11.2 m above sea level (NGVD). The top of the gauge is 1 meter above the ground.

As for its general setting, the Waquoit Bay National Estuarine Research Reserve (WBNERR) is located in the northeastern United States on the southern coast of Cape Cod, Massachusetts. Climatically, this region is considered temperate maritime, and experiences relatively mild winters and cool summers relative to the rest of New England because of its exposed oceanic location. Typical of the mid-latitudes (41° N), prevailing winds are from the southwest, while storm winds tend to be from the east. The area is adjacent to one of the world's most active regions for cyclogenesis (extra-tropical cyclone formation) off the East coast of North America. These generally winter season storms are most frequent (almost weekly) from late October until late April and are locally called Nor'easters because of the NE wind direction typical to the area during the period of peak wind speeds. These storms generally develop rapidly as secondary lows off the mid-Atlantic coast (Carolinas to New Jersey) and track northeastward passing Cape Cod either directly overhead, or to the southeast or northwest. These winter season storms are important agents of coastal erosion and shoreline alteration in the region, particularly for easterly facing coasts.

Hurricanes are also important phenomena in the region. Most years, during the period from July to November, the Cape experiences some interaction with a passing tropical storm. About once every decade the area experiences a nearby landfall, with winds exceeding hurricane threshold (>33 m/s), usually from the southerly quarter. Hurricanes are particularly important agents of change for the Cape's southern coastal areas, and can have profound effects on local estuaries, including Waquoit Bay. Typically, barrier beach over-wash (with salt marsh burial) and breaching (with new tidal inlet formation) occur during these extreme events.

Average temperature and rainfall conditions for the period 1882-1960 for Provincetown (about 50 km to the northwest) (Ptown) are shown in the table below in comparison with Waquoit Bay (WQB) monthly values for 2002.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ptown Temp (C)	-0.6	-1.1	1.7	6.7	11.7	17.2	20.6	20.0	17.2	12.2	6.7	1.7	9.5
WQB Temp (C)	0.0	3.3	5.7	10.0	13.6	18.2	22.8	22.8	18.6	11.0	6.7	1.1	11.2
Ptown Ppt (cm)	9.9	8.7	9.4	9.0	7.5	7.0	6.8	8.1	8.4	8.7	8.1	9.2	100.8
WQB Ppt (cm)	12.5	5.6	14.5	10.7	13.4	8.1	1.4	6.5	13.8	8.2	19.9	20.4	135.0

Note: The temperatures for Waquoit Bay on the southwest corner of Cape Cod vs. for Provincetown on the northeast corner are likely to be a bit warmer in Spring and Summer and a bit colder in Autumn and Winter. Provincetown is on a very small peninsula a couple of miles wide, surrounded by colder (in Summer) Gulf of Maine waters, while Waquoit Bay is closer to the mainland of New England and is bathed by the warmer shelf waters of southern New England. Also, these averages do not include the period since 1960. The last two decades, in particular, have been known to be among the warmest recorded (last 150 years), though that may be compensated in part by the historically cold periods of mid-1960s and mid-1970s.

Meteorological data from Waquoit Bay NERR can also be compared to that from other nearby meteorological stations. These stations are located at Otis Air Force Base (10 km to the north), Falmouth Water Department-Long Pond (8 km to the west), Woods Hole Oceanographic Institution–Quisset Campus (13 km to the southwest), Hyannis Airport (23 km to the northeast), and Buzzards Bay Texas Tower (41 km to the southwest) – this latter station being a particularly valuable reference site because it is offshore and weatherward (southwest) with at least 15 km of unobstructed open water around it and it also records other useful sea surface parameters (wave height and direction, and ocean temperatures). We frequently compare our observations with data from the NOAA offshore tower at the entrance to Buzzards Bay (Temperature, Wind, Air Pressure) because its current (within the hour) and archived measurements are available online (website). A comparison of monthly data for 2002 between the Buzzards Bay Tower and Waquoit Bay SWMP data is shown in the table below:

Buzzards Bay Tower and Waquoit Bay (*data*) Monthly Meteorological Statistics for 2002

Note: Water temps in Waquoit Bay are from Menauhant SWMP Station

Month	Wdir	Wspd m/s	Gust m/s	Wave ht	Barometer	Air Temp	Water Temp
Jan mean	243 (249)	9.0 (2.1)	10.0	1.3	1013.1 (1011)	4.0 (3.9)	5.7 (3.3)
Jan min	----	1.4 (0.0)	1.5	0.3	986.1 (980)	-4.5 (-4.7)	4.5 (0.6)
Jan max	----	21.5 (16.6)	24.6	2.9	1031.6 (1031)	11.1 (13.7)	8.0 (5.8)
Feb mean	220 (237)	8.6 (3.1)	9.5	1.1	1016.0 (1014)	3.1 (3.3)	4.6 (3.7)
Feb min	----	0.6 (0.0)	0.7	0.3	995.7 (992)	-6.9 (-9.7)	3.6 (1.0)
Feb max	----	21.0 (14.4)	23.6	3.1	1037.6 (1036)	11.1 (13.7)	6.1 (6.9)
Mar mean	179 (186)	8.8 (2.5)	9.6	1.3	1020.3 (1018)	4.5 (5.7)	5.1 (5.8)
Mar min	----	0.4 (0.0)	0.5	0.4	998.0 (998)	-6.6 (-5.5)	4.4 (3.2)
Mar max	----	20.0 (18.0)	22.0	3.7	1038.8 (1038)	12.7 (17.9)	5.9 (9.8)
Apr mean	201 (214)	7.6 (2.4)	8.3	0.9	1018.4 (1016)	8.0 (10.0)	7.9 (10.9)
Apr min	----	0.4 (0.0)	0.5	0.2	997.6 (995)	-0.9 (-2.0)	5.6 (6.7)
Apr max	----	21.6 (17.1)	25.4	2.3	1039.5 (1038)	22.4 (31.2)	10.2 (16.3)
May mean	200 (194)	7.8 (2.0)	8.5	0.9	1016.5 (1015)	11.4 (13.6)	11.1 (14.2)
May min	----	0.2 (0.0)	0.7	0.3	993.2 (990)	5.3 (2.4)	9.1 (10.4)
May max	----	22.1 (16.6)	24.6	2.4	1028.4 (1027)	19.6 (24.9)	14.5 (20.3)
Jun mean	175 (216)	6.9 (1.6)	7.5	0.8	1016.0 (1015)	16.2 (18.2)	15.3 (19.1)
Jun min	----	0.0 (0.0)	0.0	0.4	998.2 (996)	9.7 (5.9)	13.6 (14.9)
Jun max	----	18.6 (10.7)	20.3	1.8	1033.6 (1033)	26.2 (31.3)	18.5 (24.3)
Jul mean	207 (218)	6.6 (1.4)	7.0	0.7	1014.8 (1014)	20.6 (22.8)	18.7 (23.4)
Jul min	----	0.0 (0.0)	0.0	0.4	1005.3 (1004)	15.7 (11.2)	16.0 (21.5)
Jul max	----	15.9 (11.8)	17.1	1.6	1024.8 (1024)	29.4 (34.2)	21.5 (26.5)
Aug mean	178 (207)	6.4 (1.4)	6.8	0.6	1017.5 (1017)	21.2 (22.8)	20.0 (24.3)
Aug min	----	0.1 (0.0)	0.3	0.3	1005.4 (1006)	15.6 (11.7)	18.1 (20.6)
Aug max	----	14.2 (11.4)	14.9	1.4	1034.4 (1035)	25.9 (33.5)	22.9 (28.1)

Sep mean	180 (192)	7.1 (1.7)	7.7	0.8	1017.7 (1017)	18.8 (18.6)	19.0 (21.0)
Sep min	----	0.2 (0.0)	0.5	0.3	988.3 (992)	12.6 (7.8)	17.7 (19.0)
Sep max	----	21.2 (15.7)	24.5	2.9	1033.1 (1033)	23.9 (27.9)	20.6 (23.4)
Oct mean	177 (206)	8.5 (1.9)	9.5	0.9	1019.0 (1018)	12.5 (11.0)	16.4 (15.2)
Oct min	----	0.7 (0.0)	1.1	0.2	995.1 (995)	2.8 (-1.4)	13.2 (9.6)
Oct max	----	19.9 (13.2)	23.0	3.3	1030.3 (1029)	22.0 (24.9)	19.2 (21.3)
Nov mean	204 (241)	10.1 (2.5)	11.2	1.3	1013.0 (1012)	8.0 (6.7)	11.3 (9.0)
Nov min	----	0.1 (0.0)	0.5	0.3	987.2 (983)	-5.0 (-7.3)	8.5 (3.9)
Nov max	----	20.6 (15.8)	23.0	3.2	1028.4 (1028)	17.2 (21.1)	13.3 (14.2)
Dec mean	246 (254)	9.6 (2.8)	10.7	1.2	1014.2 (1013)	2.6 (1.1)	6.3 (3.3)
Dec min	----	0.0 (0.0)	0.0	0.3	974.3 (975)	-8.0 (-9.5)	4.4 (1.2)
Dec max	----	21.4 (17.2)	24.6	3.1	1036.4 (1035)	12.7 (13.0)	9.6 (6.7)
Ann mean	201 (218)	8.1 (2.1)	8.9	1.0	1016.4 (1015.0)	10.9 (11.5)	11.8 (12.8)
Ann min	----	0.0 (0.0)	0.0	0.2	974.3 (975)	-8.0 (-9.7)	3.6 (0.6)
Ann max	----	22.1 (18.0)	25.4	3.7	1039.5 (1038)	29.4 (34.2)	22.9 (28.1)

Meteorological differences between the offshore Buzzards Bay Tower and our Waquoit Bay station are to be expected because of a separation of about 40 km and because of the site geographies (offshore vs. coastal land). Wind direction values generally are higher for Waquoit Bay versus Buzzards Bay Tower, meaning a more westward and northward component at the Waquoit Bay site. This is an expected result of winds encountering greater friction over land than over water causing the wind to turn more to the right over land. Average wind speeds are notably lower at Waquoit Bay by about a factor of four. Somewhat lower wind speeds are expected again because of the greater surface friction and topography encountered at land versus offshore stations, but a factor of four appears to us to be unusually large. We have verified our Wind Monitor wind speeds using a hand-held Kestrel, but our wind speeds are also lower by a factor of 2-3 compared with other nearby land stations (Otis Air Base and Hyannis Airport). The Buzzards Bay station is noted for its very high (often the highest) wind speeds recorded for even nearby offshore sites, so the fact that it has some “outlier” characteristics relative to other regional stations is to be noted. As for local topographic effects at Waquoit Bay, the site (as noted above) is about 100 m from a 6 m bluff and the surrounding area is forested with tree canopies topping out at about 10 m., so the wind sensors no doubt experience a fairly turbulent (gusty) wind stream. In contrast maximum wind speeds at Waquoit are not so different (80%) from Buzzards Bay Tower values strongly indicating that the Waquoit wind sensor is calibrated correctly and that the winds at Waquoit show more variability. Air pressure values between stations track closely with Waquoit showing only a slightly lower average of about 1 mb. Air Temperatures also track closely, with the expected land/ocean contrasts of Waquoit’s land site showing more extreme hot and cold values, and with colder averages in the winter and warmer averages in the summer. Water temperatures also show a similar though more subdued set of contrasts between stations.

Other stations which are also used for reference are 1) the Woods Hole Oceanographic Institution in Woods Hole (Temperature, Air Pressure, Solar Radiation), 2) Falmouth DPW (rainfall), 3) Otis Air Force Base (wind), and 4) Hyannis Airport (Temperature, Wind, Rainfall, Air Pressure, Relative Humidity) and Menauhant Yacht Club weather station operated and maintained by Dr. Richard Taylor

7) Data collection period

Weather data has been collected at the Waquoit Bay NERR Carriage House since December 2001. The current weather station has been operational since this date. Data were collected continuously for the entire year in 2008 from 1/1/2008 00:00 through 12/31/2008 23:45, except for when sensors were calibrated, or when sensors were removed due to failure. A lightening strike occurred on January 11 and damped the Precipitation gauge wires and reed switch and diode and created moisture inside the PAR and SORAD sensors. Data were downloaded from the logger on the following dates:

2008 DATA MANAGEMENT CHECKLIST

METEROLOGICAL DATA

Site	Raw Data File Name	Data Range	File Size	CDMO 1 ^o QC Submission
Carriage House	CR1000_SWMP.dat1.backup.txt	121907 11:15 – 010208 14:45	184 KB	ATT 6310127.txt
Carriage House	CR1000_SWMP.dat.2.backup.txt	010208 15:15 – 012208 13:45	292 KB	ATT 6306663.txt
Carriage House	CR1000_SWMP.dat.backup	012208 14:15 – 022708 14:00	522 KB	ATT 6307385.txt
Carriage House	CR1000_SWMP.dat.1.backup	022708 13:30 – 022908 11:30	32 KB	ATT 6307769.txt
Carriage House	CR1000_SWMP.dat.2.backup	022908 12:00 – 030508 14:15	81 KB	ATT 6307895.txt
Carriage House	CR1000_SWMP.dat.3.backup	030508 14:30 – 032608 13:30	346 KB	ATT 6307978.txt
Carriage House	CR1000_SWMP.dat.4.backup	032608 14:15 – 042308 13:45	418 KB	ATT 6308122.txt
Carriage House	CR1000_SWMP.dat.5.backup	042308 14:00 – 051208 13:15	293 KB	ATT 6308660.txt
Carriage House	CR1000_SWMP.dat.6.backup	051208 14:30 – 060608 15:45	376 KB	ATT 6308902.txt
Carriage House	CR1000_SWMP.dat.7.backup	060608 16:00 – 061608 13:45	170 KB	ATT 6309009.txt
Carriage House	CR1000_SWMP.dat.8.backup	061608 14:00 – 063008 12:45	204 KB	ATT 6309132.txt
Carriage House	063008_071808.csv (Lost data) **	063008 13:15 – 071808 23:45		
Carriage House	CR1000_SWMP091208.dat(2008 raw files)	071808 23:30 – 091208 10:15	370 KB	CR1000_SWMP091208.dat
Carriage House	CR1000_SWMP100708.dat(2008 raw files)	091208 10:30 – 100708 15:00	364 KB	ATT 6309846.tx
Carriage House	CR1000_SWMP103008.dat(2008 raw files)	100708 15:15 – 103008 13:00	329 KB	ATT 3511310.txt
Carriage House	CR1000_SWMP111008.dat(2008 raw files)	103008 13:15 – 111008 13:00	159 KB	CR1000_SWMP111008.QC.dat
Carriage House	CR1000_SWMP.dat	111008 13:15 – 112508 16:45	222 KB	ATT 6997097.txt
Carriage House	CR1000_SWMP.dat	112508 17:00 – 112908 00:45	49 KB	ATT 8727932.txt
Carriage House	CR1000_SWMP.dat	112908 01:00 – 120408 14:15	81 KB	ATT 8725904.txt
Carriage House	CR1000_SWMP.dat.9.backup	120408 14:30 – 120508 16:00	”	” “
Carriage House	CR1000_SWMP.dat.10.backup	120508 16:15 – 010209 13:45	”	” “
	** downloaded from CDMO 091208			

8) 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 Section 1 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 homepage) and online at the CDMO home page <http://cdmo.baruch.sc.edu>. Data are available in comma separated format.

9) Associated researchers and projects

This data is part of a larger data set associated with the System Wide Monitoring Program (SWMP) that includes Water Quality and Nutrient Data.

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

LiCor Quantum Sensor
 Model #: LI-190SZ S/N Q12415
 Stability: $\leq \pm 2\%$ change over a 1 year period
 Operating Temperature: -40 to +65 °C
 Sensitivity: typically 5 μ A per 1000 μ moles $s^{-1}m^{-2}$
 Light spectrum wavelength: 400 to 700 nm
 Date of last calibration: 5/12/2008

Multiplier: <i>Prog</i> <i>Download Date</i>	<i>PARs</i> <i>Multiplier</i>
05/12/08 02:20 PM	0.2372
05/12/08 01:30 AM	Install replacement PAR
03/26/08 10:00 AM	0.3012
03/05/08 02:20 PM	0.2257
03/05/08 02:00 PM	Install replacement PAR
03/03/08 01:00 PM	Removed PAR & Sorad, shorted inputs to datalogger
01/11/08 12:00 PM	Lighting storm, Prec, PAR Sorad stopped working-PAR/SORAD got water inside sensor

EPLAB Pyranmeter(SoRAD)
 Model #: 8-48 SW/N 9698
 Stability: $>1\%$ over 5 years (0.2 % per year)
 Operating Temperatures: ± 1.5 percent constancy from -20 to + 40 °C
 Sensitivity: 11 microvolts/watt meter $^{-2}$ approximately
 Impedance: 350 ohms approximately
 Response Time: 5 seconds (1/e signal)
 Linearity: ± 1 percent from 0 to 1400 watts meter $^{-2}$
 Installed November 15th, 2005
 Calibrated 3/26/2008

Wind Monitor
 Model #05103
 Range: 0-60 m/s (130 mph), threshold: 0.5 m/s (1.1 kts)
 (Note: from observation we note that the monitor seems to have a lower threshold than 0.5 m/s with the wind propeller spinning and values down to 0.1 m/s being measured).
 Direction Range: 360°; Threshold Sensitivity: 0.5 m/s (1.1 kts) at 10° displacement
 Calibration 6/6/2008

Temperature and Relative Humidity
Model #: HMP35C
Operating Temperature: -20 to +60°C
Temperature Measurement Range: -35 to +50°C
Temperature Accuracy: 0.5°C
Relative Humidity Measurement Range: 0 to 100%
RH Accuracy: ±2% RH, 0 to 90% or ±3% RH, 90-100%
Uncertainty of calibration: 0.3% RH
Calibration: 6/6/2008

Barometric Sensor
Model #: PTP101B
Operating Range: 600-1060 hPa
Temperature: -40 to +60°C
Humidity: non-condensing
Accuracy: ±0.5 hPa
Stability: NA
Calibration: 6/6/2008

Heated Tipping Bucket Rain Gauge
Model #: TR-525
Range: 0.1 mm
Accuracy: 1.0% at <10 mm/hour
Direct calibration 12/4/2008

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. This station was installed on 7/12/2006.

Additional CR1000 specification can be found at: http://www.campbellsci.com/documents/lit/s_cr1000.pdf.

11) Coded variable indicator and variable code definitions

Site definitions: CH=Carriage House
Station code: wqbchmet

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	Good Data
1	Suspect Data
2	<i>Open - reserved for later flag</i>
3	<i>Open - reserved for later flag</i>
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 datalogger, 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 coded can be applied to a particular data point.

General Errors

GIM	Instrument Malfunction
GIT	Instrument Recording Error, Recovered Telemetry Data
GMC	Instrument Maintenance
GMT	Instrument Maintenance
GPD	Power down
GPF	Power Failure/Low Battery
GPR	Program reload
GQR	Data Rejected Due to QAQC 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 Comments on Data

As of 12/04/2014 the CDMO has removed all Total Solar Radiation data for 2008-2012. Please contact the WQB NERR for more information or to request those data.

- 1) 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.
- 2) Cumulative precipitation data are recorded from 00:00 to 23:59 with the daily total recorded at the midnight mark (00:00). The midnight CumPrpc value is actually the total from the previous day.
- 3) 15 min sample rainfall amount differences of over 5mm in 15 minutes can occur during storms and indicate intense ppt bursts during thunderstorms or frontal passages.
- 2) Sensor calibration occurred at different times this year. Different sensors were out of operation at various times while others continued in operation. The calibration and replacement events resulted in several categories of corrupted or incorrect data (missing data, and deleted data. (See note below in other remarks).

2008 Weather Sensor Calibration dates

LiCor PAR L1190SZ	3/05/08, 14:00 & 5/12/08 12:30
Eppley 8-48 SORAD	3/26/08, 13:45-14:00
Vaisala Temp/RH/BP	1/2/08,14:45 & 6/6/08 14:56
Anemometer Wind	6/6/08 12:00
Rain Gauge	6/18/08, 13:00-13:45 & 12/4/08

- 3) Small negative PAR values sometimes occur at night. These small values are within the range of the sensors. The maximum signal noise error for the Licor sensor is +/- 2.214 mmoles/m² over a 15 minute interval. These data, which range from negative -0.01 to -1.0 have been retained and flagged as <1> suspect and commented with "CAF". However, the sensor began to record erratic data (up to -15.6 values) so by 12/17/08 the second sensor was removed and both sent in for repair. All data that was less than -1.0 was rejected [-3] and commented with "SSM and CSM". The PAR sensor had to be replaced several times during the year, starting with a lightning strike on 1/11/08.
 - 03/3/08 Water inside connectors due from lightening strike, remove
 - 03/5/08 Install replacement PAR
 - 05/12/08 Install replacement PAR
 - 12/5/08 Remove PAR sensor (giving large negative values), Install replacement PAR
 - 12/17/08 Remove replacement PAR, values too low. No replacement PAR sensors available
- 4) The Vaisala Air Temp and Relative Humidity. Relative Humidity data greater than 100% have been observed; these data are within the range of the sensor accuracy of +/- 3%. These data have been retained, flagged as "suspect" [1] with a comment code of "CAF" The AT/RH sensor had to be replaced several times during the year.
- 5) Precipitation data
 - 1/11/08: A lightening strike hit the Carriage House and damaged the reed switch and lightening diode. The Rain gauge was replaced on 3/26/08 13:45 – 14:00
 - 06/18/08 13:00-13:45 Adjust magnet in precipitation gauge. Testing put lots of counts in precipitation records.
 - 10/09/08 00:00-12/16/08, 14:30: Rain gauge failed to record ppt due frayed cable. The main underground cable connecting rain gauge to the Carriage House Campbell unit(100ft length) had three frayed points. This may have occurred with the lightening event in January. Its function appeared to be good until October but there may have been short interruptions over time but failure to record actually ppt was noticed on 10/9/08. New cable replaced the old for the entire length and protected inside reinforced conduit where roads crossed over the wiring.
 - 12/08/08 00:00 – 12/16/08 15:00 Tipping cup became jammed off its axis, probably due to high winds.
- 6) Anemometer Wind Speed and Wind Direction sensor
 - 01/01/08 00:00 to 06/03/08 10:15 Wind direction data are suspect due to the stagnate values recorded for these dates and times.
 - 06/03/08 10:30 to 06/06/08 13:00 Anemometer removed and new sensor replaced.
 - 06/10/08 07:30-08:45 Tower down and wind direction adjusted
 - 12/17/08 12:30 Max Wind Speed data are flagged as suspect due to no Max WSpdT time being recorded.
- 7) Pyranometer Data

WQBNERR has been collecting Total Solar Radiation data since November 16th, 2005 at 3:15pm on an experimental basis. See section 9: Sensor specifications, operating range, accuracy, date of last calibration for detailed information on the Pyranometer instrumentation. **Contact Waquoit Bay NERR Research Coordinator for questions on the Pyranometer data or to request the raw data files.**
- 8) Local National Weather Service Reporting Station.

Since December 2002, in the SW corner of the Reserve, at the outlet of Eel River and located at the Menauhant Yacht Club, a National Weather Service Reporting Station in East Falmouth has been recording local 24 hour weather conditions (Data Garrison <https://datagarrison.com/>). Dr. Doc Taylor records daily observations at 0700 and 1900 for the following weather parameters: Temperature (°F; minimum and maximum), Precipitation (inches; rain and melted snow, snow fall, initial and endpoint times of events), Sky Conditions and Wind Direction (mph; gusts). WBNERR compares its weather data with this station and other local weather stations which include Hyannis Airport (<http://www.wunderground.com/cgi-bin/findweather/getForecast?query=02601#History>), and WHOI Climate Reports (<http://cis.whoi.edu/science/PO/climate/index.cfm>). A complete monthly data set from the East Falmouth Reporting Station is available by contacting WBNERR Research Coordinator.