Waquoit Bay National Estuarine Research Reserve Meteorological Metadata
January 2003-December 2003
Latest Update: **August 23, 2024**

I. Data Set & Research Descriptors

1) Principal Investigator(s) & contact persons

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2) Entry Verification

a) Data Input Procedures:

In 2003 a number of changes were made to our weather data management system. From January until late October the system remained essentially the same as the previous year 2002 and is described below in System I. In late October and early November, a new data handling program was installed on the CR10X, and we converted to the EQWin data management system for all water quality and meteorological data, described below in System II.

System I.

The meteorological information is sampled every 5 seconds from each instrument on the weather station and stored on a Campbell Scientific CR10X datalogger. The CDMO Data Logger Program (ner30.csi) was loaded into the CR10X and controls the sensors and data collection schedule (see 2b of the Entry Verification section for the data collection schedule). The CR10X then interfaces with the PC208W software supplied by Campbell Scientific.

The data was saved as a monthly raw data file (RAW0100.dat) onto a separate hard drive and backed up onto the Waquoit Bay NERR server.

As an entire month of data becomes available, the CDMO Weather Data Management Program (WDMP) is used to convert the raw data files to an Access database. The program was developed in Visual Basic to interface with the NERR Meteorological Data Collection Schedule (see 2b of the Entry Verification section for the data collection schedule). The WDMP automatically inputs and converts the monthly raw files into an Access database. There are three main steps the WDMP performs.

First, it converts the comma delimited monthly raw data files into an Access database. Secondly, it checks the data against a predetermined set of error criteria (see Appendix G for CDMO Meteorological Data Collection Error/Anomalous Data Criteria). Finally, it produces error and summary reports. Any anomalous data are investigated and noted below in the Anomalous Data Section. Any data corrections that were performed are noted in the Data Anomaly/Data Correction Section below.

The most common reported errors/anomalies noted in the monthly error reports in 2002 were:

1) 1-hour average temperature greater than 10% above the maximum 15 min sample recorded in the past 1 hour.
2) Wind direction greater than 360 or less than 0 degrees.
3) 15 minute sample rainfall amount differences of over 5mm from previous sample.
4) Relative humidity differences greater than 25% between 15-minute samples.
5) Air temp differences between 15-minute samples greater than 3 degrees.
6) Air pressure below 980 mb

Most of these common reported errors/anomalies are artifacts of the simple flagging criteria used by the WDMP, and we have commented on the cause of such "artifactual flags" in blanket comments at the beginning of the Data Anomaly/Data Correction Section. In all cases, though reported errors/anomalies are double checked, and where data truly appear anomalous, they are compared with other regional meteorological data for verification. Also, when power-down events occurred, we lost the earlier 5-second data for those calendar days, resulting in incorrect values of those days' 24-hour average, maximum and minimum values. Therefore, those days' 24-hour values were deleted. We also lost a lot of our PAR data from January until mid-April due to using signal conversion coefficient 3 orders of magnitude too large (we were attempting to measure micro-volts as opposed to milli-volts of PAR). Since the CR10X program is geared to only save 5 digits, the PAR values maxed out at 99,999 for most of the mid-day readings causing us to lose most of the daily PAR signal. Consequently, we deleted all of our PAR data for period.

System II.

In late October a new CR10X program was installed.
The 15 minute , 1 hour average, 24 hour meteorological data were downloaded from each instrument on the weather station to a Campbell Scientific CR10X datalogger.

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In late October 2003 a new 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 program is laid out for 15 minute, hourly and 24 hour outputs.

The data was saved as a monthly raw data file (RAW0100.dat) onto a separate hard drive and backed up onto the Waquoit Bay NERR server.

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8) Wind direction greater than 360 or less than 0 degrees.
9) 15 minute sample rainfall amount differences of over 5mm from previous sample.
10) Relative humidity differences greater than 25% between 15-minute samples.
11) Air temp differences between 15-minute samples greater than 3 degrees.
12) Air pressure below 980 mb

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Both raw data files and Access databases were saved to Compact Disc for archival and backed-up on the server. SWMP Technician Kelly Chapman and Research Coordinator Chris Weidman error checked and compiled the 2003 weather data.

b) Data Collection Schedule

i) Data is collected in the following formats.
(1) Instantaneous 5 sec sample data points are collected every 15 minutes.
(2) Hourly averages (based on 5 sec data) are produced every 60 minutes.
(3) Daily average, maximum, and minimum (based on 5 sec sample data) every 24 hours.

ii) 15 minute sample point parameters:
Date, Time, Air Temperature (C), Relative Humidity (%), LiCor (PAR), Barometric Pressure (mb), Wind Speed (m/s), Wind Direction, Rainfall (mm)

iii) Hourly average parameters:
Date, Time, Air Temperature (C), Relative Humidity (%), LiCor (PAR), Barometric Pressure (mb), Wind Speed (m/s), Wind Direction, Wind Direction Standard Deviation (using Yamartino's Algorithm)

iv) Daily Averages parameters:
Date, Time, Air Temperature (C), Relative Humidity (%), LiCor (PAR), Barometric Pressure (mb), Wind Speed (m/s), Wind Direction

v) Daily Maximum parameters:
Date, Time, Air Temperature (C), Time, Relative Humidity (%), Time, LiCor (PAR), Time, Barometric Pressure (mb), Time, Wind Speed (m/s), Time, battery Voltage, Time

vi) Daily Minimum parameters:
Date, Time, Air Temperature (C), Time, Relative Humidity (%), Time, LiCor (PAR), Time, Barometric Pressure (mb), Time, Wind Speed (m/s), Time, Battery Voltage, Time

c) Error/Anomalous Data Criteria

Air Temp:
15 min sample not greater than *max* for the day
15 min sample not less than the *min* for the day
15 min sample not greater than 3.0 C from the previous 15 minutes
1-hour average not greater than 10% above the greatest 15 min sample recorded in the hour

Relative Humidity:
Not changed by more than 25% from the previous 15 minutes
1 hour average not greater than 10% above the greatest 15 min sample recorded in the hour

Rainfall:
Precipitation not greater than 5 mm in 15 min
No precipitation for the month

Wind Speed:
Wind speed greater than 30 m/s
Wind speed less than 0.5 m/s

Wind direction:

Wind direction not greater than 360 degrees
Wind direction not less than 0 degrees

Pressure:

Pressure greater than 1040 mb or less than 980 mb
Pressure changes greater than 5 mb per hour
1 hour average not greater than 10% above the greatest 15 min sample recorded in the hour

Time:

15-minute interval recorded

For all data:

Duplicate interval data

3) 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 half-hourly 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.

4) Research Methods

The Campbell Scientific weather station samples every 5 seconds continuously throughout the year. These data are used by the CR10X to produce hourly and daily averages of those measurements of air temperature, relative humidity, barometric pressure, rainfall, wind speed, and wind direction. An instantaneous sample is taken every 15 minutes and that data is stored as array 150. In 2002 we used a 1 month sampling interval. CR10X raw data are currently stored on 2 data storage modules capable in combination of storing about 3 months worth of data. The CR10X 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. This display is checked and recorded every regular work day (Mon-Fri) along with a brief visual observation of the current weather conditions. All collected data is quality checked immediately after the monthly downloads using the SWMP WDMP. The error/anomaly reports and all monthly parameter graphs are printed and reviewed. Any error/anomaly messages are further investigated and the data is either corrected/deleted (if necessary) or commented on and left unchanged.

Sensors on the weather station are inspected monthly for damage or debris. The rain gauge tends to collect debris and is cleaned out every few days, particularly before and after major storms events. Sensors are removed and calibrated on an annual or biannual basis depending on the particular sensor. Also, once a month on download day, we use a handheld Kestrel 4000, to run a comparative set of observations as a general check on the Campbell station sensors.

5) Site Location and character

The weather station is located on a 24-acre parcel of Reserve land that includes the Reserve headquarters at 41^{o} 34.895 N, 70^{o} 31.511' W. Wind (speed and direction), temperature and relative humidity sensors are mounted on 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 is mounted about 10 m away on an extended aluminum arm at a height of 3 m above the ground level and is well exposed at all times to the sun in both winter and summer. The air pressure sensor is mounted next to the CR10X in the laboratory. The rain gauge is located in an open field away from trees about 55 m northwest of the laboratory and tower at 41^{O} 34.908' N, 70^{O} 31.546' W and 11.2 m above sea level (NGVD).

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 brush 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	Ann
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	Baro	Air T	Water T
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 both 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). A comparison of daily data from WBNERR and Buzzards Bay Tower and Falmouth DPW is shown below for the Month of December 2001.

Waquoit Bay(WQB) vs Buzzards Bay Tower(BUZ) and Falmouth DPW(FAL): December 2001
Note: ppt is only measured once a day at Falmouth DPW.

DAY	WQB Temp	BUZ Temp	WQB Baro	BUZ Baro	WQB WSpd	BUZ WSpd	WQB WDir	BUZ WDir	WQB PPT	FAL PPT
1	15.4	14.8	1014.1	1015.7	2.8	10.3	244	200	0.762	0.000
2	9.3	11.5	1021.4	1019.8	1.3	7.0	319	296	0	0.000
3	7.8	8.8	1024.0	1025.7	1.6	5.6	267	268	0.254	0.000
4	11.1	10.6	1024.4	1024.9	1.0	8.0	251	245	0	0.508
5	13.6	12.1	1022.9	1025.7	1.0	6.0	211	216	0	0.000
6	15.0	13.5	1014.2	1020.0	2.4	8.9	239	224	0	1.016
7	11.3	12.5	1012.9	1013.2	1.1	7.0	288	257	1.27	0.000
8	4.7	8.3	1019.3	1019.0	1.1	7.0	10	214	2.54	13.208
9	2.7	3.9	1016.2	1016.3	2.2	9.2	356	74	15.24	0.508
10	4.9	3.4	1027.3	1026.7	1.5	6.1	245	265	0.254	0.000
11	8.3	8.9	1025.2	1026.5	1.1	6.2	21	138	3.302	0.000
12	7.6	7.4	1030.0	1029.9	1.5	9.3	43	31	0	0.508
13	10.7	8.3	1015.6	1024.6	1.4	5.6	151	83	4.064	2.540
14	11.7	10.9	1010.6	1013.6	1.5	7.4	251	239	4.826	0.000
15	6.2	9.6	1014.1	1009.4	3.4	8.4	331	200	0.508	0.762
16	0.6	2.1	1026.4	1026.4	2.0	10.1	329	333	0	0.000

17	3.3	3.6	1014.6	1025.2	1.3	4.1	43	98	6.604	19.812
18	6.8	8.9	990.9	997.5	3.3	8.8	314	218	28.702	10.668
19	6.2	5.7	1006.9	1002.6	2.5	13.2	290	284	0	0.000
20	7.3	8.7	1002.1	1006.8	3.2	5.6	322	213	0	0.000
21	2.9	4.6	1008.2	1005.1	4.2	13.4	314	289	0	0.000
22	0.3	0.9	1021.7	1019.7	2.7	11.9	325	324	0	0.000
23	2.6	1.9	1019.2	1024.1	0.9	5.2	258	314	0	0.000
24	9.2	9.2	1004.7	1011.6	1.8	7.1	189	168	19.304	10.160
25	2.1	4.5	1012.2	1009.2	1.3	8.8	302	276	0	5.080
26	1.3	2.8	1006.9	1014.0	0.6	3.9	9	160	2.54	6.350
27	-0.4	0.3	1000.0	1002.1	2.9	8.4	296	230	0.254	0.000
28	1.7	0.2	1002.8	1004.7	2.3	11.5	275	264	1.27	0.000
29	2.2	3.0	1004.0	1004.3	2.7	12.1	286	256	0	0.000
30	-0.1	0.7	1007.2	1007.5	3.4	10.2	284	278	0	0.000
31	-1.1	-1.1	1011.6	1011.6	3.0	11.6	287	270	0	0.000
Mean	5.97	6.47	1013.9	1015.6	2.0	8.32	237.1	223.4	91.694	72.078
SD	0.85	0.80	1.66	1.63	0.16	0.47	18.7	13.5		

6) 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 was collected for the entire year in 2003.

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 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 text format and Access data tables.

8) Associated researchers and projects

Not applicable at this time.

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

LiCor Quantum Sensor
Model #: LI-190SZ S/N Q12415
Stability: <±2% change over a 1 year period
Operating Temperature: -40 to +65 °C
Sensitivity: typically 5μA per 1000 μmoles $s^{-1}m^{-2}$
Light spectrum wavelength: 400 to 700 nm
Date of last calibration: 6/20/01

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 not required. Bearings replaced 6/2003

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
Date of last calibration: 6/25/03

Barometric Sensor
Model #: PTP101B
Operating Range: 600-1060 hPa
Temperature: -40 to +60°C
Humidity: non-condensing
Accuracy: ±0.5 hPa
Stability: NA
Date of last calibration: 6/20/01

Tipping Bucket Rain Gauge
Model #: TR-525
Range: 0.1 mm
Accuracy: 1.0% at <10 mm/hour
Calibration not required. Check operation regularly

10) Coded variable indicator and variable code definitions

Site definitions: CH=Carriage House

11) Data anomalies/Data corrections

Arrays:
During 2022 all pre-2007 weather data were revisited by the CDMO. Historically those datasets included 15 minute, hourly (60), and daily data arrays (144). As directed by the NERRS Data Management Committee, the CDMO removed the hourly and daily data arrays leaving only the 15 minute data to make the entire NERRS SWMP weather dataset consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should

be aware that they are largely no longer relevant. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout the fall of 2022.

PAR flagging update August 2024:
During SWMP data synthesis work it was noted that PAR values from 07/29/2003 14:45 – 08/01/2003 00:00 were much higher than would be expected. Those data were removed from the dataset by the CDMO as they were most likely caused by an incorrect multiplier.

COMMENT 1: The error message in WDMP "1 hour average greater or less than 10% above/below the greatest/least 15 min sample recorded in the hour" can occur when no real error has transpired. This occurs with WDMP for two reasons:

a) Because hourly averages are based on all 5 sec samples in that hour and 15 min values are instantaneous 5 sec samples taken once every 15 min, it is possible for the hourly average to be above the max 15 minute value for that hour or below the 15 min for that hour. While such offsets are generally within the 10% margin, this error flagging strategy fails when temperatures are near 0 degrees C, because 10% of 0 is 0 so the margin for error evaporates at zero. Slight temperature variations by tenths and thousandths of degrees can show up as "anomalous". In fact the problem with this error recognition strategy is that the margin is much greater at warmer temperatures than at low temperatures around freezing.
b) The second reason seems to be a basic problem with the WDMP program – it seems it cannot properly handle the error calculation with negative temperatures. Consequently, when temperature fall below 0 degrees C, it often indicates a greater than 10% difference when in fact the difference is often less than 10%.

COMMENT 2: The error message "wind direction greater than 360 or less than 0" can occur when slightly negative wind directions (0 to –10) are recorded. This occurs when the wind direction is in the extreme NNW (between 350 and 360). The data can be adjusted (if interested) by adding 360 to the slightly negative values.

COMMENT 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.

COMMENT 4: Relative humidity differences greater than 25% between 15 min samples are not unusual with frontal passages and are usually associated with wind shifts.

COMMENT 5. Air temp differences between 15 min samples greater than 3 degrees are not unusual with frontal passages and are usually associated with wind shifts.

COMMENT 6. Intense extra-tropical cyclones and hurricanes often affect the region and air values below 980 mb are not uncommon, especially in the autumn, winter and spring months.

COMMENT 7. Wind speed was less than 0.5 m/s for more than 12 hours. During these times, the wind speed data were corrected due to an instrument calibration error. These gaps of low wind speeds are not unusual for this site. The wind speeds can be calm for long periods of time.

COMMENT 8. Missing Data Comment 2: When the CR10X is powered down for maintenance or other causes all temporary 5 sec data for that calendar date are lost at the moment of power down. When the CR10X is powered again the 5 sec data from that point on for that date are again stored in the daily temporary file for that calendar date. Consequently, the 24 hr averages, maximums and minimums for all parameters, which are calculated for the calendar date using the 5 sec data file, will be incorrect for the calendar date because only a portion of the day's data will used for calculation. Also, the hourly averages for the period affected by the maintenance (CR10x power outage or reboot) will be incorrect as well for similar reasons. Current protocol is to delete the 24 hr data for these dates as well as any hourly averages so affected. If desired, these missing 24 hr values can be estimated using the 15 min sample data for the calendar date.

COMMENT 9. During the 2003 collection period there were periods of odd losses of summary data that were characteristic of what happens during power down events – most of the time this could be seen in the 15min or hrly data but not always – we just would have an absence of summary 24hr data – in these cases we could not determine when such a "power down" occurred –only the evidence that it had occurred during a given calendar day. In most cases like this we were never able to determine how this was occurring (power surge, some sort of bug – some loss of 5 sec data). Eventually, with a new WDMP this stopped happening.

COMMENT 10: All PAR data for period Jan1 00:00 to April 14 12:30 have been deleted due to a calibration error that resulted in values numerically maxing out during most of each day. Consequently, most daytime 15 minute, hourly, 24-hour data were incorrect, and so all PAR data were deleted for this period of time.

COMMENT 11: A malfunctioning PAR sensor resulted in incorrect values for all PAR data from April 14 13:00 to July 29 XXXX. However, the incorrect PAR values were determined to be a constant fraction of the correct PAR as derived from nearby (Woods Hole Oceanographic Institution) solar radiation data for the same period. A simple multiplier of 6.3 was used to correct all of the PAR data for this period.

COMMENT 12: A malfunctioning new data storage module (ironically with greater memory capacity) installed in early November 2003 resulted in the overwriting and loss of about two weeks of data every month of operation – roughly the first half of every month's data set. Unfortunately, the problem went undetected because of the new data management program changes –training on the new EQWIN system occurred in late January 2004 – until late March 2004 when the problem was detected.

COMMENT 13: Small negative PAR values sometimes occur at night. None have been deleted or corrected.

January 2003

PAR for entire month changed to 55555 because of incorrect data collected. See Comment 10.

24 hour data for 1/7/2003 (7) were deleted because of CR10X power-down event on this date from 20:15 to 21:00: See Comment 8.

The following wind speed data are correct and were not deleted.

Array ID	Calendar Day	Julian	Time	Error Message
102	5	5	1800	Wind speed is less than 0.5 m/s from 5(5) 1800 to 6(6) 700

Air pressure data from 9 (9) 530 through 9 (9) 745 was less than 980. These data are correct and were not deleted. See Comment 6.

The following air temperature data are correct and were not deleted. See Comment 1.

Array ID	Calendar Day	Julian	Time	Error Message
101	5	5	500	Air temp average in 1 hour data (-1.6271) is less than 15 minute minimum (-1.4354) by at least 10%
101	6	6	1600	Air temp average in 1 hour data (-.17981) is less than 15 minute minimum (-.14611) by at least 10%
101	30	30	2000	Air temp average in 1 hour data (.38865) is less than 15 minute minimum (.29708) by at least 10%

February 2003

PAR for entire month changed to 55555 due to incorrect data collected. See Comment 10.

The following air temperature data are correct and were not deleted. See Comment 5.

Array ID	Calendar Day	Julian	Time	Error Message
150	23	54	1000	Air temp difference from 23 (54) 1000 (9.7561) to 23 (54) 1015 (5.7183) is greater than 3.0 degrees C

The following air temperature data are correct and were not deleted. See Comment 1.

Array ID	Calendar Day	Julian	Time	Error Message
101	10	41	1400	Air temp average in 1 hour data (.40736) is less than 15 minute minimum (.32903) by at least 10%
101	24	55	2200	Air temp average in 1 hour data (-.57015) is less than 15 minute minimum (-.69578) by at least 10%

The following relative humidity data are correct and were not deleted. See Comment 4.

Array ID	Calendar Day	Julian	Time	Error Message
150	12	43	1145	Rel hum difference from 12 (43) 1145 (82.368) to 12 (43) 1200 (55.035) is greater than 25%

The following wind direction data were not deleted. See Comment 2.

Array ID	Calendar Day	Julian	Time	Error Message
150	15	46	45	Wind direction is greater than 360 or less than 0 on 15 (46) 45 (-1.4138)
150	15	46	145	Wind direction is greater than 360 or less than 0 on 15 (46) 145 (-1.6024)

March 2003

PAR for entire month changed to 55555 due to incorrect data collected. See Comment 10.

24 hour data and hourly data at 12:00 for 3/3/03 (62) were deleted because of CR10X power down event on this date at 11:30.
See Comment 8.

24 hour and hourly data at 12:00 for 3/14/03 (73) were deleted because of CR10X power down event on this date from 11:15 to 11:30. See Comment 8.

24 hour data for 3/30/2003 were deleted because of CR10X power down event on that date (time of power down event is unknown. Until the new weather program was loaded there were instances of daily data loss, possibly due to power surges, or some sort of bug where 5 sec. data was lost). See Comment 8.

The following wind direction data are correct and were not deleted. See Comment 2.

Array ID	Calendar Day	Julian	Time	Error Message
150	10	69	345	Wind direction is greater than 360 or less than 0 on 10 (69) 345 (-1.6949)
150	13	72	2330	Wind direction is greater than 360 or less than 0 on 13 (72) 2330 (-3.8613)

150	18	77	1430	Wind direction is greater than 360 or less than 0 on 18 (77) 1430 (-.28245)
150	19	78	1900	Wind direction is greater than 360 or less than 0 on 19 (78) 1900 (-.28248)

The following air temperature data are correct and were not deleted. See Comment 1.

Array ID	Calendar Day	Julian	Time	Error Message
101	2	61	400	Air temp average in 1 hour data (.29786) is less than 15 minute minimum (.42386) by at least 10%
101	19	78	1700	Air temp average in 1 hour data (.69321) is greater than 15 minute maximum (.59287) by at least 10%
101	24	83	2400	Air temp average in 1 hour data (1.0156) is less than 15 minute minimum (1.224) by at least 10%

April 2003

PAR from 4/01/03 00:00 until 4/14/03 at 1230 were changed to 55555. See Comment 10.

PAR data from 4/14/03 13:00 until 4/30/03 23:45 were corrected. See Comment 11.

On 4/14/03 (104) 1300 the nerr3.4 version of the program was reinstalled. Unfortunately, the data were not downloaded before the reinstallation, causing all meteorological data for the period from 4/5/03 0015 through 4/14/03 1215 to be lost (as well as all Minimum values for 00:00 on 4/5/2003). As a result all Daily data for 4/14/03 where deleted as well as Hourly data at 13:00 on 4/14/03.

The following wind direction data are correct and were not deleted. See Comment 2.

Array ID	Calendar Day	Julian	Time	Error Message
150	17	107	700	Wind direction is greater than 360 or less than 0 on 17 (107) 700 (-4.049)

The following pressure data are correct and were not deleted. This error message is an artifact of the early April missing data gap. See Comment 11.

Array ID	Calendar Day	Julian	Time	Error Message
150	4	94	2400	Pressure difference from 4 (94) 2400 (1018.3) to 14 (104) 1230 (1028.1) is greater than 5 mb

The following air temperature data are correct and were not deleted. See Comment 1.

Array ID	Calendar Day	Julian	Time	Error Message
101	4	94	1500	Air temp average in 1 hour data (1.2555) is greater than 15 minute maximum (1.1382) by at least 10%

May 2003

PAR data from 5/01/03 00:00 until 5/31/03 23:45 were corrected. See Comment 11.

The following relative humidity data are correct and were not deleted. See Comment 1.

Array ID	Calendar Day	Julian	Time	Error Message
101	3	123	100	Rel humidity average in 1 hour data (96.342) is greater than 24 hour maximum (95.616)

June 2003

PAR data from 6/01/03 00:00 until 6/30/03 23:45 were corrected. See Comment 11.

24 hour Data for 6/24/2003 (175) were deleted because of CR10X power-down event on that date: See Comment 8.

Missing data for period from 6/24/2003 7:45 until 6/27/2003 14:45. Shut down entire met station for maintenance (changing bearings in anemometer, Rh and temp recalibration, changes to program, etc.). Hourly data at 15:00 and Daily data for 6/27/03 were deleted.

The following air temperature data are correct and were not deleted. See Comment 1.

Array ID	Calendar Day	Julian	Time	Error Message
150	29	180	15	Air temp is less than minimum temp (17.328) for this date

The following precipitation data are correct and were not deleted. See Comment 3.

Array ID	Calendar Day	Julian	Time	Error Message
151	5	156	145	Precip difference from 5(156) 145 (.254) to 5 (156) 200 (6.35) is greater than 5 mm
151	5	156	215	Precip difference from 5(156) 7.366) to 5(156) 230 (1.524) is greater than 5 mm

The following pressure data are correct and were not deleted. This error message is an artifact of the missing data gap in late June (maintenance shutdown).

Array ID	Calendar Day	Julian	Time	Error Message
150	24	175	730	Pressure difference from 24 (175) 730 (1014.1) to 27(178) 1500 (1007.7) is greater than 5 mb

July 2003

PAR data from 7/01/03 00:15 until 7/29/03 14:45 were corrected. See Comment 11.

Data are missing on 7/21/2003 at 16:00: See Comment 9. Therefore daily data for this day were deleted.

On 7/22/03 replaced PAR sensor and uploaded new Nerr_333.dld at 16:12 EST and again at 16:41 EST. Hourly data at 17:00 and 24 hour Data for 7/22/2003 (203) were deleted because of CR10X power-down event on that date: See Comment 8.

After the loading of the new sensor it seems that a wrong multiplier was used causing very high PAR values to be recorded. These values were deleted from 7/22/2003 at 16:00 to 7/26/2003 at 7/29/2003 at 14:30. After the station was powered down on 7/29 and powered on again the values returned to normal.

On 7/23/03 downloaded the data and reloaded the program at 13:00 EST.
Hourly data at 13:00 and 24 hour Data for 7/23/2003 (204) were deleted because of CR10X power-down event on this date: See Comment 8

24 hour Data for 7/25/2003 (206) were deleted because of CR10X power-down event on this date at approximately 23:30: See Comment 8.

24 hour Data for 7/26/2003 (207) were deleted because of CR10X power-down event on this date: See Comment 8 & 9.

On 7/29/03 downloaded the data and reloaded the program at 14:27 EST, Hourly data at 15:00 and 24 hour Data for 7/29/2003 (210) were deleted because of CR10X power-down event on this date: See Comment 8.

Missing data for period from 7/26/2003 13:15 until 7/29/2003 14:15. Shut down met station for reprogramming and maintenance.

Duplicate data for the times 7/10/2003 1415 and 7/24/2003 13:15 were replaced with 55555.

The following wind direction data are correct and were not deleted. See Comment 2.

Array ID	Calendar Day	Julian	Time	Error Message
150	13	194	1415	Wind direction is greater than 360 or less than 0 on 13 (194) 1415 (-2.0699)

The following precipitation data are correct and were not deleted. See Comment 3.

Array ID	Calendar Day	Julian	Time	Error Message
151	24	205	630	Precip difference from 24 (205) 630 (8.128) to 24 (205) 645 (1.524) is greater than 5 mm

The following pressure data are correct and were not deleted. This error message is an artifact of the early April missing data gap. See Comment 11.

Array ID	Calendar Day	Julian	Time	Error Message
150	29	210	1430	Pressure difference from 7/26/03 1315 to 7/29/2003 14:15 is greater than 5 mb

August 2003

Hourly data at 23:00 and 24 hour Data for 8/21/2003 (233) were deleted because of CR10X power-down event on this date: See Comment 8.

There appears to have been an ATemp sensor malfunction on 8/16/2003 at 24:00 affecting the average temp. and the minimum temp.

The following precipitation data are correct and were not deleted. See Comment 3.

Array ID	Calendar Day	Julian	Time	Error Message
151	7	219	2330	Precip difference from 7 (219) 2330 (5.842) to 7 (219) 2345 (0.762) is greater than 5 mm
151	16	228	2300	Precip difference from 16 (228) 2300 (9.398) to 16 (228) 2315 (14.986) is greater than 5 mm
151	16	228	2315	Precip difference from 16 (228) 2315 (14.986) to 16 (228) 2330 (9.398) is greater than 5 mm) to
151	16	228	2330	Precip difference from 16 (228) 2330 (9.398) to 16 (228) 2345 (1.524) is greater than 5 mm

The following wind direction data are correct and were not deleted. See Comment 2.

Array ID	Calendar Day	Julian	Time	Error Message
150	18	230	1730	Wind direction is greater than 360 or less than 0 on 18 (230) 1730 (-1.035)
150	26	238	900	Wind direction is greater than 360 or less than 0 on 18 (230) 1730 (-1.035)

September 2003

24 hour Data for 9/18/03 (261) were deleted because of CR10X power-down event on that date: See Comment 8 & 9.

The following rainfall data are correct and were not deleted. See Comment 3.

Array ID	Calendar Day	Julian	Time	Error Message
151	23	266	1615	Precip difference from 23 (266) 1615 (.508) to 23 (266) 1630 (10.922) is greater than 5 mm
151	23	266	1630	Precip difference from 23 (266) 1630 (10.922) to 23 (266) 1645 (.254) is greater than 5 mm

October 2003

Due to the installation of the new CR10x program (NERR_4.csi) data are missing at 08:45 on 10/31/2003. Therefore hourly data at 09:00 and daily data were deleted.

Data from 10/31/2003 8:45 until 10/31/200 24:00 imported to EQWin database.

The following air temperature data are correct and were not deleted See Comment 5.

Array ID	Calendar Day	Julian	Time	Error Message
150	2	275	1730	Air temp difference from 2 (275) 1730 (13.265) to 2 (275) 1745 (9.7229) is greater than 3.0 degrees C

The following air temperature data are correct and were not deleted. See Comment 1.

Array ID	Calendar Day	Julian	Time	Error Message
101	25	298	100	Air temp average in 1 hour data (.19027) is less than 15 minute minimum (.26857) by at least 10%

The following wind direction data are correct and were not deleted. See Comment 2.

Array ID	Calendar Day	Julian	Time	Error Message
150	7	280	730	Wind direction is greater than 360 or less than 0 on 7 (280) 730 (-1.2241)

November 2003

DATA IMPORTED INTO EQWin –new data management system.

Missing all met data from 11/02/2003 12:00 (with the exception of ATemp and MaxATemp) to 11/16/2003 07:00. Therefore hourly data at 07:00 and daily data at 24:00 were deleted. See Comment 12.

Small Negative PAR values recorded from time to time during November. See Comment 13.

December 2003

DATA IMPORTED INTO EQWin–new data management system.

Missing all met data from 12/02/2003 8:30 to 12/23/2003 13:15, therefore hourly data at 14:00 and daily data at 24:00 were deleted. See Comment 12.

Small Negative PAR values recorded from time to time during December. See Comment 13.

12) Missing data

Arrays:

During 2022 all pre-2007 weather data were revisited by the CDMO. Historically those datasets included 15 minute, hourly (60), and daily data arrays (144). As directed by the NERRS Data Management Committee, the CDMO removed the hourly and daily data arrays leaving only the 15 minute data to make the entire NERRS SWMP weather dataset consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should be aware that they are largely no longer relevant. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout the fall of 2022.

January 2003

Array ID	Calendar Day	Julian	Time	Error Message
101	7	7	2100	Missing 101 Array data (Hourly Averages)
102	7	7	2100	Missing 102 Array data (Hourly Average Wind Parameters)

February 2003

No missing data for the month of February.

March 2003

No missing data for the month of March.

April 2003

Array ID	Calendar Day	Julian	Time	Error Message
150	5	95	15	Missing 150 Array data (15 minute data) from 5 (95) 15 to 14 (104) 1215
101	5	95	100	Missing 101 Array data (Hourly Averages) from 5 (95) 100 to 14 (104) 1200
102	5	95	100	Missing 102 Array data (Hourly Average Wind Parameters) from 5 (95) 100 to 14 (104) 1200
241	5	95	2400	Missing 241 data (Daily Averages) from 5 (95) 2400 to 13 (103) 2400
242	5	95	2400	Missing 242 data (Daily Average Wind Parameters) from 5 (95) 2400 to 13 (103) 2400
243	5	95	2400	Missing 243 data (Daily Max/Time Values) from 5 (95) 2400 to 13 (103) 2400
244	5	94	2400	Missing 244 data (Daily Min/Time Values) from 5 (95) 2400 to 13 (103) 2400

May 2003
No missing data for the month of May.

June 2003

Array ID	Calendar Day	Julian	Time	Error Message
150	24	175	745	Missing 150 Array data (15 minute data) from 24 (175) 745 to 27(178) 1445
101	24	175	800	Missing 101 Array data (Hourly Averages) from 24 (175) 800 to 27 (178) 1400
102	24	175	800	Missing 102 Array data (Hourly Average Wind Parameters) from 24 (175) 800 to 27 (178) 1400
241	24	175	2400	Missing 241 data (Daily Averages) from 24 (175) 2400 to 26 (177) 2400
242	24	175	2400	Missing 242 data (Daily Average Wind Parameters) from

				24 (175) 2400 to 26 (177) 2400
243	24	175	2400	Missing 243 data (Daily Max/Time Values) from 24 (175) 2400 to 26 (177) 2400
244	24	175	2400	Missing 244 data (Daily Min/Time Values) from 24 (175) 2400 to 26 (177) 2400

July 2003

Array ID	Calendar Day	Julian	Time	Error Message
150	22	203	1600	Missing 150 Array data (15 minute data) from 22 (203) 1600 to 22 (203) 1630
150	24	205	2345	Missing 150 Array (15 minute data)
150	26	207	1330	Missing 150 Array data (15 minute data) from 26 (207) 1330 to 29 (210) 1415
101	22	203	1600	Missing 101 Array (Hourly Averages)
101	26	207	1400	Missing 101 Array data (Hourly Averages) from 26(207) 1400 to 29 (210) 1400
102	22	203	1600	Missing 102 Array (Hourly Average Wind Parameters)
102	26	207	1400	Missing 102 Array data (Hourly Average Wind Parameters) from 26 (207) 1400 to 29 (210) 1400
241	26	207	2400	Missing 241 data (Daily Averages) from 26 (207) 2400 to 28 (209) 2400
242	26	207	2400	Missing 242 data (Daily Average Wind Parameters) from 26 (207) 2400 to 28 (209) 2400
243	26	207	2400	Missing 243 data (Daily Max/Time Values) from 26 (207) 2400 to 28 (209) 2400
244	26	207	2400	Missing 243 data (Daily Min/Time Values) from 26 (207) 2400 to 28 (209) 2400

August 2003

Array ID	Calendar Day	Julian	Time	Error Message
150	21	233	2245	Missing 150 Array (15 minute data)

September 2003

No missing data for the month of September.

October 2003

The following data was found missing because the last data of the month was imported into EQWin.

Array ID	Calendar Day	Julian	Time	Error Message
150	31	304	845	Missing Array data (15 minute data) from 31 (304) 845 to 31 (304) 2400
101	31	304	900	Missing 101 Array data (Hourly Averages) from 31(304) 900 to 31 (304) 2400
102	31	304	900	Missing 102 Array (Hourly Average Wind Parameters) from 31 (304) 900 to 31 (304) 2300

November 2003

Copied into EQWin

Missing all met data from 11/02/2003 12:00 to 11/16/2003 07:00. See Comment 12.

December 2003

Copied into EQWin

Missing all met data from 12/02/2003 8:30 to 12/23/2003 08:30. See Comment 12.

13) Other remarks

On 10/11/2023 this dataset was updated to include embedded QAQC flags for anomalous/suspect data. System-wide monitoring data beginning in 2007 were processed to allow for QAQC flags and codes to be embedded in the data files rather than detailed in the metadata alone (as in the anomalous/suspect, deleted, and missing data sections above). Prior to 2007, rejected data were deleted from the dataset so they are unavailable to be used at all, but suspect data were only noted in the metadata document. Suspect data flags <1> were embedded retroactively in order to allow suspect data to be easily identified and filtered from the dataset if desired for analysis and reporting purposes. No other flags or codes were embedded in the dataset and users should still refer to the detailed explanations above for more information.

Arrays:
During 2022 all pre-2007 weather data were revisited by the CDMO. Historically those datasets included 15 minute, hourly (60), and daily data arrays (144). As directed by the NERRS Data Management Committee, the CDMO removed the hourly and daily data arrays leaving only the 15 minute data to make the entire NERRS SWMP weather dataset consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should be aware that they are largely no longer relevant. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout the fall of 2022.

Precipitation:
During the initial years of NERRS SWMP weather data collection the CR10X programming was inconsistent in how precipitation values were recorded. For most reserves, zeros were not recorded when rainfall had not occurred between 2001-2003, instead no rainfall was represented by a blank cell. The CDMO verified which datasets were impacted by this issue for the 2001-2006 datasets and inserted zeros when the metadata indicated that no precipitation occurred and data were not missing for other reasons. In some cases, zero values for precipitation data were evaluated and removed where the metadata confirmed that no rainfall should have been in the dataset. The pre-2007 data did not go through a thorough QAQC process again at that time (in addition to previous QAQC); however, if discrepancies were noticed between what was documented in the metadata and what was in the dataset, additional updates may have been made. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout early 2023.

During precipitation edits mentioned above it was noted that the 01/01/2003 00:00 line of data was missing. Those data were found in an archived original file and added back to the dataset.

PAR flagging update August 2024:
During SWMP data synthesis work it was noted that PAR values from 07/29/2003 14:45 – 08/01/2003 00:00 were much higher than would be expected. Those data were removed from the dataset by the CDMO as they were most likely caused by an incorrect multiplier.

In June 2009, in order to repopulate data tables, the Centralized Data Management Office removed all -99999 from SWMP weather data files and replaced them with -99.

Monthly Rain amounts (mm)
Note: Monthly totals are not available for months where data were missing.

January 2003

1	12.446
2	9.144
3	26.416
4	22.606
6	.762
7	5.842
8	2.794
9	3.048
10	.508
30	2.794
31	.508

Monthly Total 86.9

February 2003

1	14.224
2	.254
7	.254
8	.508
10	.254
11	.508
2	5.842
4	4.826
18	1.270
19	9.398
20	4.572
22	47.244
23	29.210

Monthly Total 118.4

March 2003

2	35.052
3	.254
5	4.572
6	.254
7	2.286
8	2.286
14	11.430
15	3.302
16	.254
18	.254
21	32.258
22	.254
23	.254
27	2.032
29	1.016
30	90.170
31	7.112

Monthly Total 193.0

April 2003

1	.762

2	1.778
3	.254
4	5.080
22	12.192
24	.254
26	16.002
27	.508
29	1.270

Monthly Total 38.1

May 2003

1	.254
6	2.540
7	.254
8	2.286
12	1.270
13	.254
14	.254
15	.254
21	3.556
22	8.128
23	12.446
24	15.494
25	3.048
26	15.494
27	.508
31	6.858

Monthly Total 72.9

June 2003

1	58.674
4	16.256
5	18.796
6	.254
7	13.716
12	4.826
13	5.334
14	7.112
18	4.064
19	3.556
21	2.286
22	21.590
23	.508
24	.254

Monthly Total 157.2

July 2003

9	.762
11	.762
15	.254
18	.508
19	2.032
24	18.288

3	5.080

Monthly Total 27.7

August 2003

1	6.604
2	9.906
5	16.510
6	.254
7	34.544
8	7.620
9	7.874
10	1.270
11	9.398
12	.508
16	37.846
17	22.352

Monthly Total 154.7

September 2003

2	32.512
3	.254
4	30.734
5	3.556
7	.254
9	.254
10	.254
12	.254
16	2.794
21	.254
23	13.716
25	.254
27	.254
28	.254

Monthly Total 85.6

October 2003

1	.254
2	9.398
4	2.032
6	.254
10	.254
11	.254
12	23.114
13	.254
15	29.972
17	.254
18	5.080
19	9.144
20	.254

21	2.794
22	.762
27	21.844
28	5.080
29	27.178

Monthly Total 138.2

November 2003

EQWin

Missing all met data from 11/02/2003 12:00 to 11/16/2003 07:00. See Comment 12.

December 2003

EQWin

Missing all met data from 12/02/2003 8:30 to 12/23/2003 08:30. See Comment 12.