Narragansett Bay (NAR) National Estuarine Research Reserve Meteorological Metadata

January – December 2003

Latest Update: **August 23, 2024**

I. Data Set & Research Descriptors

1) Principal investigator & contact persons:

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2) Entry verification:

a) Data Input Procedures:

The 15-minute, 1-hour average, and 24-hour data were downloaded from each instrument on

the weather station to a Campbell Scientific CR10X datalogger. The CDMO Data Logger Program

(nbnerr.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

interfaced with the PC208W software supplied by Campbell Scientific. This software was

located on a laptop computer at the reserve to which data was downloaded via the RS232

interface connection. The data was saved at regular intervals to a data file (mmddyy.dat)

onto the computer’s hard drive and backed up to a desktop computer, also located at the reserve.

January 1 2003 – October 30, 2003 Sampling Period:

Once an entire month of data was available, the CDMO Weather Data Management Program (WDMP)

was used to convert the files to an Access database. This program was developed in Visual Basic

to interface with the NERRS data collection schedule (see 2b of the Entry Verification section

for the data collection schedule). The WDMP will automatically input and convert the monthly

raw data file into an Access Database. There are three main steps the WDMP performs. First,

it converts the comma delimited monthly raw data file into an Access Database. Secondly, it

checks the data against a predetermined set of error criteria (see Part C of this section).

Finally, it produces error and summary reports. Any anomalous data were investigated and are

noted below in the Anomalous Data section. Any data corrections that were performed are noted

in the Data Correction section below.

Common errors noted in the monthly error reports were temperature change of greater than

3 C in a 15-minute period and relative humidity difference of greater than 25% in 15 minutes.

Hourly and daily averages and/or totals were removed in instances when data were missing for a

portion of the sampling period. Both raw data files and Access databases were saved to Zip Disks

for backup.

October 30, 2003 – December 31, 2003 Sampling Period:

A new storage module (SM4M) was installed on 10/30 which required an updated program, NERR\_4.CSI.

The new program no longer records the data to multiple 15 minute instanteous (Array 150 and 151),

hourly (Arrays 101, 102, 105, and 106), and daily (Arrays 241, 242, 243,244, 245, and 246) arrays.

The format has been simplified to include only a single 15 minute average (Array 15), hourly average

(Array 60), and daily average (Array 144) data array. As a result of the change in formatting,

data through 10/30 at 1000 are included in the October data files, and data for 10/30 at 1100

through 10/31 at 2400 are included with the November-December data file.

Data files were exported from PC208W in a comma-delimited format (.DAT) and opened in

Microsoft Excel for pre-processing with the EQWin format macro that was developed by the CDMO

to reformat the header columns, insert station codes, insert a date column (mm/dd/yyyy), correct

the time column format, and reformat the data to the appropriate number of decimal places.

EQwin now replaces the WDMP as the NERR MET primary QA/QC program. The pre-processed file is

then ready to be copied into the EQWin weather.eqi file where the data are QA/QC checked and

archived in a database. EQWin queries, reports, and graphs are used to discover data set

outliers (values which fall outside the range that the instrument is designed to measure)

and large changes in the data. EQWin is also used to generate statistics, view graphs, create

customized queries and reports of the data, cross query the water, weather, and nutrient data

and finally export the data to the CDMO.

The Centralized Data Management Office converted all SWMP weather data collected with CR10X

program versions prior to version 4.0 which was distributed in October 2003. This was necessary

in order to merge the old data format (12 array output) with the new data format found in version 4.0

(3 array output). The new format produces averages, maximums and minimums every fifteen minutes

(array 15), every hour (array 60) and every day (array 144) for any sensors hooked up to the CR10X.

Specifically, the 150 and 151 fifteen minute data were converted to the new 15 array;

the hourly 101, 102, 105 and 106 data were converted to the new 60 array; and the daily 241, 242,

243, 244, 245 and 246 data were converted to the new 144 array. With the new format, the use of

55555's to code for deleted data and 11111's to code for missing data has been abandoned.

Hence, all 55555's or 11111's contained in the SWMP weather data collected prior to Version 4.0

of the CR10X program were removed and left blank.

b) Data Collection Schedule:

For data collection, the CR10X datalogger was programmed to collect data in the

following formats:

i) 15-minute data are collected instantaneously for Air Temperature (C),

Relative Humidity (%), Barometric Pressure (mb), Wind Speed (m/s), and

Wind Direction (degrees). 15-minute Precipitation (mm) and PAR

(mmol/m^2) data are totaled from 5-second readings, prior to NERR\_4.CSI

ii) 15-minute average, maximum and minimum data are averages of 5-second

readings for Air Temperature (oC), Relative Humidity (%), Barometric

Pressure (mb) and Wind Speed (m/s) with NERR\_4.CSI.

iii) Hourly average, maximum, and minimum data are averages of 5-second

readings for Air Temperature (oC), Relative Humidity (%), Barometric

Pressure (mb), Wind Speed (m/s), and Wind Direction (degrees). Hourly

totals for PAR (mmol/m^2) and Precipitation (mm) are totals of 15-minute

readings.

iv) Daily average, maximum and minumum data are averages of 5-second

readings for Air Temperature (oC), Relative Humidity (%), Barometric

Pressure (mb), Wind Speed (m/s), and Wind Direction (degrees). Daily totals

for PAR (mmol/m^2) and Precipitation (mm) are totals of 15-minute readings.

c) Error/Anomalous Data Criteria:

WDMP error reports and EQWin queries were based on the following 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 (WDMP only)

- Max and min temp recorded for the day (WDMP only)

- 1-hour average not greater than 10% above the greatest 15 min sample recorded in the

hour (WDMP only)

- Sample not greater than 50 C or less than –40 C (EQWin only)

Relative Humidity:

- Not changed by more than 25% from the previous 15 minutes (WDMP only)

- Max and min humidity recorded for the day (WDMP only)

- 1-hour average not greater than 10% above the greatest 15 min sample recorded in the

hour (WDMP only)

- Sample not greater than 100% or less than 0% (EQWin only)

Pressure:

- Pressure not greater than 1040 mb or less than 980 mb (WDMP only)

- Pressure changes greater than 5 mb per hour (WDMP only)

- Maximum and minimum values recorded for the day (WDMP only)

- 1-hour average not greater than 10% above the greatest 15 min sample recorded in the

hour (WDMP only)

- Sample not greater than 1060 mb or less than 900 mb (EQWin only)

Wind Speed:

- Wind speed not greater than 30 m/s or less than 0.5 m/s (WDMP only)

- Wind speed not greater than 30 m/s (EQWin only)

- Wind speed not less than 0.5 m/s for 12 consecutive hours (EQWin only)

Wind Direction:

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

Rainfall:

- Precipitation not greater than 5 mm in 15 min

- No precipitation for the month (WDMP only)

Solar Radiation (LiCor):

- Sample not greater than 5000 millimoles per meter squared (mmol/m^2)

- Sample not less than 0 millimoles per meter squared (mmole/m^2)

Time:

- 15-minute interval recorded

For all data:

- No duplicate data

3) Research objectives:

The principal objective is to record long-term meteorological data for Narragansett Bay in order to

observe any environmental changes or trends over time. These data are also used in support of both

water quality and biological sampling data.

4) Research methods:

The Campbell Scientific weather station samples every 5 seconds to produce both hourly and daily

averages of those measurements of air temperature, relative humidity, barometric pressure, rainfall,

wind speed and wind direction. Prior to installation of the new CR10X program, NERR\_4.CSI, an

instantaneous sample is taken every 15 minutes and that data are stored in array 150. An approximate

two week sampling interval was chosen so that the CR10X datalogger would not run out of memory and

overwrite data. The short haul modem link was inoperable so the data had to be downloaded periodically

from the storage module to a laptop computer. Sensors on the weather station are inspected monthly

for damage or debris. If any is found, it is repaired and/or cleaned. There were no other analyses

done on the meteorological data at present.

5) Site location and character:

The NBNERR consists of 4376 acres of diverse estuarine and terrestrial habitats ranging from open

estuarine water to salt marshes to forested uplands. The land holdings include 60% of Prudence Island,

most of nearby Patience Island, all of Hope Island off the west shore of Prudence Island, and Dyer

Island located in the East Passage of Narragansett Bay. The reserve is located close to the geographic

center of Narragansett Bay in Rhode Island. The bay has a drainage basin of 1,800 square miles.

The weather station is located on Prudence Island, east of Potter’s Cove (lat: 41 deg 38.335'N,

long: 71 deg 20.362' W). The Wind Sentry and the Temperature and Humidity sensor are located on

an aluminum tower approximately 10m in height. The Licor sensor is located on a shorter (3m)

aluminum tower. The tipping Bucket Rain gauge is located to the NW away from the tower and the

platform. The barometer is located within the housing of the CR10X.

Descriptions of the specific sampling station follows:

The Potter’s Cove weather station is in a grassland area bordering the cove. This location is

approximately 100 yards from a water quality monitoring station maintained by the NBNERR since 1995.

The water quality in the cove is considered to be adversely affected by boater’s wastes and storm

runoff from urban areas. Locating the weather station near this site might help to determine whether

meteorological factors further influence water quality within the cove.

6) Data collection period:

Weather data have been collected at the Potter’s Cove weather station since 1992. The current datalogger,

a CR10X, was installed February of 2002, replacing an inoperable CR21X datalogger. Data reported

this period was continuously collected from January 1, 2003 through December 31, 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 home page) 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:

The NERR Water Quality Monitoring Project has a station located nearby at Potter’s Cove. The

principal objective of this study is to record long-term water quality data for Narragansett Bay

in order to observe any physical changes or trends in water quality over time. Four sites were

selected; one to represent an impacted site, two in open water (at both the surface and near-bottom),

and one located in a salt marsh tidal creek. The Potter’s Cove site is located on Prudence Islands’

northeastern shore and is impacted by boat traffic and storm runoff from mainland urban and

residential areas. Measurements are taken every 30 minutes over a roughly two week collecting

periods at all water quality monitoring locations throughout the year.

A Physical Oceanographic Real-Time System (PORTS) meteorological station is housed in the NERRS

weather station at Potter’s Cove and independently records wind speed, wind direction, atmospheric

pressure, and air temperature. This is one of six PORTS meteorological stations in Narragansett Bay.

The purpose of PORTS is to support safe and cost efficient navigation. data are available real-time

and the system is managed for quality control.

Volunteers from the Prudence Conservancy have maintained a drum-recorder rain gauge located at

the Potter’s Cove weather station since 1992. The volunteers clean the rain gauge periodically,

as well as replace the recording pens and paper as necessary. The data are managed by the NBNERR.

II. Physical Structure Descriptors

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

Parameter: Solar Radiation (LiCor Quantum Sensor)

Units: mmoles m-2 (total flux)

Sensor Type: High stability silicon photovoltaic detector (blue enhanced)

Model #: LI190SB

Light spectrum wavelength: 400 to 700 nm

Temperature dependence: 0.15% per degree C maximum

Stability: <±2% change over 1 yr

Operating Temperature: -40 to 65°C

Sensitivity: typically 5 µA per 1000µmoles s-1 m-2

Date of last calibration: 6-11-03 (new sensor installed)

Parameter: Wind Speed

Units: meter per second (m/s)

Sensor type: 12 cm diameter cup wheel assembly; 40 mm diameter hemispherical cups

Model #: R.M. Young 03001 Wind Sentry

Range: 0-50 m/s (112 mph); gust survival 60 m/s (134 mph)

Date of last calibration: 7-01-02 (new sensor installed)

Parameter: Wind Direction

Units: degrees

Sensor type: Balanced vane, 16 cm turning radius

Model #: R.M. Young 03001 Wind Sentry

Range: 360o mechanical, 355o electrical (5o open)

Date of last calibration: 7-01-02 (new sensor installed)

Parameter: Temperature

Units: degree Celsius

Sensor type: Platinum resistance temperature detector (PRT)

Model #: HMP45C Temperature and Relative Humidity Probe

Operating Temperature: -40-+60°C

Range: -40-+60°

Accuracy: ± 0.2 °C @ 20°C

Date of Last calibration: 8-15-03 (new sensor installed)

Parameter: Relative Humidity

Units: Percent

Sensor type: Vaisala HUMICAP© 180 capacitive relative humidity sensor

Model #: HMP45C Temperature and Relative Humidity Probe

Range: 0-100% non-condensing

Accuracy at 20°C: ± 2% RH (0-90%) and ± 3% (90-100%)

Temperature dependence of RH measurement: ± 0.05% RH/°C

Date of Last calibration: 8-15-03 (new sensor installed)

Parameter: Barometric Pressure

Units: millibars (mb)

Sensor type: Vaisala Barocap© silicon capacitive pressure sensor

Model # CS-105

Operating Range: Pressure 600-1060 mb; Temperature: -40°C to +60°C

Humidity: non-condensing

Accuracy: ± 0.5 mb @ 20°C; ± 2 mb @ 0°C to 40°C; ± 4 mb @ -20°C to 45°C; ± 6 mb @ -40°C to 60°C

Stability: ± 0.1 mb per year

Date of Last calibration: Unknown

Parameter: Precipitation

Units: millimeters (mm)

Sensor type: Tipping Bucket Rain Gauge

Model #: TE 525

Rainfall per tip: 0.01 inch

Operating range: Temperature: 0°C to ±50°C; Humidity: 0 to 100%

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

Date of Last calibration: 2-6-02

Storage Module

Model#: SM192

Storage capacity: 192,896 bytes

Operating range temperature: -35°C to + 65°C

Processor: Hitachi 6303

Memory type: User selectable for either ring style (default) or fill and drop

Power requirements: 5 ± 0.4 VDC @ 100 mA

Storage Module

Model #: SM4M

Storage capacity: 2 million low-resolution data values

Program storage: stores up to 8 programs with a total capacity of 128 KB

Processor: Hitachi H8S

Operating system: 64 KB, flash memory based, user downloadable

Operating range temperature: -35°C to +65°C

Memory type: User selectable for either ring style (default) or fill and drop

Power requirements: 5 ± 0.3 VDC @ 100 mA

The Cambell Scientific CR10X Wiring Panel has 128K of flash memory (EEPROM), in which it stores

the operating system and weather station data retrieval programming. Additionally, there are

128K of SRAM, which it uses to run the program, temporarily store 5 second measurements (for

computing averages and totals), and for final data storage.

10) Coded variable indicator and variable code definitions:

Site Definitions: PC = Potter’s Cove

EQWin station code: narpcmet

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](http://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 were anomalously high for part of 2003. PAR data flagging was changed by the CDMO to suspect from June 11, 2003 11:15 to October 30, 2003 10:00.

January 2003:

All Eppley data (array 112) were removed for the month.

February 2003:

These data appear to be correct.

Array Day Date Time Error Message

150 16 47 800 Pressure is greater than 1040 or less than 980 on 16 ( 47) 800 ( 1040.3)

150 16 47 815 Pressure is greater than 1040 or less than 980 on 16 ( 47) 815 ( 1040.7)

150 16 47 830 Pressure is greater than 1040 or less than 980 on 16 ( 47) 830 ( 1040.5)

150 16 47 845 Pressure is greater than 1040 or less than 980 on 16 ( 47) 845 ( 1040.7)

150 16 47 900 Pressure is greater than 1040 or less than 980 on 16 ( 47) 900 ( 1040.6)

150 16 47 915 Pressure is greater than 1040 or less than 980 on 16 ( 47) 915 ( 1040.7)

150 16 47 930 Pressure is greater than 1040 or less than 980 on 16 ( 47) 930 ( 1040.4)

150 16 47 945 Pressure is greater than 1040 or less than 980 on 16 ( 47) 945 ( 1040.1)

All Eppley data (array 112) were removed for the month.

March 2003:

This rate of change, although considered excessive in a 15 minute period, is not uncommon in this region due to fast moving weather fronts and their associated wind shifts.

Array Day Date Time Error Message

150 17 76 1215 Air temp difference from 17 ( 76) 1215 ( 18.196) to 17 ( 76) 1230 (14.745) is greater than 3.0 degrees C

150 22 81 2145 Rel hum difference from 22 ( 81) 2145 ( 91.212) to 22 ( 81) 2200 (61.938) is greater than 25%

All Eppley data (array 112) were removed for the month.

April 2003:

As previously stated, excessive changes in these parameters are common due to fast moving fronts. However, in this instance, the quick succession of increasing and decreasing values for this period are considered suspect.

Array Day Date Time Error Message

150 16 106 1245 Air temp difference from 16 ( 106) 1245 ( 21.23) to 16 ( 106) 1300 (24.38) is greater than 3.0 degrees C

150 16 106 1300 Air temp difference from 16 ( 106) 1300 ( 24.38) to 16 ( 106) 1315 (19.82) is greater than 3.0 degrees C

150 16 106 1330 Air temp difference from 16 ( 106) 1330 ( 21.87) to 16 ( 106) 1345 (25.32) is greater than 3.0 degrees C

150 16 106 1515 Air temp difference from 16 ( 106) 1515 ( 23.28) to 16 ( 106) 1530 (27.07) is greater than 3.0 degrees C

150 16 106 1530 Air temp difference from 16 ( 106) 1530 ( 27.07) to 16 ( 106) 1545 (14.56) is greater than 3.0 degrees C

150 16 106 1530 Rel hum difference from 16 ( 106) 1530 ( 25.353) to 16 ( 106) 1545 (63.384) is greater than 25%

This rate of change, although considered excessive in a 15 minute period, is not uncommon in this region due to fast

moving weather fronts and their associated wind shifts.

150 29 119 2100 Rel hum difference from 29 ( 119) 2100 ( 89.187) to 29 ( 119) 2115 (62.464) is greater than 25%

This error message is associated with a missing data period.

Array Day Date Time Error Message

150 9 99 1315 Pressure difference from 9 ( 99) 1315 ( 1023.4) to 12 ( 102) 2015 (1004.9) is greater than 5 mb

All Eppley data (array 112) were removed for the month.

May 2003:

All Eppley data (array 112) were removed for the month.

June 2003:

This rate of change, although considered excessive in a 15 minute period, is not uncommon in this region due to fast

moving weather fronts and their associated wind shifts.

Array Day Date Time Error Message

150 20 171 800 Air temp difference from 20 ( 171) 800 ( 16.463) to 20 ( 171) 815 (19.916) is greater than 3.0 degrees C

These data appear to be correct.

Array Day Date Time Error Message

151 22 173 100 Precip difference from 22 ( 173) 100 ( 5.334) to 22 ( 173) 115 ( .254) is greater than 5 mm

151 22 173 945 Precip difference from 22 ( 173) 945 ( 1.016) to 22 ( 173) 1000 ( 6.096) is greater than 5 mm

All values for temperature and relative humidity were changed to read 55555 on the following dates: 6/6, 6/10, 6/14, 6/15, and 6/23-6/30. The sensor was beginning to fail this month. As a result, all days that contained data that were definitely incorrect (either extremely high or low values) were removed in their entirety for these two parameters.

Array Day Date Time Error Message

101 6 157 100 Technician changed 101 Array data from 6 ( 157) 100 to 6 ( 157) 2400

101 10 161 100 Technician changed 101 Array data from 10 ( 161) 100 to 10 ( 161) 2400

101 14 165 100 Technician changed 101 Array data from 14 ( 165) 100 to 15 ( 166) 2400

101 23 174 100 Technician changed 101 Array data at 23 ( 174) 100 to 30 ( 181) 2400

150 6 157 15 Technician changed 150 Array data from 6 ( 157) 15 to 6 ( 157) 2400

150 10 161 15 Technician changed 150 Array data from 10 ( 161) 15 to 10 ( 161) 2400

150 14 165 15 Technician changed 150 Array data from 14 ( 165) 15 to 15 ( 166) 2400

150 23 174 15 Technician changed 150 Array data at 23 ( 174) 15 to 30 ( 181) 2400

241 6 157 2400 Technician changed 241 Array from 6 ( 157) 2400 to 6 ( 157) 2400

241 10 161 2400 Technician changed 241 Array from 10 ( 161) 2400 to 10 ( 161) 2400

241 14 165 2400 Technician changed 241 Array from 14 ( 165) 2400 to 15 ( 166) 2400

241 23 174 2400 Technician changed 241 Array data at 23 ( 174) 2400 to 30 ( 181) 2400

243 6 157 2400 Technician changed 243 Array data from 6 ( 157) 2400 to 6 ( 157) 2400

243 10 161 2400 Technician changed 243 Array data from 10 ( 161) 2400 to 10 ( 161) 2400

243 14 165 2400 Technician changed 243 Array data from 14 ( 165) 2400 to 15 ( 166) 2400

243 23 174 2400 Technician changed 243 Array data at 23 ( 174) 2400 to 30 ( 181) 2400

244 6 157 2400 Technician changed 244 Array data from 6 ( 157) 2400 to 6 ( 157) 2400

244 10 161 2400 Technician changed 244 Array data from 10 ( 161) 2400 to 10 ( 161) 2400

244 14 165 2400 Technician changed 244 Array data from 14 ( 165) 2400 to 15 ( 166) 2400

244 23 174 2400 Technician changed 244 Array data at 23 ( 174) 2400 to 30 ( 181) 2400

Corrected data values:

For the following dates and times the 24 hour maximum and minimum temperature and relative humidity values were corrected using 15 minute instanteous (150) data arrays.

Array Date Day Variable corrected Original value Corrected value

243 171 20 Max air temp 49.891 22.174 @ 1500

Max rel humid 100 99.078 @ 400

244 171 20 Min air temp -2.649 13.378 @ 2330

Min rel humid 50.724 61.102 @ 1515

A new Licor sensor was installed on 6/11/03. This task occurred from 930 through 1100. Although data were not listed as missing for this time period, values were changed to 11111 by the technician to indicate that these data were not valid. Changes were made to the 15 minute (150) data arrays from 930 through 1100 and hourly (105) data arrays from 1000 through 1100.

All Eppley data (array 112) were removed for the month. Eppley sensor wasd removed on 6/11/03, however values were still recorded even though the sensor was removed because the CR10X program was not changed to reflect the removal of the Eppley sensor.

July 2003:

These data appear to be correct.

Array Day Date Time Error Message

151 11 192 1000 Precip difference from 11 ( 192) 1000 ( 3.556) to 11 ( 192) 1015 (11.684) is greater than 5 mm

151 11 192 1015 Precip difference from 11 ( 192) 1015 ( 11.684) to 11 ( 192) 1030 (4.572) is greater than 5 mm

151 22 203 2330 Precip difference from 22 ( 203) 2330 ( .254) to 22 ( 203) 2345 ( 9.144) is greater than 5 mm

151 22 203 2345 Precip difference from 22 ( 203) 2345 ( 9.144) to 22 ( 203) 2400 (2.286) is greater than 5 mm

Values for temperature and relative humidity were changed to read 55555 for almost the entire month. The sensor was failing. All days which contained data which were definitely incorrect (either extremely high or low values) were removed in their entirety for these two parameters. Although data were retained for some dates (7/11, 7/14, 7/24, 729-7/31), they should be considered suspect given the generally poor performance of this sensor.

Array Day Date Time Error Message

101 1 182 100 Technician changed 101 Array data from 1 ( 182) 100 to 10 ( 191) 2400

101 12 193 100 Technician changed 101 Array data from 12 ( 193) 100 to 13 ( 194) 2400

101 15 196 100 Technician changed 101 Array data from 15 ( 196) 100 to 23 ( 204) 2400

101 25 206 100 Technician changed 101 Array data from 25 ( 206) 100 to 28 ( 209) 2400

150 1 182 15 Technician changed 150 Array data from 1 ( 182) 15 to 10 ( 191) 2400

150 12 193 15 Technician changed 150 Array data from 12 ( 193) 15 to 13 ( 194) 2400

150 15 196 15 Technician changed 150 Array data from 15 ( 196) 15 to 23 ( 204) 2400

150 25 206 15 Technician changed 150 Array data from 25 ( 206) 15 to 28 ( 209) 2400

241 1 182 2400 Technician changed 241 Array from 1 ( 182) 2400 to 10 ( 191) 2400

241 12 193 2400 Technician changed 241 Array from 12 ( 193) 2400 to 13 ( 194) 2400

241 15 196 2400 Technician changed 241 Array from 15 ( 196) 2400 to 23 ( 204) 2400

241 25 206 2400 Technician changed 241 Array from 25 ( 206) 2400 to 28 ( 209) 2400

243 1 182 2400 Technician changed 243 Array data from 1 ( 182) 2400 to 10 ( 191) 2400

243 12 193 2400 Technician changed 243 Array data from 12 ( 193) 2400 to 13 ( 194) 2400

243 15 196 2400 Technician changed 243 Array data from 15 ( 196) 2400 to 23 ( 204) 2400

243 25 206 2400 Technician changed 243 Array data from 25 ( 206) 2400 to 28 ( 209) 2400

244 1 182 2400 Technician changed 244 Array data from 1 ( 182) 2400 to 10 ( 191) 2400

244 12 193 2400 Technician changed 244 Array data from 12 ( 193) 2400 to 13 ( 194) 2400

244 15 196 2400 Technician changed 244 Array data from 15 ( 196) 2400 to 23 ( 204) 2400

244 25 206 2400 Technician changed 244 Array data from 25 ( 206) 2400 to 28 ( 209) 2400

Corrected data values:

For the following date and time, the 24 hour minimum temperature value was corrected using 15 minute instanteous (150) data arrays.

Array Date Day Variable corrected Original value Corrected value

244 211 30 Min air temp 1.616 14.728 @ 2400

All Eppley data (array 112) were removed for the month.

August 2003:

These data appear to be valid.

Array Day Date Time Error Message

151 1 213 645 Precip difference from 1 ( 213) 645 ( .508) to 1 ( 213) 700 ( 7.874) is greater than 5 mm

151 7 219 2015 Precip difference from 7 ( 219) 2015 ( .508) to 7 ( 219) 2030 ( 10.16) is greater than 5 mm

151 7 219 2045 Precip difference from 7 ( 219) 2045 ( 7.112) to 7 ( 219) 2100 ( .508) is greater than 5 mm

151 13 225 1915 Precip difference from 13 ( 225) 1915 ( 10.414) to 13 ( 225) 1930 (4.318) is greater than 5 mm

This error message is associated with a missing data period.

Array Day Date Time Error Message

150 27 239 930 Pressure difference from 27 ( 239) 930 ( 1010.8) to 30 ( 242) 1900 (1020.9) is greater than 5 mb

This error is a result of altering the 24 hour minimum value using 15 minute data.

Array Day Date Time Error Message

101 1 213 100 Air temp average in 1 hour data ( 19.648) is less than 24 hour minimum ( 19.661)

All values for temperature and relative humidity were changed to read 55555 from 8/2 through 8/15 at 1330. The sensor was failing and was replaced on 8/15 between 930 and 1330. The wind speed and direction sensor was also off-line for a brief period on this day to allow for re-wiring of the air temperature and relative humidity sensor through a conduit. The Barometric Pressure for the daily readings were also changed to read 55555 due to possible skewed data from wire clean ups.

Array Day Date Time Error Message

101 2 214 100 Technician changed 101 Array data from 2 ( 214) 100 to 15 ( 227) 1400

102 15 227 1000 Technician changed 102 Array from 15 ( 227) 1000 to 15 ( 227) 1400

150 2 214 15 Technician changed 150 Array data from 2 ( 214) 15 to 15 ( 227) 1330

241 2 214 2400 Technician changed 241 Array from 2 ( 214) 2400 to 15 ( 227) 2400

242 15 227 2400 Technician changed 242 Array from 15 ( 227) 2400 to 15 ( 227) 2400

243 2 214 2400 Technician changed 243 Array data from 2 ( 214) 2400 to 15 ( 227) 2400

244 2 214 2400 Technician changed 244 Array data from 2 ( 214) 2400 to 15 ( 227) 2400

The CR10X output -99999 for Temp, RH, MinRH and MinTemp on 8/15 @ 2400 most likely because the sensors where offline for a good period of time on this day.

Corrected data values:

For the following date and time, the 24 hour minimum air temperature was corrected using 15 minute

instanteous (150) data arrays.

Array Date Day Variable corrected Original value Corrected value

244 213 1 Min air temp 2.925 19.661 @ 15

All Eppley data (array 112) were removed for the month.

September 2003:

This rate of change, although considered excessive in a 15 minute period, is not uncommon in this region due to fast moving weather fronts and their associated wind shifts.

Array Day Date Time Error Message

150 29 272 1500 Air temp difference from 29 ( 272) 1500 ( 18.698) to 29 ( 272) 1515 (14.374) is greater than 3.0 degrees C

150 29 272 1500 Rel hum difference from 29 ( 272) 1500 ( 67.011) to 29 ( 272) 1515 (92.289) is greater than 25%

All Eppley data (array 112) were removed for the month.

October 2003:

A new storage module (SM4M) was installed on 10/30 which required an updated program, NERR\_4.CSI. The new program no longer records the data to multiple 15 minute instanteous (Array 150 and 151), hourly (Arrays 101, 102, 105, and 106), and daily (Arrays 241, 242, 243,244, 245, and 246) arrays. The format has been simplified to include only a single 15 minute average (Array 15), hourly average (Array 60), and daily average (Array 144) data array. As a result of the change in formatting, data through 10/30 at 1000 are included in the October data files, and data for 10/30 at 1100 through 10/31 at 2400 are included with the November-December data file.

Following the programming and data formatting change, there was one negative PAR value during this month. These values occur as the result of a calibration error and were very slight. All negative PAR values were corrected to zero.

This rate of change, although considered excessive in a 15 minute period, is not uncommon in this region due to fast moving weather fronts and their associated wind shifts.

Array Day Date Time Error Message

150 2 275 1615 Air temp difference from 2 ( 275) 1615 ( 13.487) to 2 ( 275) 1630 (9.9328) is greater than 3.0 degrees C

150 2 275 1615 Rel hum difference from 2 ( 275) 1615 ( 55.13) to 2 ( 275) 1630 (84.071) is greater than 25%

All Eppley data (array 112) through the installation of the new CR10X NERR\_4.CSI program on 10/30/03 were removed for the month. The new CR10X NERR\_4.CSI program no longer includes an Eppley output, therefore no Eppley data were recorded for the remainder of the year.

November 2003:

Following the programming and data formatting change, there were a number of negative PAR values. These values occur as the result of a calibration error and were very slight. All negative PAR values were corrected to zero.

December 2003:

Following the programming and data formatting change, there were a number of negative PAR values. These values occur as the result of a calibration error and were very slight. All negative PAR values were corrected to zero.

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](http://www.nerrsdata.org/get/landing.cfm) throughout the fall of 2022.

January – March 2003:

NONE

April 2003:

These data are missing due to a file overwrite.

Array Day Date Time Error Message

150 9 99 1330 Missing 150 Array data (15 minute data) from 9 ( 99) 1330 to 12 ( 102) 2000

101 9 99 1400 Missing 101 Array data (Hourly Averages) from 9 ( 99) 1400 to 12 ( 102) 2000

102 9 99 1400 Missing 102 Array data (Hourly Average Wind Parameters) from 9 ( 99) 1400 to 12 ( 102) 2000

241 9 99 2400 Missing 241 data (Daily Averages) from 9 ( 99) 2400 to 12 ( 102) 2400

242 9 99 2400 Missing 242 data (Daily Average Wind Parameters) from 9 ( 99) 2400 to 12 ( 102) 2400

243 9 99 2400 Missing 243 data (Daily Max/Time Values) from 9 ( 99) 2400 to 12 ( 102) 2400

244 9 99 2400 Missing 244 data (Daily Min/Time Values) from 9 ( 99) 2400 to 12 ( 102) 2400

May-July 2003:

NONE

August 2003:

These data are missing due to a file overwrite.

Array Day Date Time Error Message

150 27 239 945 Missing 150 Array data (15 minute data) from 27 ( 239) 945 to 30 (242) 1845

101 27 239 1000 Missing 101 Array data (Hourly Averages) from 27 ( 239) 1000 to 30 (242) 1900

102 27 239 1000 Missing 102 Array data (Hourly Average Wind Parameters) from 27 (239) 1000 to 30 ( 242) 1900

241 27 239 2400 Missing 241 data (Daily Averages) from 27 ( 239) 2400 to 30 ( 242)2400

242 27 239 2400 Missing 242 data (Daily Average Wind Parameters) from 27 ( 239) 2400 to 30 ( 242) 2400

243 27 239 2400 Missing 243 data (Daily Max/Time Values) from 27 ( 239) 2400 to 30 (242) 2400

244 27 239 2400 Missing 244 data (Daily Min/Time Values) from 27 ( 239) 2400 to 30 (242) 2400

September 2003:

NONE

October 2003:

These data were written in a new format for processing in EQWin beginning on 10/30 at 1100. These data are attached to the November-December data file. Missing data still includes the 15 minute data from 1015 through 1045, hourly data at 1100, and daily data on this date (10/30/03).

Array Day Date Time Error Message

150 30 303 1015 Missing 150 Array data (15 minute data) from 30 ( 303) 1015 to 31 (304) 2400

101 30 303 1100 Missing 101 Array data (Hourly Averages) from 30 ( 303) 1100 to 31 (304) 2400

102 30 303 1100 Missing 102 Array data (Hourly Average Wind Parameters) from 30 (303) 1100 to 31 ( 304) 2300

241 30 303 2400 Missing 241 Array (Daily Averages)

242 30 303 2400 Missing 242 Array (Daily Average Wind Parameters)

243 30 303 2400 Missing 243 Array (Daily Max/Time Values)

244 30 303 2400 Missing 244 Array (Daily Min/Time Values)

November-December 2003:

NONE

13) Other Remarks/notes

**On 10/29/2023 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](http://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](http://www.nerrsdata.org/get/landing.cfm) throughout early 2023.

**PAR flagging update August 2024:**

During SWMP data synthesis work it was noted that PAR values were anomalously high for part of 2003. PAR data flagging was changed by the CDMO to suspect from June 11, 2003 11:15 to October 30, 2003 10:00.

LiCor:

Prior to the installation of the new NERR\_4.CSI program, all values less

than 0 were altered in the raw data to read 0. These values may indicate an incorrect

multiplier, calibration problems, or a sensor malfunction. Because these values are

changed in the raw data, we cannot confirm that they are all valid data points.

Relative Humidity:

Prior to the installation of the new NERR\_4.CSI program, all values over

100% were altered in the raw data to read 100%. These values may indicate super

saturated air, calibration problems, or a sensor malfunction. Because these values

are changed in the raw data, we cannot confirm that they are all valid data points.

Rain Events:

Note: Monthly totals are not available during those months where data were missing due to power down or reload or re-wiring.

January

Date RainAmount (mm)

1 13.716

2 3.556

3 16.764

4 8.636

8 3.302

9 .508

17 .254

30 .508

"Monthly Total" 47.2

February

Date RainAmount (mm)

1 4.572

2 5.080

4 5.842

9 2.540

10 .508

18 1.270

19 2.794

22 25.654

23 12.700

"Monthly Total" 61.0

March

Date RainAmount (mm)

2 34.036

5 3.048

7 6.096

13 1.270

14 3.048

20 3.302

21 18.034

22 .254

26 1.270

29 14.224

30 40.640

31 .254

"Monthly Total" 125.5

April

Date RainAmount (mm)

1 .508

2 .254

3 1.270

4 2.540

5 2.286

7 1.016

8 2.794

9 3.810

22 42.672

26 20.066

May

Date RainAmount (mm)

1 3.302

2 .254

6 1.778

7 .254

8 2.286

11 6.604

12 1.270

14 .254

21 4.064

22 4.826

23 7.366

24 3.556

26 31.242

27 .254

31 6.096

"Monthly Total" 73.4

June

Date RainAmount (mm)

1 20.320

4 14.224

5 11.176

7 10.160

12 5.588

13 11.684

14 10.668

18 11.938

21 3.302

22 29.972

23 .508

24 .254

"Monthly Total" 129.8

July

Date RainAmount (mm)

3 16.256

9 3.048

10 .254

11 30.480

12 .254

18 3.556

19 .254

22 13.970

23 1.524

24 19.304

29 4.826

"Monthly Total" 93.7

August

Date RainAmount (mm)

1 30.734

2 10.160

5 1.270

6 4.826

7 32.004

8 29.972

9 1.778

10 .254

12 .508

13 22.352

17 7.874

18 1.524

"Monthly Total" 143.3

September

Date RainAmount (mm)

1 4.572

2 31.242

4 10.160

16 7.112

19 4.826

23 3.810

28 5.080

29 5.080

"Monthly Total" 71.9

October

Date RainAmount (mm)

2 1.016

4 2.540

12 9.144

15 36.322

17 3.302

18 6.096

19 4.572

21 .508

22 1.778

26 1.778

27 21.336

28 1.270

29 32.512

November

Date RainAmount (mm)

5 7.1

6 2.3

11 3.0

12 1.0

13 3.6

20 11.7

21 6.6

25 4.1

28 6.9

29 1.5

Monthly Total 47.8

December

Date RainAmount (mm)

6 1.3

8 4.3

9 4.3

10 2.3

11 19.6

14 25.4

15 6.4

17 11.4

24 10.9

25 2.0

30 1.5

Monthly Total 89.4