ACE Basin (ACE) National Estuarine Research Reserve
Meteorological Metadata Report
March - December 2001

Latest Update: **January 30, 2023**

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 meteorological data recorded by each sensor are stored in a Campbell Scientific CR10X datalogger. The CDMO Data Logger Program (nerr30.csi) that is loaded into the datalogger controls the sensors and data collections 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.

The PC208W software is installed on a laptop computer. This computer is used to download the weather data from the datalogger via a SC32A interface. This data are saved in a text file (*.DAT).

Once an entire month of data is collected, the CDMO Weather Data Management Program (WDMP) is used to convert the files to an Access database. This 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 inputs and converts the monthly raw data file into the database, as described below. First, it converts the comma delimited monthly raw data file into an Access database.

Next, it checks the data against a predetermined set of error criteria (see Appendix G for the CDMO Meteorological Data Collection Error/Anomalous Data Criteria). Finally, it produces error and summary reports. Any anomalous data are investigated and noted in the Anomalous Data/Data Corrections Section. Any data corrections that are performed are noted in the Anomalous Data/Data Correction Section below.

Common error noted in the monthly error reports was missing data, which was caused by a faulty solar panel regulator and lead acid battery.
Saundra Upchurch and Amy Whitaker Dukes are responsible for these tasks.

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

i) Data is collected in the following formats:

1) 15 minute data are instantaneous readings except for PAR and precipitation data that are totalized from 5 second samples sorted by date and time. (Arrays 150 and 151)
2) Hourly averages (Arrays 101 and 102) are calculated from 5 second samples sorted by date and time except for PAR and precipitation data that are hourly totals calculated from 15 minute totals (Arrays 105 and 106).
3) Daily average (arrays 241 and 242), maximum with time, and minimum with time (arrays 243 and 244) are calculated from 5 second samples sorted by date and time except for PAR and precipitation data which are 24 hour totals calculated from hourly totals (arrays 245 and 246).

ii) 15 minute sample point parameters: Date, Time, Air Temperature (°C), Relative Humidity (%), LiCor (PAR), Barometric Pressure (mb), Wind Speed (m/s), Wind Direction (Array 150); Rainfall (mm) (Array 151)

iii) Hourly average parameters: Date, Time, Air Temperature (°C), Relative Humidity (%), Barometric Pressure (mb) (Array 101); Wind Speed (m/s), Wind Direction, Wind Speed Maximum (Array 102)

iv) Hourly total parameters: LiCor (PAR) (Array 105); Rainfall (mm) (Array 106)

v) Daily Average parameters: Date, Time, Air Temperature (°C), Relative Humidity (%), Barometric Pressure (mb) (Array 241); Wind Speed (m/s), Wind Direction, Wind Direction Standard Deviation (using Yamartino's Algorithm) (Array 242)

vi) Daily Total parameter: LiCor (PAR) (Array 245); Rainfall (mm) (Array 246)

vii) 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 (Array 243)

viii) 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 (Array 244)

c) Error/Anomalous Data Criteria

Air Temp:

- 15 min sample greater than max for the day
- 15 min sample less than the min for the day
- 15 min sample greater than 3.0 °C from the previous 15 minutes
- Max and Min values not recorded for the day
- 1-hour average greater than 10% above the greatest 15 min sample recorded in the hour

Relative Humidity:

- Changed by more than 25% from the previous 15 minutes
- Max and Min values not recorded for the day
- 1-hour average greater than 10% above the greatest 15 min sample recorded in the hour

Rainfall:

- Precipitation greater than 5 mm in 15 minutes
- 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 greater than 360 degrees
- Wind direction less than 0 degrees

Pressure:

- Pressure greater than 1040 mb or less than 980 mb
- Pressure changes greater than 5 mb per hour
- Max and Min values not recorded for the day
- 1-hour average greater than 10% above the greatest 15 min sample recorded in the hour

Time:

- 15-minute interval not recorded

For all data:

- Duplicate interval data

3. Research objectives (Campbell Weather Station):

The principal objective of the Weather Monitoring Program is to record long-term meteorological data for the ACE Basin in order to observe any environmental changes or trends over time.

4. Research Methods

The Campbell Scientific weather station measures the parameters 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. An instantaneous sample is taken every 15 minutes and that data is stored in array 150. A laptop computer is used to download the data from the datalogger via the SC32A interface. On -site weather conditions are measured to verify the accuracy of the readings by the sensors. After downloading data, sensors on the weather station are inspected for damage or debris. If any problems are found, it is repaired and/or cleaned. Tree limbs and other shrubs are cut back to prevent obstruction of the sensors. Sensors will be removed and sent back to Campbell Scientific for calibration at a minimum of every two years.

5. Site Location and Character

The ACE Basin National Estuarine Research Reserve is located on the Southeastern Atlantic coast of the United States, including portions of Charleston, Colleton and Beaufort Counties in South Carolina. The study area encompasses the Ashepoo, Combahee, and South Edisto River basins, which empty into St. Helena Sound. Diverse estuarine wetlands provide extensive and complex habitat types for fish and wildlife. The NERR consist of approximately 92,000 acres of tidal marshes. Of this, 65,600 acres are salt marshes, 13,600 acres are brackish marshes and 12,100 acres are freshwater marshes. Inter-spread within these three tidal marsh zones are approximately 26,000 acres of managed wetlands or marsh impoundments. St. Helena Sound comprises approximately 23,870 acres of open coastal marine and estuarine waters.

The weather station (32º 33.5623 N; 80º 27.2715 W) is located at the Bennett's Point field station on Mosquito Creek, a navigable tributary off of the Ashepoo River. The station is approximately 90 m from the creek (800 m from the Ashepoo River) in a grassy field, 80 m to the southwest of the field station. The closest wind obstructions are oak trees, 25 m to the south and southwest of the weather station and 70 m from a public paved road. The CR10X datalogger and the barometric sensor are enclosed in a 1.8 m elevated aluminum box. Two long poles are attached to the aluminum box, which elevate sensors above potential barriers and enhance the performance of each sensor. The Wind Sentry sensor and Temperature/Relative Humidity sensor are attached to a cross bar mounted on top of a 3 m pole. The Solar Panel is attached to 2.5 m long pole, and is oriented to the east at approximately a 47 degree angle. The LiCor sensor is attached to the outside top of the box. The Tipping Bucket Rain gauge (1.3 m height) is located 2.5 m to the southeast of the box on a concrete level platform. The sensors are wired to the CR10X following protocol in the CDMO Manual, with minor changes due to upgraded sensors.

6. Data Collection Period

Bennett's Point Weather Station

BEGIN	END
03/02/2001 (61), 12:45	03/26/2001 (85), 11:45
03/26/2001 (85), 12:00	04/11/2001 (101), 11:00
05/01/2001 (121), 11:00	05/07/2001 (127), 12:45
05/07/2001 (127), 13:00	05/15/2001 (135), 14:00
06/12/2001 (163), 12:45	06/19/2001 (170), 10:30
06/19/2001 (170), 10:45	07/03/2001 (182), 10:15
06/19/2001 (170), 10:45	07/03/2001 (182), 10:15
07/03/2001 (184), 10:30	07/11/2001 (192), 12:00
07/11/2001 (192), 12:15	08/02/2001 (214), 14:30
08/02/2001 (214), 14:45	08/16/2001 (228), 12:45
08/16/2001 (228), 13:00	08/23/2001 (235), 12:15
08/23/2001 (235), 12:30	09/12/2001 (255), 11:45
09/12/2001 (255), 12:00	09/27/2001 (270), 12:30
09/27/2001 (270), 12:45	10/08/2001 (281), 14:30
10/08/2001 (281), 14:45	10/18/2001 (291), 11:30
10/18/2001 (291), 11:45	11/05/2001 (309), 11:30
11/05/2001 (309), 11:45	11/21/2001 (325), 11:15
11/21/2001 (325), 11:30	12/07/2001 (341), 11:15
12/07/2001 (341), 11:30	12/18/2001 (352), 15:15
12/18/2001 (352), 15:30	01/08/2002 (008), 13:15

7. Distribution

According to the Ocean and Coastal Resource Management Data Dissemination Policy for the NERRS System-wide Monitoring Program, is as follows.

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 is a study which records long-term water quality data for the ACE Basin in order to observe any physical changes or tends in water quality over time. The two sampling sites are in separate tributaries of the South Edisto River. One site represents an urban or "treatment" site is in a tidal marsh creek off Big Bay Creek (approximately 14 kilometers from the weather station, GPS coordinates: 32'29"38.72125N and 80'19"21.69864W). It is surrounded by residential and commercial development and subject to nonpoint source pollution. The other site is our pristine site and is located in a tidal creek off St. Pierre Creek (approximately 9 kilometers from the weather station, GPS coordinates: 32'31"40.59518N and 80'21"41.25481W). The tidal creek and St. Pierre Creek are surrounded by a wide expanse of Spartina alterniflora marsh. Extensive mud flats and oyster reefs fringe the banks. Development in the immediate area is sparse, and this creek is subject to relatively light boat traffic. Measurements for both sites are taken every thirty minutes over roughly a two-week collection period.

In July 1997, the Reserve staff initiated nutrient monitoring study. The objective of the study is to ascertain the annual and tidal fluctuations in nutrient levels near our two data logger sites. Nutrient levels are measured during a complete tidal cycle each month, and the samples are analyzed for ammonia, nitrite-nitrate, ortho-phosphate, and chlorophyll a concentrations.

In the spring of 2000, SCDNR Geologists completed the construction of sediment/erosion tables (SET) in the ACE Basin NERR, including our water quality stations, to determine the effects hydrologic changes on the marsh elevation.

Dr. Amy Ringwood of SCDNR/Marine Resources Research Institute received CICEET funding to conduct this study in ACE Basin and North Inlet/Winyah Bay Reserves. Funds for this project were awarded in October 1998. Eight sites were selected in the ACE Basin, including the two water quality monitoring stations. Oysters (Crassostrea virginica), grass shrimp (Paleomonetes pugio), and mummichogs (Fundulus heteroclitus) were collected from these sites during the February-April time frame. Hepatopancreatic/liver tissues were dissected and used for three different cellular biomarker assays (lysosomal destabilization, glutathione concentrations, and lipid peroxidation).
Drs. James T. Morris, Madilyn Fletcher, John Jensen, Alan Lewitus, Peter A. Noble, and Dwayne Porter of University of South Carolina received CISNet funding to conduct this three-year study in the North Inlet/Winyah Bay Reserve; and, prior to the first sampling season (summer 1999), the investigators added the ACE Basin NERR to the study. The researchers will compare nutrient loading, nutrient dynamics, and productivity in the North Inlet to that of the S. Edisto River (ACE Basin NERR).

II. Physical Structure Descriptors

9. Sensor Specifications, Operating Range, Accuracy, Date of Last Calibration

LiCor Quantum Sensor

Model #: LI-190SA
Stability: < +/- 2% change over a 1 year period
Operating Temperature: -20 to +65 oC
Sensitivity: Typically 30 nA per 100 klux
Light Spectrum Wavelength: 400 to 700 nanomaters
Date of last calibration: 11/13/2000

Wind Sentry

Model #: 03001
Range: 0-50 m/s; 360o Mechanical
Date of last calibration: Exact date is unknown; Purchase date 10/27/2000

Temperature and Relative Humidity

Model #: HMP45C
Operating Temperature: -40 to +60 oC
Temperature Measurement Range: -40 to +60 oC
Temperature Accuracy: +/- 2% oC @ 20 oC

Relative Humidity Measurement Range: 0 - 100% non-condensing
RH Accuracy: +/- @% RH (0 - 90%) and +/- 3% (90 - 100%)
Uncertainty of calibration: +/- 1.2% RH
Date of last calibration: 09/11/2000

Barometric Sensor

Model #: 090C-26/32-1
Calibrated Range: 26" - 32" (Standard)
Supply Voltage: 12 VDC at 12 mA
Accuracy: +/- 0.7 of span
Operating Temperature Range: -22 to +55 oC
Date of last calibration: 11/22/2000

Tipping Bucket Rain Gauge

Model #: P/N 100097
Calibration: 0.01 inch per tip
Accuracy: +/- 3% (Rates of 1 to 6 inches per hour)
Date of last calibration: Unknown

Tipping Bucket Rain Gauge

Texas Electronics
Model #: TR-525I
Calibration: 0.01 inch per tip
Accuracy: +/- 3% (Rates of 1 to 6 inches per hour)
Date of last calibration: Exact date is unknown; Purchase date June of 2001

10. Coded Variable Indicator and Variable Code Definition

Site definition : BP = Bennett's Point

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.

March 1-31, 2001

a) The drop in temperature is caused by an increase in cloud cover. This is indicated by a drop in PAR values, a rain shower that afternoon and an increase in relative humidity.

From 13:30 to 13:45 on March 3, air temp difference is greater than 3.0 degrees C (27.523 to 23.853)
From 15:00 to 15:15 on March 14, air temp difference is greater than 3.0 degrees C (24.52 to 20.851)

b) The following data appears to be correct.
From 15:00 to 15:15 on March 14, relative humidity difference is greater than 25% (24.687 to 57.181)
From 20:45 to 21:00 on March 16, relative humidity difference is greater than 25% (88.436 to 59.336)

c) The following data appears to be correct.
From 07:00 to 07:15 on March 23, pressure difference is greater than 5 mb (1005.8 to 1017.2)
From 06:45 to 07:00 on March 24, pressure difference is greater than 5 mb (1001.8 to 1007.7)
From 07:00 to 07:15 on March 25, pressure difference is greater than 5 mb (1007.7 to 1019.7)
From 08:30 to 08:45 on March 25, pressure difference is greater than 5 mb (1002.5 to 1012.4)
From 06:45 to 07:00 on March 26, pressure difference is greater than 5 mb (1002.4 to 1010.9)
From 07:00 to 07:15 on March 26, pressure difference is greater than 5 mb (1010.9 to 1018.2)

d) The following data appears to be correct.
From March 15 at 21:00 to March 16 at 9:00, wind speed was less than 0.5 m/s.
From March 23 at 20:00 to March 24 at 8:00, wind speed was less than 0.5 m/s.

e) On March 2, March 24 and March 25, daily averages, maximums, and minimums (array 241,242,243,244, and 245) were deleted. Fifteen-minute data and hourly data points were missing which are used to calculate daily values.

April 1-30, 2001

a) The following data is suspect. The rain gauge may have malfunctioned due to a high volume of rainfall. A small amount of debris was cleaned from the cylinder on 4/11/01, and the balance bubble was repositioned to level the gauge.
From 12:30 to 12:45 on April 1, precipitation difference greater than 5 mm occurred
From 13:15 to 13:30 on April 1, precipitation difference greater than 5 mm occurred
From 14:00 to 14:15 on April 1, precipitation difference greater than 5 mm occurred
From 15:15 to 15:30 on April 1, precipitation difference greater than 5 mm occurred
From 15:30 to 15:45 on April 1, precipitation difference greater than 5 mm occurred
From 15:45 to 16:00 on April 1, precipitation difference greater than 5 mm occurred
From 16:30 to 16:45 on April 1, precipitation difference greater than 5 mm occurred

From 06:15 to 06:30 on April 3, precipitation difference greater than 5 mm occurred

b) The following data appears to be correct.
From 06:45 to 07:00 on April 1, pressure difference is greater than 5 mb (993.73 to 1007.6)
From 06:45 to 07:00 on April 2, pressure difference is greater than 5 mb (1001.9 to 1020.4)
From 06:45 to 07:00 on April 3, pressure difference is greater than 5 mb (1002.8 to 1008.5)
From 07:00 to 07:15 on April 3, pressure difference is greater than 5 mb (1008.5 to 1017.1)
From 07:00 to 07:15 on April 4, pressure difference is greater than 5 mb (1002.5 to 1009.1)
From 07:15 to 07:30 on April 4, pressure difference is greater than 5 mb (1009.1 to 1020.0)
From 04:00 to 06:45 on April 5, pressure difference is greater than 5 mb (1005.1 to 1011.2)
From 06:45 to 07:00 on April 5, pressure difference is greater than 5 mb (1011.2 to 1026.3)
From 07:00 to 07:15 on April 6, pressure difference is greater than 5 mb (1005.9 to 1011.2)
From 07:15 to 07:30 on April 6, pressure difference is greater than 5 mb (1011.2 to 1025.1)
From 03:15 to 06:45 on April 7, pressure difference is greater than 5 mb (1002.4 to 1007.7)
From 06:45 to 07:00 on April 7, pressure difference is greater than 5 mb (1007.7 to 1022.3)
From 06:45 to 07:00 on April 8, pressure difference is greater than 5 mb (1007.1 to 1020.0)
From 06:30 to 06:45 on April 9, pressure difference is greater than 5 mb (1002.1 to 1009.6)
From 06:45 to 07:00 on April 9, pressure difference is greater than 5 mb (1009.6 to 1018.2)
From 02:45 to 06:45 on April 10, pressure difference is greater than 5 mb (995.72 to 1005.2)
From 06:45 to 07:00 on April 10, pressure difference is greater than 5 mb (1005.2 to 1015.1)
From 06:30 to 06:45 on April 11, pressure difference is greater than 5 mb (999.66 to 1007.4)
From 06:45 to 07:00 on April 11, pressure difference is greater than 5 mb (1007.4 to 1016.1)

c) On April 1 thru April 10, daily averages, maximums, and minimums (array 241,242,243,244, and 245) were deleted. Fifteen-minute data and hourly data points were missing which are used to calculate daily values.

d) At 0700 on April 3, the relative humidity hourly (array 102) average was not configured by the CR10X, possibly due to a system error.

May 1-31, 2001

a) The following data appears to be correct.
From 01:15 to 06:15 on May 2, pressure difference is greater than 5 mb (1001.1 to 1013.3)
From 06:15 to 06:30 on May 2, pressure difference is greater than 5 mb (1013.3 to 1019.9)
From 01:15 to 06:15 on May 3, pressure difference is greater than 5 mb (1003.7 to 1022.6)
From 01:15 to 06:15 on May 4, pressure difference is greater than 5 mb (1004.7 to 1015.2)
From 06:15 to 06:30 on May 4, pressure difference is greater than 5 mb (1015.2 to 1023.4)
From 06:30 to 06:45 on May 5, pressure difference is greater than 5 mb (1002.8 to 1019.9)
From 06:15 to 06:30 on May 6, pressure difference is greater than 5 mb (999.81 to 1018.7)
From 07:15 to 07:30 on May 7, pressure difference is greater than 5 mb (1010.0 to 1022.3)

b) On May 1 thru May 6, daily averages, maximums, and minimums (array 241,242,243,244, and 245) were deleted. Fifteen-minute data and hourly data points were missing which are used to calculate daily values.

June 1-30, 2001

a) The drop in temperature is caused by an increase in cloud cover. This is indicated by a drop in PAR values, a rain shower that afternoon and an increase in relative humidity.

From 14:30 to 14:45 on June 14, air temp difference is greater than 3.0 degrees C (33.37 to 29.701)
From 15:00 to 15:15 on June 14, air temp difference is greater than 3.0 degrees C (27.167 to 22.698)
From 16:15 to 16:30 on June 15, air temp difference is greater than 3.0 degrees C (32.503 to 29.368)

b) The rise in relative humidity is a result of an afternoon rain shower.
From 15:00 to 15:15 on June 14, relative humidity difference is greater than 25% (58.029 to 86.377)

c) The following data is suspect. The rain gauge may have malfunctioned due to a high volume of rainfall. A possible solution to this reoccurring problem is replacement of the tipping rain gauge.

From 20:30 to 20:45 on June 12, precipitation difference is greater than 5 mm (4.572 to 20.574)
From 20:45 to 21:00 on June 12, precipitation difference is greater than 5 mm (20.574 to 5.842)
From 21:00 to 21:15 on June 12, precipitation difference is greater than 5 mm (5.842 to 0.762)
From 21:15 to 21:30 on June 12, precipitation difference is greater than 5 mm (0.762 to 7.112)
From 21:45 to 22:00 on June 12, precipitation difference is greater than 5 mm (4.064 to 9.906)
From 11:15 to 11:30 on June 13, precipitation difference is greater than 5 mm (1.778 to 7.112)

d) The following data appears to be correct.
From June 17 at 17:00 to June 18 at 6:00, wind speed was less than 0.5 m/s.

e) On June 12, daily averages, maximums, and minimums (array 241,242,243,244, and 245) were deleted. Fifteen-minute data and hourly data points were missing which are used to calculate daily values.

f) At 1300 on June 12, the hourly (array 102) wind speed average and wind speed maximum values (99999) were not configured by the CR10X, possibly due to a system error. Values were changed to -99999 to reflect sensor error.

July 2001

a.) The following data appears to be correct. The drop in temperature is caused by an increase in cloud cover. A drop in PAR values, a rain shower, and an increase in relative humidity indicate this.

From 12:30 to 12:45 on July 1, air temp difference is greater than 3.0 degrees C, (31.642 to 27.635).
From 13:45 to 14:00 on July 4, air temp difference is greater than 3.0 degrees C, (28.501 to 24.766).
From 17:15 to 17:30 on July 22, air temp difference is greater than 3.0 degrees C, (28.634 to 24.632).

b.) The following data is suspect. The rain gauge may have malfunctioned due to high volume of rainfall; although, summer afternoon thunderstorms often drop large amounts of rain in a short amount of time.

From 22:30 to 22:45 on July 20, precipitation difference greater than 5 mm occurred.
From 7:15 to 7:30 on July 23, precipitation difference greater than 5 mm occurred.

c.) The following data appears to be correct.
From July 1 at 19:00 to July 2 at 8:00, wind speed was less than 0.5 m/s.
From July 9 at 19:00 to July 10 at 10:00, wind speed was less than 0.5 m/s.
From July 14 at 19:00 to July 15 at 8:00, wind speed was less than 0.5 m/s.
From July 16 at 19:00 to July 17 at 7:00, wind speed was less than 0.5 m/s.
From July 26 at 15:00 to July 27 at 7:00, wind speed was less than 0.5 m/s.
From July 28 at 18:00 to July 29 at 8:00, wind speed was less than 0.5 m/s.

August 2001

a.) The following data appears to be correct. The drop in temperature is caused by an increase in cloud cover. A drop in PAR values, a rain shower, and an increase in relative humidity indicate this.

From 11:15 to 11:30 on August 5, air temp difference is greater than 3.0 degrees C, (29.042 to 25.437).
From 19:15 to 19:30 on August 13, air temp difference is greater than 3.0 degrees C, (28.701 to 25.166).
From 17:30 to 17:45 on August 18, air temp difference is greater than 3.0 degrees C, (28.034 to 24.832).
From 16:30 to 16:45 on August 20, air temp difference is greater than 3.0 degrees C, (26.833 to 23.832).
From 18:45 to 19:00 on August 31, air temp difference is greater than 3.0 degrees C, (28.834 to 25.766).

b.) The following data is suspect. The rain gauge may have malfunctioned due to high volume of rainfall; although, summer afternoon thunderstorms often drop large amounts of rain in a short amount of time.

From 23:45 to 24:00 on August 13, precipitation difference greater than 5 mm occurred.
From 7:00 to 7:15 on August 20, precipitation difference greater than 5 mm occurred.
From 7:15 to 7:30 on August 20, precipitation difference greater than 5 mm occurred.
From 17:00 to 17:15 on August 20, precipitation difference greater than 5 mm occurred.
From 20:00 to 20:15 on August 31, precipitation difference greater than 5 mm occurred.
From 20:15 to 20:30 on August 31, precipitation difference greater than 5 mm occurred.

c.) At 13:00 on August 16, the fifteen-minute rainfall recording was edited and replaced with 55555. A natural rain-event did not occur. The rain gauge bucket was accidentally tipped while cleaning debris from the gauge.

d.) The following data appears to be correct.
From August 3 at 23:00 to August 4 at 11:00, wind speed was less than 0.5 m/s.
From August 5 at 21:00 to August 6 at 11:00, wind speed was less than 0.5 m/s.
From August 20 at 19:00 to August 21 at 10:00, wind speed was less than 0.5 m/s.
From August 22 at 19:00 to August 23 at 7:00, wind speed was less than 0.5 m/s.
From August 26 at 18:00 to August 27 at 7:00, wind speed was less than 0.5 m/s.
From August 29 at 23:00 to August 30 at 11:00, wind speed was less than 0.5 m/s.
From August 30 at 17:00 to August 31 at 8:00, wind speed was less than 0.5 m/s.

September 2001

a.) The following data appears to be correct. The drop in temperature is caused by an increase in cloud cover. A drop in PAR values, a rain shower, and an increase in relative humidity indicate this.

From 18:45 to 19:00 on September 2, air temp difference is greater than 3.0 degrees C, (25.243 to 21.843).
From 13:00 to 13:15 on September 11, air temp difference is greater than 3.0 degrees C, (29.568 to 26.367).
From 15:15 to 15:30 on September 21, air temp difference is greater than 3.0 degrees C, (27.167 to 22.231).
From 9:45 to 10:00 on September 24, air temp difference is greater than 3.0 degrees C, (26.188 to 22.986).

b.) The following data is suspect. The rain gauge may have malfunctioned due to high volume of rainfall; although, summer afternoon thunderstorms often drop large amounts of rain in a short amount of time.

From 19:00 to 19:15 on September 2, precipitation difference greater than 5 mm occurred.
From 19:15 to 19:30 on September 2, precipitation difference greater than 5 mm occurred.
From 15:30 to 15:45 on September 21, precipitation difference greater than 5 mm occurred.
From 9:45 to 10:00 on September 24, precipitation difference greater than 5 mm occurred.

c.) The following data appears to be correct.

From September 16 at 19:00 to September 17 at 7:00, wind speed was less than 0.5 m/s.
From September 17 at 17:00 to September 18 at 8:00, wind speed was less than 0.5 m/s.
From September 18 at 19:00 to September 19 at 9:00, wind speed was less than 0.5 m/s.
From September 19 at 19:00 to September 20 at 8:00, wind speed was less than 0.5 m/s.
From September 21 at 17:00 to September 22 at 13:00,wind speed was less than 0.5 m/s.
From September 23 at 19:00 to September 24 at 7:00, wind speed was less than 0.5 m/s.
From September 27 at 17:00 to September 28 at 7:00, wind speed was less than 0.5 m/s.

October 2001

a.) The following data appears to be correct. The drop in relative humidity occurred at 19:15, after the sun had set at 18:52.

From 19:15 to 19:30 on October 16, relative humidity difference is greater than 25%, (84.337 to 53.912).

b.) The following data is suspect. The rain gauge may have malfunctioned due to high volume of rainfall; although, summer afternoon thunderstorms often drop large amounts of rain in a short amount of time.

From 16:30 to 16:45 on October 14, precipitation difference greater than 5 mm occurred.
From 16:45 to 17:00 on October 14, precipitation difference greater than 5 mm occurred.
From 17:00 to 17:15 on October 14, precipitation difference greater than 5 mm occurred.

c.) The following data appears to be correct.

From October 1 at 18:00 to October 2 at 10:00, wind speed was less than 0.5 m/s.
From October 2 at 19:00 to October 3 at 8:00, wind speed was less than 0.5 m/s.
From October 3 at 19:00 to October 4 at 9:00, wind speed was less than 0.5 m/s.
From October 4 at 19:00 to October 5 at 11:00, wind speed was less than 0.5 m/s.
From October 12 at 16:00 to October 13 at 8:00, wind speed was less than 0.5 m/s.
From October 15 at 19:00 to October 16 at 8:00, wind speed was less than 0.5 m/s.
From October 23 at 17:00 to October 24 at 8:00, wind speed was less than 0.5 m/s.
From October 29 at 18:00 to October 30 at 6:00, wind speed was less than 0.5 m/s.

November 2001

a.) The following data appears to be correct.

From November 6 at 17:00 to November 7 at 9:00, wind speed was less than 0.5 m/s.
From November 7 at 18:00 to November 8 at 8:00, wind speed was less than 0.5 m/s.
From November 8 at 18:00 to November 9 at 8:00, wind speed was less than 0.5 m/s.
From November 9 at 18:00 to November 10 at 8:00, wind speed was less than 0.5 m/s.
From November 10 at 18:00 to November 11 at 8:00, wind speed was less than 0.5 m/s.
From November 19 at 16:00 to November 20 at 8:00, wind speed was less than 0.5 m/s.
From November 25 at 18:00 to November 26 at 10:00,wind speed was less than 0.5 m/s.
From November 26 at 18:00 to November 27 at 9:00, wind speed was less than 0.5 m/s.
From November 27 at 21:00 to November 28 at 9:00, wind speed was less than 0.5 m/s.
From November 28 at 18:00 to November 29 at 9:00, wind speed was less than 0.5 m/s.

December 2001

a.) The following data appears to be correct.

From December 1 at 17:00 to December 2 at 10:00, wind speed was less than 0.5 m/s.
From December 6 at 18:00 to December 7 at 10:00, wind speed was less than 0.5 m/s.
From December 7 at 17:00 to December 8 at 10:00, wind speed was less than 0.5 m/s.
From December 12 at 23:00 to December 13 at 12:00, wind speed was less than 0.5 m/s.
From December 13 at 17:00 to December 14 at 6:00, wind speed was less than 0.5 m/s.
From December 18 at 18:00 to December 19 at 10:00, wind speed was less than 0.5 m/s.
From December 20 at 18:00 to December 21 at 8:00, wind speed was less than 0.5 m/s.
From December 21 at 18:00 to December 22 at 7:00, wind speed was less than 0.5 m/s.
From December 30 at 17:00 to December 31 at 9:00, wind speed was less than 0.5 m/s.

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 1-31, 2001

a) No data were collected in January due to insufficient voltage from lead acid battery to operate the datalogger. New lead acid battery was ordered from Campbell Company. Received new battery on March 1st.

February 1-28, 2001

a) No data were collected in February due to insufficient voltage from lead acid battery to operate the datalogger. New lead acid battery was ordered from Campbell Company. Received new battery on March 1st.

March 1-31, 2001

a) From 00:15 on March 1 to 12:30 on March 2, no data were collected due to insufficient voltage from lead acid battery to operate the datalogger. New lead acid battery was ordered from Campbell Company. Replaced new battery prior to the 12:45 reading on March 2. All data are missing during this period (150, 101, 102, 241-244).

b) During the following periods, no data were collected due to a faulty solar panel regulator, which was not a Campbell product. The regulator did not generate sufficient voltage to fully charge the lead acid battery. Thus, the battery did not contain the power needed to operate the datalogger during the nighttime hours. Initially, we thought lightning was the culprit because data loss was intermittent. The cause of the data loss was not discovered until late April when the datalogger stopped recording data completely. On May 2, we ordered a new lead acid battery and switched to a Campbell solar panel and regulator. New battery arrived on June 12.

At 06:00 on March 25, missing 15-minute data (150 array) from 600 to 800.
At 12:00 on March 26 thru March 31 at 24:00, all 15-minute data (array 150) are missing.

At 06:00 on March 25, missing hourly averages data (101 array) from 600 to 800.
At 12:00 on March 26 thru March 31 at 24:00, all hourly averages data (array 101) are missing.

At 06:00 on March 25, missing hourly average wind parameters (102 array) from 600 to 800.
At 12:00 on March 26 thru March 31 at 24:00, all hourly averages wind parameters (array 102) are missing.

Missing daily averages (241 array) at 24:00 from March 26 thru March 31.

Missing daily average wind parameters (242 array) at 24:00 from March 26 thru March 31.

Missing daily Max/Time values (243 array) at 24:00 from March 26 thru March 31.

Missing daily Min/Time values (244 array) at 24:00 from March 26 thru March 31.

April 1-30, 2001

a) During the following periods, no data were collected due to a faulty solar panel regulator, which was not a Campbell product (see March section for explanation).
(* indicates corrected missing data points that were missed by the SWMP program)

At 04:30 on April 1, missing 15 minute data (150 array) from 430 to 630.
At 04:15 on April 2, missing 15 minute data (150 array) from 415 to 630.
At 04:30 on April 3, missing 15 minute data (150 array) from 430 to 615.
At 04:30 on April 4, missing 15 minute data (150 array) from 430 to 645.
At 04:15 on April 5, missing 15 minute data (150 array) from 415 to 630.
At 04:30 on April 6, missing 15 minute data (150 array) from 430 to 645.
At 03:30 on April 7, missing 15 minute data (150 array) from 330 to 630.
At 03:15 on April 8, missing 15 minute data (150 array) from 315 to 630.
At 03:00 on April 9, missing 15 minute data (150 array) from 300 to 615.
At 03:00 on April 10, missing 15 minute data (150 array) from 300 to 630.
At 02:45 on April 11, missing 15 minute data (150 array) from 245 to 615.
At 11:15 on April 11, missing 15 minute data (150 array) from 1115 to 2400.
* From April 12 through April 30, missing all 15 minute data (150 array).

At 05:00 on April 1, missing hourly averages data (101 array) from 500 to 600.
At 05:00 on April 2, missing hourly averages data (101 array) from 500 to 600.
At 05:00 on April 3, missing hourly averages data (101 array) from 500 to 600.
At 05:00 on April 4, missing hourly averages data (101 array) from 500 to 600.
At 05:00 on April 5, missing hourly averages data (101 array) from 500 to 600.
At 05:00 on April 6, missing hourly averages data (101 array) from 500 to 600.
At 04:00 on April 7, missing hourly averages data (101 array) from 400 to 600.
At 04:00 on April 8, missing hourly averages data (101 array) from 400 to 600.
At 03:00 on April 9, missing hourly averages data (101 array) from 300 to 600.
At 03:00 on April 10, missing hourly averages data (101 array) from 300 to 600.
At 03:00 on April 11, missing hourly averages data (101 array) from 300 to 600.
At 12:00 on April 11, missing hourly averages data (101 array) from 1200 to 2400.
* From April 12 through April 30, missing all hourly averages data (101 array).

At 05:00 on April 1, missing hourly average wind parameters (102 array) from 500 to 600.
At 05:00 on April 2, missing hourly average wind parameters (102 array) from 500 to 600.
At 05:00 on April 3, missing hourly average wind parameters (102 array) from 500 to 600.
At 05:00 on April 4, missing hourly average wind parameters (102 array) from 500 to 600.
At 05:00 on April 5, missing hourly average wind parameters (102 array) from 500 to 600.
At 05:00 on April 6, missing hourly average wind parameters (102 array) from 500 to 600.
At 04:00 on April 7, missing hourly average wind parameters (102 array) from 400 to 600.
At 04:00 on April 8, missing hourly average wind parameters (102 array) from 400 to 600.
At 03:00 on April 9, missing hourly average wind parameters (102 array) from 300 to 600.
At 03:00 on April 10, missing hourly average wind parameters (102 array) from 300 to 600.
At 03:00 on April 11, missing hourly average wind parameters (102 array) from 300 to 600.

At 12:00 on April 11, missing hourly average wind parameters (102 array) from 1200 to 2400.
From April 12 through April 30, missing all hourly average wind parameters (102 array).

Missing daily averages (241 array) at 24:00 from April 11 through April 30

Missing daily average wind parameters (242 array) at 24:00 from April 11 through April 30

Missing daily Max/Time values (243 array) at 24:00 from April 11 through April 30

Missing daily Min/Time values (244 array) at 24:00 from April 11 through April 30

May 1-31, 2001

a) During the following periods, no data were collected due to a faulty solar panel regulator, which was not a Campbell product (see March section for explanation).

From May 15 at 14:15 to May 31 at 24:00, no data was collected due to complete failure of lead acid battery resulting in datalogger shut down.

At 00:15 on May 1, missing 15 minute data (150 Array) from 15 to 1045.
At 01:30 on May 2, missing 15 minute data (150 Array) from 130 to 600.
At 01:30 on May 3, missing 15 minute data (150 Array) from 130 to 600.
At 01:30 on May 4, missing 15 minute data (150 Array) from 130 to 600.
At 01:15 on May 5, missing 15 minute data (150 Array) from 115 to 615.
At 01:15 on May 6, missing 15 minute data (150 Array) from 115 to 600.
At 01:15 on May 7, missing 15 minute data (150 Array) from 115 to 645.
From May 7 at 13:00 through May 15 @ 1400, missing all 15 minute data (150 array).

At 01:00 on May 1, missing hourly averages data (101 array) from 100 to 1000.
At 02:00 on May 2, missing hourly averages data (101 array) from 200 to 600.
At 02:00 on May 3, missing hourly averages data (101 array) from 200 to 600.
At 02:00 on May 4, missing hourly averages data (101 array) from 200 to 600.
At 02:00 on May 5, missing hourly averages data (101 array) from 200 to 600.
At 02:00 on May 6, missing hourly averages data (101 array) from 200 to 600.
At 02:00 on May 7, missing hourly averages data (101 array) from 200 to 600.
From May 7 at 13:00 through May 15 @ 1400, missing all hourly averages (101 array).

At 01:00 on May 1, missing hourly average wind parameters data (102 array) from 100 to 1000.
At 02:00 on May 2, missing hourly average wind parameters data (102 array) from 200 to 600.
At 02:00 on May 3, missing hourly average wind parameters data (102 array) from 200 to 600.
At 02:00 on May 4, missing hourly average wind parameters data (102 array) from 200 to 600.
At 02:00 on May 5, missing hourly average wind parameters data (102 array) from 200 to 600.
At 02:00 on May 6, missing hourly average wind parameters data (102 array) from 200 to 600.
At 02:00 on May 7, missing hourly average wind parameters data (102 array) from 200 to 600.

From May 7 at 13:00 through May 15 @ 1400, missing all hourly average wind parameters data (102 array).

Missing daily averages (241 array) at 24:00 from May 7 through May 31

Missing daily average wind parameters (242 array) at 24:00 from May 7 through May 31

Missing daily Max/Time values (243 array) at 24:00 from May 7 through May 31

Missing daily Min/Time values (244 array) at 24:00 from May 7 through May 31

June 1-30, 2001

a) During the following periods, no data were collected due to a faulty solar panel regulator, which was not a Campbell product (see March section for explanation).

From June 1 at 00:15 to June 12 at 12:30, no data was collected due to complete failure of lead acid battery resulting in datalogger shut down. A new battery was installed prior to the 12:45 reading on June 12. All data was missing during this time (150, 101, 102, 241-244).

There are no missing data for July thru December of 2001.

13. Other Remarks

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.

The November 21 raw DAT file was edited. During the downloading process, all stored weather data in the Campbell datalogger was retrieved rather than just current data. The DAT file contained duplicate data. The Weather Data Management Program (WDMP), when attempting to compile the data, did not accept the duplicate data. The duplicate data was deleted from the DAT file, and the data file was accepted and compiled by the WDMP.

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.

Rain Events:

Note that monthly totals are not available during months where data was missing.

March

Date	RainAmount (mm)
19	8.890
20	40.640
21	1.016
22	.508
25	1.270

April

Date	RainAmount (mm)
1	154.686
3	260.100

May

Date	RainAmount (mm)
6	2.032

June

Date	RainAmount (mm)
12	60.198
13	24.638
14	5.080
18	1.016

July

Date	RainAmount (mm)
1	.508
2	.508
3	1.270
4	6.096
7	5.588
12	2.540
13	3.302
20	18.796
21	.508
22	1.524
23	20.066
24	1.016
25	5.588
26	4.826
27	3.048
28	10.414
29	1.778

Monthly Total 87.4

August

Date	Rainamount (mm)
5	.508
9	.254
10	.508
13	27.432
14	6.350
16	2.794

18	17.526
19	20.574
20	58.928
21	5.334
22	.254
31	17.780

Monthly Total 158.2

September

Date	RainAmount (mm)
1	.254
2	23.876
3	12.192
5	10.922
9	2.540
10	.254
11	2.794
13	4.572
21	18.288
24	24.638
25	1.270

Monthly Total 101.6

October

Date	Rainamount (mm)
6	2.032
14	27.432

Monthly Total 29.5

November

Date	Rainamount (mm)
25	1.016

Monthly Total 1.0

December

Date	RainAmount (mm)

8	2.032
9	.254
10	.508
13	.254
14	2.794
17	.254
18	1.270

Monthly Total 7.4