Wells (WEL) National Estuarine Research Reserve Meteorological Metadata
January-December 2001
Latest Update: **October 9, 2023**

I. Data Set & Research Descriptors

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2). Entry verification:

A. Data Input Procedures

The 15-minute, 1-hour average, and 24-hour meteorological data were downloaded from each instrument on the weather station to a Campbell Scientific CR10X datalogger. The CDMO Data Logger Program 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 computer to which the data was uploaded (every 15 minutes) via a short haul modem to a computer located at the Coastal Ecology Center. The data was saved as a raw data file (LF_RAW.dat) onto a separate hard drive and backed up.

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 and 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 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 wind speeds below the 0.5 m/s criteria, temperature change of greater than 3 C in a 15 minute period, and relative humidity change of greater than 25% in a 15 minute period. All errors of these types were double checked with other data that could support such "anomalous" weather changes and noted in the sections that follow. Both raw data files and Access databases were saved to the DCP server with daily tape back-up.

Jim Dochtermann error checked and compiled the 2001 weather data.

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

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

4) Research Methods

The Campbell Scientific weather station (CR10X datalogger) is programmed to measure parameters every 5 seconds to produce both hourly and daily averages of measurements, including air temperature, relative humidity, barometric pressure, LiCor (solar radiation), rainfall, wind speed and wind direction. An instantaneous sample is taken every 15 minutes and that data is stored in array 150. Data are downloaded to a desktop computer from the datalogger via the SC32A interface. On-site weather conditions are measured to verify the accuracy of the readings by the sensors. Sensors on the weather station are inspected for damage or debris periodically. Sensors are sent back to Campbell Scientific for calibration at a minimum of every two years.

The data is analyzed using the Weather Data Management Program where a database and error report is create for each month from the raw data files. The error reports are used to assist in the QA/QC of the data. Data is then edited in Access and recompiled in the WDMP. All edits and errors are documented in the metadata.

5) Site location and character

The Wells National Estuarine Research Reserve is located in York County, within the Town of Wells, on the coast of southern Maine and faces the Atlantic Ocean. The Wells NERR is approximately 31 km (20 miles) south of Portland, Maine and 110 km (70 miles) north of Boston, Massachusetts. The Reserve encompasses 1,690 acres along the Gulf of Maine coastline of tidally flushed wetlands, riparian and transitional upland fields and forests within the Little River Estuary and the larger Webhannet River Estuary. Both estuaries arise in the sandy glacial outwash plain about eight miles inland. Both rivers empty into Wells Bay, a sandy basin stretching for approximately ten miles along the Atlantic coast. Bordering each river's inlet are double spit barrier beaches attached to the mainland. The backbarrier system is approximately 5 sq. km and is composed of large intertidal marshes (predominantly S. patens and S. alterniflora), intertidal sand and mud flats, and tidal channels. The watershed for the Webhannet River

estuary covers an area of 35 sq. km and has a total of 6 streams, brooks or creeks, which enter the estuary. These tributaries flow across sand and gravel deposits near the headwaters and the impermeable sandy mud of the Presumpscot Formation in the lower reaches. The Webhannet River is connected to the ocean via Wells Inlet, which has a spring tidal prism of 28,200,000 cub. m (Ward 1993). The force and volume of tidal action affect the salinity level of both rivers. In the Wells region, the annual mean wave height is almost 20 inches. The estuarine system is dominated by semi-diurnal tides having a range of 8.5 to 9.8 feet. The volume of freshwater influx into both estuaries is moderate to low (on the order of 0.5 cubic meters/second), especially in the summer, because of the rivers' relatively small drainage areas and the presence of deep glacial deposits. The relatively low flows from these two rivers taken in with the 20 inch per year average runoff of the area surrounding the estuaries combine to form a freshwater flow that is dwarfed by tidal flushing. Twelve-foot tides dwarf the freshwater flow into the Webhannet estuary, which has a drainage area of 14.1 square miles. The Webhannet estuary, fed by both Blacksmith and Depot Brooks, is adjacent to the harbor and greatly developed land. It offers a valuable opportunity for comparison with the relatively pristine Little River estuary. The land use of the Webhannet estuary include a total of 15% for wetland, fresh water, and tidal marsh; a total of 63.7 % for woodland; and a total of 18.6% for developed land (compared to a total of 5.7% development in the Little River estuary) (WNERR RMA 1996; Holden 1997).

The weather station is located (43 deg 20.244 Latitude, 70 deg 33.000 Longitude) on a 32' telephone pole surrounded by mowed grass. The temperature and humidity probes are located on the north side of the pole at a height of 10'. To the NW of the pole is the Coastal Ecology Center, a 20' high, 111' long building, at a distance of 37', running NE/SW. Further to the NW (153' from the pole) is the library, in a 25' high wing of the barn. The barn itself is 223' from the station and runs NE/SW. It is 38' high and is the largest obstruction in the area. The rain gauge is located 9' southeast of the weather station pole and is situated on a post with the top of the funnel is 10' from the ground.

There are two SWMP water quality sampling sites in the Webhannet River estuary. These are located at the Head of Tide and at the Inlet. The tidal range at each of these sites is 2.6-2.9 meters.

The Head of Tide site is located 4 miles south of the Wells Reserve, just downstream of the Webhannet Falls (freshwater) and 10 feet east of Route One (43 deg 17' 54.25227" Latitude, 70 deg 35' 13.82728" Longitude). Route One is used heavily with traffic all year, especially during the summer tourist months. This site has soft mud, sand, and a rocky substrate, and the low and high tide depth is relatively shallow. The salinity range here is 0-31 ppt, with a mean of 3.6 ppt. These head waters of the Webhannet are relatively undeveloped. This site is located just 10 feet east of the Route One

bridge, and is our roving site.

The Inlet site is located 1.5 miles south of the Wells Reserve, at the Wells Harbor pier (43 deg 19' 12.44804" Latitude, 70 deg 33' 13.82728" Longitude). The mouth of the Webhannet estuary forms an extensive wetland/salt marsh area which is surrounded by development. Wells Harbor, which was most recently dredged in 1971, has moorings for approximately 200 commercial fishing and recreational boats. The mouth of the river flows between two jetties to the Atlantic Ocean. This channel was dredged in 1974. This site has a predominately sand substrate and is characterized by strong current during incoming and outgoing tides. The maximum depth of the Inlet site is 3 meters. The salinity range here is 7-35 ppt, with a mean of 31 ppt. The Inlet site is heavily impacted at the Wells Harbor dock and is our long-term monitoring site.

6.) Data collection period

Weather data has been collected at the Wells NERR since December 1996. Data was collected for the entire year in 2001.

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.

8). Associated researchers and projects

WELLS NATIONAL ESTUARINE RESEARCH RESERVE RESEARCH AT THE RESERVE for 2000-2001:

The Research Program at the Wells NERR conducts and supports research, monitoring, workshops, and research/resource management planning of relevance at local, regional and national levels. The overall aim of our work is to produce science-based information needed to sustain or restore Gulf of Maine coastal habitats and resources, especially those found in salt marsh estuaries and watersheds. During 2000-2001 twenty-three different studies (involving 79 scientists, students, and staff from the Reserve, 26 academic institutions and 19 resource management groups) focused on several related themes: 1) the quality of water resources in salt marsh estuaries and watersheds 2) land conservation strategies to protect coastal watersheds 3) factors controlling salt marsh accretion, erosion and plant community vigor 4) the value of salt marsh as habitat for fish, shellfish and birds, and 5) restoration of salt marsh habitat degraded through human actions.

Estuarine Water Resource Quality

Water quality is monitored continuously at several stations with automated instruments as part of a NERRS systemwide monitoring program, as well as bimonthly at 15-20 stations through our WET volunteer monitoring program. The WET program also monitors two important biological parameters: fecal coliform bacterial contamination (an indicator of human health risk) and phytoplankton productivity (an indicator of estuarine health). These data have 1) allowed us to identify several bacterial "hot spots" that we will be working to eliminate, 2) are used to identify and open areas safe for shellfishing, and 3) have uncovered a relation between tides and low dissolved oxygen (a stressful condition for marine life) that needs further study. Our water quality work has contributed to the designation of several Priority Watersheds in coastal Southern Maine by the Maine Department of Environmental Protection.

Coastal Conservation Strategies

The Coastal Mosaic Project is a new program developed in response to requests for support from the conservation community to increase the

quantity, quality and ecological integrity of conserved lands in our region. Research staff organize and facilitate meetings, workshops, and communications for 18 partner conservation groups. A key element of the Project is the Conservation Resource Center, a Reserve staffed GIS facility with a growing database able to provide maps of property, natural features and other data needed to develop effective conservation goals and strategies. The Project is nearing completion of conservation lands maps for 13 Southern Maine coastal towns, and is undertaking an initiative to develop coastal watershed conservation strategies for 12 coastal watersheds within these towns. The Reserve has a particular interest in educating communities about the ecologic and economic benefits of land conservation, especially along estuarine and riverine shorelines.

Salt Marsh Habitats and Communities

Factors that control the dynamics and vigor of salt marsh plant communities and marsh peat formation consequently determine the ability of a salt marsh to persist in the face of sea level rise. Through a combination of experimental manipulations and long term monitoring, a number of multi-year studies are currently producing data to answer questions concerning the sustainability of salt marsh habitats in this region. These studies are looking at nutrient-plant relations, plant community responses to physical and hydrologic disturbance, and the relative contribution of short-term natural events (e.g. storms) and human activities (dredging, tidal restriction) on patterns of sediment accretion and erosion. The Reserve's marshes and beaches are already among the best studied sites in the U.S. with regard to long term accretion and erosion (over thousands of years).

Habitat value for fish, shellfish and birds

The Reserve combines long-term monitoring with periodic surveys and short-term experiments to identify species and measure trends and changes in populations of fish, crustaceans, clams and birds. We have 10 years of data on upland and shore birds with which to assess the status of resident and migratory avian populations, and 8 years of wading bird data that we use as a gross level indicator of salt marsh health, which appears to be stable. Our periodic larval, juvenile and adult fish surveys have produced the best available data for fish utilization of salt marsh estuaries in the Gulf of Maine. In the coming year we plan to develop a long-term monitoring program for finfish that will be coordinated with other sites within the Gulf of Maine and along the east coast. Since 1994 we have been conducting surveys and field experiments to look at the survival and growth of hatchery seed, juvenile and adult softshell clam with regard to habitat characteristics and predation by the invasive green crab.

Salt Marsh Degradation and Restoration

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

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

• The Wells NERR Research Dept. completed the work on the following project:
"Community-based plan to manage current and future threats from point and non-source point pollution in the Merriland River and Branch Brook Watersheds of the Little River Estuary". There was a shoreline survey of the Little River and its Watershed this past March. The goal of this project was a)to produce a community-based watershed management plan for the Branch Brook, Merriland River, Little River combined watersheds, and b)to convey the elements of the plan to critical audiences through a succinct "road show", culminating in a public event to showcase the plan. The project results are currently being written up.

• The Wells NERR Research Dept. also completed the work on the following project:
"Measuring the Health of the York River Ecosystem using Fish as Indicators". The results of this study have provide information on the ecology and fisheries of the York River that is essential for wise stewardship of this precious but threatened community resource. The goal of this project was to assist the York Rivers Association and

partners in their work as stewards of the York River and its watershed, through an assessment of the current and potential fish habitat value of this exemplary coastal ecosystem. The project results are currently being written up.

•The Wells NERR Research Dept. is involved with the following two CICEET* Projects-

I. Project Title: Estuarine Responses to Dredging: Analysis of Sedimentary and Morphological Change in Back Barrier Marsh to Aid Local Management and Develop a Regional Management Tool
Principal Investigator(s): Michele Dionne, Wells NERR, ME; Duncan Fitzgerald, Boston University; Joe Kelley, University of Maine; David Burdick and Larry Ward, University of New Hampshire

Management Issue: Coastal management tool for assessing the impacts of dredging in estuaries
Project Summary: An adequate supply of sediment is essential for maintaining salt marshes. Human activities, such as channel dredging and tidal restriction due to road construction, can alter water flows in estuaries and result in dramatic changes in salt marsh sediment supply, affecting the speed of salt marsh erosion. The objective of this project is to determine the impact of dredging and tidal restriction on salt marshes in the Wells NERR. A digital coastal management guide will be created on CD ROM, providing coastal managers with useful conceptual models for predicting the impacts of dredging and other activities that affect water flow and sediment deposition in salt marshes.

II. Project Title: Application of a Continuous Imaging Flow Cytometer for Monitoring Estuarine Microplankton
Principal Investigators: Mike Sieracki and Chris. Sieracki, Bigelow Laboratory for Ocean Studies

Management Issue: New technology for detecting harmful algal blooms
Project Summary: Marine plankton is a significant component of highly productive estuaries, affecting the distribution of oxygen, nutrients, and contaminants. Estuarine marine plankton is also the primary food for the larvae of many commercially and ecologically important finfish and shellfish. In addition to their highly productive role, some species of plankton occasionally form nuisance or toxic blooms that affect human health as well as fish and shellfish. This project is developing an imaging system, called FlowCam, to continuously monitor plankton for the presence and abundance of harmful algal species. The same technology could also be used to monitor the effects of harbor dredging on plankton.

•The Wells NERR Research Dept. is assisting with the maintenance and data collection of the FlowCAM instrument and FlowCAM computer.

*The following information on CICEET taken directly from its website: (http://www.ciceet.unh.edu)
Wells NERR Past Graduate Research Fellowships (GRF's):
1)Patrick Ewanchuck and Mark Bertness, Ph.D.; Brown University
Project Title: Patch persistence and seedling dynamics in a Southern Maine marsh and the process and pattern in western Atlantic salt marsh plant communities: a biogeographical perspective.
2)Lindsay Whitlow, University of Michigan
Project Title: Integration of individual behavior and community dynamics to determine mechanisms by which the invasive green crab impacts populations of the native soft-shell clam.
3)Pamela Morgan, University of New Hampshire
Project Title: Functions and values of salt marshes in northern New England: a comparison of fringing marshes and back barrier marshes.

Other Onsite Research:
Michele Dionne, Wells NERR, Nancy McReel, Chuck Lubelczyk
Project Title: Effect of herbivory by deer on forest regeneration

June Ficker
Project Title: Monitoring avian productivity and survivorship

Outside Researchers:
•Theresa Theodose, Ph.D., University of Southern Maine
Project Title: Relationships between soil nutrient availability and species composition of a high salt marsh in southern Maine.

•David Burdick, Ph.D. and Roelof Boumans, Ph.D.
University of New Hampshire, University of Maryland
Project Title: Sediment dynamics in salt marshes: functional assessment of accretionary biofilters

•Peter Rand, M.D., Chuck Lubelczyk, Robert Smith, M.D.
Maine Medical Center
Project Title: Ecological determinants of the spread of the tick vector of Lyme disease and other pathogens.

†This summary was taken from summaries written by Michele Dionne, Research Director, and put together and updated from Scott Orringer, Research Associate

II. Physical Structure Descriptors

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

CSI LiCor Quantum Sensor
Model # LI190SB
Stability: <±2% change over one year
Operating Temperature: -40 to 65°C
Sensitivity: typically 5 µA per 1000µmoles s-1 m-2
Light spectrum wavelength: 400 to 700 nm
Date of last calibration: 12/96 and 04-07-01 and 10-17-01

CSI Wind Sentry
Model # 03001
Range: 0-50 m/s; 360° mechanical
Date of last calibration: 12/96 and 10-17-01

CSI Temperature and Relative Humidity
Model #: HMP45C
Operating Temperature: -40 to +60°C
Temperature Measurement Range: -40 to +60°C
Temperature Accuracy: ± 0.2 °C @ 20°C
Relative Humidity Measurement Range: 0-100% non-condensing
RH Accuracy: +/-2% RH (0-90%) and +/-3%(90-100%)
Uncertainty of calibration: ± 1.2% RH
Date of Last calibration: 12/96 and 02-01-01 and 10-17-01

CSI Barometric Sensor
Model #PTB101B
Operating Range: Pressure: 600 to 1060 mb
Temperature: -40 to +60C
Humidity: non-condensing
Accuracy: ±0.5 to 6.0 mb (+20 to 60C)
Stability: ± 0.1 mb per year
Date of Last calibration: 12/96 and 10-17-01

Met One Tipping Bucket Rain Gauge
Model #: 385/385M
Range: 0.1 mm
Accuracy: ±0.5%<0.5"(1.27 cm)/hr rate
±2.0%<3.0"(7.62 cm)/hr rate
Date of Last calibration: 12/96 and 10-17-01

10) Coded variable code definitions

LF = Laudholm Farm

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.

January 2001

The following data appear to be correct:

Array	CalD	JulD	Time	Error Message
150	22	22	215	Air temp difference from 22 (22) 215 (-9.4428) to 22 (22) 230 (-13.328) is greater than 3.0 degrees C
150	26	26	2400	Air temp difference from 26 (26) 2400 (-4.0609) to 27 (27) 15 (-7.3409) is greater than 3.0 degrees C
150	11	11	1130	Pressure difference from 11 (11) 1130 (1004.9) to 12 (12) 1945 (1023.4) is greater than 5 mb

The following erroneous Air_TempC data was caused by an undocumented and unexplained glitch or power down that caused the CR10X to reset and record erroneous hourly averages and daily averages. Data was edited accordingly for arrays 101 and 102 at time 1300 and arrays 241, 242, 243, 244 at time 2400, for 28 (28):

Array	CalD	JulD	Time	Error Message
101	28	28	1300	Technician changed 101 Array data from 28 (28) 1300
102	28	28	1300	Technician changed 102 Array from 28 (28) 1300
241	28	28	2400	Technician changed 241 Array from 28 (28) 2400
242	28	28	2400	Technician changed 242 Array from 28 (28) 2400
243	28	28	2400	Technician changed 243 Array data from 28 (28) 2400
244	28	28	2400	Technician changed 244 Array data from 28 (28) 2400

The following 15 min and 1 hour data for wind speed is suspect due to a possible but undocumented, sensor freeze or malfunction. Daily averages, and max and min data are also suspect:

Array	CalD	JulD	Time	Error Message
102	19	19	1800	Wind speed is less than 0.5 m/s from 19 (19) 1800 to 21 (21) 1500
150	19	19	1715	Wind speed is less than 0.5 m/s from 19 (19) 1715 to 21 (21) 1530

There are no 15 min wind speed maximums for the entire month possibly due to a glitch in the CR10X datalogger.

All LiCor data for entire month is incorrect due to a wrong multiplier in the csi program. All 15 min, 1 hour and daily averages, and max and min data has been deleted:

Array	CalD	JulD	Time	Error Message
150	1	1	15	Technician changed 150 Array data from 1 (1) 15 to 11 (11) 1130
150	12	12	1945	Technician changed 150 Array data at 12 (12) 1945 to 31 (31) 2400
243	1	1	2400	Technician changed 243 Array data from 1 (1) 2400 to 10 (10) 2400
243	12	12	2400	Technician changed 243 Array data at 12 (12) 2400 to 31 (31) 2400
244	1	1	2400	Technician changed 244 Array data from 1 (1) 2400 to 10 (10) 2400
244	12	12	2400	Technician changed 244 Array data at 12 (12) 2400 to 31 (31) 2400

There is no wind direction standard deviation for the entire month possibly due to a problem with the csi program.

February 2001

There are no 15 min wind speed maximums for the entire month possibly due to a glitch in the CR10X datalogger.

All LiCor data for entire month is incorrect due to a wrong multiplier in the csi program. All 15 min, 1 hour and daily averages, and max and min data has been deleted:

Array	CalD	JulD	Time	Error Message
150	1	32	15	Technician changed 150 Array data at 1 (32) 15 to 28 (59) 2400
243	1	32	2400	Technician changed 243 Array data at 1 (32) 2400 to 28 (59) 2400
244	1	32	2400	Technician changed 244 Array data at 1 (32) 2400 to 28 (59) 2400

There is no wind direction standard deviation for the entire month possibly due to a problem with the csi program.

March 2001

The following data appear to be correct:

Array	CalD	JulD	Time	Error Message
150	16	75	1245	Rel hum difference from 16 (75) 1245 (32.682) to 16 (75) 1300 (66.366) is greater than 25%
150	16	75	1630	Rel hum difference from 16 (75) 1630 (70.679) to 16 (75) 1645 (38.249) is greater than 25%

The following erroneous Air_TempC, Rhum, and P_mb data was caused by a change in the datalogger program during 5 (64). Data was edited accordingly for arrays 101 and 102 on 5(64) at time 1400 and arrays 241, 242, 243, 244 on 5(64) at time 2400:

Array	CalD	JulD	Time	Error Message

101 5 64 1400 Technician changed 101 Array data from 5 (64) 1400
102 5 64 1400 Technician changed 102 Array from 5 (64) 1400
241 5 64 2400 Technician changed 241 Array from 5 (64) 2400
242 5 64 2400 Technician changed 242 Array from 5 (64) 2400
243 5 64 2400 Technician changed 243 Array data from 5 (64) 2400
244 5 64 2400 Technician changed 244 Array data from 5 (64) 2400

The following erroneous Air_TempC data was caused by an undocumented and unexplained glitch or power down that caused the CR10X to reset and record erroneous hourly averages and daily averages. Data was edited accordingly for arrays 101 and 102 at time 900 and arrays 241, 242, 243, 244 at time 2400, for 27 (86):

Array	CalD	JulD	Time	Error Message
101	27	86	900	Technician changed 101 Array data from 27 (86) 900
102	27	86	900	Technician changed 102 Array from 27 (86) 900
241	27	86	2400	Technician changed 241 Array from 27 (86) 2400
242	27	86	2400	Technician changed 242 Array from 27 (86) 2400
243	27	86	2400	Technician changed 243 Array data from 27 (86) 2400
244	27	86	2400	Technician changed 244 Array data from 27 (86) 2400

All LiCor data for entire month is incorrect due to a wrong multiplier in the csi program. All 15 min, 1 hour and daily averages, and max and min data has been deleted:

Array	CalD	JulD	Time	Error Message
150	1	60	15	Technician changed 150 Array data at 1 (60) 15 to 31 (90) 2400
243	1	60	2400	Technician changed 243 Array data at 1 (60) 2400 to 31 (90) 2400
244	1	60	2400	Technician changed 244 Array data at 1 (60) 2400 to 31 (90) 2400

There is no wind direction standard deviation for the entire month possibly due to a problem with the csi program.

April 2001

The following data appear to be correct:

Array	CalD	JulD	Time	Error Message
150	9	99	1215	Air temp difference from 9 (99) 1215 (10.286) to 9 (99) 1230 (14.001) is greater than 3.0 degrees C
150	13	103	1545	Air temp difference from 13 (103) 1545 (11.071) to 13 (103) 1600 (15.139) is greater than 3.0 degrees C
150	24	114	1630	Air temp difference from 24 (114) 1630 (15.899) to 24 (114) 1645 (22.882) is greater than 3.0 degrees C
150	30	120	1530	Air temp difference from 30 (120) 1530 (17.727) to 30 (120) 1545 (14.719) is greater than 3.0 degrees C
150	13	103	1545	Rel hum difference from 13 (103) 1545 (85.827) to 13 (103) 1600 (46.385) is greater than 25%
150	29	119	1730	Rel hum difference from 29 (119) 1730 (26.733) to 29 (119) 1745 (54.603) is greater than 25%

The following data appear to be correct, all data between the dates and times stated is missing for reasons stated in section 12 of the metadata report:

Array	CalD	JulD	Time	Error Message
150	17	107	800	Pressure difference from 17 (107) 800 (1006) to 23 (113) 1000 (1022) is greater than 5 mb

The following erroneous data was caused by the rain gauge being reinstalled, rewired, and tested. The data was edited accordingly.

Array	CalD	JulD	Time	Error Message
151	9	99	1015	Technician changed 151 Array from 9 (99) 1015 to 9 (99) 1100

The following data is suspect due to the offset being output when there was no wind recorded:

Array	CalD	JulD	Time	Error Message
150	4	94	730	Wind direction is greater than 360 or less than 0 on 4 (94) 730 (-.09501)
150	6	96	2330	Wind direction is greater than 360 or less than 0 on 6 (96) 2330 (-.095)
150	16	106	515	Wind direction is greater than 360 or less than 0 on 16 (106) 515 (-.09503)
150	27	117	45	Wind direction is greater than 360 or less than 0 on 27 (117) 45 (-.09502)

All LiCor data for entire month is incorrect due to a wrong multiplier in the csi program. All 15 min, 1 hour and daily averages, and max and min data has been deleted:

Array	CalD	JulD	Time	Error Message
150	1	91	15	Technician changed 150 Array data from 1 (91) 15 to 17 (107) 800
150	23	113	1000	Technician changed 150 Array data at 23 (113) 1000 to 30 (120) 2400
243	1	91	2400	Technician changed 243 Array data from 1 (91) 2400 to 16 (106) 2400
243	23	113	2400	Technician changed 243 Array data at 23 (113) 2400 to 30 (120) 2400
244	1	91	2400	Technician changed 244 Array data from 1 (91) 2400 to 16 (106) 2400
244	23	113	2400	Technician changed 244 Array data at 23 (113) 2400 to 30 (120) 2400

There is no wind direction standard deviation for the entire month possibly due to a problem with the csi program.

May 2001

The following data appear to be correct:

Array	CalD	JulD	Time	Error Message
150	2	122	245	Air temp difference from 2 (122) 245 (16.002) to 2 (122) 300 (10.34) is greater than 3.0 degrees C
150	2	122	630	Air temp difference from 2 (122) 630 (16.75) to 2 (122) 645 (19.917) is greater than 3.0 degrees C
150	2	122	1000	Air temp difference from 2 (122) 1000 (26.087) to 2 (122) 1015 (30.715) is greater than 3.0 degrees C

150 2 122 1545 Air temp difference from 2 (122) 1545 (33.263) to 2 (122) 1600 (25.126) is greater than 3.0 degrees C
150 2 122 1615 Air temp difference from 2 (122) 1615 (24.698) to 2 (122) 1630 (31.528) is greater than 3.0 degrees C
150 3 123 1515 Air temp difference from 3 (123) 1515 (33.045) to 3 (123) 1530 (27.91) is greater than 3.0 degrees C
150 3 123 1530 Air temp difference from 3 (123) 1530 (27.91) to 3 (123) 1545 (24.004) is greater than 3.0 degrees C
150 3 123 1615 Air temp difference from 3 (123) 1615 (25.452) to 3 (123) 1630 (22.256) is greater than 3.0 degrees C
150 3 123 1715 Air temp difference from 3 (123) 1715 (24.03) to 3 (123) 1730 (30.964) is greater than 3.0 degrees C
150 4 124 1400 Air temp difference from 4 (124) 1400 (31.292) to 4 (124) 1415 (25.27) is greater than 3.0 degrees C
150 4 124 1415 Air temp difference from 4 (124) 1415 (25.27) to 4 (124) 1430 (21.821) is greater than 3.0 degrees C
150 7 127 600 Air temp difference from 7 (127) 600 (4.6675) to 7 (127) 615 (7.7355) is greater than 3.0 degrees C
150 11 131 800 Air temp difference from 11 (131) 800 (21.305) to 11 (131) 815 (17.959) is greater than 3.0 degrees C
150 11 131 915 Air temp difference from 11 (131) 915 (20.504) to 11 (131) 930 (17.329) is greater than 3.0 degrees C
150 12 132 115 Air temp difference from 12 (132) 115 (16.024) to 12 (132) 130 (12.615) is greater than 3.0 degrees C
150 2 122 245 Rel hum difference from 2 (122) 245 (53.401) to 2 (122) 300 (82.74) is greater than 25%
150 5 125 1430 Rel hum difference from 5 (125) 1430 (74.17) to 5 (125) 1445 (39.959) is greater than 25%
150 30 150 1345 Rel hum difference from 30 (150) 1345 (49.307) to 30 (150) 1400 (75.965) is greater than 25%
151 28 148 1600 Precip difference from 28 (148) 1600 (.254) to 28 (148) 1615 (5.588) is greater than 5 mm
151 28 148 1615 Precip difference from 28 (148) 1615 (5.588) to 28 (148) 1630 (.508) is greater than 5 mm

The following data appear to be correct, all data between the dates and
times stated is missing for reasons stated in section 12 of the
metadata report:

Array	CalD	JulD	Time	Error Message
150	25	145	1330	Pressure difference from 25 (145) 1330 (1023.6) to 27 (147) 1945 (1010.3) is greater than 5 mb

The following data is suspect due to the offset being output when there
was no wind recorded:

Array	CalD	JulD	Time	Error Message
150	6	126	15	Wind direction is greater than 360 or less than 0 on 6 (126) 15 (-.09498)

All LiCor data for entire month is incorrect due to a wrong multiplier in the csi program. All 15 min, 1 hour and daily averages, and max and min data has been deleted:

Array	CalD	JulD	Time	Error Message
150	1	121	15	Technician changed 150 Array data from 1 (121) 15 to 25 (145) 1330
150	27	147	1945	Technician changed 150 Array data at 27 (147) 1945 to 31 (151) 2400
243	1	121	2400	Technician changed 243 Array data from 1 (121) 2400 to 24 (144) 2400
243	27	147	2400	Technician changed 243 Array data at 27 (147) 2400 to 31 (151) 2400
244	1	121	2400	Technician changed 244 Array data from 1 (121) 2400 to 24 (144) 2400
244	27	147	2400	Technician changed 244 Array data at 27 (147) 2400 to 31 (151) 2400

There is no wind direction standard deviation for the entire month possibly due to a problem with the csi program.

June 2001

The following data appear to be correct:

Array	CalD	JulD	Time	Error Message
150	1	152	1200	Air temp difference from 1 (152) 1200 (18.902) to 1 (152) 1215 (14.501) is greater than 3.0 degrees C
150	6	157	1315	Air temp difference from 6 (157) 1315 (22.382) to 6 (157) 1330 (18.31) is greater than 3.0 degrees C
150	6	157	1700	Air temp difference from 6 (157) 1700 (20.538) to 6 (157) 1715 (23.745) is greater than 3.0 degrees C
150	6	157	1815	Air temp difference from 6 (157) 1815 (23.353) to 6 (157) 1830 (19.708) is greater than 3.0 degrees C
150	7	158	1215	Air temp difference from 7 (158) 1215 (22.977) to 7 (158) 1230 (19.548) is greater than 3.0 degrees C
150	7	158	1730	Air temp difference from 7 (158) 1730 (20.189) to 7 (158) 1745 (17.142) is greater than 3.0 degrees C
150	10	161	1415	Air temp difference from 10 (161) 1415 (22.984) to 10 (161) 1430 (19.951) is greater than 3.0 degrees C
150	10	161	1615	Air temp difference from 10 (161) 1615 (21.009) to 10 (161) 1630 (17.083) is greater than 3.0 degrees C
150	12	163	1915	Air temp difference from 12 (163) 1915 (18.149) to 12 (163) 1930 (14.984) is greater than 3.0 degrees C
150	14	165	930	Air temp difference from 14 (165) 930 (24.51) to 14 (165) 945 (21.075) is greater than 3.0 degrees C
150	15	166	900	Air temp difference from 15 (166) 900 (21.69) to 15 (166) 915 (24.71) is greater than 3.0 degrees C
150	15	166	1000	Air temp difference from 15 (166) 1000 (22.478) to 15 (166) 1015 (25.554) is greater than 3.0 degrees C
150	16	167	745	Air temp difference from 16 (167) 745 (23.35) to 16 (167) 800 (26.491) is greater than 3.0 degrees C
150	1	152	1200	Rel hum difference from 1 (152) 1200 (47.896) to 1 (152) 1215 (78.087) is greater than 25%

150 6 157 1700 Rel hum difference from 6 (157) 1700 (66.045) to 6 (157) 1715 (37.997) is greater than 25%
150 6 157 1815 Rel hum difference from 6 (157) 1815 (37.59) to 6 (157) 1830 (65.966) is greater than 25%
151 17 168 1615 Precip difference from 17 (168) 1615 (1.27) to 17 (168) 1630 (15.748) is greater than 5 mm
151 17 168 1645 Precip difference from 17 (168) 1645 (16.002) to 17 (168) 1700 (4.826) is greater than 5 mm
151 24 175 1430 Precip difference from 24 (175) 1430 (5.842) to 24 (175) 1445 (.254) is greater than 5 mm

The following wind speed data is suspect, and was deleted, due to a possible, but undocumented, sensor malfunction or glitch.

Array	CalD	JulD	Time	Error Message
102	10	161	1600	Max hourly wind speed is greater than 30 m/s on 10 (161) 1600 (63.8)
243	10	161	2400	Max daily wind speed is greater than 30 m/s on 10 (161) 2400 (63.8)

All LiCor data for entire month is incorrect due to a wrong multiplier in the csi program. All 15 min, 1 hour and daily averages, and max and min data has been deleted:

Array	CalD	JulD	Time	Error Message
150	1	152	15	Technician changed 150 Array data from 1 (152) 15 to 28 (179) 1530
243	1	152	2400	Technician changed 243 Array data from 1 (152) 2400 to 27 (178) 2400
244	1	152	2400	Technician changed 244 Array data from 1 (152) 2400 to 27 (178) 2400

There is no wind direction standard deviation for the entire month possibly due to a problem with the csi program.

July 2001

The following data appear to be correct:

Array	CalD	JulD	Time	Error Message
150	23	204	1015	Air temp difference from 23 (204) 1015 (29.645) to 23 (204) 1030 (23.807) is greater than 3.0 degrees C
150	23	204	2245	Air temp difference from 23 (204) 2245 (20.293) to 23 (204) 2300 (24.827) is greater than 3.0 degrees C
150	31	212	1445	Air temp difference from 31 (212) 1445 (22.295) to 31 (212) 1500 (26.383) is greater than 3.0 degrees C

All LiCor data for entire month is incorrect due to a wrong multiplier in the csi program. All 15 min, 1 hour and daily averages, and max and min data has been deleted

Array	CalD	JulD	Time	Error Message
150	19	200	1115	Technician changed 150 Array data at 19 (200) 1115 to 31 (212) 2400

243 19 200 2400 Technician changed 243 Array data at 19 (200) 2400 to 31 (212) 2400
244 19 200 2400 Technician changed 244 Array data at 19 (200) 2400 to 31 (212) 2400

There is no wind direction standard deviation for the entire month
possibly due to a problem with the csi program.

August 2001

The following data appear to be correct:

Array	CalD	JulD	Time	Error Message
150	2	214	2015	Air temp difference from 2 (214) 2015 (20.376) to 2 (214) 2030 (23.74) is greater than 3.0 degrees C
150	6	218	2115	Air temp difference from 6 (218) 2115 (21.394) to 6 (218) 2130 (25.297) is greater than 3.0 degrees C
150	9	221	1730	Air temp difference from 9 (221) 1730 (34.6) to 9 (221) 1745 (31.437) is greater than 3.0 degrees C
150	9	221	1745	Air temp difference from 9 (221) 1745 (31.437) to 9 (221) 1800 (27.626) is greater than 3.0 degrees C
150	9	221	1945	Air temp difference from 9 (221) 1945 (22.326) to 9 (221) 2000 (29.589) is greater than 3.0 degrees C
150	10	222	245	Air temp difference from 10 (222) 245 (25.812) to 10 (222) 300 (22.074) is greater than 3.0 degrees C
150	10	222	545	Air temp difference from 10 (222) 545 (19.345) to 10 (222) 600 (24.05) is greater than 3.0 degrees C
150	10	222	1445	Air temp difference from 10 (222) 1445 (27.926) to 10 (222) 1500 (24.337) is greater than 3.0 degrees C
150	10	222	1500	Air temp difference from 10 (222) 1500 (24.337) to 10 (222) 1515 (21.273) is greater than 3.0 degrees C
150	10	222	1800	Air temp difference from 10 (222) 1800 (21.146) to 10 (222) 1815 (26.198) is greater than 3.0 degrees C
150	29	241	1300	Air temp difference from 29 (241) 1300 (22.497) to 29 (241) 1315 (25.565) is greater than 3.0 degrees C

Erroneous data was caused by a malfunction in the relative humidity
sensor. All relative humidity data with in the following time ranges
has been edited accordingly, as well as all relative humidity in array
150 from 2(214) time 1215 to 31(243) time 2400, array 101 from 2(214)
time 1300 to 31(243) time 2400, arrays 241, 243 and 244 from 2(214) to
31(243):

Array	CalD	JulD	Time	Error Message
101	2	214	1300	Technician changed 101 Array data at 2 (214) 1300 to 31 (243) 2400
150	2	214	1215	Technician changed 150 Array data at 2 (214) 1215 to 31 (243) 2400
241	2	214	2400	Technician changed 241 Array data at 2 (214) 2400 to 31 (243) 2400
243	3	215	2400	Technician changed 243 Array data at 3 (215) 2400 to 31 (243) 2400
244	2	214	2400	Technician changed 244 Array data at 2 (214) 2400 to 31 (243) 2400

All LiCor data for entire month is incorrect due to a wrong multiplier

in the csi program. All 15 min, 1 hour and daily averages, and max and min data has been deleted:

Array	CalD	JulD	Time	Error Message
150	1	213	15	Technician changed 150 Array data at 1 (213) 15 to 31 (243) 2400
243	1	213	2400	Technician changed 243 Array data at 1 (213) 2400 to 31 (243) 2400
244	1	213	2400	Technician changed 244 Array data at 1 (213) 2400 to 31 (243) 2400

There is no wind direction standard deviation for the entire month possibly due to a problem with the csi program.

September 2001

The following data appear to be correct:

Array	CalD	JulD	Time	Error Message
150	13	256	164	Air temp difference from 13 (256) 1645 (20.307) to 13 (256) 1700 (23.695) is greater than 3.0 degrees C

The following data is suspect due to the offset being output when there was no wind recorded:

Array	Date	Day	Time	Error Message
150	14	257	445	Wind direction is greater than 360 or less than 0 on 14 (257) 445 (-.09492)

Erroneous data was caused by a malfunction in the relative humidity sensor. All relative humidity data for the entire month has been edited:

Array	Date	Day	Time	Error Message
101	1	244	100	Technician changed 101 Array data at 1 (244) 100 to 30 (273) 2400
150	1	244	15	Technician changed 150 Array data at 1 (244) 15 to 30 (273) 2400
241	1	244	2400	Technician changed 241 Array data at 1 (244) 2400 to 30 (273) 2400
243	1	244	2400	Technician changed 243 Array data at 1 (244) 2400 to 30 (273) 2400
244	1	244	2400	Technician changed 244 Array data at 1 (244) 2400 to 30 (273) 2400

All LiCor data for entire month is incorrect due to a wrong multiplier in the csi program. All 15 min, 1 hour and daily averages, and max and min data has been deleted:

Array	CalD	JulD	Time	Error Message
101	1	244	100	Technician changed 101 Array data at 1 (244) 100 to 30 (273) 2400
150	1	244	15	Technician changed 150 Array data at 1 (244) 15 to 30 (273) 2400
243	1	244	2400	Technician changed 243 Array data at 1 (244) 2400 to 30 (273) 2400
244	1	244	2400	Technician changed 244 Array data at 1 (244) 2400 to 30 (273) 2400

There is no wind direction standard deviation for the entire month possibly due to a problem with the csi program.

October 2001

The following data appear to be correct:

Array	CalD	JulD	Time	Error Message
150	4	277	1400	Air temp difference from 4 (277) 1400 (28.015) to 4 (277) 1415 (24.162) is greater than 3.0 degrees C
150	4	277	1630	Air temp difference from 4 (277) 1630 (25.149) to 4 (277) 1645 (19.03) is greater than 3.0 degrees C
150	4	277	1830	Air temp difference from 4 (277) 1830 (18.201) to 4 (277) 1845 (21.61) is greater than 3.0 degrees C
150	6	279	1045	Air temp difference from 6 (279) 1045 (22.226) to 6 (279) 1100 (18.902) is greater than 3.0 degrees C
150	10	283	1300	Air temp difference from 10 (283) 1300 (20.284) to 10 (283) 1315 (17.135) is greater than 3.0 degrees C
150	4	277	1630	Rel hum difference from 4 (277) 1630 (51.538) to 4 (277) 1645 (81.246) is greater than 25%

The following erroneous data was caused by a malfunction in the relative humidity sensor. All relative humidity data in the following time ranges has been edited accordingly, as well as all relative humidity in array 150 from 1(274) time 15 to 1(274) time 1400, array 101 from 1(274) time 100 to 1(274) time 1500, arrays 241, 243 and 244 on 1(274):

Array	CalD	JulD	Time	Error Message
101	1	274	100	Technician changed 101 Array data from 1 (274) 100 to 1 (274) 1500
150	1	274	15	Technician changed 150 Array data from 1 (274) 15 to 1 (274) 1400
241	1	274	2400	Technician changed 241 Array from 1 (274) 2400
243	1	274	2400	Technician changed 243 Array data from 1 (274) 2400
244	1	274	2400	Technician changed 244 Array data from 1 (274) 2400

The following erroneous data was caused by changing of weather instruments on 11(284) time 1000, not re-wiring until 15(288), though new instruments and new wiring did not produce usable data. Reloaded .dld program – Wells4_.dld, on 17(290). All Rhum, Temp_C, W_Dir and P_mb data in arrays 150, 101, and 102 from 11(284) time 1000 to 17(290) time 1015 [no more data available for month after this date and time- see section 12 of metadata report] and arrays 241, 242, 243, 244 from 11(284) to 17(290) is erroneous. This data was edited accordingly. All other data within these time frames is suspect.

Array	CalD	JulD	Time	Error Message
150	11	284	1000	Technician changed 150 Array data from 11 (284) 1000 to 17 (290) 1015
101	11	284	1000	Technician changed 101 Array data from 11 (284) 1000 to 17 (290) 1000
102	11	284	1000	Technician changed 102 Array from 11 (284) 1000 to 17 (290) 1000
241	11	284	2400	Technician changed 241 Array from 11 (284) 2400 to 16 (289) 2400
242	11	284	2400	Technician changed 242 Array from 11 (284) 2400 to 16 (289) 2400

243 11 284 2400 Technician changed 243 Array data from 11 (284) 2400 to 16 (289) 2400
244 11 284 2400 Technician changed 244 Array data from 11 (284) 2400 to 16 (289) 2400

The following Air_TempC data is also erroneous and was edited accordingly:

Array	CalD	JulD	Time
150	16	289	515
150	16	289	630

All 15 min and 1 hour data for wind speed is suspect due to a possible but undocumented, sensor freeze or malfunction from 11(284) time 1100 to 15(288) time 1300. Daily averages, and max and min data in this time frame are also suspect.

All LiCor data for entire month is incorrect due to a wrong multiplier in the csi program. All 15 min, 1 hour and daily averages, and max and min data has been deleted:

Array	CalD	JulD	Time	Error Message
150	1	274	15	Technician changed 150 Array data from 1 (274) 15 to 17 (290) 1015
243	1	274	2400	Technician changed 243 Array data from 1 (274) 2400 to 16 (289) 2400
244	1	274	2400	Technician changed 244 Array data from 1 (274) 2400 to 16 (289) 2400

There is no wind direction standard deviation for the entire month possibly due to a problem with the csi program.

November 2001
None- no data is available for this month.

December 2001

The following data appear to be correct:

Array	CalD	JulD	Time	Error Message
150	6	340	945	Air temp difference from 6 (340) 945 (13.343) to 6 (340) 1000 (17.688) is greater than 3.0 degrees C

The following data is suspect due to changing of temperature probe on an uncertain time on that day:

Array	CalD	JulD	Time	Error Message
150	19	353	1545	Air temp difference from 19 (353) 1545 (4.5454) to 19 (353) 1600 (10.569) is greater than 3.0 degrees C
150	19	353	1600	Air temp difference from 19 (353) 1600 (10.569) to 19 (353) 1615 (3.8796) is greater than 3.0 degrees C

The following data is suspect. There is no record of a powerdown or probe failure:

Array	CalD	JulD	Time	Error Message
101	19	353	100	Pressure average in 1 hour data (996.02) is less than 24 hour minimum (1005.8)
101	19	353	200	Pressure average in 1 hour data (996.88) is less than 24 hour minimum (1005.8)
101	19	353	300	Pressure average in 1 hour data (997.79) is less than 24 hour minimum (1005.8)
101	19	353	400	Pressure average in 1 hour data (998.67) is less than 24 hour minimum (1005.8)
101	19	353	500	Pressure average in 1 hour data (999.18) is less than 24 hour minimum (1005.8)
101	19	353	600	Pressure average in 1 hour data (1000.2) is less than 24 hour minimum (1005.8)
101	19	353	700	Pressure average in 1 hour data (1001.4) is less than 24 hour minimum (1005.8)
101	19	353	800	Pressure average in 1 hour data (1002.6) is less than 24 hour minimum (1005.8)
101	19	353	900	Pressure average in 1 hour data (1003.3) is less than 24 hour minimum (1005.8)
101	19	353	1000	Pressure average in 1 hour data (1004.1) is less than 24 hour minimum (1005.8)
101	19	353	1100	Pressure average in 1 hour data (1004.5) is less than 24 hour minimum (1005.8)
101	19	353	1200	Pressure average in 1 hour data (1004.6) is less than 24 hour minimum (1005.8)
101	19	353	1300	Pressure average in 1 hour data (1005) is less than 24 hour minimum (1005.8)
101	19	353	1400	Pressure average in 1 hour data (1005.3) is less than 24 hour minimum (1005.8)

The following erroneous Air_TempC data was caused by an undocumented and unexplained glitch or power down that caused the CR10X to reset and record erroneous hourly averages and daily averages. The erroneous data on 19(353) might be due to the changing of the air temperature probe that occurred at an uncertain time that day. Data was edited accordingly for arrays 101 and arrays 241, 243, 244:

Array	CalD	JulD	Time	
101	17	351	1100	Technician changed 101 Array data from 17 (351) 1100
101	18	352	600	Technician changed 101 Array data from 18 (352) 600
101	19	353	1600	Technician changed 101 Array data from 19 (353) 1600
241	17	351	2400	Technician changed 241 Array from 17 (351) 2400 to 19 (353) 2400
243	17	351	2400	Technician changed 243 Array data from 17 (351) 2400 to 19 (353) 2400

244 17 351 2400 Technician changed 244 Array data from 17 (351) 2400 to 19 (353) 2400

All LiCor data for entire month is incorrect due to a wrong multiplier in the csi program. All 15 min, 1 hour and daily averages, and max and min data has been deleted:

Array	CalD	JulD	Time	Error Message
150	5	339	1530	Technician changed 150 Array data from 5 (339) 1530 to 10 (344) 1130
150	16	350	2015	Technician changed 150 Array data at 16 (350) 2015 to 31 (365) 2400
243	5	339	2400	Technician changed 243 Array data from 5 (339) 2400 to 9 (343) 2400
243	16	350	2400	Technician changed 243 Array data at 16 (350) 2400 to 31 (365) 2400
244	5	339	2400	Technician changed 244 Array data from 5 (339) 2400 to 9 (343) 2400
244	16	350	2400	Technician changed 244 Array data at 16 (350) 2400 to 31 (365) 2400

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 2001

The following missing data is missing due to an overwrite by the CR10X due to the data not being collected in regular intervals:

Array	CalD	JulD	Time	Error Message
150	11	11	1145	Missing 150 Array data (15 minute data) from 11 (11) 1145 to 12 (12) 1930
101	11	11	1200	Missing 101 Array data (Hourly Averages) from 11 (11) 1200 to 12 (12) 1900
102	11	11	1200	Missing 102 Array data (Hourly Average Wind Parameters) from 11 (11) 1200 to 12 (12) 1900
241	11	11	2400	Missing 241 Array (Daily Averages)
242	11	11	2400	Missing 242 Array (Daily Average Wind Parameters)
243	11	11	2400	Missing 243 Array (Daily Max/Time Values)
244	11	11	2400	Missing 244 Array (Daily Min/Time Values)

All 151 Array data is missing from 11(11) 1145 to 12(12) 1930 for the same reason as stated above.

February 2001
None

March 2001
None

April 2001

The following missing data is missing due to an overwrite by the CR10X
due to the data not being collected in regular intervals:

Array	CalD	JulD	Time	Error Message
150	17	107	815	Missing 150 Array data (15 minute data) from 17 (107) 815 to 23 (113) 945
101	17	107	900	Missing 101 Array data (Hourly Averages) from 17 (107) 900 to 23 (113) 900
102	17	107	900	Missing 102 Array data (Hourly Average Wind Parameters) from 17 (107) 900 to 23 (113) 900
241	17	107	2400	Missing 241 data (Daily Averages) from 17 (107) 2400 to 22 (112) 2400
242	17	107	2400	Missing 242 data (Daily Average Wind Parameters) from 17 (107) 2400 to 22 (112) 2400
243	17	107	2400	Missing 243 data (Daily Max/Time Values) from 17 (107) 2400 to 22 (112) 2400
244	17	107	2400	Missing 244 data (Daily Min/Time Values) from 17 (107) 2400 to 22 (112) 2400

All 151 Array data is missing from 17(107) 815 to 23(113) 945 for the
same reason as stated above.

May 2001

The following missing data is missing due to an overwrite by the CR10X
due to the data not being collected in regular intervals:

Array	CalD	JulD	Time	Error Message
150	25	145	1345	Missing 150 Array data (15 minute data) from 25 (145) 1345 to 27 (147) 1930
101	25	145	1400	Missing 101 Array data (Hourly Averages) from 25 (145) 1400 to 27 (147) 1900
102	25	145	1400	Missing 102 Array data (Hourly Average Wind Parameters) from 25 (145) 1400 to 27 (147) 1900
241	25	145	2400	Missing 241 data (Daily Averages) from 25 (145) 2400 to 26 (146) 2400
242	25	145	2400	Missing 242 data (Daily Average Wind Parameters) from 25 (145) 2400 to 26 (146) 2400
243	25	145	2400	Missing 243 data (Daily Max/Time Values) from 25 (145) 2400 to 26 (146) 2400
244	25	145	2400	Missing 244 data (Daily Min/Time Values) from 25 (145) 2400 to 26 (146) 2400

All 151 Array data is missing from 25 (145) 1345 to 27(147) 1945 for
the same reason as stated above.

June 2001

The following missing data is missing due to an overwrite by the CR10X
due to the data not being collected in regular intervals:

Array	CalD	JulD	Time	Error Message
150	28	179	1545	Missing 150 Array data (15 minute data) from 28 (179) 1545 to 30 (181) 2400
101	28	179	1600	Missing 101 Array data (Hourly Averages) from 28 (179) 1600 to 30 (181) 2400
102	28	179	1600	Missing 102 Array data (Hourly Average Wind Parameters) from 28 (179) 1600 to 30 (181) 2400
241	28	179	2400	Missing 241 data (Daily Averages) from 28 (179) 2400 to 30 (181) 2400
242	28	179	2400	Missing 242 data (Daily Average Wind Parameters) from 28 (179) 2400 to 30 (181) 2400
243	28	179	2400	Missing 243 data (Daily Max/Time Values) from 28 (179) 2400 to 30 (181) 2400
244	28	179	2400	Missing 244 data (Daily Min/Time Values) from 28 (179) 2400 to 30 (181) 2400

All 151 Array data is missing from 28(179) 1545 to 30(181) 2400 for the
same reason as stated above.

July 2001

The following missing data is missing due to an overwrite by the CR10X
due to the data not being collected in regular intervals and/or a
undocumented and unexplained glitch in the program:

Array	CalD	JulD	Time	Error Message
150	1	182	30	Missing 150 Array data (15 minute data) from 1 (182) 15 to 19 (200) 1100
101	1	182	100	Missing 101 Array data (Hourly Averages) from 1 (182) 100 to 19 (200) 1100
102	19	182	100	Missing 102 Array (Hourly Average Wind Parameters)
102	1	182	100	Missing 102 Array data (Hourly Average Wind Parameters) from 1 (182) 100 to 19 (200) 1000
241	1	182	2400	Missing 241 data (Daily Averages) from 1 (182) 2400 to 18 (199) 2400
242	1	182	2400	Missing 242 data (Daily Average Wind Parameters) from 1 (182) 2400 to 18 (199) 2400
243	1	182	2400	Missing 243 data (Daily Max/Time Values) from 1 (182) 2400 to 18 (199) 2400
244	1	182	2400	Missing 244 data (Daily Min/Time Values) from 1 (182) 2400 to 18 (199) 2400

All 151 Array data is missing from 1(182) 15 to 19(200) 1100 for the
same reason as stated above.

August 2001
The following missing data may be due to a glitch in the CR10X datalogger:

Array	CalD	JulD	Time	Error Message
102	20	232	1300	Missing 102 Array (Hourly Average Wind Parameters)

September 2001
None

October 2001

The following missing data is missing due to an overwrite by the CR10X. The data was not able to be collected because the computer being used to collect data lost its motherboard rendering it unusable. Also, due to changing of weather instruments on 11(284) time 1000, not re-wiring until 15(288), though new instruments and new wiring did not produce usable data. Reloaded .dld program – Wells4_.dld, on 17(290):

Array	CalD	JulD	Time	Error Message
150	17	290	1030	Missing 150 Array data (15 minute data) from 17 (290) 1030 to 31 (304) 2400
101	17	290	1100	Missing 101 Array data (Hourly Averages) from 17 (290) 1100 to 31 (304) 2400
102	17	290	1100	Missing 102 Array data (Hourly Average Wind Parameters) from 17 (290) 1100 to 31 (304) 2400
241	17	290	2400	Missing 241 data (Daily Averages) from 17 (290) 2400 to 31 (304) 2400
242	17	290	2400	Missing 242 data (Daily Average Wind Parameters) from 17 (290) 2400 to 31 (304) 2400
243	17	290	2400	Missing 243 data (Daily Max/Time Values) from 17 (290) 2400 to 31 (304) 2400
244	17	290	2400	Missing 244 data (Daily Min/Time Values) from 17 (290) 2400 to 31 (304) 2400

All 151 Array data is missing from 17(290) 1030 to 31(304) 2400 for the same reason as stated above.

November 2001

All data is missing for the entire month. Data was never collected due to problems with the datalogger program. Instruments appeared not to be reading. Other programs were tried but did not seem to work.

December 2001

The following missing data is missing due to an overwrite by the CR10X due to the data not being collected in regular intervals because there were problems with the datalogger program (see November 2001). There appears to be a possible glitch or powerdown, that was undocumented and

unexplained, for the missing data starting 10(344) to 16(350):

Array	CalD	JulD	Time	Error Message
150	1	335	15	Missing 150 Array data (15 minute data) from 1 (335) 15 to 5 (339) 1515
150	10	344	1145	Missing 150 Array data (15 minute data) from 10 (344) 1145 to 16 (350) 2000
101	1	335	100	Missing 101 Array data (Hourly Averages) from 1 (335) 100 to 5 (339) 1500
101	10	344	1200	Missing 101 Array data (Hourly Averages) from 10 (344) 1200 to 16 (350) 1900
102	1	335	100	Missing 102 Array data (Hourly Average Wind Parameters) from 1 (335) 100 to 5 (339) 1500
102	10	344	1200	Missing 102 Array data (Hourly Average Wind Parameters) from 10 (344) 1200 to 16 (350) 1900
241	1	335	2400	Missing 241 data (Daily Averages) from 1 (335) 2400 to 4 (338) 2400
241	10	344	2400	Missing 241 data (Daily Averages) from 10 (344) 2400 to 15 (349) 2400
242	1	335	2400	Missing 242 data (Daily Average Wind Parameters) from 1 (335) 2400 to 4 (338) 2400
242	10	344	2400	Missing 242 data (Daily Average Wind Parameters) from 10 (344) 2400 to 15 (349) 2400
243	1	335	2400	Missing 243 data (Daily Max/Time Values) from 1 (335) 2400 to 4 (338) 2400
243	10	344	2400	Missing 243 data (Daily Max/Time Values) from 10 (344) 2400 to 15 (349) 2400
244	1	335	2400	Missing 244 data (Daily Min/Time Values) from 1 (335) 2400 to 4 (338) 2400
244	10	344	2400	Missing 244 data (Daily Min/Time Values) from 10 (344) 2400 to 15 (349) 2400

All 151 Array data is missing from 1(315) 15 to 5(339) 1515 and 10(344) 1145 to 16(350) 2000 for the same reasons as stated above.

13. Other Remarks

On 10/09/2023 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.

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.

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.

Due to missing data (see section 12), certain monthly rain totals are incomplete and not available, and not all rain events may be accounted for because of this.

Rain Events:

January

Date	RainAmount (mm)
1	.254
7	.254
14	.254
16	.254

Monthly Total n/a

February

Date	RainAmount (mm)
n/a	

March

Date	RainAmount (mm)
n/a	

April

Date	RainAmount (mm)
9	.254
12	18.288

Monthly Total n/a

May

Date	RainAmount (mm)
5	3.302
12	3.048
15	2.540
16	.762
19	.762
28	7.366
29	.254
30	1.778

Monthly Total n/a

June

Date	RainAmount (mm)
1	9.144
2	49.530
3	5.588
10	5.334
11	20.574
12	8.382
17	49.022
20	10.160
21	.254
23	2.794

24	11.684
	Monthly Total n/a

July

Date	RainAmount (mm)
26	12.700
	Monthly Total n/a

August

Date	Rainamount (mm)
3	1.778
4	3.048
5	.508
12	19.558
17	.254
20	3.302
21	.254
27	1.016
28	2.540
	Monthly Total 32.3

September

Date	RainAmount (mm)
1	15.494
4	6.350
5	.254
14	1.270
20	9.398
21	23.876
24	.254
25	22.098
26	.254
28	7.112
	Monthly Total 86.4

October

Date	Rainamount (mm)
6	.762
	Monthly Total n/a

November

Date	Rainamount (mm)
n/a	
	Monthly Total n/a

December

Date	RainAmount (mm)
9	4.318
10	.508
17	12.192
18	7.366
19	.762
20	.508
21	1.016
24	13.462
	Monthly Total n/a