Elkhorn Slough (ELK) **NERR Meteorological Metadata**
January 2024-Dec 2024
Latest Update: 14 nov 2024

Note: This is a provisional metadata document; it has not been authenticated as of its download date. Contents of this document are subject to change throughout the QAQC process and it should not be considered a final record of data documentation until that process is complete. Contact the CDMO (cdmosupport@belle.baruch.sc.edu) or Reserve with any additional questions.

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons

Contact Persons:
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2) Entry verification

Data are uploaded from the CR1000 data logger to a personal computer with a Windows 7 or newer operating system. Files are exported from LoggerNet in a comma-delimited format and uploaded to the CDMO where they undergo automated primary QAQC and become part of the CDMO's online provisional database. During primary QAQC, data are flagged if they are missing or out of sensor range. The edited file is then returned to the Reserve where it is opened in Microsoft Excel and processed using the CDMO's NERRQAQC Excel macro. The macro inserts station codes, creates metadata worksheets for flagged data and summary statistics, and graphs the data for review. It allows the user to apply QAQC flags and codes to the data, append files, and export the resulting data file to the CDMO for tertiary QAQC and assimilation into the CDMO's authoritative online database. For more information on QAQC flags and QAQC codes, see Sections 11 and 12.

All data files are backed up on an external hard drive. SWMP Technician John Haskins and Research Assistant Rikke Priesler error checked and compiled the 2019 weather data.

3) Research objectives

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

4) Research methods

The Campbell Scientific weather station samples every 5 seconds continuously throughout the year. Sensors on the weather station are inspected monthly for damage or debris. The rain gauge tends to collect debris and is cleaned out every month, particularly before and after major storms events. Sensors are removed and calibrated on an annual or biannual basis depending on the particular sensor. Also, once a month on download day,

we use a handheld Kestrel 4000, to run a comparative set of observations as a general check on the Campbell station sensors. Data are collected in Pacific Standard Time (PST) for the entire year.

Campbell Scientific data telemetry equipment was installed at Caspian Weather station to transmit to the NOAA GOES satellite, NESDIS ID #3B0155FC. The transmissions are scheduled hourly and contain four (4) datasets reflecting the fifteen min data sampling interval. Upon receipt by the CDMO, the data undergoes the same automated primary QAQC process detailed in Section 2 above. The "real-time" telemetry data becomes part of the provisional dataset until undergoing secondary and tertiary QAQC and assimilation in the CDMO's authoritative online database. Provisional and authoritative data are available at http://cdmo.baruch.sc.edu.

The 15 minute Data are collected in the following formats for the **CR1000**:

Averages from 5-second data:

Air Temperature (°C), Relative Humidity (%), Barometric Pressure (mb), Wind Speed (m/s), Wind Direction (degrees), Battery Voltage (volts)

Maximum, Minimum, and their times from 5-second data (these data are available from the reserve):

Maximum Wind Speed (m/s) and time from 5-second data

Wind Direction Standard Deviation (degrees)

Totals:

Precipitation (mm), PAR (millimoles/m^2), and Cumulative Precipitation (mm) (Cumulative precipitation is no longer available via export from the CDMO. Please contact the reserve or the CDMO for more information or to obtain these data.)

Recommended calibration frequency for the MET station sensors:

- Temperature/Humidity- yearly recalibration
- Rain Gauge- yearly recalibration
- Wind Speed/Direction- yearly or every 2 years (depending on the sensor)
- Barometric Pressure- every 2 years recalibration
- PAR- every 2 years recalibration
- CR1000-every 5 years (required beginning 2014, one year initial grace period)
- *Total Solar Radiation (this is an optional sensor, only include if you are collecting TSR data)*-

Eppley 8-48 - every 5 years, but annual recalibration encouraged

LI-COR LI-200S - every 2 years, with recalibrations performed during the spring and summer

5) Site location and character

The Elkhorn Slough NERR is located on the central California coast at the head of the Monterey Bay. It connects with the Pacific Ocean near Moss Landing, California and harbors the largest tract of tidal salt marsh in California outside of San Francisco Bay. There is one weather station on the reserve that is located approximately one kilometer south of the South Marsh water quality site (36°49'05.00"N, 121°44'21.83"W). The sensors are located on a 10 ft tower placed according to descriptions outlined in the CDMO Manual V 6.6 and are located approximately 100 feet above the marsh on a grassy low shrub bluff in the uplands of the marsh. The wind and PAR sensors are located at a height of approximately 12 ft, the temp/RH sensor is are located at approximately 6 ft, and the barometric pressure sensor is located at approximately 5 ft. The tipping bucket is located to the west of the tower on the ground, approximately 20 ft away. There are no shadow or wind obstructions from buildings or trees in the immediate area surrounding the location of any of the sensors.

Station Code	Station Name	SWMP Status	Location	Active Dates	Reason Decommissioned	Notes
ELKCWMET	Caspian Weather Station	P	36° 45' 55.57 N, 121° 44' 17.32 W	01/01/2001 -	NA	NA

6) Data collection period

Weather data has been collected since September 18, 1998. The current weather station has been operational since this date. Data was collected from 01/01/2024 00:00 thru 04/11/2024 11:15.

Here are the start and end times of the raw files

01/03/24 13:30 - 03/07/24 15:00
03/07/24 15:15 – 04/11/24 11:15
04/11/24 11:30 – 05/08/24 09:45
05/08/24 10:00 – 06/05/24 12:15
06/05/24 12:30 – 08/09/24 15:00
08/09/24 15:15 – 08/14/24 09:45
08/14/24 10:00 – 09/17/24 09:00
09/17/24 09:15 – 10/07/24 09:00
10/11/24 10:45 – 10/24/24 14:30
10/24/24 14:45 – 11/13/24 11:30
11/13/24 11:45 – 12/12/24 13:00

7) Distribution – This section will address data ownership and data liability with the following excerpt from the Ocean and Coastal Resource Management Data Dissemination Policy for the NERRS System-wide Monitoring Program in the metadata.

NOAA retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The NERRS retains the right to be fully credited for having collected and process the data. Following academic courtesy standards, the NERR site where the data were collected should be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. The data set enclosed within this package/transmission is only as good as the quality assurance and 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.

Requested citation format:
NOAA National Estuarine Research Reserve System (NERRS). System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: http://www.nerrsdata.org/; *accessed* 12 October 2021.

NERR meteorological data and metadata can be obtained from the Research Coordinator at the individual NERR site (please see 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 www.nerrsdata.org. Data are available in comma delimited format.

8) Associated researchers and projects

As part of the SWMP long-term monitoring program, ELK NERR also monitors 15-minute water quality (pH, salinity, DO, depth, turbidity and temperature) along with monthly grab samples and diel sampling for nutrient data (ammonia, phosphate, nitrate and chlorophyll) which may be correlated with this meteorological dataset. These data are available at www.nerrsdata.org.

II. Physical Structure Descriptors

9) Sensor specifications –

Parameter: Temperature
Units: Celsius
Sensor type: Pt1000 Class A
Model #: EE 181 Temperature and Relative Humidity Probe
Operating Temperature: -40°C to +60°C
Range: -40°C to +60°C
Accuracy: ± 0.2 °C @ 23°C
Serial Number: 21091600204263
Date of Last calibration: June 06, 2023
Dates of sensor use: June 16, 2023- Oct 07, 2024

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Sensor type: Pt1000 Class A
Model #: EE 181 Temperature and Relative Humidity Probe
Operating Temperature: -40°C to +60°C
Range: -40°C to +60°C
Accuracy: ± 0.2 °C @ 23°C
Serial Number: 21091600204263
Date of Last calibration: Oct 14, 2024
Dates of sensor use: Oct 24, 2024- present

Parameter: Relative Humidity
Units: Percent
Sensor type: HC101
Model #: EE 181 Temperature and Relative Humidity Probe
Range: 0-100% non-condensing
Accuracy: –15 to 40 °C: ≤90% RH ± (1.3 + 0.003 • RH reading) % RH
–15 to 40 °C: >90% RH ± 2.3% RH
–25 to 60 °C: ± (1.4 + 0.01 • RH reading) % RH
–40 to 60 °C: ± (1.5 + 0.015 • RH reading) % RH
Temperature dependence of RH measurement +/- 0.03% RH/^{O}C
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Serial Number: 21091600204263
Date of Last calibration: Oct 14, 2024
Dates of sensor use: Oct 24, 2024 – present

Parameter: Barometric Pressure
Units: millibars (mb)
Sensor type: Vaisala Barocap © silicon capacitive pressure sensor
Model #: CS-105

Operating Range: Pressure: 600 to 1060 mb; Temperature: -40°C to +60°C;
Humidity: non-condensing
Accuracy: ± 0.5 mb @ 20°C; +/- 2 mb @ 0°C to 40°C; +/- 4 mb @ -20°C to 45°C; +/- 6 mb @ -40°C to 60°C
Stability: ± 0.1 mb per year
Serial Number: U1810422
Date of Last calibration: May 02, 2022
Dates of sensor use: Aug 22, 2022 – Sept 17, 2024

Units: millibars (mb)
Sensor type: Vaisala Barocap © silicon capacitive pressure sensor
Model #: CS-105
Operating Range: Pressure: 600 to 1060 mb; Temperature: -40°C to +60°C;
Humidity: non-condensing
Accuracy: ± 0.5 mb @ 20°C; +/- 2 mb @ 0°C to 40°C; +/- 4 mb @ -20°C to 45°C; +/- 6 mb @ -40°C to 60°C
Stability: ± 0.1 mb per year
Serial Number: S3520631
Date of Last calibration: April 24, 2024
Dates of sensor use: Sept 17, 2024 - Present

Parameter: Wind speed
Units: meter per second (m/s)
Sensor type: 18 cm diameter 4-blade helicoids propeller molded of polypropylene
Model #: R.M. Young 05103 Anemometer
Serial Number: 149693
Range: 0-100 m/s (224 mph)
Accuracy: +/- 0.3 m/s or 1% of reading
Date of last calibration: Mar 08, 2022
Dates of sensor use: Mar 31, 2022 - present

Parameter: Wind direction
Units: degrees
Sensor type: balanced vane, 38 cm turning radius
Model #: R.M. Young 05103 Wind Vane
Serial Number: 149693
Date of last calibration: Mar 08, 2022
Dates of sensor use: Mar 31, 2022 - present

Parameter: Photosynthetically Active Radiation (PAR)

Units: mmoles m-2 (total flux)
Sensor type: anodized aluminum with cast acrylic diffuser
Model #SQ110 Apogee Quantum Sensor
Light spectrum waveband: 410 to 655 nm
Temperature dependence: 0.06+/-0.06% per °C
Stability: <±2% change over 1 yr
Operating Temperature: -40°C to 70°C; Humidity 0 to 100%
Cosine Response: 45° zenith angle: +/- 2%; 75° zenith angle: +/- 5%
Sensitivity: 0.2mV per μmol s-1 m-2
Serial number: SQ-101-18025

Date of last calibration: September 11, 2023
Dates of sensor use: Sept 28, 2023 - present

Parameter: Precipitation

Units: millimeters (mm)
Sensor type: Tipping Bucket Rain Gauge
Model #: TE525
Rainfall per tip: 0.01 inch
Operating range: Temperature: 0° to 50°C; Humidity: 0 to 100%
Accuracy: +/- 1.0% up to 1 in./hr; +0, -3% from 1 to 2 in./hr; +0, -5% from 2 to 3 in./hr
Date of Last calibration: Sept 13, 2023

Another 128 K Flash is used to store configuration settings. A minimum of 2 MB SRAM is (4 MB optional) is available for program storage (16K), operating system use, and data storage. Additional storage is available by using a compact flash card in the optional CFM100 Compact Flash Module.
Date installed: July 18, 2006-present
Date CR1000 Calibrated: April 03, 2019 – Oct 09, 2024
CR1000 Firmware Version (s): Version
CR1000 Program Version(s): elkcwmet_5.6_032519

Date CR1000 Calibrated: Oct 09, 2024 - Present
CR1000 Firmware Version (s): Version
CR1000 Program Version(s): elkcwmet_5.6_102424

10) Coded variable definitions -

Sampling station:	Sampling site code:	Station code:
Caspian Weather	CW	elkcwmet

11) QAQC flag definitions –

QAQC flags provide documentation of the data and are applied to individual data points by insertion into the parameter's associated flag column (header preceded by an F_). During primary automated QAQC (performed by the CDMO), -5, -4, and -2 flags are applied automatically to indicate data that is above or below sensor range, or missing. All remaining data are then flagged 0, as passing initial QAQC checks. During secondary and tertiary QAQC 1, -3, and 5 flags may be used to note data as suspect, rejected due to QAQC, or corrected.

-5 Outside High Sensor Range
-4 Outside Low Sensor Range
-3 Data Rejected due to QAQC
-2 Missing Data
-1 Optional SWMP supported parameter
0 Passed Initial QAQC Checks
1 Suspect Data
2 *Open - reserved for later flag*
3 *Open - reserved for later flag*
4 Historical Data: Pre-Auto QAQC

5 Corrected Data

12) QAQC code definitions –

QAQC codes are used in conjunction with QAQC flags to provide further documentation of the data and are also applied by insertion into the associated flag column. There are three (3) different code categories, general, sensor, and comment. General errors document general problems with the CR1000, sensor errors are sensor specific, and comment codes are used to further document conditions or a problem with the data. Only one general or sensor error and one comment code can be applied to a particular data point, but some comment codes (marked with an * below) can be applied to the entire record in the F_Record column.

General Errors

GIM	Instrument malfunction
GIT	Instrument recording error, recovered telemetry data
GMC	No instrument deployed due to maintenance/calibration
GMT	Instrument maintenance
GPD	Power down
GPF	Power failure / Low battery
GPR	Program reload
GQR	Data rejected due to QA/QC checks
GSM	See metadata

Sensor Errors

SDG	Suspect due to sensor diagnostics
SIC	Incorrect calibration constant, multiplier or offset
SIW	Incorrect wiring
SMT	Sensor maintenance
SNV	Negative value
SOC	Out of calibration
SQR	Data rejected due to QAQC checks
SSD	Sensor drift
SSN	Not a number / unknown value
SSM	Sensor malfunction
SSR	Sensor removed

Comments

CAF	Acceptable calibration/accuracy error of sensor
CCU	Cause unknown
CDF	Data appear to fit conditions
CML	Snow melt from previous snowfall event
CRE*	Significant rain event
CSM*	See metadata
CVT*	Possible vandalism/tampering
CWE*	Significant weather event

13) Other remarks/notes

Data are missing due to equipment or associated specific sensors not being deployed, equipment failure, time of maintenance or calibration of equipment, or repair/replacement of a sampling station platform. Any NANs in the dataset stand for "not a number" and are the result of low power,

disconnected wires, or out of range readings. If additional information on missing data is needed, contact the Research Coordinator at the reserve submitting the data.

Small negative PAR values are within range of the sensor and are due to normal errors in the sensor and the CR1000 Datalogger. The Maximum signal noise error for the Licor sensor is +/- 2.214 mmoles/m2 over a 15 minute interval.

Relative Humidity data greater than 100 are within range of the sensor accuracy of +/-3% and are flagged and coded as suspect, <1> (CAF). Values greater than 103 are rejected <-3>.

Data recorded for all parameters (with the exception of cumulative precipitation) at the midnight timestamp (00:00) are the 15 minute averages and totals for the 23:45-23:59 time period of the previous day. Cumulative precipitation data at the midnight timestamp (00:00) are the sum of raw (unrounded) precipitation data from 00:00 to 23:59 of the previous day. Summing each individual 15-minute total precipitation value from the same period will result in small differences from cumulative precipitation due to rounding. It is especially important to note how data at the midnight timestamp are recorded when using January 1st and December 31st data. **Note: Cumulative precipitation is no longer available via export from the CDMO. Please contact the Reserve or the CDMO for more information or to obtain these data.**

Rain comparison was made with CoCoRaHS certified rain gauge. Here are the comparisons on total rain accumulation between maintenance checks

Dec 12 2024 Tipping bucket 76.45, CoCoRaHS 77.216 mm
Jan 14, 2025 Tipping bucket 70.86, CoCoRaHS 71.12 mm
Average difference 1%

Aug 17, 2024 – our upload this month had an issue with incorrect DateTimeStamp given to the data. Starting 9/15/2024 12:15 the DateTimeStamp had to be adjusted to the correct date. The raw file gave the dates in January of 2005 with the same time. Dates were adjusted to represent the correct date. This date we also swapped out the BP sensor.

Sept 15, 2024 12:15 – Sept 17, 2024 09:30 times had to be adjusted due to a glitch with the TX312 attaching same date and time but from year 2005. Date Time was corrected.

Oct 7, 2024 09:00
Data stopped recording. All sensors were removed and CR1000 was sent in for recalibration.

Oct 11, 2024 10:45
Data recording restarted. All sensors except for the Temp/RH sensor (out for calibration) were rewired to the CR1000 and started at this date and time. Incorrect PAR multiplier was inputted so these data were flagged to be rejected.

Oct 24, 2024
Changed the program to accommodate the date time stamp issue with Tx312. Also put in newly calibrated Temp/RH probe s/n 21091600204263. Correct PAR multiplier was inputted so PAR data was reinstated.