

Tijuana River (TJR) National Estuarine Research Reserve Meteorological Metadata
January - December 2004
Latest Update: **October 15, 2023**

I. Data Set & Research Descriptors

1) Principal investigator(s) & contact persons

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2) Entry verification

The meteorological sensors at the station are sampled every five seconds by a Campbell Scientific model CR10x datalogger. At 15 minute intervals the 5 second data are written to file (see section below for sampling details) on the CR10x. The data are downloaded in comma delimited ascii format via modem from the CR10x at 15 minute intervals to a computer located in the Tijuana River NERR visitor's center using PC208W software provided by Campbell Scientific. Following download from the CR10x the data are automatically uploaded via FTP to a mySQL database server at San Diego State University (SDSU) where it is made available near-real time for viewing on the web (<http://www.perl.sdsu.edu/TRNERR>). Raw data files are kept both at Tijuana River NERR and at SDSU.

Data are QA/QC'd using Microsoft Access as a front-end, using ODBC, to the SQL database to generate reports which detail data outliers and anomalies (see section 2c for the CDMO Meteorological Data Collection Error/Anomalous Data Criteria). Graphs are generated using a web interface to the SQL database to aid in identifying anomalous data. Any necessary edits are made directly to the SQL database using Microsoft Access. A log is generated on the SQL server of any changes made to the database. Any anomalous data were investigated and are noted below in the Anomalous Data Section. Any data corrections that were performed are noted in the Data Correction Section below. All error messages and anomalous data were compared to reference data obtained from a nearby (1/2 mile) weather station operated by the U.S. Navy and another located on the Imperial Beach pier operated by the Scripps Institute of Oceanography.

Following preliminary editing, data are exported from Access into the EQWin database software where reports, queries and graphs are generated before data is exported from EQWin as a tab delimited text file and is uploaded to the CDMO.

3) Research objectives (Campbell Weather Station):

The principal objective is to record long-term and episodic meteorological data for the Tijuana Estuary in order to observe any environmental changes or trends over time. Data are also used as corollary information in ongoing biologic, hydrologic and geographic studies being conducted at the reserve.

4) Research Methods

a) Data Collection Schedule

The sensors are sampled every 5 seconds and the results are placed in volatile memory on the CR10x datalogger. Measurements are recorded from the 5 sec data every 15 minutes, 60 minutes and 24 hours for the following parameters for each time interval:

Prior to November 7, 2003:

15 minute sample point parameters:

Date, Time, Air Temperature (c), Relative Humidity (%), LiCor (par), Barometric Pressure (mb), Wind Speed (m/s), Wind Direction, Rainfall (mm)

60 minute average parameters:

Date, Time, Air Temperature (c), Relative Humidity (%), LiCor (par), Barometric Pressure (mb), Wind Speed (m/s), Wind Direction, Wind Direction Standard Deviation (using Yamartino's Algorithm)

Daily Average parameters:

Date, Time, Air Temperature (c), Relative Humidity (%), LiCor (par), Barometric Pressure (mb), Wind Speed (m/s), Wind Direction

24 hour 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

24 hour 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

Beginning November 7, 2003 the data collection protocol was changed to the following, all parameters listed are sampled at 15 minute, 60 minute and 24 hour intervals:

Average:

Temperature, relative humidity, barometric pressure, wind speed, wind direction, battery voltage

Maximum:

Temperature, Maximum Temperature Time, relative humidity, Maximum Relative Humidity Time, barometric pressure, Maximum Barometric Pressure Time, Wind Speed, Maximum Wind Speed Time

Minimum:

Temperature, Minimum Temperature Time, relative humidity, Minimum Relative Humidity Time, barometric pressure, Minimum Barometric Pressure Time, Wind Speed, Minimum Wind Speed Time

Total:

Precipitation, Licor

b) Error/Anomalous Data Criteria

Air Temp:

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

Relative Humidity:

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

Rainfall:

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

Wind Speed:

- Wind speed greater than 30 m/s
- Wind speed less than .5 m/s

Wind Direction:

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

Pressure:

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

Time:

- 15 minute interval recorded

For all data:

- Duplicate interval data

4) Research methods:

The Campbell Scientific weather station samples every 5 seconds to produce both hourly and daily averages of those measurements of air temperature, relative humidity, barometric pressure, rainfall, wind speed and wind direction. An instantaneous sample is taken every 15 minutes and that data is stored in array 150. A

one-week sampling interval was chosen so that the CR10X datalogger would not run out of room and overwrite data, especially if the short haul modem link failed and data could not be automatically sent from the datalogger to the computer. If this were the case, the data would have to be downloaded at the storage module to a laptop or the storage module would be replaced and brought back to the lab for uploading following procedures in Part D. Section 4.5 of the CDMO Operations Manual. Periodically, sensors on the weather station are inspected for damage or debris. If any is found, it is repaired and/or cleaned. Sensors are removed and sent back to Campbell Scientific for calibration at minimum of every two years. There were no other analyses done on the meteorological data at present.

5) Site location and character:

The Tijuana River NERR is located on the Southern Pacific Coast, next to the California border with Mexico at a latitude of 32 deg. 34 min. N and Longitude of 117 deg. 07 min. W. The area surrounding the 2,531 acre reserve is heavily developed by residential housing as is the watershed which drains into the estuary. Approximately 2/3 of the watershed is in Mexico and is subject to periodic raw sewage outflows. The North Eastern section of is bordered by a military helicopter training base. Vegetation in the area is dominated by common pickleweed (*Spartina virginica*) and Pacific cordgrass (*Spartina foliosa*).

Description of the specific sampling station:

The weather station is located approximately 30m west of the TR NERR Visitor Center at a Latitude of 32deg 34min 28.32sec N and a Longitude of 117deg 07min 37.05sec W. The station is 50m north of the water quality sampling station. The vegetation surrounding the weather station are mainly upland scrub species.

The anemometer, wind direction and Licor sensors are located at the top of a 3.5 meter aluminum tower. The temperature and humidity sensors are located midway up and on the west side of the tower. The Tipping Bucket rain gauge sits on a separate 2 meter high pole located approx. a meter to the west of the main tower. It is above the ground to limit interference from the security fence surrounding the weather station. The sensors were wired to the CR10X following the protocol in the CDMO Manual.

6) Data collection period:

Weather data collection began at the Tidal Linkage station in 1999 and has been operational since. Data was collected for the entire year of 2004.

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 this 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 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.

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 the CDMO Staff 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:

The Tijuana River NERR has a water quality station located at the Tidal Linkage. The principal objective of this study is to record long-term water quality data for the Tijuana Estuary in order to observe any physical changes or trends in water quality both spatially and over time. Additionally, NERR SWMP tier 1 nutrient monitoring is being conducted at the Tidal Linkage station. Dr. Eric Terrell at Scripps Institute of Oceanography has been utilizing the meteorological data as ancillary data for a met station they have located on the Imperial beach pier.

II. Physical Structure Descriptors

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

Parameter: LI-COR Quantum Sensor

Units: mmol m⁻² (total flux)

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

Model#: LI190SA

Serial#: Q9301

Light spectrum waveband: 400 to 700 nm

Temperature dependence: 0.15% per °C maximum

Stability: <±2% change over 1 yr

Operating Temperature: -40°C to 65°C; Humidity: 0 to 100%

Sensitivity: typically 5 µA per 1000 µmol s⁻¹ m⁻²

Date of last calibration: 09/11/2003

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 05103-5 Wind Monitor

Range: 0-60 m/s (130 mph); gust survival 100 m/s (220 mph)

Accuracy: +/- 2%

Date of last calibration: 09/03/2003

Parameter: Wind direction

Units: degrees

Sensor type: balanced vane, 38 cm turning radius

Model#: R.M. Young 05103-5 Wind Monitor

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

Accuracy: +/- 5%

Date of last calibration: 09/03/2003

Parameter: Temperature and Relative Humidity

Model#: HMP35C
Serial#: R2720004
Operating Temperature: -35 to +50°C
Temperature Measurement Range: -35 to +50°C
Temperature Accuracy: ± 0.2 °C (0-60°C)
Relative Humidity Operating Temperature: -20 to +60°C
Relative Humidity Measurement Range: 0 - 100% non-condensing
RH Accuracy: $\pm 2\%$ RH (0-90%) and $\pm 3\%$ (90-100%)
Date of last calibration: May 2001
Dates in service: 01/01/2004 – 02/10/2004

Parameter: Temperature and Relative Humidity
Model#: HMP45AC
Serial#: Y4410095
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: $\pm 2\%$ RH (0-90%) and $\pm 3\%$ (90-100%)
Date of last calibration: October 2003
Dates in service: 02/10/2004 – 12/31/2004

Parameter: Barometric Pressure
Model#: PTB101B
Serial#: P4830024
Operating Temperature: -40 to +60C
Pressure Measurement Range: 600-1060 mb
Humidity: non-condensing
Accuracy: ± 0.5 to 6.0 mb (+20-60C)
Stability: ± 0.1 mb per year
Date of Last calibration: June 2001
Dates in service: 01/01/2004 – 05/21/2004

Parameter: Barometric Pressure
Model#: BTB101B
Serial#: Y3420009
Operating Temperature: -40 to +60C
Pressure Measurement Range: 600-1060 mb
Humidity: non-condensing
Accuracy: ± 0.5 to 6.0 mb (+20-60C)
Stability: ± 0.1 mb per year
Date of last calibration: June 2003
Dates in service: 05/21/2004 – 12/31/2004

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: $\pm 1.0\%$ 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: June 2001

10) Coded variable indicator and variable code definitions:

Site definitions: TL = Tidal Linkage

11) Anomalous data/suspect 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 2004

a) Relative Humidity data greater than 100% have been observed; these data are within range of the sensor accuracy of +/-3%. These data have been retained.

b) Negative PAR data have been observed during the night; small negative values are within range of the sensor and are due to normal errors in the sensor and the CR10X Datalogger. The Maximum signal noise error for the Licor sensor is +/- 2.214 mmoles/m² over a 15 minute interval. These data have been retained.

c) From 03/07/2004 to 03/08/2004 and from 03/28/2004 to 03/29/2004 higher than average air temperature values were recorded which were inconsistent with surrounding data set. The data are consistent with an ancillary station located ¼ mile away so were not deleted.

February 2004

a) Negative PAR data have been observed during the night; small negative values are within range of the sensor and are due to normal errors in the sensor and the CR10X Datalogger. The Maximum signal noise error for the Licor sensor is +/- 2.214 mmoles/m² over a 15 minute interval. These data have been retained.

b) Storm events during the month resulted in increased precipitation, and wind speed values and lower than average temperatures

March 2004

a) Negative PAR data have been observed during the night; small negative values are within range of the sensor and are due to normal errors in the sensor and the CR10X Datalogger. The Maximum signal noise error for the Licor sensor is +/- 2.214 mmoles/m² over a 15 minute interval. These data have been retained.

b) On the following date and time total precipitation for a 15 minute period was greater than 5 millimeters. The data appear to be correct so were not removed.

DATE	TIME	TotPrcp
03/02/2004	03:15	06.6

April 2004

a) Negative PAR data have been observed during the night; small negative values are within range of the sensor and are due to normal errors in the sensor and the CR10X Datalogger. The Maximum signal noise error for the Licor sensor is +/- 2.214 mmoles/m² over a 15 minute interval. These data have been retained.

b) On the following date and time total precipitation for a 15 minute period was greater than 5 millimeters. The data appear to be correct so were not removed.

DATE	TIME	TotPrcp
4/1/2004	23:45	5.3

May 2004

a) From 05/02/2004 to 05/03/2004 higher than average air temperature values were recorded which were inconsistent with surrounding data set. The data are consistent with an ancillary station located ¼ mile away so were not deleted.

June 2004

No anomalous data.

July 2004

No anomalous data.

August 2004

No anomalous data.

September 2004

a) Negative PAR data have been observed during the night; small negative values are within range of the sensor and are due to normal errors in the sensor and the CR10X Datalogger. The Maximum signal noise error for the Licor sensor is +/- 2.214 mmoles/m² over a 15 minute interval. These data have been retained.

b) From 09/05/2004 to 09/22/2004 higher than average air temperature values were recorded. The data are consistent with an ancillary station located ¼ mile away so were not deleted.

October 2004

a) Negative PAR data have been observed during the night; small negative values are within range of the sensor and are due to normal errors in the sensor and the CR10X Datalogger. The Maximum signal noise error for the Licor sensor is +/- 2.214 mmoles/m² over a 15 minute interval. These data have been retained.

b) On the following date and time total precipitation for a 15 minute period was greater than 5 millimeters. The data appear to be correct so were not removed.

DATE	TIME	TotPrcp
10/27/2004	3:30	11.2

c) Storm events beginning 10/18/2004 resulted in increased precipitation, and wind speed values and lower than average temperatures

November 2004

a) Negative PAR data have been observed during the night; small negative values are within range of the sensor and are due to normal errors in the sensor and the CR10X Datalogger. The Maximum signal noise error for the Licor sensor is +/- 2.214 mmoles/m² over a 15 minute interval. These data have been retained.

b) Storm events during the month resulted in increased precipitation, and wind speed values and lower than average temperatures

December 2004

a) Negative PAR data have been observed during the night; small negative values are within range of the sensor and are due to normal errors in the sensor and the CR10X Datalogger. The Maximum signal noise error for the Licor sensor is +/- 2.214 mmoles/m² over a 15 minute interval. These data have been retained.

b) On the following date and time total precipitation for a 15 minute period was greater than 5 millimeters. The data appear to be correct so were not removed.

DATE	TIME	TotPrcp
12/29/2004	3:00	5.8

c) Storm events during the month resulted in increased precipitation, and wind speed values and lower than average temperatures

12) Deleted 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 2004

No data were deleted

February 2004

a) Total par values on the following date and times were deleted due to replacement of the sensor holder:

02/10/2004 11:30 to 12:15 the 15 minute (array 15) values were deleted.

02/10/2004 12:00 to 13:00 the 60 minute (array 60) values were deleted.

02/10/2004 24:00 the 24 hour (array 144) values were deleted.

b) Air temperature, max air temperature, max air temperature time, min air temperature, min air temperature time, relative humidity, max relative humidity, max relative humidity time, min relative humidity, min relative humidity time were deleted on the following date and times. The Vaisala model HMP35C temperature/relative humidity sensor was upgraded to the Vaisala model HMP45C sensor.

02/10/2004 14:15 to 14:45 the 15 minute (array 15) values were deleted.

02/10/2004 15:00 the 60 minute (array 60) values were deleted.

02/10/2004 24:00 the 24 hour (array 144) values were deleted.

March 2004

c) On 03/18/2004 at 14:15 the cr10x program was reloaded for testing with a hardwired ysi water quality datalogger so all parameters were deleted for the 15 minute array at 14:15, the 60 min array at 15:00 and the 24 hour array at 24:00 on that date.

April 2004

No data were deleted

May 2004

a) Barometric pressure, max barometric pressure, max barometric pressure time, min barometric pressure, min barometric pressure time were deleted on the following date and times. A new barometric pressure sensor was installed in order to calibrate the old one. The new sensor was installed with the circuit board jumper off which caused erroneously low values which necessitated deletion of data during the times the jumper was not in place.

05/21/2004 12:00 to 13:00 the 15 minute (array 15) values were deleted.

05/21/2004 13:00 the 60 minute (array 60) values were deleted.

05/21/2004 24:00 the 24 hour (array 144) values were deleted.

June 2004

No data were deleted.

July 2004

No data were deleted.

August 2004

No data were deleted.

September 2004

No data were deleted.

October 2004

No data were deleted.

November 2004

No data were deleted.

December 2004

No data were deleted.

13) 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.

Missing data are denoted by a blank in the data set. Data are missing due to equipment failure or power loss, where no sensors were deployed, for maintenance or calibration of equipment, elimination of obvious outliers or elimination of data due to calibration problems. For more details on deleted data, see the Anomalous Data/Suspect Data section. To find out more details about missing data, contact the Research Coordinator at the site submitting the data.

January 2004: Data are missing from 1/15/04 at 1430 to 02/01/04 at 0445. Due to conflicts with the telemetry system setup and our PC208 near realtime data collection as well as an increased memory need for the new CR10x program caused a memory overwrite on the CR10x before the manual download took place.

September 2004: Data are missing on 9/22 at 1030, MaxRH- AvgVolts are missing due to an overwrite– it was a glitch in the way the communication software was working.

14. Other remarks

On 10/15/2023 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.