**Tijuana River (TR) NERR Meteorological Metadata**

**January – December 2021**

**Latest Update: 2/1/2023**

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@baruch.sc.edu) or reserve with any additional questions.

**I. Data Set & Research Descriptors**

**1) Principal investigator(s) & 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. Justin McCullough is responsible for all data management.

**3) Research objectives**:

The Tijuana River National Estuarine Research Reserve (TRNERR) represents the largest, most intact coastal marsh system remaining in Southern California. It has contiguous beach, dune, tidal channel, mudflat, marsh, transitional, and upland habitat. It is also home to numerous threatened and endangered species. Because of its highly urbanized setting, situated between the cities of Tijuana, Baja California, Mexico, and San Diego, California, USA, it is heavily impacted. A primary management issue is transboundary flows of the Tijuana River, which convey anthropogenic pollutants (primarily associated with partially-treated and untreated wastewater), nutrients, and sediment. The principal objective is to record long-term and episodic meteorological data for the Tijuana River Estuary in order to observe any environmental changes or trends over time. Data are also used as corollary information in ongoing biological, hydrological and geographical studies being conducted at the reserve. Of particular management interest is rainfall, which can trigger large flow events in the Tijuana River.

**4) Research Methods**

A model CR1000 Campbell Scientific datalogger samples meteorological sensors every 5 seconds. At 15 minute intervals, averages, totals, or instantaneous readings are taken, depending upon sensor type, and written to a storage table on the CR1000. Data are reported in Pacific Standard Time (PST).

Monthly, 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 one to two years, depending on the sensor.

Campbell Scientific data telemetry equipment was installed at the Tidal Linkage station on 06/12/2006 and transmits data to the NOAA GOES satellite, NESDIS ID #3B01468A. The transmissions are scheduled hourly and contain four (4) data sets reflecting fifteen minute data sampling intervals. Upon receipt by the CDMO, the data undergoes the same automated primary QAQC process detailed in Section 2 above. The “real-time” telemetry data become 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), and Battery Voltage (volts)

-Maximum and Minimum Air Temperature (°C) and 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) from 5-second data

-Totals:

Precipitation (mm), PAR (millimoles/m2), 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 - every 2 years factory maintenance

-Barometric Pressure - every 2 years recalibration

-Photosynthetically Active Radiation (PAR) - Apogee Quantum Sensor - every 2 years recalibration

-CR1000 - every 5 years (required beginning 2014, one year initial grace period)

**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 32º34’N and longitude of 117º07’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 two-thirds of the watershed resides in Mexico and is subject to periodic raw sewage outflows. The northeastern section is bordered by a military helicopter training base. Vegetation in the area is dominated by common pickleweed (*Salicornia pacifica*) and Pacific cordgrass (*Spartina foliosa*).

Description of the specific sampling station:

The weather station is located approximately 30m west of the TRNERR Visitor Center at a latitude of 32º34’28.5”N and longitude of 117º07’37.3”W. The station is about 800m northeast of the water quality sampling station at Oneonta Slough. The vegetation surrounding the weather station is mainly upland scrub species.

The anemometer, wind direction and PAR sensors are located at the top of a 3.5m aluminum tower. The temperature and humidity sensors are located midway up (~1.75m) and on the west side of the tower. The barometric pressure sensor is mounted in the CR1000 enclosure at a height of 1.5m. The Tipping Bucket rain gauge (relocated in 2014) is attached to the fence 2.4 meters to the south-southwest of the main tower. It is 2m above the ground to limit interference from the security fence surrounding the weather station. The sensors were wired to the CR1000 following the protocol in the CDMO Manual.

SWMP Station Timeline:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Station Code | SWMP Status | Station Name | Location | Active Dates | Reason Decommissioned | Notes |
| TL | Primary | Tidal Linkage | 32º34’28.5”N  117º07’37.3”W | Jan 2001 - present | N/A | None |

**6) Data collection Period**

Data was collected for all parameters at the station from 01/01/2021 00:00 and continued through 12/31/2021 23:45.

|  |  |
| --- | --- |
| **File Start Date and Time** | **File End Date and Time** |
| **12/21/2021 14:45** | **01/17/2022 12:15** |
| **01/17/2022 12:30** | **02/16/2022 14:45** |
| **02/16/2022 15:00** | **03/15/2022 11:30** |
| **03/15/2022 11:45** | **04/13/2022 14:30** |
| **04/13/2022 14:45** | **05/17/2022 14:45** |
| **05/17/2022 14:45** | **06/22/2022 10:15** |
| **06/22/2022 10:30** | **07/13/2022 14:00** |
| **07/13/2022 14:15** | **08/17/2022 10:45** |
| **08/17/2022 11:00** | **09/28/2022 11:00** |
| **09/28/2022 11:15** | **10/13/2022 12:45** |
| **10/13/2022 13:00** | **11/17/2022 14:45** |
| **11/17/2022 15:00** | **12/15/2022 12:45** |
| **12/15/2022 13:00** | **01/19/2023 14:15** |

**7) Distribution**

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 2022

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**

The meteorological station is part of the NERRS System Wide Monitoring Program (SWMP) that also includes data collection for water quality using YSI data loggers for in situ measurements (temperature, salinity, dissolved oxygen, turbidity, pH and water depth) and collecting monthly grab and diel water samples to analyze nutrient/pigment contents (orthophosphate, ammonium, nitrate/nitrite, chlorophyll) in the laboratory. These data may be correlated with this meteorological dataset and are available at www.nerrsdata.org.

**II. Physical Structure Descriptors**

**9) Sensor specifications**

**Photosynthetically Active Radiation (PAR) Apogee Quantum Sensor**

Units: mmoles/m2 (total flux)

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

Model#: SQ-110

Light spectrum waveband: 410 to 655 nm

Temperature dependence: .06± .06% per °C

Stability: ± 2% change over 1 yr

Operating Temperature: -40°C to 70°C; Humidity: 0 to 100%

Sensitivity: 0.2 mV per µmol m-2 s-1

Multiplier: 0.025

Serial#: 18025

Date of last calibration: March 2021

Dates in service: 04/20/2021 – present

**Wind speed**

Units: meter per second (m/s)

Sensor type: 18 cm diameter 4-blade helicoids propeller molded of polypropylene

Model#: R.M. Young 05106 Wind Monitor - Marine

Range: 0-100 m/s (224 mph)

Accuracy: ± 1%

Serial#: WM 150921

Date of last factory calibration: November 11, 2020

Dates in service: 12/15/2020 – present

**Wind direction**

Units: degrees

Sensor type: balanced vane, 38 cm turning radius

Model#: R.M. Young 05106 Wind Monitor - Marine

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

Accuracy: ± 3°

Serial#: WM 150921

Date of last factory calibration: November 11, 2020

Dates in service: 12/15/2020 – present

**Temperature and Relative Humidity**

Units: degrees Celsius (°C) and percent (%)

Model#: HC2S3

Operating Temperature: -40 to +100°C

Temperature Measurement Range: -40 to +60°C

Temperature Accuracy: ± 0.1°C (@23°C)

Long-term Temperature Stability: <.1°C/year

Relative Humidity Measurement Range: 0-100% non-condensing

RH Accuracy: ± 0.8% RH (@23°C)

Long-term RH Stability: <1% RH/year

Serial#: 20002606

Date of last calibration: 04/30/2021

Dates in service: 05/18/2021 – 05/17/2022

Model#: EE181-M1A1

Operating Temperature: -40 to +60°C

Temperature Measurement Range: -40 to +60°C

Temperature Accuracy: ± 0.2°C (@23°C)

Relative Humidity Measurement Range: 0-100% non-condensing

RH Accuracy:

± (1.3 + 0.003 • RH reading) % RH (at -15° to +40°C, 0 to 90% RH)

± 2.3% RH (at -15° to +40°C, 90 to 100% RH)

± (1.4 + 0.01 • RH reading) % RH (at -25° to +60°C)

± (1.5 + 0.015 • RH reading) % RH (at -40° to +60°C)

Serial#: 21091600204263

Date of last calibration: 11/03/2021

Dates in service: 05/17/2022 – present

**Barometric Pressure**

Units: millibars (mbar)

Model#: PTB110

Operating Temperature: -40 to +60C

Pressure Measurement Range: 600-1060 mb

Humidity: non-condensing

Accuracy: ±0.3 mb at +20 °C

Stability: ± 0.1 mb per year

Serial#: K1040006

Date of Last calibration: 02/28/2020

Dates in service: 05/12/2020 – 05/17/2022

Serial#: L3220432

Date of Last calibration: 02/14/2022

Dates in service: 05/18/2022 – present

**Precipitation**

Units: millimeters (mm)

Sensor type: Tipping Bucket Rain Gauge

Model#: TR-525UWS

Rainfall per tip: 0.01 inch

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

Accuracy: +/- 1.0% up to 2 in/hr

Serial#: 59850-514

Dates of calibration: July 15, 2015; July 15, 2016; July 26, 2017; July 16, 2018, August 2, 2019, July 10, 2020, August 2, 2021

Dates in service: 07/24/2015 – 02/07/2022

Model#: TR-525-U-01

Rainfall per tip: 0.01 inch

Operating range: Temperature: 0 to 70°C; Humidity: 0 to 100%

Accuracy: +/- 1.0% up to 2 in/hr

Serial#: 89520-0122

Dates of calibration: February 7, 2022; August 30, 2022

Dates in service: 02/07/2022– present

**Datalogger**

Model: CR1000

Specs: The CR1000 has a 2MB Flash EEPROM that is used to store the Operating System. Another 128K Flash is used to store configuration settings. A minimum of 2MB SRAM (4MB 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.

CR1000 firmware/OS version: cr1000.Std.32.04; updated when calibrated 01/07/2015

CR1000 Program Versions: tjrtlmet\_CR1000\_6.2\_022015.cr1

Serial#: 5478

Date of Calibration: 12/13/2019

Dates in service: 01/10/2020 – present

**10) Coded variable definitions**

Sampling station: Sampling site code: Station code:

Tidal Linkage TL tjrtlmet

**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, respectively.

-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.

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.**

All periods where sensor values deviated noticeably from the rest of the data set, e.g. periods of high or low temperature, low barometric pressure etc., were evaluated against data from nearby weather stations and also compared to local daily analog measurements when available. All such periods were found to be comparable with the ancillary data, unless noted otherwise, below.

Additional Flagging Notes:

After the monthly maintenance on **12/21/2021**, one of the tipping bucket rain gauge’s wires was inadvertently left unplugged, resulting in all tips not being recorded. The data was corrected to be missing **<-2>**. Data from two nearby rain gauges (www.wunderground.com) are shown below for the period **12/21/2021 – 1/17/2022.** The tipping bucket was activated at **12:30 1/17/2022** as a test. This data point was rejected <-3> and **CumPrcp** data from **1/17/2022 12:30** to **1/18/2022 00:00** werecorrected and flagged accordingly, **<5>**.

|  |  |  |
| --- | --- | --- |
| KCAIMPER28 |  | KCAIMPER32 |
| 0.57 | 12/23/21 | 0.60 |
| 0.28 | 12/24/21 | 0.27 |
| 0.13 | 12/25/21 | 0.09 |
| 0.01 | 12/26/21 | 0.01 |
| 0.03 | 12/27/21 | 0.03 |
| 0.20 | 12/28/21 | 0.09 |
| 0.14 | 12/29/21 | 0.08 |
| 0.02 | 12/31/21 | 0.01 |
| 0.05 | 1/15/22 | 0.05 |

In December 2021, telemetry began to dropout. Initially, the GPS was replaced, which appeared to fix the problem. Dropouts again occurred days later. Troublshooting the issue took place multiple times over the next few months as each event appeared to fix the problem for a couple of weeks before failing again. Troublshooting took place during the following time frames, during which power was disconnected that resulted in missing **<-2>** and rejected **<-3>[SMT](CSM**) data:

**1/26/2022 13:30 - 13:56 3/2/2022 13:46 – 14:26**

**1/31/2022 14:25 - 14:40 3/3/2022 15:06 – 15:25**

**2/16/2022 13:46 – 14:40 4/13/2022 14:08 – 14:31**

The wind set was completely wiped down and cleaned during monthly maintenance. **WSpd**, **Wdir**, and **SDWDir** were all rejected **<-3>[SMT](CSM)** at **5/17/2022 13:15**.

**Temp** and **rH** were rejected **<-3>[SQR](CSM)** because there was an anomalously low minimum temperature at **5/17/2022 13:30**. **BP** was also rejected **<-3>[SMT](CSM)** at this time as it was swapped for a newly calibrated sensor at 13:24.

The entire system was powered down between 14:02 and 14:34 on 5/17/2022, during which the temp/rh probe was swapped for a newly calibrated probe. This resulted in missing data **<-2>** at **5/17/2022 14:14 – 14:30** and rejected data **<-3>[GPD][CSM)** of all parameters except **TotPrcp** and **CumPrcp** at **5/17/2022 14:45**.

The wind set was completely wiped down and cleaned during monthly maintenance. **WSpd**, **Wdir**, and **SDWDir** were all rejected **<-3>[SMT](CSM)** at **6/22/2022 10:15**.

During grounds maintenance on 7/27/2022, the tipping bucket rain gauge’s wire was severed. During the repair, the wiring tripped the logger into recording a very large number of tips. **TotPrcp** at **7/27/2022** **13:45 – 14:00** and **CumPrcp** at **7/27/2022 13:45 – 7/28/2022 00:00** were rejected **<-3> [SMT] (CSM)**. Rewiring occurred again the next day to reposition the rain gauge. **TotPrcp** at **7/28/2022** **9:15 – 10:15** and **11:00 – 11:15** and **CumPrcp** at **7/27/2022 9:15 – 7/29/2022 00:00** were rejected **<-3> [SMT] (CSM)**.

**TotPrcp** data at **8/30/2022 9:00** and **14:30** and **CumPrcp** for **8/30/2022 9:00 – 8/31/2022 00:00** were rejected **<-3> [SQR] (CSM)** during the QAQC process as this rain event could not be confirmed by nearby weather stations and it is unknown as to why this occurred. It’s possible that maintenance occurred and was just not documented.

It was discovered in early January that the wiring for the tipping bucket rain gauge was damaged, resulting in several rain events not being recorded. These rain events were captured at nearby weather stations (www.wunderground.com) and are presented below. **TotPrcp** and **CumPrcp** from **12/27/2023 00:00** thru **1/12/2023 00:00** are flagged as missing **<-2>(CSM)**.

|  |  |  |
| --- | --- | --- |
| KCAIMPER28 |  | KCAIMPER24 |
| 0.16 | 12/27/22 | 0.10 |
| 0.69 | 12/28/22 | 0.57 |
| 0.02 | 12/31/22 | 0.05 |
| 1.01 | 1/1/23 | 1.12 |
| 0.06 | 1/2/23 | 0.02 |
| 0.10 | 1/3/23 | 0.13 |
| 0.12 | 1/5/23 | 0.22 |
| 0.01 | 1/6/23 | 0.02 |
| 0.38 | 1/10/23 | 0.25 |
| 0.01 | 1/11/23 | 0.01 |

On **1/19/2023** between **12:15** and **14:15**, the **wind** set was being replaced with a newly calibrated set. After the installation, the spinning of the propeller was audible, so the old wind set was reinstalled. This maintenance resulted in the rejection **<-3> [GMT](CSM)** of **WSpd**, **Wdir**, and **SDWDir** for the above time frame.