

Tijuana River (TJR) NERR Meteorological Metadata
January - December 2015
Latest Update: November 14, 2016

I. Data Set & Research Descriptors

1) Principal investigator(s) & contact persons

Jeff Crooks, Research Coordinator	301 Caspian Way Imperial Beach, CA 91932 Phone: (619) 575-3613 Fax: (619) 575-6913 E-mail: jcrooks@tijuanaestuary.org
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Justin McCullough, Research Associate	301 Caspian Way Imperial Beach, CA 91932 Phone: (619) 575-3613 x321 E-mail: jmccullough@trnerr.org
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2) Entry verification

Data are uploaded from the CR1000 data logger to a Personal Computer (IBM compatible). Files are exported from or 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 (Campbell Weather Station):

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.

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.

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 two years. There were no other analyses done on the meteorological data at present.

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>.

Data collection information:

- 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:
 - Maximum and Minimum Air Temperature (°C) (these data are available from the Reserve)
 - Maximum Wind Speed(m/s)
- Wind Direction Standard Deviation (degrees) from 5-second data
- Totals:
 - Precipitation (mm), PAR (millimoles/m2), and Cumulative Precipitation (mm)

Recommended calibration frequency for the MET station sensors:

- Temperature/Humidity- yearly recalibration
- Rain Gauge- yearly recalibration
- Wind Speed/Direction- every 2 years (depending on the sensor)
- Barometric Pressure- every 2 years recalibration
- Photosynthetically Active Radiation (PAR) - Apogee Quantum Sensor - every 2 years
- 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 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 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 TR NERR Visitor Center at a Latitude of 32deg 34min 28.5sec N and a Longitude of 117deg 07min 37.3sec 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 3.5 meter 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.

6) Data collection Period

Data was collected for all parameters at the station from 01/01/2015 00:00 and continued through 12/31/2015 23:45:00.

File Start Date and Time	File End Date and Time
12/15/2014 08:45	01/14/2015 10:15
01/14/2015 10:30	02/24/2015 11:15
02/24/2015 11:30	03/17/2015 15:30
03/17/2015 15:45	04/15/2015 10:45
04/15/2015 11:00	05/18/2015 11:15
05/18/2015 11:30	06/19/2015 13:00
06/19/2015 13:15	07/15/2015 11:45
07/15/2015 12:00	08/17/2015 12:15
08/17/2015 12:30	09/16/2015 13:00
09/16/2015 13:15	10/16/2015 14:45
10/16/2015 15:00	11/16/2015 10:00
11/16/2015 10:15	12/14/2015 10:30
12/14/2015 10:45	01/15/2015 08:45

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 2012.

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 grab samples to analyze nutrient contents (orthophosphate, chlorophyll, ammonia, nitrate/nitrite) in the laboratory.

II. Physical Structure Descriptors

9) Sensor specifications

Parameter: LI-COR Quantum Sensor (Photosynthetically Active Radiation)
Units: mmoles m^{-2} (total flux)
Sensor type: High stability silicon photovoltaic detector (blue enhanced)
Model#: LI190SA
Serial#: Q48068
Light spectrum waveband: 400 to 700 nm
Temperature dependence: 0.15% per $^{\circ}\text{C}$ maximum
Stability: $\leq \pm 2\%$ change over 1 yr
Operating Temperature: -40°C to 65°C ; Humidity: 0 to 100%
Sensitivity: typically 5 μA per 1000 $\mu\text{moles s}^{-1} \text{m}^{-2}$
Multiplier: 1.258
Date of last calibration: June 28, 2012
Dates of sensor use: 03/01/2013 – 02/20/2015 **(note that this sensor and the Apogee SN 12144 have overlapping dates in use. See Section 13 for more information)**

Parameter: Apogee Quantum Sensor (Photosynthetically Active Radiation)
Units: mmoles/m^2 (total flux)
Sensor type: High stability silicon photovoltaic detector (blue enhanced)
Model#: SQ-110
Serial#: 12144
Light spectrum waveband: 410 to 655 nm
Temperature dependence: $.06 \pm .06\%$ per $^{\circ}\text{C}$
Stability: $\pm 2\%$ change over 1 yr
Operating Temperature: -40°C to 70°C ; Humidity: 0 to 100%
Sensitivity: 0.2 mV per $\mu\text{mol m}^{-2} \text{s}^{-1}$
Multiplier: 0.025
Date installed: February 20, 2015
Date of last calibration: November 8, 2012
Dates of sensor use: 04/17/2013 – 04/20/2015 **(note that this sensor and the LiCor SN Q48068 have overlapping service times. See Section 13 for more information)**

Parameter: Apogee Quantum Sensor (Photosynthetically Active Radiation)
Units: mmoles/m^2 (total flux)
Sensor type: High stability silicon photovoltaic detector (blue enhanced)
Model#: SQ-110
Serial#: 18025
Light spectrum waveband: 410 to 655 nm
Temperature dependence: $.06 \pm .06\%$ per $^{\circ}\text{C}$
Stability: $\pm 2\%$ change over 1 yr

Operating Temperature: -40°C to 70°C; Humidity: 0 to 100%
Sensitivity: 0.2 mV per $\mu\text{mol m}^{-2} \text{s}^{-1}$
Multiplier: 0.025
Date installed: February 20, 2015
Date of last calibration: March 18, 2015
Dates of sensor use: 04/20/2015 - current as of 12/31/2015

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: $\pm 2\%$
Date of last factory calibration: September 5, 2014
Dates of sensor use: 09/30/2014 - current as of 12/31/2015

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: $\pm 5\%$
Date of last factory calibration: September 5, 2014
Dates of sensor use: 09/30/2014 - current as of 12/31/2015

Parameter: Temperature and Relative Humidity
Model#: HC2S3
Serial#: 0061217910
Operating Temperature: -40 to +100°C
Temperature Measurement Range: -40 to +60°C
Temperature Accuracy: $\pm 0.1^\circ\text{C}$ (@23°C)
Long-term Temperature Stability: $< .1^\circ\text{C}/\text{year}$
Relative Humidity Measurement Range: 0-100% non-condensing
RH Accuracy: $\pm 0.8\%$ RH (@23°C)
Long-term RH Stability: $< 1\%$ RH/year
Date of last calibration: 9/26/2013
Dates of sensor use: 05/19/2014 - 06/08/2015

Parameter: Temperature and Relative Humidity
Model#: HC2S3
Serial#: 0020002606
Operating Temperature: -40 to +100°C
Temperature Measurement Range: -40 to +60°C
Temperature Accuracy: $\pm 0.1^\circ\text{C}$ (@23°C)
Long-term Temperature Stability: $< .1^\circ\text{C}/\text{year}$
Relative Humidity Measurement Range: 0-100% non-condensing
RH Accuracy: $\pm 0.8\%$ RH (@23°C)
Long-term RH Stability: $< 1\%$ RH/year
Date of last calibration: 9/26/2013
Dates of sensor use: 06/08/2015 - current as of 12/31/2015

Parameter: Barometric Pressure
Model#: PTB110
Serial#: K1040006
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
Date of Last calibration: March 6, 2014
Dates of sensor use: 05/19/2014 - current as of 12/31/2015

Parameter: Precipitation
Serial#: 59850-514
Model#: TR-525UWS
Units: millimeters (mm)
Sensor type: Tipping Bucket Rain Gauge
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
Previous calibration and in service: July 15, 2014; 07/24/2014 - 7/24/2015
Date of last calibration: July 15, 2015
Dates of sensor use since calibration: 07/15/2015 - current as of 12/31/2015

Datalogger:
Model: CR1000
Serial#: 005478
Specs: The CR1000 has two MB Flash EEPROM that is used to store the Operating System. 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.
Dates in service: 7/12/2006 - 01/15/2015
CR1000 firmware/OS version: cr1000.Std.21
CR1000 Program Versions: TJRTLMET_5.5_20140519.CR1, TJRTLMET_6_20140612a.CR1, TJRTLMET_6_20140612b.CR1, TJRTLMET_6_20141016.CR1

Datalogger:
Model: CR1000
Serial#: 22371
Specs: The CR1000 has two MB Flash EEPROM that is used to store the Operating System. 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 of Calibration: 01/07/2015
Dates of sensor use: 01/15/2015 - current as of 12/31/2015

CR1000 firmware/OS version: cr1000.Std.21
CR1000 Program Versions: TJRTLMET_6_20141016.CR1, TJRTLMET_6_20150220.CR1

10) Coded variable definitions

Sampling station:	Sampling site code:	Station code:
Tidal Linkage	TL	tjrtlmnet

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%.

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 (Ream Field NALF and Imperial Beach pier) and also compared to local daily analog measurements when available. All such periods were found to be comparable with the ancillary data.

Due to sensor drift, PAR data collected from 01/01/2015 00:00 - 01/15/2015 12:45 with the LiCor sensor (Q48068) were replaced with PAR data collected by the Apogee PAR sensor (SN 12144) that was installed during the same time period. These data are flagged and coded as <0> CSM. Both data sets are available from the Reserve.

Rejected PAR Data from 01/15/2015 15:00 - 02/20/2015 10:15: Data for these dates and times were collected with the LiCor sensor (SN Q48068); data collected with an Apogee sensor are not available to replace these. Due to the dip in values, these PAR data were rejected, <-3> CSM. The CR1000 program was changed to output Apogee data instead of LiCor data on 02/20/2015. Following the program reload, all PAR data from 02/20/2015 11:00 until the sensor swap to another more recently calibrated Apogee (SN 18025) on 04/20/2015 09:45 were collected using the Apogee SN 12144 sensor (this is a best estimate of sensor swap time since the exact time was not recorded). Those data are coded as CSM while PAR data on 04/20/2015 09:45 were rejected.

Rejected CumPrctp 01/12/2015 08:15 - 22:45 and 01/13/2015 07:30 - 01/14/2015 00:00: Data were rejected. These values were rejected since cumulative precipitation values are not considered accurate due to missing chunks of data.

Data are missing 01/15/2015 13:00 - 14:30 due to a logger swap to replace the CR1000 with a recently calibrated logger. There was also a firmware update at 14:40 where CR1000.Std.21 was updated to CR1000.Std.27.05. Data at 14:45 were rejected since those were not a full 15 minutes of 5-second data.

Rejected data 01/27/2015 05:00: Program reload with edits to site specific data tables.

Missing and rejected data 02/20/2015 10:30 - 10:45: Program reload resulted in missing data for 15 minute averages and totals.

Rejected data 02/21/2015 10:15: Program reload with edits to site specific data tables.

Missing and rejected data due to what appears to be intermittent battery failures. Data following the gaps were rejected due to not being a full 15 minutes of 5-second data. The battery was replaced on 3/11/2015.

01/04/2015 01:00 - 01/04/2015 08:30, rejected 08:45
01/04/2015 18:00 - 01/05/2015 08:30, rejected 08:45
01/05/2015 21:00 - 01/06/2015 07:30, rejected 07:45
01/11/2015 23:00 - 01/12/2015 08:00, rejected 08:15
01/12/2015 23:00 - 01/13/2015 07:15, rejected 07:30
01/27/2015 06:00 - 06:15, rejected 06:30
02/07/2015 00:00 - 08:00, rejected 08:15
02/07/2015 20:00 - 02/08/2015 08:15, rejected 08:30
02/08/2015 22:00 - 02/09/2015 07:30 and 08:00, rejected 07:45 and 08:15
02/20/2015 05:00 - 07:30, rejected 07:45
02/21/2015 01:00 - 10:00, rejected 10:15
02/24/2015 20:00 - 02/25/2015 08:15, rejected 08:30
02/26/2015 05:00 - 06:45, rejected 07:00
03/02/2015 05:00 - 05:15 and 06:00 - 06:30, rejected 05:30 and 06:45
03/05/2015 23:00 - 03/06/2015 07:00 and 08:00 - 08:15, rejected 07:15 and 08:30
03/06/2015 20:00 - 03/07/2015 08:15, rejected 08:30
03/08/2015 22:00 - 03/09/2015 07:45, rejected 08:00
03/09/2015 15:00 - 03/10/2015 07:15 and 07:45 - 08:15, rejected 07:30 and 08:30

Missing and rejected data on 03/11/2015 at 12:15 and 12:30: Maintenance to replace the battery that may have been causing nighttime power failures.

Rejected Temp/RH 06/08/2015 13:15: Installed Temp/RH probe. BP values were also affected by this swap and were rejected.

Rejected TotPrcp and CumPrcp 07/15/2015 15:15: Calibrated and installed tipping bucket rain gauge, tipped bucket as test. CumPrcp rejected through the end of the day (07/16/2015 00:00)

In late June 2015, it was noticed that data was not being telemetered at night. On numerous occasions, troubleshooting occurred, resulting in intermittent loss of power. During such times, the data would have been compromised (averages and totals would not be complete), therefore, the following dates and times were missing/rejected:

06/22/2015 10:45 - 11:30
08/24/2015 11:15 - 13:45
08/25/2015 08:30 - 09:00
08/27/2015 09:15 - 09:45
09/01/2015 11:00 - 12:30

The following time stamps recorded a large negative **MinTemp** value and, therefore, the **ATemp** and **RH** values were rejected (SQR):

06/08/2015 09:00	08/14/2015 23:30	11/23/2015 21:30
06/23/2015 19:15	08/18/2015 01:30	11/24/2015 18:45
07/10/2015 12:30	08/26/2015 16:15	11/25/2015 13:00
07/17/2015 20:00	09/04/2015 10:30	11/27/2015 18:15
07/26/2015 00:45	09/14/2015 13:30	
08/08/2015 02:45	10/21/2015 06:15	