

Reserve Name (HUD) NERR Meteorological Metadata
January 1st – Dec 31st
Latest Update: October 13, 2022

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons –

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2) Entry verification –

Data are uploaded from the CR1000/CR1000X 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.

The Research Assistant is responsible for data verification.

3) Research objectives –

The objective of this study is to monitor the meteorological conditions at the Tivoli Bays component site of the Hudson River National Estuarine Research Reserve. Measurements of air temperature, relative humidity, barometric pressure, precipitation, photosynthetically active radiation, and wind speed and direction are taken throughout the year at the Tivoli Bays Field Station. A water quality-monitoring program has been ongoing since 1991 at this component site, and the

meteorological data will help provide ancillary data. This will help us to better understand the relationships between the atmospheric conditions and aquatic environments at this site.

In 2018, a “secondary SWMP” meteorological monitoring station was incorporated into the reserve. This station will provide a secondary source of the above mentioned protocol and parameters in the vicinity around the Norrie Point Environmental Center which is home to HRNERR offices. This station will provide supplemental data in conjunction with a newly established water quality station at the same location. The station has been operational since 2008 and historical data is available upon request. **Secondary SWMP stations do not undergo tertiary review.**

4) Research methods –

Campbell Scientific data telemetry equipment was installed at the Field Station (FS) station on 11/14/2005 and transmits data to the NOAA GOES satellite, NESDIS ID #3B00B4F4. Identical telemetry equipment is installed at the Norrie Point (NP) monitoring station which transmits data to the NOAA GOES satellite, NESDIS ID # 3B01301A. 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 are collected in Eastern Standard Time (EST) for the entire year.

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 and Minimum Air Temperature (°C) 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/m²), and Cumulative Precipitation (mm)

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/CR1000X- every 5 years (required beginning 2014, one year initial grace period)

5) Site location and character –

The Hudson River National Estuarine Research Reserve (HUDNERR) is a multi-component site totaling approximately 5,000 acres. Each component of the reserve is referenced by River Mile (RM) of the Hudson River in New York State proceeding north from the southern tip of Manhattan (RM 0). The reserve includes the following four component sites: Piermont Marsh, Rockland County (RM 24)(41°02'30"N 73°54'15"W), Iona Island, Rockland County (RM 45)(41°18'15"N 73°58'45"W), Tivoli Bays, Dutchess County (RM 98)(42°02'15"N 73°55'10"W), and Stockport Flats, Columbia County (RM 124)(42°02'30"N 73°46'00"W). The Reserve sites are managed at the Norrie Point Environmental Center, the headquarters for the Reserve, in Staatsburg NY, Dutchess County (41°49'53"N, 73°56'32"W). The four component sites include open water, tidal wetland, and adjacent upland buffer habitats and are representative of the diverse plant and animal communities that occupy the salinity gradient within the Hudson River Estuary. Development within the watersheds of the four component sites ranges from predominantly urban/suburban to forested/agricultural.

The weather station (FS) is located at the Tivoli Bays component site in Annandale, NY (42°01'05.46"N 73°55'01.13"W). A 30 foot (9.1m), aluminum tower is used to elevate some of the weather monitoring equipment. The tower is on the deck of an office building, on the west side, 9 feet (2.7m) off the ground. The wind anemometer, wind speed, and light sensors are located at the top of the tower, 39 feet (11.9m) off the ground. The datalogger and the barometric pressure sensor are enclosed within a fiberglass case attached to the tower, 12 feet (3.7m) off the ground. A heated rain gauge is next to the tower, attached to the building, 16 feet (4.9m) off the ground. The temperature/humidity sensor is next to the tower, attached to the deck handrail, 12 feet (3.7m) off the ground. GOES telemetry equipment includes a larger solar panel and battery, a larger enclosure to house the battery, a Campbell TX-312 transmitter, associated GPS for time synchronization and a Yagi antenna.

Although trees surround the area, the tree line begins approximately 60 feet (18.3m) from the tower in most directions. In past years the trees were at similar heights to the tower, but the sensors were not shaded at the location. However in recent years the surrounding forest canopy height has increased possibly leading to a decline in the accuracy of wind data during leaf-in months (typically May to October). The tower is approximately 1.2 miles (1.9km) southeast of the Tivoli South Bay water quality monitoring station, 2.3 miles (3.7km) southeast of the Tivoli North Bay water quality monitoring station, and 0.2 miles (0.3km) northwest of the Saw Kill Creek water quality monitoring station.

The NP weather station is located at the Norrie Point Environmental Center, the HRNERR headquarters in Staatsburg, NY (41°49'53"N, 73°56'32"W). A 30 foot (9.1m), aluminum tower is used to elevate all of the weather monitoring equipment. The tower is anchored to the concrete patio, south of the HRNERR offices. It is situated directly adjacent (2 meters) to the Hudson River. The wind anemometer and wind speed sensors are located at the top of the tower, 30 feet (9.1m) off the ground. The datalogger and the barometric pressure sensor are enclosed within a fiberglass case attached to the tower, 6 feet (1.8m) off the ground. A heated rain gauge is attached to the tower, 8 feet(2.4m) off the ground. The temperature/humidity sensor is attached to the tower, 10 feet(3.0m) off the ground. A light sensor is attached to an arm protruding from the tower 12 feet (3.7m) off the ground. GOES telemetry equipment includes a larger solar panel and battery, a larger enclosure to house the battery, a Campbell TX-312 transmitter, associated GPS for time synchronization and a Yagi antenna. The station is surrounded by the Hudson River in all directions but Northeast. The tower is located approximately 60 feet(18.3) from the building, which should minimize any impact from the structure.

SWMP Station Timeline

Station Code	SWMP Status	Station Name	Location	Active Dates	Reason Decommissioned	Notes
FS	P	Field Station	(42°01'05.46"N 73°55'01.13"W)	July 1999-present	NA	NA
NP	S	Norrie Point	(41°49'53"N 73°56'32"W)	Secondary SWMP January 1, 2018 - Present		Non-SWMP May 7, 2008 - December 31 2017

6) Data collection period –

Weather data have been collected at the Field Station at Tivoli Bays since July 1999. The Norrie Point station became secondary SWMP in January 2018. Weather data provided in this document were collected between 01/01/2020 at 00:00 through 12/31/20 at 23:45.

Data Retrieval intervals were as follows:

FS

12/11/2019 @ 13:45	01/29/2020 @ 14:30
01/29/2020 @ 14:45	03/03/20 @ 11:00
03/03/2020 @ 11:15	04/28/2020 @ 09:15
04/28/2020 @ 09:45	07/01/2020 @ 10:00
07/01/2020 @ 10:15	08/03/2020 @ 10:15
08/03/2020 @ 10:30	10/01/2020 @ 12:00
10/01/2020 @ 12:30	12/30/2020 @ 11:15
12/30/2020 @ 11:30	01/22/2021 @ 10:45

NP

12/10/2019 @ 13:30	01/29/2020 @ 10:00
01/29/2020 @ 10:15	02/11/2020 @ 10:00
02/11/2020 @ 11:15	02/24/2020 @ 13:15
02/12/2020 @ 15:15	02/13/2020 @ 13:15
02/24/2020 @ 13:45	03/30/2020 @ 10:00
03/30/2020 @ 10:15	06/01/2020 @ 08:30
06/01/2020 @ 08:45	06/29/2020 @ 12:45
06/29/2020 @ 13:00	08/12/2020 @ 11:45
08/12/2020 @ 12:00	09/14/2020 @ 09:45
09/14/2020 @ 10:00	10/06/2020 @ 10:45
10/06/2020 @ 11:00	12/01/2020 @ 10:30
12/1/2020 @ 10:45	12/24/2020 @ 15:00
12/24/2020 @ 15:15	03/05/2021 @ 11:00

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 processed 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 2020.

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, HUD NERR also monitors 15-minute water quality along with monthly grab samples and diel sampling for nutrient data 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: Campbell Scientific 1000 Ω Platinum Resistance Thermometer

Model #: EE-181-L Temperature and Relative Humidity Probe

Operating Temperature: -40°C to +60°C

Range: -40°C to +60°C

Accuracy: ± 0.2 °C @ 23°C

<u>Station</u>	<u>Serial Number</u>	<u>Date of Cal</u>	<u>Dates of Sensor Use</u>
FS	170516000153DE	09/02/2017	06/19/2018 – 10/29/2019
FS	1645160D0139CC	04/02/2019	10/29/2019 – current as of 12/31/2020
NP	170516000140F8	09/02/2017	10/03/2018 – 10/06/2020
NP	17051600153DE	12/03/2019	10/06/2020 – current as of 12/31/2020

Parameter: Relative Humidity

Units: Percent

Sensor type: Campbell Scientific Capacitance RH Sensor

Model #: EE-181-L Temperature and Relative Humidity Probe

Range: 0-100% non-condensing

Accuracy at 23°C: $> \pm (1.3 + 0.003 * \text{RH reading}) \%$ (0 to 90% RH)

$> \pm 2.3\% \text{ RH}$ (90 to 100% RH)

Temperature dependence of RH measurement: typically 0.03% RH/°C

Note: This sensor caps relative humidity values at 100%, measured values >100% are altered to 100%

<u>Station</u>	<u>Serial Number</u>	<u>Date of Cal</u>	<u>Dates of Sensor Use</u>
FS	170516000153DE	09/02/2017	06/19/2018 – 10/29/2019
FS	1645160D0139CC	04/02/2019	10/29/2019 – current as of 12/31/2020
NP	170516000140F8	09/02/2017	10/03/2018 – 10/06/2020
NP	17051600153DE	12/03/2019	10/06/2020 – current as of 12/31/2020

Parameter: Barometric Pressure

Units: millibars (mb)

Sensor type: Vaisala Barocap © silicon capacitive pressure sensor

Model #: CS-106

Operating Range: Pressure: 500 to 1100 mb; Temperature: -40°C to +60°C;

Humidity: non-condensing

Accuracy: $\pm 0.3 \text{ mb}$ at +20°C, $\pm 0.6 \text{ mb}$ at 0°C to 40°C, $\pm 1 \text{ mb}$ at -20°C to +45°C, $\pm 1.5 \text{ mb}$ at -40°C to +60°C

Stability: $\pm 0.1 \text{ mb}$ per year

<u>Station</u>	<u>Serial Number</u>	<u>Date of Cal</u>	<u>Dates of Sensor Use</u>
FS	N1230355	09/13/2016	10/17/2017 – 10/29/2019
FS	LI430917	04/01/2019	10/29/2019 – current as of 12/31/2020
NP	L1440691	03/13/2018	10/3/2018 – 10/06/2020
NP	N1230355	12/03/2019	10/06/2020 – current as of 12/31/2020

Parameter: Wind speed

Units: meter per second (m/s)

Sensor type:

Model #: R.M. Young 05103-45 Wind Monitor

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

Accuracy: $\pm 0.3 \text{ m/s}$ or 1%

Parameter: Wind direction

Units: degrees

Sensor type: balanced vane, 57 cm turning radius

Range: 360°

Accuracy: $\pm 3^\circ$

<u>Station</u>	<u>Serial Number</u>	<u>Date of Cal</u>	<u>Dates of Sensor Use</u>
FS	WM125404	09/27/2016	10/17/2017 – 10/29/2019
FS	WM125766	04/03/2019	10/29/2019 – current as of 12/31/2020
NP	WM140711	03/12/2018	10/3/2018 – 10/06/2020
NP	WM125404	12/06/2019	10/06/2020 – current as of 12/31/2020

Parameter: Photosynthetically Active Radiation

Units: mmoles m⁻² (total flux)

Sensor type: High stability silicon photovoltaic detector

Model #: Apogee SQ-110

Light spectrum waveband: 410to 655 nm

Temperature Response: 0.06 ±0.06% per °C

Stability: <±2% change over 1 yr

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

Sensitivity: 0.2mV per µmol s⁻¹ m⁻²

Multiplier: 0.025 (this does not change)

<u>Station</u>	<u>Serial Number</u>	<u>Date of Cal</u>	<u>Dates of Sensor Use</u>
FS	17011	10/01/2016	10/17/2017 – 10/29/2019
FS	17009	04/01/2019	10/29/2019 – current as of 12/31/2020
NP	17012	03/01/2018	10/3/2018 – 10/06/2020
NP	17011	12/03/2019	10/06/2020 – current as of 12/31/2020

Parameter: Precipitation (heated rain gauge)

Units: millimeters (mm)

Sensor type: Tipping Bucket Rain Gauge

Model #: RM52202-L

Rainfall per tip: 0.01 mm

Operating range: -20°C to +50°C (heated); Humidity: 0 to 100%

Accuracy: 2% up to 25 mm/hr, 3% up to 50 mm/hr

<u>Station</u>	<u>Serial Number</u>	<u>Date of Cal</u>	<u>Dates of Sensor Use</u>
FS	TB27014-7	10/29/2019	10/29/2019 – 07/01/2020
FS	TB27014-7	07/01/2020	07/01/2020 – current as of 12/31/2020
NP	TB11432	10/03/2018	10/03/2018 – 10/06/2020
NP	TB11432	10/06/2020	10/06/2020 – current as of 12/31/2020

Transmitter

Model #: TX321

On-board memory: Non-volatile flash for setup parameters. 16 Kbytes for data.

Data Transmission Rates: 100, 300 and 1200 BPS

Transmit Power: 5.6 Watts for 100 and 300 bps, 11.2 watts for 1200 bps

Frequency range: 401.701 MHz – 402.09850 MHz

Channel bandwidth: 100/300 BPS 1.5 KHz; 1200 BPS 3 KHz

Time Keeping: Initial setting accuracy: ± 100 microseconds synchronized to GPS; Drift ± 10 milliseconds/day over operating temperature range; GPS scheduled updates are 1 at power up and once per day thereafter. Once every 28 hours required for continual operation.

Operating range: -40° to $+60^{\circ}\text{C}$; Storage -50° to $+70^{\circ}\text{C}$; 0-99% RH, non-condensing
Power requirements: 10.8 to 16 VDC, 5 mA during GPS fix and 2.6 Amps during transmission

The CR1000 has 2 MB of 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 upgrade) 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.

The CR1000X has a total onboard memory of 128 MB of flash and 4MB of battery backed SRAM. There is 8 MB of flash memory reserved for loading the operating system and 1MB of flash reserved for configuration settings. SRAM is used for the CRBasic program operating memory, communication memory, and data storage, with 72 MB of flash for extended data storage. Additional data storage expansion is available with a removable microSD flash memory card of up to 16 GB.

<u>Station</u>	<u>Model</u>	<u>Front Serial Number</u>	<u>Rear Serial Number</u>	<u>Date of Cal</u>	<u>Dates of Sensor Use</u>
FS	CR1000	4977	005083	06/05/2006	01/18/2007- 10/02/2013
FS	CR1000	8743		03/2013	10/02/2013 – 10/29/2019
FS	Cr1000X	8215		01/17/2019	10/29/2019 – current as of 12/31/2020
NP	CR1000	3047	003020	02/09/2015	02/09/2015 – current as of 12/31/2020

CR1000 Firmware Version (s):

<u>Station</u>	<u>OS</u>	<u>Dates of Use</u>
FS	24	03/19/2012 – 10/03/2013
FS	26	10/03/2013 – 02/24/2017
FS	31	02/24/2017 – 01/07/2019
FS	32.02	01/07/2019 – 10/29/2019
NP	26	09/21/2017 – 12/19/2019
NP	32.02	12/19/2019 – 02/13/2020
NP	32.05	02/13/2020 – current as of 12/31/2020

CR1000x Firmware Version (s):

<u>Station</u>	<u>OS</u>	<u>Dates of Use</u>
FS	2.0	10/29/2019 – 04/28/2020
FS	4.02	04/28/2020 – current as of 12/31/2020

CR1000 Program Version(s):

<u>Station</u>	<u>Program Name</u>	<u>Dates Used</u>
FS	HUDFSMET_6.0.5_061918	06/19/2018- 03/01/2019
FS	HUDFSMET_CR1000_6.0.5_030119	03/01/2019 - 10/01/2019
NP	HUDNPMET_6.0.3_092117	09/21/2017 – current as of 12/31/2020

CR1000X Program Version(s):

<u>Station</u>	<u>Program Name</u>	<u>Dates Used</u>
FS	HUDFSMET_Cr1000x_6.1.0_102919	10/29/2019 – 10/01/2020
FS	HUDFSMET_CR1000X_6.1.1_100120	10/01/2020 - current as of 12/31/2020

10) Coded variable definitions -

Sampling station:	Sampling site code:	Station code:
Field Station	FS	hudfsmet
Norrie Point	NP	hudnpsmet

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/CR1000X, 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
CVI*	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.**

The CDMO does not authenticate the data from the Norrie Point station since it is a secondary site in the NERRS SWMP. Only primary SWMP sites go through tertiary review by the CDMO.

FS

Total and cumulative precipitation data are not considered suspect but are coded to make users aware that the rain gauge may have been clogged from 03/28/2020 13:30 – 04/28/2020 09:15.

Data are missing on 04/28/2020 09:30 and rejected 09:45 because of maintenance. Firmware was updated to address problems with the TX312 transmitter, <-2>[GMT](CSM), <-3> [GPR](CSM).

Timestamps were off by one minute from 04/29/2020 10:45 – 07/01/2020 10:00 and were corrected by adding a minute to the time recorded for the DateTimeStamp, {CSM}. Max and Min air temperature timestamps (those data are available from the reserve) were not corrected. MaxWSpd time was also not corrected and users should be aware that those times may be off by a minute, (CSM).

TX321-G SN: 2299 transmitter installed on 10/01/2020 12:15, no sensors were swapped, <-2> [GMT](CSM).

Data coded CRE GSM (Significant Rain Event) or CWE GSM (Significant Weather Event)

Data are coded CWE when the observed conditions or associated temperatures are indicative of snow/ice events. The CWE code is used because the nature of snow, even utilizing a precipitation

gauge with a heating element, is subject to blowing out of the collection device. Snowfall totals calculated using a tipping bucket, likely underestimate the amount of precipitation which actually fell.

Data are coded CRE when the 24 hour rainfall total exceeds 20mm. The data will be coded until the event ends, and cumulative total for the day reset's at 00:00

The following were observed CRE events (No data were coded with CWE for 2020):

FS

Event	Date/Time Started	Date/Time Ended
CRE	04/30/20 @ 03:30	05/02/20 @ 00:00
CRE	06/11/20 @ 00:30	06/13/20 @ 00:00
CRE	07/02/20 @ 18:00	07/03/20 @ 00:00
CRE	07/10/20 @ 14:00	07/11/20 @ 00:00
CRE	08/04/20 @ 03:30	08/05/20 @ 00:00
CRE	08/10/20 @ 16:00	08/11/20 @ 00:00
CRE	08/27/20 @ 06:15	08/28/20 @ 00:00
CRE	08/29/20 @ 03:45	08/30/20 @ 00:00
CRE	09/02/20 @ 06:15	09/04/20 @ 00:00
CRE	09/29/20 @ 18:30	10/01/20 @ 00:00
CRE	10/29/20 @ 06:15	10/30/20 @ 00:00
CRE	11/30/20 @ 18:15	12/01/20 @ 00:00
CRE	12/24/20 @ 14:45	12/26/20 @ 00:00

NP

Event	Date/Time Started	Date/Time Ended
CRE	04/21/20 @ 11:00	04/23/20 @ 00:00
CRE	05/08/20 @ 15:15	05/10/20 @ 00:00
CRE	06/12/20 @ 10:45	06/13/20 @ 00:00
CRE	07/03/20 03:00	07/04/20 @ 00:00
CRE	07/10/20 @ 13:00	07/12/20 @ 00:00
CRE	08/04/20 @ 03:15	08/05/20 @ 00:00
CRE	10/29/20 @ 05:30	10/31/20 @ 00:00
CRE	11/15/20 @ 16:45	11/16/20 @ 00:00
CRE	11/30/20 @ 09:00	12/01/20 @ 00:00
CRE	12/24/20@ 14:30	12/26/2020 00:00

NP

Rain bucket experienced fouling in the tipping mechanism during these timeframes. Simultaneously experienced the funnel clogging, which did not allow for accurate precipitation measurements. All precipitation data during these times are rejected. 01/08/2020 10:00 – 01/13/2020 00:00, 01/16/2020 10:15 – 04/20/2020 00:00.

The CR1000 at Norrie Point was considered out of calibration from 02/09/2020 00:15 through the end of the year. Because of the out of calibration logger, all data are considered suspect. In

addition, the air temperature/relative humidity sensor and rain gauge are considered out of calibration from 10/03/2020 00:15 until 10/06/2020 11:00.

All data are either missing or rejected from 02/11/2020 10:15 – 02/12/2020 15:15 and 02/13/2020 13:30 – 15:30. Programming for a TX325 transmitter was being tested for CBM NERR during those time periods.

Data are missing or rejected from 02/24/2020 13:30 – 13:45. Programming for a TX325 transmitter was being tested for CBNERR during those time periods and the data were not usable.

Data are missing from 10/06/2020 11:15 – 10/06/2020 12:15 due to sensor maintenance and swapping, <-2> [SMT] (CSM).