**Grand Bay (GND) National Estuarine Research Reserve Meteorological Metadata**

**January 1 – December 31, 2018**

**Latest Update:** June 16, 2020

**I. Data Set & Research Descriptors**

**1) Principal investigators & contact persons:**

Address: Grand Bay National Estuarine Research Reserve

6005 Bayou Heron Road

Moss Point, MS 39562

Phone: (228) 475-7047

Fax: (228) 475-8097

Contact Persons: Dr. Mark Woodrey, Research Coordinator

E-mail: [mark.woodrey@msstate.edu](mailto:mark.woodrey@msstate.edu)

(228) 523-4001

Kim Cressman, Research Technician

E-mail: [kimberly.cressman@dmr.ms.gov](mailto:kimberly.cressman@dmr.ms.gov)

(228) 523-4193

Elizabeth Moore, Research Technician

E-mail: [Elizabeth.moore@dmr.ms.gov](mailto:Elizabeth.moore@dmr.ms.gov)

(228) 374-5010

McKenna Koons, SWMP Assistant

E-mail: [mckenna.koons@dmr.ms.gov](mailto:mckenna.koons@dmr.ms.gov)

(228) 475-7047

**2) Entry verification:**

The meteorological information is sampled every five seconds from each instrument on the weather station and stored on a Campbell Scientific CR1000 data logger. Data are output to a file in one array: array 15 stores 15 minute average, maximum and minimum, and total data. The program run by the CR1000 is updated as necessary to reflect changes in PAR and Barometric Pressure sensor multipliers (see Section 13 below for additional program information). The CR1000 interfaces with the LoggerNet software supplied by Campbell Scientific for data retrieval and conversion.

Data are uploaded from the CR1000 data logger to a Personal Computer (PC compatible). 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.

Kim Cressman, Elizabeth Moore, and McKenna Koons are responsible for data management.

**3) Research objectives:**

The National Estuarine Research Reserve (NERR) System-wide Monitoring Program (SWMP) was designed to fulfill two major overall goals: 1) to support state-specific non-point pollution control programs by establishing local networks of continuous water quality monitoring stations in representative protected estuarine ecosystems and 2) to develop a nation-wide database of baseline environmental conditions in the NERR system of estuaries. The specific goal of SWMP is to identify and track short-term variability and long-term changes in the integrity and biodiversity of representative estuarine ecosystems and coastal watersheds for the purpose of contributing to effective national, regional, and site specific coastal zone management. This comprehensive program consists of three phased components: 1) abiotic conditions such as water quality and meteorological monitoring; 2) biodiversity monitoring; and 3) habitat mapping and change analysis. With the initial focus of phase 1, the NERR SWMP provides data necessary for intra- and inter- site baseline studies, trend analyses, and impact assessments.

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

**4) Research methods:**

The Campbell Scientific weather station samples every five seconds continuously throughout the year. These data are used by the CR1000 to produce 15 minute averages of air temperature, relative humidity, barometric pressure, rainfall, wind speed, and wind direction; maximums and minimums of air temperature and wind speed and the time of occurrence for each; standard deviation of wind speed; total precipitation, photosynthetically active radiation (PAR), and daily cumulative precipitation totals. All data are recorded in *Central Standard Time* year-round.

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 not included in the data set but 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) (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.)

Sensors on the weather station are inspected monthly for damage and/or debris. During these monthly observations, data taken from a nearby airport and a Kestrel 3000 are used to check the calibrations of the sensors. Sensors are removed and calibrated on an annual or every 2 year basis depending on the particular sensor.

*Recommended calibration frequency for the MET station sensors:*

- Temperature/Humidity- annual recalibration

- Rain Gauge- annual recalibration

- Wind Speed/Direction- annual or every 2 years inspection (depending on the sensor)

- Barometric Pressure- every 2 years recalibration

- PAR- every 2 years recalibration

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

Campbell Scientific data telemetry equipment was installed at the Crooked Bayou station on July 21, 2006 and transmits data to the NOAA GOES satellite, NESDIS ID #3B0190E2. 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 near 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](http://cdmo.baruch.sc.edu/).

**5) Site location and character:**

The Grand Bay National Estuarine Research Reserve (GBNERR) is a shallow, microtidal estuary located on the Gulf Coast in southeastern Jackson County, Mississippi. It lies within the Mississippi Delta province of the Louisianian biogeographic region of the United States as identified by the National Oceanic and Atmospheric Administration. Currently, no other reserves exist within the Mississippi Delta province of this biogeographic region. The GBNERR encompasses approximately 7,450 ha (18,400 acres) of state-owned, federally-owned, and privately-owned lands and open water areas. The primary land owners within the reserve boundaries are the State of Mississippi (3,684 ha; 9,100 ac) and the U.S. Fish and Wildlife Service (2,024 ha; 5,000 ac). The balance of the property is privately owned (1,740 ha; 4,300 acres).

The Grand Bay meteorological station is located near the center of the Reserve (30.35918° N, 88.42003° W) on a 3m x 3m platform 10m away from a saltwater marsh at an elevation of 1.5m above mean high tide. One of four hydrological monitors is located in Point Aux Chenes Bay, 1183m south. Another monitor is located on the east side of the reserve 6652m north/northeast of the station. The other two monitors are located on the west side of the reserve 3141m north/northwest and 4127m due west of the station. Although small clusters of dwarfed trees are present on nearby shell middens, they are not considered to serve as wind blocks, shades, or obstructions to the weather station due to the elevation of the station and the meteorological sensors.

The wind monitor and PAR sensor are mounted onto a crossbar sensor mount oriented in an east/west direction on the top of a 3m triangular aluminum tower on the platform; at a total height of 4.5m above mean high tide. The wind monitor is mounted on the west side of the crossbar, and the quantum sensor is mounted on the east side of the crossbar. Lower on the tower, the temperature and relative humidity probe is mounted inside a 12-plate gill radiation shield attached to the tower leg facing the prevailing wind (E/SE) 1.7m (68”) above the tower base. The barometric pressure sensor is mounted inside the control panel attached to two tower legs facing east/northeast 1.3m (50”) above the tower base. The rain gauge is mounted at a height of 1.8m (72”) to the east post of the chain link fence surrounding the weather station.

SWMP Station Timeline:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Station Code | Station Name | SWMP Status | Location | Active Dates | Reason Decommissioned | Notes |
| GNDCRMET | Crooked Bayou | P | 30° 21' 33.12 N,  88° 25' 12.00 W | 08/01/2004 - | NA | NA |

**6) Data Collection Period**

The Grand Bay NERR weather station originally began collecting data on August 17, 2004. On August 29, 2005, the platform and weather station were physically removed from the pilings by Hurricane Katrina. The 10’ x 10’ platform and meteorological station were reconstructed and began collecting data on June 21, 2006. This metadata is applicable only to data collected from January 1, 2018 00:00 to December 31, 2018 23:45.

Raw file start and end times for 2018 are:

|  |  |
| --- | --- |
| **Start** | **End** |
| 11/07/2017 12:15 | 01/24/2018 09:45 |
| 01/24/2018 10:00 | 03/21/2018 08:45 |
| 03/21/2018 09:00 | 04/12/2018 09:00 |
| 04/12/2018 09:15 | 04/16/2018 09:15 |
| 04/16/2018 09:30 | 04/21/2018 14:00 |
| 04/21/2018 14:15 | 07/11/2018 08:15 |
| 07/11/2018 10:15 | 09/10/2018 11:15 |
| 09/10/2018 11:30 | 10/26/2018 13:00 |
| 10/26/2018 16:00 | 10/28/2018 19:15 |
| 10/28/2018 19:30 | 01/17/2019 13:30 |

**7) Distribution**

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.

Requested citation format:

National Estuarine Research Reserve System (NERRS). 2018.  System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: www.nerrsdata.org; *accessed* 12 October 2018.

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](http://www.nerrsdata.org).  Data are available in comma delimited format.

**8) Associated researchers and projects:**

Several research and monitoring projects are currently using the meteorological data from the Grand Bay NERR. As part of the SWMP long-term monitoring program, GND 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.

Additional projects using SWMP meteorological data in 2018 included:

* **Application of spatially integrative metrics to salt marsh vulnerability at Grand Bay NERR** – Dr. Daniel Nowacki, Steven Suttles, Dr. Neil Ganju (USGS)
* **Sea-level and storm impacts on estuarine environments and shorelines** – Dr. Kathryn Smith, Dr. Chris Smith, Dr. Stan Locker, Dr. Nicole Kahn (USGS)
* **GNDNERR Sentinel Site Initiative: A program to better understand SLR and its effects on coastal environments** – Dr. Jonathan Pitchford, Will Underwood, Lindsay Spurrier, Jay McIlwain, Michael Archer (Grand Bay NERR)
* **Will Reintroduction of Fire along Coastal Gradients Promote Lateral Migration of Marsh and Enhance Biodiversity?** – Mike Smith (Gulf of Mexico Foundation), Dr. Loretta Battaglia (University of Southern Illinois-Carbondale), Dr. Julia Cherry (University of Alabama), Will Underwood (Alabama Department of Conservation and Natural Resources), Dr. Mark Woodrey (Grand Bay NERR/Mississippi State University)
* **Distribution and Abundance of Winter Marsh Birds Across Coastal Mississippi Tidal Marshes** – Dr. Mark Woodrey (Grand Bay NERR/Mississippi State University), Dr. Ray Iglay (Mississippi State University), Dr. Kristine Evans (Mississippi State University), Dr. Scott Rush (Mississippi State University), Spencer Weitzel (Mississippi State University
* **Erosion Monitoring - 11 Shorelines are monitored to Estimate the Rate of Erosion at Sites Representing Varying Degrees of Wave Exposure and Geological Substrates** - Jay McIlwain, Lindsay Spurrier, Michael Archer, Dr. Jonathan Pitchford, Will Underwood (Grand Bay NERR)
* **Fish Communities of Nearshore Habitats within the Grand Bay NERR/NWR** – Cher Griffin (Grand Bay NERR), Kim Cressman (Grand Bay NERR), Dr. Ayesha Gray (Grand Bay NERR), Dr. Mark Woodrey (Grand Bay NERR/Mississippi State University)
* **Atmospheric Mercury Deposition Monitoring at the Grand Bay NERR** - collaborators: Dr. Winston Luke (Air Resources Lab - NOAA), Dr. Mark Cohen (Air Resources Lab - NOAA), Dr. Ayesha Gray (Grand Bay NERR), Dr. Mark Woodrey (Grand Bay NERR/Mississippi State University).
* **Estuary Trends: Weather and Water Quality** – SWMP Status Reports, Grand Bay NERR Version
* **Conceptualizing Human Alteration and Natural Growth in Estuaries and Savannas (CHΔNGES)** – Sandra Huynh, Dennis McGrury (Grand Bay NERR)
* **Working with data and graphing in R** – Workshop at Grand Bay NERR; Dr. Auriel Fournier (Mississippi State University Coastal Research and Extension Center), Kim Cressman (Grand Bay NERR)

**II. Physical Structure Descriptors**

**9) Sensor specifications**

Parameter: ***Temperature***

Units: Celsius

Sensor type: Platinum resistance temperature detector (PRT)

Model #: **HMP45C** Temperature and Relative Humidity Probe

Operating Temperature: -40°C to +60°C

Range: -40°C to +60°C

Accuracy: ± 0.2 °C @ 20°C

Sensor installed 2/26/16 – 7/11/18: s/n A3510149, calibrated 12/19/15

Sensor type: Pt1000 Class A

Model #: **EE181** Temperature and Relative Humidity Probe

Operating Temperature: -40°C to +60°C

Range: -40°C to +60°C

Accuracy: ±0.2 °C @ 23°C

Sensor installed 7/11/18 – current as of 12/31/2018: s/n 171116000072D6, purchased new June 2018

Parameter: ***Relative Humidity***

Units: Percent

Sensor type: Vaisala HUMICAP© 180 capacitive relative humidity sensor

Model #: **HMP45C** Temperature and Relative Humidity Probe

Range: 0-100% non-condensing

Accuracy at 20°C: +/- 2% RH (0-90%) and +/- 3% (90-100%)

Temperature dependence of RH measurement: +/- 0.05% RH/°C

Date of Last calibration:

Sensor installed 2/26/16 – 7/11/18: s/n A3510149, calibrated 12/19/15

Sensor type: HC101

Model #: **EE181** Temperature and Relative Humidity Probe

Range: 0-100% non-condensing

Accuracy: –15 to 40 °C: ≤90% RH ± (1.3 + 0.003 • RH reading) % RH

–15 to 40 °C: >90% RH ± 2.3% RH

–25 to 60 °C: ± (1.4 + 0.01 • RH reading) % RH

–40 to 60 °C: ± (1.5 + 0.015 • RH reading) % RH

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

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

Sensor installed 7/11/18 – current as of 12/31/2018: s/n 171116000072D6, purchased new June 2018

Parameter: ***Barometric Pressure***

Units: millibars (mb)

Sensor type: Vaisala Barocap © silicon capacitive pressure sensor

Model #: CS-105 OR CS-106

***CS-105 specifications***:

Operating Range: Pressure: 600 to 1060 mb; Temperature: -40°C to +60°C;

Humidity: non-condensing

Accuracy: ± 0.5 mb @ 20°C; +/- 2 mb @ 0°C to 40°C; +/- 4 mb @ -20°C to 45°C; +/- 6 mb @ -40°C to 60°C

Stability: ± 0.1 mb per year

***CS-106 specifications***:

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

Humidity: non-condensing

Accuracy: Accuracy: ±0.3 mb @ +20°C; ±0.6 mb @ 0° to 40°C; ±1.0 mb @ -20° to +45°C; ±1.5 mb @ -40° to +60°C

Stability: ± 0.1 mb per year

Date of Last calibration:

Sensor installed 2/26/16 – current as of 12/31/2018: CS-105, s/n Y0930011, calibrated 1/13/16

Parameter: ***Wind speed***

Units: meters per second (m/s)

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

Model #: **R.M. Young 05103 Wind Monitor**

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

Accuracy: +/- 2%

Sensor installed 2/26/16 – 7/11/18; 10/26/18 – 1/17/19: s/n 65641, calibrated 1/8/16

Model #: **R.M. Young 05108 Heavy Duty Wind Monitor**

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

Accuracy: +/- 0.3 m/s (0.6 mph) or 1% of reading

Date of last calibration: purchased new, July 2018

s/n 159724 installed 7/11/18 – 10/26/18; 1/17/19 – current as of 12/31/2019: s/n WM159724

Parameter: ***Wind direction***

Units: degrees

Sensor type: balanced vane, 38 cm turning radius

Model #: **R.M. Young 05103 Wind Monitor**

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

Accuracy: +/- 5%

Sensor installed 2/26/16 – 7/11/18; 10/26/18 – 1/17/19: s/n 65641, calibrated 1/8/16

Model #: **R.M. Young 05108 Heavy Duty Wind Monitor**

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

Accuracy: +/- 3 degrees

Dates of calibration: purchased new, July 2018; sent in to shop November 2018 (see Other Notes section below for detail)

s/n 159724 installed 7/11/18 – 10/26/18; 1/17/19 – current as of 12/31/2019: s/n WM159724

Parameter: ***Photosynthetically Active Radiation (PAR)***

Units: mmoles m-2 (total flux)

Sensor type: anodized aluminum with cast acrylic diffuser

**Model #SQ110 Apogee Quantum Sensor**

Light spectrum waveband: 410 to 655 nm

Temperature dependence: 0.06+/-0.06% per °C

Stability: <±2% change over 1 yr

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

Cosine Response: 45° zenith angle: +/- 2%; 75° zenith angle: +/- 5%

Sensitivity: 0.2mV per µmol s-1 m-2

Multiplier: 0.025 (this multiplier does not change)

Installed 2/26/16 – 7/11/18: s/n 17013, calibrated (purchased new in 2015): November 2014

Installed 7/11/18 – 10/26/18: loaner from Campbell Scientific, new in July 2018

Installed 10/26/18 – current as of 12/31/2018: s/n 17013, calibrated 9/27/18\* note calibration was to wrong light source; data while installed was lower than it should have been and has been corrected (more detail in “Other Comments” section at the end of this document)

Parameter: ***Precipitation***

Units: millimeters (mm)

Sensor type: Tipping Bucket Rain Gauge

Model #: TE525

Rainfall per tip: 0.01 inch

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

Accuracy: +/- 1.0% up to 1 in./hr; +0, -3% from 1 to 2 in./hr; +0, -5% from 2 to 3 in./hr

s/n 36566-705

Date of last calibrations: 2/26/16, 7/11/18

The CR1000 has 2 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 CR1000 originally **installed**: June 21, 2006. Water damage occurred in September of 2010 and a CR1000 borrowed from the CDMO was installed.

Our original CR1000, s/n 5577, was repaired and **calibrated** 10/4/10, and re-installed 3/19/11.

Loaner CR1000 from Campbell installed 10/5/2015-11/10/2015

Our CR1000, s/n 5577, **calibrated** 10/20/2015 and reinstalled 11/10/2015

**CR1000 Firmware Version (s):**

OS29 installed 2/29/16 - current as of 12/31/2018

**CR1000 Program Version(s):**

gndcrmet\_6.0\_030416.cr1 running 4/5/16 – 7/11/18

gndcrmet\_6.0.1\_071118 running 7/11/18 – 10/26/18; 1/17/19 - current as of 12/31/2019

gndcrmet\_6.0.2\_102518 running 10/26/18 – 1/17/19

**10) Coded variable definitions:**

Sampling station: Sampling site code: Station Code:

Crooked Bayou CR gndcrmet

**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. No such specification exists for the Apogee sensor. Negative PAR readings from the Apogee are considered suspect and are flagged and coded as <1> CSM. This sensor was sent in to Apogee for evaluation and read within 1% of nearby sensor, so non-negative readings are ok.

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.**

**Tropical Activity:**

Tropical Storm Gordon made landfall over the marshes of Grand Bay NERR the night of September 4, 2018. Maximum wind speed recorded by the National Hurricane Center inside the storm was 110 km/hr, and minimum recorded pressure was 997 mb. Effects of this storm are visible in the water quality and weather data sets. The F\_Record is coded 09/4/2018 00:00 - 09/06/2020 00:00 {CWE}{CSM}.

**Other:**

4/16/18 9:30 – 4/21/18 14:00 – Data flagged suspect; recovered from telemetry. Time between weather station visits exceeded the memory of the logger and data between these times had to be recovered from telemetered data in the CDMO database. Cumulative precipitation data for this entire time period is missing. Additionally:

Readings completely missing due to missed transmissions are:

4/16 17:00-17:45

4/17 07:00-07:45

Time stamps where temp and rh were transmitted as -99, changed by automated QC to NAN (not a number), and rejected during quarterly QC were:

4/16 18:45

4/17 08:45

7/11/2018 8:30 – 10:15 – New EE181 Temp/RH sensor installed. Note: This sensor caps relative humidity values at 100%, measured values >100% are altered to 100%; new R.M. Young 5108 wind sensor installed; borrowed PAR sensor from Campbell installed; rain gauge calibrated. Station was powered down from 8:30 – 10:00 for this maintenance, and the 10:15 reading was rejected because it does not reflect a full 15 minute period of data collection.

7/11/2018 10:15 – 10/26/18 13:00 –

There are several blocks of 0s, some lasting several hours, for all wind data: wind speed, max wind speed, wind direction, and standard deviation of wind direction. These blocks are associated with a single wind sensor, which was purchased in early 2018 and originally installed on the station from 7/11 to 10/26 2018. After staff noticed these 0 blocks, the sensor was sent in for evaluation. It was returned after technicians at Campbell could not replicate the problem, and reinstalled on the station on 1/17/19.

Campbell’s technicians reported that our station’s program uses wind speed in the calculations of wind direction, so wind direction will be logged as 0 any time wind speed is 0. The report said “a new sensor may report this slightly more often, as the bearings will be new and will require slightly more wind to start until the bearings break in….. Also an intermittent connection to the pulse channel could cause the wind speed to read zero, which would again result in zeros for all [wind] variables.”

After reinstallation in 2019, the sensor behaved for a week and then started reporting blocks of 0s again. The exact cause of this behavior is still under investigation. The sensor will be sent in for fresh bearings and this may help. Non-zero readings are believed to be accurate.

**All wind parameters were rejected during the blocks of zero readings. All non-zero readings were flagged 0 CSM.**

9/10/18 21:00 – Tot prcp (cumulative from 9/10/18 21:00 - 9/11/18 00:00) flagged suspect because rain gauge reading was over the sensor limit. It is possible that this value, as well as cumulative precipitation for the rest of the day, is not accurate. However, any error should be small relative to the amount of precipitation received.

10/26/18 13:15 – 15:45 – Station powered down for maintenance. R.M. Young 5103 wind sensor was re-installed, as was the Apogee PAR sensor that had been removed on 7/11.

10/26/18 16:15 – 10/28/18 19:15 - Data flagged suspect; recovered from telemetry. Time between weather station visits exceeded the memory of the logger and data between these times had to be recovered from telemetered data in the CDMO database. Cumulative precipitation data for this entire time period is missing. Additionally:

Readings completely missing due to missed transmissions are:

10/27/18 04:00 – 04:45

10/26/18 16:00 – 12/31 23:45 – PAR corrected. This is the same sensor that was installed through 7/11; it was sent in for evaluation due to slight negative overnight values.

In 2018, questions arose about small negative overnight PAR values. The sensor was sent to Campbell, where it read within 1% of other sensors deployed nearby. We had it calibrated before it was returned, then reinstalled it on the station on 10/26/18. However, upon installation, it read much lower than the prior sensor (a loaner from Campbell). It was removed from the station on 5/15/19 and returned to Campbell, where it was determined that the calibration performed in 2018 had been incorrect. This is simply a mathematical offset and a correction of 1.12 (multiply the “wrong” values by 1.12) was provided by the manufacturer. Details from an email are provided below.

Readings in the 2018 file, from 10/26-12/31, have been corrected and flagged 5 SIC CSM, with the exception of 10/26 - 10/28 19:1, which are flagged as corrected but coded with GIT due to the use of telemetry data. See note below from Campbell Scientific:

***They use the same light sources to calibrate, they just scale it different when someone want to use the sensor say under electric lights in a greenhouse vs natural sunlight. The PAR sensor that was here in June of 2019 is the one that I think you are talking about and it was the one where you originally got a calibration certificate where Apogee had given you a certificate that was scaled for electric light. When you sent the sensor back the readings were 11.5% low when they checked things out at Apogee vs what you would get with the sunlight calibration certificate. The scientist at Apogee said theoretically it should have been 12% low and said there could be multiple potential reasons for the difference 11.5% vs 12% but he recommended using a correction factor of 1.12 to scale the data to the correct number.***