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

**January 1 – December 31, 2020**

**Latest Update:** February 23, 2022

**I. Data Set & Research Descriptors**

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

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**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 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.

Kim Cressman and Elizabeth Moore were responsible for data management in 2020.

**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 15 minute 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/or a Kestrel 3000 are used to check the calibrations of the sensors. Sensors are removed and calibrated on an annual or biannual basis depending on the particular sensor.

*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-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. The pilings of the weather station snapped during Hurricane Zeta on October 28, 2020 and data will be missing until it is rebuilt. This metadata is applicable only to data from January 1, 2020 to October 28, 2020.

Raw file start and end times for 2020 are:

|  |  |
| --- | --- |
| **Start** | **End** |
| 11/19/2019 13:30 | 01/06/2020 10:30 |
| 01/06/2020 10:45 | 01/28/2020 11:00 |
| 01/28/2020 11:15 | 02/28/2020 12:15 |
| 02/28/2020 12:30 | 05/05/2020 11:15 |
| 05/05/2020 11:30 | 06/15/2020 15:00 |
| 06/15/2020 15:15 | 07/30/2020 16:45 |
| 07/30/2020 17:00 | 09/04/2020 09:45 |
| 09/04/2020 10:00 | 09/30/2020 15:00 |
| 09/30/2020 15:15 | 10/28/2020 18:45\* |

\* station destroyed by Hurricane Zeta

**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 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](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 2020 included:

* **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, Jay McIlwain, Michael Archer, Michael Brochard (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)
* **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, Michael Archer, Michael Brochard, Dr. Jonathan Pitchford, Will Underwood (Grand Bay NERR)
* **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), Jared Feura (Mississippi State University), Spencer Weitzel (Mississippi State University)
* **Distribution and Abundance of Breeding 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), Jared Feura (Mississippi State University), Spencer Weitzel (Mississippi State University)
* **Fire Effects in Gulf of Mexico Marshes: Historical Perspectives, Management, and Monitoring of Mottled Ducks and Black and Yellow Rails**  - Dr. Auriel Fournier (Illinois Natural History Survey), Dr. Mark Woodrey (Mississippi State University), and Dr. Kristine Evans (Mississippi State University)
* **Fish Communities of Nearshore Habitats within the Grand Bay NERR/NWR** – Michael Brochard, Kim Cressman, Dr. Jonathan Pitchford, Dr. Ayesha Gray (Grand Bay NERR)
* **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).
* **The Feasibility of Hard Clam Aquaculture in Coastal Mississippi –**Dr. Ayesha Gray (Grand Bay NERR), Dr. Eric Sparks (Mississippi State University), Dr. William Walton (Auburn University Shellfish Lab), Dr. Mark Woodrey (Grand Bay NERR/Mississippi State University, Dr. Paul Mickle (MS Department of Marine Resources), and Brianna Andrews (Mississippi State University/Grand Bay NERR).
* **Seasonal and Interannual Variability in Net Ecosystem Production of a Subtropical Coastal Lagoon Inferred from Monthly Oxygen Surveys -**Lauren E. Seidensticker (The Pennsylvania State University), Raymond G. Najjar (Penn State), Maria Herrmann (Penn State), Joseph N. Boyer (Plymouth State University), Henry O. Briceño (Southeast Environmental Research Center, Florida International University), W. Michael Kemp (Horn Point Laboratory, U of MD Center for Environmental Science), and Daniel J. Tomaso (Penn State). Estuaries and Coasts, 2019: doi 10.1007/s12237-018-0482-8

**II. Physical Structure Descriptors**

**9) Sensor specifications**

Parameter: ***Temperature***

Units: Celsius

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 – 8/30/2019: s/n 171116000072D6, purchased new June 2018

Sensor installed 8/30/2019 – 10/28/2020: s/n 192016000526A0, purchased new July 2019

Parameter: ***Relative Humidity***

Units: Percent

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 – 8/30/2019: s/n 171116000072D6, purchased new June 2018

Sensor installed 8/30/2019 – 10/28/2020: s/n 192016000526A0, purchased new July 2019

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 – 8/30/2019: CS-105, s/n Y0930011, calibrated 1/13/16

Sensor installed 8/30/2019 – 10/28/2020: CS-106, s/n P4510059, purchased new July 2019

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; 5/15/19 – 10/28/2020: 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 – 5/15/19

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; 5/15/19 – 10/28/2020: 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 – 5/15/19

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 10/26/18 – 5/15/19: s/n 17013, calibrated September 2018\* note calibration was to wrong light source; data while installed is lower than it should be (more detail in “Other Comments” section at the end of this document)

Installed 5/15/19 – 08/30/2019: s/n 12640, calibrated (and purchased) April 2013

Installed 8/30/19 – 10/28/2020: s/n 17013, re-calibrated June 7, 2019

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: 7/11/18; 8/30/2019

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 – 10/28/2020

**CR1000 Firmware Version (s):**

OS29 installed 2/29/16 - 10/28/2020

**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 – 8/30/19

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

gndcrmet\_CR1000\_6.0.3\_082919.cr1 running 8/30/19 – 10/28/2020

**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.

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:**

2020 was a very active tropical season. Storms impacting the northern Gulf coast are listed below and may impact SWMP data. Bolded storms are those where the record comments {CWE}{CSM}, indicating a significant weather event, have been added.

* **Tropical Storm Cristobal**; landfall 6/7/2020 east of Grand Isle, LA – 06/06/2020 00:00 – 06/11/2020 00:00
* Hurricane Hanna; landfall 7/25 in Texas
* Major Hurricane Laura; landfall 8/27 in Louisiana
* Hurricane Marco; landfall 8/24 in Louisiana
* **Hurricane Sally**; landfall 9/15 in Alabama – 09/15/2020 00:00 – 09/17/2020 00:00
* Tropical Storm Beta; landfall 9/21 in Texas
* **Hurricane Delta**; landfall 10/9 in Louisiana – 10/09/2020 00:00 – 10/10/2020 23:45
* **Hurricane Zeta**; landfall 10/28 in Louisiana – 10/28/20202 00:00 – 18:45

**Other:**

A previously installed wind sensor was reinstalled in 2019. It was not recalibrated prior to reinstallation. All wind parameters are considered suspect from 01/01/2020 00:00 – 10/28/2020 18:45.

Negative PAR readings from the Apogee are considered suspect and are flagged and coded as <1> CSM.

9/30/2020 15:15 – 10/28/2020 18:45 – The GNDCRMET weather station was destroyed by Hurricane Zeta on 10/28/2020. Data after the last field visit on 9/30/2020 were transmitted via telemetry and are flagged and coded <1> [GIT] (CSM), including out of calibration wind parameters. Occasionally a telemetry transmission was missed by the station, and those data are missing, flagged and coded <-2> [GIT] (CSM). Cumulative precipitation data are not included in the telemetry file and are missing, <-2> [GIT] (CSM). Data after destruction of the station are missing and are flagged as <-2> with {CSM} coding in the F\_Record, until the station can be replaced.