

Reserve Name: JOB NERR Meteorological Metadata

Months and year the documentation covers: 01/01/2020 to 12/31/2020

Latest Update: 06/03/2024

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 data logger to a personal computer with a Windows 7 or newer operating system. Files are exported from Logger Net 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.

A Campbell Sci. transmitter is used to deliver data to the NOAA GOES satellite, NESDIS ID # 3B018394 and NWS Location ID JOXP4. The transmissions are scheduled hourly and contain four (4) datasets reflecting fifteen minute data sampling intervals. The telemetry data is flagged as "Provisional" data and after going through QAQC process is considered "Authentic" dataset used for long term monitoring and study. This data can be viewed by going to <http://cdmo.baruch.sc.edu> or <http://nerrsdata.org>.

Data management is performed by Angel Dieppa and Enid Malavé.

3) Research objectives

The principal objective is to record long-term meteorological data to track changes in meteorological conditions that can be associated to changes in estuarine habitats and conditions and regionally as well. A secondary objective is to promote the access and use of reliable baseline information by federal and local agencies, universities, researchers, educators and local communities to enhance the process by which they make decisions regarding their daily activities. This data is also invaluable in the identification and development of future monitoring and research activities.

This meteorological weather station is located at 0.40 Km off the Jobos Bay coast and record data and information of the conditions affecting the estuary. The station is part of a System Wide Monitoring Program (SWMP) designed to evaluate the relative contributions of climate on coastal forcing and watershed inputs to hydrodynamics, nutrient dynamics, and other ecological processes within the estuary. Data is used as a reference of atmospheric conditions for ongoing research projects at the Reserve as a support from NERR and for other short and long-term environmental monitoring projects within the Reserve.

4) Research methods

Campbell Scientific data telemetry equipment was installed at the JOBJBMET station on 07/20/06 and transmits data to the NOAA GOES satellite, NESDIS ID #3B018394. 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> or <http://nerrsdata.org>.

All data recorded in Atlantic Standard Time (AST) 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 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).

Calibration plan follows SWMP SOP’s. Wind Sensor, Temp, RH, Solar Radiation, Barometer are calibrated in a 1 or 2 year basis and Rain Bucket in a yearly basis.

Calibration information:

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)

5) Site location and character

The Jobos Bay National Estuarine Research Reserve (JBNERR) is located on the southern coastal plain of the island of Puerto Rico, a reserve within the West Indies geographical area. JBNERR is composed of two major areas: (1) Mar Negro, located on the western margin of the Bay, and (2) Cayos Caribe (a chain of 17 tear-shaped islets located to the southeast) and Cayos Barca (a chain of 7 tear-shaped islets located to the southwest boundaries) both with a back-reef system. The Mar Negro area comprises the bulk of the Reserve and consists of mangrove forests and a complex system of lagoons and channels interspersed with salt and mud flats. Coral

reefs and sea grass beds, with small beach deposits and upland areas fringe Cayos Caribe and Cayos Barca mangrove islands.

A description of the specific sampling station follows:

The weather station is situated in front of the JBNERR Visitor's Center, located in the community of Aguirre in Salinas, Puerto Rico. Its coordinates are latitude 17° 57' 23.34" N and longitude 66° 13' 22.56" W. The tower base is about 9m above sea level, approximately 110m north from Jobos Bay's southern shoreline. The station is installed in a 10-meter tower in front of the Main Building, the wind and PAR sensors are above the building height. At 11 meters to the northwest side of the tower there is a tree with a height of 15 meters presenting a minor obstruction to the sensors. In the southern region of Puerto Rico where JBNERR is located the winds persists from southeast and northeast, therefore the tree does not represent a significant obstruction for the winds. The high of the sensors are: wind sensor (9.75 m high), Temperature/ Humidity sensor (2.7m high), Barometric Pressure sensor (2.7 m high and inside the CR1000 enclosure), and PAR Sensor (9.60 m high) are all located on a 10m aluminum tower following the descriptions outlined in the CDMO Manual V 5.1. The Tipping Bucket Rain gauge is located to the SW side of the tower 1 meter over the ground. The sensors are wired to a CR1000 following the protocol in the CDMO Manual.

The weather station is at the following distance from SWMP stations used for water quality monitoring:

- 2.2 Km. from Station 09
- 4.2 Km. from Station 10
- 1.8 Km. from Station 19
- 3.1 Km. from Station 20

SWMP Station Timeline

Station Code	Station Name	SWMP Status	Location	Active Dates	Reason Decommissioned	Notes
jobjbmct	Jobos Bay Weather	P	17° 57' 23.34 N, 66° 13' 22.56 W	01/01/2001 -	NA	NA

6) Data collection period

The weather station was installed in 1999. On 7/20/06 new telemetry equipment was installed. From January 1st to December 31, 2020 data was collected and saved in a computer where the meteorology station is connected via wire and transmitted via NOAA-GOES near real time telemetry.

During year 2020 data is acquired following SWMP SOP's. This is in 15 minute intervals year round.

Raw file start and end dates and times:

File Start Date and Time	File End Date and Time
12/12/2019 10:15	01/16/2020 07:45
01/16/2020 08:00	02/03/2020 08:00
02/03/2020 08:15	02/18/2020 07:45
02/18/2020 08:00	03/09/2020 10:15
03/09/2020 10:30	04/15/2020 08:15
04/15/2020 08:30	05/19/2020 13:00
05/19/2020 13:15	06/08/2020 07:45
06/08/2020 08:00	06/26/2020 08:45

06/26/2020 09:00	07/14/2020 08:30
07/14/2020 08:45	07/28/2020 14:15
07/28/2020 14:30	08/11/2020 08:00
08/11/2020 08:15	08/25/2020 13:00
08/25/2020 13:15	09/09/2020 08:15
09/09/2020 08:30	09/22/2020 08:30
09/22/2020 08:45	10/06/2020 15:30
10/06/2020 15:45	10/26/2020 15:45
10/26/2020 16:00	11/10/2020 08:45
11/10/2020 09:00	11/24/2020 07:45
11/24/2020 08:00	12/08/2020 08:45
12/08/2020 09:00	01/07/2021 12:45

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 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

The Jobos Bay NERR maintains four water quality monitoring stations as part of the System Wide Monitoring Program (SWMP) to monitor variability in the estuarine environment. Meteorological station collects continuous information that support water quality data intended to address short-term variability and long-term changes in estuarine water parameters within the bay (i.e., localized impacts of seasonal storms and hurricane events, variability due to tidal circulation, seasonal and inter-annual differences in rainfall, magnitude and influence of major events such hurricanes, spatial extent of oceanic and tidal forcing).

Our water quality monitoring program is a key component of SWMP. Variables measured include Temperature, Dissolved Oxygen, Turbidity, pH, Salinity, Chl-a fluorescence, and Depth in 4 permanent stations equipped with YSI data sondes. At the same stations, nitrogen, phosphorus, and chlorophyll are measured in a monthly basis.

II. Physical Structure Descriptors

9) Sensor specifications

Sensors working from 10/11/2018 – current as of 12/31/2020

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

Serial Number: F16400118

Date of Calibration: 03/16/2018

Dates of Sensor Use: 10/11/2018 – current as of 12/31/2020

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: $\pm 2\%$ RH (0-90%) and $\pm 3\%$ (90-100%)

Temperature dependence of RH measurement: $\pm 0.05\%$ RH/°C

Serial Number: F1640118

Date of Calibration: 03/16/2018

Dates of Sensor Use: 10/11/2018 – current as of 12/31/2020

Parameter: Barometric Pressure

Units: millibars (mb)

Sensor type: Vaisala Barocap © silicon capacitive pressure sensor

Model #: CS-106 (PTB110)

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

Humidity: non-condensing

Accuracy: ± 0.3 mb at +20°C, ± 0.6 mb at 0°C to 40°C, ± 1 mb at -20°C to +45°C, ± 1.5 mb at -40°C to +60°C

Stability: ± 0.1 mb per year

Serial Number: F1610094

Date of Calibration: 03/14/2018

Dates of Sensor Use: 10/11/2018 – current as of 12/31/2020

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-L Wind Monitor

Range: 0-60 m/s (134 mph); gust survival 100 m/s (220 mph)

Accuracy: ± 0.3 m/s

Serial Number: 100693

Date of Calibration: 03/16/2018

Dates of Sensor Use: 10/11/2018– current as of 12/31/2020

Parameter: Wind direction

Units: degrees

Sensor type: balanced vane, 38 cm turning radius

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

Serial Number: 100693

Date of Calibration: 03/16/2018

Dates of Sensor Use: 10/11/2018 – current as of 12/31/2020

**Sensor oriented to True North.

Parameter: Photosynthetically Active Radiation (PAR)

Units: mmol m⁻² (total flux)

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

Model #: LI190SB

Light spectrum waveband: 400 to 700 nm

Temperature dependence: 0.15% per °C maximum

Stability: <±2% change over 1 yr

Operating Temperature: -40°C to 65°C; Humidity: 0 to 100%

Sensitivity: typically 5 µA per 1000 µmol s⁻¹ m⁻²

Serial Number: Q43066

PAR Multiplier = 1.379691

Date of Calibration: 03/21/2018

Dates of Sensor Use: 10/11/2018– current as of 12/31/2020

Parameter: Precipitation (non heated rain gauge)

Units: millimeters (mm)

Sensor type: Tipping Bucket Rain Gauge

Model #: RG-2000-C

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

Rain Gauge SN 43619-410

Most recent calibration: 05/07/2019, 06/04/2018(previous calibration)

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.

Data logger Campbell Sci.

CR1000-RMA

Serial Number: 5248

Date Installed: 06/19/2015

Date of Calibration: 05/29/2015

Dates of Logger Use: 06/19/2015 – current as of 12/31/2020

CR1000 Firmware Version (s): CR1000.Std.28; installed 06/19/2015

CR1000 Program Version(s):

JOBJBMET_V5.5_041608 used from 04/16/2008 to 02/27/2015

JOBJBMET_V5.5_022715 used from 02/27/2015 to 06/17/2015

JOBJBMET_V5.5_022715 used from 06/17/2015 to 10/10/2018

JOBJBMET_CR1000_5.5.1_101018 used from 10/11/2018 to current as of 12/31/2020

10) Coded variable definitions

Sampling station:	Sampling site code:	Station code:
Jobos Meteorology	jb	jobjbmet

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
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.

Small negative PAR values are within range of the LI-COR sensor and are due to normal errors in the sensor and the CR1000 Datalogger. The Maximum signal noise error for the LI-COR sensor is +/- 2.214 mmoles/m2 over a 15 minute interval. These values are automatically flagged and coded as <1> (CAF).

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.

Suspect Out of Calibration Data:

Beginning 06/19/2020 and continuing until 12/31/2020, all parameters are considered suspect and are coded as SOC due to the out of calibration CR1000. In addition, the air temperature/relative humidity sensor is considered out of calibration beginning 10/18/2020 through the end of the year. PAR data that were affected by Saharan dust, 06/22/2020 06:00 – 19:30 and 06/23/2020 05:30 - 20:45, are also included in the out of calibration coding (see images below).

Suspect Data:

PAR drift

PAR values are coded as suspect for all of 2020. In addition to the out of calibration logger from 06/19/2020 – 12/31/2020 (see above), there was a noticeable jump in values when a new sensor was installed in 2021. Drift or moisture intrusion may have occurred with the aging sensor that was installed at JOB in 2018. The sensor was not recalibrated after removal in 2021.

Barometric Pressure

From 04/22/2020 06:45 – 04/25/2020 17:00 and on 04/30/2020 08:15 – 08:45 barometric pressure data are considered suspect due to fluctuations in values for unknown reasons. BP values peaked at 1044 on 04/23/2020 12:15 – 12:30 and were lowest on 04/25/2020 02:00 – 03:15 with a value of 1003.

Rejected Data:

Elevated Nighttime PAR

From 01/01/2020 to 12/31/2020 there are consistent elevated night PAR values that were systematically rejected as PAR goes down to decimal values and we identify that any of those values that increase after dusk are rejected.

Significant rain events:

Significant rain events at JOB NERR are rainfall >0.75 inches (19mm) that may influence water quality. Coded as [GSM](CRE) for both total (duration of rain event) and cumulative precipitation (coded until the midnight timestamp. See images below the tracks of the tropical storms associated with significant rain events.

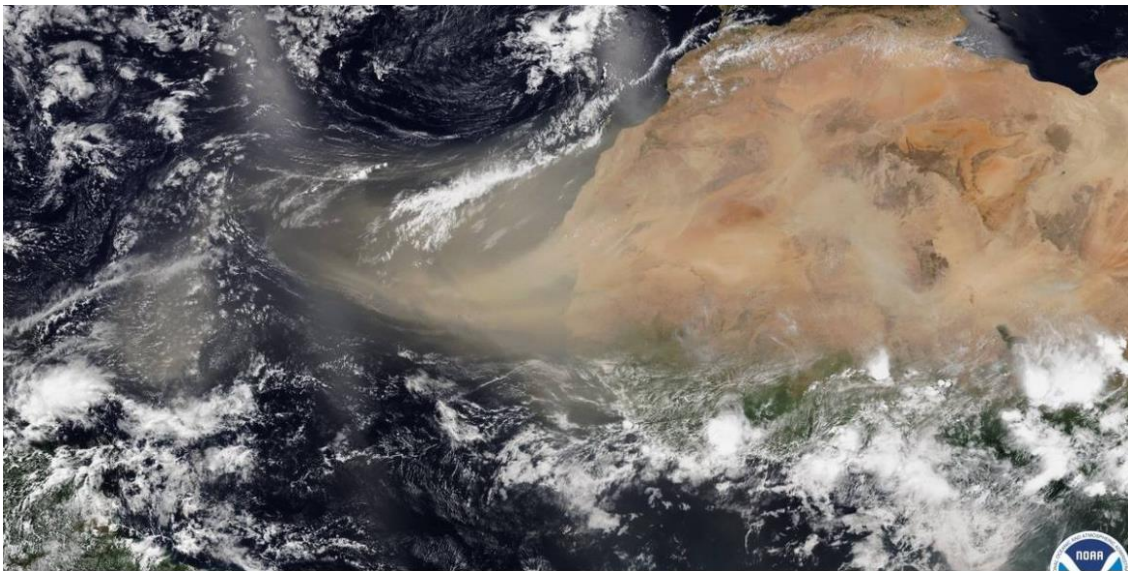
Date	Precipitation (mm)	Event associated with
07/29/2020 - 07/30/2020	52.6	Isaías Tropical Storm
08/22/2020	58.2	Laura Tropical Storm
09/30/2020	27.2	
10/02/2020	24.4	
10/16/2020	21.6	
11/10/2020	24.1	
11/11/2020	80.0	
11/12/2020	27.4	
11/23/2020	21.8	

New sensor installation (no flagging or coding):

Sensors installed on 10/11/2018 and working up to date (12/31/2020):

Active Loggers/Sensors										
Logger-CR100006192015-IN SERVICE			Add Sensor	Serial Number	Manufacture Year	Date in Service	Service	Notes	History	SWMP
				5278	2004	06/19/2015	Edit	Edit		Yes
Type	Code	Model	Serial Number	Manufacture Year	Date in Service	Service	Notes	History	SWMP	
BP	BP10112018	CS106	F1610094	2004	10/11/2018	Edit	Edit		Yes	
PAR	PAR10112018	LI-190	Q43066	2010	10/11/2018	Edit	Edit		Yes	
precip	precip06042018	RG-2000-C	43619-410	2004	06/04/2018	Edit	Edit		Yes	
temp/RH	tempRH10112018	HMP45C	F16400118	2010	10/11/2018	Edit	Edit		Yes	
wind	wind10112018	R.M. Young	100693	2004	10/11/2018	Edit	Edit		Yes	
05103										

During June 22 to June 23 PAR data decreased due to a record arrival of Saharan Dust affecting Puerto Rico and the Caribbean. (view images below). The event was called Godzilla and had no precedent. Air quality reached unhealthy rates, also reduced visibility to 3-5 miles. PAR data affected by the dust are coded with CSM on 06/22/2020 06:00 – 19:30 and 06/23/2020 05:30 – 20:45.



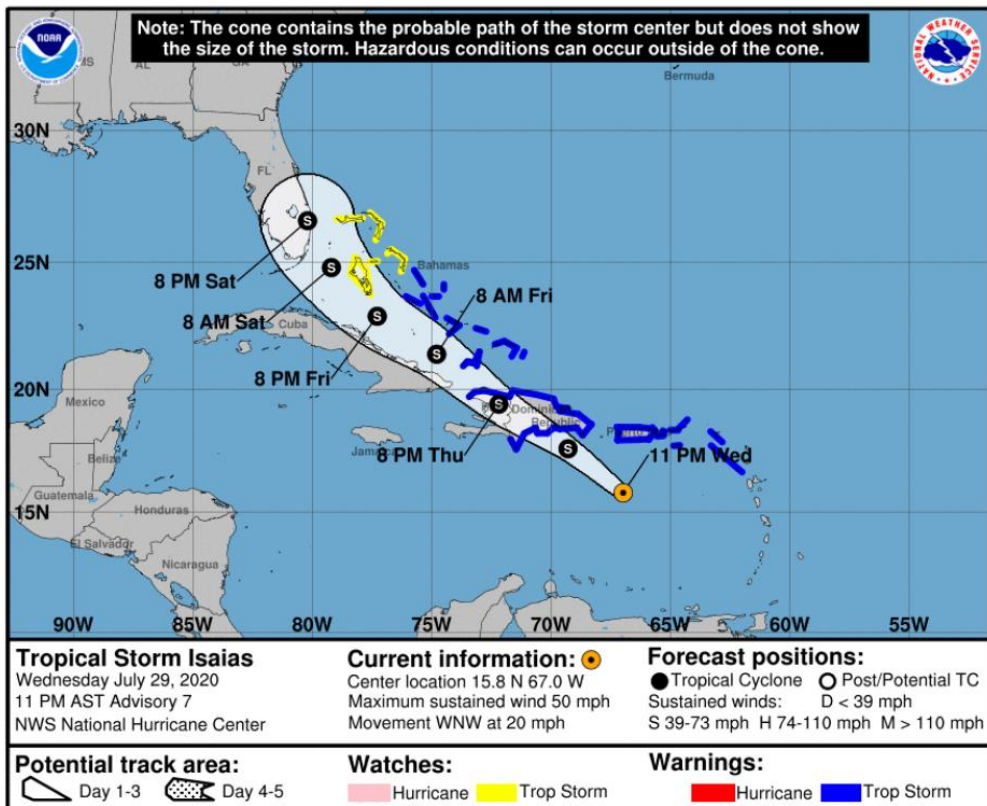
Satellite image showing Saharan Dust over Africa.



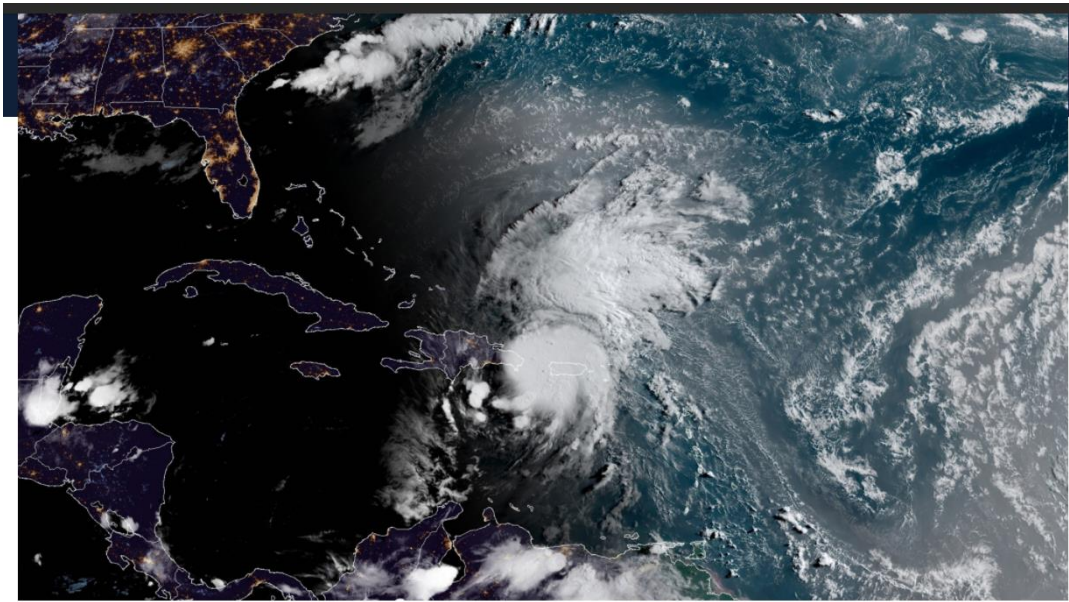
Satellite image showing Saharan Dust over Puerto Rico.



Tropical Storm Isaias 07/30/2020

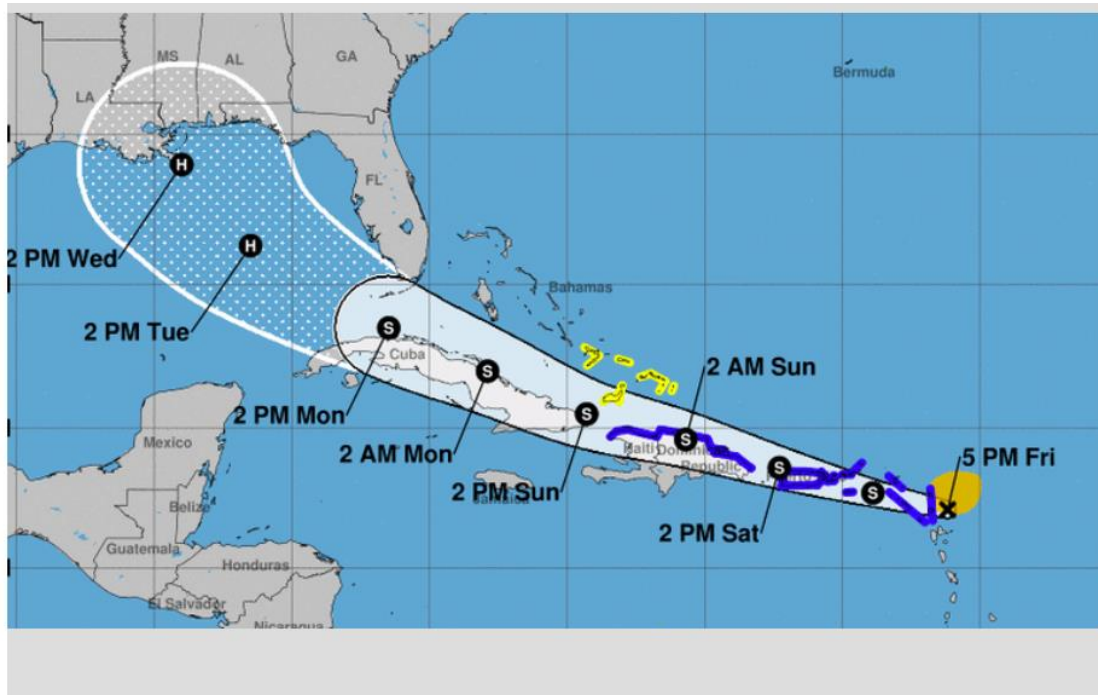


Tropical Storm Isaias 07/30/2020



— Satellite image showing Tropical Storm Isaias on July 30, 2020. NOAA

Tropical Storm Isaias 07/30/2020



Islands in the northern Caribbean Friday were bracing for Tropical Storm Laura, which was expected to come through during the weekend with gusty winds and heavy rainfall. *CENTRO NACIONAL DE HURACANES*

Tropical Storm Laura 08/22/2020 (above)



Tropical Storms Marco, left, and Laura, right, are churning in the Caribbean. A forecaster described Marco as “looking pretty organized.” NOAA

Tropical Storm Laura 08/22/2020