

Weeks Bay (WKB) NERR Meteorological Metadata
January – December 2004
First submission: **October 15, 2023**

I. Data Set & Research Descriptors

1) Principal investigator & contact persons:

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2) Entry verification

a) Data Input Procedures:

The 15-minute, 1-hour, and 24-hour data were downloaded from each instrument on the weather station to a Campbell Scientific CR10X datalogger. The CDMO Data Logger Program was loaded into the CR10X and controls the sensors and data collection schedule (see 2b of the Entry Verification section for the data collection schedule). The CR10X then interfaced with the Campbell SM4M memory module for long-term data storage.

From January through December 2004 Campbell PC208W software was used to automatically dial up the weather station via a Campbell Com200 modem and upload data to a personal computer at daily intervals. The uploaded raw data (none QA/QC'd) was periodically transferred to a separate file for archival and future QA/QC purposes.

On November 19th of 2003 the CR10X program was updated to match the requirements of the EQWin database software program, which will be employed at all NERR sites. At this time a station identification number (711) was also introduced within the CR10X program. The identification number allows a Dauphin Island Sea Lab computer to remotely dial up and identify the Weeks Bay NERR weather station. The data generated from the weather station is converted to graphic representation and posted on the Internet at <http://castnet.mobilebaynep.com/monitoringdata/default.asp>

At the end of the year the composite data file was opened in Microsoft excel for pre-processing with the EQWin format macro that was developed by the CDMO to insert a date column (mm/dd/yyyy), insert station codes, correct the time column format, and reformat the data to the appropriate number of decimal places. The pre-processed file was then copied into an EQWin weather.eqi file where the data was QA/QC checked and archived into a database. EQWin queries, reports and graphs are used to discover data set outliers (values which fall outside the range that the instrument is designed to measure) and

large changes in the data. EQWin is also used to generate statistics, view graphs, create customized queries and finally export the data to the CDMO. Any anomalous data are investigated and noted below is the Anomalous/Suspect Data Section. Any data corrections that were performed are noted in the Deleted Data Section. Missing data due to probe failure or other reason are noted in the missing data section.

b) Error checking criteria

Air Temp:

- Sample not greater than 50 degrees Celsius
- Sample not less than -10 degrees Celsius
- 15 minute averages not greater than the max for the day
- 15 minute averages not less than the min for the day

Relative Humidity:

- Sample not greater than 103 percent humidity
- Sample not less than 0 percent humidity
- 15 minute averages not greater than the max for the day
- 15 minute averages not less than the min for the day

Precipitation:

- 15 minute total not greater than 5 millimeters

Solar Radiation (PAR)

- 15 minute total not greater than 5000 millimoles per meter squared
- 15 minute total not less than -2.214 millimoles per meter squared

Wind Speed:

- Wind speed greater than 30 m/s
- Wind speed less than .5 m/s for 12 hours consecutively

Wind Direction:

- Wind direction not greater than 360 degrees
- Wind direction not less than 0 degrees

Pressure:

- Pressure greater than 1060 mb or less than 900 mb
- Pressure changes greater than 5 mb per hour
- 15 minute averages not greater than the max for the day
- 15 minute averages not less than the min for the day

Time:

- 15-minute interval recorded

For all data:

- Duplicate interval data

3) Research objectives:

The principle objective is to record long-term meteorological data for Weeks Bay in order to 1) observe any environmental changes or trends over time, 2) use as a reference for research projects at the reserve, and 3) give meteorological context to our half-hour SWMP water quality data.

4) Research methods:

The Campbell Scientific weather station samples every 5 seconds to produce fifteen minute (array 15), hourly (array 60) and daily (array 144) averages. Maximum and minimum values with there corresponding times are also recorded.

Parameters measured are air temperature, relative humidity, barometric pressure, rainfall, wind speed and wind direction. An instantaneous sample is taken every 15 minutes and assigned to array 15. Periodically, sensors on the weather station are inspected for damage or debris. If any is found, it is repaired and/or cleaned. Sensors are removed and calibrated on an annual or bi-annual basis. The sensors and tower were obtained in the fall of 1996. However the sensors were not installed until the fall of 1998. Sensors were last calibrated in 2003. There were no other analyses done on the meteorological data at present.

5) Site location and character:

The Weeks Bay National Estuarine Research Reserve is located near the Gulf coast, southeast of the city of Fairhope, Alabama. Weeks Bay (30° 23' N, 87° 50' W) is a small, shallow, microtidal sub-estuary, located on the eastern shore of Mobile Bay in the northern Gulf of Mexico. The bay is nearly diamond shaped, and its longitudinal axis (3.4 km long) runs nearly north-south from the head, where the Fish River flows in, to the mouth, where water is exchanged with Mobile Bay. Its widest point (3.1 km) is located near the center of the estuary, where the Magnolia River discharges into eastern side of Weeks Bay. Average depth is 1.4 m, although there are two areas where depths are significantly greater. The first is in the mouth of the bay, where the average depth is 6 m; the second is about 100 m upstream of the mouth of the Fish River, where the average depth is 3.5 m. Tides are principally diurnal, and have a mean range of 0.4 m.

The Fish River drainage basin encompasses 14300 hectares and contributes approximately 73% to the total incoming freshwater flow with the Magnolia River supplying the rest. Mean combined discharge is 9 cubic meters per second; although freshets up to 4 times larger occur throughout the year. These characteristics result in a freshwater residence time of 13 days under average discharge conditions, with a range from 0.5 to 100 days.

Salinity in Weeks Bay varies substantially both temporally and spatially. During periods of high flow in the river, salinity in the bay may be fresh from the head to the mouth, except in the deeper holes of the estuary that are not as easily flushed. However, during periods of low flow in the river, wind velocity and tidal stage are strong factors influencing salinity structure. Salinity greater than 25 ppt is infrequently observed in Weeks Bay and is usually restricted to the southern portion of the estuary near the mouth.

The weather station is located on a reserve owned pier (lat 30 deg 24.89'N, long 87 deg 49.56'W) just south of the highway 98 bridge, on the west side of the mouth of the Fish River. Wind sentry, tipping bucket rain gauge, temperature/RH probe, and barometric pressure sensor are mounted along an aluminum tower between 4.8 and 7.6 meters above water surface. LI-COR quantum sensor was not deployed in 2001. Approximately 100 meters upstream is a YSI datalogger deployment site for the continuous monitoring of water quality.

6) Data collection period:

Weather data has been collected from January 1, 2001 through December 31, 2004.

This metadata is applicable only to data collected from January 1, 2004 through December 31, 2004.

7) Distribution

According to the Ocean and Coastal Resource Management Data Dissemination Policy for the NERRS System-wide Monitoring Program, 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 the 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/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.

NERR weather data and metadata can be obtained from the Research Coordinator at the individual NERR site (please see Section 1 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 <http://cdmo.baruch.sc.edu> Data are available in text format and Access data tables.

8) Associated researchers and projects:

The Geological Survey of Alabama, in cooperation with the United States Geological Survey, maintains two rain gauges within the Weeks Bay watershed. One is located at the highway 98 Magnolia River overpass; the other is located at the highway 104 Fish River overpass.

The following researchers have directly requested and received meteorological data generated from the Weeks Bay weather station for use as either primary or ancillary information significant to their respective projects.

Mastioff, Gerald. Case Western Reserve University. Erosion and transport of fine sediments from watersheds tributary to NERR estuaries.

Chin, Yu-Ping. Ohio State University. Distribution and phototransformation of non-point source agricultural pesticides in freshwater and marine NERR wetlands.

Caffrey, Jane. University of West Florida. Modeling estuarine ecosystem trophic status using continuous nitrate and water quality data.

Landers, Stephen. Troy State University. Environmental factors affecting the distribution and abundance of the benthic protozoological assemblages in Weeks Bay NERR.

Wilson, Chris. Case Western Reserve University. The movement of sediment and radionuclide through Weeks Bay NERR.

Connors, James. University of South Alabama.

II. Physical Structure Descriptors

9) Sensor specifications, operating range, accuracy, date of last calibration

Parameter: Photosynthetically Active Radiation (PAR)

Units: micro-moles per square meter

Sensor type: Li-Cor Quantum Sensor

Model # LI190SB High stability silicon photovoltaic detector (blue enhanced)

Stability: $<\pm 2\%$ change over 1 yr

Operating Temperature: -40 to 65°C
Sensitivity: typically 5 μ A per 1000 μ moles s⁻¹ m⁻²
Light spectrum wavelength: 400 to 700 nm
Calibration dates: 01/05/04

Parameters: Wind Speed and Wind Direction
Units: Wind speed - meter per second (m/s); Wind direction – degrees (?)
Sensor type: Campbell Scientific Wind Sentry Set
Model # 03001
Range: 0-50 m/s; 360° mechanical
Date of last calibration: 04/18/03

Parameters: Temperature and Relative Humidity (up to 04/18/03)
Units: Celsius for temperature and percent for relative humidity
Sensor type: Campbell Scientific
Model #: HMP35C
Operating Temperature: -20-+60°C
Temperature Measurement Range: -35-+50°C
Temperature Accuracy: ± 0.4 °C over range of -24? to 48?C; ± 0.9 over range of -38°C to 53°C
Relative Humidity Measurement Range: 0-100% non-condensing
RH Accuracy: $\pm 2\%$ RH (0-90%) and $\pm 3\%$ (90-100%)
Date of Last calibration: New HMP45C installed on 04/18/03

Parameters: Temperature and Relative Humidity (post 04/18/03)
Units: Celsius for temperature and percent for relative humidity
Sensor type: Campbell Scientific
Model #: HMP45C
Operating Temperature: -40-+60°C
Temperature Measurement Range: -40 to +60°C
Temperature Accuracy: ± 0.2 °C @ 20°C
Relative Humidity Measurement Range: 0-100% non-condensing
RH Accuracy: at 20°C: $\pm 2\%$ RH(0-90%) and $\pm 3\%$ (90-100%)
Temperature dependence of RH measurement: $\pm 0.05\%$ RH/°C

Parameter: Barometric Pressure
Units: millibars (mb)
Sensor type: Campbell Scientific Analog Barometer
Model # CS-105
Operating Range: Pressure – 600-1060 mb
Temperature: -40-+60C
Humidity: non-condensing
Accuracy: ± 0.5 to 6.0 mb (+20-60C)
Stability: ± 0.1 mb per year
Date of Last calibration: New as of 05/17/04

Parameter: Precipitation
Units: millimeters (mm)
Sensor type: Tipping Bucket Rain Gauge
Model #: TE 525
Range: 0.1 mm

Accuracy: 1.0% at <2"/hr
Date of Last calibration: 06/20/04

10) Coded variable indicator and variable code definitions:

wkbwbmet = weeks bay weather station meteorological data, WB= Weeks Bay.

11) Anomalous/Suspect Data:

Arrays:

During 2022 all pre-2007 weather data were revisited by the CDMO. Historically those datasets included 15 minute, hourly (60), and daily data arrays (144). As directed by the NERRS Data Management Committee, the CDMO removed the hourly and daily data arrays leaving only the 15 minute data to make the entire NERRS SWMP weather dataset consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should be aware that they are largely no longer relevant. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout the fall of 2022.

General comments:

1. Rainfall differences of over 5mm between 15minute samples can occur during heavy rains and are common to this site.

2. Relative humidity differences greater than 25% between 15minute samples are not unusual with frontal passages and are usually associated with wind shifts.

3. Air temp differences between 15minute samples greater than 3 degrees are not unusual with frontal passages and are usually associated with wind shifts.

4. Wind speed of less than 0.5m/s are not uncommon for this site.

5. Relative humidity at or near 100% can occur at this site. Reported values up to 103% are within the accuracy range of sensor.

6. PAR: Negative PAR data have been observed during the night; small negative values are within range of the sensor and are due to normal errors in the sensor and the CR10X Datalogger. The Maximum signal noise error for the Licor sensor is +/- 2.214 mmol/m² over a 15 minute interval. The data record contains negative readings to -0008.5. These data less than -2.214 are thought to be caused by calibration drift and have been retained.

September 2004:

All wind direction data after 09/16/04 to the end of the year is approximately 25° less than recorded values (0° reads as 25°) due to the instrument tower being twisted by forces associated with Hurricane Ivan.

It is thought that the following start and end times represent the interval in which precipitation data was not recorded due to the disengagement of tipping bucket data input wire from CR10X control system, any data recorded during this time period is suspect.

Array 15 precipitation data from 09/16/04 at 0215 to 09/30/04 at 1215

Array 60 precipitation data from 09/16/04 at 0300 to 09/30/04 at 1300

Array 144 precipitation data from 09/16/04 to 09/30/04

Precipitation data was recorded on 9/16/04 prior to the disengagement of the wires therefore daily data for 9/16/04 is suspect.

12) Deleted data:

Arrays:

During 2022 all pre-2007 weather data were revisited by the CDMO. Historically those datasets included 15 minute, hourly (60), and daily data arrays (144). As directed by the NERRS Data Management Committee, the CDMO removed the hourly and daily data arrays leaving only the 15 minute data to make the entire NERRS SWMP weather dataset consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should be aware that they are largely no longer relevant. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout the fall of 2022.

January 2004:

Due to malfunctioning LiCor quantum sensor the following data was deleted from the record

Array 15 PAR data from 01/01/04 at 0015 to 01/06/04 1000

Array 60 PAR data from 01/01/04 0000 to 01/06/04 1000

Array 144 PAR data from 01/01/04 to 01/06/04

All data for the following intervals were deleted from the record due to the shutdown of the CR10X control system while replacing LiCor and Barometric Pressure sensors.

Array 15 all data from 01/05/04 at 0830 to 01/05/04 at 1630

Array 60 all data from 01/05/04 at 0900 to 01/05/04 at 1700

Array 144 all data for 01/05/04

Due to new sensor failure the following barometric pressure records were deleted from the record

Array 15 barometric pressure data from 01/05/04 1630 to 01/06/04 0915

Array 60 barometric pressure data from 01/05/04 1700 to 01/06/04 1000

Array 144 barometric pressure data for 01/05/04 and 01/06/04

All data for the following intervals were deleted. Appears that CR10X programming was corrupted, possibly due to attempts to get data online via Dauphin Island Sea Lab.

Array 15 all data from 01/28/04 0845 to 01/31/04 2400

Array 60 all data from 01/28/04 0900 to 01/31/04 2400

Array 144 all data from 01/28/04 to 01/31/04

February 2004:

All data for the following intervals were deleted. Appears that CR10X programming was corrupted, possibly due to attempts to get data online via Dauphin Island Sea Lab.

Array 15 all data from 02/01/04 0015 to 02/05/04 1045

Array 60 all data from 02/01/04 0100 to 02/05/04 1100

Array 144 all data from 02/01/04 to 02/05/04

March 2004:

Deleted all data for the following intervals from the record due to missing array 15 data.

Array 60 all data for 03/19/04 at 2100

Array 144 all data for 03/19/04

April 2004:

Deleted all data for the following intervals from the record due to missing array 15 data.

Array 60 all data for 04/25/04 at 1800

Array 144 all data for 04/25/04

May 2004:

The following barometric pressure data was deleted from the record due to malfunctioning sensor.

Array 15 barometric pressure data from 05/14/04 at 1000 to 05/17/04 at 1245

Array 60 barometric pressure data from 05/14/04 at 1000 to 05/17/04 at 1300

Array 144 barometric pressure data from 05/14/04 to 05/17/04

The following minimum air temperature data was deleted from the record. Record showed a -40.0°C data point, reason unknown.

Array 15 minimum air temperature on 05/14/04 at 1200

Array 60 minimum air temperature on 05/14/04 at 1200

Array 144 minimum air temperature on 05/14/04

June 2004: None

July 2004:

The following PAR data was deleted from the record due to a malfunctioning LiCor quantum sensor.

Array 15 PAR data from 07/16/04 0015 to end of year

Array 60 PAR data from 07/16/04 0015 to end of year

Array 144 PAR data from 07/16/04 to end of year

August 2004: All PAR data was deleted from the record due to a malfunctioning LiCor quantum sensor.

September 2004: All PAR data was deleted from the record due to a malfunctioning LiCor quantum sensor

October 2004: All PAR data was deleted from the record due to a malfunctioning LiCor quantum sensor

November 2004: All PAR data was deleted from the record due to a malfunctioning LiCor quantum sensor

December 2004: All PAR data was deleted from the record due to a malfunctioning LiCor quantum sensor

13) Missing data

Arrays:

During 2022 all pre-2007 weather data were revisited by the CDMO. Historically those datasets included 15 minute, hourly (60), and daily data arrays (144). As directed by the NERRS Data Management Committee, the CDMO removed the hourly and daily data arrays leaving only the 15 minute data to make the entire NERRS SWMP weather dataset consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should be aware that they are largely no longer relevant. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout the fall of 2022.

January 2004: None

February 2004: None

March 2004:

All data for the following time interval is missing from the record, reason unknown

Array 15 all data from 03/18/04 at 1130 to 03/19/04 at 2030

April 2004:

All data for the following time interval is missing from the record due to overwriting existing file.

Array 15 all data from 04/15/04 at 0930 to 04/25/04 at 1715

Array 60 all data from 04/15/04 at 1000 to 04/25/04 at 1700

Array 144 all data from 04/15/04 to 04/24/04

May 2004: None

June 2004: None

July 2004: None

August 2004: None

September 2004: None

October 2004: None

November 2004:

14) Other Remarks/notes

On 10/15/2023 this dataset was updated to include embedded QAQC flags for anomalous/suspect data.

System-wide monitoring data beginning in 2007 were processed to allow for QAQC flags and codes to be embedded in the data files rather than detailed in the metadata alone (as in the anomalous/suspect, deleted, and missing data sections above). Prior to 2007, rejected data were deleted from the dataset so they are unavailable to be used at all, but suspect data were only noted in the metadata document. Suspect data flags <1> were embedded retroactively in order to allow suspect data to be easily identified and filtered from the dataset if desired for analysis and reporting purposes. No other flags or codes were embedded in the dataset and users should still refer to the detailed explanations above for more information.

Arrays:

During 2022 all pre-2007 weather data were revisited by the CDMO. Historically those datasets included 15 minute, hourly (60), and daily data arrays (144). As directed by the NERRS Data Management Committee, the CDMO removed the hourly and daily data arrays leaving only the 15 minute data to make the entire NERRS SWMP weather dataset consistent in its reporting. All references to the 60 and 144 arrays were left in the metadata document as they may still provide valuable information, but users should be aware that they are largely no longer relevant. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout the fall of 2022.

Precipitation:

During the initial years of NERRS SWMP weather data collection the CR10X programming was inconsistent in how precipitation values were recorded. For most reserves, zeros were not recorded when rainfall had not occurred between 2001-2003, instead no rainfall was represented by a blank cell. The CDMO verified which datasets were impacted by this issue for the 2001-2006 datasets and inserted zeros when the metadata indicated that no precipitation occurred and data were not missing for other reasons. In

some cases, zero values for precipitation data were evaluated and removed where the metadata confirmed that no rainfall should have been in the dataset. The pre-2007 data did not go through a thorough QAQC process again at that time (in addition to previous QAQC); however, if discrepancies were noticed between what was documented in the metadata and what was in the dataset, additional updates may have been made. The updated datasets were uploaded to the database and made available through the various data applications at www.nerrsdata.org/get/landing.cfm throughout early 2023.

9/16/04 Hurricane Ivan