

Chesapeake Bay Virginia (CBV) NERR Meteorological Metadata
January 1, 2018 to December 31st, 2018
Latest Update: May 19, 2020

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons.

Chesapeake Bay National Estuarine Research Reserve of Virginia (CBNERRVA)
Virginia Institute of Marine Science, College of William and Mary
PO Box 1346, Gloucester Point, VA 23062
Phone: (804) 684-7135 (main phone line)

Dr. William Reay, Director

E-mail: wreay@vims.edu; (804) 684-7119

Dr. Kenneth Moore, Research Coordinator

E-mail: moore@vims.edu; (804) 684-7384

Mr. Scott Lerberg, Stewardship Coordinator

E-mail: lerbergs@vims.edu; (804) 684-7129

Responsible for Data Management and Submission of MET Data and Metadata.

Mr. Eduardo Miles, Marine Scientist

E-mail: emiles@vims.edu; (804) 684-7836

Responsible for Field Data Collection, Sensor Switch-outs and Weekly Download Efforts

Additional monitoring program support in addition to above stated:

Alynda Miller (Laboratory Specialist), Betty Neikirk (Marine Scientist), Erin Shields (Marine Scientist), Steve Snyder (Laboratory Specialist), Lisa Ott (Laboratory Specialist), Dave Parrish (Marine Scientist), Joy Austin (Lab Manager), Alex Demeo (Field Specialist).

2) Entry verification –

a) Data Input Procedures:

Some History: In 2005, the Centralized Data Management Office converted all SWMP (System Wide Monitoring Program) weather data collected with CR10X program versions prior to version 4.0. This was necessary in order to merge the old data format (12 array output) with the new data format found in version 4.0 (3 array output). The new format (which was used in 2006 metadata reporting) produces averages, maximums and minimums every fifteen minutes (array 15), every hour (array 60) and every day (array 144) for any sensors connected to the CR10X.

At the Taskinas Creek Met Station prior to November 30th, 2006, 15-minute, 1-hour average, and 24-hour data were downloaded from each sensor on the weather station to a Campbell Scientific CR10X datalogger. The CDMO Data Logger Program (NERR.SCI) was loaded into the CR10X and controlled the sensors and data collection schedule. Data collected from the CR10X were stored on a Campbell Scientific storage module (SM4M) and downloaded manually onto a laptop computer using PC208W program from Campbell Scientific. Data were downloaded biweekly or monthly from the storage module located within the weather station.

The raw data files were then exported from the PC208W program in comma-delimited format (.DAT files) and opened in Microsoft Excel using the EQWIN Format Macro developed by CDMO to reformat the header columns, insert station codes, insert a date column, correct the time column format, and format all columns to the correct number of decimal places. This formatted file was

then copied into the EQWIN weather.eqi file where the data were QA/QC checked and archived in a database. Data were investigated as recommended in the CDMO NERR SWMP Data Management Manual Version 5.2, and included the use of queries, graphs, and reports. EQWIN was also used to generate customized reports and export the data in a standardized format to send to CDMO. Any anomalous data were investigated and noted in an Anomalous Data section (Section 11). Data tagged as being “anomalous” are double checked and where the data truly appear anomalous, they are compared with other regional meteorological data for verification. Any data corrections or removed data were noted in the Deleted Data section (Section 12). Any missing data was documented in the Missing Data section (Section 13).

After switching out the Campbell Scientific CR10X Datalogger for a CR1000 instrument at the Taskinas Creek Station (on December 1, 2006) programming changes dictated only 15-minute data being downloaded from each sensor. The CDMO Data Logger Program (CBV_CBVTCMET_V3.0_113006.CR1) was loaded into the CR1000 that controls the sensors and data collection schedule. Data are downloaded biweekly to monthly directly from the CR1000, as the storage module was no longer needed in this new configuration.

For data collection from December 1, 2006 to present, CBNERRVA staff programmed the CR1000 datalogger to collect data in the following formats:

- Averages from 5-second data:
 - Air Temperature (°C), Relative Humidity (%), Barometric Pressure (mb), Wind Speed (m/s), Wind Direction (°), Wind Direction Standard Deviation (°), Battery (volts)
- Maximum, Minimum, and their times from 5-second data:
 - Maximum and Minimum Air Temperature (°C) (these data are not available in the dataset but are available from the CBV NERR)
- Maximum and times from 5-second data:
 - Wind Speed, (m/s)
- Totals from 5-second data:
 - Precipitation (mm), PAR (millimoles/m²), and Cumulative Precipitation (mm) (CBNERRVA started collecting this parameter on May 23rd, 2008 with new program)

Following the installation of the CR1000 (and associated programs), hourly and daily data were no longer collected. In addition, hardware and software changes resulted in a reduced parameter list which no longer included collecting the following parameters (now considered Non-SWMP or Optional parameters):

- Maximum Relative Humidity
- Maximum Relative Humidity Time
- Minimum Relative Humidity
- Minimum Relative Humidity Time
- Maximum Barometric Pressure
- Maximum Barometric Pressure Time
- Minimum Barometric Pressure
- Minimum Barometric Pressure Time
- Minimum Wind Speed
- Minimum Wind Speed Time

Data collected from the CR1000 Version 3.0 Meteorological Program were processed in a slightly different manner than the CR10X. Data were collected directly from the CR1000 and downloaded onto a Personal Computer (IBM compatible) using the LoggerNET Ver. 3.2 program from Campbell Scientific. These raw data files are then exported from the LoggerNET program in comma-delimited

format (.DAT files) and run through a PERL Script program (CONVERT1_GUI_BATCH_V4.exe) to convert the CR1000 raw data file to the CR10X format (with a .csv extension). This intermediate file can then be opened with the EQWIN Format Macro developed by CDMO (November 2006) to reformat the header columns, insert station codes, insert a date column, correct the time column format, and format all columns to the correct number of decimal places (although with a reduced parameter list – see above). The formatted file could then be processed in EQWIN using the same methods described in the paragraph above for the CR10X data.

Effective with the submission of 2007 SWMP MET data, the data submission process was enhanced in order to improve the data delivery and availability of the non-telemetered NERRS SWMP data to the public. CDMO developed a new data upload tool for the submission raw 2007 MET files to the CDMO (including SWMP and Non-SWMP parameters) as well as a new QA/QC Process.

Data are still collected from the CR1000 data logger via Loggernet (Version 3.2) using a laptop computer (Dell Toughbook). Files are exported from LoggerNet in a comma-delimited format (.Dat files) and uploaded to the CDMO where they are stored in a Microsoft SQL provisional database and undergo automated primary QAQC and become part of the CDMO's online provisional database. During primary QAQC, data were flagged if they are missing, out of sensor range, or outside 2 or 3 standard deviations from the historical seasonal mean (although flagging data 2 or 3 standard deviation from the historical seasonal mean was discontinued around September 15, 2008 after deliberations from the Data Management Committee). The edited file is then returned to CBNERRVA where it is opened in Microsoft Excel and processed using the CDMO's NERRQAQC Excel macro (Now Version 2.1202012). The macro inserts station codes, creates metadata worksheets for flagged data, 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 (ODIS). For more information on QAQC flags and QAQC codes, see Sections 11 and 12.

The Meteorological Program stored in the CR1000 was updated from Version 3.0 to Version 4.2 on 9/19/2007 to fix NAN values in the wind speed data and allow for negative PAR values. The Meteorological Program was again updated (from Version 4.2 to Version 5.5) on 5/23/2008 and 6/5/2008 to adjust for how PAR data was transmitted through the GOES system as well as allow for the collection of cumulative precipitation data and again on 6/5/2008 to account for a new 7-Wire Temperature/Humidity Sensor. The Meteorological program was updated one more time on 1/5/2009 (still version 5.5 however) to adjust the programming code to fix a problem with a fluctuating temperature probe. Additional updates to the CR1000 program are identified in the "CR1000" subsection of Section 9 "Sensor Specifications" found below in this document.

Scott Lerberg is currently responsible for the QA/QC of the 2018 Weather Data.

3) Research objectives:

The principal objective is to record long-term meteorological data within the York River watershed in order to observe any environmental changes or trends over time. Data may also be used for watershed related research and to support data collected from the Taskinas Creek water quality station. This data may be used for a number of research purposes including storm surge modeling, understanding storm impacts and intensity, wind data to help define high water level events, atmospheric nutrient loading to the watershed, and useful for atmospheric corrections to water level data.

Taskinas Creek (TC) Component of CBNERRVA:

The Taskinas Creek watershed is representative of an inner coastal plain, rural watershed within the southern Chesapeake Bay system. This watershed is dominated by forested and agricultural land uses with an increasing urban land use component. The drainage basin is suited for investigating hydrologic and non-point source water quality issues associated with developing land use patterns.

4) Research methods:

The Campbell Scientific weather station samples every 5 seconds to produce 15 minute averages (or totals in the case of rainfall and PAR readings) of measurements of air temperature, relative humidity, barometric pressure, rainfall, PAR, wind speed and wind direction (for more information see section 2). Data are collected in Eastern Standard Time (EST) for the entire year. A bi-weekly to occasionally monthly sampling interval (depending on availability of staff personnel) was chosen to periodically inspect and perform field verifications of the accuracy of the sensors and collect and send the raw data to CDMO for primary QA/QC. Sensors are scheduled to be removed and sent back to Campbell Scientific for calibration at minimum of every two years (with the exception of the temperature/humidity sensor and tipping bucket which are scheduled to be calibrated every year). The timing of these replacements were conducted following protocols described in Management Manual Version 6.6 (for more information see Section 9 of this document).

Campbell Scientific data telemetry equipment was installed at the Taskinas Creek station on 11/30/2006 and transmits data to the NOAA GOES satellite, NESDIS ID # 3B009218. 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>.

Brief Summary of Standard, Non-Standard, and Flagged Data Criteria for 2017 Meteorological Data.

- Averages from 5-second data:
 - Air Temperature (Standard and Flagged)
 - Relative Humidity (Standard and Flagged)
 - Barometric Pressure (Standard and Flagged)
 - Wind Speed (Standard and Flagged)
 - Max Wind Speed (Standard and Flagged)
 - Wind Direction (Standard and Flagged)
 - Wind Direction Standard Deviation (Standard and Flagged)
 - Battery Voltage (Non-Standard and Not Flagged)
- Maximum, Minimum, and their times from 5-second data:
 - Maximum and Minimum Air Temperature (Non-Standard and Not Flagged)
 - Note: These data are available from the Reserve
- Times
 - Maximum and Minimum Air Temperature Time (Non-Standard and Not Flagged)
 - Maximum Wind Speed Time (Standard but Not Flagged)
- Totals:
 - Precipitation (mm) (Standard and Flagged)
 - PAR (millimoles/m²) (Standard and Flagged)
 - 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.

Recommended calibration frequency for the MET station sensors:

- Temperature/Humidity – yearly recalibration
- Rain Gauge - yearly recalibration
- Wind Speed/Direction – yearly 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)

5) Site location and character:

The Chesapeake Bay National Estuarine Research Reserve in Virginia (CBNERRVA) is located on the York River, a tributary of the Chesapeake Bay. The Taskinas Creek Reserve, one component of CBNERRVA, encompasses 397 ha (980 acres) and is located within the boundaries of York River State Park near the town of Croaker, Virginia. This small sub-estuary of the York River is located on the southern side of the river, approximately 37 km up river from the mouth of the York River. The Taskinas Creek watershed is representative of an inner coastal plain, rural watershed within the southern Chesapeake Bay system. The watershed is dominated by forested and agricultural land uses with an increasing residential land use component. The non-tidal portion of Taskinas Creek contains feeder streams that drain oak-hickory forests, maple-gum-ash swamps and freshwater marshes.

CBNERRVA maintains a long-term water quality-monitoring station and stream gauge station at Taskinas Creek, a tributary of the York River that is located in the transitional zone of the York River State Park. The Taskinas Creek weather station is also located within York River State Park. The park is located on the mainstem of the York River, which is 50 km long, 38 kilometers from the mouth of the river, and 2.25 kilometer wide near the weather station. The weather station is located (37°24' 50.79850" N, 76°42' 44.51934" W) on a bluff (11m elevation) 60m (horizontal distance) from the York River in a manicured lawn area of the park. No trees or other major structures are within a 35m radius of weather station. The stream gauge is located 2km NW (288 degrees) of the weather station and the water quality station is located 200m (298 degrees) from the weather station. The weather station has a landscape fence around it to deter park visitors from tampering with it. All the instruments are located on the approximately 3.5 m aluminum tower following the descriptions outlined in the CDMO Manual V 4.0. The Tipping Bucket Rain gauge is located within 2m of the tower. The sensors were wired to the CR1000 following the protocol in the CDMO Manual. The station is located approximately 40 feet above mean sea level.

Specific sensor heights are as follows:

Ground to Precipitation Gauge (center of tipping unit) = 172.8 cm

Ground to Screen on Funnel over Precipitation Gauge = 193.7 cm

From Humidity Sensor (Closest Sensor on Tower) to Precipitation Gauge = 157.5 cm

Ground to Bottom of Solar Panel = 170.8 cm

Ground to Top of Solar Panel = 201.9 cm

Ground to Temperature and Humidity Probe = 183.5 cm

Ground to Barometric Pressure Sensor (in box) = 171.5 cm

Ground to Par Sensor (TOP) = 336.6 cm

Ground to Wind Sensor (along main line) = 360.7 cm

Station Code	SWMP Status	Station Name	Location	Active Dates	Reason Decommissioned	Notes
CBVTCMET	P	Taskinas Creek	37° 24' 50.76 N, 76° 42' 44.53 W	1/1/2000 – current	NA	NA

6) Data collection period:

Weather data has been collected from this meteorological station at Taskinas Creek since 2000. Within the calendar year 2018, data was collected (by field downloads onto the laptop computer) on the following dates:

- 1) January 11, 2018 (from 12/14/2017 at 14:15 to 01/11/2018 at 10:30)
- 2) January 24, 2018 (from 01/11/2018 at 10:45 to 01/24/2018 at 12:45)
- 3) February 8, 2018 (from 01/24/2018 at 13:00 to 02/08/2018 at 09:00)
- 4) February 21, 2018 (from 02/08/2018 at 09:15 to 02/21/2018 at 10:00)
- 5) March 8, 2018 (from 02/21/2018 at 10:15 to 03/08/2018 at 09:45)
- 6) March 22, 2018 (from 3/08/2018 at 10:00 to 03/22/2018 at 07:45)
- 7) April 05, 2018 (from 03/22/2018 at 08:00 to 04/05/2018 at 10:00)
- 8) April 19, 2018 (from 04/05/2018 at 10:15 to 04/19/2018 at 10:30)
- 9) May 02, 2018 (from 04/19/2018 at 10:45 to 05/02/2018 at 07:30)
- 10) May 21, 2018 (from 05/02/2018 at 07:45 to 05/21/2018 at 08:00)
- 11) June 06 2018 (from 05/21/2018 at 08:15 to 06/06/2018 at 10:00)
- 12) June 27, 2018 (from 06/06/2018 at 10:15 to 06/27/2018 at 08:45)
- 13) July 9, 2018 (from 06/27/2018 at 09:00 to 07/09/2018 at 10:45)
- 14) July 24, 2018 (from 07/09/2018 at 11:00 to 07/24/2018 at 11:00)
- 15) August 07, 2018 (from 07/24/2018 at 11:15 to 08/07/2018 at 12:30)
- 16) August 22, 2018 (from 08/07/2018 at 12:45 to 08/22/2018 at 12:00)
- 17) September 5, 2018 (from 08/22/2018 at 12:15 to 09/05/2018 at 09:30)
- 18) September 19, 2018 (from 09/05/2018 at 09:45 to 09/19/2018 at 11:45)
- 19) October 3, 2018 (from 09/19/2018 at 12:00 to 10/03/2018 at 09:15)
- 20) October 16, 2018 (from 10/03/2018 at 09:30 to 10/16/2018 at 07:45)
- 21) November 01, 2018 (from 10/16/2018 at 08:00 to 11/01/2018 at 08:30)
- 22) November 16, 2018 (from 11/01/2018 at 08:45 to 11/16/2018 at 10:00)
- 23) November 30, 2018 (from 11/16/2018 at 10:15 to 11/30/2018 at 11:45)
- 24) December 18, 2018 (from 11/30/2018 at 12:15 to 12/18/2018 at 09:45)
- 25) January 09, 2019 (from 12/18/2018 at 10:00 to 01/09/2019 at 11:30).

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.nerrsddata.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.nerrsddata.org. Data are available in comma delimited format.

8) Associated researchers and projects:

CBNERRVA System Wide Monitoring Program. Since its initiation in 1995, CBNERRVA has fully participated in the NOAA/NERRS System-Wide Monitoring Program. Within the York River system, CBNERRVA maintains a network of long-term, year-round continuous water quality stations located at White House (2003-current), Sweet Hall Marsh (2000-current), Taskinas Creek (1995-current), Clay Bank (2001-current), Gloucester Point (2003-current) and Goodwin Island (1997-current). In 2002 and 2004, CBNERRVA implemented the NOAA/NERRS nutrient/plant pigment monitoring program and SAV Tier II Biological Monitoring Program, respectively. Beginning in 2000, CBNERRVA established a weather station at Taskinas Creek to support meteorological monitoring aspects of SWMP. In addition, CBNERRVA maintains additional weather stations at Sweet Hall Marsh to support York River watershed level studies and site-specific research projects. Meteorological data also supports CBNERRVA Sentinel Site Monitoring Efforts, as CBNERRVA is a NERRS Sentinel Site as well as a part of the Chesapeake Bay Sentinel Site Cooperative.

Integrated Ocean Observing System (IOOS). The CBNERRVA Meteorological Monitoring Program supports the national and Mid-Atlantic Coastal Ocean Observing Regional Association (MACOORA) through its participation in NERRS SWMP. CBNERRVA is also actively engaged at a more subregional and local level through its support of the Chesapeake Bay Observing System (CBOS) and the Virginia Estuarine and Coastal Observing System (VECOS). Real-time delivery of physical parameters is currently available for two stations through the National Weather Service's Hydrometeorological Automated Data System; stations include Taskinas Creek (NESDIS ID: 3B009218; NWS Location ID: YRSV2), and Sweet Hall Marsh (NESDIS ID: 3B0116F6; NWS Location ID: SHXV2).

II. Physical Structure Descriptors

Sensor specifications:

Parameter: Temperature (HC2-S3)

Units: Celsius

Sensor type: PT100 RTD, IEC 751 1/3 Class B

Model #: HC2-S3 Rotronics Temperature/RH Probe

Operating Temperature: -40° to +100°, Range: -40°C to +60°C

Accuracy at 23°C: ±0.1°C with standard configuration settings

Date of previous calibration (HC2-S3 SN: 20078449): 11/23/2015. Dates Installed: 3/22/2017 to 05/03/2018.

Date of previous calibration (HC2-S3 SN: 20075663): 2/21/2017. Dates Installed: 05/03/2017 to 03/22/2018.

Date of previous calibration (HC2-S3 SN: 20078449): 03/08/2018. Dates Installed: 03/22/2018 to 11/30/2018. **Note – changed to a different type sensor (the EE181) at this date (see below).**

Parameter: Temperature (EE181)

Units: Celsius

Sensor type: 1000 Ω Platinum Resistance Thermometer (PRT)

Model #: Air Temperature and Relative Humidity Sensors / EE181-L

Operating Temperature: -40° to +60°, Storage Range: -40°C to +80°C

Accuracy at 23°C: $\pm 0.2^\circ\text{C}$ with standard configuration settings

Date of last calibration (EE181 (New Sensor): 183616000082FB): 11/30/2018. Dates Installed: 11/30/2018 – current as of 05/15/2019

Parameter: Relative Humidity (HC2-S3)

Units: Percent

Sensor type: ROTRONIC® Hygromer IN-1 Relative Humidity Sensor

Model #: HC2-S3 Rotronics Temperature/RH Probe

Measurement Range: 0 to 100% RH, non-condensing

Accuracy at 23°C: $\pm 0.8\%$ RH with standard configuration settings

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

Date of previous calibration (HC2-S3 SN: 20078449): 11/23/2015. Dates Installed: 3/22/2017 to 05/03/2017.

Date of previous calibration (HC2-S3 SN: 20075663): 2/21/2017. Dates Installed: 05/03/2017 to 03/22/2018.

Date of previous calibration (HC2-S3 SN: 20078449): 03/08/2018. Dates Installed: 03/22/2018 to 11/30/2018. **Note – changed to a different type sensor (the EE181) at this date (see below).**

Parameter: Relative Humidity (EE181)

Units: Percent

Sensor type: Capacitance

Model #: Air Temperature and Relative Humidity Sensors / EE181-L

Measurement Range: 0 to 100% RH, non-condensing

Accuracy at -15° to +40°C: $\pm (1.3 + 0.003 \cdot \text{RH reading})\%$ RH (0 to 90% RH); $\pm 2.3\%$ RH (90 to 100% RH)

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

Date of last calibration (EE181 (New Sensor): 183616000082FB): 11/30/2018. Dates Installed: 11/30/2018 – current as of 05/15/2019.

Parameter: Barometric Pressure

Units: millibars (mb)

Sensor type: Vaisala Barocap © silicon capacitive pressure sensor

Model #: CS-105

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

Date of previous calibration: 12/22/2015. Dates Installed: 01/07/2016 to 2/21/2017 (SN V4040019)

Date of previous calibration: 02/09/2017. Dates Installed: 02/21/2017 to 11/30/2018 (SN R1630018)

Date of last calibration: 11/14/2018. Dates Installed: 11/30/2018 and current as of 05/15/2019: (SN Y3420020)

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 Wind Monitor

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

Accuracy: +/- 0.3 m/s

Date of previous calibration: 5/18/2015. Date Installed 6/09/2015 to 07/05/2017 (SN WM59936)

Date of last calibration: 06/08/17. Date Installed 07/05/2017 and current as of 05/15/2019: (SN WM60365)

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: +/- 3 degrees

Date of previous calibration: 5/18/2015. Date Installed 6/09/2015 to 07/05/2017 (SN WM59936)

Date of last calibration: 06/08/17. Date Installed 07/05/2017 and current as of 05/15/2019: (SN WM60365)

Parameter: Photosynthetically Active Radiation (New)

Units: mmols m⁻² (total flux)

Model #: Apogee SQ-110 Sun Calibration Quantum Sensor.

Sensor type: Next generation sensor head design, self-cleaning dome shaped head, potted solid for extreme conditions. Blue diffuser reduces spectral error to less than 5% for sunlight.

Light spectrum waveband: 410 nm to 655 nm (response is greater than 50 % of maximum)

Temperature Response: 0.06 ± 0.06 % per C

Stability: <±2% change over 1 yr

Operating Temperature: -40°C to 70°C; Humidity: 0 to 100%, Submerged in Water to 30 m.

Sensitivity: typically -120 – 0.2 mV per μmol m⁻² s⁻¹

Date of previous calibration (Apogee SQ-110 SN 18008): 3-1-2015. Dates Installed 06/09/2015 to 3/7/2017. Constant 0.025 PAR Multiplier Applied.

Date of previous calibration (Apogee SQ-110 SN 22329): 2-1-2017. Dates Installed 3/7/2017 and current until 05/15/2019. Constant 0.025 PAR Multiplier Applied.

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

Date of Last calibration: Calibrated on 11/30/2018 (before that was 11/2/2017)

CR1000

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.

Date CR1000 Installed: December 1, 2006

Date CR1000 Calibrated: None (Has Not Been Calibrated Since 2006)

- Upgrade to Operating System 19 on April 16, 2010
- Also, on April 16th, 2010 made changes to the CR1000 programming that no longer requires manual entry of the Par Multiplier variable in the numeric field.
- Upgrade to Operating System 20 on October 5, 2010
- Upgrade to Operating System 21 on December 22, 2010
- Upgrade to Operating System 24 on March 30th, 2012 (as well as some code from Jeff Adams of Campbell which allows CBNERRVA to check the LICOR PAR Readings with an independent ground unit.).
 - a. Program named cbvtcmnet 6.0 033012.cr1
 - b. Used from 1/1/2013 to 7/5/2013
- Change in Weather Program on July 5th, 2013 to allow for a new PAR multiplier to be input into the program code with replacement of LICOR Sensor.
 - a. Program named cbvtcmnet 6.0 070513.cr1
 - b. Used from 7/5/2013 to 06/09/2015.

Date of New CR1000 Installation: February 11, 2015 (at 1500 on 2/11/15).

- **Serial Number for new CR1000 is 63889, Using OS 27 (pre-installed on unit)**
- **CR1000 Program Version(s)(as of 02/11/2015):** cbvtcmnet V6.0 070513.cr1
- **CR1000 Program Version (as of 06/09/2015):** cbvtcmnet V6.0 060915.cr1
 - New Programming for Apogee SQ-110 Sun Calibration Quantum Sensor. (replaced Licor LI190 Sensor) and new programming for Campbell HC2-S3 Rotronics Temperature/RH Probe (replaced the Campbell HMP45AC).
- **CR1000 Program Version (as of 8/1/2018):** cbvtcmnet V6.0 060915.cr1
- **CR1000 Program Version (changed on 11/30/2018 and current to 05/15/2019):**
 - CBVTCMET_CR1000_6.0_113018.cr1
 - Includes new programming for EE181 Temp/RH Sensor.

10) Coded Variable Definitions:

- Sampling station: Taskinas Creek
- Sampling site code: TC
- Station code: cbvtcmnet

11) QAQC flag definitions – Describes automated primary/secondary 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 – This section details the secondary QAQC Code definitions used in combination with the QAQC flags above.

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/Codes

Some General 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 but within range of the sensor accuracy (+/-3%) have also been flagged as suspect data (<1>) and coded as “CAF” (or within accuracy error of sensor). 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.

Explanations for Coded Data in the 2018 Taskinas Creek MET Dataset

1. Precipitation Corrections (Flagged 5-Corrected Data).

- These were false rain gauge readings resulting from tipping the rain gauge (to check accuracy) during bi-weekly downloads. In all cases, the cumulative precipitation data for days the rain gauge was checked or calibrated were also corrected and flagged as <5> and coded as SMT (Instrument Maintenance) or SSM (Sensor Malfunction).

<u>Date</u>	<u>Time</u>	<u>Value</u>
01/11/2018	10:45	0.508
01/24/2018	13:00	0.508
02/08/2018	09:15	0.508
02/21/2018	10:15	0.508
03/08/2018	10:00	1.016
03/22/2018	08:00	0.762
04/05/2018	10:00	0.508
04/19/2018	10:30	0.508
05/02/2018	07:45	0.508
05/21/2018	08:15	0.508
06/06/2018	10:15	0.508
06/27/2018	09:00	0.508
07/09/2018	10:45	0.508
07/24/2018	11:15	0.508
08/07/2018	12:30	0.254
08/07/2018	12:45	0.762
08/22/2018	12:15	0.508
09/05/2018	09:45	0.508 (note – data are flagged as corrected and are considered suspect due to clogging observed in rain gauge).
09/19/2018	12:00	1.016
10/03/2018	09:30	0.762
10/16/2018	08:00	0.508
11/01/2018	08:30	0.508
11/16/2018	10:15	0.508

11/30/2018	12:45	3.302 (Rain Gauge Calibration)
11/30/2018	13:00	19.05 (Rain Gauge Calibration)
11/30/2018	13:15	18.542 (Rain Gauge Calibration)
11/30/2018	13:30	25.654 (Rain Gauge Calibration)
11/30/2018	13:45	7.874 (Rain Gauge Calibration)
12/18/2018	09:45	0.508

2. Rejected Data – Sensor Maintenance on ATemp/RH Sensor

- The data for air temperature and relative humidity at 10:45 and 11:00 on 01/11/2018 been flagged as -3 (rejected) and coded as SMT, CSM (Sensor Maintenance) because of the removal of the Teflon filter on the HC2-S3 Rotronics Temperature/RH Probe for cleaning/de-icing during this time period. Changed between 10:40 and 10:50.
- The data for air temperature and relative humidity at 08:00 and 08:15 on 03/22/2018 been flagged as -3 (rejected) and coded as SMT, CSM (Sensor Maintenance) due to changing out the HC2-S3 Rotronics Temperature/RH Probe on this day (OLD SN= 20075663 and New SN= 20078449). Temperature/RH Sensor changed between 7:55 and 8:05. As it appears that during the changing of this sensor (and taking out the wires of the old sensor and installing the wires for the new sensor), there might have been (by accident) a ground cable wire removed for the wind monitor (and quickly replaced) which caused issues for this sensor during the time period of 8:00 to 8:15. For this reason, the data for wind direction, wind speed, max wind speed, and wind direction (SD) at 8:15 was also flagged as rejected (-3) and coded as SMT, CSM (during sensor maintenance) on this day.
- The data for temperature and relative humidity at 08:45 and 09:00 on 11/01/2018) has been flagged as -3 (rejected) and coded as SMT, CSM (Sensor Maintenance) because the temperature/humidity sensor was replaced on this day. The cable on the HC2-S3 Temp/RH Sensor (SN 20078449) was replaced with a spare cable to test if the cable might be the cause of some of the questionable temperature/relative humidity readings.
- In addition, on 11/30/2018 the HCS-S3 Sensor (SN20078449) was replaced with a different model (Campbell EE181, SN 183616000082FB) during the time period of 12:05 to 12:35. Thus, the temperature/sensor data at 12:15, 12:30, and 12:45 was flagged as rejected (-3) and coded as SMT (GPR for 12:15), CSM (Sensor Maintenance). **Note: Unlike past air temperature/relative humidity sensors used at this station, the EE181-L caps relative humidity values at 100%.**

3. Suspect/Rejected Temperature and Relative Humidity Data

- The data for air temperature (and corresponding relative humidity data) has been flagged as suspect beginning on June 1st, 2018 at 00:00 and continuing until the end of this reporting period (June 30th at 23:45). Although CBNERRVA staff have no specific issues or faults with the performance of the temperature/humidity sensor during this time period (and checks with the Kestrel were on target), the values at Taskinas Creek tended to be slightly higher than those recorded at another meteorological station, Sweet Hall Marsh, and there was an upward trend in the magnitude of the differences between those stations over time. We will continue to monitor this sensor.
- Three data points for air temperature have been flagged as rejected (-3) and coded as CSM during the 2nd Quarter of 2018. These data appeared to be outliers when compared with checks against local stations and other data collected from the same station on that day. These events occurred on June 4th (at 17:00 and 17:15) as well as on June 30th (at 10:00

AM). At these dates and time, the corresponding relative humidity data was rejected as well.

- There were large continuous pieces of temperature data that has been flagged as suspect for the third quarter at Taskinas Creek. Although CBNERRVA staff haven't seen any sensor "faults" during this time period (and checks with the Kestrel were on target), there were periods of times where the recorded temperature values at Taskinas Creek were higher (both in daily highs and lows – the whole range) than those recorded at another meteorological station, Sweet Hall Marsh, as well as data from a meteorological station in West Point. These trends started during the 2nd quarter of 2018 and have continued in the 3rd and 4th quarters of 2018. . CBNERRVA believe this might be issues with the temperature/humidity sensor being deployed (HC2S3) and due to past issues with this particular model of sensor, CBNERRVA purchased a new type of temperature/RH Sensor (the EE181) and this was installed on 11/30/2018. On 11/1/2018, CBNERRVA staff changed just the cable for the HC2-S3 sensor (and not the actual HC2-S3 Sensor itself) at Taskinas Creek and there were no issues in the period of time (about 1 month, from November 1, 2018 to November 30th, 2018)when the cable was replaced and the new sensor model (the EE181) was installed at Taskinas Creek. During this time period, the following temperature (and corresponding humidity data) data was flagged as suspect (<1>) or in a couple cases flagged as rejected (<-3>). However, in some cases (see bullet 12 below), the relative humidity data will already be flagged due to separate checks for relative humidity (values recorded between 101 and 103 flagged as suspect and values recorded above 103 flagged as rejected) and in those cases, you might have temperature data flagged as suspect but have rejected relative humidity data.

- Suspect Temp data from 7/1/2018 (00:00) to 7/9/2018 (10:30) - site visit time.
- Suspect Temp data from 7/19/2018 (from 12:00 to 19:00)
- Suspect Temp data from 7/22/2018 (from 11:00 to 14:30)
- Suspect Temp data from 7/23/2018 (from 12:00 to 19:30)
- Suspect Temp data from 07/27/2018 (00:00) to 08/07/2018 (12:00) – site visit time
- Rejected Temp data on 7/28/2018 (at 13:45)
- Suspect Temp data from 09/01/2018 (from 10:45-11:15 and 13:00-13:30).
- Suspect Temp data from 09/02/2018 (from 14:15-17:00)
- Suspect Temp data from 09/05/2018 (09:30) site visit to 09/30/2018 (23:45)
- Rejected Temp data on 9/15/2015 at 22:15.
- Suspect Temperature and Humidity data from 10/1/2018 to 11/1/2018 at 8:30 AM. Note: During the time period of 8:34 to 8:49 AM on 11/1/2018 the cable running from HC2-S3 sensor to the CR1000 was replaced (to test a suggestion that the cable might be a cause of the elevated readings).

4. Suspect/Rejected Data – Elevated RH Readings.

- The data for relative humidity been flagged as either suspect (coded as CSM) or rejected (coded as SQR) for elevated relative humidity readings during this time period. This included the following dates/times.
 - 6/04/2018 (suspect at 23:30 and 23:45)
 - 6/10/2018 (suspect at 20:00)
 - 6/18/2018 (suspect at 00:15, 00:30, and 01:00)
 - 6/18/2018 (rejected at 00:45)
 - 6/19/2018 (suspect at 20:45 and 21:00).
 - 7/03/2018 (suspect at 06:00 and reject at 3:15 and 5:15-05:45)
 - 7/04/2018 (reject from 1:30 to 02:45)

- 7/05/2018 (suspect from 3:30 to 03:45)
- 7/28/2018 (suspect at 3:15 and reject 3:30 and 4:45).
- 8/04/2018 (reject at 21:30 and suspect at 21:45).
- 8/05/2018 (suspect 17:45, 19:15, 21:30 and reject at 21:45).
- 8/06/2018 (suspect at 18:45 and reject from 19:00-20:00).
- 8/07/2018 (reject at 07:00 and suspect at 07:15).
- 9/04/2018 (reject from 00:00-00:15).
- 9/05/2018 (reject from 21:45-22:00).
- 9/06/2018 (reject at 23:45).
- 9/07/2018 (suspect at 00:00)
- 9/08/2018 (suspect at 4:45,14:15,15:45,18:00-18:15)
- 9/08/2018 (reject from 1:30-4:30,14:30-15:30, 18:30-18:45)
- 9/10/2018 (reject from 23:30-23:45)
- 9/11/2018 (suspect at 00:30)
- 9/11/2018 (reject from 00:45-1:30, 02:45, 18:00-18:15, and 18:45)
- 9/12/2018 (reject from 23:30-23:45)
- 9/13/2018 (suspect from 01:45-02:00 and 07:00-07:15)
- 9/13/2018 (reject from 02:15-06:45; 07:45-10:00).
- 9/15/2018 (reject from 21:30-22:30)
- 9/15/2018 (suspect at 22:45).
- 9/18/2018 (suspect from 17:15-17:30)
- 9/19/2018 (reject at 19:30 and suspect from 19:45)
- 9/21/2018 (suspect at 19:00)
- 9/23/2018 (suspect at 01:00 and reject from 1:15)
- 9/25/2018 (suspect at 08:45)
- 9/27/2018 (suspect from 11:45-12:15 and reject from 12:30-13:00).
- 9/28/2018 (reject at 4:15 and 5:30)
- 10/03/2018 (suspect at 22:45 and reject at 23:00, 23:15, 23:30, and 23:45)
- 10/04/2018 (reject at 00:00, 00:15, and 00:45)
- 10/05/2018 (suspect at 02:00, 17:15 and reject at 02:15 and 02:30)
- 10/06/2018 (suspect at 21:45 and reject at 22:00)
- 10/08/2018 (suspect at 00:45 and reject at 01:00 and 01:15).
- 10/10/2018 (reject at 01:15, 01:30, 01:45 and 02:15 and suspect at 02:00).
- 10/11/2018 (suspect at 21:15)

5. Suspect Precipitation Data – Funnel Clogged Affecting Precipitation Data.

- During the biweekly trip for maintenance at the Taskinas Creek Weather Station on September 5, 2018 it was discovered that the rain funnel was clogged and was holding a small amount of water in the funnel. During the time period between this site visit (08/22/2018 at 12:15) and the previous site visit (09/05/2018 at 09:30) there were a few rain events captured at Sweet Hall Marsh (specifically on 9/4/2018) that were not recorded to the same degree at the Taskinas Creek site. As we can't know for sure if the rain gauge was clogged during those events and might have impacted the quality of the rain data at the Taskinas Creek Site, we have decided to mark the entire time period between site visits (starting at 00:00 on 08/30/2018 (the first day of any precipitation after the site visit) as suspect even though the data might be acceptable for use. These data were flagged as suspect (<1>) and coded as SSM (Sensor Malfunction) up until the end of the day of the following site visit on 9/6/2018 at 00:00.

6. Rejected Data– Sensor Maintenance on the Pressure Sensor

- The data for barometric pressure at 08:45 on 11/01/2018 has been flagged as rejected (-3) and coded as SMT, CSM (Sensor Maintenance) which is mostly likely due to a wire being

pulled for this sensor during work on the temperature/relative humidity cable and wires on this day.

- The data for barometric pressure at 12:30 on 11/30/2018 (work occurred on sensor between 12:10 and 12:29) has been flagged as -3 (rejected) and coded as SMT, CSM (Sensor Maintenance) because the barometric pressure sensor was replaced on this day. The sensor was changed from one sensor (Old SN = R1630018) to a newly calibrated (and repaired from Campbell) sensor (NEW SN = Y3420020).

7. Missing Data 2018 – Weather Station Maintenance

- All data is missing at 12:00 PM on 11/30/2018 due to uploading a new program (from 11:45 to 11:55) to the CR1000 at the Taskinas Creek weather station which was necessary due to coding changes in the CR1000 due to installing a new model of a new temperature and relative humidity sensor (replacing the Campbell HC2-S3 with a Campbell EE181). All data has been flagged with -2 (for missing data) and coded as GPR, CSM (for program reload).

8. Rejected Data – Weather Station Maintenance.

- Data for all parameters at 12:15 has been flagged as rejected (-3) and coded as GPR, CSM (program reload) due to work on the station on 11/30/2018. The line of data following a program upload is most likely not a full 15 minutes of 5-second data.