

Chesapeake Bay Virginia (CBV) NERR Meteorological Metadata

January 1, 2010 to December 31, 2010

Latest Update: October 15, 2014

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons.

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Responsible for Field Data Collection.

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 (degrees), Wind Direction Standard Deviation (degrees), Battery Voltage (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 laptop computer 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 2.01242009). The macro inserts station codes, creates metadata worksheets for flagged data, 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.

Brief Summary of Standard, Non-Standard, and Flagged Data Criteria for 2010 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, available from CBV NERR)
- Times
 - Maximum and Minimum Air Temperature Time (Non-Standard and Not Flagged, available from CBV NERR)

- Maximum Wind Speed Time (Standard but Not Flagged)
- Totals:
 - Precipitation (mm) (Standard and Flagged)
 - PAR (millimoles/m²) (Standard and Flagged)
 - Cumulative Precipitation (mm) (Standard and Flagged)

Scott Lerberg was responsible for the QA/QC of the 2010 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 research. Samples were taken every 5 seconds and averaged or totaled over 15 minutes for roughly two-week collecting intervals.

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). 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). It should be noted that the wind monitor was replaced with a newly calibrated unit on October 4th, 2010, the temperature/humidity probe and pressure sensor were replaced on July 27th, 2010, the licor sensor was replaced on May 7th, 2010, and the precipitation gauge was calibrated on December 22nd, 2010. The timing of these replacements were conducted following protocols described in Management Manual Version 6.3 (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>.

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. 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) of 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

6) Data collection period:

Weather data has been collected from this meteorological station at Taskinas Creek since 2000. Within the calendar year 2010 data was collected (by field downloads onto the laptop computer) on the following dates:

- 1) January 6, 2010 (from 01/01/2010 at 0:15 to 01/06/2010 at 15:30)
- 2) January 20, 2010 (from 01/06/2010 at 15:45 to 01/20/2010 at 12:30)
- 3) February 4, 2010 (from 01/20/2010 at 12:45 to 02/04/2010 at 09:45)
- 4) February 17, 2010 (from 02/04/2010 at 10:00 to 02/17/2010 at 09:30)
- 5) March 4, 2010 (from 02/17/2010 at 09:45 to 03/04/2010 at 10:15)
- 6) March 17, 2010 (from 03/04/2010 at 10:30 to 03/17/2010 at 08:45)
- 7) March 30, 2010 (from 03/17/2010 at 09:00 to 03/30/2010 at 09:15)
- 8) April 14, 2010 (from 3/30/2010 at 09:30 to 04/14/2010 at 08:45)
- 9) April 16, 2010 (from 4/14/2010 at 09:00 to 04/16/2010 at 09:00)
 - o Note: Missing Data at 09:15, 09:30, and 09:45 on 4/16/2010
- 10) April 28, 2010 (from 4/16/2010 at 10:00 to 04/28/2010 at 09:00)
- 11) May 7, 2010 (from 04/28/2010 at 09:15 to 05/07/2010 at 13:00)
 - o Note: Missing Data at 13:15 and 13:30 on 5/7/2010
- 12) May 12 2010 (from 05/07/2010 at 13:45 to 05/12/2010 at 08:15)
- 13) May 27, 2010 (from 5/12/2010 at 08:30 to 05/27/2010 at 09:00)
- 14) June 9, 2010 (from 05/27/2010 at 09:15 to 06/09/2010 at 13:15)
- 15) June 23, 2010 (from 06/9/2010 at 13:30 to 06/23/2010 at 11:30)
- 16) July 6, 2010 (from 06/23/2010 at 11:45 to 07/06/2010 at 08:45)
- 17) July 21, 2010 (from 07/06/2010 at 09:00 to 07/21/2010 at 12:00)
- 18) July 27, 2010 (from 07/21/2010 at 12:15 to 07/27/2010 at 16:45)
- 19) August 4, 2010 (from 07/27/2010 at 17:00 to 08/04/2010 at 08:15)
- 20) August 18, 2010 (from 08/04/2010 at 08:30 to 08/18/2010 at 09:45)
- 21) September 1, 2010 (from 08/18/2010 at 10:00 to 09/01/2010 at 11:30)
- 22) September 15, 2010 (from 09/01/2010 at 11:45 to 09/15/2010 at 08:45)
- 23) October 1, 2010 (from 09/15/2010 at 09:00 to 10/1/2010 at 09:15)
- 24) October 5, 2010 (from 10/1/2010 at 09:30 to 10/05/2010 at 10:15)

- Note: Missing Data at 10:30, 10:45, and 11:00 on 10/5/2010
- 25) October 13, 2010 (from 10/05/2010 at 11:15 to 10/13/2010 at 08:30)
- 26) October 27, 2010 (from 10/13/2010 at 08:45 to 10/27/2010 at 11:45)
- 27) November 15, 2010 (from 10/27/2010 at 12:00 to 11/15/2010 at 10:45)
- 28) November 29, 2010 (from 11/15/2010 at 11:00 to 11/29/2010 at 12:45)
- 29) December 15, 2010 (from 11/29/2010 at 13:00 to 12/15/2010 at 12:00)
- 30) December 22, 2010 (from 12/15/2010 at 12:15 to 12/22/2010 at 15:00)
- Note: Missing Data at 15:15 on 12/22/2010
- 31) December 31, 2010 (from 12/22/2010 at 15:30 to 12/31/2010 at 23:45) (this download was actually conducted on January 4th, 2011).

7) Distribution – This section will address data ownership and data liability with the following excerpt from the Ocean and Coastal Resource Management Data Dissemination Policy for the NERRS System-wide Monitoring Program in the metadata.

NOAA/ERD retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The PI retains the right to be fully credited for having collected and processed the data. Following academic courtesy standards, the PI and NERR site where the data were collected will be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. Manuscripts resulting from this NOAA/OCRM supported research that are produced for publication in open literature, including refereed scientific journals, will acknowledge that the research was conducted under an award from the Estuarine Reserves Division, Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration. The data set enclosed within this package/transmission is only as good as the quality assurance and quality control procedures outlined by the enclosed metadata reporting statement. The user bears all responsibility for its subsequent use/misuse in any further analyses or comparisons. The Federal government does not assume liability to the Recipient or third persons, nor will the Federal government reimburse or indemnify the Recipient for its liability due to any losses resulting in any way from the use of this data.

NERR weather 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 <http://cdmo.baruch.sc.edu/>. Data are available in comma separated 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 Mars, and Harcum Creek to support York River watershed level studies and site-specific research projects.

National Atmospheric Deposition Program's National Trends Network (NADP/NTN) and Mercury Deposition Network (NADP/MDN). CBNERRVA staff maintains the southern

Chesapeake Bay NADP/NTN and NADP/MDN station (ID: VA98) at Harcum, Va. The network's purpose is to collect data on the chemistry of precipitation for monitoring of temporal and geographical long-term trends of concentrations and loading rates. Measured physical parameters include air temperature, precipitation, PAR, wind speed and direction. Measured chemical parameters include hydrogen ion activity (acidity as pH), sulfate, nitrate, ammonium, chloride, base cations (such as calcium, magnesium, potassium and sodium), total mercury and methyl-mercury. The NADP/NTN and NADP/MDN stations were established in August, 2004 and December, 2004, respectively. Real-time delivery of physical parameters is currently available at this station through the National Weather Service's Hydrometeorological Automated Data System (HADS; NESDIS ID: 3B01236C; NWS Location ID: HAXV2) . Real-time data are available via the web at <http://www.nws.noaa.gov/oh/hads/>. Archived precipitation chemistry data are available via the web at <http://nadp.sws.uiuc.edu> . Partners: CBNERRVA, NADP and VaDEQ.

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 three stations through the National Weather Service's Hydrometeorological Automated Data System; stations include Taskinas Creek (NESDIS ID: 3B009218; NWS Location ID: YRSV2), Sweet Hall Marsh (NESDIS ID: 3B0116F6; NWS Location ID: SHXV2) and Harcum (NESDIS ID: 3B01236C; NWS Location ID: HAXV2).

II. Physical Structure Descriptors

9) Sensor specifications:

Parameter: Temperature

Units: Celsius

Sensor type: Platinum resistance temperature detector (PRT)

Model #: HMP45C Temperature and Relative Humidity Probe

Operating Temperature: -40°C to +60°C

Range: -40°C to +60°C

Accuracy: ± 0.2 °C @ 20°C

Date of previous calibration: 7/10/2008. Date Installed 12/1/2009

Date of last calibration: 6/21/2010. Date Installed 7/27/2010

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

Date of previous calibration: 7/10/2008. Date Installed 12/1/2009

Date of last calibration: 6/21/2010. Date Installed 7/27/2010

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 last calibration: 7/10/2008. Date Installed 12/1/2009

Date of last calibration: 6/21/2010. Date Installed 7/27/2010

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 last calibration 8/1/2008. Date Installed 1/5/2009

Date of last calibration 5/11/2009. Date Installed 10/4/2010

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 last calibration 8/1/2008. Date Installed 1/5/2009

Date of last calibration 5/11/2009. Date Installed 10/5/2010

Parameter: Photosynthetically Active Radiation

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: $\leq \pm 2\%$ change over 1 yr

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

Sensitivity: typically 5 μ A per 1000 μ moles s⁻¹ m⁻²

Multiplier: ***List multiplier(s) and date(s) of change***

Date of last calibration: 4/9/2008. Date Installed 12/1/2009 Par Multiplier = 1.2657715

Date of last calibration: 4/16/2010. Date Installed 5/7/2010 Par Multiplier = 1.4223615

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: $\pm 1.0\%$ up to 1 in./hr; $\pm 0, -3\%$ from 1 to 2 in./hr; $\pm 0, -5\%$ from 2 to 3 in./hr

Date of Last calibration: Calibrated on 12/22/2010 (before that was 12/1/2009)

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

- Upgrade to Operating System 19 on April 16, 2010
- Also, on April 16th, 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

10) Coded Variable Definitions:

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

11) QAQC flag definitions – This section details the automated primary and 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.

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

SIC	Incorrect Calibration Constant, Multiplier or Offset
SIW	Incorrect Wiring
SMT	Sensor Maintenance
SNV	Negative Value
SOC	Out of Calibration
SSN	Not a Number / Unknown Value
SSM	Sensor Malfunction
SSR	Sensor Removed

Comments

CAF	Acceptable Calibration/Accuracy Error of Sensor
CDF	Data Appear to Fit Conditions
CRE	Significant Rain Event
CSM	See Metadata
CCU	Cause Unknown
CVT	Possible Vandalism/Tampering

13) Other remarks/notes:

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 sensor and are due to normal errors in the sensor and the CR1000 Datalogger. The Maximum signal noise error for the Licor sensor is +/- 2.214 mmol/m² over a 15 minute interval. These data were automatically flagged as suspect data (<1>) and coded as “CAF” (or within accuracy error of sensor). More explanation can be found under bullet No. 3 (below).
- 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). This occurred on November 14th, 2010, November 29th, 2010, December 16, 2010, December 25th, and December 26, 2010 (136 relative humidity readings of 101).
- Cumulative precipitation data are recorded from 00:00 to 23:59 with the daily total recorded at the midnight mark (00:00). The midnight CumPrcp value is actually the total from the previous day.

Explanations for Data Coded as *CSM* (see metadata) within Taskinas Creek 2010 Dataset

1. **CDMO edits to 2010 metadata and data on 10/15/2014:** There were noticeable changes in PAR values following the swap to a freshly calibrated sensor (assumed to be accurate) on 03/30/2012. Apogee reported a -5.40% (-2.43% drift/year) post cal drift for the sensor that was installed from 05/07/2010-03/30/2012 (Q35110). Acceptable drift is +/- 2% for this

sensor. **All PAR data 1 year prior the sensor swap, from 03/30/2011 to 03/30/2012 are flagged and coded as <1> SSD CSM. PAR data for the remainder of this deployment (05/07/2010-03/29/2011) are flagged and coded <0> CSM** and users should note that drift for that period may have exceeded acceptable limits as well. If users are comfortable assuming that drift was linear (in a real world environment it is unlikely to be entirely linear), these data may be ‘corrected’ for assumed linear drift at the user’s discretion using manufacturer’s instructions.

2. Precipitation Corrections (Flagged as 5 for Corrected Data).

- These were false rain gauge readings resulting from tipping the rain gauge (to check accuracy) during bi-weekly downloads as well as several readings during a time where the Rain Gauge was calibrated using the Static Method (on December 22, 2010). In addition, the cumulative precipitation data for days the rain gauge was checked or calibrated were also corrected and flagged as <5> and coded as GMT (Instrument Maintenance).

<u>Date</u>	<u>Time</u>	<u>Original Value</u>
01/06/2010	15:45	0.508
01/20/2010	12:45	0.508
02/04/2010	09:45	0.508
02/17/2010	09:45	0.508
03/04/2010	10:30	1.016
03/17/2010	09:00	1.016
03/30/2010	09:30	1.016
04/14/2010	09:00	0.762
04/16/2010	09:01	0.508 (but did not register-missing data)
04/28/2010	09:15	1.016
05/07/2010	13:00	0.508
05/12/2010	08:30	0.508
05/27/2010	09:15	0.508
06/09/2010	13:30	0.508
06/23/2010	11:45	0.508
07/06/2010	08:45	0.762
07/21/2010	12:15	0.508
07/27/2010	17:00	0.508
08/04/2010	08:30	1.016
08/18/2010	10:00	0.762
09/01/2010	11:45	0.508
09/15/2010	09:00	0.508
10/01/2010	09:15	0.508
10/13/2010	08:45	0.508
10/27/2010	12:00	0.508
11/15/2010	10:45	0.508
11/29/2010	13:00	0.762
12/15/2010	12:15	0.508
12/15/2010	12:30	3.048 (slug of ice, maintenance)
12/22/2010	15:30	6.900 (rain gauge calibration)
12/22/2010	15:45	7.400 (rain gauge calibration)

3. New Operating System Upload on 4/16/2010, 10/5/2010, and 12/22/2010 as well as Sensor Switchouts on 4/16/2010, 5/7/2010, 7/27/2010 and 10/5/2010 (Data Flagged as -3 for Rejected Data).

- During program uploads, the 5-second data stored in the CR1000 is lost, which comprising the 15-minute data recorded during downloads. In a similar fashion, during times of sensor maintenance or sensor replacement, the 5-second readings are also inaccurate which compromises the corresponding 15-minute readings. The following sections describes several time periods throughout the year when maintenance was done on the Taskinas Creek MET station resulting in data which must be rejected as inaccurate (and has been coded appropriately).
- On April 16th, 2010, programming changes were conducted and a new version of the operating system (OS19) was installed at the Taskinas Creek Station resulting in no data values for the time periods of 9:15, 9:30, and 9:45 on April 16th. This data has been flagged as -2 (for missing data).
 - In addition, due to station maintenance (new operating system installation) there was one record where the data was rejected data for all parameters which occurred on 4/16/10 (at 10:00). Suspect PAR values are reason to believe that full 15 minutes (of 5 second readings) were not collected at during the 9:45 to 10:00 time interval. Flagged at -3 (for rejected) and coded at GPR (program reload) and CSM (see metadata).
- On May 7th, 2010, the LICOR sensor was replaced on the Taskinas MET station as well as some changes to the operating system. **See note #1 above. All PAR data from 5/7/2010-12/31/2010 are flagged and coded as <0> CSM, unless otherwise flagged and coded as suspect or rejected (see note #4).**
 - Due to programming changes, no data was collected at 13:15 and 13:30 on 5/7/2010. This data was flagged -2 (for missing data).
 - Due to programming changes and a LICOR sensor replacement, we have rejected the data at 13:45 on 5/7/2010 (the 15 minutes sampling interval was compromised). This data has been flagged as -3 (for rejected) and coded as GPR (program reload).
- On May 12, 2010 at 8:30, the minimum air temperature for that 15 minute time interval was measured as -38.0 (which may indicated a potential measurement error in the sensor or possibly an error introduced in recording the air temperature data as this was the time interval when the CR1000 was accessed for a standard bi-weekly download). In either case, the other data (air temperature, maximum air temperature, relative humidity) all appear to be normal for that time period, but just to be safe, we have decided to flag the data for air temperature and relative humidity at 8:30 AM on 5/12/2010 as 1 (for suspect) and coded as GMT (instrument maintenance) and CSM (see metadata).
- On July 27th, 2010, both the temperature/humidity and barometric pressure sensors were replaced in the field during the time period of 16:45 to 17:00. For this reason, the data for three parameters (temperature, relative humidity, and barometric pressure) were rejected due to sensor maintenance at 17:00. These values were flagged at -3 (for rejected) and coded at GMT (instrument maintenance) and CSM (see metadata).
- On October 5th, 2010, due to the upload of a new operating system to the CR1000 (OS20) there are 3 records with missing data (for all measurements) records on that particular day (10:30, 10:45, 11:00 on 10/5/10). These data have been flagged as -2 (for missing data) and coded as "GPR" (for General Program Reload).
 - Due to programming changes we have rejected the data at 11:15 on 10/5/2010 (the 15 minutes sampling interval was compromised). This data has been flagged as -3 (for rejected) and coded as GPR (for General Program Reload).
 - Also, on October 5, 2010 due to the installation of a re-calibrated wind monitor (and impacts to the PAR sensor during the process) between 11:15 and 11:30, some parameters have been flagged as -3 (for rejected data) and coded as GMT

(for station maintenance) on this particular day. These include total par, wind speed, wind direction, standard deviation of wind direction, and maximum wind speed).

- On December 22nd, 2010, the precipitation gauge was recalibrated at the Taskinas MET station as well as upgrading to a new operating system (OS 21).
 - Due to this station maintenance, no data was collected at 1515 on 12/22/2010. This data was flagged -2 (for missing data) and coded “GPR” for general program reload.
 - Due to this station program reload, we have rejected the data for all parameters at 15:30 (except precipitation and cumulative precipitation as we were doing a calibration on the rain gauge during this time and that has already been documented in the metadata) on 12/22/2010 (the 15 minute sampling intervals were compromised). This data has been flagged as -3 (for rejected) and coded as GPR (for station program reload).

4. PAR Values between 1/1/2010 and 12/31/2010 (Data Flagged as 1 for Suspect Data)

- This issue was addressed in the general notes portion at the beginning of this section. On 9/19/2007 the new MET Program (version 4.2) was uploaded to the CR1000 at Taskinas Creek. This program (and subsequent programs) did allow for negative PAR values (which before were “corrected” to a zero value). These small negative PAR values are within range of the sensor and are due to normal errors in the sensor and the CR1000 Datalogger. The Maximum signal noise error for the Licor sensor is +/- 2.214 mmoles/m² over a 15-minute interval. These data values were thus flagged as “1” indicating suspect data and coded “CAF” for being as acceptable within the error of the sensor. These negative PAR values (a total of 2134 values) occurred primarily during the winter and spring time periods – including occurrences from January 1, 2010 to April 11th, 2010 and occurrences from November 8th to December 31st, 2010.
- Multiple records of elevated nighttime PAR values (flagged as suspect (<1>) and coded CSM) were recorded during this 12 month time period. In most cases, these elevated (very small) night-time readings were most likely due to moisture (sometimes due to rainfall events, but not always) affecting sensor readings. The dates were January 1,7,8,12,14,15, 16,29,30,31; February 1,3, 5,6,7,10,12,13,16, September 30, October 1, November 17, 29, December 10, 13, 16, 17, 24, 25, 26, 27, 28.
- Two Values of PAR (PAR data on 5/23/2010 at 11:15 and on 5/25/2011 at 11:30) were flagged as <1> (suspect data) due to the magnitude of these values (above 2000 mmoles/m²). We have no reason to believe these values are compromised or do not represent “real” values, we decided to flag these data as a potential “outliers” in the dataset due to these values representing the highest two total PAR values in 2010.