ACE Basin National Estuarine Research Reserve
Meteorological Metadata Report
January – December 2012
Latest Update: December 1, 2021

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons

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ACE Basin NERR field station
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2) Entry verification

a) Data Input Procedures:
Meteorological data is recorded in 15-minute intervals and stored in a Campbell Scientific CR1000 datalogger. ACE staff uses a data storage card to serve as a back-up for the CR1000 datalogger. The program that controls the sampling, schedule, and storage of data by the CR1000 is provided by CDMO.

The CR1000 is interfaced with the Campbell Scientific's Loggernet software. ACE staff downloads and troubleshoots Loggernet programs with a direct connection to the weather station, using a laptop computer and a 9-pin serial cable. The GOES satellite system also uploads all 15-minute meteorological data summaries to a NOAA server every hour. These multiple methods of data retrieval ensure that all measured parameters are reported.

b) QA/QC Procedures:
Data are uploaded from the CR1000 data logger to a Personal Computer (IBM compatible). Files are exported from LoggerNet in comma-delimited format and uploaded to the CDMO where they undergo automated primary QAQC and become part of the CDMO's online provisional database. During primary QAQC, data are flagged if they are missing or out of sensor range. The edited file is then returned to the Reserve where it is processed in Microsoft Excel using the CDMO's NERRQAQC Excel macro. The macro inserts station codes, creates metadata worksheets for flagged data and summary statistics, and graphs the data for review. It allows the user to apply QAQC flags and codes to the data, append files, and export the resulting data file to the CDMO for tertiary QAQC and assimilation into the CDMO's authoritative online database. Outliers, suspect data, erroneous data, and other data flagged by the NERRQAQC macro are evaluated based on monthly field logs and NOAA historical data for the area. For more information on QAQC flags and QAQC codes, see Sections 11 and 12.

Amanda Fornal and Chuck Tucker are responsible for the above tasks.

3) **Research objectives –** (Campbell Weather Station):
The principal objective of the Weather Monitoring Program is to record long-term meteorological data for the ACE Basin NERR in order to observe any environmental changes or trends over time.

4) **Research methods**
For data collection, the CR1000 dataloggers are programmed to record data at 15-minute intervals. 15-minute data averages are based on continuous 5-second readings for air temperature (Centigrade), relative humidity (%), barometric pressure (mb), wind direction and wind speed (m/s). 15-minute precipitation (mm) and PAR (mmol/m^2) data are totaled from 5-second readings.

The 15 minute Data are collected in the following formats for the **CR1000**:
Averages from 5-second data:
Air Temperature (°C), Relative Humidity (%), Barometric Pressure (mb), Wind Speed (m/s), Wind Direction (degrees), Battery Voltage (volts)
Maximum and Minimum Air Temperature (°C) and their times from 5-second data (these data are available from the Reserve)
Maximum Wind Speed (m/s) and time from 5-second data
Wind Direction Standard Deviation (degrees)
Totals:
Precipitation (mm), PAR (millimoles/m^2), and Cumulative Precipitation (mm)

In-situ weather conditions are measured to verify the accuracy of the readings by the sensors, using a Kestrel 400 hand-held. After downloading data, sensors on the weather station are inspected for damage or debris. If any problems are found, it is repaired and/or cleaned. Tree limbs and other shrubs are cut back to prevent obstruction of the sensors. Sensors are removed and sent back to Campbell Scientific for calibration at a minimum frequency of every two years.

Recommended calibration frequency for the MET station sensors:
- Temperature/Humidity- yearly recalibration
- Rain Gauge- yearly recalibration
- Wind Speed/Direction- yearly or every 2 years (depending on the sensor)
- Barometric Pressure- every 2 years recalibration
- PAR- every 2 years recalibration

Campbell Scientific data telemetry equipment was installed at the Bennett's Point station on 06/30/2006 and transmits data to the NOAA GOES satellite, NESDIS ID #3B01E672. 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.

Data collected underwent the QA/QC process described in 2b.

5) Site location and character

The ACE Basin National Estuarine Research Reserve (NERR) is located on the Southeastern Atlantic coast of the United States, including portions of Charleston, Colleton and Beaufort Counties in South Carolina. The study area encompasses the Ashepoo, Combahee, and South Edisto River basins, which empty into St. Helena Sound. Diverse estuarine wetlands provide extensive and complex habitat types for fish and wildlife. The NERR consists of approximately 92,000 acres of tidal marshes. Of this, 65,600 acres are salt marshes, 13,600 acres are brackish marshes and 12,100 acres are freshwater marshes. Interspersed within these three tidal marsh zones are approximately 26,000 acres of managed wetlands, marsh impoundments, and hammock islands. St. Helena Sound comprises approximately 23,870 acres of open coastal marine and estuarine waters.

The weather station is located at the Bennett's Point field station on Mosquito Creek, a navigable tributary off of the Ashepoo River. The weather station's latitudinal and longitudinal coordinates are: 32° 33' 33.64 N and 80° 27' 16.41 W and is located at sea level elevation. The station is approximately 90 m from the creek (800 m from the Ashepoo River) in a grassy field, 80 m to the southwest of the field station. The closest wind obstructions are oak trees, 25 m to the south and southwest of the weather station and 70 m from a public paved road. The closest SWMP water quality station, Mosquito Creek, is approximately 1655m from the weather station.

The Campbell Scientific data logger and the barometric sensor (sensor body at 1.5m and sensor tube at 1.0m) are enclosed in a Campbell Scientific enclosure box with moisture/humidity indicators and 2 desiccant packets. A 6.1m (15 foot) galvanized steel tower elevates the sensors above potential barriers and enhances the performance of each sensor. The PAR sensor and anemometer are attached to a cross-bar at the top of the tower at a height of 6.1m and the temperature/relative humidity sensor is attached approximately half way up the tower at a height of 3.35m. The solar panel is attached to a 2.5 m long arm, and is oriented to the east at approximately 47-degrees. The tipping bucket rain gauge (1.3m height) is located 2.5 m to the southeast of the box on a concrete level platform. The sensors are wired to the CR1000 data logger following protocol in the CDMO Manual, with minor changes made in order to facilitate the function of upgraded sensors. A new larger enclosure box and solar panel were necessary with the installation of the GOES telemetry system.

6) Data collection period

Weather data have been collected at the ACE Basin NERR Bennett's Point weather station since the station became operational in March 2001. Data was collected for the quarters (January 2, 2012 at 00:00 through December 31, 2012 23:45). Missing and rejected data due to sensor errors or site maintenance are detailed in **Section 13**.

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 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:
National Estuarine Research Reserve System (NERRS). 2012. System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: www.nerrsdata.org; *accessed* 12 October 2012.

NERR meteorological data and metadata can be obtained from the Research Coordinator at the individual NERR site (please see Principal Investigators and Contact Persons), from the Data Manager at the Centralized Data Management Office (please see personnel directory under the general information link on the CDMO home page) and online at the CDMO home page www.nerrsdata.org. Data are available in comma delimited format.

8) Associated researchers and projects

The NERR Water Quality Monitoring Project is a study which records long-term water quality data for the ACE Basin in order to observe any changes or tends in water quality over time. The four sampling sites are in separate tributaries of the South Edisto and Ashepoo Rivers. Two sites represent an urban or "treatment" site, and the other two sites represent pristine areas within the Reserve. A salinity gradient is also observed between these four sites:

Big Bay Creek - approximately 14 kilometers from the weather station, GPS coordinates: 32.4941 N and -80.3241 W. The station is surrounded by residential and commercial development and subject to nonpoint source pollution.

St. Pierre Creek - approximately 9 kilometers from the weather station, GPS coordinates: 32.5279 N and -80.3615 W. The station is surrounded by a wide expanse of *Spartina alterniflora* marsh. Extensive mud flats and oyster reefs fringe the banks. Development in the immediate area is sparse, and this creek is subject to light boat traffic.

Fishing Creek – approximately 12 kilometers from the weather station, GPS coordinates: 32.6358 N and -80.3655W. The station is near Jehossee Island, a protected USFWS property, and is surrounded by extensive *Spartina cynosuroides* marsh and vast mud flats. The upland area is characterized by slash pine, live oak, and cabbage palmetto.

Mosquito Creek – approximately 2 kilometers from the weather station, GPS coordinates: 32.5558 N and -80.4380W. The station is surrounded by agriculture fields and impounded wetlands. A public boat landing and a commercial seafood business with three commercial shrimp boats and a fueling station are located about 0.8 km (0.5 mi) downstream of the monitoring station.

Measurements for all sites are taken every fifteen minutes over an approximate two-week or four week collection period (depending upon fouling previously experienced and future fouling rate expected).

In July 1997, the Reserve staff initiated nutrient monitoring study. The objective of the study is to ascertain the annual and tidal fluctuations in nutrient levels near our two data logger sites. Nutrient levels are measured during a complete tidal cycle each month, and the samples are analyzed for ammonia, nitrite & nitrate, orthophosphate, and chlorophyll a concentrations. In January of 2002, the nutrient monitoring protocol (NUT) was added to the NERR System Wide Monitoring Program (SWMP).

SCDNR/Marine Resources Research Institute began an ongoing survey of red drum (*Sciaenops ocellatus*) in the South Edisto and Combahee River basins, by electro-fishing in tidal freshwater and low salinity brackish water. Although red drum are the target species, all catches are separated, measured and weighted to provide a distribution and population size for each species.

The results from these studies and additional studies conducted in the ACE Basin can be obtained by contacting the Reserve.

II. Physical Structure Descriptors

9) Sensor specifications

Temperature and Relative Humidity
Model #: HMP45AC
Operating Temperature: -40 to +60 degree C
Temperature Measurement Range: -40 to +60 degree C
Temperature Accuracy: +/- 2% degree C @ 20 degree C
Relative Humidity Measurement Range: 0 - 100% non-condensing
RH Accuracy: +/- @% RH (0 - 90%) and +/- 3% (90 - 100%)
Uncertainty of calibration: +/- 1.2% RH
Serial Number: E3010019
Date of Calibration: 1/28/2010
Dates Installed: 1/7/2011 - 3/16/2012
Serial Number: A1710045
Date of last calibration: 02/28/2012
Dates installed: 3/16/2012-7/31/2013

Barometric Pressure
Model #: PTB101B
Calibrated Range: 26" - 32" (Standard)
Supply Voltage: 12 VDC at 12 mA
Accuracy: +/- 0.7 of span
Operating Temperature Range: -22 to +55 degree C
Serial Number: Y0930012
Date of Calibration: 2/10/2010
Dates Installed: 12/9/2010 - 3/16/2012
Serial Number: A1950003
Date of last calibration: 02/27/2012
Dates installed: 03/16/2012 - current as of 12/31/2012

Wind Sentry (Anemometer)
Model #: 03001
Range: 0-50 m/s; 360^{o} Mechanical

Serial Number: 1(serial number used by ACE NERR)
Date of Calibration: 2/4/2010
Dates Installed: 12/9/2010 - 3/16/2012
Serial Number: 2
Date of last calibration: 03/02/2012
Dates installed: 03/16/2012 - 02/27/2014

Photosynthetically Active Radiation (PAR)
Model #: LI-190SZ
Serial #: Q31559/Q35240
Stability: < +/- 2% change over a 1 year period
Operating Temperature: -20 to +65 degree C
Sensitivity: Typically 30 nA per 100 klux
Light Spectrum Wavelength: 400 to 700 nanometers
Calibration Factor: 264.70 umol m^{-2} s^{-1} per mV
Multiplier History and Date Changed:
Date of last calibration: 02/21/2012

- PAR sensor Q315591 Calibrated 09/2002 – Installed May 3, 2003 – multiplier 1.27
- PAR sensor Q35240 Calibrated 07/2005 – Installed August 22, 2005 – multiplier 1.36
- PAR sensor Q31559 Calibrated 06/2007 – Installed April 22, 2008 – multiplier 1.34
- PAR sensor Q35240 Calibrated 10/17/2008 – Installed Sept. 30, 2009 – multiplier 2.18
- PAR sensor Q31559 Calibrated 02/9/2010 – Installed Dec. 9, 2010 – multiplier 1.38
- PAR sensor Q35240 Calibrated 02/21/2012 – Installed Mar. 16, 2012 – multiplier 3.12

Tipping Bucket Rain Gauge
Texas Electronics
Model #: TR-525I
Calibration: 0.01 inch per tip
Accuracy: +/- 3% (Rates of 1 to 6 inches per hour)
Dates of calibration:
02/20/2012, 05/24/2012, 06/07/2012, 12/19/2012

Storage Module
Model # SM4M
Storage capacity: 2 million low-resolution data values
Program storage: stores up to 8 program with a total capacity of 128 KB
Processor: Hitachi H8S
Operating system: 64 KB, flash memory based, user downloadable
Operating range: Temp: -35 to +65 degree C
Baud rates: 9600, 76800
Power requirements: 5 +/- 0.3 VDC @ 100 mA

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 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: 06/29/2006-03/16/2012, New CR1000 Installed 03/16/2012 - current as of 12/31/2012

CR1000 Firmware Version (s): no firmware updates were recorded for 2012

CR1000 Program Version(s): acebpmet_5.1_022708, acebpmet_5.5_040208, acebpmet_5.5_031212

10) Coded variable definitions

Sampling station:	Sampling site code:	Station code:
Bennett's Point	BP	ACEBPMET

11) QAQC flag definitions

QAQC flags provide documentation of the data and are applied to individual data points by insertion into the parameter's associated flag column (header preceded by an F_). During primary automated QAQC (performed by the CDMO), -5, -4, and -2 flags are applied automatically to indicate data that is above or below sensor range, or missing. All remaining data are then flagged 0, as passing initial QAQC checks. During secondary and tertiary QAQC 1, -3, and 5 flags may be used to note data as suspect, rejected due to QAQC, or corrected.

-5 Outside High Sensor Range
-4 Outside Low Sensor Range
-3 Data Rejected due to QAQC
-2 Missing Data
-1 Optional SWMP supported parameter
0 Passed Initial QAQC Checks
1 Suspect Data
2 *Open - reserved for later flag*
3 *Open - reserved for later flag*
4 Historical Data: Pre-Auto QAQC
5 Corrected Data

12) QAQC code definitions

QAQC codes are used in conjunction with QAQC flags to provide further documentation of the data and are also applied by insertion into the associated flag column. There are three (3) different code categories, general, sensor, and comment. General errors document general problems with the CR1000, sensor errors are sensor specific, and comment codes are used to further document conditions or a problem with the data. Only one general or sensor error and one comment code can be applied to a particular data point, but some comment codes (marked with an * below) can be applied to the entire record in the F_Record column.

General Errors

GIM	Instrument Malfunction
GIT	Instrument Recording Error, Recovered Telemetry Data
GMC	No Instrument Deployed due to Maintenance/Calibration
GMT	Instrument Maintenance
GPD	Power Down
GPF	Power Failure / Low Battery
GPR	Program Reload

GQR	Data Rejected Due to QA/QC Checks
GSM	See Metadata

Sensor Errors

SDG	Suspect due to sensor diagnostics
SIC	Incorrect Calibration Constant, Multiplier or Offset
SIW	Incorrect Wiring
SMT	Sensor Maintenance
SNV	Negative Value
SOC	Out of Calibration
SQR	Data rejected due to QAQC checks
SSD	Sensor Drift
SSN	Not a Number / Unknown Value
SSM	Sensor Malfunction
SSR	Sensor Removed

Comments

CAF	Acceptable Calibration/Accuracy Error of Sensor
CDF	Data Appear to Fit Conditions
CML	Snow melt from previous snowfall event
CRE*	Significant Rain Event
CSM*	See Metadata
CCU	Cause Unknown
CVT*	Possible Vandalism/Tampering
CWE*	Significant weather event

13) Other remarks/notes

Data are missing due to equipment or associated specific sensors not being deployed, equipment failure, time of maintenance or calibration of equipment, or repair/replacement of a sampling station platform. Any NANs in the dataset stand for "not a number" and are the result of low power, disconnected wires, or out of range readings. If additional information on missing data is needed, contact the Research Coordinator at the reserve submitting the data.

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.

Relative Humidity data greater than 100 are within range of the sensor accuracy of +/-3%.

Please note that the 3001 MET One Wind Set has an offset of 0.2 and does not record values of 0.

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.**

During 2017 the CDMO discovered an incorrect line in the CR1000 programming. If RHumidity>100 And RHumidity<108 Then RHumidity=100. A decision was made by the DMC during 2006 to discontinue correcting >100 RH values to 100. This change was never made in our program and has remained in each updated version until it was removed during 2017. By correcting all values >100 during data collection we may have missed erroneous values that could have indicated a problem with the RH sensor. CSM coding was added to all RH data from 2007 until the programming change in 2017.

Suspect Data (Flag <1>)

There were noticeable changes in PAR values following the swap to a freshly calibrated sensor (assumed to be accurate) on 03/16/2012. Apogee reported a -2.93% post cal drift for the sensor that was installed from 12/09/2010 to 03/16/2012 (SN Q31559). Acceptable drift is +/- 2% for this sensor. All PAR data 1 year prior the sensor swap, from 03/16/2011 to 03/16/2012 are flagged and coded as <1> SSD CSM. PAR data for the remainder of this deployment (12/09/2010 to 03/16/2011) 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.

All PAR data for the 2012 dataset are commented due to elevated nighttime PAR readings. All nighttime PAR readings greater than 0.0 mmoles/m2 are flagged as suspect <1> (CSM). All other PAR values, excluding missing, rejected, and other suspect data, are coded as <0> (CSM). Those data values appear satisfactory; however, data users should be aware of possible data inconsistencies. http://www.sunrisesunset.com was used to determine the cutoff between daytime and nighttime. Moisture seeping into the sensor and/or sensor cable is thought to be the cause for the elevated nighttime PAR readings; however, it is still under investigation.

Precipitation data on the 2/20/2012 and 12/19/2012 are coded as CSM. The rain gauge was disconnected for calibration on those days; however the time for the calibration was not recorded.

Precipitation data on 5/24/2012 were corrected to 0.0 and flagged and coded as <5>SMT CSM. The rain gauge was being calibrated and any precipitation recorded during that time was not real.

Precipitation data on 6/7/2012 at 12:15 and 12:30 were coded as SSR CSM. The rain gauge was briefly disconnected for calibration. No precipitation fell during this time so the readings were not rejected and were left as 0.0.

Missing Data (Flag <-2>)

Data are missing for the following dates and times due to the station datalogger malfunction. The CR1000 began malfunctioning in 2011 and the station was powered down until the repaired CR1000 was reinstalled on 01/13/2012:
01/01/2012 – 0:00 and 01/13/2012 – 13:00
01/24/2012 – 15:00 and 02/04/2012 – 16:30

Rejected Data (Flag <-3>)
All parameters were rejected on 01/24/2012 13:15 due to a program reload following the CR1000 reinstallation.

All data for the following dates and times were rejected for air temperature and relative humidity due to sliced wire: 01/13/2012 – 13:15 through 01/24/2012 – 14:45

All data for the following dates and times were rejected for PAR due to incorrect PAR multiplier: 01/13/2012 – 13:15 through 01/24/2012 – 14:45

BP data were rejected on 1/16/2012 02:15-11:15. The sensor recorded extremely low values for unknown reasons for a brief period of time but did begin work correctly at 11:30. Low BP values were also rejected on 01/18/2012 04:45 – 05:00 and 16:00 – 20:00 and 01/20/2012 11:00.

All data were rejected on 2/4/2012 16:45 since that timestamp may not have been a full 15 minutes of 5-second data following the CR1000 malfunction.

All data were rejected on 03/16/2012 09:45 due to a program reload that more than likely resulted in missing 5-second data.

All data were rejected on 03/16/2012 10:00 - 12:00 due to maintenance at the MET station.
All data for the following dates and times were missing due to power down:
03/16/2012 -12:15 through 03/16/2012 -14:00

All data were rejected on 03/16/2012 14:15 following the power down since more than likely they were not a full 15 minutes of 5-second data.

PAR data were rejected on 03/16/2012 14:30 due to maintenance to clean the sensor.

All wind direction and SDWDir data for the following dates and times were rejected due to incorrect wiring: 03/16/2012 – 14:15 through 03/21/2012 – 09:15, data at 09:30 were rejected since more than likely they are not a full 15 minutes of 5-second data.

All data for the following dates and times were rejected for precipitation due to incorrect wiring;
03/16/2012 14:15 through 04/04/2012 – 12:45

Station History
Bennett's Point:
2001- Station became active with CR10X data logger. No data collected until **March** due to battery issues. Data collection stopped in **June**. PC208W software used to download data. Parameters measured are: temperature, humidity, barometric pressure, rainfall, wind speed and direction and PAR. Probes are located on 3-meter galvanized poles on top of control box.
2002- Data collection resumed in **January**

2002- NADP – National Atmospheric Deposition Program – began in January
2003- All new probes installed on **May 3** and old ones sent back to be calibrated.
2003- A 15-foot galvanized tower is installed on which the probes are positioned
2005- All newly calibrated probes installed on **August 22**
2006- CR10X data logger replaced with the CR1000 data logger and PC208W software replaced with LoggerNet Software in **June 29**
2006- NL115 Ethernet cable installed to allow for downloading of data and troubleshooting problems at Charleston Office.
2006- GOES satellite telemetry equipment installed to view real-time weather data.
2006- Rain tipping bucket calibrated on **July 18**
2006- NL115 Ethernet cable cut by workers in **December**
2007- NL115 Ethernet cable replaced and squirrels chewed through wire. Lost connection in **Sept.**
2007 - NADP – National Atmospheric Deposition Program – ended in December
2008- New program upload with Cumulative Precipitation parameter added in **March**
2008- All newly calibrated probes installed on **April 22**
2009- All newly calibrated probes installed on **September 30**
2010- Rain tipping bucket calibrated on **January 1**
2010- Rain tipping bucket calibrated in **March 18**
2010 – Newly calibrated probes installed on **December 9** with the exception of the temperature probe.
2011- Temperature and RH probes replaced on **January 7**
2011- Rain tipping bucket calibrated on **February 17**
2011- MET station powered down beginning **October 31** until malfunctioning CR1000 replaced in **2012**
2012 – Newly calibrated probes installed on **March 16**
2012 – New CR1000 installed on **March 16**
2012 – Rain bucket calibrated on **June 7**
2012 – Rain bucket calibrated on **Dec 19**