~~Reserve Name~~Hudson River (~~include 3 letter code here~~HUD) **NERR Meteorological Metadata**
~~Months and year the documentation covers~~**January – July** 2025
Latest Update: 9/18/2025~~Date that the last edits were made~~

Note: This is a provisional metadata document; it has not been authenticated as of its download date. Contents of this document are subject to change throughout the QAQC process and it should not be considered a final record of data documentation until that process is complete. Contact the CDMO (cdmosupport@baruch.sc.edu) or reserve with any additional questions.

I. Data Set and Research Descriptors

1) Principal investigator(s) and contact persons –

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256 Norrie Point Way
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~~[Instructions/Remove: List the staff members responsible for the design, implementation and continuation of the meteorological data set. Include name, title, mailing address, phone number, and email address for the Research Coordinator, SWMP technicians, and person(s) responsible for data management.]~~

2) Entry verification –

~~[Instructions/Remove: This section explains how the data were verified (QAQC'd) before being sent to the CDMO to be archived into the permanent database. Specifically, list how your data are acquired, validated, processed, and archived. Mention how your reserve deals with outliers, suspect and erroneous data during secondary QAQC, etc. Use the following statement or modify to fit your reserve.]~~

Data are uploaded from the ~~*[choose logger(s) in use]*~~ CR1000/CR1000X data logger to a personal computer with a Windows 7 or newer operating system. Files are exported from LoggerNet in a comma-delimited format and uploaded to the CDMO where they undergo automated primary QAQC and become part of the CDMO's online provisional database. During primary QAQC, data are flagged if they are missing or out of sensor range. The edited file is then returned to the reserve where it is opened in Microsoft Excel and processed using the CDMO's NERRQAQC Excel macro. The macro inserts station codes, creates metadata worksheets for flagged data and summary statistics, and graphs the data for review. It allows the user to apply QAQC flags and codes to the data,

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append files, and export the resulting data file to the CDMO for tertiary QAQC and assimilation into the CDMO's authoritative online database. For more information on QAQC flags and QAQC codes, see Sections 11 and 12.

The Research Coordinator is responsible for data verification~~Remember to list the person(s) responsible for data management~~.

3) Research objectives –

The objective of this study is to monitor the meteorological conditions at the Tivoli Bays component site of the Hudson River National Estuarine Research Reserve (HRNERR; the Reserve). Measurements of air temperature, relative humidity, barometric pressure, precipitation, photosynthetically active radiation, and wind speed and direction are taken throughout the year at the Tivoli Bays Field Station (FS). A water quality monitoring program has been ongoing since 1991 at this component site, and the meteorological data will help provide ancillary data. This will help us to better understand the relationships between the atmospheric conditions and aquatic environments at this site.

In 2018, a "secondary SWMP" meteorological monitoring station was incorporated into the Reserve. This station provides a secondary source of the above-mentioned protocol and parameters in the vicinity around the Norrie Point Environmental Center which is home to HRNERR offices. This station will provide supplemental data in conjunction with a water quality station at the same location. The station has been operational since 2008 and historical data are available upon request. Secondary SWMP stations do not undergo tertiary review.
~~[Instructions/Remove: Describe briefly the nature of the monitoring program resulting in this data set. Describe the goal or purpose of collecting this meteorological data.]~~

4) Research methods –

Campbell Scientific data telemetry equipment was installed at the Field Station (FS) station on 11/14/2005 and transmits data to the NOAA GOES satellite, NESDIS ID #3B00B4F4. Identical telemetry equipment is installed at the Norrie Point (NP) monitoring station which transmits data to the NOAA GOES satellite, NESDIS ID # 3B01301A. The transmissions are scheduled hourly at 0:39:30 after the hour for FS and at 0:35:40 after the hour for NP and contain four (4) data sets reflecting 15-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 ~~[Instructions/Remove: Detail the specifics of data collection (include time zone for Local Standard Time, i.e.: Eastern Standard Time), and collection intervals, QAQC of the sensors and data, the sensor calibration plan and any other analysis on the data. Include the following or similar excerpt (modify for additional real-time sites) regarding real-time data.]~~

Data are collected in Eastern Standard Time (EST) for the entire year.

~~Campbell Scientific data telemetry equipment was installed at the *(insert station name)* station on mm/dd/yyyy and transmits data to the NOAA GOES satellite, NESDIS ID #XXXXXXXX. (Where XXXXXXXX is the GOES ID for that particular station.) The transmissions are scheduled hourly at **[insert transmission time]** after the hour 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.~~

~~Include the following or similar data collection information:~~

The 15-minute data are collected in the following formats for the ~~CR1000/~~**CR1000X**:

Averages from 5-second data:

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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) (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.)

~~Averages from 5-second data:~~

~~Temperature (°C), Relative Humidity (%), Barometric Pressure (mb), Wind Speed (m/s), Wind Direction (degrees), Battery Voltage (volts)~~

~~Maximum and Minimum 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) (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.)~~

~~Include the following or similar calibration information:~~

Recommended calibration frequency for the MET station sensors:
- Temperature/Humidity- yearly recalibration
- Precipitation Gauge- yearly recalibration
- Wind Speed/Direction- yearly or every 2 years (depending on the sensor)
- Barometric Pressure- every 2 years recalibration CS-105 and CS – 106; yearly recalibration BaroVUE10
- PAR- every 2 years recalibration
- ~~CR1000/~~CR1000X - every 5 years

~~*Total Solar Radiation (this is an optional sensor, only include if you are collecting TSR data)*~~

~~Eppley 8-48 - every 5 years, but annual recalibration encouraged~~

~~LI-COR LI-200S - every 2 years, with recalibrations performed during the spring and summer~~

5) Site location and character –

The HRNERR is a multi-component site totaling approximately 5,000 acres. Each component of the Reserve is referenced by River Mile (RM) of the Hudson River in New York State proceeding north from the southern tip of Manhattan (RM 0). The Reserve includes the following four component sites: Piermont Marsh, Rockland County (RM 24) (41°02'30"N 73°54'15"W), Iona Island, Rockland County (RM 45) (41°18'15"N 73°58'45"W), Tivoli Bays, Dutchess County (RM 98) (42°02'15"N 73°55'10"W), and Stockport Flats, Columbia County (RM 124) (42°02'30"N 73°46'00"W). The Reserve sites are managed at the Norrie Point Environmental Center, the headquarters for the Reserve, in Staatsburg NY, Dutchess County (41°49'53"N, 73°56'32"W). The four component sites include open water, tidal wetland, and adjacent upland buffer habitats and are representative of the diverse plant and animal communities that occupy the salinity gradient within the Hudson River Estuary. Development within the watersheds of the four component sites ranges from predominantly urban/suburban to forested/agricultural.

The "Field Station" weather station (FS) is located at the Tivoli Bays component site in Annandale, NY (42°01'05.46"N 73°55'01.13"W). A 30-foot, aluminum tower is used to elevate some of the weather monitoring equipment. The tower is on the deck of an office building, on the west side, 9 feet (2.7m) off the ground. The wind anemometer is located at the top of the tower, 39 feet (11.9m) off the ground. The photosynthetically active radiation (PAR) sensor is situated approximately 9.7 feet (3m) above the deck and is installed onto a metal arm affixed to the tower. The datalogger and the barometric pressure sensor are enclosed within a fiberglass case attached to the tower,

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12 feet (3.7m) off the ground. A rain gauge is adjacent to the tower, attached to the building, 16 feet (4.9m) off the ground. The temperature/humidity sensor is next to the tower, attached to the deck handrail, 12 feet (3.7m) off the ground. GOES telemetry equipment includes a large solar panel and battery, a large enclosure to house the battery, a Campbell TX-312 transmitter, associated GPS for time synchronization and a Yagi antenna.

Although trees surround the area, the tree line begins approximately 60 feet (18.3m) from the tower in most directions. In past years the trees were at similar heights to the tower, but the sensors were not shaded at the location. However, in recent years the surrounding forest canopy height has increased possibly leading to a decline in the accuracy of wind data during leaf-in months (typically May to October). The tower is approximately 0.8 miles (1.3km) southeast of the Tivoli South Bay water quality monitoring station, 1.3 miles (2.1km) southeast of the Tivoli North Bay water quality monitoring station, and 0.2 miles (0.3km) northwest of the now-decommissioned Sawkill Creek water quality monitoring station.

The Norrie Point (NP) weather station is located at the Norrie Point Environmental Center, the HRNERR headquarters in Staatsburg, NY (41°49'53"N, 73°56'32"W). A 30-foot, aluminum tower is used to elevate all of the weather monitoring equipment. The tower is anchored to the concrete patio, south of the HRNERR offices. It is situated directly adjacent (2 meters) to the Hudson River. The wind anemometer and wind speed sensors are located at the top of the tower, 30 feet off the ground. The datalogger and the barometric pressure sensor are enclosed within a fiberglass case attached to the tower, 6 feet off the ground. A rain gauge is attached to the tower, 8 feet off the ground. The temperature/humidity sensor is attached to the tower, 10 feet off the ground. A light sensor is attached to an arm protruding from the tower 12 feet off the ground. GOES telemetry equipment includes a larger solar panel and battery, a larger enclosure to house the battery, a Campbell TX-325 transmitter, associated GPS for time synchronization and a Yagi antenna. The station is surrounded by the Hudson River in all directions but northeast. The tower is located approximately 60 feet from the building, which should minimize any impact from the structure.

Tables summarizing the station characteristics are below:~~[Instructions/Remove: Describe your NERR site (general) and the research site (specific) associated with each weather station. For each weather station include: a) its proximity to SWMP water quality monitoring stations, b) latitude and longitude, c) location/placement information (what is the environment on which it is located (pier, building, dock, etc.), how close are any wind blocks, does the tower get shaded or obstructed), d) sensor placement information (where the sensors are located in proximity to the tower, height of tower, how far off the ground are the sensors located, is it in accordance with MET SOP, CDMO Manual, etc.), e) other information. If possible, include your station's elevation from sea level.]~~

~~Station measurements [Instructions/Remove: At a minimum, include the tower height and all sensors and their heights on the tower. Use the notes column to add more detail and to specify where height is measured from – ground/platform/marsh/mean high water. If the tower is on a platform, include platform height.]~~

Field Station:

Tower and sensor heights	**Height (*meters*)**	**Notes**
Tower	9.144	Composed of aluminum
Platform *(if applicable)*	2.7	Tower is situated on the western deck of an office building
Temperature/Relative Humidity	3.7	Adjacent to the tower, attached to the deck handrail
Barometric Pressure	3.7	Situated within a fiberglass case attached to the tower
Wind	11.9	Situated at the topmost point of the tower
PAR	3	Situated on a metal arm, affixed to the tower
Precipitation gauge	4.9	Adjacent to the tower, affixed to the building roof

Norrie Point:

Tower and sensor heights	Height (*meters*)	Notes
Tower	9.144	Composed of aluminum
Platform *(if applicable)*		Anchored to a concrete patio directly adjacent (2m) to the Hudson River
Temperature/Relative Humidity	3.05	Installed directly onto the tower
Barometric Pressure	1.83	Situated within a fiberglass case attached to the tower
Wind	9.144	Situated at the topmost point of the tower
PAR	3.66	Affixed to an arm protruding from the tower
Precipitation gauge	2.44	Affixed to an arm protruding from the tower

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~~Tower and sensor heights~~	~~Height (*meters*)~~	~~Notes~~
~~Tower~~		
~~Platform *(if applicable)*~~		
~~Temperature/Relative Humidity~~		
~~Barometric Pressure~~	~~*height in the enclosure*~~	~~*distance from the tower*~~
~~Wind~~		
~~PAR~~		
~~Precipitation gauge~~		~~*distance from the tower*~~

SWMP Station Timeline

Station Code	SWMP Status	Station Name	Location	Active Dates	Reason Decommissioned	Notes
FS	P	Field Station	(42°01'05.46"N 73°55'01.13"W)	July 1999 - Present	NA	NA
NP	S	Norrie Point	(41°49'53"N 73°56'32"W)	Secondary SWMP January 1, 2018 - Present	NA	Non-SWMP May 7, 2008 - December 31 2017

~~SWMP station timeline [Instructions/Remove: Include all stations currently in use and any decommissioned sites in the table below. Include the site code (2 letter code), SWMP Status (P (Primary) or S (Secondary), the Station name, Location (Latitude/Longitude), Active dates (note if current). For decommissioned sites include information on why the station was decommissioned and relevant notes.]~~

~~Station code~~	~~SWMP status~~	~~Station name~~	~~Location~~	~~Active dates~~	~~Reason decommissioned~~	~~Notes~~
					~~NA~~	~~NA~~

6) Data collection period –

~~[Instructions/Remove:~~ **Included in annual metadata document.** ~~If you wish to include in the quarterly document specify the exact start and end date and time of data collection for each monitoring site for the year. At a minimum this should include the January 1st start time and quarterly end time and any breaks in the data collection; however, including the date and time for the first and last readings for each raw file is recommended. Also note when data collection began initially for your reserve or sample sites.]~~

7) Distribution –

~~[Instructions/Remove: 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.]~~

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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 processed the data. Following academic courtesy standards, the NERR site where the data were collected should be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. The data set enclosed within this package/transmission is only as good as the quality assurance and quality control procedures outlined by the enclosed metadata reporting statement. The user bears all responsibility for its subsequent use/misuse in any further analyses or comparisons. The Federal government does not assume liability to the Recipient or third persons, nor will the Federal government reimburse or indemnify the Recipient for its liability due to any losses resulting in any way from the use of this data.

> Requested citation format:
> NOAA National Estuarine Research Reserve System (NERRS). System-wide Monitoring Program. Data accessed from the NOAA NERRS Centralized Data Management Office website: http://www.nerrsdata.org/; *accessed* 12 October 2025.

~~Also include the following excerpt in the metadata which will address how and where the data can be obtained.~~

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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 –

~~[Instructions/Remove: Describe briefly other research (data collection) that correlates or enhances the data collected at your weather station. You may provide links to the other products or programs. At a minimum, mention the SWMP WQ and NUT datasets as below.]~~

As part of the SWMP long-term monitoring program, ~~XXX~~ HUD NERR also collects 15-minute water quality data and monthly grab and diel samples for nutrient/pigment data which may be correlated with this meteorological dataset. These data are available at www.nerrsdata.org.

As part of the NERRS Wetlands and Water Levels (WWL) program, HUD NERR also conducts annual surveys on freshwater emergent tidal vegetation, submerged aquatic vegetation (SAV), and marsh accretion rates at Tivoli Bays. Vegetation data are available at www.nerrsdata.org, and accretion rate data are available upon request from the Habitat Researcher (see Principal Investigators and Contact Persons).

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II. Physical Structure Descriptors

9) **Sensor specifications –**

Parameter: Temperature
Units: Celsius
Sensor type: Campbell Scientific 1000 Ω Platinum Resistance Thermometer
Model #: EE181-L Temperature and Relative Humidity Probe
Operating Temperature: -40°C to +60°C
Range: -40°C to +60°C
Accuracy: ± 0.2 °C @ 23°C

Station	Serial Number	Date of Cal	Dates of Sensor Use
FS	170516000153DE	09/22/2022	09/12/2023 – Current
NP	164516000139CC	04/21/2022	09/19/2022 – 07/26/2024
NP	170516000140F8	04/21/2022	07/26/2024 – Current

Parameter: Relative Humidity
Units: Percent
Sensor type: HC101
Model #: EE181 Temperature and Relative Humidity Probe
Range: 0-100% non-condensing
Accuracy: –15 to 40 °C: ≤90% RH ± (1.3 + 0.003 • RH reading) % RH
–15 to 40 °C: >90% RH ± 2.3% RH
–25 to 60 °C: ± (1.4 + 0.01 • RH reading) % RH
–40 to 60 °C: ± (1.5 + 0.015 • RH reading) % RH
Temperature dependence of RH measurement: typically 0.03% RH/°C
Note: This sensor caps relative humidity values at 100%, measured values >100% are altered to 100%

Station	Serial Number	Date of Cal	Dates of Sensor Use
FS	170516000153DE	09/22/2022	09/12/2023 – Current
NP	164516000139CC	04/21/2022	09/19/2022 – 07/26/2024
NP	170516000140F8	04/21/2022	07/26/2024 – Current

Parameter: Barometric Pressure
Units: millibars (mb)
In use at FS:
Sensor type: Vaisala Barocap © silicon capacitive pressure sensor
Model #: CS-106 (PTB110)
Operating Range: Pressure: 500 to 1100 mb; Temperature: -40°C to +60°C;
Humidity: non-condensing
Accuracy: ± 0.3 mb at +20°C, ± 0.6 mb at 0°C to 40°C, ± 1 mb at -20°C to +45°C, ± 1.5 mb at -40°C to +60°C
Stability: ± 0.1 mb per year

In use at NP:
Sensor type: BaroVue 10
Model #:
Operating Range: Pressure: 500 to 1100 mb; Temperature: -40°C to +60°C;
Humidity: non-condensing
Accuracy: ± 0.3 mb at 20°C, ± 0.5 mb at -40°C to 60°C
Stability: ± 0.1 mb per year

Station	Serial Number	Date of Cal	Dates of Sensor Use

FS	N1230355	09/26/2022	09/12/2023 - Current
NP	L1430917	04/13/2022	09/16/2022 – 10/11/2024
NP	2674	07/23/2023	10/11/2024 – Current

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 05103-45 Wind Monitor – Alpine Model
Range: 0-60 m/s (134 mph); gust survival 100 m/s (220 mph)
Accuracy: +/- 0.3 m/s

Parameter: Wind direction
Units: degrees
Sensor type: balanced vane, 55 cm turning radius
Range: 360°
Accuracy: +/- 3°

Station	Serial Number	Date of Cal	Dates of Sensor Use
FS	WM135260	01/11/2023	09/12/2023 - Current
NP	WM125766	04/18/2022	09/19/2022 – 10/11/2024
NP	140711	10/09/2023	10/11/2024 – Current

Parameter: Photosynthetically Active Radiation (PAR)
Units: mmoles m-2 (total flux)
Sensor type: Quantum Sensor; high stability silicon photodiode (blue enhanced) in anodized aluminum case with acrylic diffuser
Model #SQ110 Apogee Quantum Sensor
Light spectrum waveband: 410 to 655 nm
Temperature dependence: 0.06+/-0.06% per °C
Stability: <±2% change over 1 yr
Operating Temperature: -40°C to 70°C; Humidity 0 to 100%
Cosine Response: 45° zenith angle: +/- 2%; 75° zenith angle: +/- 5%
Sensitivity: 0.2mV per µmol s^{-1} m^{-2}
Multiplier: 0.025

Station	Serial Number	Date of Cal	Dates of Sensor Use
FS	17012	11/01/2020	11/18/2021 – Current
NP	17009	04/25/2022	09/19/2022 - Current

Parameter: Precipitation
Units: millimeters (mm)
Sensor type: Tipping Bucket Rain Gauge with magnetic reed switch
Model #: RainVue20
Rainfall per tip: 0.01 inch
Operating range: Temperature: 1° to +70°C; Humidity: 0 to 100%
Accuracy: 1% (0 – 500 mm/hour intensity of rainfall)

Station	Serial Number	Date of Cal	Dates of Sensor Use
FS	212610	10/24/2023	11/18/2021 – Current
NP	203321	10/06/2022	10/06/2022 - Current

GOES Transmitter:
Model #: TX321
On-board memory: Non-volatile flash for setup parameters. 16 Kbytes for data.
Data Transmission Rates: 100, 300 and 1200 BPS
Transmit Power: 5.6 Watts for 100 and 300 bps, 11.2 watts for 1200 bps
Frequency range: 401.701 MHz – 402.09850 MHz
Channel bandwidth: 100/300 BPS 1.5 KHz; 1200 BPS 3 KHz
Time Keeping: Initial setting accuracy: ± 100 microseconds synchronized to GPS; Drift ± 10 milliseconds/day over operating temperature range; GPS scheduled updates are 1 at power up and once per day thereafter. Once every 28 hours required for continual operation.
Operating range: -40° to +60°C; Storage -50° to +70°C; 0-99% RH, non-condensing
Power requirements: 10.8 to 16 VDC, 5 mA during GPS fix and 2.6 Amps during transmission

Station	Serial Number	Dates of Transmitter Use
FS	1987	11/18/2021 – Current
NP	1698	05/2008 - 08/06/2021*

Model#: TX325
Data Transmission Rates: 300 and 1200 BPS
Transmit Power: 31 dBm for 300 BPS, 37 for 1200 BPS
Frequency range: 401.701 MHz – 402.09925 MHz
Channel bandwidth: 300 BPS 0.75 KHz; 1200 BPS 2.25 KHz
Time Keeping: Initial setting accuracy: ± 100 microseconds synchronized to GPS; Drift ± 40 milliseconds/day without GPS synchronization; GPS scheduled updates are 1 at power up and once per day thereafter. Once every 28 hours required for continual operation.
Operating range: -40° to +60°C; Storage -55° to +75°C
Power requirements: 10.5 to 16 Vdc; < 2.5 A when transmitting (typical 1.8 A at 12 Vdc); > 5 mA standby (typical 2.8 mA at 12 Vdc); < 50 mA during GPS acquisition (typical 25 mA at 12 Vdc)

Station	Serial Number	Dates of Transmitter Use
NP	300001940	08/06/2021 - Current

Datalogger:
CR1000X:
The CR1000X has a total onboard memory of 128 MB of flash and 4MB of battery backed SRAM. There are 8 MB of flash memory reserved for loading the operating system and 1MB of flash reserved for configuration settings. SRAM is used for the CRBasic program operating memory, communication memory, and data storage, with 72 MB of flash for extended data storage. Additional data storage expansion is available with a removable microSD flash memory card of up to 16 GB.

Station	Type	Front Serial Number	Rear Serial Number	Date of Cal	Dates of Sensor Use
FS	CR1000x	8215		01/17/2019	10/29/2019 - Current
NP	CR1000x	23320		12/16/2020	03/17/2021 - Current

CR1000x Firmware Version (s):

Station	OS	Dates of Use
FS	5.0	11/18/2021 - Current
NP	6.02	03/10/2023 - Current

CR1000x Program Version(s):

Station	Program Name	Dates Used
FS	HUDFSMET_CR1000x_6.1.2_091523	09/15/2023 - Current
NP	HUDNPMET_CR1000x_6.0.13_110723	11/07/23 – 10/07/24
NP	HUDNPMET_CR1000x_6.0.14_100724	10/07/24 – 11/01/24
NP	HUDNPMET_CR1000x_6.0.15_110124	11/01/24 – 11/08/24
NP	HUDNPMET_CR1000x_6.0.17_119824	11/08/24 - Current

~~[Instructions/Remove: Include parameter description, units, sensor type, model #, (operating temperature), range of measurement, accuracy, (temperature dependence), (sensitivity), (stability), serial numbers, multipliers, date of last calibration, and dates in use for each sensor **(include at a minimum the sensors installed for the year covered by this metadata document)** and CR1000/CR1000X description. **Ensure that sensor information is accurate for your weather station.**]~~

~~Parameter: Temperature~~
~~Units: Celsius~~
~~Sensor type: Platinum resistance temperature detector (PRT)~~
~~Model #: HMP45C Temperature and Relative Humidity Probe~~
~~Operating Temperature: -40°C to +60°C~~
~~Range: -40°C to +60°C~~
~~Accuracy: ± 0.2 °C @ 20°C~~
~~***Serial number, dates of calibration and use:*** *Include for all sensors*~~

~~Ex. Serial number: X0350015~~
~~Date of last calibration: 06/20/2024~~
~~Dates of sensor use: 09/10/2024 – 10/06/2025~~

~~Serial number: X035001~~
~~Date of calibration: 09/07/2025~~
~~Dates of sensor use: 10/06/2025 – current as of 12/31/2025~~

~~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: ± 2% RH (0-90%) and ± 3% (90-100%)~~
~~Temperature dependence of RH measurement: ± 0.05% RH/°C~~
~~***Serial number, dates of calibration and use:*** *Include for all sensors*~~
~~Parameter: Temperature~~
~~Units: Celsius~~
~~Sensor type: PT100 RTD, IEC 751 1/3 Class B, with calibrated signal conditioning~~
~~Model #: HC2-S3 Temperature and Relative Humidity Probe~~
~~Operating Temperature: -40°C to +60°C~~
~~Range: -40°C to +60°C~~
~~Accuracy: ± 0.1 °C @ 23°C~~
~~***Serial number, dates of calibration and use:*** *Include for all sensors*~~

~~Parameter: Relative Humidity~~
~~Units: Percent~~
~~Sensor type: ROTRONIC® Hygromer IN-1~~
~~Model #: HC2-S3 Temperature and Relative Humidity Probe~~

~~Range: 0-100% non-condensing~~
~~Accuracy at 23°C: ± 0.8% RH with standard configuration settings~~
~~Temperature dependence of RH measurement ± 3% (40°C to 60C)~~
~~***Serial number, dates of calibration and use:*** *Include for all sensors*~~

~~Parameter: Temperature~~
~~Units: Celsius~~
~~Sensor type: Pt1000 Class A~~
~~Model #: EE181 Temperature and Relative Humidity Probe~~
~~Operating Temperature: -40°C to +60°C~~
~~Range: -40°C to +60°C~~
~~Accuracy: ±0.2 °C @ 23°C~~
~~***Serial number, dates of calibration and use:*** *Include for all sensors*~~

~~Parameter: Relative Humidity~~
~~Units: Percent~~
~~Sensor type: HC101~~
~~Model #: EE181 Temperature and Relative Humidity Probe~~
~~Range: 0-100% non-condensing~~
~~Accuracy: -15 to 40 °C: ≤90% RH ± (1.3 + 0.003 • RH reading) % RH~~
~~-15 to 40 °C: >90% RH ± 2.3% RH~~
~~-25 to 60 °C: ± (1.4 + 0.01 • RH reading) % RH~~
~~-40 to 60 °C: ± (1.5 + 0.015 • RH reading) % RH~~
~~Temperature dependence of RH measurement: typically 0.03% RH/°C~~
~~***Note:*** This sensor caps relative humidity values at 100%, measured values >100% are altered to 100%.~~
~~***Serial number, dates of calibration and use:*** *Include for all sensors*~~

~~Parameter: Barometric Pressure~~
~~Units: millibars (mb)~~
~~Sensor type: Vaisala Barocap © silicon capacitive pressure sensor~~
~~Model #: CS-105 (PTB101B)~~
~~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~~
~~***Serial number, dates of calibration and use:*** *Include for all sensors*~~

~~Parameter: Barometric Pressure~~
~~Units: millibars (mb)~~
~~Sensor type: Vaisala Barocap © silicon capacitive pressure sensor~~
~~Model #: CS-106 (PTB110)~~
~~Operating Range: Pressure: 500 to 1100 mb; Temperature: -40°C to +60°C~~
~~Humidity: non-condensing~~
~~Accuracy: ± 0.3 mb at +20°C, ± 0.6 mb at 0°C to 40°C, ± 1 mb at -20°C to +45°C, ± 1.5 mb at -40°C to +60°C~~
~~Stability: ± 0.1 mb per year~~
~~***Serial number, dates of calibration and use:*** *Include for all sensors*~~

~~Parameter: Barometric Pressure~~
~~Units: millibars (mb)~~
~~Sensor type: digital, silicon capacitive pressure sensor~~

~~Model#: BaroVUE 10~~
~~Operating Range: Pressure: 500 to 1100 mb; temperature: -40°C to +60°C~~
~~Humidity: non-condensing~~
~~Accuracy: ±0.3 hPa (at 20°C), ±0.5 hPa (at -40° to +60°C)~~
~~Stability: ± 0.1 mb per year~~
~~***Serial number, dates of calibration and use:*** *Include for all sensors*~~

~~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 - 100 m/s (224 mph)~~
~~Accuracy: ± 0.3 m/s or 1% of reading~~
~~Multiplier: 0.0980~~
~~***Serial number, dates of calibration and use:*** *Include for all sensors*~~

~~Parameter: Wind direction~~
~~Units: degrees~~
~~Model #: R. M. Young 5103 Wind Monitor~~
~~Sensor type: balanced vane, 38 cm turning radius~~
~~Range: 360° mechanical, 355° electrical~~
~~Accuracy: ± 3 degrees~~
~~***Serial number, dates of calibration and use:*** *Include for all sensors*~~

~~Parameter: Wind Speed~~
~~Units: meter per second (m/s)~~
~~Model #: R.M. Young 5106 Wind Monitor~~
~~Range: 0 - 100 m/s (224 mph)~~
~~Accuracy: ± 0.3 m/s or 1% or reading~~
~~Multiplier: 0.0980~~
~~***Serial number, dates of calibration and use:*** *Include for all sensors*~~

~~Parameter: Wind direction~~
~~Units: degrees~~
~~Model #: R. M. Young 5106 Wind Monitor~~
~~Sensor type: balanced vane, 38 cm turning radius~~
~~Range: 360° mechanical, 355° electrical~~
~~Accuracy: ± 3 degrees~~
~~***Serial number, dates of calibration and use:*** *Include for all sensors*~~

~~Parameter: Wind Speed~~
~~Units: meter per second (m/s)~~
~~Model #: R.M. Young 5108 Wind Monitor~~
~~Range: 0 - 100 m/s (224 mph)~~
~~Accuracy: ± 0.3 m/s or 1% or reading~~
~~Multiplier: 0.1666~~
~~***Serial number, dates of calibration and use:*** *Include for all sensors*~~

~~Parameter: Wind direction~~
~~Units: degrees~~
~~Model #: R. M. Young 5108 Wind Monitor~~
~~Sensor type: balanced vane, 38 cm turning radius~~

~~Range: 360° mechanical, 355° electrical~~
~~Accuracy: ± 3 degrees~~
~~***Serial number, dates of calibration and use:*** *Include for all sensors*~~

~~Parameter: Photosynthetically Active Radiation (PAR)~~
~~Units: mmoles m-2 (total flux)~~
~~Sensor type: High stability silicon photovoltaic detector (blue enhanced)~~
~~Model #: LI190SB~~
~~Light spectrum waveband: 400 to 700 nm~~
~~Temperature dependence: 0.15% per °C maximum~~
~~Stability: <±2% change over 1 yr~~
~~Operating Temperature: -40°C to 65°C; Humidity: 0 to 100%~~
~~Sensitivity: typically 5 µA per 1000 µmoles s-1 m-2~~
~~**Multiplier:** ***List multiplier(s) and date(s) of change***~~
~~***Serial number, dates of calibration and use:*** *Include for all sensors*~~

~~Parameter: Photosynthetically Active Radiation (PAR)~~
~~Units: mmoles m-2 (total flux)~~
~~Sensor type: Quantum Sensor; high stability silicon photodiode (blue enhanced) in anodized aluminum case with acrylic diffuser~~
~~Model #SQ110 Apogee Quantum Sensor~~
~~Light spectrum waveband: 410 to 655 nm~~
~~Temperature dependence: 0.06 ± 0.06% per °C~~
~~Stability: <±2% change over 1 yr~~
~~Operating Temperature: -40°C to 70°C; Humidity 0 to 100%~~
~~Cosine Response: 45° zenith angle: ± 2%; 75° zenith angle: ± 5%~~
~~Sensitivity: 0.2mV per µmol s-1 m-2~~
~~Multiplier: 0.025 (this does not change) – *include*~~
~~***Serial number, dates of calibration and use:*** *Include for all sensors*~~

~~Parameter: Photosynthetically Active Radiation (PAR)~~
~~Units: mmoles m-2 (total flux)~~
~~Sensor type: Quantum Sensor; high stability silicon photodiode (blue enhanced) in anodized aluminum case with acrylic diffuser~~
~~Model: CS310 (SQ-500)~~
~~Light spectrum waveband: 389 to 692 nm~~
~~Temperature dependence: -0.11 ± 0.04%/°C~~
~~Stability: < ±2% change over a 1-year period~~
~~Operating temperature: -40 to 70 °C~~
~~Cosine Response: ±5% at 75° zenith angle~~
~~Sensitivity: 0.01 mV per µmol/m2/s~~
~~Multiplier: 0.5 (this does not change) – *include*~~
~~***Serial number, dates of calibration and use:*** *Include for all sensors*~~

~~Parameter: Precipitation (**specify if heated rain gauge**)~~
~~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~~

Serial number, dates of calibration and use: *Include for all sensors*

Datalogger: (*Include the information for your datalogger)*
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.

CR1000X/CR1000Xe:
The CR1000X has a total onboard memory of 128 MB of flash and 4MB of battery backed SRAM. There are 8 MB of flash memory reserved for loading the operating system and 1MB of flash reserved for configuration settings. SRAM is used for the CRBasic program operating memory, communication memory, and data storage, with 72 MB of flash for extended data storage. Additional data storage expansion is available with a removable microSD flash memory card of up to 16 GB.

Serial number:
Date CR1000/CR1000X/CR1000Xe installed:
Date CR1000/CR1000X/CR1000Xe calibrated:

CR1000/CR1000X/CR1000Xe firmware version (s): *Version(s) and dates changed*

CR1000/CR1000X/CR1000Xe program version(s): *Use naming convention and list all versions used in 2025.* (reservecodesitecodemet_loggertype_programver#_lastdatemodified ex. delsjmet_CR1000_5.5_031025.CR1 or delsjmet_CR1000X_5.5_031025.CR1X) or delsjmet_CR1000Xe_5.5_031025.CR1X

GOES transmitter:
Model number:
Serial number:
Date installed:

10) Coded variable definitions -

Sampling station:	Sampling site code:	Station code:
Field Station	FS	hudfsmet
Norrie Point	NP	hudnpmet

[Instructions/Remove: List the sampling station, sampling site code, and station code used in the data.]

Sampling station:	Sampling site code:	Station code:
Carriage House	CH	wqbchmet

11) QAQC flag definitions –
[Instructions/Remove: This section details the automated primary and secondary QAQC flag definitions and requires no additional information. Include the following excerpt.]

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~~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.

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-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 –
~~[Instructions/Remove: This section details the secondary QAQC Code definitions used in combination with the QAQC flags above and requires no additional information. Include the following excerpt.]~~

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/CR1000X, 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.

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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
CVT* Possible vandalism/tampering
CWE* Significant weather event

13) Other remarks/notes –

~~[Instructions/Remove: Use this section for further documentation of the research data set. Include any additional notes regarding the data set in general, circumstances not covered by the flags and comment codes, or specific data that were coded with the CSM "See Metadata" comment code. Any data coded CSM must have a corresponding statement in this section.. You may include the NERRQAQC macro metadata sheets or any other information regarding significant weather events, maintenance activities, etc that may have affected the weather station and data collected. Include the following excerpts:]~~

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.

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~~***[Remove if not applicable – this applies only to the LI-COR sensor]***~~ 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~~15-minute interval. These values are automatically flagged and coded as <1> (CAF).

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Relative Humidity data greater than 100 are within range of the sensor accuracy of ±3% and are flagged and coded as suspect, <1> (CAF). Values greater than 103 are rejected <-3>.

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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.**

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~~***[Remove if not applicable – this applies to all reserves where frozen precipitation(snow/ice/hail) occurs]***~~ Precipitation data collected with rain gauges that are not designed specifically for measuring frozen precipitation (snow/ice/hail), including heated gauges and those that use antifreeze to melt frozen precipitation, may not be measured accurately. Blowing wind, sublimation, and rate of snowfall/ice melt all effect the amount of recorded precipitation. The reserve has made attempts to accurately record dates and times when frozen precipitation and subsequent melting has occurred. ~~***[Reserve explain method of QAQC and flagging and coding for now melt]***~~

Although it is not practical to indicate the exact volume of snowfall and melt, significant rainfall events are cross-referenced with air temperature taken at the simultaneous interval. During months that snowfall is typical, significant rain events (CRE) that coincide with temperatures below 0 C will be recorded as CWE. It is assumed that precipitation fell in the form of ice or snow during these events. Due the non-uniform water content in precipitation in the form of snow and ice, it is assumed that the volume collected is an average and is not indicative of blowing snow or snowdrifts.