Metadata

Dataset Title:

Cary_Met_Data_Hourly.csv

Cary Environmental Monitoring Program Hourly Meteorological and Solar Radiation Data: 1988-2019

Abstract

The Cary Institute of Ecosystem Studies Environmental Monitoring Program is a long-term data collection program designed to understand how the environment changes over time. The program includes monitoring of climate including temperature and precipitation, as well as variables related to air pollution, such as acid deposition and ozone, and water pollution and other streamwater chemistry. Our solar radiation monitoring includes diffuse and global photosynthetically active radiation (PAR), diffuse and global shortwave radiation, net radiation and UV. Long-term monitoring of solar radiation provides us with an understanding of atmospheric energy dynamics, which can affect natural and human systems. The Cary Institute of Ecosystem Studies, Environmental Monitoring Program furnishes data under the following conditions: The data have received quality assurance scrutiny by our program, and, although we are confident of the accuracy of these data, the Cary Institute will not be held liable for errors in these data. Data are subject to change resulting from updates in data screening or models used. Data citation: The following is a standard citation for referencing data from the Cary Institute of Ecosystem Studies, Environmental Monitoring Program:

Cary Institute of Ecosystem Studies, Environmental Monitoring Program. 2008 (or current year). Cary Institute of Ecosystem Studies, Box AB, Millbrook, NY 12545, www.caryinstitute.org.

Those wishing to publish data from the Cary Institute of Ecosystem Studies, Environmental Monitoring Program are encouraged to contact Data Manager Vicky Kelly, kellyv@caryinstitute.org.

Investigators

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Keywords

Cary Institute, meteorology, climate, solar radiation, PAR, net radiation, shortwave radiation, air temperature, precipitation, barometric pressure, wind speed, wind direction, relative humidity, snow depth

Timeframe

The data in this file start 1 January 1988 and end 31 December 2019. Data collection is ongoing.

Geographic location

The meteorological and solar radiation instruments are located in a flat, open field in Millbrook, NY at an elevation of 128 m. GPS coordinates are N41.785823 W073.741447.

Methods

Meteorological and solar radiation data are collected using a Campbell Scientific, Inc. datalogger (21X 1M

1987-14 September 1993, 21XL 14 September 1993- 12 October 1999, 23X 12 Oct. 1999-December 2011, CR3000 Dec. 2011-present). All sensors are sampled every 2 seconds and all data are summarized every 3, minutes, 15 minutes, hourly and at the end of every 24-hour period. Hourly summary data units are Eastern Standard Time (EST), where 100 is midnight to 1 a.m. EST and 2400 is 11 p.m. to midnight EST. Three minute summary meteorological and solar radiation data have been collected since 2011 and 15-minute data since xxxx. Snow data are collected to the nearest 0.5 inch using a ruler and a snow depth gauge or ground measurements made within 12 hours of the completion of a snow event. The meteorological and solar radiation instruments are located in a flat, open field at an elevation of 128 m. GPS coordinates for the site are: N41.785823 W073.741447.

The instruments, their accuracy and our recommendation for the number of significant figures to use:

Please note that significant figures may be reported beyond the accuracy of the instruments. Data are reported in this manner to maintain the capability of backing out calculations from the raw measurements. Instrument notes including calibration, malfunctions, repairs and anecdotal information is available upon request. The instruments, their accuracy and our recommendation for the number of significant figures to use are:

Barometric Pressure, October 1999 - present Campbell Scientific, Inc. Model CS105, sensitivity + 4 mb, recommended significant figs. 4. The barometric pressure sensor is located adjacent to the datalogger in a temperature-controlled room.
Net Radiation, 1988 - April 1992, Qualimetrics Fritschen Type Model 3030 3032, sensitivity + 4 mV, recommended significant figs. 2. Net Radiation, April 1992 - March 1994, Radiation and Energy Balance Systems (REBS) Model Q6, March 1994-Sept. 1995, REBS Model Q*6.7, Sept. 1995-present REBS Model Q*7.1, ventilator used Sept 1995-July 2000, sensitivity 0.01 Wm-2-mV, recommended significant figs. 2. Location of sensors: 2 m above a mowed grass surface (1988-July 2002), 2.5 m above mowed grass surface (July 2002-present).
PAR, 1988 - present, Li-Cor, Inc. Model LI-190SB, sensitivity 8 mA/1000 mmols-1-m2, recommended significant figs. 3. Location of sensors: 2 m above a mowed grass surface (1988-July 2002), 2.5 m above mowed grass surface (July 2002-present).
Precipitation, 1988 - June 2007, Belfort Instrument Co. Universal Recording Rain Gauge, Series 5-780, sensitivity +0.05 inch (1.3 mm), recommended significant figs. 2. Precipitation amount from each event was checked using a standard plastic rain gauge and/or a snow depth / rain gauge. Location of instruments: collector openings are approximately 3 m above a mowed grass surface. July 2007-present, Geonor Precipitation Gauge Model T-200B from co-located USCRN station.
Relative Humidity, 1988 - April 1997, Phys Chem Corp. PCRC-11 or PCRC-55, sensitivity + 3%, recommended significant figs. 2. Relative Humidity, April 1997-present, Campbell Scientific, Inc. HMP45C, which uses a Vaisala, Inc., capacitive polymer H chip, sensitivity + 3%, recommended significant figs. 2 Temperature and relative humidity sensors are housed in a motor-aspirated shield (Climatronics Corp. series TS-10) 1.6 m above a mowed grass surface.
Shortwave Radiation, 1988 - present, Eppley Laboratory, Inc. Model 8-48, sensitivity 11 m v/Wm-2, recommended significant figs. 3. Location of sensors: 2 m above a mowed grass surface (1988-July 2002), 2.5 m above mowed grass surface (July 2002-present).
Temperature, 1988 - Nov. 1998, Campbell Scientific Model 107 or 207, sensitivity + 0.4 deg C, recommended significant figs. 3. Temperature, Nov. 1998 - present, Campbell Scientific, Inc. HMP45C temperature probe, sensitivity + 0.4 deg C, recommended significant figs. 3. Temperature and relative humidity sensors are housed in a motor-aspirated shield (Climatronics Corp. series TS-10) 1.6 m above a mowed grass surface.
Wind Speed, 1988 - July 2002, Campbell Scientific, Inc. Model 014A, sensitivity +1.5%, recommended significant figs. 3. Wind Speed, July 2002 - June 2003, Met One Instruments, Inc. Model 50.5 Solid State Wind Sensor, sensitivity +2%, recommended significant figs. 3. Wind Speed, October 2003 - present, Climatronics Corp. sonimometer. Location of sensors: approximately 10 m above a mowed grass surface.

Wind Direction, 1988 - July 2002, Campbell Scientific, Inc. Model 024A, sensitivity +5 degrees, recommended significant figs. 2. Wind Direction, July 2002 - June 2003, Met One Instruments, Inc. Model 50.5 Solid State Wind Sensor, sensitivity +3 degrees, recommended significant figs. 3. Wind Speed, October 2003 - present, Climatronics Corp. sonimometer. Location of sensors: approximately 10 m above a mowed grass surface.

METEOROLOGICAL DATA QUALITY ASSURANCE AND QUALITY CONTROL PARAMETERS AND METHODS

The quality of meteorological data collected as part of the Cary Institute Environmental Monitoring Program is assured and controlled at several levels. Instruments are returned to manufacturers for audits and calibration as recommended by the manufacturer or as needed. If an instrument is known to have malfunctioned or if it is not in place for any reason, data are either removed from the database and replaced with missing values, or are replaced with data from a known working instrument. The New York State Department of Environmental Conservation has an air monitoring site co-located at the Cary Institute. Temperature data from the DEC program were sometimes used when Cary Institute instruments malfunctioned or were unavailable.

Data are checked for accuracy at several levels. Meteorological data are collected using a Campbell Scientific datalogger. The datalogger assigns out-of-range data a value of either 6999, 9999 or -9999. Data are downloaded from the datalogger on a daily basis and imported into a SAS database. The SAS program used to import data contains range-checking steps. These steps produce a temporary dataset that put out-of-range data and data that are beyond a reasonable range equal to missing values. These data are then checked and missing values are reviewed. At the end of each year, a line graph of raw data is produced together with data from previous years to check for data points that may be outliers. All outliers are checked and, if for any reason the value is suspected to be unreal, the value is replaced with a missing value code.

Instrument notes including calibration schedule, malfunctions and repairs, new instrumentation, anecdotal information etc. can be made available on request.

The quality of meteorological data collected as part of the Cary Institute Environmental Monitoring Program is assured and controlled at several levels. Instruments are returned to manufacturers for audits and calibration as recommended by the manufacturer or as needed. If an instrument is known to have malfunctioned or if it is not in place for any reason, data are either removed from the database and replaced with missing values, or are replaced with data from a known working instrument. The New York State Department of Environmental Conservation has an air monitoring site co-located at the Cary Institute.

Meteorological and solar radiation data are collected using a Campbell Scientific, Inc. datalogger. All sensors are sampled every 2 seconds and all data are summarized every 24, 60, 15 and 3 minutes. Data are checked for accuracy at several levels. The datalogger assigns out-of-range data a value of either 6999, 9999 or - 9999. Data are downloaded from the datalogger on a daily basis and imported into a SAS database. The SAS program used to import data contains range-checking steps. These steps produce a temporary dataset that put out-of-range data and data that are beyond a reasonable range equal to missing values. These data are then checked and missing values are reviewed. At the end of each year, a line graph of raw data is produced together with data from previous years to check for data points that may be outliers. All outliers are checked and, if for any reason the value is suspected to be unreal, the value is replaced with a missing value code.

Data Table

Column name	Description	Unit or code explanation or date format	Empty value code
DATE	"Date in MM/DD/YYYY format where MM is month number, DD is date number and YYYY is year"	Date	
HOUR_MIN	"Hour in hour_minute format in Eastern Standard Time. Note that data are from the preceding hour. For example, data for hour 0100 are from midnight to 1:00 a.m EST."	Numeric	Eastern Standard Time
AVE_TEMP	Average air temperature (degrees C)	Numeric	degrees C
AVE_GSW	Average global short-wave radiation (Watts/m^2)	Numeric	Watts/m^2
AVE_DSW	Average diffuse short-wave radiation (Watts/m^2)	Numeric	Watts/m^2
AVE_NETR	Average net radiation (Watts/m^2)	Numeric	Watts/m^2
AVE_GPAR	Average global PAR (micromoles/m^2-sec)	Numeric	micromoles/m^2-sec
AVE_DPAR	Average diffuse PAR (micromoles/m^2-sec)	Numeric	micromoles/m^2-sec
MIN_TEMP	Minimum air temperature (degrees C)	Numeric	degrees C
MIN_TEMT	Time of minimum air temperature (EST)	Numeric	Eastern Standard Time
MIN_RH	Minimum relative humidity (%)	Numeric	percent
MIN_RHT	Time of minimum relative humidity (EST)	Numeric	Eastern Standard Time
MIN_GSW	Minimum global short-wave radiation (Watts/m2)	Numeric	Watts per meter squared
MIN_DSW	Minimum diffuse short-wave radiation (Watts/m^2)	Numeric	Watts per meter squared
MIN_NETR	Minimum net radiation (Watts/m^2)	Numeric	Watts per meter squared
MIN_GPAR	Minimum global PAR (micromoles/m^2-sec)	Numeric	micromoles per meter squared per second
MIN_DPAR	Minimum diffuse PAR (micromoles/m^2-sec)	Numeric	micromoles per meter squared per second
MAX_WS	Maximum relative humidity (%)	Numeric	percent
MAX_WST	Time of maximum relative humidity (EST)	Numeric	Eastern Standard Time
MAX_TEMP	Maximum air temperature (degrees C)	Numeric	degrees C
MAX_TEMT	Time of maximum air temperature (EST)	Numeric	Eastern Standard Time
MAX_RH	Maximum relative humidity (%)	Numeric	percent
MAX_RHT	Time of maximum relative humidity	numeric	Eastern

	(EST)		Standard Time
MAX_GSW	Maximum global short-wave radiation (Watts/m2)	Numeric	Watts per meter squared
MAX_GSWT	Time of maximum global short-wave radiation (EST)	Numeric	Eastern Standard Time
MAX_DSW	Maximum diffuse short-wave radiation (Watts/m^2)	Numeric	Watts per meter squared
MAX_DSWT	Time of maximum diffuse short-wave radiation (Watts/m^2)	Numeric	Watts per meter squared
MAX_NETR	Maximum net radiation (Watts/m^2)	Numeric	Watts per meter squared
MAX_NETT	Time of maximum net radiation (EST)	Numeric	Eastern Standard Time
MAX_GPAR	Maximum global PAR (micromoles/m^2-sec)	Numeric	micromoles per meter squared per second
MAX_GPAT	Time of maximum global PAR (EST)	Numeric	Eastern Standard Time
MAX_DPAR	Maximum diffuse PAR (micromoles/m^2-sec)	Numeric	micromoles per meter squared per second
MAX_DPAT	Time of maximum diffuse PAR (EST)	Numeric	Eastern Standard Time
TOT_GSW	Total global short-wave radiation (KJoule/m^2)	Numeric	KJoule per meter squared
TOT_DSW	Total diffuse short-wave radiation (KJoule/m^2)	Numeric	KJoule per meter squared
TOT_GPAR	Total global PAR (mole/m^2)	Numeric	mole per meter squared
TOT_DPAR	Total diffuse PAR (mole/m^2)	Numeric	mole per meter squared
WD_SD	Standard deviation of wind direction (degrees)	Numeric	degrees
AVE_RWD	AVE_RWD	Numeric	degrees
AVE_RWS	Resultant mean wind speed (m/sec)	Numeric	meters per sec
AVE_SWS	Scalar mean wind speed (m/sec)	Numeric	meters per sec
TOT_NETR	Total net radiation (KJoule/m^2)	Numeric	KJoule per meter squared
AVE_BP	Average barometric pressure (mm Hg)	Numeric	mm Hg

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