

Meteorological Conditions at VMC Sites in 1998

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Cooperators:

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Introduction:

Continuous monitoring of basic meteorological variables continued in 1998 at several VMC sites. Hourly meteorology data from Proctor Maple Research Center (PMRC) are available from 1988 to present, and daily temperature and precipitation data from the summit of Mt. Mansfield (1205 m) are available from 1954 to present. These two stations provide the longest records of meteorological data in close proximity to the VMC's Mt. Mansfield Study Area.

This report is based on data from the PMRC air quality monitoring station (PMRC AQ, 400 m) and tower (PMRC tower, 400m), established in 1988 and 1992, respectively; the VMC meteorological station on the west side of Mt. Mansfield (MMWest, 880 m (2900 ft)), established in 1997; the National Weather Service summit station, established in 1960; Colchester Reef (CR, 38 m), established in 1996 and the Clean Air Status and Trends Network (CASTNET), established in 1994 in the Lye Brook Wilderness Area. The principle purpose of these stations are to provide high-quality, continuous, and long-term records of basic meteorological variables for VMC cooperators, other researchers, and other interested user groups.

Other sources of meteorological data not included in the report, but available through the VMC data library, include within-forest meteorological data from the forest canopy tower at PMRC and Nettle Brook. The VMC has access to National Weather Service (NWS) data, via the National Climate Data Center (NCDC). The VMC archives data from 45 currently active cooperative observer stations in Vermont, including the Mount Mansfield summit station. Data are available in Excel, Lotus, ASCII and other formats by request from the VMC data manager.

Methods:

Campbell CR10X dataloggers are used to log either hourly (PMRC AQ) or 15 minute average (CR; MMWest; PMRC tower) values for each parameter at each site. Three stations are remotely linked to the VMC server via telephone modem (PMRC AQ) or radio (MMWest; CR). CASTNET data are downloaded from the Environmental Protection Agency web site annually. Data files are continuously updated and are screened according to established QA/QC protocols. The meteorological stations are supervised by Tim Scherbatskoy and operated by Miriam Pendleton, Richard Furbush, and Carl Waite.

Variables collected at the VMC sites are summarized in Table 1

The criteria for data completeness are as follows: each hour must include a minimum of one 15 minute interval data set and each day must have at least 75% of the hourly data. Number of days in the month are reported in the appendix. Data for MMWest in May through August are not available.

This report contains a summary of annual averages; other time frames (daily, weekly, monthly) are in the Appendix. The Appendix contains summary statistics including means, maximum and minimum values, and number of observations. Fifteen minute average data (from MMWest, CR, CASTNET and PMRC tower) are arithmetically averaged to provide hourly means, which are then averaged into daily means. Monthly and yearly summaries are created from daily data.

Results and Discussion:

A comparison of several meteorological variables at individual sites can be found in the Appendix.

Daily total precipitation by month for all VMC sites is summarized (Appendix). Daily mean, minimum, and maximum temperatures for each site are shown by month (Appendix). Please note that the X-axis may cross the Y-axis at different locations, and that the Y-axis scale varies.

Growing degree days are based on start temperatures of 32 and 50 degrees Fahrenheit, temperature thresholds for plants and insects, respectively. Cumulative growing degree days are calculated by adding the degrees above the starting temperature (daily ave.) for a given day to the next day's above freezing value. Days when temperatures do not go above the base temperature are given a value of zero. Results are plotted in the Appendix.

The Northeast Regional Climate Center reported that in 1998 overall regional temperatures produced a warm winter and a wet summer. One consequence of the warm winter was the January 1998 ice storm, which resulted in the largest acreage of forestland damaged by ice in this century. Most of the northeast was dry during the second half of the year, but Vermont was not. The spring was cold and wet; May ended with severe thunderstorms and Bennington was struck by tornados. June and July were characterized by summer storms which caused statewide flooding. Ben and Jerry's had to cancel their annual summer concert in Warren, and the bridge on Route 116 in Bristol washed out. Burlington had the wettest summer on record, with 62.94 cm (24.78") of rain exceeding the previous record of 57.76 cm (22.74") from 1892.

Two excellent resources for meteorological information are the VT Climatology web site, at www.uvm.edu/~ldupigny/sc/, and the Northeast Regional Climate Center (NRCC). NRCC provides interpretive monthly climate summaries and can be accessed via www.nws.noaa.gov or directly at met-www.cit.cornell.edu/data_products.html.

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Table 1: Annual summary of meteorological variables from VMC stations. N = the number of days with acceptable data.

Variable Name	CASTNet		Colchester Reef		Mount Mansfield (West 2900')		Mount Mansfield Summit		PMRC Air Quality Site		PMRC Tower	
	Data	N	Data	N	Data	N	Data	N	Data	N	Data	N
Average Air Temperature (C)	6.76	365	9.11	298	-0.13	219	3.26	361	10.35	283	8.17	362
Maximum Air Temperature (C)	25.63	365	30.42	298	22.32	219		361	28.50	283	28.70	362
Minimum Air Temperature (C)	-22.70	365	-19.50	298	-26.42	219		361	-24.90	283	-24.14	362
Maximum Air Temperature at Summit (C)		0		0		0	25.56	365		0		0
Minimum Air Temperature at Summit (C)		0		0		0	-33.89	361		0		0
Average Water Temperature (C)		0	8.95	64		0		0		0		0
Maximum Water Temperature (C)		0	13.87	64		0		0		0		0
Minimum Water Temperature (C)		0	4.29	64		0		0		0		0
Average Snow Depth (mm)		0		0		0	658.09	363		0		0
Maximum Snow Depth (mm)		0		0		0	2870.20	363		0		0
Minimum Snow Depth (mm)		0		0		0	0.00	363		0		0
Average Barometric Pressure (mb)		0	1011.57	298		0		0	955.54	324		0
Maximum Barometric Pressure (mb)		0	1034.00	298		0		0	984.00	324		0
Minimum Barometric Pressure (mb)		0	986.00	298		0		0	930.00	324		0
Average Relative Humidity (%)	69.91	365	78.31	297	87.73	217		0	68.24	303		0
Minimum Relative Humidity (%)	100.00	365	104.60	297	104.40	217		0	100.00	303		0
Minimum Relative Humidity (%)	-0.65	365	20.23	297	20.03	217		0	20.10	303		0
Average Precipitation (mm)	0.14	364		0	0.00	46	6.74	363	0.11	328		0
Maximum Precipitation (mm)	31.24	364		0	7.00	46	78.74	363	9.90	328		0
Minimum Precipitation (mm)	0.00	364		0	0.00	46	0.00	363	0.00	328		0
Total Precipitation (mm)	1208.02	364		0	14.00	46	2447.04	363	1161.49	328		0
Average Pyranometer (watts/m^2)	129.34	365	118.74	271	33.95	210		0		0		0
Maximum Pyranometer (watts/m^2)	1019.08	365	908.00	271	1016.00	210		0		0		0
Minimum Pyranometer (watts/m^2)	0.00	365	0.00	271	0.00	210		0		0		0
Average Relative Wind Speed (m/sec)	2.28	365	6.14	298	0.77	219		0	1.67	313	0.87	362

Variable Name	CASTNet		Colchester Reef		Mount Mansfield (West 2900')		Mount Mansfield Summit		PMRC Air Quality Site		PMRC Tower	
	Data	N	Data	N	Data	N	Data	N	Data	N	Data	N
Maximum Relative Wind Speed (m/sec)	12.35	365		298	8.30	219		0	7.60	313	7.26	362
Minimum Relative Wind Speed (m/sec)	0.00	365		298				0	0.00	313		362
Average Horizontal Wind Speed (m/sec)	2.47	365		298				0	1.92	128		362
Maximum Horizontal Wind Speed (m/sec)	12.73	365		298				0	8.21	128		362
Minimum Horizontal Wind Speed (m/sec)	0.05	365		298				0	0.15	128	0.00	362
Average Wind Direction (degrees)	201.23	365		298				0	186.88	328	191.76	362
Maximum Wind Direction	360.00			298				0	360.00	328	360.00	362
Minimum Wind Direction	0.00							0	0.00	328	0.00	362
Average Standard Deviation WD	25.33							0	31.01	328	22.93	362
Maximum Standard Deviation WD	85.84							0	85.00	328	80.80	362
Minimum Standard Deviation WD	0.00							0	0.00	328	0.00	362
Average Quantum (uE/m ² /sec)								0		0		0
Maximum Quantum (uE/m ² /sec)								0		0		0
Minimum Quantum (uE/m ² /sec)								0		0		0