Spring 1992

UWM Field Station meteorological data

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UWM Field Station Meteorological Data: 1989-1991

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During 1989, the UWM Field Station obtained a digital data logger weather station manufactured by Campbell Scientific, Inc. The equipment was operational in September 1989 and has produced continuous records since that time. The weather station is located next to the laboratory building in an open field. The meteorological data produced by this station are available by request. Here, I describe the various forms in which the data are available and provide annual summaries for September 1989 through 1991.

Field Station weather records are summarized in three ways: 30-minute records, daily summaries and yearly summaries. Instantaneous readings of the sensors are collected by the data logger every 15 second for Temperature (C°), Relative Humidity (%), Precipitation (mm), Barometric Pressure (mbars), Radiation (kW/m^2), Evaporation (mm), Wind-Speed (m/s), Wind-Magnitude (m/s), and Wind-Direction (deg/s). Every 30 minutes (on the hour and half-hour), a mean value for each variable is calculated by a program stored in the data logger and stored in a portable storage module. For Precipitation the total rainfall in the 30-minute period is recorded. On a monthly basis the data are transferred from the portable storage module to a computer, processed, and stored on disc. These 30-minute records are available as SPSS files and as hard copies.

The precipitation stored on the data logger is recorded by a tipping bucket rain gauge. Tipping bucket rain gauges are inaccurate in heavy rainfalls because a substantial amount of water drips through the gauge during bucket "tips". The tipping bucket rain gauge also does not work for frozen precipitation. We employ a weighing bucket rain gauge to correct the records from the tipping bucket during heavy rainfall and to record precipitation during the winter months.

Daily summaries are produced from the 30-minute records by calculating a daily mean for each variable, except precipitation for which a daily sum is calculated. Daily summaries are available as Lotus 1-2-3 files and as hard copies. Yearly summaries have also been calculated and are presented here for 1989 (partial year) through 1991. Yearly summaries are also available as Lotus 1-2-3 files.

Yearly Summaries

The yearly summaries presented here are modelled, where possible, after the summaries provided by the National Oceanic and Atmospheric Administration (NOAA). Some differences between the two reports reflect differences in available equipment. Records for the Field Station are reported in degrees Celsius and in other metric measures. In addition, growing degree-days (at 5° and 10° C , see below for description) were substituted for the heating and cooling degree-days used by NOAA. The variables reported in the summaries are defined as follows:

Temperature

Average

-Daily Maximum: Monthly mean of the 30-min period in each day with the highest mean temperature.

-Daily Minimum: Monthly mean of the 30-min period in each day with the lowest mean temperature.

-Daily Average: Monthly mean of all 30-min means. (NOAA uses the midpoint between the daily minimum and maximum for this measure.)

Extremes

-Highest: Highest 30-min mean temperature.

-Date: Day of month with highest temperature.

-Lowest: Lowest 30-min mean temperature.

-Date: Day of month with lowest temperature.

Degree-days

At 5° C: Sum of the number of degrees by which the daily average temperatures exceeded 5° C (after 1 January).

At 10° C: Sum of the number of degrees by which the daily average temperature exceeded 10° C (after 1 January).

Radiation

Mean: Mean of all 30-min means in the month.

Maximum: Maximum 30-min mean during the month.

Number of Days

Precipitation: Number of days with 0.25 mm or more of precipitation.

Temperature

-Maximum

32° and above: Number of days with a maximum 30-min mean temperature of 32° C or above.

0° and below: Number of days with a maximum 30-min mean temperature of 0° C or below.

-Minimum

0° and below: Number of days with a minimum 30-min mean temperature of 0° C or below.

-18° and below: Number of days with a minimum 30-min mean temperature of -18° C or below.

Mean Pressure: Mean of all 30-min means in the month.

Relative humidity: Monthly mean of the 30-min means for each quarter of the day.

Precipitation

Total: Sum of all precipitation during the month.

Greatest (24 hrs): Total precipitation on the day with the most precipitation.

Wind

Direction: Monthly mean of all 30-min means.

Mean Speed: Monthly mean of all 30-min means

Maximum Speed: Highest mean wind speed during a 30-min period.

The yearly summaries are presented in Tables 1-3. The daily mean temperature, mean radiation, and total precipitation are shown in Fig 1-3. Individuals wishing to obtain further information or copies of the weather records should contact the Field Station.

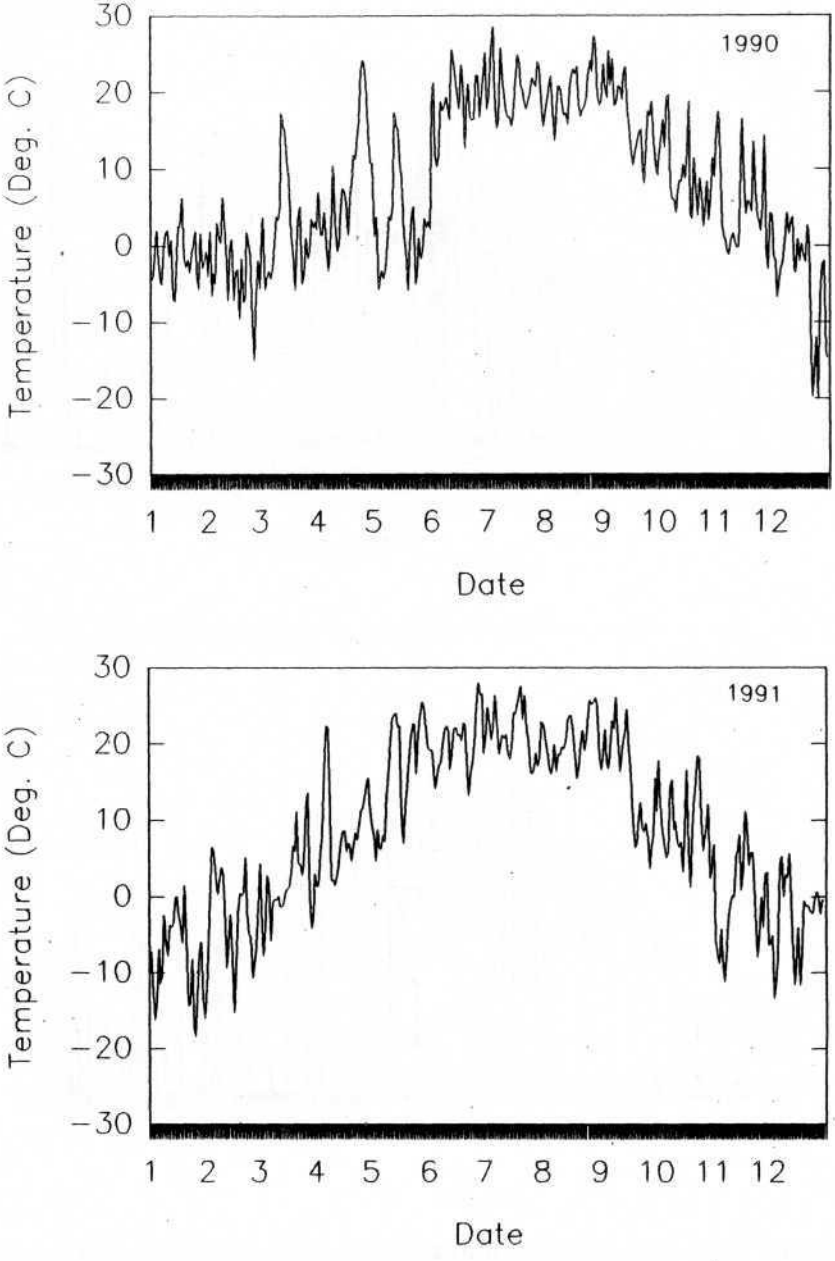

Figure 1. Mean daily temperatures at the UWM Field Station for 1990 and 1991.

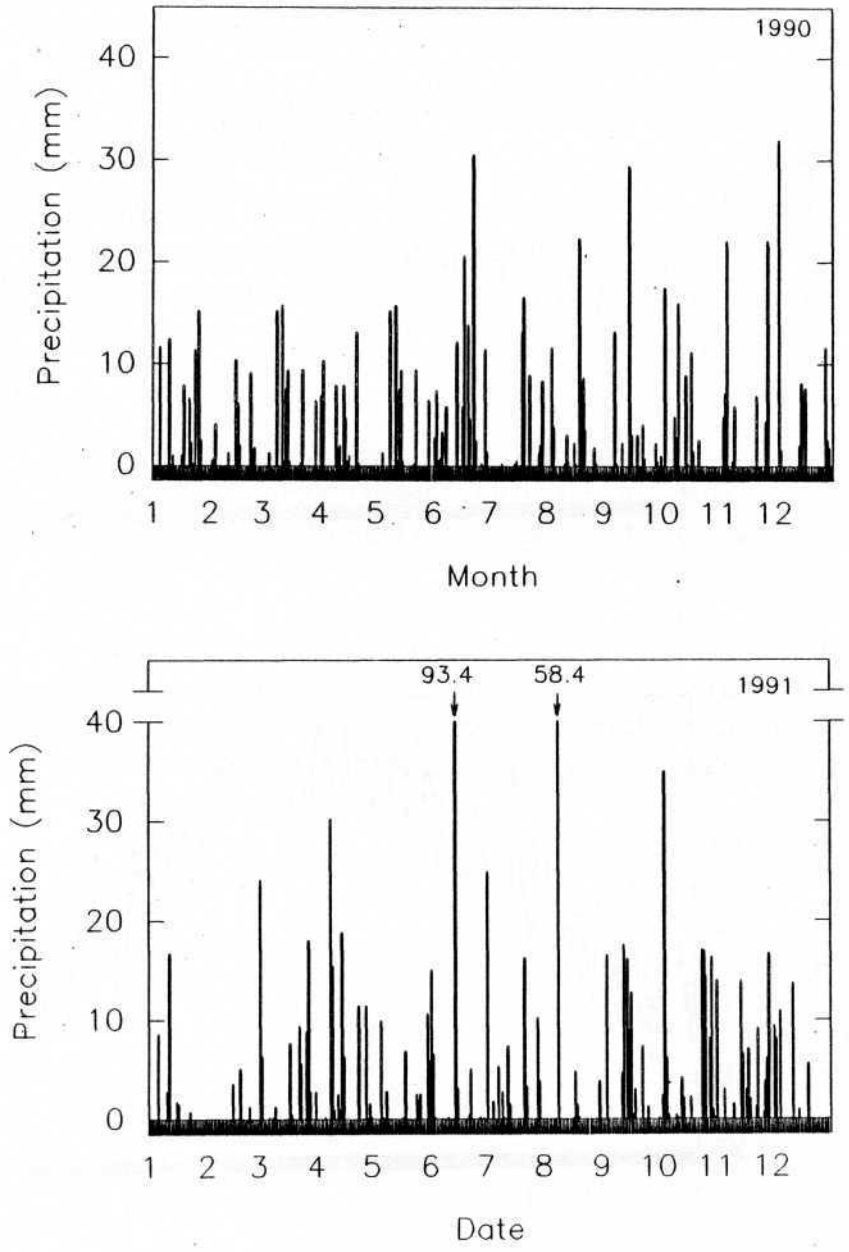

Figure 2. Total daily precipitation at the UWM Field Station for 1990 and 1991.

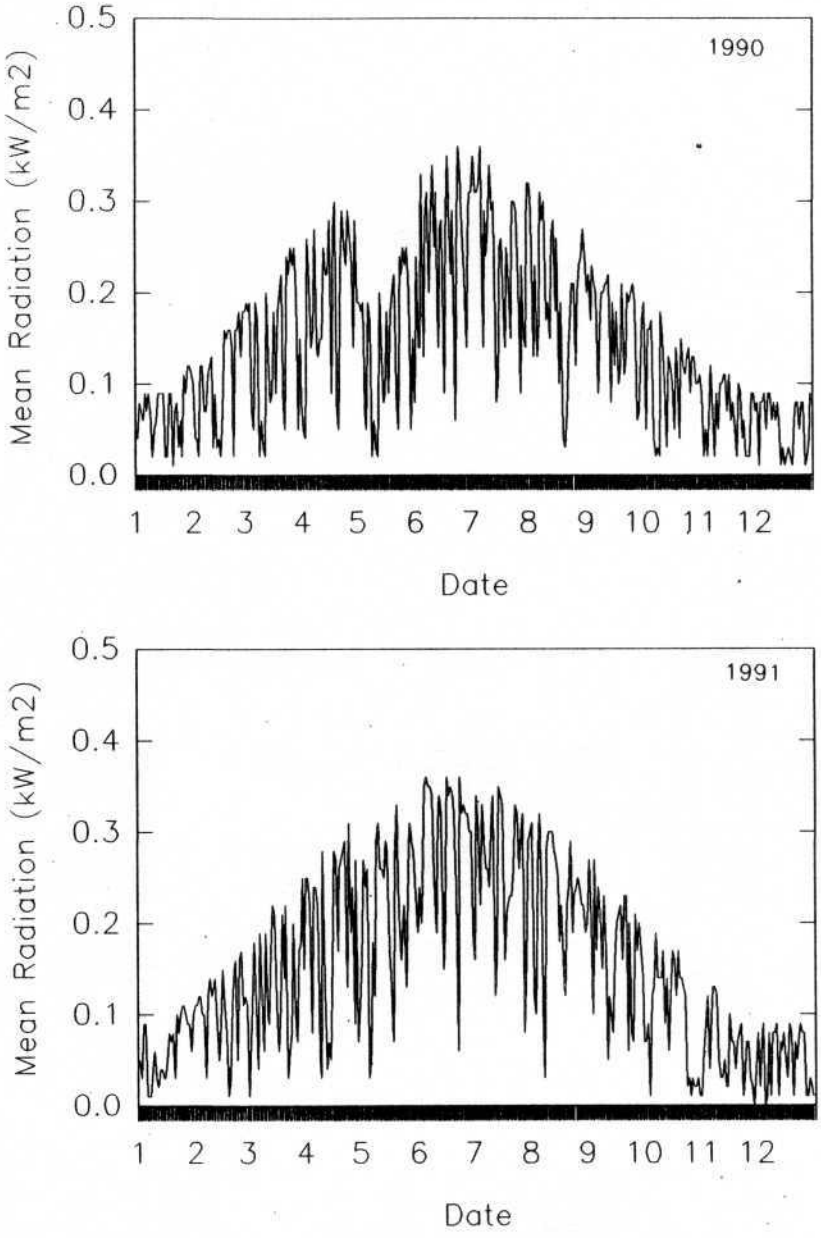

Figure 3. Mean daily radiation at the UWM Field station for 1990 and 1991.

METEOROLOGICAL DATA FOR 1989

	SEP	OCT	NOV	DEC
TEMPERATURE (C°)				
Average				
-Daily Maximum	20.7	16.0	4.8	-6.2
-Daily Minimum	8.8	4.9	-3.7	-14.4
-Daily Average	14.8	10.3	0.5	-10.2
Extremes				
-Highest	26.8	26.2	19.4	6.4
-Date	8	15	13	1
-Lowest	-1.6	-3.3	-14.3	-28.7
-Date	24	9	24	21
DEGREE DAYS				
Sum				
-At 5°	292.6	180.4	15.5	0.0
-At 10°	155.5	84.3	2.3	0.0
RELATIVE HUMIDTY (%)				
6 hr means begining				
Hour 00	85.8	79.1	80.0	75.8
Hour 06	80.4	78.4	77.4	76.5
Hour 12	62.6	58.7	66.3	65.7
Hour 18	79.1	71.1	75.8	71.8
MEAN PRESSURE (mbars)	1019.95	1017.57	1012.27	1018.02

	SEP	OCT	NOV	DEC
NUMBER OF DAYS:				
Precipitation				
.25 mm or more	10	9	9	7
Temperature				
-Maximum				
32° and above	0	0	0	0
0° and below	0	0	7	22
-Minimum				
0° and below	2	5	19	31
-18° and below	0	0	0	8
RADIATION (kW/m2)				
Mean	0.18	0.12	0.07	0.06
Maximum	0.87	0.71	0.54	0.40
PRECIPITATION (mm)				
Total	46.48	47.02	13.97	11.18
Greatest (24hrs)	20.32	20.35	4.06	3.56
Date	9	5	27	30
WIND				
Direction	247.6	252.4	282.6	292.8
Mean Speed (m/s)	4.73	7.42	8.96	8.56
Maximum Speed (m/s)	23.81	21.30	33.70	28.32

METEOROLOGICAL DATA FOR 1990

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TEMPERATURE (C°)												
Average												
-Daily Maximum	3.0	1.6	6.3	13.5	15.4	24.3	25.2	24.9	22.2	14.6	10.3	-0.4
-Daily Minimum	-6.0	-8.5	-1.8	3.4	6.0	12.5	14.8	15.0	12.0	3.7	0.3	-9.0
-Daily Average	-1.4	-3.1	2.2	8.3	10.8	18.8	20.2	19.9	16.8	9.1	5.1	-4.3
Extremes												
-Highest	10. 2	11.4	23.5	29.9	25.8	31.8	33.6	33.3	34.4	27.4	23.0	9.4
-Date	17	8	12	25	8	12	4	27	6	5	1	9
-Lowest	-12.7	-19.9	-9.4	-5.8	0.2	3.2	9.3	8.1	3.8	-3.9	-7.3	-24.6
-Date	13	25	19	7	10	4	7	1	2	22	8	26
DEGREE DAYS												
Sum												
-At 5°	1.3	1.3	43.0	142.8	180.0	413.0	471.9	460.9	353.6	135.3	71.1	0.0
-At 10°	0.0	0.0	20.0	71.8	56.4	263.0	316.9	305.9	206.8	47.3	28.4	0.0
RELATIVE HUMIDTY (%)												
6 hr means beginning												
Hour 00	81.0	74.6	72.9	73.1	77.6	77.9	80.0	80.7	78.7	73.6	68.4	72.8
Hour 06	79.6	73.3	69.8	64.8	68.5	71.4	71.4	74.1	72.7	69.1	66.2	72.4
Hour 12	71.1	63.5	59.8	50.5	57.6	60.4	63.0	64.3	60.8	55.6	55.8	66.6
Hour 18	78.8	69.8	69.5	63.5	68.5	68.5	72.9	75.6	75.3	69.6	65.6	70.3
MEAN PRESSURE (mbars)	1011.78	1017.96	1019.53	1015.29	1013.98	1012.84	1017.67	1018.34	1017.11	1015.77	1015.78	1017.62

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NUMBER OF DAYS:												
Precipitation												
.25 mm or more	11	10	10	11	10	16	9	13	10	10	8	8
Temperature												
-Maximum												
32° and above	0	0	0	0	0	0	2	1	2	0	0	0
0° and below	7	11	4	1	0	0	0	0	0	0	0	11
-Minimum												
0° and below	28	27	20	12	0	0	0	0	0	6	19	30
-18° and below	0	1	0	0	0	0	0	0	0	0	0	6
RADIATION (kW/m2)												
Mean	0.07	0.10	0.14	0.19	0.22	0.24	0.24	0.20	0.17	0.11	0.07	0.05
Maximum	0.49	0.66	0.83	0.95	1.01	0.98	1.02	0.94	0.81	0.69	0.49	0.43
PRECIPITATION (mm)												
Total	72.39	37.59	66.40	56.39	106.43	123.75	51.33	62.99	58.93	66.55	73.66	67.31
Greatest (24hrs)	15.24	10.41	15.75	13.16	29.46	30.53	16.54	22.35	13.21	17.53	22.10	32.00
Date	25	14	11	20	10	22	19	18	6	3	5 & 27	3
WIND												
Direction	253.7	288.4	233.1	248.2	31.8	244.1	12.5	197.6	283	244.8	253.8	275.6
Mean Speed (m/s)	8.86	8.41	8.14	8.04	7.32	6.81	5.16	4.42	5.61	7.60	6.48	8.96
Maximum Speed (m/s)	29.77	26.61	24.46	22.06	27.85	24.15	18.41	21.94	18.11	28.42	23.68	27.46

METEOROLOGICAL DATA FOR 1991

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TEMPERATURE (C°)												
Average												
-Daily Maximum	-4.5	1.3	6.3	13.9	21.7	25.6	26.7	26.1	20.1	14.5	4.4	1.0
-Daily Minimum	-13.0	-6.7	-2.9	4.1	11.4	14.0	16.0	15.2	9.9	4.8	-4.7	-6.7
-Daily Average	-8.5	-2.5	1.6	8.7	16.3	20.1	21.4	20.6	15.1	9.5	-0.2	-3.0
Extremes												
-Highest	5.2	11.0	20.4	29.3	33.1	33.9	33.1	33.1	32.6	24.7	17.8	13.1
-Date	19	21	21	6	28	29	20	26	9	23	18	12
-Lowest	-23.4	-17.4	-10.4	-4.7	0.8	8.1	8.6	9.2	-3.2	-3.6	-16.2	-17.2
-Date	30	15	4	2	3	7	27	6	27	19	7	16
DEGREE DAYS												
Sum												
-At 5°	0.0	2.3	23.6	129.5	349.8	452.6	507.2	483.4	303.9	147.7	18.5	0.8
-At 10°	0.0	0.0	6.2	50.3	219.0	302.6	352.2	328.4	175.9	52.7	1.2	0.0
RELATIVE HUMIDTY (%)												
6 hr means begining												
Hour 00	70.1	69.1	73.1	66.1	68.0	61.9	61.6	59.6	59.1	52.1	56.9	56.9
Hour 06	69.8	67.9	70.2	60.9	58.5	47.1	47.7	46.4	47.4	48.8	54.3	56.2
Hour 12	63.9	58.4	61.7	49.1	49.8	36.8	34.5	33.9	34.4	39.4	45.8	50.3
Hour 18	68.4	65.6	69.3	57.5	60.5	49.6	50.5	50.6	51.6	48.4	53.8	54.8
MEAN PRESSURE (mbars)	1018.99	1016.36	1010.65	1015.20	1016.65	1017.96	1015.86	1019.17	1019.41	1015.75	1016.92	1019.26

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NUMBER OF DAYS:												
Precipitation												
.25 mm or more	6	3	13	12	10	10	11	6	10	17	14	6
Temperature												
-Maximum												
32° and above	0	0	0	0	1	2	5	4	1	0	0	0
0° and below	27	12	3	0	0	0	0	0	0	0	9	11
-Minimum												
0° and below	31	23	22	7	0	0	0	0	3	5	23	29
-18° and below	9	0	0	0	0	0	0	0	0	0	0	0
RADIATION (kW/m2)												
Mean	0.06	0.11	0.13	0.18	0.22	0.29	0.26	0.22	0.17	0.10	0.06	0.05
Maximum	0.58	0.63	0.86	0.91	1.01	0.99	1.02	0.98	0.85	0.69	0.56	0.45
PRECIPITATION (mm)												
Total	32.26	9.91	87.88	100.36	43.41	124.71	77.44	69.11	88.80	128.27	89.05	48.77
Greatest (24hrs)	16.76	5.08	24.13	30.25	10.64	93.42	24.89	58.45	17.60	35.08	16.66	13.72
Date	11	18	1	8	30	14	1	8	12	4	29	12
WIND												
Direction	289.9	292.9	327.9	75.2	171.3	103.1	268.6	324.1	247.5	270	259.1	275.3
Mean Speed (m/s)	5.95	8.36	9.31	8.71	5.94	5.08	4.78	4.54	5.61	8.01	5.77	5.00
Maximum Speed (m/s)	19.54	24.97	29.81	22.72	18.65	19.15	15.46	13.67	20.86	20.86	20.27	23.58