Meteorological Conditions at VForEM Sites in 1996

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Cooperators: UVM Proctor Maple Research Center (PMRC), VT Department of Environmental Conservation (DEC), WCAX-TV staff at Mt. Mansfield transmitter station, US Geological Survey (USGS), National Oceanic and Atmospheric Administration (NOAA), Lake Champlain Research Consortium (LCRC), National Weather Service (NWS), the Electric Power Research Institute (EPRI).

Abstract

Continuous monitoring of basic meteorological data has been conducted at several VForEM sites. Continuous 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. This report is based on the PMRC air quality monitoring station data (PMRC AQ, 400 m) and on the data made available to VForEM in 1996 from stations at Colchester Reef (ColchReef) and Clear Air Status and Trends Network (CASTNET) in the Lye Brook Wilderness (LYE145).

METHODS:
Air temperature, relative humidity, mean resultant and horizontal wind speed and direction are monitored at four VForEm sites. Data from the Mount Mansfield 2900' site (MM2900) will be available as of 1997. Precipitation is recorded from PRMC AQ, CASTNET and MM2900. Barometric pressure is monitored at the Colchester Reef and PMRC AQ sites; pyranometer reading are collected from Colchester Reef and MM2900. Photosynthetically active radiation is available from the CASTNET site; and water temperature is monitored at Colchester Reef.

Minimum and maximum values are calculated and the number of sample dates are given. Data from 1996 is available from Colchester Reef as of July and from CASTNET for November and December. In addition, meteorological conditions are monitored within the forest at the canopy research tower and the Nettle Brook gauging station; these provide continuous mnitoring at within-forest sites. Although not reported here, these data are available from the VForEM data manager.VForEM has access to National Weather Service (NWS) data; there are 77 NWS stations currently active in Vermont.

The PMRC AQ station has remote (modem) access and has been in continuous operation since June 1988. Data are updated continuously and are stored electronically and as hard copy. Data are available from the VForEM as spreadsheets (Lotus, Excel), and in Voyager format. Station supervision is by Tim Scherbatskoy and operated by Miriam Pendleton and Carl Waite. Consolidation of the historic and current basic meteorology data from the VForEM Mansfield site has been completed, and consists of annual daily and hourly data for all variables. Monthly data summaries are produced routinely. These data are available in ASCII text files, and Excel spreadsheets from the VForEM Data Manager.

RESULTS AND DISCUSSION:

Monitoring occurs at 15 minute intervals at Colchester Reef and MM2900; and as of 1998 at PMRC AQ, too. Data is averaged to generate hourly means. Monitoring at hourly intervals takes place at LYE145 and PMRC AQ; all hourly data is summarized to create daily means. Yearly and monthly means are calculated from the daily data. The principle goal of these projects is to provide a high-quality, long-term comparative database on meteorological conditions for use by VForEM cooperators and others.

Visual analysis of trends and relationships in these projects is presented graphically. Complete meteorological monitoring data from these four VForem sites began at the end of 1996; only the PMRC air quality station has a complete year of data.

Yearly and monthly summaries.for each site are presented in tables 1 and 2. Four basic meteorological variables summarized by month are displayed for site to site comparison (Figure 1); note that the Y-axis scale varies. Statistical analysis of these comparisons will be made in 1997, when full data sets are available. Comparison of multiple meteorological variables on individual sites can be seen in Figure 2. Daily total precipitation is summarized in Figure 3; note that the Y-axis scale has been standardized to facilitate comparisons across time. Daily mean, minimum and maximum temperature from PMRC AQ is shown in Figure 4. The X-axis crosses the Y-axis at 0 degrees Celsius to better visualize fluctuations, and note the standardized Y-axis scale.

Cumulative growing degree days based on start temperatures of 32 and 50 degrees Farhenheit are plotted together on Figure 6. Growing degree day temperature thresholds of 32 and 50 degrees Farhenheit represent those of plants and insects, respectively.

Table 1: VForem Yearly Data Comparisons For 1996

Site	Air Temp	Barom Press	Rel Humd	Precip	Pyranom	H2O Temp	Wind Speed: Max	Wind Speed: Mean Resultant	Wind Speed: Mean Horizontal	Wind Direction: Mean Resultant	Wind Direction: Std Dev
			%	mm		deg C		m/second		degrees	
Castnet											
Mean	-3.13		87.02	0.20	26			2.69	3.00	204	4.00
Max	10.6		99	10.4	534		0	5.41	6	326	18
Min	-23.7		34	0	1		0	1.02	1	76	2
N	41		41	41.00	41		0	41	41	41	41
Sum											
ColchReef											
Mean	10.49	1014.04	76.87		111	13.00		6.38		187	8.00
Max	28.96	1044	102.2		982	29	20	18.86		360	78
Min	-17.58	989	32.65		0	1	0	0.06		0	1
N	156	156	156		156	156	156	156		156	156
Sum											
PMRC AQ											
Mean	5.96	931.03	56.72	3.53				1.83	0.00	0	0.00
Max	27.9	984	99.2	9.7			0	8.30	0	0	0
Min	-26.4	0	0	0			0	0.00	0	0	0
N	357	357	357	357.00			0	357	0	0	0
Sum											

Table 2: VForem Meteorological Monthly Data Comparisons Fo 1996

Site	Month	Air Temp	H2O Temp	Barom Press	Rel Humd	Precip	Pyranom	Wind Speed:	Mean Resultant	Wind Direction: StDev
					%	mm	watts/m2	m/second		
ColchReef										
Jul										
Mean		20.51	20		79.67		104		6.59	175.00
Max		25.03	22		95.6		622	13.23	12.33	244.10
Min		16.98	19		60.18		0	1	0.81	48.88
N		3	3	3	3	0	3	3		
Sum										
Aug										
Mean		20.69	21	1014.80	79.05		226		4.81	183.00
Max		28.96	25	1025	100.8		982	14.45	13.08	360.00
Min		13.77	16	1004	32.65		0	0	0.11	0.01
N		31	31	31	31	0	31	31	31	
Sum										
Sep										
Mean		17.46	18	1010.71	78.79		152		5.82	182.00
Max		26.51	29	1026	98.3		896	18.51	17.35	359.80
Min		7.8	8	1001	38.65		0	0	0.17	0.02
N		30	30	30	30	0	30	30	30	
Sum										
Oct										
Mean		9.88	10	1013.58	72.97		99		7.36	193.00
Max		19.16	19	1037	98.7		672	18.78	17.44	359.80
Min		0.69	2	991	33.87		0	0	0.06	0.01
N		31	31	31	31	0	31	31	31	
Sum										
Nov										
Mean		2.12	8	1017.27	73.26		48		6.45	199.00
Max		17.94	13	1044	102.2		552	20.25	18.86	359.90
Min		-9.25	1	989	37.72		0	1	0.06	0.20
N		30	30	30	30	0	30	30	30	
Sum										

Site Month	Air Temp	H2O Temp	Barom Press	Rel Humd	Precip	Pyranom	Wind Speed: Max	Wind Speed: Mean Resultant	Wind Direction: Mean Resultant	Wind Direction: StDev
				%	mm	watts/m2	m/second			
ColchReef										
Dec										
Mean	1.30	7	1014.25	79.96		28		7.45	181.00	
Max	12.17	7	1032	100.4		458	19.39	18.11	359.80	
Min	-17.58	3	993	40.66		0	1	0.16	0.36	
N	31	31	31	31	0	31	31	31		
Sum										
LYE145										
Nov										
Mean	-5.44	0		85.84	0.17	36		1.98	241.00	10.49
Max	5.4	0		99	8.1	534		3.21	325.63	15.66
Min	-13.8	0		44	0	1	0	1.24	171.33	4.27
N	30	0		30	30	30		10	10	10
Sum					39.7					
Dec										
Mean	-2.38	0		87.40	0.21	23		2.92	192.00	7.50
Max	10.6	0		99	10.4	418		5.41	283.46	18.29
Min	-23.7	0		34	0	1	0	1.02	75.58	2.43
N	31	0		31	31	31		31	31	31
Sum					157.9					
PMRC AQ										
January										
Mean	-9.44		945.25	63.30	2.76	0		2.18	0.00	28.91
Max	13.5		977	99.1		0		8.30	360.00	88.80
Min	-26.4		0	0		0	0	0.00	0.00	0.00
N	31			0	0	0	31	31	31	31
Sum					85.7					
February										
Mean	-6.88		953.30	49.89	2.04	0		2.29	0.00	27.64
Max	9.8		972	88		0		7.20	360.00	85.80
Min	-23.1		930	20.1		0	0	0.00	0.00	6.60
N	28			0	0	0	28	28	28	28
Sum					57					

Site Month	Air Temp	H2O Temp	Barom Press	Rel Humd	Precip	Pyranom	Wind Speed: Max	Wind Speed: Mean Resultant	Wind Direction: Mean Resultant	Wind Direction: StDev
				%	mm	watts/m2	m/second			
PMRC AQ										
March										
Mean	-2.52		954.71	38.65	0.93	0		2.11	0.00	28.64
Max	14.2		982	84.4		0		6.10	360.00	84.50
Min	-16.8		934	10		0	0	0.20	0.00	8.60
N	29			0	0	0	29	29	29	29
Sum					27					
April										
Mean	4.19		947.04	47.55	7.11	0		2.38	0.00	30.59
Max	19.6		970	92.4		0		7.60	360.00	78.90
Min	-8.3		927	11.7		0	0	0.00	0.00	9.70
N	30			0	0	0	30	30	30	30
Sum					213.2					
May										
Mean	10.96		955.03	50.52	4.93	0		1.92	0.00	30.36
Max	25.8		973	88.8		0		5.20	360.00	93.30
Min	0.1		921	16.9		0	0	0.10	0.00	3.80
N	31			0	0	0	31	31	31	31
Sum					152.9					
June										
Mean	17.12		956.45	64.59	3.93	0		1.36	0.00	38.36
Max	27.2		971	87.2		0		5.20	359.00	79.80
Min	8.1		939	21.6		0	0	0.10	2.00	5.70
N	29			0	0	0	29	29	29	29
Sum					113.9					
July										
Mean	18.18		951.55	64.32	5.65	0		1.52	0.00	38.98
Max	25.7		966	83.9		0		5.80	360.00	89.00
Min	10.4		936	33.4		0	0	0.10	1.00	4.80
N	31			0	0	0	31	31	31	31
Sum					175.3					

Month	Air Temp	H2O Temp	Barom Press	Rel Humd	Precip	Pyranom	Wind Speed:	Mean Resultant	Wind Direction:	StDev
				%	mm	watts/m2		m/second		
PMRC AQ										
August										
Mean	18.54		960.52	65.82	1.54	0		1.27	0.00	34.32
Max	27.9		972	87.5		0		3.50	360.00	88.90
Min	8.1		943	37.9		0	0	0.10	0.00	3.70
N	31			0	0	0	31	31	31	31
Sum					47.6					
September										
Mean	14.59		946.47	70.39	2.11	0		1.33	0.00	40.46
Max	25.1		970	93.5		0		5.10	360.00	85.90
Min	3.3		778	36.2		0	0	0.10	1.00	3.80
N	29			0	0	0	29	29	29	29
Sum					61.1					
October										
Mean	7.80		917.19	50.20	4.89	0		1.89	0.00	34.47
Max	20.1		975	99.2		0		6.20	360.00	84.40
Min	-3.9		769	0		0	0	0.20	1.00	4.60
N	29			0	0	0	29	29	29	29
Sum					141.9					
November										
Mean	-0.73		879.47	49.99	2.72	0		1.67	0.00	29.63
Max	19.2		984	88.7		0		7.50	360.00	85.30
Min	-15.2		771	9.4		0	0	0.10	0.00	5.40
N	30			0	0	0	30	30	30	30
Sum					81.7					
December										
Mean	-1.41		801.31	64.52	3.59	0		2.04	0.00	28.69
Max	10.8		966	89.8		0		6.50	360.00	80.00
Min	-24.3		781	18.2		0	0	0.00	0.00	0.00
N	29			0	0	0	29	29	29	29
					104.					

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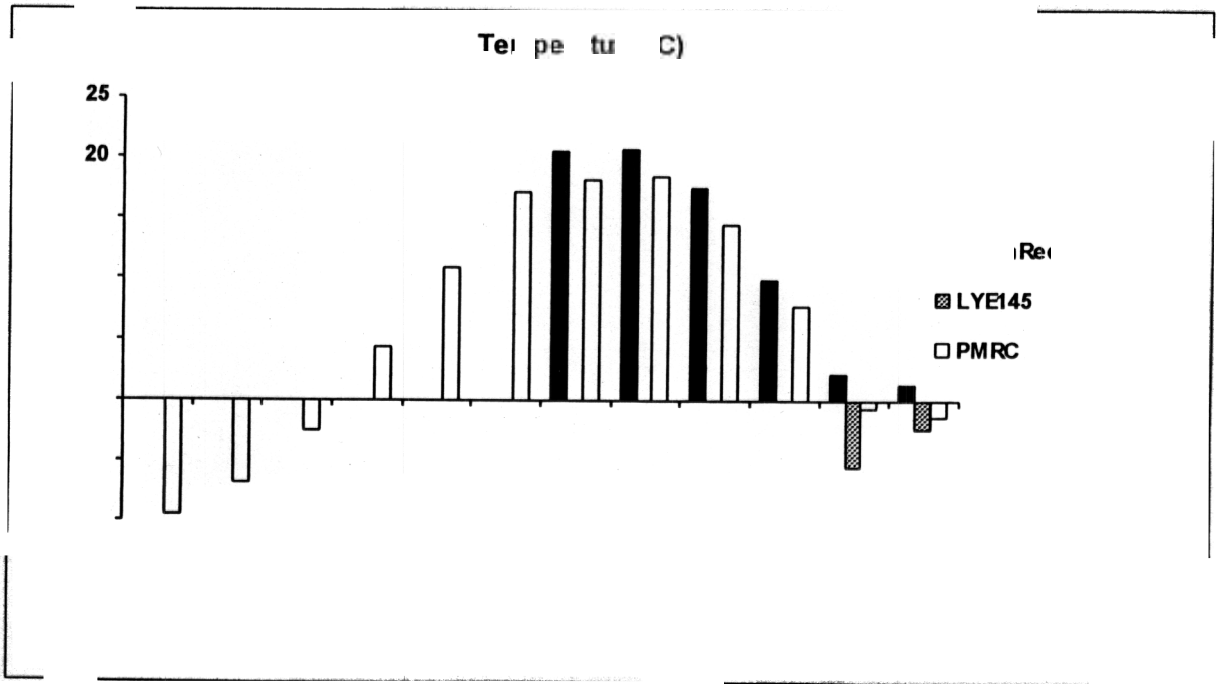

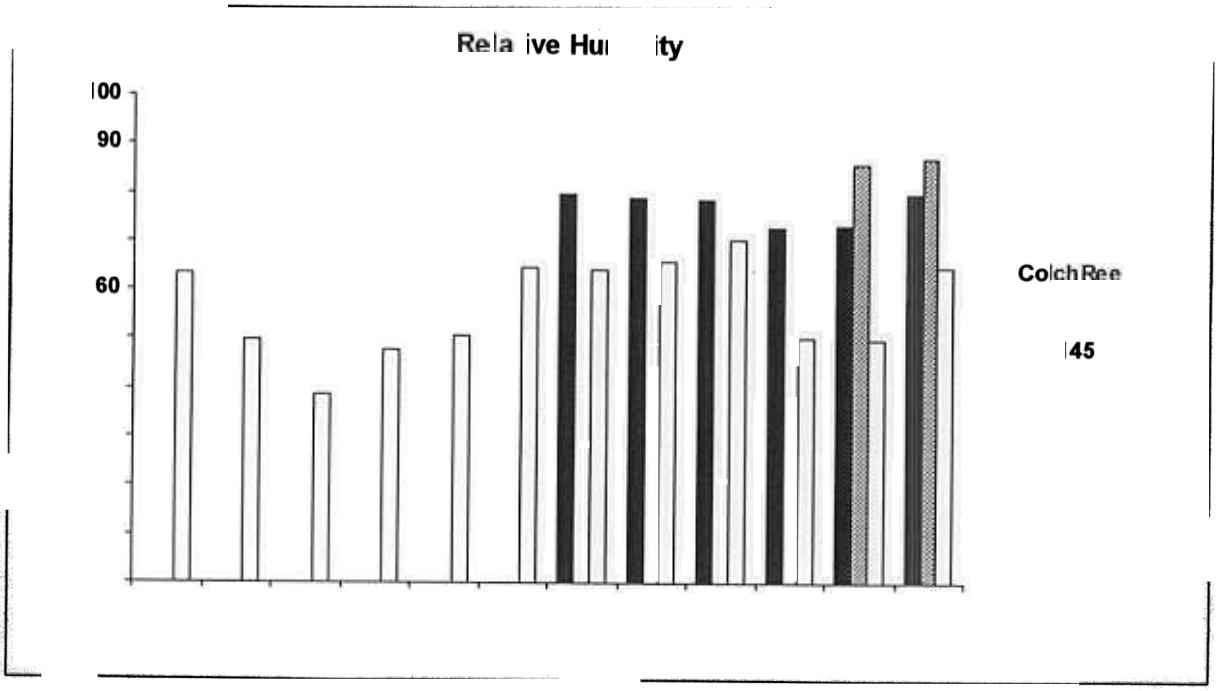

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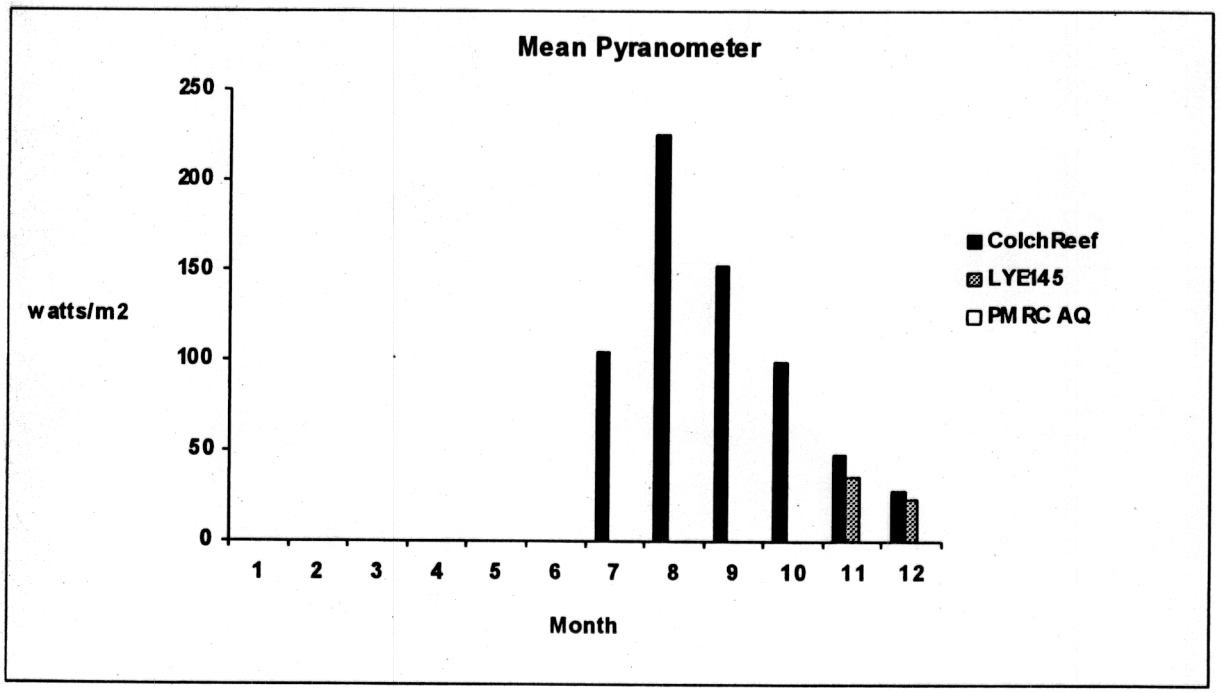


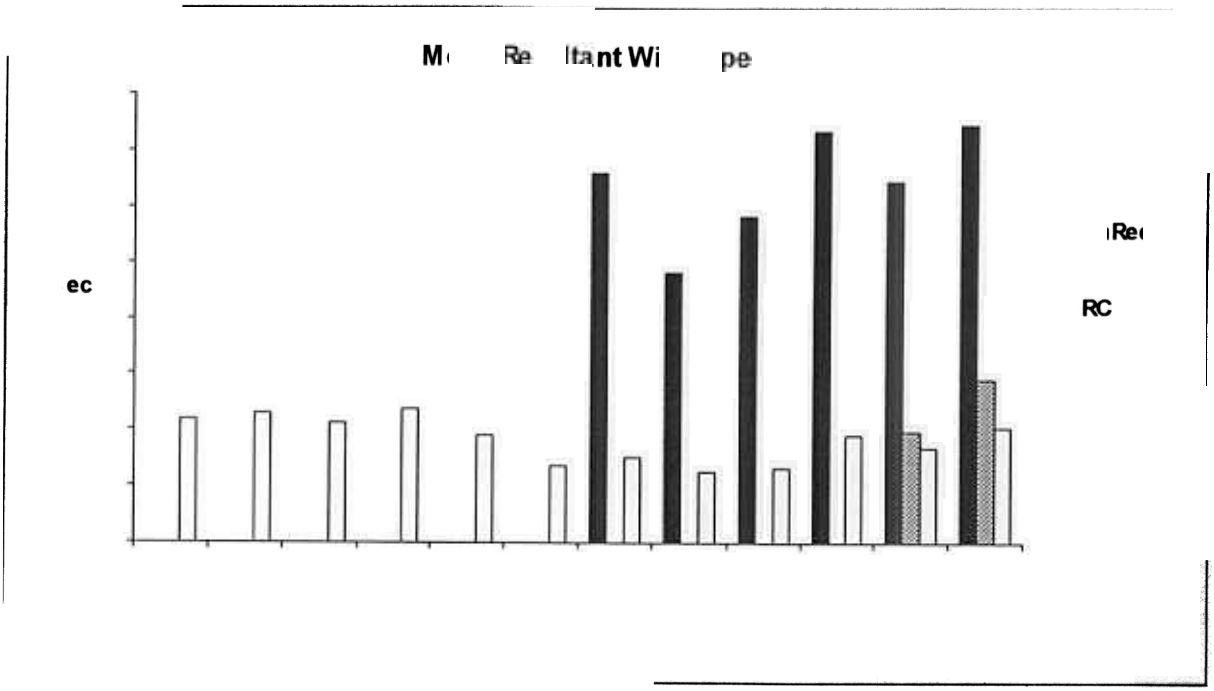
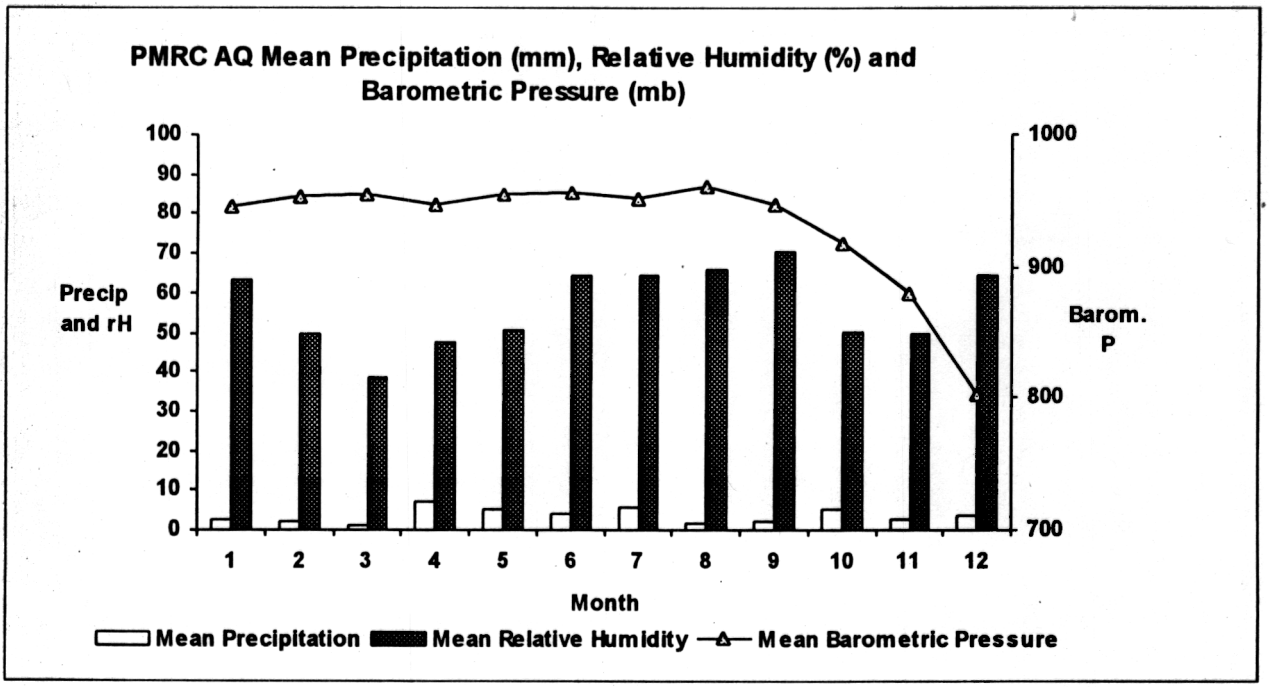


Figure Meteorological V ibles Summarized By M th On Individ al Sites



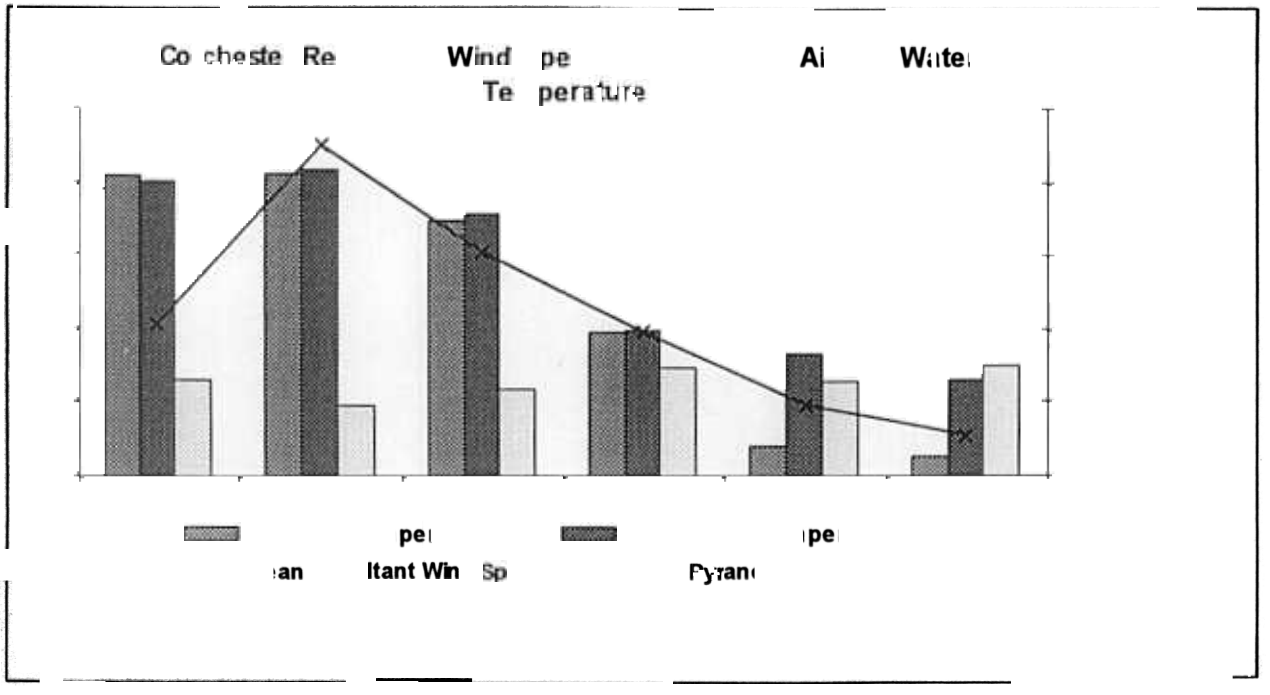


Figure 3: PMRC AQ Total Daily Precipitation

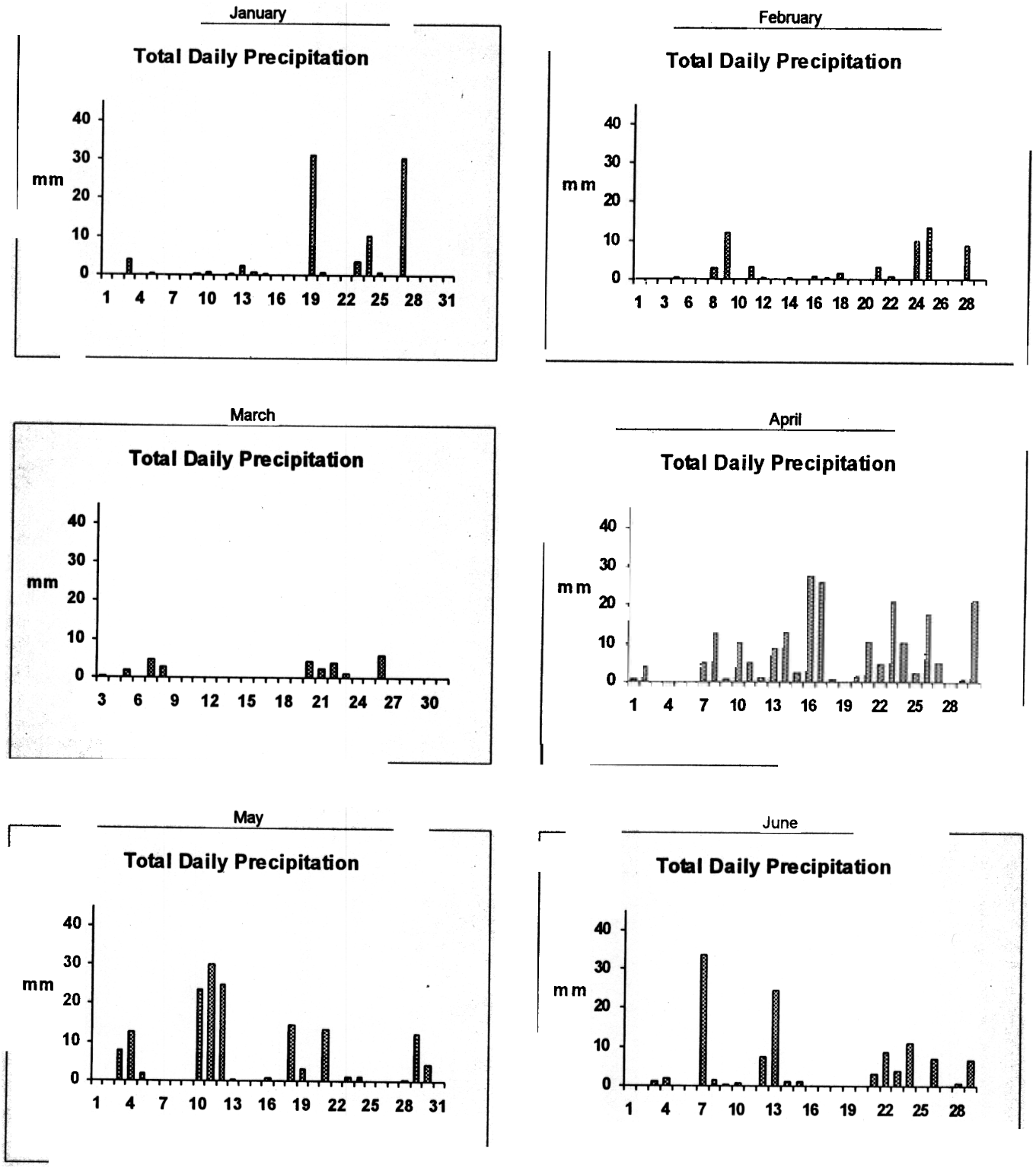


Figure 3: PMRC AQ Total Daily Precipitation

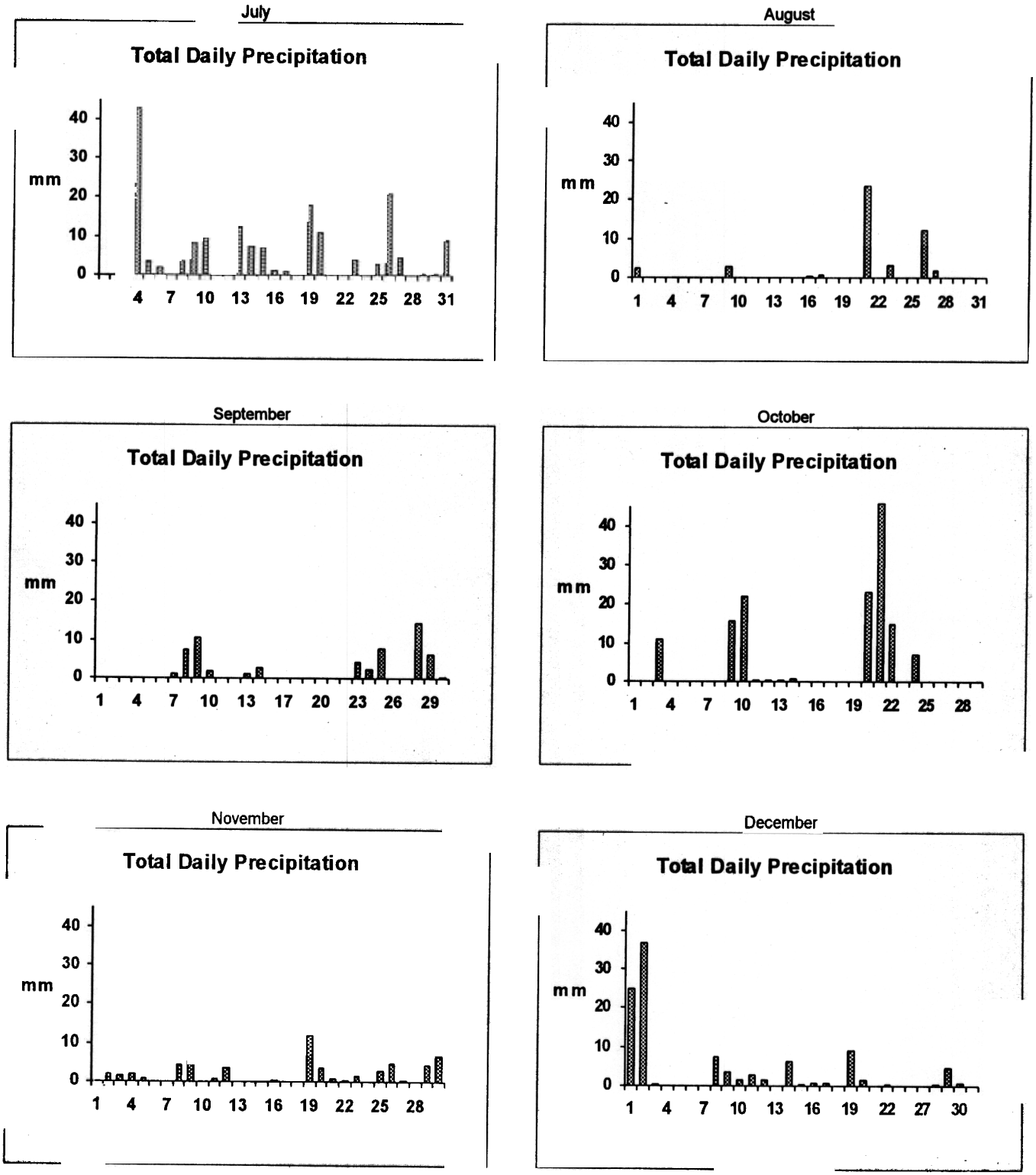


Figure 4: PMRC AQ Daily Temperature

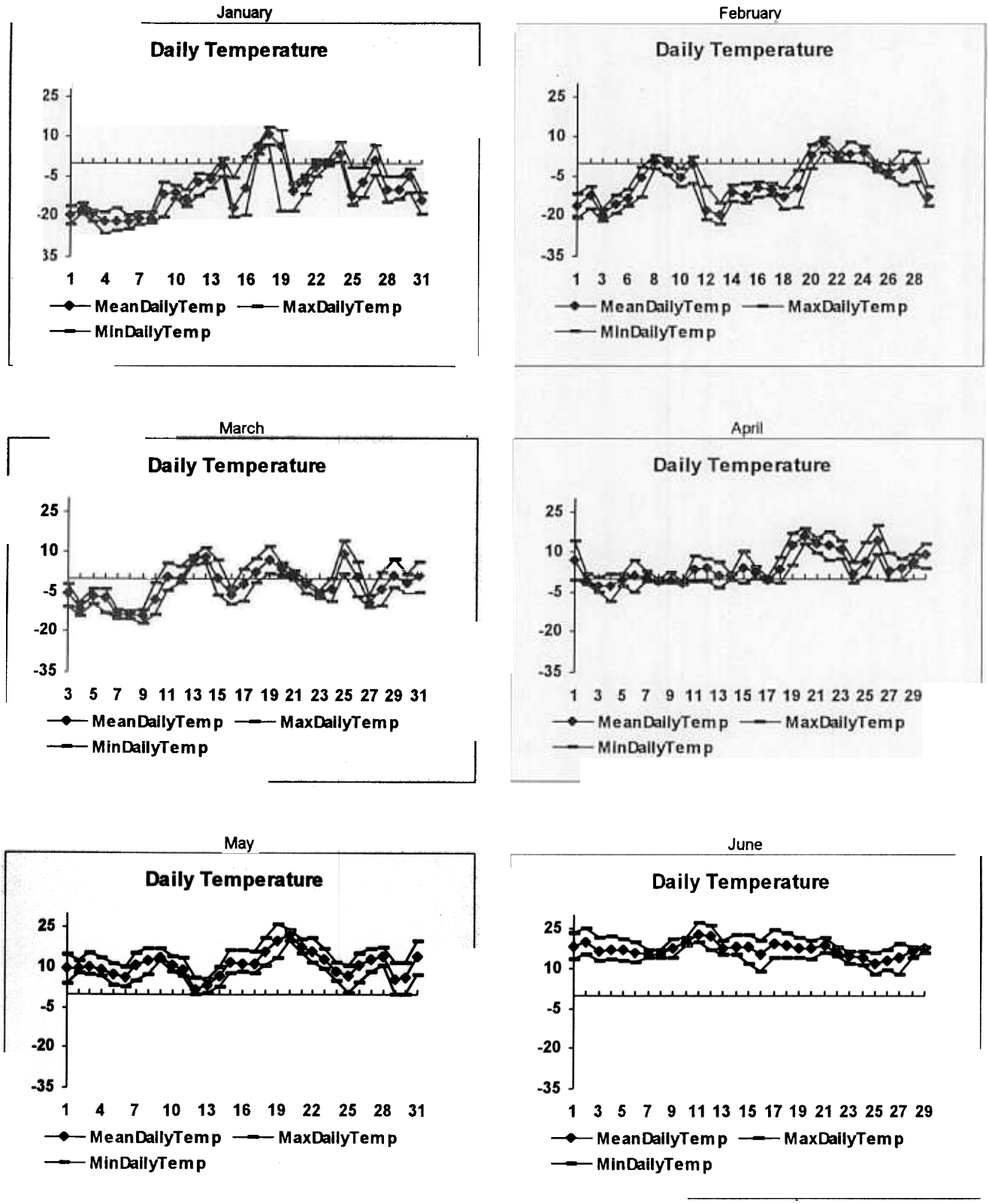
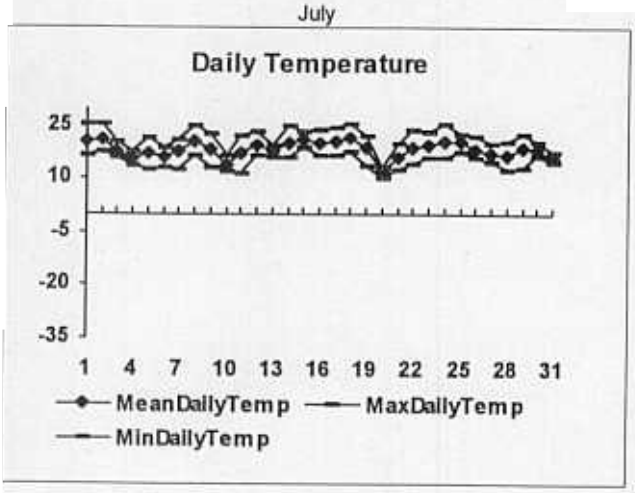
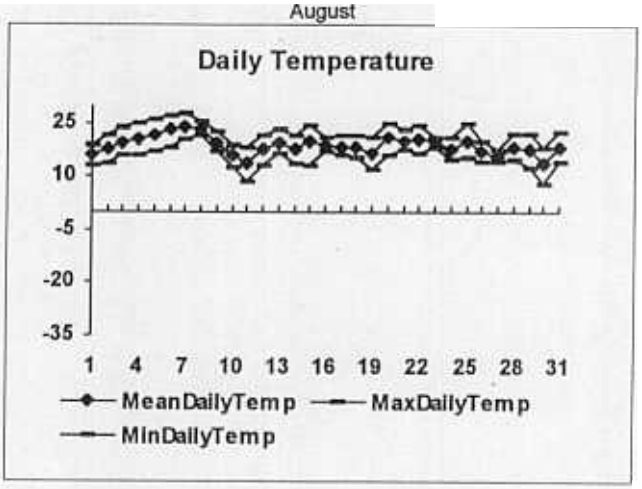


Figure 4: PMRC AQ Daily Temperature

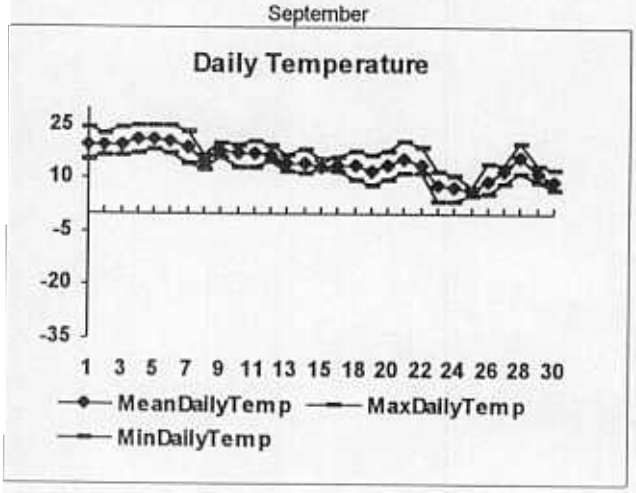
July



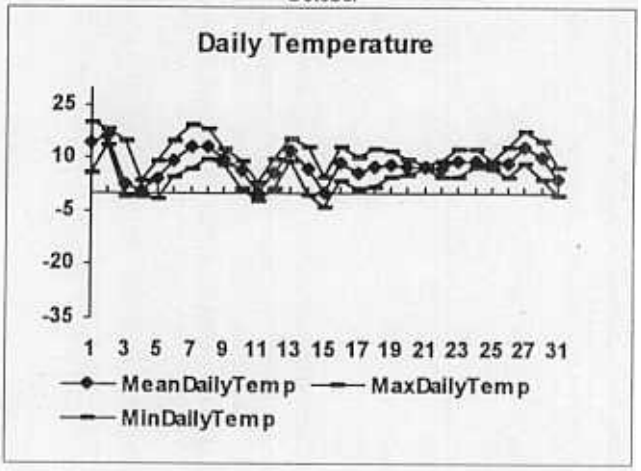
August



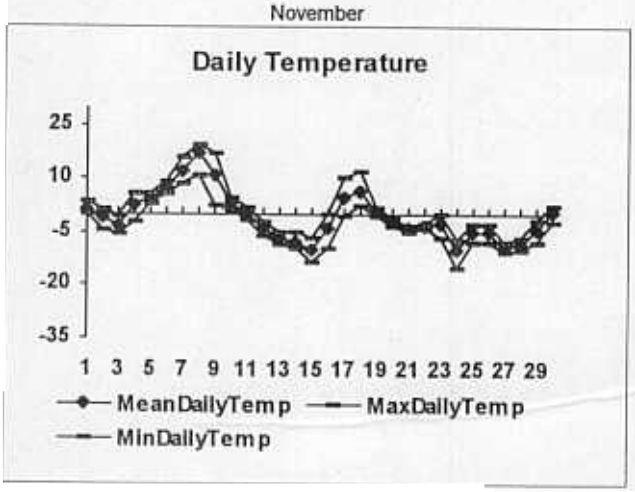
September



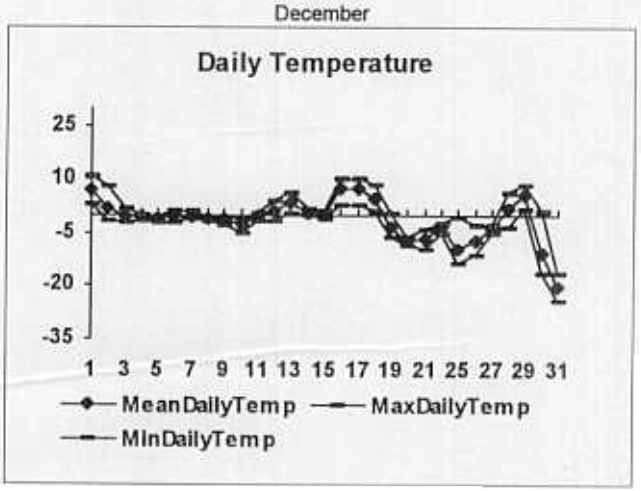
October



November



December



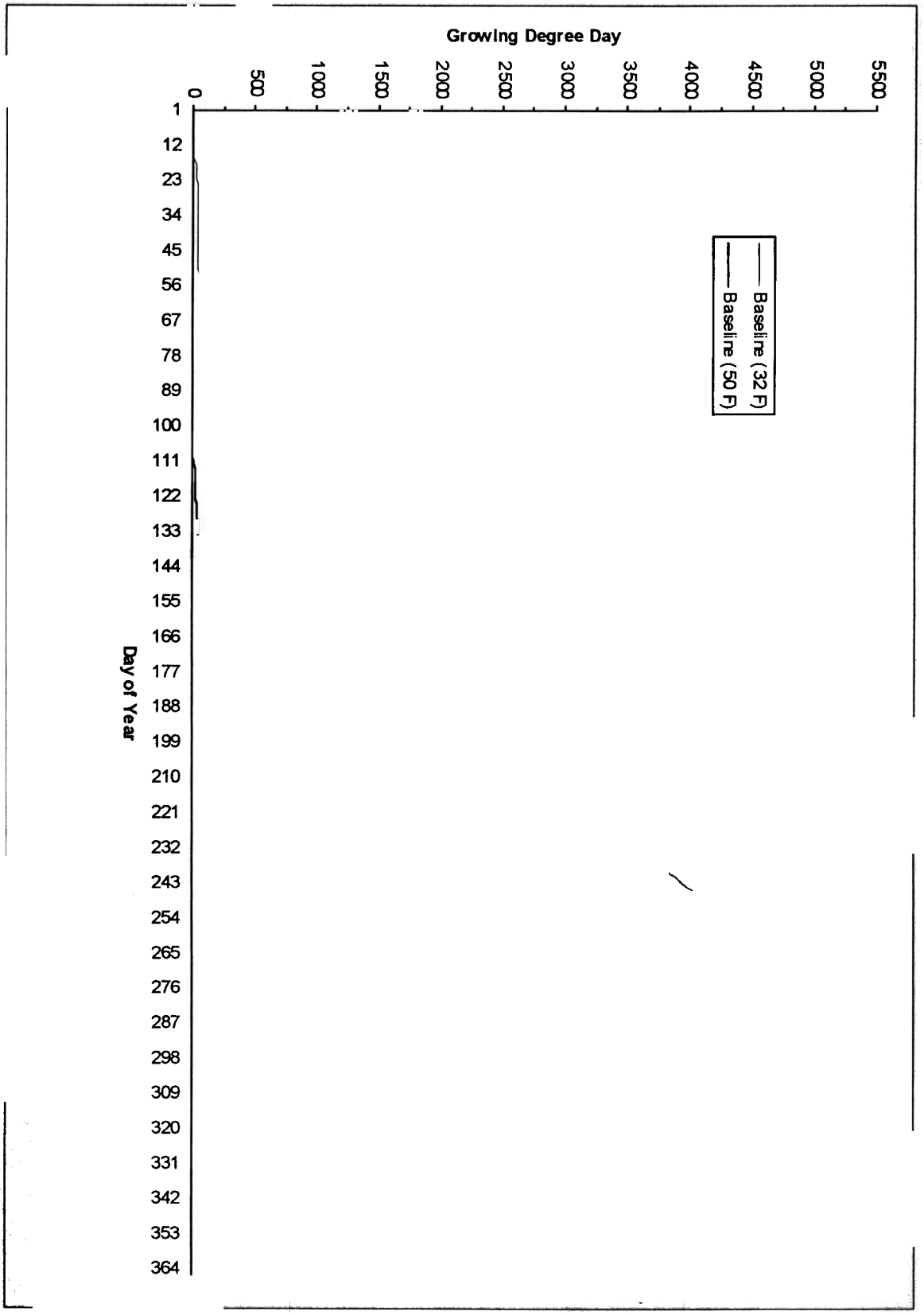


Figure 6: PMRC AQ Cumulative Growing Degree Days