

MADRAS, INDIA

Latitude = 13.00 N

Longitude = 80.18 E

Period of Record = 1973 to 1995

WMO No. 432790

Elevation = 52 feet

Average Pressure = 29.70 inches Hg

Design Criteria Data

	Design Value	Mean Coincident (Average) Values			
		Wet Bulb Temperature (°F)	Humidity Ratio (gr/lb)	Wind Speed (mph)	Prevailing Direction (NSEW)
Dry Bulb Temperature (T)	(°F)				
Median of Extreme Highs	106	76	89	8.1	W
0.4% Occurrence	102	77	103	8.6	W
1.0% Occurrence	100	78	109	8.6	W
2.0% Occurrence	98	78	113	8.5	W
Mean Daily Range	13	-	-	-	-
97.5% Occurrence	70	68	99	1.9	NW
99.0% Occurrence	68	66	93	2.0	WNW
99.6% Occurrence	67	66	92	2.0	W
Median of Extreme Lows	65	64	87	1.8	W
	Design Value	Mean Coincident (Average) Values			
		Dry Bulb Temperature (°F)	Humidity Ratio (gr/lb)	Wind Speed (mph)	Prevailing Direction (NSEW)
Wet Bulb Temperature (T_{wb})	(°F)				
Median of Extreme Highs	86	93	174	8.6	S
0.4% Occurrence	84	91	162	8.8	S
1.0% Occurrence	83	90	157	8.3	S
2.0% Occurrence	82	89	152	7.7	S
	Design Value	Mean Coincident (Average) Values			
		Dry Bulb Temperature (°F)	Vapor Pressure (in. Hg)	Wind Speed (mph)	Prevailing Direction (NSEW)
Humidity Ratio (HR)	(gr/lb)				
Median of Extreme Highs	182	89	1.19	7.9	S
0.4% Occurrence	167	88	1.09	7.9	S
1.0% Occurrence	161	87	1.06	7.5	S
2.0% Occurrence	158	86	1.04	6.6	S
Air Conditioning/ Humid Area Criteria	# of Hours	T ≥ 93°F	T ≥ 80°F	T _{wb} ≥ 73°F	T _{wb} ≥ 67°F
		789	5850	6574	8346

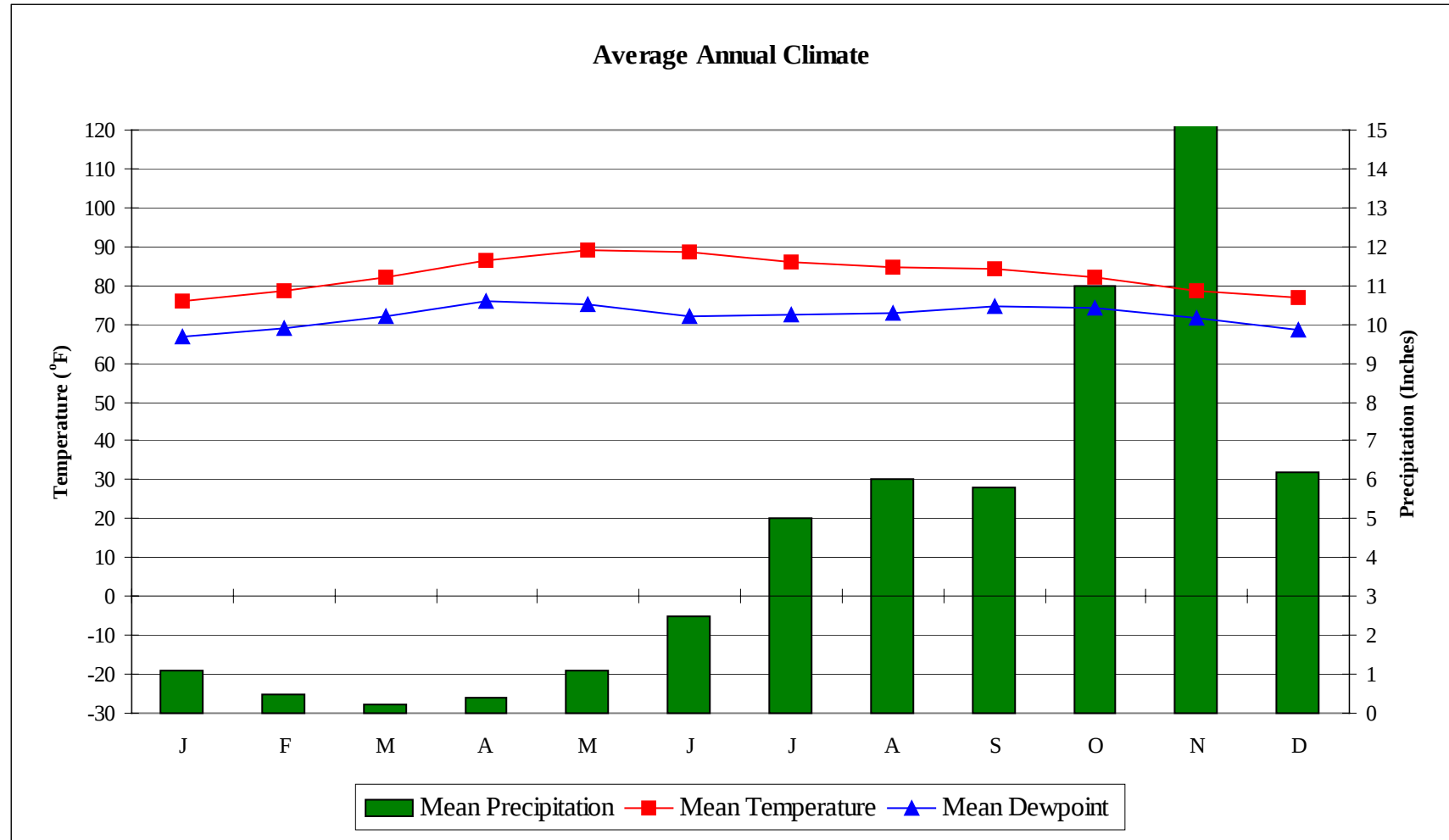
Other Site Data

Weather Region	Rain Rate 100 Year Recurrence (in./hr)	Basic Wind Speed 3 sec gust @ 33 ft 50 Year Recurrence (mph)	Ventilation Cooling Load Index (Ton-hr/cfm/yr) Base 75°F-RH 60% Latent + Sensible
10	N/A	N/A	5.8 + 6.6
Ground Water Temperature (°F) 50 Foot Depth *	Frost Depth 50 Year Recurrence (in.)	Ground Snow Load 50 Year Recurrence (lb/ft ²)	Average Annual Freeze-Thaw Cycles (#)
85.3	N/A	N/A	0

*Note: Temperatures at greater depths can be estimated by adding 1.5°F per 100 feet additional depth.

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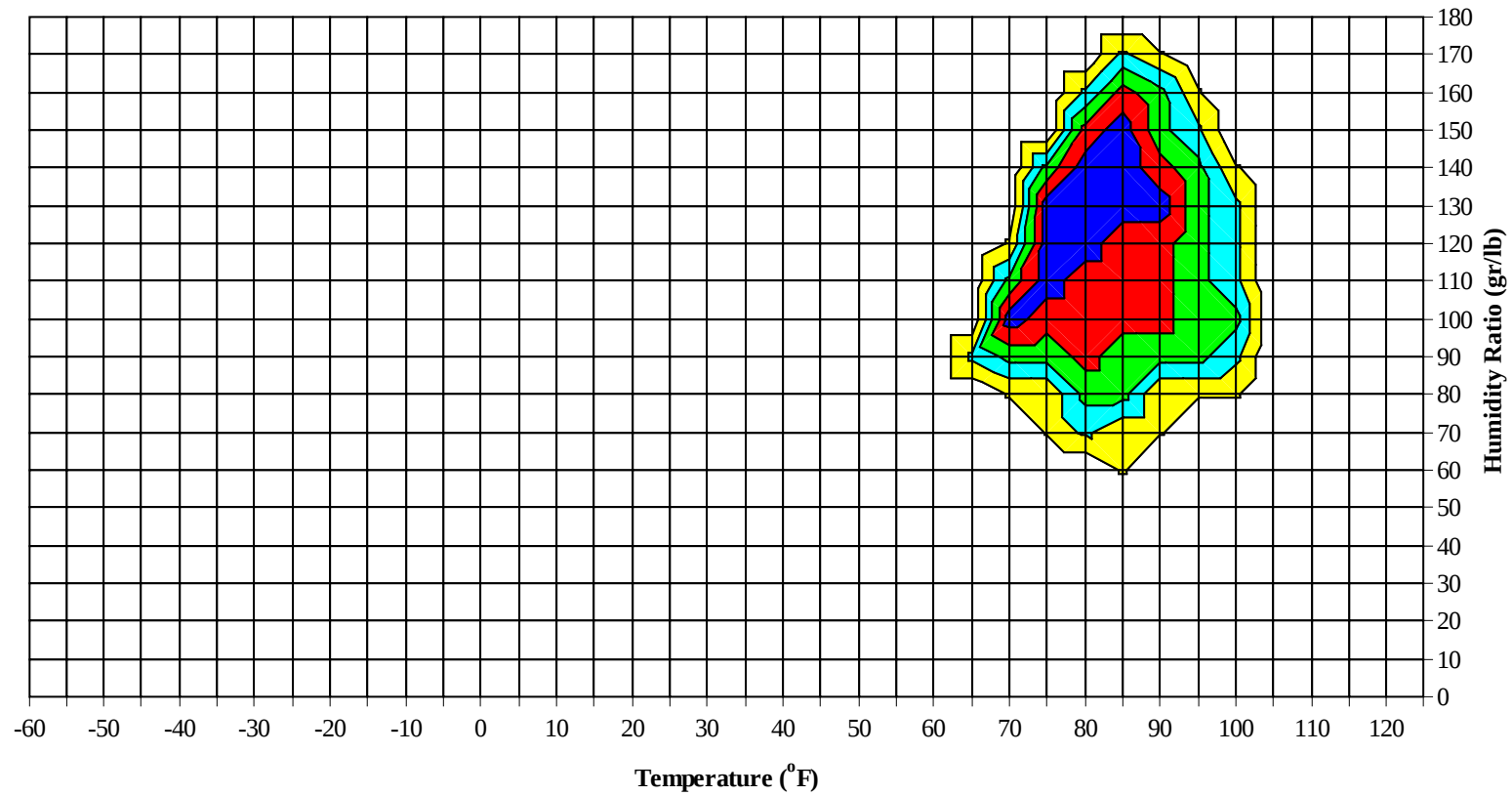
WMO No. 432790



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Long Term Psychrometric Summary

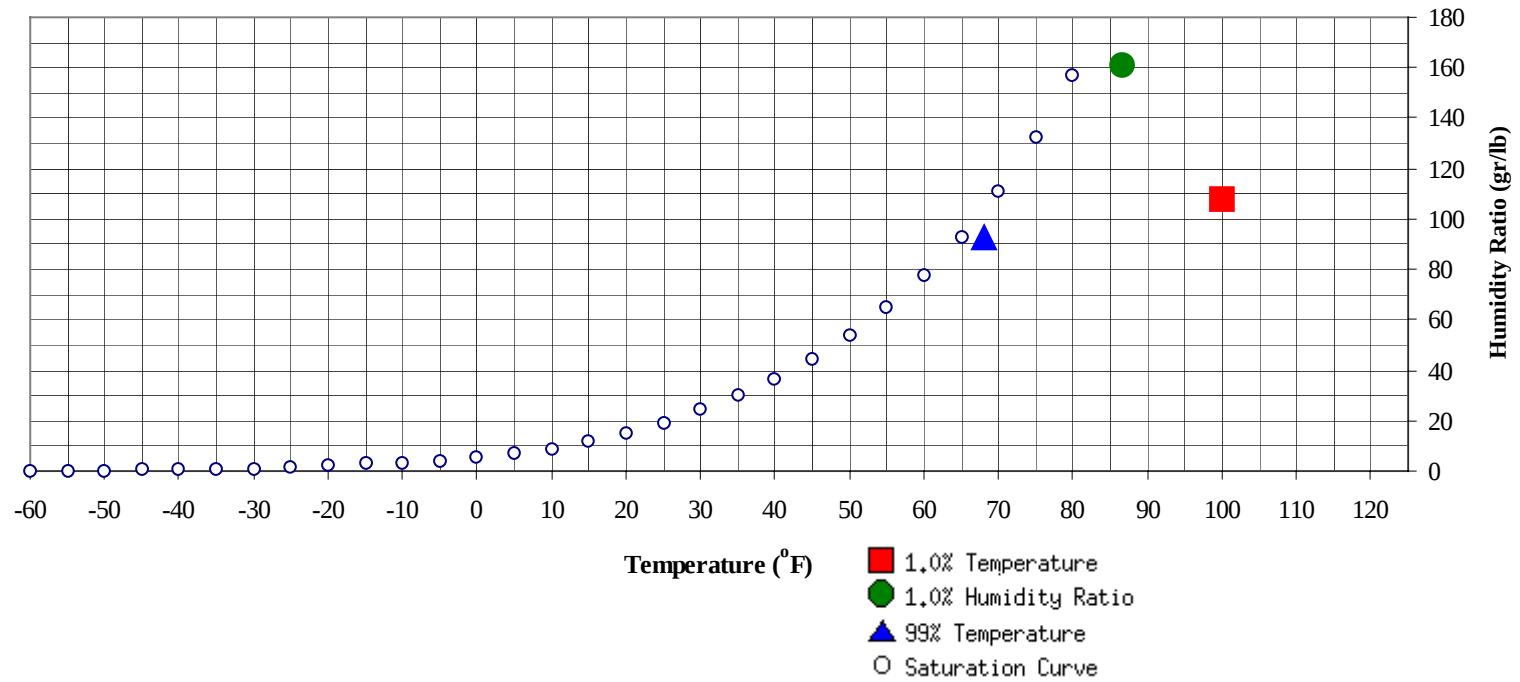


- 50% of all observations
- 80% of all observations
- 95% of all observations
- 97.5% of all observations
- 99% of all observations

MADRAS, INDIA

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Psychrometric Summary of Peak Design Values



	(°F)	MCHR (gr/lb)	Enthalpy (btu/lb)	1.0% Humidity Ratio	(gr/lb)	MCDB (°F)	MCWB (°F)	MC Dewpt (°F)	Enthalpy (btu/lb)
99% Dry Bulb	68	92.6	30.8		161	86.5	82.2	80.6	46.0

1.0% Dry Bulb	(°F)	MCHR (gr/lb)	MCWB (°F)	Enthalpy (btu/lb)
	100	107.9	77.6	41.0

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Dry-Bulb Temperature Hours For An Average Year (Sheet 1 of 5)

Period of Record = 1973 to 1995

Temperature Range (°F)	January					February					March				
	Hour Group (LST)			Total Obs	M C W B (°F)	Hour Group (LST)			Total Obs	M C W B (°F)	Hour Group (LST)			Total Obs	M C W B (°F)
	01 To 08	09 To 16	17 To 00			01 To 08	09 To 16	17 To 00			01 To 08	09 To 16	17 To 00		
105 / 109															
100 / 104							0		0	80.0		0	0	0	77.0
95 / 99							1	0	1	74.6		11	0	11	74.8
90 / 94	0	0	0	0	69.9	0	12	0	12	73.5	0	85	3	88	76.3
85 / 89	0	11	0	11	71.3	0	82	5	87	73.3	0	71	55	126	75.6
80 / 84	0	143	40	183	71.0	3	66	86	155	72.8	33	56	117	207	76.0
75 / 79	22	39	121	183	70.9	63	49	99	211	72.5	146	24	67	237	73.8
70 / 74	148	52	80	279	69.0	132	15	31	178	69.6	67	1	6	74	70.6
65 / 69	75	3	6	84	65.8	25	0	2	27	66.1	1	0	0	1	65.4
60 / 64	3		0	3	62.4	1	0		1	62.4			0	0	58.0

Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.

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Dry-Bulb Temperature Hours For An Average Year (Sheet 2 of 5)

Period of Record = 1973 to 1995

Temperature Range (°F)	April					May					June				
	Hour Group (LST)			Total Obs	M C W B (°F)	Hour Group (LST)			Total Obs	M C W B (°F)	Hour Group (LST)			Total Obs	M C W B (°F)
	01 To 08	09 To 16	17 To 00			01 To 08	09 To 16	17 To 00			01 To 08	09 To 16	17 To 00		
105 / 109		0		0	82.0		7	0	7	76.1		1		1	77.5
100 / 104		5	0	5	79.5	0	30	3	33	77.7	0	23	4	27	76.8
95 / 99	0	54	1	55	79.7	0	81	9	90	79.3	0	79	19	99	76.8
90 / 94	0	98	22	120	79.1	4	79	60	142	79.2	3	70	57	131	76.9
85 / 89	6	64	101	171	79.2	76	40	134	251	79.5	83	51	107	241	77.2
80 / 84	170	17	110	297	78.4	158	6	39	204	78.4	138	12	45	195	76.6
75 / 79	63	1	5	70	75.4	10	3	4	16	75.5	16	3	8	27	75.6
70 / 74	1	1	1	3	69.0	0	1	0	1	69.1		0	0	0	61.5
65 / 69			0	0		0			0	58.0					
60 / 64															

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Dry-Bulb Temperature Hours For An Average Year (Sheet 3 of 5)

Period of Record = 1973 to 1995

Temperature Range (°F)	July					August					September				
	Hour Group (LST)			Total Obs	M C W B (°F)	Hour Group (LST)			Total Obs	M C W B (°F)	Hour Group (LST)			Total Obs	M C W B (°F)
	01 To 08	09 To 16	17 To 00			01 To 08	09 To 16	17 To 00			01 To 08	09 To 16	17 To 00		
105 / 109															
100 / 104		3	1	4	76.7		0	0	0	78.8		0	0	0	81.0
95 / 99		43	9	52	76.7	0	28	7	35	76.4		19	1	20	76.7
90 / 94	0	86	38	124	76.8	0	84	28	111	76.9	0	87	16	102	77.6
85 / 89	33	67	91	191	76.8	10	66	75	150	77.0	1	68	68	138	77.9
80 / 84	149	40	87	276	76.4	144	59	108	311	76.5	129	52	129	310	77.5
75 / 79	63	9	21	93	75.1	92	11	28	130	75.3	107	13	24	145	75.4
70 / 74	3	0	2	4	71.7	3	1	2	5	70.8	3	0	2	5	72.2
65 / 69			0	0											
60 / 64															

Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.

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Dry-Bulb Temperature Hours For An Average Year (Sheet 4 of 5)

Period of Record = 1973 to 1995

Temperature Range (°F)	October					November					December				
	Hour Group (LST)			Total Obs	M C W B (°F)	Hour Group (LST)			Total Obs	M C W B (°F)	Hour Group (LST)			Total Obs	M C W B (°F)
	01 To 08	09 To 16	17 To 00			01 To 08	09 To 16	17 To 00			01 To 08	09 To 16	17 To 00		
105 / 109															
100 / 104		0	0	0	79.0							0		0	77.0
95 / 99	0	3	0	3	77.9	0	0	0	0	77.7		0		0	
90 / 94	0	52	2	54	77.3	0	3	0	3	75.7		0	0	0	76.3
85 / 89	0	82	38	119	77.1	0	56	2	58	74.9	0	7	0	7	73.6
80 / 84	47	81	140	268	77.1	6	104	83	193	74.8	1	142	35	178	72.0
75 / 79	193	29	67	288	75.3	144	70	132	346	74.0	56	71	149	276	71.9
70 / 74	8	2	2	12	71.4	83	8	23	114	70.2	151	27	62	240	69.7
65 / 69	0	0		0	65.0	7	0	0	7	65.5	38	1	3	42	66.1
60 / 64											1			1	60.5

Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.

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Period of Record = 1973 to 1995

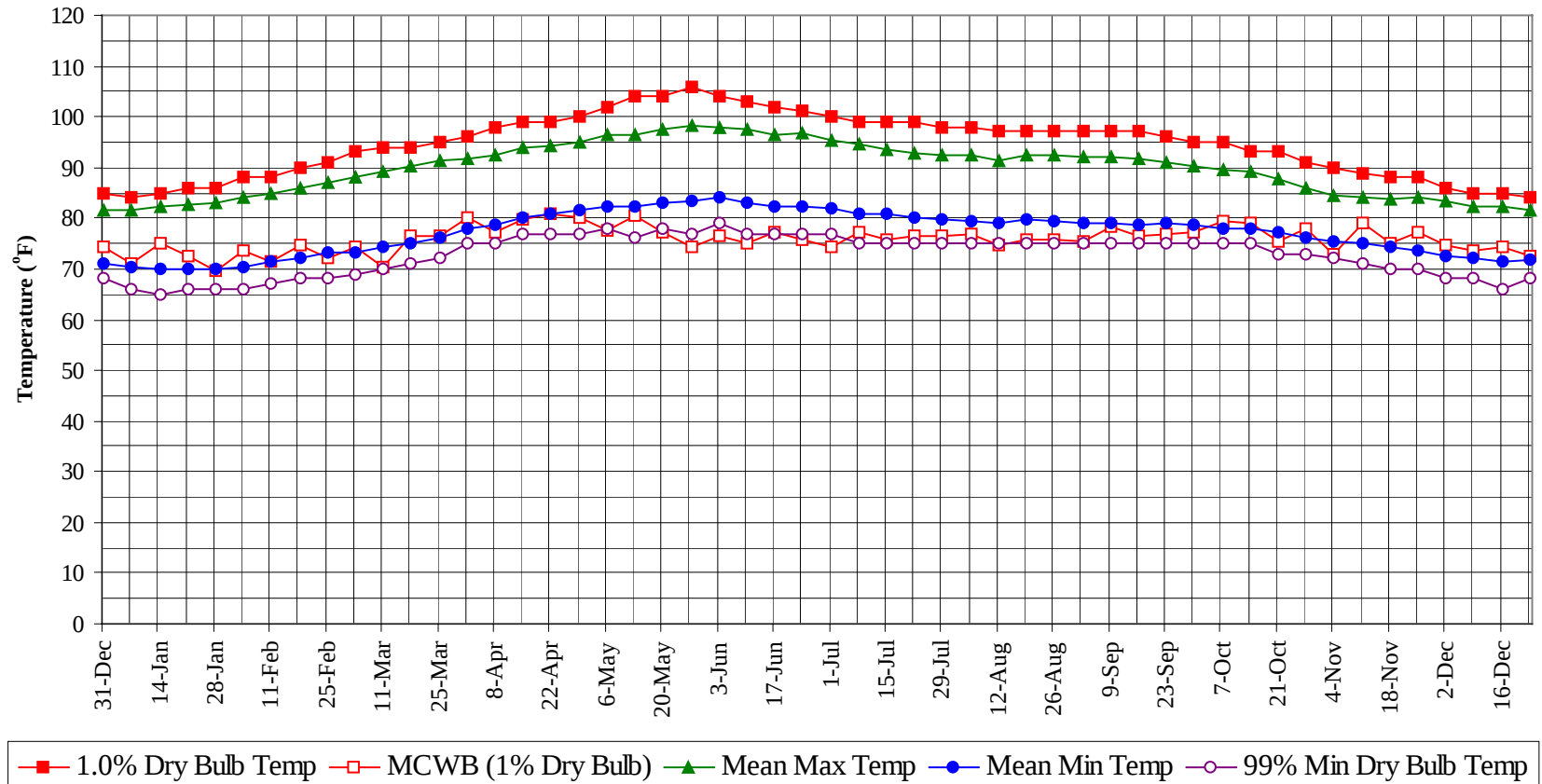
Annual Totals					
Temperature Range (°F)	Hour Group (LST)			Total Obs	M C W B (°F)
	01 To 08	09 To 16	17 To 00		
105 / 109		8	0	8	76.3
100 / 104	1	62	8	71	77.5
95 / 99	1	317	45	364	77.7
90 / 94	11	654	224	888	77.5
85 / 89	213	665	673	1551	77.2
80 / 84	980	779	1021	2781	75.8
75 / 79	969	322	727	2018	73.6
70 / 74	592	108	209	910	69.6
65 / 69	146	4	12	163	65.9
60 / 64	6	0	0	6	62.0

Caution: This summary reflects the typical distribution of temperature in a typical year. It does not reflect the typical moisture distribution. Because wet bulb temperatures are averaged, this summary understates the annual moisture load. For accurate moisture load data, see the long-term humidity summary and the ventilation and infiltration load pages in this manual.

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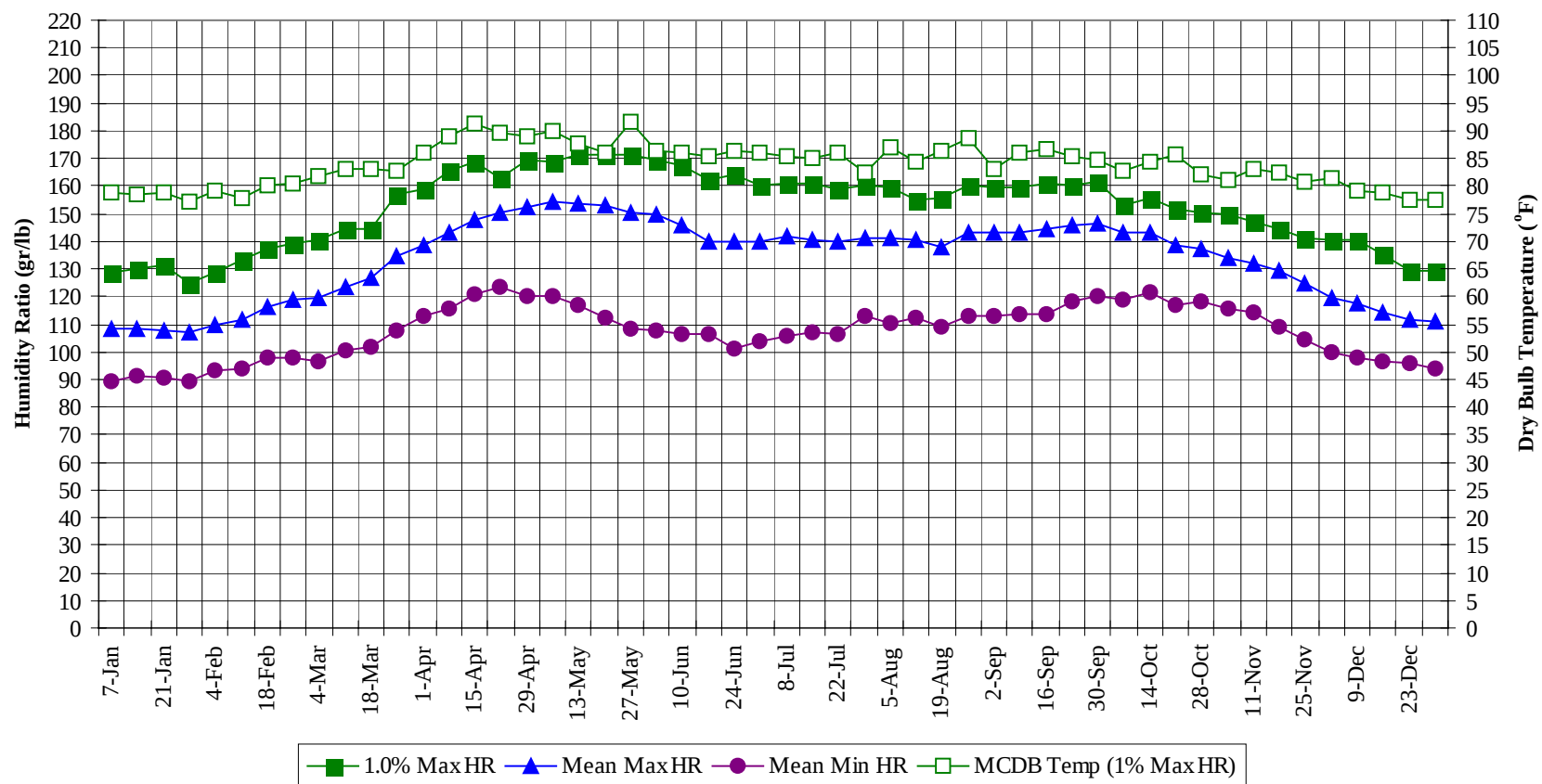
Annual Summary of Temperatures



MADRAS, INDIA

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Long Term Humidity and Dry Bulb Temperature Summary



MADRAS, INDIA

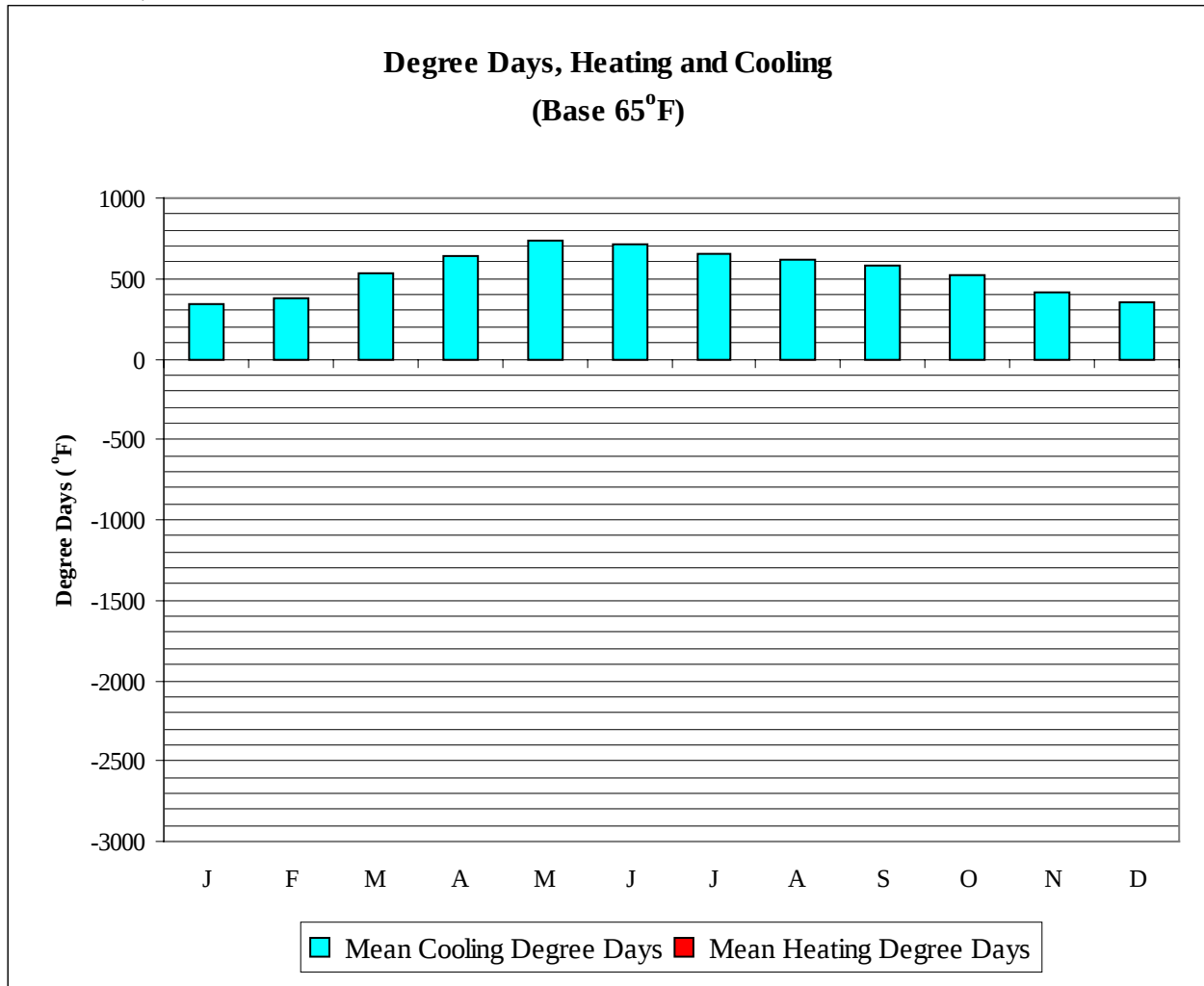
WMO No. 432790

Long Term Dry Bulb Temperature and Humidity Summary

Week Ending	1.0% Temp (°F)	MCWB @ 1% Temp (°F)	Mean Max Temp (°F)	Mean Min Temp (°F)	99% Temp (°F)	1.0% HR (gr/lb)	MCDB @ 1% HR (°F)	Mean Max HR (gr/lb)	Mean Min HR (gr/lb)
7-Jan	84.0	71.2	81.7	70.3	66.0	128.8	78.7	108.2	89.5
14-Jan	85.0	75.0	82.2	69.8	65.0	130.2	78.4	108.0	91.3
21-Jan	86.0	72.7	82.7	70.1	66.0	131.6	78.9	107.9	90.5
28-Jan	86.0	69.7	83.0	70.0	66.0	124.6	77.3	107.2	89.5
4-Feb	88.0	73.5	84.0	70.2	66.0	128.8	79.2	109.7	93.1
11-Feb	88.0	71.6	84.8	71.4	67.0	133.0	77.8	111.6	93.8
18-Feb	90.0	74.7	85.9	72.3	68.0	137.2	80.0	116.4	98.0
25-Feb	91.0	72.3	87.2	73.3	68.0	139.3	80.4	118.8	98.2
4-Mar	93.0	74.2	88.2	73.3	69.0	140.7	81.9	119.4	96.2
11-Mar	94.0	70.3	89.0	74.4	70.0	144.2	83.1	123.6	100.2
18-Mar	94.0	76.4	90.2	75.0	71.0	144.2	83.0	127.1	101.6
25-Mar	95.0	76.4	91.5	76.3	72.0	156.8	82.8	134.4	107.4
1-Apr	96.0	80.0	91.6	77.8	75.0	158.9	86.0	138.4	112.9
8-Apr	98.0	77.3	92.6	78.6	75.0	165.2	89.0	143.0	115.4
15-Apr	99.0	79.7	94.0	80.2	77.0	168.7	91.3	147.8	120.5
22-Apr	99.0	80.7	94.2	80.9	77.0	163.1	89.7	150.4	123.3
29-Apr	100.0	80.1	95.0	81.5	77.0	169.4	89.0	152.4	120.3
6-May	102.0	77.6	96.6	82.5	78.0	168.7	90.0	154.3	120.4
13-May	104.0	80.5	96.4	82.2	76.0	171.5	87.7	153.8	116.6
20-May	104.0	77.2	97.6	82.9	78.0	171.5	86.0	152.7	112.6
27-May	106.0	74.2	98.1	83.4	77.0	171.5	91.5	150.6	108.7
3-Jun	104.0	76.4	97.9	84.0	79.0	169.4	86.5	149.8	107.9
10-Jun	103.0	75.2	97.7	83.1	77.0	167.3	86.0	145.9	106.1
17-Jun	102.0	77.4	96.3	82.4	77.0	162.4	85.3	140.0	106.2
24-Jun	101.0	75.8	96.7	82.3	77.0	164.5	86.3	140.1	100.9
1-Jul	100.0	74.5	95.4	82.0	77.0	160.3	86.1	139.6	103.6
8-Jul	99.0	77.2	94.5	80.7	75.0	161.0	85.4	142.0	105.9
15-Jul	99.0	76.0	93.7	80.7	75.0	161.0	85.1	140.4	107.2
22-Jul	99.0	76.4	92.8	80.3	75.0	158.9	86.0	139.8	106.3
29-Jul	98.0	76.5	92.4	79.6	75.0	160.3	82.5	141.4	112.7
5-Aug	98.0	77.0	92.6	79.6	75.0	159.6	87.0	140.9	110.6
12-Aug	97.0	74.7	91.5	78.9	75.0	154.7	84.4	140.8	112.6
19-Aug	97.0	75.6	92.3	79.6	75.0	155.4	86.4	137.9	108.7
26-Aug	97.0	75.9	92.4	79.6	75.0	160.3	88.6	143.3	112.9
2-Sep	97.0	75.5	91.9	79.2	75.0	159.6	83.0	143.1	112.8
9-Sep	97.0	78.3	92.2	78.9	75.0	159.6	86.0	143.4	113.6
16-Sep	97.0	76.4	91.9	78.7	75.0	161.0	86.7	144.3	113.5
23-Sep	96.0	76.7	91.1	78.9	75.0	160.3	85.5	146.0	118.2
30-Sep	95.0	77.2	90.2	78.8	75.0	161.7	84.8	146.5	119.9
7-Oct	95.0	79.3	89.6	78.0	75.0	153.3	82.7	143.0	118.7
14-Oct	93.0	79.2	89.4	77.9	75.0	155.4	84.2	143.1	121.6
21-Oct	93.0	75.5	87.6	77.3	73.0	151.9	85.7	138.4	116.6
28-Oct	91.0	78.0	86.0	76.3	73.0	150.5	82.2	137.5	118.4
4-Nov	90.0	72.9	84.6	75.3	72.0	149.8	81.0	133.9	115.7
11-Nov	89.0	79.0	84.0	75.1	71.0	147.0	83.0	131.9	114.5
18-Nov	88.0	74.9	83.8	74.2	70.0	144.2	82.4	129.1	108.8
25-Nov	88.0	77.1	84.2	73.7	70.0	141.4	80.9	124.8	104.2
2-Dec	86.0	74.5	83.3	72.6	68.0	140.7	81.4	119.6	100.0
9-Dec	85.0	73.6	82.4	72.2	68.0	140.7	79.2	117.3	97.9
16-Dec	85.0	74.2	82.3	71.6	66.0	135.1	78.8	114.1	96.4
23-Dec	84.0	72.4	81.5	71.7	68.0	129.5	77.5	111.8	96.1
31-Dec	85.0	74.5	81.7	71.1	68.0	129.5	77.3	110.8	93.8

MADRAS, INDIA

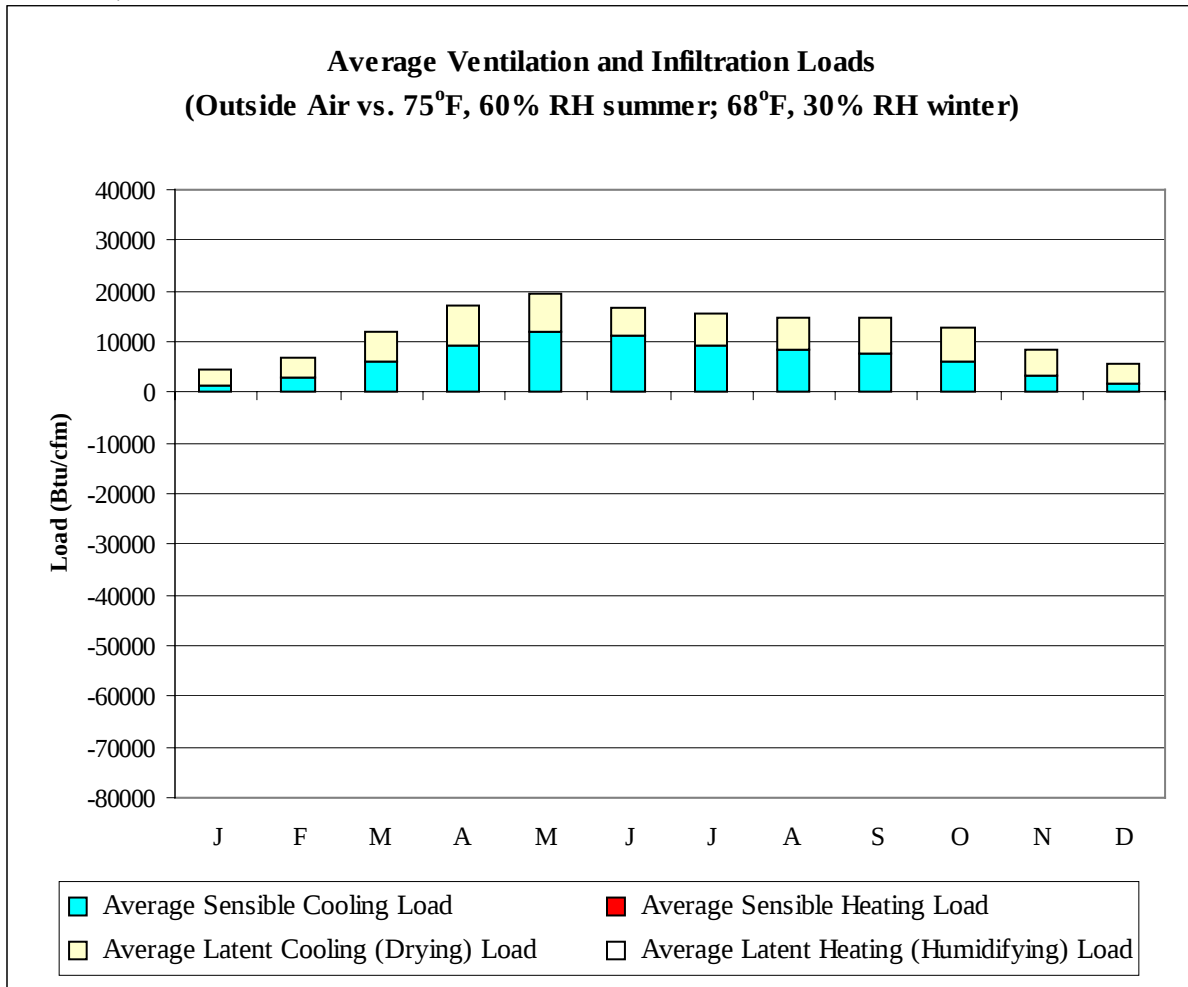
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	Mean Cooling Degree Days (°F)	Mean Heating Degree Days (°F)
JAN	337	0
FEB	383	0
MAR	535	0
APR	639	0
MAY	742	0
JUN	707	0
JUL	649	0
AUG	612	0
SEP	579	0
OCT	526	0
NOV	410	0
DEC	358	0
ANN	6479	0

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	Average Sensible Cooling Load	Average Sensible Heating Load	Average Latent Cooling Load	Average Latent Heating Load
	(Btu/cfm)	(Btu/cfm)	(Btu/cfm)	(Btu/cfm)
JAN	1468	-13	3002	0
FEB	3090	-5	3721	0
MAR	6226	0	5829	0
APR	9228	0	7889	0
MAY	11859	0	7666	0
JUN	11148	0	5705	0
JUL	9291	0	6191	0
AUG	8379	0	6454	0
SEP	7671	0	6973	0
OCT	5926	0	6942	0
NOV	3154	0	5423	0
DEC	1770	-4	3799	0
ANN	79210	-22	69594	0

Average Annual Solar Radiation – Nearest Available Site
(Source: National Renewable Energy Laboratory, Golden CO, 1995)

No Solar Radiation
Data Available

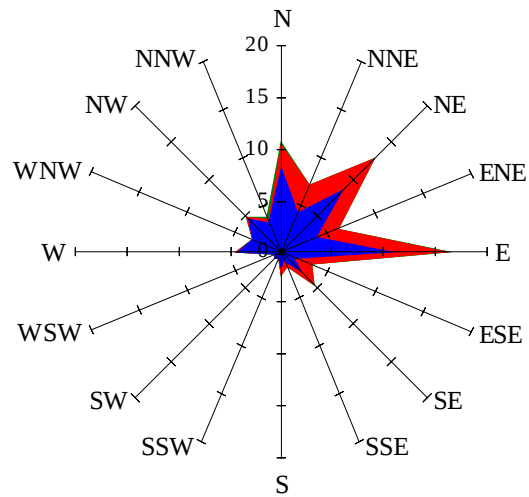


Average Annual Solar Heat and Illumination – Nearest Available Site

(Source: National Renewable Energy Laboratory, Golden CO, 1995)

Wind Summary - December, January, and February

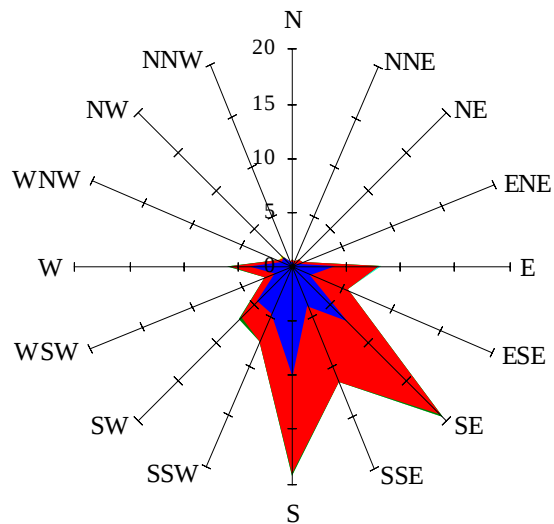
Labels of Percent Frequency on North Axis



Percent Calm = 19.69

Wind Summary - March, April, and May

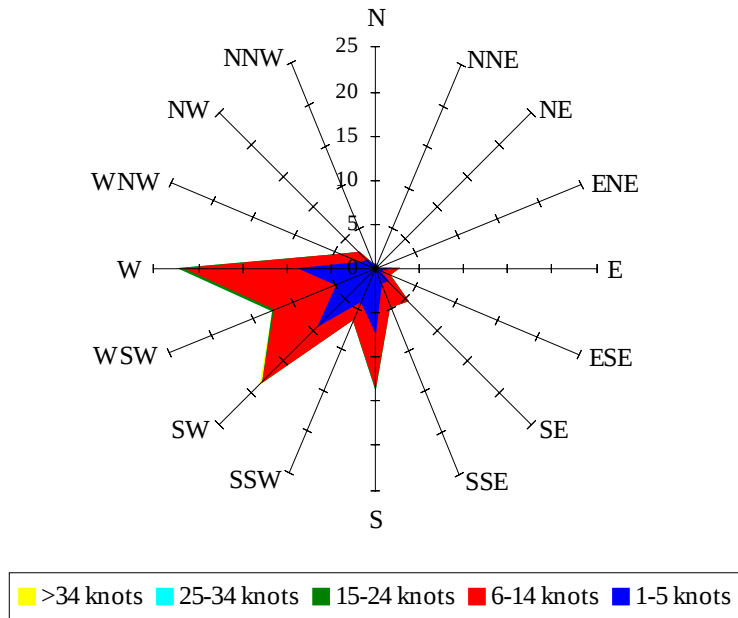
Labels of Percent Frequency on North Axis



Percent Calm = 9.96

Wind Summary - June, July, and August

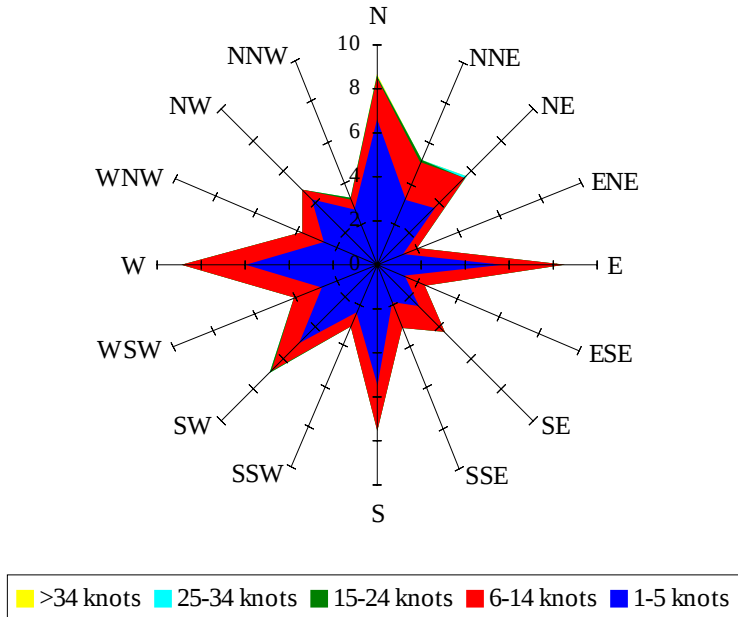
Labels of Percent Frequency on North Axis



Percent Calm = 6.23

Wind Summary - September, October, and November

Labels of Percent Frequency on North Axis



Percent Calm = 19.41