

KARLSRUHE, GERMANY

Latitude = 49.03 N

Longitude = 8.37 E

Period of Record = 1973 to 1996

WMO No. 107270

Elevation = 476 feet

Average Pressure = 29.50 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	93	70	79	7.0	WSW
0.4% Occurrence	89	68	74	7.2	ENE
1.0% Occurrence	85	67	73	7.1	WSW
2.0% Occurrence	82	66	71	7.0	WSW
Mean Daily Range	14	-	-	-	-
97.5% Occurrence	25	24	16	5.2	NE
99.0% Occurrence	19	18	12	5.0	NE
99.6% Occurrence	14	13	9	5.7	NE
Median of Extreme Lows	14	13	9	5.7	NE
	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	73	88	97	6.7	WSW
0.4% Occurrence	70	83	89	6.6	WSW
1.0% Occurrence	69	82	86	6.6	WSW
2.0% Occurrence	67	78	81	6.4	WSW
	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	106	77	0.70	5.8	SW
0.4% Occurrence	98	76	0.65	5.6	SW
1.0% Occurrence	92	74	0.61	6.2	SW
2.0% Occurrence	88	72	0.58	6.4	SW
Air Conditioning/ Humid Area Criteria	# of Hours	T ≥ 93°F	T ≥ 80°F	T _{wb} ≥ 73°F	T _{wb} ≥ 67°F
		9	275	10	238

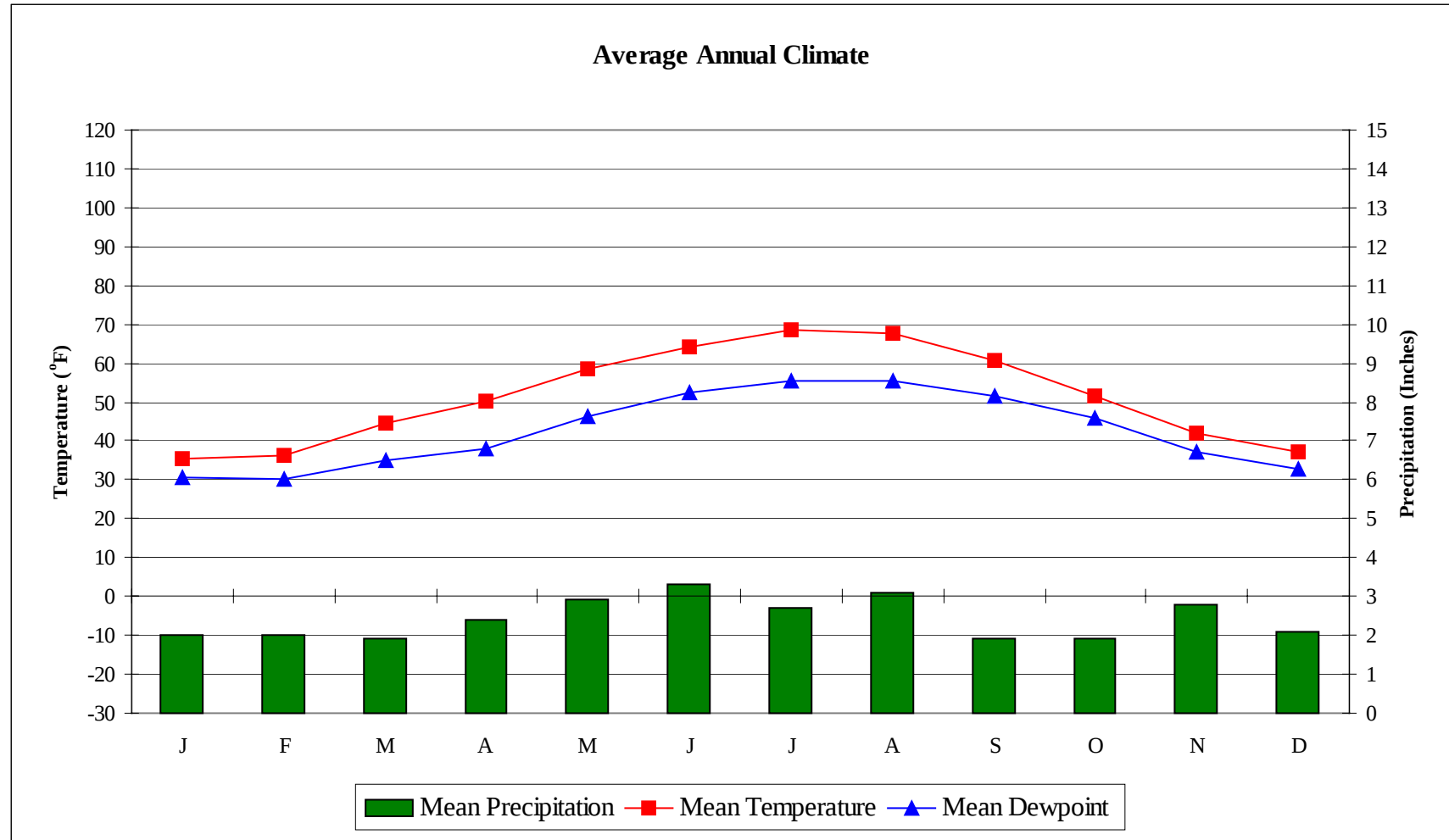
Other Site Data

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
7	N/A	N/A	0.1 + 0.2
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 (#)
53.9	N/A	N/A	34

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

KARLSRUHE, GERMANY

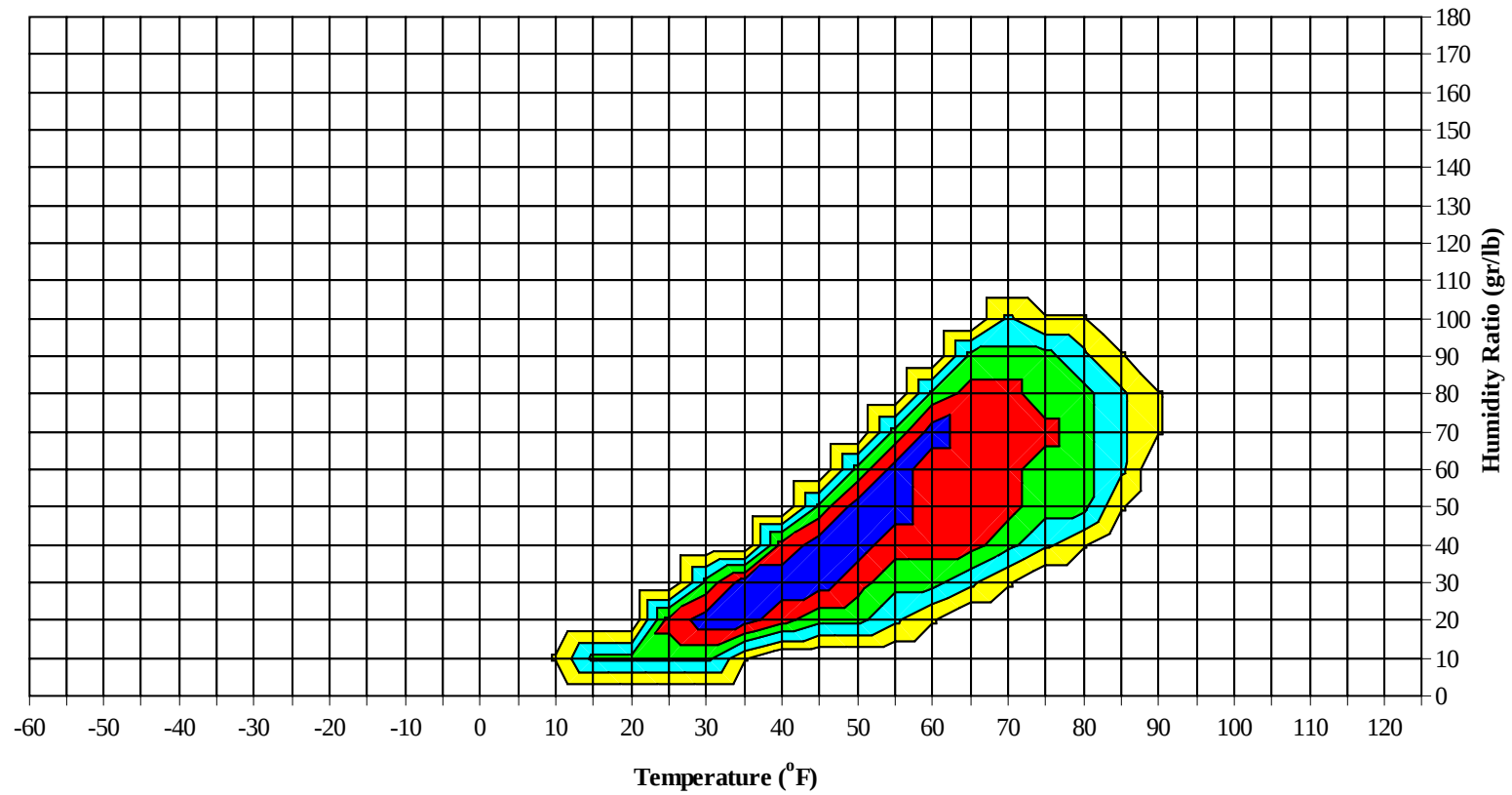
WMO No. 107270



KARLSRUHE, GERMANY

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Long Term Psychrometric Summary

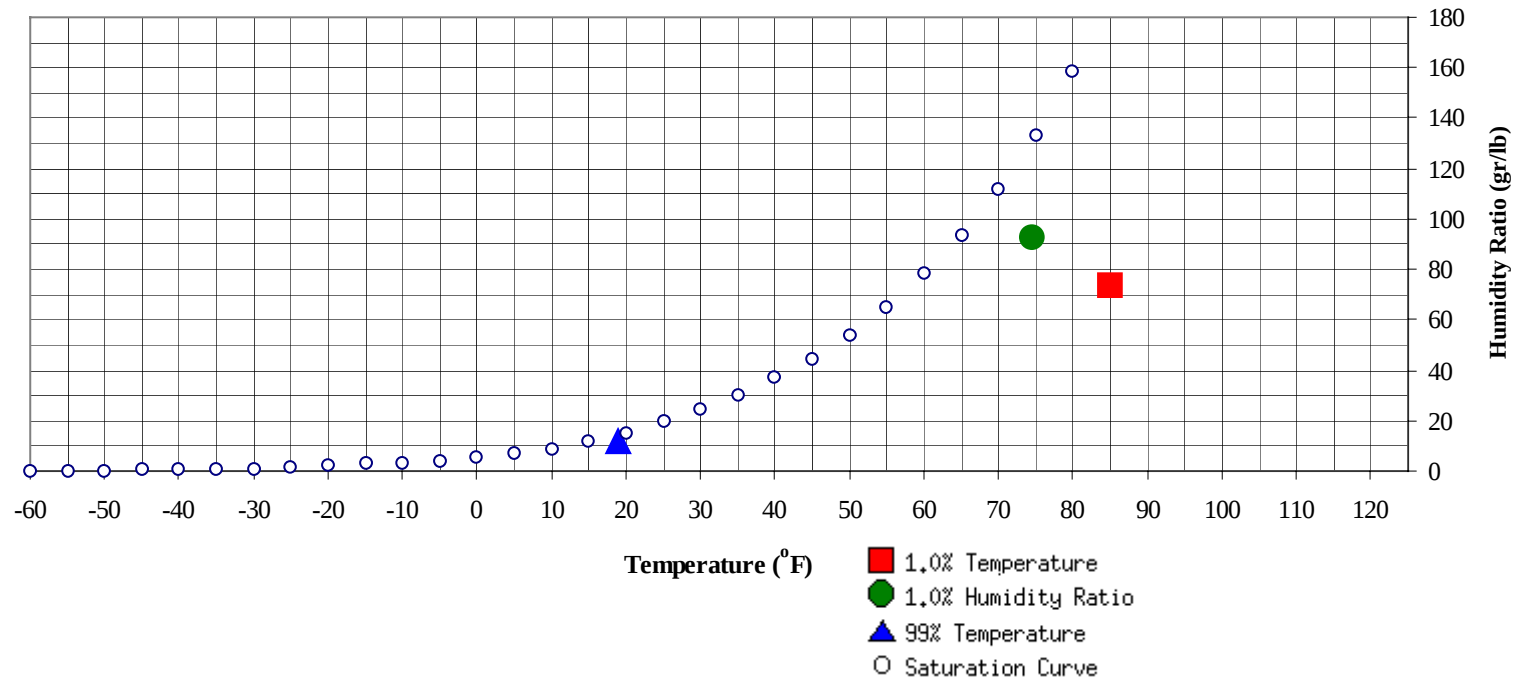


- 50% of all observations
- 80% of all observations
- 95% of all observations
- 97.5% of all observations
- 99% of all observations

KARLSRUHE, GERMANY

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Psychrometric Summary of Peak Design Values



	(°F)	MCHR (gr/lb)	Enthalpy (btu/lb)			MCDB (°F)	MCWB (°F)	MC Dewpt (°F)	Enthalpy (btu/lb)
99% Dry Bulb	19	12	6.4	1.0% Humidity Ratio	92.4	74.4	67.7	64.4	32.3

	(°F)	MCHR (gr/lb)	MCWB (°F)	Enthalpy (btu/lb)
1.0% Dry Bulb	85	73.4	67.4	31.9

KARLSRUHE, GERMANY

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

Period of Record = 1973 to 1996

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		
100 / 104															
95 / 99															
90 / 94															
85 / 89															
80 / 84															
75 / 79												1	0	1	59.1
70 / 74							0		0	55.0		1	1	3	57.3
65 / 69							0	0	0	54.1		4	4	8	53.9
60 / 64		0		0	52.0	0	2	1	3	50.4		13	10	23	51.4
55 / 59	0	3	1	4	50.0	0	4	4	8	48.5	5	27	22	53	49.2
50 / 54	6	10	9	25	47.5	2	15	11	28	46.1	15	45	43	102	46.1
45 / 49	19	35	28	82	43.6	16	35	33	84	42.9	38	62	61	160	42.3
40 / 44	32	42	39	113	39.5	26	38	38	101	39.1	51	48	52	150	38.7
35 / 39	59	62	66	187	35.2	43	50	55	148	34.8	69	32	38	139	34.8
30 / 34	60	51	56	167	30.9	65	47	53	165	30.4	45	12	16	72	30.3
25 / 29	31	23	23	76	25.9	35	21	20	76	25.4	21	3	2	26	25.5
20 / 24	18	11	11	40	21.3	20	7	6	33	20.5	5	1	0	6	21.1
15 / 19	13	7	9	29	16.4	8	3	3	14	16.0	1	0	0	1	16.8
10 / 14	8	4	4	16	11.6	7	1	1	10	11.4					
5 / 9	2	1	1	4	6.9	1	0		1	7.5					
0 / 4	0	0	0	0	0.9										
-5 / -1	0	0		0	-2.1										

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 1996

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		
100 / 104															
95 / 99															
90 / 94								0	0	69.0		1	1	2	66.5
85 / 89							1	0	1	66.6		6	4	10	67.5
80 / 84		1	1	2	59.9		7	4	11	63.0		19	15	34	65.7
75 / 79		4	1	5	57.8		20	14	33	60.4		32	25	57	63.6
70 / 74		11	9	20	55.2	0	31	23	55	58.3	4	42	38	85	61.5
65 / 69		16	13	29	53.3	2	36	29	67	56.3	20	42	37	99	59.2
60 / 64	1	31	23	55	51.2	18	53	52	123	54.5	54	50	53	157	57.0
55 / 59	10	41	37	88	48.8	54	50	53	158	52.1	79	35	45	159	53.5
50 / 54	36	51	48	134	46.4	79	34	47	160	48.7	64	12	18	94	50.1
45 / 49	51	49	56	156	42.6	60	14	21	94	44.9	18	1	3	21	45.8
40 / 44	67	27	36	130	39.4	24	3	5	33	40.4	1			1	41.0
35 / 39	54	8	15	77	35.5	9	0	0	9	36.7	0			0	36.7
30 / 34	19	1	1	21	31.1	1			1	32.5					
25 / 29	2		0	2	26.2										
20 / 24	0			0	23.3										
15 / 19															
10 / 14															
5 / 9															
0 / 4															
-5 / -1															

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

Period of Record = 1973 to 1996

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		
100 / 104			0	0	72.0		0		0	76.0					
95 / 99		1	0	1	70.1		1	0	1	71.5					
90 / 94		8	6	14	69.5		6	1	7	69.5			0	0	68.5
85 / 89		18	11	29	68.1		13	8	21	67.7		1	0	1	67.3
80 / 84	0	30	21	51	66.3		31	20	51	66.1		8	3	11	66.2
75 / 79	1	43	35	79	64.4	1	44	33	78	64.0		19	13	33	64.1
70 / 74	15	52	50	117	62.2	7	54	51	112	62.4	0	35	25	60	61.4
65 / 69	46	43	45	134	60.8	32	44	51	128	60.9	7	42	34	83	59.2
60 / 64	79	38	48	166	58.1	92	40	56	188	58.5	35	61	61	157	57.0
55 / 59	76	14	28	119	54.6	79	13	23	115	54.7	72	48	59	179	53.9
50 / 54	27	1	3	31	51.0	31	1	4	37	50.5	72	23	37	132	50.1
45 / 49	3			3	46.4	6		0	6	46.0	38	3	8	48	45.9
40 / 44						0			0	44.0	16	0	0	16	41.7
35 / 39											1			1	38.0
30 / 34															
25 / 29															
20 / 24															
15 / 19															
10 / 14															
5 / 9															
0 / 4															
-5 / -1															

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KARLSRUHE, GERMANY

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

Period of Record = 1973 to 1996

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		
100 / 104															
95 / 99															
90 / 94															
85 / 89															
80 / 84		1	0	1	63.5										
75 / 79		2	1	3	62.6										
70 / 74		8	2	10	60.7										
65 / 69	0	15	8	23	58.4		0		0	55.0		0		0	54.0
60 / 64	5	34	26	65	55.8	1	5	1	7	54.2		0	0	0	53.8
55 / 59	32	57	52	141	53.1	5	15	11	31	51.7	2	5	4	11	50.5
50 / 54	64	60	68	193	49.2	20	37	30	86	48.4	12	18	13	43	47.9
45 / 49	68	44	57	169	44.9	39	56	53	149	44.2	24	34	33	91	44.1
40 / 44	44	20	24	88	40.9	53	51	57	161	40.1	42	44	44	131	39.9
35 / 39	26	7	7	40	36.6	54	42	48	144	35.9	59	62	62	183	35.5
30 / 34	8	2	1	11	32.2	43	25	30	97	30.9	58	53	58	169	30.8
25 / 29	0			0	27.5	21	8	10	38	26.4	28	19	23	70	26.0
20 / 24						5	2	1	7	21.9	13	7	5	25	21.0
15 / 19						0	0		0	17.9	7	4	5	16	16.5
10 / 14											2	1	1	4	11.8
5 / 9											1	0		1	6.3
0 / 4															
-5 / -1															

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

Period of Record = 1973 to 1996

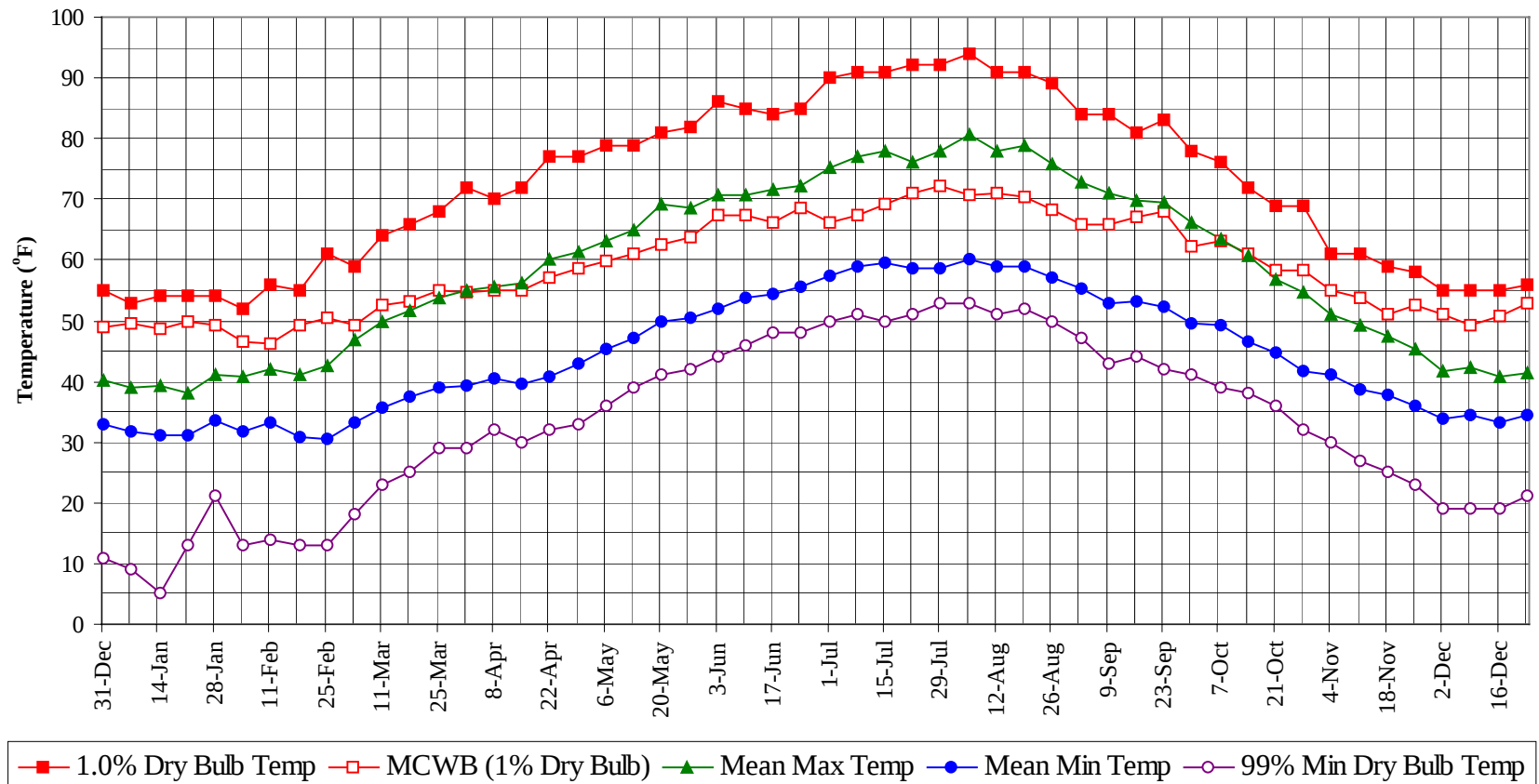
Annual Totals					
Temperature Range (°F)	Hour Group (LST)			Total Obs	M C W B (°F)
	01 To 08	09 To 16	17 To 00		
100 / 104		0	0	0	74.0
95 / 99		3	1	4	70.8
90 / 94		15	8	23	69.2
85 / 89		40	22	62	67.8
80 / 84	0	95	59	154	65.8
75 / 79	2	163	113	278	63.5
70 / 74	29	235	186	449	61.2
65 / 69	109	243	209	560	59.1
60 / 64	292	330	315	937	56.5
55 / 59	420	315	335	1070	52.7
50 / 54	432	309	336	1076	48.5
45 / 49	379	333	368	1079	43.8
40 / 44	354	272	309	934	39.7
35 / 39	370	261	305	936	35.3
30 / 34	293	188	224	705	30.7
25 / 29	135	73	82	290	25.8
20 / 24	57	26	24	108	21.0
15 / 19	27	13	17	58	16.3
10 / 14	16	7	6	29	11.6
5 / 9	5	1	1	7	6.9
0 / 4	0	0	0	0	0.9
-5 / -1	0	0		0	-2.1

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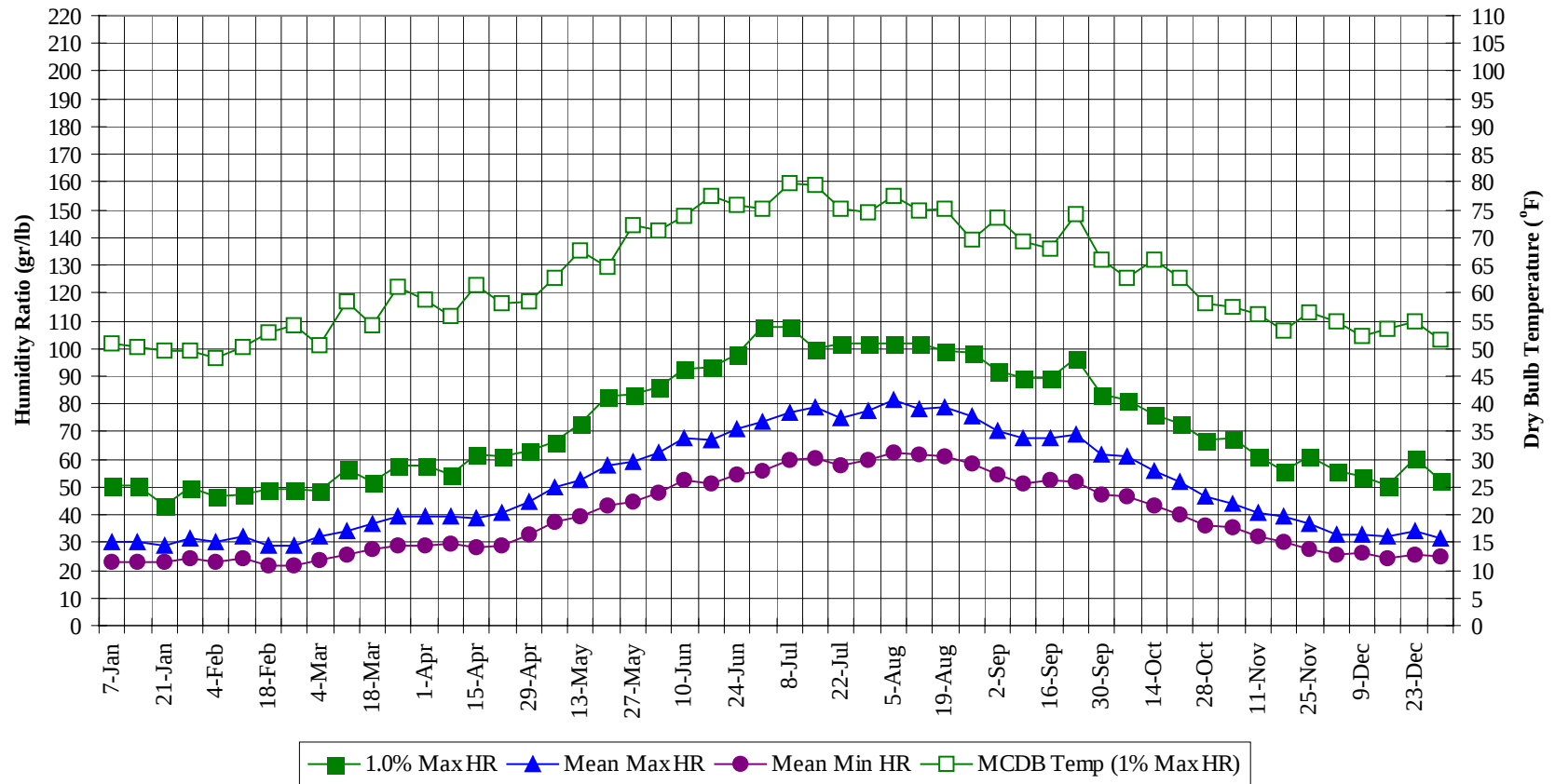
Annual Summary of Temperatures



KARLSRUHE, GERMANY

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Long Term Humidity and Dry Bulb Temperature Summary

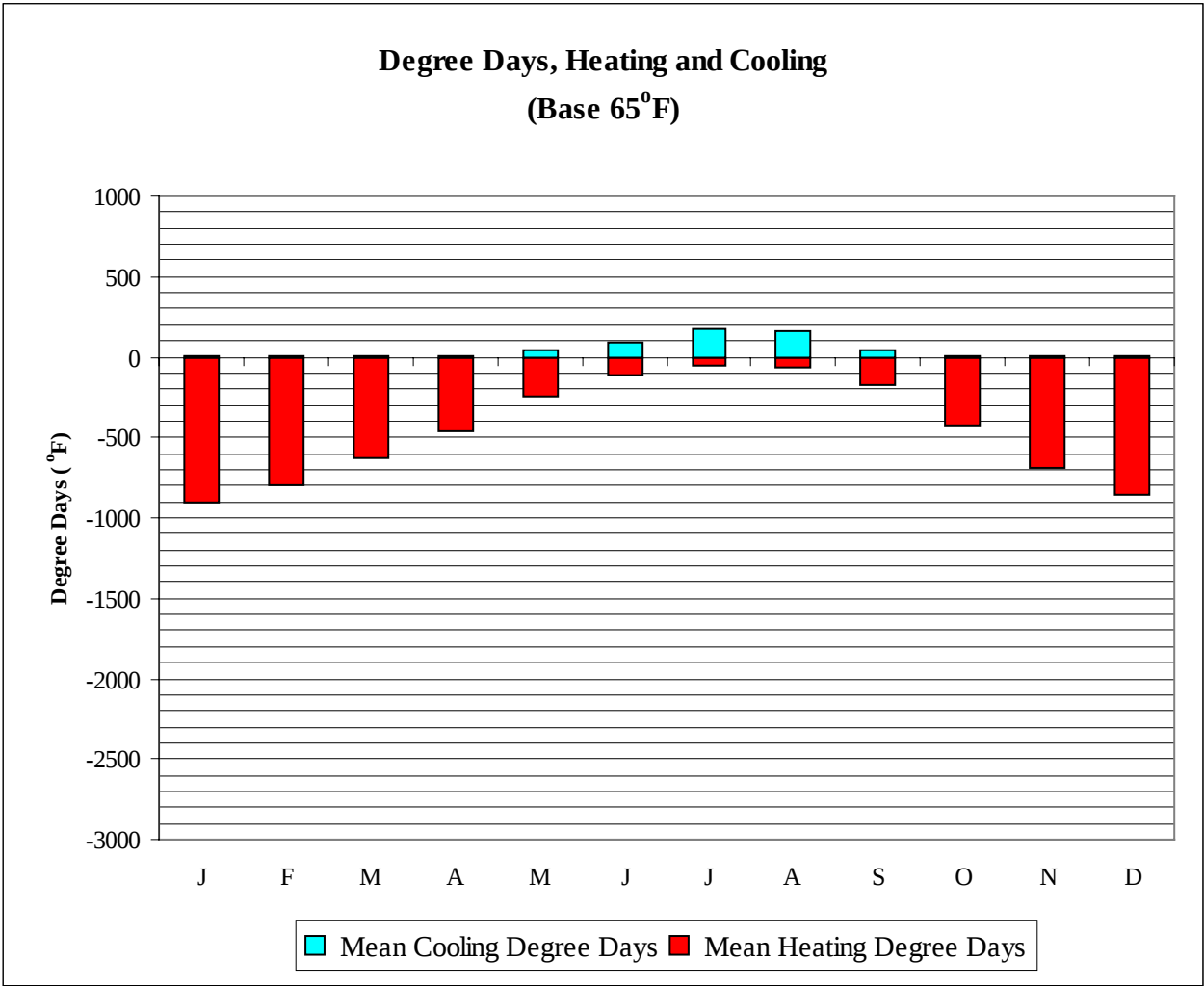


KARLSRUHE, GERMANY

WMO No. 107270

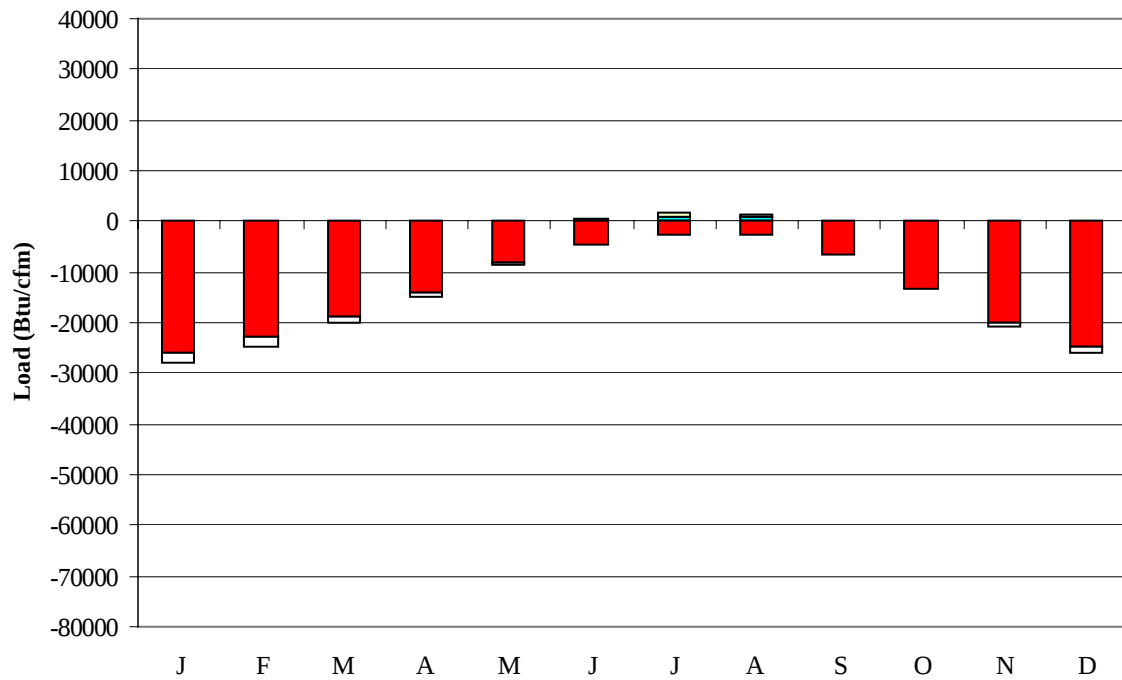
Long Term Dry Bulb Temperature and Humidity Summary

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	53.0	49.7	39.0	31.6	9.0	50.4	51.0	30.4	23.3
14-Jan	54.0	48.7	39.4	31.2	5.0	50.4	50.4	30.2	23.3
21-Jan	54.0	50.0	38.2	31.1	13.0	43.4	49.6	28.6	22.7
28-Jan	54.0	49.3	41.0	33.5	21.0	49.7	49.6	31.4	24.1
4-Feb	52.0	46.6	40.7	31.7	13.0	46.9	48.4	30.2	23.1
11-Feb	56.0	46.2	42.0	33.2	14.0	47.6	50.4	32.2	24.2
18-Feb	55.0	49.2	41.0	30.7	13.0	49.0	52.9	28.7	21.8
25-Feb	61.0	50.5	42.5	30.4	13.0	49.0	54.1	28.7	21.6
4-Mar	59.0	49.4	46.8	33.3	18.0	48.3	50.4	32.1	23.7
11-Mar	64.0	52.5	49.7	35.6	23.0	56.7	58.6	34.2	25.3
18-Mar	66.0	53.1	51.6	37.4	25.0	51.8	54.2	36.6	27.3
25-Mar	68.0	55.0	53.6	38.9	29.0	58.1	61.1	39.2	29.0
1-Apr	72.0	54.8	54.9	39.4	29.0	58.1	58.9	39.3	28.7
8-Apr	70.0	54.9	55.5	40.6	32.0	54.6	55.8	39.6	29.8
15-Apr	72.0	54.9	56.3	39.4	30.0	61.6	61.3	38.5	28.3
22-Apr	77.0	57.0	60.2	40.8	32.0	60.9	58.1	40.5	29.2
29-Apr	77.0	58.5	61.2	43.0	33.0	63.0	58.4	44.6	32.9
6-May	79.0	59.9	63.3	45.5	36.0	66.5	62.7	49.8	37.1
13-May	79.0	61.0	65.0	47.1	39.0	72.8	67.7	52.6	39.5
20-May	81.0	62.5	69.1	49.9	41.0	82.6	64.8	58.0	43.6
27-May	82.0	63.8	68.4	50.6	42.0	83.3	72.3	58.9	44.8
3-Jun	86.0	67.4	70.6	51.9	44.0	86.1	71.2	62.7	47.7
10-Jun	85.0	67.4	70.7	53.8	46.0	92.4	73.8	67.5	52.3
17-Jun	84.0	66.1	71.7	54.4	48.0	93.1	77.3	67.0	51.2
24-Jun	85.0	68.6	72.3	55.6	48.0	98.0	75.7	70.9	54.2
1-Jul	90.0	66.1	75.3	57.3	50.0	107.8	75.2	73.4	56.0
8-Jul	91.0	67.4	77.0	58.8	51.0	107.8	79.8	76.6	59.7
15-Jul	91.0	69.2	78.0	59.4	50.0	100.1	79.5	78.8	60.5
22-Jul	92.0	71.0	76.2	58.7	51.0	101.5	75.2	74.9	57.6
29-Jul	92.0	72.1	78.0	58.7	53.0	101.5	74.6	77.8	59.7
5-Aug	94.0	70.8	80.8	60.3	53.0	101.5	77.4	81.1	62.3
12-Aug	91.0	70.9	78.1	58.9	51.0	101.5	74.7	78.2	61.8
19-Aug	91.0	70.3	78.9	58.9	52.0	99.4	75.1	78.9	61.0
26-Aug	89.0	68.2	75.9	57.2	50.0	98.7	69.6	75.4	58.3
2-Sep	84.0	65.9	73.0	55.1	47.0	91.7	73.6	70.0	54.7
9-Sep	84.0	65.9	70.9	52.8	43.0	89.6	69.2	67.5	51.4
16-Sep	81.0	66.9	69.7	53.1	44.0	89.6	67.8	67.9	52.6
23-Sep	83.0	67.9	69.5	52.2	42.0	96.6	74.3	68.6	51.7
30-Sep	78.0	62.3	66.0	49.6	41.0	83.3	65.9	61.9	47.5
7-Oct	76.0	63.2	63.6	49.3	39.0	81.2	62.8	61.0	46.9
14-Oct	72.0	60.9	60.8	46.5	38.0	76.3	66.0	56.1	43.5
21-Oct	69.0	58.4	56.8	44.6	36.0	72.8	62.9	52.2	39.9
28-Oct	69.0	58.4	54.7	41.8	32.0	67.2	58.0	46.5	36.0
4-Nov	61.0	55.0	51.0	41.2	30.0	67.9	57.5	44.2	35.5
11-Nov	61.0	53.7	49.2	38.7	27.0	60.9	56.3	40.8	32.2
18-Nov	59.0	51.1	47.4	37.7	25.0	56.0	53.3	39.2	30.3
25-Nov	58.0	52.6	45.3	36.0	23.0	60.9	56.5	36.8	27.8
2-Dec	55.0	51.0	41.7	33.8	19.0	56.0	54.8	33.1	25.9
9-Dec	55.0	49.2	42.3	34.4	19.0	53.9	52.1	33.0	26.0
16-Dec	55.0	50.9	40.7	33.1	19.0	50.4	53.5	32.3	24.5
23-Dec	56.0	52.9	41.4	34.3	21.0	60.2	54.8	34.1	25.8
31-Dec	55.0	49.1	40.1	32.9	11.0	52.5	51.7	31.6	25.0



	Mean Cooling Degree Days (°F)	Mean Heating Degree Days (°F)
JAN	0	909
FEB	0	797
MAR	1	633
APR	9	458
MAY	40	244
JUN	90	119
JUL	169	58
AUG	156	63
SEP	47	176
OCT	5	422
NOV	0	688
DEC	0	858
ANN	517	5425

Average Ventilation and Infiltration Loads
(Outside Air vs. 75°F, 60% RH summer; 68°F, 30% RH winter)



■ Average Sensible Cooling Load ■ Average Sensible Heating Load
■ Average Latent Cooling (Drying) Load ■ Average Latent Heating (Humidifying) Load

	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	0	-25975	0	-1851
FEB	0	-22849	0	-1937
MAR	1	-18831	0	-1100
APR	14	-14099	0	-573
MAY	119	-8323	13	-58
JUN	415	-4602	220	-3
JUL	1049	-2591	552	0
AUG	878	-2764	391	0
SEP	143	-6391	115	-2
OCT	7	-13287	4	-86
NOV	0	-20170	0	-755
DEC	0	-24642	0	-1442
ANN	2626	-164524	1295	-7807

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

No Solar Radiation
Data Available

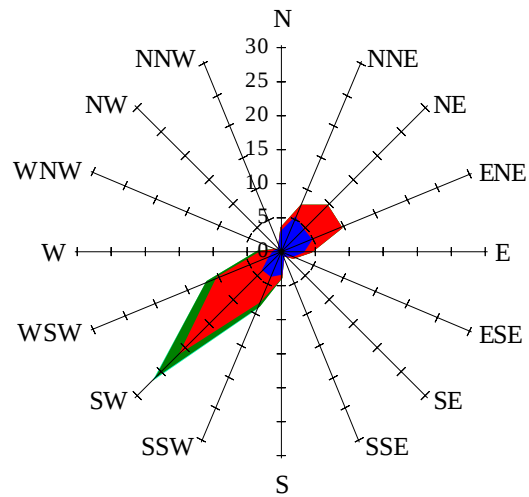


Average Annual Solar Heat and Illumination – Nearest Available Site

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

Wind Summary - December, January, and February

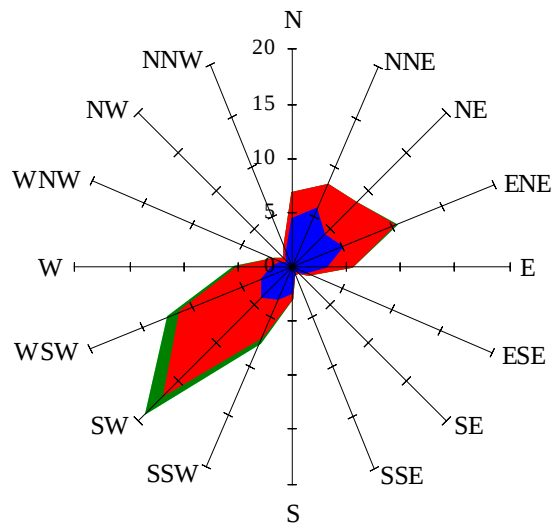
Labels of Percent Frequency on North Axis



Percent Calm = 6.82

Wind Summary - March, April, and May

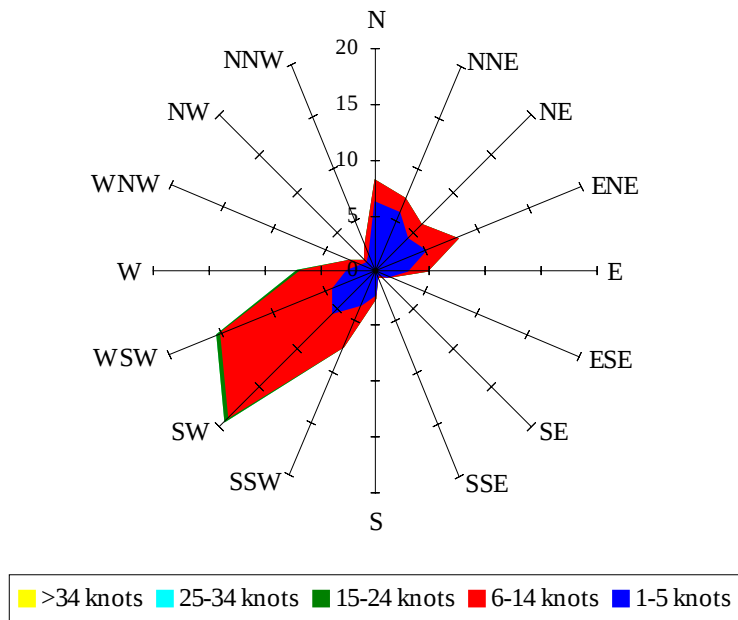
Labels of Percent Frequency on North Axis



Percent Calm = 6.08

Wind Summary - June, July, and August

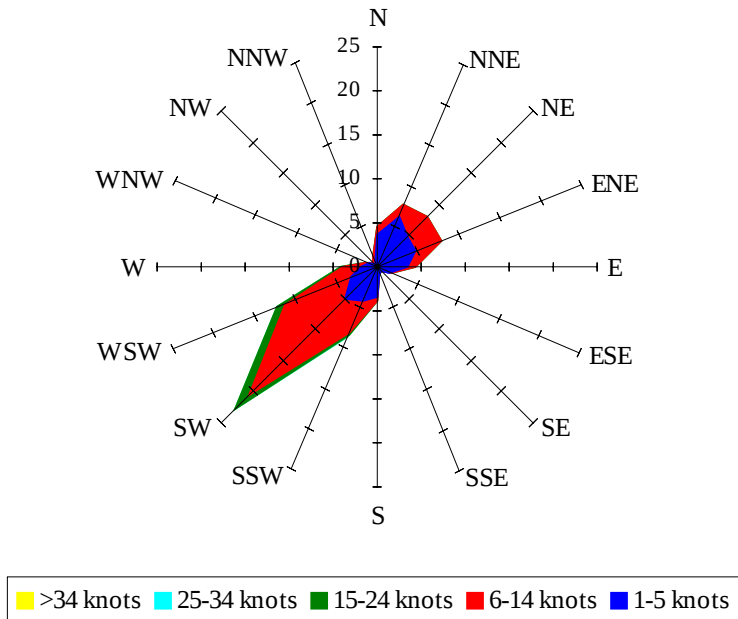
Labels of Percent Frequency on North Axis



Percent Calm = 6.39

Wind Summary - September, October, and November

Labels of Percent Frequency on North Axis



Percent Calm = 9.15