

FRANKFURT, GERMANY

Latitude = 50.05 N

Longitude = 8.60 E

Period of Record = 1967 to 1996

WMO No. 106370

Elevation = 371 feet

Average Pressure = 29.59 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	90	67	63	8.0	NE
0.4% Occurrence	87	67	67	7.9	E
1.0% Occurrence	83	66	67	7.6	E
2.0% Occurrence	80	64	66	7.6	E
Mean Daily Range	14	-	-	-	-
97.5% Occurrence	24	23	15	5.8	NE
99.0% Occurrence	19	18	12	5.6	NE
99.6% Occurrence	14	13	9	6.5	NE
Median of Extreme Lows	10	9	7	7.3	NNE
	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	72	84	96	6.9	SSW
0.4% Occurrence	69	81	86	6.8	SSW
1.0% Occurrence	67	78	81	7.0	SSW
2.0% Occurrence	66	76	79	7.0	SSW
	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	104	76	0.69	4.5	VARIABLE
0.4% Occurrence	92	71	0.61	6.2	SSW
1.0% Occurrence	88	70	0.59	6.0	S
2.0% Occurrence	85	70	0.57	6.1	SSW
Air Conditioning/ Humid Area Criteria	# of Hours	T ≥ 93°F	T ≥ 80°F	T _{wb} ≥ 73°F	T _{wb} ≥ 67°F
		4	168	2	120

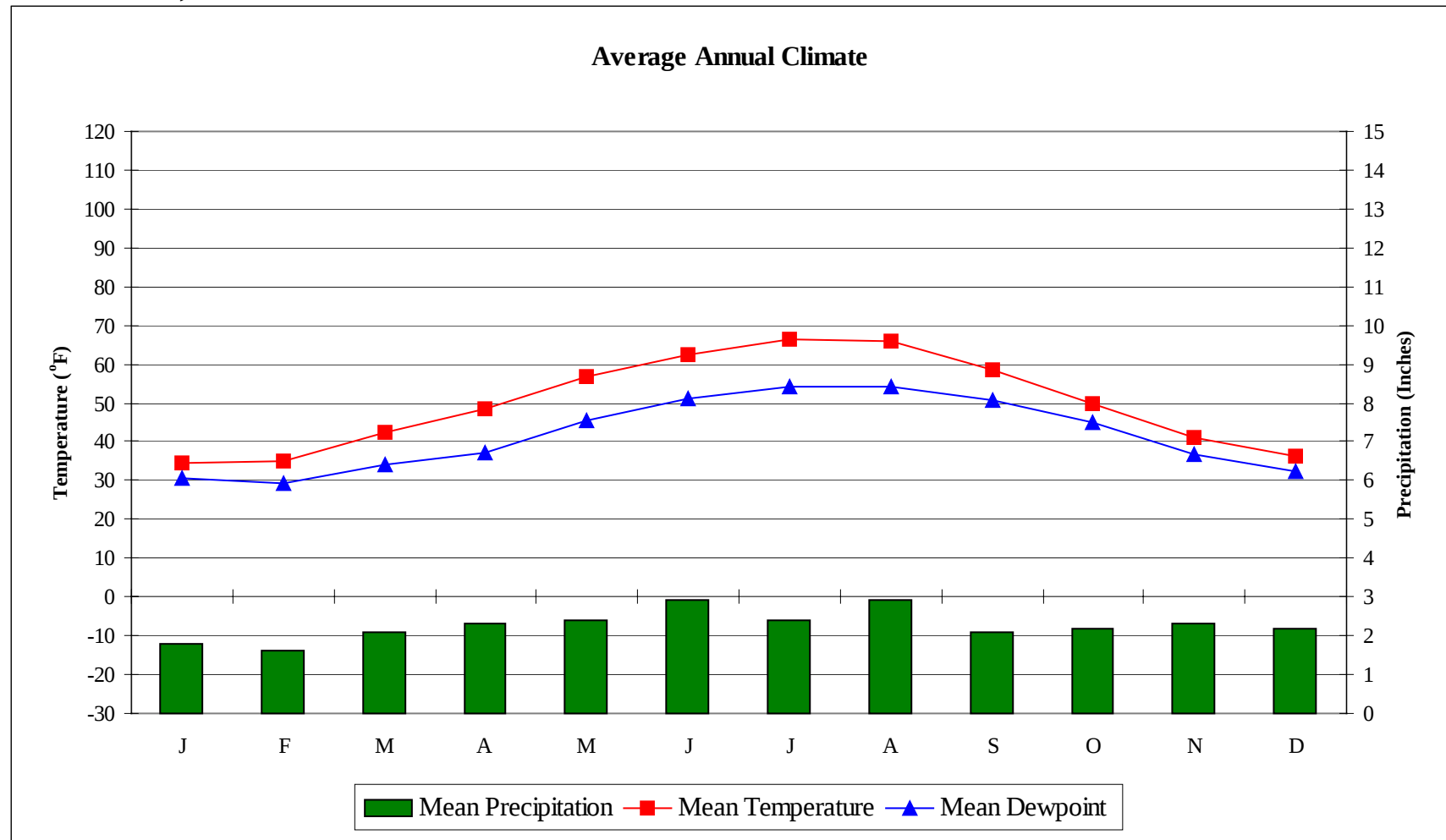
Other Site Data

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
6	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 (#)
52.4	N/A	N/A	39

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

FRANKFURT, GERMANY

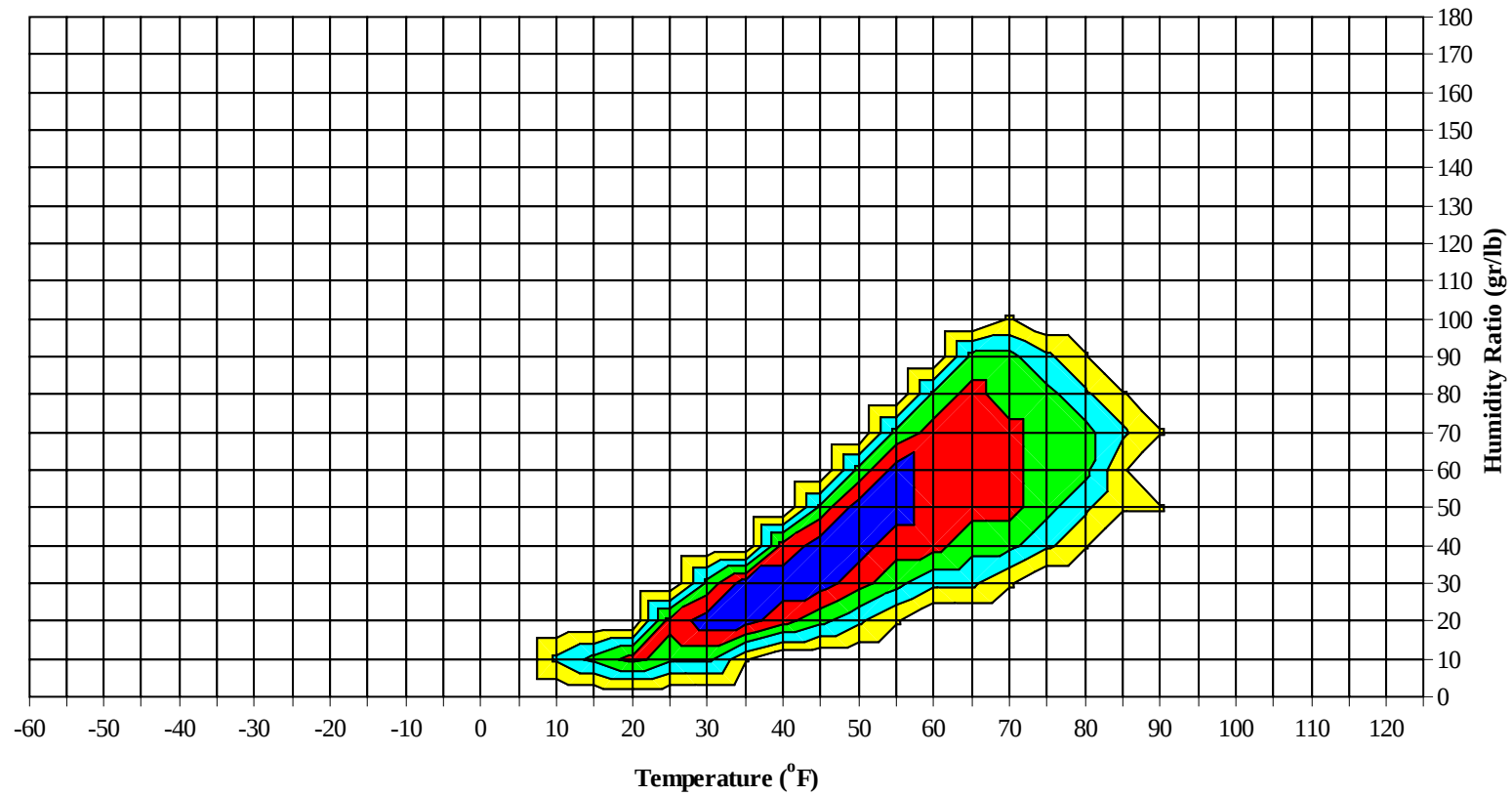
WMO No. 106370



FRANKFURT, GERMANY

WMO No. 106370

Long Term Psychrometric Summary

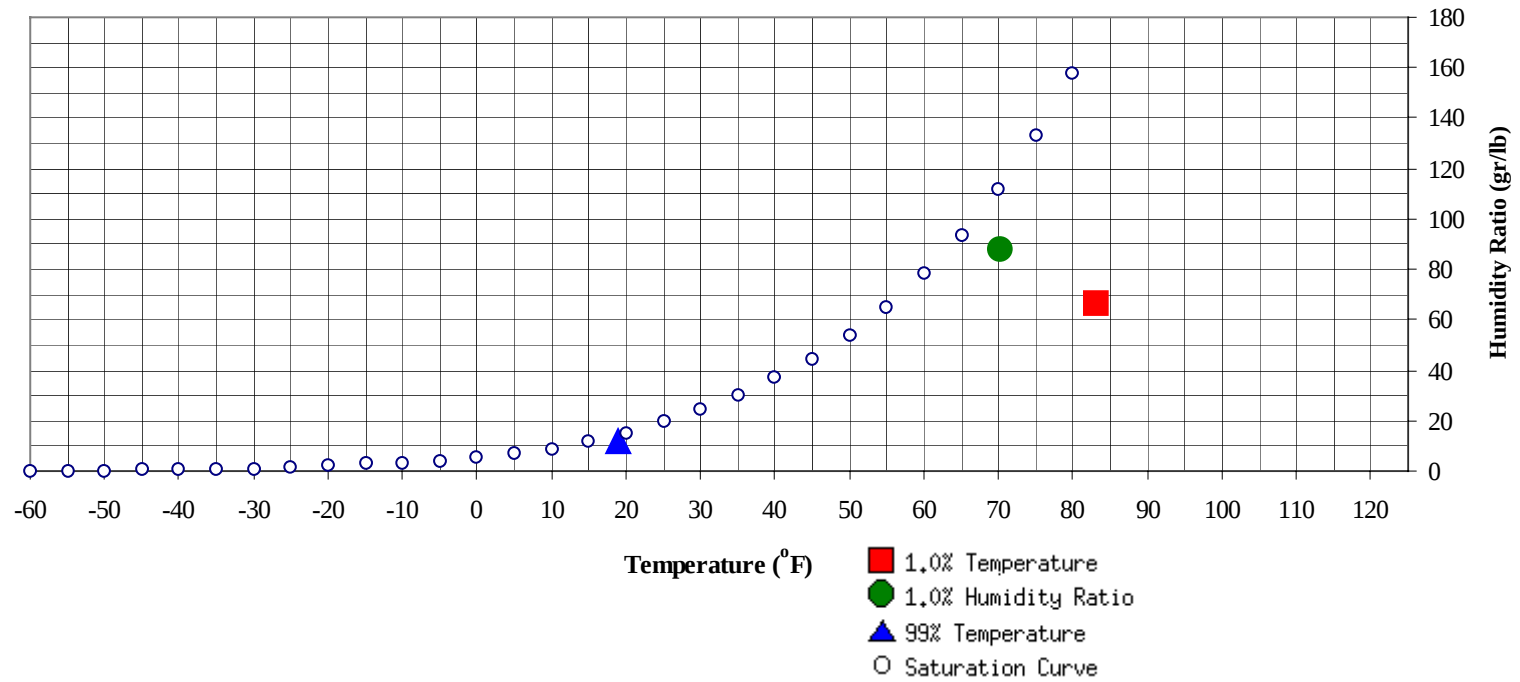


- 50% of all observations
- 80% of all observations
- 95% of all observations
- 97.5% of all observations
- 99% of all observations

FRANKFURT, GERMANY

WMO No. 106370

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	19	11.8	6.4		88.2	70.3	65.5	63.2	30.6

	(°F)	MCHR (gr/lb)	MCWB (°F)	Enthalpy (btu/lb)
1.0% Dry Bulb	83	66.4	65.4	30.3

FRANKFURT, GERMANY

WMO No. 106370

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

Period of Record = 1967 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		
95 / 99															
90 / 94															
85 / 89															
80 / 84															
75 / 79												0		0	56.0
70 / 74												0	0	0	56.8
65 / 69												2	1	3	53.9
60 / 64						0	0	0	0	52.9		7	5	12	52.0
55 / 59	0	1	1	2	50.7	1	3	2	6	49.5	2	22	15	39	49.4
50 / 54	5	8	6	19	48.2	1	11	6	18	46.3	12	40	38	89	46.5
45 / 49	19	31	26	76	44.0	12	28	22	62	43.0	37	65	60	162	42.5
40 / 44	31	44	39	113	39.7	23	41	39	102	39.2	50	54	57	161	38.8
35 / 39	59	63	66	188	35.4	51	59	59	170	35.0	67	41	46	153	34.9
30 / 34	64	52	58	173	31.0	57	45	54	156	30.3	52	14	20	86	30.3
25 / 29	32	26	27	85	25.8	43	26	30	100	25.6	22	3	5	30	25.6
20 / 24	16	12	10	38	21.0	19	8	8	35	20.7	5	1	1	7	20.9
15 / 19	11	7	8	26	16.3	10	3	3	16	16.1	2	0	0	2	16.6
10 / 14	7	4	5	16	11.4	4	1	1	6	10.9	0	0		0	11.3
5 / 9	4	1	1	6	6.8	2	0	0	2	6.1	0			0	9.0
0 / 4	1	0	0	1	1.4	1	0	0	1	2.2					
-5 / -1	0	0		0	-2.9	0			0	-1.0					

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.

FRANKFURT, GERMANY

WMO No. 106370

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

Period of Record = 1967 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		
95 / 99															
90 / 94												1	1	2	66.2
85 / 89							0	0	0	66.4		4	3	7	66.9
80 / 84		0	0	0	59.3		5	3	8	63.1		15	10	25	64.8
75 / 79		2	1	3	57.6		15	10	25	60.1	0	28	21	49	63.1
70 / 74		8	4	12	55.3	0	29	18	47	58.0	4	41	31	76	61.0
65 / 69	0	13	10	23	53.5	2	34	25	61	56.2	15	41	38	94	59.0
60 / 64	1	25	20	46	51.5	15	54	45	113	54.3	50	55	58	163	56.6
55 / 59	8	43	36	86	48.9	49	55	60	163	51.9	76	40	50	165	53.3
50 / 54	31	51	49	131	46.2	75	40	53	167	48.6	66	14	24	104	49.8
45 / 49	54	53	55	162	42.5	64	15	25	104	44.3	24	1	3	28	45.6
40 / 44	60	33	40	133	39.0	27	3	6	36	40.3	5		0	5	41.4
35 / 39	56	12	21	89	35.3	14	0	2	16	36.4	1			1	37.2
30 / 34	25	1	4	30	30.8	3		0	3	32.3					
25 / 29	5		0	5	26.6	0			0	28.0					
20 / 24	0		0	0	21.3										
15 / 19															
10 / 14															
5 / 9															
0 / 4															
-5 / -1															

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WMO No. 106370

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

Period of Record = 1967 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		
95 / 99		1	0	1	68.7		0	0	0	70.8					
90 / 94		4	3	7	67.3		3	2	5	67.6			0	0	67.0
85 / 89		13	9	22	66.7		9	5	14	66.6		1	0	1	66.1
80 / 84	0	27	19	46	65.6	0	24	15	39	65.2		4	2	6	65.0
75 / 79	2	40	30	72	63.9	1	42	29	72	63.2		13	6	19	63.8
70 / 74	13	51	47	110	61.8	7	56	48	110	61.8		31	17	48	61.5
65 / 69	36	47	47	129	60.3	29	48	51	127	60.2	4	39	30	72	59.2
60 / 64	74	47	55	176	57.9	78	49	59	186	58.1	26	68	61	155	56.9
55 / 59	78	19	33	130	54.3	81	17	31	130	54.5	73	58	70	201	53.7
50 / 54	38	1	5	44	50.6	40	2	7	49	50.6	77	23	41	140	50.0
45 / 49	6		0	6	46.2	10		1	11	46.3	44	4	11	59	45.9
40 / 44	1			1	41.3	2			2	42.1	13	0	1	14	41.7
35 / 39	0			0	38.5	0			0	38.0	4		0	4	37.3
30 / 34											0			0	32.7
25 / 29															
20 / 24															
15 / 19															
10 / 14															
5 / 9															
0 / 4															
-5 / -1															

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FRANKFURT, GERMANY

WMO No. 106370

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

Period of Record = 1967 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		
95 / 99															
90 / 94															
85 / 89															
80 / 84		0		0	63.0										
75 / 79		0	0	0	63.1										
70 / 74		4	1	5	61.4										
65 / 69		9	4	13	58.9										
60 / 64	3	31	19	53	56.5	0	1	0	1	55.2		0		0	53.8
55 / 59	27	57	49	133	53.3	5	11	7	23	52.4	1	3	2	6	51.5
50 / 54	58	68	66	193	49.3	16	32	24	72	48.9	12	15	12	39	48.6
45 / 49	67	52	59	178	44.8	39	59	51	148	44.4	21	31	27	79	44.4
40 / 44	43	18	32	93	40.9	52	56	59	167	40.2	36	40	40	115	40.0
35 / 39	33	8	15	56	36.6	60	47	53	160	35.8	61	71	67	199	35.5
30 / 34	15	1	2	18	31.7	40	25	32	97	31.1	59	54	57	170	30.9
25 / 29	2		0	2	27.8	21	9	12	42	26.2	32	22	26	80	25.9
20 / 24						6	1	2	9	22.0	13	8	9	30	21.2
15 / 19						1	0	0	1	18.0	10	4	5	19	16.8
10 / 14											3	1	1	5	12.0
5 / 9											1	0	1	2	6.5
0 / 4											0	0	0	0	2.8
-5 / -1															

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FRANKFURT, GERMANY

WMO No. 106370

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

Period of Record = 1967 to 1996

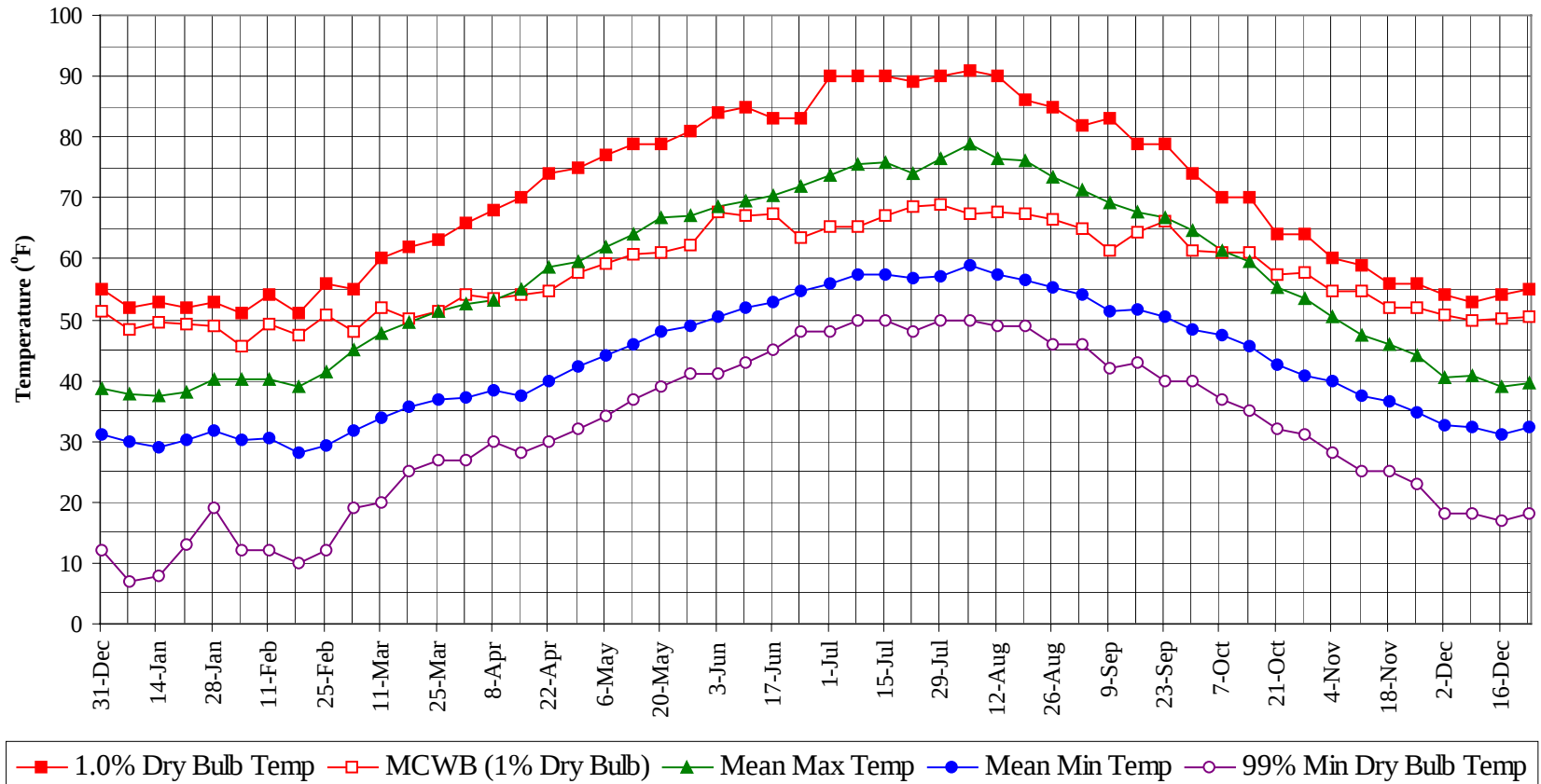
Annual Totals					
Temperature Range (°F)	Hour Group (LST)			Total Obs	M C W B (°F)
	01 To 08	09 To 16	17 To 00		
95 / 99		1	1	2	69.6
90 / 94		8	5	13	67.2
85 / 89		28	18	46	66.7
80 / 84	0	76	50	125	65.1
75 / 79	3	138	98	239	63.0
70 / 74	24	219	168	411	61.0
65 / 69	85	232	206	523	59.0
60 / 64	246	336	321	904	56.6
55 / 59	400	327	354	1080	52.9
50 / 54	429	304	331	1065	48.7
45 / 49	395	337	341	1072	43.9
40 / 44	343	288	312	943	39.7
35 / 39	406	301	329	1037	35.4
30 / 34	317	190	226	733	30.8
25 / 29	156	85	102	344	25.8
20 / 24	61	29	30	120	21.0
15 / 19	33	13	17	63	16.5
10 / 14	14	7	7	28	11.4
5 / 9	6	2	2	10	6.6
0 / 4	2	0	0	2	1.8
-5 / -1	0	0		0	-2.7
	</				

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FRANKFURT, GERMANY

WMO No. 106370

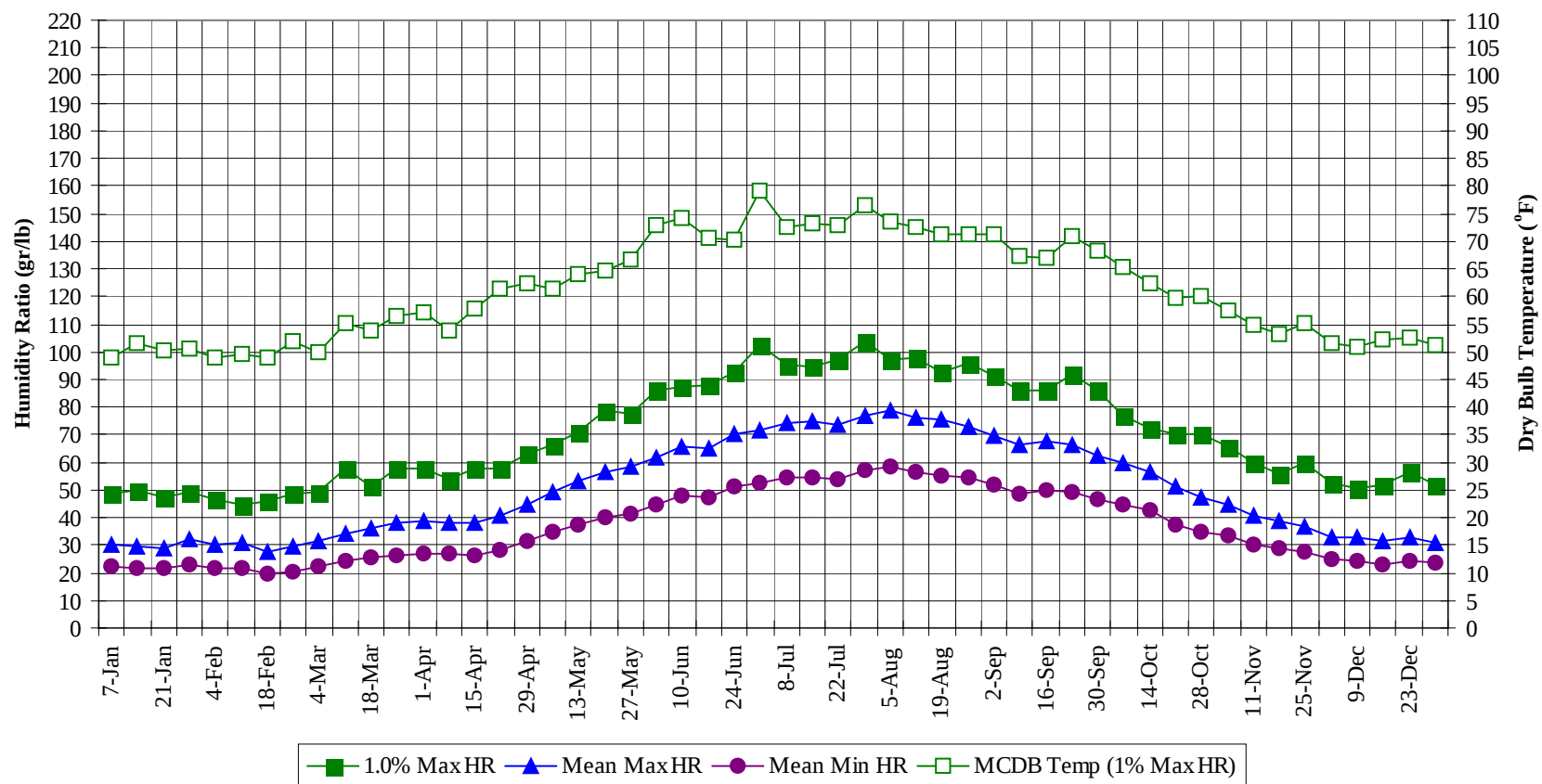
Annual Summary of Temperatures



FRANKFURT, GERMANY

WMO No. 106370

Long Term Humidity and Dry Bulb Temperature Summary



FRANKFURT, GERMANY

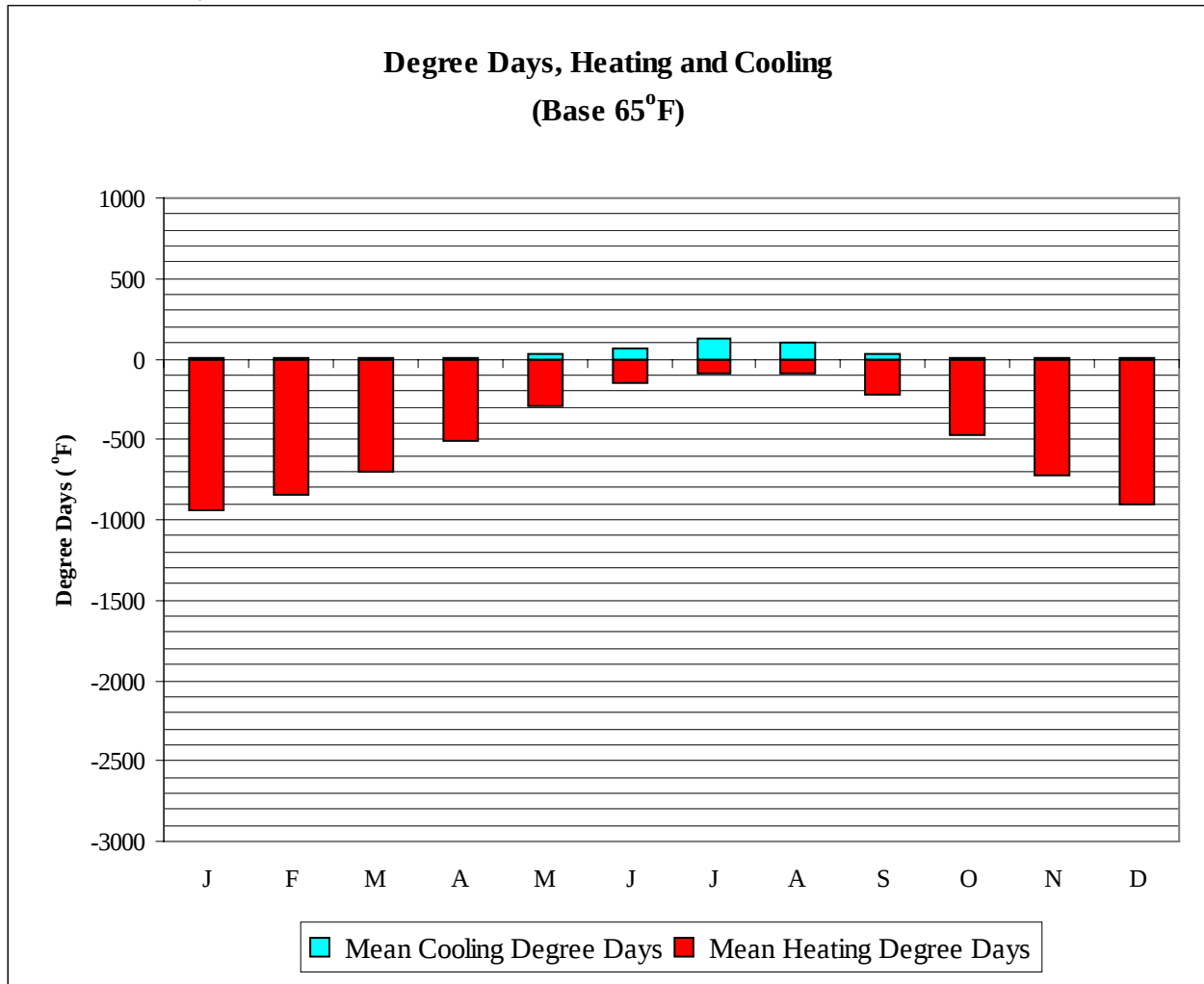
WMO No. 106370

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	52.0	48.4	37.8	29.8	7.0	48.3	49.0	30.5	22.0
14-Jan	53.0	49.7	37.5	29.1	8.0	49.7	51.5	29.7	21.7
21-Jan	52.0	49.3	38.1	30.3	13.0	47.6	50.3	29.1	22.0
28-Jan	53.0	48.8	40.2	31.6	19.0	49.0	50.7	32.4	23.2
4-Feb	51.0	45.5	40.1	30.3	12.0	46.9	48.8	30.4	21.8
11-Feb	54.0	49.2	40.3	30.6	12.0	44.8	49.5	30.9	21.8
18-Feb	51.0	47.4	39.1	28.2	10.0	46.2	48.9	27.7	19.8
25-Feb	56.0	50.7	41.5	29.4	12.0	48.3	51.9	29.5	20.7
4-Mar	55.0	48.0	44.9	31.7	19.0	49.0	50.0	31.5	22.2
11-Mar	60.0	52.0	47.7	33.8	20.0	58.1	55.3	34.0	24.2
18-Mar	62.0	50.2	49.4	35.6	25.0	51.1	53.8	36.0	25.5
25-Mar	63.0	51.4	51.3	37.0	27.0	58.1	56.5	38.3	26.5
1-Apr	66.0	54.0	52.6	37.3	27.0	58.1	57.1	38.8	26.7
8-Apr	68.0	53.4	53.1	38.4	30.0	53.9	53.8	38.0	27.1
15-Apr	70.0	54.2	55.1	37.5	28.0	58.1	57.8	37.8	26.4
22-Apr	74.0	54.7	58.6	39.9	30.0	58.1	61.3	40.8	28.0
29-Apr	75.0	57.7	59.6	42.4	32.0	63.0	62.5	44.5	31.5
6-May	77.0	59.2	61.9	44.1	34.0	66.5	61.5	49.2	34.9
13-May	79.0	60.7	64.2	46.0	37.0	70.7	64.0	53.0	37.5
20-May	79.0	61.2	66.9	48.0	39.0	79.1	64.7	56.7	40.1
27-May	81.0	62.1	67.1	48.8	41.0	77.7	66.5	58.2	41.6
3-Jun	84.0	67.7	68.5	50.5	41.0	86.1	72.8	61.6	44.9
10-Jun	85.0	67.0	69.5	52.0	43.0	87.5	74.1	65.6	48.2
17-Jun	83.0	67.5	70.4	52.8	45.0	88.2	70.5	65.3	47.0
24-Jun	83.0	63.5	71.8	54.8	48.0	92.4	70.2	70.0	51.4
1-Jul	90.0	65.2	73.6	55.8	48.0	102.2	79.0	71.7	52.3
8-Jul	90.0	65.3	75.6	57.4	50.0	95.2	72.4	73.9	54.3
15-Jul	90.0	66.9	75.8	57.3	50.0	94.5	73.3	75.1	54.7
22-Jul	89.0	68.5	74.0	56.7	48.0	97.3	73.1	73.4	53.9
29-Jul	90.0	68.8	76.3	57.2	50.0	103.6	76.4	77.1	57.5
5-Aug	91.0	67.2	78.8	58.9	50.0	97.3	73.7	79.0	58.7
12-Aug	90.0	67.8	76.5	57.5	49.0	98.0	72.6	76.5	56.4
19-Aug	86.0	67.5	76.1	56.6	49.0	92.4	71.1	75.8	55.4
26-Aug	85.0	66.4	73.3	55.3	46.0	95.9	71.3	73.0	54.4
2-Sep	82.0	65.0	71.4	54.0	46.0	91.0	71.1	69.8	52.1
9-Sep	83.0	61.3	69.2	51.3	42.0	86.1	67.4	66.5	48.4
16-Sep	79.0	64.5	67.5	51.6	43.0	86.1	66.8	67.4	50.2
23-Sep	79.0	66.2	66.7	50.5	40.0	91.7	70.9	66.2	49.3
30-Sep	74.0	61.2	64.5	48.3	40.0	86.1	68.2	62.4	46.5
7-Oct	70.0	61.0	61.2	47.6	37.0	77.0	65.3	59.4	44.7
14-Oct	70.0	61.0	59.5	45.8	35.0	72.1	62.3	56.6	42.5
21-Oct	64.0	57.4	55.4	42.5	32.0	70.0	59.8	51.1	37.4
28-Oct	64.0	57.6	53.4	40.7	31.0	70.0	60.0	47.2	35.1
4-Nov	60.0	54.8	50.4	40.0	28.0	65.8	57.6	44.9	33.7
11-Nov	59.0	54.6	47.5	37.4	25.0	59.5	54.7	40.6	30.3
18-Nov	56.0	51.9	46.0	36.5	25.0	56.0	53.3	38.7	28.7
25-Nov	56.0	52.0	44.0	34.9	23.0	59.5	55.1	36.9	27.3
2-Dec	54.0	50.7	40.6	32.5	18.0	52.5	51.5	32.9	24.7
9-Dec	53.0	49.8	40.8	32.3	18.0	50.4	51.0	32.8	24.1
16-Dec	54.0	50.3	38.9	31.1	17.0	51.8	52.3	31.2	23.1
23-Dec	55.0	50.6	39.6	32.3	18.0	56.7	52.4	32.9	24.1
31-Dec	55.0	51.3	38.8	31.1	12.0	51.8	51.3	31.2	23.3

FRANKFURT, GERMANY

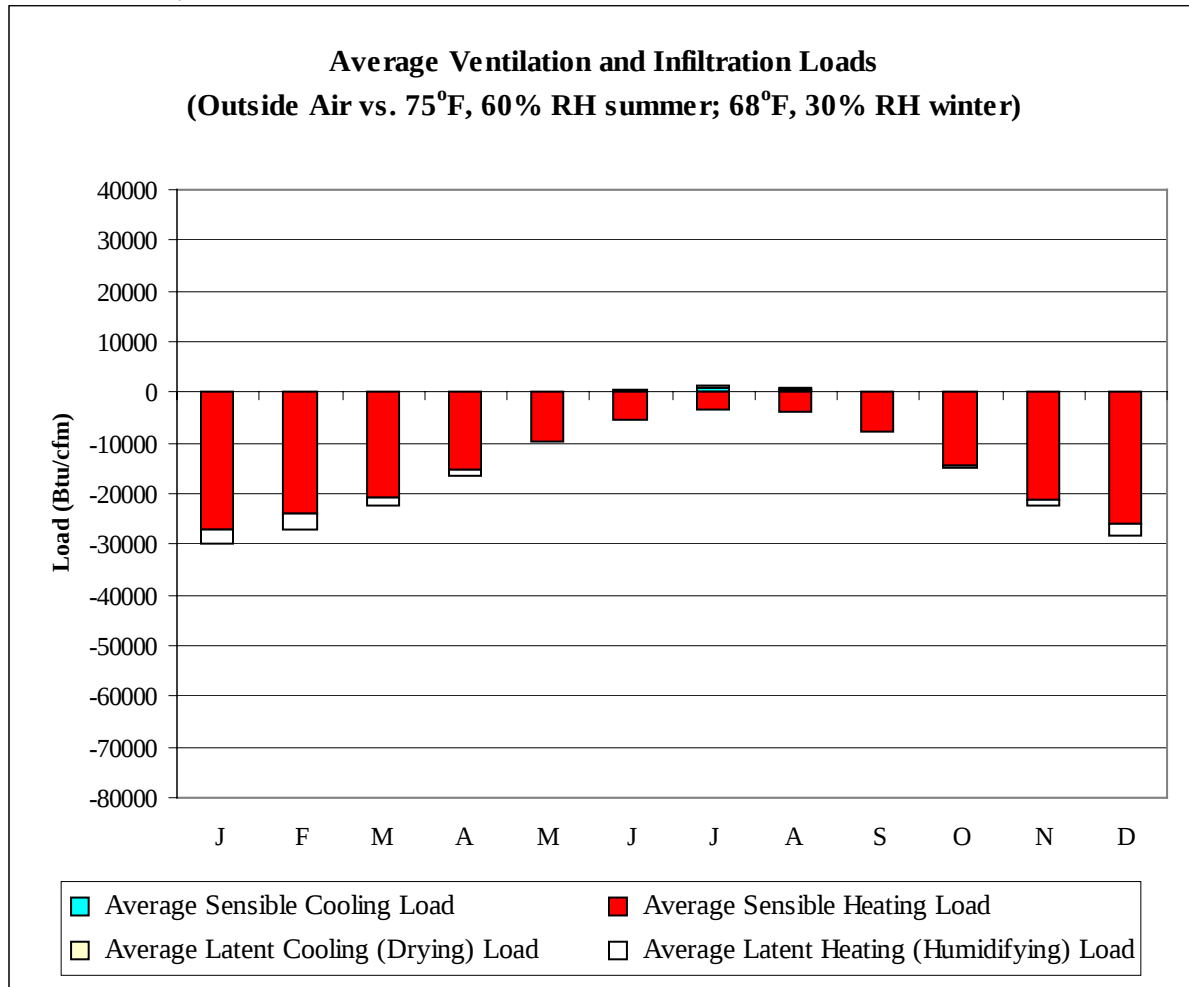
WMO No. 106370



	Mean Cooling Degree Days (°F)	Mean Heating Degree Days (°F)
JAN	0	946
FEB	0	847
MAR	0	704
APR	6	510
MAY	31	293
JUN	70	151
JUL	124	87
AUG	107	94
SEP	28	222
OCT	2	469
NOV	0	722
DEC	0	909
ANN	368	5954

FRANKFURT, GERMANY

WMO No. 106370



	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	-26947	0	-2994
FEB	0	-24134	0	-3073
MAR	0	-20640	0	-1880
APR	10	-15437	0	-1081
MAY	96	-9652	8	-154
JUN	365	-5572	208	-6
JUL	845	-3583	472	0
AUG	633	-3833	436	-1
SEP	77	-7691	103	-4
OCT	2	-14485	1	-203
NOV	0	-21050	0	-1228
DEC	0	-25978	0	-2499
ANN	2028	-179002	1228	-13123

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

No Solar Radiation
Data Available

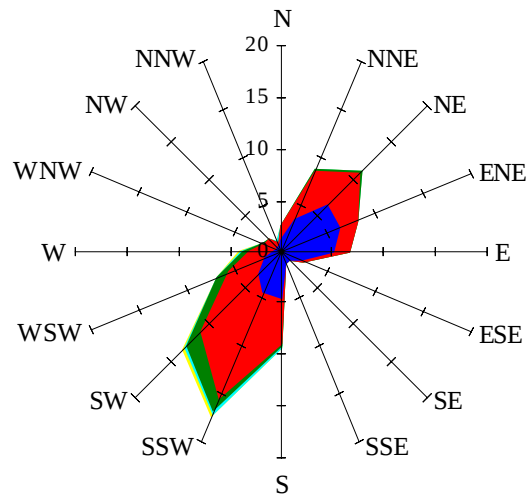


Average Annual Solar Heat and Illumination – Nearest Available Site

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

Wind Summary - December, January, and February

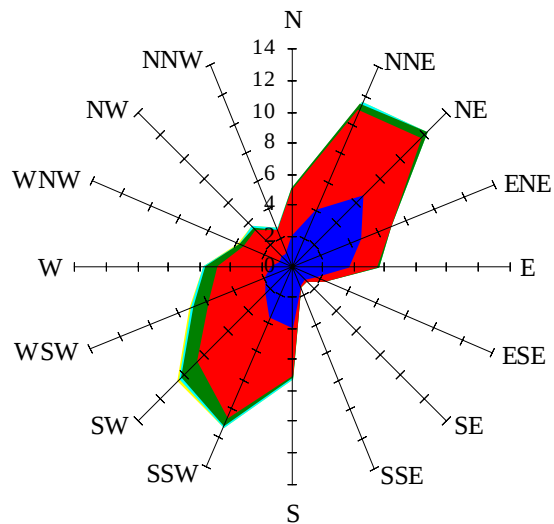
Labels of Percent Frequency on North Axis



Percent Calm = 3.17

Wind Summary - March, April, and May

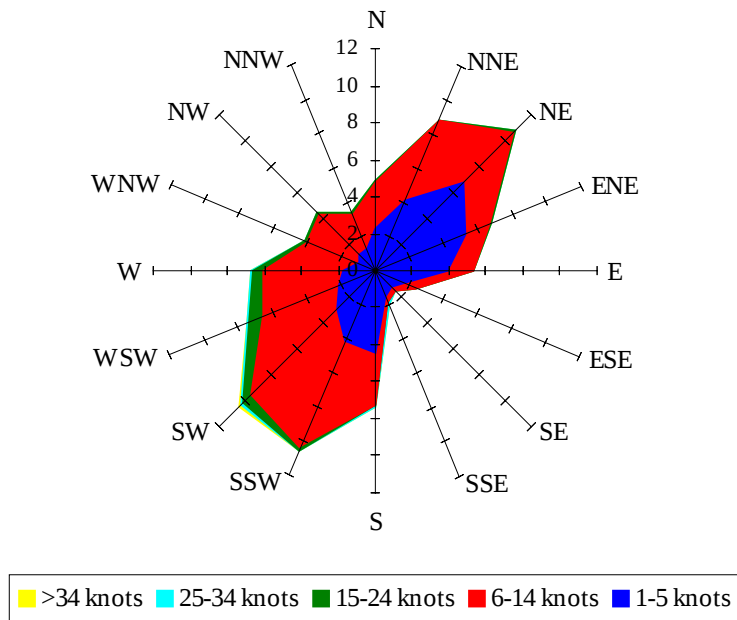
Labels of Percent Frequency on North Axis



Percent Calm = 2.90

Wind Summary - June, July, and August

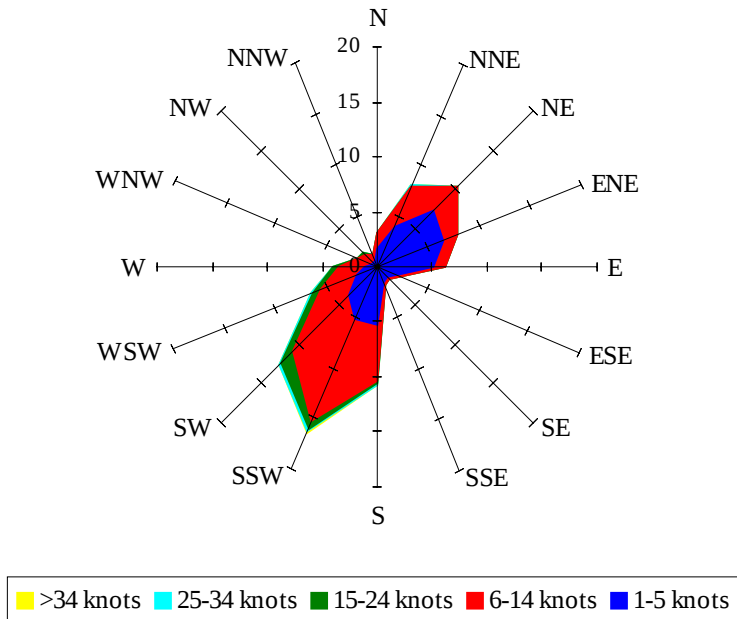
Labels of Percent Frequency on North Axis



Percent Calm = 3.47

Wind Summary - September, October, and November

Labels of Percent Frequency on North Axis



Percent Calm = 3.87