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HOURLY DISTRIBUTION AND INTENSITY OF PRECIPITATION AT KANSAS CITY, MO.

By HOWARD H. MARTIN

[Weather Bureau, Kansas City, Mo., November 1941]

The climatic records of Kansas City, in the heart of the Midwestern agricultural belt, are to be considered as representative of the greater part of that area, especially northwestern Missouri, northeastern Kansas, southwestern Iowa and southeastern Nebraska. It is not surprising, therefore, to find that the distribution of precipitation in the Kansas City area is of the type most favorable to plant growth, i. e., predominantly during nighttime hours. Considering the year as a whole, 64 percent of measurable precipitation falls between sunset and sunrise, and 77 percent falls between 11 p. m. and 11 a. m. (See fig. 1.) A study of figure 2 shows a rather sharp line of demarcation between the distribution during the dormant, or winter season, and during the vegetal, or growing season. During the dormant period there is but a slight variation of frequency throughout the 24 hours, the maximum being between 3 and 4 a. m. However, during the vegetal period, with the maximum frequency at sunrise, 88 percent of the hours with measurable precipitation are between 11 p. m. and 11 a. m. A study of figure 3, showing the distribution of precipitation by months, reveals that January shows two periods of maximum frequency, the major between 3 a. m. and 6 a. m. with a minor between 11 a. m. and 12 noon, and a definite period of minimum frequency between 7 and 9 p. m. In February the distribution is even more equable, with maxima at 3 a. m. and 4 p. m. and minima at 7 p. m. and 9 p. m.

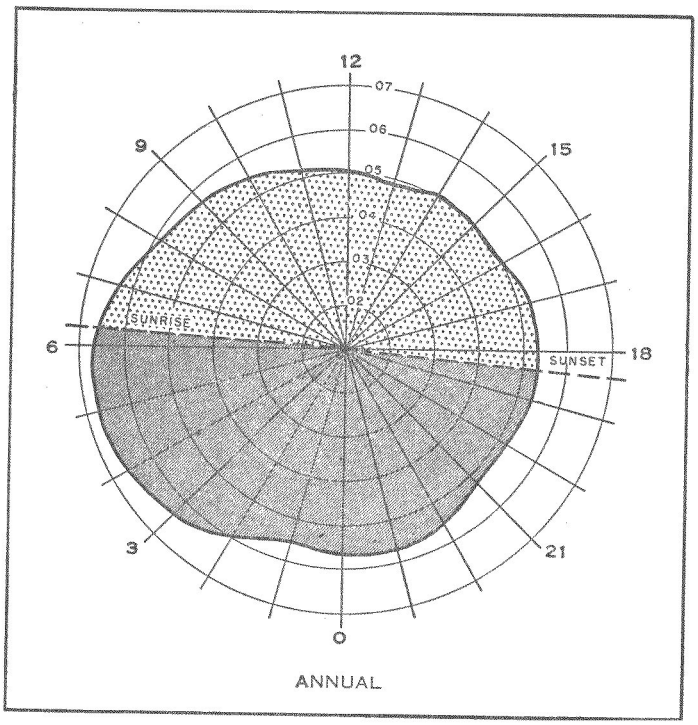

FIGURE 1.—Hourly distribution of precipitation throughout the day, entire year considered, at Kansas City, Mo., 1911–40.

Although March maintains a fairly equable distribution, there is now first evidence of a swing to summer trend. A definite maximum period of frequency between 5 and 7 a. m., and a minimum between 9 and 10 p. m. are indicated. April is the first month to show the frequency common to the vegetal period, with a prominent maximum between 5 and 6 a. m., and an equally pronounced minimum between 3 and 5 p. m. In April, 82 percent of the hours with measurable precipitation fall between 9 p. m. and 9 a. m.

While throughout the greater part of the year a preponderance of the measurable precipitation occurs during nighttime, in May the preponderance swings into the daylight period. With maxima at 4 a. m. and at 7 a. m., and a definite minimum at noon, 73 percent of hours with measurable rainfall lie between 11 p. m. and 11 a. m. June, also, shows a pronounced tendency toward daylight hours, 70 percent of the hours with precipitation falling between midnight and noon, with a frequency maximum between 4 a. m. and 7 a. m., and a minimum at 1 p. m. In July, but 38 percent of hours with measurable rainfall lie between sunset and sunrise, and a vast preponderance (86 percent) between the hours of 10 p. m. and 10 a. m. with a pronounced frequency maximum at 6 a. m., and minima at 11 a. m., 2 p. m. and 9 p. m.

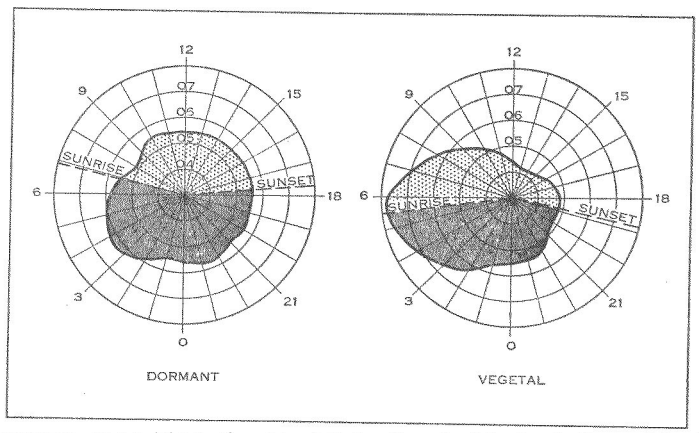

FIGURE 2.—Hourly distribution of precipitation throughout the day for the vegetal and dormant seasons of the year at Kansas City, Mo., 1911–40.

In August, hours with precipitation are again more frequent between sunset and sunrise, although 82 percent of the total lie between 10 p. m. and 10 a. m., with a definite frequency maximum at 6 a. m. and a minimum between 3 and 4 p. m. In September, although the bulk of hours with rainfall lie during the night period, 91 percent of these hours lie between 11 p. m. and 11 a. m., with a definite frequency maximum at 6 a. m. and a minimum from 3 to 9 p. m.

In October, there is a tendency to revert to the distribution common to the dormant period. Maxima occur at 5 a. m. and at 9–10 a. m., with minima at 2 p. m. and from 12–1 p. m. In November, a fairly equable distribution prevails with a frequency maximum 9–10 p. m. and a minimum at 9 a. m. In December, maxima are recorded at 3 p. m. and from 1–2 a. m., with minima at 7 a. m. and 7 p. m.

Figure 4 presents these distribution values in terms of number of times measurable rain was actually recorded; and figure 5 in actual amounts of rainfall measured for the several hours during the 30-year period of study.

Tables 1 to 4 are self-explanatory. In table 2 it is to be noted that the percentage value tabulated is the relation of the times that measurable precipitation actually occurred to the times possible in the 30-year period, while in table 3 the relation is between the times that measurable precipitation was recorded and the total hours of precipitation for the month within the period of study. In preparing the data for presentation, they were smoothed by the formula $\frac{a+2b+c}{4}$ in order to emphasize their salient characteristics and to eliminate or reduce sporadic fortuitous variations.

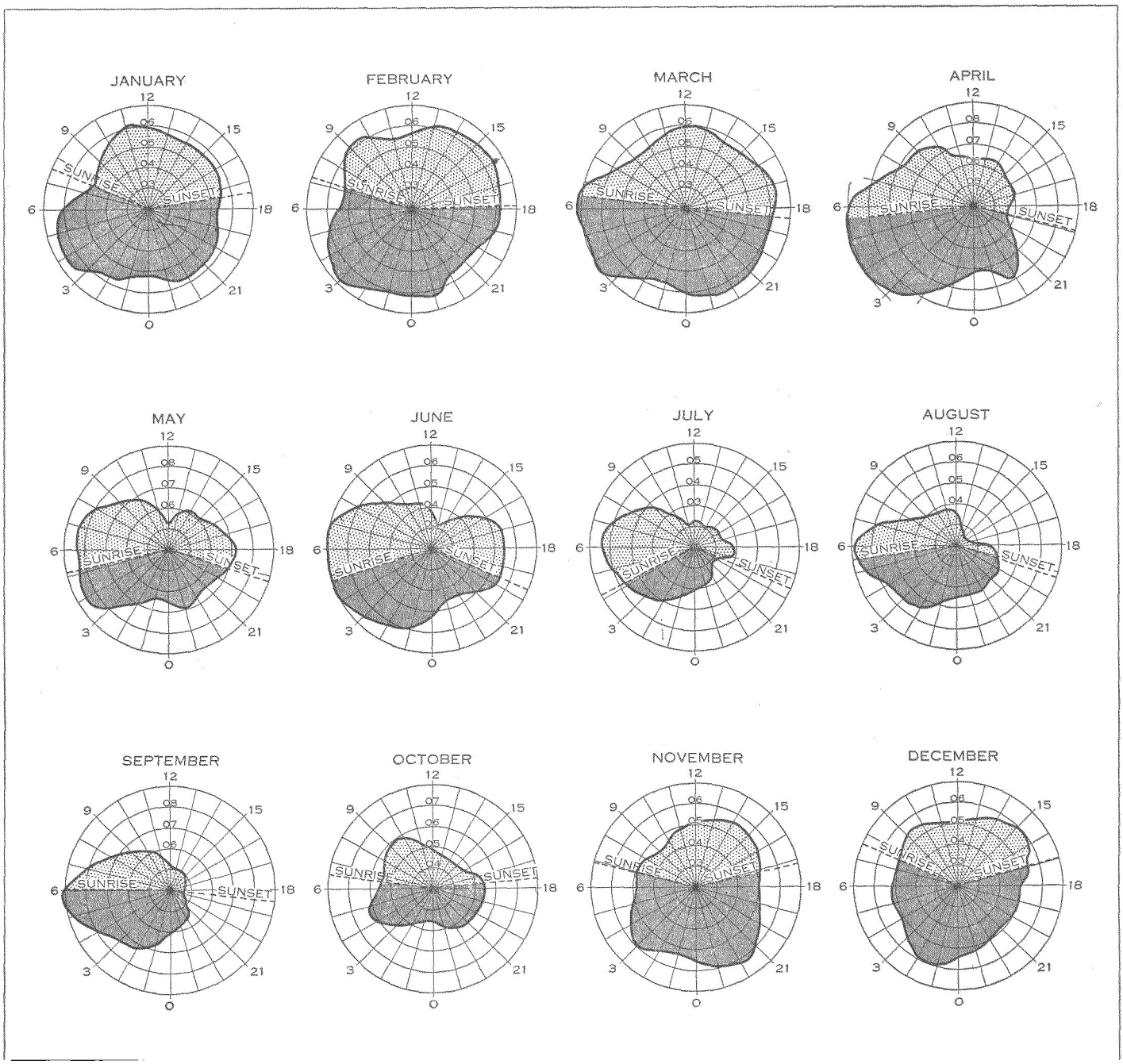

FIGURE 3.—Distribution of measurable precipitation throughout the day, by months, at Kansas City, Mo., 1911–40.

In the study of intensities and their distribution it is to be noted, from figures 6, 7, and 8, that there is no apparent relation between the period of maximum intensity and the period of greatest frequency. In fact, it is for the most

part true that throughout the year the maximum intensity, or greatest fall of rain per hour, occurs at or near the period of minimum frequency. Compare the two figures for April, May, July, August, and October, especially. From January to June the heaviest rainfall occurs during the daylight hours. In July the maximum intensity centers about 11 p. m., the secondary maximum in June lying between midnight and 2 a. m. In August the two maxima are at night, at 8 p. m. and 2 a. m., with a third period of intensity at 11 a. m. In September, the two maxima are at 3 a. m. and 8 a. m., while in October there is a definite shift the other way, with maxima at 10 p. m. and 5 p. m. In November and December the period of maximum intensity returns to daylight hours, being at 3 p. m. in November and at 7 a. m. in December.

Table 5 presents these data in actual values, and table 6 shows the heaviest hourly recording for each month of the period studied.

For purposes of local forecasting, the past data on distribution of precipitation may prove of value. For instance, there are no definite periods of maximum frequency in January, February and March; but in April, measurable precipitation is 30 percent more frequent between 2 and 7 a. m. than between 5 and 8 p. m. In May, measurable rain is 25 percent more likely between 3 and 4 a. m. than 11 a. m. and noon. In June, the relative frequency of precipitation between 2 and 7 a. m. is 62 percent, while between 12 noon and 1 p. m. it is but 30 percent, a difference of 32 percent. In July, measurable rain is 32 percent more likely between 5 and 6 a. m. than between 11 a. m. and 3 p. m., and in August 29 percent more between 4 and 6 a. m. than between 1 and 5 p. m. In September, precipitation is 38 percent more frequent between 4 and 6 a. m. than between 4 and 8 p. m., while in October it is but 26 percent more likely between 4 and 7 a. m. than between 3 and 5 p. m.

In November and December the intensities as well as the distribution return to the equable character of the winter months. As a rule, whenever precipitation of measurable amount is to be expected in the Kansas City area at all, the probabilities appear to be heavily in favor of its fall during the early morning hours. Afternoon precipitation is more infrequent but heavier, on an average, although a study of the excessive values (1.00 inch or more per hour) will show a fairly even distribution around the clock, with a minimum in the early afternoon, and maxima at several points from 6 p. m. to 10 a. m.

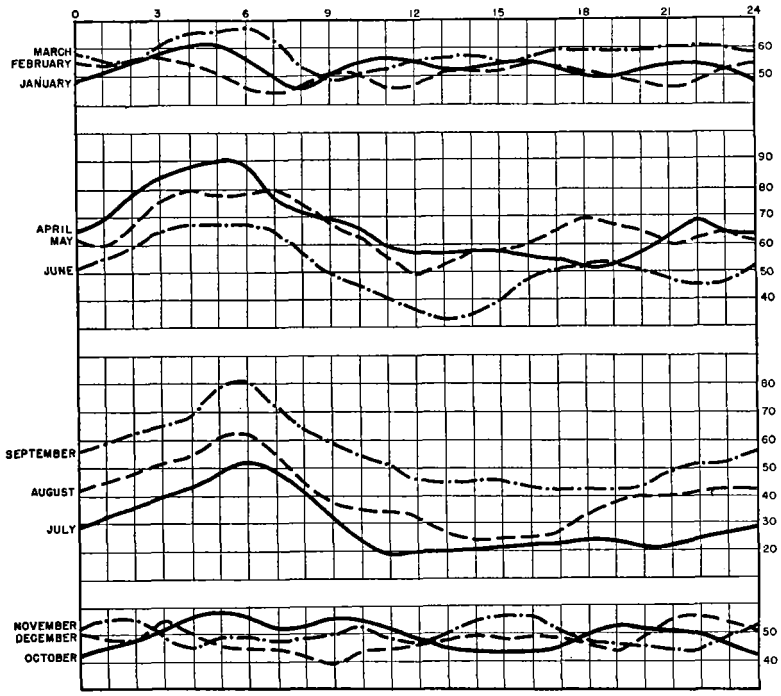

FIGURE 4.—Hourly relative frequency of precipitation at Kansas City, Mo., by months, in terms of percentage of average number of hourly recordings, 1911-40.

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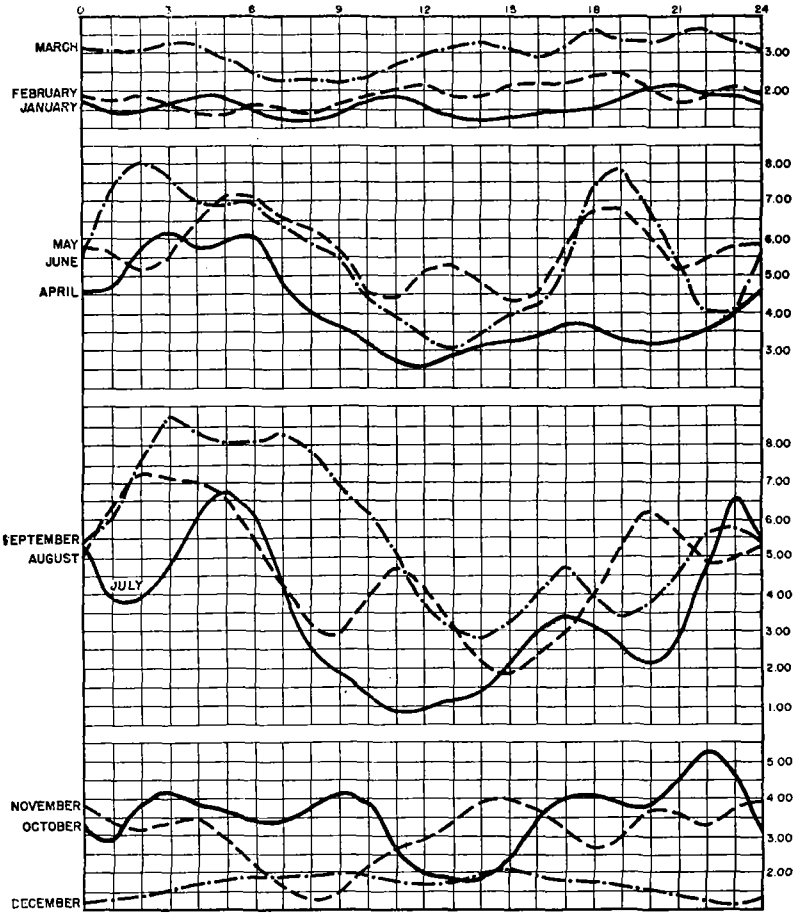

FIGURE 5.—Distribution of precipitation at Kansas City, Mo., hourly by months, in terms of total amount of precipitation recorded, 1911–40.

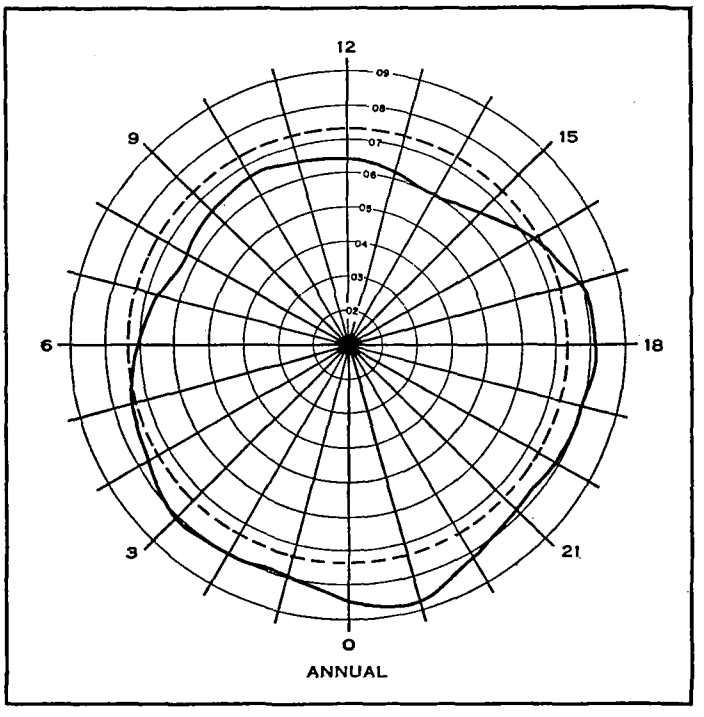

FIGURE 6.—Hourly intensity of precipitation, full yearly records, at Kansas City, Mo., 1911–40.

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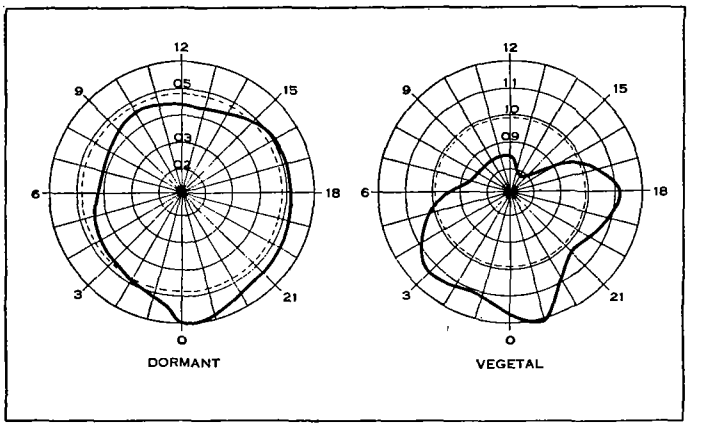

FIGURE 7.—Hourly intensi y of precipitation at Kansas City, Mo., during the vegetal and dormant seasons of the year, 1911–40.

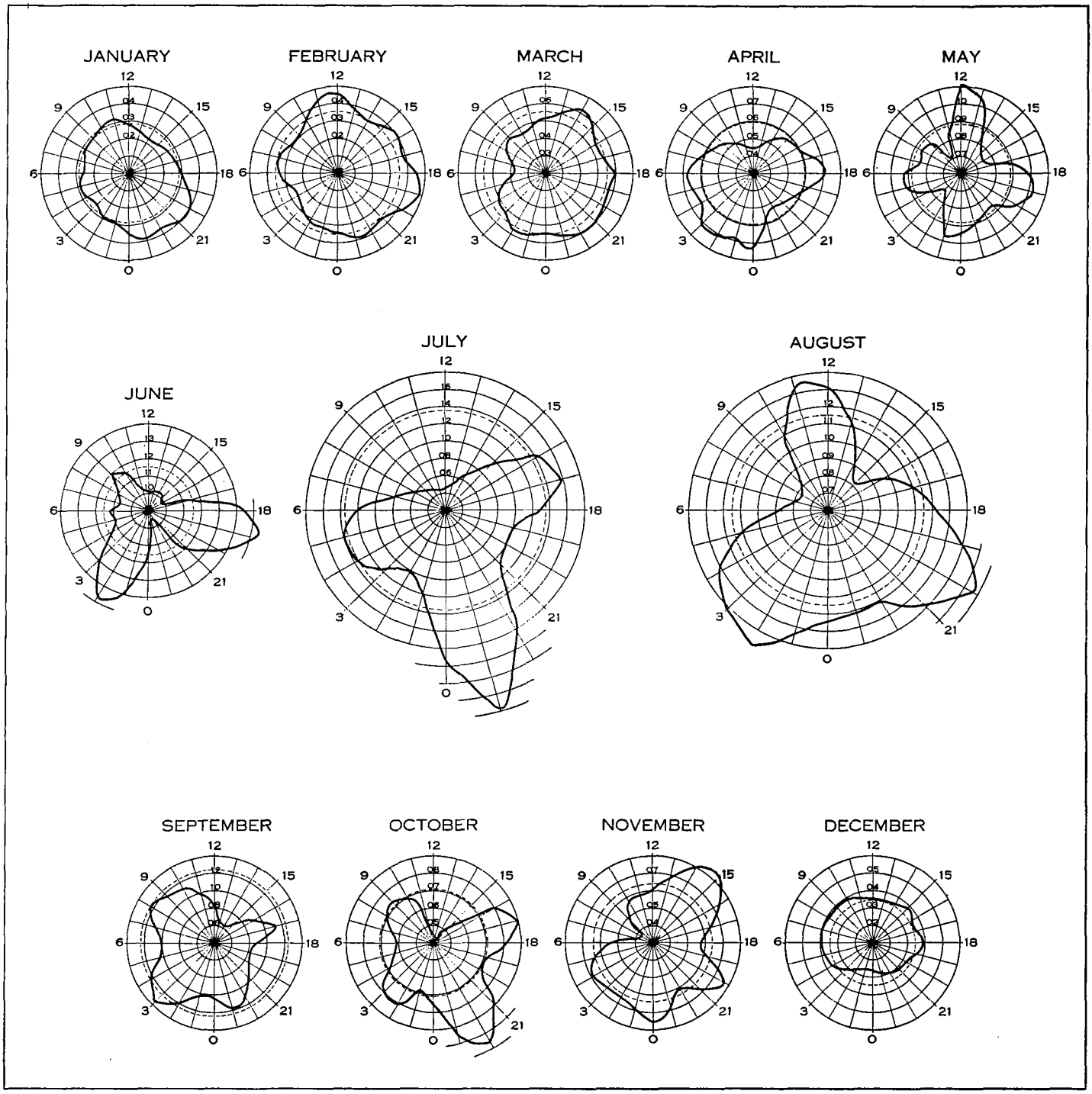

FIGURE 8.—Hourly intensity of precipitation by months at Kansas City, Mo., 1911–40.

TABLE 1.—*Showing the number of times measurable precipitation has occurred during each hour of the day, for the period of record, 1911 to 1940*

Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
January	48	58	55	64	59	62	47	39	52	53	60	56	51	51	55	56	50	53	46	53	52	57	50	49
February	49	58	57	56	51	45	43	46	54	51	44	44	54	52	51	56	51	54	50	51	44	47	55	55
March	52	51	63	67	61	67	69	47	49	49	54	53	59	52	54	55	60	60	57	60	58	63	60	60
April	67	80	85	86	90	95	77	63	75	65	57	57	55	60	52	54	59	46	52	53	62	72	67	60
May	54	68	73	85	77	74	85	72	67	62	61	38	55	61	51	64	62	72	64	62	59	61	69	61
June	54	54	60	64	64	61	66	52	49	37	43	33	28	31	40	41	53	45	52	51	43	42	39	51
July	31	38	40	43	48	53	52	39	36	23	15	12	21	17	24	20	21	26	25	20	18	29	25	29
August	44	51	51	50	65	66	54	41	36	36	35	33	27	22	25	22	25	33	39	40	40	41	42	40
September	60	64	65	65	82	85	71	63	60	53	54	45	43	45	47	41	44	41	42	41	49	51	52	51
October	42	49	51	60	57	56	50	49	60	55	50	48	45	42	44	41	45	48	56	48	51	52	47	40
November	48	46	54	53	42	43	46	40	38	41	46	43	51	47	49	49	49	46	43	50	53	59	51	51
December	56	55	50	44	52	45	48	45	52	53	48	43	51	55	55	57	50	45	48	46	45	39	52	47

TABLE 2.—*Showing the distribution of measurable precipitation by hourly percentage of the total number of hours possible, for the period, 1911 to 1940, inclusive*

Hours	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
January	5.2	6.2	5.9	6.9	6.3	6.7	5.1	4.2	5.6	5.7	6.4	6.0	5.5	5.5	5.9	6.0	5.4	5.7	4.9	5.7	5.6	6.1	5.4	5.3
February	5.2	6.9	6.8	6.7	6.1	5.4	5.2	5.5	6.4	6.1	5.2	5.2	6.4	6.2	6.1	6.7	6.1	6.4	6.0	6.1	5.2	5.6	6.5	6.5
March	5.6	5.5	6.8	7.2	6.6	7.2	7.4	5.1	5.3	5.3	5.8	5.7	6.3	5.6	5.8	5.9	6.4	6.4	6.1	6.4	6.2	6.8	6.4	6.4
April	7.4	9.0	9.4	9.6	10.0	10.6	8.6	7.0	7.7	7.3	6.3	6.3	6.1	6.7	5.8	6.0	6.6	5.1	5.8	5.9	6.9	8.0	7.5	6.7
May	5.8	7.3	7.8	9.1	8.3	8.0	9.1	7.7	7.2	6.7	6.6	4.1	5.9	6.6	5.5	6.9	6.7	7.7	6.9	6.7	6.3	6.6	7.4	6.6
June	6.0	6.0	6.7	7.1	7.1	6.8	7.3	5.8	5.4	4.0	4.8	3.7	3.1	3.3	4.4	4.5	6.0	5.0	5.8	5.7	4.8	4.7	4.3	5.7
July	3.3	4.1	4.3	4.6	5.2	5.7	5.6	4.2	3.9	2.5	1.6	2.4	2.3	1.8	2.6	2.2	2.3	2.8	2.7	2.2	1.9	3.1	2.7	3.1
August	4.7	5.5	5.5	5.4	7.0	7.1	5.8	4.4	3.9	3.9	3.8	3.5	2.9	2.4	2.7	2.4	2.7	3.5	4.2	4.3	4.3	4.4	4.5	4.3
September	6.7	7.1	7.3	7.3	9.1	9.4	8.0	7.0	6.7	6.0	6.0	5.0	4.8	5.0	5.2	4.6	4.9	4.6	4.7	4.6	5.4	5.7	5.8	5.7
October	4.5	5.3	5.5	6.4	6.1	6.0	5.4	5.3	6.4	5.9	5.4	5.2	4.8	4.5	4.7	4.4	4.8	5.2	6.0	5.2	5.5	5.6	5.1	4.3
November	5.3	5.1	6.0	5.9	4.7	4.8	5.1	4.5	4.2	4.5	5.1	4.8	5.7	5.2	5.4	5.4	5.4	5.1	5.1	5.5	6.0	6.2	5.9	5.6
December	6.0	5.9	5.4	4.7	5.6	4.8	5.2	4.8	5.6	5.7	5.2	4.6	5.5	5.9	5.9	6.1	5.4	4.8	5.2	4.9	4.8	4.2	5.6	5.1
Year	5.5	6.2	6.5	6.7	6.9	6.9	6.5	5.5	5.7	5.3	5.2	4.7	4.9	4.9	5.0	5.1	5.2	5.2	5.3	5.3	5.2	5.6	5.6	5.4

TABLE 3.—*Showing the distribution of measurable precipitation by hourly percentages of the total hours recorded, for period, 1911 to 1940, inclusive, Kansas City, Mo.*

Hours	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
January	3.8	4.5	4.3	5.0	4.6	4.9	3.7	3.1	4.1	4.2	4.7	4.4	4.0	4.0	4.3	4.4	3.9	4.2	3.6	4.2	4.1	4.5	3.9	3.8
February	4.0	4.8	4.7	4.6	4.2	3.7	3.5	3.8	4.4	4.2	3.6	3.6	4.4	4.3	4.2	4.6	4.2	4.4	4.1	4.2	3.6	3.8	4.5	4.5
March	3.8	3.7	4.6	4.9	4.4	4.9	5.0	3.1	3.6	3.6	3.9	3.8	4.3	3.7	3.9	4.0	4.3	4.3	4.1	4.3	4.2	4.6	4.3	4.3
April	4.2	5.0	5.3	5.4	5.7	5.9	4.8	4.0	4.7	4.1	3.6	3.6	3.5	3.8	3.3	3.4	3.7	2.9	3.3	3.3	3.9	4.5	4.2	3.8
May	3.5	4.4	4.7	5.5	4.9	4.8	5.5	4.6	4.3	4.0	3.9	2.4	3.5	3.9	3.3	4.1	4.0	4.6	4.1	4.0	3.8	3.9	4.4	3.9
June	4.7	4.7	5.2	5.6	5.6	5.3	5.7	4.5	4.2	3.2	3.7	2.9	2.4	2.7	3.5	3.6	4.6	3.9	4.5	4.4	3.7	3.6	3.4	4.4
July	4.3	5.3	5.6	6.0	6.7	7.4	7.4	5.5	5.0	3.2	2.1	3.1	3.1	2.4	3.4	2.8	3.1	3.6	3.5	2.8	2.5	4.1	3.5	4.1
August	4.6	5.3	5.3	5.2	6.8	6.9	5.6	4.3	3.8	3.8	3.7	3.4	2.8	2.3	2.6	2.3	2.6	3.3	4.1	4.2	4.2	4.3	4.4	4.2
September	4.6	4.9	4.9	4.9	6.2	6.5	5.4	4.8	4.6	4.0	4.1	3.4	3.3	3.4	3.6	3.1	3.3	3.1	3.2	3.1	3.7	3.9	4.0	3.9
October	3.5	4.1	4.3	5.1	4.8	4.7	4.2	4.1	5.1	4.6	4.2	4.0	3.8	3.5	3.7	3.5	3.8	4.0	4.7	4.0	4.3	4.4	4.0	3.4
November	4.2	4.0	4.7	4.7	3.7	3.8	4.0	3.5	3.3	3.6	4.0	3.8	4.5	4.1	4.3	4.3	4.3	4.0	3.8	4.4	4.7	5.2	4.5	4.5
December	4.7	4.7	4.2	3.7	4.4	3.8	4.1	3.8	4.4	4.5	4.1	3.6	4.3	4.7	4.7	4.8	4.2	3.8	4.1	3.9	3.8	3.3	4.4	4.0
Year	4.2	4.6	4.8	5.0	5.2	5.2	4.9	4.1	4.3	3.9	3.8	3.5	3.7	3.6	3.7	3.8	3.8	3.8	3.9	3.9	3.9	4.2	4.1	4.1

TABLE 4.—*Showing the distribution of measurable precipitation by hourly totals, Kansas City, Mo., period 1911 to 1940, inclusive*

Hours	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
January	1.41	1.57	1.34	1.89	1.84	1.53	1.18	1.14	1.36	1.65	2.07	1.54	1.21	1.29	1.15	1.61	1.36	1.52	1.53	2.33	2.09	1.80	2.08	1.55
February	1.52	2.05	1.55	1.40	1.43	1.42	1.66	1.33	1.55	1.84	1.84	2.46	1.73	1.62	2.23	2.12	1.95	2.40	2.81	1.77	1.62	1.81	2.28	1.75
March	3.48	2.60	3.46	3.51	2.71	2.46	2.28	2.49	2.24	2.19	2.87	2.71	3.15	3.43	3.21	2.72	2.74	4.32	2.84	3.54	3.53	3.45	3.93	2.48
April	4.06	5.55	7.28	4.46	6.40	6.68	4.53	3.92	3.71	3.31	2.72	2.50	2.59	3.32	2.91	3.03	3.91	3.58	3.23	2.94	3.62	3.31	3.68	5.20
May	6.14	4.48	5.72	6.09	7.74	7.06	6.49	6.07	6.77	3.18	4.90	4.96	5.65	4.91	4.23	4.03	5.63	7.36	6.06	7.18	3.69	6.21	5.48	5.86
June	7.72	8.28	7.71	6.93	6.45	7.67	6.15	5.91	5.63	4.84	3.68	3.61	2.75	3.07	4.49	3.40	5.30	7.71	8.83	6.07	6.01	3.30	3.52	5.65
July	2.34	4.59	3.83	6.61	6.93	6.37	4.57	1.79	2.20	1.48	0.43	0.92	1.30	0.95	1.99	3.14	3.63	3.48	2.14	2.25	1.48	5.32	7.41	5.89
August	6.00	8.32	6.61	7.33	6.94	5.14	4.83	2.50	3.10	2.99	6.37	3.28	3.69	1.66	1.80	2.36	2.64	4.01	5.17	7.17	5.53	4.43	5.43	4.61
September	6.34	7.07	9.89	7.86	8.18	8.01	7.94	9.07	5.70	7.33	4.80	3.87	3.02	2.29	3.75	2.92	6.38	2.87	3.77	3.28	4.44	5.96	6.44	4.53
October	2.13	4.38	4.65	3.14	4.26	2.98	3.42	3.68	4.10	4.45	2.43	1.86	2.01	1.39	2.18	3.76	4.04	4.18	3.75	3.22	4.31	6.16	4.60	2.98
November	3.41	2.92	3.49	3.65	3.12	1.97	1.74	1.12	1.07	2.29	2.80	2.29	3.90	3.64	4.35	3.50	3.21	2.29	2.48	4.54	3.33	3.01	3.85	3.96
December	1.43	1.24	1.69	1.60	1.78	1.86	1.87	1.82	1.96	2.05	1.73	1.65	1.65	1.80	2.25	1.79	1.68	1.84	1.62	1.55	1.38	1.30	1.07	1.26
Year	3.83	4.42	4.77	4.54	4.82	4.43	3.89	3.40	3.28	3.13	3.05	2.64	2.72	2.45	2.88	2.86	3.54	3.80	3.70	3.82	3.42	3.84	4.15	3.81

TABLE 5.—*Showing the intensity of hourly precipitation, Kansas City, Mo., period 1911 to 1940, inclusive (expressed in thousandths of an inch)*

Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
January	0.029	0.027	0.025	0.028	0.031	0.025	0.025	0.029	0.026	0.031	0.035	0.027	0.024	0.024	0.021	0.028	0.027	0.029	0.033	0.044	0.040	0.032	0.042	0.032
February	.031	.035	.027	.025	.028	.033	.039	.030	.029	.036	.042	.056	.032	.031	.044	.038	.038	.044	.056	.035	.037	.038	.042	.032
March	.065	.051	.055	.052	.044	.037	.033	.053	.046	.045	.053	.051	.053	.066	.060	.050	.046	.072	.050	.059	.061	.055	.067	.041
April	.061	.069	.086	.052	.071	.070	.059	.062	.050	.051	.047	.044	.047	.055	.056	.057	.066	.077	.062	.056	.059	.046	.055	.087
May	.114	.066	.078	.071	.100	.095	.077	.084	.100	.051	.080	.131	.103	.080	.083	.063	.091	.102	.095	.116	.064	.102	.079	.096
June	.143	.154	.129	.109	.100	.126	.093	.114	.115	.131	.086	.110	.098	.099	.112	.083	.100	.171	.170	.119	.140	.079	.090	.111
July	.075	.121	.096	.154	.144	.120	.088	.046	.053	.065	.029	.042	.062	.056	.083	.157	.173	.135	.086	.112	.082	.183	.298	.203
August	.134	.163	.130	.147	.107	.078	.090	.061	.086	.083	.182	.100	.137	.075	.072	.107	.106	.122	.133	.179	.138	.108	.129	.115
September	.106	.110	.152	.121	.099	.098	.112	.144	.095	.138	.089	.086	.070	.051	.085	.071	.145	.070	.090	.080	.091	.117	.128	.089
October	.051	.089	.091	.052	.075	.053	.068	.075	.068	.081	.049	.039	.045	.033	.049	.092	.090	.087	.067	.067	.085	.119	.097	.075
November	.071	.064	.065	.069	.074	.046	.039	.028	.054	.056	.058	.053	.076	.077	.089	.072	.066	.050	.058	.091	.063	.051	.076	.078
December	.026	.023	.034	.034	.034	.041	.039	.040	.038	.039	.036	.038	.032	.033	.041	.032	.034	.041	.034	.034	.031	.034	.021	.027
Year	.077	.081	.081	.076	.076	.068	.066	.064	.064	.067	.067	.065	.065	.057	.066	.071	.082	.083	.078	.083	.074	.080	.094	.082

TABLE 6.—*Showing the maximum amounts of precipitation recorded by hours at Kansas City, Mo., for the period 1911 to 1940, inclusive. The maximum precipitation for any hour within the period was 2.94 inches in September 1914. The maximum precipitation for any hour of record at Kansas City was 4.79 inches in August 1906*

Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
January	0.16	0.14	0.13	0.15	0.24	0.15	0.13	0.15	0.20	0.15	0.24	0.20	0.26	0.11	0.08	0.32	0.17	0.19	0.26	0.48	0.15	0.12	0.15	0.15
February	.17	.20	.13	.11	.18	.20	.16	.11	.11	.10	.24	.30	.18	.13	.19	.16	.20	.60	.45	.31	.23	.27	.39	.13
March	.38	.27	.31	.52	.17	.32	.28	.32	.20	.16	.33	.24	.24	.31	.22	.35	.15	1.15	.21	.50	.31	.31	.37	.22
April	.58	.99.	.60	.42	.93	.42	.34	.32	.27	.17	.21	.23	.18	.25	.25	.25	.88	.56	.56	.41	.77	.86	.86	.72
May	1.47	.50	.33	.83	1.38	.67	1.12	1.12	1.57	.36	.53	1.00	.50	.64	.39	.67	.77	1.10	.63	1.12	.43	.53	.54	.80
June	1.35	1.15	.43	.46	.56	1.79	1.48	.65	.87	2.28	.86	.89	.93	.61	1.00	.98	.79	1.48	1.42	1.14	.74	.36	.89	.96
July	.40	1.01	.52	1.15	1.90	1.24	.55	.24	.23	.46	.15	.25	.36	.20	.23	.58	.93	.64	.67	.70	.39	.99	2.62	1.92
August	.84	1.75	1.08	1.26	1.00	.70	1.45	.40	.49	.94	1.50	.62	.75	.56	.38	.53	.46	.76	.94	1.03	1.06	.56	1.07	.67
September	.84	.82	1.33	1.36	.58	.84	1.86	2.57	1.11	1.04	.35	.57	.46	.35	.66	.48	.93	.25	.78	.52	.63	.40	1.17	.40
October	.21	.55	.61	.27	.62	.35	.33	.72	.58	.52	.35	.63	.39	.33	.25	.43	54.	.57	.40	.38	1.67	1.65	.62	.79
November	.28	.30	.47	.41	.34	.80	.46	.28	.23	.26	.32	.31	.34	.37	.67	.50	.31	.25	.20	.54	.40	.36	.67	.42
December	.10	.09	.20	.22	.34	.37	.17	.33	.17	.45	.21	.15	.18	.10	.24	.19	.16	.26	.33	.19	.15	.20	.35	.16
Year	1.47	1.75	1.33	1.36	1.90	1.79	1.86	2.57	1.57	2.28	1.50	1.00	.93	.64	1.00	.98	.93	1.48	1.42	1.14	1.67	1.65	2.62	1.92

METEOROLOGICAL AND CLIMATOLOGICAL DATA FOR JULY 1942

[Climate and Crop Weather Division, J. B. KINCER, in charge]

AEROLOGICAL OBSERVATIONS

TABLE 1.—*Mean free-air barometric pressure in millibars, temperature in degrees Centigrade, and relative humidities in percent, obtained by airplanes and radiosondes during July 1942*

Altitude (meters) m. s. l.	Stations with elevations in meters above sea level																							
	Albuquerque, N. Mex. (1,620 m.)				Atlanta, Ga. (300 m.)				Bismarck, N. Dak. (505 m.)				Boise, Idaho (864 m.)				Brownsville, Tex. (6 m.)				Buffalo, N. Y. (221 m.)				Caribou, Maine (191 m.)			
	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity	Number of observations	Pressure	Temperature	Relative humidity
Surface	29	840	26.1	32	31	984	24.2	83	31	955	20.2	78	31	914	25.6	32	30	1,016	26.6	87	31	990	19.4	79	29	991	15.1	83
500	----	------	------	----	31	962	24.8	76	----	------	------	----	----	------	------	----	30	961	24.8	84	31	958	19.4	73	29	955	16.6	68
1,000	----	------	------	----	31	909	22.6	72	31	902	19.5	65	31	900	27.7	29	30	908	22.4	66	31	904	16.9	70	29	901	14.1	65
1,500	----	------	------	----	31	858	19.3	74	31	851	16.5	65	31	850	25.5	27	30	857	20.0	60	31	853	13.8	73	29	849	10.8	67
2,000	29	805	24.7	33	31	809	16.0	73	31	801	13.6	62	31	803	21.5	27	30	808	17.0	57	31	803	10.7	67	29	799	7.6	70
2,500	29	760	21.0	34	31	763	12.9	72	31	756	10.7	59	31	757	17.2	28	30	762	14.1	56	31	756	8.2	56	28	752	4.9	67
3,000	29	717	17.1	35	31	719	10.0	72	31	711	7.5	56	31	714	13.0	30	30	718	11.4	54	31	712	5.7	53	28	707	2.4	63
4,000	29	637	8.7	42	31	637	4.5	68	31	630	1.3	51	31	632	5.3	34	30	636	5.9	50	30	629	.7	49	28	624	−2.4	52
5,000	29	564	.8	51	31	563	−1.0	64	31	555	−5.3	47	31	559	−2.2	37	30	563	.4	47	29	555	−5.0	45	28	550	−8.2	49
6,000	29	497	−6.6	57	31	496	−6.7	62	31	488	−11.7	43	31	492	−9.5	38	30	496	−5.7	45	29	488	−11.3	40	27	483	−14.3	45
7,000	29	437	−12.9	56	31	436	−13.2	60	31	428	−18.9	40	31	431	−16.9	37	28	436	−11.8	43	28	428	−17.8	39	27	422	−21.4	43
8,000	29	382	−19.8	53	31	381	−19.8	58	31	372	−26.3	39	28	377	−24.5	36	27	382	−18.9	43	28	373	−24.7	38	27	368	−28.8	42
9,000	28	333	−26.8	51	31	332	−26.7	57	28	324	−33.7	39	28	328	−32.1	36	27	332	−26.0	42	27	324	−31.5	38	27	319	−36.1	42
10,000	28	290	−34.3	50	31	289	−34.1	55	28	280	−41.0	----	27	284	−39.2	35	25	289	−33.7	42	25	282	−38.6	36	27	276	−42.8	----
11,000	28	251	−42.1	----	30	250	−42.0	----	28	241	−47.7	----	25	245	−45.8	----	25	250	−41.8	----	22	243	−45.8	----	26	238	−48.0	----
12,000	28	216	−49.3	----	30	215	−49.6	----	28	207	−52.2	----	23	210	−51.0	----	24	215	−50.0	----	21	209	−51.9	----	26	204	−51.4	----
13,000	28	185	−55.8	----	30	184	−57.1	----	28	177	−54.9	----	22	180	−54.2	----	23	184	−57.8	----	21	179	−55.9	----	25	175	−53.4	----
14,000	25	158	−61.8	----	29	157	−63.2	----	28	151	−56.8	----	20	154	−56.7	----	22	157	−64.8	----	20	152	−58.4	----	24	150	−54.5	----
15,000	23	134	−66.0	----	28	133	−66.5	----	26	129	−58.5	----	17	131	−59.7	----	22	133	−69.7	----	18	130	−60.2	----	23	128	−55.8	----
16,000	21	114	−68.6	----	28	113	−67.9	----	22	110	−58.8	----	16	112	−61.8	----	21	112	−72.5	----	17	111	−61.1	----	22	110	−56.2	----
17,000	20	96	−69.1	----	26	96	−66.8	----	18	94	−58.6	----	14	95	−61.4	----	17	94	−73.1	----	14	94	−60.6	----	16	94	−55.8	----
18,000	19	81	−66.7	----	25	81	−64.9	----	14	80	−58.0	----	14	81	−59.3	----	16	80	−71.4	----	12	80	−59.1	----	10	80	−55.0	----
19,000	16	69	−63.5	----	21	69	−62.3	----	6	68	−55.9	----	11	69	−57.2	----	13	67	−68.6	----	5	68	−57.8	----	----	------	------	----
20,000	12	59	−60.8	----	8	59	−59.3	----	----	------	------	----	7	59	−55.5	----	10	56	−64.4	----	----	------	------	----	----	------	------	----
21,000	7	50	−57.5	----	----	------	------	----	----	------	------	----	----	------	------	----	----	------	------	----	----	------	------	----	----	------	------	----