produce their encysted forms. The bottom is crusted with matted algæ bearing their own spores or oögonia, resting stages which long retain their vitality and which are ready at any time to profit by wind transport. Among the algæ there may be flagellates, bacteria, diatoms, the spores of aquatic mosses, of horsetails, of club mosses, and quillworts, and the minute seeds of rushes. There may be also cysts of protozoa, gemmules of fresh-water sponges, the statoblasts of bryozoa, and the eggs of worms, leeches, crustacea, insects, and molluscs, all of which may be minute enough to be carried readily by the wind and resistant enough to survive the process. Untold numbers of these reproductive bodies may be gathered up by the wind and carried long distances. This goes far to explain the extremely wide, often cosmopolitan distribution of fresh water microorganisms.

It is not only aquatic organisms that have spores suitable for carriage by the wind, but also a long series of terrestrial ones including bacteria, algæ, fungi, mosses, liverworts, ferns, and club mosses. Dust-like seeds as those of orchids, broom-rapes, pyrolas, live-for-evers, etc., are almost as well adapted to wind transport as are spores. Perhaps the best illustration that can be given of the potency of the wind in distributing these plants is the part it played in the revegetation of the isolated volcanic island Krakatoa from which all life was extirpated by the 1883 eruption of almost unparalleled violence. From 16 to 30 per cent of the phanerogams established on Krakatoa 25 years after the catastrophe of 1883 were carried there by winds, as were all of the ferns (16 species) and lower cryptogams, almost without exception (more than 30 species). Between 49 and 63 per cent of its flora, therefore, is wind-borne. The first recolonization of the island in 1886 was entirely by wind-distributed species as algæ, bacteria, diatoms, liverworts, mosses, and ferns.[61]

The distribution of spores and other light reproductive cells does not depend on sporadic gusts of wind that suddenly pick up a quantity of these objects to later drop them as showers of organisms; there seem to be a certain number of them always in the atmosphere. In fact, aeroscopes reveal a steady fall of atmospheric dust, including minute organisms, that must be a far more important element in the distribution of such life than the more impressive but sporadic showers.

CONCLUSION.

It would appear, therefore, that the more spectacular the shower of organic matter the less its importance in the distribution of life. The rains of larger animals have attracted much attention and excited wonder, but in many cases the animals have been dead; in others they were doomed to die because of falling in an unsuitable environment. Not often are all the conditions propitious for the species to secure a new foothold.

The unobtrusive, but steady and widespread movement of minute eggs and spores by the atmosphere, however, is of great importance in distribution because these organic bodies are adapted to survive such transport; their numbers are so great and their dispersal so wide that some of them will necessarily fall in favorable places. The chances are, in fact, that every suitable environment will be populated. So far as mere preservation of species is concerned, we see here, as in other phases of biological investigation, the superiority of the pigmy over the giant, of insignificance over conspicuousness, of passivity and adaptability over strenuous effort. "Blessed are the meek, for they shall inherit the earth."

[61] *Ernst, A.* The new flora of the volcanic island of Krakatau (Engl. transl. by A. C. Seward, 1908), pp. 60-68.

RECORDS AT THE ABBE METEOROLOGICAL OBSERVATORY COMPARED WITH THOSE AT THE GOVERNMENT BUILDING, CINCINNATI.

551.501 (771)

By WILLIAM CHARLES DEVEREAUX, Meteorologist.

[Abbe Meteorological Observatory, Lafayette Circle, Cincinnati, Ohio, Apr. 11, 1917.]

During the 24 months from April 1, 1915, to March 31, 1917, both inclusive, complete weather records were made at the Government Building, Cincinnati, and at the Abbe Meteorological Observatory maintained by the United States Weather Bureau at Lafayette Circle, Clifton, Cincinnati, Ohio. The following pages present a discussion of these comparative observations.

LOCATIONS OF EXPOSURES.

The Government Building, Cincinnati, is located 900 yards from the Ohio River, which forms the southern boundary of the city, and is near the center of the principal business section. (See fig. 1). Moderately high hills form a semicircle around the business section, which lies on the comparatively level ground between the hills and the river. The Government Building stands some distance east of the center of the semicircle of inclosing hills; the nearest hill is northeast from the building, the ground beginning to rise rapidly within a distance of half a mile and reaching an altitude of 247 feet above the ground at the Government Building, or of 800 feet above sea level. The hills to the north are distant ¾ mile, to the west 2 miles, to the southwest in Kentucky 1½ miles, and to the south 2½ miles from the Government Building. The highest of these hills lies between 800 and 900 feet above sealevel.

The elevations of the instruments above the ground at the Government building are as follows: Barometer, 74 feet; raingage, 145 feet; thermometers, 152 feet; anemometer, 160 feet; and wind vane, 161 feet. Within a radius of 600 feet and from a point directly southwest to a point a little east of south, there are buildings considerably higher than the wind vane. To the east, north, and west the buildings are about the same height as the wind vane. The general surroundings are illustrated in figures 2 and 3.

The Abbe Meteorological Observatory is located on Lafayette Circle, in the suburb of Clifton, and is near the geographic center of the city. This is not the highest point in the city but is one of the highest, and the nearest hill of the same elevation is about 2 miles distant. The visible horizon of the Observatory is nearly level on all sides. The ground slopes away from the Observatory in all directions, and is mostly covered with trees. The only buildings in the vicinity of the Observatory are residences. The elevations of the instruments above ground are as follows: Barometer, 5.8 feet; raingage, 3.1 feet; thermometers, 10.8 feet; anemometer, 50.8 feet; and wind vane, 52.2 feet. (See figs. 1, 4, and 5.)

WIND RECORD.

In order to tabulate in detail the direction and velocity of the wind, a new form was prepared which shows the number of hours the wind blows from each direction, and the velocity of the wind from each direction. By the use of this form the percentage of time the wind blew from each direction and the mean velocity for each direction were obtained for each month, season, and the two years. Table 1 presents the form secured for March, 1916.

FIG. 2.—View of Weather Bureau instruments at Government building seen from neighboring roof and looking southward.

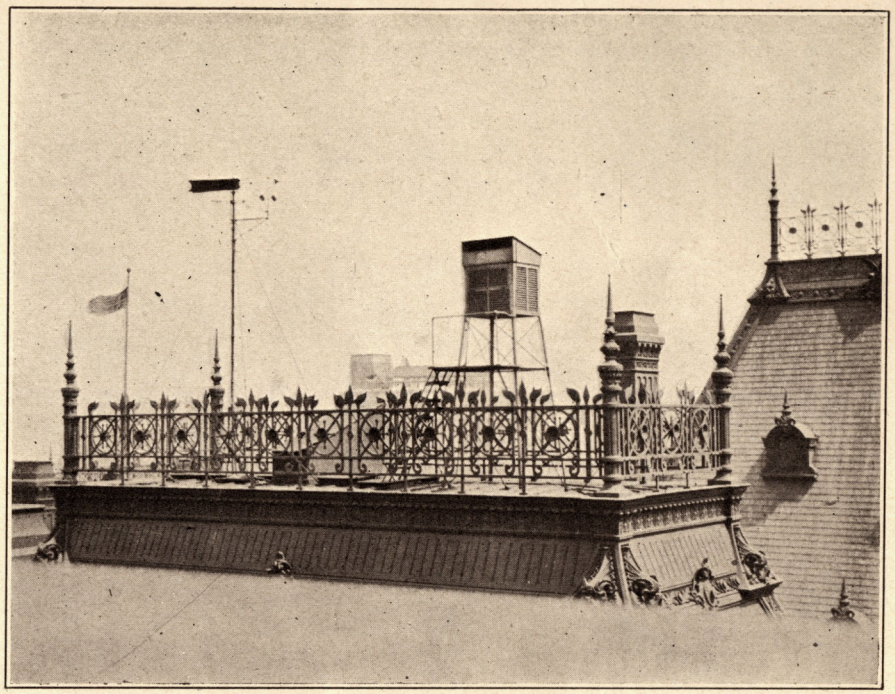

FIG. 3.—Same as in figure 2, but looking southeastward.

FIG. 4.—Abbe Meteorological Observatory, Cincinnati, looking northward at the south front.

FIG. 5.—Same as in figure 4, but looking eastward at the west front.

[Facing page 224.]

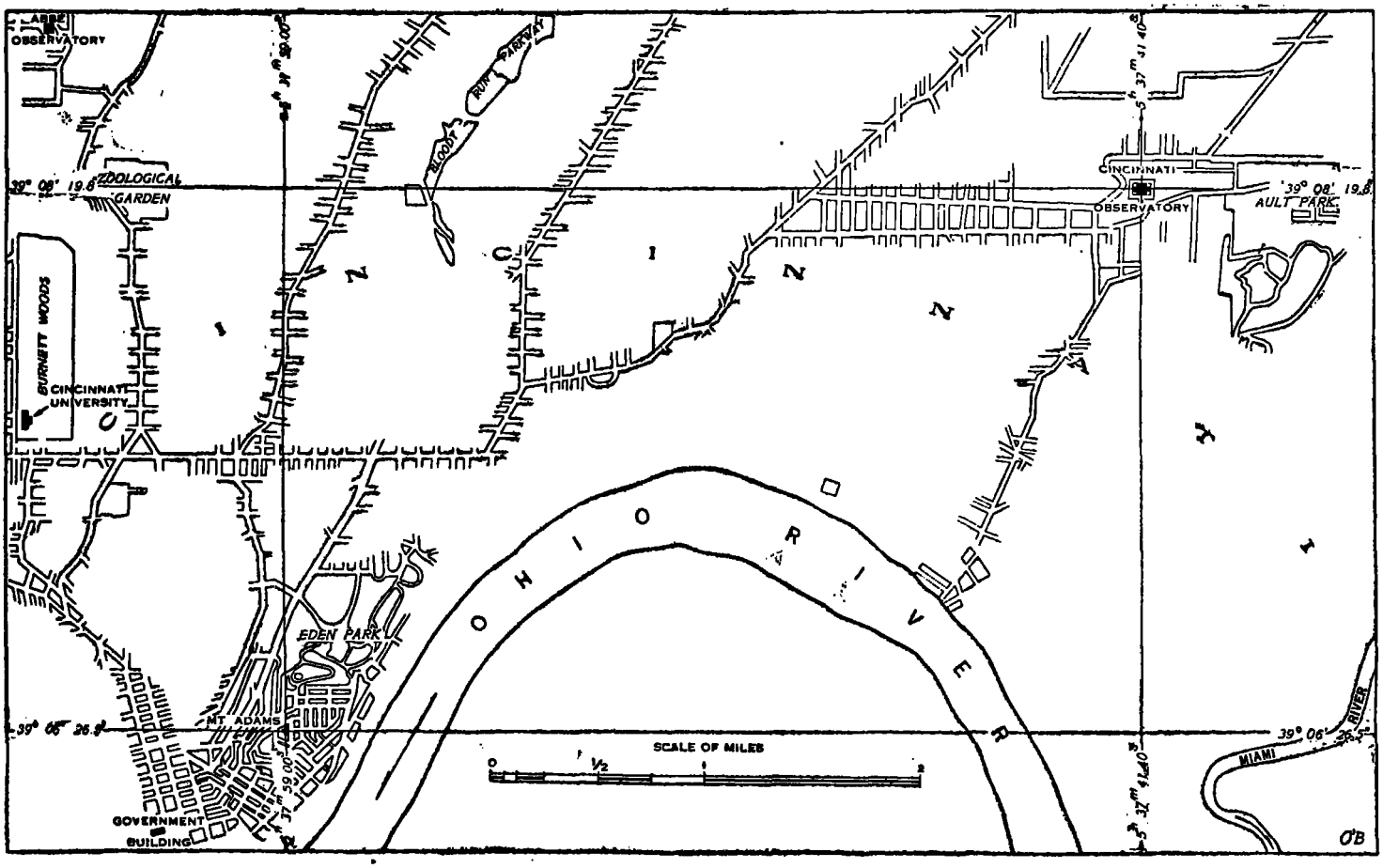

FIG. 1.—Outline map of Cincinnati, Ohio, showing locations of the Government Building, Abbe Meteorological Observatory of the Weather Bureau, the Cincinnati Observatory on Mount Lookout, and the position of the old Cincinnati Observatory on Mount Adams (in 1869–1873). Longitudes are west of Greenwich.

TABLE 1.—*Wind duration in hours (H) and travel in miles (M) from each direction at the Government building, Cincinnati, daily during March, 1916.*

Date.	N.		NE.		E.		SE.		S.		SW.		W.		NW.		Calm.		Total.		Max.
1916.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	M.
Mar. 1					3	11	17	148	3	10			1	6			0		24	175	18
2	10	75	7	47									7	61			0		24	183	13
3	5	39	4	26									5	59	10	126	0		24	250	24
4							2	7	2	13	11	89	9	99			0		24	208	17
5	1	5	2	12	15	119					1	6	3	24	2	11	0		24	177	14
6							8	58			13	153	3	46			0		24	257	42
7									1	6	11	96	12	219			0		24	321	35
8													18	288	6	92	0		24	380	26
9											17	208	5	42	2	15	0		24	265	24
10	18	177									4	62	1	12	1	13	0		24	264	20
11	6	39	1	5	6	37	3	16	3	11	4	16	1	5			0		24	129	9
12							4	9			20	166					0		24	175	15
13					6	28	1	5	3	10	12	57	2	12			0		24	112	12
14	20	197	1	9			2	5	1	1							0		24	212	26
15	7	78													17	188	0		24	266	18
16											3	18	12	102	9	53	0		24	173	14
17	4	28	12	76	6	58									2	15	0		24	177	13
18	3	13			10	75	4	39							7	55	0		24	182	14
19	9	67	2	8	4	13							1	6	8	62	0		24	156	12
20					5	22	11	107	7	15	1	3					0		24	147	18
21					1	10	17	115	6	16							0		24	141	16
22	7	95	2	12	3	15					4	58	7	194	1	16	0		24	390	39
23			1	4	16	105	7	41									0		24	150	12
24					1	6	20	106	2	7	1	2					0		24	121	12
25							20	99	1	3			3	12			0		24	114	11
26					3	18	6	54	3	10	1	7	11	77			0		24	166	15
27			1	6	1	6					2	14	14	113	6	56	0		24	195	15
28	3	22											6	58	15	138	0		24	218	16
29	19	126	5	24													0		24	150	13
30	14	51	6	36											4	13	0		24	100	10
31	8	12	1	2			1	4	4	14	4	15	6	31			0		24	78	9
Sums	134	1,024	45	267	80	523	123	813	37	116	109	970	127	1,466	90	853	0	0	744	6,032	
Per cent	18.0		6.0		10.8		16.5		5.0		14.7		17.1		10.8		0				
Means		7.6		5.9		6.5		6.6		3.1		8.9		11.5		9.5		0			

Figures 6, 7, and 8 show the direction and force of the wind at both places for the year, the seasons, and the months. In these wind roses the length of the black radii represents the time the wind blew from each direction and the width of the black radii represents the force of the wind, as tabulated from the record made at Abbe Observatory. The white radii represent the corresponding data for the Government building. The most pronounced feature shown by the charts and diagrams is the great difference in the amount and force of the south wind as recorded at the two locations. During April, 1915, a south wind was recorded at the Government building only 4.7 per cent of the time, with an average velocity of 2.1 miles per hour; at the observatory during the same month it was from the south 16.1 per cent of the time, with an average velocity of 5.5 miles per hour. These deficiencies in the recorded south wind at the Government building were very large during each month, but greatest during January, when the time was less than one-fifth and the velocity was less than one-third of those recorded at the observatory. For the two years as a whole the record of the south wind at the Government building was deficient 69 per cent in duration and 60 per cent in velocity as compared with the record at the observatory. Directly south of the wind instruments on the Government Building there are no high buildings, but there is a portion of the roof on the Government building about 50 feet south of the instruments and extending up to the same height as the wind vane. (See fig. 3.) This roof apparently deflects most of the south wind into the southeast, where there is a large excess shown. The total time of the record of the southeast wind at the Government building is nearly equal to that of the south and southeast wind combined as recorded at the Abbe Observatory.

Nearly 50 per cent of the northeast wind at the Government building was recorded as an east wind. This was not due to high buildings, but to the hill known as Mount Adams,[1] about one-half mile distant. (See fig. 1.) This hill is only about 100 feet higher than the Government building wind vane and probably at that distance the hill alone would not affect the wind direction so much, but the valley of the Ohio River follows a northeast-southwest line along the south side of the hill and the wind tends to flow around the hill and through the valley. The velocity of the east wind at the Government building is greater than at the Abbe Observatory, but for the year the average velocity of the east wind at the Government building is nearly the same as the average velocity of the northeast wind at the observatory, showing that at the Government building the stronger northeast wind is recorded as an east wind.

The north and the northwest winds do not show much difference at the two locations. There are no very high buildings in these directions, and the hills are at a sufficient distance and of such shape that they do not affect the wind records. In the west there is an excess in both direction and velocity at the Government building. This is due to the fact that the highest buildings in the city are located to the southwest of the Government building and that they deflect about 50 per cent of the southwest wind into the west. (See fig. 2.) The total duration of the west and southwest wind at the Government building is equal to the duration of the same winds at the observatory.

An examination of the wind roses (figs. 6, 7, and 8) shows that the variation in the direction of the wind is similar for all seasons.

The prevailing direction of the wind at Cincinnati is given in all the previous Weather Bureau records as southeast. This is due to the poor exposure of the wind vane during the past years, and the records should be corrected to make the prevailing direction southwest the same as at most other places in the Ohio Valley.

TABLE 2.—*Mean percentage frequencies and hourly velocities of the winds from each of the recorded directions for each month at the Abbe Meteorological Observatory and at the Government building, Cincinnati, for the period April 1, 1915, to March 31, 1917.*

Abbe Meteorological Observatory.

Month.	N.		NE.		E.		SE.		S.		SW.		W.		NW.		Calms.	Annual mean velocity.	Maximum 5-minute velocity and direction.
	Freq.	Vel.	Freq.	Vel.	Freq.	Vel.	Freq.	Vel.	Freq.	Vel.	Freq.	Vel.	Freq.	Vel.	Freq.	Vel.			
	%	*Mi./hr.*	%	*Mi./hr.*	%	*Mi./hr.*	%	*Mi./hr.*	%	*Mi./hr.*	%	*Mi./hr.*	%	*Mi./hr.*	%	*Mi./hr.*	%	*Mi./hr.*	*Mi./hr.*
January	5.5	7.7	10.8	7.4	5.2	4.3	6.6	6.2	21.4	9.4	30.3	12.1	9.3	10.0	10.7	8.6	.....	9.4	39 sw.
February	11.2	9.9	13.1	8.4	5.1	5.4	5.3	6.4	8.6	8.1	26.4	11.4	13.6	13.0	16.8	10.4	.....	10.1	38 w.
March	12.8	11.6	13.8	8.7	6.2	7.0	7.1	8.7	16.2	10.4	24.4	13.8	9.2	13.4	10.2	10.8	.....	11.1	52 w.
April	11.0	8.0	19.0	8.4	4.0	4.6	4.1	3.6	13.4	6.8	24.7	9.9	11.0	9.6	12.6	9.0	0.2	8.4	36 sw.
May	8.3	5.0	20.4	6.8	7.7	6.1	5.2	5.4	13.3	6.8	26.0	9.4	8.8	9.3	10.2	7.3	.....	7.4	36 sw.
June	7.6	5.4	17.8	4.5	7.2	4.8	7.5	4.8	17.0	6.2	23.8	7.0	8.4	6.1	10.3	5.9	0.3	5.8	37 nw.
July	11.6	4.1	24.9	3.8	8.8	4.0	3.3	2.8	12.8	4.2	23.6	5.3	6.2	5.0	7.4	4.2	1.4	4.4	44 nw.
August	8.6	5.5	23.6	5.5	5.3	4.0	3.8	3.6	12.6	4.2	30.0	6.2	8.2	5.3	7.2	4.7	0.6	5.3	28 w.
September	7.3	5.5	21.6	6.2	4.8	6.4	4.7	3.6	23.8	5.8	23.4	7.2	5.6	5.6	8.0	6.8	0.5	6.2	28 sw.
October	9.0	7.2	14.6	5.2	9.8	3.8	7.4	4.0	22.4	5.5	21.4	9.0	8.6	7.0	6.2	7.2	0.6	6.2	36 sw.
November	2.1	6.1	10.4	5.6	4.4	5.5	7.2	6.5	18.6	9.2	37.0	11.3	12.9	11.2	7.4	8.6	.....	9.4	40 w.
December	6.6	6.4	15.0	6.4	6.3	6.0	6.2	6.0	18.6	9.2	24.2	10.9	13.6	11.2	9.3	8.0	.....	8.9	35 sw.
Year	9.8	7.2	17.8	7.1	6.1	5.5	5.6	5.3	15.4	7.4	24.9	10.0	9.9	9.6	10.3	8.2	0.2	8.2	52 w.

Government Building.

January	4.4	6.8	4.7	6.4	9.4	6.2	24.4	5.4	3.5	3.2	22.0	7.4	19.5	10.8	11.9	8.9	.....	7.4	33 w.
February	10.8	7.4	9.1	6.3	7.5	6.8	12.6	6.4	1.8	3.4	17.0	7.6	22.6	12.0	17.6	9.8	.....	8.6	33 nw.
March	13.5	8.2	7.6	6.4	8.0	8.6	21.7	6.6	3.2	3.0	15.4	8.8	19.6	12.6	10.4	10.2	.....	8.7	42
April	10.6	5.6	11.7	6.5	9.1	7.6	14.5	4.4	4.2	2.6	19.6	7.6	16.8	10.2	13.1	7.8	0.4	7.1	33 sw.
May	7.6	4.6	10.8	6.4	13.5	7.2	15.7	5.8	5.0	3.0	18.4	7.6	16.4	10.0	12.4	7.4	0.2	7.0	38 w.
June	7.3	4.6	8.0	4.6	13.6	5.6	22.4	5.0	6.2	2.5	16.4	6.3	16.1	7.8	9.6	6.7	0.5	5.6	33 sw.
July	8.3	5.8	11.4	4.4	19.8	5.2	14.2	4.0	8.2	3.2	15.6	5.4	13.4	6.2	8.6	5.6	0.4	5.2	50 nw.
August	7.6	5.8	13.6	5.5	12.0	5.0	11.1	4.7	8.8	3.0	19.6	5.4	19.2	6.8	7.6	4.8	0.4	5.4	28 w.
September	7.0	5.4	12.3	10.2	11.8	6.2	20.6	4.0	8.2	3.3	18.6	6.4	13.0	6.4	7.8	7.2	.....	5.5	27 nw.
October	9.0	5.6	6.0	4.6	12.1	4.6	29.0	4.0	7.2	3.0	13.1	7.3	15.6	8.0	6.9	6.2	1.2	5.4	30 sw.
November	1.4	5.2	3.6	5.0	9.9	5.8	21.1	5.6	6.0	3.1	26.6	8.0	22.6	10.6	8.8	8.6	.....	7.4	30 w.
December	5.4	6.0	4.8	5.4	14.5	7.3	22.2	5.4	3.8	3.4	17.0	7.0	21.2	11.8	10.9	8.0	0.2	7.6	29 w.
Year	9.4	6.0	9.6	6.2	11.2	7.0	18.4	5.3	4.8	3.0	17.8	7.6	17.4	10.1	10.9	8.0	0.2	7.2	50 nw.

[1] Mount Adams was the site of the Cincinnati Observatory in 1869–1873 when Prof. Cleveland Abbe was director and making weather forecasts for the Cincinnati Chamber of Commerce.—C. A., Jr.

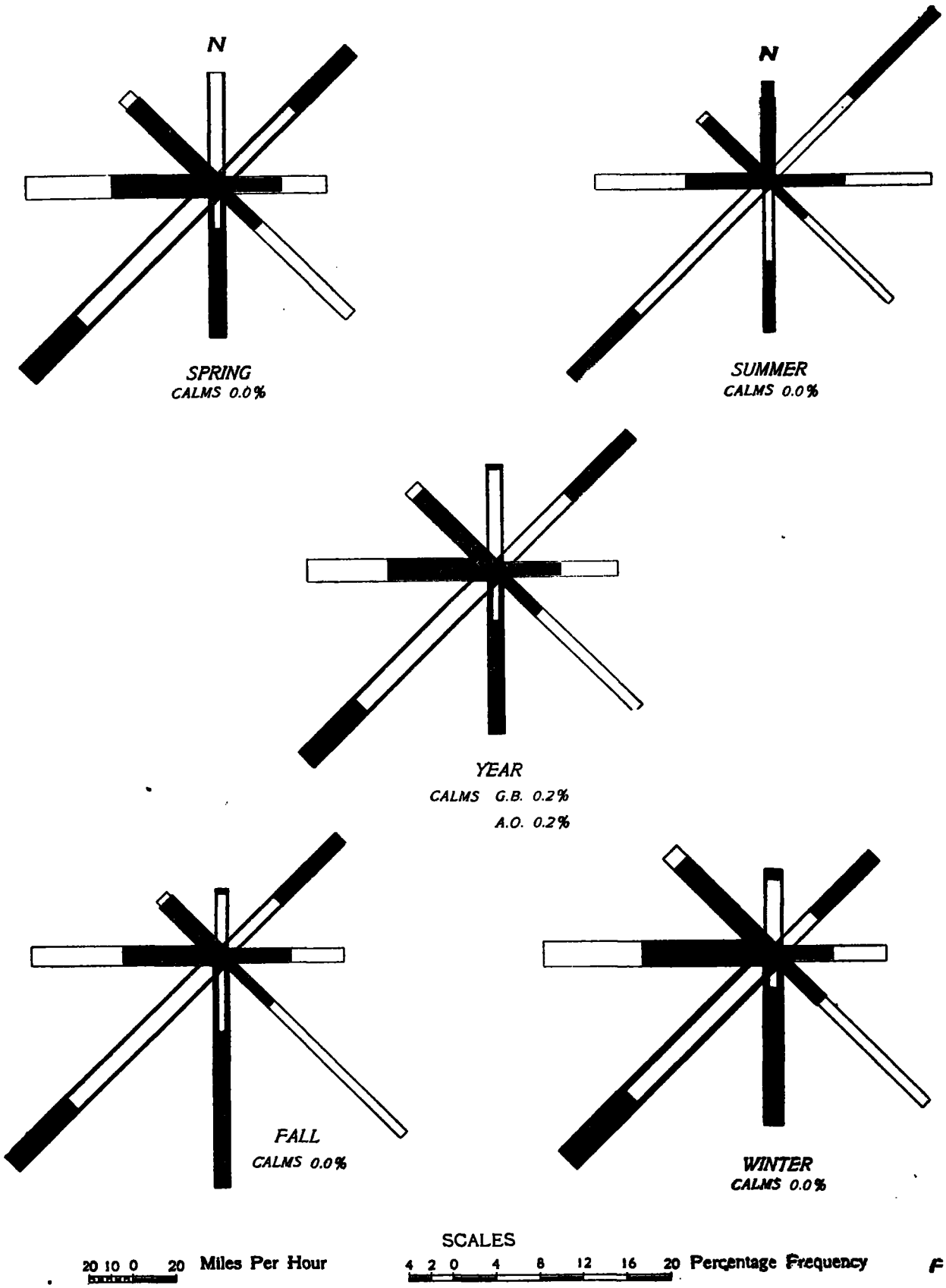

FIG. 6.—Seasonal direction-velocity windroses for Cincinnati, 1915–1917: Government building, white; Abbe Meteorological Observatory, black. Width of the ray is proportional to the velocity.

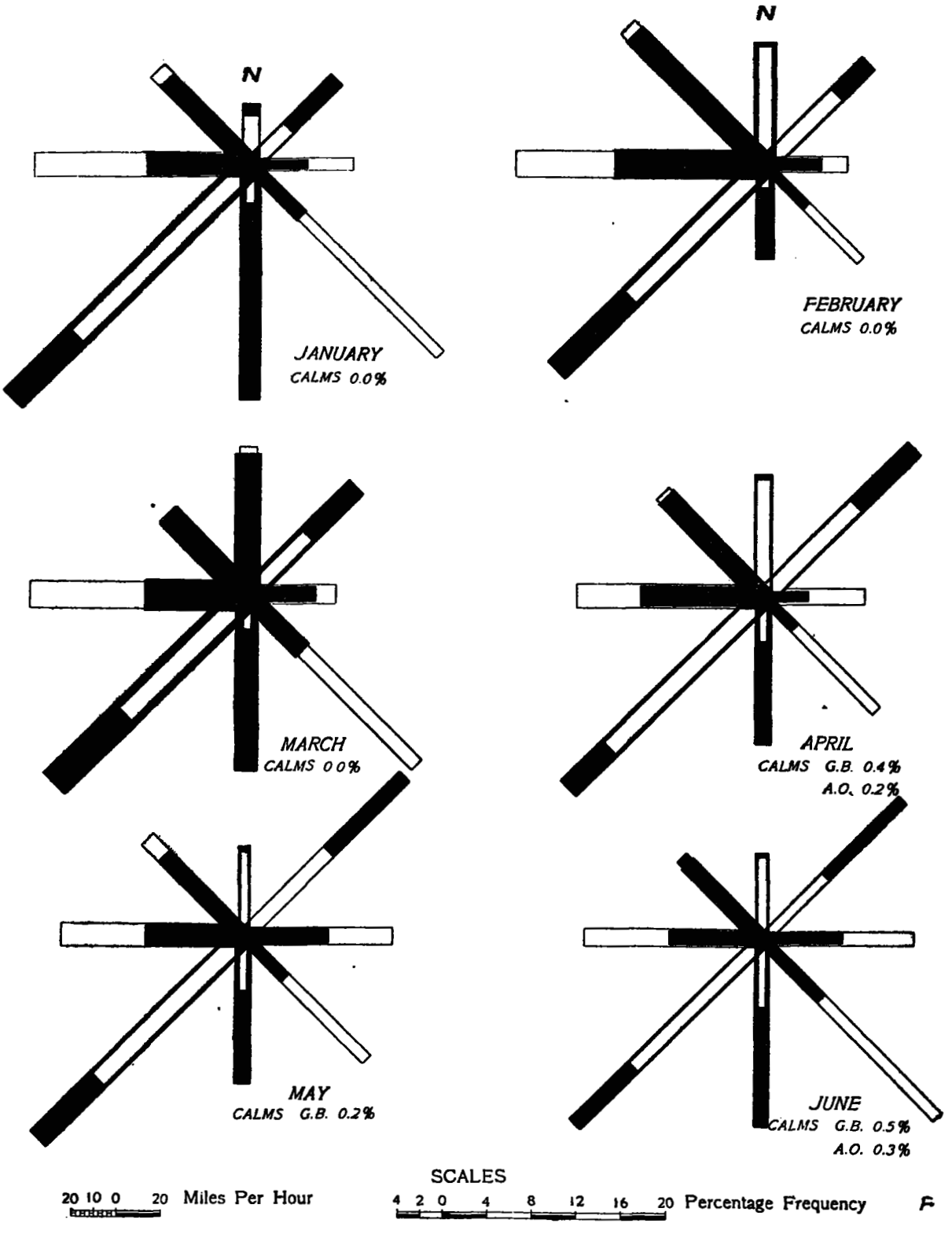

FIG. 7.—Monthly direction-velocity windroses for Cincinnati, 1915–1917: Government building, white; Abbe Meteorological Observatory, black. Width of the ray is proportional to the velocity.

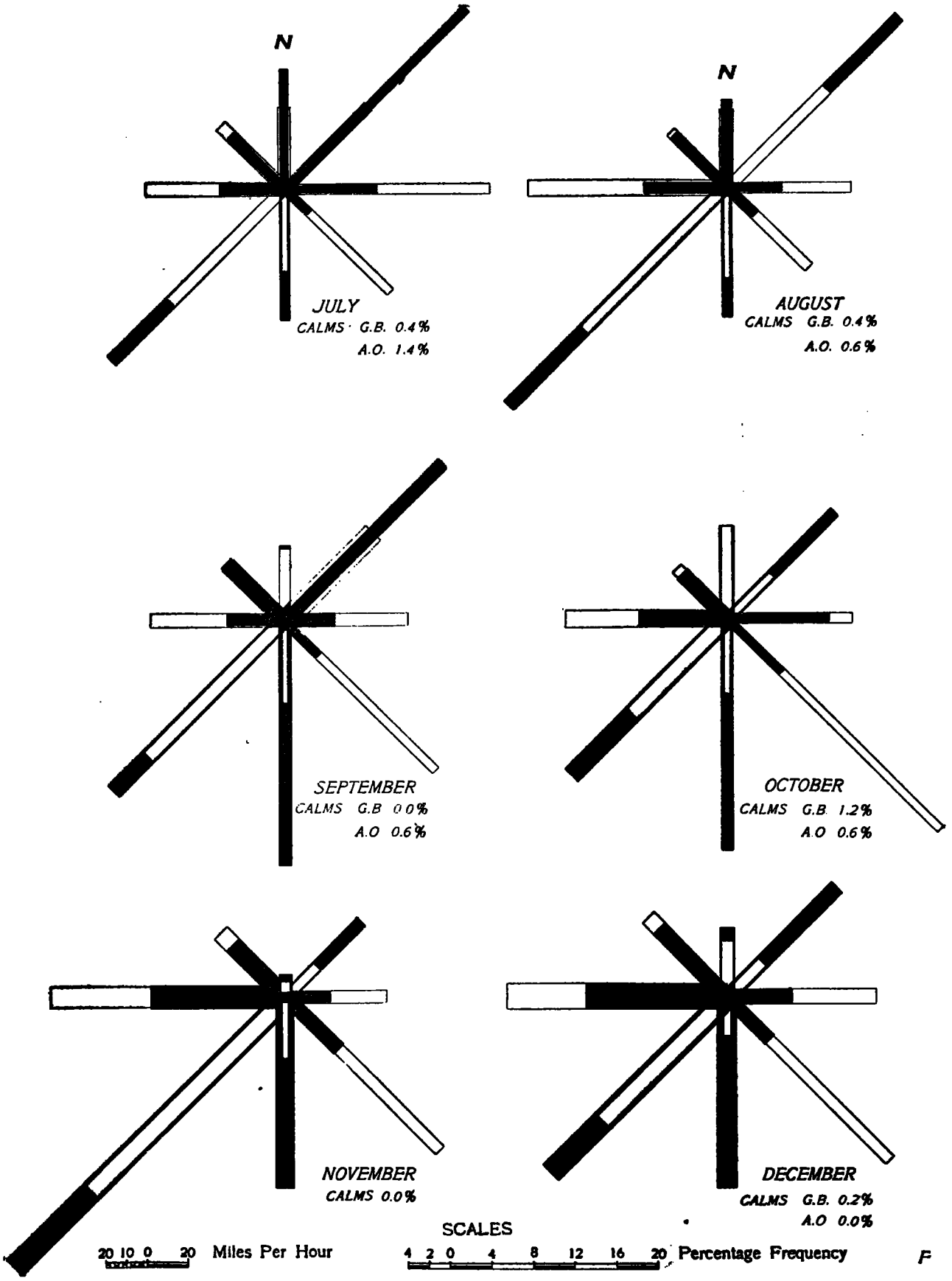

FIG. 8.—Monthly direction-velocity windroses for Cincinnati, 1915–1917, concluded: Government building, white; Abbe Meteorological Observatory, black. Width of the ray is proportional to the velocity.

The difference in the velocity of the wind at the two locations has not the constancy during the year shown by the difference in the direction, but changes with the season. The average velocity in miles per hour is given in Table 3.

TABLE 3.—*Average velocities of all winds, by seasons, at the Abbe Observatory and the Government building, Cincinnati, for the two years under discussion.*

Season.	Abbe Observatory.	Government building.	Difference at Government building.
	Mls./hr.	*Mls./hr.*	*Mls./hr.*
Winter	9.5	7.9	−1.6
Spring	9.0	7.6	−1.4
Summer	5.2	5.4	+0.2
Fall	7.3	6.1	−1.2
Year	8.2	7.2	−1.0

During the winter months when the storm winds prevail, the pressure gradients being strong and the amount of insolation small, the wind is stronger at the observatory. During the midsummer months, however, these conditions are reversed and then the wind is slightly stronger at the Government building. In July, 1915, the wind at the observatory averaged but 4 miles per hour, while at the Government building during the same time it averaged 5.6 miles per hour. An examination of the daily record for that month shows that the excess in the velocity at the Government building was greatest on days having a high percentage of the possible number of sunshine hours and with nearly stationary pressure. For example: On July 9, when the day's percentage of possible hours of sunshine was 99 and the pressure-change for the 24 hours was but 0.08 inch, the wind at the observatory averaged 3.3 miles per hour, while at the Government building it averaged 8 miles. Again, on July 15, with a percentage of possible hours of sunshine of 100 and a stationary pressure, the wind averaged 3.8 miles at the observatory as against 8 miles at the Government building. On July 16 also, with 93 per cent of the sunshine hours and the pressure still stationary, the wind averaged 4.2 miles at the observatory, but 9 miles per hour at the Government building. No storm was in the vicinity on any of these days. During July 8, however, while the sunshine hours was 41 per cent and the pressure rose 0.32 inch during the day as a LOW passed eastward from the upper Ohio Valley, the total movement of the wind at the two locations differed by only 2 miles, being 198 miles at the observatory and 200 miles at the Government building. The slight relative increase in the midsummer wind velocity at the Government building may result from the topography of the city and the greater heating of the air over the paved streets and buildings in the center of the city as compared with that over the grassy or wooded slopes of the hills and over the water in the Ohio.

One of the remarkable things shown by the wind roses (fig. 6) is that the west wind is stronger at the Government building than at the observatory during each season, and the average is distinctly stronger for the year. The east wind also averages the stronger at the Government building, but this is probably due to the fact that a portion of the strong northeast wind is there recorded as an east wind.

TEMPERATURE RECORD.

The temperature at the observatory averaged 2 degrees lower than at the Government building, the difference between maximum temperatures being 1.4 degrees and between minimum temperatures 2.7 degrees. The greatest difference during the two years was 8 degrees between the maximum temperatures and 8 degrees between the minimum temperatures. The greatest difference occurred during most of the months on clear days, specially when the weather was clear on the hill and fog and smoke filled the valley. During 88 per cent of the time the difference ranged between zero and 3 degrees, and either the maximum or minimum was highest at the observatory on only 43 days during the two years. The difference between the maximum temperatures was usually greatest in the Winter and least in the Summer—the reverse of what is generally expected. These extremes are compared by months in Table 4, which follows.

TABLE 4.—*Comparison of extreme temperatures at the Abbe Observatory (O.) and the Government building (G.), April, 1915–March, 1917.*

Month.	Maxima.						Minima.					
	Extreme.		Mean.		Daily difference.		Extreme.		Mean.		Daily difference.	
	O.	G.	O.	G.	Greatest.	Mean.	O.	G.	O.	G.	Greatest.	Mean.
	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.
April	89	91	64.9	66.0	6	1.1	23	28	45.0	47.2	6	2.2
May	89	90	72.0	73.2	4	1.2	38	40	52.6	55.1	7	2.5
June	92	91	77.8	79.0	3	1.2	48	53	58.8	61.0	5	2.2
July	98	99	86.5	87.6	3	1.1	54	57	65.7	68.6	7	2.9
August	96	97	81.7	82.8	3	1.1	43	46	63.2	66.1	6	2.9
September	90	92	76.9	78.2	4	1.4	36	39	56.7	59.2	7	2.5
October	88	88	67.8	69.0	5	1.2	27	33	45.1	48.0	7	2.9
November	76	78	55.7	57.4	5	1.7	14	17	36.4	39.2	7	2.8
December	63	65	39.9	41.6	5	1.7	1	7	24.4	27.4	7	3.0
January	70	71	44.6	46.4	8	1.8	−4	0	25.5	28.4	8	2.9
February	70	70	38.7	40.4	4	1.8	−9	−7	19.8	22.4	7	2.6
March	79	79	50.6	52.1	6	1.5	8	11	31.3	33.8	5	2.5
Mean	....	....	63.1	64.5	.....	1.4	....	....	43.7	46.4	.....	2.7

Mean 2-year temperature:	°F.
Abbe Observatory	53.4
Government building	55.4
Difference	2.0

PRECIPITATION.

Table 5 below presents a comparison between the precipitation measurements at the two locations during the two years. The deficiency in the amount recorded at the Government building was 1.96 inches, or 5 per cent of the amount recorded at the Abbe Observatory, where the gage is exposed under more natural conditions. Our illustrations do not show the exposure of the raingage at either station.

Usually the greatest difference in the measured amounts of precipitation occurs in the summer months; the precipitation that occurs as snow about the Government building is measured in the neighboring parks and not at the gage at the Government building, where it is impossible to secure correct snow depths. During all the months except January and February the measured precipitation was greatest at the observatory. The greatest excess at the observatory occurred during September, 1915, and amounted to 1.02 inches, or 18 per cent of the monthly total.

TABLE 5.—*Comparison of mean and extreme rainfalls at the Abbe Observatory (O.) and at the Government building (G.), April, 1915–March, 1917.*

Month.	Mean totals.		Difference.	Greatest in 24 hours.		Greatest differences. For the hour. Amounts.		Difference.	For the day. Amounts.		Difference.
	O.	G.		O.	G.	O.	G.		O.	G.	
	Inch.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
April	1.68	1.52	0.16	0.77	0.57	0.55	0.37	0.18	0.73	0.49	0.24
May	5.02	4.81	0.21	2.34	1.75	0.83	0.44	0.39	2.29	1.71	0.58
June	4.40	4.18	0.22	1.37	1.59	0.24	0.77	0.53	1.06	0.41	0.65
July	3.36	3.04	0.32	1.44	1.36	0.43	0.00	0.43	1.43	0.35	1.08
August	3.85	3.84	0.01	1.70	1.34	0.25	0.61	0.36	1.01	0.53	0.48
September	4.47	3.55	0.08	2.32	2.04	0.78	0.47	0.31	1.36	0.89	0.47
October	2.08	1.89	0.19	1.32	1.10	0.09	0.32	0.23	1.32	0.90	0.42
November	2.10	1.94	0.16	1.27	1.09	0.25	0.19	0.06	1.23	1.02	0.21
December	4.10	4.02	0.08	2.10	2.03	0.12	T.	0.12	1.28	1.49	0.21
January	5.29	5.42	0.13	1.72	1.82	0.40	0.24	0.16	0.11	0.29	0.18
February	1.62	1.82	0.20	1.13	1.29	0.11	0.42	0.31	0.76	1.18	0.42
March	3.70	3.68	0.02	1.19	1.38	0.22	0.77	0.55	0.98	1.38	0.40
Year	41.67	39.71	1.96	2.34	2.04	0.22	0.77	0.55	1.43	0.35	1.08

The greatest amount of precipitation in 24 hours did not vary greatly at the two places, the greatest difference being 0.59 inch during May, 1916. During this month and also during several other months the greatest amount in 24 hours did not occur on the same day at the two places. A greater difference is shown when the same days are considered at each station. On July 28, 1915, the precipitation at the observatory was 1.43 inches and only 0.35 inch at the Government building, making a difference of 1.08 inches. On July 28 there was a rainfall of 0.48 inch at the observatory of which 0.43 inch fell in one hour, while none occurred at the Government building. The greatest difference for any hour during the two years occurred in March, 1917, when 0.22 inch fell at the observatory and 0.77 inch was measured at the Government building. The greatest amounts of precipitation for 5, 10, 15, and 30 minutes and for one and two hours during each month did not, as a rule, differ much at the two locations, but in several months the maximum amounts for those periods did not occur on the same day at the two places.

It will require several years of comparative records to determine accurately the percentage difference between the precipitation measurements at the Abbe Observatory and at the Government building, due to the difference in exposure of the raingages.

CLOUDINESS AND FOG.

The number of clear, partly cloudy, and cloudy days during the year at the two places were the same. There was more cloudiness and light fog during the early morning hours at the Government building than at the observatory, but this was due, at least in part, to the extra amount of local smoke that collected in the valley on mornings when the wind was very light. As soon as the velocity of the wind increased the smoke was mostly blown out of the valley. Under low atmospheric pressure, even with moderate wind velocity, the clouds were more dense at the Government building than at the observatory, as the local smoke tended to settle toward the ground instead of rising high in the atmosphere. On two occasions there were dense fogs on the hilltops and very little fog in the valley. On these occasions the pressure was moderately high, and the fogs on the hilltops were caused by the passing of low clouds which did not settle in the valley.

WINTER INDOOR ARIDITY IN TOPEKA, KANS.[1]

628.8

By S. D. FLORA, Meteorologist.
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It is somewhat of a surprise to find that in the winter season a majority of persons in the northern part of the United States live in an indoor climate that is ultra-desert in regard to moisture conditions. A few years ago the writer was greatly interested in an account of the investigation of indoor aridity by Prof. R. DeC. Ward in Cambridge, Mass. (MONTHLY WEATHER REVIEW, September, 1908, **36**:281–283), and determined—in the apparent absence of corresponding data for a western State where conditions were probably more acute on account of the atmosphere being drier—to make a series of humidity observations, both indoors and out, that should cover an entire winter. The program was interfered with by other duties, but it was carried far enough to indicate that indoor climate in Kansas was drier under ordinary circumstances than in Massachusetts, and in severely cold weather was even drier than the desert region of the Southwest.

TABLE 1.—*Relative humidity indoors and outdoors at Topeka, Kans., November and December, 1909.*

Date.	Temperature of office room. Dry-bulb.	Wet-bulb.	Relative humidity. Indoors.	Outdoors.	Temperature outdoors.	State of weather.
1909.	°F.	°F.	%	%	°F.	
Nov. 18, 8 a. m.	71	55	33	77	27	Clear.
noon	72	53	25	49	43	Partly cloudy.
4 p. m.	72	54	28	47	53	Do.
19, 8 a. m.	71	53	29	76	38	Clear.
noon	72	54	30	46	54	Do.
4 p. m.	72	54	30	38	62	Partly cloudy.
20, 8 a. m.	72	58	40	93	47	Partly cloudy.
noon	71	57	39	60	59	Do.
4 p. m.	72	58	40	50	67	Do.
22, 8 a. m.	64	50	34	90	32	Cloudy.
noon	71	54	31	84	31	Do.
4 p. m.	72	57	39	70	37	Do.
23, 8 a. m.	75	55	25	85	23	Cloudy.
noon	73	55	28	70	40	Partly cloudy.
4 p. m.	72	54	30	56	48	Clear.
24, 8 a. m.	76	57	29	78	44	Clear.
noon	76	57	28	48	59	Do.
4 p. m.	76	59	32	46	65	Do.
25, noon	66	55	49	95	52	Cloudy.
26, 8 a. m.	66	56	53	83	58	Cloudy.
noon	74	62	52	79	66	Do.
4 p. m.	73	63	60	73	68	Partly cloudy.
27, 8 a. m.	73	62	53	81	61	Cloudy.
noon	72	61	52	79	64	Do.
4 p. m.	74	64	56	79	65	Do.
28, noon	69	55	38	92	38	Cloudy.
29, 8 a. m.	78	60	32	100	41	Foggy.
noon	70	66	39	99	44	Cloudy.
4 p. m.	72	58	40	97	46	Do.
30, 8 a. m.	82	62	31	100	46	Foggy.
noon	73	59	44	100	50	Cloudy.
4 p. m.	72	60	48	91	52	Do.
Dec. 1, 8 a. m.	74	60	44	100	49	Raining.
noon	76	59	35	69	52	Partly cloudy.
4 p. m.	74	58	37	74	50	Cloudy.
2, 8 a. m.	70	55	37	84	42	Cloudy.
noon	70	54	32	73	43	Do.
4 p. m.	73	56	33	67	45	Do.
3, 8 a. m.	67	53	36	80	41	Sprinkling.
noon	69	54	37	95	41	Do.
4 p. m.	74	58	37	99	41	Raining.
4, 8 a. m.	69	53	31	94	26	Sleeting.
noon	72	52	22	100	23	Cloudy.
4 p. m.	71	52	25	89	22	Do.

[1] A summary of the results of these measurements was published in Bulletin, Kansas State Board of Health, Topeka, January, 1917, 13: 9–11. 8°.