a long one or a short one, the numerous paths of rapid movement and short duration, outweigh those of slow movement and long duration. If the movement of a center of high or low pressure depends upon the general movement of the upper layers of atmosphere, or is in any way a partial index to the velocity of the general circulation, then from that point of view, the averages taken by days are to be preferred. The average daily movement in 1895 was 556 miles for the high areas and 598 for the low, or an average of 577; in the current year the above table shows average daily velocities in both cases 5 miles larger than the preceding year, giving an average of 582, or about 24 miles per hour. This average undoubtedly gives us a first approximation to the annual average velocity of the wind at some upper level, probably between 5,000 and 10,000 feet, but nearer the latter. If studied in connection with a system of upper isobars such as that shown on Chart VII, of the November REVIEW, they seem to harmonize with the general statement that our high and low areas and weather changes form part of the system of circulation around the north Polar Region of low pressure.

TABLE A.—*Movements of areas of high and low pressure for* 1896.

Month.	High areas.				Low areas.			
	By paths.		By days.		By paths.		By days.	
	No.	Movement.	No.	Movement.	No.	Movement.	No.	Movement.
		Miles.		*Miles.*		*Miles.*		*Miles.*
January	10	5,317	45.5	21,880	9	5,435	38.0	21,830
February	14	9,931	50.0	33,950	7	4,447	34.5	20,260
March	8	4,512	39.0	22,460	10	6,693	42.0	26,760
April	6	3,036	36.0	13,430	9	5,093	36.5	20,330
May	7	3,941	33.0	18,520	10	5,075	41.5	19,960
June	7	3,965	44.5	24,470	8	4,620	35.0	20,350
July	7	3,734	22.0	11,660	11	6,302	38.5	22,550
August	6	3,234	39.0	20,950	10	6,617	34.0	22,360
September	7	4,148	39.0	22,900	11	6,631	39.0	22,320
October	10	5,244	44.0	22,530	9	4,832	35.0	18,060
November	5	3,307	22.5	13,810	8	6,491	33.5	25,250
December	8	4,754	32.5	18,390	12	9,171	43.0	31,530
Sums	95	55,123	437.0	244,950	114	71,407	450.5	271,560
Mean daily velocity	580		561		626		603	
Mean hourly velocity	24.2		23.4		26.1		25.1	

TEMPERATURE.

The mean annual temperature is shown by the isotherms on Chart I. These temperatures relate to the surface of the ground, and the individual figures are given in Table I of the annual meteorological summary of data for Weather Bureau stations. The lowest annual averages within the United States were: Williston, 37.6; Moorhead, 37.7; Bismarck, 38.9; Sault Ste. Marie, 39.5; Duluth, 39.6; Havre, 39.7. For Canada: Prince Albert, 30.5; Battleford, 31.1; White River, 31.2; Minnedosa, 31.6. The highest averages were: Key West, 76.4; Jupiter, 73.4; Yuma, 73.1; Tampa, 71.4; for Canada, Halifax, 43.2; Charlottetown, 43.1; Yarmouth, 43.0.

The mean annual temperature was above the normal at nearly all stations. The largest departures were in the middle Slope and the west Gulf States. The annual temperatures were below normal in the Florida Peninsula and on the north Pacific Coast and in portions of New England.

The maximum temperatures are shown both by the figures in Table I and the full lines on Chart II; the minimum temperatures of the year are shown by the figures in Table I and the dotted lines on the same chart. The absolute range of temperature during the year is easily obtained by comparing the full and dotted lines on this chart. In general maximum temperatures exceeding 105, occurred as follows: Yuma, 117; Phœnix, 115; Fresno, 111; Red Bluff, 109; Fort Smith, 107; Shreveport and Wichita, 106. The absolute maximum for the whole country was 117 at Yuma. Minimum temperatures of —25 or more occured at: Havre, —33; Lander, —31; Northfield, —30; Moorhead, —28; Williston and Idaho Falls, —26; Sault Ste. Marie, Duluth, Miles City, —25.

The regions of large annual ranges of temperature were, as usual, the north, middle, and south Pacific slopes and the Missouri Valley. The stations of small annual range were: Hatteras, 76; Key West, 38; Tatoosh Island, 48; Eureka, 45; Point Reyes Light, 51.

The accumulated departures of average monthly temperatures from the normal values are given in Table III, and show that there was a steady diminution in the deficit with which the year began in the Atlantic and Gulf States, generally turning into a surplus before the end of the year. In other sections of the country the year began with an excess of temperature which generally increased steadily until the close. The greatest deficits for the year were: —0.77, Florida Peninsula. The greatest excesses for the year were: the middle Slope, +2.07; Abilene, +2.19.

MOISTURE.

The mean temperature of the dew-point and of the mean relative humidity are given in Table I.

For the sake of certain studies in hygiene the mean temperature of the wet-bulb thermometer has been given each month. The thermometer from which this temperature is read is whirled at the rate of about 10 feet per second within the light wooden shelter that protects from direct radiation. The average wet-bulb for the year can be easily inferred from the mean temperature and dew-point of Table I as the wet-bulb reading is approximately midway between these two.

The total quantity of moisture in the air for the current year can be found by the table given on pages 539–540 of the ANNUAL SUMMARY for 1894, and does not differ to any important extent from the figures there given for that year.

PRECIPITATION.

The total annual fall of rain and melted snow for 1896 is shown on Chart III. The greatest precipitation was: Tatoosh Island, 100.8; Astoria, 94.8; Fort Canby, 78.6; East Clallam, 78.1. The least was: Yuma, 2.6; San Diego, 8.7; El Paso, 9.3; Pueblo, 10.8.

An annual rainfall above 60 inches occurred on small portions of the coast of Florida and Alabama, Nova Scotia, and Newfoundland, as also along the entire coast of Oregon and Washington. An annual rainfall of less than 10 inches occurred in southern California, Nevada, Utah and Colorado, western New Mexico, and northern Arizona.

The accumulated departures of total monthly precipitation from the normal values are shown in Table IV, from which it appears that a steadily increasing deficit has prevailed over the Atlantic States, Ohio Valley, and Lake Region; but elsewhere a slight excess has accumulated. The large total annual deficits are the west Gulf States, 12.50; South Atlantic States, 10.70. The largest accumulated excess was north Pacific, 10.10.

WIND.

The prevailing direction of the wind, namely that which occurred most frequently at the two hours of regular observations for telegraphic report, 8 a. m. and 8 p. m. (eastern time) is given in Table I. The annual resultant wind deduced from these same observations without taking into account the force of the wind (which is equivalent to attributing a uniform force to all winds) is given in Table V. These resultants are also presented graphically on Chart I in connection with the barometric means. They should also be compared with the pressures on Charts IV and V to which they are intimately related.

Owing to the great labor of computation the resultant winds, as deduced from hourly readings of the self-registering anemometers, have not been computed during the year 1896, but the relation between the resultants from two observations per day, and those from twenty-four hourly observations can be estimated by a comparison between Tables V and VI, pp. 544 and 545 of the SUMMARY for 1894.

The general agreement of the resultant winds within any climatological section depends upon the nature of the irregularities in the immediate neighborhood of the station; an intimate agreement can not be expected when stations are so far apart and so variously located as those of the Weather Bureau. In such cases as that of Erie, Cleveland, Sandusky, and Toledo, all similarly located on the south shore of Lake Erie, the agreement is very close, so, also, with Block Island and Nantucket.

FREQUENCY OF THUNDERSTORMS.

The successive MONTHLY WEATHER REVIEWS have given for each day and each State the number of thunderstorms reported by both regular and voluntary observers. Tables VI and VII give a summary of these monthly tables. In order to ascertain the relative frequency of thunderstorms, as explained in the SUMMARY for 1894, it is proper to divide the number of storms reported by the number of stations in order to deduce the average number per station. The results of this division are given in the eighth column of Table B, which shows

TABLE B.—*Frequency of thunderstorms and auroras during* 1896.

State.	Areas in units of 10,000 sq. miles.	Number of stations.		Reduction factor.	Total for 1896.		Frequency per station.	
		Needed.	Reporting.		Thunderstorms.	Auroras.	Thunderstorms.	Auroras.
Alabama	5.1	128	45	2.8	376	0	8.4	0.00
Arizona	11.4	385	30	12.8	213	0	7.1	0.00
Arkansas	5.2	130	40	3.2	465	0	11.6	0.00
California	15.8	395	115	3.4	381	0	3.3	0.00
Colorado	10.4	260	70	3.4	562	7	8.0	0.10
Connecticut	0.5	12	20	0.6	270	38	13.5	1.90
Delaware	0.2	5	6	0.8	111	16	18.5	2.67
District of Columbia	0.01	0.2	2	0.5	33	1	16.5	0.50
Florida	5.9	148	30	4.9	837	0	27.9	0.00
Georgia	5.8	145	45	3.2	343	1	7.6	0.02
Idaho	8.1	215	35	8.3	298	27	8.5	0.77
Illinois	5.5	138	80	1.8	1,441	57	18.0	0.71
Indiana	3.4	85	40	2.4	529	12	13.2	0.30
Indian Territory	6.9	172	5	34.4	36	0	7.2	0.00
Iowa	5.5	138	80	1.7	1,204	72	15.0	0.90
Kansas	8.1	202	65	3.1	792	35	12.2	0.54
Kentucky	3.8	95	40	2.7	375	7	9.4	0.18
Louisiana	4.1	102	45	2.3	781	0	15.1	0.00
Maine	3.5	88	15	5.9	134	97	9.6	6.47
Maryland	1.1	28	30	0.9	496	38	16.5	1.27
Massachusetts	0.8	20	65	0.3	539	95	8.3	1.46
Michigan	5.6	140	70	2.3	879	130	12.6	1.86
Minnesota	8.4	210	60	8.5	839	194	14.0	3.23
Mississippi	4.7	118	45	3.0	564	1	12.5	0.02
Missouri	6.5	162	85	1.0	1,945	17	22.9	0.20
Montana	14.4	360	35	1.4	175	128	5.0	3.66
Nebraska	7.6	190	90	2.4	808	67	9.0	0.74
Nevada	11.2	280	35	8.0	247	12	7.1	0.34
New Hampshire	0.9	22	20	1.1	187	121	9.4	6.05
New Jersey	0.8	20	45	0.4	701	52	15.6	1.16
New Mexico	12.1	302	30	12.1	277	0	9.2	0.00
New York	4.7	118	65	2.0	650	114	10.0	1.75
North Carolina	5.1	128	50	2.6	1,267	2	25.3	0.04
North Dakota	7.5	185	35	6.2	241	224	6.9	6.40
Ohio	4.0	100	125	0.8	2,016	123	16.3	0.06
Oklahoma	......	....	18	.....	130	0	7.2	0.00
Oregon	9.5	238	45	5.3	119	1	2.7	0.02
Pennsylvania	4.6	115	70	1.6	868	38	17.3	0.55
Rhode Island	0.1	2	6	0.3	57	15	9.5	2.50
South Carolina	3.4	85	35	2.4	582	0	16.0	0.00
South Dakota	7.6	190	40	4.8	280	70	7.0	1.75
Tennessee	4.6	115	35	3.3	716	5	20.5	0.14
Texas	27.4	686	75	9.1	568	1	7.4	0.04
Utah	8.4	210	25	8.4	226	0	9.0	0.00
Vermont	1.0	25	12	2.1	138	46	11.5	3.84
Virginia	6.1	152	35	4.3	543	7	15.2	0.20
Washington	7.0	175	45	3.9	101	21	2.2	0.48
West Virginia	2.3	58	30	1.9	421	5	14.0	0.17
Wisconsin	5.3	132	55	2.2	895	191	16.3	3.47
Wyoming	9.8	245	10	24.5	45	6	4.5	0.60

that the greatest frequencies per station per year were: Florida, 27.9; North Carolina, 25.3; Missouri, 22.9; Tennessee, 20.5. The smallest frequencies were: California, 3.3; Montana, 5.0; Oregon, 2.7; Washington, 2.2.

The product of the observed number of thunderstorms by the reduction factors given in column five of Table B would give the approximate total number of thunderstorms for the respective States, which total number, of course, depends largely on the area of the State, and is omitted from this table, as it has no meteorological significance as compared with the frequency per station.

FREQUENCY OF AURORAS.

Tables VIII and IX give a summary of the detailed tables of auroral frequency in the respective MONTHLY WEATHER REVIEWS. In the absence of more precise knowledge, it is assumed that the number of observers reporting all auroras is the same as those reporting all thunderstorms; the total number of either class of observers is decidedly less than the total number of those who report rainfall and temperature, and is estimated to be as given in the fourth column of Table B. The total number of auroras reported divided by the number of observing stations for any State gives the relative frequency per station, and this number relates to a physical phenomenon, and is comparable with similar ratios for other parts of the world, provided the aurora is so low as not to be obscured by a cloudy sky. On the other hand, if the auroral light emanate from a region far above the cloud, then a further correction for cloudiness is needed, but this has not been applied in the present case, as the Editor believes that we have no certain proof as to the extreme altitude of the auroras, and that, on the other hand, there are many reasons to believe that the light emanates from the cloud region itself.

The States that report the greatest frequency of auroras per station are: Maine, 6.47; North Dakota, 6.40; New Hampshire, 6.05; Vermont, 3.84; Montana, 3.66; Wisconsin, 3.47; Minnesota, 3.23.

SUNSHINE AND CLEAR SKY.

The successive MONTHLY WEATHER REVIEWS have presented in Table XI the percentages of sunshine, as recorded by self-registers of either the photographic or the thermometric type, and the corresponding chapter in the text has called attention to the systematic differences between the instrumental and the personal observations of the average daily sunshine or clear sky. These differences are, doubtless, in part due to what may be called instrumental and personal peculiarities as affecting the respective records. In addition to these peculiarities we must consider the fact that the photographic register gives essentially a record of the duration of a certain limiting intensity of actinic effect of direct sunshine; the thermometric register gives a record of the duration of certain limiting values of the total heat of direct sunshine plus atmospheric and terrestrial radiation; the personal observation of cloudiness aims to give the percentage of area of clear sky. There is no simple relation between these three classes of data, and yet as the records are often used indiscriminately, each for the other, it becomes interesting to ascertain how nearly they agree. The differences between the instrumental and personal records, as given from month to month, are collected together in the two following tables for the photographic and the thermometric stations respectively. A cursory examination of these tables shows that there is an annual periodicity by reason of which the differences are, in both cases, larger in the summer than in the winter months. This annual period is apparently due to the greater altitude of the sun in the summer season by reason of which both the actinic and the thermal power of the sun's rays is increased, wherefore the instrumental records must be interpreted to mean that, for the same percentage of clear sky as determined by personal estimates, there is, in the summer time, a larger proportion of hours during which the limiting thermal or actinic effect prevails. The stations are arranged from south to north in the order of latitude, that is to say, in the order of