extreme velocities are gusts of shorter duration, and are not given in this table):

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
		Miles				*Miles*	
Amarillo, Tex	13	50	e.	Hatteras, N. C.	17	54	n.
Do	17	52	n.	Huron, S. Dak	27	54	se.
Do	27	60	w.	Kittyhawk, N. C.	11	58	sw.
Do	28	56	w.	Do	19	50	se.
Do	31	62	n.	Marquette, Mich.	24	52	s.
Baltimore, Md	19	50	s.	New Haven, Conn	11	50	ne.
Block Island, R. I	11	72	ne.	New York, N. Y	2	70	w.
Boston, Mass	11	50	ne.	Do	3	60	nw.
Buffalo, N. Y	7	54	w.	Do	4	72	nw.
Cheyenne, Wyo	7	50	w.	Do	5	53	nw.
Do	27	52	nw.	Do	19	66	se.
Chicago, Ill	21	57	s.	Do	26	55	nw.
Do	25	57	sw.	Do	27	54	nw.
Cleveland, Ohio	19	52	nw.	Philadelphia, Pa.	3	50	nw.
Denver, Colo	25	58	nw.	Pueblo, Colo.	17	50	n.
Do	27	60	sw.	Tatoosh Island, Wash.	1	50	e.
Dodge City, Kan	27	50	sw.	Do	2	52	ne.
Eastport, Me	1	68	e.	Williston, N. Dak	21	56	nw.
Do	12	53	sw.	Winnemucca, Nev.	6	50	sw.
Do	19	55	se	Woods Hole, Mass	2	50	nw.
Elpaso, Tex	4	62	sw.	Do	3	58	nw.
Do	17	54	nw.	Do	4	56	nw.
Do	27	58	w.	Do	12	50	w.
Fort Canby, Wash	28	57	s.	Do	20	55	sw.

SUNSHINE AND CLOUDINESS.

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere, and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 17 regular stations of the Weather Bureau by its photographic, and at 21 by its thermal effects. At one station records are kept by both methods. The photographic record sheets show the apparent solar time, but the thermometric sheets show seventy-fifth meridian time; for convenience the results are all given in Table XI for each hour of local mean time.

Photographic and thermometric registers give the duration of that intensity of sunshine which suffices to make a record, and, therefore, they generally fail to record for a short time after sunrise and before sunset, because, even in a cloudless sky, the solar rays are then too feeble to affect the self-registers. If, therefore, such records are to be used for determining the amount of cloudiness, they must be supplemented by special observations of the sky near the sun at these times. The duration of clear sky thus specially determined constitutes the so-called twilight correction (more properly a low-sun correction), and when this has been applied, as has been done in preparing Table XI, there results a complete record of the clearness of the sky from sunrise to sunset in the neighborhood of the sun. The twilight correction is not needed when the self-registers are used for ascertaining the duration of a special intensity of sunshine, but is necessary when the duration of cloudiness is alone desired, as is usually the case.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table XI.

COMPARISON OF DURATIONS AND AREAS.

The sunshine registers give the *durations* of effective sunshine whence the duration relative to possible sunshine is derived; the observer's personal estimates give the percentage of *area* of clear sky. These numbers have no necessary relation to each other, since stationary banks of clouds may obscure the sun without covering the sky, but when all clouds have a steady motion past the sun and are uniformly scattered over the sky, the percentages of duration and of area agree closely. For the sake of comparison, these percentages have been brought together, side by side, in the following table, from which it appears that, in general, the instrumental records of percentages of durations of sunshine are almost always larger than the observers' personal estimates of percentages of area of clear sky; the average excess for March, 1896, is 10 per cent for photographic and 11 per cent for thermometric records. The details are shown in the following table, in which the stations are arranged according to the greatest possible duration of sunshine, and not according to the *observed* duration as heretofore.

Difference between instrumental and personal observations of sunshine.

Stations.	Apparatus.	Total possible duration.	Personal estimated area of clear sky.	Instrumental record of sunshine.			
				Photographic.	Difference.	Thermometric.	Difference
		Hrs.	%	%	%	%	%
Galveston, Tex	P.	372.6	46	50	+ 4	.....	.....
New Orleans, La	T.	372.5	45	.....	.....	49	+ 4
Atlanta, Ga	T.	372.3	42	.....	.....	65	+23
Phœnix, Ariz	P.	372.3	53	75	+22	.....	.....
San Diego, Cal	P.	372.3	52	68	+16	.....	.....
Wilmington, N. C	T.	372.2	61	.....	.....	72	+11
Little Rock, Ark	T.	372.1	33	.....	.....	48	+15
Savannah, Ga	P.	372.1	58	69	+11	.....	.....
Vicksburg, Miss	T.	372.1	51	.....	.....	57	+ 6
Santa Fe, N. Mex	P.	371.9	55	67	+12	.....	.....
Baltimore, Md	T.	371.4	49	.....	.....	52	+ 3
Cincinnati, Ohio	T.	371.4	41	.....	.....	49	+ 8
Dodge City, Kans	P.	371.4	57	69	+12	.....	.....
Kansas City, Mo	P.	371.4	47	53	+ 6	.....	.....
Louisville, Ky	T.	371.4	39	.....	.....	54	+15
St. Louis, Mo	T.	371.4	48	.....	.....	58	+10
San Francisco, Cal	T.	371.4	46	.....	.....	51	+ 5
Washington, D. C	P.	371.4	57	57	0	.....	.....
Columbus, Ohio	T.	371.2	37	.....	.....	49	+12
Denver, Colo	P.	371.2	43	66	+23	.....	.....
Eureka, Cal	P.	371.2	44	45	+ 1	.....	.....
New York, N. Y	T.	371.2	47	.....	.....	55	+ 8
Philadelphia, Pa	T.	371.2	49	.....	.....	64	+15
Salt Lake City, Utah	P.	371.2	26	48	+22	.....	.....
Buffalo, N. Y	T.	370.9	36	.....	.....	53	+17
Rochester, N. Y	T.	370.9	49	.....	.....	58	+ 9
Boston, Mass	T.	370.8	45	.....	.....	56	+11
Chicago, Ill	T.	370.8	54	.....	.....	65	+11
Cleveland, Ohio	P.	370.8	32	42	+10	.....	.....
Des Moines, Iowa	T.	370.8	36	.....	.....	51	+15
Detroit, Mich	T.	370.8	50	.....	.....	57	+ 7
Eastport, Me	P.	370.7	32	46	+14	.....	.....
Northfield, Vt	P.	370.7	32	40	+ 8	.....	.....
Portland, Me	T.	370.7	43	.....	.....	55	+12
Bismarck, N. Dak	P.	370.3	44	50	+ 6	.....	.....
Helena, Mont	P.	370.3	50	51	+ 1	.....	.....
Portland, Oreg.	T.	370.3	44	.....	.....	48	+ 1
	P.	370.3	44	44	0	.....	.....

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table X, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

The dates on which reports of thunderstorms for the whole country were most numerous were: 27th, 118; 28th, 164; 29th, 152; 31st, 127.

Thunderstorm reports were most numerous in Illinois, 85; Ohio, 89; Tennessee, 69.

Thunderstorms were most frequent in: Texas, 14 days; Illinois and Mississippi, 13.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, from the 1st to the 3d, and also the 24th to the 31st, inclusive. On the remaining twenty days of this month 362 reports were received, or an average of about 18 per day. The dates on which the number of reports especially exceeded

this average were: 4th, 102; 6th, 37; 11th, 52; 13th, 72; 14th, 41.

Auroras were reported by a large percentage of observers in: North Dakota, 165; Minnesota, 61; Wisconsin, 57; Michigan, 54.

Auroras were reported most frequently in: North Dakota, 16 days; Iowa, Michigan, and Minnesota, 10.

CANADIAN REPORTS.

Thunderstorms and auroras. No thunderstorms were reported.

Auroras were reported as follows: St. Johns, 13th; Halifax, 13th; Yarmouth, 31st; St. Andrews, 13th, 14th; Charlottetown, 13th, 14th; Father Point, 6th, 14th, 15th; Quebec, 13th, 14th, 28th, 31st; Montreal, 14th, 22d; Rockliffe, 4th, 13th, 14th, 31st; Toronto, 4th, 13th, 14th; White River, 4th, 12th, 13th, 14th, 19th, 20th, 21st; Port Stanley, Saugeen, and Parry Sound, 4th; Port Arthur, 12th, 13th, 14th, 17th, 26th, 27th; Winnipeg, 3d, 6th, 7th, 10th to 14th, 20th, 25th, 31st; Minnedosa, 3d, 6th to 12, 15th, 26th, 30th; Qu'Appelle, 2d, 3d, 11th; Medicine Hat, 5th, 12th; Swift Current, 11th; Prince Albert, 3d, 4th, 11th; Battleford, 4th, 7th, 14th, 18th, 28th.

INLAND NAVIGATION.

The *extreme and average stages of water* in the rivers during the current month are given in Table VIII, from which it appears that the only river that rose above the danger line was the Ohio, at Evansville, Ind., which on the 25th attained the gauge reading of 32.1. In a number of cases, however, the rivers rose to a point but very little below danger line, for example, the Mississippi, at New Orleans, attained 12.6 on the 1st; the Monongahela, at Pittsburg, 20.8 on the 31st; the Big Sandy, at Louisa, Ky., 33.4 on the 31st, and the Tennessee, at Johnsonville, 20.9 on the 23d. The Mississippi, at St. Paul, La Crosse, and Dubuque, became sufficiently free from ice to allow observations to be taken on the 10th, 22d, and 23d, respectively. Heavy floods and great damage occurred on most of the rivers of New England on the 1st, 2d, and 3d of the month. As the Weather Bureau has no river stations in this region we can only summarize the newspaper accounts which state that the Connecticut, at Hartford, was 25 feet above low water, and at Bellows Falls, Vt., 17 feet. At Hudson, N. Y., the freshet in the Hudson River reached proportions never before known, but the ice in the river remained firm; at Albany the Hudson rose to 16 feet 10 inches above the normal level of the stream, or two inches below the high-water mark of 1893. The Mohawk River, at Rome and Schenectady, was the highest known in many years. The Passaic River, at Paterson, N. J., attained a point 3 feet lower than the great freshet of February. The Merrimac, at Lowell, reached 12 feet 9 inches on the dam, or nearly a foot beyond the freshet of 1895; at Lawrence and Haverhill, Mass., the Merrimac reached the highest point ever known.

The heavy rains in eastern Tennessee and southwestern Virginia, on the 29th, caused a number of landslides and the loss of bridges throughout that region. Five persons were drowned by the floods in Russell County, Va., two others near Abrams Falls, and two lives were lost in Clay County, Ky., by the sudden flooding of Sextons Creek. The water is reported to have risen so rapidly that it seemed as if it were a solid wall 15 or 20 feet high. Several other dwelling houses and a number of outbuildings in the valley of the creek were washed away.

ICE IN RIVERS AND HARBORS.

The state of ice in rivers and harbors is shown in detail on the Charts of Snow on the Ground, published weekly by the Weather Bureau, from which it appears that there was a general diminution in the thickness of ice, and on March 30 the condition was about as follows: (Thickness in inches.)

Rivers and harbors were generally free from ice, except Buffalo, 6; Sault Ste. Marie, 22; and Duluth, 25. Fields of ice impeded navigation in all the lakes, but the prospects were good for an early opening. The Missouri and Mississippi rivers were free from ice.

ANCHOR ICE IN AQUEDUCTS.

Serious difficulty was caused by the formation of ice, and especially "anchor" ice, in the early portion of the month at Macopin Dam, on the Pequannock River, which supplies the city of Newark, N. J., with water. As the formation of "anchor" ice is still but little understood, and is liable to cause a great deal of trouble in reservoirs and water pipes, these occurrences deserve special study. It is stated that the gate screens and intake screens at the Macopin Dam and at the Clifton Avenue reservoir were suddenly and entirely choked up by the accumulation of anchor ice attached to the solid surfaces underneath the water surface. It is said that such trouble had never occurred before in this aqueduct, and it is hoped it will not occur again.

METEOROLOGY AND MAGNETISM.

By Prof. FRANK H. BIGELOW.

For a description of the methods of constructing the tables and curves of Chart V, see the WEATHER REVIEW for October, 1895, and January, 1896. The numbers in the columns H. and D. are added respectively to the mean values for Washington and Toronto, i. e., H=0.18250; D=175.0. The values of the vertical forces are omitted, as well as $dz.\ s.\ a$, which depend upon it. The month of March was characterized by very stagnant eastward circulation, and local rather than general weather conditions. The magnet watch also showed signs of inversion from the direct type, which had prevailed for several periods, to the inverse type, and was attended by considerable unsteadiness in the 24-hourly rates.

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective services.

Snowfall and rainfall are expressed in inches.

Alabama.—The mean temperature was 53.0°, or 1.1° below normal; the highest was 92°, at Jasper on the 29th, and the lowest, 20°, at Newburg on the 12th and 13th. The average precipitation was 5.10, or 0.66 less than normal; the greatest monthly amount was 10.05, at Daphne, and the least, 2.48, at Opelika.

Arizona.—The mean temperature was 57.6°, or 4.0° above normal; the highest was 103°, at Fort Mojave on the 25th, and the lowest, 2°, at Whipple Barracks on the 6th. The average precipitation was 0.44, or 0.65 less than normal; the greatest monthly amount was 1.44, at Oracle, and the least, 0.05, at Wilcox.

Arkansas.—The mean temperature was 48.7°, or 2.0° below normal; the highest was 85°, at Warren on the 29th, and at Camden and Washington on the 31st, and the lowest, 12°, at Keeses Ferry on the 13th. The average precipitation was 5.28, or 0.47 above normal; the greatest monthly amount was 7.88, at Russellville, and the least, 2.06, at Silver Springs.

California.—The mean temperature was 53.5°, or 0.5° above normal; the highest was 111°, at Ogilby on the 25th, and the lowest, 14° below