

Reports were most numerous from: Montana, 6; Nevada, 7; North Dakota, 8.

The number of reports was a large percentage of the number of observers in: North Dakota, 17; Montana, 16; Nevada, 15.

In Canada.—Auroras were reported on the following dates: Father Point, 4; Quebec, 16, 17; Toronto, 11; White River, 18; Minnedosa, 15, 16, 21, 24; Medicine Hat, 23, 30; Battleford, 27; Banff, 14.

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 21 regular stations of the Weather Bureau by its photographic, and at 45 by its thermal effects; at one of these stations records are kept by both methods. The photographic record sheets show the apparent solar time, but the thermometric records show seventy-fifth meridian time; for convenience the results are all given in Table X for each hour of local mean time. In order to complete the record of the duration of cloudiness these registers are supplemented by special personal observations of the state of the sky near the sun in the hours after sunrise and before sunset, and the cloudiness for these hours has been added as a correction to the instrumental records, whence there results a complete record of the duration of sunshine from sunrise to sunset.

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 X for the stations at which instrumental self-registers are maintained.

COMPARISON OF DURATIONS AND AREAS.

The sunshine registers give the *durations* of effective sunshine whence the durations relative to possible sunshine are derived; the observers' personal estimates give the percentages 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 November, 1897, is 7 per cent for photographic and 6 per cent for thermometric records.

The details are shown in the accompanying table, in which

the stations are arranged according to the *total possible duration* of sunshine, and not according to the *observed duration*. In obtaining the total possible sunshine the value for the parallel of latitude nearest the station is used.

Difference between instrumental and personal observations of sunshine.

Stations.	Latitude.	Apparatus.	For whole month.		Instrumental record of sunshine.			
			Total possible.	Personal.	Photographic.	Difference.	Thermometric.	Difference.
Key West, Fla.	24 34	T.	326.2	65	...	...	73	+13
Tampa, Fla.	27 57	T.	323.5	61	...	...	68	+3
Galveston, Tex.	29 18	P.	321.7	61	66	+5	...	...
New Orleans, La.	29 58	T.	319.7	58	...	...	57	-1
Jacksonville, Fla.	30 20	T.	319.7	48	...	...	63	+15
Savannah, Ga.	32 05	P.	315.0	58	66	+8	...	...
Vicksburg, Miss.	32 22	T.	315.9	65	...	...	66	+1
San Diego, Cal.	32 43	P.	314.0	83	85	+2	...	...
Charleston, S. C.	32 47	T.	314.0	62	...	...	64	+2
Phoenix, Ariz.	33 28	P.	314.0	78	91	+15	...	...
Atlanta, Ga.	33 45	T.	312.2	85	...	...	64	-1
Los Angeles, Cal.	34 03	P.	312.2	81	88	+7	...	...
Wilmington, N. C.	34 14	T.	312.2	65	...	...	72	+7
Little Rock, Ark.	34 45	T.	310.1	54	...	...	73	+19
Chattanooga, Tenn.	35 04	T.	310.1	52	...	...	56	+4
Santa Fe, N. Mex.	35 41	P.	308.3	70	81	+11	...	...
Raleigh, N. C.	35 45	T.	308.3	56	...	...	67	+11
Knoxville, Tenn.	35 56	T.	308.3	56	...	...	61	+3
Nashville, Tenn.	36 10	T.	306.3	52	...	...	55	+3
Fresno, Cal.	36 48	T.	305.7	63	...	...	78	+15
Dodge City, Kans.	37 45	P.	304.0	66	74	+8	...	...
San Francisco, Cal.	37 48	T.	304.0	44	...	...	59	+15
Louisville, Ky.	38 15	T.	304.0	40	...	...	54	+14
St. Louis, Mo.	38 28	T.	301.5	46	...	...	52	+6
Washington, D. C.	38 54	P.	301.5	49	55	+6	...	...
Kansas City, Mo.	39 05	P.	301.5	52	53	+1	...	...
Cincinnati, Ohio	39 06	T.	301.5	43	...	...	44	+0
Parkersburg, W. Va.	39 18	T.	301.5	31	...	...	31	+0
Baltimore, Md.	39 18	T.	301.5	48	...	...	55	+7
Atlantic City, N. J.	39 22	P.	301.5	44	59	+15	...	...
Denver, Colo.	39 45	P.	299.7	47	66	+19	...	...
Indianapolis, Ind.	39 46	T.	299.7	37	...	...	42	+9
Philadelphia, Pa.	39 57	T.	299.7	36	...	...	47	+11
Columbus, Ohio	39 58	T.	299.7	37	...	...	36	-1
Harrisburg, Pa.	40 16	T.	299.7	37	...	...	47	+18
Pittsburg, Pa.	40 32	T.	297.3	29	...	...	34	+5
New York, N. Y.	40 42	T.	297.3	34	...	...	50	+16
Salt Lake City, Utah	40 46	P.	297.3	40	45	+5	...	...
Eureka, Cal.	40 48	P.	297.3	39	33	0	...	...
Cheyenne, Wyo.	41 08	P.	297.3	52	61	+9	...	...
Omaha, Nebr.	41 16	P.	294.9	50	...	...	...	...
Cleveland, Ohio	41 30	T.	294.9	16	...	...	20	+4
Des Moines, Iowa	41 35	T.	294.9	55	...	...	55	+0
Chicago, Ill.	41 53	T.	294.9	31	...	...	32	+1
Erie, Pa.	42 07	T.	294.9	26	...	...	16	-11
Binghamton, N. Y.	42 08	T.	294.9	24	...	...	32	+8
Detroit, Mich.	42 20	T.	294.9	23	...	...	27	+4
Boston, Mass.	42 21	T.	294.9	32	...	...	40	+8
Dubuque, Iowa	42 30	T.	294.9	45	...	...	42	+3
Albany, N. Y.	42 39	T.	293.3	23	...	...	35	+12
Buffalo, N. Y.	42 58	T.	292.8	12	...	...	23	+11
Yankton, S. Dak.	42 54	T.	292.3	48	...	...	55	+10
Rochester, N. Y.	43 08	T.	292.3	20	...	...	21	+3
Idaho Falls, Idaho	43 29	T.	292.3	30	...	...	33	+3
Portland, Me.	43 38	T.	289.7	84	...	...	42	+8
Northfield, Vt.	44 10	P.	289.7	20	27	+7	...	...
Huron, S. Dak.	44 21	T.	289.7	35	...	...	47	+2
Eastport, Me.	44 54	P.	287.2	26	37	+11	...	...
St. Paul, Minn.	44 58	P.	287.2	37	40	+3	...	...
Minneapolis, Minn.	44 59	T.	287.2	...	...	...	80	...
Portland, Oreg.	45 32	T.	284.1	15	...	...	23	+8
Helena, Mont.	46 34	P.	284.1	15	12	-3	...	...
Bismarck, N. Dak.	46 47	P.	281.0	29	33	+4	...	...
Tacoma, Wash.	47 16	T.	281.0	51	61	+10	...	...
Seattle, Wash.	47 38	T.	278.0	12	...	...	16	+6
Spokane, Wash.	47 40	T.	278.0	12	...	...	4	-8

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 sections of the Climate and Crop Service. The name of the section director is given after each summary.

Snowfall and rainfall are expressed in inches.

Alabama.—The mean temperature was 54.6°, or 0.6° above normal; the highest was 85°, at Newburg on the 14th, and the lowest, 21°, at Jasper on the 30th. The average precipitation was 2.03, or 0.97 below normal; the greatest monthly amount, 6.58, occurred at Riverton, and the least, 0.50, at Highland Home.—*F. P. Chaffee.*

Arizona.—The mean temperature was 55.0°, or normal; the highest was 101°, at Maricopa, and the least, 9°, at Snowflake. The average precipitation was 0.02, or 0.83 below normal; the greatest monthly

amount, 0.50, occurred at Oracle, while none fell at numerous stations.—*W. T. Blythe.*

Arkansas.—The mean temperature was 51.6°, or 1.8° above normal; the highest was 88°, at Lutherville on the 15th, and the lowest, 15°, at Silver Springs on the 30th. The average precipitation was 2.82, or 1.53 below normal; the greatest monthly amount, 5.80, occurred at Forest City, and the least, 0.86, at Dardanelle.—*F. H. Clarke.*

California.—The mean temperature was 50.8°, or 2.6° below normal; the highest was 95°, at Volcano Springs on the 2d, and the lowest, 2° below zero, at Bodie on the 8th and 25th. The average precipitation was 1.41, or 1.02 below normal; the greatest monthly amount, 10.45, occurred at Crescent City.—*W. H. Hammon.*

Colorado.—The mean temperature was 37.7°, or 4.8° above normal; the highest was 84°, at Minneapolis on the 20th, and the lowest, 7° below zero, at Steamboat Springs on the 15th. The average precipitation was 0.54, or 0.21 below normal; the greatest monthly amount, 3.50, occurred at Ruby, while none fell at several stations.—*F. H. Brandenburg.*

Florida.—The mean temperature was 67.4°, or 2.3° above normal; the highest was 89°, at Perry on the 1st and 2d, and the lowest, 36°, at Perry on the 12th, and at Wausau on the 14th. The average precipitation was 1.84, or 1.50 below normal; the greatest monthly amount, 6.49, occurred at Jupiter, and the least, trace, at Carrabelle.—*A. J. Mitchell.*

Georgia.—The mean temperature was 55.6°, or 1.9° above normal; the highest was 86°, at Crescent on the 7th and 10th, and the lowest, 21°, at Clayton on the 24th. The average precipitation was 1.48, or 1.62 below normal; the greatest monthly amount, 3.99, occurred at Clayton, and the least, trace, at Fleming.—*J. B. Marbury.*

Idaho.—The mean temperature was 36.4°; the highest was 72°, at Nampa on the 1st, and at Payette on the 3d; and the lowest, 6° below zero, at Swan Valley on the 8th. The average precipitation was 3.18; the greatest monthly amount, 10.98, occurred at Murray, and the least, 0.16, at Gray.—*D. P. McCullum.*

Illinois.—The mean temperature was 40.8°, or 1.7° above normal; the highest was 78°, at Mount Vernon on the 15th, and the lowest, 8° below zero, at Zion on the 29th. The average precipitation was 4.09, or 0.95 above normal; the greatest monthly amount, 7.85, occurred at Robinson, and the least, 1.15, at Scales Mound.—*C. E. Linney.*

Indiana.—The mean temperature was 42.6°, or 1.5° above normal; the highest was 72°, at Washington on the 21st, and the lowest, 6°, at Laporte on the 30th. The average precipitation was 6.54, or 2.62 above normal; the greatest monthly amount, 9.84, occurred at Shelbyville, and the least, 0.88, at Hammond.—*C. F. R. Wappenhans.*

Iowa.—The mean temperature was 34.3°; the highest was 81°, at Albia and Iowa City on the 20th, and the lowest, 19° below zero, at Rock Rapids on the 28th. The average precipitation was 0.66; the greatest monthly amount, 2.24, occurred at Fort Madison, and the least, trace, at Atlantic and Glenwood.—*G. M. Chappel.*

Kansas.—The mean temperature was 42.2°, or 1.8° above normal; the highest was 89°, at Englewood on the 20th, and the lowest, 1° below zero, at Eureka Ranch on the 29th. The average precipitation was 0.27, or 0.59 below normal; the greatest monthly amount, 1.25, occurred at Kansas City, while none fell at several stations.—*T. B. Jennings.*

Kentucky.—The mean temperature was 47.8°, or 2.5° above normal; the highest was 78°, at Canton on the 8th, at Paducah on the 21st, and at Pilot Oak on two days; the lowest was 12°, at Loretto on the 30th. The average precipitation was 4.69, or 0.67 above normal; the greatest monthly amount, 9.29, occurred at Owenton, and the least, 2.34, at Eubank.—*Frank Burke.*

Louisiana.—The mean temperature was 60.5°, or 2.1° above normal; the highest was 89°, at Lawrence on the 27th and at Plaquemine on the 20th, and the lowest, 23°, at Robeline on the 18th. The average precipitation was 3.06, or 0.76 below normal; the greatest monthly amount, 7.39, occurred at Jeanerette, and the least, 0.65, at Venice.—*R. E. Kerkam.*

Maryland and Delaware.—The mean temperature was 45.0°, or 1.3° above normal; the highest was 80°, at Newmarket, Md., on the 15th, and the lowest, 8°, at Grantsville, Md., on the 24th. The average precipitation was 4.69, or 1.56 above normal; the greatest monthly amount, 8.43, occurred at Bachmans Valley, Md., and the least, 1.59, at Pocomoke City, Md.—*F. J. Wals.*

Michigan.—The mean temperature was 33.9°, or 1.2° below normal; the highest was 69°, at Mount Clemens on the 1st, and the lowest, 11° below zero, at Iron River on the 27th. The average precipitation was 3.12, or 0.15 above normal; the greatest monthly amount, 6.03, occurred at Fitchburg, and the least, 0.85, at Gladwin.—*O. F. Schneider.*

Minnesota.—The mean temperature was 26.6°, or 0.6° above normal; the highest was 79°, at Luverne on the 3d, and the lowest, 22° below zero, at Koochiching on the 28th. The average precipitation was 0.53, or 0.61 below normal; the greatest monthly amount, 1.30, occurred at Tower, and the least, 0.04, at Ada.—*T. S. Outram.*

Mississippi.—The mean temperature was 56.0°, or 2.3° above normal; the highest was 89°, at French Camp on the 22d, at Palo Alto on the 15th, and at Waynesboro on the 1st; the lowest was 22°, at French Camp on the 30th. The average precipitation was 2.45, or 2.19 below normal, the greatest monthly amount, 6.44, occurred at Corinth, and the least, 0.72, at Agricultural College.—*R. J. Hyatt.*

Missouri.—The mean temperature was 43.3°, or 1.8° above normal; the highest was 82°, at Zeitonia on the 13th, and the lowest, 3° below zero, at Maryville and Pickering on the 29th. The average precipitation was 2.51, or 0.07 above normal; the greatest monthly amount, 6.21, occurred at St. Louis, and the least, 0.27, at Conception.—*A. E. Hackett.*

Montana.—The mean temperature was 26.2°, or 2.8° below normal; the highest was 77°, at Fort Benton on the 19th, and the lowest, 35° below zero, on the 28th. The average precipitation was 2.36, or 0.21 above normal; the greatest monthly amount, 10.04, occurred at Columbia Falls, and the least, 0.25, at Wibaux.—*J. Warren Smith.*

Nebraska.—The mean temperature was 34.9°, or 0.4° above normal; the highest was 84°, at Lodgepole on the 13th, and the lowest, 16° below zero, at Valentine on the 29th. The average precipitation was 0.51, or 0.19 below normal; the greatest monthly amount, 1.74, occurred at Kennedy, and the least, trace, at Madrid, Seneca, and Wilber.—*G. A. Loveland.*

Nevada.—The mean temperature was 40.3°, or 2.0° above normal; the highest was 77°, at Candelaria on the 18th, and the lowest, 6° below zero, at Empire Ranch on the 15th. The average precipitation was 0.69, or 0.02 below normal; the greatest monthly amount, 3.66, occurred at Lewers Ranch, while none fell at Hot Springs, Mill City, and Las Vegas.—*R. F. Young.*

New England.—The mean temperature was 36.9°, or 0.7° below normal; the highest was 68°, at numerous stations in southern New England on the 6th and 16th; the lowest was 3° below zero, at Hartland, Vt., on the 24th. The average precipitation was 6.38, or 2.51 above normal; the greatest monthly amount, 10.25, occurred at Kingston, R. I., and the least, 2.69, at Kineo, Me.—*J. W. Smith.*

New Jersey.—The mean temperature was 43.8°, or 0.4° above normal; the highest was 75°, at Toms River on the 16th, and the lowest, 10°, at Franklin Furnace on the 24th. The average precipitation was 4.59, or 0.93 above normal; the greatest monthly amount, 5.95, occurred at Belvidere, and the least, 2.42, at Cape May City.—*E. W. McGann.*

New Mexico.—The mean temperature was 46.5°, or 2.6° above normal; the highest was 87°, at Roswell on the 21st, and the lowest, 5° below zero, at Buckmans on the 27th. The average precipitation was decidedly below normal; the greatest monthly amount, 0.78, occurred at Angus Ranch, while none fell at numerous stations.—*H. B. Hersey.*

New York.—The mean temperature was 38.4°, or 0.6° above normal; the highest was 70°, at Bedford on the 4th, and the lowest, 3° below zero, at Number Four on the 24th. The average precipitation was 4.74, or 1.59 above normal; the greatest monthly amount, 10.02, occurred at Glens Falls, and the least, 2.19, at Avon.—*R. M. Hardinge.*

North Carolina.—The mean temperature was 51.3°, or 1.6° above normal; the highest was 79°, at Newbern on the 5th and at Tarboro on the 16th, and the lowest, 12°, at Linville on the 24th. The average precipitation was 2.89, or 0.45 below normal; the greatest monthly amount, 5.71, occurred at Greenville, and the least, 0.82, at Rockingham.—*C. F. von Herrmann.*

North Dakota.—The mean temperature was 20.0°, or 0.3° above normal; the highest was 86°, at Berthold Agency on the 19th, and the lowest, 28° below zero, at Bottineau on the 27th. The average precipitation was 0.32, or 0.63 below normal; the greatest monthly amount, 1.07, occurred at Hamilton, and the least, trace, at Ashley, Dunsieith, Ellendale, and Glenullin.—*B. H. Bronson.*

Ohio.—The mean temperature was 42.2°, or 1.5° above normal; the highest was 76°, at Thurman on the 1st and at Portsmouth on the 4th, and the lowest, 8°, at Levering on the 30th. The average precipitation was 6.62, or 3.36 above normal; the greatest monthly amount, 10.18, occurred at New Paris, and the least, 3.84, at Dupont.—*H. W. Richardson.*

Oklahoma.—The mean temperature was 49.6°; the highest was 95°, at Anadarko on the 8th, and the lowest, 7°, at Arapaho on the 29th. The average precipitation was 0.51; the greatest monthly amount, 1.61, occurred at Burnett, while none fell at Jefferson and Waukomis.—*J. I. Widmeyer.*

Oregon.—The mean temperature was 42.6°, or 2.8° below normal; the highest was 82°, at Prineville on the 2d, and the lowest, 2°, at Burns on the 23d. The average precipitation was 9.30, or 3.96 above normal; the greatest monthly amount, 32.91, occurred at Glenora, and the least, 0.13, at Silver Lake.—*B. S. Payne.*

Pennsylvania.—The mean temperature was 41.6°, or 1.8° above normal; the highest was 76°, at Cannonsburg on the 4th, and the lowest, 2°, at Dyberry on the 24th. The average precipitation was 5.28, or 2.13 above normal; the greatest monthly amount, 7.04, occurred at Hamburg, and the least, 2.37, at Reedsville.—*T. F. Townsend.*

South Carolina.—The mean temperature was 55.3°, or 0.2° above normal; the highest was 88°, at Trial on the 12th, and the lowest, 23°, at Holland on the 19th, and at Walhalla on the 30th. The average precipitation was 1.99, or 0.62 below normal; the greatest monthly amount, 5.05, occurred at Gaffney, and the least, 0.26, at Gillisonville.—*J. W. Bauer.*

South Dakota.—The mean temperature was 26.0°, or 0.8° below normal; the highest was 88°, at Cherry Creek on the 2d, and the lowest, 26° below zero, at Ladelle on the 29th, and at Nowlin on the 26th. The average precipitation was 0.59, or 0.06 above normal; the greatest monthly amount, 2.70, occurred at Oelrichs, and the least, trace, at Cherry Creek and Shiloh.—*S. W. Glenn.*

Tennessee.—The mean temperature was 49.5°, or about 2.0° above normal; the highest was 79°, at St. Joseph on the 14th and 15th, and at Union City on the 22d, and the lowest, 13°, at Rugby on the 30th. The average precipitation was 3.10, or about 0.75 below normal; the greatest monthly amount, 6.90, occurred at Hickory Withe, and the least, 0.69, at Bristol.—*H. C. Bate.*

Texas.—The mean temperature for the State during the month was 1.2° above the normal. There was a general excess throughout the State, except over the western portion of west Texas and the central portion of north Texas, where there was a deficiency ranging from 0.3° to 1.9°, with the greatest deficit in the vicinity of Weatherford. The excess ranged from 0.3° to 3.1° over central Texas, the panhandle, the western portion of north Texas, and the eastern portions of north and west Texas, and from 0.1° to 3.9° over southwest Texas and the coast district. Temperature was generally normal over east Texas. The greatest excess was in the vicinity of Fort McIntosh. The highest was 96°, at Camp Eagle Pass on the 4th, and the lowest, 8°, at Tulia on the 29th. The precipitation on an average for the State during the month was 1.88 below the normal. There was a general deficiency in all localities except at Fort Ringgold and Fort Brown, where there was an excess. The deficiency ranged from 0.24 to 1.78 over central and west Texas and the panhandle, from 0.66 to 3.38 over southwest Texas and the coast district except in the vicinity of Fort Ringgold. The greatest monthly amount, 3.03, occurred at Fort Brown, while none fell at several stations.—*I. M. Olive.*

Utah.—The mean temperature was 39.3°; the highest was 78°, at Fillmore on the 2d, and the lowest, 1° below zero, at Loa on the 8th and at Soldier Summit on the 24th. The average precipitation was 0.96, or

about 0.50 below normal; the greatest monthly amount, 2.44, occurred at Logan, and the least, 0.04, at Pahreah.—*J. H. Smith.*

Virginia.—The mean temperature was 46.5°, or slightly above normal; the highest was 80°, at Ashland on the 16th, and the lowest, 10°, at Burkes Garden on the 24th. The average precipitation was 2.49, or 0.01 above normal; the greatest monthly amount, 4.37, occurred at Bonair, and the least, 0.69, at Bristol.—*E. A. Evans.*

Washington.—The mean temperature was 39.4°, or 2.0° below normal; the highest was 75°, at Walla Walla on the 18th, and the lowest, 10° below zero, at Waterville on the 28th. The average precipitation was 9.13, or 2.90 above normal; the greatest monthly amount, 23.85, occurred at Clearwater, and the least, 0.75, at Loomis.—*G. N. Salisbury.*

West Virginia.—The mean temperature was 45.0°, or 1.0° above normal; the highest was 76°, at Eastbank and Green Sulphur Springs on the 26th and at Uppertract on the 6th. The average precipitation was 4.45, or 1.50 above normal; the greatest monthly amount, 7.15, occurred at Kingwood, and the least, 0.30, at Beckly.—*H. L. Ball.*

Wisconsin.—The mean temperature was 30.4°, or 0.3° above normal; the highest was 79°, at Medford on the 3d, and the lowest, 25° below zero, at Osceola Mills on the 27th. The average precipitation was 1.32, or 0.46 below normal; the greatest monthly amount, 2.99, occurred at Oconto, and the least, 0.04, at Medford.—*W. M. Wilson.*

Wyoming.—The mean temperature was 33.4°, or 1.4° above normal; the highest was 76°, at Wheatland on the 2d, at Fort Laramie on the 3d, and at Sheridan on the 19th; the lowest was 16° below zero, at Sheridan on the 29th. The average precipitation was 0.88, or 0.08 below normal; the greatest monthly amount, 2.98, occurred at Fort Yellowstone, and the least, 0.12, at Carbon.—*W. S. Palmer.*

RIVER AND FLOOD SERVICE.

By PARK MORRILL, Forecast Official, in charge of River and Flood Service.

The period of low water has been unusually protracted this year. As a rule, the annual rise in all the rivers, except the upper Mississippi, the Missouri, and the Arkansas, is well underway by the first of November. This year the Ohio rose first, and that but slightly, the rise beginning on November 7. The lower Mississippi followed with a slow rise during the latter half of November, but the other rivers remain at low ebb. At all points the rivers are below their normal height. The Mississippi, at Keokuk, at the end of November was 1.5 foot below its normal stage; at St. Louis, 3.4 feet; at Cairo, 7.6 feet; at Memphis, 7.3 feet; and at Vicksburg, 14.2 feet. The Arkansas River, at Little Rock, at the same time was 4.7 feet below its normal stage; the Red, at Shreveport, 9.8 feet; and the Ohio, at Cincinnati, 1.5 below. The rising condition of the Ohio and the lower Mississippi and the stationary low stage of other rivers of the Mississippi system are seen in the hydrographs for the month.

The highest and lowest water, mean stage, and monthly range at 116 river stations are given in the accompanying table. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Cairo, Memphis, and Vicksburg, on the Mississippi; Cincinnati, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.

The following résumé of river stages and conditions of navigation in the respective streams is compiled from reports by the officials of the Weather Bureau at various river stations and section centers:

Atlantic Coast Rivers. (Reported by A. F. Sims, Albany, N. Y.; E. R. Demain, Harrisburg, Pa.; E. A. Evans, Richmond, Va.; C. F. von Herrmann, Raleigh, N. C.; L. N. Jesunofsky, Charleston, S. C.; D. Fisher, Augusta, Ga.; and J. B. Marbury, Atlanta, Ga.)—The heavy rain of the 1st and 2d of November found its way to tide-water rapidly, so that by the 4th of the month the Hudson River at Albany was 4 feet above the normal. The stream flowing by the intake of the Albany City Waterworks was very turbid, and the city pumps were shut down in consequence. A dense fog, the heaviest thus far this season, prevailed along the Hudson on the 5th; one could not see objects across the river and buildings near by seemed mere shadows; the sun a dull red blot in the gray sky. At 10 a. m. the fog lifted and

soon cleared away. Light snow fell on the upper watershed on the 13th.

Observations of temperature of water were commenced on the morning of the 18th; the temperature of the water in the Hudson at Albany was 39.5° on that date. On the 19th the river temperature was 37.5° at top and bottom; thin ice, the first of the season, formed along the edges of the basin in the vicinity of Green Island. The fall in temperature on the 18th and 19th checked the flow of surface water on the upper watershed and caused the river to fall to its normal height at Albany. On the 23d thin ice formed in the Erie Canal slips; thin ice formed in the Albany basin during the night of the 23d and 24th. The cold wave of the 23d lowered the air temperature to 12.5° and the water temperature to 35.5°.

On the 28th there was a 4-foot freshet in the river and swift current conditions, not conducive to a freeze-up. The fall in temperature experienced during the night of the 28th checked the flow of surface water in the feeders and lowered the tide-water portion of the Hudson 1 foot. At the end of the month the Hudson was high for the season, very turbid, and the current abnormally swift.

All river interests have made preparation to go into winter quarters; the Albany basins have already taken on a winter aspect. Some of the International Dredging Company's boats, used on the Hudson River improvements, are now being dismantled, and other boats, requiring extensive overhauling, are now in winter berths. Forwarding agents have ceased to take cargoes for points along the upper portion of the Hudson on account of the risk involved in unloading boats in shallow water at this season of the year. The last decade of November was replete with calls for river information, and no small measure of reward for our work comes with the increased confidence manifested by all river interests in the work of the Weather Bureau.

As a result of the rain, averaging 1.75 inch, which began to fall early on the morning of November 1, and continued steadily until the night of the 2d, throughout the greater portion of the Susquehanna basin, the low stages of water prevailing in all streams of the system at the end of October were followed during the first few days of November by a general rise, ranging from a fraction of a foot to 4.5 feet at the different reporting stations. Frequent, well distributed rains during the rest of the month maintained and gradually increased the flow, and November closed with higher stages of water at most of the stations than have been reported since May. The average stage of water was about 0.5 foot lower than during the same period last year, notwithstanding the fact that there was an increase of about 50 per cent in the rainfall as compared with November, 1896. The rainfall at Harrisburg (4.09 inches) was, with two exceptions, the largest amount that has fallen in November during the past ten years, and exceeded the normal by 1.12 inch. It is believed Harrisburg represents, approximately, the conditions obtaining generally over the watershed. The apparent discrepancy between rainfall and river stages in the streams the past month is due to the fact that at the beginning of the month the streams were so much lower than at the same time last year that a large percentage of the rainfall was required to give the same flow as