

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 64 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 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 October, 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.	358.6	61	.....	.....	.....	.....	+11
Tampa, Fla.....	27 57	T.	356.3	66	.....	.....	.....	.....	+3
Galveston, Tex.....	29 18	P.	355.9	62	63	+1	.....	.....	.....
New Orleans, La.....	29 58	T.	354.7	59	.....	.....	58	.....	-1

Difference between instrumental and personal observations.—Cont'd.

Stations.	Latitude.	Apparatus.	For whole month.		Instrumental record of sunshine.				
			Total possible.	Personal.	Photographic.	Difference.	Thermometric.	Difference.	
Savannah, Ga.....	32 05	P.	352.8	52	58	+6	.....	.....	.....
Vicksburg, Miss.....	32 23	P.	352.8	69	.....	.....	75	.....	+6
San Diego, Cal.....	32 43	P.	351.5	80	79	+1	.....	.....	.....
Charleston, S. C.....	32 47	P.	351.5	45	.....	.....	46	.....	+1
Phoenix, Ariz.....	33 28	P.	351.5	75	85	+10	.....	.....	.....
Atlanta, Ga.....	33 45	P.	350.9	71	.....	.....	69	.....	-3
Los Angeles, Cal.....	34 03	P.	350.9	64	70	+6	.....	.....	.....
Wilmington, N. C.....	34 14	T.	350.9	53	.....	.....	56	.....	+3
Little Rock, Ark.....	34 45	T.	350.1	72	.....	.....	87	.....	+15
Chattanooga, Tenn.....	35 04	T.	350.1	75	.....	.....	76	.....	+1
Santa Fe, N. Mex.....	35 41	P.	348.9	60	66	+6	.....	.....	.....
Raleigh, N. C.....	35 45	T.	348.9	46	.....	.....	54	.....	+8
Nashville, Tenn.....	36 10	T.	348.9	82	.....	.....	86	.....	+4
Fresno, Cal.....	36 43	T.	347.9	72	.....	.....	76	.....	+4
Dodge City, Kans.....	37 45	P.	347.3	63	70	+7	.....	.....	.....
San Francisco, Cal.....	37 48	T.	347.3	56	.....	.....	70	.....	+14
Louisville, Ky.....	38 15	T.	347.3	75	.....	.....	82	.....	+7
St. Louis, Mo.....	38 38	T.	346.0	77	.....	.....	88	.....	+11
Washington, D. C.....	38 54	P.	346.0	48	51	+3	.....	.....	.....
Kansas City, Mo.....	39 05	P.	346.0	69	76	+7	.....	.....	.....
Cincinnati, Ohio.....	39 06	T.	346.0	79	.....	.....	83	.....	+3
Parkersburg, W. Va.....	39 16	T.	346.0	73	.....	.....	75	.....	+3
Baltimore, Md.....	39 18	T.	346.0	46	.....	.....	52	.....	+6
Atlantic City, N. J.....	39 22	P.	346.0	47	54	+7	.....	.....	.....
Denver, Colo.....	39 45	P.	344.9	50	65	+15	.....	.....	.....
Indianapolis, Ind.....	39 46	T.	344.9	71	.....	.....	81	.....	+10
Philadelphia, Pa.....	39 57	T.	344.9	47	.....	.....	58	.....	+11
Columbus, Ohio.....	39 58	T.	344.9	65	.....	.....	76	.....	+11
Harrisburg, Pa.....	40 16	T.	344.9	45	.....	.....	59	.....	+14
Pittsburg, Pa.....	40 32	T.	343.9	55	.....	.....	54	.....	+1
New York, N. Y.....	40 43	T.	343.9	50	.....	.....	56	.....	+6
Salt Lake City, Utah.....	40 46	P.	343.9	42	61	+19	.....	.....	.....
Eureka, Cal.....	40 48	P.	343.9	51	54	+3	.....	.....	.....
Cheyenne, Wyo.....	41 08	P.	343.9	54	65	+11	.....	.....	.....
Omaha, Nebr.....	41 16	P.	343.9	56	65	+9	.....	.....	.....
Cleveland, Ohio.....	41 30	T.	342.5	46	.....	.....	55	.....	+9
Des Moines, Iowa.....	41 35	T.	342.5	60	.....	.....	61	.....	+1
Chicago, Ill.....	41 53	T.	342.5	71	.....	.....	73	.....	+1
Erie, Pa.....	42 07	T.	342.5	40	.....	.....	57	.....	+8
Binghamton, N. Y.....	42 08	T.	342.5	53	.....	.....	61	.....	+8
Detroit, Mich.....	42 20	T.	342.5	53	.....	.....	59	.....	+6
Boston, Mass.....	42 31	T.	342.5	59	.....	.....	67	.....	+8
Dubuque, Iowa.....	42 30	T.	342.5	73	.....	.....	69	.....	-3
Albany, N. Y.....	42 39	T.	341.8	61	.....	.....	85	.....	+24
Buffalo, N. Y.....	42 53	T.	341.8	37	.....	.....	56	.....	+19
Rochester, N. Y.....	43 06	T.	341.8	41	.....	.....	42	.....	+1
Idaho Falls, Idaho.....	43 29	T.	341.8	46	.....	.....	46	.....	0
Yankton, S. Dak.....	43 54	T.	341.8	49	.....	.....	58	.....	+9
Portland, Me.....	43 39	T.	340.5	62	.....	.....	74	.....	+12
Northfield, Vt.....	44 10	P.	340.5	56	64	+8	.....	.....	.....
Huron, S. Dak.....	44 21	T.	340.5	47	.....	.....	50	.....	+3
Eastport, Me.....	44 54	P.	339.8	53	67	+14	.....	.....	.....
St. Paul, Minn.....	44 58	P.	339.8	41	47	+6	.....	.....	.....
Minneapolis, Minn.....	44 59	T.	339.8	.....	.....	.....	86	.....	.....
Portland, Oreg.....	45 32	T.	338.5	56	.....	.....	58	.....	+3
Helena, Mont.....	46 34	P.	336.7	61	66	+5	.....	.....	.....
Bismarck, N. Dak.....	46 47	P.	336.7	53	59	+6	.....	.....	.....
Tacoma, Wash.....	47 16	T.	336.7	35	.....	.....	51	.....	+16
Seattle, Wash.....	47 38	T.	335.8	46	.....	.....	31	.....	-15
Spokane, Wash.....	47 40	T.	335.8	51	.....	.....	61	.....	+10

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 67.2°, or 4.2° above normal; the highest was 97°, at Goodwater on the 17th, and the lowest, 30°, at Newburg on the 24th and at Hamilton on the 29th. The average precipitation was 1.34, or 0.74 below normal; the greatest monthly amount, 5.00, occurred at Daphne, while none fell at Brewton, Goodwater, and Mount Willing.—*F. P. Chaffee.*

**Arizona.**—The mean temperature was 62.2°, or 2.9° below normal; the highest was 108°, at Texas Hill, and the lowest, 21°, at Fort Defiance on the 18th and at Fort Whipple on the 27th. The average precipitation was 0.47, or 0.22 below normal; the greatest monthly

amount, 2.65, occurred at Williams, while none fell at several stations.—*W. T. Blythe.*

**Arkansas.**—The mean temperature was 67.7°, or 6.3° above normal; the highest was 99°, at Helena on the 3d, and the lowest, 28°, at Keesees Ferry on the 30th. The month was the warmest October on record. The average precipitation was 2.01, or 0.13 below normal; the greatest monthly amount, 5.36, occurred at Blanchard, and the least, 0.29, at Russellville.—*F. H. Clarke.*

**California.**—The mean temperature was 58.5°, or 2.6° below normal; the highest was 108°, at Salton on the 1st, and the lowest, 10°, at Bodie on the 16th. The average precipitation was 1.79, or 0.57 above normal; the greatest monthly amount, 7.85, occurred at Follows Camp.—*W. H. Hammon.*

**Colorado.**—The mean temperature was 47.0°, or 1.0° above normal; the highest was 93°, at Lamar on the 2d, and the lowest, 2° below zero, at Breckenridge on the 28th. The average precipitation was 2.07, or 1.17 above normal; the greatest monthly amount, 6.50, occurred at Santa Clara, and the least, 0.31, at Walden.—*F. H. Brandenburg.*

**Florida.**—The mean temperature was 72.4°, or 0.2° below normal; the highest was 95°, at Lake Butler on the 5th, 13th, and 15th, and the lowest, 40°, at Wausau on the 26th and 27th. The average precipitation was 4.61, or slightly below normal; the greatest monthly amount, 10.26, occurred at Sebastian, and the least, 0.25, at Wausau.—*A. J. Mitchell.*

**Georgia.**—The mean temperature was 66.0°, or 1.4° above normal; the highest was 91°, at Crescent on the 7th, and the lowest, 34°, at Ramsey on the 30th. The average precipitation was 2.61, or 0.12 below normal; the greatest monthly amount, 8.80, occurred at Fleming, and the least, 0.40, at Whitesburg.—*J. B. Marbury.*

**Idaho.**—The mean temperature was 46.1°; the highest was 92°, at Minidoka on the 9th, and the lowest, 4°, at Swan Valley on the 16th. The average precipitation was 1.77; the greatest monthly amount, 6.90, occurred at Kootenai, and the least, 0.14, at Warren.—*D. P. McCallum.*

**Illinois.**—The mean temperature was 60.3°, or 6.8° above normal, and was the warmest October on record; the highest was 98°, at Walnut on the 1st and at Alexander on the 2d, and the lowest, 20°, at Scales Mound on the 26th. The average precipitation was 0.49, or 2.35 below normal, and was the least recorded in any October; the greatest monthly amount, 1.64, occurred at Hallidayboro, and the least, 0.04, at Peoria.—*C. E. Linney.*

**Indiana.**—The mean temperature was 59.7°, or 6.5° above normal; the highest was 94°, at Mount Vernon on the 3d, 4th, and 6th, and at Bluffton on the 16th, and the lowest, 21°, at Cambridge City on the 30th. The average precipitation was 0.90, or 1.30 below normal; the greatest monthly amount, 3.68, occurred at Mauzy, and the least, 0.23, at Hammond.—*C. F. R. Wappenhans.*

**Iowa.**—The mean temperature was 56.8°, or 6.8° above normal; the highest was 97°, at Ottumwa on the 1st, and the lowest, 20°, at Plover on the 29th. The average precipitation was 1.14, or 1.64 below normal; the greatest monthly amount, 3.30, occurred at Thurman, and the least, 0.03, at North McGregor.—*G. M. Chappel.*

**Kansas.**—The mean temperature was 60.9°, or 5.4° above normal; the highest was 97°, at Atchison on the 3d, at Gibson on the 7th, and at Oswego on the 2d; the lowest, 22°, at Ulysses on the 24th and at Lakin on the 28th. The average precipitation was 2.39, or 0.73 above normal; the greatest monthly amount, 5.80, occurred at Concordia, and the least, 0.54, at Fort Scott.—*T. B. Jennings.*

**Kentucky.**—The mean temperature was 63.2°, or 7.2° above normal, and was the warmest October on record; the highest was 96°, at Russellville and Greensburg on the 1st and at Shelby City on the 15th; the lowest was 26°, at Greensburg and Marrowbone on the 30th. The average precipitation was 1.10, or 0.91 below normal; the greatest monthly amount, 4.26, occurred at Ensor, and the least, 0.07, at Sergeant.—*Frank Burke.*

**Louisiana.**—The mean temperature was 71.0°, or 4.2° above normal, and was the warmest October on record; the highest was 98°, at Liberty Hill on the 3d, and the lowest, 38°, at Como on the 31st and at Robeline on the 29th and 30th. The average precipitation was 3.48, or 0.86 above normal; the greatest monthly amount, 6.69, occurred at Jeanerette, and the least, 0.95, at Amite.—*R. E. Kerkam.*

**Maryland and Delaware.**—The mean temperature was 56.6°, or 2.4° above normal; the highest was 91°, at Taneytown, Md., on the 16th, and the lowest, 20°, at Sunnyside, Md., on the 31st. The average precipitation was 3.21, or 0.20 above normal; the greatest monthly amount, 8.17, occurred at Millsboro, Del., and the least, 0.55, at Grantsville, Md.—*F. J. Walz.*

**Michigan.**—The mean temperature was 52.2°, or 5.5° above normal, and was the warmest October on record; the highest was 93°, at Waverly on the 5th, and the lowest, 18°, at Iron River on the 29th. The average precipitation was 2.34, or 0.01 above normal; the greatest monthly amount, 4.69, occurred at East Tawas, and the least, 0.23, at Allegan.—*C. F. Schneider.*

**Minnesota.**—The mean temperature was 50.0°, or 4.9° above normal; the highest was 92°, at Milan on the 1st, and the lowest, 10°, at Tower on the 9th. The average precipitation was 1.55, or 0.31 below normal; the greatest monthly amount, 3.35, occurred at Le Sueur, and the least, 0.15, at Wilmar.—*T. S. Outram.*

**Mississippi.**—The mean temperature was 69.0°, or 3.8° above normal; the highest was 99°, at Brookhaven and Yazoo City on the 7th, and the lowest, 30°, at Aberdeen on the 30th. The average precipitation was 1.85, or 0.97 below normal; the greatest monthly amount, 3.88, occurred at Briers, and the least, 0.35, at Waynesboro.—*R. J. Hyatt.*

**Missouri.**—The mean temperature was 62.6°, or 7.1° above normal, and was the warmest October on record; the highest was 99°, at Maryville on the 14th, and the lowest, 23°, at Potosi on the 30th. The average precipitation was 0.72, or 1.85 below normal; the greatest monthly amount, 1.84, occurred at Sikeston, while none fell at Darksville.—*A. E. Hackett.*

**Montana.**—The mean temperature was 41.1°, or nearly 2.0° above normal; the highest was 93°, at Glendive on the 1st, and the lowest, 10°, at Kipp on the 26th. The average precipitation was 1.25; the greatest monthly amount, 2.92, occurred at Bozeman, and the least, trace, at Wibaux.—*J. Warren Smith.*

**Nebraska.**—The mean temperature was 53.5°, or 3.3° above normal; the highest was 98°, at Rulo on the 14th, and the lowest, 16°, at Kim-

ball on the 31st. The average precipitation was 3.34, or 1.75 above normal; the greatest monthly amount, 8.33, occurred at Sutton, and the least, trace, at Fort Robinson.—*G. A. Loveland.*

**Nebraska.**—The mean temperature was 47.1°, or 3.1° below normal; the highest was 95°, at St. Thomas on the 1st, and the lowest, 9°, at Hamilton on the 15th and 16th. The average precipitation was 1.71, or 1.24 above normal; the greatest monthly amount, 4.41, occurred at Lewer's Ranch, and the least, 0.08, at Hot Springs.—*R. F. Young.*

**New England.**—The mean temperature was 50.1°, or 1.9° above normal; the highest was 91°, at Lake Cochituate, Mass., on the 16th, and the lowest, 12°, at West Milan, N. H., on the 31st. The average precipitation was 1.10, or 2.84 below normal; the greatest monthly amount, 2.44, occurred at Vineyard Haven, Mass., and the least, 0.15, at Newton, N. H.—*J. W. Smith.*

**New Jersey.**—The mean temperature was 55.8°, or 2.5° above normal; the highest was 95°, at Somerville on the 16th, and the lowest, 22°, at Charlotteburg on the 31st. The average precipitation was 2.43, or 1.15 below normal; the greatest monthly amount, 6.49, occurred at Cape May City, and the least, 0.87, at Englewood.—*E. W. McGann.*

**New Mexico.**—The mean temperature was 55.6°, or 1.5° below normal; the highest was 90°, at Los Lunas on the 8th and at Roswell on the 14th, and the lowest, 3°, at Winsor's on the 28th. The average precipitation was slightly above normal; the greatest monthly amount, 6.43, occurred at Fort Union, and the least, 0.20, at Eddy.—*H. B. Hersey.*

**New York.**—The mean temperature was 51.6°, or 3.2° above normal; the highest was 90°, at Willets Point on the 1st and at West Point on the 17th, and the lowest, 17°, at Canton on the 30th and 31st. The average precipitation was 0.88, or 2.57 below normal; the greatest monthly amount, 2.38, occurred at Number Four, and the least, 0.13, at Poughkeepsie.—*R. M. Hardinge.*

**North Carolina.**—The mean temperature was 62.2°, or 2.8° above normal; the highest was 94°, at Salisbury on the 2d, and the lowest, 23°, at Linville on the 5th. The average precipitation was 3.99, or 0.44 above normal; the greatest monthly amount, 12.24, occurred at Kittyhawk, and the least, 0.55, at Selma.—*O. F. von Herrmann.*

**North Dakota.**—The mean temperature was 45.9°, or 3.5° above normal; the highest was 93°, at Minot on the 1st and at Williston on the 12th, and the lowest, 6°, at Dickinson and Minto on the 9th. The average precipitation was 0.77, or 0.19 below normal; the greatest monthly amount, 2.50, occurred at Wahpeton, and the least, 0.05, at Berthold Agency.—*B. H. Bronson.*

**Ohio.**—The mean temperature was 58.1°, or 6.4° above normal, the warmest October on record; the highest was 97°, at New Paris and Thurman on the 1st, and the lowest, 20°, at Levering on the 8th and 30th, and at McArthur on the 30th. The average precipitation was 0.64, or 1.62 below normal, the driest month on record; the greatest monthly amount, 2.78, occurred at Hiram, while none fell at New Alexandria.—*H. W. Richardson.*

**Oklahoma.**—The mean temperature was 65.7°; the highest was 99°, at Wagoner on the 17th, and the lowest, 28°, at Mangum and Tahlequah on the 29th. The average precipitation was 1.37; the greatest monthly amount, 2.73, occurred at Fort Sill, and the least, 0.34, at Edmond.—*J. I. Widmeyer.*

**Oregon.**—The mean temperature was 51.6°, or 0.4° below normal; the highest was 94°, at Langlois on the 5th; this is the first time since the establishment of the service in Oregon that the thermometer ever rose to 94° in October. The average precipitation was 1.92, or 1.82 below normal; there was a deficiency in all districts; the greatest monthly amount, 8.18, occurred at Langlois, while none fell at Fife.—*B. S. Pague.*

**Pennsylvania.**—The mean temperature was 54.2°, or 4.1° above normal; the highest was 95°, at Cannonsburg on the 15th, and at Aqueduct on the 16th, and the lowest, 16°, at Shingle House on the 18th. The average precipitation was 1.32, or 1.91 below normal; the greatest monthly amount, 5.93, occurred at Reading, and the least, trace, at Greensboro.—*T. F. Tmnsend.*

**South Carolina.**—The mean temperature was 65.8°, or 1.8° above normal; the highest was 96°, at Little Mountain on the 2d, and the lowest, 35°, at Holland on the 30th. The average precipitation was 3.23, or 0.13 above normal; the greatest monthly amount, 7.04, occurred at Charleston, and the least, 1.20, at Effingham.—*J. W. Bauer.*

**South Dakota.**—The mean temperature was 50.0°, or 2.0° above normal; the highest was 96°, at Oelrichs on the 7th, and the lowest, 6°, at Cherry Creek on the 31st. The average precipitation was 1.24, or 0.25 above normal; the greatest monthly amount, 3.15, occurred at Plankinton, and the least, trace, at Cherry Creek and Nowlin.—*S. W. Glenn.*

**Tennessee.**—The mean temperature was 63.6°, or 5.5° above normal; the highest was 97°, at Sylvia on the 3d, and the lowest, 25°, at Erasmus on the 30th. The average precipitation was 1.61, or about 0.50 below normal; the greatest monthly amount, 4.20, occurred at Harriman, and the least, 0.10, at Union City.—*H. C. Butts.*

**Texas.**—The mean temperature for the State was 2.4° above the normal. There was a general excess in all sections, except in the vicinity of Cuero, El Paso, and Mount Blanco, where there was a slight deficiency, with the greatest, 2.3° at the latter place. The excess for the month ranged from 0.5° to 4° over north Texas and the panhandle;

from 0.2° to 5.1° over central, east, and southwest Texas, and from 0.3° to 4.7° over the coast district. The greatest excess was 5.1° at Waco. The highest was 102°, at Camp Eagle Pass on the 12th, and the lowest, 27°, at Amarillo and Mount Blanco on the 28th. The average precipitation for the State was 1.01 above the normal. There was a general excess, ranging from 0.25 to 7.77, over east Texas, the eastern portions of central and southwest Texas, the coast district, and the central portion of north Texas and the panhandle, while there was a general deficiency over the other portions of the State, ranging from 0.22 to 2.03 over the west and east portions of north Texas, the western portions of central and southwest Texas and coast district, and over west Texas, except in the vicinity of El Paso, where there was a slight excess. The greatest excess was 7.77 at Brazoria and the greatest deficiency was 2.03 in the vicinity of Brownsville. The rainfall was well distributed through the month, but was generally irregular over the State, being excessive in some localities, while there was very little in others. The greatest monthly amount, 10.23, occurred at Brazoria, while none fell at Camp Eagle Pass.—*I. M. Oline.*

*Utah.*—The mean temperature was 47.8°; the highest was 86°, at Cisco on the 9th, and the lowest, 7°, at Loa on the 26th. The average precipitation was 2.18; the greatest monthly amount, 3.76, occurred at Pinto, and the least, 0.28, at Park City.—*J. H. Smith.*

*Virginia.*—The mean temperature was 59.0°, or 1.6° above normal; the highest was 97°, at Buckingham on the 16th, and the lowest, 25°, at

Burkes Garden on the 31st. The average precipitation was 4.26, or 1.09 above normal; the greatest monthly amount, 9.64, occurred at Spottsville, and the least, 0.34, at Swords Creek.—*E. A. Evans.*

*Washington.*—The mean temperature was 49.8°, or 0.3° below normal; the highest was 90°, at Centerville on the 7th, and the lowest, 19°, at Centerville and Lind on the 15th. The average precipitation was 1.55, or 1.23 below normal; the greatest monthly amount, 4.55, occurred at Lapush, and the least, 0.07, at Dayton.—*G. N. Salisbury.*

*West Virginia.*—The mean temperature was 58.2°, or about 6.0° above normal; the highest was 95°, at Beverly on the 16th, and the lowest, 22°, at Marlinton on the 31st. The average precipitation was 0.53; the greatest monthly amount, 2.27, occurred at Harpers Ferry, and the least, 0.07, at Charleston.—*H. L. Ball.*

*Wisconsin.*—The mean temperature was 52.7°, or 5.1° above normal, and was the warmest October on record; the highest was 95°, at Gratiot on the 14th, and the lowest, 15°, at Wausaukee on the 17th. The average precipitation was 1.54, or 0.43 below normal; the greatest monthly amount, 3.93, occurred at Crandon, and the least, 0.27, at Viroqua.—*W. M. Wilson.*

*Wyoming.*—The mean temperature was 45.1°, or 0.7° below normal; the highest was 85°, at Fort Laramie on the 1st, and the lowest, 6° below zero, at Atlantic City on the 26th. The average precipitation was 1.04, or 0.28 above normal; the greatest monthly amount, 1.94, occurred at Wise, and the least, 0.21, at Lusk.—*J. B. Sloan.*

## RIVER AND FLOOD SERVICE.

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

This is the time of year at which the rivers normally reach their lowest ebb. The fall has continued to the end of the month, except in the Ohio and Tennessee, which have, perhaps, taken a lasting turn toward higher water, to be soon followed by the lower Mississippi. The slight rise at New Orleans must be attributed to the effect of the Gulf tide or of wind, as the fall has been steady and pronounced at Vicksburg, and also in the Red River. It may be noted that the river stages at New Orleans during September, as well as the past month, were subject to irregular changes, which are not shown at higher stations on the Mississippi or in the Red River. The tidal effect from the Gulf is felt, in very low water, as far up the Mississippi as the mouth of the Red.

All the rivers of the Mississippi system have reached lower stages this month than are usual in their annual decline. It is, perhaps, not strange that the great flood of the spring, arising from an excessive rainfall, should be followed by a period of light rains and abnormally low water in the rivers. At all events, the Mississippi throughout its length, with the exception of the lower 100 or 200 miles, is below its normal lowest stage by 2 or 3 feet.

The highest and lowest water, mean stage, and monthly range at 117 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 volume of water flowing in the Hudson River past Albany suffered a daily decrease from the 1st to the 18th, when it fell to its lowest point reached so far this season. On the 18th the Bath and Rensselaer boats struck bottom several times on their trips, and they found it necessary to seek the dock above Bath for landing, to insure safety. Except where the channels have been cut out, the water in the Albany basin was but 2 feet deep, and in many places the bottom was bare. A fall of 4 feet was experienced during the first two decades of October. The lowest

stage ever recorded at the head of tidewater was reached on Sunday, the 17th. The Troy ferryboat was obliged to stop running, and some deep-draught tugboats had to put out guy lines to prevent them from capsizing. The tug *Crandell*, with a tow of six canal boats, was stranded in the middle of the river, near the Congress street bridge, on the 17th. More than the normal amount of fog prevailed over the Hudson River during the month, the heaviest occurring on the morning of the 27th. Night boats and tows were greatly delayed, and the loss to shippers by missing trains, because of the delay of the boats, is quite an important item. The close of the month still finds a low stage of water in the Hudson.

The drought, which prevailed during the greater part of the month, affected the flow of water in all streams of the Susquehanna River system, but not so much as dry periods in some previous years, especially in the lower river. In 1895, with a rainfall of 1.63 inch at Harrisburg, the river stage averaged 0.3 foot in October, while during the past month, with a rainfall of only 1.35 inch, the average stage was 0.9 foot. The river averaged much lower, however, than during the same period last year, but the rainfall was less, averaging only about 36 per cent of the amount that fell during October, 1896. Seventeen reporting stations gave an average rainfall of 3.70 inches in October, 1896, while for October, 1897, the average for the same number of stations was 1.35 inch. The average river gauge readings of 16 stations in October, 1896, was 2.5 feet, and in 1897 less than 0.2 foot. At Renovo, Cameron, Cedar Run, Sinnemahoning, and Wilkesbarre, the water was at or below zero of the gauges during the whole month. At Lockhaven the river fell to zero on the 5th, and at East Bloomsburg it reached zero on the 9th, remaining at or below that point at both stations during the rest of the month. The highest stages for the month prevailed, as usual, in the Juniata; the stage at Huntingdon averaged 2.8 feet, and at Mifflin, 1.6 foot.

Owing to the extremely dry weather of the first and part of the second decade of the month, the James River continued at an unusually low stage, the readings being below the zero of the gauge. During this time the falls of the river at this point could be crossed without wetting the feet. During the last decade rains were abundant and long continued, and, under their influence, the river rose slowly to a maximum of 1.0 foot. Under ordinary circumstances the amount of rainfall which occurred over the basin would have produced a freshet, but the ground being very dry and the rain falling steadily, the greater quantity of it was absorbed before entering the stream.

The stages of the rivers throughout North Carolina continued unusually low during the month of October. During the first decade even lower gauge readings were recorded than during September. A stage of -0.1 foot was reached at Clarksville on the Dan, and 0.2 foot at Fayetteville on Cape Fear. The drought was finally broken by copious rains during the last decade, but the rainfall had remarkably little effect on the rivers, causing a rise of barely two feet in the larger streams, which continued much below the average stage at the end of the month. The first boat, since September 27, passed from Wilmington to Fayetteville on October 26. Salt water was reported farther upstream than usual, reaching, for example, to Vanceboro, a village 24 miles above Newbern.

The river basins of South Carolina were entirely rainless from September 23 to October 10, and, in consequence, the streams receded to