

light frosts occurred in the northern part of the State, and the same condition occurred about a week later. Toward the close of the month high temperatures were reported in the great valleys of California, but, with the exception of the morning of the 30th, the winds were not particularly high.—*A. G. McAdie, Professor.*

PORTLAND, OREG., FORECAST DISTRICT.

The month in the North Pacific States was unseasonably cool, and frosts frequently occurred in eastern Oregon and southern Idaho which did great damage to fruit and gardens. Most of the frosts were forecast, but some occurred without warnings, due to its being impossible to accurately foretell the irregular movements taken by abnormal high pressure areas.

The annual flood crest in the Columbia River passed Portland on the 3d, with a stage of 20.8 feet. The river remained nearly on a stand for five days, and then slowly fell, passing below the danger line of 15 feet on the 20th. Forecasts of the daily stages for three days in advance for both Portland and The Dalles were made from the 1st until the 15th, when the announcement was made that the river would continue to fall at the rate of about three-tenths (0.3) of a foot a day during the next three days.—*E. A. Beals, Forecast Official.*

HAVANA, CUBA, FORECAST DISTRICT.

No general storm occurred in the West Indies during the month. During the second and third weeks excessive rains occurred over the greater part of Cuba, flooding lowlands, causing rivers to overflow, inundating contiguous lands, washing away crops, houses, stock, etc., and causing the loss of a few lives.—*W. B. Stockman, Forecast Official.*

RIVERS AND FLOODS.

The Missouri River, as is usual during the month of June, rose somewhat, but not to any unusual heights, no danger-line stages having been reported. The Missouri rise also caused a rise in the Mississippi River from Alton, Ill., to the mouth of the Ohio River. Above Alton, and below Cairo, Ill., the average stages were considerably lower than during May, 1901.

Over the Ohio watershed the rains were sufficiently timely and abundant to provide excellent navigable stages of water, averaging over 20 feet below the mouth of the Great Kanawha River. There was a moderate flood in the Great Kanawha on the 24th, the stage at Charleston, W. Va., reaching

30.9 feet, 0.9 foot above the danger line. This flood contributed an additional 10 feet to the Ohio below Point Pleasant, W. Va.

The James River and the rivers of South Carolina were high at times, and in several of the latter the danger lines were exceeded by several feet. Timely and accurate warnings of these floods were given. In the James River the danger lines were not quite reached, but in the vicinity of Richmond, Va., some inconvenience was caused in the lower portions of the city. The losses, however, were trifling, as the warnings were well heeded.

The highest and lowest water, mean stage, and monthly range at 137 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, 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.—*H. C. Frankenfield, Forecast Official*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.							<i>Miles.</i>	<i>Days.</i>	<i>Miles.</i>	<i>Miles.</i>
I.....	5, a. m.	53	109	11, p. m.	52	65	3,180	6.5	485	30.3
II.....	10, a. m.	54	114	13, p. m.	42	70	2,550	3.5	728	30.3
III.....	12, a. m.	54	114	15, p. m.	45	75	2,000	3.5	571	28.8
IV.....	16, a. m.	57	105	19, p. m.	40		2,000	3.0	667	27.8
Sums.....							9,700	16.5	2,451	102.1
Mean of 4 paths.....							2,425		608	25.5
Mean of 16.5 days.....									588	24.5
Low areas.										
I.....	1, p. m.	42	90	4, p. m.	46	60	1,780	3.0	598	24.7
II.....	1, p. m.	51	104	3, p. m.	58	97	800	1.0	800	35.3
III.....	3, a. m.	51	120	10, a. m.	49	64	3,500	7.0	500	20.8
IV.....	11, a. m.	37	105	13, a. m.	45	89	1,500	2.0	750	31.2
V.....	12, a. m.	33	82	14, a. m.	32	86	900	2.0	450	18.8
VI.....	13, a. m.	44	104	15, a. m.	43	79	2,050	5.0	530	22.1
VII.....	16, a. m.	33	84	18, p. m.	35	76	535	2.5	210	8.8
VIII.....	22, a. m.	44	98	24, a. m.	44	71	925	2.0	462	19.2
IX.....	24, a. m.	51	114	25, p. m.	50	97	520	1.5	547	23.8
X.....	37, p. m.	35	105	30, a. m.	48	68	2,100	2.5	840	35.0
XI.....	29, p. m.	41	109	*1, p. m.	47	84	1,350	3.0	675	28.1
Sums.....							16,850	30.5	6,357	264.8
Mean of 11 tracks.....							1,532		578	24.1
Mean of 30.5 days.....									552	23.0

*July.

Geo. E. Hunt, Chief Clerk Forecast Division.

CLIMATE AND CROP SERVICE.

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

The following summaries relating to the general weather and crop conditions are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau.

[Temperature is expressed in degrees Fahrenheit and precipitation in inches and hundredths.]

Alabama.—The mean temperature was 78.5°, or 0.3° above normal; the highest was 103°, at Livingston on the 27th, and the lowest, 48°, at Riverton on the 1st. The average precipitation was 2.80, or 1.90 below normal; the greatest monthly amount, 5.88, occurred at Camp Hill, and the least, 0.48, at Marion.

Wind and hailstorms in central and northern counties during first half of month caused considerable local damage to crops; otherwise, conditions moderately favorable for farm work and crop growth.—*F. P. Chaffee.*

Arizona.—The mean temperature was 77.3°, or 3.8° below normal; the highest was 123°, at Mohawk Summit on the 23th, and the lowest, 30°, at Flagstaff on the 11th, 14th, and 15th. The average precipitation was 0.01, or 0.24 below normal; the greatest monthly amount, 0.34, occurred at Supai, while none fell at a great number of stations.

Generally favorable conditions for the development of crops obtained during the first part of the month, and the harvesting of wheat was in active progress in the lower agricultural valleys during the second de-

cade. The wheat is of good quality and of average yield. The second crop of alfalfa had been cut by the middle of the month. A greatly diminished water supply for irrigation, during the latter period of the month, interfered with farming operations and materially arrested the growth of latter crops of hay.—*W. G. Burns.*

Arkansas.—The mean temperature was 79.4°, or 2.8° above normal; the highest was 110°, at Jonesboro on the 29th, and the lowest, 41°, at Pond on the 1st and 2d and at Witt Springs on the 1st. The average precipitation was 1.44, or 2.62 below normal; the greatest monthly amount, 4.13, occurred at Forrest City, and the least, 0.25, at Marvell.

The weather was generally hot and dry, except during the first ten days of the month when the rainfall was fairly well distributed throughout the State. Corn, though generally small for the time of year, was doing fairly well and was laid by in generally good condition; it had begun to tassel out by the end of the month; in some sections it had been affected by the dry, hot weather and had commenced to twist. Cotton had been well worked out, and, though small and the stands uneven, was growing nicely and was bunching well; in some localities squares were forming and some blooms had been reported. Wheat and oat harvest was about completed by the end of the month, and thrashing was progressing. The yield of wheat was fair to good, and in some sections it was turning out better than was expected, both as to yield and quality. Oats were short and in some localities almost an entire failure. Irish potatoes were generally fair to good, but were being injured by the drought and bugs. Fruit generally was in good condition, but in some sections continued to rot and drop before maturity.—*H. B. Richards.*

California.—The mean temperature was 70.5°, or 0.6° below normal; the highest was 124°, at Salton and Volcano on the 28th, and the lowest, 16°, at Bodie on the 24th. The average precipitation was 0.01, or 0.26 below normal; the greatest monthly amount, 0.43, occurred at Sierra Madre, while none fell at more than two-thirds of the stations.

The temperature was below normal during the greater part of the month, and heavy frosts occurred in some places, slightly damaging corn, potatoes, and other summer crops; fruit was not injured. Very high temperatures prevailed toward the close, the maximum reaching over 100° at many places, and 124° at two stations. The hot weather was accompanied by light northers in some sections, but crops were not materially damaged.—*G. H. Willson.*

Colorado.—The mean temperature was 63.2°, or about normal; the highest was 108°, at Delta on the 29th, and the lowest, 20°, at Wagon Wheel Gap on the 12th. The average precipitation was 1.45, or about normal; the greatest monthly amount, 4.58, occurred at Holyoke, and the least, 0.12, at Buena Vista.

Conditions generally favorable to agricultural interests. Winter and spring grains made favorable advancement, but the development of many upland field crops was retarded by lack of moisture. Small fruits were plentiful and the outlook for tree fruits continues satisfactory. Ranges afforded excellent pasturage, but many were failing rapidly at the close of the month.—*F. H. Brandenburg.*

Cuba.—The mean temperature was 81°; the highest was 101°, at Batabano on the 5th, and the lowest, 57°, at Matanzas on the 8th. The average precipitation was 8.22; the greatest monthly amount, 17.52, occurred at Manzanillo, and the least, 1.19, at Los Canos.

During the weeks ending June 15 and 22 the rains were excessive generally over the island and much damage was done by the submerging of lowlands, overflowing of rivers inundating contiguous lands and washing away many dwellings and tobacco houses, drowning of stock, washing out of crops on hillsides and glens, etc. At the close of the month there was an improvement in the conditions as the flooded rivers were subsiding, but much water was still standing in places in northwestern Matanzas. In northwestern Santa Clara much recently planted cane, in places amounting to more than one-half, was destroyed by the excessive rains, as were all small crops. Crops were also destroyed in southwestern Puerto Principe, and on the lowlands generally throughout the island crops were more or less damaged. At the close of the month tobacco selecting was progressing in Pinar del Rio and northwestern Puerto Principe, and soils where the plantings had been washed out or destroyed were being replanted. Worms are seriously damaging the canes and corn, and even the pastures, in southwestern Santiago, and the corn crop is jeopardized.—*W. B. Stockman.*

Florida.—The mean temperature was 79.4°, or 0.5° below normal; the highest was 103°, at Wausau on the 27th, and the lowest, 50°, at Quincy on the 2d. The average precipitation was 9.77, or 2.62 above normal; the greatest monthly amount, 21.72, occurred at Miami, and the least, 0.27, at Pensacola.

At the close of the month dry weather prevailed over the western portion of the State; elsewhere well distributed rains had fallen. Prospects favored a good corn crop over a large portion of the State. Cotton was small, fruiting slowly and very backward; in eastern and central sections it was grassy. Vegetables and fruits advanced very well, and large shipments were made. Setting sweet potatoes was delayed in western counties, owing to dry weather. Cane made a good growth.—*A. J. Mitchell.*

Georgia.—The mean temperature was 77.6°, or about normal; the highest was 103°, at Vidalia on the 25th, and the lowest, 47°, at Diamond on the 4th. The average precipitation was 5.26, or 0.71 above

normal; the greatest monthly amount, 10.03, occurred at Millen, and the least, 0.99, at Oakdale.

The month was nearly normal with respect to temperature and precipitation, but the general conditions of the weather were detrimental to crops, and the situation at the close of the month was unsatisfactory. Lack of cultivation greatly damaged crops, and many fields of cotton were abandoned and allowed to run to grass. Peaches continued to rot and shed badly, lessening the output.—*J. B. Marbury.*

Idaho.—The mean temperature was 56.3°, or 4.0° below normal; the highest was 101°, at Garnet on the 18th, and the lowest, 17°, at Forney and Soldier on the 5th. The average precipitation was 1.10, or 0.20 above normal; the greatest monthly amount, 5.34, occurred at Murray, and the least, trace, at Boise, Garnet, and Idaho City.

On the morning of June 5 a frost of great severity and destructiveness occurred. It was most severe in the southwest and central counties, reducing the prospects for more than average crops of fruit to an outlook for very light yields. The damage to alfalfa and wheat was also considerable.—*S. M. Blandford.*

Illinois.—The mean temperature was 74.8°, or 2.2° above normal; the highest was 105°, at Centralia on the 23d, and the lowest, 32°, at Che-mung and Lanark on the 9th. The average precipitation was 3.39, or 0.45 below normal; the greatest monthly amount, 7.76, occurred at Mount Pulaski, and the least, 0.91, at Cairo and Raum.

Very warm weather most of month, with frequent showers, improved crops in central district, especially corn, which has done well over most of the State. Grasses and oats did not improve much in the northern and southern districts on account of dry weather. A good average crop of wheat harvested.—*M. E. Blystone.*

Indiana.—The mean temperature was 73.4°, or 1.4° above normal; the highest was 103°, at Laporte on the 30th, and the lowest, 36°, at Auburn on the 3d. The average precipitation was 4.35, or 0.26 above normal; the greatest monthly amount, 8.14, occurred at Salem, and the least, 1.14, at Greensburg.

Cool weather and local rains nearly every day during the early part of June retarded the growth of crops. Corn looked yellow, and cut worms injured it in many fields. Wheat was heading; in many localities it was rank and had lodged; the fly also did much damage. Near the middle of the month tobacco was all transplanted and looked well. Oats grew nicely, and barley, rye, and clover matured slowly and well; in the southern counties they were nearly ready to cut. Late potatoes were being planted; early potatoes grew well, but the ground was too wet for cultivation. Meadows were short and full of white top. Vegetables were abundant. During the latter part of the month warm weather, with local rains, improved growing crops, but cultivation, haying, and harvesting, were delayed. In localities, heavy wind and large hail did much damage. The wheat and rye harvests began; the heads were well filled, promising good yields. In many localities, clover was all housed, and a fair crop of hay was being secured. Tobacco grew well. Oats were heading nicely. Cornfields were clean; much had been replanted and was small, but of good color. Fruits, except pears, were abundant; apples had continued to fall, although many still remained on the trees.—*C. F. R. Wappenhans.*

Iowa.—The mean temperature was 72.3°, or 2.3° above normal; the highest was 106°, at Wapello on the 30th, and the lowest, 30°, at Larrabee on the 7th. The average precipitation was 3.71, or 0.55 below normal; the greatest monthly amount, 7.84, occurred at Logan, and the least, 1.05, at Columbus Junction.

First decade cooler than usual, and prevalence of cold nights checked germination; balance of month warmer, with unseasonable heat in closing decade. Conditions were generally favorable for corn, which was well cultivated and made rapid progress. Lack of moisture in eastern half of State prevented full development of spring grain crops and hay. Heat was intensified by high winds, causing rapid evaporation of the deficient moisture. Good crops of cherries and strawberries were produced; apples and plums much below average.—*John R. Sage.*

Kansas.—The mean temperature was 77.3°, or 3.5° above normal; the highest was 108°, at Hays City on the 29th, and the lowest, 37°, at Colby on the 1st and Achilles on the 6th. The average precipitation was 2.33 or 1.73 below normal; the greatest monthly amount, 6.50, occurred at Marion, and the least, 0.30, at Englewood.

Abundant rain in central counties, deficient over rest of State. Wheat harvest begun first week, nearly completed at close of month, with thrashing progressing, good yield, fine berry. Corn grew rapidly after first week, beginning to tassel last week, good condition. Oat harvest general last week, crop light. Pastures and meadows beginning to fail. First crop alfalfa cut and stacked first week, very fine crop; second crop cut last week, much lighter.—*T. B. Jennings.*

Kentucky.—The mean temperature was 75.6°, or 0.9° above normal; the highest was 104°, at Bowling Green on the 29th, and the lowest, 42°, at Eubank, Greensburg, and Vanceburg on the 1st and at Loretto on the 8th. The average precipitation was 3.97, or 0.37 below normal; the greatest monthly amount, 6.80, occurred at Manchester, and the least, 0.72, at Franklin.

The first ten days of the month were too cool for satisfactory advancement of crops, but nothing was injured permanently. Frequent showers occurred and tobacco setting progressed rapidly, the greater part being set by the 10th. From the 10th to the 25th the weather

was very favorable and all crops progressed rapidly. The last week was rather dry and at the close of the month some localities in the western portion were suffering somewhat from drought. Wheat was generally harvested during the last ten days of month.—*H. B. Hersey.*

Louisiana.—The mean temperature was 81.2°, or 1.6° above normal; the highest was 106°, at Alexandria on the 17th and Oak Ridge on the 24th, and the lowest, 53°, at Mansfield on the 2d. The average precipitation was 2.99, or 3.28 below normal; the greatest monthly amount, 7.74, occurred at Paincourtville, and the least, 0.25, at Ruston.

Showers, generally light and not sufficient for crop needs but fairly well distributed throughout the State, fell on the 4th, 5th, and 6th, from the latter date until about the beginning of the last week of the month drought prevailed. During the last week showers were frequent, well distributed, and copious in the southern parishes, lighter and less evenly distributed in the central portion of the State, and very light and scattered in the northern portion. Sugar cane made slow growth during the drought, but thorough cultivation kept the crop in good color and the fields clear of extraneous vegetation; cotton also stood the drought very well, but was small everywhere, and in the northern parishes the crop suffered. Providence rice and, in some localities where water in the bayous failed, irrigated rice was injured before the drought terminated. Corn and all other minor growing crops were materially injured, and the acreage of cowpeas and sweet potatoes was lessened by the protracted dry spell.—*W. T. Blythe.*

Maryland and Delaware.—The mean temperature was 71.1°, or 0.6° below normal; the highest was 102°, at Sharpsburg, Md., on the 29th and 30th, Hancock, Md., and Sudlersville, Md., on the 30th; and the lowest, 32°, at Deerpark, Md., on the 10th. The average precipitation was 3.14, or 0.20 below normal; the greatest monthly amount, 6.72, occurred at Maryland Agricultural College, Md., and the least, 0.70, at Johns Hopkins Hospital, Md.

The rains were unevenly distributed, but generally sufficient. Hot spell at close of month favored corn and hastened maturity of wheat, rye, and barley, but was slightly damaging to tobacco. Winter grain mostly saved; heavy straw, but heads light, and yields not satisfactory in east and south, although better in northern counties. Timothy and clover generally light crops. Fruit prospects slightly decreased by continued fall during the month; apples will be scarce, pears light to medium, and peaches fair to good; cherries yielded well. Shipments of peas and strawberries were heavy. Most minor crops in good condition, potatoes especially fine.—*Olofer L. Füssig.*

Michigan.—The mean temperature was 66.0°, or 1.5° above normal; the highest was 102°, at Traverse City on the 26th and 27th, and the lowest, 22°, at Ludington on the 1st, 3d, and 9th. The average precipitation was 2.51, or 0.72 below normal; the greatest monthly amount, 6.93, occurred at Calumet, and the least, trace, at Lake City.

The first half of the month was cool and retarded the germination and growth of corn, sugar beets, oats, and garden truck, although favorable for wheat, rye, and grass. During the latter half the temperature was above the normal and much more favorable for spring seeding. The precipitation was generally ample for most crops. High winds and frosts during the first decade did some damage to fruit. Frosts also injured some early corn and potatoes, but the damage was not serious or general.—*C. P. Schneider.*

Minnesota.—The mean temperature was 65.5°, or about normal; the highest was 99°, at Red Wing on the 26th, and the lowest, 26°, at Pokegama Falls on the 8th. The average precipitation was 5.81, or 1.68 above normal; the greatest monthly amount, 10.37, occurred at Leech Lake Dam, and the least, 2.50, at Rolling Green.

The month opened with late sown grain and crops on sandy land indicating need of rain, but abundant rains began on the 3d and continued at intervals during the month, supplying all the moisture the soil could absorb and flooding some lands in the Red River Valley. The temperature ranged from about the freezing point on the 7th to from 90° to 99° on the 25th and 26th. Wheat, oats, and barley were in good condition, and they were heading by the end of the month in all parts of the State. Corn was retarded and injured by the frosts of the 7th, and it continued backward till the moist and hot weather late in the month started a rapid growth. The flax was uneven, and much of it poor, especially in northern counties, where grasshoppers have affected it. Potatoes were generally very fine. Clover and timothy were short in the southeast, because of the early dry weather; elsewhere they were better. Hay making was attempted between rains late in the month. The aggregate damage by hail on different dates in the State was considerable.—*T. S. Outram.*

Mississippi.—The mean temperature was 80.4°, or 1.6° above normal; the highest was 104°, at Aberdeen on the 22d, 24th, and 26th, and at Brookhaven on the 28th, and the lowest, 47°, at Ripley on the 1st. The average precipitation was 2.33, or 2.58 below normal; the greatest monthly amount, 6.90, occurred at Windham, and the least, 0.16, at Pontotoc.

Maximum temperatures ranged above 90° from the 8th to the close of the month. The average rainfall was next to the lightest during the past fourteen years. Cotton, although from two to three weeks late, generally did well throughout the month, while early corn was seriously injured by the dry weather of the last two weeks.—*W. S. Belden.*

Missouri.—The mean temperature was 77.9°, or 4.1° above normal, the highest June mean during the past fourteen years; the highest was 110°, at Appleton City on the 26th, and the lowest, 40°, at Ironton on the 1st. The average precipitation was 2.13, or 2.79 below normal, the least amount recorded for any June during the past sixteen years; the greatest monthly amount, 5.31, occurred at Palmyra, and the least, 0.26, at Nevada.

In a majority of the central and southern counties of the State it was the driest June on record. Except in the extreme northern counties, where the rainfall was about normal, and in a few scattered localities in the central and southern sections, which were favored with several heavy showers during the fore part of the month, the drought, which had already become alarming at the close of May, continued with increased severity throughout the month of June. Over the greater part of the central and southwest sections and in a number of the northern and eastern counties the total precipitation for May and June, 1901, was less than 50 per cent of the normal, and at a considerable number of stations in the central and western sections it was less than 25 per cent, some localities receiving only 10 to 15 per cent. Where there was sufficient rainfall to keep the soil moist corn made good growth, but over the greater part of the State its progress was slow, and at the close of the month the crop was in a critical condition. Oats and meadows continued to deteriorate until at the end of the month it was estimated that little more than half the oats would be worth cutting, while timothy meadows promised only about one-third of a crop, many not being worth cutting. Many oats were too short to be cut with binders and were mown or pastured. Pastures became very dry and short, and at the close of the month some stock was being fed. Water also became scarce in many localities. Early potatoes were generally a very light crop, gardens were practically a failure, and apples dropped badly. The drought and consequent crop failure of 1901 will long be remembered as one of the worst in the history of Missouri.—*A. E. Hackett.*

Montana.—The mean temperature was 54.1°, or 5.5° above normal; the highest was 92°, at Glasgow on the 1st, and the lowest, 22°, at Adel on the 6th and Dell on the 5th and 9th. The average precipitation was 2.86, or 0.60 above normal; the greatest monthly amount, 7.42, occurred at Wibaux, and the least, 0.04, at Manhattan.

Copious rains occurred in the east portion, where during the month of May there was a drought, which assures a fair hay crop for that section. Weather has been too cool for crops to make rapid growth.—*E. J. Glass.*

Nebraska.—The mean temperature was 70.7°, or 1.0° above normal; the highest was 109°, at Fairbury on the 28th, and the lowest, 26°, at Kennedy on the 7th. The average precipitation was 4.54, or 0.67 above normal; the greatest monthly amount, 13.27, occurred at Agee, and the least, 0.65, at Seneca.

A large excess in precipitation in the central and northern counties and a nearly equally large deficiency in southeastern and a portion of the southwestern counties makes crop conditions vary widely in the different sections of the State. Conditions were favorable for winter wheat and a large crop ripened rapidly during the last week of the month. Spring wheat and oats were considerably damaged by dry weather and insects in southern counties, but promise a good crop in northern. Corn has grown slowly and is small for the 1st of July, partially due to low temperature the first three weeks and partially to lack of moisture in southern counties. However, the crop was in thrifty condition at the end of the month. Hay promises a heavy crop in northern counties and a light one in southern.—*G. A. Loveland.*

Nevada.—The mean temperature was 59.1°, or 2.4° below normal; the highest was 99°, at Martins Ranch and Tybo, and the lowest, 21°, at Palmetto. The average precipitation was 0.02, or 0.27 below normal; the greatest monthly amount, 0.70, occurred at Hamilton, while none fell at several stations.

Warm days and cold nights characterized the weather of the month. Severe frosts on the 11th and 14th caused considerable damage in eastern and northern districts to alfalfa, fruit, potatoes, and garden truck. In portions of Elko County potatoes were cut to the ground and the fruit crop practically destroyed.—*J. H. Smith.*

New England.—The mean temperature was 65.8°, or 0.9° above normal; the highest was 101°, at Claremont, N. H., on the 28th, and the lowest, 30°, at Grafton, N. H., on the 17th. The average precipitation was 1.97, or 0.91 below normal; the greatest monthly amount, 6.55, occurred at Kineo, Maine, and the least, 0.25, at New Haven, Conn.

The first part of the month was cool, with much cloudiness, and frequent showers; the latter part generally fair, with a deficiency in precipitation, and the closing days were excessively warm. There were no severe or destructive storms, and, considered as a whole for the entire district, the weather of the month was favorable to crops.—*J. W. Smith.*

New Jersey.—The mean temperature was 70.0°, or 0.3° above normal; the highest was 103°, at Vineland on the 30th, and the lowest, 35°, at Charlotteburg on the 1st. The average precipitation was 1.57, or 1.97 below normal; the greatest monthly amount, 4.36, occurred at Toms River, and the least, 0.73, at Elizabeth.

The intensely hot weather during the last five days of the month intensified the droughty conditions that have prevailed in all sections

of the State; potatoes, oats, peas, and pastures suffering the most injury, while corn advanced very rapidly.—*E. W. McGann.*

New Mexico.—The mean temperature was 69.3°, or 0.8° below normal; the highest was 105°, at San Marcial on the 29th and 30th, and the lowest, 30°, at Folsom on the 6th. The average precipitation was 0.53, or 0.52 below normal; the greatest monthly amount, 2.64, occurred at Gallinas Springs, while none fell at Lordsburg, and only a trace at Deming, Fort Bayard, Los Lunas, Olio, and Silver City.

An unusually dry month. Owing to early rains growing crops suffered little from the drought, but toward the close of the month grass on the ranges had dried up considerably.—*R. M. Hurdinge.*

New York.—The mean temperature was 66.7°, or 1.0° above normal; the highest was 100°, at Schenectady on the 29th, and the lowest, 26°, at Liberty on the 10th. The average precipitation was 3.35, or 0.13 below normal; the greatest monthly amount, 8.06, occurred at North Lake, and the least, 0.94, at New York, N. Y., and Primrose.

Showers, heavy in places, were frequent during the first ten days of June, causing a rapid growth of crops, but greatly delaying farm operations, particularly corn and potato planting, which was not finished until late in the month. The last half of month was favorable for crops and operations, during which time a large crop of excellent hay was being harvested under very favorable conditions. Wheat suffered a marked decline in parts of western New York by reason of the hessian fly, many correspondents reporting the crop as being entirely ruined. Apples will be very light, and pears and plums much less than an average crop, but peaches promise a good crop. The last part of the month was very dry and intensely hot, causing a splendid growth of potatoes and corn, which were, however, quite backward.—*E. G. Allen.*

North Carolina.—The mean temperature was 74.0°, or 0.4° below normal; the highest was 101°, at Washington on the 24th, and the lowest, 41°, at Highlands on the 1st. The average precipitation was 5.36, or 1.00 above normal; the greatest monthly amount, 11.67, occurred at Lenoir, and the least, 1.29, at Tarboro.

There were several periods of favorable weather during June, which enabled farmers to properly cultivate and clean their crops. The rainfall was beyond the needs of all crops, and although some improvement occurred, the general outlook is very unpromising.—*C. F. von Herrmann.*

North Dakota.—The mean temperature was 61.6°, or 1.8° below normal; the highest was 95°, at Steele on the 24th, and the lowest, 22°, at Ashley on the 7th. The average precipitation was 6.14, or 2.45 above normal; the greatest monthly amount, 9.71, occurred at Jamestown, and the least, 2.94, at Ashley.

The rainfall during the month, the heaviest on record, revived and improved all crops, which were suffering severely from drought. Some slight damage by hail and excessive rains at some widely separated points, but as a general thing the month was very favorable for crops.—*B. H. Bronson.*

Ohio.—The mean temperature was 70.9°, or 0.7° above normal; the highest was 103°, at Norwalk on the 27th, and the lowest, 30°, at New Waterford on the 9th. The average precipitation was 4.38, or 0.87 above normal; the greatest monthly amount, 10.97, occurred at New Lexington, and the least, 1.86, at Bellefontaine.

The first of month unusually cool, last part unusually warm. Precipitation excessive in central and southeastern counties. Cultivated corn, though small, is growing rapidly, but in many sections the fields are too wet to cultivate. Grains are badly tangled by high winds and rain, and rust has appeared. Fruit was unfavorably affected by the heat, and dropping increased.—*J. Warren Smith.*

Oklahoma and Indian Territories.—The mean temperature was 79.3°, or 2.3° above normal; the highest was 105°, at Prudence, Okla., on the 18th, and the lowest, 40°, at Kenton, Okla., on the 16th. The average precipitation was 1.97, or 1.35 below normal; the greatest monthly amount, 5.93, occurred at Jefferson, Okla., while none fell at Woodward, Okla.

Clear, hot weather, with high southerly winds, and a marked deficiency of rainfall characterized the month. Wheat, oats, and rye harvesting were completed. Good yields of wheat of fine quality were generally reported, while the yield of oats was very poor. Crops, in general, were in fair condition at the close of the month, yet the need of rain was becoming very apparent. A very violent local thunderstorm passed over the western part of Kay County on the 7th, causing the death of three persons, and more or less serious injury to fifteen others. Considerable damage was also done to growing crops by hail, and to houses and barns by high winds.—*Charles N. Strong.*

Oregon.—The mean temperature was 57.7°, or 2.9° below normal; the highest was 98°, at Beulah on the 17th, and the lowest, 13°, at Silverlake on the 10th. The average precipitation was 1.07, or 0.32 below normal; the greatest monthly amount, 6.64, occurred at Government Camp, while none fell at Buckhorn Farm, P. Ranch, and Merlin.

The month was characterized by cloudy and unseasonably cool weather. In the Columbia River Valley and in eastern Oregon the mean temperature averaged nearly 4° below the normal, while the mean for the State as a whole was the lowest on record, except that of 1893. Temperatures several degrees below the freezing point occurred in eastern Oregon during the first decade, and gardens and tree fruit suffered considerable damage therefrom.—*Edward A. Beals.*

Pennsylvania.—The mean temperature was 69.1°, or 0.3° above normal;

the highest was 103°, at York on the 30th, and the lowest, 32°, at Saegerstown on the 9th and Smethport on the 10th. The average precipitation was 3.47, or 0.70 below normal; the greatest monthly amount, 7.61, occurred at Uniontown, and the least, 0.88, at Point Pleasant.

From the 9th to the 10th the coolest weather of the month prevailed throughout the State, except in the extreme southeast portion. During the last of the month an increase of temperature was general over the State, and especially hot weather prevailed on the 28th, 29th, and 30th. The rainfall was heaviest in the western portion of the State; there were five rainy periods over all of Pennsylvania, but in the Ohio basin they were of longer duration after the 11th of the month and, in fact, the last twenty days were unusually wet in that section, the greater portion of the precipitation being in the form of thunder-showers. In the Susquehanna basin showers were fairly frequent after the 13th, but fair days were more numerous than in the Ohio basin, while in the Delaware basin the most general rains were on the 1st, 2d, 3d, 7th, 15th, 21st, 27th, and 28th. Farm work was frequently interrupted by the rains, but the weather was generally propitious for growing crops. Haying was in progress at the close of the month and an average yield was being obtained. Wheat and rye made good progress and these crops are good, except in some localities where lodged by heavy rains and damaged by the hessian fly. The oat crop is very generally affected by rust. Corn and potatoes are good but the former is late. Buckwheat sowing received considerable attention; the acreage will be large. Apples are dropping, but other fruits are doing very well.—*T. F. Townsend.*

Porto Rico.—The mean temperature was 79.7°, or about normal; the highest was 98°, at Arecibo on the 12th and at Juana Diaz on the 24th, and the lowest, 58°, at Ponce on the 17th. The average precipitation was 3.11, or 2.96 above normal; the greatest monthly amount, 25.34, occurred at Hacienda Perla, and the least, 0.72, at Ponce.

The weather has been generally favorable for farm work, and good progress has been made, except in the Ponce and eastern San German districts, where the drought has continued. Grinding of cane is practically over. Corn is being harvested in good quantities. Coffee is beginning to ripen and a good crop is promised. The bean crop is almost a total loss. Small crops are abundant in nearly all districts. All growing crops are doing well.—*E. C. Thompson.*

South Carolina.—The mean temperature was 76.7°, or 1.4° below normal; the highest was 102°, at Batesburg on the 24th, and the lowest, 48°, at Walhalla on the 1st. The average precipitation was 6.55, or 2.02 above normal; the greatest monthly amount, 11.92, occurred at Pinopolis, and the least, 3.60, at Walhalla.

The temperature during June was favorable for crop growth, but the excessive rainfall largely prevented cultivation, so that fields became foul with grass and weeds. There was also too much moisture for the normal development of field crops. On river bottoms crops were extensively damaged by floods. The condition of all crops was poor at the close of the month, especially corn and cotton.—*J. W. Bayer.*

South Dakota.—The mean temperature was 66.3°, or 1.0° below normal; the highest was 100°, at Menno on the 26th, and the lowest, 24°, at Leola on the 7th. The average precipitation was 6.29, or 2.97 above normal; the greatest monthly amount, 11.62, occurred at Greenwood, and the least, 3.73, at Milbank.

Heavy to killing frost on the 7th over much of the eastern portion of the State seriously damaged many fields of early corn—a number irreparably—also some potatoes and millet, and materially reduced the fruit prospect. Excessive rains occurred in many localities, on some lowlands injury to crops resulting therefrom. Generally the conditions were favorable for spring wheat, oats, barley, rye, and grass crops, but until the latter part of the month unfavorable for corn. Several farm dwellings and some barns and outbuildings were destroyed or damaged and about a dozen persons injured by winds of tornadic nature over limited areas in Beadle, Kingsbury, and Pennington counties, and local gales of sufficient intensity to damage small outbuildings occurred in several other localities. There was some local damage to crops by hail.—*S. W. Glenn.*

Tennessee.—The mean temperature was 76.3°, or 1.1° above normal; the highest was 105°, at Dyersburg on the 28th, and the lowest, 39°, at Erasmus on the 1st. The average precipitation was 3.11, or 1.42 below normal; the greatest monthly amount, 8.40, occurred at Andersonville, and the least, 0.19, at Dover.

The weather of the month was, on the whole, favorable to the growth of crops, and farm work progressed well. The average rainfall was decidedly below the normal, and toward the end of the month crops generally were beginning to suffer from lack of moisture; also, the very high temperature of the last ten days was severe on some crops. During the haying and harvesting season the weather was very favorable.—*H. C. Bats.*

Texas.—The mean temperature was 81.6°, or 1.1° above normal; the highest was 108°, at College Station on the 17th and Haskell on the 18th, and the lowest, 49°, at Amarillo on the 15th. The average precipitation was 1.27, or 2.39 below normal; the greatest monthly amount, 5.41, occurred at Nacogdoches, while none fell at Dublin, Haskell, and Sanderson.

Cool weather at the opening of the month was unfavorable for the germination and growth of cotton. By the middle of the month the

crop was fruiting generally. The crop is in an excellent state of cultivation but needs rain. The plant is small, irregular, and, as a rule, ten days late. Cotton on upland is suffering, while on lowland the crop is holding out well. The dry weather has been very unfavorable for corn. Early corn has matured a good crop in some localities over the State, but, as a rule, it is very light. In some places much of the crop was cut for forage. The yield will be considerably below the average. Water for irrigating rice has not been sufficient for the needs of the crop in all localities, and in some places it has suffered. Rice which was dependent on rainfall for water is almost a failure.—*I. M. Olin.*

Utah.—The mean temperature was 63.3°, or 2.4° below normal; the highest was 109°, at Green River on the 30th, and the lowest, 19°, at Loa on the 14th. The average precipitation was 0.25, or 0.15 below normal; the greatest monthly amount, 0.97, occurred at Frisco, while none fell at Cisco, Promontory, St. George, and Terrace.

Dry farm wheat was badly damaged by the drought of the latter half of the month. Irrigated crops made fair advancement and were in good condition at the close of the month.—*L. H. Murdoch.*

Virginia.—The mean temperature was 72.3°, or 1.1° above normal; the highest was 103°, at Stephens City on the 30th, and the lowest, 40°, at Burkes Garden on the 1st. The average precipitation was 5.05, or 1.10 above normal; the greatest monthly amount, 14.37, occurred at Dale Enterprise, and the least, 1.40, at Ashland.

The month opened with wet weather prevailing and soil sodden. This was followed by bright, warm weather, during which crops made excellent growth and farm work was much advanced. After the 20th the weather became hot and the month closed with a heat wave of great severity prevailing. Wheat matured and harvesting was general during the latter half of the month.—*Edward A. Evans.*

Washington.—The mean temperature was 56.3°, or 3.8° below normal; the highest was 99°, at Pasco on the 18th, and the lowest, 26°, at Lind on the 5th. The average precipitation was 1.94, or 0.22 above normal; the greatest monthly amount, 8.33, occurred at Montecristo, and the least, 0.25, at Pasco.

The extraordinary coolness of the month prevented rapid growth and made corn and vegetables very backward, but the ample supply of rain and cool weather at filling season was very favorable for wheat. There was no good haying weather except in the eastern section.—*G. N. Salisbury.*

West Virginia.—The mean temperature was 70.7°, or 0.2° above normal; the highest was 104°, at Creston on the 30th, and the lowest, 32°, at Philippi on the 2d. The average precipitation was 5.67, or 1.38 above normal; the greatest monthly amount, 11.10, occurred at Spencer, and the least, 1.37, at Magnolia.

At the close of month wheat was filling well, although rather thin on the ground, and was beginning to turn with prospect of fair yield; meadows had improved but were weedy; oats were heading and corn was growing fast, but needed cultivation; early potatoes were promising, but late ones were not so good; apples had deteriorated considerably by dropping, but the prospect for peaches was excellent.—*E. C. Vose.*

Wisconsin.—The mean temperature was 67.4°, or about normal; the highest was 103°, at Brodhead on the 25th, and the lowest, 26°, at Medford on the 8th. The average precipitation was 4.17, or 0.16 below normal; the greatest monthly amount, 8.68, occurred at Ashland, and the least, 1.12, at Milwaukee.

Month moderately cool until last decade when extremely high temperatures occurred generally. Precipitation largely in excess of the normal over central and northern sections, while in the southern section the lack of rain was a serious menace to crops. Crops generally satisfactory, except along southern border, where the drought was becoming quite serious at the close of the month.—*W. M. Wilson.*

Wyoming.—The mean temperature was 57.5°, or 2.4° below normal; the highest was 98°, at Fort Laramie on the 29th, and the lowest, 20°, at Fort Yellowstone and Evanston on the 5th. The average precipitation was 1.79, or 0.19 above normal; the greatest monthly amount, 3.92, occurred at Parkman, and the least, 0.20, at Hyattville.—*W. S. Palmer.*

SPECIAL CONTRIBUTIONS.

SUN SPOTS AND THE WEATHER.

By H. H. KIMBALL, U. S. Weather Bureau.

Numerous attempts have been made to show a relation between the variations in sun-spot frequency and the departures from normal weather conditions on our globe. Of these we need for the present only mention the following:

In 1880, Mr. Fred. Chambers¹ presented tables and diagrams showing that at certain stations within the Tropics there exists a periodicity of about eleven years in the curve representing the secular variations in the barometer, corresponding to the 11-year period in the curve of sun-spot frequency, the maximum of the pressure curve occurring at the time of minimum sun-spot frequency, and vice versa. He also undertook to show that a maximum of pressure was followed by a minimum of rainfall, and consequently by famines in India, but his deductions were questioned by Mr. E. Douglas Archibald, who showed that winter rains were quite apt to be abundant in northern India after a period of maximum pressure, and that no one rule could therefore be applied to the whole of India.

In 1894, Mr. W. L. Dallas,² after first accepting the theory that years of maximum sun spots are years of maximum solar radiation, advanced the theory that these years should also be years of increased activity in the atmospheric circulation, since, as is well known, the general circulation depends primarily upon a difference of temperature between the equator and the poles. Likewise, since years of maximum heat should be years of maximum evaporation, they should also be years of maximum rainfall, and this latter circumstance

¹ Abnormal variations of barometric pressure in the Tropics, and their relation to sun spots, rainfall, and famine. *Nature*, Vol. XXIII, pp. 88, 107, and 399.

² The relations between sun spots and weather as shown by meteorological observations taken on board ship in the Bay of Bengal during the years 1856 to 1879. *Indian Meteorological Memoirs*, Vol. VI, Part I, No. 1.

would exert such a modifying influence on the temperature of a country like India that the relative heating effect of the sun for the different years of the cycle might be entirely obliterated. Since the effects of the variations in the radiation from the sun could apparently best be studied in a tropical region as little under the influence of local conditions as possible, he selected for discussion observations taken on ship-board in the Bay of Bengal, and presented tables and diagrams showing in general the existence of a cycle of eleven years in the pressure and temperature variations. His pressure curve has the same general characteristics as that of Chambers, and his curve of temperature fluctuations coincides in a general way with the sun-spot curve, in that the years of maximum and minimum temperature occur at about the same time as the years of maximum and minimum sun spots.

In 1898, Prof. F. H. Bigelow presented a diagram³ showing the relations between areas of sun spots, terrestrial magnetism, and certain elements of American weather for the years 1878-1893. His curves, showing the variations in sun-spot areas, terrestrial magnetism, and the barometric pressure for selected American stations, agree quite closely in their phases and characteristics, but the temperature curve is the reverse of these, the years of maximum temperature occurring during years of minimum sun spots, and vice versa. This is contrary to the relation found by Chambers in the Tropics, but is consistent with the modifications that Dallas pointed out might be introduced by local influences. Bigelow's theory of the relation between sun spots and the weather is, however, very different from the others we have mentioned.

In 1900, Sir Norman Lockyer and his son Dr. W. J. S. Lockyer presented to the Royal Society some conclusions⁴

³ Abstract of a report on solar and terrestrial magnetism in their relation to meteorology. *W. B. Bulletin* No. 21, p. 125.

⁴ On solar changes of temperature and variations in rainfall in the region surrounding the Indian Ocean. *Nature*, volume 63, pp. 107 and 128.