foundations and literally mashed to pieces. Three of these seemed to have been pushed off their foundations in the direction of the storm's progress and mashed, while the fourth was rolled over, as shown by marks on the ground, and the fact that the floors were upside down. Another house was rolled over on its side and left intact.

To sum up, 5 houses were completely demolished; 8 barns were completely destroyed, and 1 rolled over; 14 houses were moved from their foundations, some only a few inches, and others 10 to 12 feet; in two cases houses fell towards each other; 2 barns were displaced; the east side of one house was torn out, probably owing to the fact that it had a square front rising above the roof; 10 houses and 2 barns were unroofed to a greater or less extent; a large pottery, south of what appeared to be the path of the tornado, had its roof torn off and carried nearly in the direction of the storm's progress; the top of the brick wall of the pottery was injured somewhat, but the north end of the building was torn out, the upper bricks being thrown a distance of 15 feet, the lower ones not so far. The appearance was that some force had pushed the wall over, while shelving immediately inside was intact. This may have been an explosion, as I could not conceive of any way in which the departing roof could give the wall such an outward shove. All prostrations of trees in the immediate path of the storm were in the direction of the storm's progress, as nearly as could be expected, considering the unequal resistance by the different roots of a tree, and by the shape and size of houses. Objects outside the path were prostrated in general toward the path and, roughly, at right angles to it. In some few cases the prostrations were almost exactly the opposite of this, and I have noticed, chiefly on the north side, that some of the trees were prostrated to the n. and nw. In no case have I found that a tree moved after it struck the ground; they were simply pushed over, one-half the roots being pulled out of the ground, the other half remaining firmly in the ground. In the midst of fallen trees are others standing, some showing by openings in the ground, at one side, that they had experienced strong wind, while others, apparently under the same conditions, show no such evidence.

Of the material carried forward by the storm very little was left over 150 feet from the main line of the storm. Timbers and boards were left lying almost entirely lengthwise of the storm's path. Two cases are reported where south cellar doors of houses north of the storm's path were blown open. In shape the tornado cloud has been very generally described as a cone, though by no means regular in its outlines, nor do the cones described agree in shape, as they vary from the conventional cone of geometry, with wide base, to the pineapple cone. Observers state that the cloud column was not a solid column of cloud, but was made up of detached, fragmentary cloud masses. All report that the motion was counter-clockwise. Two observers saw the tornado cross streets, and using width of street as a unit of measure, the base of the cloud column had a diameter of 40 to 50 feet. Many report that its passage was attended by a noise resembling that made by a train of cars. The general conditions of the weather were: a large cloud overspread the sky from the southwest, and the wind was from the same quarter and very light. I was one-fourth of a mile north of the tornado when it passed, and there was no perceptible breeze. Inside of a minute after it passed a sharp breeze sprang up from the northwest, which died out in a short time. The lightning in the general storm was mild, and observers say that there was none in the cloud column. No hail was reported. Rain was not excessive and apparently did not change in quantity after the tornado passed. After the wind changed to northwest the clouds began to break, and the late evening was almost entirely clear. It is difficult to decide upon which side of the track the force of the storm was greater. The total amount of damage is estimated at about $80,000. No lives were lost; three persons were seriously and several slightly injured.

INLAND NAVIGATION.

FLOODS.

The Mississippi River fell below the danger-line at Vicksburg, Miss., on the 3d, and at New Orleans, La., on the 12th. Large areas of swamp and low land in southeastern and southern La., and tracts of land in the river parishes as far north as Madison parish, La., were under water during the month. In the early part of the month melting snow in the Sierra Nevada Mountains caused the Carson River to overflow its banks, and thousands of acres of land in Ormsby and Douglas counties, Nev., were inundated. Advices dated the 7th state that great damage was caused by floods in Ontario, Canada. Railroads and dams were washed out; buildings and bridges were swept away; and much live stock was drowned. Reports of the 12th state that great damage was caused by floods in central N. Y. Large quantities of lumber and buildings were washed away by the overflow of streams, and traffic on railroads was delayed by washouts. On the 13th rivers and streams in northern Ill., and southern Wis. were overflowing their banks. At Rockford, Joliet, Elgin, Dixon, Aurora, and other places in northern Ill., great damage was done to property, and southwestern Wis. was largely inundated.

STAGE OF WATER IN RIVERS AND HARBORS.

The following table shows the danger-points at the several stations; the highest and lowest water during June, 1890, with the dates of occurrence and the monthly ranges:

Heights of rivers above low-water mark, June, 1890 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
Red River:						
Shreveport, La.	29.9	1	23.3	30	11.7	11.6
Arkansas River:						
Fort Smith, Ark.	22.0	5	11.2	22	2.3	8.9
Little Rock, Ark.	23.0	8	13.7	25	6.2	7.5
Missouri River:						
Ft. Buford, N. Dak.	.....	7	12.3	13	7.8	4.5
Sioux City, Iowa	.....	7	13.5	18	9.1	4.4
Omaha, Nebr.	18.0	9	12.9	1	8.4	4.5
Kansas City, Mo.	21.0	11	17.2	1	8.9	8.3
Mississippi River:						
Saint Paul, Minn.	14.5	23	7.0	1	3.7	3.3
La Crosse, Wis.	24.0	15	9.7	1	7.4	2.3
Dubuque, Iowa	16.0	26	14.2	1	7.0	7.2
Davenport, Iowa	15.0	29	11.7	1	4.4	7.3
Keokuk, Iowa	14.0	30	12.6	1	4.1	8.5
Saint Louis, Mo.	32.0	30	20.7	3,4	11.6	9.1
Cairo, Ill.	40.0	1	33.1	12	21.4	11.7
Memphis, Tenn.	34.6	1	26.3	15	17.4	8.9
Vicksburg, Miss.	41.0	1	41.3	30	28.9	12.4
New Orleans, La.	13.0	1, 2, 3	13.7	30	10.7	3.0
Ohio River:						
Pittsburgh, Pa.	22.0	22	8.5	30	2.3	6.2
Parkersburg, W. Va.	38.0	22	16.2	14	6.0	10.2
Cincinnati, Ohio	50.0	1	37.5	10	16.0	21.5
Louisville, Ky.	25.0	1	14.8	10	7.2	7.6
Cumberland River:						
Nashville, Tenn.	40.0	1	17.1	30	3.3	13.8
Tennessee River:						
Chattanooga, Tenn.	33.0	1	6.1	30	3.1	3.0
Monongahela River:						
Pittsburgh, Pa.	29.0	22	8.5	30	2.3	6.2
Savannah River:						
Augusta, Ga.	32.0	4	9.4	30	6.1	3.3
Willamette River:						
Portland, Oregon	15.0	1	17.6	29, 30	12.4	5.2

ATMOSPHERIC ELECTRICITY.

AURORAS.

Auroras were reported as follows: 7th, Lyons, N. Y. 8th, Carson, Iowa; Quakertown, Pa. 19th, Quakertown, Pa.

THUNDER-STORMS.

The more severe thunder-storms of the month are described under "Local storms." East of the Rocky Mountains thunder-storms were reported in the greatest number of states, 30 to 34, on the 5th, 6th, 11th to 15th, 18th, and 23d; in 20 to 29 on the 1st, 3d, 4th, 7th, 9th, 10th, 16th, 17th, 19th to 22d, and 24th to 30th; in 19 on the 2d; and in 14 on the 8th.

East of the Rocky Mountains thunder-storms were reported on the greatest number of dates, 30, in Fla., N. C., and Tenn.; on 20 to 29 in Ala., Ga., Ill., Ind., Iowa, Kans., Ky., La., Mich., Minn., Miss., Mo., Mont., Nebr., N. Y., N. Dak., Pa., S. C., S. Dak., Tex., and Wis.; on 10 to 19 in Ark., Md., Mass., N. H., N. J., R. I., Vt., Va., and W. Va.; and on 1 to 9 in Conn., D. C., Ind. T., Me., and S. C. West of the Rocky

Mountains thunder-storms were reported as follows: Ariz., 8th, 17th, 25th, 27th, and 30th; Cal., 1st, 11th, 15th, 23d, 24th, 29th, and 30th; Colo., 1st, 6th, 9th, 10th, 13th, 16th to 19th, 23d, and 26th to 30th; Idaho, 1st, 9th, 11th, 14th, 15th, 17th to 19th, 25th, and 30th; Nev., 16th, 19th, 29th, and 30th; N. Mex., 6th, 8th, 17th, 18th, and 28th to 30th; Oregon, 23d, 30th, and 31st; Utah, 2d to 9th, 20th, and 25th; Wash., 7th, 11th, 16th, 17th, 23d, and 25th; Wyo., 3d, 10th, and 25th to 27th. There were no states or territories west of the Rocky Mountains in which thunder-storms were not reported.

MISCELLANEOUS PHENOMENA.

HALOS.

In the MONTHLY WEATHER REVIEW from January to May, 1890, inclusive, the solar and lunar halos reported in the several sections of the country have been considered in connection with precipitation on the days attending and the second and third days following their occurrence, and also with relation to their occurrence in advance, or following the passage, of storms. This treatment of halos for the period named shows that 73 per cent. of the halos were attended on the first day, 70 per cent. were followed on the second day, and 62 per cent. were followed on the third day by precipitation, and indicates that about three-fourths of the halos noted in the United States were attended on the same day by precipitation at or near the station where they were observed. As regards the percentage of halos which were followed on the second and third days by precipitation in any given district, it is shown that in a large majority of instances halos were also reported for the three consecutive dates. In considering the relations of halos with storms it has been found that in districts lying east of the Rocky Mountains 57 per cent. of the halos occurred in advance, or within the eastern quadrants, of well-defined storms, and that 43 per cent. of the halos were noted in the western quadrants of areas of low pressure or within the limits of areas of high pressure. In the Rocky Mountain and plateau regions less than 50 per cent., and on the Pacific coast less than 20 per cent. of the halos occurred within the influence, or in advance, of storms. As about 75 per cent. of the halos reported were attended on the same day by precipitation at or near the place of observation, and nearly 50 per cent. of the halos occurred after the passage of, and attending, the clearing conditions which follow storms, it will be seen that halos indicate merely a moist condition of the atmosphere, and that they point to a prevalence, or to a strong probability of the occurrence on the same day, of precipitation in the districts where they are observed.

In future issues of the MONTHLY WEATHER REVIEW halos of unusual brilliancy or of a remarkable character only will be noted, and in such cases full descriptions will be given.

DROUGHT.

Drought damaging to crops and vegetation was reported near Charlotte, N. C., Double Springs, Ala., Santa Maria and Mesquite, Tex., Lead Hill, Ark., Howe, Nebr., La Monte and Oak Ridge, Mo., Havensville, Kans., and Lexington, Nebr.

MIRAGE.

At Duluth, Minn., a fine mirage was observed from 11.00 a. m. to 12.30 p. m., 16th. The Wis. shore for 20 to 30 miles stood out in bold relief; forests at an unknown distance appeared inverted; and the mouth of the Brule River, 20 miles distant, was plainly visible.

SUN SPOTS.

Haverford College Observatory, Pa. (observed by Prof. F. P. Leavenworth):

Date.	Number of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Faculæ.	Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	
June, 1890.										
1, 1 p. m...	0	0	0	0	0	0	0	0	1	Definition good.
2, 10 a. m...	0	0	0	0	0	0	0	0	1	Definition good.
3, 10 a. m...	2	5	0	0	0	0	2	5	2	Definition good; spots small.
4, 10 a. m...	1	1	0	0	0	0	1	1	1	Definition good; spots small.
5, 10 a. m...	0	6	0	0	0	0	1	7	1	Definition fair.
6, 10 a. m...	0	4	0	0	0	0	1	11	0	Definition poor.
7, 10 a. m...	0	4	0	0	0	0	1	15	1	Definition good; 1 large spot.
8, 10 a. m...	0	0	0	0	0	0	1	4	1	Definition bad; 1 large spot.
9, 9 a. m...	0	0	0	0	0	0	1	6	1	Definition poor; spots small.
10, 9 a. m...	1	2	0	0	0	0	2	3	1	Definition good.
11, 9 a. m...	0	1	1	1	0	0	1	3	0	Definition fair.
12, 12 m	0	0	0	0	0	0	0	3	1	Definition fair.
13, 10 a. m...	0	0	0	0	0	0	0	0	1	Definition fair.
14, 9 a. m...	1	4	0	0	0	0	1	4	3	Definition good; spots small.
18, 10 a. m...	0	0	0	0	0	0	0	0	1	Definition good.
19, 10 a. m...	0	0	0	0	0	0	0	0	0	Definition fair.
20, 10 a. m...	0	0	0	0	0	0	0	0	0	Definition good.
22, 12 m	0	0	0	0	0	0	0	0	0	Definition poor.
23, 9 a. m...	1	1	0	0	0	0	1	1	1	Definition good.
24, 5 p. m...	0	0	0	0	0	0	0	0	1	Definition good.
25, 10 a. m...	0	0	0	0	0	0	0	0	1	Definition good.
26, 10 a. m...	0	0	0	0	0	0	0	0	1	Definition fair.
27, 10 a. m...	0	0	0	0	0	0	0	0	1	Definition poor.
28, 11 a. m...	0	0	0	0	0	0	0	0	0	Definition fair.
29, 10 a. m...	0	0	0	0	0	0	0	0	2	Definition good.
30, 10 a. m...	0	0	0	0	0	0	0	0	0	Definition fair.

Mr. C. E. Buzzell, Leaf River, Ill.: June 4th and 5th, poor definition; 6th, two small groups near meridian in south latitude, unchanged on 7th, and decreasing on the 8th; 9th and 10th cloudy, clear disc on 11th. None seen on other dates.

Mr. John W. James, Riley, Ill.: observations taken on 1st to 4th, 6th, 7th, 8th, 10th to 13th, 19th, 21st to 30th, or on 22 days of the month, but the only spots seen were: 6th, one group, estimated 31,600 miles long, two days from western edge of the disc; and 7th to 8th, one spot.

Mr. M. A. Veeder, Lyons, N. Y.: 1st, a group of faculæ was about two days advanced from the eastern limb; 5th, spots were seen in the vicinity of this group, and gradually increased in size during the remainder of transit. Faculæ appeared by rotation at the eastern limb, 2d, 5th, 7th, 25th, and 26th. Faculæ were seen at the western limb, 1st and 6th.

H. D. Gowey, North Lewisburgh, Ohio: sun spots were observed on the 7th and 8th.

VERIFICATIONS.

CAUTIONARY SIGNALS FOR JUNE, 1890.

[Verifications made by Assistant Professor C. F. Marvin, assisted by Mr. H. E. Williams, chief clerk of the Forecast Division.]

Statement showing percentages of justifications of wind signals for the month of June, 1890:

Wind signals.—(Ordered by Assistant Professor H. A. Hazen.) Total number of signals ordered, forty-three; justified as to velocity, wholly, twenty-two, partly, one; justified as to direction, forty-three. Of the signals ordered, thirty-nine were cautionary signals, of which nineteen were wholly justified; and four were storm signals, of which three were wholly, and one partly justified. Twenty-seven signals were ordered for easterly winds, and sixteen for westerly winds, all of which were justified. Percentage of justifications, 59.8.