Heights of rivers above low-water mark, September, 1887 (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	30	5.5	8 to 11	*—0.6	6.1
Arkansas River:						
Fort Smith, Ark	22.0	11	4.5	1	1.7	2.8
Little Rock, Ark	23.0	15	3.8	2	1.7	2.1
Missouri River:						
Omaha, Nebr	18.0	13	11.9	30	7.3	4.6
Leavenworth, Kans	20.0	15	13.4	27	8.2	5.2
Mississippi River:						
Saint Paul, Minn	14.5	4	2.6	24 to 26, 30	1.8	0.8
La Crosse, Wis	24.0	10	5.7	1	2.7	3.0
Dubuque, Iowa	16.0	13	5.8	1, 2	2.6	3.2
Davenport, Iowa	15.0	15 to 19	3.8	1	1.4	2.4
Keokuk, Iowa	14.0	20 to 22	3.6	4	1.0	2.6
Saint Louis, Mo	32.0	19	11.6	5 to 7	6.7	4.9
Cairo, Ill	40.0	22	7.8	11	3.8	4.0
Memphis, Tenn	34.0	24, 25	6.8	13	4.4	2.4
Vicksburg, Miss	41.0	29	3.1	17, 18	*—0.1	3.2
New Orleans, La	13.0	1	4.1	10, 11	1.9	2.2
Ohio River:						
Pittsburg, Pa	22.0	7	6.1	12, 23	5.5	0.6
Cincinnati, Ohio	50.0	1, 2	4.1	17	2.8	1.3
Louisville, Ky	25.0	12	3.0	26	2.4	0.6
Cumberland River:						
Nashville, Tenn	40.0	28, 29	0.9	14 to 16	*—0.3	1.2
Tennessee River:						
Chattanooga, Tenn	33.0	1	4.0	19, 25	1.3	2.7
Monongahela River:						
Pittsburg, Pa	29.0	7	6.1	12, 23	5.5	0.6
Savannah River:						
Augusta, Ga	32.0	30 [30	14.0	26	5.6	8.4
Sacramento River:						
Red Bluff, Cal		2 to 9, 12 to	0.5	1, 10, 11	0.4	0.1
Sacramento, Cal		1 to 11	7.3	12 to 30	7.2	0.1
Willamette River:						
Portland, Oregon		1	5.7	26 to 28	2.0	3.7

* Below bench mark.

FLOODS.

Fort Maginnis, Mont., 2d: the rains of the past four days have been the heaviest ever known in this section. The Missouri River rose twelve feet in three hours, carrying away property valued at from $8,000 to $9,000. Considerable damage was also done to grain and hay.

Poplar River, Mont.: the heavy rain northwest of this station caused a rise of four feet in the Missouri River on the 2d.

Fort Buford, Dak., 3d: on account of the recent heavy rains the Missouri River has risen very rapidly, and reports from the Yellowstone Valley state that the creeks are overflowing and partly flooding the surrounding country.

Tucson, Ariz.: heavy rains caused freshets in the Santa Cruz and Rillito rivers on the 9th. Several miles of the Southern Pacific Railroad track and some bridges in the vicinity of Pantano were washed away.

The Chicago "Times" of the 13th contained the following:

TUCSON, ARIZ., *September* 13.—The extent of the destruction to the railroad by washouts is much greater than at first supposed. * * * One filling fifty feet high on the Dragoon grade is washed out for eight miles. It will take three weeks to repair the washed out places between Benson and Tucson so that trains can pass over the road. * * * The present is the most destructive washout yet suffered by the Southern Pacific Road, and it will cost not less than $200,000 to repair the damage. A through wire to the east was made to day. The heavy rains of yesterday extended into Sonora, where five miles of track and three bridges were washed out on the Sonora Road. The streets of Tucson are flooded with perishable freight for the eastern market.

Brownsville, Tex.: the Rio Grande River began to overflow on the 13th, and continued to rise on subsequent dates; by the 27th much of the adjacent country was flooded. On the latter date the river was higher than has been known for twenty years. At the close of the month the river was still overflowing.

New Orleans, La.: the high tides caused by the strong easterly winds of the 18–19th, with rainfall on the latter date, resulted in washouts along the Louisville and Nashville Railroad between this city and Mobile.

Comfort, Kendall Co., Tex.: all streams in this region were much swollen by the heavy rains on the night of the 25–26th, and numerous bridges were washed away.

ATMOSPHERIC ELECTRICITY.

AURORAS.

Auroras were observed during the month, as follows: 1st, Butlerville, Ind. 6th, Berlin Mills, N. H. 9th, Henry and Webster, Dak.; Clayton, N. J. 11th, Berlin Mills, N. H. 12th, Poplar River, Mont. 13th, Starkey, N. Y. 14th, Webster, Dak.; Duluth, Minn. 15th, Bismarck and Fort Buford, Dak.; Traverse City, Alpena, and Marquette, Mich.; Duluth and Moorhead, Minn.; Poplar River and Fort Assinaboine, Mont.; Madison, Wis. 16th, Fort Totten and Webster, Dak.; Gardiner, Me.; Moorhead, Minn.; Northfield, Vt. 17th, Gardiner, Me.; Thornville, Mich.; Saint Vincent, Minn. 18th, Clayton, N. J. 21st, Fort Totten and Webster, Dak.; Marquette, Mich.; Duluth and Moorhead, Minn. 22d, Fort Totten, Dak.; Saint Vincent, Minn.; Poplar River, Mont. 23d, Webster, Dak.; Fort Maginnis, Mont. 24th, Windsor, Ill.; Taunton, Mass.; Thornville, Mich. 25th, Voluntown, Conn.; Bismarck, Fort Totten, and Webster, Dak.; Bulterville, Ind.; Bar Harbor, Cornish, Gardiner, Orono, Eastport, and Portland, Me.; Blue Hill Observatory, Fall River, Newburyport, North Truro, Somerset, and Taunton, Mass.; Birmingham, Harrisville, Lansing, Thornville, Traverse City, Alpena, Port Huron, and Marquette, Mich.; Fort Maginnis and Poplar River, Mont.; Concord, N. H.; Tiffin, Ohio; Fort Laramie, Wyo. 26th, Thornville, Mich.; Poplar River, Mont. 27th, Fort Totten, Fort Buford, and Webster, Dak.; Alpena, Mich.; Saint Vincent and Duluth, Minn.; Fort Maginnis, Poplar River, and Fort Assinaboine, Mont.; Mount Washington, N. H. 28th, Moorhead, Minn.

The most noteworthy auroral displays of the month were those of the 25–27th, which were observed at stations in the states and territories along the northern border from Montana eastward to the New England coast. Reporting stations were most numerous on the evening of the 25th, although at that time over Dakota, Minnesota, Wisconsin, and northern New York, cloudiness prevailed, through which the aurora could not be seen; but over the greater part of the Lake region, in the upper Missouri valley, and New England, the weather was clear and the aurora was observed at many stations.

On the evening of the 26th an area of cloudiness overspread the upper Mississippi valley, Lake region, and portions of New England, and the aurora was noted at but two stations, viz., Poplar River, Mont., and Thornville, Mich.

On the following evening cloudiness covered the greater part of the country east of the Mississippi, but the weather was clear in the northern part of the upper lake region and to the westward, where numerous stations observed auroral displays.

Concerning the displays of the 25–27th, the following notes are given:

Fort Totten, Dak.: though the sky was partially obscured on the evening of the 25th it was sufficiently clear to indicate the existence of a brilliant and prolonged auroral light, with shooting beams reaching nearly to the zenith. The display was seen from 9.30 to 11.30 p. m.

Escanaba, Mich.: a faint and poorly defined auroral light was observed from 8.00 p. m. on the 25th until 1.30 a. m. the following date; the aurora assumed fantastic shapes and colors extending upward to an altitude of 80°; it covered only a narrow part of the horizon.

Bismarck, Dak.: a bright yellow auroral light was observed at 8.25 p. m. on the 25th; it rapidly spread from azimuth 120° to 255°; beams of light shot upwards to a height of 90°. At 10 p. m. the light began to fade, and by 11 p. m. it had disappeared.

Mackinaw City, Mich.: a brilliant aurora appeared at 7.30 p. m. on the 25th; it was of a light yellow color and presented the appearance of a huge curtain hanging in folds. The light extended from the northeast to the northwest, and reached an altitude of 90°; for a short time the light extended to 10° south of the zenith. The aurora gradually assumed an elliptical shape, still retaining its curtain-like appearance, its long diameter being about 100° in length, and crossing the magnetic meridian at right angles at altitude 85°. The maximum intensity occurred at about 8.10 p. m.; after that time it gradually faded, and

at 8.40 p. m. it had entirely changed its shape and appeared as a narrow arch of about 2° in width, extending from the northeast to the northwest, and crossing the magnetic meridian at altitude 10°. The aurora was scarcely visible at 11 p. m.

Alpena, Mich.: an aurora was observed at 7.00 p. m. on the 25th, consisting of brilliant streamers and "merry dancers," extending to an altitude of 65° and covering the horizon from east to west; the aurora had an apparent motion from east to west, and was very brilliant at 11.30 p. m.; the display lasted until daylight of the 26th.

Port Huron, Mich.: a faint auroral light was visible from 9.30 until 10.15 p. m. on the 25th; it consisted of slender streamers reaching an altitude of 50°.

Lansing, Mich., 25th: an auroral light was observed in the north at 7.45 p. m., in the form of a curtain fold, with occasional streamers between northeast and northwest shooting up towards the zenith. The display was not brilliant, and had disappeared at 10.20 p. m.

Mr. Joseph Wood, voluntary observer at Bar Harbor, Me., reports, relative to this aurora, as follows:

"The display of northern lights on the evening of the 25th was the finest we have ever known, and we have seen many and grand exhibitions of the aurora. The brilliant spears of colored light, showing all the hues of the rainbow, flashed and crinkled across the northern heavens from east to west, and shot up in great sheets of flame in the northeast and northwest; the rosy light that passed to the zenith opened itself more than half way down to the southern horizon, forming a scene of grandeur rarely witnessed."

Eastport, Me., 25th: a brilliant auroral arch was observed from 6.40 to 11 p. m., having an altitude of 35°, and extending from northeast to northwest; eight beams or shafts of light, waving and flashing up to the zenith, were observed during the display.

Portland, Me.: a bright aurora was observed from 9 to 10.30 p. m. on the 25th; it consisted of waves of light, moving mostly eastward from a point a little to the east of north, with slender streamers reaching from near the horizon to the zenith.

Fort Totten, Dak.: a brilliant aurora was observed from 9.20 to 11 p. m. on the 27th; the display consisted of two parallel arches, reaching altitudes of 25° and 45°, respectively, with shooting beams extending nearly to the zenith and covering 120° of the horizon.

Saint Vincent, Minn.: an auroral light was observed at twilight on the evening of the 27th in the form of an arch; a partial corona formed about 15° or 20° northeast of the zenith at 9.35 p. m., at which time the arch had become striated and irregular, and at 9.50 had broken up into small fibrous clouds of whitish color. The aurora was most brilliant at 10.55 p. m., after which it faded somewhat, but was quite bright again at 11.15 p. m.

Moorhead, Minn.: an auroral arch was observed at 9.40 p. m. on the 27th; streamers of light shot upward, and waved to and fro as the display increased in brilliancy. At 10.05 the aurora assumed the "curtain" form, and showed a variety of colors. The display ended at 11 p. m.

ELECTRICAL PHENOMENON.

The Signal Service observer at Keeler, Cal., reports that during the evening of the 21st the atmosphere was so charged with electricity as to render telegraphic communication difficult.

THUNDER-STORMS.

Thunder-storms are reported to have occurred in the various states and territories on the several dates as follows:

1st.—Colo., Dak., Iowa, Kans., Mich., Minn., Mont., Nebr., N. Mex., Oregon, Wis., Wyo.

2d.—Colo., Dak., Fla., Iowa, Kans., Mo., Mont., Nebr., N. Y., Tex., Wyo.

3d.—Ark., Dak., Ill., Iowa, Kans., Minn., Mo., Nebr., N. Mex., Wis., Wyo.

4th.—Ark., Dak., Fla., Ill., Iowa, Kans., Minn., Mo., Nebr., Wis.

5th.—Ariz., Cal., Dak., Ill., Ind., Iowa, Kans., Mich., Minn., Nebr., Wis.

6th.—Cal., Dak., Fla., Ill., Iowa, Kans., Mass., Mich., Nebr., N. H., N. Y., Ohio, Oregon, Pa., Wis.

7th.—Ariz., Ark., Colo., Conn., Fla., Ill., Kans., Me., Md., Mass., Nebr., N. H., N. J., N. Mex., N. Y., N. C., Ohio, Oregon, Pa., Tenn., Vt., Va., Wash., W. Va., Wyo.

8th.—Ariz., Colo., Dak., Fla., Iowa, Kans., Mass., Minn., Mont., Nebr., N. C., S. C., Va., Wash., Wis.

9th.—Ariz., Fla., Ill., Ind., Iowa, Kans., Mich., Mo., Nebr., Tex.

10th.—Ariz., Ark., Cal., Colo., Fla., Ga., Ill., Ind. T., Kans., Mo., Tenn., Tex.

11th.—Ark., Colo., Ill., Ind., Ind. T., Kans., Ky., Nebr., N. Y., Ohio, Wash.

12th.—Colo., D. C., Fla., Iowa, Kans., La., Mich., Mont., Nebr., N. J., Ohio, Tex., Utah, Va., Wis.

13th.—Ariz., Ark., Fla., Ill., Ind., Ind. T., Iowa, Kans., Mich., Mo., N. Y., N. C., Ohio, Pa., Tenn., Tex., Va., Wis.

14th.—Ala., Ariz., Ark., Dak., Fla., Ind., Ind. T., Kans., La., Me., Miss., N. Y., N. C., Ohio, Pa., S. C., Tenn., Tex., Va., W. Va.

15th.—Ala., Ariz., Ark., Colo., Fla., Ga., La., N. C., S. C., Tex., Va.

16th.—Ala., Ariz., Colo., Fla., Ga., Miss., Tenn., Tex.

17th.—Fla., Mass., Tex.

18th.—Ariz., Ind. T., Oregon, Tenn., Tex., Va., Wash.

19th.—Ariz., Me.

20th.—Ariz., Dak., Minn., Nebr., Tex., Va., Wis., Wyo.

21st.—Ariz., Cal., Colo., Dak., Ill., Kans., Mich., Nebr., N. Y., Ohio, Tex., Wyo.

22d.—Ariz., Cal., Colo., Ill., Iowa, Kans., Mo., Nebr., Ohio, Tenn., Tex.

23d.—Ariz., Colo., Nev., S. C., Utah, Va.

24th.—Nev., S. C., Utah, Wyo.

25th.—Kans., Nebr., Pa., Tex., Wyo.

26th.—Dak., Ill., Ind. T., Kans., Nebr., Pa., Tex.

27th.—Fla., Ky.

28th.—Fla., Ga., N. C.

29th.—Fla., Ill., Ind., Iowa, Mich., N. C., Ohio, S. C., Va., Wis.

30th.—Conn., Fla., Mass., Mich., N. J., N. Y., N. C., Ohio, Pa., Va.

OPTICAL PHENOMENA.

HALOS.

1st–3d.—Solar and lunar halos were observed on these dates in the central valleys, middle and south Atlantic states, preceding and accompanying the passage of low pressure area number ii from the lower lake region eastward to, and off, the Nova Scotia coast.

4–7th.—Lunar halos were reported from stations in the Mississippi Valley on the 4th and 5th, and from the Ohio Valley on the latter date. Solar halos were noted at widely separated stations east of the Rocky Mountains on the 6th, and on the 7th lunar halos were reported from scattering stations in the Missouri, upper Mississippi and Ohio valleys, and middle Atlantic states.

9–10th.—Solar halos were numerous in New England and the middle Atlantic states on the 9th and on the upper lakes on the 10th.

12th.—Solar halos in the Ohio and central Mississippi valleys.

16th.—Solar halos in the Ohio Valley and middle Atlantic states.

20th.—Solar and lunar holos in the lower lake region and middle Atlantic states.

26–30th.—During this period both solar and lunar halos were frequent in the states bordering on the Atlantic; it was also during these dates that area of low pressure number xi passed from the west Gulf coast to the upper lake region.

The phases of the moon, Washington mean time, during September, as given in "The American Ephemeris and Nautical Almanac" for 1887, are as follows: Full moon, 1st, 18 h. 4.4 m.; last quarter, 9th, 21 h. 55 m.; new moon, 16th, 20 h. 51.6 m.; first quarter, 23d, 11 h. 55.6 m.; apogee, 4th, 22.1 h.; perigee, 17th, 13.7 h.

MIRAGE.

Moorhead, Minn.: a mirage was observed at 3.00 p. m. on the 9th; elevators, buildings, trees, and other objects situated eighteen miles southeast of this place, were plainly seen. All