Temperature and rainfall data for the cotton districts, October.

Districts.	Rainfall.			Temperature.						
				Maximum.			Minimum.			Extremes for Oct., 1886.
	Average for October of four preceding years.	Average for October, 1886.	Departures.	Mean for Oct. of four preceding years.	Mean for Oct. 1886.	Departures.	Mean for Oct. of four preceding years.	Mean for Oct. 1886.	Departures.	Max. / Min.
	Inch.	Inch.	Inch.	°	°	°	°	°	°	° / °
New Orleans	2.35	1.40	— 0.95	80.7	77.4	— 3.3	59.3	55.0	— 4.3	88 / 30
Savannah	2.35	1.04	— 1.31	80.7	78.8	— 1.9	59.5	56.6	— 2.9	92 / 31
Charleston	2.62	0.68	— 1.94	77.3	76.5	— 0.8	54.9	52.0	— 2.9	88 / 31
Atlanta	2.66	0.09	— 2.57	75.3	75.4	+ 0.1	54.2	49.7	— 4.5	88 / 23
Wilmington *	2.01	0.70	— 1.31	76.9	74.6	— 2.3	54.6	49.7	— 4.9	89 / 30
Memphis	2.65	0.66	— 1.99	75.4	74.8	— 0.6	52.4	48.1	— 4.3	88 / 24
Galveston *	3.31	1.41	— 1.90	81.1	79.0	— 2.1	59.4	57.3	— 2.1	91 / 34
Vicksburg	2.99	0.90	— 2.09	78.6	76.8	— 1.8	55.9	54.2	— 1.7	85 / 31
Montgomery	1.60	0.13	— 1.47	79.2	78.5	— 0.7	59.9	55.9	— 4.0	90 / 33
Augusta	2.36	0.25	— 2.11	77.1	75.5	— 1.6	54.8	50.0	— 4.8	88 / 30
Little Rock	2.03	1.11	— 0.92	76.1	75.5	— 0.6	50.8	50.3	— 0.5	93 / 22
Mobile	2.13	0.27	— 1.86	79.7	78.1	— 1.6	56.3	51.3	— 5.0	89 / 28

* Averages for three years only.

ATMOSPHERIC ELECTRICITY.

AURORAS.

Mount Washington, New Hampshire: a faint auroral light became visible at 9.20 p. m. of the 5th, it gradually increased in brilliancy and extent. At 9.50 p. m. a well-defined arch was formed from which slender streamers rose to an altitude of 50° above the horizon. The dark segment upon which the arch usually rests was replaced by a slightly luminous atmosphere. The aurora was most brilliant at 10.10 p. m. At 9.40 p. m. of the 6th an aurora was observed which had attained considerable brilliancy; an arch of about four degrees width, and extending ten degrees east and west of the magnetic meridian, rested upon a dark segment. Slender luminous beams rose from the arch at intervals, those west of north being the most brilliant and of greatest duration. The maximum brilliancy occurred at 10.45 p. m., after which it faded gradually and disappeared in the early morning of the 7th. An auroral light was also visible on the 7th from 9.30 to 11.15 p. m.; it was without arch, streamers, or other distinctive features.

Eastport, Maine: an auroral arch was observed at 10 p. m. of the 5th, altitude 15°; the light disappeared at 1.50 a. m. of the 6th. Auroras were also visible on the 7th, 8th, 18th, 26th, and 27th. The aurora of the 8th was visible from 7.15 to 9 p. m. in the form of an arch from which beams of white light shot upward, appearing and disappearing very rapidly.

Fort Totten, Dakota: a brilliant auroral display occurred between 10.30 and 11 p. m. of the 7th with streamers extending upward to the altitude of 45°; azimuth of aurora 90°. Waves of light, red at their bases and green at the upper extremities, moved with great speed along the arch. Auroral lights were also seen on the 21st, 27th, 28th, 29th, 30th.

Duluth, Minnesota: an aurora was visible at 12.45 a. m. of the 8th; the display was characterized by constantly shifting vertical bands of pale yellow light in the northwest and broad horizontal waves of the same color in the north. It was only faintly visible at 1.15 a. m. and had disappeared at 1.35 a. m. An aurora was also seen on the 22d in the form of a broad belt of light stretching along the northern horizon, with waving streamers flashing upward from the lower portion of the belt to an altitude of 15°. The display disappeared at 2 a. m.

Fort Buford, Dakota: a fine auroral display began at 9.45 p. m. of the 7th and continued throughout the night. It at first presented the appearance of a number of white and rose colored curtains moving rapidly across the sky from the northwestern to the northeastern horizon and extending to a height of 45°. At 10.15 p. m. long streamers began shooting upward from the dark portions of the sky. A faint auroral light was visible during the night of the 8-9th.

Poplar River, Montana: an aurora was seen at 8.10 p. m. of the 7th. It appeared in the form of slender luminous beams of pale yellow light rising to an altitude of 40°. The aurora changed its form several times during the night and disappeared at dawn of the 8th.

Fort Custer, Montana: a faint aurora consisting of a few pale streamers was visible from 10.25 to 10.50 p. m. of the 7th. It extended from azimuth 150° to 210° and altitude 23°.

Bismarck, Dakota: an auroral light, extending from azimuth 140° to 225° and to an altitude of 40°, was visible from midnight to 4.40 a. m. of the 8th. On the 28th, at 9.30 p. m., an aurora, consisting of streamers of white light, extending from azimuth 150° to 230°, and to an altitude of 30°, was observed; it disappeared at 12.20 a. m. of the 29th.

Saint Vincent, Minnesota: at 12.20 a. m. of the 21st a faint white auroral light was visible in the north. It rapidly increased in brilliancy and, at 1.15 a. m., numerous beams were constantly falling and rising, while the "merry dancers" incessantly played backward and forward. The display ended at 2 a. m. An aurora was seen at 11.45 p. m. of the 27th; no streamers or "merry dancers" were seen, but a varying degree of brightness was a very noticeable feature, the light at times being strong and brilliant and again dull and faint. No change in the outline or position of the aurora occurred. The display continued until the early morning of the 28th; altitude, 30°; azimuth, 60°. An aurora also became visible on the 28th at 9.15 p. m., rising up in the north in the form of a pale white light. At a later hour the display became more brilliant and at midnight numerous streamers shot up to the zenith.

Moorhead, Minnesota: an aurora was observed at 9.35 p. m. of the 28th, consisting of two arches of white light, tinged with green. The arches were five degrees apart and at the highest point 45° above the northern horizon.

Mackinaw City, Michigan: at 8.10 p. m. of the 28th an aurora was observed, azimuth, 50°; altitude, 20°. At 9.30 p. m. the light began to increase in altitude, forming an arch, with bright streamers shooting up to an altitude of 40°. From 10.12 to 10.35 p. m. the display appeared in the form of two parallel arches, shortly afterwards it began to fade and had disappeared at 11.30 p. m.

Auroral displays were also observed during the month, as follows:

1st.—Milton and Blue Hill Observatory, Massachusetts; Cornish, Kent's Hill, and Orono, Maine; Mackinaw City, Michigan; Moorhead, Minnesota; Poplar River, Montana.

2d.—Kent's Hill, Maine; Poplar River, Montana.

4th.—Pekin, Illinois; Des Moines, Iowa.

5th.—Gardiner, Maine; Burlington, Vermont.

6th.—Blue Hill Observatory and Milton, Massachusetts; Cornish, Maine; Berlin Mills, New Hampshire; Newport and Burlington, Vermont.

7th.—Cresco, Iowa; Gardiner, Maine; Marquette and Mackinaw City, Michigan; Nashua, New Hampshire.

8th.—North Colebrook, Connecticut; Cottage City and Cambridge, Massachusetts; Cornish, Maine; Berlin Mills and Nashua, New Hampshire; Oswego, New York; Walla Walla, Washington Territory.

9th.—Marquette, Michigan; Moorhead, Minnesota.

10th.—Pekin, Illinois.

12th.—Pekin, Illinois; Portland, Maine.

16th.—Pekin, Illinois.

17th.—Richmond, Kentucky.

18th.—Cornish, Gardiner, and Orono, Maine; Marquette, Michigan; Newport and Post Mills, Vermont.

21st.—Marquette, Michigan.

22d.—Nashua, New Hampshire.

24th.—Poplar River, Montana.

25th.—Gardiner, Maine.

26th.—Mackinaw City and Escanaba, Michigan; Poplar River, Montana.

27th.—Henry, Dakota; Mackinaw City, Escanaba, and Traverse City, Michigan; Poplar River, Montana; Delavan and Madison, Wisconsin.

28th.—Yankton, Dakota; Riley, Illinois; Bancroft, Cresco, Independence, and West Union, Iowa; Gardiner, Kent's Hill,

and Orono, Maine; Traverse City, Marquette, and Escanaba, Michigan; Duluth, Minnesota; Poplar River, Montana; Newport, Vermont; Delavan, Embarras, Lancaster, Wausau, and Prairie du Chien, Wisconsin.

29th.—Marquette and Escanaba, Michigan; Poplar River, Montana.

30th.—Escanaba, Michigan; Monticello, Iowa.

31st.—Dale Enterprise, Wisconsin.

CHART OF ELECTROMETER READINGS.

[Prepared under the direction of Prof. T. C. MENDENHALL, Assistant.]

Observations have been made during the month of October, 1886, at the six stations having the necessary apparatus. At Washington City several sets of simultaneous observations have been made at the Signal Office and at the top of the Washington Monument. The curves obtained on October 4th, a clear, pleasant day, with a light, dry fog in the morning, may be taken as illustrative of the difference in values obtained, under such conditions of weather, at the two places. At the Monument, feeble sparks could be obtained, on connecting the ground with the needle, when the deflection indicated over 700 volts. The observations in this, as in all the other series of simultaneous observations at these places, are taken at intervals of five minutes, except between 1 and 2 o'clock, when they are taken at minute intervals. October 5th was likewise a clear day, with light northeasterly winds. The values at both stations were approximately but half of those obtained on the preceding day. A feeble spark could be obtained when the potential indicated exceeded 455 volts. October 7th was also a day like the others. The values are much higher than those obtained on the 5th, but somewhat less than those of the 4th. The potential at the Monument averages for these dates 300 volts higher than the lower station. This value is less than that usually given. The following abridged table will serve to show, roughly, the differences on the three dates, as well as the correspondence between the two stations:

Time.	October 4.		October 5.		October 7.	
	Monument.	Signal Office.	Monument.	Signal Office.	Monument.	Signal Office.
	Volts.	Volts.	Volts.	Volts.	Volts.	Volts.
9 a. m.	.....	+186	.....	+102	.....	+132
11 a. m.	.....	228	.....	126	.....	138
11.30 a. m.	.....	96	.....	108	.....	114
11.50 a. m.	+595	198	+280	114	+368	120
12 m.	805	168	455	36	385	120
12.05 p. m.	700	150	420	102	385	126
12.10 p. m.	700	162	420	90	438	114, 126
12.15 p. m.	560	216	420	102	455	114, 126
12.20 p. m.	648	180	420	102, 114	385	84
12.25 p. m.	560	204	455	108, 120	455	84, 90
12.30 p. m.	525	192	525	72, 84	455	84, 96
12.35 p. m.	525	246	455	30, 60	420	102
12.40 p. m.	560	252	420	114	455	96
12.45 p. m.	420	234	350	114	455	102
12.50 p. m.	735	222	297	108	350, 455	108
12.55 p. m.	700	198	280	126	455	114
1 p. m.	543	174	.....	102	490	102
1.01 p. m.	543	120, 180	.....	108	490	114
1.02 p. m.	508	174	.....	102	490	120
1.03 p. m.	508	198	.....	102	490	108
1.04 p. m.	490	180, 210	.....	60, 108	490	114
1.05 p. m.	490	204	385	102	508	102
1.06 p. m.	508	198	385	120	490	114
1.07 p. m.	490	192	350	108	455	84, 114
1.08 p. m.	525	180	260	114	455	90, 120
1.09 p. m.	560	162	315	132	420	114
1.10 p. m.	595	162	350	144	438	120
1.11 p. m.	560	186	333	138	420	102
1.12 p. m.	578	204	350	132	438	108
1.13 p. m.	560	234	350	144	455	102
1.14 p. m.	560	234	350	150	473	108
1.15 p. m.	560	234	315	144	455	102
1.20 p. m.	350	186	280	120	473	108
1.25 p. m.	560	156	.....	60, 108	455	120
1.30 p. m.	630	222	337	120	438	120
1.35 p. m.	630	150	298	138	490	102
1.40 p. m.	525	210	280	96	473	138
1.45 p. m.	630	174	280	102	455	120
1.50 p. m.	525	174	210	126	455	114
1.55 p. m.	525	240	245	132	420	102
2 p. m.	595	210	245	114	403	96
2.05 p. m.	840	216	210	90, 120	403	102
2.10 p. m.	560	294	175	114	403	132
2.15 p. m.	770	162	245	120	455	132
2.20 p. m.	840	150	210	72	438	102
2.25 p. m.	700	138	245	72	385	126
2.30 p. m.	595	132	315	84	455	108
2.35 p. m.	735	138	315	30, 60	455	114
2.40 p. m.	665	150	280	84	438	108
2.45 p. m.	525	234	245	84	455	108
2.50 p. m.	490	168	245	66	490	126
2.55 p. m.	472	174	245	84	455	126
3 p. m.	525	114	245	90	438	114

On October 14th, after a long spell of dry weather, cloudy weather, with brisk easterly winds and threatening rain, prevailed. The values obtained at the Monument and the Signal Office on this date agree closely in character and degree, although much less in degree than those usually obtained. These values are represented in the first diagram of chart number vi.

The second diagram represents the results of the observations made at Boston, Massachusetts, during the month, the numbers corresponding to dates. The third diagram gives the results of the observations made at New Haven, Connecticut.

At Baltimore, Maryland, a continuous photographic record has been obtained. The following notes are abstracted from the observer's report: During October 14–15th stratus clouds covered the sky until about 6.30 a. m. of the 15th. The potential indicated is abnormally low, until the disappearance of the clouds, when it increases rapidly. During rainfall on several occasions the curves show decided variation. A curve characteristic of fair weather with upper clouds is shown by the records of the 17th and 18th. A variation synchronous with a change in wind direction appears on October 18th from 3 to 7 p. m., the wind having changed from sw. to ne., backing through the south points.

At New Haven, Connecticut, negative indications occurred on October 18th, at the 9 a. m. observation, during heavy rain; at 3 p. m. on the 21st, during clear weather, although it had rained during the forenoon; at 9 a. m. of the 26th, during threatening weather, and on the 27th, during heavy rain. Rain with positive values occurred but once, on October 28th, at 3 p. m. The highest values were obtained on October 1st, during clear weather and light northwest winds, and on October 4th, during clear weather and light southwest winds. The lowest values were on October 27th, 11th, and 26th, during rainy weather. The values nearest zero occurred on October 7th, during clear, somewhat hazy weather, with northeasterly winds.

At Boston, Massachusetts, a complete set of observations has been made. On October 2d variations in the potential were noticed at times corresponding with the passage of certain cumulo-stratus clouds. A thunder-storm, with hail, occurred at midnight of the 30th. Negative indications were given on October 4th, at 11 a. m., when there were no clouds, and a fresh west wind was blowing. Negative indications were also observed on the 15th at 11 a. m., during fair weather, following rain; on the 21st, at 11 a. m., during fair weather, with the wind northwest and brisk; on the 28th, at 11 a. m., with threatening weather, and at 3 p. m. of the 31st, preceding by more than an hour, light rain. Rain occurred without negative values on the 27th, 28th, and on the 29th and 30th,