

Valley, forming a junction with the low area traced as number v, after which the single disturbance moved northeastward with an apparent loss of energy and disappeared to the north-eastward on the 14th. The lowest pressure observed was that noted at Cedar Keys, Fla., on the afternoon of the 8th.

V.—Number v originated north of Montana on the 8th when the general distribution of pressure was similar as described in the cases of low areas numbers ii and iii, and it followed a corresponding path to the eastward, nearly coincident with the fiftieth parallel, inclining first to the south of east, and causing secondary depressions of slight energy to form in the Northwest and Rocky Mountain regions, while the centre of the principal disturbance remained to the north of the stations of observation. It passed north of the Lake region during the 11th and apparently attained its maximum energy when the centre was north of Lake Superior. When the disturbance approached the Saint Lawrence Valley it was apparently drawn toward the tropical storm which was then moving along the Atlantic coast, and the two storms united, as previously stated, when near Quebec. The angle made by the direction of these tracks previous to their union was about 70°, and the direction of movement after the union was approximately a continuation of the path of the tropical storm. Each storm was deflected from its course as the centres approached the point of union. The lowest barometer reading observed during the passage of number v was 29.46 at Medicine Hat, Northwest Territory, on the afternoon of the 9th.

VI.—This disturbance developed in the central Mississippi valley on the 15th within an extended barometric trough which resulted from an area of low pressure which was first observed over the plateau regions on the 11th. The early movements of this depression were not traced, owing to the uncertainty as to the positions of its centre. A barometric disturbance formed on the 12th to the north of Montana and moved eastward to the north of the stations of observation, in a manner similar to that described in low areas numbers ii, iii, and v. Secondary disturbances formed in the Missouri Valley on the 13th, which were attended by high northerly winds in the states and territories of the Missouri Valley. After the barometric trough reached the central valleys on the 15th the pressure apparently increased at the northerly stations and a secondary disturbance formed to the southward, which has been traced as number vi. Heavy rains occurred from the Gulf States northward over the Lake region, and during the first twelve hours the direction of movement of this area of low pressure was to the northeast from Illinois to Michigan, after which it apparently moved slowly westward for thirty-six hours, carrying the centre of disturbance to the southern portion of Wisconsin, from which point it moved slowly northward and disappeared by an increase of pressure during the afternoon of the 18th. An ex-

amination of the weather charts shows that there was a well-defined movement of this disturbance to the westward on the 16th and 17th. A minimum pressure of 29.64 was observed at Grand Haven, Mich., on the 16th.

VII.—The marine reports received at this office indicate that this storm originated east of and near the Florida coast on the 24th. It moved rapidly northward, passing from the latitude of northern Florida to southern New England in twenty-four hours. Reports received from Hatteras, N. C., indicate that the centre passed to the east of, and near, that station on the afternoon of the 25th, while on the morning of the 26th the centre had reached the vicinity of Nantucket, where dangerous gales were reported, the wind reaching a velocity of 60 miles northeast at Block Island, and 50 miles southeast at Nantucket, Mass. On the southern New England coast the barometer fell .78 in twelve hours, and reached a minimum of 29.08 at Nantucket on the morning of the 26th. By 8 p. m. of that date the centre had reached the vicinity of Eastport, Me., and the wind attained a maximum velocity of 60 miles per hour at both Boston and Eastport during that day. It will be seen from the table of velocities, etc., that this storm moved at an unusually rapid rate, and it probably passed beyond the stations northeast of New England during the 27th.

VIII.—This storm appeared in the region to the north of Montana on the 25th and moved southeastward during the next forty-eight hours, reaching the vicinity of Lake Huron where it attained its maximum energy, being attended by brisk to high westerly winds throughout the Lake region. At this point the course changed in the direction of the Saint Lawrence Valley, the centre of disturbance extending rapidly and the pressure increasing with the easterly movement. It was last marked central in the vicinity of Father Point, Quebec, on the morning of the 28th. The lowest barometer reading, 29.42, was observed at Sault Ste. Marie, Mich., on the morning of the 26th.

IX.—This storm was central north of Manitoba on the morning of the 30th and it moved rapidly southeastward, the centre reaching the western portion of Lake Superior by 8 p. m. of that date, attended by general rains throughout the Lake region. The rapid fall of the barometer during the last twelve hours on the 30th indicated that this storm would increase rapidly in energy and cause severe gales on the lakes. While the morning report of the 30th did not justify the ordering of cautionary signals for the upper lake region, the conditions were sufficiently threatening to cause special reports to be called for, which were received in time to enable the central office at Washington to order cautionary signals several hours before the storm. The lowest barometer reading that had been observed before the close of the month was 29.46 at Marquette, Mich., in the afternoon.

NORTH ATLANTIC STORMS FOR SEPTEMBER, 1888.

[Pressure in inches and millimetres; wind-force by Beaufort scale.]

The paths of the depressions that appeared over the north Atlantic Ocean during September, 1888, have been determined from international simultaneous observations by captains of ocean steamships and sailing vessels, received through the cooperation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

Nine depressions have been traced, of which three advanced eastward from the American coast north of the fiftieth parallel; five apparently developed over mid-ocean, and one originated in the vicinity of the West Indies. One storm, which appeared over the Bahama Islands on the 6th and from thence moved north of west into the Gulf of Mexico, is traced and described as a land low area. The depressions whose paths are plotted in high latitudes generally pursued normal east-northeast tracks; over mid-ocean south of the fiftieth parallel the progressive movements of the storms were irregular, while over

the southern portion of the ocean the anomalous course of depression number 1 is an especially noteworthy feature.

In September, 1887, nine depressions were traced, of which five were of tropical or sub-tropical origin; three advanced eastward from the American continent north of the forty-fifth parallel, and one first appeared over the British Isles. The storms were generally deficient in energy, and while the depressions of tropical origin somewhat exceeded the average for the month, there was a corresponding decrease in the number that passed eastward near Newfoundland, and an almost entire absence of storms of pronounced strength in high latitudes east of the fortieth meridian.

In September, 1888, the disastrous hurricane which traversed the West Indies and the Gulf of Mexico from the 1st to the 7th, inclusive, and the severe storms which attended the presence of depressions located, respectively, over mid-ocean and

off the coast of the United States during the last decade, constituted the more noteworthy meteorological features of the month. The weather in the trans-Atlantic tracks east of the fiftieth meridian continued generally fine until the 21st, after which there was a succession of severe gales. In the vicinity of the American coast south of the forty-fifth parallel settled weather prevailed, except during portions of the first and third decades.

In the following descriptions of the depressions traced positions are given in degrees of latitude and longitude, except in cases where from twenty-five to thirty-five minutes have been cited, when they are shown in degrees and half degrees.

1.—This storm was remarkable both on account of its exceptional energy and by reason of the abnormal path it pursued after having advanced to the westward of the eightieth meridian. The first information relative to its advance was communicated by Captain Edwards, of the s. s. "Jamaican," who experienced a violent hurricane on the 31st of August, one hundred and fifty miles northeast of Sombrero Island, and who calculated that its vortex had passed one hundred and twenty miles north of the Virgin Islands on a north by west course, or between west and west by north, and estimated its diameter at five hundred miles. At noon (Greenwich time) of September 1st the hurricane centre was apparently located north of the western extremity of Puerto Rico. On the 2d a hurricane devastated Turks Islands, where the minimum pressure, 28.95 (735.3), was noted at about 5 p. m. (Greenwich time). Twenty-one lives were lost; more than two hundred and fifty houses of the peasantry and over 400,000 bushels of salt were entirely destroyed, and nearly every house left standing was more or less damaged. In the morning the weather was threatening, with falling barometer and northeast wind; subsequent to the passage of the storm-centre the wind shifted to southerly and the barometer rose rapidly. By noon (Greenwich time) of the 3d the centre had moved to the northward of Great Inagua Island, in which locality the barometer fell to about 28.76 (729.0). On this date the wind at Santiago de Cuba began at northwest and backed to southwest, and at 5 p. m. was from south-southwest, blowing fresh. At Boca de Sagua the barometer fell, with heavily clouded and rainy horizon and northerly squalls. At Santa Clara the barometer fell during the afternoon and evening to 29.33 (746.2) at 11 p. m. At 5 p. m. heavy rain was falling in the first, and one point of the second, quadrant, which changed into a short vigorous rain from north-northwest, with strong squalls from the same direction. The sky then cleared somewhat up to 10 p. m., at which hour the rain-squalls came again in greater strength from the same direction as before, flying around to east-southeast, and although of short duration, covered the first two quadrants and left the wind at south-southwest. The cyclone affected the barometer in Jamaica on the 3d, and the upper cloud-drift was west. At noon (Greenwich time) of the 4th the centre had arrived off the Cuban coast somewhat to the eastward of Sagua, where the barometer fell to 28.90 (734.0) at 9.10 a. m., and the wind attained a velocity of one hundred and twenty miles an hour.

During this and the early part of the following date the depression moved westward over Cuba, and passed somewhat to the southward of Havana at about 2 a. m. of the 5th, where the minimum pressure was 29.20 (741.7), and the wind reached a velocity of ninety miles an hour. Advancing in a south of west course the centre left the western extremity of the island during the 5th. Attending the passage of the storm-centre over Cuba the losses by destruction of property and crops amounted to millions of dollars, and about eight hundred lives were lost. The principal buildings of the large cities were demolished, and whole towns situated near the seaboard were entirely destroyed by the gigantic waves that swept inland. After leaving Cuba the vortex apparently moved in a nearly west-southwest direction over or off the northern coast of Yucatan, and reached the Mexican coast between Vera Cruz and Coatzacoalcos during the night of the 7-8th, where it ex-

hibited great strength and occasioned considerable damage to property and shipping.

The paths of storms of this class hitherto plotted have trended to the north of west, and finally recurved to the northward or northeastward, their course subsequent to the recurvature generally causing the paths to describe a parabolic curve. The movement of the vortex of this storm after the 4th presented a marked departure from the general meteorological laws which govern the movements of West Indian hurricanes which can only be accounted for by the supposition that there existed abnormal atmospheric conditions whereby the deviation from a practically fixed law was occasioned.

Assuming that these conditions would be apparent attending the advance of the cyclone previous to, and accompanying, the southward deflection of its path, it would appear that a study of the general atmospheric movements and conditions over the North American continent and adjacent waters during the prevalence of this and other storms of the same type would materially aid in determining the nature of the disturbing causes which existed during the advance of the cyclone under consideration. It is known that areas of high barometer will deflect or retard storms when situated in their line of advance. In the present instance an area of unusually high barometer swept eastward over the United States from the 4th to the 6th, inclusive, and was preceded by an area of high which advanced eastward over Nova Scotia during the 4th. It is further shown that, owing to the abnormally high barometer readings within the second of the areas of high pressure referred to, an unusually steep gradient existed from the West Indies northward. Admitting that the steepness of this gradient would largely contribute to prevent the storm-vortex from making the usual recurve to the northward, it remains to consider, so far as reports will permit, any additional marked meteorological phenomena which appeared during that period. On the 6th and 7th a cyclonic area of moderate energy, which had followed a general course similar to the one which reached Cuba on the 4th, was central over the Bahama Islands. As regards the possible influence that this storm may have exerted in causing the abnormal southerly movement of its predecessor, it may be stated that, in the several instances noted in which storms of this class have closely followed one another, this result has not been shown. An important feature is presented in reliable advices from Jamaica, to the effect that while the large cyclone was passing north of Cuba a very shallow barometric depression crossed Jamaica September 3d. It moved west-northwest at the rate of fifteen miles an hour, and passed the centre of the island at 2 p. m., and it is thought that after it left Jamaica it developed into a cyclone. A reference to the foregoing report from Santa Clara, will show that the wind-directions at that place were evidently influenced by this depression at about 10 p. m. of the 3d.

As cyclonic depressions not infrequently unite and form one system, which fact would seem to indicate that they possess an attraction for others of their kind, it is not unreasonable to suppose that, attending the advance and subsequent strong development of a cyclone to the south and west of the principal storm herein considered, an influence was exerted, which, taken in connection with the very marked barometric gradient to the northward, may have occasioned the anomalous course of this remarkable hurricane.

2.—This depression passed northeast from the Gulf of Saint Lawrence, and at noon, Greenwich time, of the 3d was central in about N. 55°, W. 49°, whence it moved east-northeast, and disappeared north of the British Isles after the 6th, attended throughout by moderate to fresh gales.

3.—This depression is given a probable track over mid-ocean north of the fifty-fifth parallel during the 10th and 11th, on which dates fresh to strong gales occurred in that region. Subsequent to the 11th the storm-centre apparently moved to the vicinity of Iceland.

4.—This depression first appeared in N. 50°, W. 39° on the 11th, whence it had advanced from northeast of Newfoundland.

On this date fresh to strong gales prevailed along the trans-Atlantic tracks between the thirtieth and fiftieth meridians. By the 12th the cyclone centre had moved slightly to the south-eastward of its former position, with minimum pressure about 28.80 (731.5) and strong to whole gales. From this position the storm passed northeast, with an appreciable loss of energy, and disappeared north of the region of observation after the 13th.

5.—This depression moved northeast from the Gulf of Saint Lawrence, and on the 14th was central in about N. 54°, W. 50°, from whence it passed slowly east-northeast and disappeared north of the fifty-fifth parallel after the 15th, without evidence of marked energy.

6.—This was a depression of moderate strength which moved from off the southern extremity of Greenland, where it was central on the 17th, southeastward over mid-ocean, where it apparently united with depression number 7 after the 20th. The abnormal course of this storm was evidently due to the presence over the ocean to the eastward of an area of high barometric pressure, whereby it was deflected to the southward. Its subsequent recurve to the southwest was occasioned by the advance from that quarter of the important storm traced as number 7.

7.—This was the most important depression that appeared in the vicinity of the trans-Atlantic tracks during the month, and during the period of its prevalence over mid-ocean, where it remained nearly stationary from the 21st to the 26th, inclusive, strong to whole gales attaining hurricane force, and very low barometric pressure, were reported. Reports at hand will not admit of determining the causes which would seem to occasion the almost stationary position of the centre of this storm during the period referred to further than showing that the barometric pressure over, and to the eastward of, the British Isles was high and slowly falling from the 21st to the 26th, and that subsequent to the latter date, and attending the northeast movement of the depression, this area of high gave way and was superseded by low pressure and cyclonic winds.

8.—This was a depression of moderate energy which apparently originated over mid-ocean northwest of the Azores on the 28th, and from thence moved eastward over the Bay of Biscay, where it disappeared after the 29th.

9.—This depression was central on the 29th midway between the Azores and the Banks of Newfoundland, and during that and the following date moved slowly eastward to the thirty-third meridian, without evidence of marked energy.

OCEAN ICE.

The following table shows the southern and eastern limits of the region within which icebergs or field-ice were reported for September during the last six years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Long. W.	Month.	Lat. N.	Long. W.
September, 1883.....	48 25	47 10	September, 1883.....	49 01	44 33
September, 1884.....	46 06	53 21	September, 1884.....	47 39	49 14
September, 1885.....	45 40	48 22	September, 1885.....	48 40	46 27
September, 1886.....	46 40	53 00	September, 1886.....	48 00	48 40
September, 1887.....	45 37	40 50	September, 1887.....	45 37	40 50
September, 1888.....	Off Cape Race		September, 1888.....	53 00	52 08

On chart i the following positions of icebergs observed during September, 1888, are shown by ruled shading:

- 7th.—S. S. "Lake Winnipeg," off Belle Isle, a berg.
- 8th.—S. S. "Glendale," N. 51° 45', W. 55° 20', a medium sized berg.
- 12th.—S. S. "Vancouver," N. 53° 00', W. 52° 08', a very large berg.
- 13th.—S. S. "Lake Superior," in Belle Isle Strait, one berg and a quantity of small ice; s. s. "Glendale," N. 49° 49', W. 54° 40', a small berg.
- 15th.—S. S. "Colina," off Point Amour, a large berg.
- 20th.—S. S. "Devonia," 28 miles southeast from Cape Race,

a large berg, very high and evidently aground; s. s. "Glendale," in Belle Isle Strait, a small berg.

26th.—S. S. "Glendale," near Belle Isle, a medium sized berg.

28th.—S. S. "Parisian," off Belle Isle, a large berg.

29th.—S. S. "Sarnia," entrance to Belle Isle Strait, a large berg.

30th.—S. S. "Wandrahm," off Belle Isle, a large berg.

Ice was reported south of the fiftieth parallel on two dates only. In the Straits of Belle Isle and off the extreme northern coast of Newfoundland icebergs were observed on ten dates.

In August, 1888, no icebergs were reported save in the Straits of Belle Isle and off the extreme northern coast of Newfoundland, where their presence was noted on fourteen days. The September ice reports for the last five years show that the average southern limit of Arctic ice for this month is in about N. 46° 30', and the average eastern limit in about W. 46°. It will therefore be seen that in September, 1888, the southernmost position in which ice was reported corresponded with the average southern limit, while the easternmost ice was encountered about six degrees west of the average eastern limit.

FOG.

The following are the limits of fog-areas on the north Atlantic Ocean during September, 1888, as reported by ship-masters:

Date.	Entered.		Cleared.		Date.	Entered.		Cleared.	
	Lat. N.	Lon. W.	Lat. N.	Lon. W.		Lat. N.	Lon. W.	Lat. N.	Lon. W.
1	40 50	61 15	41 50	61 40	10-11	48 15	45 50	45 10	50 00
1	45 57	45 55	45 42	46 47	11	41 00	62 00	40 59	62 05
1-2	42 40	62 30	42 27	68 10	13	46 00	46 30	45 00	53 00
1-2	40 30	71 20	40 30	70 12	13	40 36	69 04	40 34	69 19
2	40 15	71 45	41 06	65 00	14	44 34	47 43	43 48	50 07
2	43 22	59 50	42 12	63 30	14	51 48	55 00	51 45	55 40
2-3	47 12	43 14	46 22	46 31	14-15	47 21	45 02	46 53	46 23
3	44 30	56 30	44 06	57 55	17	42 16	69 00	42 18	70 45
3	39 55	68 15	39 43	68 30	17-18	41 00	67 15	Off Shinecock.	
3	48 00	42 00	47 08	45 30	17-18	43 33	61 10	43 17	62 14
4	40 35	70 43	40 34	71 27	18	42 17	64 45	40 38	69 28
5	43 01	60 10	42 00	63 20	18-19	41 10	66 09	40 58	67 57
5	38 40	73 56	Off Long Branch.		19	40 50	66 40	40 39	67 42
5	43 52	50 24	44 12	50 32	22	41 00	67 00	41 00	69 00
5-6	47 00	47 23	46 10	50 23	26	44 00	56 00	44 00	57 00
9	43 26	59 30	42 32	61 30	27	45 00	49 00	45 00	51 00
9-10	42 46	61 48	40 43	69 24	28	44 00	58 00	44 00	59 00
10	41 10	66 52	40 02	71 24	28-29	52 00	55 00	52 00	55 00
10	48 00	43 00	47 00	47 00	29-30	52 00	50 00	Belle Isle.	
10	43 35	47 30	44 37	51 50	29-30	46 45	45 00	45 15	50 00

The limits of fog-belts to the westward of the fortieth meridian are shown on chart i by dotted shading. In the vicinity of the Banks of Newfoundland fog was reported on sixteen days, as compared with twenty-six days for August, 1888, and twenty-two days for September, 1887. To the westward of the sixtieth meridian fog was reported for a total of twelve days, as compared with nine days for the preceding month, and four days for September, 1887.

As compared with the charted fog-belts for August, 1888, the limit has contracted nearly two degrees in the vicinity of the fiftieth meridian, while to the westward of the sixtieth meridian it remains approximately the same.

The development of fog over or near the Grand Banks attended the circulation of winds in the eastern or southern quadrants of areas of low barometric pressure which advanced eastward or northeastward from the American continent. To the westward of the sixtieth meridian fog was generally reported attending or immediately following the passage of cyclonic areas.

Fog reports of the last eighteen months show that there has been a marked diminution in the number of fog-areas over and west of the Grand Banks during the successive fall and winter months, and that fog has been less frequent in January and February, after which there is an increase until July and August, when the maximum occurs. This fact may be ascribed to the absolute differences in temperature in these localities, which, on account of the presence of ice fields, are more marked during the spring and summer months.

TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature for September, 1888, is exhibited on chart ii by dotted isothermal lines. In the table of miscellaneous data the monthly mean temperatures and the departures from the normal are given for stations of the Signal Service. The figures opposite the names of the geographical districts in the columns for mean temperature, precipitation, and departures from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the departure is below the normal and subtracting when above. Chart iii exhibits normal and current September temperature curves for selected stations.

The mean temperature was highest in the lower Colorado valley, where a reading of 88°.2 was reported from Yuma, Ariz. Values rising above 80° were also reported in the Sacramento and San Joaquin valleys, and over the southern half of the Florida Peninsula. The lowest mean temperatures occurred in the lower Saint Lawrence valley, where they fell below 50°, and in the extreme northwest part of Washington Territory, where they ranged below 55°.

The mean temperature corresponded with the normal along a line traced in a general southwest direction from northern Minnesota to southern New Mexico. To the westward of this line it was above the normal, the greatest departures occurring over parts of Idaho, Oregon, and Washington Territory, and in the Saskatchewan Valley, where they exceeded 8°. Over the eastern portion of the country the temperature was below the normal, except along the west coast of the Gulf of Saint Lawrence, the deficiencies being greatest over parts of western Pennsylvania and western New York, where they exceeded 6°.

The following are some of the most marked departures from the normal at the older established Signal Service stations:

Above normal.		Below normal.	
Swift Current, N. W. T.....	9.3	Pittsburg, Pa.....	6.4
Boise City, Idaho.....	8.1	Rochester, N. Y.....	6.0
Spokane Falls, Wash.....	7.6	Grand Haven, Mich.....	5.8
Helena, Mont.....	6.6	Columbus, Ohio.....	5.7
Winnemucca, Nev.....	6.6	Lynchburg, Va.....	5.6
Salt Lake City, Utah.....	6.6	Chicago, Ill.....	5.2

RANGES OF TEMPERATURE.

The monthly and the greatest and least daily ranges of temperature at Signal Service stations are given in the table of miscellaneous meteorological data. The greatest ranges occurred over Nebraska and thence northward to the British Possessions, in parts of the northern plateau region, and in southwestern Oregon and north-central California, where they exceeded 60°. They were least over southern Florida, where they fell below 20°, and along portions of the California and Texas coasts, where they were less than 30°.

The following are some of the extreme monthly ranges:

Greatest.		Least.	
Valentine, Nobr.....	70.2	Key West, Fla.....	17.8
Fort Yates, Dak.....	69.8	Jupiter, Fla.....	21.6
Fort Buford, Dak.....	68.5	Galveston, Tex.....	21.7
Spokane Falls, Wash.....	62.2	San Diego, Cal.....	23.6
Ashland, Oregon.....	61.9	Eureka, Cal.....	26.5
Boise City, Idaho.....	60.2	Corpus Christi, Tex.....	27.5

DEVIATIONS FROM NORMAL TEMPERATURES.

The following table shows for certain stations, as reported by voluntary observers, (1) the normal temperatures for a series of years; (2) the length of record during which the observations have been taken, and from which the normal has been computed; (3) the mean temperature for September, 1888; (4) the departures of the current month from the normal;

(5) and the extreme monthly means for September during the periods of observation and the year of occurrence:

State and Station.	County.	(1) Normal for the month of Sept.	(2) Length of record.	(3) Mean for Sept., 1888.	(4) Departure from normal.	(5) Extreme monthly mean temperature for September.			
						Highest.		Lowest.	
						Am't.	Year.	Am't.	Year.
<i>Arkansas.</i>			Years						
Lead Hill.....	Boone.....	72.3	7	68.9	-3.4	76.4	1884	67.5	1883
<i>California.</i>									
Sacramento.....	Sacramento.....	66.8	22	68.6	+1.8	72.0	1875	61.7	1871
<i>Connecticut.</i>									
Southington.....	Hartford.....	61.4	19	59.0	-2.4	.....	.....	.....	.....
<i>Florida.</i>									
Merritt's Island.....	Brevard.....	79.3	5	78.4	-0.9	80.0	1884	78.4	1888
<i>Illinois.</i>									
Aurora.....	Kane.....	63.7	10	58.9	-4.8	.....	.....	.....	.....
Greenville.....	Bond.....	68.9	10	63.3	-5.6	.....	.....	.....	.....
Golconda.....	Pope.....	70.7	11	67.3	-3.4	.....	.....	.....	.....
Peoria.....	Peoria.....	66.9	33	61.9	-5.0	73.3	1881	59.9	1866
Riley.....	McHenry.....	60.5	27	56.4	-4.1	.....	.....	.....	.....
<i>Indiana.</i>									
Blue Lick.....	Clark.....	68.3	11	64.0	-4.3	.....	.....	.....	.....
Vevay.....	Switzerland.....	68.7	21	64.3	-4.4	76.3	1881	63.8	1875
<i>Iowa.</i>									
Cresco.....	Howard.....	59.2	15	55.8	-3.4	.....	.....	.....	.....
Independence.....	Buchanan.....	60.0	13	57.0	-3.0	64.0	1884	57.0	1888
Monticello.....	Jones.....	61.5	35	58.4	-3.1	73.0	1865	51.0	1856
<i>Kansas.</i>									
Yates Centre.....	Woodson.....	67.7	8	65.3	-2.4	73.9	1884	64.0	1883
<i>Maine.</i>									
Gardiner.....	Kennebec.....	58.3	52	55.3	-3.0	64.2	1841	53.3	1845
<i>Maryland.</i>									
Cumberland.....	Alleghany.....	63.7	17	59.3	-4.4	70.0	1881	59.3	1888
<i>Massachusetts.</i>									
Somerset.....	Bristol.....	64.3	18	62.0	-2.3	.....	.....	.....	.....
Worcester.....	Worcester.....	61.4	50	56.9	-4.5	69.3	1881	56.7	1883
<i>Michigan.</i>									
Adrian.....	Lenawee.....	61.5	11	58.7	-2.8	.....	.....	.....	.....
Kalamazoo.....	Kalamazoo.....	62.3	13	59.0	-3.3	.....	.....	.....	.....
Thornville.....	Lapeer.....	62.9	12	58.2	-4.7	.....	.....	.....	.....
<i>New Jersey.</i>									
Moorestown.....	Burlington.....	65.3	25	63.0	-2.3	73.6	1881	60.6	1871
<i>New York.</i>									
Palermo.....	Oswego.....	57.7	35	56.0	-1.7	67.8	1881	54.1	1867'83
<i>Ohio.</i>									
Wauseon.....	Fulton.....	62.7	18	59.2	-3.5	71.1	1881	57.2	1883
<i>Oregon.</i>									
Albany.....	Linn.....	60.4	10	64.7	+4.3	64.7	1888	53.3	1884
Eola.....	Polk.....	56.0	18	64.1	+8.1	.....	.....	.....	.....
<i>Pennsylvania.</i>									
Dyberry.....	Wayne.....	58.8	22	54.5	-4.3	66.9	1881	52.5	1871
Wellsborough.....	Tioga.....	61.4	10	55.4	-6.0	73.8	1881	52.3	1883
<i>South Carolina.</i>									
Stateburg.....	Sumter.....	73.4	8	69.9	-3.5	77.9	1881	69.9	1888
<i>Tennessee.</i>									
Milan.....	Gibson.....	69.7	6	67.1	-2.6	87.0	1884	55.0	1883
<i>Texas.</i>									
New Ulm.....	Austin.....	77.7	17	76.5	-1.2	81.0	1872	75.6	1876
<i>Vermont.</i>									
Strafford.....	Orange.....	59.2	14	57.4	-1.8	64.4	1881	56.2	1876
<i>Virginia.</i>									
Bird's Nest.....	Northampt'n.....	70.6	19	68.5	-2.1	79.8	1881	61.2	1877
<i>West Virginia.</i>									
Helvetia.....	Randolph.....	61.4	12	58.6	-2.8	.....	.....	.....	.....

Excessive maximum temperatures were reported in localities throughout the extreme northwestern part of the country and in the Sacramento Valley, the reading at Spokane Falls being 11°, and that at Sacramento 5° higher than for any preceding September during the last eight and eleven years, respectively. Over the eastern part of the United States north of the thirty-fifth parallel the maximum generally ranged from 10° to 23° below those reported during the spell of excessive heat in September, 1881.

The minimum temperatures generally fell below any previously recorded at stations east of the Mississippi River, the lowest readings being registered, as a rule, on the 30th. To the westward of the Mississippi and over the upper lake region the minima were above those reported for previous years by amounts ranging to 18° in northern Nevada.

FROST.

Frosts occurred during September as follows:
 1st, Colo., Dak., Ill., Mich., Minn., Wis. 2d, Ill., Ind., Mich., Minn., Mont., N. Y., Ohio. 3d, Ind., N. H., Wis. 4th, Dak., Mich., Minn. 5th, Iowa, Mich., Minn., N. H., N. Y., Oregon. 6th, Conn., Me., Mass., Mich., N. H., N. Y., Pa., Vt. 7th, Conn., Me., Mass., N. H., N. Y., Pa., Vt. 8th and 9th Dak.

10th, Mich., Minn., Wis. 11th, Mont., Wyo. 12th, Dak., Iowa, Mich., Minn., Wis. 13th, Cal., Ill., Ind., Iowa, Mich., Minn., Mo., N. Y., Ohio, Pa., Wis. 14th, Conn., Ill., Ind., Me., Mich., N. Y., Ohio, Pa., S. C., W. Va., Wis., Wyo. 15th, Dak., Iowa, Kans., Mich., Nebr., Pa., Vt. 16th, Dak., Ind., Minn., Mo., Nebr., Oregon. 17th, Dak., Iowa, Kans., Minn., Nebr., N. Y. 18th, Dak., Iowa, Minn., Nebr., Nev., Oregon, Pa. 19th, Cal., Colo., Ill., Iowa, Minn., Nev., Oregon. 20th, Dak., Mich., Mont., Oregon, Wyo. 21st, Ind., Mich., Nebr., Nev., Oregon, Wyo. 22d, Mich., Nev., Oregon. 23d, Oregon, Wash. T., Wis. 24th, Mich., N. Y., Vt. 25th, Conn., Dak., Ky., Mass., Mich., Minn., Nebr., N. H., Vt. 26th, Ala., Cal., Ill., Ind., Mich. 27th, Dak., Ill., Iowa, Kans., Mich., Minn., Mont., Nebr., Ohio, Tenn., W. Va., Wis., Wyo. 28th, Ala., Dak., Ga., Ill., Ind., Iowa, Kans., Ky., Md., Mass., Mich., Minn., Mo., Nebr., N. H., N. Y., Ohio, Pa., Tenn., W. Va., Wis. 29th, Ala., Conn., Dak., Ga., Ill., Ind., Iowa, Kans., Ky., Me., Md., Mass., Mich., Minn., Nebr., N. H., N. J., N. Y., N. C., Ohio, Pa., R. I., Tenn., Vt., Va., W. Va., Wis. 30th, Ala., Conn., Dak., D. C., Fla., Ga., Ill., Ind., Iowa, Kans., Ky., Me., Md., Mass., Mich., Mo., Nebr., N. H., N. J., N. C., Ohio, Pa., R. I., S. C., Tenn., Vt., Va., W. Va., Wis.

The following reports of killing frost have been received:

Whitehall, Muskegon Co., Mich.: the heavy frost which occurred on the morning of the 3d caused severe damage to the corn and buckwheat crops.

Berlin, Green Lake Co., Wis.: frost caused considerable damage to cranberries in dry marshes on the 3d. Reports from several sections in Waushara county state that buckwheat and corn have been much injured.

La Crosse, Wis.: a severe frost occurred at Mather's, Juneau Co., on the 3d; the damage done to the cranberry crop is estimated at about 25 per cent.

Vassar, Tuscola Co., Mich.: buckwheat and vegetables were seriously injured by frost on the 6th.

Elmira, Chemung Co., N. Y.: a heavy frost occurred in this section on the 6th, damaging the tobacco and buckwheat crops.

Danbury, Fairfield Co., Conn.: reports from various parts of the state show that the frost on the 7th caused widespread damage to the corn and tobacco crops.

Portland, Me.: Reports from all parts of the state show that the frost on the 7th was very destructive, it is estimated that the damage done in this state will exceed \$1,000,000.

BOSTON, MASS., Sept. 7.—One of the most destructive early frosts known for years visited a considerable portion of the counties of Middlesex, Norfolk, and Worcester last night, and hundreds of farmers are mourning the loss of valuable crops, such as cucumbers, tomatoes, squash, and corn. In some places the grape crop is injured seriously. Reports from points in northern New England indicate enormous damage to vines and crops from the frosts, and the loss to farmers will reach many thousands of dollars.—[The Morning Herald, Baltimore, Md., Sep. 8th.]

Great Barrington, Berkshire Co., Mass.: reports from the eastern section of this county state that all wheat and tobacco crops were destroyed by the heavy frost of the 6-7th.

Newport, Sullivan Co., N. H., 7th: the heavy frost which occurred during the last two nights throughout this county caused much damage to corn, freezing vines and checking the growth of potatoes.

Bellows Falls, Windham Co., Vt., 7th: reports from the surrounding country show that the frost during the night of the 6-7th was very destructive to corn and garden vegetables.

Saratoga, Saratoga Co., N. Y., 7th: a very heavy frost occurred during the last two nights throughout this county, almost completely ruining the buckwheat crop. Counties north of this city also report heavy frost.

Madison, Wis.: a very heavy frost occurred in this section on the 13th, causing some damage to corn, tobacco, etc.

Chicago, Ill., 14th: reports from several points in Wisconsin state that the frost of yesterday caused much damage to tobacco, cranberries, corn, etc.

Chippewa Falls, Chippewa Co., Wis.: cranberry pickers re-

turning here on the 14th report that the late frost has entirely ruined the cranberry crop.

Tyler's Creek, Cabell Co., W. Va.: heavy frost occurred on the morning of the 29th, damaging crops and vegetables.

Stateburg, Smith Co., S. C.: a heavy white frost occurred on the lowlands on the 30th, severely nipping pea and potato vines.

The occurrence of light frosts in the south Atlantic and east Gulf states during September is unusual though not unparalleled, except in North Carolina, where they frequently occur in this month. In South Carolina light frosts were reported September 24th and 25th, 1885. On September 30th, 1880, light frosts were observed at Gainesville, Ga., and in September, 1879, in parts of South Carolina and Georgia. The records of this office do not show a previous occurrence of frost during this month in northern Florida. It would therefore appear that the month was characterized in these districts by abnormally low minimum temperatures and excessive rainfalls and the year by the premature occurrence of light frosts.

Table of comparative maximum and minimum temperatures for September.

State or Territory.	Stations.	For 1888.		Since establishment of station.			Length of record.
		Max.	Min.	Max.	Year.	Min.		Year.
Alabama.....	Mobile.....	90.0	52.0	96.2	1887	53.0	1871
Do.....	Montgomery.....	90.5	46.2	98.8	1887	50.0	1887
Arizona.....	Prescott.....	90.4	46.0	100.0	1879	29.0	1880
Do.....	Fort Apache.....	93.1	48.2	96.0	1883	32.0	1880
Arkansas.....	Fort Smith.....	93.0	48.0	99.9	1884	39.6	1883
Do.....	Little Rock.....	89.0	55.0	97.0	1887	47.0	1881
California.....	San Diego.....	82.0	58.4	101.0	1883	49.5	1882
Do.....	San Francisco.....	87.7	50.1	93.9	1886	49.9	1887
Colorado.....	Denver.....	90.0	38.0	93.0	1878	28.0	1873
Do.....	Montrose.....	88.0	40.0	86.0	1885	31.1	1885, 1886
Connecticut.....	New Haven.....	78.0	31.8	100.0	1881	35.0	1879
Do.....	New London.....	78.8	34.8	92.0	1881	37.0	1879
Dakota.....	Fort Buford.....	93.3	24.8	100.0	1882	18.0	1883
Do.....	Yankton.....	93.0	35.0	100.0	1881	26.0	1876
Dis. of Columbia.....	Washington City.....	84.5	38.8	104.3	1881	38.0	1879
Florida.....	Jacksonville.....	92.0	55.0	98.0	1875	55.3	1887
Do.....	Key West.....	88.7	70.9	96.9	1886	70.5	1886
Georgia.....	Atlanta.....	86.9	43.0	95.1	1887	44.0	1879
Do.....	Savannah.....	91.8	47.5	96.0	1876, 1877	50.0	1887
Idaho.....	Boise City.....	100.3	40.1	96.0	1878	27.9	1886
Illinois.....	Cairo.....	87.9	42.5	97.0	1881	42.0	1876
Do.....	Chicago.....	88.2	36.0	93.9	1881	37.0	1876
Indiana.....	Indianapolis.....	87.9	33.7	94.5	1881	34.0	1887
Indian Ter.....	Fort Sill.....	83.0	52.0	100.0	1881	44.0	1878
Iowa.....	Dubuque.....	83.0	31.0	94.2	1881	33.0	1873
Do.....	Des Moines.....	90.4	32.0	93.2	1886	34.0	1879
Kansas.....	Dodge City.....	94.0	41.0	99.3	1881	30.0	1876
Do.....	Leavenworth.....	92.5	38.9	101.0	1882	37.0	1876
Kentucky.....	Louisville.....	85.7	36.0	99.0	1881	42.0	1875, 1876
Louisiana.....	New Orleans.....	91.0	55.0	94.0	1887	58.0	1871
Do.....	Shreveport.....	92.5	52.0	101.0	1881	47.0	1881
Maine.....	Eastport.....	70.8	35.6	82.8	1884	35.0	1875
Do.....	Portland.....	77.7	33.2	94.5	1881	36.5	1887
Maryland.....	Baltimore.....	84.5	39.0	101.0	1881	40.0	1873, 1879
Massachusetts.....	Boston.....	78.3	36.2	101.5	1881	34.0	1879
Michigan.....	Marquette.....	83.4	35.6	97.0	1874	28.0	1883
Do.....	Grand Haven.....	74.0	36.9	85.0	1881	30.0	1879
Minnesota.....	Saint Vincent.....	84.0	24.0	89.0	1883	17.0	1883
Do.....	Saint Paul.....	81.2	30.9	94.0	1878	30.0	1873
Mississippi.....	Vicksburg.....	90.2	50.2	98.0	1881	48.0	1871
Missouri.....	Saint Louis.....	89.5	43.0	101.5	1881	40.0	1875
Montana.....	Fl. Assinaboine.....	92.9	33.0	92.7	1885	25.0	1884
Do.....	Helena.....	89.0	33.0	88.1	1885	30.0	1880, 1882
Nebraska.....	North Platte.....	96.0	31.0	101.0	1881	21.0	1876
Do.....	Omaha.....	95.3	39.1	98.8	1881	30.0	1873
Nevada.....	Winnemucca.....	93.5	40.0	94.0	1878, 1880	22.0	1880, 1881
New Jersey.....	Atlantic City.....	80.2	37.0	94.0	1880	40.9	1887
New Mexico.....	Santa Fe.....	82.5	43.1	90.0	1879	27.0	1880
New York.....	Buffalo.....	80.0	36.3	88.1	1884	35.0	1878
Do.....	New York City.....	84.2	40.8	100.2	1881	30.0	1872
North Carolina.....	Charlotte.....	88.0	38.2	94.0	1881	39.5	1887
Do.....	Wilmington.....	87.5	43.9	96.0	1872	42.3	1887
Ohio.....	Cincinnati.....	83.4	35.0	95.0	1881	40.2	1887
Do.....	Sandusky.....	87.0	31.1	95.8	1881	38.0	1880
Oregon.....	Portland.....	90.5	43.5	93.0	1886	39.0	1873, 77, 82
Do.....	Roseburg.....	99.1	40.8	95.5	1886	34.6	1881
Pennsylvania.....	Pittsburg.....	81.2	39.2	101.6	1881	35.0	1879
Do.....	Philadelphia.....	81.6	40.5	101.5	1881	42.4	1887
Rhode Island.....	Block Island.....	74.7	44.3	86.5	1881	41.5	1883
South Carolina.....	Charleston.....	89.0	50.0	94.0	1876	49.2	1887
Tennessee.....	Knoxville.....	85.3	35.0	97.1	1881	37.8	1887
Do.....	Memphis.....	88.2	50.2	98.7	1887	44.0	1875
Texas.....	Brownsville.....	94.0	65.0	96.0	77-9, 83-4	57.0	1883
Do.....	Fort Elliott.....	92.8	44.6	98.0	1881	37.0	1880
Utah.....	Salt Lake City.....	92.3	48.5	93.0	1875	36.0	1881
Virginia.....	Lynchburg.....	84.0	35.4	98.3	1881	36.8	1887
Do.....	Norfolk.....	88.1	40.0	96.0	1881	46.0	1887
Washington.....	Spokane Falls.....	98.1	35.9	87.0	1882	31.0	1886
Do.....	Olympia.....	83.0	41.0	82.8	1887	31.0	1877
Wisconsin.....	La Crosse.....	81.7	29.3	92.0	1873	31.0	1873
Do.....	Milwaukee.....	81.8	33.8	94.0	1872, 1874	32.0	1876
Wyoming.....	Cheyenne.....	87.6	30.3	88.0	1875	23.0	1878

TEMPERATURE OF WATER.

The following table shows the temperature of the sea-water for September, 1888, as observed at the harbors of the several stations; the monthly range of water temperature; and the mean temperature of the air:

Station.	Temperature at bottom.				Mean temperature of air at the station.
	Max.	Min.	Range.	Monthly mean.	
Canby, Fort, Wash.....	66.0	56.0	10.0	61.7	59.0
Cedar Keys, Fla.....	88.5	71.9	16.4	80.9	75.4
Charleston, S. C.....	83.1	73.8	9.3	80.4	74.0
Eastport, Me.....	51.0	49.7	1.3	50.3	52.8
Galveston, Tex.....	87.0	75.5	11.5	84.3	77.5
Key West, Fla.....	87.0	81.0	6.0	85.0	82.4
New York City.....	69.8	61.6	8.2	67.6	62.9
Pensacola, Fla.....	84.0	70.6	13.4	80.4	74.6
Portland, Me.....	59.9	52.0	7.9	56.0	55.2
Portland, Oregon.....	74.0	64.0	10.0	68.7	65.8

COTTON REGION REPORTS.

In the districts bordering on the lower Mississippi river and the west Gulf coast the rainfall was generally below the September average, the deficiency being greatest in the Galveston district. In the districts of the east Gulf and south Atlantic states the rainfall was in excess by amounts which averaged over ten inches in the Atlanta district. The mean temperature was below the normal in all districts, the departures generally averaging more than 2°. In the districts east of the Missis-

issippi River the minimum temperatures registered on the 30th were the lowest September readings ever reported to this office, the greatest departures below the record of minima being 4°, at Montgomery, Ala.

In the following table the average rainfall and the means of the maximum and minimum temperatures in the cotton regions for September, 1888, are given, together with normals computed from similar observations for the corresponding month of the past six years, and the departures for the current month:

Temperature and rainfall data for the cotton districts, September.

Districts.	Rainfall.			Temperature.						Extremes for Sept., 1888.	
	Average for Sept. of six preceding years.	Average for Sept., 1888.	Departures.	Maximum.		Minimum.		Departures.			
				Mean for Sept. of six preceding years.	Mean for Sept., 1888.	Mean for Sept. of six preceding years.	Mean for Sept., 1888.		Max.	Min.	
New Orleans..	3.24	1.16	- 2.08	87.5	86.0	66.6	63.9	2.7	95	44	
Savannah....	3.42	7.60	+ 4.18	86.7	84.3	66.9	66.5	0.4	97	43	
Charleston....	3.56	7.67	+ 4.11	84.7	82.2	64.4	66.5	2.2	93	38	
Atlanta.....	2.68	12.75	+ 10.07	83.8	79.1	62.9	62.3	0.6	90	32	
Wilmington..	3.85	9.19	+ 5.34	82.4	79.6	61.7	63.1	1.4	95	34	
Memphis.....	2.48	2.72	+ 0.24	87.6	85.0	61.3	59.8	1.5	90	36	
Galveston....	4.03	1.54	- 2.49	87.6	84.2	66.7	65.7	1.0	99	43	
Vicksburg....	3.55	1.90	- 1.65	87.6	84.2	65.6	63.4	2.2	94	44	
Montgomery..	1.93	4.75	+ 2.82	82.2	81.3	64.0	63.6	0.4	91	42	
Augusta.....	2.58	10.05	+ 7.47	84.9	80.0	64.7	63.1	1.6	91	35	
Little Rock... Mobile.....	2.39 2.07	0.83 3.74	- 1.56 + 1.67	86.4 88.4	83.2 83.5	60.4 64.3	62.0 63.4	1.6 0.9	97 94	42 44	

PRECIPITATION (expressed in inches and hundredths).

The distribution of rainfall over the United States and Canada as determined from reports of about one thousand stations, is exhibited on chart iv by ruled shading. In the table of miscellaneous meteorological data the total precipitation and the departures from the normal are given for each Signal Service station. The figures opposite the names of geographical districts in the columns for precipitation show the averages for the several districts. Chart v exhibits the normal distribution of September precipitation as determined from the observations of eighteen years, 1871 to 1888.

The heaviest rainfall for September, 1888, occurred in the south Atlantic and east Gulf states. In the upper valley of the Chattahoochee River the excess over the normal amounted to more than eleven inches, while at Lynchburg, Va., there was an excess of more than seven inches. In New England the precipitation was excessive, notably at Wood's Holl, Mass., where the total fall was greater than the average by more than eight inches. In the Lake region west of Lake Ontario, in the Ohio Valley, and all districts lying in and west of the Mississippi Valley, the depth of rainfall reported generally fell below the average for the month, the greatest deficiency occurring in southwestern Missouri where it was more than seven inches. Throughout a great part of the central valleys the deficiencies averaged less than three inches; they were most marked in the central and southern districts where in localities they amounted to more than three, and at one station (Galveston, Tex.) to over four inches. At isolated stations, notably at Charleston, S. C., Hatteras, N. O., and Rochester, N. Y., there were small deficiencies. In the Rocky Mountain regions the total rainfalls were unusually small, the deficiencies being most marked in the northern and southern plateau. On the Pacific coast the precipitation was normal along the southern coast of California; at San Francisco the excess was more than .80 inch, while along the coast of Washington Territory the deficiencies varied from 1.79 inches at Fort Canby and 2.58 inches at Astoria to 3.44 inches at Neah Bay.

DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows for certain stations, as reported

by voluntary observers, (1) the average precipitation for a series of years; (2) the length of record during which the observations have been taken, and from which the average has been computed; (3) the total precipitation for September, 1888; (4) the departures of the current month from the average; (5) and the extreme monthly precipitation for September during the periods of observation and the year of occurrence:

State and station.	County.	(1) Average for month of Sept.	(2) Length of record.	(3) Total for Sept., 1888.	(4) Departure from average.	(5) Extreme monthly precipitation for Sept.			
						Greatest.		Least.	
						Am't.	Year.	Am't.	Year.
Arkansas.		Inches	Years	Inches	Inches	Inches	Inches	Inches	Year
Lead Hill.....	Boone.....	4.60	8	0.48	-4.12	8.44	1886	0.48	1888
California.									
Sacramento....	Sacramento..	0.15	22	0.51	+0.36	0.90	1883	0.00	*
Connecticut.									
Southington....	Hartford....	2.64	19	7.80	+5.16	10.13	1882	0.38	1881
Florida.									
Merritt's Island.	Broward....	8.18	11	8.01	-0.17	23.78	1878	3.01	1882
Illinois.									
Aurora.....	Kane.....	2.84	10	1.89	-0.95	.....	.....	.....	.....
Golconda.....	Pope.....	4.12	11	0.72	-3.40	.....	.....	.....	.....
Peoria.....	Peoria.....	3.54	33	4.79	+1.25	9.61	1875	0.60	1867
Riley.....	McHenry....	3.57	27	1.00	-2.57	.....	.....	.....	.....
Indiana.									
Vevay.....	Switzerland.	3.43	21	4.22	+0.79	6.72	1868	0.47	1871
Iowa.									
Cresco.....	Howard.....	4.39	16	0.82	-3.57	.....	.....	.....	.....
Independence....	Buchanan....	5.36	13	1.13	-4.23	12.87	1887	1.13	1888
Monticello.....	Jones.....	4.07	35	1.85	-2.22	10.15	1881	0.00	1871
Kansas.									
Yates Centre....	Woodson....	3.91	8	3.91	0.00	8.31	1881	0.44	1883
Maine.									
Gardiner.....	Kennebec....	3.30	50	7.12	+3.82	8.24	1868	1.00	1846
Maryland.									
Cumberland.....	Alleghany....	2.69	17	2.95	+0.26	8.50	1882	0.40	1873
Fallston.....	Harford.....	4.21	18	7.69	+3.48	12.95	1876	0.23	1884
Massachusetts.									
Somerset.....	Bristol.....	2.67	18	7.27	+4.60	.....	.....	.....	.....
Worcester.....	Worcester....	3.32	50	7.56	+4.24	10.01	1882	0.20	1855
Michigan.									
Thornville.....	Lapeer.....	2.91	12	1.52	-1.39	.....	.....	.....	.....
Kalamazoo.....	Kalamazoo....	3.37	13	2.40	-0.97	.....	.....	.....	.....
Adrian.....	Lenawee.....	4.06	11	1.19	-2.87	.....	.....	.....	.....
New Jersey.									
Moorestown....	Burlington..	3.73	25	5.30	+1.57	11.71	1882	0.16	1884
New York.									
Palermo.....	Oswego.....	3.06	35	4.23	+1.17	7.30	1866	1.04	1880
Humphrey.....	Cattaraugus..	3.77	6	3.55	-0.22	4.82	1884	2.85	1883