and Newfoundland shores, and forty large and small bergs at entrance to Belle Isle Strait.

14th.—S. S. "Toronto," from Strait of Belle Isle to Point Amour, numerous icebergs; from Belle Isle Light to Greenly Island, many bergs close to the north shore.

15th.—S. S. "Concordia," from 60 miles east of Belle Isle, in Strait, and as far west as Greenly Island, a great number of bergs.

16th.—S. S. "Suez," off Cape Race, two bergs.

18th.—S. S. "Parisian," 60 miles east of Belle Isle, a great number of bergs; from Belle Isle to Point Amour, coast thickly studded with bergs, and from Point Amour to Mectina, a few bergs.

20th.—S. S. "Lake Winnipeg," in Strait of Belle Isle, a number of bergs; s. s. "Sarnia," from Belle Isle to Cape Norman, several bergs.

21st.—Several large and small bergs between Cape Norman and Belle Isle.

22d.—S. S. "Gothenburg," N. 46° 38′, W. 52° 45′, a small berg; s. s. "Nestorian," off Cape Norman, eight bergs.

23d.—S. S. "Hibernian," N. 52° 24′, W. 53° 32′, a large berg; s. s. "Cremon," N. 51° 30′, W. 55° 45′, a berg.

25th.—S. S. "Hibernian," from Belle Isle to Point Amour, a large number of bergs.

26th.—S. S. "Surrey," off Cape Race, two bergs; s. s. "Lake Superior," N. 52° 37′, W. 53° 18′, several large bergs; off Belle Isle, numerous large bergs; s. s. "Oregon," N. 52° 30′, W. 53° 06′, a few bergs; in Strait of Belle Isle, bergs.

27th.—S. S. "Circassian," off Belle Isle, a number of large bergs.

27–29th.—S. S. "Grecian," steaming along the east and south coasts of Newfoundland, saw two bergs, one off Cape Bonavista and the other off Cape Race.

28th.—S. S. "State of Pennsylvania," off Cape Race, four bergs close under the land.

In July, 1888, no ice was reported over the Banks of Newfoundland, and its presence along the south and east coasts of Newfoundland was not indicated during the first half of the month. Numerous icebergs and quantities of field ice were observed in the Strait of Belle Isle and off the coasts of Labrador and northern Newfoundland during the entire month. Subsequent to the 15th icebergs were encountered in the vicinity of Cape Race on six days.

As compared with June, 1888, the southern limit of ice has contracted about 3°, and the easternmost position in which ice has been reported for July is about 7° farther west than in the preceding month. The heavy flow of Arctic ice along the northern coasts of Newfoundland, noted during the latter half of June, has continued, while off the south and east coasts of Newfoundland there was a marked decrease in the quantity of ice observed. As compared with the corresponding month of previous years, the southernmost ice reported for July, 1888, was about 2°.5 north of the average southern limit, and the easternmost ice observed was about 6° west of the mean eastern limit. Off the east and south coasts of Newfoundland the aggregate quantity of ice reported was largely deficient when compared with the July average, while in the Strait of Belle Isle and along the Labrador and northern Newfoundland coasts the total amount observed coincided with the average for the month.

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

The distribution of mean temperature over the United States and Canada for July, 1888, is exhibited on chart ii by dotted isothermal lines. In the table of miscellaneous data are given the monthly mean temperatures, with the departures from the normal, for the various 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.

The temperature was below the normal in northern California, along the southwestern border from the lower Rio Grande valley to the Colorado River, in the Lake region, Ohio Valley, and in the states bordering on the Atlantic and Gulf. In all other districts it was normal or above. The greatest deficiency of temperature occurred in the upper Ohio valley, lower lake region, and in the states bordering on the Atlantic, the greatest excess occurring over the middle Rocky Mountain slope and Missouri Valley. Ovér the greater part of the country the monthly mean temperatures differed but slightly from the normal. The departures were nowhere more than 4° and at most stations were less than 3°.

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

Above normal.	°	Below normal.	°
Huron, Dak	2.4	Norfolk, Va	4.7
Cheyenne, Wyo	2.2	Wilmington, N. C	4.1
Dodge City, Kans	2.0	Philadelphia, Pa	3.9
Fort Elliott, Tex	2.0	Charleston, S. C	3.5
Leavenworth, Kans	2.0	Savannah, Ga	3.5
Yankton, Dak	1.8	Hatteras, N. C	3.4

The maximum temperatures over the greater part of the country during the month were not unusual, but in a few districts, viz., the middle Pacific coast, Missouri and lower Mississippi valleys, they were exceptionally high, reaching, in numerous instances, within a fraction of a degree the highest recorded since the establishment of Signal Service stations, and at San Francisco, Cal., it exceeded the former July maximum by about 10°. At New Orleans the previous July maximum was also exceeded, that of July, 1888, being half a degree higher than the former maximum. The records at both New Orleans and San Francisco cover eighteen years. All of the unusually high temperatures occurred about the middle of the month, most stations reporting the maximum on the 15th.

The minimum temperatures closely approached, and in a few instances fell below, any previously recorded in the states bordering on the Atlantic and in the north Pacific coast region, those occurring about the 13th on the middle Atlantic coast being the most notable.

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 monthly ranges occurred over the plateau districts, eastern Rocky Mountain slope, and upper Missouri valley, where they generally exceeded 50°; they were, as usual, least along the Gulf and north Pacific coasts, where they fell to 25°, or below, at many stations.

The following are some of the extreme monthly ranges:

Greatest.	°	Least.	°
Boisé City, Idaho	59.0	Corpus Christi, Tex	17.0
Fort Klamath, Oreg	59.0	Galveston, Tex	17.8
Fort Verde, Ariz	58.7	Cedar Keys, Fla	19.4
Fort Assinaboine, Mont	58.0	Tatoosh Island, Wash	19.9
Fort Custer, Mont	57.9	Brownsville, Tex	21.8
Carson City, Nev	56.4	Key West, Fla	22.3

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 July, 1888; (4) the departures of the current month from the normal; (5) and the extreme monthly means for July during the period of observations and the year of occurrence:

State and Station.	County.	(1) Normal for the month of July.	(2) Length of record.	(3) Mean for July, 1888.	(4) Departure from normal.	(5) Extreme monthly mean temperature for July. Highest. Am't.	Highest. Year.	Lowest. Am't.	Lowest. Year.
		°	Years	°	°	°		°	
Arkansas.									
Lead Hill	Boone	80.6	6	84.2	+3.6	.....	.....	.....	.....
California.									
Sacramento	Sacramento	73.3	22	70.2	−3.1	78.7	1870	69.4	1887
Connecticut									
Southington	Hartford	71.3	19	69.2	−2.1	76.0	1887	68.5	1884
Florida.									
Merritt's Island	Brevard	79.9	5	80.2	+0.3	80.8	1887	78.2	1886
Illinois.									
Golconda	Pope	79.4	11	79.5	+0.1	.....	.....	.....	.....
Greenville	Bond	78.9	10	76.8	−2.1	.....	.....	.....	.....
Griggsville	Livingston	79.4	10	78.0	−1.4	.....	.....	.....	.....
Peoria	Peoria	78.0	32	79.7	+1.7	.....	.....	.....	.....
Riley	McHenry	70.7	27	70.7	0.0	.....	.....	.....	.....
Rockford	Winnebago	72.3	16	71.4	−0.9	.....	.....	.....	.....
Indiana.									
Logansport	Cass	76.1	34	78.0	+1.9	82.0	1866	.....	.....
Vevay	Switzerland	78.7	21	76.7	−2.0	.....	.....	.....	.....
Iowa.									
Cresco	Howard	71.5	15	72.2	+0.7	.....	.....	.....	.....
Independence	Buchanan	72.7	12	73.2	+0.5	76.0	1887	68.0	1882
Monticello	Jones	73.0	35	75.3	+2.3	80.2	1868	63.2	1863
Kansas.									
Lawrence	Douglas	78.0	21	79.5	+1.5	85.1	1868	72.0	1882
Wellington	Sumner	78.1	10	80.9	+2.8	81.2	1887	73.0	1882
Louisiana.									
Point Pleasant	Tensas	83.4	7	83.4	0.0	.....	.....	.....	.....
Maine.									
Gardiner	Kennebec	68.7	52	67.5	−1.2	74.2	1854	65.0	1884
Maryland.									
Cumberland	Alleghany	73.4	17	70.3	−3.1	77.7	1887	70.3	1888
Massachusetts.									
Somerset	Bristol	74.2	18	71.4	−2.8	.....	.....	.....	.....
Michigan.									
Thornville	Lapeer	72.9	12	69.7	−3.2	.....	.....	.....	.....
Kalamazoo	Kalamazoo	72.5	13	72.4	−0.1	.....	.....	.....	.....
Adrian	Lenawee	71.6	11	72.2	+0.6	.....	.....	.....	.....
New Jersey.									
South Orange	Essex	73.2	18	69.4	−3.8	77.8	1876	69.3	1884
Moorestown	Burlington	75.3	25	70.6	−4.7	78.8	1863	70.6	1888
New York.									
Palermo	Oswego	69.2	35	67.0	−2.2	79.1	1868	62.1	1860
Ohio.									
Wauseon	Fulton	72.8	18	71.6	−1.2	75.3	1878	67.7	1882
Oregon.									
Albany	Linn	66.1	10	65.8	−0.3	68.9	1886	63.2	1881
Eola	Polk	64.4	18	61.8	−2.6	.....	.....	.....	.....
Pennsylvania.									
Dyberry	Wayne	68.1	21	63.7	−4.4	73.8	1868	60.8	1884
Wellsborough	Tioga	70.9	15	65.6	−5.3	76.1	1881	67.1	1879
South Carolina.									
Stateburg	Sumter	79.1	8	77.9	−1.2	84.0	1881	77.5	1882, '86
Tennessee.									
Milan	Gibson	78.3	6	80.0	+1.7	92.6	1887	67.5	1886
Texas.									
New Ulm	Austin	82.7	17	81.6	−1.1	85.0	1879	80.6	1880
Vermont.									
Strafford	Orange	69.3	14	68.8	−0.5	73.5	1887	67.0	1881
Virginia.									
Bird's Nest	Northampt'n	79.2	19	74.7	−4.5	84.0	1887	74.7	1888
Wytheville	Wythe	72.4	24	74.0	+1.6	75.6	1887	67.0	1861
West Virginia.									
Helvetia	Randolph	70.0	12	68.0	−2.0	73.8	1887	66.6	1884

Table of comparative maximum and minimum temperatures for July.

State or Territory.	Stations.	For 1888. Max.	For 1888. Min.	Since establishment of station. Max.	Year.	Min.	Year.	Length of record.
		°	°	°		°		Y'rs.
Alabama	Mobile	96.6	68.5	101.0	1883	63.8	1882	18
Do	Montgomery	97.6	67.2	106.9	1881	60.8	1882	16
Arizona	Prescott	96.1	45.7	103.0	1878	42.0	1879	13
Do	Fort Apache	100.8	50.0	102.5	1881	41.0	1879	10
Arkansas	Fort Smith	99.5	63.4	104.5	1884	61.0	1882	7
Do	Little Rock	97.3	65.6	101.3	1884	61.0	1882	10
California	San Francisco	93.4	51.0	83.0	1881, 1884	49.0	1874, 1881	18
Do	San Diego	77.2	54.6	86.0	1877	53.7	1884	17
Colorado	Denver	100.3	51.4	102.3	1874	42.0	1873	17
Do	Montrose	97.0	45.9	98.2	1886	47.8	1887	4
Connecticut	New Haven	89.8	50.6	95.0	1876	50.3	1885	16
Do	New London	86.5	53.5	93.0	1876, 1878	51.0	1879	17
Dakota	Fort Buford	95.0	49.0	105.9	1886	37.5	1884	10
Do	Yankton	101.8	54.2	103.0	1883	44.0	1877	16
Dis. of Columbia	Washington City	93.7	55.5	102.8	1887	54.1	1885	18
Florida	Jacksonville	98.4	68.0	104.0	1879	68.0	1879	17
Do	Key West	90.5	68.2	99.5	1886	70.1	1887	18
Georgia	Atlanta	94.5	65.3	100.0	1887	57.8	1882	10
Do	Savannah	99.1	66.9	105.0	1879	65.4	1885	18
Idaho	Boisé City	102.4	43.4	106.9	1886	40.0	1883	12
Illinois	Cairo	95.0	64.8	99.0	1881	60.0	1883	17
Do	Chicago	94.3	56.3	99.8	1887	50.0	1873	17
Indiana	Indianapolis	94.8	57.5	101.0	1881	47.5	1885	16
Indian Ter	Fort Sill	99.0	59.8	107.0	1884	56.0	1877, 1880	12
Iowa	Dubuque	94.5	54.0	101.0	1874	50.4	1882	16
Do	Des Moines	99.0	56.8	104.4	1886	52.0	1887	10
Kansas	Dodge City	102.0	59.5	108.0	1876	50.0	1877	14
Do	Leavenworth	97.0	60.5	104.0	1874	53.5	1882	18
Kentucky	Louisville	95.6	60.8	102.0	1874	54.0	1885	16
Louisiana	New Orleans	96.5	72.0	96.0	1877	69.8	1882	18
Do	Shreveport	98.5	66.9	107.0	1875	64.0	1882	16
Maine	Eastport	77.3	45.2	87.4	1886	45.0	1882, 1884	16
Do	Portland	87.1	50.5	97.0	1876	48.5	1886	17
Maryland	Baltimore	94.3	56.8	101.8	1887	56.0	1885	16
Massachusetts	Boston	88.0	5.10	101.0	1880	46.0	1874	18
Michigan	Marquette	90.5	46.6	100.0	1878	38.0	1886	15
Do	Grand Haven	84.0	49.0	90.0	1878	40.0	1873	16
Minnesota	Saint Vincent	89.0	45.4	94.9	1886	38.1	1887	8
Do	Saint Paul	94.0	55.5	100.0	1883	46.0	1873	16
Mississippi	Vicksburg	97.0	65.3	100.0	1881	62.0	1881	16
Missouri	Saint Louis	97.9	64.5	104.0	1881	57.0	1876	18
Montana	Ft. Assinaboine.	102.0	44.0	108.4	1886	35.0	1881	9
Do	Helena	99.1	46.5	103.1	1886	38.0	1880	9
Nebraska	North Platte	101.2	53.4	107.0	1877	45.0	1882	14
Do	Omaha	101.2	60.0	105.0	1874	51.0	1873	16
Nevada	Winnemucca	96.0	40.5	104.0	1877	37.0	1877, 1878	9
New Jersey	Atlantic City	91.0	54.8	99.0	1880	53.0	1880	15
New Mexico	Santa Fé	96.6	51.0	95.5	1878	46.0	1872, 1880	15
New York	Buffalo	84.0	48.6	92.1	1887	47.5	1876	16
Do	New York City	89.9	55.3	99.0	1876	56.2	1885	18
North Carolina	Charlotte	99.6	60.0	102.2	1887	56.1	1885	10
Do	Wilmington	95.9	59.8	103.0	1879	62.0	1881	18
Ohio	Cincinnati	95.4	58.2	103.5	1881	53.0	1885	18
Do	Sandusky	90.4	57.0	98.0	1887	53.1	1885	11
Oregon	Portland	97.0	46.0	99.0	1885	45.7	1887	16
Do	Roseburg	100.0	44.7	100.8	1885	39.6	1887	12
Pennsylvania	Pittsburg	90.3	50.5	102.7	1881	50.0	1885	16
Do	Philadelphia	93.8	56.8	100.0	1876	56.0	1883	18
Rhode Island	Block Island	.....	.....	87.8	1885	55.0	1883	8
South Carolina	Charleston	102.0	67.5	104.0	1879	64.7	1886	16
Tennessee	Knoxville	93.0	60.4	100.2	1887	52.2	1885	18
Do	Memphis	97.2	66.4	99.0	1875, 79, 81	60.0	1882	17
Texas	Brownsville	93.8	72.0	98.0	1877	65.1	1887	12
Do	Fort Elliott	101.4	60.2	102.0	1881	49.0	1880	9
Utah	Salt Lake City	97.9	51.7	99.7	1885	45.0	1880	15
Virginia	Lynchburg	95.0	55.4	101.8	1887	54.4	1885	16
Do	Norfolk	94.2	58.3	102.5	1887	59.4	1885	18
Washington	Spokane Falls	96.1	42.2	100.3	1886	41.4	1887	8
Do	Olympia	92.0	40.5	97.0	1885	39.8	1887	12
Wisconsin	La Crosse	90.9	56.9	101.0	1874	48.7	1887	16
Do	Milwaukee	90.8	52.5	99.9	1887	49.7	1886	17
Wyoming	Cheyenne	97.2	45.2	105.0	1881	37.6	1882	16

FROST.

Frosts are reported to have occurred as follows: *Colorado:* Pike's Peak, 18th, 19th, 24th. *Nevada:* Carson City, 1st, 13th, 27th. *New Hampshire:* Mount Washington, 15th, 16th, 30th. *New York:* West Monroe, 1st. *Oregon:* Fort Klamath, 2d, 26th. *Pennsylvania:* Wellsborough, 13th, 14th, 16th.

Heavy frost occurred at Humphrey, Cattaraugus Co., N. Y., on the 16th, causing considerable damage to corn, buckwheat, vines, etc.

AVERAGE DATE OF FIRST KILLING FROST AT STATIONS OF VOLUNTARY AND STATE WEATHER SERVICE OBSERVERS.

Chart number vi shows, in graphic form, the average date on which the first killing frost occurs generally over the country. This chart has been prepared solely from observations made at voluntary observers' stations. The data from the regular Signal Service stations were not incorporated because it is believed that observations as to the occurrence of frost are made in the country with greater opportunities for accuracy as to earliest date and extent of damage than in large cities, where Signal Service stations are generally located. In the preparation of the chart and table diligent effort has been made to secure reliable information as to killing frosts *only*, especially those frosts which were injurious to vegetables and other crops. It is probable that in some cases the first frost reported may have been "light" instead of "killing." It was found that killing frost occurred throughout the year along the northern boundary of the United States north of Dakota and Minnesota. In California killing frosts are very unusual in the extreme east and northeast portions. Through-

out the western portion of the state light frosts in winter (appearing about the middle of December and continuing not later than February) are not unusual, but rarely injure even delicate plants. The observations from which deductions have been made vary in length of records of from two to forty-nine years, thirty-six stations having records of fifteen years or more. The total number of stations involved in the work number four hundred and thirty-two.

The following table shows (1) the number of years of observation from which the data is drawn; (2) the average date of first killing frost; (3) the earliest date of first killing frost; (4) the extreme interval (number of days) between the earliest date and the average; (5) the last date of first killing frost; (6) the extreme interval between the latest date and the average; (7) the number of intervals of ten days or more; (8) the percentage of times when the interval was less than ten days:

Station.	Number of years, record.	Average date.	Earliest date.	Extreme interval, days.	Latest date.	Extreme interval, days.	Number of times interval was ten days or more.	Per cent. of times interval was less than ten days.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Arkansas.								
Lead Hill	7	Oct. 27	Oct. 12	15	Nov. 13	17	3	57
California.								
Washington	24	Oct. 28	Sept. 30	28	Nov. 16	19	9	62
Willows	7	Nov. 19	Oct. 30	20	Nov. 21	2	3	57
Sacramento	23	Nov. 19	Oct. 17	33	Dec. 31	42	18	22
Colorado.								
Como (near)	6	Aug. 23	Aug. 7	16	Sept. 15	23	3	50
Fort Collins	5	Sept. 9	Aug. 20	20	Oct. 1	22	2	60
Husted	6	Sept. 10	Aug. 31	10	Sept. 15	5	1	83
Connecticut.								
Middletown	29	Oct. 2	Sept. 10	22	Oct. 22	20	12	59
Southington	18	Oct. 13	Oct. 1	12	Nov. 2	20	7	61
Dakota.								
Gallatin	7	Sept. 13	Sept. 1	12	Oct. 1	18	2	71
Highmore	5	Sept. 7	Sept. 1	6	Sept. 15	8	0	100
Florida.								
Archer	5	Nov. 7	Oct. 31	7	Nov. 17	10	1	80
Mayport	10	Dec. 2	Nov. 11	21	Dec. 16	14	2	80
Saint Augustine	6	Dec. 24	Nov. 30	24	Feb. 6	44	4	33
Georgia.								
Forsyth	13	Nov. 8	Oct. 17	22	Nov. 25	17	3	77
Illinois.								
Aledo	6	Oct. 16	Oct. 1	15	Oct. 25	9	2	67
Anna	12	Oct. 23	Sept. 20	33	Nov. 15	23	5	58
Aurora	5	Sept. 4	Aug. 2	33	Sept. 29	25	2	60
Eberle	5	Nov. 2	Oct. 12	21	Dec. 5	33	3	40
Fairfield	5	Oct. 13	Oct. 1	12	Oct. 23	10	2	60
Golconda	10	Oct. 5	Sept. 14	24	Nov. 5	28	7	30
Griggsville	8	Oct. 22	Oct. 3	19	Nov. 12	21	5	38
Marengo	7	Sept. 16	Sept. 5	11	Sept. 29	13	3	57
Mascoutah	6	Nov. 9	Oct. 30	10	Nov. 20	11	2	67
Mattoon	8	Oct. 2	Sept. 9	23	Nov. 3	32	5	38
Melvin	15	Oct. 16	Sept. 27	19	Nov. 22	36	8	47
Oswego	8	Oct. 18	Oct. 5	13	Oct. 30	12	3	62
Palestine	5	Sept. 22	Sept. 9	13	Sept. 29	7	1	80
Peoria	32	Oct. 27	Oct. 1	26	Nov. 17	21	11	66
Pontiac	5	Sept. 17	Sept. 2	15	Sept. 28	11	3	40
Prairieville	5	Sept. 22	Sept. 9	13	Oct. 6	14	3	40
Rockford	15	Sept. 29	Sept. 9	20	Oct. 19	20	9	40
Sandwich	38	Sept. 26	Aug. 28	29	Nov. 28	63	22	42
Springfield	6	Sept. 22	Sept. 8	14	Oct. 19	27	5	17
Sycamore	6	Sept. 11	Aug. 24	18	Oct. 5	24	6	0
Indiana.								
Blue Lick	17	Oct. 27	Oct. 9	18	Nov. 15	19	8	53
Connersville	6	Oct. 11	Sept. 21	20	Nov. 1	21	2	67
Jeffersonville	5	Oct. 13	Oct. 2	11	Oct. 27	14	2	60
Laconia	14	Oct. 2	Sept. 14	18	Oct. 30	28	7	50
Mount Vernon	5	Oct. 5	Sept. 24	11	Oct. 14	9	1	80
Sunman	5	Oct. 17	Oct. 2	15	Nov. 1	15	3	40
Vevay	14	Oct. 5	Sept. 14	21	Nov. 4	30	12	14
Iowa.								
Cresco	13	Aug. 26	Aug. 8	18	Sept. 17	22	7	46
Dubuque	5	Sept. 14	Sept. 4	10	Sept. 29	15	2	60
Elkader	9	Sept. 20	Aug. 31	20	Oct. 16	26	5	44
Glenwood	29	Sept. 25	Aug. 29	27	Oct. 20	25	12	59
Iowa City	6	Sept. 27	Sept. 9	18	Oct. 17	20	2	67
Monticello	38	Sept. 17	Aug. 25	23	Oct. 13	26	16	58
Muscatine	49	Sept. 25	Sept. 2	23	Oct. 27	32	31	37
Sibley	5	Sept. 9	Aug. 23	17	Sept. 28	19	4	20
Waukon	5	Sept. 7	Aug. 10	28	Sept. 20	13	3	40
Kansas.								
Lawrence	18	Oct. 20	.....	.....	.....	.....	.....	.....
Manhattan	8	Oct. 8	Sept. 28	10	Oct. 18	10	2	75
Morse	6	Sept. 16	Sept. 11	5	Sept. 20	4	0	100
Salina	6	Oct. 4	Sept. 6	28	Oct. 19	95	3	50
Yates Centre	9	Oct. 7	Sept. 16	21	Oct. 18	11	3	67
Kentucky.								
Bowling Green	6	Oct. 20	Oct. 1	19	Nov. 15	26	5	17
Frankfort	6	Oct. 13	Sept. 24	19	Nov. 1	19	4	33
Louisiana.								
Grand Coteau	6	Dec. 7	Nov. 29	8	Dec. 18	11	1	83
Maine.								
Gardiner	29	Oct. 1	Sept. 4	27	Oct. 22	21	10	65
Lewiston	12	Oct. 1	Sept. 14	17	Oct. 17	16	6	50
Orono	19	Sept. 29	Sept. 15	14	Oct. 7	8	2	89

Average date of first killing frost, &c.—Continued.

Station.	Number of years, record.	Average date.	Earliest date.	Extreme interval, days.	Latest date.	Extreme interval, days.	Number of times interval was ten days or more.	Per cent. of times interval was less than ten days.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Maryland.								
Barren Creek Sp'gs	6	Oct. 12	Sept. 25	17	Nov. 3	22	3	50
Fallston	12	Oct. 4	Sept. 10	24	Oct. 25	21	8	33
McDonough School	5	Oct. 12	Oct. 1	11	Nov. 3	22	3	40
Woodstock College	13	Oct. 7	Sept. 15	22	Nov. 2	26	7	46
Massachusetts.								
Amherst	47	Sept. 20	Aug. 10	41	Oct. 8	18	16	16
Fall River	14	Sept. 21	Aug. 23	29	Oct. 12	21	10	29
Fitchburg	5	Sept. 24	Sept. 1	23	Oct. 21	27	5	0
Somerset	15	Oct. 18	Sept. 23	25	Nov. 3	16	7	53
Westborough	13	Sept. 11	Aug. 16	26	Oct. 5	24	7	46
Williamstown	8	Sept. 28	Aug. 25	34	Oct. 22	24	5	38
Michigan.								
Adrian	7	Oct. 10	Sept. 26	14	Oct. 26	16	2	71
Hudson	5	Sept. 10	Sept. 2	8	Sept. 21	11	2	60
Lansing	10	Aug. 31	Aug. 2	29	Oct. 4	34	7	30
Lansing (b'd of h'lth)	9	Oct. 4	Sept. 8	26	Oct. 23	19	6	33
Northport	10	Sept. 28	Sept. 9	19	Oct. 18	20	3	70
Minnesota.								
Northfield	5	Sept. 29	Sept. 5	24	Oct. 21	22	3	40
Mississippi.								
Holly Springs	32	Oct. 30	Oct. 10	20	Nov. 30	31	15	53
Missouri.								
Fayette	5	Oct. 13	Sept. 24	19	Nov. 5	23	8	.....
Ironton	9	Sept. 25	Sept. 2	23	Oct. 23	28	5	44
Kirksville	8	Oct. 14	Oct. 1	13	Oct. 23	9	4	50
Mexico	12	Oct. 11	Sept. 9	32	Oct. 27	16	4	67
Miami	8	Oct. 9	Sept. 13	26	Oct. 31	22	3	62
Oregon	33	Oct. 9	Sept. 17	22	Nov. 3	25	16	52
Montana.								
Virginia City	5	Sept. 18	Sept. 5	13	Oct. 8	20	4	20
Nebraska.								
Brownville	8	Oct. 21	Oct. 12	9	Nov. 2	12	1	88
De Soto	17	Oct. 10	Sept. 24	16	Oct. 31	21	8	53
Fremont	16	Oct. 17	Sepl. 20	27	Nov. 9	23	9	44
Genoa	11	Oct. 1	Sept. 13	18	Nov. 1	31	7	36
Nebraska City	8	Oct. 15	Oct. 1	14	Oct. 29	14	3	62
Ravenna	13	Sept. 28	Sept. 12	16	Oct. 18	20	4	69
Syracuse	5	Oct. 14	Oct. 4	10	Oct. 27	13	2	60
Weeping Water	13	Sept. 13	Aug. 30	14	Oct. 9	26	4	69
New Hampshire.								
Concord	29	Oct. 3	Sept. 12	21	Oct. 30	27	10	66
New Jersey.								
Billingsport	7	Oct. 16	Oct. 3	13	Nov. 3	18	3	57
Dover	5	Sept. 19	Sept. 10	9	Oct. 1	12	1	80
Readington	13	Oct. 4	Sept. 14	20	Nov. 3	30	5	62
South Orange	18	Oct. 20	Oct. 5	15	Nov. 3	14	5	72
New York.								
Cooperstown	30	Sept. 27	Sept. 3	24	Oct. 22	25	13	57
Cortland	8	Sept. 14	Aug. 19	26	Sept. 30	16	5	38
Factoryville	20	Oct. 7	Aug. 24	44	Oct. 30	23	10	50
Fortsville	10	Sept. 22	Sept. 12	10	Oct. 10	18	2	80
Humphrey	5	Sept. 6	Aug. 28	9	Sept. 17	11	1	80
Palermo	27	Sept. 19	Aug. 16	34	Nov. 21	63	13	52
Savona	6	Oct. 1	Sept. 10	21	Oct. 17	16	3	50
North Carolina.								
Greensborough	7	Oct. 16	Sept. 24	22	Nov. 6	21	4	43
Lenoir	14	Oct. 4	Sept. 15	19	Nov. 1	28	5	64
Raleigh	9	Oct. 10	Sept. 14	26	Nov. 2	23	5	44
Weldon	16	Oct. 20	Oct. 3	17	Nov. 9	20	5	69
Ohio.								
Clarksville	5	Oct. 16	Sept. 24	22	Nov. 14	29	3	40
Cleveland	21	Oct. 24	Oct. 9	15	Nov. 15	22	10	52
Margaretta Township	10	Oct. 10	Sept. 10	30	Nov. 1	23	6	40
Napoleon	5	Sept. 12	Sept. 1	11	Sept. 21	9	2	60
North Lewisburg	16	Oct. 19	Oct. 2	17	Nov. 18	30	6	62
Portsmouth	44	Oct. 11	Sept. 11	30	Nov. 14	34	21	52
Quaker City	5	Sept 18	Sept. 9	9	Sept. 24	6	0	100
Urbana	5	Sept. 17	Sept. 9	8	Sept. 22	5	0	100
Wauseon	18	Sept. 26	Sept. 2	24	Oct. 10	14	6	67
Tiffin	5	Oct. 1	Sept. 19	12	Oct. 24	23	2	60
Oregon.								
Albany	9	Oct. 26	Oct. 3	23	Nov. 21	26	3	67
Bandon	14	Oct. 9	Sept. 9	30	Nov. 18	40	11	21
Eola	12	Oct. 26	Oct. 9	19	Nov. 29	32	8	33
Portland	14	Nov. 11	Oct. 14	28	Dec. 6	25	9	36
Roseburg	11	Nov. 4	Oct. 13	22	Nov. 30	26	7	36
Pennsylvania.								
Carlisle	8	Oct. 1	Sept. 15	16	Oct. 19	18	5	38
Corry	8	Sept. 19	Sept. 2	17	Oct. 9	20	3	62
Dyberry	26	Sept. 23	Aug. 30	24	Oct. 21	28	9	65
New Bloomfield	12	Sept. 28	Sept. 10	18	Oct. 22	24	7	42
Pottstown	29	Oct. 7	Sept. 4	33	Oct. 27	20	9	69
Quakertown	7	Oct. 2	Sept. 10	22	Oct. 25	23	4	44
Wellsborough	14	Oct. 13	Sept. 24	19	Nov. 16	34	8	43
West Chester	9	Sept. 28	Sept. 16	12	Oct. 25	27	3	67
South Carolina.								
General average	.....	Oct. 25	.....	.....	Nov. 23	29	.....	.....
Stateburg	.....	Nov. 17	Nov. 2	15	Nov. 30	13	4	43
Tennessee.								
Andersonville	5	Oct. 13	Sept. 24	19	Oct. 31	18	3	40
Ashwood	8	Oct. 3	Sept. 14	19	Oct. 15	12	4	50
Austin	5	Oct. 9	Sept. 24	15	Oct. 30	21	4	20
Beech Grove	5	Oct. 13	Sept. 24	19	Oct. 31	18	4	20
Bolivar	5	Oct. 20	Oct. 7	13	Oct. 28	8	1	80
Careyville	5	Oct. 20	Sept. 24	26	Oct. 30	10	2	60
Cookeville	5	Oct. 8	Sept. 19	19	Oct. 31	23	5	0
Covington	5	Oct. 22	Oct. 12	10	Oct. 28	6	1	80
Farmingdale	5	Oct. 6	Sept. 20	16	Oct. 31	25	3	50
Florence	5	Oct. 7	Sept. 21	16	Oct. 26	19	4	20
Greeneville	5	Oct. 16	Sept. 24	22	Oct. 31	15	4	20

Average date of first killing frost, &c.—Continued.

Station.	Number of years, record.	Average date.	Earliest date.	Extreme interval, days.	Latest date.	Extreme interval, days.	Number of times interval was ten days or more.	Per cent. of times interval was less than ten days.
Tennessee—Cont'd.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Hohenwald	5	Oct. 8	Sept. 24	14	Oct. 31	23	5	0
Howell	5	Oct. 12	Sept. 24	18	Oct. 31	19	4	20
Hurricane Switch	5	Oct. 11	Sept. 24	17	Oct. 31	20	3	40
Jonesboro	5	Oct. 12	Sept. 23	19	Oct. 31	19	4	20
Lexington	5	Oct. 17	Oct. 3	14	Oct. 31	14	3	40
McMinnville	5	Oct. 17	Oct. 3	14	Oct. 31	14	3	40
Manchester	5	Oct. 12	Sept. 24	18	Oct. 31	9	4	20
Milan	5	Oct. 26	Oct. 22	4	Nov. 2	7	0	100
Paris	5	Oct. 5	Sept. 21	14	Oct. 24	19	3	40
Parksville	5	Oct. 7	Sepr. 24	23	Oct. 31	24	4	20
Riddleton	6	Oct. 10	Sept. 24	16	Nov. 1	22	4	33
Rodgersville	5	Oct. 8	Sept. 23	15	Oct. 30	22	4	20
Sailors Rest	5	Oct. 14	Sept. 24	20	Oct. 31	17	3	40
Somerville	5	Oct. 21	Oct. 7	14	Oct. 31	10	2	60
Trenton	5	Oct. 18	Sept. 24	24	Oct. 30	12	3	40
Waynesboro	5	Oct. 9	Sept. 24	15	Oct. 31	22	4	20
Texas.								
Clarksville	9	Oct. 17	Sept. 12	35	Nov. 12	26	4	56
New Ulm	12	Nov. 25	Nov. 12	13	Dec. 15	20	5	58
Utah.								
Coalville	8	Sept. 5	Aug. 10	26	Sept. 26	21	5	38
Vermont.								
Charlotte	17	Oct. 21	Oct. 8	13	Nov. 1	11	3	82
Lunenburgh	28	Sept. 20	Aug. 5	46	Nov. 16	57	16	43
Virginia.								
Dale Enterprise	19	Oct. 2	Sept. 15	17	Oct. 31	29	7	63
Woodlawn	10	Oct. 13	Sept. 26	17	Nov. 6	24	6	40
Wytheville	10	Sept. 19	Aug. 26	24	Oct. 14	25	5	50
Washington Territory.								
Blakely	11	Nov. 16	Oct. 23	24	Dec. 10	24	7	36
Port Townsend	5	Nov. 8	Oct. 2	36	Dec. 7	29	4	20
Walla Walla	10	Oct. 26	Sept. 8	48	Feb. 28	125	8	20
West Virginia.								
Parkersburg	8	Oct. 25	Sept. 26	29	Nov. 22	28	6	25
Wisconsin.								
Deuster	9	Sept. 9	Aug. 22	18	Sept. 18	9	1	89
Fond du Lac	8	Sept. 29	Sept. 9	20	Oct. 19	20	4	50
Manitowoc	31	Oct. 16	Sept. 18	28	Nov. 13	28	17	45

TEMPERATURE OF WATER.

The following table shows the temperature of the sea-water for July, 1888, observed, under conditions as given, at the harbors of the several stations; the monthly range of water temperature; the average depth at which the observations were made, and the mean temperature of the air:

Station.	Temperature at bottom.				Mean temperature of air at the station.
	Max.	Min.	Range.	Monthly mean.	
	°	°	°	°	°
Cedar Keys, Fla	89.9	85.0	4.9	87.5	80.8
Charleston, S. C	85.5	81.0	4.5	83.1	78.5
Eastport, Me	48.2	45.0	3.2	46.7	58.1
Galveston, Tex	89.5	78.8	10.7	86.2	82.0
Key West, Fla	90.1	84.1	6.0	87.9	83.3
New York City	72.6	68.0	4.6	70.1	70.5
Pensacola, Fla	87.0	81.3	5.7	83.4	82.0
Portland, Me	58.5	50.4	8.1	55.8	65.5
Portland, Oregon	75.3	62.5	12.8	68.3	66.2

COTTON REGION REPORTS.

In the accompanying table are given for July, 1888, the average rainfall and the means of the maximum and minimum temperatures in the cotton regions, together with normals computed from similar observations of former years:

Temperature and rainfall data for the cotton districts, July.

Districts.	Rainfall.			Temperature.							
				Maximum.			Minimum.			Extremes for July, 1888.	
	Average for July of six preceding years.	Average for July, 1888.	Departures.	Mean for July of six preceding years.	Mean for July, 1888.	Departures.	Mean for July of six preceding years.	Mean for July, 1888.	Departures.	Max.	Min.
	Inches	*Inches*	*Inches.*	°	°	°	°	°	°	°	°
New Orleans	4.39	3.51	— 0.88	92.8	93.7	+ 0.9	72.9	71.0	— 1.9	104	50
Savannah	6.22	2.54	— 3.68	92.4	94.5	+ 2.1	72.1	71.7	— 0.4	104	60
Charleston	6.46	4.11	— 2.35	91.9	92.3	+ 0.4	70.8	69.5	— 1.3	103	53
Atlanta	4.97	3.27	— 1.70	90.2	91.1	+ 0.9	69.1	70.0	+ 0.9	104	57
Wilmington	5.53	3.21	— 2.32	91.0	90.3	— 0.8	69.4	67.3	— 2.1	104	54
Memphis	3.70	1.79	— 1.81	90.7	92.5	+ 1.8	68.8	69.7	+ 0.9	102	52
Galveston	2.09	2.36	+ 0.27	95.4	92.6	— 2.8	72.9	70.9	— 2.0	105	54
Vicksburg	5.16	2.11	— 3.05	92.1	92.9	+ 0.8	71.6	72.5	+ 0.9	100	62
Montgomery	5.01	2.64	— 2.37	91.5	93.8	+ 2.3	69.5	71.6	+ 2.1	100	61
Augusta	1.26	2.43	+ 1.17	92.3	92.0	— 0.3	70.4	69.7	— 0.7	108	56
Little Rock	2.55	2.82	+ 0.27	92.9	93.3	+ 0.4	68.2	72.3	+ 4.1	105	56
Mobile	4.05	4.90	+ 0.85	93.5	94.8	+ 1.3	70.3	71.9	+ 1.6	104	61

PRECIPITATION (expressed in inches and hundredths).

The rainfall has been in excess of the average in some districts, but for the most part it was below the average, the deficiencies being very marked in the districts of Savannah, Charleston, Wilmington, Vicksburg, and Montgomery. The means of the maximum and minimum temperatures differed but little from their respective normals.

The distribution of precipitation over the United States and Canada for July, 1888, as determined from the reports of about one thousand stations, is exhibited on chart iv. In the table of miscellaneous meteorological data are given, for each Signal Service station, the total precipitation, with the departures from the normal. The figures opposite the names of the geographical districts in 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 precipitation is below the normal, and subtracting when above.

So far as is shown by records of Signal Service stations, the rainfall during July was below the average over nearly the whole country, the only exception being a few areas of limited extent, the more important of which were two embracing, respectively, a part of the central Missisippi valley and northeastern Texas and the adjacent portions of the Indian Territory and Arkansas, where the monthly rainfalls were unusually heavy. The largest monthly rainfalls, however, occurred in the upper Ohio valley, and these were almost entirely due to the very heavy rains accompanying the storms described under areas of low pressure as numbers ii and v.

It may be generally stated that, with the exception of Florida where the rainfall was about normal, in the states bordering on the Atlantic and east Gulf coasts the percentages of average precipitation ranged from 60 to 70; in the Lake regions, Ohio and Missouri valleys, middle plateau, and in the middle and southern Rocky Mountain slopes from 70 to 80. In the upper Mississippi valley, northern plateau, and on the north Pacific coast more than the average amount of rain fell, the percentage of excess ranging from 20 to 45.

HAIL.

Descriptions of the more severe hail storms of the month are given under "Local storms." In addition to those given under that heading, hail is reported to have fallen in the various states and territories as follows: 1st, Dak., Mass., Mont., Wyo. 3d, Iowa, Nev., Wis. 4th, Dak., Iowa, 5th, Mass., N. J., N. Mex., N. Y., Wyo. 6th, Mont., Tex. 7th, Colo., Iowa, N. H., W. Va. 8th, Colo., Mich., Wyo. 11th, Ariz., N. Y. 13th, Colo., Va. 14th, Colo. 16th, Colo., Nebr., Nev., Wyo. 17th, Colo., Kans. 18th, Colo., La., Oregon. 19th, Colo., N. Y., Pa. 20th, Dak., Mont., Pa., Va. 21st, Iowa. 22d, Ill., Nebr., Wis. 23d, Colo., Ind., Mich., Ohio. 24th, Ala., Colo., Ga., Mo. 25th, Colo., Minn., S. C., Wyo. 26th, Ill., Iowa, Wyo. 27th, Kans., Ohio, Pa. 28th, Ind., Mont., Tenn. 29th, Fla. 30th, Wyo. 31st, Ill., N. Y., Vt.