UNITED STATES OF AMERICA:
WAR DEPARTMENT.

MONTHLY WEATHER REVIEW.

(GENERAL WEATHER SERVICE OF THE UNITED STATES.)

MARCH, 1887.

CONTENTS.

PREPARED UNDER THE DIRECTION OF
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SIGNAL OFFICE.
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List of merchant marine steam and sailing vessels from which International Simultaneous Meteorological reports were received at the Office of the Chief Signal Officer, U. S. Army, Washington, D. C., in time to be used in the preparation of the Weather Review for the month of March, 1887.

Name of vessel.	Captain.
Allan Line.	
Br. s. s. Grecian	Capt. C. E. Le Gallias.
Hibernian	J. Brown.
Manitoban	W. Dalziel.
Sarmatian	Wm. Richardson.
American Line.	
Br. s. s. British King	John Kelly.
British Prince	S. Nowell.
British Princess	E. H. Freeth.
Am. Illinois	G. H. Dodge.
Anchor Line.	
Br. s. s. Australia	A. McRitchie.
Alsatia	J. Brown.
British Crown	Archibald Smith.
British Queen	R. Wills.
Circassia	A. Campbell.
Devonia	Hugh Young.
Dorian	J. McKeagne.
Elysia	W. Baxter.
Arrow Line.	
Br. s. s. Critic	W. R. Lord.
Atlas Line.	
Br. s. s. Ailsa	J. W. Sanson.
Alvena	—. McKay.
Andes	T.M.MacKnight.
Athos	H. Low.
Booth's S. S. Co. (limited).	
Br. s. s. Basil	H. Thompson.
Bernard	Ch. Off. S. Richards.
Clement	Capt. Thos. Burley.
Jerome	Benj. Crimp.
Bordeaux Steam Navigation Co.	
Fr. s. s. Chateau Leoville	M. Le Chapelain.
Chateau Yquem	C. F. Journiel.
Bristol-City Line.	
Br. s. s. Brooklyn City	W. Fitt.
Jersey City	E. Horlor.
Llandaff City	T. H Gore.
Cromwell Line.	
Am. s. s. Louisiana	E. V. Gager.
Cunard Line.	
Br. s. s. Aurania	W. H. P. Hains.
Catalonia	Edward Wylie.
Cephalonia	Henry Walker.
Etruria	T. Cook.
Gallia	M. Murphy.
Pavonia	A. McKay.
Samaria	B. Watt.
Scythia	T. Roberts.
Servia	H. McKay.
Umbria	W. McMickan.
Edward Carr's S. S. Line.	
Ger. s. s. Amalfi	Julius Bahr.
Australia	G. Franck.
Polaria	Johannes Schade.
Polynesia	A. Kuhn.
Furness Line.	
Br. s. s. Borderer	F. Manley.
Stockholm City	K. Doyle.
General Trans-Atlantic Steamship Co.	
Fr. s. s. La Bourgogne	E. Franquel.
La Brotagne	M. de'Jousselin.
La Champagne	E. Traub.
La Gascogne	Santelli.
Great Western S. S. Line.	
Br. s. s. Warwick	J. H. Janes.
Union Line.	
Br. s. s. Alaska	Geo. S. Murray.
Arizona	S. Brooks.
Wyoming	C. L. Rigby.
Hamburg-American Line.	
Ger. s. s. Gellert	W. Kuhlowein.
Gothia	C. Kordell.
Lessing	H. Barends.
Moravia	O. Pezoldt.
Rhaetia	R. Karlowa.
Rugia	A. Albers.
Slavonia	H. Schmidt.
Suevia	C. Ludwig.
Wieland	C. Hebich.
Harrison Line.	
Br. s. s Counsellor	Wm. Lang.
Inman Line.	
Br. s. s. City of Berlin	Francis S. Land.
City of Chester	A. Lewis.
City of Richmond	A. Redford.
Johnston Line.	
Br. s. s. Nessmore	John Inch.
Lamport & Holt's Steamship Company.	
Br. s. s. Bessel	C. J. Watson.
Bicla	Fred Graham.
Dalton	J. Russell.
Humboldt	Jas. Grimes.
Olbers	Jas. Clark.
Nasmyth	Thos. T. Farrell.
Leyland Line.	
Br. s. s. Bavarian	J. Oseinak.
Bulgarian	E. Parry.
Istrian	T. H. Fox.
Virginian	M. Fitt.
Mallory Line.	
Am. s. s. Alamo	Sam Risk.
Lampassas	M. B. Crowell.
Rio Grande	J. F. Lewis.
Mediterranean & New York S. S. Co.	
Br. s. s. Pontiac	Ch. Off. R. Blyth
Ponca	Capt. W. Bowen.
Miss. & Dominion S. S. Co.	
Br. s. s. Ontario	W. P. Couch.
Sarnia	Jos. Gibson.
Toronto	Jas. McAuley.
Vancouver	C. J. Lindall.
Morgan Line.	
Am. s. s. Eureka	R. B. Quick.

Name of vessel.	Captain.
National Line.	
Br. s. s. Canada	Capt. Thos. Foote.
Denmark	R. S. Rigby.
Egypt	J. Sumner.
England	T. P. Heeley.
Erin	J. Robinson.
France	A. D. Hadley.
Helvetia	G. Cochrane.
Holland	Wm. Tyson.
Italy	Wm. Pearce.
Spain	W. A. Griffiths.
The Queen	John Milligan.
Navigazione Generale Italiana.	
It. s. s. Gottardo	Domenico Viola.
Indipendente	P. Pirandello.
New York and Cuba Mail S. S. Co.	
Am. s. s. Cienfuegos	F. M. Fulcloth.
N. Y., Havana & Mexican Mail S. S. Co.	
Am. s. s. City of Alexandria	J. W. Reynolds.
City of Washington	W. M. Rittig.
North German Lloyd Steamship Co.	
Ger. s. s. Aller	H. Christoffers.
Donau	H. Supmer.
Elder	P. H. Berdrow.
Elbe	G. Meyer.
Ems	Th. Jungst.
Fulda	R. Ringk.
Main	H. Boedeker.
Rhein	L. Jahns.
Saale	H. Richter.
Trave	W. Willigerod.
Werra	R. Bussius.
Weser	H. Bruns.
Occidental and Oriental Steamship Co.	
Br. s. s. Gaelic	W. G. Pearne.
Oceanic	H. Davison.
Ocean Steamship Company.	
Am. s. s. City of Augusta	J. W. Catharine.
Oceanic Steamship Company.	
Am. s. s. Alameda	G. H. Morse.
Old Dominion Steamship Company.	
Am. s. s. Manhattan	Frank Stevens.
Oregon Railway and Navigation Co.	
Am. s. s. Columbia	Fred Bolles.
Oregon	E. Polemann.
Pacific Coast Steamship Company.	
Am. s. s. City of Chester	J. Wallace.
Orizaba	John N. Ingalls.
Pacific Mail Steamship Company.	
Am. s. s. Acapulco	C. S. Coye.
City of New York	R. R. Searle.
City of Para	L. Dexter.
City of Peking	H. C. Dearborn.
Colima	J. M. Caverly.
Colon	Chas. C. Lima.
Granada	J. L. Lockwood.
Newport	W. G. Shackford.
San Blas	Thos Chapman.
Pyman Line.	
Br. s. s. Netley Abbey	H. N. Vyvyan.
Quebec Steamship Company.	
Br. s. s. Murlol	G. S. Locke.
Orinoco	J. S. Garvin.
Trinidad	W. J. Fraser.
Red Cross Line.	
Br. s. s. Portuonso	F. Hews.
Red "D" Line.	
Am. s. s. Philadelphia	Sam. Hess;
Valencia	W. Woodrick.
Red Star Line.	
Belg. s. s. Belgenland	W. A. Beynon.
Nederland	A. J. Griffin.
Noordland	H. E. Nickels.
Pennland	Rud. Weyer.
Rhynland	J. C. Jamison.
Switzerland	H. Buschmann.
Waesland	J. Ueberweg.
Westernland	Com. W. G. Randle.
Rotterdam Line.	
Dtch. s. s. Edam	Capt. J. H. Taat
P. Caland	F. H. Bonjer.
Rotterdam	G. J. Vis.
Schiedam	A. Potjer.
W. A Scholten	G. Bakker.
Zaandam	H. v. d. Zee.
Royal Mail Steamship Co.	
Am. s. s. City of Dallas	C. W. Read.
Royal West India Mail Steamship Co.	
Dtch s. s. Oranje Nassau	J. A. J. Lacrooy.
State Line.	
Br. s. s. State of Georgia	G. Moodie.
State of Pennsylvania	A. J. A Mann.
State of Nebraska	A. G. Braes.
State of Nevada	J. A. Stewart.
Thingvalla Line.	
Dan. s. s. Geiser	C. W. Möller.
Hekla	A. G. Thomsen.
Island	W. Skjodt.
Thingvalla	S. T. H. Laub.
Twin Screw Line.	
Br. s. s. Richmond Hill	A. Hyde.
Tower Hill	F.Archer, R.N.R.
Tyne and Wear Steamship Co.	
Br. s. s. City of Newcastle	R. Townsend.
Warren Line.	
Br. s. s. Iowa	Samuel Walters.
Kansas	W. Gleig.
White Cross Line.	
Belg. s. s. DeRuyter	J. J. Brarens.
Jan Broydel	H. Meyer.
Pieter de Coninck	E. Smit.

Name of vessel.	Captain.
White Star Line.	
Br. s. s. Adriatic	Capt. H. Parsell.
Britannic	H. Perry.
Celtic	P. J Irving.
Germanic	Benj. Glendell.
Republic	P. J. Irving.
Wilson Line.	
Br. s. s. Buffalo	J. H. Malet.
Chicago	J. W. Jones.
Galileo	R. T. Jones.
Lepanto	T. M. Irvin.
Marengo	W. Abbott.
Otranto	W. Rippeth.
Santiago	R. Potter.
Miscellaneous.	
Nor. s. s. Amicitia	P. M. Relmers
Br. Bedford	T. Aitkenhead.
Coventry	W. C. Bacon.
Chiswick	E. Leighton.
Dragonfly	J. W. Howling.
Edith Godden	J. H. Bennett.
El Callao	Jos. Scholtz.
Span. Elcano	V. de Ispizua.
Br. Elstow	T. Robertson.
Br. Fitzroy	Henry Gibb.
Gwendoline	Rob't Milburn.
Span. Hugo	A. de Mugica.
Ger. India	M. Halsen.
Am. Light-ship No. 37	Andrew Jackson.
Br. Lord Lansdowne	C. H. Baskfield.
Am. Lorenzo D. Baker	Warren F. Wiley.
Nor. Ludwig Holberg	N. Houge.
Br. Madrid	M. Garson.
Span. Manuel L. Villaverde	Claudio Perales.
Mexico	M. Carmona.
Navarro	S. de Aldecoces.
Br. Pomona	J. Legoe.
Queen	J. Annison.
Saint Ronans	Henry Campbell.
Swed. Victoria	J. A. Kinnman.
Br. Viola	L. Murray.
New York Herald Weather Service.	
Br. s. s. Bolivia	J. McFarlane.
Am. Caracas	N. M. Hopkins.
City of Puebla	John Deaken.
Fr. Chateau Lafite	C. Ollivier.
Am. El Monte	J. W. Hawthorn.
El Paso	H. S. Quick.
Br. Ethiopia	John Wilson.
Greece	A. J. Jeffrey.
Am. Knickerbocker	F. Remble.
New Orleans	T. P. C. Halsey.
New York	J. B. Perry.
Br. Nevada	J. A. R. Cushing.
Am. Niagara	S. Y. Bennis.
Br. Samana	W. Taylor.
Sailing vessels.	
Br. bg. Abyssinian	John Hughes.
Am. schr. Anna B. Hutcheson	D. Zeluff.
bg. Arcot	J. W. Cates.
Ger. sp. August	G. H. Jaburg.
Am. schr. Benjamin Hale	John Hull.
Nor. sp. B. D. Metcalf	E. P. Larson.
Am. bkt. Bonny Doon	C. Burgess.
Ger. bk. Bremerhaven	A. Witte.
Am. schr. C. B. Church	N A Anderson.
Br. sp. Chas. S. Whitney	Geo. D. Spicer.
Am. schr. Comet	W. A. Aldrich.
Ger. sp. Columbus	L. Haesloop.
Am. bg. Daisy Boynton	C Harding.
Ger. sp. Dakota	N. E. Schaffer.
Am. schr. Edward R. Emerson	A. H. Child.
Ger. bk. Emilie	W. Siems
Aust. bk. Errante	A. G. Nicolich.
Am. Ethel	W. Thompson.
schr. Florence Rogers	J. S. F. McLeod.
It. bk. Fratelli Laurin	L. Laurin.
Nor. Grundloven	O. G. Ellingsen.
Am. General Fairchild	H. R. Coombs.
Ger. sp. Hedwig	Th. Minssen.
Am. schr. Henry Waddington	W. H. Magee.
Nor. bk. Hermon	O. Olsen.
Ger. sp. Ida	J. Winter.
Am. bg. Jane Adeline	G. W. Cates.
bkt. Josephine	Chas. Brown.
bk. José E. More	Asmus Lenhard.
bg. L. & W. Armstrong	A. Alexander.
Br. bk. Lalla	Paul Le Blanc.
Ger. Leocadia	John Stohff.
Am. bkt. Levanter	G. F. Gerry.
bg. Lillian	H. T. Schive.
Hait. Les Trois Soeurs	R. H. Cox.
Am. L Staples	J. P. Stowens.
Swed. bk. Maria Margretha	J. E. Fogman.
Br. sp. Mabel Taylor	C. E. Durkee.
Aust. bk. Matteo	G. V. Vidulich.
Nor. Matthanja	D. T. Pedersen.
Br. Mizpah	M. Dowley.
Ger. sp. Otto	W. Langen.
Am. bgt. Pearl	John B. Zimmer.
Nor. bk. Qvos	G. Olsen.
Br. Recovery	T. E. Blagdon.
River Ganges	T. Nalle.
It. Rosina	G. Tomaselli.
Br. Rothiemay	Ch. Off. O. M. Lund.
Am. bg. Ruby	Capt. A. J. Van Post.
Br. sp. Sapphire	G. W. Murray.
Am. bk. Sarah Doe	B. S. Merryman.
Ger. sp. Shakspere	C. Müller.
It. bk. Teresa Accame	G. Bootto.
Rus. Toivo	W. H. Snellman.
Ger. sp. Union	H. Fokken.
bk. Western Chief	F. Sander.
Am. schr. Winnie Lawry	A. McRitchie.
Br. sp. Winnifred	R. Macdonald.

UNITED STATES SIGNAL SERVICE

MONTHLY WEATHER REVIEW.

VOL. XV. WASHINGTON CITY, MARCH, 1887. No. 3.

INTRODUCTION.

This REVIEW treats generally the meteorological conditions of the United States and Canada for March, 1887, and is based upon reports of regular and voluntary observers of both countries.

Descriptions of the storms which occurred over the north Atlantic Ocean during the month are also given, and their approximate paths shown on chart i. In tracing the centres of the paths of these storms, data from the reports of two hundred and thirty-eight vessels have been used. The general character of the weather over the north Atlantic Ocean was particularly severe during the second, and early portion of the third, decade of the month.

The southward movement of Arctic ice was unusually large for the season, and heavy ice jammed in on the coast of Newfoundland, in the vicinity of Saint John's, at intervals from the 11th to 23d.

On chart i for this month are traced the paths of eleven areas of low pressure; this is one less than the average number for March during the past thirteen years. No storm of unusual severity occurred, although low area number ix exhibited considerable energy during its presence in the Lake region and Ohio Valley on the 24th, it being attended by high winds, heavy rain or snow, and in Ohio by thunder-storms.

The mean pressure of the month was very nearly normal in all parts of the country; in Maine and the Canadian Maritime Provinces it was slightly below, and in the upper lake region and Mississippi valley slightly above, the normal.

The temperature has been below the normal in all states bordering on the Lakes and Atlantic Ocean, along the east Gulf coast, and in southern Texas; in all other districts the month has been warmer than the average March. The extremely low temperatures that prevailed in the Southern States on the 18–19th and 29–30th were accompanied by frosts which were destructive to vegetables and blossoms of fruit trees.

The precipitation was generally below the normal in all parts of the country, except Washington Territory, Oregon, Idaho, and extreme southern Texas; at the end of the month the remainder of the state was still suffering from the long drought.

In the preparation of this REVIEW the following data, received up to April 20, 1887, have been used, viz., the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and thirty-three Signal Service stations and twenty-three Canadian stations, as telegraphed to this office; one hundred and fifty-seven monthly journals; one hundred and fifty-eight monthly means from Signal Service stations; twenty-three monthly means from Canadian stations; two hundred and eighty monthly registers from voluntary observers; fifty-eight monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the publishers of "The New York Maritime Register;" monthly weather reports from the local weather services of Alabama, Arkansas, Illinois, Indiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New England, New Jersey, North Carolina, Ohio, Oregon, South Carolina, and Tennessee; and of the Central Pacific Railway Company; trustworthy newspaper extracts, and special reports.

ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean pressure for March, 1887, determined from the tri-daily telegraphic observations of the Signal Service, is shown by isobarometric lines on chart ii.

On this chart are shown two areas of high pressure, the first extends over Minnesota, Dakota, and northward beyond the limit of observation, and is enclosed by the isobar of 30.15; at two stations within this line, Saint Vincent, Minn., and Fort Garry, Manitoba, the highest mean pressure of the month, 30.18, is attained. From this region eastward the pressure decreases rapidly until in New England the isobar of 29.80, and in Nova Scotia 29.75, is reached; within the latter line the lowest mean pressure of the month, 29.71, at Sydney, Cape Breton Island, occurs. The second area of high pressure, also bounded by the isobar of 30.15, is situated in Oregon and northern California, from this region northeastward to central Montana and southeastward to Arizona the pressure decreases, attaining a mean of 29.98 at Fort Maginnis, Mont., and 29.97 at Yuma, Ariz. The position of the areas of highest and lowest pressure for the present month and for March, 1886, nearly coincide.

The departures from the normal pressure are given in the table of miscellaneous meteorological data, and are also shown on chart iv by lines connecting stations of equal departure. The mean pressure of the month is normal, or nearly so, in all parts of the country, except Maine and the Canadian Maritime Provinces, where departures below the normal, ranging from .06 at Portland, Me., to .19 at Sydney, Cape Breton Island, occur. In New England, the middle Atlantic states, south Atlantic states, Florida, and the east Gulf states, the pressure of the month is from .01 to .08 below the normal pressure for March. From the districts named westward to the Pacific Ocean the pressure is slightly above the normal, the largest departures occurring in the upper lake region and upper Mississippi valley, where they range from .06 at several stations to .11 at Escanaba, Mich., and .13 at La Crosse, Wis., in excess of the normal; in Nevada and northern California it is about .07.

When compared with the pressure of the preceding month, February, 1887, very large differences, both above and below, occur. Along the Pacific coast and in the Rocky Mountain regions the pressure for March is from .03 to .18 in excess of that of February; in Washington Territory, Oregon, and northern California the excess averages about .13. From the Rocky Mountain region eastward to the Atlantic Ocean the pressure is below that of the preceding month, the deficiencies becoming very large in the eastern part of the country, averaging along the Atlantic about .25.

BAROMETRIC RANGES.

The monthly barometric ranges at the various Signal Service stations are given in the table of miscellaneous data. The largest ranges occur in New England, the lower lake region, and middle Atlantic states; the smallest in California. The following are some of the extreme ranges:

Greatest.	Inch.	Least.	Inch.
Eastport, Me	1.98	San Diego, Cal	0.28
Portland, Me	1.86	Los Angeles, Cal	0.28
Block Island, R. I	1.80	Yuma, Ariz	0.37
Boston, Mass	1.79	San Francisco, Cal	0.41
New London, Conn	1.78	Sacramento, Cal	0.44
New Haven, Conn	1.73	Red Bluff, Cal	0.46
Mount Washington, N. H	1.60	Fort Grant, Ariz	0.50

AREAS OF HIGH PRESSURE.

In the examination of the tri-daily weather charts of the United States and the Dominion of Canada, eight well-defined areas of high pressure have been traced with sufficient accuracy to warrant a brief description of each as to its movements and its relation to other current phenomena. The general direction of movement of these areas was easterly, with two exceptions, numbers v and viii, which were a little east of south. They first appeared in the field of observation at the stations located in British America, just north of Montana and Washington Territories, with the exceptions of numbers iii and iv, which were first noticed upon the Pacific coast of the United States.

The intimate relation prevailing between areas of low temperature, cold waves, and areas of high pressure makes it convenient to discuss their movements and conditions in the same text, although it is not proper to say that a cold wave, as defined by the rules of the Signal Service, is always found with an area of high pressure. It will be well to state here that the definition of a "cold wave" is that there must be a sudden and decided fall of fifteen or more degrees in temperature, after eliminating the diurnal changes, and that this fall must be to, or below, the point at which frost is formed.

The following are general descriptions of the several areas of high pressure traced:

I.—The afternoon reports of the 1st indicated the presence of an area of high pressure to the northward of Washington Territory, the isobar of 30.30 extending southward into western Oregon. Subsequent reports located its path eastward into British Columbia thence over Manitoba, bending to the southeast over Lake Superior, and passing directly eastward over Upper Canada into the Gulf of Saint Lawrence on the 6th. The uniformity of pressure above the normal, from .4 to 1.00, which this area maintained, was remarkable. Its centre did not come within the range of stations making telegraphic reports until the morning of the 3d, when it was just north of Dakota, with a corrected reading of 30.99. When it passed into the Gulf of Saint Lawrence on the 6th it had only fallen to 30.84. During its passage eastward cold northerly winds prevailed in all the regions south of its track, except along the northern coast of the Gulf of Mexico. The temperature fell to the freezing point as far south as the thirty-sixth parallel. The lowest temperatures accompanying this cold wave were —34° in Manitoba on the 4th, and —33° in Lower Canada on the 5th. It also fell below zero in Dakota, Minnesota, northern Michigan, and northern New England.

II.—This area appeared in the Saskatchewan Valley on the evening of the 6th, with a pressure of 30.37 and a temperature of —9°. It moved over a path almost directly east-southeast and arrived on the New England coast on the morning of the 9th, with an isobar of 30.40. During its progress eastward the temperature fell below the freezing point in the upper Mississippi valley, the Lake region, and New England. It being closely followed by an area of low pressure, the lowest temperature did not continue at any point over twenty-four hours.

III.—The evening reports from the Oregon coast of the 4th indicated the presence of an area of high pressure in the Pacific Ocean just off the coast. The pressure at Roseburg, Oregon, was 30.21. From this time until the morning of the 8th this area remained nearly stationary, its centre appearing to oscillate over a region of about two hundred miles in diameter, including the southern Oregon and north California coasts. As is usually the case when an area of high pressure is located in this vicinity, southerly winds and rain prevailed in Oregon and Washington Territory, and continued for ninety-six hours, or until the area moved eastward. On the afternoon of the 8th the reports indicated that the high area had started eastward, the highest presssure, 30.48, being in northern Utah. It then pursued a course southwestward into Colorado, then eastward into central Kansas, then northeastward, arriving over the region just north of Lake Superior on the morning of the 10th. It slowly drifted southeastward over the Lake region and middle Atlantic states and disappeared after the evening observation of the 12th. The pressure gradient surrounding this high area was uniformly light, and seldom exceeded one tenth of an inch to one hundred miles. The decrease in the temperature with this area was moderate throughout its path, being most decided in the lower lake region, where 20° above zero was recorded on the morning of the 12th.

IV.—This area was first observed over the country just north of Montana on the morning of the 12th, with a pressure of 30.66. It moved to northern Minnesota by the afternoon of the 13th, registering a pressure of 30.80. Its course after this date was in a northeasterly direction toward Hudson Bay. During its progress the gradient was often quite steep, sometimes indicating a change of pressure of one-tenth of an inch to thirty-three miles. During the time the isobars were most crowded brisk and high winds prevailed over Dakota, Minnesota, and Wisconsin. Freezing temperature was experienced southward to Kansas, Missouri, and Kentucky, and a minimum depression to zero was recorded in northern Dakota and Minnesota. The southern limit of this area extended to the Gulf of Mexico.

V.—The evening reports of the 18th indicated the approach of an area of high pressure into Montana from the northwest, the station at Calgarry, Northwest Territory, reporting a reading of 30.19. It had moved southeastward into Montana by the morning of the 20th, with highest pressure 30.50. After this its path was almost due south, leaving the coast of Texas on the evening of the 22d. The pressure gradually decreased a it moved southward, and when last observed in Texas as as defined area, 30.25 was the maximum pressure. The temperature accompanying this area was below the freezing point until it arrived in southern Texas. The pressure gradient was light, and the wind-velocities were moderate. The unusual southerly course of this high area appears to have been influenced by the presence of an area of low pressure in the western portion of the Gulf of Mexico, having an easterly course.

VI.—This area first appeared in the country north of Dakota on the morning of the 24th, with an isobar of 30.10 and a temperature slightly below zero. By the morning of the 26th the central portion had reached northern Minnesota, with a pressure of 30.50. After this date its progress was towards the southern part of Hudson Bay, then directly southeastward to Nova Scotia. It passed into the Atlantic Ocean on the evening of the 27th, with a pressure of 30.30. During its progress eastward cold northerly winds prevailed directly south of its path, with some precipitation in the lower lake region. So far as could be determined by the observations received, the gradient was uniformly light.

VII.—The reports received on the evening of the 26th indicated the presence of a high area over British Columbia. On the evening of the 27th the pressure permitted an isobar of 30.70 to be drawn in western Manitoba, with a gradient to the south of about one-tenth of an inch to fifty miles. Subsequent observations defined its path to be slightly north of east. Arriving at a point north of Minnesota on the afternoon of the 28th there were indications of the area dividing, for the isobar of 30.30 extended southward into Missouri, while the distance

between its east and west line was less than five hundred miles. The separation had been completed on the afternoon map, as a distinct area covered the lower Missouri and Mississippi valleys, with a maximum pressure of 30.36 in Missouri. This second high area moved slowly eastward, covering the entire region east of the Mississippi River, and was central over the New England States on the evening of the 31st, with an isobar of 30.30. The conditions prevailing along its easterly path was generally dry, pleasant weather and light winds.

VIII.—The reports from Montana on the afternoon of the 30th permitted the drawing of an isobar of 30.40 in the northern portion. About the same time an area of low pressure was moving eastward over the lower Mississippi valley. The area of high pressure moved rapidly southward and occupied western Texas on the evening of the 31st, with a pressure diminished to 30.28. During its progress southward its gradient was light and the temperature slightly below freezing, except in southern Texas.

AREAS OF LOW PRESSURE.

Eleven areas of low pressure have been defined and their paths traced from the tri-daily telegraphic observations received from the stations controlled by the Canadian Meteorological Office and the United States Signal Service during the month of March. In investigating the many barometric depressions appearing on the tri-daily March maps it was decided to discuss and trace only those areas which displayed decided cyclonic conditions, such as the general inflow of the surrounding air, the apparent movement of the area, and the final appearance of cloud and precipitation. The unavoidable absence of reports from the Pacific coast stations during the last two-thirds of the month prevented the use of the reports from that region in tracing low areas passing over the Pacific coast states. Of the eleven paths defined, seven were first noticed in the country north of Montana and Dakota, two in Colorado, one in northern Texas, and one in southern Dakota. The direction of the paths of the low areas was generally easterly, but a reference to chart i will show an unusual and remarkable diversity of courses pursued. It will be noticed, however, that upon approaching the Atlantic coast the paths have a tendency toward the forty-fifth parallel, off the Gulf of Saint Lawrence. The westerly and then northerly movement of number ii will be noticed as extraordinary, and will be more fully discussed under the proper headings.

The following table will show the latitude and longitude in which the apparent centre of each low area was first and last observed, and average hourly progress it made in travelling the routes described on chart i:

Areas of low pressure.	First observed.			Last observed.			Average progress in miles per hour.
	Date and time.	Lat. N.	Long. W.	Date and time.	Lat. N.	Long. W.	
		° ′	° ′		° ′	° ′	
No. I	1, 7 a. m.	51 00	100 00	2, 10 p. m.	49 00	60 00	43.0
II	2, 3 p. m.	41 00	106 00	7, 10 p. m.	60 00	69 00	16.0
III	6, 3 p. m.	36 00	100 00	7, 10 p. m.	38 00	75 00	43.0
IV	6, 10 p. m.	51 00	119 00	11, 3 p. m.	44 00	62 00	34.0
V	9, 3 p. m.	54 00	114 00	14, 7 a. m.	37 00	70 00	19.0
VI	17, 3 p. m.	49 00	115 00	23, 11 p. m.	49 00	57 00	30.0
VII	19, 7 a. m.	44 00	99 00	21, 3 p. m.	34 00	78 00	22.0
VIII	22, 2 p. m.	53 00	105 00	23, 3 p. m.	49 00	83 00	34.0
IX	23, 7 a. m.	51 00	114 00	25, 10 p. m.	47 00	59 00	42.0
X	24, 3 p. m.	41 00	107 00	29, 3 p. m.	47 00	58 00	23.0
XI	28, 3 p. m.	50 00	113 00	30, 3 p. m.	34 00	74 00	32.0

Average rate of progress, 31 miles per hour.

Referring to chart i, it will be noticed that the apparent centres of the eleven areas of low pressure in moving eastward crossed either southern Manitoba, southern Dakota, or northern Texas on the one hundredth meridian.

The following are brief descriptions of the areas of low pressure traced, with mention of some of the more important meteorological conditions attending them:

I.—The morning reports of the 1st located this area in Manitoba, having a minimum pressure of 29.45, with light winds and some cloudiness. An area of high pressure was central over the northern portion of the Gulf of Mexico, with an isobar of 30.40. The gradient between the two areas was nearly uniform, averaging about one hundred miles to the tenth of an inch. The path pursued by this area was a little south of east, arriving in the Province of Ontairo on the morning of the 2d. It then followed the Saint Lawrence Valley and passed off the coast on the evening of the 2d, with lowest pressure 29.58. No precipitation occurred along its path until it reached the Maritime Provinces, where light snow fell on the 2d. The centre of the area was closely followed by colder northerly winds, becoming fresh and brisk over the Lake region.

II.—The isobar of 29.90 was constructed wholly within the limits of Colorado on the evening of the 2d, while a high area was to the northward in the Saskatchewan Valley, with a pressure of 30.68. During the next forty-eight hours the progress of this area was not more than four hundred miles, and the centre continued within the limits of Colorado, with a gradual decrease in pressure to 29.64. A reference to chart i will show its peculiar path southward, then westward, and finally northward on the evening of the 4th, being apparently attracted toward the British American border by a depression in that vicinity. The evening reports of the 4th indicated that the two depressions had merged into one, and was central just north of Montana, with a pressure of 29.41. At this time a high area was located north of Lake Huron, with a maximum pressure of 30.88. Between the two areas there was a difference of pressure of 1.47, and of temperature, 40°. Severe gales prevailed in Minnesota and Manitoba during the succeeding night. The low area at once started eastward, passing over Manitoba, then southeastward to the New England coast, the central pressure having increased to 30.06. During its progress eastward both the pressure and temperature gradients decreased, and no dangerous winds were reported after leaving Manitoba. Rain or snow prevailed over the entire region east of the Mississippi River.

III.—During the time that number ii was in Manitoba a slight depression was noticed forming in southern Texas. The afternoon reports of the 6th showed an isobar of 29.80 in that region. A high area was located off the coast of South Carolina, with a maximum pressure of about 30.25. The barometer gradient between the two areas was about two hundred and twenty miles for each tenth of an inch pressure. There was no perceptible temperature gradient. Number iii at once started eastward and passed off the Virginia coast on the evening of the 7th. Its course was slightly north of east, and its rate of progress forty-three miles per hour. Heavy rain, with occasional thunder, prevailed in all the states south of Kansas, Missouri, and the Ohio River. The low pressure and temperature gradients continued throughout its course.

IV.—This area of low pressure appeared to be located north of Washington Territory on the evening of the 6th, and extended southeastward, in a trough like shape, to northern Wyoming. By the evening of the 7th it had moved southeastward into western Montana, with the isobar of 29.80 extending into northern Wyoming. It moved rapidly eastward into southeastern Dakota, and then turned southward and reached northern Texas on the afternoon of the 8th. At this point it was bounded by an isobar of 29.80, but the isobar of 29.90 extended from southern Texas to northern Minnesota, indicating a subsidiary low area in Minnesota. It moved eastward from Texas into northern Arkansas, and then directly northeast to Michigan. The subsidiary low joined it at this point. Although the lowest pressure was over Michigan within an isobar of 29.90, yet the isobar for 30.00 extended to the Gulf of Mexico and preserved the trough like condition previously noted. The path pursued by this low area after leaving Michigan was eastward to the vicinity of Montreal, then southward to the coast of New Jersey, joining a low area which had formed over the Chesapeake Bay on the evening of the 9th. It at once changed its course and moved northeastward, disappearing off the coast of Nova Scotia on the evening of the 11th. During its eastward progress after leaving Michigan general rains commenced over the lower lake region and the country east of the

Appalachian range. Brisk and high northerly winds prevailed along its path off the Atlantic coast.

V.—The pressure of 29.75 reported from Calgarry, Northwest Territory, on the afternoon of the 9th indicated a fall of .17 in the past eight hours. During the next forty-eight hours a well defined area of low pressure had moved southeastward to the country just north of Montana, with a minimum pressure of 29.34. During this time dry and warm southerly winds had commenced to prevail over the Rocky Mountain region aud Missouri Valley. A high pressure area was located north of Lake Huron, with a maximum reading of 30.42. The low area first moved rapidly to southern Minnesota, then changing its course to northeastward it appeared over Lake Superior on the evening of the 12th. The central isobar had risen to 29.80, but as a high area had moved from the north into northern Dakota, with a maximum reading of 30.77, the gradient to the westward was quite steep and severe gales prevailed in Dakota and Minnesota. The course travelled by the low area from Lake Superior was directly toward the North Carolina coast, followed by light snow in the Lake region and rain in the middle Atlantic states, and freezing weather throughout the country north of the thirty-fifth parallel. Dangerous winds prevailed in the upper lake region.

The following notes from observers relate to this storm:

Fort Totten, Dak.: high southerly winds prevailed during the afternoon of the 11th. On the 12th the barometer rose rapidly and a violent gale blew from the northwest, maximum velocity sixty-four miles per hour. The observer at Moorhead, Minn., reports light rain with brisk southerly winds on the 11th; on the 12th the wind veered from south to northwest and a gale set in at 11.40 a. m., continuing until 4.50 a. m. of the 13th, maximum velocity, thirty-six miles per hour, at 3 p. m. of the 12th.

Marquette, Mich.: at 1.15 a. m. of the 13th a heavy gale set in from the northwest and continued until 11.46 p. m., blowing at an average rate of twenty-eight miles per hour and reaching a maximum of thirty-nine miles per hour at 5.19 a. m. The gale did considerable damage by blowing down chimneys, telegraph wires, etc. Snow fell during the night of the 13–14th and until 12.30 p. m. of the 14th.

Milwaukee, Wis.: on the 13th a northwesterly gale prevailed from 3.30 a. m. until 2.50 p. m., attaining at 5.20 a. m. a velocity of forty miles per hour. During the storm several houses in course of construction were blown down.

VI.—The afternoon reports of the 16th from northern Montana indicated the approach of a low area from the Northwest. In the evening reports of the 17th, Helena, Mont., reported a pressure of 29.66, with warm southerly winds in the vicinity. The area immediately started southward and reached the Texas coast on the afternoon of the 19th. Light pressure gradients and dry variable winds prevailed along its path during its progress southward. After leaving Texas the area moved eastward to the Georgia coast. Rain prevailed in the Mississippi Valley as far north as Iowa, and eastward to the Atlantic Ocean. The pressure and temperature gradients continued moderate, and only brisk winds were observed in the Gulf States. After leaving the Georgia coast the area moved directly northeast and at once began to develop decided cyclonic conditions, increased precipitation, and dangerous gales. The lowest isobar on the Georgia coast was 29.80. During the progress of the area northward the depression gradually increased until it arrived over the Gulf of Saint Lawrence on the afternoon of the 23d, when it was 28.90. Dangerous gales were reported from Cape Hatteras northward. The maximum velocity of wind (in miles per hour) was: Chincoteague, Va., 50; Sandy Hook, N. J., 52; Block Island, R. I., 48; and at Eastport, Me., 50. During the progress of this cyclone along the New Jersey and New England coasts the pressure gradient ranged between forty and sixty miles to the tenth of an inch pressure.

The following notes from observers relate to this low area:

Block Island, R. I.: on the 22d high easterly winds prevailed during the early morning, shifting to heavy northwest gale in the afternoon; maximum velocity forty-eight miles per hour.

Eastport, Me.: heavy snow began at 2.30 p. m. of the 22d; at 5.20 the precipitation changed to sleet, and at 7.54 to heavy rain. A gale set in at 3.10 p. m. and continued until 10.20 p. m., attaining at 6.45 p. m. a velocity of fifty miles per hour from the east. Rain fell throughout the night of the 22–23d, but changed to snow during the early morning of the 23d.

VII.—When number vi was in northern Texas on the morning of the 19th the major axis ran in a northerly and southerly direction, forming a trough extending to Manitoba. In southern Dakota, and within this trough, a secondary low area was noticed. Subsequent reports increased the gradient between it and the primary area, and it developed all the conditions necessary for a well-defined low area. It at once moved southeastward and joined number vi off the South Carolina coast on the afternoon of the 21st. Light rain or snow prevailed along its path.

VIII.—On the afternoon of the 22d a slight depression was central in western Manitoba. It moved southeastward into Minnesota and then changed its course to northeast and was located north of Lake Superior in the evening of the 23d. At this time another, and more marked, depression was in Dakota, moving southeastward. The following report failed to give sufficient data to locate number viii, and it is believed that it had ceased to be a distinct low area and had joined number ix. During its eastward progress light rains had prevailed in Dakota and Minnesota.

IX.—The morning map of the 23d showed that the pressure north of Montana had fallen to 29.47, with fresh and brisk southerly winds in the vicinity. A high area was located over Utah, with a maximum pressure of 30.36. This low area developed rapidly and moved southeast to Iowa in twenty-four hours, accompanied by brisk and high winds and light snow. The steepness of the gradient to the south and west had increased. Its rapid movement continued, and its course over the lower lakes, New England States, and the Maritime Provinces was made at the rate of forty-two miles per hour. The central depression increased as it approached the Gulf of Saint Lawrence, and on the morning of the 25th it was bounded by the isobar of 29.20. General rain or snow prevailed along its path and severe gales were reported from the Saint Lawrence Valley and the New England coast. The temperature fell rapidly behind this low area, some stations in the Lake region reporting a fall of 20° to 30° in twenty-four hours.

The following notes from observers are of interest in connection with this storm:

Des Moines, Iowa: the mercury fell rapidly in the early morning of the 24th, and during the remainder of the day it rose as rapidly. At 9 a. m. a northwesterly gale set in, attaining at 11 a. m. a velocity of thirty-eight miles per hour. The gale continued until 5 p. m.

Moorhead, Minn.: heavy northerly wind, with snow, began at 12.35 a. m. of the 24th. The gale continued until 10.05 a. m., attaining at 1.15 a. m. a velocity of forty miles per hour.

Vevay, Ind.: the voluntary observer at this place states that high winds prevailed on the 24th, blowing with increased velocity as the day advanced. At 7 a. m. it blew from the west; temperature 36°, rising to 70° at 3 p. m.; during the same time the pressure diminished 0.30.

Columbus, Ohio: on the 24th the pressure fell rapidly until 4.25 p. m., when it commenced to rise. At 4.30 p. m. a southwesterly gale set in and increased in velocity until 8.10 p. m., when it reached its maximum, fifty-one miles per hour. The gale continued until after midnight, and did considerable damage to roofs, fences, and light buildings. In the Hocking Valley, south of the city, a large number of houses were unroofed.

Sandusky, Ohio: a thunder-storm, with heavy rain and high wind, occurred on the afternoon of the 24th; maximum velocity of the wind, fifty miles per hour from the northwest.

Parkersburg, W. Va.: a gale commenced at 6 p. m. of the 24th and continued until 4 a. m. of the 25th. At Marietta considerable damage was done. At Ripley the court house was unroofed by the wind.

Helvetia, W. Va.: the heavy wind storm of the 24th did considerable damage to fencing and trees.

X.—This area of low pressure was first fully defined on the afternoon map of the 24th in Colorado, with lowest pressure at Denver, 29.75. As no reports had been received from the Southwest for several days it is not practicable to state whether or not it originated in Colorado. It at once moved slowly into northwestern Texas, the central pressure gradually decreasing. A high area appeared at this time in Manitoba, the centre bounded by an isobar of 30.50, with a minimum temperature of —19°. The gradients were sufficiently steep to cause strong "northers" in Nebraska and Kansas. The low area moved almost directly northeastward, and arrived off the coast of

Nova Scotia on the afternoon of the 29th, with a minimum pressure of 29.10. After reaching the Mississippi Valley general precipitation set in over the Mississippi and Missouri valleys and all the country to the eastward. Although the barometer gradient was at times quite steep, dangerous winds were only reported along the Atlantic coast north of Cape Hatteras. The temperature fell to the freezing point in all districts, except along the coast of the Gulf of Mexico, seriously injuring the early vegetable crops in the Southern States.

XI.—It was noticed on the afternoon map of the 28th that the temperature had risen 16°, and the pressure had decreased .28 in twenty-four hours in northern Montana. The evening map of the same date permitted an isobar of 29.80 to be drawn, and other conditions appeared favorable to the presence of a moderate cyclone. The low area at once began to move in a southerly direction, arriving in northern Texas in twenty-four hours, with a central isobar of 29.50. A high area was then central in the Ohio Valley, with highest pressure 30.25. The low area changed its direction to an easterly course and passed off the coast of North Carolina on the evening of the 31st. Light rains prevailed over the Gulf States during its progress, with occasional thunder-storms.

NORTH ATLANTIC STORMS DURING MARCH, 1887.

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

The paths of the depressions that have appeared over the north Atlantic Ocean during the month are determined, approximately, from international simultaneous observations furnished by captains of ocean steamships and sailing vessels; abstracts of ships' logs and other data collected by the Signal Service agencies at the ports of New York, Boston, and Philadelphia; reports received through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the proprietors of the "New York Maritime Register," and from other miscellaneous data received at this office up to April 21, 1887.

Eleven depressions are traced, the tracks largely predominating to the southeastward and southward of Newfoundland and Nova Scotia, where their rate of progression was, in general, very slow, and the course of direction greatly diversified. During the first two decades of the month the more important storms which appeared were confined to the western half of the ocean, where deep barometric depressions, accompanied by storms of great violence, followed one another in rapid succession. During this period the barometric pressure over the eastern portion of the ocean remained almost continuously high, with generally settled weather within the region of observation east of the twenty-fifth meridian. During the last decade of the month cyclonic areas traversed the ocean from coast to coast, and the region of greatest storm frequency was included within an area extending from the east of the Banks of Newfoundland to the west coasts of the British Isles.

For March, 1886, ten depressions were traced, the tracks being rather evenly distributed over the ocean, with a general direction of movement from east to northeast. The depressions, as a rule, exhibited great depth and energy, and severe gales and generally unsettled weather prevailed throughout the month.

As compared with the corresponding month of previous years, the weather over the north Atlantic during March, 1887, was unusually severe west of the thirty-fifth meridian, this fact being due rather to the frequency of storms than to their exceptional individual strength.

The following are brief descriptions of the depressions:

1.—The presence of this storm to the southeast of Newfoundland was indicated by reports of the 1st, on which date it was central in about N. 45°, W. 48°, with barometric pressure about 29.50 (749.3). By the 2d the centre of depression had moved southeast to N. 41°, W. 43°, with a marked rise in central pressure, after which it apparently dissipated.

2.—This storm appeared on the 2d to the westward of the position occupied by depression number 1 on that date, having apparently developed to the southward of Newfoundland; passing slowly north of east, the storm-centre is traced to N. 42°, W. 46° by the 3d, and to N. 44°, W. 40° by the 4th, after which it disappeared. This depression, though shallow throughout its course, was accompanied on the 2d by severe storms, relative to which Capt. T. H. Fox, of the s. s. "Istrian," reports: "2d, in N. 41° 56′, W. 51° 0′ (at noon), wind veered to east and rapidly increased to a whole gale, with thick fog and very heavy snow; found it necessary to put the ship's head to the sea and lessen speed; gale continued until noon of the 3d, in N. 41° 59′, W. 48° 53′."

3.—This storm first appeared to the eastward of Newfoundland on the 6th, with central pressure about 29.10 (739.1); during the next four days the depression, shifting its position but slightly, occupied the ocean southeast of the Banks of Newfoundland, with barometric pressure ranging but slightly above 29.00 (736.6). During the 11th and 12th the centre of disturbance circled eastward, and apparently filled up to the northward of the Azores after the latter date. This depression was attended by disturbances of pronounced strength, as is shown by the following special reports:

Capt. A. G. Griffin, of the s. s. "Nederland," reports a whole gale from the 5th to the 7th; wind veered from s. to nw.; lowest barometer, 29.62 (752.3), at midnight of the 5th, in N. 43° 40′, W. 41° 10′. Capt. T. M. Irwin, of the s. s. "Lepanto," reports a whole northerly gale on the 5th and 6th; lowest barometer, 29.52 (749.8), at 4 p. m. of the 5th, in N. 42° 20′, W. 47° 40′. Capt. W. R. Lord, of the s. s. "Critic," reports an easterly hurricane on the 6th; lowest barometer, 29.23 (742.4), at noon, in N. 47° 5′, W. 43° 41′. Capt. H. Parsell, of the s. s. "Adriatic," reports a strong to whole gale on the 7th and 8th; wind backed from se. to ne. and n.; lowest barometer, 29.00 (736.6), at 5 p. m. of the 7th, in N. 45° 47′, W. 43° 7′. During the gale the sea was very confused, being characterized chiefly by a long heavy swell from n. and nnw., meeting a heavy sea from sse., continuing, after the backing of the wind, until midnight, then subsiding quickly. The north swell had no apparent local cause, and it appeared as though the locality steered over had been recently disturbed. Capt. G. Bakker, of the s. s. "W. A. Scholten," reports a storm of hurricane force from n. to nnw.; lowest barometer, 29.34 (745.2), at 12 noon of the 7th, in N. 42° 12′, W. 46° 42′. Oil was used with good effect to keep the heavy waves clear of the ship. Capt. A. Redford, of the s. s. "City of Richmond," reports a whole n. to nnw. gale on the 7th and 8th; lowest barometer, 29.32 (744.7), at 2 a. m. of the 7th, in N. 40° 0′, W. 51° 50′. The s. s. "Critic," having passed through the centre of a cyclone, encountered a very high sea, and laid-to thirty-six hours, in N. 48° 49′, W. 40° 9′. The s. s. "Bedford," Capt. T. Aitkenhead, commanding, in N. 39° 50′, W. 43° 24′ (at noon), had a fierce w. by n. gale, with terrific squalls; at 6 p. m. the wind shifted to n. in a heavy gale, with squalls of hurricane force and dangerous seas, which condition continued until midnight without abatement.

Capt. W. C. Bacon, of the s. s. "Coventry," reports: "8th, in N. 32° 27′, W. 26° 11′ (at noon); heavy squalls from the westward and much rain; barometer fell to 29.45 (748.0), and afterwards rose to 29.55 (750.6), but fell again to 29.25 (742.9) in the evening, with the wind backing to sw. and blowing force 8, with occasional showers." Capt. G. W. Murray, of the s. s. "Sapphire," reports: "9th, in N. 32° 58′, W. 44° 28′ (at noon); 6 hours, tremendous squalls of wind and rain, wsw. gale, incessant, barometer falling rapidly; 13 hours, wind hauled to nw., with rising barometer and terrific breaking seas

from wnw.; after the wind hauled the gale commenced to moderate and the sea to go down." Second Officer Potts, of the s. s. "British Crown," Capt. A. Smith, commanding, reports a fresh easterly gale on the 11th; lowest barometer, 29.39 (746.5), at noon of the 11th, in N. 48° 19′, W. 35° 10′. Capt. G. Meier, of the s. s. "Elbe," reports a whole easterly gale on the 12th and 13th; lowest barometer, 29.47 (748.5), at 4 a. m. of the 12th, in N. 48° 13′, W. 25° 29′.

4.—The presence of this storm to the southward of Nova Scotia was shown by reports of the 7th, and, while strong gales prevailed within its area during that date, the depression was shallow and evidently moved eastward and united with depression number 3 by the 8th.

5.—This depression was a continuation of low area number iv which is traced across the North American continent. Passing southward over Long Island during the early morning of the 10th, the storm circled eastward to N. 39°, W. 58° by the 13th; thence passing eastward of north and disappearing beyond the northern limit of the region of observation after the 14th. This depression had pressure ranging below 29.00 (736.6), and was accompanied by gales, attaining hurricane force. The following special reports refer to disturbances encountered within its area:

Capt. L. W. Hoff, of the s. s. "R. F. Matthews," reports: "10th, while running before an ese. gale the wind suddenly increased to hurricane force and veered to sw. and w., with increasing strength; when the wind shifted the sky cleared for about two hours; lowest barometer, 28.62 (726.9), at 10.20 p. m. of the 19th, in N. 40° 12′, W. 65° 45′. Capt. H. Parsell, of the s. s. "Adriatic," reports a whole gale on the 10th and 11th; wind backed from ese. to nw.; lowest barometer, 29.27 (743.4), at 7 p. m. of the 10th, in N. 40° 52′, W. 67° 15′. Capt. D. T. Pedersen, of the bark "Matthanja," reports: "10th, in in N. 36° 48′, W. 65° 49′ (at noon); hard gale commenced, and by 4 p. m. it was blowing a heavy storm from se. The sea was heavy and from the same direction, and heavy rain fell; 12 midnight, storm went to sw. 11th, 4 a. m., storm veered to w.; ship running ese. against a heavy sea. During the 12th the storm attained a fearful force, and continued until midnight of the 13th, in N. 35°, W. 53°." The s. s. "Gwendoline," Capt. Robert Milburn, commanding, on the 10th, in N. 38° 50′, W. 71° 30′ (at noon), passed through the centre of the cyclone at 3 p. m., and encountered very heavy weather during the next two days.

Capt. M. Fitt, of the s. s. "Virginian," reports a whole gale on the 11th; wind backed from ene. to nnw.; lowest barometer, 29.24 (742.7), at 7.52 a. m., in N. 42° 33′, W. 64° 54′. The gale was accompanied by heavy snow and high seas throughout, and sleet at intervals. Capt. D. Williams, of the s. s. "Roman," reports a whole gale on the 11th; wind backed from e. to n.; lowest barometer, 29.30 (744.2), at noon, in N. 42° 7′, W. 65° 47′. The gale was attended by violent squalls, terrific seas, and heavy snow. Capt. A. G. Griffin, of the s. s. "Nederland," reports a whole gale on the 11th and 12th; wind veered from e. to se. and backed to ene., n., and nw.; lowest barometer, 28.99 (736.6), on the evening of the 11th, in N. 40° 30′, W. 66° 40′, Capt. W. McMickan, of the s. s. "Umbria," reports a strong gale on the 11th and 12th; wind veered from se. to nw.; lowest barometer, 28.83 (732.3), at 4 a. m. of the 12th, in N. 41° 0′, W. 62° 30′. Capt. F. Archer, of the s. s. "Tower Hill," reports: "13th, 19 hours 12 minutes, in N. 43° 49′, W. 47° 50′, lowest barometer, 29.06 (738.1), with heavy sw. swell, followed by moderate sw. to w. winds."

6.—This storm was a continuation of low area number v which first appeared over the North American continent and passed eastward off the coast in about N. 36° during the early morning of the 14th; thence moving slowly northward, the depression disappeared over mid-ocean after the 18th. The disturbances accompanying this very deep depression were exceptionally severe in their character, as is shown by the following special reports of shipmasters:

Capt. H. Supmer, of the s. s. "Donau," reports a gale on the 14th and 15th; wind backed from nne. to nw.; lowest barometer, 29.00 (736.6), at 4 a. m. of the 15th, in N. 39° 18′, W. 67° 11′. Capt. S. Nowell, of the s. s. "British Prince," reports a gale on the 14th and 15th; wind backed from ne. to nw.; lowest barometer, 29.29 (744.0), from 2 to 4 a. m. of the 15th, in N. 39° 29′, W. 68° 25′. The s. s. "British Crown" had an ene. gale on the 16th; lowest barometer, 28.70 (729.0), at 2 a. m., when fifteen miles south of Sable Island. Capt. W. Tyson, of the s. s. "Holland," reports a strong gale from the 15th to 17th; wind veered from se. to nw.; lowest barometer, 28.56 (725.4), at 4 a. m. of the 16th, in N. 41° 40′, W. 59°, 0′. Capt. W. Kuhlewein, of the s. s. "Gellert," reports a strong sw. to nw. gale during the 16th and 17th; lowest barometer, 28.96 (735.6), at 11 a. m. of the 16th, in N. 41° 30′, W. 55° 10′. Capt. J. Brown, of the s. s. "Alsatia," reports a strong westerly gale on the 16th; lowest barometer, 28.58 (725.9), at 3 a. m., in N. 40° 20′, W. 59° 50′.

Mr. J. W. Mitchell, observer on the s. s. "Queen," Capt. J. Milligan, commanding, reports: "17th, in N. 44° 10′, W. 45° 20′, at 4.12 p. m. the weather was threatening, with every appearance of an approaching storm, the barometer fell rapidly, with sw. wind, rain, high sea, and frequent lightning; from 8 p. m. to midnight the barometer fell from 29.22 (742.2) to 28.64 (727.4); the wind during that time was blowing with hurricane force, with very heavy rain; at 1 a. m. of the 18th the wind shifted in a remarkable squall to nw. and blew steadily for three hours, when it gradually moderated, the barometer rising between 1 and 3.30 p. m. from 28.64 (727.4) to 29.40 (746.7), and after this rising in an ordinary manner; position at noon of the 18th, N. 42° 50′, W. 50° 3′." Capt. G. Franck, of the s. s. "Australia," reports a n. to w. storm on the 17th; lowest barometer, 28.76 (730.5), at noon, in N. 41° 1′, W. 54° 26′. Capt. E. Franguel, of the s. s. "La Bourgogne," reports a gale attaining hurricane force on the 17th; wind veered from s. to wnw.; lowest barometer, 28.67 (728.2), at 3 p. m., in N. 42° 0′, W. 53° 0′. Third Officer C. A. Ledder, of the s. s. "Waesland," Capt. J. Ueberweg, commanding, reports: "18th, in N. 44° 43′, W. 38° 22′, at 3 p. m., barometer 29.30 (744.2), fresh gale commenced, lasting six hours, attended by very heavy squalls and rain; a tremendous sea continued until midnight, when wind and sea moderated; wind during gale from w. and wnw."

7.—This storm apparently advanced from the southwestward to N. 40°, W. 56° on the 18th, whence it moved northeast and disappeared to the northward of the Banks of Newfoundland, in which region its centre cannot be located, owing to an absence of reports. In the position above cited the depression had central pressure ranging below 29.00 (736.6), and was attended by hard gales and rain, which prevailed over a considerable area.

The following special reports have been rendered relative to this depression:

Capt. W. A. Freethy, of the s. s. "Jeanie," reports a whole westerly gale on the 17th and 18th; lowest barometer, 29.30 (744.2), in N. 32° 50′, W. 70° 11′. Capt. T. Burley, of the s. s. "Clement," reports a fresh gale from the 17th to the 20th; wind veered from sw. by s. to nw. by n.; lowest barometer, 29.38 (746.2), at 2.30 p. m. of 17th, in N. 32° 5′, W. 68° 45′. Capt. R. Milburn, of the s. s. "Gwendolin,", reports a hurricane on the 17th; wind veered from sse. to nw.; lowest barometer at noon, in N. 39° 42′, W. 53° 10′. Capt. W. Gleig, of the s. s. "Kansas," reports a fresh gale on the 19th; wind veered from sse. to wnw.; lowest barometer, 29.01, (736.8), at midnight, in N. 42° 40′, W. 45° 20′.

8.—This storm was central on the 20th in N. 48°, W. 39°, with central pressure about 28.80 (731.5), and, while it was probably a continuation of number 7, an absence of reports from the intervening territory will not justify the uniting of their tracks on the chart. By the 21st the centre of depression had passed rapidly east-northeast to N. 52°, W. 18°, with slight changes in central pressure, thence passing northeast beyond the region of observation. This was the first depression for the month that is traced eastward of the thirtieth

meridian; in advance of its passage the area of high barometer which occupied the eastern half of the ocean gave way, and for the balance of the month the storms are, as a rule, traced to the vicinity of the British Isles.

The following reports show the general character of the disturbances encountered during the passage of this depression:

Captain Barends, of the s. s. "Lessing," reports: "20th, in N. 46° 10′, W. 38° 50′, at noon; at 12.30 p. m. the wind veered from wsw. to nw., and increased very rapidly to force 11, the barometer being down to 28.69 (728.7), and afterwards rising rapidly, with wind decreasing slowly to fresh gale by 6.30 p. m., and changing from nw. to nnw. and back again." Third Officer W. H. Logan, of the s. s. "Istrian," Capt. T. H. Fox, commanding, reports: "19th, strong gale from sse., with very high and confused sea. 20th, in N. 51° 38′, W. 26° 49′, at noon; at 6 a. m. the wind moderated, but the sea was getting more confused and the ship rolled and labored heavily; at 4 p. m. the wind had fallen to a fresh breeze, but a tremendous sea was running from all quarters; at 10 p. m. the wind shifted suddenly to westward and blew with hurricane force for about two hours, after which it settled into a heavy gale with mountainous seas until 6 a. m. of the 21st; lowest barometer, 28.68 (728.5), at midnight of the 20th, in N. 50° 16′, W. 28° 37′."

Capt. A. W. Lewis, of the s. s. "City of Chester," reports a whole gale, westerly, on the 20th; lowest barometer, 28.86 (733.0), at 10 a. m., in N. 45° 30′, W. 37° 40′. Capt. G. Cochrane, of the s. s. "Helvetia," reports a whole s. to nnw. gale on the 20th; lowest barometer, 28.61 (726.7), at 10.10 a. m., in N. 45° 30′, W. 38° 0′. Capt. H. Richter, of the s. s. "Saale," reports a whole sw. to nw. gale on the 20th and 21st; lowest barometer, 28.57 (725.7), at 5 p. m. of the 20th, in N. 47° 36′, W. 29° 45′. Capt. P. J. Irving, of the s. s. "Republic," reports a fresh gale on the 19th and 20th; wind veered from se. to nw.; lowest barometer, 28.83 (732.3), at noon of the 20th, in N. 48° 8′, W. 33° 59′. Capt. W. Janes, of the s. s. "Warwick," reports a storm on the 19th and 20th; wind veered from sse. to s.; lowest barometer, 28.70 (729.0), at 2.30 a. m. of the 20th, in N. 44° 56′, W. 44° 25′.

Capt. J. Wilson, of the s. s. "Ethiopia," reports a whole gale from the 19th to the 22d; wind veered from sse. to sw.; lowest barometer, 28.36 (720.3), at midnight of the 20th–21st, in N. 53° 30′, W. 22° 30′. Capt. J. Schade, of the s. s. "Polaria," reports a whole gale on the 21st and 22d; wind veered from ssw. to nw.; lowest barometer, 28.95 (735.3), at 2 p. m. of the 21st, in N. 50° 21′. W. 15° 20′. Capt. M. de Jousselin, of the s. s. "La Bretagne," reports a storm on the 21st; wind veered from se. to wnw.; lowest barometer, 28.79 (731.3), at 6 a. m., in N. 49° 25′, W. 19° 0′. Captain Schuldt, of the s. s. "Grasbrook," reports a whole gale on the 20th and 21st; wind veered from s. to nw.; lowest barometer, 28.72 (729.5), at 5 a. m. of the 21st, in N. 49° 55′, W. 21° 26′. Capt. W. Skjodt, of the s. s. "Island," reports a westerly storm on the 22d and 23d; lowest barometer, 29.40 (746.7), at midnight of the 22d, in N. 59° 30′, W. 1° 40′.

9.—This depression first appeared in N. 42°, W. 55° on the 20th, with central pressure about 29.40 (746.7), whence it had apparently advanced from the westward; from this position the storm-centre moved east to the forty-eighth meridian by the 21st, where minimum pressure about 29.20 (741.7) was shown; thence passing rapidly north of east the depression is charted under date of the 22d in N. 46°, W. 29°, with slight changes in barometric pressure; by the 23d the storm-centre had moved rapidly northeast to about N. 58°, W. 15°, without an appreciable loss of energy, after which it disappeared beyond the region of observation.

The following special reports refer to this storm:

Capt. J. B. Watt, of the s. s. "Samaria," reports a strong e. to nne. gale on the 21st and 22d; lowest barometer, 29.04 (737.6), at midnight of the 21st, in N. 44° 30′, W. 43° 50′. Capt. T. Jungst, of the s. s. "Ems," reports a sw. to nw. storm or hurricane on the 20th and 21st; lowest barometer, 28.77 (730.7), at 4 a. m. of the 21st, in N. 44° 34′, W. 43° 10′. Capt. S. T. H. Laub, of the s. s. "Thingvalla," reports a hurricane on the 22d and 23d; wind veered from sse. to nnw.; lowest barometer, 28.79 (731.3), from 1 to 2 a. m. of the 23d, in N. 56° 40′, W. 18° 10′. Capt. J. Bentley, of the s. s. "Austrian," reports a whole westerly gale on the 24th; lowest barometer, 29.13 (739.9), at noon, in N. 55° 33′, W. 7° 48′.

10.—This storm was a continuation of land depression number vi which passed northeastward along the coast and over the Maritime Provinces during the 22d and 23d, accompanied by severe gales over the ocean to the southward of Newfoundland and Nova Scotia. During the early morning of the 24th the depression passed eastward from the northern extremity of Newfoundland, whence it is given a probable east-northeast track to the northwestward of the British Isles by the 26th. This storm, while evidently possessing considerable depth, passed too far to the northward to be seriously felt over, and to the southward of, the trans-Atlantic tracks.

11.—This storm appeared over mid-ocean, in N. 50°, on the 28th, thence moving slowly east-southeast to N. 48° W. 23° by the 29th, after which it filled up. The depression was slight and its passage was unattended by noteworthy features.

During the last five days of the month severe disturbances were encountered off the eastern coast of the United States and over the Gulf of Mexico, attending the passage over the United States of low areas numbers x and xi. From special reports received relative to these disturbances, it would appear, that in instances, they were due to the development of subsidiary depressions in the second or southeast quadrant of the principal low areas referred to.

OCEAN ICE.

On chart i are also exhibited the limits within which icebergs and field ice were reported during March, 1887. These limits are determined from reports furnished by shipmasters, and from data collected by the Signal Service agencies.

During this month the easternmost icebergs reported were passed on the 4th, in N. 45° 31′, W. 42° 56′, by the s. s. "Shakspere." From this position an area in which no ice was reported during the month extended westward over the Banks of Newfoundland. Between the forty-first and forty-fifth parallels, and from W. 46° to W. 51°, ice was observed in large quantities throughout the month. From the 20th to the 24th icebergs and extensive ice-fields were encountered along the coast of Newfoundland in the vicinity of Saint John's and Cape Race, and on the 20th a field of ice passed to the southward of Sable Island. Advices from Ottawa, under date of the 22d, stated that the Gulf of Saint Lawrence was filled with closely packed ice, except off Cape Rozier. Mr. J. Higgins, observer at Saint John's, Newfoundland, reports that heavy ice jammed in on the land on the 11th, 15th, 16th, 19th, 20th, 21st, and 23d, driving off fast during the 24th.

Compared with the chart for the preceding month, February, 1887, the eastern and southern limits of the ice-region have contracted slightly, while the movement of ice along the east coast of Newfoundland has very largely increased.

Compared with the corresponding month of previous years, the southward movement of Arctic ice during March, 1887, was unusually large, and, as compared with the ice reported during March, 1886, the quantity was vastly in excess.

The following table shows the southern and eastern limits of the region within which ice was reported for March during the last six years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Lon. W.	Month.	Lat. N.	Lon. W.
	° ′	° ′		° ′	° ′
March, 1882	42 30	50 00	March, 1882	46 30	46 00
March, 1883	41 46	49 48	March, 1883	48 40	43 03
March, 1884	41 20	54 06	March, 1884	45 00	40 15
March, 1885	40 55	49 04	March, 1885	45 57	43 15
March, 1886	40 20	49 02	March, 1886	47 20	44 40
March, 1887	41 00	49 07	March, 1887	45 31	42 56

Icebergs and field ice were reported as follows:

1st.—The s. s. "Jersey City," in N. 44° 06′, W. 48° 10′, at noon, passed to the southward of an ice floe. The s. s. "Principia," in N. 44° 0′, W. 48° 30′, passed an iceberg one hundred feet high. The s. s. "Crystal," in N. 47° 15′, W. 43° 35′, at 1.30 p. m., passed a medium-sized berg.

2d.—The s. s. "Viola," in N. 44° 5′, W. 47° 41′, at 10 a. m., passed an iceberg about two hundred feet high. The s. s. "Catalonia," in N. 43° 35′, W. 48° 31′, at 4 p. m., passed an iceberg one hundred and fifty feet high. The s. s. "Crystal," in N. 45° 20′, W. 47° 45′, at 3 p. m., encountered heavy field ice and steered s. and sw. to clear it; saw four large bergs in it, and passed the southern edge of the pack on the 3d, at 10 a. m., in N. 43° 0′, W. 49° 30′.

3d.—The s. s. "California," in N. 43° 7′, W. 49° 23′, passed large fields of field ice from 6.30 p. m. to 9.25 p. m. The s. s. "La Gascogne," in N. 43° 2′, W. 49° 10′, at 4 p. m., passed several icebergs and field ice. The s. s. "Suevia," in N. 43° 5′, W. 49° 23′ passed some field ice. The s. s. "Etna," in N. 44° 20′, W. 48° 25′, encountered heavy field ice, and steamed southerly fifteen hours to clear it. The s. s. "Bristol," in N. 46° 15′, W. 45° 0′, passed two large icebergs.

4th.—The s. s. "Devonia," in N. 43° 37′, W. 48° 30′, at 4.42 p. m., passed icebergs, and at 11.30 p. m., in N. 42° 30′, W. 50° 20′ passed field ice. The s. s. "Arizona," in N. 42° 56′, W. 49° 30′, passed the southern edge of heavy field ice, extending north as far as could be seen from the masthead. The s. s. "Zaandam," from N. 44° 0′, W. 48° 30′, to N. 43° 0′, W. 49° 30′, saw several medium-sized icebergs and passed through two ice fields. The s. s. "Bristol," in N. 44° 25′, W. 48° 36′, passed enormous quantities of field ice. The s. s. "Shakspere," in N. 45° 31′, W. 42° 56′, passed two large icebergs.

5th.—the s. s. "Germania," in N. 48° 9′, W. 46° 12′, encountered heavy field ice, interspersed with icebergs, through which she, with difficulty, forced her way southward and southwestward during the next four days, sustaining considerable damage from heavy ice. The bark "Scotland," at 2 a. m. of March 5th, in N. 42° 40′, W. 49° 30′, passed a great number of icebergs; while endeavoring to clear them she ran into a huge pack of drift ice. Twelve hours were spent in clearing the floe.

6th.—The s. s. "Shakspere," in N. 43° 19′, W. 49° 0′, in early a. m., ran into field ice, and put back until daylight; at 9 a. m. sighted numerous icebergs and much field ice.

7th.—The s. s. "Scandinavian," in N. 43° 0′, W. 48° 42′, at 8 p. m. passed an iceberg, and at 10.30 p. m. saw another.

8th.—The s. s. "Pavonia" passed icebergs in N. 41° 59′, W. 48° 34′, N. 41° 47′, W. 48° 52′, and N. 41° 52′, W. 48° 58′. The s. s. "Adriatic," from N. 43° 48′, W. 48° 9′ to N. 43° 40′, W. 48° 49′, passed three small icebergs and one ice floe. The s. s. "Virginian," in N. 44° 0′, W. 46° 20′, at 7.30 a. m., passed an iceberg, and in N. 43° 0′, W. 48° 30′ passed three large bergs. The s. s. "Nederland," in N. 41° 43′, W. 50° 40′, at 5 p. m., passed two icebergs.

9th.—The s. s. "Elbe," in N. 42° 18′, W. 48° 39′, at 4 a. m., passed an iceberg.

10th.—The s. s. "Nessmore," in N. 47° 10′, W. 49° 0′, passed four large and two small bergs. The s. s. "Marengo," in N. 44° 35′, W. 46° 53′, passed an iceberg of moderate size. The s. s. "Erin," in 44° 28′, W. 46° 6′, passed an iceberg, and in N. 43° 19′, W. 48° 25′, passed a small iceberg and several pieces of ice. The s. s. "Ems," in N. 44° 30′, W. 46° 9′, at 5.10 a. m., passed a large iceberg. The s. s. "Umbria," between N. 41° 50′, W. 47° 50′, and N. 41° 24′, W. 48° 50′, from 8 a. m. to 10 a. m., passed several icebergs. The s. s. "Elbe," in N. 43° 14′, W. 45° 24′, at 2.30 p. m., passed an iceberg.

11th.—The s. s. "British Prince" passed a large iceberg in N. 41° 44′, W. 50° 2′, and a small berg in N. 41° 28′, W. 50° 16′. The s. s. "Marengo," in N. 43° 15′, W. 49° 0′, passed an iceberg, and in N. 42° 45′, W. 50° 30′, passed a berg about two hundred feet high and several hundred feet long. The s. s. "City of Newcastle," in N. 41° 50′, W. 50° 40′, passed icebergs. The s. s. "Moravia," in N. 42° 0′, W. 47° 48′, at 6 p. m., passed one iceberg one hundred feet high and several small ones. The s. s. "Hartville," at 9 p. m., in N. 43° 20′, W. 47°, collided with a large iceberg and sustained damage.

12th.—The s. s. "State of Nevada" passed a large iceberg in N. 43° 10′, W. 47° 7′, and one in N. 42° 31′, W. 48° 19′. The s. s. "Eider," in N. 40° 43′, W. 48° 46′, at 7.45 a. m., passed a large iceberg. The s. s. "Alsatia," in N. 41° 15′, W. 47° 50′, at 11.30 p. m., passed two icebergs. The s. s. "Belgravia," in N. 42° 10′, W. 47° 44′, at 1.30 p. m., passed an iceberg. The s. s. "Donau," in N. 41° 58′, W. 48° 21′, from 1.30 to 2 a. m., passed icebergs.

13th.—The s. s. "State of Nevada" passed three small icebergs in N. 42° 6′, W. 50° 11′, and a moderate-sized berg in N. 42° 6′, W. 50° 43′. The s. s. "Alsatia," in N. 41° 14′, W. 48° 17′, at 2 a. m., passed between three icebergs, and in N. 41° 0′, W. 49° 7′, at 6 a. m., passed north of two large icebergs. The s. s. "Toronto," in N. 44° 30′, W. 47° 23′, at 7.45 a. m., and in N. 44° 05′, W. 48° 45′, at 2.15 p. m., encountered field ice. The s. s. "British Crown," in N. 45° 20′, W. 49° 10′, from 2 p. m. to 5 p. m., passed icebergs. The s. s. "Holland" encountered icebergs in N. 43° 52′, W. 46° 57′ at 8 a. m., in N. 43° 28′, W. 47° 57′ at 2 p. m., and in N. 43° 18′, W. 48° 26′ at 4.35 p. m.

14th.—The s. s. "Slavonia," in N. 43° 13′, W. 46° 13′, passed icebergs. The s. s. "Borderer," in N. 43° 29′, W. 48° 4′, at 7 a. m., passed a large iceberg and several small pieces, and at 4 p. m. passed a large iceberg in N. 43° 0′, W. 49° 20′.

15th.—The s. s. "Slavonia," from N. 42° 56′, W. 48° 10′ to N. 43° 16, W. 49° 50′, passed eleven icebergs and field ice; and in N. 43° 07′, W. 49° 52′, passed an iceberg. The s. s. "Australia," in N. 43° 10′, W. 49° 52′, passed an iceberg. The s. s. "Australia," in N. 43° 10′, W. 47° 04′, passed nine icebergs, three of them being each about one hundred feet in height. The s. s. "Gellert" passed icebergs, as follows: in N. 41° 59′, W 47° 19′, one about fifty feet high and four hundred feet long; in N. 41° 32′, W. 47° 44′, one about one hundred feet high; in N. 41° 13′, W. 47° 50′, one. The s. s. "Britannic" sighted and passed icebergs and field ice from N. 43° 32′, W. 48° 29′ to N. 43° 2′, W. 50° 1′. The s. s. "Trave," from N. 41° 48′, W. 56° 40′ to N. 42° 26′, W. 50° 49′, passed fourteen small bergs.

16th.—The s. s. "Island," in N. 43° 0′, W. 47° 0′, passed several small icebergs. The s. s. "Bavarian," in N. 42° 48′, W. 49° 28′, at 6.45 a. m., and in N. 42° 52′, W. 49° 56′, at 10 a. m., passed large bergs. The s. s. "Concordia," in N. 42° 40′, W. 51° 12′, passed two large bergs.

17th.—The s. s. "Circassia," in N. 43° 12′, W. 47° 27′, passed icebergs. The s. s. "La Bourgogne," in N. 42° 40′, W. 49° 2′, at 2 a. m., passed an iceberg. The s. s. "Wingates," in N. 48° 40′, W. 47° 30′, passed a large berg.

18th and 19th.—The s. s. "Wingates" passed heavy field ice and several bergs between N. 47° 05′, W. 49° 0′ and N. 46° 12′, W. 51° 0′.

19th.—The s. s. "Ems," in N. 42° 22′, W. 49° 28′, at 9.30 a. m., passed an iceberg.

20th.—The s. s. "Wingates," in N. 45° 05′, W. 53° 30′, passed a large berg. The fishing schooner "Frank A. Williams" encountered a field of ice at night while lying-to about twenty miles southeast of Sable Island. The ice came down on the vessel with great rapidity, and by morning she was completely blocked. The ice began to break up a few hours after daylight of the 21st, and the schooner was liberated, after having received such injuries as to cause her to leak.

21st.—The s. s. "Warwick" passed icebergs in N. 42° 43′, W. 49° 35′; N. 42° 30′, W. 50° 3′, and N. 42° 30′, W. 50° 10′.

22d.—The s. s. "Lessing," in N. 42° 9′, W. 51° 55′, at 9.40 a. m., passed a large iceberg about one hundred and fifty feet high, and a small berg at 10.05 a. m., in N. 42° 8′, W. 52° 0′. The s. s. "Republic," from 2.30 to 4.30 p. m., between N. 43° and N. 43° 30′ and W. 49° and W. 50°, passed icebergs; air temperature, 34°; water temperature, 30°.

23d.—The s. s. "Helvetia" passed icebergs in N. 42° 36′, W. 48° 21′, at 2 a. m.; in N. 42° 28′, W. 49° 6′, at 7 a. m.;

and in N. 42° 17′, W. 49° 55′, at 10.30 a. m. Reports received from Newfoundland stated that the coast around Saint John's was packed with ice, and that vessels ready for sea were unable to proceed. The steamer "Newfoundland" was to have sailed on the 22d for Halifax, but had not been able to leave up to the evening of the 23d. A cable dispatch received stated that it was expected that the block would be broken up sufficiently by night to allow vessels to sail.

24th.—The s. s. "Etruria," in N. 42° 38′, W. 48° 40′, at 2.15 p. m., passed a medium sized iceberg, and at 3.15 p. m., in N. 42° 24′, W. 49° 0′, passed an iceberg. The s. s. "Carthagenian," in N. 42° 16′, W. 51° 08′, passed a large berg. The steamship "Newfoundland" encountered a tremendous ice-field off Cape Race on the night of the 24th, and had to remain on the edge of it until the following morning, when she passed through, the passage taking three hours. Her bow was damaged by ice. On the 25th vessels were seen on the outer edge, being unable to continue on their way.

25th.—The s. s. "Istrian," in N. 44° 0′, W. 49° 15′, at 1 p. m., passed icebergs. The s. s. "Jan Breydel," in N. 43° 30′, W. 49° 20′, passed two bergs.

26th.—The s. s. "Llandaff City," in N. 42° 54′, W. 50° 37′, passed two large bergs. The s. s. "Prussian," in N. 42°, 36′, W. 48° 30′, passed a small berg. The s. s. "Polaria," in N. 42° 40′, W. 50° 56′, passed quantities of drift ice.

27th.—The s. s. "Dominion," in N. 43° 30′, W. 49° 0′, passed three large bergs.

FOG.

In each of the instances wherein fog was encountered in the vicinity of the Banks of Newfoundland, or along the southern margin of the ice-field, the vessel was either within the area of a barometric depression in close proximity to its centre, or to the eastward of an advancing depression whose approach had occasioned continued winds from the southern quadrants. It is observable, therefore, in this connection, that the conditions which appeared favorable for fog development in this region during March, 1887, corresponded with those noted for preceding months.

The following are the limits of fog-areas on the north Atlantic Ocean during March, 1886, as reported by shipmasters:

Dates.	Vessel.	Entered.		Cleared.	
		Lat.N.	Lon.W.	Lat.N.	Lon.W.
		° ′	° ′	° ′	° ′
2d	Bk. Josephine	40 56	69 08, 1.20 p. m.	41 07	69 08, 3.00 p. m.
5th	S. S. California	42 06	56 30, 1.00 a. m.	42 30	59 30, 11.00 p. m.
6th	Bg. Edward D	38 34	72 18, 1.00 a. m.		
6th	S. S. Rotterdam	40 28	70 46	40 28	69 36
6th	S. S. Rotterdam	40 28	69 18	40 28	69 00
8th	Bg. Edward D			39 00	73 58, midnight.
10th	S. S. Erin	43 50	47 15	43 36	48 33
11th	S. S. Erin	43 00	50 30	42 55	51 15
12–14th.	Dense fog prevailed at Saint John's, N. F.				
13th	S. S. British Crown	45 37	47 30		
13th	S. S. Norseman	43 20	48 36, 12.30 to 12.44 a. m.		
13th	S. S. Norseman	42 38	53 00, 9.30 to 11.25 p. m.		
14th	S. S. Borderer	43 29	48 14, 8.00 a. m.	43 00	49 25, 4.30 p. m.
15th	S. S. British Crown			44 00	57 00
16th	S. S. Bavarian	42 48	49 25, 4.30 a. m.	42 52	49 56, 10.00 a. m.
19–20th.	S. S. Adriatic	42 06	48 40	42 23	47 59

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

The distribution of mean temperature over the United States and Canada for March, 1887, is exhibited on chart ii by the 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, and in the figures above the geographical districts, the average temperature and departure for each district. The normal for any district may be found by adding the departure to the current mean for the district when the departure is below the normal, and subtracting when above. On chart iv the departures from the normal are illustrated by lines connecting stations of normal or equal abnormal values.

The temperature of the month is below the normal in all states bordering on the Lakes and Atlantic Ocean, along the coast of the east Gulf states, and in southern Texas. The departures in these districts are nowhere very large, the greatest occur in the Lake region, where they average about 3°.0 below the normal. In Tennessee, Kentucky, southern Illinois, and from the Mississippi River westward to the Pacific Ocean, the temperature is above the normal, slightly along the eastern slope of the Rocky Mountains and Pacific coast, and considerably in the plateau regions. The month was remarkable for the extremely low temperatures that prevailed in the Southern States and Ohio Valley on the 28–30th, the minimum temperature in these districts occurring on the 29th.

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

Above normal.	°	Below normal.	°
Pike's Peak, Colo	7.2	Marquette, Mich	4.7
Prescott, Ariz	7.1	Oswego, N. Y	4.7
Denver, Colo	6.6	Albany, N. Y	4.0
Fort Grant, Ariz	6.4	Baltimore, Md	4.0
Helena, Mont	6.4	Sandusky, Ohio	3.8
Fort Maginnis, Mont	5.9	Alpena, Mich	3.6

RANGES OF TEMPERATURE.

The monthly, and the greatest and least daily, ranges of temperature, are given in the table of miscellaneous meteorological data.

The following are some of the greatest and least monthly ranges at Signal Service stations:

Greatest.	°	Least.	°
Yankton, Dak	79.0	Tatoosh Island, Wash	21.6
Valentine, Nebr	78.9	Key West, Fla	23.2
Fort Assinaboine, Mont	74.9	Port Angeles, Wash	29.6
Fort Totten, Dak	74.7	Philadelphia, Pa	31.5
Fort Custer, Mont	73.9	San Francisco, Cal	33.0
Huron, Dak	72.2	New York City	33.3

DEVIATIONS FROM NORMAL TEMPERATURES.

In the table below are given, for certain stations, as reported by voluntary observers, the normal temperatures of March for a series of years, the mean temperature for March, 1887, and the departures from the normal:

Station.	County.	Normal temperature for March.	Number of years.	Mean temperature for Mar., 1887.	Departure.
		°		°	°
Arkansas.					
Lead Hill	Boone	48.4	5	51.4	+ 3.0
California.					
Sacramento	Sacramento	54.6	21	54.2	— 0.4
Connecticut.					
Middletown *	Middlesex	33.3	29	30.3	— 3.0
New Haven *	New Haven	35.8	101	31.3	— 4.5
Waterbury *	New Haven	33.4	12	28.0	— 5.4
Florida.					
Archer	Alachua	59.8	4	55.3	— 4.5
Illinois.					
Collinsville	Madison	41.9	8	44.6	+ 2.7
Mattoon	Coles	38.0	7	41.0	+ 3.0
Peoria	Peoria	38.3	31	38.9	+ 0.6
Riley	McHenry	30.0	26	28.8	— 1.2
Sandwich	De Kalb	34.2	35	34.4	+ 0.2
Sycamore	De Kalb	31.4	6	30.4	— 1.0
Indiana.					
Lafayette	Tippecanoe	36.2	8	37.6	+ 1.4
Logansport	Cass	41.1	33	37.2	— 3.9
Vevay	Switzerland	42.8	21	42.9	+ 0.1
Iowa.					
Monticello	Jones	32.1	34	32.0	— 0.1
Muscatine	Muscatine	34.4	49	34.4	0.0

Deviations from normal temperatures—Continued.

Station.	County.	Normal temperature for March.	Number of years.	Mean temperature for Mar., 1887.	Departure.
		°		°	°
Kansas.					
Independence	Montgomery	45.1	16	48.4	+ 3.3
Lawrence	Douglas	41.5	19	43.4	+ 1.9
Wellington	Sumner	43.7	9	48.8	+ 5.1
Louisiana.					
Grand Coteau	Saint Landry	64.8	4	64.9	+ 0.1
Maine.					
Belfast *	Waldo	29.8	28	28.1	— 1.7
Cornish	York	28.2	30	26.2	— 2.0
Gardiner *	Kennebec	29.4	51	27.5	— 1.9
Orono *	Penobscot	26.8	19	25.9	— 0.9
Maryland.					
Cumberland	Alleghany	37.4	15	34.9	— 2.5
Fallston	Harford	38.2	16	34.6	— 3.6
Massachusetts.					
Amherst*	Hampshire	32.6	50	30.7	— 1.9
Cambridge *	Middlesex	33.9	65	30.1	— 3.8
Fitchburg *	Worcester	30.4	31	27.5	— 2.9
New Bedford *	Bristol	34.9	75	31.4	— 3.5
Somerset	Bristol	34.0	17	33.0	— 1.0
Springfield *	Hampden	32.6	20	30.4	— 2.2
Taunton *	Bristol	35.1	16	31.8	— 3.3
Williamstown *	Berkshire	30.3	33	25.3	— 5.0
Nevada.					
Carson City	Ormsby	40.9	8	46.4	+ 5.5
New Hampshire.					
Concord *	Merrimac	30.8	19	28.2	— 2.6
Hanover *	Grafton	27.2	27	26.7	— 0.5
New Jersey.					
Dover	Morris	31.5	4	29.6	— 1.9
South Orange	Essex	35.8	17	33.4	— 2.4
New York.					
Factoryville	Tioga	33.9	5	31.4	— 2.5
North Volney	Oswego	28.0	20	24.9	— 3.1
Palermo	Oswego	23.0	33	23.0	0.0
Ohio.					
Wauseon	Fulton	32.4	17	31.5	— 0.9
Pennsylvania.					
Dyberry	Wayne	28.9	23	25.7	— 3.2
Grampian Hills	Clearfield	29.1	17	29.5	+ 0.4
Wellsborough	Tioga	33.6	10	30.7	— 2.9
South Carolina.					
Stateburg	Sumter	53.2	7	51.9	— 1.3
Texas.					
New Ulm	Austin	63.0	15	64.2	+ 1.2
Vermont.					
Lunenburg*	Essex	25.8	38	23.4	— 2.4
Newport *	Orleans	24.7	13	21.1	— 3.6
Strafford	Orange	26.0	13	22.3	— 3.7
Virginia.					
Bird's Nest	Northampton	46.3	19	42.8	— 3.5
Dale Enterprise	Rockingham	41.6	7	42.0	+ 0.4
Variety Mills	Nelson	44.1	10	40.6	— 3.5
Wytheville	Wythe	42.5	22	40.8	— 1.7
West Virginia.					
Helvetia	Randolph	39.1	11	37.4	— 1.7
Wisconsin.					
Delavan	Walworth	27.9	4	26.8	— 1.1

* From the "Bulletin of the New England Meteorological Society."

The following notes on temperature are furnished by voluntary observers:

Illinois.—Riley, McHenry, Co.: the warmest March in the past twenty-six years occurred in 1878; mean temperature, 41°.7; the coldest in that time occurred in 1877, mean, 21°.9.

Indiana.—Lafayette, Tippecanoe Co.: in the past eight years the maximum temperature for March is 76°.0, in 1876; the minimum, —5°.0, in 1884.

Logansport, Cass Co.: during the past thirty-three years the highest March temperature, 84°.0, occurred in 1875; the lowest, —10°.0, also in 1875.

Vevay, Switzerland Co.: comparisons of temperature for the month of March, 1887, with the March means of the past twenty-one years: the maximum temperature, 76°.0, on the 2d, is 3°.7 above the mean maximum; the minimum, 18°.0, on the 29th, is 2°.5 above the mean minimum; the range, 58°, is 1°.2 greater than the average range.

Iowa.—Monticello, Jones Co.: the maximum March temperature of the past thirty-four years is 78°.0, in 1875; the minimum, —14°.0, in 1873.

Maryland.—Cumberland, Alleghany Co.: temperature table for March of the past fifteen years:

Year.	Highest.	Lowest.	Mean.	Year.	Highest.	Lowest.	Mean.
	°	°	°		°	°	°
1873	68.0	— 4.0	38.0	1882	72.0	24.0	43.0
1874	66.0	20.0	31.0	1883	66.0	12.0	35.0
1875	69.0	18.0	30.0	1884	65.0	8.0	40.0
1876	71.0	11.0	36.5	1886	66.0	6.0	33.0
1877	62.0	— 6.0	39.0	1886	68.0	12.0	40.0
1878	74.0	20.0	46.0	1887	60.0	18.0	35.0
1879	70.0	22.0	39.0				
1880	70.0	20.0	38.5	Average	67.2	13.6	37.4
1881	62.0	24.0	37.0				

Fallston, Harford Co.: during the past sixteen years the warmest March occurred in 1871, mean temperature, 46°.2; the coldest in 1885, mean, 30°.6.

Maine.—Cornish, York Co.: the warmest March of the past thirty years occurred in 1871, mean temperature, 36°.2; the coldest in 1863, mean, 20°.7.

New York.—Palermo, Oswego Co.: during the past thirty-three years the highest mean temperature for March, 38°.1, occurred in 1878; the lowest mean, 19°.0, in 1872 and 1883.

North Volney, Oswego Co.: the coldest March in the past twenty years occurred in 1885, the mean temperature of the month being 18°.6; the warmest occurred in 1878, mean, 37°.4.

Ohio.—Wauseon, Fulton Co.: during March in the past seventeen years the highest mean temperature, 43°.2, occurred in 1878; the lowest mean, 24°.5, in 1885; the highest maximum temperature, 79°.5, in 1875; the lowest minimum, —17°.4, in 1883.

Pennsylvania.—Dyberry, Wayne Co.: the highest March mean temperature of the past twenty-three years, 37°.5, occurred in 1878; the lowest mean, 19°.5, in 1885.

Grampian Hills, Clearfield Co.: the highest March mean temperature of the past seventeen years, 36°.4, occurred in 1871; the lowest, 20°.1, in 1885.

South Carolina.—Stateburg, Sumter Co.: during March of the past seven years the highest mean temperature, 59°.0, occurred in 1882; the lowest mean, 48°.3, in 1885; the highest maximum temperature, 89°.0, in 1882; the lowest minimum, 26°.0, in 1885.

Virginia.—Wytheville, Wythe Co.: during March of the past twenty-two years the highest maximum, 76°.0, and the lowest minimum, —1°0, occurred in the same year, viz., 1869.

FROSTS.

Savannah, Ga.: cold and clear weather prevailed on the 18th and 19th, with frost and formations of ice on calm water. The frost did considerable damage to fruit trees, field crops, and vegetation of all kinds in the numerous truck farms contiguous to the city. Frosts occurred also on the mornings of the 29th and 30th, considerably injuring vegetation. Reports from Columbia, S. C., state that very cold weather prevailed on the 18th and 19th, with a destructive frost on the morning of the 19th. This frost was general along the coast line of the Carolinas, and injured early vegetables on the truck farms of that district to the estimated extent of $100,000.

Raleigh, N. C.: during the 28th and 29th very cold weather prevailed, the temperature falling 33° on the 28th, and reaching the minimum of the month, 24°, on the night of the 29–30th. Heavy hoar frost occurred each night, doing much damage to fruit trees and garden plants. Reports from the voluntary observers at Aiken, Spartanburg, and Kirkwood, S. C., state that the heavy frosts of the latter part of the month were very destructive to vegetables and the blossoms of fruit trees.

Louisville, Ky.: on the 28th and 29th very low temperatures prevailed, the minimum, on the morning of the 29th, being 18°.0. Reports from the surrounding country state that this cold wave did serious damage to fruit trees.

Lynchburg, Va.: very low temperatures prevailed on the 29th; minimum, 26°.5; early fruit and vegetables are reported to have been considerably damaged.

Norfolk, Va.: reports from the surrounding country indicate that serious damage was done to vegetables by the snow and ice of the morning of the 29th.

Fort Smith, Ark.: on the 28th and 29th heavy frost occurred in the western part of the state and the eastern part of the Indian Territory, doing much damage to peach trees, the greater number of which were in full bloom.

Little Rock, Ark.: the heavy frosts of the 29th and 30th did much damage to fruit trees, which were in blossom. On the morning of the 29th thin ice formed on calm water. The voluntary observer at Lead Hill states that on the morning of the 29th the temperature fell to 21°, with heavy frost, which killed nearly all the peach blossoms.

Cairo, Ill.: very cold weather and killing frosts occurred on the mornings of the 28th and 29th; minimum temperature, 24°.2, on the 29th. The observer states that the frosts were very destructive to early vegetables and to the peach crop. Large fires were kept burning in the vicinity during the night of the 28–29th. In some orchards in Pulaski county many barrels of coal oil were consumed in trying to save the peach buds.

The following is from the March, 1887, report of the "South Carolina Weather Service:"

The heavy frost of the 18th and 19th did considerable damage to early vege-

Table of comparative maximum and minimum temperatures for March.

State or Territory.	Station.	For 1887.		Since establishment of station.			
		Max.	Min.	Max.	Year.	Min.	Year.
		°	°	°		°	
Alabama	Mobile	76.8	36.2	85.0	1879	29.0	1885
Do	Montgomery	79.9	32.4	86.3	1882	25.0	1873
Arizona	Prescott	76.2	23.1	90.0	1879	— 8.0	1876
Do	Fort Apache	78.9	21.8	83.0	1879	11.0	1881
Arkansas	Fort Smith	76.0	28.0	82.8	1884	23.5	1884
Do	Little Rock	74.9	30.0	83.0	1882	23.0	1886
California	San Francisco	78.0	45.0	77.0	1879	39.0	1880
Do	San Diego	82.2	43.5	99.0	1879	38.0	1880
Colorado	Denver	74.7	13.2	81.0	1879	—10.7	1886
Do	Pike's Peak	31.3	— 4.9	43.0	1879	—29.0	1875
Connecticut	New Haven	51.4	11.5	69.0	1880	— 0.2	1885
Do	New London	53.3	15.2	64.0	1878	4.0	1884
Dakota	Fort Buford	59.0	— 9.8	70.0	1879, 1882	—23.0	1880
Do	Yankton	77.5	— 1.5	87.0	1879	—16.0	1876, 1880
District of Columbia	Washington City	65.0	20.8	79.0	1880	4.0	1873
Florida	Jacksonville	80.0	35.7	88.0	1882	31.0	1873, 1876
Do	Key West	81.6	58.4	89.0	1873, 1874	53.0	1873, 1886
Georgia	Atlanta	73.5	25.2	81.0	1882	20.4	1885
Do	Savannah	81.2	32.5	87.0	1882	27.0	1873
Idaho	Boisé City	73.6	23.8	76.0	1881	9.0	1882
Illinois	Cairo	74.6	24.2	84.0	1879	10.0	1873
Do	Chicago	68.0	9.3	73.0	1875	—12.0	1873
Indiana	Indianapolis	69.6	15.8	77.0	1875	3.2	1885
Indian Territory	Fort Sill	86.0	26.0	95.0	1879	10.0	1880
Iowa	Dubuque	70.5	1.7	75.0	1875	—10.0	1875
Do	Des Moines	72.4	9.8	80.0	1880	— 5.6	1884
Kansas	Dodge City	80.1	16.6	89.0	1879	— 8.0	1880
Do	Leavenworth	83.6	20.5	84.0	1879	2.0	1876
Kentucky	Louisville	79.3	18.0	79.0	1879	3.0	1873
Louisiana	New Orleans	80.8	43.8	84.0	1879	36.0	1885
Do	Shreveport	83.8	34.6	90.0	1882	26.0	1876
Maine	Eastport	45.0	— 2.0	53.0	1878	— 7.9	1886
Do	Portland	46.4	0.5	65.0	1874	— 7.0	1872
Maryland	Baltimore	56.6	21.4	76.0	1880	5.0	1873
Massachusetts	Boston	52.9	9.8	72.0	1880	— 7.5	1872
Michigan	Marquette	46.1	—14.2	70.0	1878	—16.0	1884
Do	Grand Haven	59.8	7.4	71.0	1878	— 4.9	1885
Minnesota	Saint Vincent	45.0	—27.0	49.0	1881	—31.0	1883
Do	Saint Paul	53.6	— 7.1	68.0	1879	—22.5	1873
Mississippi	Vicksburg	80.1	36.9	85.0	1880	27.0	1885
Missouri	Saint Louis	79.1	22.9	82.0	1879	8.0	1873, 1876
Montana	Fort Assinaboine	60.2	—14.7	68.2	1885	—25.8	1884
Do	Helena	67.4	4.2	66.0	1881	—10.0	1886
Nebraska	North Platte	78.0	10.0	86.0	1879	—21.0	1880
Do	Omaha	78.1	10.2	82.0	1879	— 7.0	1880
Nevada	Winnemucca	74.7	17.7	82.0	1879	— 3.0	1882
New Hampshire	Mount Washington	32.3	—25.9	47.0	1876	—49.0	1872
New Jersey	Atlantic City	56.2	18.4	72.0	1880	8.0	1884
New Mexico	Santa Fé	67.0	19.5	82.0	1879	0.0	1880
New York	Buffalo	51.0	11.4	72.0	1875	— 4.1	1885
Do	New York City	49.6	16.3	72.0	1879	3.0	1872
North Carolina	Charlotte	79.7	26.8	79.0	1879, 1880	23.0	1884
Do	Wilmington	81.9	27.7	84.0	1878	20.0	1873
Ohio	Cincinnati	73.0	18.6	77.0	1875	1.0	1873
Do	Sandusky	62.0	10.9	76.0	1886	— 3.4	1885
Oregon	Portland	75.2	31.2	79.0	1886	25.5	1880
Do	Roseburg	81.0	28.6	80.0	1881, 1883	19.0	1880
Pennsylvania	Pittsburg	68.5	14.9	80.0	1876	2.0	1877
Do	Philadelphia	53.3	21.8	75.0	1880	5.0	1872
Rhode Island	Block Island	53.7	17.2	56.0	1886	5.8	1886
South Carolina	Charleston	80.0	33.9	85.0	1882	28.0	1876
Tennessee	Knoxville	75.6	21.6	83.0	1882	6.0	1873
Do	Memphis	76.8	30.2	85.0	1879	18.0	1876
Texas	Brownsville	84.8	46.9	92.3	1884	35.0	1880
Do	Fort Elliott	82.8	24.0	86.0	1880	— 2.0	1880
Utah	Salt Lake City	73.9	27.5	77.0	1879	4.0	1874
Virginia	Lynchburg	80.6	23.5	79.0	1879	16.0	1884
Do	Norfolk	75.8	25.1	81.0	1880	16.0	1872
Washington Ter.	Spokane Falls	65.7	15.2	74.0	1881	7.0	1882
Do	Olympia	63.2	25.2	71.0	1881	23.1	1880
Wisconsin	La Crosse	65.9	— 1.0	72.0	1875	—23.0	1873
Do	Milwaukee	56.8	— 4.2	70.0	1878	— 8.5	1884

tables and fruit, especially in the upper counties, while the freeze on the 29th and 30th was very disastrous throughout the state; much of the fruit which survived the first-mentioned frost succumbing to the latter. All the early varieties of peaches were killed. Plums and cherries suffered severely. Strawberries were set back about two weeks. In some instances potatoes were injured, while beans, cucumbers, and squashes were killed.

Frosts occurred in the various districts as follows:

New England.—1st to 31st.

Middle Atlantic states.—1st to 31st.

South Atlantic states.—1st, 2d, 3d, 10th to 20th, 22d, 23d, 24th, 26th, 29th, 30th, 31st.

Florida.—Cedar Keys and Limona, 1st; Archer, 1st, 2d, 15th, 18th, 19th, 20th, 23d, 24th, 25th, 30th; Sanford, 1st, 18th, 19th; Duke, 1st, 19th 20th, 24th, 30th; Manatee, 1st, 29th; Alva, 15th, 17th, 18th.

East Gulf states.—15th, 18th to 20th, 22d, 23d, 29th, 30th.

West Gulf states.—10th, 11th, 14th, 17th, 18th, 21st to 25th, 28th, 29th, 30th.

Tennessee.—11th to 15th, 18th to 20th, 23d, 25th, 28th to 31st.

Ohio Valley.—1st to 6th, 8th to 31st.

Lake region.—1st to 31st.

Extreme northwest.—2d to 10th, 12th to 31st.

Upper Mississippi and Missouri valleys.—1st to 31st.

Northern slope.—1st to 31st.

Middle slope.—1st to 12th, 15th to 23d, 25th to 28th, 30th, 31st.

Southern slope.—1st to 6th, 8th to 11th, 13th, 14th, 16th, 17th, 20th to 25th, 27th, 28th, 29th, 31st.

Southern plateau.—1st 2d, 3d, 5th to 13th, 15th to 18th, 20th to 25th, 28th to 31st.

Middle plateau.—1st to 23d, 25th to 31st.

Northern plateau.—1st, 3d, 4th, 5th, 8th to 13th, 16th, 18th to 23d, 25th to 30th.

North Pacific coast region.—1st to 4th, 10th, 12th, 17th to 22d, 26th, 27th, 29th, 30th.

Middle Pacific coast region.—1st, 5th, 6th, 8th, 18th to 21st.

ICE.

Ice formed in the southern parts of the country as follows:

Arkansas.—Lead Hill, 22d, 23d, 28th, 29th; Little Rock, 29th.

Georgia.—Savannah, 28th, 31st.

Louisiana.—Liberty Hill, 22d, 23d.

South Carolina.—Spartanburg and Stateburg, 15th, 18th, 19th, 20th, 29th, 30th; Charleston, 18th, 29th.

Texas.—Corsicana, 23d, 28th, Palestine, 28th.

TEMPERATURE OF WATER.

The following table shows the maximum and minimum temperature of the water at the several stations; the monthly ranges of water temperature; the mean water temperature; the average depth at which the observations were made; and the mean temperature of the air:

Temperature of water for March, 1887.

Station.	Temperature at bottom.		Range.	Mean water temperature.	Mean temperature of the air at station.	Average depth, feet and tenths.
	Max.	Min.				
	°	°	°	°	°	
Alpena, Mich *a*						
Baltimore, Md	41.5	37.8	3.7	39.4	37.8	11.6
Boston, Mass	37.9	31.0	6.9	34.5	31.6	22.9
Buffalo, N. Y. *a*						
Cedar Keys, Fla	72.4	57.3	5.1	64.6	61.3	8.3
Charleston, S. C. *b*	58.9	54.3	4.6	56.6	54.8	36.0
Chincoteague, Va	51.4	37.4	14.0	42.7	40.3	3.3
Cleveland, Ohio *a*						
Detroit, Mich. *a*						
Duluth, Minn. *a*						
Eastport, Me	36.0	34.0	2.0	35.1	28.5	14.1
Escanaba, Mich. *a*						
Grand Haven, Mich	36.1	32.1	4.0	33.7	27.3	17.8
Jacksonville, Fla	69.9	56.1	13.8	63.4	59.5	18.0
Key West, Fla	78.3	69.0	9.3	74.3	70.7	18.9
Mobile, Ala	57.0	52.3	4.7	54.6	58.9	16.2
New London, Conn	38.9	33.8	5.1	36.3	34.0	11.5
New York City	38.2	33.1	5.1	35.7	34.3	14.9
Norfolk, Va	49.3	44.2	5.1	46.1	44.1	15.2
Pensacola, Fla	68.4	58.3	10.1	64.4	60.2	18.0
Portland, Me	37.1	30.0	7.1	33.9	28.8	17.0
Portland, Oregon	48.2	40.6	7.6	45.6	49.4	57.4
Sandusky, Ohio *c*	38.0	33.0	5.0	35.1	31.6	11.5
Savannah, Ga	59.4	53.3	6.1	56.4	56.5	10.3
Toledo, Ohio *d*	42.5	33.2	9.3	38.2	31.8	15.8

a Frozen throughout the month. *b* Record for 26 days. *c* Record for 20 days; observations interrupted by ice. *d* Record for 29 days; observations interrupted by ice.

PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for March, 1887, as determined from the reports of about six hundred stations, is exhibited on chart iii. 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 above the several geo-

graphical districts show the average precipitation and the average excess or deficiency as compared with the normal of each district. The normal for any district may be found by adding the departure to the current mean when the departure is below normal, and subtracting when above.

The precipitation of the month is generally below the normal in all parts of the country, except Washington Territory, southern Oregon, Idaho, extreme southern Texas, and parts of New England. The deficiency is especially large in the Gulf States and Tennessee, some stations showing a departure of over five inches; the total rainfall at several stations in these districts is less than 25 per cent. of the normal. In Tennessee, Kentucky, Mississippi, Alabama, and Georgia the greater part of the rainfall of the month fell on two days, the 6th and 7th; the precipitation in Tennessee, especially, being very heavy on these days, a number of stations in that state reporting two, and some over three, inches in less than thirty-six hours. At the end of the month the greater part of the state of Texas was still suffering from the effects of the protracted drought. The average normal rainfall for March of stations in New Mexico and Arizona is 1.22, while the average amount for the current month is only 0.07. At a majority of stations in these territories no rain fell during the month. In Washington Territory, Idaho, and northern Oregon the rainfall of the month is very large, the total amount at several stations being over ten inches, and two stations on the coast, Tatoosh Island, Wash., and Astoria, Oregon, over sixteen inches.

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

Above normal.		Below normal.	
	Inches.		*Inches.*
Astoria, Oregon	12.34	Montgomery, Ala	5.79
Tatoosh Island, Wash	11.15	Atlanta, Ga	5.30
Olympia, Wash	5.79	Augusta, Ga	4.96
Port Angeles, Wash	2.22	Mobile, Ala	4.55
Brownsville, Tex	1.63	Hatteras, N. C	4.15

DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows, for certain stations, as reported by voluntary observers, the average precipitation for the month of March for a series of years, the precipitation for March 1887, and the departures from the average:

Station.	County.	Average precipitation for March.	Number of years.	Precipitation for March 1887.	Departure.
Arkansas.		*Inches.*		*Inches.*	*Inches.*
Lead Hill	Boone	3.89	5	2.84	— 1.05
California.					
Sacramento	Sacramento	2.35	21	1.02	— 1.33
Connecticut.					
Canton *	Hartford	4.18	26	3.76	— 0.42
Hartford *	Hartford	4.01	16	3.52	— 0.49
Middletown *	Middlesex	4.42	29	4.62	+ 0.20
New Haven *	New Haven	4.73	15	4.22	— 0.51
Wallingford *	New Haven	4.64	29	5.05	+ 0.41
Florida.					
Archer	Alachua	6.51	4	4.14	— 2.37
Illinois.					
Collinsville	Madison	3.44	5	3.80	+ 0.36
Mattoon	Coles	3.45	7	3.20	— 0.25
Peoria	Peoria	2.61	31	0.94	— 1.67
Riley	McHenry	2.58	26	1.01	— 1.57
Sandwich	De Kalb	3.62	35	1.24	— 2.38
Sycamore	De Kalb	2.13	6	0.89	— 1.24
Indiana.					
Lafayette	Tippecanoe	2.20	8	1.41	— 0.79
Logansport	Cass	2.98	33	1.81	— 1.17
Vevay	Switzerland	3.98	21	2.78	— 1.20
Iowa.					
Monticello	Jones	2.44	34	2.45	+ 0.01
Muscatine	Muscatine	2.68	40	1.14	— 1.54
Kansas.					
Independence	Montgomery	2.10	15	2.18	+ 0.08
Lawrence	Douglas	2.11	19	2.75	+ 0.64
Wellington	Sumner	1.24	9	0.22	— 1.02
Louisiana.					
Grand Coteau	Saint Landry	6.88	4	2.28	— 4.60
Maine.					
Gardiner *	Kennebec	3.95	49	7.27	+ 3.32
Orono *	Penobscot	4.04	19	5.88	+ 1.84
Maryland.					
Cumberland	Alleghany	2.87	15	1.57	— 1.30
Fallston	Harford	4.38	16	3.61	— 0.77

Deviations from average precipitation—Continued.

Station.	County.	Average precipitation for March.	Number of years.	Precipitation for March, 1887.	Departure.
Massachusetts.		*Inches.*		*Inches.*	*Inches.*
Amherst *	Hampshire	3.40	52	4.18	+ 0.78
Cambridge *	Middlesex	3.83	46	5.65	+ 1.82
Chestnut Hill *	Middlesex	4.32	12	5.20	+ 0.88
Framingham *	Middlesex	4.37	13	4.96	+ 0.59
Lake Cochituate *	Middlesex	4.15	36	5.10	+ 0.95
Ludlow *	Hampden	3.78	12	4.92	+ 1.14
Lynn *	Essex	4.35	13	5.50	+ 1.15
Mystic Lake *	Middlesex	4.25	12	5.04	+ 0.79
New Bedford *	Bristol	4.14	74	5.83	+ 1.69
Somerset	Bristol	4.59	17	5.03	+ 0.44
Springfield *	Hampden	3.62	40	4.19	+ 0.57
Waltham *	Middlesex	3.45	63	5.23	+ 1.78
Williamstown *	Berkshire	3.05	22	5.15	+ 2.10
Nevada.					
Carson City	Ormsby	1.63	8	0.23	— 1.40
New Hampshire.					
Concord *	Merrimac	3.00	31	3.04	+ 0.04
Hanover *	Grafton	2.14	21	2.43	+ 0.29
New Jersey.					
South Orange	Essex	3.68	17	2.45	— 1.23
New York.					
Factorville	Tioga	1.87	5	1.54	— 0.33
Palermo	Oswego	3.03	33	1.08	— 1.95
Ohio.					
Wauseon	Fulton	2.99	14	1.49	— 1.50
Pennsylvania.					
Dyberry	Wayne	3.07	18	3.55	+ 0.48
Grampian Hills	Clearfield	4.07	17	2.49	— 1.58
South Carolina.					
Kirkwood	Kershaw	3.34	20	1.37	— 1.97
Statesburg	Sumter	3.62	7	0.97	— 2.65
Texas.					
New Ulm	Austin	5.07	15	1.27	— 3.80
Vermont.					
Lunenburg *	Essex	3.34	38	2.20	— 1.14
Newport *	Orleans	3.25	13	3.85	+ 0.60
Strafford	Orange	3.36	13	4.30	+ 0.94
Virginia.					
Bird's Nest	Northampton	4.59	19	4.70	+ 0.11
Dale Enterprise	Rockingham	3.24	7	3.03	— 0.21
Variety Mills	Nelson	4.18	8	2.97	— 1.21
Wytheville	Wythe	3.68	22	2.94	— 0.74
West Virginia.					
Helvetia	Randolph	4.80	11	3.02	— 1.78

* From the "Bulletin of the New England Meteorological Society."

The following notes on precipitation are furnished by voluntary observers:

Indiana.—Logansport, Cass Co.: the total snowfall of the present month, 5.4 inches, is 4.3 inches below the average for march of the past thirty-three years; the largest snowfall in that time was 29.2 inches, in 1869.

Iowa.—Monticello, Jones Co.: during the past thirty-four years the greatest March monthly precipitation, 6.54, occurred in 1877; the least, 0.07, in 1869; the greatest March monthly snowfall in that time, 26.6 inches, fell in 1876; the least, 0.0, in 1877; the snowfall of the present month, 16.0 inches, is 8.8 inches above the average.

New York.—Palermo, Oswego Co.: the total snowfall of the present month, 9.5 inches, is 4.0 inches below the average for March during the past thirty-three years.

Ohio.—Wauseon, Fulton Co.: during the past fourteen years the largest March precipitation, 6.52, fell in 1875; the smallest, 0.62, in 1885; the largest monthly snowfall, 41.7 inches, in 1877; the smallest, 0.2 inch, in 1878; the snowfall of the present month, 4.3 inches, is 8.0 inches below the average.

Pennsylvania.—Dyberry, Wayne Co.: in the past eighteen years the largest March precipitation, 5.78, fell in 1871; the least, 1.03, in 1885; the total snowfall of the present month, 23 inches, is 8 inches above the March average of the past thirty-three years; the largest March snowfall in that time, 38 inches, occurred in 1875; the least, 1 inch, in 1858.

Grampian Hills, Clearfield Co.: the total snowfall of the month, 6.5 inches, is 11.1 inches below the normal of the past seventeen years.

Vermont.—Strafford, Orange Co.: during the past thirteen years the largest March precipitation, 7.10, occurred in 1876; the least, 1.55, in 1878.

Virginia.—Wytheville, Wythe Co.: the total precipitation of the three months ending March 31st, 9.58, is 0.99 below the average of the same months for the past twenty-two years.

SNOW.

Louisville, Ky.: snow began falling heavily during the night of the 29–30th and continued without cessation until the following night. This fall of snow, 12.4 inches, is the heaviest that has occurred here since 1869. The storm was general throughout the state; at Lexington a number of roofs were crushed by the weight of snow.

Lynchburg, Va.: snow began falling heavily during the early morning of the 31st and continued until 5.35 p. m.; total fall, 7.3 inches. Reports from the mountainous districts of the southwestern portion of the state indicate that the fall was

heavy; at Christianburg and Fincastle, snow fell to a depth of 9 inches.

The dates on which snow fell in the various districts are as follows:

New England.—1st, 2d, 4th to 30th.
Middle Atlantic states.—1st to 11th, 13th to 25th, 27th to 31st.
South Atlantic states.—14th, 18th, 21st, 27th to 31st.
West Gulf States.—Lead Hill, Ark., 21st, 28th.
Tennessee.—16th, 17th, 18th, 20th, 22d, 28th, 29th.
Ohio Valley.—1st, 4th, 5th, 13th to 23d, 26th to 31st.
Lower lake region.—1st, 4th to 7th, 13th to 31st.
Upper lake region.—1st, 4th to 7th, 10th, 11th, 13th, 14th, 16th, 17th, 18th, 20th to 31st.
Extreme northwest.—1st, 6th, 7th, 8th, 12th, 15th to 20th, 22d to 29th.
Upper Mississippi valley.—4th, 5th, 6th, 17th, 19th to 31st.
Missouri Valley.—1st to 7th, 9th, 13th, 14th, 15th, 18th to 31st.
Northern slope.—2d to 8th, 12th, 19th, 21st, 22d, 24th to 30th.
Middle slope.—3d, 4th, 5th, 7th, 19th, 24th, 26th, 27th, 28th, 30th, 31st.
Southern slope.—Fort Stanton, N. Mex., and Fort Davis, Tex., 27th.
Southern plateau.—Santa Fé, N. Mex., 4th, 26th, 27th; Lava, N. Mex., 27th.
Middle plateau.—3d to 6th, 8th, 17th, 18th, 25th, 26th.
Northern plateau.—1st to 8th, 17th, 18th, 22d, 30th.
North Pacific coast region.—4th, 9th, 12th, 15th, 19th, 23d, 26th, 27th.

MONTHLY SNOWFALLS.

[*Expressed in inches and tenths.*]

The following stations report a monthly snowfall of three inches or more:

California.—Summit, 14; Cisco, 8; Emigrant Gap, 7.
Colorado.—Pike's Peak, 14.3; Montrose, 4.
Connecticut.—North Colebrook, 26.2; Canton, 14.5; Collinsville, 12.8; Bethel, 10.2; Hartford, 9; Middletown, New London, and New Haven, 3.
Dakota.—Richardton, 11; Bismarck, 7.6; Parkston, 6.5; Fort Totten, 6.3; Huron, 5.1.
District of Columbia.—Washington City, 4.7; Kendall Green, 3.3.
Illinois.—Lake Forest, 12; Windsor, 11.9; Rockford, 11.2; Cedarville, 10.8; Pekin, 9.5; Joliet, Oneida, and Sandwich, 9; Minonk, 7.5; Woodstock, Sterling, and Peoria, 7; Riley and Aurora, 6.5; Martinsville and Chicago, 6.2; Waukegon and Monmouth, 6; Payson, 5.5: Ottawa, 5.2; Collinsville, 5; Belvidere, Pontiac, and Camden, 4; Mattoon, 3.9; Hoopeston, 3.8; Melvin, 3.7; Sycamore and Griggsville, 3.5.
Indiana.—Jeffersonville, 15; Laconia, 12; Logansport, 5.4; Vevay, 5; La Grange and Indianapolis, 3.
Iowa.—Des Moines *a*, 18; Cedar Rapids *a*, 16.5; Monticello, 16; Dubuque, 14.7; Oskaloosa *a*, 13.5; Independence, 12.5; Cedar Rapids *b*, 12; Des Moines *b*, 10.8; Muscatine, 9.1; Oskaloosa *b*, 9; Davenport, 7.8; Clinton, 7; Cresco, 6.5; Keokuk, 6.2; Bancroft, 5.
Kansas.—Wakefield, 7.4; Globe, 7; Leavenworth, 6.8; Wyandotte, 6.2; Manhattan *a* and Lawrence, 6; Manhattan *b*, 4; Belleville, 3.
Kentucky.—Harper's Ferry, 15.6; Midway, 13; Louisville, 12.4.
Maine.—Kent's Hill, 31; Cornish, 29; Portland, 27.6; Orono, 26.5; Lewiston, 26.1; Gardiner, 25.1; Belfast, 19; Eastport, 18.1; Bar Harbor, 14.
Maryland.—Fallston, 15; Woodstock, 9.5; New Midway, 8.2; Baltimore, 6.8; Cumberland, 6.
Massachusetts.—Rowe, 35; Williamstown, 34; Dalton, 30; Gilbertville, 25; Fitchburg *a*, 22; Fitchburg *b*, 21.8; Monson, 21; Ludlow, 20.5; Mansfield, 19.8; Concord, 18.2; Somerset, 18; Worcester, 16.7; South Hingham, Blue Hill Observatory, and Dudley, 16; Plymouth and Deerfield, 15; Amherst *a*, 14.5; North Truro, 14.4; Milton, 14.2; Westborough, 14; Springfield and Amherst *b*, 13.5; Groton and Newburyport, 13; Northampton and Fall River, 12; Taunton *a*, 11.8; Boston and Lawrence, 11.5; New Bedford *a*, 10.5; Randolph and Taunton *b*, 10; New Bedford *b*, 9; Cambridge, 8.3; Nantucket, 4.4.
Michigan.—Traverse City, 17.5; Harrisville and Lansing, 11.5; Detroit, 11.4; Alpena and Thornville, 10.5; East Saginaw, 7.8; Benton Harbor, 7.5; Ovid and Mottville, 7; Saint John's, 6.8; Kalamazoo, 6.2; Saint Louis and Grand Rapids, 6.1; Cassopolis, 6; Alma, 5.7; Mackinaw City and Greenville, 5.3; Detroit, 5; Jonesville, 4.5; Ganges, 4; Adrian, 3.8; Birmingham and Port Huron, 3.
Minnesota.—Duluth, 5.4; Spring Valley and Rochester, 5.2; Minneapolis and Saint Vincent, 4.9; Red Wing, 3.8; Albert Lea, 3.7; Eau Claire and Moorhead, 3.5.
Missouri.—Saint Louis, 3.5.
Montana.—Fort Maginnis, 12.4; Fort Custer, 3.9.
Nebraska.—Hay Springs, 7.5; Brownville, 7.2; Valentine, 7; Fairbury, 6.5; De Soto, 5.6; Lincoln, 5.2; Omaha, 4.8; Genoa, 3.7; North Platte, 3.4; Fremont, 3.3.
New Brunswick.—Parker's Ridge, 36.
New Hampshire.—Shelburne, 38; Berlin Mills, Grafton, and Mount Washington, 33; Quincy, 30; Strafford, 24; Hanover, 22.5; Walpole, 21.5; Concord, 20; West Milan, 19.2; Manchester *a*, 16; Manchester *b*, 15, *c*, 12.6; Nashua, 13.5.
New Jersey.—Clayton, 11.2; Atlantic City, 7; South Orange, 6.8; Dover, 6; Beverly, 4.8; Roseland, 4.5; Moorestown, 4.3.
New Mexico.—Santa Fé, 3.5.
New York.—Lebanon Springs, 37; Cooperstown, 33.5; Auburn, 24; Albany, 22.2; Menands 20.1; Oswego, 16.6; Humphrey, 12.8; Boyd's Corners, 11; White Plains, 10.2; Le Roy, 9.7; Palermo, 9.5; Ithaca, 8.9; Buffalo, 7.9; Penn Yan, 7.5; Rochester, 6.3.
North Carolina.—Reidsville, 4.
Ohio.—Cleveland, 10.1; Yellow Springs, 9.3; Garrettsville, 5.3; Ruggles, 5; Lewisburg, 4.5; Wauseon, 4.3; Portsmouth and Tiffin, 4; Sandusky, 3.2; Jacksonborough, 3.
Pennsylvania.—Dyberry, 23; Blooming Grove, 18.5; West Chester, 9.2; Bethlehem, 7.2; Grampian Hills, 6.5; Wilkesbarre and Erie, 5.5; Wellsborough, 4.6; Easton, 4.5; Pittsburg, 4.4; Philadelphia, 3.2.
Rhode Island.—Bristol, 11.5; Providence, 9; Woonsocket, 7.2; Olneyville, 7; Block Island, 6.7.
Utah.—Frisco, 3.1.
Vermont.—Strafford, 53; Northfield, 44.9; Townshend, 43.3; Charlotte, 37; Jacksonville, 36.5; Burlington, 35; Marlborough, 31.6; Newport, 29.5; Chelsea, 27.5; Poultney, 25.6; Brattleborough, 23.8; Lunenburg, 22; Vernon, 20.
Virginia.—Lynchburg, 13.8; Dale Enterprise, 13.5; Bruington, 10; Rappahannock, 5.3; Marion and Wytheville, 4.5; Chincoteague, 4.4; Variety Mills, 3.9.
West Virginia.—Middlebrook, 25.5; Helvetia, 12.5.
Wisconsin.—Fond du Lac, 11; Milwaukee, 10.9; Franklin, 10; Delavan, 9.2; Prairie du Chien, 7; Manitowoc, 6.2; Green Bay, 4.7.
Wyoming.—Camp Sheridan, 6.5.

DEPTH OF UNMELTED SNOW ON GROUND AT END OF MONTH.

[*Expressed in inches and tenths.*]

Connecticut.—North Colebrook, 26; Bethel, trace.
Dakota.—Fort Totten, 1; Fort Buford, trace.
District of Columbia.—Washington City, 1.
Illinois.—Chicago, trace.
Indiana.—Laconia, 12; Jeffersonville, 6; Vevay, 1; La Grange, trace.
Iowa.—Des Moines *a*, 6 to 8; Cedar Rapids *a*, and Monticello, 6; Independence and Cedar Rapids *b*, 2 to 3; Des Moines *b*, 2; Oskaloosa, 1.5; Muscatine and Dubuque, 1; Cresco, 0 to 3.
Kansas.—Wakefield and Wyandotte, trace.
Kentucky.—Midway, 10; Harper's Ferry, 9; Louisville, 2.7.
Maine.—Cornish, 36; Gardiner, 24; Orono, 8; Bar Harbor, 3; Portland, 2; Eastport, 1.

Maryland.—Fallston and New Midway, 4; Baltimore, 3; Woodstock, 2.

Massachusetts.—Deerfield, 12; Blue Hill Observatory, North Truro, Taunton, Somerset, and Westborough, trace.

Michigan.—Escanaba and Mackinaw City, 14; Alpena, 7; Marquette, 5; Lansing, 1.5; Grand Haven, 1; Port Huron, 0.5.

Minnesota.—Saint Vincent, 2.2; Duluth, 2; Saint Paul, trace.

Missouri.—Centreville, trace.

Montana.—Poplar River, trace.

Nebraska.—Brownville, trace.

New Hampshire.—Mount Washington, 20; Manchester, 14; Nashua, trace.

New Jersey.—Clayton and Atlantic City, 3; Lakewood and Moorestown, 1.5; Beverly, 1.2; Dover and South Orange, trace.

New York.—North Volney 30 (in the woods); Cooperstown, 20; Palermo, 12; Albany, 9; Menands, 6; Oswego, 0.5; Ithaca and Le Roy, trace.

North Carolina.—Reidsville, 3.

Ohio.—Portsmouth, 4; Yellow Springs, 0.8; Elyria, trace.

Pennsylvania.—Dyberry, 24; Blooming Grove, 5; Fallsington, 1.5; West Chester, 1; Philadelphia, 0.3; Grampian Hills, Phillipsburg, Quakertown, and Erie, trace.

Vermont.—Charlotte, 60 to 120; Strafford, 48; Newport, 40; Northfield, 36; Brattleborough, 24.5; Poultney, 20; Burlington, 8.

Virginia.—Lynchburg, 7; Dale Enterprise, 4.5; Variety Mills, 3.2; Rappahannock, 2.1; Chincoteague, 1.5; Marion, 1.

West Virginia.—Middlebrook, 6; Helvetia, 1.

Wisconsin.—Wausau, 8; Franklin, 4; Madison, 3; Fond du Lac and Milwaukee, 2; Embarras, 0.8; La Crosse, trace.

HAIL.

Little Rock, Ark.: on the 10th a violent wind and hail storm visited Bradley county in this state. The storm was very destructive, blowing down a number of houses and barns and injuring several persons. Large tracts of timber were destroyed.

Cairo, Ill.: high westerly wind, with light rain at intervals, prevailed on the 27th; maximum velocity of the wind, thirty-two miles per hour. A thunder-storm, accompanied by heavy hail, occurred during the afternoon. The hail-stones were the size of marbles, and remained on the ground unmelted about an hour. The high wind and hail were very destructive to fruit trees in this vicinity, nearly stripping them of blossoms. The hail storm was severe at Paducah, Ky., the stones being as large as walnuts.

Lynchburg, Va.: a heavy thunder-storm, with hail and snow, occurred in Tazewell county on the 31st.

Hail is also reported to have occurred, as follows:

Arkansas.—Little Rock, 27th.

California.—Nicolaus, 3d.

Colorado.—Montrose, 26th.

Florida.—Limona, 17th.

Georgia.—Milledgeville, 28th.

Idaho.—Cœur d'Alene, 29th.

Illinois.—South Evanston, 5th, 27th; Cairo, 20th, 21st, 27th; Jacksonville and Pekin, 27th.

Indiana.—Indianapolis, 5th.

Kansas.—El Dorado and Leavenworth, 8th; Independence, 8th, 26th; Fort Riley and Wakefield, 26th.

Kentucky.—Harper's Ferry, 6th, 27th; Frankfort, 27th.

Maine.—Cornish, 28th.

Maryland.—New Midway, 3d.

Massachusetts.—Amherst, 6th, 27th; Somerset and Westborough, 19th.

Mississippi.—Vicksburg, 27th.

Missouri.—Saint Louis, 27th.

Nebraska.—Brownville, 8th; Tecumseh, 26th.

New Jersey.—Dover, 2d, 5th; Clayton, 3d; Moorestown, 3d, 22d; Atlantic City, 28th.

New York.—Brooklyn, 3d; Factoryville, 22d, 27th; Setauket, 22d, 28th; Madison Barracks, 28th.

North Carolina.—Reidsville, 26th, 31st.

Ohio.—Garrettsville, 5th; Elyria, 12th; Napoleon, 27th.

Pennsylvania.—Wellsborough, 5th; Dyberry, 6th, 28th; Bethlehem and Grampian Hills, 28th.

South Carolina.—Spartanburg, 4th; Stateburg, 28th.

Tennessee.—Milan, 21st; Nashville and Memphis, 27th.

Texas.—Austin, 8th.

Virginia.—Chincoteague, 5th; Lynchburg and Rappahannock, 9th.

Washington Territory.—Neah Bay, 13th; Spokane Falls, 29th.

SLEET.

Sleet fell in the various states and territories during the month as follows: Lead Hill, Ark., 21st. New London, Conn., 6th. Fort Sully, Dak., 7th. Cape Henlopen, Del., 4th. Washington City, 4th, 5th, 8th. Mattoon, Ill., 2d; Springfield, Ill., 5th, 26th, 27th; Rockford, Ill., 6th. Butlerville and Fort Wayne, Ind., 5th. Cresco, Iowa, 20th; Keokuk, Iowa, 27th; Fort Madison, Iowa, 31st. Eastport, Me., 22d, 28th. Baltimore, Md., 3d, 5th. Marquette, Mich., 8th; Mackinaw City, Mich., 9th. Saint Paul, Minn., 30th. Saint Louis, Mo., 4th, 21st, 26th, 27th. Poplar River, Mont., 7th. Hay Springs, Nebr., 22d. Dover, N. J., 10th; Beverly, N. J., 28th. Oswego and West Point, N. Y., 6th; Palermo, N. Y., 6th, 27th, 28th; Albany, N. Y., 6th, 28th; Fort Columbus, N. Y., 22d; Plattsburg Barracks and Le Roy, N. Y., 27th. Raleigh, N. C., 28th; Hatteras, N. C., 29th; Charlotte and Statesville, N. C., 31st. Cincinnati, Cleveland, Napoleon, and Yellow Springs, Ohio, 5th; Wauseon, Ohio, 5th, 11th, 12th, 21st, 27th; Columbus, Ohio, 5th, 14th; Garrettsville, Ohio, 5th, 27th. Philadelphia, Pa., 3d; Pittsburg, Pa., 5th; Dyberry, Pa., 28th. Snowville, Va., 4th, 8th. Tatoosh Island, Wash., 18th. Parkersburg, W. Va., 4th, 5th, 19th, 20th. Milwaukee and Embarras, Wis., 6th, 24th; Fond du Lac, Wis., 9th. Camp Sheridan, Wyo., 19th, 26th, 30th.

Table of excessive and greatest monthly precipitation for March, 1887.

Station.	Specially heavy.		Largest monthly.	Station.	Specially heavy.		Largest monthly.
	Date.	Amt.	Amount.		Date.	Amt.	Amount.
Arkansas.				*Massachusetts—C'd*			
Lead Hill	6	2.02		Williamstown	5, 6	2.24	
Alabama.				New Bedford	10, 11	2.20	
Florence	7	2.00		*New York.*			
Colorado.				White Plains	17	2.12?	9.91?
Pike's Peak	26	2.06		Do	21, 22	3.20?	
Florida.				Do	27, 28	2.25	
Alva	25	5.50	7.55	Cooperstown	5, 6	2.00	
Tallahassee	8	2.40		*Ohio.*			
Duke	27, 28	2.12		Jacksonborough	4, 5	2.40	
Archer	27, 28	3.50		Jefferson	5, 6	2.08	
Jacksonville	27, 28	2.04		Lovering	5, 6	2.01	
Illinois.				*Oregon.*			
Flora	5	4.51	6.56	Astoria	3	3.23	16.11
Olney	5, 6	4.00	6.00	Do	6 to 10	5.97	
Collinsville	4, 5	2.54		Mount Angel	5, 6, 7	5.06	10.30
Mattoon	5	2.23		Albany	4, 5, 6	4.60	9.03
Charleston	5	2.10		Portland			8.00
Summer	6	4.10		Bandon	5, 6	3.47	7.07
Palestine	5, 6	3.25		Eola			6.41
Vandalia	5, 6	2.25		East Portland			6.34
Centralia	5	4.50		*Tennessee.*			
Irishtown	5, 6	3.10		Milan	5, 6	2.18	
Mascoutah	6	3.30		Cookeville	7	2.00	
Albion	5, 6	4.00		Florence Station	6	2.67	
Fairfield	5, 6	3.50		Hurricane Switch	6, 7	3.34	
Richview	5, 6	4.02		Ashwood	6, 7	2.82	
Three Mile	5	2.00		Waynesborough	6, 7	3.10	
Jordan's Grove	5	3.50		Waverly	6, 7	2.06	
Indiana.				Savannah	6, 7	2.27	
Summan	5, 6	2.30		*Woodstock*	6	2.35	
Butlerville	5, 6	2.15		Memphis	6, 7	3.00	
Iowa.				Knoxville	7	2.07	
Cedar Rapids	26, 27	2.00		Chattanooga	8, 9	2.20	
Kentucky.				*Vermont.*			
Harper's Ferry	27	2.30?	6.80?	Townsend			7.52
Maine.				*Virginia.*			
Gardiner	6	2.02	7.27	Rappahannock	10	2.27	7.52
Do	10	2.58		*Washington Ter.*			
Orono	28, 29	2.90		Tatoosh Island	8, 9, 10	7.07	16.36
Bar Harbor	28, 29	2.62		Do	15, 16, 17	2.92	
Massachusetts.				Olympia	7, 8	2.29	10.60
Randolph			6.27	Blakely			8.60
Mansfield			6.24	Tacoma			7.77

DROUGHT.

New Ulm, Tex.: the total precipitation for January, February, and March, 1887, 4.36 inches, is 9.39 inches below the average of the same months during the past fifteen years. The total precipitation of the present month, 1.27 inches, is the least that has fallen in any March during that time. The voluntary observer at Corsicana and other places in the eastern part of Texas state that a protracted drought has prevailed since December, 1886.

San Antonio, Tex.: on the 31st the observer at this place reports, concerning the drought in Texas, as follows:

> The drought in this section continues, little rain having fallen since the first frost which occurred November 18th; cattle and horses are dying in large numbers, chiefly from want of water. Market reports indicate that the number of fallen hides, or hides from cattle that have died on the range, handled this year has been unprecedentedly large. Several cattle owners in Atascosa and Frio counties are shipping their herds to the Indian Territory for pasturage. The agricultural outlook for this section is decidedly gloomy. Corn is coming up slowly, but if rain does not fall soon it will not make a stand, while oats, barley, and all small grain are regarded as complete failures.

Fort Grant, Ariz.: the observer at this place reports the total rainfall of the month to be a few drops on the 22d. The soil at the end of the month was exceptionally dry for the season and rain was needed badly. This section of the territory depends, from spring until early autumn, for its supply of water on the melted snow from the Graham Mountains, about five miles northeast of station. These mountains are usually covered with snow at this season of the year. The absence of unmelted snow in this range during the present month indicates a severe drought for the coming summer, which will greatly damage the extensive cattle interests of this vicinity.

Fort Smith, Ark.: at the end of the month throughout Arkansas and the Indian Territory, vegetation of all kinds was suffering from lack of rain. Farmers stated that the ground was too hard to plow, and that crops already planted would be a failure unless rain fell shortly. The Arkansas River was very low and the cotton and lumber industries of this town were at a standstill, awaiting a rise in the river. Navigation was practically closed at all river ports above this place. The Canadian River in the Indian Territory, a tributary of the Arkansas, was lower than it has ever been before within the memory of the oldest settlers.

Wellington, Kans.: the voluntary observer at this place states that the month has been exceedingly dry, the total precipitation being only 0.22 inch. The growth of vegetation of all kinds was greatly delayed by want of moisture. At Salina the total fall of the month was only 0.01 inch, and crops were beginning to feel the effects of the drought.

Key West, Fla.: on the 12th, during a thunder-storm, 1.36 inches of rain fell; this rain ended a drought that had prevailed for several months and relieved the people of many inconveniencies and discomforts. It was the only heavy rainfall since October 26, 1886, and the majority of the cisterns of the town had become dry.

WINDS.

Report of tornadoes for the month of March, 1887, by Lieut. John P. Finley, Signal Corps, U. S. Army, Assistant.

Place.	Date.	Time.	Direction.	Form of cloud.	Number of persons killed.	Number of persons wounded.	Width of path.	Number and kind of animals killed.	Number and kind of buildings destroyed.	Total valuation of property destroyed.	Authority.
							Feet.				
Tampa, Fla	17	5 p. m	no.		2	Several	Narrow	None	Several houses	$10,000	J. G. Knapp, Limona, Fla.; "New York World," March 19, 1887.
Topin's Grove and Ripley, W. Va.	24	4.30 p. m.	ne.	Funnel	None.	None.	1,720		Court house and residences.		N. A. Duffield, Rock Castle; P. B. Vanham, Topin's Grove, W. Va.
Burton, W. Va. *a*	24	6.30 p. m.	ne.		None.	None.		None	10 houses and barns besides many unroofed; fences demolished.		A. V. McDonnell, Burton, W. Va.
Hockingport, Ohio *b*	24	4 p. m	no.		None.	None.		None	Several		Neal White, Hockingport, Ohio.
Vinton, Ohio	24	5 p. m	no.		None.	None.		None	Several		Hiram Wilcox, Vintou, Ohio.
Point Pleasant, W. Va	24	5 p. m	no.		None.	None.	Narrow		10 houses unroofed, fences destroyed, and timber blown down.		F. D. Hay, Point Pleasant, W. Va.
Tyler Creek, W. Va	24	5 p. m	ne.		None.	Several	Narrow		Houses unroofed and trees prostrated.		F. M. Swann, Tyler Creek, W. Va.
Ripley, W. Va	24	6 p. m	ne.				Narrow	None	Court house and other buildings.	2,800	Jackson County "Herald," W. Va.
Lincoln, Ohio	24	4 to 8 p. m.	ne.		None.	None.	Narrow	None	Great destruction of property.		M. M. Walter, Lincoln, Ohio.
Murraysville, W. Va. *c*	24	About 4 p. m.	no.	Funnel			Narrow				D. K. Barrett, Murraysville, W. Va.
Evergreen, Ohio	24	About 5 p. m.	easterly						12 to 15 buildings destroyed, with damage to other property.		J. H. Morris, Evergreen, Ohio.
Roney's Point, W. Va. *d*	24	5.30 p. m.	no.				Narrow	None	Buildings unroofed and other damage.		Thomas J. Orr, Roney's Point, W. Va.
Pilot Point, Tex	26	5.30 p. m.	ne.		None.	None.	Narrow		Very destructive		J. B. Pondrom, Pilot Point, Tex.
Bigbyville, Tenn. *e*	27	4.30 p. m.	ne.				90	None	Very destructive		O. F. Williams, Ashwood, Tenn.
Bartow and near Moxley, Ga. *f*	31	6 p. m	ne.	Funnel	None.	None.	600 to 900	None	Considerable damage to houses, timber, and fences.		W. H. H. Stewart, Bartow; James A. Thigpen, Wadley; B. S. Carswell, Moxley, Ga.

a A large and very dark cloud, covering the nw. horizon and moving rapidly from nw. to se. and then e. Storms of this character very uncommon in this locality.
b A large quantity of water in the Ohio River was lifted by the force of the wind and carried some two hundred and fifty yards.
c The funnel-shaped cloud appeared in the w., having a light color at the lower end and very dark above. There was a heavy roaring noise on the approach of the storm.
d A copper-colored cloud was seen to approach from the nw., preceded by light, feathery clouds.
e Two very dark clouds, one from sw. and the other from the w., rolled and tumbled in wild commotion, accompanied by loud noise, and then moved to the e.
f Cloud first formed twenty miles sw. of Bartow.

The most frequent directions of the wind during March, 1887, are shown on chart ii by the arrows flying with the wind; they are also given in the table of miscellaneous data. The general movement of the air over the eastern half of the country, except in Florida and the Gulf States, has been from the northwest; along the coast of Washington Territory and Oregon, from the south or southwest. In other parts of the country the wind-direction was variable.

HIGH WINDS.

[*In miles per hour.*]

Wind-velocities of fifty or more miles per hour, other than the maximum velocities for the month, which are given in the table of miscellaneous data:

Mount Washington, N. H., 68, nw., 1st; 80, w., 2d; 88, w., 3d; 80, nw., 4th; 68, nw. 5th; 70, sw., 6th; 90, w., 8th; 60, w., 9th; 66, n., 11th; 58, e., 12th; 52, ne., 15th; 50, e., 18th; 80, e. 22d; 88, w., 23d; 80, nw., 24th; 100, nw., 26th; 90, nw., 27th; 80, sw., 28th; 52, se., 29th; 102, nw., 30th; 81, nw., 31st.

Pike's Peak, Colo., 56, w., 1st; 50, nw., 2d; 60, sw., 3d; 60, nw., 6th; 64, w., 8th; 67, sw., 14th; 52, w., 19th; 56, nw., 20th; 56, nw., 23d; 64, nw., 24th; 62, w., 25th; 52, nw., 27th; 62, n., 28th.

Fort Totten, Dak., 52, s., 4th.

Fort Elliott, Tex., 50, nw., 8th.

Fort Maginnis, Mont., 52, w., 10th; 54, nw., 12th; 56, nw., 18th.

Valentine, Nebr., 60, nw., 12th; 54, nw., 19th.

Fort Buford, Dak., 52, nw., 12th.

Fort Assinaboine, Mont., 52, nw., 12th.

INLAND NAVIGATION.

STATE OF WATER IN RIVERS AND HARBORS.

In the following table are shown the danger-points at the various river stations; the highest and lowest depths for March, 1887, with the dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, March, 1887.

[*Expressed in feet and tenths.*]

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
Red River:						
Shreveport, La	29.9	19	18.4	31	14.7	3.7
Arkansas River:						
Fort Smith, Ark	22.0	11	5.6	29, 30, 31	1.7	3.9
Little Rock, Ark	23.0	9	10.4	31	3.0	7.4
Missouri River:						
Omaha, Nebr	18.0	28	17.9	24	9.1	8.8
Leavenworth, Kans	20.0	30, 31	18.2	1	6.6	11.6
Mississippi River:						
Saint Paul, Minn	14.5	25, 26	7.9	22	6.9	1.0
La Crosse, Wis.*a*	24.0	17	6.3	10	4.5	1.8
Dubuque, Iowa	16.0	13	9.0	26–30	5.8	3.2
Davenport, Iowa*b*	15.0	10, 13	8.4	31	4.7	3.7
Keokuk, Iowa	14.0	16	10.4	2	4.3	6.1
Saint Louis, Mo	32.0	19, 31	20.0	4	13.0	7.0
Cairo, Ill	40.0	9, 10	48.6	31	22.1	26.5
Memphis, Tenn	34.0	10,11,13–18	36.4	31	23.6	12.8
Vicksburg, Miss	41.0	26–31	44.7	1	42.1	2.6
New Orleans, La	13.0	30	14.7	1, 2	12.9	1.8
Ohio River:						
Pittsburg, Pa	22.0	8	13.1	25, 27	3.0	10.1
Cincinnati, Ohio	50.0	1	54.6	30	12.9	41.7
Louisville, Ky	25.0	2	32.0	31	6.4	25.6
Cumberland River:						
Nashville, Tenn	40.0	2	44.2	30	6.4	37.8
Tennessee River:						
Knoxville, Tenn		9	11.8	27, 30, 31	2.4	9.4
Chattanooga, Tenn	33.0	1	27.3	31	5.2	22.1
Savannah River:						
Augusta, Ga	32.0	10	18.2	27, 28	7.3	10.9
Mobile River:						
Mobile, Ala		31	17.0	22	14.9	2.1
Sacramento River:						
Red Bluff, Cal		18	7.0	1	2.1	4.9
Sacramento, Cal		29	20.5	1, 2, 3	15.5	5.0
Willamette River:						
Portland, Oregon		10	14.1	5	3.0	11.1

a Record for 20 days. *b* Record for 21 days.

Mississippi River.—Dubuque, Iowa: on the 10th the ice in the river moved about two hundred feet; on the 12th it began breaking up and moving out rapidly; on this date the transfer steamer "Campbell" made her first regular trip and navigation was considered opened. From the 12th to the 16th large quantities of ice passed down.

Davenport, Iowa: on the 7th the ice in the river opposite the city moved in a mass about one hundred feet, on the 8th about two hundred feet; it began breaking up rapidly on the 9th and 10th and moved down the river slowly. From the 11th to the 14th, inclusive, large quantities of ice passed down. The first boat of the season, the steamer "Wes Rambo," arrived on the 14th.

Keokuk, Iowa: the steamer "Josephine," the first boat of the season, arrived on the 18th.

Cairo, Ill.: the water in the river at this point reached its highest stage on the 9th and 10th, when it was 48.6 feet above the low-water mark; from the 10th until the end of the month it subsided slowly, being 22.1 feet above on the 31st. On the 7th the Missouri Pacific Railroad trains were shut out from their transfer landing at Bird's Point, Mo., the tracks being covered with water and heavy driftwood.

Memphis, Tenn.: the river remained high throughout the month, reaching its highest stage, 36.4 feet above low-water mark, on the 10th, 11th, 13th, and 18th; this is 0.4 foot higher than any other flood on record at this station. The observer states that from February 16th until March 25th the river was 34.0 feet above the danger-line, but that it did no damage in the immediate vicinity of Memphis, except slightly interrupting traffic and submerging the lower floors of houses.

Missouri River.—Fort Buford, Dak.: the Missouri River at this point remained frozen until the 11th, when the ice below the mouth of the Yellowstone began breaking up. At Rocky Point, Mont., the ice gorged and the river rose thirty-five feet in twelve hours, flooding the warehouse of the Benton Transportation Company, damaging some stores. Above the mouth of the Yellowstone the ice did not break up until the 16th, when it began running out freely, but the water rose rapidly until the 18th, from that date until the end of the month the flood subsided slowly and large quantities of ice passed down.

Leavenworth, Kans.: the water in the river rose steadily from the 1st to 30th, on the latter date and the 31st it remained stationary at 18.2 feet above low-water mark. On the 1st and 2d large quantities of ice passed down. During the remaining days of the month the river at this point was clear of ice, but a considerable amount of driftwood was noted.

At Omaha and Brownville, Nebr., Yankton and Fort Randall, Dak., the ice in the river broke up and commenced floating down on the 12th. On the 22d the river overflowed its banks at Fort Randall and flooded the bottom lands.

Lake Michigan.—Milwaukee, Wis.: the heavy northerly gales of the month drove the ice in the lake southward, and large fields of it still remained in the southern end of the lake at the close of the month. Several vessels left this port on the 30th for Chicago, but were obliged to return, being unable to force a passage through the heavy ice off Racine Point.

Grand Haven, Mich.: the schooner "Jennie Mullen," from Chicago, arrived at this port on the morning of the 10th; this was the first sailing vessel to arrive this season. On the above date the lake was nearly clear of ice, and craft of all kinds were getting ready to leave port at an early date.

Escanaba, Mich.: at the end of the month Little Bay de Noquet and adjacent waters were still covered with three feet of hard ice. The following, from the records of the Signal Office, shows the dates of opening and closing of navigation at this port for the fifteen years from 1872 to 1886:

Years.	Opened.	Closed.	Years.	Opened.	Closed.
1872	April 28	Nov. 30	1880	April 13	Nov. 29
1873	May 2	Dec. 10	1881	May 4	Dec. 5
1874	April 30	Nov. 30	1882	April 1	Dec. 1
1875	May 4	Dec. 1	1883	April 24	Dec. 8
1876	April 27	Dec. 9	1884	April 9	Dec. 9
1877	April 18	Jan. 25, 1878	1885	May 5	Dec. 1
1878	March 5	Dec. 29	1886	April 23	Dec. 6
1879	April 25	Dec. 12			

Lake Erie.—Cleveland, Ohio: the schooner "C. Huchinson" left this port for the Islands on the 14th; she obtained her cargo and returned, reaching here on the 20th, after having been fast in the ice off this place for several days. On the 28th the steamer "City of Cleveland" arrived from Detroit.

Lake Superior.—Duluth, Minn.: the lake at this point remained frozen solid throughout the month.

Detroit River.—Detroit, Mich.: the ice in the river moved out on the 2d, doing no damage; on the 3d the river was clear.

Hudson River.—Newburg, N. Y.: navigation on the river, between here and New York City, was reopened on the 11th. The steamer "Newburg," of the Homer Ramsdell Transportation Line, left this place at 1 a. m. and reached New York City in four hours. On the above date the river above Newburg was still covered with ice.

FLOODS.

Bismarck, Dak.: on the 16th the ice in the Missouri River at this point broke up and began moving down, but soon formed a gorge at a point about half a mile below the town, and at 3 p. m. the water had risen six feet. On the same day a gorge formed at Washburn, a town forty miles north of Bismarck. During the 17th the greater part of the ice in the Missouri River above the mouth of the Yellowstone began moving, but in the afternoon of the same day it gorged twenty-five miles below Fort Buford and flooded many miles of country. During the night of the 17–18th the gorge at Washburn gave way; in the morning the water began rising rapidly at Bismarck. Although the ice at this point was nearly solid from bank to bank, yet the flow of rapidly rising water broke it into large pieces, some an acre in extent, forming a gorge at Sibley Island, five miles below the town. The water rose rapidly, overflowing the river banks, and on the afternoon of the 18th the river, which is usually at this point about three-fourths of a mile wide, had increased to five miles. A number of small buildings were carried away, and the telegraph line between Bismarck and Fort Lincoln was completely demolished. About 6,000 acres of meadow land south of Bismarck were covered to a great depth with water and ice flowing at the rate of about six miles per hour. The water continued rising until the 22d; from the 23d until the 26th it fell slowly, on the latter date the gorge at Sibley Island broke and the water receded rapidly. The river attained a greater depth during this flood than it did during the spring flood of 1881, causing great suffering and loss of property to settlers along its banks for miles above the gorge.

Sioux City, Woodbury Co., Iowa: the Missouri River rose rapidly at this point on the 25th, and during the afternoon attained a height but little lower than that of the high water of 1881. At points on the river above this town large areas of bottom lands were overflowed, and considerable damage done.

Yankton, Dak: the Missouri River at this point reached its greatest height on the 26th, and the water backing into the James River did considerable damage to roads and railways. The track of the Milwaukee Railroad at Burbank, on the Sioux City and Dakota branch, was badly washed and traffic was delayed for several days. After the 26th the water subsided slowly.

Saint Joseph, Buchanan Co., Mo.: the Missouri River at this placed overflowed its banks on the 28th and flooded about a square mile of the lowlands on the Kansas side.

ATMOSPHERIC ELECTRICITY.

AURORAS.

The auroral light was reported from very few stations during March, 1887. That which appeared on the night of the 20th–21st was the most extensively observed; it was visible at but one station in New England, Mount Washington, N. H., and one in the upper lake region, Escanaba, Mich., although generally clear weather prevailed in these districts; it was also reported from Saint Vincent, Minn., and two stations in eastern Dakota. The sky over the lower lakes and Ohio and Mississippi valleys was obscured by clouds. This aurora, as it appeared at Saint Vincent, was of a faint white color, and very dim; toward midnight it increased in brilliancy, but shortly after began to fade, and disappeared at 1.30 a. m.

An auroral light of moderate brilliancy was reported from nearly all stations in northern Michigan and one in northeastern Montana on the night of the 19–20th. This display probably extended from the Lake region to eastern Montana, but was obscured over the intervening region by the clouds which covered the sky. The light was most brilliant at Marquette, Mich., where it appeared in the form of a bright white arch, extending from azimuth 145° to 215°, and to an altitude of 45°. Several streamers were visible at 10.30 p. m.; the display disappeared shortly after 11 p. m.

On the night of the 1st–2d an aurora was visible at Tatoosh Island, Wash., but was reported from no other station, although clear weather prevailed over all portions of the country, except Montana, northern Dakota, and parts of the lower lake region and New England. It consisted of a pale white light, extending from 40° north to 55° south of the magnetic meridian, and to an altitude of 8°. At 12.20 a. m. streamers of a bright yellow color shot up to an altitude of 35°; they increased in number and brightness until 12.50 a. m. when the display began to diminish in intensity and had faded away at 1.35 a. m.

On the night of the 23d–24th an aurora was observed at a few stations in northern New England and one in New York. Clear weather prevailed over all parts of the country, except the upper lake region, Minnesota, and Dakota. At Burlington, Vt., it was quite brilliant, and was visible from 10 p. m. of the 23d until 1 a.m of the 24th. Several streamers flashed up in the northwest at 12.30 a. m. to a height of 20°.

The place of observation and condition of the sky during the remaining displays are as follows:

On the 8th a very faint aurora was observed at Pekin, Ill., and Des Moines, Iowa; clear or fair weather prevailed in all northern sections of the country, except the upper lakes and upper Mississippi valley.

On the 13th, at Fort Totten, Dak., and Cresco, Iowa; sky clear, except in the Lake region and middle Atlantic states.

On the 15th, at Mackinaw City and Alpena, Mich., and Poplar River, Mont.; the sky was clear of clouds over the region lying between these stations.

On the 21st, at North Truro, Mass., and Nashua, N. H.; clear or fair weather prevailed over New England; to the westward as far as Wisconsin the sky was obscured by clouds.

On the 24th, at Gardiner, Me., Oswego, N. Y., Marquette, Mich., and Crete, Nebr.; the sky was clear in all portions of the country, except over the lower lakes and middle Atlantic states.

THUNDER-STORMS.

Thunder-storms occurred in the various states and territories, as follows:

Alabama.—Greensborough, 6th, 20th; Montgomery, 7th; Mobile, 8th, 20th, 31st.

Arizona.—Prescott, 24th.

Arkansas.—Lead Hill, 5th, 19th, 26th, 27th.

Colorado.—Pike's Peak, 19th; Denver, 30th.

District of Columbia.—Washington City, 27th.

Florida.—Archer, 8th, 9th, 17th, 20th, 26th, 27th, 28th; Jacksonville, 8th, 9th, 27th; Pensacola, 8th, 16th, 17th, 20th, 31st; Sanford, 8th, 27th, 28th; Tallahassee, 8th, 27th, 31st; Merritt's Island, 9th, 17th, 25th, 27th; Duke, 9th, 27th; Key West, 12th, 13th; 25th; Cedar Keys, 20th.

Georgia.—Forsyth, 7th; Atlanta, 7th, 27th; Milledgeville, 7th, 28th, 31st; Quitman, 8th, 27th, 31st; Savannah, 28th, 31st.

Illinois.—Charleston, 27th.

Indiana.—Butlerville and Sunman, 9th; Jeffersonville and Vevay, 9th, 27th.

Indian Territory.—Fort Sill, 8th; Fort Reno, 8th, 26th; Fort Gibson, 9th.

Iowa.—Des Moines, Cresco, Independence, and Monticello, 8th; Cedar Rapids, 8th, 19th.

Kansas.—Wyandotte, 8th; Globe and Independence, 8th, 19th, 26th; Wellington and Wakefield, 8th, 26th; Salina, 10th; El Dorado, 19th, 26th; Fort Riley, Emporia, and Manhattan, 26th.

Kentucky.—Harper's Ferry, 1st, 6th, 7th, 27th; Midway, 3d, 4th, 6th, 9th, 27th; Frankfort, 3d, 27th; Louisville, 9th, 27th.

Louisiana.—Shreveport, 6th, 7th, 29th; Grand Coteau, 7th, 8th, 10th, 20th, 27th, 31st.

Maryland.—Cumberland, 24th.

Mississippi.—Vicksburg, 7th, 20th, 27th.

Missouri.—Springfield, 26th; Saint Louis, Centreville, and Central College, 27th.

Nebraska.—Brownville, 8th, 26th.

New York.—Humphrey, 24th.

North Carolina.—Raleigh, 7th, 27th, 28th; Reidsville, 25th, 26th; Hatteras and Kitty Hawk, 21st, 28th, 31st; Lincolton and Statesville, 27th, 28th; Charlotte, Wash Woods, Wilmington, Weldon, and Lenoir, 28th.

Ohio.—College Hill, Tiffin, and West Milton, 9th; Yellow Springs, 9th, 26th; Cleveland, Sandusky, and Elyria, 24th; Columbus and Portsmouth, 27th.

Pennsylvania—Pittsburg, Grampian Hills, Phillipsburg and Wellsborough, 24th; Meadville, 25th.

South Carolina.—Spartanburg, 4th, 27th, 28th; Aiken, 7th; Stateburg, 7th, 28th; Charleston, 28th, 31st.

Tennessee.—Nashville, 3d, 4th, 6th; Memphis, 6th, 27th, 30th; Chattanooga and Milan, 27th.

Texas.—Palestine, 5th, 6th, 9th, 27th; Cleburne, 5th, 6th, 27th; Corsicana, 5th, 26th; Comfort, 6th, 9th, 19th; New Ulm, 7th, 8th, 9th; Galveston, 7th, 10th; Brownsville, Rio Grande City, and Austin, 8th; San Antonio, 9th; Corpus Christi, 9th, 27th.

Utah.—Salt Lake City, 18th.

Virginia.—Bird's Nest and Variety Mills, 28th.

Washington Territory.—Walla Walla, 16th.

Wisconsin.—La Crosse, 4th; Madison and Prairie du Chien, 8th.

RARE ELECTRICAL PHENOMENON AT SEA.

Capt. C. D. Swart, of the Dutch bark "J. P. A.," makes the following report of a remarkable phenomenon observed by him at 5 p. m. March 19, 1887, in N. 37° 39′, W. 57° 00′:

During a severe storm saw a meteor in the shape of two balls, one of them very black and the other illuminated. The illuminated ball was oblong, and appeared as if ready to drop on deck amidships. In a moment it became as dark as night above, but below, on board and surrounding the vessel, everything appeared like a sea of fire. The ball fell into the water very close alongside the vessel with a roar, and caused the sea to make tremendous breakers which swept over the vessel. A suffocating atmosphere prevailed, and the perspiration ran down every person's face on board and caused everyone to gasp for fresh air. Immediately after this solid lumps of ice fell on deck, and everything on deck and in the rigging became iced, notwithstanding that the thermometer registered 19° Centigrade. The barometer during this time oscillated so as to make it impossible to obtain a correct reading. Upon an examination of the vessel and rigging no damage was noticed, but on that side of the vessel where the meteor fell into the water the ship's side appeared black and the copper plating was found to be blistered. After this phenomenon the wind increased to hurricane force.

ELECTROMETER READINGS.

Observations of the electrical potential of the air were made during the month of March, 1887, at 9. a. m., 11 a. m., 1 p. m., and 3 p. m., daily, at Washington City, Baltimore, Md., New Haven, Conn., Boston, Mass., Ithaca, N. Y., and Columbus, Ohio. At Washington City, in addition to the regular series of observations, a set of simultaneous observations were made on March 24th at the Signal Office, elevation 45 feet, and at the top of the Washington Monument, elevation 500 feet. The following table shows, briefly, the results:

Time.	Monument.	Signal Office.	Difference.	Time.	Monument.	Signal Office.	Difference.
	Volts.	*Volts.*	*Volts.*		*Volts.*	*Volts.*	*Volts.*
12 m	950	90	860	1.15 p. m	825	.....	.....
12.05 p. m	825	84	741	1 20 p. m	875	42	833
12.10 p. m	825	72	753	1.25 p. m	850	60	790
12.15 p. m	825	54	771	1.30 p. m	925	54	871
12.20 p m	850	72	778	1.35 p. m	900	60	840
12.25 p. m	800	54	746	1.40 p. m	875	48	827
12.30 p. m	850	36	814	1.45 p. m	950	60	890
12.31 p. m	825	36	789	1.50 p. m	950	60	890
12.32 p. m	800	42	758	1.55 p. m	950	42	808
12.33 p. m	825	36	789	2 p. m	925	30	895
12.34 p. m	800	42	758	2.05 p. m	850	54	796
12.35 p. m	500 / 875	42	833	2.10 p. m	900	114	786
12.36 p. m	825	42	783	2.15 p. m	850	72	778
12.37 p. m	800	60	740	2.20 p. m	925	90	835
12 38 p. m	800	54	746	2.25 p. m	1000	90	910
12.39 p. m	875	54	821	2 30 p. m	950	66	884
12.40 p. m	850	48	802	2.35 p. m	850	108	742
12.45 p. m	800	42	758	2.40 p. m	900	90	810
12.50 p. m	750	48	702	2.45 p. m	925	102	823
12.55 p. m	850	54	796	2.50 p. m	900	186	714
1 p. m	800	.....	.....	2.55 p. m	950	162	788
1.05 p. m	875	.....	.....	3 p. m	450	96	354

Average difference for forty-four observations, 800 volts.

Of the regular series of observations, the following points appear to be noteworthy: Negative values were obtained on March 4th, during light snow; on the 5th, during threatening weather; on the 7th, during heavy rain; on the 9th, during rain; on the 14th, during cloudy weather; on the 17th, during clear weather; on the 18th, during snow; on the 21st and 22d, during rain and snow; on the 24th, during light snow; and on the 31st, during heavy snow.

At Boston, Mass., negative values occurred at 3 p. m. on March 16th, preceding light snow by six hours; on the 17th, preceding snow by five hours, and during the snow; on the 18th, preceding and during rain; on the 19th, at 11 a. m. and 3 p. m., light rain beginning at 11.30 a. m. ending at 1.45 p. m., beginning again at 3.35 p. m. ending at 5.40 p. m.; on the 21st, preceding sleet about fifteen hours; on the 22d, at 3 p. m., preceding rain one hour, and snow the next morning. During the snow the values are positive. On the 24th a negative value occurred at 1 p. m. under a cloudless sky; light snow occurred during the early morning of the 25th; on the 27th, at 3 p. m., a negative value is recorded; light rain began in the early morning of the 28th and lasted until 12.45 p. m.; negative values occur at 1 p. m. and 3 p. m., preceding sleet by nine hours.

At Columbus, Ohio, negative values occur on March 21st, at 1 p. m. and 3 p. m., during fine rain and mist, and do not appear to have any predictive values. Snow on several occasions was accompanied by positive values, apparently average values, not influenced by the occurrence of the snow.

At Ithaca, N. Y., negative values occur on March 1st, and at 11 a. m. and 1 p. m., during threatening weather, but no rain or snow followed, and the indication for the purpose of prediction was misleading. Negative values occur on the 3d, not followed by precipitation; at 1 p. m. on March 5th, light snow, beginning one hour and three-quarters later; on the 6th, at all four observations, light rain and snow, continuing until midday; on the 8th negative values at all four observations, during cloudless weather, and not apparently reconcilable with any change in the weather. On March 10th, at all four observations, during threatening weather and preceding snow twenty hours; on the 14th negative values are recorded at 9 a. m., 11 a. m., and 1 p. m., and a very high positive value at 3 p. m. Sleet began early in the morning, ending at 10 a. m., and snow began at 2 p. m., continuing that day and the next; on the 16th, at 11 a. m., a negative value was recorded, and light snow began three hours later. Snow on the 17th was accompanied by positive values. Snow on the 18th was not preceded by negative indications, but was followed on the 19th by low positive and negative values during threatening weather, which, it may be noted, continued for some time, but unaccompanied by precipitation. Low positive values on the 21st precede snow

on the 22d. The values during the snow are positive, increasing with the continuance of the snow. Following the snow negative and low positive values; on the 25th negative values precede snow by at least ten hours; on the 27th low positive values, preceding, and on the 28th negative values during, light rain.

At New Haven, Conn., light snow on March 1st was not preceded, accompanied, or followed, by any marked change in the character of the electrometer readings, Low positive values on the 9th precede rain by nine hours, and large negative values occur on the 10th during the rain, turning to positive when the rain ended. Low positive values are recorded on the 17th, preceding light snow; on the 21st low positive values precede rain by nine hours, and rain and snow on the 22d are accompanied by negative and positive values. The following conditions on this date are noteworthy: snow began at 8.50 a. m. and ended at 10.30 a. m., beginning again at 1 p. m.; rain began at 11.20 a. m., ending sometime in the afternoon, beginning again at 6 p. m. The four recorded values are —135.4, 22, 3.8, and 94.2 volts. Rain on the 28th is accompanied by high negative values, turning to low positive when the rain had ended, and increasing in value, although rain began again at 6 p. m.

At Baltimore, Md., where a continuous record is maintained, the most violent disturbance occurred from 5.40 p. m. of the 21st to 11 a. m. of the 22d, during which, for a considerable time, the fluctuations exceeded the limits of the record, 700 volts on either side of the zero. A disturbance of large amplitude, but small duration, occurred from 9.30 p. m. of the 13th to 2.40 a. m. of the 14th. On other dates disturbances occurred, particularly on the 5th, from 3 p. m. to 6.30 p. m.; on the 7th from 8 a. m. to 11 a. m.; and on the 9th from 1 p. m. to 11 p. m. Chart vi shows, in the first diagram, the observations made simultaneously at the Monument and the Sig-Office, and on the other diagrams the observations for the month at Boston, Mass., and at Ithaca, N. Y.

OPTICAL PHENOMENA.

HALOS.

Solar and lunar halos were observed on the 3d and 4th at the majority of stations in Iowa, Illinois, Indiana, southern Wisconsin and Michigan, Ohio, New York, and Massachusetts, preceding and accompanying in these states the highest pressure of the month, and followed in the Lake region and New England on the 4th and 5th by a severe cold wave. During the presence of these halos cirrus and cirro-cumulus clouds, with light haze, prevailed.

On the 6th lunar, and on the morning of the 7th solar, halos were observed at a number of stations in the Lake region and Ohio Valley; they were followed by a steady rise in pressure, the mercury at different stations within these districts rising two to four-tenths of an inch during the succeeding twenty-four hours.

The storm of the 24th was preceded in New England, the middle Atlantic states, and lower lake region by cirro-stratus and cirro-cumulus clouds, with solar halos, which were reported from a number of stations. During the 25th and 26th this low area was succeeded over the northeastern quarter of the United States by rapidly rising pressure, and from the 27th to 29th by a general cold wave, which extended over the greater part of the country. The area of high pressure was accompanied on the 25th and 26th by solar halos which were reported on the 25th from a number of stations in the Ohio and upper Mississippi valleys, and on the 26th, with haze, from stations in the lower lake region, Ohio valley, and south Atlantic states.

Lunar halos were reported from a large number of stations in the lower lake region and the upper Mississippi valley on the 30th and 31st; those of the 30th were followed by rising pressure.

The phases of the moon (Washington mean time) during March, as given in "The American Ephemeris and Nautical Almanac" for 1887, are as follows: New moon, 23d, 23 h. 1.5 m.; first quarter, 2d, 7 h. 59.5 m., and 31st, 20 h. 44.6 m.; full moon, 9th, 3h. 25.7 m.; last quarter, 15th, 20 h. 33.9 m.; perigee, 9th, 7.0 h.; apogee, 23d, 1.7 h.

MIRAGE.

Fort Maginnis, Mont.: from 10 a. m. until noon of the 4th a very distinct mirage was visible toward the southwest, bringing into view the valley of the Yellowstone River, which is over sixty miles distant. With the aid of a field glass, hills and cañons, covered with undergrowth, were plainly seen.

Mirages were also observed at the following places:

Arizona.—Willcox, 27th, 28th, 29th.

Dakota.—Parkston, 10th, 11th, 24th, 31st; Webster, 1st, 16th, 17th, 18th.

Kansas.—Salina, 1st, 2d, 4th, 7th, 8th, 9th, 15th, 30th; Wakefield, 23d.

Nebraska.—Fairbury and Marquette, 1st.

North Carolina.—Reidsville, 14th, 17th.

MISCELLANEOUS PHENOMENA.

FOREST AND PRAIRIE FIRES.

Forest and prairie fires occurred at the following places:

Fort Reno, Ind. T., prairie fires, 1st, 2d, 16th, 17th; Duke, Fla., forest fires, 1st, 24th; Yankton, Dak., prairie fires, 9th, 10th, 11th, 15th, 16th, 17th; Wytheville, Va., fires on the mountains, 12th, 14th; Hay Springs, Nebr., prairie fires, 13th to 16th; North Platte, Nebr., prairie fires, 14th, 15th, 19th to 24th, 29th; Archer, Fla., forest fires, 16th to 19th, 22d; Pike's Peak, Colo., prairie fires toward the southeast, 22d, 23d, 24th; Fort Meade, Dak., timber fire in the southeast, 23d; Fort Elliott, Tex., prairie fires, 24th, 25th, 29th; Ninnescah, Kans., prairie fires, 25th to 28th; Fort Sill, Ind. T., prairie fires, 27th; Alva, Fla., forest fires, 31st.

METEORS.

Huron, Dak.: at 10.40 p. m. of the 12th a brilliant meteor was seen moving from a point about 20° above the southern horizon. It moved slowly, and parallel to the horizon, disappearing at a point south of west, and leaving a line of bluish light, with numerous brilliant sparks. The observer states that the meteor was visible about one minute.

Escanaba, Mich.: at 10.05 p. m., of the 14th a brilliant meteor was seen starting from a point near the zenith and moving northwesterly about 45°, when it disappeared.

Meteors were also reported to have been observed at the various stations, as follows: Fort Thomas, Ariz, 13th; Keeler, Cal., 23d, 28th; Nicolaus, Cal., 26th; Parkston, Dak., 12th; Quitman, Ga., 14th; Pekin, Ill., 25th; Vevay, Ind., 25th; Clinton, Iowa, 18th; Monticello, Iowa, 19th; Cedar Rapids, Iowa, 25th; Woodstock, Md., 8th, 11th, 14th, 20th; Escanaba, Mich., 14th; Kalamazoo, Mich., 22d, 31st; Moorhead, Minn., 13th; Beverly, N. J., 1st, 2d; Menands, N. Y., 1st; Hiram, Ohio, 10th, 11th; Mount Angel, Oregon, 20th; Stateburg, S. C., 24th; Cleburne, Tex., 14th; Salt Lake City, Utah, 18th; Poultney, Vt., 29th; Rappahannock Va., 11th; Variety Mills, Va., 23d; Embarras, Wis., 18th; Delavan, Wis., 24th; La Crosse, Wis., 31st.

MIGRATION OF BIRDS.

Geese flying northward.—Bancroft and Davenport, Iowa, and Genoa, Nebr., 1st; Corsicana, Tex., 1st, 5th, 18th; Charleston, Ill., 1st, 6th, 8th, 20th; Muscatine, Iowa, and Ninnescah, Kans., 2d; Garrettsville, Ohio, 2d, 22d; Lead Hill, Ark., 3d, 6th, 14th, 15th, 19th; Silver Falls, Tex., 3d, 19th; Erie, Pa., 5th; Fort Reno, Ind. T., 5th, 6th, 16th, 17th; Tecumseh, Nebr., 6th; Parkston, Dak., and Palmyra, N. Y., 7th; Cedar Rapids, Iowa, 7th, 19th; Hiram, Ohio, and Phillipsburg, Pa., 8th; Webster, Dak., 10th, 11th, 12th, 15th, 18th, 23d, 29th, 30th, 31st; Wakefield, Kans., 10th, 30th, 31st; Fort Wayne, Ind., 11th, 16th, 23d; Kitty Hawk, N. C., and Saint Vincent, Minn., 13th; Fort Meade, Dak., 13th, 18th, 20th; North Truro, Mass., 13th, 21st, 24th; Somerset, Mass., 14th; Liberty Hill, La., 15th; North Platte, Nebr., 15th, 16th; Palestine, Tex., 15th, 18th, 20th; Hay Springs, Nebr., 16th, 17th; Poplar River, Mont., 18th; Fort Sill, Ind. T., 19th; Astoria, Oregon, 22d; Bird's Nest, Virginia, 24th, 25th; Frisco, Utah, 30th; Moorhead, Minn., 31st.

Geese flying southward.—Fort Bidwell, Cal., 3d, 14th; Memphis, Tenn., 5th; Tatoosh, Island, Wash., 10th.

Geese flying eastward.—Wauseon, Ohio, 10th.

Geese flying westward.—Wauseon, Ohio, 21st.

Ducks flying northward.—Kitty Hawk, N. C., 6th, 7th, 31st; Charleston, Ill., 6th; Duke, Fla., 7th, 11th; Oswego, N. Y., 9th; Bancroft, Iowa, 10th; Tatoosh Island, Wash., 13th, 16th, 25th, 27th; Poplar River, Mont., 15th, 16th; Cedar Rapids, Iowa, 19th; Wakefield, Kans., 30th.

Cranes flying northward.—Elk Falls, Kans., 20th.

Cranes flying eastward.—Wauseon, Ohio, 7th, 16th.

POLAR BANDS.

Polar bands were reported from the following stations:

Prescott, Ariz., 18th; Keeler, Cal., 11th, 31st; Montrose, Colo., 31st; North Colebrook, Conn., 31st; Jacksonville, Fla., 15th; Archer, Fla., 31st; Riley, Ill., 3d, 8th; Pekin, Ill., 24th; Salina, Kans., 7th, 8th, 30th; Gardiner, Me., 2d, 4th, 14th; Central College, Mo., 15th; Moorestown, N. J., 9th; Wauseon, Ohio, 1st, 3d, 4th, 28th, 31st; Tiffin, Ohio, 25th; Dale Enterprise, Va., 26th; Variety Mills, Va., 30th; Prairie du Chien, Wis., 4th, 19th.

SAND STORMS.

Fort McDowell, Ariz., 22d; Fort Grant, Ariz., 20th, 22d; Yuma, Ariz., 21st, 22d; Rio Grande City, Tex., 5th.

WATER-SPOUT.

Captain Dakin, of the s. s. "Austria," reports having observed one large and several small water-spouts on March 11th, in N. 36° 44′, W. 71° 30′, during terrific hail squalls.

SUN SPOTS.

Mr. H. D. Gowey, of North Lewisburg, Champaign Co., Ohio, reports having observed sun spots on the 22d and 31st.

VERIFICATIONS.

INDICATIONS.

The predictions for March, 1887, were made by 2d Lieutenant Frank Greene, Signal Corps, U. S. Army, Assistant; they were verified by 1st Lieutenant Thomas M. Woodruff, 5th Infantry, Acting Signal Officer and Assistant.

The detailed comparison of the tri-daily indications for March, 1887, with the telegraphic reports of the twenty-four hours for which the indications were prepared, shows the general average percentage of verifications to be 74.35. The percentages for the different elements are: Weather, 76.59; wind, 72.53; temperature, 72.01. By states, etc., the percentages are: For Maine, 72.80; New Hampshire, 74.35; Vermont, 75.35; Massachusetts, 74.86; Rhode Island, 75.08; Connecticut, 77.93; eastern New York, 77.02; western New York, 73.01; eastern Pennsylvania, 75.73; western Pennsylvania, 69.92; New Jersey, 75.27; Delaware, 74.70; Maryland, 74.53; District of Columbia, 72.39; Virginia, 74.06; North Carolina, 78.98; South Carolina, 77.47; Georgia, 77.31; eastern Florida, 74.38; western Florida, 76.10; Alabama, 75.59; Mississippi, 75.73; Louisiana, 76.34; Texas, 74.76; Arkansas, 77.45; Tennessee, 72.37; Kentucky, 74.38; Ohio, 74.81; West Virginia, 72.45; Indiana, 76.45; Illinois, 75.21; eastern Michigan, 74.44; western Michigan, 69.85; Wisconsin, 74.54; Minnesota, 68.47; Iowa, 72.77; Kansas, 75.71; Nebraska, 71.74; Missouri, 72.12; Colorado, 76.85; eastern Dakota, 63.95.

There were six omissions to predict, out of 11,067, or 0.05 per cent. Of the 11,061 predictions that have been made, nine hundred and seventy-eight, or 8.84 per cent., are considered to have entirely failed; five hundred and eighty-two, or 5.26 per cent., were one-fourth verified; 2,144, or 19.38 per cent., were one-half verified; 1,647, or 14.89 per cent., were three-fourths verified; 5,710, or 51.62 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

Below are given for the Pacific coast the percentages of indications verified for February, 1887; this data was received too late for publication in the REVIEW of that date. The predictions were made by 2d Lieutenant J. E. Maxfield, Signal Corps, U. S. Army, Assistant; they were verified by 1st Lieutenant Robert Craig, 4th Artillery, Acting Signal Officer and Assistant. The percentages for the different districts are: Washington Territory, 64.89; Oregon, 64.84; northern California, 74.81; southern California, 82.21.

CAUTIONARY SIGNALS.

Of the total number of signals ordered during March, 1887, it was practical to determine the verifications of one hundred and seventy-three; of these, one hundred and forty-seven, or 84.97 per cent., were fully verified both as to direction and velocity. Number of signals ordered for on-shore winds, two, both of which were verified. Number of signals ordered for northeast winds, nine, all of which were fully verified both as to direction and velocity Number of signals ordered for northwest winds, seventy; fully verified both as to direction and velocity, fifty-two, or 74.29 per cent; verified as to velocity only, one, or 1.43 per cent. Number of signals ordered for winds without regard to direction, ninety-two; verified, eighty-four, or 91.30 per cent. Number of signals ordered late, *i. e.*, after the verifying velocity had begun, six, or 3.47 per cent.

In addition to the above, three hundred and seventy-nine signals were ordered at display stations, the verifications of which it was impracticable to determine.

In twenty-one instances winds were reported which would have justified the display of cautionary signals, but for which no signals were ordered, and in seven instances winds which would have justified the display of on-shore signals, but for which no signals were ordered.

COLD-WAVE SIGNALS.

Total number of cold-wave signals ordered, the verifications of which were determined, one hundred and thirty-three; verified, one hundred and seven, or 80.45 per cent. Thirty signals were ordered, the verifications of which it was impracticable to determine.

In addition to the above, in two hundred and eighty-seven instances, the signals ordered from this office were repeated by the observers at the regular stations to towns in their vicinity. The verifications of these it was impracticable to determine.

LOCAL VERIFICATIONS.

The following is from the March, 1887, report of the "Minnesota Weather Service:"

Verifications of weather signals for Minnesota were 74 per cent. for weather and 70 per cent. for temperature; for eastern Dakota, 90 per cent. for weather and 81 per cent. for temperature; for northern Iowa, 76 per cent. for weather and 82 per cent. for temperature.

The following is from the March, 1887, report of the "Tennessee Weather Service:"

The percentage of verifications of weather and temperature predictions were: for Nashville, weather 100 per cent., temperature 87.1 per cent.; for Clarksville, weather 85.2 per cent., temperature 66.6 per cent.

The following is from the "Bulletin of the New England Meteorological Society" for March, 1887:

Verification of weather signals at New Haven was 92 per cent. for temperature, 87 for weather. At Nashua the 1 a. m. predictions had a local verification of 71 per cent. and the 10 a. m. predictions of 54.8 per cent.

STATE WEATHER SERVICES.

The following is an extract from the March, 1887, report of the "Alabama Weather Service," P. H. Mell, jr., of the Agricultural and Mechanical College, Auburn, director:

The very small precipitation has made the month remarkable. The average amount of rain was 5.36 inches below the normal. Even at those stations where records have been kept for a number of years such a small precipitation has not been given in any previous March. Slight falls of snow were reported by several observers, too meagre, however, to measure.

The temperature was 4°.4 below the normal for March, and colder by 2°.2 than the average for February of this year. Frosts were frequent throughout the month, and considerable damage was done to fruit and early vegetables. In the northern portion of the state the fruit is reported as entirely destroyed. The sudden changes in temperature were very serious drawbacks to market gardening, and large losses have been sustained.

Summary.

Mean temperature, 54°.6; highest temperature, 80°.0, at Eufaula and Newton, on the 6th, and at Livingston on the 4th; lowest temperature, 19°, at Gadsden, on the 19th; range of temperature, 61°; greatest monthly range of temperature, 59°, at Gadsden; least monthly range of temperature, 40°, at Fayette; mean daily range, 18°; greatest daily range, 46°, at Gadsden, on the 2d; least daily range of temperature, 0°, on the 17th, at Greensborough, and at Union Springs on the 13th.

Mean depth of rainfall, 1.97 inches; mean daily rainfall, 0.064 inch; greatest depth of monthly rainfall, 4.07 inches, at Tuscumbia; least depth of monthly rainfall, 0.07 inch, at Troy.

Average number of days on which rain fell, 4; average number of cloudy days, 6; average number of fair days, 10; average number of clear days, 15.

Warmest days, 4th, 6th, 13th, and 26th; coldest day, 29th.

Prevailing direction of wind, northwest.

The following is an extract from the March, 1887, report of the "Arkansas Weather Service," Mr. George R. Brown, of Little Rock, director:

Hail storms were reported from Searcy and Fayetteville on the 26th; Little Rock, Palarm, and Monticello the 27th; and Palarm 30th. Snows, at Fayetteville, Eureka Springs, and Conway the 28th.

Heavy rains at Conway 5th and Searcy 26th. The heaviest rain and most general of the month was on the 6th. Reports from nearly all portions of the state, and the stations at Cairo, Ill., Memphis, Tenn., and Shreveport, La., show the average for that day to be from one to three inches.

Two cool waves passed over the state, on the 3d and and 18th, doing but little damage, and in most places not cold enough for a frost. The cold wave of the 27th, 28th, and 29th was more severe and did great damage to fruits and early vegetables. At Judsonia the temperature was 10° below freezing on the 29th, and ice a quarter of an inch thick.

Frosts were reported from Russellville 2d, 22d, and 29th; Palarm, Cairo, Ill., Shreveport, La., 22d; and generally on the 23d 28th, and 29th, with ice at most places even as far south as Helena and Monticello.

The highest observed temperature was 88°.0 at Fayetteville University, and the lowest 24°.0 at same place.

The rainfall throughout the state has been from one-half to one and a half inches less than usual, while the mean temperature is from one to four degrees above the average of March.

The following extracts are from the March, 1887, "Monthly Review of the Illinois Weather Service," Col. Charles F. Mills, of Springfield, director:

The month of March was, all things considered, very pleasant. There was an absence of the fierce storms of winter, high winds, and heavy drifting snows that tend to make it, climatically, the least favored of the winter months. The meterological conditions were reversed, in that the first part of the month was warm and spring-like, while the last few days were marked by the occurrence of the only severe cold-wave and heavy snowfall (the latter in the southern counties only).

Five areas of high pressure and seven of low pressure passed over the state during the month. Of the former, that of the 4th was the most marked, and of the latter that of the 24th, neither being remarkable for extremes. The range of pressure was greatest in the northern and least in the southern part of the state.

Temperature.—The temperature was normal for the month, being slightly below in the northern and central counties, and slightly above in the southern.

The highest temperatures occurred on the 12th in the northern and central counties, and on the 1st and 2d in the southern counties.

The lowest temperature occurred on the 28th and 29th throughout the state, ranging from —7° in Jo Daviess county to 24° in Alexander county.

The mean daily range of temperature was about 2° above the March normal for the past six years.

The mean temperature of the month for the state, 37°.6, was exactly the March normal for tne past thirteen years. March, 1877, with a mean temperature of 31°.5, being the coldest, and March, 1880, with a mean temperature of 48°.0, being the warmest on record. The mean temperature of the northern counties was 31°.8; of the central, 38°.1, and the southern, 43°.6.

The lowest monthly mean temperature reported was 23°.6, from Lake Forest, Lake Co., and the highest, 47°.9, from Cairo, Alexander Co., making a range of 24°.3 from the extreme northern to the extreme southern portion of the state, or a rise of about 1° in the mean temperature for every sixteen miles traversed going south.

Precipitation (inches).—General precipitation fell on six days, the amount deposited being very light in the northern counties, nearly an inch below the normal in the central, and about the average in the southern. Excessive rainfall (over four inches) was reported from Marion and Clay counties on the 5th. A heavy snowfall was reported from the same section on the 30th.

The average precipitation for the state for the month, 2.27, was 0.39 below the March normal for the past ten years. March, 1882, 4.47, being the greatest, and March, 1885, 0.51, the least monthly precipitation on record. The average for the northern counties, 1.02, was 1.21 below; for the central counties, 1.70, was 0.87 below, and for the southern counties, 4.19, was 1.02 above the March normal for the past ten years.

The average snowfall for the state for the month was 6.1, exactly the March normal for the past four years; for the northern counties, 6.2; central, 4.3, and southern, 7.4. The greatest monthly snowfall reported was 17.0, from Richland county; the least, 1.0, from Pope county. A heavy snowfall, aggregating 12 inches, occurred in the south-central part of the state on the 30th (about the same section that had the heavy rainfall on the 5–6th); the northern boundary of this snow storm reached to the central part of the state. But little of this snow remained on the ground on a. m. of April 1st.

The prevailing direction of the wind was from the northwest. The maximum velocity was from forty to fifty miles per hour from the west on the 24th, caused by the rapid movement of an area of low pressure moving northeastward through the Saint Lawrence Valley.

The cold waves were few and none severe. That of the 28–29th covered the entire section of country east of the Mississippi River.

The following is an extract from the March, 1887, "Bulletin of the Colorado Meteorological Association," Prof. F. H. Loud, of Colorado Springs, director:

The March weather has been remarkably pleasant, being warm, and, to a great degree, free from the wind-storms which prevailed in February. The rainfall in most sections was also light. At Denver, as will be seen by the annexed table, the five lowest March rainfalls on record (including that of the present year) differ but slightly from one another, while the mean temperature for last March is but one-tenth of a degree below the highest which is recorded, that of 1879.

Table of temperature and precipitation at Denver and Colorado Springs for March during sixteen years.

Year.	Denver.		Colorado Springs.		Year.	Denver.		Colorado Springs.	
	Temperature.	Precipitation.	Temperature.	Precipitation.		Temperature.	Precipitation.	Temperature.	Precipitation.
	°	Inches.	°	Inches.		°	Inches.	°	Inches.
1872	36.3	1.71	35.4	1.15	1880	34.2	0.21	.....	0.59
1873	44.0	0.22	41.9	0.19	1881	37.6	0.87	.....	.....
1874	36.3	0.49	34.5	0.50	1882	43.2	0.20	.....	.....
1875	33.3	0.39	30.4	1.12	1883	43.8	0.21	39.6	.....
1876	34.7	1.80	33.5	0.13	1884	39.0	0.93	36.4	.....
1877	42.8	1.40	.....	.....	1885	38.5	0.97	38.6	.....
1878	45.5	1.82	.....	.....	1886	33.5	2.36	34.0	0.39
1879	46.0	1.00	44.2	0.73	1887	45.9	0.23	43.4	0.19

The following is an extract from the March, 1887, report of the "Indiana Weather Service," Prof. H. A. Huston, of Purdue University, Lafayette, director:

The mean temperature was about normal over the greater part of the state, the greatest departure being 3°.9 below at Logansport. The warmest day was the 2d, and the coldest the 29th. The highest temperature was 78° at Marengo, and the lowest 8° at Angola.

Precipitation was mostly below the normal, except at Worthington where it was 1.36 inches above, and at Sunman where it was 1.13 inches above. A very heavy snow storm occurred in the southern portion of the state on the 30th and 31st, fourteen inches being reported from some stations. Thunderstorms were reported on the 5th, 9th, and 27th.

The observer at Princeton, Gibson Co., reports that on the morning of the 6th, after a heavy rainfall the previous night, the ground was thickly covered with yellow dust resembling sulphur. The quantity was so great that in some places it had gathered in drifts like snow. This dust extended over the entire county, and was believed to be the pollen of the southern pines which had been caught up and carried along by the wind. The observer at Angola reports that, owing to the lack of snow, the wheat crop in his neighborhood is considerably injured by the frost.

The following is an extract from the report of the Michigan State Board of Agriculture for March, 1887. The state weather service is in charge of N. B. Conger, Sergeant, Signal Corps:

Temperature.—The mean temperature for the state for March, 27°.6, is the same as the mean obtained from a series of readings extending from five years at Mackinaw City to nineteen years at the Agricultural College.

The mean temperature for the central counties, as obtained from the mean temperature for this month at Port Huron, Agricultural College, and Grand Haven, is 30°.1.

The absolute range of temperature for the state is 78°.5. The maximum temperature, 64°, at Cassopolis, and the minimum temperature, —14°.5, at Grayling. The greatest range of temperature at any station was 67°, at Grayling, and the least range was 41°.4, at Saginaw City.

Prof. R. C. Kedzie, of the Agricultural College, who has a continuous record for the last twenty-four years, furnishes the following means, obtained from observations made at the college: Mean temperature, 31°.46; mean barometer, 28.933; mean rainfall, 2.63 inches. As these observations extend over nearly a quarter of a century they are reliable for the mean of central Michigan.

Precipitation.—The precipitation has been below the normal about 0.96 inch in the state. The maximum rainfall, 3.00 inches, at Port Huron, and the minimum rainfall, 0.22 inch, at Mackinaw City. The central part of the state received the highest average precepitation, while the northern and southern portions are below the normal from 1.00 to 1.12 inches. The average number of rainy days is but 7.3. On the 5th instant rain fell, which continued until the morning of the 6th, and melted what snow there was on the ground, leaving it bare throughout the central and southern portions of the state. Snow fell on the 13th, but melted as rapidly as it fell.

The snow that fell on the 21st and 22d, lay in some portions two inches deep on the level.

The snow of the 24th, which began in the afternoon, was remarkable for the size of the flakes, which in several instances were carefully measured and found to be two and a half inches long by one and three-fourths inches wide. These heavy flakes fell for fully thirty minutes, when they became smaller. The snow storm of the 27th left a covering of snow on the ground of from 2 to 4 inches.

The total snowfall in the state ranges from 2.0 inches to 11.5 inches. The precipitation along the peach belt of west Michigan has been light.

The growth of the weather signal stations has been very gratifying, as sixty stations have been established since January 1st.

Three cold-wave signals were ordered during the month, and were all justified by the anticipated fall of 15° to 25°. The signals were ordered from twelve to thirty-six hours in advance of the wave.

The following extracts are from the March, 1887, report of the "New England Meteorological Society," Prof. Wm. H. Niles, of the Institute of Technology, Boston, Massachusetts, president:

Reports for the month were received from one hundred and forty-four observers.

The average precipitation for the month for thirty-two stations was somewhat in excess of normal; the excess was most distinct in Massachusetts, where thirteen stations average 1.11 inches above their normal, while eight stations in southern New England had an average deficiency of 0.23 inch. During, and at the end of, the month the snow in northern New England was exceptionally deep. The mean temperature for the month at twenty-five stations averaged 2°.6 below the normal.

The weather of the month was controlled by seven cyclonic storms; four of these, on the 2d, 7th, 25th, and 28th, passed down the Saint Lawrence Valley; two came from the south, passing along our coast on the 10th and 22d; one apparently crossed from the Lakes over northern New England and lingered nearly a week off-shore, from the 14th to 20th, the anti-cyclones preceding and following it passing by on the 12–13th and 21st.

March opened with clear, quiet, cold weather, under an anti-cyclone, giving a low morning minimum that was at many stations the lowest of the month (5° to 15° in the south, 0° to 24° in the north); but in the afternoon clouds appeared in advance of a weak cyclonic storm that passed over Canada on the 2d, giving us higher temperature, halos, and some cloudiness, but very little precipitation. The weather then remained fair up to the 5th, when a strong anti-cyclone (30.8 inches) gave a second low morning minimum, the lowest of the month for nearly all stations that had not already had their lowest temperature on the 1st (5° to 15° in the south, —10° to 33° in the north). In the White Mountain region a strong inversion of temperature accompanied this rapid nocturnal cooling, as appears from the following list of noon maxima on the 4th and morning minima on the 5th; the Gorham record is from a Draper thermograph:

	Max.	Min.	Fall.		Max.	Min.	Fall.
	°	°	°		°	°	°
Mount Washington	1	—15	16	Berlin Mills	38	—29	67
Stratford	38	—21	59	Gorham	30	—15	45
West Milan	38	—33	71	Shelburne	36	—23	59

As this anti-cyclone moved off the coast, and while the next succeeding cyclonic centre was still in the far northwest, there was a rapid fall of pressure to about thirty inches, causing a heavy and unexpected snow storm, beginning with easterly winds about 18h. to 20h. on the 5th and continuing over night till morning or about noon of the 6th, and yielding when melted one to two inches of water; in the south the snow generally changed to rain on the morning of the 6th. During the snow storm the temperature stood at most stations between 15° and 30°, rising to between 20° and 40°, with small diurnal variations during the cloudy 7th; but as the cyclonic centre passed eastward over Canada and the pressure began to rise about midnight of the 7th the temperature fell, preparatory to marked diurnal variation under the clear anti-cyclone of the 8th and 9th; the noon maximum of the 8th and the morning minimum of the 9th differed by more than forty degrees at many of the northern interior stations.

* * * * * * *

The Hampshire Natural History Society has established a number of thermometer stations in Northampton, Mass., at points about a quarter of a mile apart, and all within a mile of the post-office; the following abstract from the records for March is furnished by the secretary of the society, Mr. W. R. Jones:

Station.	Altitude above sea.	Maximum temperature.			Minimum temperature.			Monthly mean.
		Mean.	Absolute.	Date.	Mean.	Absolute.	Date.	
	Feet.	°	°		°	°		°
Paradise Road	182	38.0	52	21	19.5	7	1	28.7
Green Street	150	39.2	52	13, 20	20.8	0	5	30.0
Maple Street	125	38.9	49	14, 19	19.1	—2	5	29.0
Round Hill	285	35.8	49	21	22.2	7	5	29.0
Holyoke Street	135	37.4	47	21	19.1	2	5	28.2
North Street	125	35.7	47	21	18.2	—2	5	27.0
Munroe Street	140	39.1	48	19	18.4	—3	5	28.8
North Prospect Street	195	37.7	50	21	20.4	2	5	29.0
Prospect Street	182	39.5	51	25	21.0	3	5	30.2

The following is an extract from the March, 1887, report of the "Minnesota Weather Service," Prof. Wm. W. Payne, Carleton College, Northfield, director:

The month was characterized by a deficiency in precipitation, a temperature slightly below the normal, and twenty-two days on which the weather was either fair or clear.

Temperature.—The mean was 25°.5, which is 1°.3 below that of the corresponding month of 1886 and 1°.3 above that of 1885. Cold waves passed over the state on the 3d and 4th, and 24th and 25th; during the prevalence of the former the minimum temperature of the month occurred. Some of the lowest were Saint Vincent, —27°.0; Grand Forks, —22°; and Moorhead, —19°.2. The mild weather, which generally prevailed from the 6th to the 28d, caused the snow to rapidly disappear. The maximum temperature for the month was 65°.9, and occurred at La Crosse on the 12th; the next highest was 61° at Winona on the same day. The temperature was 3° below the average of seventeen years in the northeastern portion of the state, and 1° below in the southeastern portion, while in the northwestern portion it was 2° above the average of fourteen years. North of latitude 45° 30′, the temperature was 2° below that of the corresponding month of last year, while to the south is was not quite 1° below. The monthly range of temperature for the state was 92°.9, which is exceptionally great; this is 14° above the range of 1886, and 20° above that of 1885. The greatest ranges reported were 77° at Grand Forks, and 72° at Saint Vincent; the least ranges were 53° at Spring Valley, and 53°.6 at Mankato.

Precipitation (in inches).—The average for the state was 0.34, which is considerably below the normal, and 0.75 below that of the corresponding month of 1886. The precipitation was mainly in the form of snow, and occurred during the periods of the 5th to 8th (inclusive), 19th and 20th, 22d to 24th, 29th and 30th. No station reported as much as an inch of precipitation, while some of the greatest amounts recorded were Duluth, 0.55, Saint Vincent, 0.48, Spring Valley, 0.44, and Red Wing, 0.43; some of the smallest were Saint Cloud, 0.14, Northfield, 0,18, Winona, 0.25, La Crosse and Moorhead, 0.26. At La Crosse it was 1.32 below the average of fifteen years; Saint Paul, 1.11 below that of seventeen years; and Duluth 0.95 below that of seventeen years. The greatest amount of snow reported as having fallen was five inches at Spring Valley and Rochester. At the close of the month snow had generally disappeared, except in localities where there were severe drifts.

The following is from the March, 1887, report of the "Mississippi Weather Service," Prof. R. B. Fulton, of the University of Mississippi, Oxford, director:

Summary.

Mean temperature, 58°; highest temperature, 87°, on the 12th, at Greenville; lowest temperature, 28°, on the 30th, at Lamar and Palo Alto; monthly range, 59°. Mean monthly rainfall, 2.90 inches; greatest monthly rainfall, 5.36 inches, at Batesville; least monthly rainfall, 1.02 inches, at Waynesborough; average number of days rain fell, 6.

Frost occurred generally throughout the state, except in the extreme southern portion on the following dates: 1st 17th, 18th, 19th, 21st, 22d, 23d, 25th, 29th, 30th, 31st.

Hail occurred at Biloxi, 20th; Edwards, 27th; Jackson, 27th; Oxford, 30th.

Extracts from reports of observers.

Jackson, March 26: at 5.30 p. m. a dark cloud arose in the northwest, followed by considerable wind, rain, and very heavy hail. No damage done to crops or fruit. The thermometer fell in two hours from 78° to 48°.

Artonish Plantation: This month has been an unexceptional one—no violent storms and but very little rain.

The following is from the March, 1887, report of the "Missouri Weather Service," Prof. Francis E. Nipher, of Washington University, Saint Louis, director:

March, 1887, has had a mean temperature of 46°.1, which is 2°.4 above the normal at the central station. The highest temperature recorded was 78°.7 on the 1st, and the lowest was 26° on the 29th, both being common temperatures for March. The temperature fell to, or below 32°, on six days during the month. The rainfall and melted snow was 3.87 inches, which is very near the average, 3.74. Nearly two and one-half inches of this fell in about eighteen hours on the 5th. Snow fell on four days, viz., on the 21st, 28th, 29th, and 30th, that on the 30th being rather heavy, between three and four inches. ing on that day.

The lowest temperatures reported from the state are: 14°, at Ironton, Kirksville, and Louisiana; 16°.2, at Fayette; 18°, at Miami and Sedalia; and 19°, at Houstonia. The highest temperatures were: 85°, at Pro Tem; 80°, at Columbia, Sedalia, Steelville, and Troy; and 79°, at Oregon.

The following is from the March, 1887, report of the "Nebraska Weather Service," Prof. Goodwin D. Swezey, of Doane College, Crete, director:

The most marked feature of the weather for the month has been the great deficiency in snow which, with the corresponding deficiency for the two preceding months, has rendered the early germination of crops impossible, although the early arrival of warm weather has permitted prompt beginning of spring's work, so that farm work is well advanced.

Precipitation.—The average precipitation for southeastern Nebraska is only 0.36 inch against an average of 1.11; the average for the entire state is 0.47; the largest precipitation is, this month, in the extreme west, which is the only part of the state having over one inch. A small area in the southeast corner has over one-half an inch, while an area in the east-central portion of the state along the Platte has scarcely any, and one station near the centre of this area reports absolutely no appreciable precipitation. All this is in striking contrast with the unprecedented snowfall of last March.

Temperature.—There has been nothing marked in the temperature of the month. The mean is 1°.2 above the normal; the noon temperature is 1°.8 above the average of past Marches; the extremes have been considerable, the range being from 80° to —5°.5, the usual range being from about 70° to 5°.

Comparison of past Marches.

The table shows the mean temperature, the noon temperature, and the number of days below 32° for the past ten Marches in southeastern Nebraska; they are found by averaging the numbers reported at the different stations. It also shows the highest temperature and the lowest recorded anywhere in the state by standard self-registering thermometers:

March.	Mean temperature.	Noon temperature.	Below 32°.	Highest temperature.	Lowest temperature.
	°	°	*Days.*	°	°
1878	46.8	57.8	.....	80.0	22.0
1879	40.6	52.1	.....	86.0	1.0
1880	34.8	46.6	1.8	.....	.....
1881	39.2	37.5	0.0	51.0	4.0
1882	40.2	49.2	0.0	77.3	4.5
1883	33.6	42.2	0.1	71.0	3.0
1884	34.8	43.1	1.4	73.0	— 4.7
1885	35.7	45.8	0.0	70.2	7.0
1886	31.7	39.1	1.6	73.0	—15.0
1887	37.7	47.9	0.0	79.8	— 5.5

The following is an extract from the March, 1887, report of the "New Jersey Weather Service," Prof. George H. Cook, of the Agricultural College, New Brunswick, director:

March came in to us mild mannered, and without a hint as to its boisterous blusterings that greeted us farther on, and left us at the end of the month with snow on the ground to an average depth of one inch.

Five storm-centres were traced across the country on the Signal Service maps and several disturbances affected our weather conditions, whose centres passed along the Gulf stream in their usual northeasterly course and are not included in the above number. Suffice it to say that the storm movements were rapid and high winds followed, and that after the 10th of the month they were effective in drying up the roads and clearing away the fog, and traveling in the state became more agreeable.

The temperature for March was lower than the average March temperature for sixteen years, but still higher than the remarkably cold March of 1885, when the mean at New Brunswick was 29°.8. The mean monthly temperature for the state, as given below at eleven stations—Atlantic City, Dover, Lambertville, Moorestown, New Brunswick, New York City, Paterson, Philadelphia, Princeton, Somerville, and South Orange—when compared with the normals determined for those stations, shows an average deficiency of 3°.3. The excess of heat received in February has thus been lost in March; and, strange as it may seem, it was just 3°.3.

Frosts were quite frequent in March, and in many places exposed to the south it remained in the ground to a depth of three inches when the month closed.

The following is from the March, 1887, report of the "North Carolina Weather Service," Dr. Charles W. Dabney, jr., of Raleigh, director:

That popular and proverbial maxim relating to the month of March, "Enter as a lamb, exit as a lion," and *vice versa*, was practically illustrated in this case. The month opened balmy and spring-like, with warm, genial sunshine, high temperatures (the maximum at nearly all stations was noted on the 2d), clear skies, and general absence of rain; peach trees began to bud and leaf, fresh grass appeared, and many early garden plants burst forth in blossom. On the other hand, four of the final days were remarkable for strong winds, hoar frosts, heavy rains, snow, and sleet, with decidedly freezing weather at all points. The temperatures were generally reduced to 10° and 15° below freezing, and in the moutainous districts even 21° below freezing was recorded. It was during this period (on the 30th) that most of the observers noted their minimum for the month. The severity of this change and its general scope was, unfortunately, largely destructive to plant life. The approaching frost was duly announced by the United States Signal Service, and the cold-wave signal was hoisted at Raleigh before 11 a. m. of the 28th, nineteen hours in advance of the change. The temperature dropped 33°. Warm, cold, and equable temperatures were about evenly divided; the daily variations were as follows: normal on the 4th, 6th, 9th, 11th, 12th, 20th, 21st, 23d, 27th, and 28th; abnormally high on the 1st, 2d, 3d, 7th, 8th, 10th 13th, 24th, 25th, and 26th; abnormally low on the 5th, 14th to 19th, 22d, 29th, 30th, and 31st.

The heavy and continuous rains in connection with the abnormally high temperatures during the first part of the month were favorable conditions under which vegetation obtained an early start. The average monthly rainfall, 3.15 inches, as compared with the official records at eleven stations of the Signal Service within and adjacent to the state, shows a deficiency of 2.85 inches.

The following is an extract from the March, 1887, report of the "Ohio Meteorological Bureau," Prof. B. F. Thomas, of the Ohio State University, Columbus, president:

The weather for the month presented no very marked departures from the records for the same month in preceding years. The mean barometric pressure was 30.05 inches, agreeing with the average. The highest pressure, 30.68 inches, was recorded on the 4th, following the cold wave of the 3d. This is our highest March record.

The temperature for the month was unusually steady. The mean was, 35°.8, with a range between the maximum of 75° on the 2d, and the minimum of 5°.5 on the 29th. This range of 69°.5 is smaller by 7° than in any preceding March. Cold waves occurred on the 3d and 28th. The above mean temperature is 2°.4 below the normal, but our five-year average for March is 1°.1 lower still.

The mean rainfall was 2.23 inches, .06 below the average, and 1.14 below the normal. General rains occurred on the 5th, 6th, 9th, 21st, 22d, 27th, and 28th, the heaviest fall being recorded on the 5th and 6th.

The following is from the March, 1887, report of the "Oregon Weather Service," in charge of B. S. Pague, Private, Signal Corps, Roseburg:

Temperature.—The temperature has been above the normal throughout the state. A warm wave spread over the state on the 22d; the highest temperature recorded was 81°, at Roseburg. In the northern part of the state the coldest weather was from the 1st to 5th; in the southern part from the 17th to 21st. The lowest temperature was 28°, at Linkville, on the 18th.

Rainfall.—The rainfall has been above the average from the Calapooia Mountain to the Columbia River, and below the average thence to the southern boundary. From the 3d to 6th, heavy rain fell from Roseburg northward; from the 1st to 15th it was generally rainy throughout the state; from the 16th to the end of the month an occasional light rain fell.

Winds.—The winds were southerly along the Columbia and through the Willamette Valley; northwesterly in the Umpqua Valley; and southerly in the Rogue River Valley. Severe gales prevailed on the 11th along the coast and interior valleys, and on the 28th in the vicinity of Portland.

The following is from the March, 1887, report of the "South

Carolina Weather Service," Hon. A. P. Butler, Commissioner of Agriculture for South Carolina, director:

The month has been cool and dry, with temperature and rainfall both below the average. At Charleston the mean temperature was 54°.8, or 2°.4 below the mean of the last sixteen years, and the total rainfall was only .50 inch, or 3.68 inches less than the average for the same period.

The mean temperature for the entire state was 51°.4, or 1°.2 lower than that of the preceding month. The average rainfall was 1.85 inches, being 1.56 inches less than that for February.

The opening days of the month were warm and pleasant, but after the general rains which occurred on the 8th and 9th cool west to northwest and north winds set in and continued with more or less regularity until the 20th. After that date the winds became variable and there was a gradual increase of temperature until the 28th, when a sudden fall occurred and the northwest winds again predominated.

As a whole the month was unfavorable for truck gardening and fruit growing interests, the cool winds referred to having chilled the plants and stunted their growth.

The heaviest rainfall of the month occurred throughout the state on the 8th and 9th, and was accompanied by a marked decrease of temperature, these conditions probably causing the formation of the area of low barometer which appeared off the North Carolina coast on the 9th, and which moved slowly northeastward along the coast until the 11th, when it reached Nova Scotia. The northwest and west winds which prevailed over our state until the 20th were due to the presence of an extensive area of low barometer central over the Atlantic Ocean and off the coasts of New England and Nova Scotia from the 11th to the 20th.

During the 21st an area of low barometer passed within the limits of our state. This storm developed in Louisiana on the 20th and passed eastward along the Gulf coast into southern Georgia; thence northeastward along the South Carolina coast during the 21st. The storm increased in severity during its northeasterly movement and caused violent winds on the middle Atlantic and New England coasts. It was followed in this state by brisk west and north winds and clear weather.

The temperature fell suddenly in our state during the night of the 28th, the reports showing a decrease in temperature of 25° to 30° between 2 p. m. of the 28th and the same hour on the 29th.

The following telegram from the Chief Signal Officer of the Army, at Washington, D. C., was received at Columbia at 11.30 a. m. on the 28th:

"WASHINGTON, D. C., *March* 28.

"*To Observer, Columbia, S. C.:*

"Hoist cold-wave signal. The temperature will probably fall suddenly twenty degrees by 7 a. m. Tuesday.

"(Signed) GREELY."

A few minutes later the following was received:

"WASHINGTON, D. C., *March* 28.

"*To Observer, Columbia, S. C.:*

"Severe frosts are expected in the interior of South Carolina, Georgia, and Alabama on the morning of the 29th.

"(Signed) GREELY."

This information was immediately distributed, through the co-operation of the railroads and by special telegrams, throughout the state, so that at 1 p. m., or several hours in advance of the cold wave, by energetic effort on the part of those whose interests were liable to damage by frost, preparation could have been made to protect plants, gardens, etc. An examination of the reports from display stations shows that this warning was of great benefit to many people, and that such preparations were made, and with successful results, many gardens of early vegetables having been saved from injury.

Summary.

Mean temperature, 51°.4; highest temperature, 82°, at Columbia and Spartanburg, on the 2d; lowest temperature, 23°, at Spartanburg, on the 19th; range of temperature, 59°; greatest daily range of temperature, 43°, at Florence, on the 1st; Cheraw, on the 2d; and Spartanburg, on the 26th; least daily range of temperature, 2°, at Newberry, on the 5th.

Mean daily rainfall, 1.85 inches; greatest monthly rainfall, 3.89 inches, at Abbeville; Least monthly rainfall, 0.50 inches, at Charleston; greatest daily rainfall, 1.47 inches, at Bennettsville, on the 8–9th; date of heaviest rainfall throughout the state, 9th. Average number of rainy days, 7.

The following is an extract from the "Tennessee State Board of Health Bulletin" for March, 1887, prepared under the direction of J. D. Plunkett, M. D., President of the State Board of Health. The weather report is prepared by H. C. Bate, Director of the State Meteorological Service:

The mean temperature for March was 49°, slightly above the normal. The highest temperature was 77°, recorded on the 1st and 26th, and was the lowest maximum reported in the five years beginning with 1883. The lowest temperature was 18°, recorded on the 29th, and was the highest minimum reported in the period above-named, the lowest being 5°, reported in 1885. The mean daily range of temperature was very nearly normal.

The state was visited by three cold waves during the month, viz., on the 3–4th, 13–14th, and 27–28th; the predictions of which were all fully verified, the temperature reaching even 5° to 15° below the predictions.

The mean rainfall was 3.79 inches, slightly below the normal, and nearly two inches below the mean of the past five years in March. Of this amount the eastern division received an average of nearly three and three-fourths inches; the middle division nearly four inches, and the western division a little more than three and a half inches. The greatest rainfall was 5.41 inches, reported at Florence Station, and the least was 1.60 inches, reported at Fostoria. The days of the greatest rainfall were the 4th, 6th, 7th, 9th, and 27th; of these, the greatest fall occurred on the 6th, when an average of 1.11 inches fell throughout the state. The greatest local daily rainfall occurred at Florence Station on the 6th, and measured 2.85 inches. But few of the rains were general. Those on the 14th, 17th, 18th, 21st, and 28th were reported with snow; most of them were light and partial. The 1st, 2d, 10th, 11th, 12th, 13th, 15th, 24th, 25th, and 26th were reported without rain. Snow fell in various parts of the state on the 14th, 17th, 18th, 21st, and 28th; most of these falls were very light; the greatest depth reported was at Fostoria, 2 inches.

Summary.

Mean temperature, 49°.0; range of temperature, 59°; mean monthly range of temperature, 49°.5; greatest monthly range of temperature, 56°, at Greeneville and Hohenwald; least monthly range of temperature, 42°, at Covington; mean daily range of temperature, 16°.8; greatest daily range of temperature, 42°, on the 1st, at Grief, and on the 12th, at Hohenwald; least daily range, 1°, on the 4th, at Riddleton, and on the 20th, at Trenton; mean of maximum temperatures, 74°.0; mean of minimum temperatures, 24°.5.

Average number of clear days, 13.4; average number of fair days, 6.7; average number of cloudy days, 10.9; average number of days on which rain or snow fell, 9.4.

Warmest day, 26th; coldest day, 29th.

Prevailing direction of wind, northwest.

METEOROLOGICAL NOTES.

AVERAGE STORM TRACKS FOR THE MONTH OF MARCH.

[By 2d Lieut. FRANK GREENE, Signal Corps, U. S. Army, Assistant.]

In the construction of chart number vii, showing the average storm tracks for the month of March, ninety-nine storm tracks have been considered, the storms occurring in the years from 1873 to 1885. Only those storms were considered whose paths clearly laid within the limits of observation in the United States. Many tracks that only skirted the northern boundary of the United States were not considered, because, owing to the sparsity of stations of observation in the British Provinces, the exact location of the storm-centre was not clearly defined.

Upon examination it is found that these storm-centres pursued, in a general way, paths of such similarity that they may be said to be divided into four classes, the path of each class being distinct and different from the others, and readily discerned.

These paths, as shown on the chart, are designated by the letters *A A*, *B B*, *C C*, *D D*, with secondary paths, *A aa′*, *B bb′*, *C cc′*.

A A. These storms first appear near the northern boundary of the United States, about the one hundred and tenth meridian west from Greenwich, and move southeastward through Montana and Dakota, passing then eastward near the latitude of Saint Paul, Minn., thence crossing Lakes Michigan and Huron, move down the Saint Lawrence Valley, disappearing generally off the Nova Scotian coast. A smaller number, *A aa′*, after following the general direction *A A*, appear to be deflected more to the south after passing Saint Paul, and moving down over Lake Erie disappear to the east of Delaware Bay.

B B. These storms are first noticed in Montana about the one hundred and seventh meridian west from Greenwich, and at once take a more southerly course, southeastward through Nebraska and northern Kansas, passing eastward near Saint Louis, thence inclining gradually to the northward, moving up the Ohio Valley along the southern edge of Lakes Erie and Ontario, and moving down the Saint Lawrence Valley, disappearing near its mouth. A smaller number after first following the general course *B B*, continue in a direct east course after passing Saint Louis, and pass to the eastward, disappearing near the mouth of Delaware Bay.

C C. These storms are first noticed in northwestern Texas between latitudes 32° and 35° N., near the one hundredth meridian west, one portion moving in a direction a little north of east through Arkansas, Tennessee, and southern Virginia, passing off into the Atlantic Ocean south of Norfolk, Va. A slightly greater number, *C cc′*, take at once a course in a nearly direct northeast line through the Indian Territory, Missouri, Illinois, the lower part of eastern Michigan, and following the Saint Lawrence Valley disappear in the Atlantic Ocean near Newfoundland.

D D. These storms appear to originate in the western part of the Gulf of Mexico, in the vicinity of Galveston, Tex., and in general move in a direct northeast course through Louisiana, Mississippi, northern Alabama, east Tennessee, following the trend of the Blue Ridge Mountains and skirting the southern coast of New England, disappear in the Atlantic Ocean about the southern shores of Nova Scotia. Very rarely storms appearing in the Gulf of Mexico are apparently pressed southward by the influence of an area of high barometric

pressure in the Mississippi and lower Missouri valleys, and move eastward along the Gulf shores to the Atlantic Ocean, and following the Atlantic coast closely move off into the Atlantic off the Nova Scotian coast; these are so few in number as to occupy no place on the chart.

The relative frequency of storms on the different paths in the month of March is, *A*, 48.5 per cent.; *B*, 22.2 per cent.; *C*, 21.2 per cent.; *D*, 8.1 per cent.

Of the forty-eight storms included in track *A*, but five, or 10 per cent., followed the path of *A aa'*, and these disappeared off the Atlantic coast between North Carolina and Connecticut; twenty-seven, or 57 per cent., disappeared east of the Gulf of Saint Lawrence and north of Massachusetts, and sixteen, or 33 per cent., disappeared north and west of the Gulf of Saint Lawrence.

Of the twenty-two storms composing track *B*, nine, or 40 per cent., pursued the track *B bb'*; eleven, or 50 per cent., disappeared east of the Gulf of Saint Lawrence and north of Massachusetts; one, or 4.5 per cent, disappeared west of the Gulf of Saint Lawrence, and one erratic storm, after dipping as far south as the Gulf of Mexico, disappeared off the coast of South Carolina.

Of the twenty-one storms composing track *C*, eleven, or 52.4 per cent pursued the track *C C*, and disappeared east of the Gulf of Saint Lawrence and north of Massachusetts, and nine, or 42.9 per cent., pursued the track *C cc'* and disappeared east of the Atlantic coast and south of Delaware; of these nine, two moved eastward to the north coast of Florida; one other storm moved eastward along the Gulf coast and afterwards moved up close along the Atlantic coast.

Of the 8 storms composing the track *D*, seven, or 87.5 per cent., disappeared east of the Gulf of Saint Lawrence, and one, or 12.5 per cent., disappeared west of that gulf.

Number of storms of each class which occurred in each year in the month of March.

Class.	Year.												Total.
	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	
A	7	3	5	2	0	1	6	6	2	8	3	3	2	.....
B	2	0	1	3	6	0	2	2	3	0	0	2	1	.....
C	2	3	3	2	0	1	1	1	3	0	2	2	1	.....
D	0	0	2	0	0	1	0	2	0	1	1	1	0	.....
Total	11	6	11	7	6	3	9	11	8	9	6	8	4	99

PREDICTION OF FOG NEAR NEWFOUNDLAND.

[By Sergt. E. B. GARRIOTT, Signal Corps.]

The fog-banks which are encountered over, and in the vicinity of, the Banks of Newfoundland constitute the most dreaded feature of trans-Atlantic travel, more particularly during the annual southward movement of the Arctic ice-fields. It is therefore evident that investigations likely to lead to meteorological facts which govern the formation of fog in that region would be of unusual interest to mariners.

In the pursuit of these investigations it is allowable to presume that, with a knowledge of the conditions under which fog is formed, the possibility of foreseeing the development of those conditions would not be remote. The obvious cause of fog formation over the Banks is the intermingling of warm and cold air and water currents. As regards differences in temperature of the water, considered alone, it is not shown that this is the element which contributes to the development of dense fog, and it therefore follows that the air currents constitute the chief auxiliary cause of the more dense formations. The ice-fields necessarily, and very appreciably, lower the temperature of the air in their vicinity, and the amount of moisture precipitated in the form of fog is governed by the differences in temperature of the air currents which intermingle on their margins. A natural sequence to the approval of this theory would be the conclusion that the greater the differences in temperature of opposing air currents the greater the amount of fog precipitated at their point of contact. With this fact granted we have only to ascertain the causes by which masses of air exhibiting great ranges in temperature may be brought together. As has been stated the ice-fields contribute atmosphere exhibiting low temperatures; for the opposing warm air currents it is necessary to consider the position of the Banks with reference to the relative flow of ocean currents and wind-directions calculated to draw into this locality masses of warm air. The principal source of warmth is found in the waters of the Gulf Stream which flow from the southwestward and pass over the southern portion and to the southward of the Great Banks.

The atmosphere over this warm stream is necessarily more humid and warm than that which overlies the adjacent ocean or the neighboring land, and in this fact we have the second condition requisite to the precipitation of fog atoms. It now remains to determine the general meteorological conditions necessary to cause a continued and large intermingling of the fog engendering masses of air. In this connection it is necessary that the wind-directions whereby the atmosphere is propelled must be considered, as this element constitutes the apparent active agent by means of which it is thought that the probable occurrence and location of fog-banks may be foreseen. As herein shown the region of warm, moist air lies to the southward and southwestward of the Banks of Newfoundland, and, as will be readily seen, the wind-directions necessary to force this air upon the colder air over the ice-fields would be included within the southeast and southwest quadrants. As this region embraces an area traversed by a greater portion of the storm-centres which pass eastward from the continent, and which advance, as a rule, over the Great Lakes and along the Saint Lawrence Valley, it is not unreasonable to conclude that, with a knowledge of the laws which govern wind-directions in advance of and within storm-areas, the presence of dense fog over the Banks could be determined with a considerable degree of accuracy.

Recent investigations by the Signal Service have verified the above conclusions with reference to the general conditions under which fog has been encountered over the Banks during the past few months, and it is believed that a further study of the subject will result in the possession of knowledge which will prove of practical benefit to maritime interests.

The voluntary observer at Manatee, Fla., lat. 27° 27′, long. 82° 35′, reports:

"Several farmers have informed me of queer streaks in which frost is appearing. In one field, where tomatoes were planted, every plant was killed, excepting two rows in about the middle of the field. Another farmer noticed in a field of beans that frost killed in spots, the whole field being apparently level. Several others give about the same experience."

Very slight undulations in the surface of the ground would permit the coldest air to settle in the lowest places. Variations in the conditions, quality, color, or constitution of the soil would permit some parts of the field to radiate heat and cool more rapidly than others; variations in the conditions of the plants, so that the sap of some are more easily frozen than others. A trough or general slight incline of the field may cause a flow of air along a few rows of vegetables and save them from freezing. Special parts of the field that are wetter than others will not suffer as much from frost as neighboring dry spots, because the upward conduction of heat prevents the cooling to the freezing point. When such peculiarities are noted by observers they will assist in reaching a solution if they will report in reference to both the frosted and unfrosted places: (1) as to the difference in elevation; (2) whether the soil is light or heavy; (3) whether the surface has been cultivated since rain has fallen; (4) does either portion appear to be more moist than the other; (5) did adjacent bushes or trees protect either portion from the wind, if any; (6) whether the unfrosted parts were near trees; (7) any other relative conditions noticed. [Editor REVIEW.]

Prof. Selin Lemström, the Finnish *savant*, well know for his observations and studies of the aurora, has recently published in Paris the results of his auroral research within the Arctic circle. The following reviews of his work are given:

* * * The view that auroras are due to positive currents of electricity, illuminating the air on their passage to the earth, has been solidly established by M. Lemström's results at Sodankylä, Finland. His "discharging apparatus" served the precise purpose of Franklin's kite. The one experiment was not more decisive than the other. Not only did luminous appearances accompany the setting-in of a current towards the earth from the network of insulated wires spread over the summit of Mount Oratuntura, but the light evoked was distinctly *auroral*. Examined with the spectroscope, it yielded the still enigmatical "citron line" discovered by Angström in 1867. This is the invariable and chief constituent of auroral radiations. Besides one fitfully present, detected by Zöllner in the red, it is the only vivid line its spectrum includes. Ten others, more or less dubiously enumerated, are faint, hazy, indeterminate. M. Lemström says that there is a fair agreement between some of them and the lines in the laboratory-spectrum of rarefied air.—*Nature, vol.* 35, *page* 435.

* * * The aurora borealis is, we learn, an *electrical* phenomenon in a form different to lightning, but still of an atmospheric nature. At a certain distance from each pole is a belt or zone whence a continuous but varying discharge of electricity into the atmosphere takes place; this is the aurora borealis and australis. This theory is now accepted by all leading *savants* as the only natural explanation of the phenomenon, and it has recently been greatly strengthened by the removal of one important point against it, viz., that electricity could not be transmitted through a vacuum or chamber of rarefied air, an assumption by Prof. Edlund, the celebrated Swedish physicist.

Prof. Lemström demonstrates that the aurora borealis has a double periodicity of about eleven and fifty-six years, and that the terrestrial magnetic storms follow the same laws, and that these, too, strange to say, coincide with those regulating the sun spots.—*London Electrical Review, vol.* 20, *page* 274.

FROST-WARNING SIGNALS.

Superintendent of Telegraph Simpson, of the Chicago, Milwaukee, and Saint Paul Railway, has issued a circular that the company, with a view of protecting the interests of those engaged in the culture of tobacco and cranberries, have made arrangements with the United States Signal Service Department, through Sergeant Rhode, the observer at Milwaukee, to furnish frost warnings to the company from May 1st to October 1st, in each year, for distribution to stations in the cranberry and tobacco-growing regions. A frost signal, consisting of a black flag eight feet square, with a white centre three feet square, has been adopted, and it will be displayed from the top of a flag-pole, where it will be plainly visible from the surrounding country. The company assumes the expense of sending these warnings by telegraph, and the parties interested in the growing of the crops are expected to furnish the flag and display it. * * * The first warning will enable the cranberry growers to flood their marshes, and the tobacco cultivators to build smudges around their fields to keep the frost away. The Saint Paul company is entitled to credit for trouble and expense in securing this favor for the people on its lines.—*Evening Wisconsin, April* 20, 1887.

Table of miscellaneous meteorological data for March, 1887—Signal Service observations.

Stations and districts.	Elevation above sea-level, feet.	Atmospheric pressure (in inches and hundredths): Mean actual barometer.	Mean reduced barometer.	Departure from normal.	Extremes: Highest barometer	Date.	Lowest barometer	Date.	Monthly range of barometer.	Temperature of the air (in degrees Fahrenheit): Monthly mean.	Departure from normal.	Extremes: Max.	Date.	Mean max	Min.	Date.	Mean min.	Monthly range.	Daily ranges: Greatest.	Date.	Least.	Date.	Mean relative humidity, per cent.	Mean temperature of the dew-point (degrees Fahrenheit).	Precipitation (in inches).	Departure from normal precipitation (in inches).	Winds: Total movement, miles.	Prevailing direction.	Maximum velocity: Miles p.h.	Direction.	Date.	No. of rainy days.	No. of cloudy days.	No. of fair days.	No. of clear days.
New England.										31.3	− 1.7														4.28	− 0.04									
Eastport	53	29.72	29.78	−.08	30.85	5	28.86	23	1.98	28.5	+ 0.4	45.0	28	35.0	− 2.0	5	21.1	47.0	27.5	2	3.9	19	73.2	20.4	4.46	− 0.65	10,275	n.	50	e.	22	17	14	9	8
Portland	99	29.73	29.84	−.06	30.85	5	28.99	22	1.86	28.8	− 3.3	46.4	14	35.2	0.5	1	21.7	45.9	25.0	2	2.0	10	72.0	20.1	4.15	+ 1.00	7,379	nw.	36	sw.	25	13	13	11	7
Mount Washington	6,279	23.32	29.83	....	30.84	5	29.13	23	1.72	10.3	+ 0.3	32.3	28	18.1	−25.9	1	1.1	58.2	30.9	31	6.2	13	92.0	8.5	2.88	− 3.24	b	nw.	116	nw.	25	15	1	21	9
Boston	124	29.73	29.86	−.06	30.81	5	29.02	22	1.79	31.6	− 2.2	52.9	21	39.1	9.8	1	23.9	43.1	25.7	2	6.2	22	65.8	20.4	3.86	− 0.75	10,755	nw.	44	ne.	22	11	13	10	8
Edgartown a	....	....	....	....	....	...	....	...	.....	32.9	....	51.7	28	40.2	15.0	1	25.6	36.7	26.1	28	5.8	5	.....	....	1.73	....	....	ne.	.....	....	...	10	...	...	...
Nantucket	14	29.85	....	....	....	...	....	...	.....	33.3	....	52.0	28	38.8	5.7	1	26.5	46.3	22.1	29	4.8	18	81.3	28.2	2.84	....	10,517	nw.	41	se.	22	14	11	14	6
Vineyard Haven	....	....	....	....	....	...	....	...	.....	33.6	....	55.8	29	41.5	13.2	1	25.6	42.6	.....	...	.....	...	.....	....	2.98	....	....	nw.	.....	....	...	11	...	...	...
Block Island	27	29.85	29.87	−.05	30.76	5	28.97	22	1.80	33.7	− 0.9	53.7	28	40.0	17.2	1	28.2	36.5	20.2	2	6.6	20	80.8	28.4	4.49	+ 0.23	13,522	n.	48	n.	11	10	8	19	4
Narragansett Pier	....	....	....	....	....	...	....	...	.....	32.8	....	57.0	28	40.5	13.0	1	25.0	44.0	.....	...	.....	...	.....	....	4.15	+ 0.57	....	....	.....	....	...	10	...	...	...
New Haven	107	29.80	29.91	....	30.79	5	29.05	22	1.73	31.3	− 3.4	51.4	28	38.9	11.5	15	23.6	39.9	26.1	14	6.6	7	63.1	19.5	4.22	− 0.55	8,089	nw.	34	ne.	22	9	7	17	7
New London	47	29.84	29.88	−.07	30.76	5	28.98	22	1.78	34.0	− 1.1	53.3	28	41.8	15.2	15	26.0	38.1	23.5	14	8.1	10	72.7	25.8	4.65	− 0.16	6,187	n.	28	nw.	29	9	7	18	6
Mid. Atlantic States.										38.3	− 2.5														3.18	− 0.52									
Albany	85	29.88	29.97	−.01	30.86	5	29.26	22	1.60	28.1	− 4.0	46.3	21	35.9	4.4	5	19.2	41.9	28.7	24	10.2	17	75.7	21.2	2.90	+ 0.15	6,566	nw.	26	w.	30	9	10	16	5
New York City	158	29.76	29.92	−.05	30.77	5	29.19	22	1.58	34.3	− 2.1	49.6	8	41.7	16.3	30	27.3	33.3	23.9	14	7.9	6	61.2	21.5	3.51	− 0.37	8,177	nw.	34	nw.	23	10	9	15	7
Philadelphia	117	29.86	29.98	.00	30.75	5	29.31	22	1.44	36.4	− 2.7	53.3	21	43.8	21.8	5	28.9	31.5	25.5	24	7.1	4	63.9	24.4	2.59	− 0.59	10,241	nw.	38	nw.	22	14	10	14	7
Atlantic City	13	29.95	29.95	−.02	30.74	5	29.15	22	1.59	35.6	− 2.3	56.2	28	42.9	18.4	30	29.1	37.8	23.6	28	6.7	31	80.4	29.8	2.94	− 0.89	8,327	nw.	30	se.	22	14	6	13	12
Cape Henlopen	....	....	....	....	....	...	....	...	.....	37.9	....	63.0	2	44.6	18.3	15	31.3	44.7	27.5	9	5.2	7	.....	....	1.67	− 0.76	....	nw.	.....	....	...	15	...	...	...
Baltimore	45	29.95	29.98	−.03	30.74	5	29.43	22	1.31	37.8	− 4.0	56.6	25	45.4	21.4	30	31.2	35.2	24.1	24	6.9	5	60.6	24.0	3.49	− 0.51	5,892	nw.	27	nw.	22	13	12	15	4
Ocean City a	....	....	....	....	....	...	....	...	.....	39.6	....	55.8	25	46.5	21.6	30	33.3	34.2	21.6	16	8.3	21	.....	....	1.64	− 0.66	....	no.	.....	....	...	13	...	...	...
Washington City	106	29.90	30.00	−.01	30.72	5	29.49	22	1.23	38.5	− 3.0	65.0	2	46.7	20.8	30	30.8	44.2	35.3	2	8.0	29	59.6	24.0	3.83	− 0.40	6,347	nw.	27	nw.	29	14	11	14	6
Cape Henry	16	....	....	....	....	...	....	...	.....	44.6	− 1.6	74.2	2	52.8	26.4	30	36.4	47.8	38.7	2	3.2	27	.....	....	4.14	− 1.43	....	nw.	.....	....	...	13	...	...	...
Chincoteague	8	29.95	29.94	−.03	30.66	5	29.30	22	1.36	40.3	− 0.2	59.8	7	47.4	22.7	30	33.0	37.1	25.7	1	9.6	23	77.0	33.2	4.47	+ 0.73	13,177	nw.	52	w.	29	15	11	10	10
Lynchburg	652	29.30	29.98	−.01	30.68	5	29.54	17	1.14	43.5	− 1.9	80.6	2	53.9	23.5	30	33.8	57.1	47.6	2	3.9	31	60.7	28.5	2.58	− 1.39	4,537	nw.	24	nw.	29	9	8	15	8
Norfolk	30	29.95	29.96	−.04	30.62	5	29.47	21	1.15	44.1	− 3.5	75.8	2	53.9	25.1	30	35.9	50.7	34.5	2	7.2	4	69.7	33.4	4.38	− 0.06	6,414	n.	27	n.	28	14	12	10	9
South Atlantic States.										52.6	− 1.7														2.26	− 2.54									
Charlotte	808	29.16	30.00	.00	30.56	5	29.59	28	0.97	47.7	− 2.3	79.7	2	59.7	26.8	18	37.4	52.9	36.4	1	6.0	31	63.9	34.2	2.93	− 2.48	4,929	sw.	21	sw.	24	8	8	11	12
Hatteras	12	29.99	29.98	−.02	30.53	5	29.51	28	1.02	49.4	+ 0.6	69.3	2	56.3	31.8	30	42.8	37.5	27.7	1	5.9	5	76.0	41.7	3.04	− 4.15	10,777	n.	39	sw.	29	8	4	15	12
Kitty Hawk	9	....	....	....	....	...	....	...	.....	49.3	+ 1.8	74.2	2	58.6	26.0	30	40.0	48.2	36.5	2	4.6	26	.....	....	4.60	− 1.36	....	ne.	.....	....	...	11	...	...	...
Raleigh	439	....	....	....	....	...	....	...	.....	....	....	.....	...	....	....	...	....	.....	.....	...	.....	...	.....	....	....	....	....	....	.....	....	...	...	...	...	...
Smithville	34	....	....	....	....	...	....	...	.....	50.8	− 2.4	67.1	3	59.2	29.1	18	42.5	38.0	25.9	12	6.9	16	.....	....	0.82	− 3.29	....	sw.	.....	....	...	6	...	...	...
Wash Woods	....	....	....	....	....	...	....	...	.....	45.2	....	72.0	2	53.2	26.0	30	37.2	46.0	32.0	8	5.0	5	.....	....	4.28	+ 0.69	....	ne.	.....	....	...	14	...	...	...
Wilmington	52	29.94	29.97	−.04	30.50	5	29.54	17	0.97	52.1	− 2.1	81.9	3	63.1	27.7	30	40.7	54.2	33.6	1	10.3	5	67.7	40.4	1.48	− 2.90	5,903	sw.	25	sw.	7	6	5	11	15
Charleston	52	29.98	30.00	−.02	30.46	5	29.63	17	0.83	54.8	− 2.5	80.0	7	65.0	31.9	18	46.6	46.1	29.5	1	10.2	5	68.5	43.5	0.50	− 3.68	6,658	sw.	28	e.	8	6	4	12	15
Augusta	183	29.86	30.03	−.02	30.48	5	29.66	16	0.82	53.1	− 2.6	82.7	2	67.1	28.9	18	41.1	53.8	38.6	1	8.0	9	74.4	44.0	0.64	− 4.96	3,224	w.	20	w.	28	5	5	10	16
Savannah	87	29.96	30.02	−.02	30.41	5	29.63	17	0.78	56.5	− 2.7	81.2	7	67.4	32.5	19	46.7	48.7	29.7	28	7.0	5	60.1	40.6	0.76	− 3.24	6,199	nw.	25	nw.	28	7	4	9	18
Jacksonville	43	30.02	30.03	−.02	30.42	1	29.66	17	0.76	59.5	− 2.9	80.0	7	69.9	35.7	19	50.5	44.3	29.8	1	19.8	11	74.2	50.3	3.51	+ 0.01	2,763	sw.	24	w.	17	4	4	12	15
Florida Peninsula.										64.8	− 2.0														2.03	− 0.98									
Cedar Keys	22	30.06	30.04	−.01	30.43	1	29.72	17	0.72	61.3	− 1.6	76.0	5	68.3	40.3	19	54.4	35.7	22.3	12	6.0	9	73.4	52.0	1.87	− 2.66	6,755	w.	41	nw.	29	5	5	11	15
Key West	22	30.07	30.04	.00	30.36	1	29.79	17	0.57	70.7	− 2.6	81.6	27	75.3	58.4	1	66.7	23.2	15.5	25	4.6	11	74.8	62.0	1.99	+ 1.29	8,436	e.	37	n.	29	5	5	8	18
Sanford	25	30.03	30.02	....	30.41	1	29.65	17	0.76	62.3	− 1.9	82.7	9	73.6	39.4	1	52.7	43.3	30.6	1	7.0	25	70.4	51.0	2.22	− 1.58	4,787	sw.	25	sw.	21	8	3	9	19
Eastern Gulf States.										58.3	− 0.1														2.46	− 4.27									
Atlanta	1,129	28.87	30.03	−.01	30.40	5	29.77	16	0.63	50.7	− 1.7	75.3	26	61.5	25.2	29	41.2	50.1	32.2	1	6.3	8	77.1	43.0	1.99	− 5.30	8,825	w.	30	nw.	17	10	5	11	15
Pensacola	30	30.05	30.04	.00	30.41	1	29.77	16	0.64	60.2	0.0	74.8	10	68.0	40.3	22	52.6	34.5	22.8	1	6.9	7	74.4	51.2	2.25	− 3.43	5,077	n.	24	s.	20	5	5	8	18
Mobile	35	30.05	30.05	+.01	30.43	1	29.78	16	0.64	58.9	− 0.6	76.8	13	68.7	36.2	22	49.4	40.6	28.8	13	9.3	8	68.9	47.1	3.65	− 4.55	5,682	s.	29	se.	20	6	5	14	12
Montgomery	219	29.83	30.03	−.01	30.36	1	29.74	16	0.62	57.6	+ 0.2	79.9	7	68.7	32.4	29	47.5	47.5	32.4	30	8.0	8	64.9	44.5	0.72	− 5.79	4,715	s.	24	nw.	17	3	3	13	15
Vicksburg	222	29.84	30.05	.00	30.40	1	29.81	16	0.59	60.4	+ 1.8	80.1	6	70.1	36.9	29	50.9	43.2	31.0	15	7.3	21	61.1	45.4	2.77	− 3.79	5,231	sw.	26	nw.	27	6	4	9	18
New Orleans	52	30.02	30.04	+.01	30.44	1	29.80	16	0.63	62.1	− 0.5	80.8	6	72.0	43.8	22	54.2	37.0	26.0	15	8.0	8	69.5	50.7	3.37	− 2.78	5,656	s.	23	n.	31	7	4	12	15
Western Gulf States.										60.4	+ 2.9														1.88	− 1.57									
Shreveport	227	29.82	30.03	−.01	30.37	1	29.75	30	0.62	61.0	+ 2.7	83.8	16	74.3	34.6	28	50.1	49.2	36.5	1	12.0	6	68.2	49.4	1.28	− 3.61	5,045	n.	26	sw.	30	3	3	7	21
Fort Smith	500	29.56	30.02	−.02	39.30	13	29.69	26	0.61	54.4	+ 5.2	76.0	2	66.4	28.0	29	41.7	48.0	40.5	30	10.0	9	77.9	46.8	1.53	− 0.51	4,448	ne.	21	nw.	27	5	6	10	15
Little Rock	309	29.74	30.02	−.02	30.28	29	29.75	27	0.53	55.4	+ 2.5	74.9	24	66.0	30.0	29	44.5	44.9	33.9	24	9.9	6	66.9	43.4	4.54	− 0.09	4,387	nw.	20	sw.	24	6	6	6	19
Galveston	40	30.05	30.05	+.03	30.44	1	29.81	19	0.63	65.2	+ 1.9	79.4	27	70.9	45.5	28	60.3	33.9	19.3	27	3.7	20	74.7	56.4	1.98	− 1.16	7,753	s.	33	n.	28	5	5	9	17
Palestine	533	29.52	30.05	.00	30.39	1	29.76	26	0.62	61.5	+ 3.1	85.1	16	72.9	33.9	28	51.2	51.2	37.5	29	11.7	8	66.2	48.6	1.45	− 2.19	7,711	s.	36	s.	30	4	5	8	18
San Antonio	781	29.23	30.01	+.01	30.39	1	29.70	19	0.69	65.0	+ 1.9	93.2	16	78.0	39.3	28	53.2	53.9	38.2	16	11.7	6	57.8	46.9	0.51	− 1.88	6,818	s.	27	ne.	20	5	6	14	11
Rio Grande Valley.										68.2	− 1.0														2.44	+ 1.28									
Brownsville	57	30.00	30.00	+.04	30.37	1	29.71	19	0.66	66.9	− 1.5	84.8	17	77.5	46.9	29	58.7	37.9	30.2	14	4.8	23	80.3	59.5	2.87	+ 1.63	6,665	s.	36	s.	5	6	5	7	19
Rio Grande City	230	29.85	30.05	+.10	30.39	1	29.73	19	0.67	69.4	− 0.4	96.4	16	84.2	45.9	23	58.3	50.5	36.5	16	7.5	23	60.0	52.6	2.01	+ 0.93	5,300	n.	24	s.	5	4	2	10	19
Ohio Val. & Tenn.										44.4	− 0.3														2.98	− 1.67									
Chattanooga	783	29.25	30.06	+.02	30.31	5	29.81	16	0.50	50.8	0.0	76.1	26	61.6	25.2	29	41.7	50.9	33.5	26	7.9	21	62.4	36.7	4.52	− 2.55	5,705	nw.	28	nw.	24	8	8	9	14
Knoxville	980	29.02	30.05	.00	30.34	4	29.75	16	0.59	47.9	+ 0.4	75.6	26	58.7	21.6	29	38.5	54.0	37.2	26	7.2	18	68.3	36.6	3.97	− 2.11	4,999	sw.	24	sw.	24	11	11	8	12
Memphis	320	29.72	30.04	+.01	30.32	29	29.78	27	0.54	53.7	+ 2.1	76.8	26	63.1	30.2	29	45.8	46.6	34.5	5	4.2	21	67.7	42.1	4.18	− 1.60	5,321	nw.	32	nw.	28	7	6	8	17
Nashville	549	29.46	30.02	−.01	30.31	4	29.68	24	0.62	49.2	+ 0.1	76.7	1	59.4	24.0	29	40.2	52.7	32.9	30	7.1	21	65.3	35.8	3.36	− 1.86	5,568	nw.	31	sw.	24	11	9	9	13
Louisville	551	29.47	30.05	+.03	30.40	4	29.47	24	0.93	45.3	+ 1.1	79.3	2	55.8	18.0	29	36.3	61.3	33.5	24	10.3	6	60.1	30.9	1.88	− 2.20	6,186	w.	43	sw.	24	12	11	12	8
Indianapolis	766	29.23	30.05	+.04	30.47	4	29.40	24	1.07	38.2	− 1.6	69.6	2	47.1	15.8	29	29.8	53.8	30.9	24	7.0	21	67.4	27.2	2.78	− 1.07	5,218	nw.	31	nw.	24	7	10	15	6
Cincinnati	628	29.37	30.04	+.02	30.46	4	29.38	24	1.08	40.9	− 2.0	73.0	2	49.7	18.6	29	33.1	54.4	31.6	24	5.5	15	67.1	30.1	2.07	− 1.49	7,097	nw.	40	nw.	24	12	15	11	5
Columbus	812	29.16	30.04	+.01	30.57	4	29.40	24	1.18	37.0	− 1.2	68.2	2	45.5	13.8	29	29.1	54.4	30.9	24	7.5	19	66.7	26.4	2.56	− 0.71	6,918	nw.	51	sw.	24	13	16	12	3
Pittsburg	847	29.08	29.98	.00	30.56	4	29.40	24	1.16	36.8	− 1.3	68.5	2	45.9	14.9	29	29.0	53.6	31.3	24	5.7	20	66.7	25.8	1.49	− 1.47	6,128	nw.	34	w.	24	17	14	12	5
Lower lake region										29.4	− 3.2														1.89	− 0.94									
Buffalo	690	29.25	30.02	+.04	30.74	4	29.22	24	1.52	27.4	− 2.6	51.0	9	35.6	11.4	29	21.2	39.6	29.1	24	2.8	20	81.7	22.3	2.12	− 0.85	8,208	w.	36	sw.	25	16	16	8	7
Oswego	335	29.61	29.99	.00	30.80	5	29.33	24	1.47	26.4	− 4.7	48.2	2	33.1	5.9	5	18.9	42.3	28.5	24	5.0	20	73.1	18.5	1.21	− 1.89	10,397	n.	40	nw.	25	11	17	10	4
Rochester	621	29.31	30.00	.00	30.78	5	29.25	24	1.54	26.8	− 3.3	53.5	9	34.2	8.7	5	19.8	44.8	30.3	2	4.1	20	78.7	20.8	0.94	− 2.27	10,056	nw.	40	w.	28	17	20	7	4
Erie	681	29.28	30.03	+.03	30.69	4	29.35	24	1.34	29.1	− 3.7	58.3	2	40.7	11.8	29	21.9	46.5	31.2	24	10.2	21	78.4	23.0	3.06	− 0.01	8,569	nw.	35	s.	27	18	13	10	8
Cleveland	690	29.28	30.04	+.03	30.68	4	29.17	24	1.31	31.3	− 2.2	63.0	2	37.8	11.2	29	24.1	51.8	31.0	2	5.7	17	77.0	24.6	3.05	+ 0.19	7,109	nw.	27	s.	2	13	11	10	10
Sandusky	638	29.36	30.06	+.06	30.69	4	29.34	24	1.34	31.6	− 3.8	62.0	9	38.4	10.9	29	25.5	51.1	29.7	2	5.4	21	78.4	25.5	2.16	− 0.48	10,666	nw.	50	nw.	24	10	13	10	8
Toledo	651	29.35	30.06	+.06	30.67	4	29.32	24	1.35	31.8	− 3.5	59.9	2	39.5	7.8	29	24.2	52.1	32.7	13	6.9	21	69.0	22.1	1.12	− 1.04	6,881	nw.	33	ne.	27	10	9	15	7
Detroit	662	29.32	30.06	+.06	30.71	4	29.32	24	1.39	31.0	− 1.8	52.0	2	37.4	7.4	29	23.6	44.6	23.5	30	7.0	27	76.2	24.3	1.44	− 1.17	6,506	n.	27	e.	27	10	12	12	7
Upper lake region.										23.7	− 2.7														0.77	− 1.46									
Alpena	609	29.39	30.08	+.08	30.79	4	29.44	24	1.35	20.0	− 3.6	45.0	7	28.6	− 7.6	5	11.0	52.6	29.7	23	6.1	17	78.2	14.4	1.22	− 1.01	7,524	nw.	31	nw.	13	10	8	15	8
Escanaba	608	29.43	30.13	+.11	30.83	4	29.53	24	1.30	19.2	− 2.8	44.2	7	28.7	−12.1	5	9.4	56.3	37.8	23	6.6	27	74.3	12.1	0.31	− 1.53	6,864	n.	36	n.	13	7	5	15	11
Grand Haven	620	29.38	30.07	+.08	30.66	4	29.40	24	1.26	27.3	− 3.4	59.8	12	35.2	7.4	30	20.4	52.4	39.2	13	3.3	7	68.9	17.8	0.95	− 1.58	8,326	n.	35	nw.	13	6	6	21	4
Lansing	870	29.12	30.10	....	30.80	4	29.37	24	1.44	32.4	....	55.7	9	40.1	8.2	29	23.9	47.5	24.7	30	6.7	27	77.5	25.8	1.98	....	5,474	nw.	28	w.	13	8	9	12	10
Mackinaw City	605	29.40	30.10	+.08	30.81	4	29.49	24	1.32	20.1	+ 0.3	39.5	7	29.1	−10.3	5	8.6	49.8	37.1	30	7.5	27	63.0	9.2	0.22	− 1.26	6,137	w.	40	e.	5	6	6	15	10
Marquette	672	29.36	30.13	+.08	30.87	4	29.51	24	1.35	18.7	− 4.7	46.1	2	28.1	−14.2	5	10.2	60.3	37.4	2	6.2	21	77.6	12.8	0.31	− 1.14	7,334	nw.	39	nw.	13	9	7	18	6
Port Huron	639	29.34	30.06	+.06	30.76	4	29.36	24	1.40	25.6	− 3.0	46.3	24	30.8	3.9	29	19.5	42.4	22.6	30	5.0	17	77.9	19.8	1.20	− 2.31	8,956	n.	33	n.	14	11	15	7	9
Chicago	715	29.29	30.06	+.06	30.62	4	29.42	24	1.19	31.9	− 3.0	68.0	12	39.4	9.3	28	25.0	58.7	32.9	13	5.2	3	74.3	24.2	0.89	− 1.85	8,271	n.	35	n.	2	6	9	13	9
Green Bay	616	29.42	30.12	....	30.79	4	29.51	24	1.28	23.8	....	46.0	12	32.0	− 7.0	5	14.7	53.0	33.0	1	8.0	10	82.4	19.2	1.01	....	5,571	ne.	28	n.	13	4	5	19	7
Milwaukee	697	29.31	30.08	+.07	30.68	4	29.49	24	1.19	29.2	− 1.0	56.8	12	36.9	4.2	29	22.4	52.6	25.0	13	6.5	22	76.0	22.4	1.25	− 1.45	8,321	nw.	40	nw.	13	4	7	16	8
Duluth	672	29.38	30.15	+.08	30.86	4	29.57	23	1.29	21.1	− 2.9	52.8	12	32.7	−13.0	4	12.0	65.8	37.9	1	7.2	10	74.3	13.6	0.55	− 1.01	4,219	ne.	29	ne.	8	4	8	10	13
Extreme northwest.										21.8	+ 2.6														0.42	− 0.20									
Moorhead	926	29.10	30.15	+.06	30.87	3	29.48	23	1.39	22.0	+ 3.1	45.7	11	31.8	−19.2	4	12.8	64.9	30.3	21	7.5	19	73.5	14.9	0.26	− 0.62	7,546	n.	41	s.	5	8	8	18	5
Saint Vincent	804	29.25	30.18	+.05	30.93	3	29.36	6	1.57	16.1	+ 2.2	45.0	11	27.1	−27.0	4	5.0	72.0	38.8	4	7.1	16	85.0	12.3	0.48	− 0.02	6,919	nw.	45	s.	5	8	9	11	11
Bismarck	1,694	28.26	30.14	+.06	30.88	3	29.45	23	1.43	24.9	+ 2.7	54.0	23	38.0	−15.7	4	15.7	69.7	35.7	24	5.1	26	86.1	21.1	0.78	− 0.27	6,253	n.	44	nw.	12	6	7	15	9
Fort Buford	1,854	28.00	30.05	+.03	30.81	3	29.32	5	1.48	27.0	+ 3.4	59.0	23	38.5	− 9.8	4	16.9	68.8	39.2	6	4.5	17	77.5	20.4	0.12	− 0.31	7,999	nw.	57	w.	6	3	9	19	3
Fort Totten	1,487	28.46	30.16	+.05	30.89	3	29.45	6	1.44	19.0	+ 1.4	52.0	11	29.8	−22.7	4	8.4	74.7	39.8	9	9.8	19	79.1	13.5	0.56	+ 0.04	10,882	nw.	64	nw.	12	8	4	21	...
Fort Yates	....	....	....	....	....	...	....	...	.....	28.6	....	57.4	11	39.4	−11.0	4	17.9	68.4	.....	...	.....	...	.....	....	0.35	− 0.03	....	....	.....	....	...	6	...	...	...

Table of miscellaneous meteorological data for March, 1887—Signal Service observations—Continued.

Stations and districts.	Elevation above sea-level, feet.	Atmospheric pressure (in inches and hundredths).								Temperature of the air (in degrees Fahrenheit).														Mean relative humidity, per cent.	Mean temperature of the dew-point (degrees Fahrenheit).	Precipitation (in inches).	Departure from normal precipitation (in inches).	Winds.				No. of rainy days.	No. of cloudy days.	No. of fair days.	No. of clear days.
		Mean actual barometer.	Mean reduced barometer.	Departure from normal.	Extremes.				Monthly range of barometer.	Monthly mean.	Departure from normal.	Extremes.					Monthly range.	Daily ranges.										Total movement, miles.	Prevailing direction.	Maximum velocity.						
					Highest barometer	Date.	Lowest barometer	Date.				Max.	Date.	Mean max	Min.	Date.	Mean min.		Greatest.	Date.	Least.	Date.							Miles p. h.	Direction.	Date.				
Upper Miss. Valley.																																		
Saint Paul	831	29.19	30.12	+.10	30.80	4	29.49	24	1.30	26.2	— 1.4	53.6	12	35.3	— 7.1	4	18.4	60.7	38.1	1	6.5	10	75.8	20.0	0.33	— 1.19	4,908	nw.	28	w.	13	4	9	11	11
La Crosse	744	29.32	30.15	+.13	30.79	4	29.46	24	1.33	29.6	— 1.6	65.9	12	37.9	— 1.0	4	21.7	66.9	29.3	12	7.5	27	72.3	21.4	0.26	— 1.42	6,469	nw.	35	nw.	13	3	9	16	6
Davenport	615	29.42	30.09	+.06	30.61	4	29.46	24	1.14	34.3	— 0.8	70.0	12	44.5	9.1	29	26.9	60.9	32.1	8	10.0	10	71.8	25.6	0.77	— 1.49	6,365	nw.	32	nw.	24	7	6	14	11
Des Moines	856	29.18	30.10	+.06	30.65	4	29.47	24	1.18	35.7	+ 0.7	72.4	11	45.3	9.8	28	27.1	62.6	36.8	11	7.8	26	71.8	26.9	1.79	+ 0.45	6,158	n.	38	nw.	24	7	6	12	13
Dubuque	665	29.37	30.10	.....	30.67	4	29.40	24	1.27	32.4	— 0.6	70.5	12	41.1	1.7	29	24.2	68.8	31.7	12	5.8	27	75.2	25.4	1.86	— 0.63	3,277	se.	20	nw.	24	7	3	18	10
Keokuk	618	29.43	30.09	+.08	30.58	4	29.46	24	1.12	38.9	+ 1.3	72.0	12	48.5	18.7	28	31.3	53.3	30.8	8	5.1	20	72.1	29.9	0.76	— 1.46	7,015	n.	36	nw.	24	8	7	13	11
Cairo	359	29.69	30.06	+.02	30.35	4	29.68	24	0.67	47.9	+ 0.9	74.6	24	55.5	24.2	29	40.4	50.4	29.0	27	3.1	21	61.1	33.3	2.18	— 1.71	7,045	n.	44	w.	24	10	10	10	11
Springfield	644	29.40	30.09	+.06	30.51	4	29.55	24	0.96	40.7	+ 1.0	71.2	1	50.1	18.0	28	31.2	53.2	33.2	2	7.0	21	66.9	30.2	1.41	— 1.36	7,504	nw.	34	nw.	24	7	6	14	11
Saint Louis	571	29.46	30.06	+.02	30.44	4	29.59	24	0.86	45.8	+ 2.7	79.1	1	55.2	22.9	29	37.1	56.2	35.6	13	5.7	30	60.0	31.3	3.54	+ 0.67	7,176	n.	38	w.	24	9	8	10	13
Missouri Valley.										36.3	+ 4.1														0.64	— 0.61								
Lamar	1,028	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Leavenworth	842	29.20	30.10	+.05	30.53	13	29.64	24	0.89	42.7	+ 2.0	83.6	12	54.3	20.5	28	32.9	63.1	39.1	1	7.3	4	62.1	29.1	1.59	— 0.68	5,987	n.	28	nw.	24	8	3	13	15
Omaha	1,113	28.94	30.11	+.04	30.69	4	29.65	24	1.04	38.0	+ 2.6	78.1	11	50.5	10.2	4	29.0	67.9	33.1	12	9.0	29	69.8	28.3	0.48	— 1.00	5,533	n.	40	nw.	12	5	6	16	9
Valentine	2,604	27.34	30.09	.....	30.75	3	29.54	23	1.20	35.8	+ 9.1	73.4	11	48.8	— 5.5	4	25.7	78.9	37.5	10	8.6	26	55.0	19.8	0.23	— 0.30	11,345	n.	65	nw.	23	2	7	11	13
Huron	1,307	28.70	30.14	+.07	30.84	3	29.49	23	1.34	30.5	+ 2.5	67.8	11	42.5	4.4	4	21.1	72.2	35.0	14	7.2	26	73.7	22.4	0.64	— 0.06	5,997	se.	40	nw.	12	5	7	15	9
Yankton	1,234	28.75	30.09	+.01	30.74	4	29.41	23	1.34	34.4	+ 4.5	77.5	11	45.8	— 1.5	4	24.9	79.0	42.5	11	5.5	25	74.5	26.8	0.26	— 1.03	6,791	nw.	46	nw.	12	6	6	17	8
Northern slope.										35.5	+ 3.8														0.46	— 0.25								
Fort Assinaboine	2,690	27.15	30.04	—.01	30.73	3	29.35	5	1.38	33.6	+ 3.2	60.2	31	45.3	—14.7	4	22.2	74.9	53.4	4	9.3	25	57.0	19.8	0.07	— 0.61	10,015	sw.	55	nw.	23	1	8	14	9
Fort Custer	3,040	26.85	30.05	+.03	30.64	3	29.54	5	1.10	37.9	+ 4.9	72.0	17	49.8	— 1.9	4	27.4	73.9	37.3	17	10.5	30	69.4	27.3	1.19	+ 0.73	5,627	se.	45	n.	23	11	8	18	5
Fort Maginnis	4,320	25.52	29.98	.....	30.60	3	29.35	5	1.24	36.7	+ 5.9	69.2	17	48.0	— 2.7	4	24.8	71.9	49.3	4	9.1	29	55.1	21.4	1.19	— 0.05	10,339	nw.	64	nw.	19	9	7	17	7
Helena	4,069	25.80	29.99	—.05	30.48	3	29.50	5	0.98	40.3	+ 6.4	67.4	16	50.2	4.2	4	29.8	63.2	37.0	4	8.3	25	71.2	31.2	0.12	— 0.36	7,168	sw.	36	sw.	6	5	6	20	5
Poplar River	2,002	27.89	30.08	.....	30.84	3	29.37	5	1.47	26.2	— 1.0	58.5	23	59.9	—11.6	3	15.6	70.1	37.2	29	10.2	17	69.0	16.9	0.14	— 0.18	6,467	w.	45	nw.	23	4	2	21	8
Deadwood	4,600	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cheyenne	6,105	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Fort Laramie	.....	.....	.....	.....	.....	.....	.....	.....	.....	43.2	.....	73.0	17	58.3	8.2	5	28.4	64.8	45.0	17	14.7	6	.....	.....	0.30	— 0.90	.....	w.	.....	.....	.....	2	.....	.....
North Platte	2,841	27.13	30.11	+.06	30.66	3	29.63	23	1.03	38.5	+ 3.2	78.0	11	53.8	10.0	4	27.4	68.0	44.2	11	11.0	4	69.7	28.3	0.22	— 0.39	7,275	nw.	44	nw.	20	6	3	17	11
Middle slope.										46.5	+ 4.8														0.21	— 0.71								
Denver	5,294	24.76	30.01	+.04	30.44	3	29.60	25	0.84	45.9	+ 6.6	74.7	11	60.0	13.2	4	31.9	61.5	38.5	11	16.0	4	42.9	20.6	0.23	— 0.74	6,055	s.	44	w.	29	4	3	18	10
Pike's Peak	14,134	17.72	30.08	.....	30.52	31	29.64	29	0.88	14.6	+ 7.2	31.3	17	19.0	— 4.9	31	9.8	36.2	16.2	31	4.8	24	74.2	7.5	2.52	+ 0.41	15,859	nw.	68	nw.	25	9	4	15	12
Las Animas	3,899	26.07	30.02	+.06	30.58	13	29.51	29	1.07	45.4	+ 4.9	80.9	29	64.0	18.3	9	27.1	62.6	52.6	11	14.8	3	62.2	31.8	0.09	— 0.34	5,804	w.	39	n.	19	2	5	12	14
Concordia	1,384	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dodge City	2,523	27.44	30.10	+.06	30.61	13	29.66	25	0.95	44.6	+ 2.9	80.1	12	61.8	16.6	22	30.9	63.5	47.9	29	10.3	3	50.3	22.8	0.17	— 0.70	7,648	n.	38	n.	12	3	3	8	20
Fort Reno	.....	.....	.....	.....	.....	.....	.....	.....	.....	55.7	.....	84.1	29	69.9	24.2	23	41.5	59.9	.....	.....	.....	.....	.....	.....	0.59	— 1.02	.....	.....	.....	.....	.....	2	.....	.....
Fort Supply	.....	.....	.....	.....	.....	.....	.....	.....	.....	50.6	.....	85.4	1	67.7	23.7	28	33.6	34.1	55.4	1	15.8	26	.....	.....	0.01	— 0.96	.....	n.	.....	.....	.....	1	.....	.....
Fort Elliott	2,700	27.28	29.99	+.08	30.40	13	29.46	29	0.94	50.3	+ 4.9	82.8	29	67.2	24.0	27	34.4	58.8	50.9	25	9.4	4	46.2	27.1	0.19	— 0.48	10,314	nw.	56	nw.	27	1	2	10	19
Southern slope.										53.2	+ 3.6														0.22	— 0.99								
Fort Sill	1,200	28.80	30.05	+.01	30.44	13	29.60	29	0.84	54.2	+ 2.5	86.0	29	69.5	26.0	28	40.7	60.0	42.8	10	5.4	4	48.1	31.9	0.60	— 0.76	9,753	n.	37	sw.	29	2	2	7	22
Abilene	1,748	28.23	30.01	.....	30.36	13	29.64	18	0.72	59.1	+ 5.7	91.4	18	73.7	34.3	26	47.0	57.1	41.3	14	12.2	22	39.5	32.0	0.03	— 2.44	10,164	sw.	36	sw.	9	1	4	10	17
Fort Davis	4,928	25.22	30.01	+.05	30.34	28	29.68	25	0.66	55.7	+ 1.6	81.8	18	70.3	24.7	28	40.2	57.1	47.7	24	13.0	23	26.4	15.6	trace	— 0.39	5,809	sw.	28	sw.	6	0	1	5	25
Fort Stanton	6,150	23.99	29.93	.....	.....	.....	.....	.....	.....	44.0	+ 4.8	73.0	17	61.2	13.5	23	28.5	59.5	46.4	17	12.9	22	50.5	23.4	0.25	— 0.36	6,277	nw.	37	nw.	8	2	2	5	24
Southern plateau.										55.1	+ 5.2														0.07	— 1.15								
El Paso	3,764	26.28	30.00	+.06	30.35	28	29.74	26	0.62	59.1	+ 2.9	86.8	17	75.0	29.3	1	42.2	57.3	48.3	1	17.2	20	40.7	33.4	0.32	— 0.17	3,383	nw.	23	nw.	9	1	0	4	27
Lava	.....	.....	.....	.....	.....	.....	.....	.....	.....	53.8	.....	83.5	21	73.4	21.0	24	34.2	62.5	.....	.....	.....	.....	.....	.....	trace	— 0.54	.....	.....	.....	.....	.....	0	.....	.....
Santa Fé	7,026	23.29	30.04	+.07	30.33	28	29.65	25	0.69	43.0	+ 3.8	67.0	16	57.7	19.5	23	30.2	47.5	37.0	28	17.0	5	41.3	18.1	0.66	+ 0.08	2,830	n.	15	e.	13	4	0	8	23
Fort Apache	5,020	25.08	30.08	+.06	30.37	10	29.79	25	0.58	49.5	+ 4.8	78.9	16	66.8	21.8	5	29.0	57.1	49.4	16	18.7	4	36.5	19.5	0.04	— 1.70	5,496	e.	32	e.	22	1	1	6	24
Fort Bowie	.....	.....	.....	.....	.....	.....	.....	.....	.....	56.9	.....	77.0	13	68.8	37.0	6	45.0	40.0	.....	.....	.....	.....	.....	.....	0.00	— 3.10	.....	.....	.....	.....	.....	0	.....	.....
Fort Grant	4,910	25.26	30.03	.....	30.30	28	29.80	25	0.50	57.8	+ 6.4	78.7	16	69.7	33.4	5	47.6	45.3	29.0	28	13.8	4	27.4	22.0	trace	— 1.32	5,687	n.	40	e.	13	0	0	7	24
Fort McDowell	.....	.....	.....	.....	.....	.....	.....	.....	.....	63.3	.....	93.0	16	83.6	34.0	5	43.0	59.0	.....	.....	.....	.....	.....	.....	0.00	— 1.86	.....	.....	.....	.....	.....	0	.....	.....
Fort Thomas	2,710	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Fort Verde	.....	.....	.....	.....	.....	.....	.....	.....	.....	57.4	.....	86.0	16	76.8	29.5	5	37.1	56.5	.....	.....	.....	.....	.....	.....	0.02	— 1.50	.....	.....	.....	.....	.....	1	.....	.....
Maricopa	.....	.....	.....	.....	.....	.....	.....	.....	.....	66.1	.....	97.0	9	86.7	37.1	27	45.6	59.9	.....	.....	.....	.....	.....	.....	trace	— 1.56	.....	.....	.....	.....	.....	0	.....	.....
Phœnix	.....	.....	.....	.....	.....	.....	.....	.....	.....	69.2	.....	97.1	31	90.6	39.1	2	47.8	58.0	.....	.....	.....	.....	.....	.....	trace	— 0.78	.....	.....	.....	.....	.....	0	.....	.....
Prescott	5,389	24.78	30.05	+.06	30.30	28	29.77	25	0.53	49.9	+ 7.1	76.2	16	66.8	23.1	23	31.7	53.1	44.9	31	11.5	4	51.7	30.2	trace	— 1.57	4,437	sw.	32	sw.	4	0	0	11	20
San Carlos	.....	.....	.....	.....	.....	.....	.....	.....	.....	59.6	.....	87.8	20	79.7	30.5	1	39.5	57.3	.....	.....	.....	.....	.....	.....	0.00	— 1.47	.....	.....	.....	.....	.....	0	.....	.....
Willcox	.....	.....	.....	.....	.....	.....	.....	.....	.....	54.0	.....	86.0	15	79.3	22.0	4	28.6	64.0	.....	.....	.....	.....	.....	.....	0.00	— 1.14	.....	.....	.....	.....	.....	0	.....	.....
Yuma	141	29.85	29.97	+.02	30.14	28	29.77	25	0.37	69.9	+ 5.5	92.2	12	85.0	42.6	6	53.3	49.6	40.3	15	15.0	22	60.0	53.8	0.00	— 0.22	41,578	n.	28	n.	21	0	0	4	27
Keeler	3,622	26.39	30.01	.....	30.27	9	29.73	24	0.53	56.5	+ 5.6	77.1	28	69.1	33.0	5	44.4	44.1	32.9	15	13.7	17	30.1	22.7	0.00	— 0.36	3,529	sw.	29	se.	3	0	0	9	22
Middle plateau.										43.4	+ 5.1														0.46	— 1.08								
Fort Bidwell	4,615	25.47	30.16	.....	30.48	21	29.81	17	0.67	43.6	.....	67.1	27	55.2	18.0	1	31.8	49.1	36.1	27	11.2	7	60.5	29.7	0.97	.....	5,012	w.	40	w.	5	6	10	8	13
Winnemucca	4,358	25.71	30.12	+.08	30.42	21	29.78	17	0.64	45.6	+ 4.6	74.7	16	60.2	17.7	23	29.8	57.0	49.1	23	14.3	3	41.2	19.2	0.40	— 0.40	6,475	sw.	44	sw.	28	4	3	10	18
Frisco	6,406	23.78	30.00	.....	30.29	22	29.66	25	0.64	45.1	.....	66.1	28	54.7	25.5	5	36.4	40.6	27.7	27	10.6	2	41.4	21.4	0.46	.....	7,174	sw.	37	sw.	13	2	5	6	20
Salt Lake City	4,348	25.70	30.09	+.06	30.50	8	29.73	24	0.76	47.1	+ 5.6	73.9	16	58.3	27.5	27	36.2	46.4	34.8	16	6.7	4	54.7	30.0	0.35	— 1.76	3,933	se.	27	nw.	21	7	3	12	16
Montrose	5,780	24.34	30.04	.....	30.44	9	29.58	25	0.86	43.5	.....	72.5	17	59.1	16.5	27	28.7	56.0	41.1	1	12.9	5	47.2	22.4	0.28	.....	4,759	se.	40	nw.	29	3	5	7	19
Fort Bridger	6,643	23.56	30.13	.....	30.42	22	29.77	25	0.65	35.5	.....	59.6	16	45.6	17.2	4	27.0	42.4	33.4	17	4.4	26	55.8	20.5	0.33	.....	8,320	w.	48	sw.	6	4	3	18	10
Northern plateau.										46.6	+ 4.0														1.52	+ 0.20								
Boisé City	2,750	27.28	30.15	.....	30.50	21	29.73	17	0.77	47.6	+ 4.4	73.6	16	58.8	23.8	19	35.0	49.8	39.2	28	10.1	7	59.6	32.2	1.33	+ 0.08	3,433	se.	24	nw.	18	6	13	7	11
Cœur d'Alene	.....	.....	.....	.....	.....	.....	.....	.....	.....	41.0	.....	64.7	16	51.6	4.4	3	30.4	60.3	.....	.....	.....	.....	.....	.....	3.31	+ 2.30	.....	.....	.....	.....	.....	24	.....	.....
Ashland	.....	.....	.....	.....	.....	.....	.....	.....	.....	49.3	.....	80.0	22	62.9	25.0	19	35.7	55.0	40.0	30	13.0	11	.....	.....	0.99	— 0.54	.....	w.	.....	.....	.....	10	.....	.....
Fort Klamath	.....	.....	.....	.....	.....	.....	.....	.....	.....	38.4	.....	61.0	27	49.6	15.0	19	27.4	46.0	.....	.....	.....	.....	.....	.....	0.86	— 1.22	.....	.....	.....	.....	.....	7	.....	.....
Lakeview	.....	.....	.....	.....	.....	.....	.....	.....	.....	42.4	.....	64.5	22	53.0	26.0	22	31.8	38.5	38.5	22	8.0	31	.....	.....	1.06	— 0.70	.....	s.	.....	.....	.....	5	.....	.....
Linkville	.....	.....	.....	.....	.....	.....	.....	.....	.....	45.7	.....	72.4	10	57.8	23.0	18	33.6	49.4	.....	.....	.....	.....	.....	.....	0.49	— 1.27	.....	.....	.....	.....	.....	4	.....	.....
Fort Spokane	.....	.....	.....	.....	.....	.....	.....	.....	.....	43.9	.....	67.0	22	55.7	11.9	4	32.1	55.1	.....	.....	.....	.....	.....	.....	1.35	+ 0.89	.....	.....	.....	.....	.....	13	.....	.....
Spokane Falls	1,909	28.01	30.07	+.02	30.62	21	29.68	5	0.93	42.6	+ 2.6	65.7	22	53.8	15.2	2	31.9	50.5	36.6	22	8.7	15	82.9	37.3	2.50	+ 1.47	3,774	sw.	25	s.	11	15	11	13	9
Walla Walla	1,018	29.01	30.11	.....	30.55	21	29.60	11	0.95	49.6	+ 5.1	72.3	16	59.4	20.7	3	40.7	51.6	31.0	22	9.1	5	58.2	34.4	1.83	+ 0.77	5,428	sw.	45	sw.	11	12	12	11	8
N. Pac. coast region.										45.8	+ 0.6														9.51	+ 5.34								
Fort Canby	179	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Neah Bay	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Olympia	36	30.06	30.10	+.03	30.58	20	29.58	11	1.00	45.3	+ 1.0	63.2	24	52.6	25.2	4	38.2	38.0	32.0	22	5.2	28	85.4	40.9	10.60	+ 5.79	3,587	s.	20	sw.	11	20	17	6	8
Port Angeles	14	30.03	30.05	.....	30.56	21	29.45	11	1.12	40.7	— 1.5	53.3	22	47.5	23.7	3	33.9	29.6	23.9	22	6.5	28	89.1	37.5	3.65	+ 2.21	3,488	s.	29	w.	11	18	15	12	4
Pysht	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tatoosh Island	86	29.94	30.04	+.01	30.55	20	29.41	11	1.14	43.9	— 0.6	54.6	22	48.4	33.0	1	40.0	21.6	16.0	11	4.6	9	83.7	38.9	16.36	+11.15	10,831	se.	50	w.	11	23	21	6	4
Astoria	.....	.....	.....	.....	.....	.....	.....	.....	.....	46.3	.....	65.5	21	51.9	30.1	4	41.7	35.4	22.3	21	3.6	5	83.9	41.3	16.11	+12.34	6,076	sw.	32	sw.	11	23	17	11	3
Portland	80	30.04	30.13	+.06	30.56	20	29.73	11	0.83	49.4	+ 2.1	75.2	22	58.8	31.2	2	40.9	44.0	32.2	22	7.2	6	75.7	41.3	8.00	+ 1.64	5,350	s.	27	sw.	7	19	14	11	6
Roseburg	523	29.59	30.15	+.06	30.48	20	29.76	10	0.72	49.6	+ 2.2	81.0	22	61.9	28.6	19	39.6	52.4	46.5	22	4.7	5	72.1	40.1	2.38	— 1.06	2,726	nw.	33	s.	11	12	14	12	5
Mid. Pac. coast reg.										57.0	+ 2.6														0.97	— 2.10								
Red Bluff	342	29.77	30.11	+.07	30.32	8	29.86	16	0.46	58.9	+ 4.0	79.8	22	69.7	39.2	19	46.1	40.6	32.8	26	6.0	3	57.5	41.6	1.13	— 1.78	4,379	n.	28	s.	16	5	5	12	14
Sacramento	64	30.05	30.10	+.06	30.32	8	29.88	24	0.44	57.8	+ 3.1	78.7	31	69.4	40.7	6	46.9	38.0	31.3	30	10.5	3	67.7	46.2	0.94	— 2.33	4,469	nw.	24	nw.	18	5	2	8	21
San Francisco	60	30.09	30.13	+.07	30.33	5	29.92	3	0.41	54.3	+ 0.7	78.0	22	64.0	45.0	0	47.7	33.0	27.8	21	6.2	3	75.0	45.8	0.84	— 2.30	5,887	w.	28	w.	24	4	6	13	12
S. Pac. coast region.										58.2	+ 2.2														0.15	— 2.07								
Los Angeles	339	29.72	30.05	+.01	30.19	5	29.91	21	0.28	59.1	+ 3.2	85.0	10	72.6	41.1	14	46.4	43.9	36.4	9	9.9	3	78.5	51.4	0.29	— 2.66	3,823	w.	18	w.	2	2	1	12	18
San Deigo	66	30.02	30.06	+.03	30.19	5	29.91	21	0.28	57.2	+ 1.3	82.2	2	65.3	43.5	16	49.5	38.7	31.2	22	7.0	4	79.1	49.7	0.02	— 1.48	4,250	nw.	24	ne.	22	1	4	13	14

NOTE.—The data at Mount Washington, N. H., Pike's Peak, Colo., and stations having no departures are not used in computing the district averages.

a Record for 26 days. b 23,285, record for 25 days. c 6th, 8th, 18th, 19th, and 20th.

Meteorological record of voluntary observers and Army post surgeons, March, 1887.

The maximum and minimum temperatures at stations marked thus (*) are from readings of other than standard instruments.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation.
Alabama.	°	°	°	*Inches*
Greensborough	80	34	58.0	1.04
Livingston	80	34	56.2	1.54
Mount Vernon B'ks.	81	35	60.2	0.93
Arizona.				
Huachuca, Fort	80	26	50.1	0.00
McDowell, Fort	93	33	65.3	trace
Mojave, Fort	93	41	65.8	trace
Arkansas.				
Hot Springs	78	32	55.4	4.38
Lead Hill	85	21	51.4	2.84
California.				
Alcatraz Island	74	44	52.2	0.85
Angel Island	89	39	56.5	.....
Benicia Barracks	75	42	56.1	0.59
Bidwell, Fort	69	21	45.2	1.05
Cahnenga	.....	.....	.....	0.28
College City*	80	38	59.0	0.80
Gaston, Fort	80	30	51.4	2.63
Mason, Fort	73	45	53.9	0.82
Nicolaus	83	42	59.6	0.96
Oakland	76	38	53.9	0.71
Oroville	84	37	61.1	0.98
Presidio of San F	77	41	52.7	0.78
Princeton	78	35	56.5	0.98
Poway	83	42	57.4	0.34
Riverside*	88	39	60.9	0.02
Sacramento	81	34	54.2	1.02
Salinas	82	33	52.1	0.54
Santa Barbara	83	43	57.0	0.13
Santa Maria	83	38	58.2	0.25
Colorado.				
Collins, Fort	80	7	39.8	0.45
Lewis, Fort	63	16	39.4	0.40
Connecticut.				
Bethel	.....	.....	.....	3.15
North Colebrook	45	— 3	22.3	.....
Voluntown	57	12	.....	3.45
Dakota.				
Abr. Lincoln, Fort	43	—28	15.1	0.90
Henry	64	—13	27.6	0.29
Meade, Fort	73	— 2	37.0	0.76
Parkston*	60	—10	30.5	0.65
Pembina, Fort	44	—27	15.2	1.58
Randall, Fort	66	— 8	34.2	0.20
Richardton	50	— 9	24.0	2.00
Sisseton, Fort	67	—13	25.3	0.42
Sully, Fort	70	— 5	33.6	0.34
Totten, Fort	57	—20	20.5	0.82
Webster	74	—22	28.8	1.64
Yates, Fort	54	—11	26.8	1.70
District of Columbia.				
Distributing reserv'r	58	24	39.4	3.21
Kendall Green	54	22	38.2	2.08
Receiving reservoir	55	22	38.2	3.43
Rock Creek bridge	60	25	42.2	.....
Florida.				
Archer*	80	32	55.3	4.14
Alva*	87	30	61.0	7.55
Duke	84	31	58.3	2.45
Meade, Fort*	.....	.....	.....	1.20
Limona*	88	40	64.2	1.51
Manatee	89	45	65.2	1.63
Merritt's Island	84	43	64.1	1.95
Tallahassee	79	38	60.0	4.35
Georgia.				
Athens	73	25	49.4	2.79
Forsyth*	84	32	57.1	3.29
Milledgeville	78	28	54.0	2.07
Quitman*	79	36	58.8	1.10
Idaho.				
Boisé Barracks	74	23	48.1	1.31
Cœur d'Alene, Fort	65	3	39.3	2.85
Lewiston	82	31	.....	0.82
Illinois.				
Bloomington	66	16	.....	.....
Collinsville	75	22	44.6	3.80
Charleston*	74	17	38.5	3.40
Geneseo	72	6	33.9	0.70
Jacksonville	71	17	38.6	1.20
Mattoon*	74	18	41.0	3.20
Pekin*	74	11	40.8	1.10
Peoria*	73	12	38.9	0.94
Riley	64	— 2	28.8	1.01
Rockford	63	2	29.6	1.25
Sandwich	69	10	34.4	1.24
South Evanston	68	6	.....	1.66
Sycamore	65	0	30.4	0.89
Windsor	70	17	38.9	2.66
Indian Territory.				
Gibson, Fort	80	25	53.6	1.22
Reno, Fort	84	22	52.8	0.55
Supply, Fort	85	31	.....	.....
Indiana.				
Butlerville*	76	20	42.5	3.11
Fort Wayne*	67	16	36.9	1.21
Jeffersonville	74	19	43.8	1.88
Laconia	75	16	43.4	2.25
Lafayette	69	14	37.6	1.41
Indiana—Cont'd.				
La Grange	59	5	30.9	1.17
Logansport*	72	13	37.2	1.81
Mauzy	67	13	35.3	2.97
Sunman*	66	14	39.2	3.26
Vevay	76	18	42.9	2.78
Iowa.				
Bancroft	60	— 8	29.0	0.46
Cedar Rapids	72	6	31.8	3.50
Cresco	62	0	28.0	0.73
Clinton	71	0	32.4	1.32
Des Moines	73	5	36.0	.....
Independence*	61	11	31.1	2.02
Logan	76	18	39.4	0.60
Fort Madison	71	16	.....	.....
Monticello*	70	— 5	32.0	2.45
Mount Vernon	58	6	34.0	.....
Muscatine	74	7	34.4	1.14
Oskaloosa *a**	74	10	33.1	1.45
Oskaloosa *b**	73	14	.....	.....
Kansas.				
Allison	88	11	39.6	trace
Hays, Fort	84	5	43.2	0.10
Elk Falls	.....	.....	.....	0.57
El Dorado	81	20	45.5	0.04
Emporia	82	20	44.4	1.20
Globe	78	21	42.8	1.72
Independence	79	26	48.4	2.18
Lawrence	81	22	43.4	2.75
Manhattan *a*	82	22	40.7	0.63
Manhattan *b*	83	23	42.4	0.42
Ninnescah	86	21	46.1	0.05
Riley, Fort	81	19	43.1	.....
Salina*	61	31	43.5	0.01
Wellington	85	15	48.8	0.22
Wakefield	75	23	44.0	0.68
Wyandotte	78	22	42.7	1.69
Kentucky.				
Bowling Green	75	22	.....	.....
Frankfort	75	16	43.8	2.88
Harper's Ferry	78	20	46.6	6.80?
Midway	71	17	43.0	2.77
Louisiana.				
Grand Coteau	81	39	64.9	2.28
Liberty Hill	.....	.....	.....	2.00
Maine.				
Bar Harbor	48	— 1	.....	5.03
Cornish	48	— 4	26.2	3.55
Gardiner	47	—10	27.5	7.27
Orono*	44	—14	25.9	5.88
Maryland.				
Cumberland	60	18	34.9	1.57
Fallston*	53	16	34.6	3.61
Great Falls	58	20	37.9	4.10
McDonogh	56	17	35.3	2.36
McHenry, Fort	64	19	37.7	1.67
New Midway*	58	19	37.0	1.97
Woodstock	56	15	36.0	3.24
Massachusetts.				
Amherst	46	— 2	26.4	4.05
Blue Hill Obs'y:				
Summit	50	6	27.7	4.93
Base	50	6	.....	5.63
Deerfield	48	— 3	21.3	5.59
Dudley	48	5	25.4	3.30
Fall River	50	11	30.7	4.35
Heath	46	0	.....	.....
Milton	52	13	31.8	5.10
New Bedford	50	14	31.4	5.69
North Truro	.....	.....	.....	2.71
Somerset*	57	12	33.0	5.03
Taunton	59	11	31.8	4.79
Westborough	53	10	31.8	4.35
Williamstown	42	0	24.9	5.15
Worcester	46	9	24.2	4.98
Michigan.				
Birmingham	49	3	.....	1.23
Brady, Fort	44	—24	16.5	0.69
East Saginaw	50	3	28.6	1.27
Harrisville*	45	— 5	23.5	1.85
Kalamazoo	55	11	33.0	1.35
Lansing	50	5	27.8	1.30
Mottville*	55	— 2	.....	0.75
Thornville*	48	3	27.6	1.85
Traverse City	48	— 7	.....	2.27
Minnesota.				
Minneapolis	47	—12	25.8	0.71
Snelling, Fort	52	—13	27.1	0.85
Missouri.				
Centreville	87	15	.....	1.90
Central College	78	16	.....	1.21
Conception	75	17	38.9	.....
Springfield*	74	17	45.8	2.50
Montana.				
Keogh, Fort	67	4	36.1	0.16
Missoula, Fort	61	11	39.5	0.24
Shaw, Fort	72	4	40.0	0.00

Meteorological record of voluntary observers, etc.—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation.
Nebraska.	°	°	°	*Inches*
Brownville*	79	19	40.9	1.00
Crete	80	11	37.8	0.09
De Soto*	78	9	37.0	0.58
Fremont*	75	9	37.2	0.40
Genoa	77	5	35.9	0.37
Hay Springs*	75	6	37.1	1.22
Lincoln	79	10	37.3	0.52
Marquette	.....	.....	.....	0 02
Niobrara, Fort	81	— 8	37.0	0.22
Robinson, Fort	76	2	41.2	0.63
Stockham	.....	.....	.....	0.20
Sidney, Fort	78	8	40.6	0.88
Tecumseh*	70	18	38.5	0.90
Nevada.				
Carson City	74	4	46.4	0.23
McDermit, Fort	70	25	43.3	.....
New Hampshire.				
Antrim*	37	—10	22.8	3.78
Ashland	.....	.....	.....	2.74
Belmont	.....	.....	.....	3.30
Berlin Mills	50	—10	.....	2.38
Bristol	.....	.....	.....	2.84
Lake Village	.....	.....	.....	3.57
Nashua	51	— 6	28.6	4.43
Wier's Bridge	.....	.....	.....	3.18
Wolfborough	.....	.....	.....	4.69
Woodstock	.....	.....	.....	2.52
New Jersey.				
Beverly	55	21	34.5	3.25
Clayton*	57	19	34.1	3.37
Dover	49	12	29.6	2 45
Lakewood	60	20	39.8	3.66
Moorestown	50	20	34.1	2.85
Readington	60	20	36.1	.....
Roseland	49	12	.....	2.85
South Orange	52	16	33.4	2.45
New Mexico.				
Bayard, Fort	86	25	56.4	0.00
Gallinas Spring	75	31	.....	.....
Selden, Fort	89	27	57.1	0.00
Union, Fort	76	10	45.5	.....
Wingate, Fort	69	20	44.4	0.50
New York.				
Auburn	47	13	28.6	3.64
Brooklyn *a*	50	14	32.9	3.69
Brooklyn *b*	49	19	34.9	.....
Columbus, Fort	51	10	33.7	3.85
Cooperstown*	48	— 2	24.0	4.32
Factoryville*	57	12	31.4	1.54
Humphrey	50	14	25.9	2.29
Ithaca	54	10	27.4	1.87
Le Roy	53	9	24.7	1.74
Madison Barracks	45	0	25.6	1.34
Menands	42	5	26.8	3.38
Niagara, Fort	54	8	28.3	1.42
North Volney*	47	5	24.9	.....
Palermo*	45	1	23.0	1.08
Palmyra*	58	10	29.9	.....
Penn Yan	.....	.....	.....	1.52
Plattsburg Barracks	46	— 6	23.6	1.78
Setauket	54	13	32.5	4.96
Utica*	54	0	23.1	.....
West Point	54	10	30.9	3.10
White Plains	50	12	34.1	9.91?
North Carolina.				
Chapel Hill	83	26	43.7	3.93
Lenoir	74	26	.....	2.30
Lincolnton	68	27	43.6	3.10
Raleigh	81	26	49.0	3.00
Reidsville	75	12	43.5	2.26
Statesville*	74	27	45.2	3.16
Wake Forest	80	20	47.9	4.45
Weldon*	77	29	44.8	4.30
Ohio.				
Cleveland	60	14	31.7	2.89
College Hill*	79	14	40.8	2.80
Elyria	63	12	.....	3.05
Garrettsville	63	4	28.6	2.46
Hiram	61	7	30.0	2.86
Jacksonborough*	66	12	36.5	3.50
Napoleon	63	10	33.9	1.21
North Lewisburg	66	10	37.7	2.20
Portsmouth	75	18	42.3	1.94
Ruggles*	60	10	31.1	3.25
Tiffin *a**	64	10	33.0	2.23
Tiffin *b**	62	12	32.9	2.26
West Milton*	70	15	40.0	4.50
Wauseon	62	7	31.5	1.49
Westerville	65	11	35.5	2.39
Yellow Springs	66	13	37.4	2.45
Oregon.				
Albany*	72	31	49.7	9.03
Bandon*	74	31	47.9	7.07
East Portland*	72	31	.....	6.34
Eola*	67	32	46.2	6.41
Klamath, Fort	69	13	38.6	0.57
La Grande	66	17	.....	2.25
Mount Angel	67	31	48.0	10.30
Pennsylvania.				
Altoona	73	20	38.1	0.52
Blooming Grove*	54	5	28.7	1.90
Bethlehem	50	19	33.6	1.86
Dyberry	53	— 4	25.7	3.55
Easton	.....	.....	.....	3.34
Fallsington*	52	20	34.9	2.98
Franklin*	54	10	33.6	2.57
Germantown	48	20	.....	.....
Grampian Hills*	58	12	29.5	2.49
Meadville	59	17	33.0	.....
Phillipsburg*	65	12	31.8	4.00
Quakertown*	47	13	30.4	2.08
State College	60	11	30.6	1.08
Wellsborough*	55	10	30.7	0.60
West Chester	50	16	33.3	3.66
Wilkesbarre	52	13	31.4	1.73
Wysox	52	12	31.8	1.44
South Carolina.				
Aiken	77	30	54.2	0.98
Kirkwood*	72	29	50.9	1.37
Spartanburg*	62	33	48.3	3.07
Stateburg*	75	29	51.9	0.97
Tennessee.				
Ashwood	73	28	50.0	4.56
Milan	77	27	50.2	3.37
Texas.				
Austin*	89	36	63.2	1.76
Cleburne	85	21	57.2	0.32
Comfort	97	40	.....	0.35
Concho, Fort	95	34	60.0	.....
Corsicana	.....	.....	.....	0.75
McIntosh, Fort	92	44	66.7	0.56
New Ulm	91	41	60.7	1.27
Ringold, Fort	100	43	70.8	1.92
Silver Falls	88	25	.....	trace
Vermont.				
Brattleborough	48	— 5	27.8	3.63
Burlington	44	— 4	26.4	1.87
Charlotte*	48	— 6	24.3	3.90
Lunenburg	46	—12	22.0	2.20
Newport	44	—20	21.1	3.85
Poultney	45	—11	23.3	3.68
Strafford*	42	— 6	22.3	4.30
Virginia.				
Bird's Nest*	73	26	42.8	4.70
Bruington	55	21	.....	4.05
Dale Enterprise*	76	17	42.0	3.03
Marion	70	16	39.5	2.82
Monroe, Fort	67	23	43.8	4.55
Rappahannock	67	20	40.6	7.52
Summit	70	14	39.0	.....
University of Va.	62	28	44.5	2.11
Variety Mills	74	14	40.6	2.97
Wytheville	70	16	40.8	2.94
Washington Territory.				
Blakely*	64	30	46.8	8.60
Konewick	72	22	.....	0.35
Spokane, Fort	67	10	42.3	.....
Tacoma*	61	25	45.2	7.77
Townsend, Fort	60	25	45.8	1.75
Walla Walla, Fort	73	20	49.4	2.17
West Virginia.				
Clarksburg	65	11	37.6	0.76
Helvetia*	67	5	37.4	3.02
Middlebrook	61	4	31.4	.....
Parkersburg	72	16	39.0	1.64
Wisconsin.				
Delavan	62	— 6	26.8	1.85
Embarras	52	— 6	25.7	1.00
Fond du Lac	57	—10	29.1	1.13
Madison	46	1	28.0	2.14
Manitowoc	43	0	27.8	0.93
Prairie du Chien	67	3	31.2	1.15
Wausau	56	— 8	24.7	0.28
Wyoming.				
Laramie, Fort	74	11	42.4	0.08
Camp Sheridan	59	2	34.6	.....
Washakie, Fort	72	6	41.0	0.40

ERRATA.

In the "Meteorological record of voluntary observers and Army post surgeons for February, 1887," the rainfall for Pacolet, S. C., should be 5.05 instead of 5.97 inches.

In the same REVIEW, on page 52, the rainfall departure at Wilmington, N. C., should be —1.70 instead of +1.70.

Form 106 G 1884.

Chart I. Tracks of Areas of Low Pressure. March, 1887.

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE U.S. ARMY

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

A. W. GREELY, Chief Signal Officer.

Observations for the Signal Service are taken at 7 A.M. 3 P.M & 10 P.M. 75th Meridian Time.

NOTES.

The Roman letters show number and order of areas of low pressure. The figures above the lines show the days of the month, those below (7, 2, and 3) indicate, respectively, the 7 a. m., 3 p. m., and 11 p. m. (75th meridian time) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

The shaded spots ( ) indicate position of icebergs observed.

xxx→ Tornado tracks—see tabulated list in REVIEW.

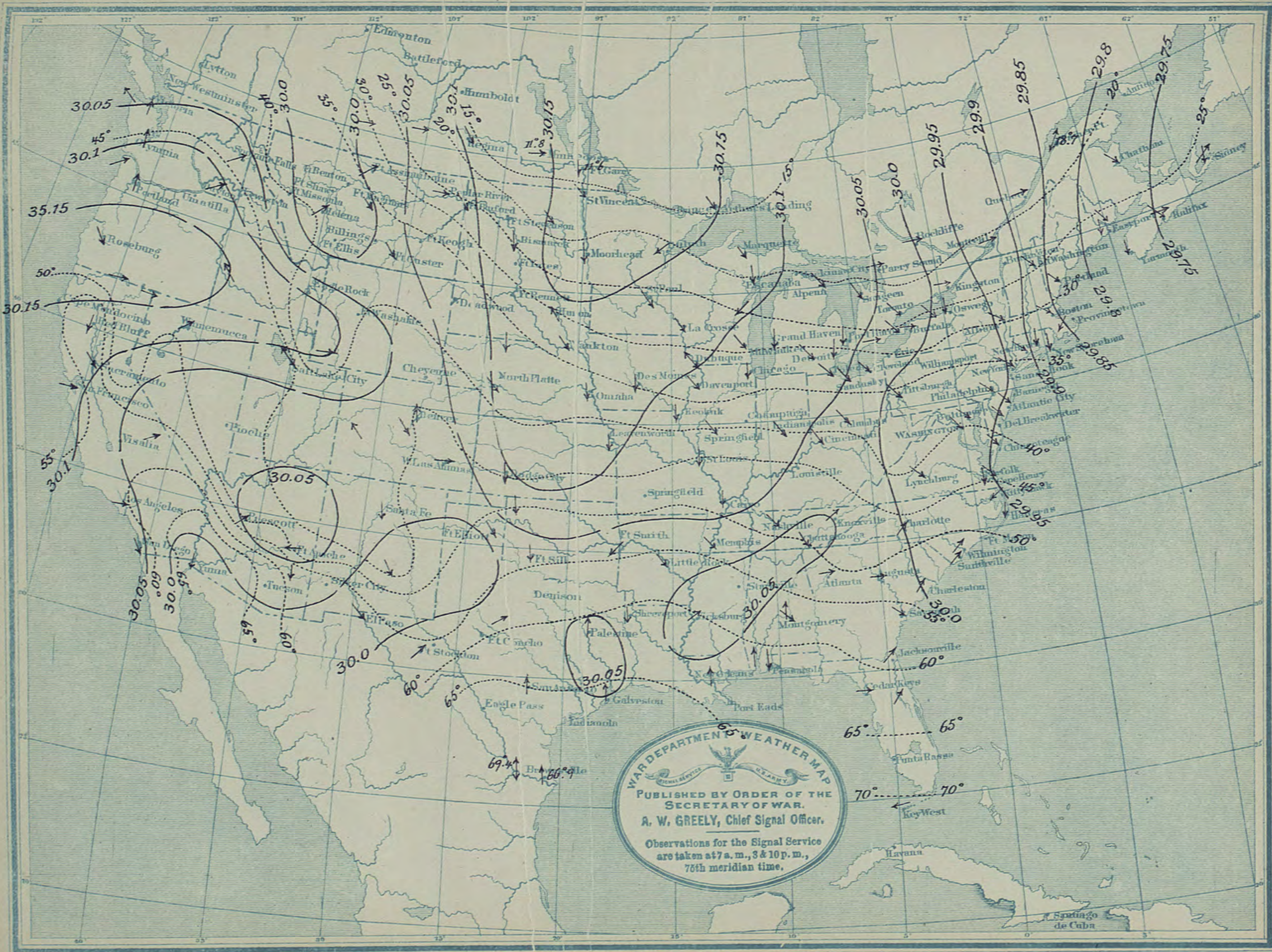
West from Greenwich

West from Washington

Signal Office Lith.

Chart II. Isobars, Isotherms, and Winds. March, 1887.

Form 106 F.



Signal Office Lith.

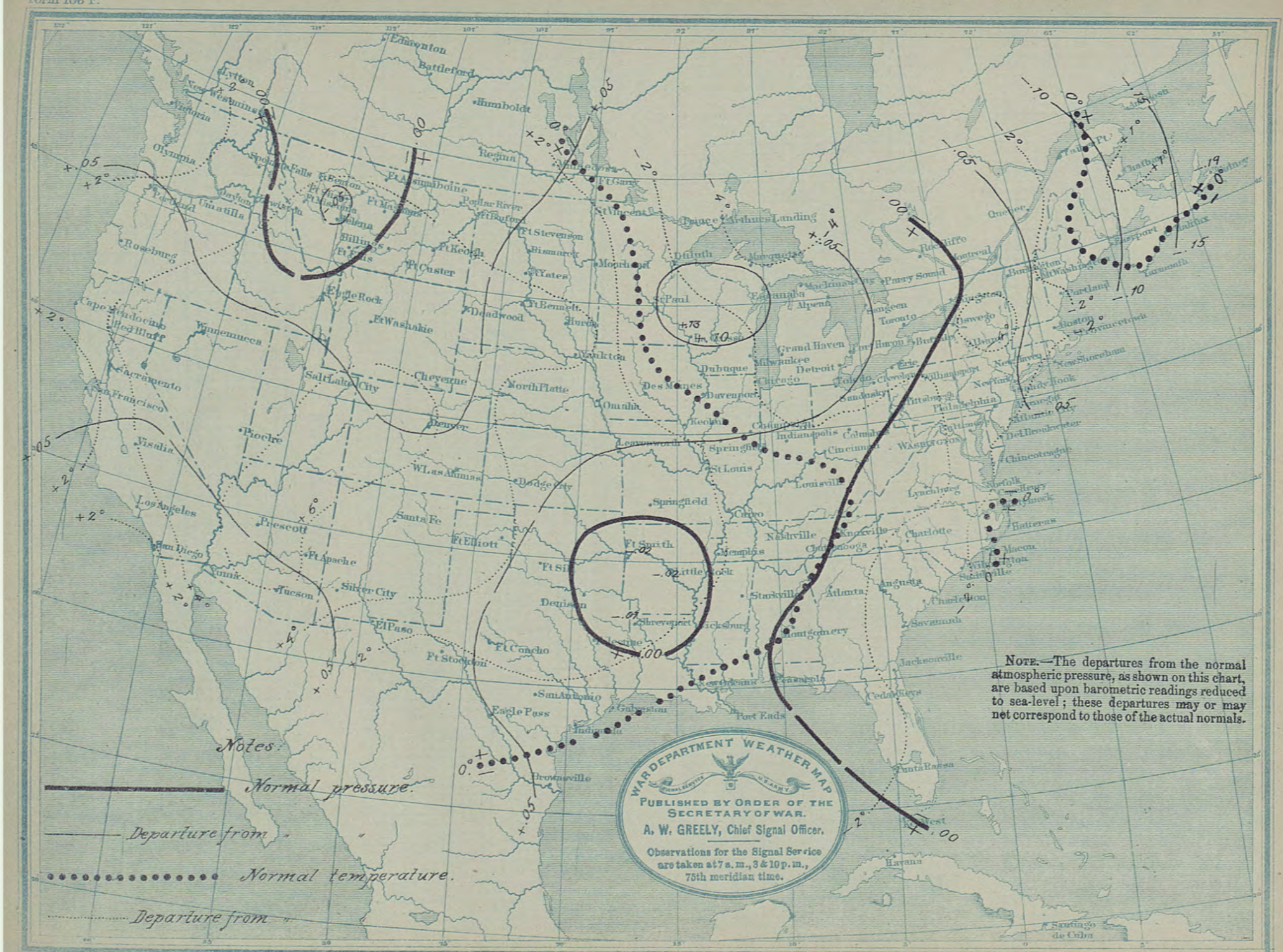
Chart III. Precipitation, March, 1887.

Form 106 F.

Signal Office Lith.

Chart IV. Departures from Normal Atmospheric Pressure and Temperature. March, 1887.

Form 106 F.



Notes.

Normal pressure.

Departure from " "

Normal temperature.

Departure from " "

WAR DEPARTMENT WEATHER MAP

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

A. W. GREELY, Chief Signal Officer.

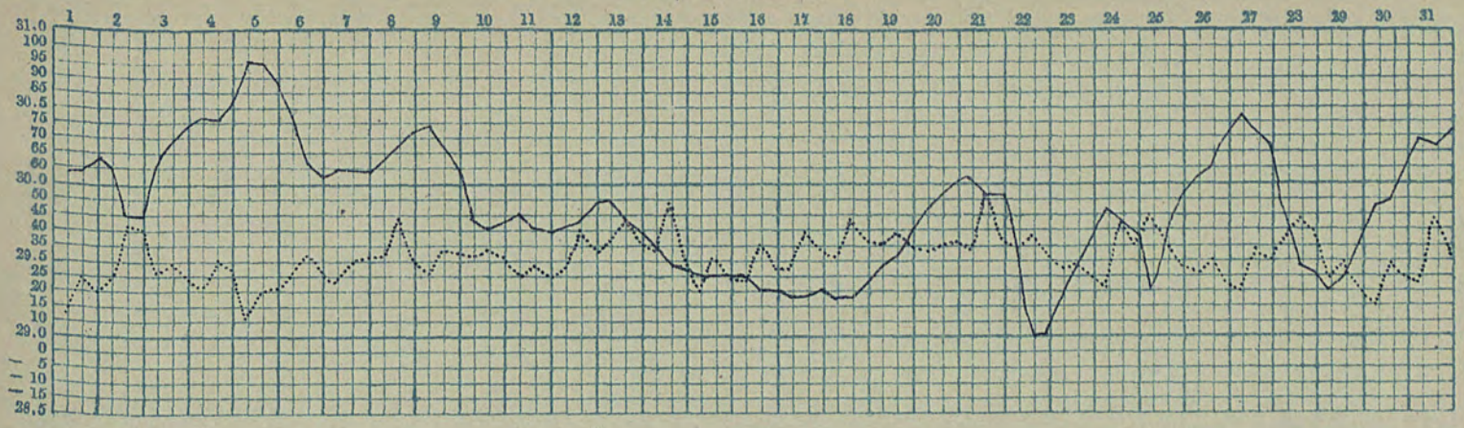
Observations for the Signal Service are taken at 7 a.m., 3 & 10 p.m., 75th meridian time.

NOTE.—The departures from the normal atmospheric pressure, as shown on this chart, are based upon barometric readings reduced to sea-level; these departures may or may not correspond to those of the actual normals.

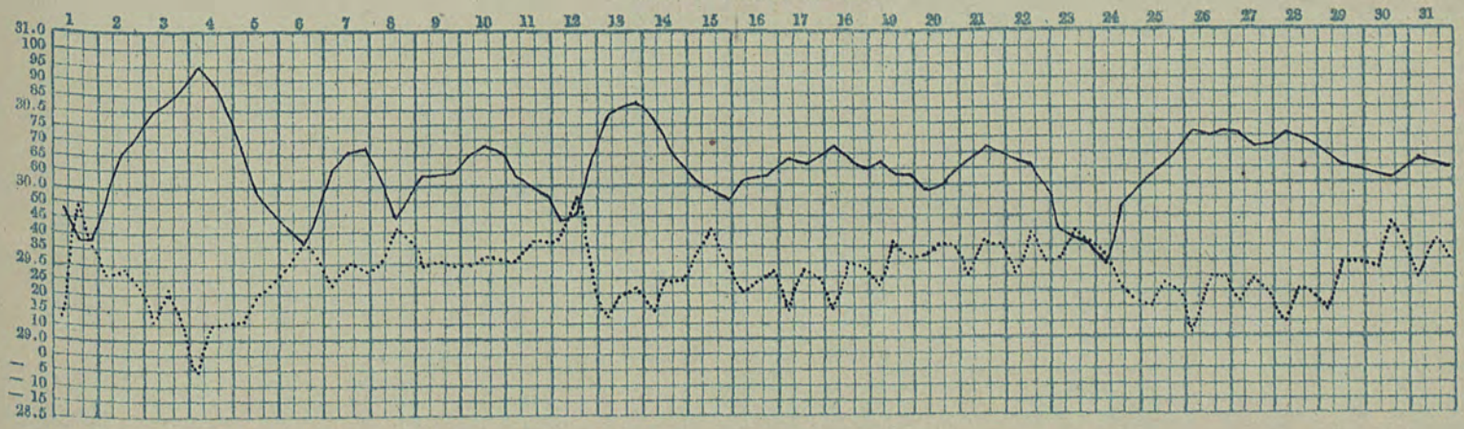
Signal Office Lith.

Chart V. Pressure (———) and Temperature (.....) Curves. March, 1887.

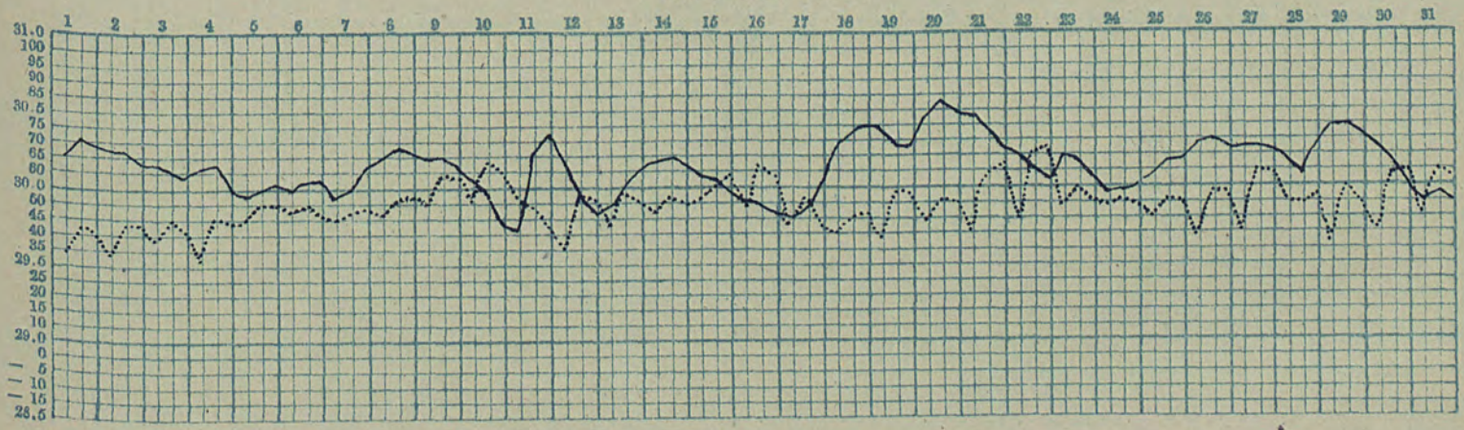
BOSTON, MASS.



SAINT PAUL, MINN.



PORTLAND, OREG.



NEW ORLEANS, LA.

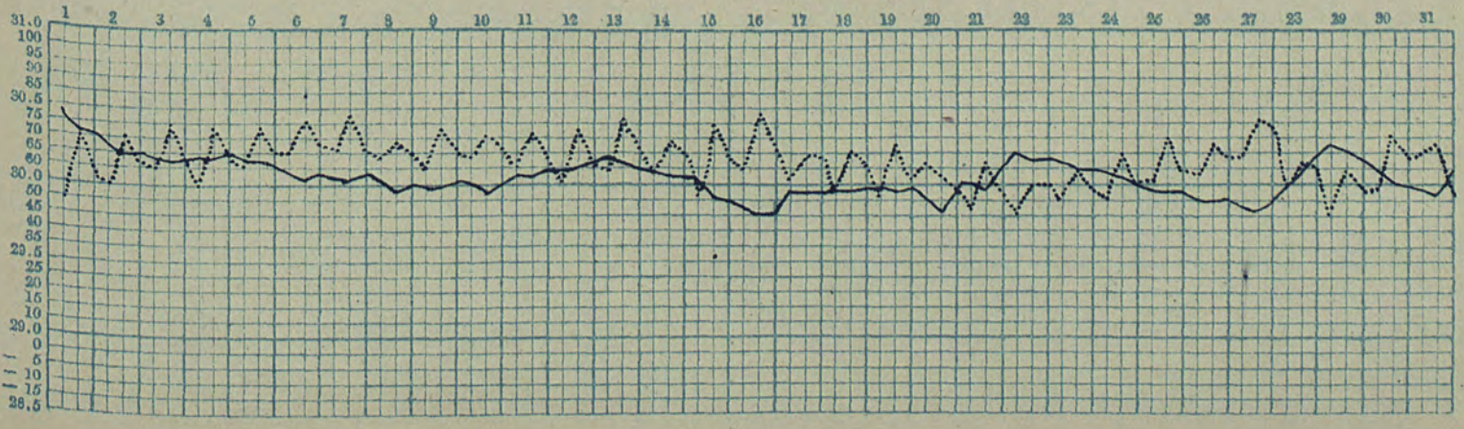
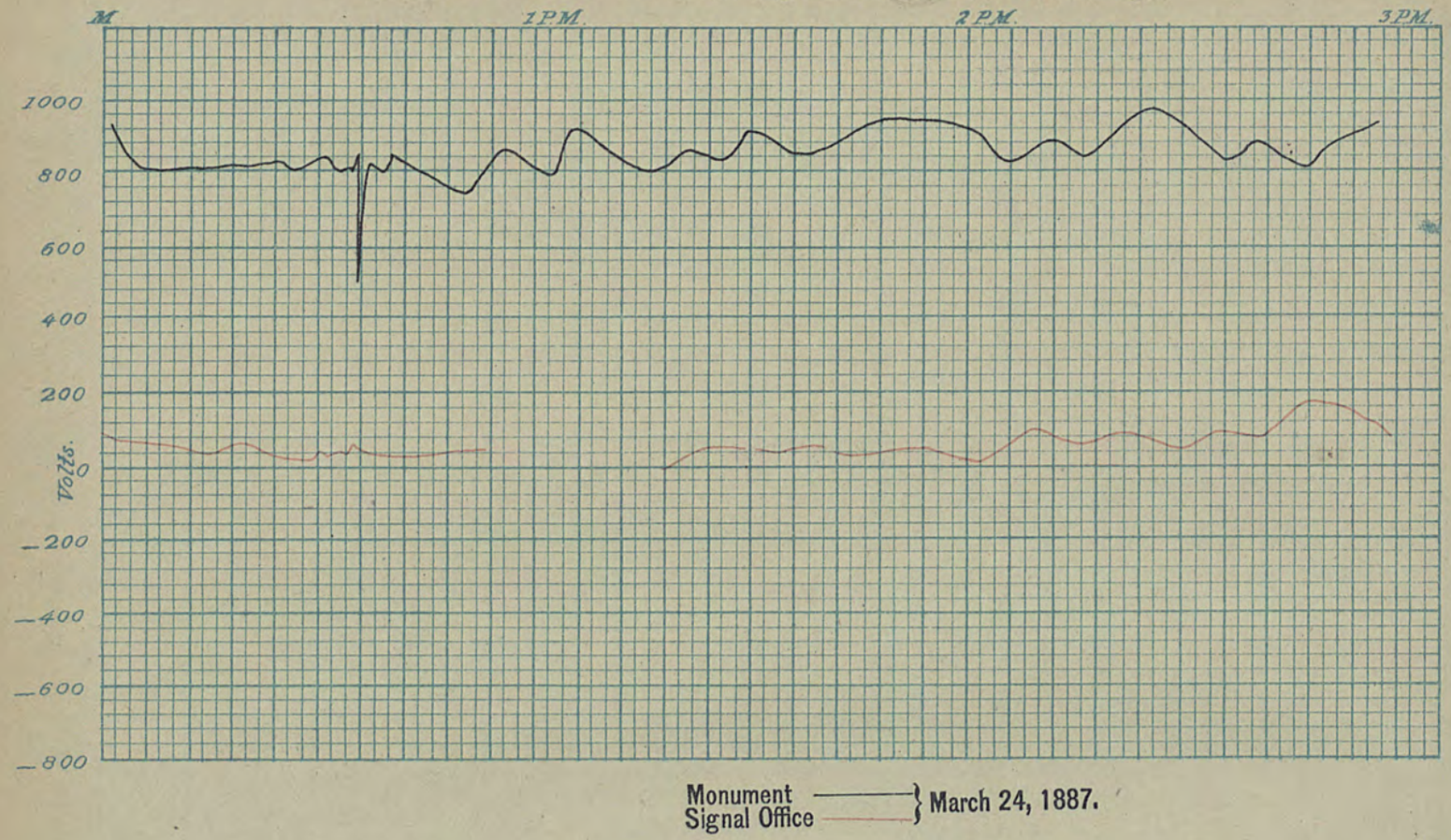
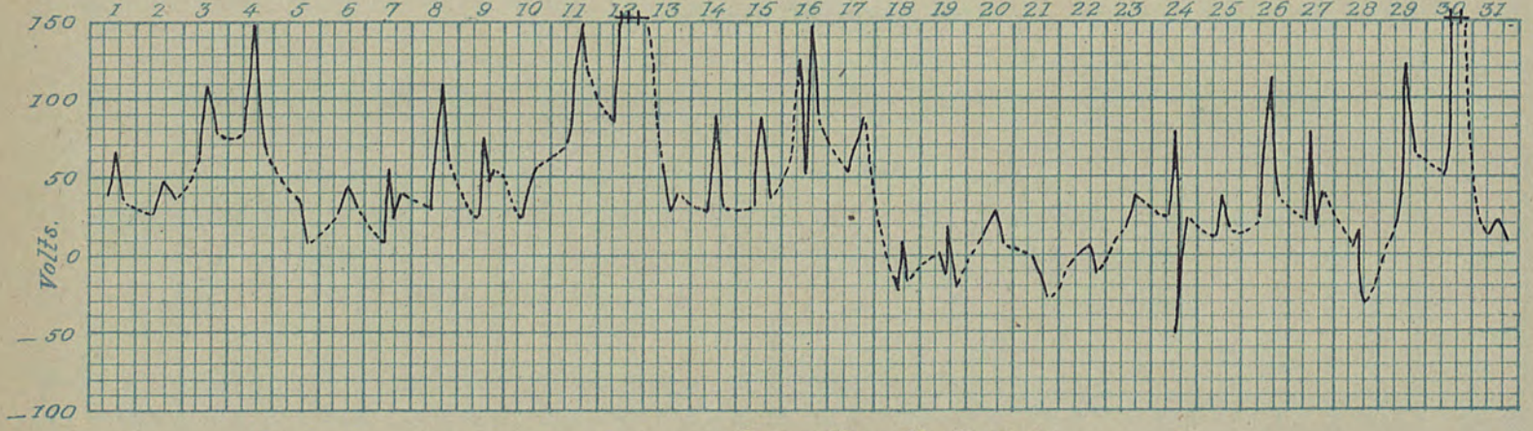


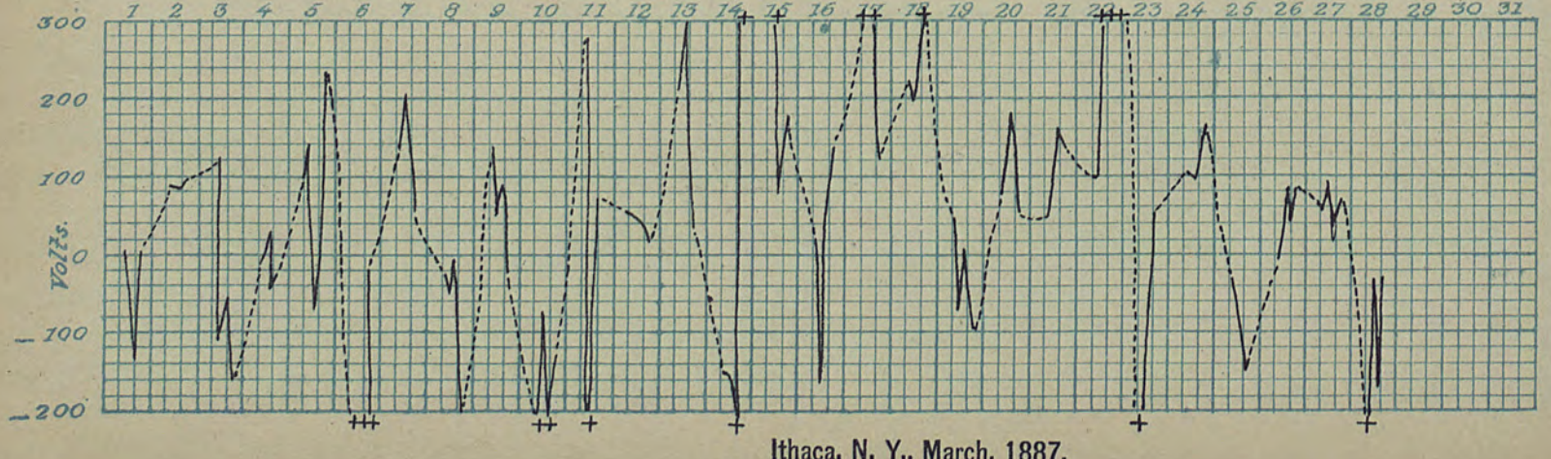
Chart VI. Curves showing Electrometer Readings.



Monument
Signal Office
} March 24, 1887.



Boston, Mass., March, 1887.



Ithaca, N. Y., March, 1887.

Chart VII. Average storm tracks for the month of March.

Form 106 F.