

Deviations from normal temperature—Continued.

State and station.	County.	(1) Normal for the month of Jan.	(2) Length of record.	(3) Mean for Jan., 1891.	(4) Departure from normal.	(5) Extreme monthly mean for Jan.			
						Highest.	Year.	Lowest.	Year.
<i>Massachusetts.</i>									
Amherst	Hampshire..	0	Years	0	0				
Newburyport	Essex	24.2	14	27.4	+ 3.9	32.3	1889	13.5	1857
Somerset	Bristol	26.8	18	29.0	+ 4.8	33.1	1880	13.7	1857
<i>Michigan.</i>									
Kalamazoo	Kalamazoo ..	21.6	15	29.2	+ 7.6	36.0	1880	14.0	1881
Thornville	Lapeer	22.2	14	28.4	+ 6.2	35.6	1880	15.6	1881
<i>Minnesota.</i>									
Minneapolis	Hennepin ...	8.3	26	20.7	+ 12.4	23.2	1880	- 4.4	1875
<i>Montana.</i>									
Fort Shaw	Lewis & Clarke	15.9	21	33.8	+ 17.9	33.8	1891	- 2.2	1875
<i>New Hampshire.</i>									
Hanover	Grafton	17.4	53	21.2	+ 3.8	26.5	1838	6.8	1857, '83
<i>New Jersey.</i>									
Moorestown	Burlington ..	29.4	27	33.9	+ 4.5	40.1	1890	22.2	1867
South Orange	Essex	28.8	20	31.9	+ 3.1	37.6	1880	23.8	1884
<i>New York.</i>									
Cooperstown	Otsego	20.3	37	23.4	+ 3.1	31.6	1880	10.3	1857
Palermo	Oswego	20.8	37	24.9	+ 4.1	29.4	*	11.6	1885
<i>North Carolina.</i>									
Lenoir	Caldwell	36.2	19	38.0	+ 1.8	46.5	1890	30.2	1882
<i>Ohio.</i>									
N'th Lewisburgh.	Champaign ..	27.5	59	31.1	+ 3.6	41.0	1880	14.0	1856, '57
Wauseon	Fulton	23.1	21	27.9	+ 4.8	37.7	1880	12.2	1875
<i>Oregon.</i>									
Albany	Linn	37.3	13	40.9	+ 3.6	43.8	1887	22.8	1868
Eola	Polk	37.0	20	40.8	+ 3.8	42.7	1874	29.7	1875
<i>Pennsylvania.</i>									
Dyberry	Wayne	21.1	26	24.9	+ 3.8	31.6	1890	13.9	1865
Grampian Hills..	Clearfield ..	23.1	26	27.0	+ 3.9	35.0	1880	16.1	1867
Wellsborough ..	Tioga	25.7	11	25.7	0.0	35.8	1890	19.1	1884
<i>South Carolina.</i>									
Statesburgh	Sumter	45.5	9	46.1	+ 0.6	54.6	1890	39.0	1886
<i>Tennessee.</i>									
Austin	Wilson	37.2	22	40.5	+ 3.3	53.1	1880	28.2	1884
<i>Texas.</i>									
New Uim	Austin	50.7	17	50.7	0.0	63.7	1880	34.8	1875
<i>Vermont.</i>									
Strafford	Orange	16.0	17	22.2	+ 6.2	25.4	1889	6.9	1888
<i>Virginia.</i>									
Birdsnest	Northamp'tn	39.8	22	41.2	+ 1.4	49.6	1890	33.7	1881
<i>Washington.</i>									
Fort Townsend ..	Jefferson	37.8	19	42.3	+ 3.6	55.4	1888	29.6	1869
<i>Wisconsin.</i>									
Madison	Dane	16.8	28	25.2	+ 8.4	33.6	1880	4.1	1875

* 1863, 1880, and 1890.

MAXIMUM AND MINIMUM TEMPERATURES.

The highest temperature reported by a regular station of the Signal Service was 88, at Rio Grande City, Tex., on the 30th. The maximum temperature was 80, or above, at Tampa and Jacksonville, Fla., Brownsville, Tex., and Los Angeles, Cal., and was above 70 in the east Gulf states, along the Atlantic coast south of the 35th parallel, in the Rio Grande Valley, in south and southwest California, southwest Arizona, and in the middle Sacramento valley. Over the north part of the upper lake region and the east part of the middle plateau the maximum temperature was below 40, and it was below 50 north of a line traced from the south Maine coast westward to south Iowa, and thence northwestward to northwest Montana. The reports of United States Army post surgeons and voluntary observers show the following maximum temperatures in states and territories where temperature rising to or above 80 was reported: Fort Ringgold, Tex., 90; Pomona, Cal., and Eustis, Fla., 88; Tucson, Ariz., Hattiesburgh, Miss., and several stations in Louisiana, 81; Citronelle, Ala., and Hardeeville, S. C., 80.

The lowest temperature reported by a regular station of the Signal Service was -27, at Saint Vincent, Minn., on the 15th. The minimum temperature was below -10 in north Vermont, extreme east upper Michigan, central and north Minnesota, North Dakota, northeast Montana, and in areas in northeast Utah and central Colorado, and the temperature fell below 0 (zero) north of a line traced along the Maine coast, thence westward north of the lower lakes to south Minnesota, thence southwest to south-central New Mexico, thence northwest to northwest Nevada, and thence east of north over the northern plateau. The highest minimum temperature, 53, was reported at Key West, Fla., and the minimum readings were above 30 along the immediate south Atlantic, Gulf, and Pacific coasts. The reports of United States Army post surgeons and volun-

tary observers show the following minimum temperatures in states and territories where minimum temperature falling to or below 0 (zero) was reported: Breckenridge, Colo., -36; West Milan, N. H., -30; Pokegama Falls, Minn., -26; Elko (2), Nev., -25; Grafton and Fort Pembina, N. Dak., -24; East Berkshire, Vt., and Oelrichs, S. Dak., -23; Choteau, Mont., -22; Fairfield, Me., -20; Boca, Cal., Henry's Lake, Idaho, and Antelope Spring, N. Mex., -19; Ogdensburgh, N. Y., -18; Hayward, Wis., -16; Fort Fetterman, Wyo., and Roscommon, Mich., -15; Silver Lake, Oregon, -14; Fort Du Chesne, Utah, -13; Fort Niobrara and North Loup, Nebr., -10; Carroll, Iowa, -8; Cooleys, Ariz., -7; New Hartford (1), Conn., and several elevated stations in Pennsylvania, -4; Lakin and Spearville, Kans., -3; several stations in Massachusetts, -2; Adrian and Pickering, Mo., -1; Bolar, Va., and Warren and Winnebago, Ill., 0 (zero).

LIMITS OF FREEZING WEATHER.

The southern limit of freezing weather is shown on Chart IV by a line traced over the Florida Peninsula in latitude about 29° and a second line traced just inside the west Gulf coast line. The western limit of freezing weather is shown on this chart by a line traced along the immediate north Pacific coast and a second line traced inside the Pacific coast line south of the 40th parallel.

RANGES OF TEMPERATURE.

The greatest and least daily ranges of temperature are given in the table of Signal Service data. The greatest monthly ranges of temperature occurred over the north-central part of the country, where they exceeded 60, whence they decreased eastward to less than 40 on the south New England coast, southeastward to less than 30 over extreme south Florida, southward to less than 40 on the middle west Gulf coast, southwestward to less than 50 over the middle and south plateau and on the south Pacific coast, and westward to less than 30 on the north Pacific coast.

FROST.

The first killing frost of the season was reported at Yuma, Ariz., 7th; at San Antonio, Tex., 11th; and at Titusville, Fla., 14th.

The first black frost of the season was reported at Jacksonville, Fla., 14th, and at Aiken, S. C., 18th.

The first light frost of the season was reported at San Diego, Cal., 8th; at Colegrove, Cal., 9th; at Corpus Christi, Tex., 11th; and at Jupiter, Fla., 14th. Light frost occurred as far south as Lee county, Fla., on the 5th, 6th, 14th, 15th, 19th, 20th, and 25th; along the immediate Gulf coast on a number of dates; in the lower Rio Grande valley on the 24th; at Yuma, Ariz., on the 1st, 2d, 7th, and 8th; and at San Diego, Cal., on the 8th and 9th. The light frost of the 9th at San Diego, Cal., injured plants in the Cajon Valley, and the light frost of the 14th at Jupiter, Fla., injured vegetation.

THE COLD WINTER OF 1890-1891 IN EUROPE.

The period of low temperature in central and western Europe which continued through the greater part of the past winter was probably the most persistent in the annals of European meteorology. A determination of the causes which contributed to produce the cold spell is of paramount importance to the science of meteorology, and this work will doubtless be undertaken by European meteorologists. It is not within the province of this publication, nor is it possible at the present time and with the data at hand, to attempt more than a brief review of the general meteorological conditions over a considerable area of the northern hemisphere during the prevalence of the great cold. A recognized fact in connection with abnormally high barometric pressure and unusually low temperature is their dependence upon each other, and an interesting line of investigation is that which has for its object the confirmation of the theory that abnormal cold over one portion of the northern hemisphere is compensated in some degree by an excess of

temperature over some other. For reasons above stated general meteorological features only can be presented in this brief reference.

In the second decade of December the barometric pressure was markedly high over east-central and central Europe, the 11th, 16th, and 17th being the only dates the area of high pressure was central west of the 20th meridian of east longitude. During this period the pressure rose above 30.30 and the temperature fell below -10° within the area of highest pressure. From the 19th to 24th the pressure was above 30.90 over northeast Russia, and on the 24th the temperature was below -20° in that region. On the 25th and 26th the pressure was above 31.10 in central Russia (the highest pressure noted in Europe during the period under discussion). During the last few days of the month the area of highest pressure occupied west-central Europe with pressure varying from 30.30 to 30.90. During this month the Asiatic area of high pressure seemed to have shifted its position to the westward, and the pressure was apparently below the normal over central Asia. During the third decade of the month the area of highest pressure shifted its position from east-central and central Europe to west-central Europe. The pressure for the month was above the normal over the south-central part of the United States, and it was below the normal over southeast and south-central Europe, over the north Atlantic Ocean along the trans-Atlantic steamship routes, over the Canadian Maritime Provinces, along the Atlantic coast of the United States, and over the northwest and extreme southwest parts of the United States. The European cold wave seemed to extend westward in the middle latitudes over the northeast part of the United States, while over the north-central part of the United States there was a marked excess of temperature.

During the early part of January the area of high pressure occupied a more southerly position than in December, and the pressure was high over the British Isles. On the 8th and 9th the pressure was above 30.70 over central Europe, and on the 10th the pressure was above 30.70 over southeast Europe, and an area of high pressure occupied west-central Europe. After the date last named the area of high pressure seemed to divide, one part receding into Asia, and the other showing an inclination to settle to the westward and southwestward over the British Isles. On the 14th and 15th the pressure was above 31.00 along the trans-Atlantic steamship routes east of the 25th meridian. During the latter part of January the mean pressure was generally low over the British Isles, and the area of high pressure was confined to east-central Europe, whence it extended over central Asia. In this month the mean pressure was below the normal over extreme southeast Europe, and generally over the United States and Canada east of the 100th meridian. The mean pressure was above the normal over the east part of the north Atlantic Ocean, between the 40th and 55th parallels, and over the west and extreme southeast parts of the United States; and in the middle plateau region the mean pressure was the highest ever noted in the United States for January. The mean temperature was the

highest on record for January over the northwest part of the United States, and it was above the normal in parts of central Asia and southeast Europe. The European cold did not extend westward to the American continent, where the month was warmer than usual, except in the south-central and extreme southeast parts.

The following are among the lowest temperatures noted in western Europe during the past winter: -2° at Berlin, January 18th; -2° at Munich, January 17th; -2° at Vienna, December 30th; 0 at Stockholm, January 10th; 3° at Brussels, December 30th; 8° at Paris, January 20th; 14° at London, December 25th; 21° at Leith, January 8th; 30° at Lisbon, January 19th; and 28° at Algiers, January 19th. During the period of 41 days from December 13th to January 22d the minimum temperature fell below the freezing point on 41 days at Vienna, Munich, and Stockholm; on 40 days at London and Brussels; on 39 days at Berlin; on 37 days at Paris; on 25 days at Leith; on 6 days at Rome; on 2 days at Algiers; and on one day at Lisbon. Over the south part of England, where the mean temperature for December was more than 10° below the normal, the cold spell was reported the most persistent since 1814, although the temperature was not exceptionally low nor the snowfall remarkably heavy. Over the north part of the British Isles the mean temperature was above the normal. Over the west part of the continent of Europe the winter will number among the most severe of the century. In Austria the cold was unprecedented in a quarter of a century. The severer winters of the century in western Europe were those of 1807-1808, 1812-1813, 1813-1814, and 1829-1830, the last being the most severe. Other cold spells occurred in January, 1838, February, 1845, February, 1855, December, 1879, and January, 1881.

Among notable features of the past winter were the unusually small number of cold waves of marked severity which reached the Atlantic coast of the United States from the interior of the continent; the marked tendency of north Atlantic storms to pass southeastward over the Bay of Biscay, southeast Europe, and the Mediterranean Sea in December, to which course they were probably deflected by the area of high pressure over central Europe; and the northerly course of north Atlantic storms over the eastern part of the ocean in January, in which month the area of high pressure occupied a more southerly and westerly position than in December, and the storms were apparently deflected to a northerly course before reaching European waters. Referring to the period of cold in Europe, Mr. C. J. Lyons, in charge of the weather service of the Hawaiian Government Survey at Honolulu, reports that the characteristics of the winter at that place were the unusual persistence of trade winds and a tendency in variable winds to the northwest quadrant rather than the southwest quadrant, resulting in an enormous disproportion of rainfall on the northeast coasts and mountain sides. The barometric pressure was only about .006 above the normal, and the temperature very slightly in excess, owing to the prevalence of the trades.

PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for January, 1891, as determined from the reports of nearly 2,000 stations, is exhibited on Chart III. In the table of Signal Service data the total precipitation and the departure from the normal are given for each Signal Service station. The figures opposite the names of the geographical districts in the columns for precipitation and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the precipitation is below the normal and subtracting when above.

The heaviest precipitation occurred on the north Pacific coast,

where 15.93 fell at Neah Bay, Wash. The monthly precipitation exceeded 10.00 in southeast Massachusetts, west Connecticut, southeast New York, north New Jersey, north-central Alabama, central and southwestern Mississippi, the interior of Louisiana and eastern Texas, and on the central Oregon coast; it exceeded 8.00 over central Nova Scotia, from southeast New York and east Pennsylvania over north New Jersey, north Connecticut, and a part of southeast Massachusetts, in north-central Alabama, from central Mississippi over east Texas, and on the central Oregon and extreme north Washington coasts. No precipitation was reported in the lower Colorado and lower Gila valleys and thence over southeast California to