

MAXIMUM AND MINIMUM TEMPERATURES.

The highest temperatures for the month were reported along the east coast of southern Florida, and in southeastern Texas west of the coast line, where the values rose above 80°, the highest reading, 88°, being noted at Rio Grande City, Tex. At Kitty Hawk, N. C., at stations in the south Atlantic states, over the southern parts of the eastern and middle Gulf states, and a greater portion of Texas, in the vicinity of Eureka, Cal., and in southern California and southwestern Arizona, the readings rose to, or above, 70°. From northern New England westward to the one hundred and seventh meridian, and in the Rocky Mountain regions west of that longitude southward into New Mexico and Arizona, the maximum temperatures fell below 50°, except in north-central Montana, where 51° and 52° were reported at Fort Assinaboine and Fort Maginnis, respectively. At Albany, N. Y., Saint Paul, and Saint Vincent Minn., and Fort Canby, Wash., the maximum temperatures were higher than for any previous January during the periods of observation, by 3°, 3°, 9°, and 2°, respectively. At Albany the highest temperature previously noted occurred in 1876, at Saint Paul and Saint Vincent in 1885, and at Fort Canby in 1888. The most notable deficiencies were reported along the eastern slope of the Rocky Mountains, where at stations the maximum temperatures were from 20° to 30° below the maximum values for the corresponding month of previous years.

The lowest temperatures occurred in the valley of the Red River of the North, where a reading of -36 was noted at Saint Vincent, Minn. Over northern New England and northern New York, Wisconsin, except near the west coast of Lake Michigan, the upper Mississippi and Missouri valleys north of the forty-first parallel, the plateau regions of the Rocky Mountains southward into central Arizona, except near Salt Lake City, Utah, and in the valleys of the Snake and Columbia rivers, the temperature fell below zero. Unusually low temperatures have not been reported, and the minimum readings were above the lowest values previously reported for January in the several districts as follows: New England 14° to 25°, middle and south Atlantic states 17° to 37°, Gulf states 11° to 25°, Lake region 20° to 31°, Ohio, upper Mississippi, and lower Missouri valleys, and Tennessee 24° to 37°, above the minimum temperatures of 1884; in the middle and northern Rocky Mountain regions, 22° to 44°; on the north Pacific slope, 14° to 32°; on the middle and southern Pacific slopes, and in southern Rocky Mountain regions, generally less than 15°.

The table of comparative maximum and minimum temperatures heretofore published in the REVIEW has been discontinued, as similar data for the regular stations of the Signal Service will be published in the table of miscellaneous meteorological data, commencing with the current month.

RANGES OF TEMPERATURE.

The monthly and the greatest and least daily ranges of temperature at Signal Service stations are given in the table of miscellaneous meteorological data. The greatest monthly ranges occurred in the valley of the Red River of the North, where they exceeded 80°. In north-central Montana they were more than 70°, while in northern Vermont, southeastern Iowa, central Colorado, the upper Missouri valley, and at stations in the middle and southern plateau regions they ranged above 60°. The monthly ranges were least over the southern extremity of Florida, west-central California, and the western part of Washington Territory, where they were less than 30°. Along the middle and west Gulf coasts, in southwestern Ohio, in the vicinity of Salt Lake City, Utah, over a greater portion of California and Washington Territory, and in northwestern Oregon, the ranges were less than 40°.

The following are some of the extreme monthly ranges:

| Greatest. | Least. |
|-----------------------------------|---------------------------------|
| Saint Vincent, Minn. 84.0 | Pysht, Wash. 22.0 |
| Moorhead, Minn. 75.0 | San Francisco, Cal. 24.0 |
| Fort Assinaboine, Mont. 72.0 | Port Angeles, Wash. 24.0 |
| Huron, Dak. 67.0 | Key West, Fla. 25.0 |
| Northfield, Vt. 67.0 | Cincinnati, Ohio. 39.0 |
| Winnemucca, Nev. 63.0 | Salt Lake City, Utah. 39.0 |

FROST.

Frost occurred in the south Atlantic and Gulf states as follows: 1st, Tex; 2d, Ala., Tex.; 3d, Ala., Ga., La., Miss., S. C., Tex.; 4th, S. C., Tex.; 5th, Ala., La., Miss., Tex.; 6th, Ala., La., Miss., S. C., Tex.; 7th, Ala., Ga., La., Miss., S. C.; 8th, Ala., Ga., S. C.; 9th, Ala., Ga., S. C., Tex.; 10th, Ala., Ga., La., Miss., S. C., Tex.; 11th, Ala., Ga., La., S. C., Tex.; 12th, Ala., Ga., La., Miss., S. C., Tex.; 13th, Ala., Ga., La., Miss., S. C., Tex.; 14th, Ala., Ga., Miss., S. C.; 15th, Ga., S. C., Tex.; 17th, La., Tex.; 18th, 19th, Tex.; 20th, Ala., La., Tex.; 21st, Ala., Ga., La., Miss., Tex.; 22d, Ala., Ga., La., Miss., S. C., Tex.; 23d, Ala., S. C., Tex.; 24th, 25th, 26th, Tex.; 27th, Ala., Tex.; 28th, Ala., Ga., La., Miss., Tex.; 29th, Ala., Fla., Ga., La., Miss., S. C., Tex.; 30th, Ala., Fla., Ga., La., Miss., S. C., Tex.; 31st, Ala., Ga., La., Miss., S. C., Tex.

In South Carolina and Georgia no frost was reported along the immediate coast. In Florida frost was not noted until the 29th, except at Pensacola; it was reported generally throughout the northern half of the state on that and the following date. In Alabama frost was reported frequently during the month in the interior of the state. In Mississippi and Louisiana it was observed on fourteen and seventeen dates, respectively, and was of frequent occurrence along the Mississippi River in the southern parts of the states. In Texas frost was reported on twenty-six dates, but was not noted along the immediate coast, save at Corpus Christi, where it was reported on the 21st. Frost was also reported on the 21st at Rio Grande City. When compared with the preceding month the southern limit of frost in Florida for January, 1889, was about 1° farther north, while in Texas it was extended considerably to southward.

LIMITS OF FREEZING WEATHER.

On chart v are shown the southern and western limits of freezing weather during January, 1889. East of the Rocky Mountains the temperature fell below 32°, except in Florida south of the thirtieth parallel, and at stations on the immediate Gulf coast. On the Pacific coast the temperature fell to 32° at Fort Canby, Wash., while to the southward a line representing the western limit of freezing weather is traced over western California, south of the fortieth parallel, to Los Angeles, and thence southeastward to the southwest portion of Arizona.

TEMPERATURE OF WATER.

The following table shows the maximum, minimum, and mean water temperature as observed at the harbors of the several stations; the monthly range of water temperature; and the mean temperature of the air for January, 1889:

| Stations. | Temperature at bottom. | | | | Mean temperature of air at the station. |
|-------------------------|------------------------|------|--------|---------------|---|
| | Max. | Min. | Range. | Monthly mean. | |
| Canby, Fort, Wash. | 47.5 | 42.5 | 5.0 | 45.2 | 43.7 |
| Cedar Keys, Fla. | 62.0 | 50.3 | 11.7 | 59.0 | 57.0 |
| Charleston, S. C. | 54.9 | 51.2 | 3.7 | 52.9 | 50.0 |
| Eastport, Me. | 40.6 | 37.1 | 3.5 | 39.1 | 27.0 |
| Galveston, Tex. | 58.3 | 47.5 | 10.8 | 53.8 | 52.4 |
| Key West, Fla. | 76.1 | 67.1 | 9.0 | 71.9 | 70.3 |
| New York City | 38.6 | 35.2 | 3.4 | 36.7 | 36.2 |
| Pensacola, Fla. | 58.7 | 51.0 | 7.7 | 56.2 | 51.4 |
| Portland, Oregon | 42.3 | 37.7 | 4.6 | 39.8 | 38.6 |

PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for January, 1889, as determined from the reports of nearly 1,500 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 departure from the normal. 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.

On the north Pacific coast, over the northern portions of the plateau districts and eastern Rocky Mountain slope, over an area extending from Louisiana, Mississippi, and northern Alabama to the upper Ohio valley and Lake region, and in portions of New England and the Maritime Provinces, the precipitation for January, 1889, was below the normal. In all other portions of the country, with the exception of a small area in the lower Missouri valley, it was in excess of the normal. The marked deficiency on the Pacific coast and the equally noteworthy excess in Florida and over the greater part of the country from the lower Mississippi valley westward to Arizona, form the most important features of this month's precipitation. Upon the whole there was not more than 40 per cent. of the normal rainfall on the Pacific coast, the deficiency being greatest in northern California, where less than 15 per cent. of the normal amount of rain fell. In southern California and on the north Pacific coast the percentages of normal rainfall were about 42 and 63, respectively. A marked deficiency also occurred in the middle and northern plateau districts, northern slope, and Ohio Valley, where the precipitation ranged from one-half to three-fourths of the monthly normal. There was more than three times the normal precipitation over the middle and southern portions of the eastern slope of the Rocky Mountains; about double the average in the southern plateau, and from 70 to 80 per cent. more than the normal in Florida, the west Gulf states, and Missouri Valley. In the upper lake region, Rio Grande Valley, middle and south Atlantic states there was an excess ranging from 20 to 40 per cent. of the normal. In the extreme northwest, upper Mississippi valley, lower lake region, New England, and the east Gulf states the monthly precipitation closely approached the normal, there being a slight deficiency in New England and the extreme northwest, and a slight excess in the other districts mentioned.

DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows for certain stations, as reported by voluntary observers, (1) the average precipitation for a series of years; (2) the length of record during which the observations have been taken, and from which the average has been computed; (3) the total precipitation for January, 1889; (4) the departure of the current month from the average; (5) and the extreme monthly precipitation for January during the period of observation and the years of occurrence:

| State and station. | County. | (1) Average for the month of Jan. | (2) Length of record. | (3) Total for Jan., 1889. | (4) Departure from average. | (5) Extreme monthly precipitation for January. | | | |
|--------------------|-------------|-----------------------------------|-----------------------|---------------------------|-----------------------------|--|--------|--------|-------|
| | | | | | | Greatest. | | Least. | |
| | | | | | | Am't. | Year. | Am't. | Year. |
| Arkansas. | | Inches | Years | Inches | Inches | Inches | Inches | Inches | Years |
| Lead Hill | Boono | 2.41 | 7 | 3.78 | +1.37 | 3.78 | 1889 | 1.33 | 1887 |
| California. | | | | | | | | | |
| Sacramento | Sacramento | 3.87 | 35 | 0.19 | -3.68 | 15.04 | 1862 | 0.19 | 1889 |
| Colorado. | | | | | | | | | |
| Fort Lyon | Bent | 0.16 | 14 | 0.53 | +0.37 | 0.68 | 1886 | trace | 1876 |
| Connecticut. | | | | | | | | | |
| Middletown | Middlesex | 4.24 | 27 | 5.64 | +1.40 | 7.18 | 1859 | 1.45 | 1876 |
| Florida. | | | | | | | | | |
| Merritt's Island | Brevard | 3.46 | 11 | 10.21 | +6.75 | 10.45 | 1878 | 0.57 | 1880 |
| Georgia. | | | | | | | | | |
| Forsyth | Monroe | 5.01 | 15 | 8.86 | +3.85 | 10.08 | 1883 | 2.22 | 1880 |
| Illinois. | | | | | | | | | |
| Peoria | Peoria | 1.70 | 31 | 1.70 | 0.00 | 4.27 | 1862 | 0.20 | 1872 |
| Riley | McHenry | 1.95 | 38 | 1.86 | -0.09 | 5.96 | 1876 | 0.45 | 1867 |
| Indiana. | | | | | | | | | |
| Vevay | Switzerland | 4.04 | 22 | 2.62 | -1.22 | 9.03 | 1876 | 0.75 | 1872 |
| Iowa. | | | | | | | | | |
| Cresco | Howard | 1.31 | 17 | 1.55 | +0.24 | 3.72 | 1886 | 0.38 | 1872 |
| Monticello | Jones | 1.65 | 34 | 1.72 | +0.07 | 3.77 | 1886 | 0.29 | 1865 |
| Logan | Harrison | 1.27 | 20 | 1.49 | +0.22 | 3.10 | 1881 | 0.10 | 1872 |

Deviations from average precipitation—Continued.

| State and station. | County. | (1) Average for the month of Jan. | (2) Length of record. | (3) Total for Jan., 1889. | (4) Departure from average. | (5) Extreme monthly precipitation for January. | | | |
|--------------------|----------------|-----------------------------------|-----------------------|---------------------------|-----------------------------|--|--------|--------|-------|
| | | | | | | Greatest. | | Least. | |
| | | | | | | Am't. | Year. | Am't. | Year. |
| Kansas. | | Inches | Years | Inches | Inches | Inches | Inches | Inches | Years |
| Lawrence | Douglas | 1.25 | 24 | 0.79 | -0.46 | 3.05 | 1878 | 0.12 | 1875 |
| Wollington | Sumner | 0.71 | 10 | 0.96 | +0.25 | 1.53 | 1886 | 0.18 | 1881 |
| Louisiana. | | | | | | | | | |
| Grand Coteau | St. Landry | 7.12 | 6 | 5.70 | -1.42 | 13.30 | 1883 | 2.52 | 1887 |
| Maine. | | | | | | | | | |
| Gardiner | Kennebec | 3.72 | 47 | 5.20 | +1.48 | 7.32 | 1887 | 0.92 | 1849 |
| Maryland. | | | | | | | | | |
| Cumberland | Alleghany | 2.11 | 17 | 3.01 | +0.90 | 3.90 | 1878 | 0.30 | 1887 |
| Massachusetts. | | | | | | | | | |
| Amherst | Hampshire | 3.34 | 53 | 3.50 | +0.16 | 5.87 | 1870 | 0.99 | 1849 |
| Newburyport | Essex | 3.69 | 11 | 5.89 | +2.20 | 7.76 | 1886 | 1.60 | 1875 |
| Somerset | Bristol | 4.33 | 16 | 6.20 | +1.87 | 7.60 | 1878 | 1.57 | 1879 |
| Michigan. | | | | | | | | | |
| Kalamazoo | Kalamazoo | 2.56 | 13 | 1.46 | -1.10 | 4.90 | 1876 | 1.10 | 1879 |
| Thornville | Lapeer | 1.93 | 12 | 2.51 | +0.58 | 2.78 | 1881 | 0.58 | 1879 |
| Minnesota. | | | | | | | | | |
| Minneapolis | Hennepin | 1.23 | 23 | 0.69 | -0.54 | 3.01 | 1886 | 0.06 | 1869 |
| Montana. | | | | | | | | | |
| Fort Shaw | Lewis & Clarke | 0.63 | 18 | 0.38 | -0.25 | 2.50 | 1881 | 0.00 | 1869 |
| New Hampshire. | | | | | | | | | |
| Concord | Merrimack | 3.23 | 7 | 3.81 | +0.58 | 4.92 | 1886 | 1.50 | 1867 |
| New Jersey. | | | | | | | | | |
| Moorestown | Burlington | 3.81 | 15 | 4.07 | +0.26 | 5.82 | 1882 | 1.13 | 1867 |
| South Orange | Essex | 3.95 | 17 | 7.15 | +3.20 | 7.15 | 1889 | 1.17 | 1876 |
| New York. | | | | | | | | | |
| Cooperstown | Otsego | 2.44 | 35 | 2.22 | -0.22 | 4.31 | 1869 | 0.32 | 1860 |
| Palermo | Oswego | 3.14 | 35 | 3.48 | +0.34 | 6.50 | 1874 | 0.16 | 1884 |
| North Carolina. | | | | | | | | | |
| Lenoir | Caldwell | 4.51 | 17 | 3.50 | -1.01 | 9.60 | 1878 | 1.60 | 1872 |
| Ohio. | | | | | | | | | |
| N. Lewisburgh | Champaign | 3.63 | 17 | 4.80 | +1.17 | 8.67 | 1876 | 0.44 | 1877 |
| Wauseon | Fulton | 2.22 | 15 | 2.17 | -0.05 | 3.53 | 1880 | 1.29 | 1879 |
| Oregon. | | | | | | | | | |
| Albany | Linn | 9.05 | 12 | 3.96 | -5.09 | 14.45 | 1867 | 2.22 | 1882 |
| Eola | Polk | 6.20 | 19 | 3.08 | -3.12 | 16.68 | 1888 | 2.53 | 1875 |
| Pennsylvania. | | | | | | | | | |
| Dyberry | Wayne | 3.20 | 19 | (†) | (†) | 4.75 | 1878 | 0.70 | 1872 |
| Grampian Hills | Clearfield | 3.76 | 18 | 3.22 | -0.54 | 5.47 | 1888 | 1.21 | 1872 |
| Wellsborough | Tioga | 6.73 | 9 | 8.20 | +1.47 | 12.17 | 1886 | 3.70 | 1888 |
| South Carolina. | | | | | | | | | |
| Statesburgh | Sumter | 3.72 | 7 | 4.91 | +1.19 | 6.04 | 1885 | 2.14 | 1888 |
| Tennessee. | | | | | | | | | |
| Austin | Wilson | 5.44 | 20 | 4.62 | -0.82 | 18.11 | 1882 | 2.66 | 1886 |
| Milan | Gibson | 5.79 | 5 | 4.82 | -0.97 | 7.50 | 1885 | 4.45 | 1884 |
| Texas. | | | | | | | | | |
| Fort Concho | Tom Green | 0.84 | 14 | 1.94 | +1.10 | 4.36 | 1880 | 0.00 | 1887 |
| New Ulm | Austin | 4.04 | 15 | 8.38 | +4.34 | 10.56 | 1882 | 1.09 | 1887 |
| Vermont. | | | | | | | | | |
| Strafford | Orange | 3.40 | 15 | 4.80 | +1.40 | 5.50 | 1887 | 1.70 | 1878 |
| Virginia. | | | | | | | | | |
| Bird's Nest | Northampton | 3.68 | 20 | 5.85 | +2.17 | 6.75 | 1882 | 1.00 | 1876 |
| Wytheville | Wythe | 3.53 | 24 | 3.05 | -0.48 | 7.10 | 1882 | 1.50 | 1872 |
| West Virginia. | | | | | | | | | |
| Helvetia | Randolph | 5.05 | 12 | 2.95 | -2.10 | 9.50 | 1882 | 2.95 | 1889 |
| Wisconsin. | | | | | | | | | |
| Madison | Dane | 1.96 | 23 | 1.59 | -0.37 | 3.65 | 1874 | 0.40 | 1878 |
| Washington. | | | | | | | | | |
| Fort Townsend | Jefferson | 2.12 | 18 | 1.02 | -1.10 | 3.62 | 1878 | 0.66 | 1859 |

† Report not received.

HAIL.

Hail fell during January on the several dates as follows: 2d, Conn., La. 3d, Me., Oregon. 5th, Mass. 6th, Me., Mass., N. H., N. Y. 7th, Me. 8th, La. 9th, N. H., N. J., N. Y., Pa., Wis. 12th, Cal. 13th, Kans., Tex. 14th, Ariz., Kans., Ohio. 15th, Ariz., Idaho., Ind. T., Kans., Tex., Wis. 16th, Ill., Iowa, Wis. 17th, Mich., Oregon, Wash. 18th, Oregon. 20th, Mich., Oregon. 24th, N. Y., Pa. 27th, Conn., Me., Mass., N. H., Tenn. 31st, D. C., Ind.

SLEET.

Sleet fell during January on the several dates as follows: 1st, Oregon, Tex. 2d, Oregon, Vt. 3d, Dak. 4th, Dak., Minn., W. Va. 5th, Dak., Ind., Mich., Minn., Nebr. 6th, Kans., Mass., N. H., N. Y., W. Va. 7th, N. H., N. Y., Ohio. 8th, Dak., Iowa, Mo., Wis. 9th, Conn., Mass., Mich., Tenn., Vt., Wis. 12th, Kans. 13th, Ariz., Kans., Mo. 14th, Ariz., Ind., Kans., Mo., Nebr. 15th, Ariz., Iowa, Kans., Mich., Minn., Nebr., Wis. 16th, Ariz., Iowa, Mich., Minn., Wis. 17th, W. Va. 18th, Miss. 19th, Mo. 20th, Ind., Ky., Md., N. J., N. C., Ohio, Pa. 21st, Cal., Me. 23d, Cal. 24th, Vt., Wash. 25th, Nebr. 26th, Ind. T., La., Md., Tex. 27th, Conn., Me., Mass., N. Y., Tenn. 28th, Me., Mass., Pa. 30th, Minn. 31st, Pa.

SNOW.

On the 28th snow reached its southernmost latitude for the

month and, so far, for the winter also. On the date mentioned it fell generally throughout the east Gulf and south Atlantic states, and was reported from stations on both the east Gulf and south Atlantic coasts. As usual in the winter season, snow was of daily occurrence in some part of the country. In Michigan there were but three days during the month, viz., the 2d, 3d, and 23d, on which it did not occur in some part of the state, and in Dakota, Minnesota, Wisconsin, Iowa, Pennsylvania, New York, and Vermont it fell on from twenty to twenty-six days. On the 9th, 10th, 13th to 15th, 18th to 21st, 27th and 28th, snow fell in more than twenty states or territories, being reported from as many as thirty-one on the 20th. The date on which it was least extensively reported was the 2d, when it occurred only in Montana, New York, Oregon, and Vermont.

MONTHLY SNOWFALLS (inches and tenths) IN JANUARY.

While in some portions of the country, viz., northern New York and the northern portion of the upper lake region, the monthly snowfalls have been heavy, and have probably equalled, or exceeded, the January average, as a whole the snowfalls of January, like those of the two preceding months, have been unusually small. There can be no doubt that the winter snowfall, to the close of January, over much of the country, particularly the central and southern portions, is the smallest that has occurred for a number of years. In the northern portions of the country from Dakota eastward to New England, and over limited areas in the Rocky Mountain and plateau regions, the aggregate snowfall for January generally exceeded ten inches, and in portions of the Lake region and New England depths ranging from twenty to fifty inches were reported, the greatest occurring in northern New York, Lowell, and Number Four, in that state, reporting 56.1 and 59.9, respectively.

Below are given all monthly snowfalls of ten inches, or more, and in states or territories where the maximum depth was below that amount, the station reporting the greatest is given:

Alabama.—Bermuda, 2. *Arizona.*—Fort Grant, 11; Prescott, 10. *Arkansas.*—Lead Hill, 7.1. *California.*—Fort Bidwell, 11.4; Emigrant Gap, 11; Coles and Dunsmuir, 10. *Colorado.*—Coulter and Leadville, 11. *Connecticut.*—New Hartford, 8.5. *Dakota.*—Huron, 15.1; Grand Forks, 12.2; Kimball, 11; Fort Sully, 10.6; Webster, 10.4. *Delaware.*—Newark, 2.5. *District of Columbia.*—Washington City, 3. *Georgia.*—Duck, 1. *Idaho.*—Boisé City, 7. *Illinois.*—Rockford, 17; Cedarville and Warren, 12; Winnebago, 11.5; Mount Morris and Oneida, 11; Petersburg, 10.8; Rock Island, 10. *Indiana.*—Columbia City, 9.5. *Indian Territory.*—Fort Gibson, 4.5. *Iowa.*—Iowa City, 13.5; Keokuk, 12.5; Dubuque, 11.5; Maquoketa, 11. *Kansas.*—Seneca, 7.5. *Kentucky.*—Madisonville, 3. *Louisiana.*—Arcadia, Farmerville, Lake Providence, Liberty Hill, Point Pleasant, Saint Joseph, and Trinity, trace. *Maine.*—Calais and Lewiston, 17; Belfast, 16; Orono, 15.5; Cornish and Kent's Hill, 15; Gardiner, 14.5; Fairfield, 10. *Maryland.*—Cumberland, 11. *Massachusetts.*—Rowe, 16; Deerfield, 13.5; Groton, 13; Fitchburgh b, Gilbertville, Lawrence and Leominster, 12; Amherst, Fitchburgh a, Newburyport, and Waltham, 10. *Michigan.*—Marquette, 39.2; Calumet, 38.3; Atlantic, 38; West Branch, 25; Harrisville, 22.8; Hillman, 22; Alpena, 21.2; Traverse City b, 19.9; Roscommon, 19.8; Fletcher, 19.5; Lathrop, 19; Buchanan and Gulliver Lake, 18.8; Benzonia, 18; Traverse City a, 17.5; Mio, 17.4; Deer Lake and Port Huron, 17; Manistee, 16.4; Alma, 15.5; Omer and Thornville, 14; Ionia, 13.5; Cassopolis and Washington, 13; May, 12.5; Paw Paw, 12.2; Bear Lake, Benton Harbor, East Tawas, and Vandalia, 12; Fremont, 11.7; East Saginaw, 10.9; Fort Brady, 10.6; Hudson, Lansing, and Mottville, 10.5; Ypsilanti, 10.4. *Minnesota.*—Lake Winnibigoshish, 14.8; Pokegama Falls, 12.4; Moorhead, 12.3; Leech Lake, 11.1. *Mississippi.*—Palo Alto and Pontotoc, 0.2. *Missouri.*—Miami, 12; Mound City, 10.8; Wither's Mill, 10.7. *Montana.*—Sheldon, 13.7; Fort Maginnis, 10.6. *Nebraska.*—

Burner's Ranch, 45; Tuscarora, 19; Pioche, 12.2; Eureka, 12.1; Austin, 12; Wellington, 10.8. *New Hampshire.*—Berlin Falls and Berlin Mills, 25; North Conway, 24; West Milan, 18; North Chesterfield, 17; Antrim, 16; Hanover, 14; Concord and Plymouth, 13; Manchester, 10.5; Nashua, Shaker Village, and Walpole, 10. *New Jersey.*—South Orange, 6. *New Mexico.*—Fort Wingate, 13; Fort Union, 12; Las Vegas, 11.9. *New York.*—Number Four, 59.9; Lowville, 56.1; Saranac Lake, 43.8; Potsdam, 38; Barnes' Corners, 36; Canton and North Hammond, 34.4; Constableville and Utica, 32; Oswego, 25.2; Buffalo, 24.9; Nineveh, 24; Fort Porter, 23; Penn Yan, 22.5; Auburn, 21.9; Queensborough, 20.6; Ilion, 20; Angelica, Palermo, and Plattsburgh Barracks, 19.5; Perry City, 19; Hess' Road Station, 17.9; Rochester, 17.8; Wedgewood, 15.7; Ithaca, 14.1; Eden, 14; Geneva, 13.8; Le Roy, 13; Albany, 12.2; Cooperstown, Friendship, and Humphrey, 12; Factoryville, 10.4; Elmira, 10. *North Carolina.*—Lenoir and Hot Springs, 2. *Ohio.*—North Lewisburgh, 12.8; Caledonia, 12; Cleveland, 11.7; Kenton, 11.5; Bellevue, and Wauseon, 10.8; Tiffin, 10.7. *Oregon.*—Fort Klamath, 16.1; Siskiyou, 14. *Pennsylvania.*—Meadville b, 21; Eagle's Mere, 19.2; Coudersport, 17.5; Grampian Hills, 17; Meadville a, 14.8; Somerset, 12.8; Wellsborough, 12.4; Rimersburgh, 12.2; Le Roy, 10.9; New Castle, 10.5; Tionesta, 10. *Rhode Island.*—Woonsocket, 7. *South Carolina.*—Brewer's Mines, Cedar Springs, and Trial, trace. *Tennessee.*—Clarksville, 3. *Texas.*—Decatur, 8. *Utah.*—Salt Lake City, 6.8. *Vermont.*—Burlington, 33; Coventry, 32.6; Northfield, 30.2; Chelsea, 25; East Berkshire, 23; Stratford, 22; Conway, 21; Middlebury, 19.4; Jacksonville and Saint Johnsbury, 19; Lunenburg, 16; Saxton's River, 15; Vernon, 14; Manchester, 13. *Washington.*—Fort Spokane, 20.5; Spokane Falls, 15. *West Virginia.*—Middlebrook, 23; Helvetia, 13.5. *Wisconsin.*—Green Bay, 32.6; Oshkosh, 20.5; Fond du Lac, 17; Cadiz, 12; Waucousta, 11.5; Phillips, 10. *Wyoming.*—Carter, 22; Fort Bridger and Fort Washakie a, 11.5; Fort Washakie b, 10.

DEPTH OF SNOW REMAINING ON GROUND AT 15th AND CLOSE OF MONTH.

On chart v are shown the portions of the country covered by snow at the close of January (also the southern and western limits of freezing weather) and in the table of data for voluntary stations are given the depths as reported by the various observers. In the Red River Valley of the North, northern portion of the upper lake region, and over the greater portion of New York and the New England states there remained at the end of January upwards of six inches of snow, and over limited areas in the districts named the depth was much greater. In the upper Michigan peninsula and in the northern portions of New York and Vermont depths ranging from twenty to thirty inches were reported from numerous stations. South of the 40th parallel eastward of the Rocky Mountains there was very little snow on the ground at the close of the month, and over much of the country northward of that parallel the depth did not exceed two inches. In the central and northern portions of the Rocky Mountain and plateau regions the depths generally range from two to eight inches. The following are some of the greatest depths reported: Barnes' Corners, N. Y., 36; Number Four, N. Y., 29.8; Canton and Constableville, N. Y., 26; Calumet, Mich., and North Volney, N. Y., 24.

As was the case at the middle of the two preceding months, there was not sufficient snow on the ground on the 15th of January to justify the issue of a chart. While a number of reports show depths of four inches and upwards at that date, it appears that these depths covered areas of very limited extent in northern New York, portions of Michigan, Wisconsin, Minnesota, Nebraska, Colorado, and western Kansas. The following are the greatest depths reported on the 15th of the month: Number Four, N. Y., 15; Barnes' Corners, N. Y., 13; Ouray, Colo., 12; Independence, Iowa, 10.

EXCESSIVE PRECIPITATION, JANUARY, 1889.

It will be seen from the accompanying table of excessive

Valentine, 12.5; North Platte, 10.8; Fairbury, 10. Nevada.— precipitation that monthly rainfalls exceeding ten inches occurred only in Florida, Georgia, Oregon, and Texas; the largest amount being 13.85, at Tyler, Tex.

Daily falls of 2.50, or more, were reported from Alabama, Arkansas, Florida, Georgia, Massachusetts, Mississippi, New Jersey, Pennsylvania, Tennessee, Virginia, and Washington, and occurred mostly on the 15th and 16th. The most remarkable daily fall was 4.00 on the 26th at Saint Martinsville, La.

The rate of one inch per hour was attained in but one instance, viz., Titusville, Fla., where 1.03 fell in 23 minutes on the 4th, giving a rate of 2.21 per hour.

| State and station. | Monthly rainfall 10 inches or more. | | Rainfall 2.50 inches, or more, in 24 hours. | | Rainfall of 1 inch, or more, in one hour. | | |
|------------------------------|-------------------------------------|----------------|---|------|---|--------------|------|
| | Amt. | Day. | Amt. | Day. | Amt. | Time. | Day. |
| <i>Alabama.</i> | <i>Inches.</i> | <i>Inches.</i> | | | <i>Inches.</i> | <i>h. m.</i> | |
| Bermuda | 3.02 | 16 | | | | | |
| Mount Vernon Barracks | 3.71 | 16 | | | | | |
| <i>Arkansas.</i> | | | | | | | |
| Camden | 2.84 | 16 | | | | | |
| Helena | 2.77 | 16 | | | | | |
| Hot Springs | 2.60 | 8 | | | | | |
| Little Rock | 3.54 | 15-16 | | | | | |
| Little Rock Barracks | 3.88 | 15-16 | | | | | |
| <i>Florida.</i> | | | | | | | |
| Altamonte Springs | 11.15 | | | | | | |
| Jupiter | 6.38 | 11-12 | | | | | |
| Merritt's Island | 2.81 | 23 | | | | | |
| Mico | 10.22 | 23 | | | | | |
| Titusville | 10.52 | | | | 1.03 | 0 28 | 4 |
| <i>Georgia.</i> | | | | | | | |
| Hephzibah | 10.24 | 6.03 | 19-20 | | | | |
| Quitman | 10.40 | 3.25 | 16 | | | | |
| <i>Indiana.</i> | | | | | | | |
| Huntingburgh | 3.50 | 16 | | | | | |
| <i>Louisiana.</i> | | | | | | | |
| Saint Martinsville | 4.00 | 26 | | | | | |
| <i>Massachusetts.</i> | | | | | | | |
| Blue Hill | 3.10 | 6 | | | | | |
| <i>Mississippi.</i> | | | | | | | |
| Kosciusko | 2.75 | 16 | | | | | |
| <i>New Jersey.</i> | | | | | | | |
| Freehold | 3.56 | 5-6 | | | | | |
| Hanover | 2.50 | 6 | | | | | |
| Plainfield | 3.48 | 5-6 | | | | | |
| Tom's River | 2.96 | 6 | | | | | |
| <i>Oregon.</i> | | | | | | | |
| Astoria | 10.67 | | | | | | |
| <i>Pennsylvania.</i> | | | | | | | |
| Wellborough | 3.00 | 5-6 | | | | | |
| <i>Tennessee.</i> | | | | | | | |
| Trenton | 2.58 | 16 | | | | | |
| <i>Texas.</i> | | | | | | | |
| Austin | 2.85 | 14 | | | | | |
| Brazoria | 10.04 | | | | | | |
| Coricauna | 2.60 | 15 | | | | | |
| Longview | 2.90 | 15 | | | | | |
| Mexia | 3.90 | 23-24 | | | | | |
| Tyler | 13.85 | | | | | | |
| Waco | 2.50 | 23 | | | | | |
| <i>Virginia.</i> | | | | | | | |
| Cape Henry | 2.65 | 27 | | | | | |
| <i>Washington Territory.</i> | | | | | | | |
| Fort Canby | 2.89 | 23-24 | | | | | |

SUMMARY OF EXCESSIVE PRECIPITATION.

The following table gives the aggregate number of excessive monthly, daily, and hourly rainfalls for the several states and territories, shown by the monthly and supplementary tables of excessive precipitation, published in the MONTHLY WEATHER REVIEW during 1888:

| States. | Rainfalls of 10 inches, or more, per month. | Rainfalls of 2.50 inches, or more, in 24 hours. | Rainfalls equalling, or exceeding, one inch per hour. | Number of stations. | Average length of record. | Average interval of excessive monthly rainfall for each station. | |
|----------------------|---|---|---|---------------------|---------------------------|--|--------|
| | | | | | | Years. | Years. |
| Alabama | 218 | 242 | 28 | 31 | 8 | 1 | |
| Arizona | 6 | 14 | 12 | 12 | 5 | 1 | |
| Arkansas | 69 | 134 | 35 | 86 | 6 | 1 | |
| California | 462 | 77 | 30 | 86 | 12 | 1 | |
| Colorado | 7 | 16 | 6 | 5 | 8 | 1 | |
| Connecticut | 52 | 102 | 6 | 12 | 14 | 1 | |
| Dakota | 16 | 86 | 34 | 12 | 14 | 1 | |
| Delaware | 11 | 27 | 1 | 4 | 10 | 1 | |
| District of Columbia | 12 | 16 | 7 | 1 | 50 | 1 | |

Summary of excessive precipitation—Continued.

| States. | Rainfalls of 10 inches, or more, per month. | Rainfalls of 2.50 inches, or more, in 24 hours. | Rainfalls equalling, or exceeding, one inch per hour. | Number of stations. | Average length of record. | Average interval of excessive monthly rainfall for each station. | |
|----------------|---|---|---|---------------------|---------------------------|--|--------|
| | | | | | | Years. | Years. |
| Florida | 344 | 338 | 106 | 45 | 8 | 1 | |
| Georgia | 299 | 388 | 72 | 64 | 6 | 1 | |
| Idaho | 0 | 0 | 0 | 0 | 0 | 0 | |
| Illinois | 82 | 265 | 64 | 42 | 9 | 4 | |
| Indiana | 94 | 139 | 40 | 46 | 7 | 3 | |
| Indian T. | 17 | 48 | 10 | 6 | 16 | 6 | |
| Iowa | 183 | 290 | 126 | 89 | 8 | 4 | |
| Kansas | 92 | 279 | 129 | 38 | 10 | 4 | |
| Kentucky | 21 | 60 | 8 | 7 | 14 | 5 | |
| Louisiana | 179 | 272 | 25 | 41 | 5 | 1 | |
| Maine | 36 | 43 | 5 | 16 | 15 | 7 | |
| Maryland | 46 | 226 | 24 | 17 | 12 | 4 | |
| Massachusetts | 130 | 264 | 19 | 47 | 14 | 5 | |
| Michigan | 33 | 93 | 51 | 19 | 14 | 8 | |
| Minnesota | 28 | 64 | 18 | 15 | 14 | 6 | |
| Mississippi | 153 | 210 | 27 | 38 | 6 | 1 | |
| Missouri | 98 | 169 | 50 | 43 | 9 | 4 | |
| Montana | 2 | 13 | 8 | 2 | 15 | 15 | |
| Nebraska | 56 | 133 | 103 | 28 | 6 | 3 | |
| New Hampshire | 62 | 48 | 10 | 12 | 9 | 2 | |
| New Jersey | 85 | 179 | 8 | 34 | 9 | 4 | |
| New Mexico | 5 | 4 | 7 | 5 | 12 | 12 | |
| New York | 179 | 160 | 31 | 59 | 18 | 6 | |
| Nevada | 0 | 0 | 0 | 0 | 0 | 0 | |
| North Carolina | 224 | 394 | 75 | 45 | 6 | 1 | |
| Ohio | 92 | 153 | 3 | 41 | 14 | 8 | |
| Oregon | 226 | 46 | 0 | 21 | 8 | 5 | |
| Pennsylvania | 80 | 132 | 79 | 34 | 11 | 10 | |
| Rhode Island | 13 | 38 | 3 | 8 | 15 | 2 | |
| South Carolina | 132 | 212 | 39 | 35 | 7 | 2 | |
| Tennessee | 112 | 258 | 60 | 49 | 6 | 3 | |
| Texas | 201 | 556 | 168 | 64 | 8 | 3 | |
| Utah* | 0 | 6 | 0 | 0 | 0 | 0 | |
| Vermont | 8 | 16 | 3 | 9 | 13 | 15 | |
| Virginia | 79 | 117 | 36 | 26 | 9 | 3 | |
| Washington | 166 | 46 | 0 | 14 | 10 | 1 | |
| West Virginia | 5 | 12 | 4 | 3 | 6 | 4 | |
| Wisconsin | 27 | 58 | 11 | 13 | 11 | 6 | |
| Wyoming | 0 | 2 | 6 | 0 | 0 | 0 | |

*The monthly rainfall of 10 inches in March, 1877, for Mount Carmel, Utah, published in tables, is considered doubtful and is not noted herein.

In referring to the above table for information relative to the comparative frequency of excessive rainfall in the different sections, the number of stations which represent the several states and territories, and their distribution and length of record, should be considered. As indicated by the heading, the table presents a summary of excessive rainfalls published in the MONTHLY WEATHER REVIEW during 1888. While these publications contained all available data, the summarized results cannot be unreservedly used in determining the comparative frequency of excessive rainfall, more particularly for short intervals, as the system and extent of rainfall observation vary in the different states and territories: resulting in complete and exhaustive reports from some sections and comparatively meagre data from others. It is considered, however, that the summary of excessive monthly rainfall, when considered with the number of stations and average length of record for each state and territory, presents a fairly accurate record for a greater portion of the country. In the column "Average interval of excessive monthly rainfall for each station," it is intended to show the probable frequency, in years, of excessive monthly precipitation at each station in the several states, i. e., at Alabama stations monthly rainfalls of ten inches occur once in one year; at Arizona stations once in five years. In this connection it will also be necessary to consider the distribution of stations, more particularly as regards their proximity to one another, as, in cases where a number of stations are located in the same portion of the state, the probable interval of excessive monthly rainfall would be smaller. This fact is the more apparent in cases where stations are numerous, and bunched in river valleys, as in California; in such instances figures showing general results must be considered with a due allowance for the distribution and number of stations. This column also indicates, with a fair degree of accuracy, the comparative frequency of excessive monthly rainfall by states and territories, and any lack of uniformity, or apparent incon-

sistency in the results therein shown, may be attributed to a more perfect system of observation in vogue in some of the states. Thus, in New Hampshire the average interval of excessive monthly precipitation is given as two years, while in the adjoining state of Vermont the interval is fifteen years. This discrepancy is doubtless due to the more complete reports from New Hampshire, the observations taken at several points by the Lake Winipiseogee Cotton and Woolen Manufacturing Co. constituting an exceptionally accurate and valuable record extending over many years. Aside from this most marked exception it will be seen that, as a rule, there is a remarkable uniformity shown in the average interval of monthly excessive rainfalls in contiguous states and territories, the interval being smallest in Oregon, where it is only eight months, and only slightly greater in the Gulf States, North Carolina, and Washington, where it averages about one year. Exclusive of Vermont, the greatest average interval of excessive monthly rainfall, fifteen years, is shown for Montana, while in Dakota, Michigan, and Minnesota it is seven and eight years, respectively.

In the column of rainfalls of ten inches, or more, per month, it will be seen that by far the greatest number of excessive monthly rainfalls (482) have been reported in California, where stations are numerous, and that none have been noted in Idaho, Nevada, Utah, and Wyoming, where, while stations are comparatively few and scattered, it is not probable that rain has fallen in amounts to equal or exceed ten inches in a month. Following in order of greater frequency are, Florida with 344, and Georgia, North Carolina, Oregon, and Texas, with more

than 200, while in Arizona, Colorado, Montana, New Mexico, Vermont, and West Virginia, the instances of their reported occurrence are very limited in number.

The greatest number of daily excessive rainfalls, 556, have been reported in Texas, while in Idaho and Nevada none have been noted. In North Carolina, Georgia, and Florida over 300 instances have been reported in which 2.50 inches, or more, of rain have fallen in twenty-four hours, while in Alabama, Illinois, Iowa, Kansas, Louisiana, Maryland, Massachusetts, Mississippi, and Tennessee excessive daily rainfalls have been noted in more than 200 instances. In Arizona, Colorado, Montana, New Mexico, Utah, Vermont, West Virginia, and Wyoming the number of excessive daily rainfalls recorded is less than 20.

Excessive hourly rainfalls have been reported in the greatest number of instances, 168, in Texas, and none have been noted in Idaho, Nevada, Oregon, Utah, and Washington. They have been reported in more than 100 instances in Florida, Iowa, Kansas, and Nebraska, while in Arizona, California, Colorado, Connecticut, District of Columbia, Indian Territory, Kentucky, Maine, Massachusetts, Minnesota, Montana, New Jersey, New Hampshire, New Mexico, Ohio, Rhode Island, Vermont, West Virginia, Wisconsin, and Wyoming, excessive hourly rainfalls have been noted in less than 20 instances.

Over portions of the Rocky Mountain region where monthly rainfalls equalling or exceeding ten inches have not been reported, the largest monthly rainfalls noted in the several states and territories have been published in the tables of excessive precipitation in the REVIEW during 1888.

WINDS.

The prevailing winds during January, 1889, are shown on chart ii by arrows flying with the wind. In the Atlantic coast states north of the thirty-seventh parallel; over a greater portion of the Lake region; in the upper Mississippi, Missouri, and Ohio valleys, and along the south Pacific slope, the winds were mostly westerly. In the south Atlantic and Gulf states, and over the eastern slope and plateau regions of the Rocky Mountains, they were variable. On the north Pacific slope they were from south to east, while along the middle Pacific slope northerly winds were most frequently noted.

HIGH WINDS (in miles per hour).

Maximum velocities of fifty miles, or more, per hour, other than those given in the table of miscellaneous meteorological data, have been reported as follows: Wood's Holl, Mass., 57, s, 9th; 50, nw., 19th; 54, se., 21st. Buffalo, N. Y., 52, sw., 16th and 17th; 52, w., 21st. Block Island, R. I., 54, e., 5th; 54, nw., 10th; 60, se., 21st; 52, e., 27th. Fort Elliott, Tex., 52, nw., 8th. Fort Canby, Wash., 50, se., 3d. Valentine, Nebr., 52, nw., 8th; 54, n., 30th.

LOCAL STORMS.

Descriptions of severe local storms which attended the passage of low area iii are given under the heading "Areas of low pressure," and the following reports refer to disturbances occasioned by the passage of depressions traced on chart i.

5th. Virginia.—Lynchburgh: a severe wind and rain storm occurred during the early morning. It came from the east and did some damage in this city and vicinity. Maximum velocity of wind, thirty-six miles per hour from the east, at about 6 a. m.

Rain continued during the day, 1.26 of an inch being measured at the morning and 0.52 at the evening observation.

6-7th. New York.—New York City: the high northeasterly shifting to westerly winds were very destructive in Brooklyn; six houses in course of erection, and numerous trees and fences in that city were blown down. Watertown: reports show that the sleet storm which prevailed during these dates destroyed thousands of valuable shade, fruit, and forest trees in Jefferson and Saint Lawrence counties. The telegraph and telephone wires were heavily coated with ice and broke under its weight, seriously interrupting communication.

20-21st. Massachusetts.—Boston: heavy snow and high wind prevailed during the night. The wind blew a gale of forty to fifty miles per hour for five hours, and attained a maximum velocity of fifty-four miles per hour at 2 a. m., 21st. The storm was very severe in this vicinity; several lives were lost and considerable damage was caused to shipping.

21st. North Carolina.—Hatteras: storm began from the southwest 2.55 a. m. and ended 3.10 a. m.; maximum velocity of the wind thirty-five miles per hour. The life-saving station at Cape Hatteras reports five men drowned, one barkentine and one three masted schooner sunk, and other vessels disabled on Hatteras shoal during the gale.

WATER-SPOUTS.

"The San Pedro (Cal.) Advocate," of January 19, 1889, states that two water-spouts were observed off San Pedro 15th; one on the east side of the bay near Anaheim Landing, and the other in the vicinity of Catalina Island. They were funnel shaped, the larger end in the cloud, and the smaller end in the water. They moved rapidly and broke before reaching the coast.

INLAND NAVIGATION.

ICE IN RIVERS AND HARBORS.

Albany, N. Y., 23d: the Hudson River froze over for the first time this season this morning.

Buffalo, N. Y.: the lake, open to the 28th, was covered with ice on that date as far as could be seen from this place.

Cleveland, Ohio: a transfer ferry-boat for use at Detroit,