

Ice formed during the month in few localities, and invariably in the region north of parallel 40°. Strafford, Vt., 1st, 3d, 4th, 5th; Mt. Washington, 14th; Fall River, Mass., 1st; Rowe, Mass., 3d, 4th, 5th; Friendship and Flushing, N. Y., 1st; Milton, Pa., 4th; Chicago, 4th; Eagle Rock, Idaho, 7th, 18th, 19th.

PRECIPITATION.

The general distribution of rainfall (including melted snow) for May, 1881, is shown on Chart No. III, from the reports of over 500 stations. From the table in the left hand corner of the chart is obtained a monthly average for each of the various districts, determined from the records (covering a period of many years) of Signal Service stations, and also a comparison of the present month with such averages. In general there is a marked deficiency for the month, which, however, is coupled with striking irregularities in the distribution, particularly in Texas and the Missouri valley, where in several localities the heaviest precipitation ever recorded has fallen. This unusual record of rain fall was probably due, in large measure to the peculiar direction and sluggish movement of low area No. V. The largest deficiencies occurred in the South Atlantic, Eastern Gulf States and in the North Pacific Coast region, where, particularly in the two former districts, large excesses are common to the month of May. The largest excess was reported from New England, where the deviation from the normal for the month has not been exceeded in any previous year since the establishment of Signal Service stations. The deficiency in the Upper Lake region, although small, is not unusual, while over the Lower Lakes the deficiency, though larger, is considerably below the average. The deficiency in the Upper Mississippi valley is very unusual and larger than ever before recorded. In the Southern Pacific coast region the condition is normal, being the only district reporting the same. Throughout the San Joaquin and Sacramento valleys the deficiency has been considerable, but few stations reporting any rainfall at all, the largest being 0.79 inches at Red Bluff. Over the Rocky Mountain and Plateau districts there appears to be an excess at many stations, although the usual irregularity of distribution is observable. Elsewhere the changes are unimportant.

In connection herewith the following notes from voluntary observers are of interest: *Alabama*: Auburn, month unusually dry. *Florida*: Houston, month very dry; no rain; garden truck drying up. *Georgia*: Forsyth, exceedingly dry; crops seriously injured. *Illinois*: Riley, monthly rain-fall 2.02 inches above mean for past 20 years, and only exceeded twice during that time, viz.: in 1861 and 1868. *Indiana*: Vevay, monthly rain-fall 3.24 below mean for several years; crops suffering severely. Wabash, rain-fall below the average; crops suffering. *Iowa*: Ft. Madison, month very dry; wells and streams drying up. Independence, month unusually dry; crops suffering; streams very low. *Kansas*: Lawrence, monthly rain-fall 0.64 below the average, but quite evenly distributed. Clay Center, month remarkable for frequent and heavy rains. Yates Center, month characterized by unusually heavy rains. Wellington, monthly rain-fall 6.84 above mean of past 2 years; month remarkable for an excessive and general distribution of rain-fall, and likewise for the absence of violent or heavy rains with stormy gales. *Maine*: Gardiner, month very wet; monthly rain-fall 2.02 above average for past 45 years. *Michigan*: Litchfield, month very dry; crops suffering and streams low. Thornville, month very dry; crops suffering. *Missouri*: St. Louis, "Missouri Weather Service" reports a deficiency of about 0.70; larger deficiencies were reported, as follows: 1.73 in 1860, 2.79 in 1870 and 1.51 in 1880; throughout the State the precipitation has been decidedly less than in 1878, more than in 1879 and about the same as in 1880. *Nebraska*: Lincoln, "Nebraska Weather Service" reports average rain-fall for entire State at 6.65 inches, or 1.75 above the average for past 9 years, and double the rain-fall of 1880; in some parts of the State rain fell on 23 days. *New Hampshire*: Contoocookville, monthly rain-fall above the average of past 10 years. *New Jersey*: Newark, monthly rain-fall 1.25 below the mean of past 35 years; total rain-fall for spring 10.24, or 4.64 below the average for past 35 years. *New York*: Waterburg, monthly rain-fall 2.70 above average for past 9 years. North Volney, monthly rain-fall 0.22 above average for past 8 years; smallest rainfall for that period occurred in 1876; largest in 1878. Palermo, monthly rain-fall 1.10 below mean for past 22 years. *North Carolina*: Weldon, month very dry. *Ohio*: Cleveland, monthly rain-fall 2.34 below mean of past 27 years; largest precipitation during that period occurred in 1858, 7.74 inches; smallest in 1877, 0.75 inch. Esgles, month very dry; crops suffering. *Tennessee*: Ashwood, month very wet; precipitation unusually heavy. *Texas*: Melissa, month remarkable for heavy rains; rain-fall for the month nearly the annual average; largest precipitation for the past 30 years. Clarksville, month remarkable for incessant rains. *Virginia*: Wytheville, monthly rainfall 0.93, or less than for any May in past 17 years except 1875, when it was 0.50; rain-fall for the month 2.67 below the average of the past 17 years; drought during the month very severe; crops suffering, and seed lying in the ground does not germinate. *West Virginia*: Flemington, month very dry; crops suffering, and wells and small streams drying up.

Special Heavy Rain-falls.—2d, Melissa, Tex., 3.00 inches. 3d, Mason, Tex., 2.19; Paducah, Ky., 2.19. 4th, Paducah, Ky., 2.25. 4th and 5th, Fort Davis, Tex., 2.85. 5th, Fayette, Miss., 2.00; Melissa, Tex., 4.00. 5th and 6th, Castroville, 2.22. 6th, Wellsboro' Pa., 2.10; San Antonio, 2.10; Browns-

ville, 2.07. 7th, Melissa, Tex., 2.50; Ft. Smith, Ark., 2.02. 8th, Shreveport, 2.70; Mt. Ida, Ark., 5.15. 10th, Vail, Ia., 2.37; Lincoln, Neb., 2.25; Chattanooga, 2.31; Ft. Fetterman, Wy. Ty., 3.10. 10th and 11th, Lincoln, Neb., 3.50. 14th, New Corydon, Ind., 2.01; Dodge City, 2.65. 15th and 16th, Rowe, Mass., 4.10. 16th, Ft. Randall, Dak., 2.00. 17th, Antrim, N. H., 2.80; Orono, Me., 2.76; Eastport, 5.48; Concho, Tex., 3.40; Morrision, Dak., 3.40; Yankton, 2.10. 18th, Lincoln, Neb., 2.33; Dodge City, 2.10; Omaha, 2.26; Yates Centre, Kans., 2.82; New Shoreham, 2.76. 19th, Mt. Washington, 2.80. 19th and 20th, Wellington, Kans., 3.75. 20th, Eastport, 4.17; Southington, Conn., 2.85; Yates Centre, Kans., 2.89; Melissa, Tex., 3.10. 22d, Ashwood, Tenn., 2.50; Mt. Ida, Ark., 2.15; Franklin, N. C., 2.30; Melissa, Tex., 2.00. 23d, Pierce City, Mo., 2.00. 24th, North Platte, 2.25; Melissa, Tex., 4.00; Elizabeth, N. J., 2.07. 24th and 25th, Corsicana, 6.46. 26th, Ft. Meade, Dak., 2.75. 27th, Holton, Kans., 2.25; Melissa, Tex., 4.00; Olivet, Dak., 3.61. 28th, Corsicana, 3.74; Melissa, Tex., 2.00; Ft. Hartsuff, Neb., 2.14. 30th, Elsworth, N. C., 2.25; Melissa, Tex., 2.50.

Largest Monthly Rainfalls.—Melissa, Tex., 34.85 inches; Corsicana, 14.33; Eastport, 13.22; Mt. Washington, 12.50; Lincoln, Neb., 11.89; Mt. Ida, Ark., and Paducah, Ky., 10.15; Olivet, Dak., 10.08; Yankton, 9.88; Wellington, Kans., 9.37; Ashwood, Tenn., and Logan, Ia., 9.30; Yates Centre, Kans., 9.09; Shreveport, 8.63; Ft. Hartsuff, Neb., 8.42; Eagle Pass, 8.16; De Soto Neb., 8.09; Denison, 8.03; Omaha, 7.94; Escanaba, 7.91; Laredo, 7.75; Morrision, Dak., 7.40; Rowe, Mass., 7.25; Thatcher's Island, 7.22; Creswell, Kans., 7.16; Ft. Gibson, 6.96; Genoa, Neb., 6.85; Ft. Smith, Ark., 6.84; Concho, 6.82; Pierce City, Mo., 6.70; Manhattan, Kans., 6.67; Independence, Kans., 6.61; Uvalde, 6.44; Ft. Snelling, Minn., 6.39; Ft. Davis, 6.31; Fredericksburg, 6.30; Howard, Neb., 6.28; Antrim, N. H., 6.15; Ft. Randall, Dak., 6.05; Ft. Sill, 6.04; Clay Centre, Kans., 6.00.

Smallest Monthly Rainfalls.—Ft. Yuma, Salinas City, Lathrop, Stockton, Brighton, Rocklin, Alta, Byron, Davis, Niles, Pleasanton, Livermore, Tracy, Galt, Auburn, Colfax, Cisco, Summit, Boca, Martinez, Brentwood, Woodland, Menlo Park, Gilroy, Hollister, Pajaro, Solidad, Monterey, Santa Cruz, Chico, Modesto, Turlock, Merced, Kingsbury, Goshen, Sumner, Mojave, Ravenna, Newhall, San Fernando, Los Angeles, Spadra, Colton, Indio, Mammoth Tank, Ione, Farmington, Lemoore, Anaheim, Petaluma, and Benson, Cal., Halleck, Toano, Browns and Humboldt, Nev., and Texas Hill and Maricopa, Ariz., none; Sacramento, Benicia Barracks, Colfax, Marysville, Antioch, Borden and Wilcox, Cal., trace; Kelton, Utah and Los Angeles, 0.01; Reno, Nev., 0.02; San Mateo and Poway, Cal., 0.03; Tucson and San Diego, 0.04; Alcatraz Island and Delano, Cal., 0.03; Napa and Tehachapi, Cal., and Umatilla, 0.06; Ft. Thomas, Ft. Verde, Wickenburg, Ariz., and Boise City, 0.07; Wadsworth and Tecoma, Nev., and Fresno and Suisun, Cal., 0.10; Princeton, Cal., 0.11; Tulare and Campo, Cal., Hot Springs and Terrace, Nev., and Phenix, Ariz., 0.12; Ft. San Jose, Cal., and Florence, 0.13; Angel Island, Cal., and Carson City, Nev., 0.15; Williams, Cal., 0.17; Keene, Cal., 0.19; Dunnigan, Cal., 0.20; Pioche, 0.21; San Francisco, 0.22; Hermosa, Col., Calienta, Cal., and Lewiston, 0.23; Calistoga and Knight's Landing, Cal., 0.25; Ft. Lapwai, Idaho, and Ft. Grant, Ariz., 0.26; South Vallejo, Cal., 0.27; Ft. Apache, Ariz., and Tuohy's Rancho, Cal., 0.28; Visalia, Cal., and Missoula, Mont., 0.29; Wallace, Kans., and Oakland, Cal., 0.30; Kinneyloa, Cal., 0.32; Wells, Cal., 0.35; Ft. McDermit, Nev., and Margaretta, O., 0.36; Emigrant Gap, Cal., 0.37; Oakland, Cal., 0.30; Ft. Madison, Ia., Ft. Bridger, Wyo., and Truckee, and Tehama, Cal., 0.40; Battle Mountain and Beowawe, Nev., 0.42; Prescott, 0.44; Toledo, and Dayton, 0.45; Charleston, 0.48; Greensboro, N. C., Genesee, Ill., and Spokane, Wash. Ty., 0.50.

Cloudy Days.—The number varied in New England from 5 to 17; Middle Atlantic States, 5 to 16; South Atlantic States, 3 to 10; Eastern Gulf States, 1 to 8; Western Gulf States, 2 to 14; Ohio valley and Tennessee, 1 to 9; Lower Lake region, 4 to 11; Upper Lake region, 4 to 14; Upper Mississippi valley, 4 to 14; Missouri valley, 8 to 23; Red River of the North valley, 8 to 14; Texas, 2 to 19; Rocky Mountains, 5 to 11; Middle Plateau, 4 to 6; Southern Plateau, 0 to 9; California, 0 to 12; North Pacific Coast region, 6 to 11.

Rainy Days.—The number of days on which rain has fallen varies as follows: New England, 10 to 18; Middle Atlantic States, 7 to 17; South Atlantic States, 5 to 14; Eastern Gulf States, 3 to 11; Western Gulf States, 8 to 18; Ohio valley and Tennessee, 6 to 19; Lower Lake region, 10 to 17; Upper Lake region, 6 to 21; Upper Mississippi valley, 10 to 15; Missouri valley, 12 to 20; Red River of the North valley, 11 to 15; Texas, 7 to 21; Rocky Mountains, 12 to 24; Middle Plateau, 2 to 6; Southern Plateau, 1 to 15; California, 0 to 6; North Pacific Coast region, 2 to 13.

Rain from a Cloudless Sky.—Ft. Myer, Va., 21st, 10.10 p. m., a shower of rain, lasting five minutes, fell when the entire sky overhead seemed free from clouds, and stars could be seen shining brightly, although some light clouds were visible near the western horizon.

Snow fell, with few exceptions, over a narrow belt of country reaching from northwestern Montana, southeastward to central Colorado, and was reported from various stations on the following dates: Ft. Shaw, 22d, 23d; Helena, Deer Lodge and Ft. Benton, 22d; Fort Ellis, 13th; Deadwood, 11th; Ft. Washakee, Wyo. Ty., 12th, 18th; Cheyenne and Denver, 17th; summit of

Pike's Peak, 1st to 4th; 6th, 7th, 12th, 18th, 19th, 20th, 23d, 26th, 29th, 30th, 31st; Colorado Springs, 17th, 18th, 19th; Carson City, Nev., 22d on mountains west of station; Otego, Nev., no date; Summit and Truckee, Cal., no date; on summit of Mt. Washington, 2d, 6th.

Snow on Ground at end of Month.—Pike's Peak, 16.50 inches.

Hail-storms were of frequent occurrence in various parts of the country, the most destructive being reported as follows: Newtown, Pa., 28th, between 5 and 6 p. m., very violent, thousands of panes of glass were broken, vegetable gardens and fields of grain entirely destroyed, fruit trees stripped of blossoms and leaves, and in several cases of bark. Path of storm very narrow, in some cases being so sharply defined as to follow the highway committing damages on but one side. In some portions of the track hailstones as large as walnuts fell, covering the ground to a depth of two to three inches. Direction of storm path, southwest to northeast, length about six miles. Terrific hailstorms visited this section about the middle of May, in 1860 and 1869. Belle County, Tex., 28th, p. m., very violent, destroying crops and damaging buildings; especial injury was inflicted upon corn, cotton, and wheat. New Hackensack, N. Y., 31st, during afternoon, terrific storm, extending from this point to Fishkill Plains. All grain along the storm's path entirely destroyed and corn and young fruit killed. Storm lasted about 45 minutes. Some hailstones were two inches in diameter, and on the following morning hail was found in some places a foot deep. St. Clair, Mich., 14th, 3.30 p. m., rain fell in almost incredible quantities, and hailstones were as large as hickory nuts; a large quantity of window glass was broken and great damage done to fruit trees. Bellville, Mo., 14th, about 1 p. m., very violent; fruit trees and garden truck suffered severely; large quantities of window glass broken; much damage to farm crops. Brockway Centre, Mich., 14th, about 3 p. m., terrific storm of hail and wind, hailstones largest ever known to have fallen here, some measured $1\frac{1}{2}$ inches in diameter. Hardly a house in the track of the storm but had all the glass in the north and west sides broken out. Several buildings were blown down and great damage done to grain crops and fruit trees. Length of storm path about six miles, direction from southwest to northeast. Bloomfield, N. J., 22d, hail fell in great quantities and of large size, doing terrible damage to greenhouses, tender plants and strawberries. This storm was equally severe at other points in New Jersey, viz, Paterson, Orange and Irvington. La Mesilla, 18th, half inch in diameter. Colorado Springs, 17th, 3.10 p. m., lasting 15 minutes; stones one inch in diameter. Spearville, Kans., 1st, stones size of walnuts; much property destroyed. Ft. Davis, 2d, 4th, 26th, stones as large as quails' eggs. Highland Station, Tex., 8th, doing considerable damage to crops and window glass. Corsicana, 24th, hailstones as large as hickory nuts, great damage to growing crops. Macon, N. C., 18th, 10.07 to 11.45 a. m., completely destroying gardens and farm crops in vicinity. Nora Springs, Ia., 30th, stones varying in size from peas to filberts.

RELATIVE HUMIDITY.

The percentage of mean relative humidity for the month ranges as follows: New England, 71 to 89; Middle Atlantic States, 58 to 90; South Atlantic States, 59 to 81; Eastern Gulf States, 59 to 81; Western Gulf States, 66 to 77; Ohio Valley and Tennessee, 55 to 69; Lower Lake region, 62 to 75; Upper Lake region, 65 to 75; Upper Mississippi valley, 57 to 69; Missouri valley, 66 to 70; Red River of the North valley, 67 to 69; Texas, 31 to 76; Middle Plateau, 26 to 34; Southern Plateau, 24 to 39; California, 39 to 75; Oregon, 44 to 57; Washington Territory, Olympia, 68. *High stations* report the following percentages not corrected for altitude: Pike's Peak, 65.4; Santa Fe, 35.8; Cheyenne, 52.8; Denver, 52.2; Mt. Washington, 82.1.

WINDS.

The prevailing winds during May, 1881, at Signal Service stations, are shown on chart No. II by arrows which fly with the wind. Along the New England and South Atlantic coasts, and from the Ohio valley southeastward to the ocean, they were from the *northeast*; along the Middle Atlantic coast, from *southeast* to *southwest*; throughout the Mississippi valley and in Texas, *southeast* and *south*; in the Lake region, *variable*; in the Rocky Mountain region, *southerly*; over the Middle and Northern Plateaux and Northern Pacific coast region, *north* to *west*.

Total Movements of the Air.—The following are the largest total movements at Signal Service stations: Mt. Washington, 20,133; North Platte, 11,418; Pikes Peak, 11,269; Portsmouth, N. C., 10,870; Dodge City, 10,576; Hatteras, 10,526; Kittyhawk, 10,430; Chincoteague, 10,318; Delaware Breakwater, 9,665; Ft. Elliott, 9,206; Thatcher's Island, 9,196; New Shoreham, 9,007; San Francisco, 8,776; Cape Henry, 8,763; Bismarck and Stockton, 8,662; Moorhead, 8,659; Sandusky, 8,459; Eagle Rock, 8,026. The *smallest* are: Phoenix, 1,721; Memphis, 1,860; La Mesilla, 1,981; Florence, 2,164; Silver City, 2,324; San Antonio, 2,595; Uvalde, 2,611; Nashville, 2,663; Deadwood, 2,771; Indianapolis, 2,803.

High Winds.—Winds of 50 miles per hour and over were reported as follows: On summit of Pikes Peak, 10th, a violent hurricane prevailed, reaching a maximum velocity of 112 miles per hour at 12.15 a. m. of the 11th, when the anemometer cups were blown away. From this time