

VI.—First noted in Arizona p. m. of 17th. Its track was due east, and very short, disappearing in Oklahoma p. m. of 20th.

VII.—First noted a. m. of 18th to the north of Washington State. Its motion was eastward, and it was last seen over Newfoundland a. m. of 23d.

VIII.—First noted at the same point as VII, p. m. of 21st. Its motion was in the same line as VII, and it was last noted at the mouth of the St. Lawrence a. m. of 27th.

IX.—First seen p. m. of 26th in extreme southwestern Nebraska. Its track was short, in an east-northeast direction, being last seen in the St. Lawrence Valley a. m. of 30th.

In connection with this storm occurred the severest tornado ever noted in this country, that at St. Louis, Mo., afternoon of 27th. A full description of this tornado, by Mr. Frank- enfield, will be found in the March WEATHER REVIEW, pp. 77-81.

X.—First noted p. m. of 27th in Arizona. Its motion was eastward, being last seen in Arkansas p. m. of 31st.

LOCAL STORMS.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

The severe local storms of the month, including under that term tornadoes, thunderstorms, high winds, with or without electrical manifestations, occurred on 22 dates, as follows: 2d, 3d, 5th, 9th, 10th, 11th, 12th, 13th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 24th, 25th, 26th, 27th, 28th, 30th, and 31st. The severity of the individual storms varied from that of an ordinary thunderstorm to that of a violent tornado. Tornadoes occurred on 10 dates, viz: 11th, 15th, 17th, 19th, 20th, 24th, 25th, 27th, and 28th (see REVIEW, March, 1896, page 82). The disturbances on the remaining dates were mainly thunderstorms and hailstorms. In some cases the wind attained a high velocity, and much damage was done to barns and outbuildings, and especially to crops.

The following is a brief statement of the general characteristics of the storm dates:

2d.—Thunderstorms occurred in the lower Lake Region and the Ohio Valley; not especially destructive.

3d.—A damaging hailstorm, having a path 2 miles in width, passed through the southern part of Vernon County, Mo.

5th.—Fruit trees and vegetables were reported as being damaged by a severe hailstorm that occurred on the line of the P. W. & B. R. R. between Port Deposit and Bush River, Md.

9th.—From the 5th to the 9th there were no severe storms. From the 9th to the end of the month storms of greater or less severity visited the greater part of the territory east of the Rocky Mountains. There were no violent storms in the Gulf States, with the exception of Texas, nor in the south Atlantic States and New England. This unusual storm period began with thunderstorms in North Dakota and Minnesota, destructive hailstorms in the northeastern portion of South Dakota, and a miniature tornado was reported near Fergus Falls, Minn.

10th.—Thunderstorm conditions prevailed over northern Texas and the Dakotas, but no severe storms occurred. A very severe windstorm was experienced in southern Maine on the night of the 10th; more than 50 barns were wrecked or injured in and about the vicinity of Belgrade, Vienna, and Mt. Vernon, all about 20 miles northwest of Augusta, and at South Jefferson, about the same distance southeast of that city; the loss was probably somewhere near \$30,000.

11th.—Tornadoes were reported from Rice County, Kans., and Worthington, Minn; loss about \$2,000.

12th.—In the West severe windstorms visited portions of Nebraska, Iowa, Kansas, Oklahoma, Texas, Illinois, and Minnesota. Tornadoes also occurred in Nebraska, Kansas, and Texas. In the East severe wind and hail storms prevailed

in Maryland and Virginia. It is not possible to estimate the damage done in the rural districts by wind and hail. Estimates of the damages to buildings, streets, sewers, electric light plants, etc., place the total for the day at \$24,000.

13th.—Heavy wind and rain storms prevailed in Maryland, Virginia, Wisconsin, Iowa, Illinois, Nebraska, Kansas, Missouri, Oklahoma, and Texas. Snow fell on the mountains of western Montana on the same date.

15th.—A series of very destructive tornadoes passed over portions of Denton and Grayson counties, Texas, on the afternoon of this date. Loss of property, \$150,000 to \$200,000. Damages to fences and outbuildings were also reported from portions of Arkansas. A tornado occurred near Moundridge, Kans. (See Special Bulletin, No. 8, of the Texas Service.)

16th.—High winds and heavy rains prevailed throughout portions of Illinois and Iowa. Damage by wind about \$15,000.

17th.—A very destructive tornado visited the counties of Clay, Riley, Marshall, Nemaha, and Brown, Kans., and Richardson, Nebr., on the afternoon of this date. Graves and Marshall counties, Ky., were also the scene of tornadic violence on the same date. The winds throughout Wisconsin and Lower Michigan reached the proportions of a gale. Strong winds were also reported from Buffalo and Niagara, N. Y.

18th.—Severe wind and hail storms prevailed in Maryland and Virginia; houses were unroofed in Baltimore and other points, and many trees were prostrated.

19th.—Severe thunderstorms occurred at a number of points in Missouri. The damage by wind and water in that State, and also in Minnesota and Illinois, was very great. At Eldon and Sedalia, Mo., the losses are reported to have been at least \$50,000.

20th.—Tornadoes occurred in Lyon and Cowley counties, Kans., also near Topeka in the same State, and in Kay Co., Cherokee Strip, Okla. Damages light.

21st.—A heavy thunderstorm damaged buildings, fences, and standing timber in the southern part of Adair County, Ky. Heavy rains in Missouri and southern Kansas caused a general flooding of all the streams and much damage to bottom lands, fences, and bridges.

24th.—Hailstorms occurred in portions of the Dakotas and Minnesota, and destructive tornadoes and floods in Iowa.

25th.—The Iowa storm of the 24th continued throughout northern Illinois, being most severe in Ogle and Winnebago counties, and near Chicago. An independent series of very destructive tornadoes occurred in southeastern Michigan on the evening of the same date.

26th.—Severe wind and rain storms visited portions of Tennessee, Kentucky, Ohio, West Virginia, and Virginia.

27th.—The most destructive tornado in the history of the country passed over St. Louis, Mo., at 6.10 p. m. of this date (see p. 77 March REVIEW). Portions of Indiana and Ohio were also visited by severe and destructive windstorms on the night of the 27th.

28th.—A series of violent thunderstorms passed over Virginia, Maryland, Delaware, Pennsylvania, and New Jersey on the afternoon of this date. In southeastern Pennsylvania tornadoes occurred in two separate localities. The property losses were very great.

30th.—A severe windstorm visited the southern and western sections of Chicago; trees were blown down and a number of outbuildings were damaged.

31st.—High winds accompanied by a heavy downpour of rain were experienced in eastern Kansas and western Missouri on the morning of the 31st.

TEMPERATURE OF THE AIR.

[In degrees Fahrenheit.]

The mean temperature is given for each station in Table

II, for voluntary observers. Both the mean temperatures and the departures from the normal are given in Table I for the regular stations of the Weather Bureau.

The monthly mean temperatures published in Table I, for the regular stations of the Weather Bureau, are the simple means of all the daily maxima and minima; for voluntary stations a variety of methods of computation is necessarily allowed, as shown by the notes appended to Table II.

The regular diurnal period in temperature is shown by the hourly means given in Table V for 29 stations selected out of 82 that maintain continuous thermograph records.

The distribution of the observed monthly mean temperature of the air over the United States and Canada is shown by the dotted isotherms on Chart IV; the lines are drawn over the Rocky Mountain Plateau Region, although the temperatures have not been reduced to sea level, and the isotherms, therefore, relate to the average surface of the country occupied by our observers; such isotherms are controlled largely by the local topography, and should be drawn and studied in connection with a contour map.

The highest mean temperatures were: Key West, 79.4; Corpus Christi, 77.9; New Orleans, 77.8; Jacksonville, 77.7; Savannah and Pensacola, 77.6; Charleston and Yuma, 76.8. The lowest mean temperatures were: Eastport, 48.2; Tatoosh Island, 48.4. Among the Canadian stations the highest were: Bermuda, 68.6; Port Stanley, 59.1. The lowest were: St. Johns, N. F., 39.8; Grindstone, 41.0; Banff, 41.5; Sydney, 43.6; Calgary, 44.6.

As compared with the normal for May the mean temperature for the current month was in excess in the Lake Region, the valleys of the Mississippi and its tributaries, the Atlantic and Gulf States. The greatest excesses were: Port Stanley, 10.4; White River, 9.8; Greenbay, 9.5; Chicago, 9.2; Minneapolis and Cleveland, 9.1. The temperature was generally deficient over the Rocky Mountain and Pacific Coast Region and Newfoundland. The greatest deficits were: Walla Walla, 8.4; Salt Lake City, 7.9; Baker City, 6.7; Calgary, Spokane, and Helena, 6.4.

Considered by districts the mean temperatures for the current month show departures from the normal as given in Table I. The greatest positive departures were: Lower Lake, 7.1; Upper Lake, 8.2; Upper Mississippi, 7.4; Southern Slope (Abilene), 7.0.

The years of highest and lowest mean temperatures for May are shown in Table I of the REVIEW for May, 1894. The mean temperature for the current month was the highest on record at: Abilene, 78.8; Galveston, 78.4; Corpus Christi, 77.9; New Orleans, 77.8; Savannah and Columbia, S. C., 77.6; Augusta, 77.4; Shreveport, Tampa, Vicksburg, 77.2; Meridian and Montgomery, 77.0; Charleston, 76.8; Mobile, Palestine, Pensacola, 76.6; Memphis, 76.4; Little Rock, 75.6; Charlotte, 75.2; Atlanta, 74.9; Wilmington, 74.4; Fort Smith, Chattanooga, and Raleigh, 74.0; Nashville, 73.5; Oklahoma, 73.3; Knoxville, 73.2; St. Louis, 73.0; Cairo, 72.7; Louisville, 72.6; Wichita, 71.8; Cincinnati and Columbia, Mo., 71.2; Lexington, 70.9; Hatteras and Indianapolis, 70.8; Keokuk and Parkersburg, 70.2; Springfield, Ill., 70.0; Topeka, 69.8; Columbus, Ohio, 69.7; Kansas City, 69.6; Springfield, Mo., 69.5; Pittsburg, 69.2; Dodge City, 68.4; Albuquerque, 68.0; Concordia, 67.5; Harrisburg, 66.0; Cleveland, 65.8; Chicago, 65.5; Detroit 65.3; Sioux City, 64.4; Minneapolis, 64.0; Greenbay, 62.9; Port Huron, 62.8; Pueblo, 62.2; Milwaukee, 62.1; Grand Haven, 61.8; Alpena, 56.6; Sault Ste. Marie, 53.6; Duluth, 52.3. It was the lowest on record at: Baker City, 46.4; Helena and Idaho Falls, 46.6; Winnemucca, 48.6; Port Angeles, 49.0; Fort Canby, 49.7; Neahbay, 49.8; Spokane, 50.4; Carson City, 50.6; Astoria, 51.2; Salt Lake City, 51.4; Eureka, 51.5; Portland, Oreg., 52.2; Walla Walla, 54.4; Sacramento, 60.0; Red Bluff, 61.2; Fresno, 63.9.

The maximum and minimum temperatures of the current month are given in Table I. The highest were: 112, Yuma (27th); 110, Phoenix (28th); 105, Abilene (30th); 103, Los Angeles (25th); 102, El Paso (29th), Fresno (26th); 101, Dodge City (24th). The lowest maxima were: 61, Tatoosh Island (29th); 62, Eureka (frequently); 65, Fort Canby (29th); 68, Astoria (28th). The highest minima were: 71, Key West (frequently); 70, Port Eads (frequently); 65, New Orleans (frequently), Galveston (3d), Corpus Christi (10th); 64, Pensacola (2d); 63, Mobile (7th). The lowest minima were: 19, Lander (15th); 24, Idaho Falls, (18th); 26, Cheyenne (14th), Baker City (18th), Winnemucca and Carson City (10th); 29, Northfield (1st), Helena (17th); 30, Havre (3d), Salt Lake City (15th); 31, Rapid City (15th), Santa Fe (14th); 32, Miles City and Denver (15th).

The years of highest maximum and lowest minimum temperatures are given in the last four columns of Table I of the current REVIEW. During the present month the maximum temperatures were the highest on record at: Yuma, 112; Abilene, 105; Los Angeles, 103; Dodge City, 101; San Diego and Amarillo, 98; Wichita, Charleston, and Baltimore, 96; Meridian, 95; Louisville and Oklahoma, 94; New Haven, Little Rock, Palestine, 93; Lexington, New Orleans, Narragansett Pier, 92; Eastport and Point Reyes Light, 85. The minimum temperatures were the lowest on record at: Fort Canby, 38; Salt Lake City, 30.

The greatest daily range of temperature and the extreme monthly ranges are given for each of the regular Weather Bureau stations in Table I, which also gives data from which may be computed the extreme monthly ranges for each station. The largest values of the greatest daily ranges were: Bismarck and Pueblo, 45; Duluth, Lander, and Dodge City, 44; Northfield, Harrisburg, El Paso, and Yuma, 43; Amarillo, and Narragansett Pier, 42; San Luis Obispo, Idaho Falls, and East Callam, 41. The smallest values were: Key West, 12; Galveston, 14; Corpus Christi and Tatoosh Island, 15; Jupiter and New Orleans, 19; Fort Canby and Eureka, 20. Among the extreme monthly ranges the largest values were: Phoenix, 65; Lander and Yuma, 63; Los Angeles, 62; San Luis Obispo and Fresno, 61; Dodge City, 60. The smallest values were: Key West, 14; Galveston and Corpus Christi, 21; Jupiter and Eureka, 24; Pensacola and Tatoosh Island, 26; Fort Canby and New Orleans, 27.

The accumulated monthly departures from normal temperatures from January 1 to the end of the current month are given in the second column of the following table, and the average departures are given in the third column for comparison with the departures of current conditions of vegetation from the normal condition.

Districts.	Accumulated departures.		Districts.	Accumulated departures.	
	Total.	Average.		Total.	Average.
Middle Atlantic.....	+ 3.1	+ 0.6	New England.....	- 1.1	- 0.2
South Atlantic.....	+ 8.0	+ 1.6	Florida Peninsula.....	- 9.3	- 1.9
West Gulf.....	+ 6.5	+ 1.3	East Gulf.....	- 0.8	- 0.2
Ohio Valley and Tenn.....	+ 9.6	+ 1.9	Middle Plateau.....	- 0.9	- 0.2
Lower Lake.....	+ 9.1	+ 1.8	North Pacific.....	- 2.9	- 0.6
Upper Lake.....	+18.0	+3.6	Middle Pacific.....	- 0.9	- 0.2
North Dakota.....	+ 8.7	+ 1.7			
Upper Mississippi.....	+20.1	+ 4.0			
Missouri Valley.....	+20.6	+ 4.1			
Northern Slope.....	+ 8.2	+ 1.6			
Middle Slope.....	+20.9	+ 4.2			
Abilene (southern Slope).....	+17.0	+ 3.4			
Southern Plateau.....	+ 4.4	+ 0.9			
Northern Plateau.....	+10.8	+ 2.2			
Southern Pacific.....	+ 3.1	+ 0.6			

The limit of freezing weather is shown on Chart VI by the isotherm of minimum 32°C, and the approximate limit of frost by the isotherm of minimum 40°C. These minimum

temperatures are such as occur within the thermometer shelters of the Weather Bureau stations.

MOISTURE.

The quantity of moisture in the atmosphere at any time may be expressed by the weight of the vapor coexisting with the air contained in a cubic foot of space, or by the tension or pressure of the vapor, or by the temperature of the dew-point. The mean dew-points for each station of the Weather Bureau, as deduced from observations made at 8 a. m. and 8 p. m., daily, are given in Table I.

The rate of evaporation from a special surface of water on muslin at any moment determines the temperature of the wet-bulb thermometer, but a properly constructed evaporimeter may be made to give the quantity of water evaporated from a similar surface during any interval of time. Such an evaporimeter, therefore, would sum up or integrate the effects of those influences that determine the temperature as given by the wet bulb; from this quantity the average humidity of the air during any given interval of time may be deduced.

Measurements of evaporation within the thermometer shelters are difficult to make so as to be comparable at temperatures above and below freezing, and may be replaced by computations based on the wet-bulb temperatures. The absolute amount of evaporation from natural surfaces not protected from wind, rain, sunshine, and radiation, are being made at a few experimental stations and will be discussed in special contributions.

Sensible temperatures.—The sensation of temperature experienced by the human body and ordinarily attributed to the condition of the atmosphere depends not merely on the temperature of the air, but also on its dryness, on the velocity of the wind, and on the suddenness of atmospheric changes, all combined with the physiological condition of the observer. A complete expression for the relation between atmospheric conditions and nervous sensations has not yet been obtained.

PRECIPITATION.

[In inches and hundredths.]

The distribution of precipitation for the current month, as determined by reports from about 2,500 stations, is exhibited on Chart III. The numerical details are given in Tables I, II, and III. The total precipitation for the current month was heaviest (14 to 18 inches) in a small portion of western Missouri; it exceeded 6 inches in western Kentucky and the greater part of Illinois, Iowa, and Missouri, as also in eastern Kansas and Nebraska, southern Minnesota, Wisconsin, and Indiana. No rain fell, except an occasional "trace" in New Mexico, Arizona, and the southern portions of California and Nevada. The larger values at regular stations were: St. Louis, 9.1; Omaha, 9.5; Topeka, 9.3; Springfield, Mo., 11.5.

The diurnal variation, as shown by tables of hourly means of the total precipitation, deduced from self-registering gauges kept at the regular stations of the Weather Bureau, is not now tabulated.

The current departures from the normal precipitation are given in Table I, which shows that precipitation was in excess over a region extending from northern North Carolina and southern Virginia westward to Arkansas and Missouri and thence northward to Manitoba, thence west and southwest to the Pacific Coast. The large excesses were: Cairo, 7.0; Cape Henry, 6.7; Springfield, Mo., 5.4; St. Louis and Sault Ste. Marie, 4.5; Astoria, 3.8; Williston, 3.7; Topeka and Duluth, 3.6; Eureka, 3.2; Hannibal, 3.1; Sioux City, 3.0. The large deficits were: Little Rock, 4.4; Charleston and Vicksburg, 3.5; Hatteras, 3.1; Galveston, Meridian, and Jupiter, 3.0.

The average departure for each district is also given in Table

I. By dividing these by the respective normals the following corresponding percentages are obtained (precipitation is in excess when the percentages of the normals exceed 100):

Above the normal: Middle Atlantic, 103; North Dakota, 170; upper Mississippi, 141; Missouri Valley, 145; middle Plateau, 232; northern Plateau, 154; north Pacific, 143; middle Pacific, 144.

Below the normal: New England, 80; south Atlantic, 73; Florida Peninsula, 47; East Gulf, 53; West Gulf, 67; Ohio Valley and Tennessee, 89; lower Lake, 60; upper Lake, 95; northern Slope, 96; middle Slope, 83; southern Slope (Abilene), 19; southern Plateau, 15; south Pacific, 38.

The years of greatest and least precipitation for May are given in the REVIEW for May, 1890. The precipitation for the current month was the greatest on record at: Springfield, Mo., 11.46; Cairo, 10.82; Cape Henry, 10.61; St. Louis, 9.12; Sault Ste. Marie, 6.70; Williston, 5.79; Havre, 4.27; Idaho Falls, 2.78; Winnemucca, 2.77. It was the least on record at: Eastport, 1.00; Pierre, 0.30; Rapid City, 0.60.

The total accumulated monthly departures from normal precipitation from January 1 to the end of the current month are given in the second column of the following table; the third column gives the ratio of the current accumulated precipitation to its normal value.

Districts.	Accumulated departures.	Accumulated precipitation.	Districts.	Accumulated departures.	Accumulated precipitation.
	Inches.	Per ct.		Inches.	Per ct.
North Dakota.....	+ 3.90	162	New England.....	- 3.50	82
Upper Mississippi.....	+ 0.40	103	Middle Atlantic.....	- 1.70	94
Missouri Valley.....	+ 1.50	112	South Atlantic.....	- 4.80	76
Northern Slope.....	+ 0.40	107	Florida Peninsula.....	- 2.70	80
Middle Plateau.....	+ 2.30	134	East Gulf.....	- 6.00	76
North Pacific.....	+ 5.70	119	West Gulf.....	- 3.90	79
Middle Pacific.....	+ 3.10	117	Ohio Valley and Tenn.....	- 6.00	72
			Lower Lakes.....	- 0.40	97
			Upper Lakes.....	- 0.90	88
			Middle Slope.....	- 2.10	77
			Abilene (southern Slope).....	- 5.80	42
			Southern Plateau.....	- 0.80	65
			Northern Plateau.....	- 0.30	97
			South Pacific.....	- 1.80	77

Details as to excessive precipitation are given in Tables XII and XIII.

The total monthly snowfall at each station is given in Table II. Its geographical distribution is shown on Chart VI. The southern limit of freezing temperatures and possible snow is shown on this chart by the isotherm of minimum 32°. The isotherm of minimum 40°, namely, the air temperature within the thermometer shelter, is also given on this chart, and shows approximately the southern limit of frost on exposed surfaces.

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 1, 22, 26. Arizona, 29. Arkansas, 2, 12, 13, 15, 28. California, 4 to 9, 11, 18, 28, 29. Colorado, 21. Connecticut, 31. District of Columbia, 28. Florida, 4, 6, 15, 21. Georgia, 2, 22, 26, 29. Idaho, 1 to 9, 11 to 17, 19 to 23, 25, 26, 28, 29. Illinois, 1, 11 to 21, 25 to 28, 30. Indiana, 1, 4, 11, 13, 18 to 21, 25 to 28. Indian Territory, 16. Iowa, 1, 11 to 14, 16, 17, 18, 23, 24, 26, 27. Kansas, 3, 4, 8 to 23, 25, 26, 27, 29, 30, 31. Kentucky, 1, 2, 11, 19, 26. Louisiana, 13, 14, 20. Maine, 5, 10, 30. Maryland, 12, 18, 19, 26, 28. Massachusetts, 5, 11, 17. Michigan, 4, 6, 11, 12, 14, 25, 27, 28, 30. Minnesota, 7 to 12, 16, 23, 25, 26, 28. Mississippi, 1, 2, 3, 13, 14, 28. Missouri, 1, 2, 11, 12, 13, 15 to 21, 23, 24, 26, 27, 28, 30, 31. Montana, 6, 8, 9, 10, 12, 14, 15, 24, 25. Nebraska, 3, 7, 8, 11, 12, 15, 16, 17, 19, 20, 23, 24, 26, 27. Nevada, 29. New Hampshire, 5, 10, 22, 29, 30. New Jersey, 5, 15, 17, 28,