

Wind.—Prevailing direction, southwest; average direction, as deduced from many years observations, northeast.—*Dr. Herbert B. Battle, Raleigh, director; C. F. von Herrmann, Sergeant, Signal Corps, assistant.*

NORTH AND SOUTH DAKOTA.

The monthly mean temperature for the states is about normal, or possibly 1 below, and the average temperature is about 0.31 below the normal.

SUMMARY.

Temperature.—Monthly mean, 27.0; highest monthly mean, 33, at Spearfish and Rapid City; lowest monthly mean, 20, at Napoleon; maximum, 75, at Wapeton, 9th; minimum, —28, at Fort Buford, 28th; range for the states, 103; greatest local monthly range, 89, at Fort Buford; least local monthly range, 56, at Canton.

Precipitation.—Average for the states, 0.33; greatest monthly, 1.08, at Canton; least monthly, trace, at Clark and Woonsocket.—*S. W. Glenn, Sergeant, Signal Corps, Huron, in charge.*

OHIO.

SUMMARY.

The mean temperature of the northern section was 40.5, of the middle section, 40.3, and of the state, 41.0. These means are 0.8, 0.3, and 0.3 above the averages for the past eight years. The mean temperature of the southern section, 42.4, was 0.1 below the eight year average. The maximum temperature reported was 77.0, at Hanging Rock, 1st, and the minimum, 8.6, at Wauseon, 30th. The mean daily range of temperature was 15.1. The greatest daily range was 38.5, at Portsmouth, 12th, and the smallest, 2.0, at Cincinnati, on the 22d.

Precipitation.—The mean rainfall in the northern section, 2.81, was 0.08 below the eight year average. The mean in the middle section was 4.38, and in the southern section, 4.85. These means are 1.14 and 1.64 above the averages for these sections for November. The mean for the state, 4.02, is 0.92 above the average. The greatest monthly rainfall reported was 8.00 at West Milton, and the smallest, 1.71, at Sandusky and Vienna.

Wind.—Prevailing direction, west.—*Prof. B. F. Thomas, Columbus, director; Lieut. Charles E. Kilbourne, secretary; C. M. Strong, Corporal, Signal Corps, assistant.*

OREGON.

SUMMARY.

Temperature.—The monthly average for the state, 42.7, is 2.1 above the normal. The average excess along the immediate coast is 2.8; in the interior valleys, 2.3; and in the eastern portion of the state, 1.2. The mean temperature along the coast was 50; in the interior valleys, 46; and in eastern Oregon, 39; highest monthly mean, 50.8, at Bandon; lowest monthly mean, 33, at Joseph and North Powder; maximum, 74, at Bandon; minimum, 5, at North Powder; range for state, 69.

Precipitation.—The precipitation was below the average in all sections of the state, except in Douglas and Coos counties, and undoubtedly in all southwestern counties. The deficiency ranged from 5.00, at Fort Canby, to 0.35, at Mount Angel. Along the coast from 4.00 to 7.00 fell; in the interior valleys from 3.00 to 5.00; and in eastern Oregon about 0.75. The average for the state was 3.00.

Wind.—Prevailing direction, southwest.—*Hon. H. E. Hayes, Master State Grange, Portland, director; B. S. Pague, Sergeant, Signal Corps, assistant.*

PENNSYLVANIA.

SUMMARY.

Temperature.—The mean temperature of sixty-six stations was 41.9, which is from 2 to 3 above the normal, and the same as that of November, 1888. The means of the daily maximum and minimum, 48.8 and 34.7, give a mean temperature of 41.8, and an average daily range of 14.1. The highest temperatures reported during the month were Greensburgh, 73; Annville and Centre

Valley, 71. The lowest were Dyberry, Somerset, and Coudersport, 10; Lock Haven, Wellsborough, and Columbus, 12.

Precipitation.—The average precipitation for the state was 6.72, which is double the usual quantity for November. As there was only a slight excess in the northwestern portion of the state, this ratio was greater in other parts. The greatest totals were Girardville, 10.16; Meyerstown, 9.99; Westchester, 9.91; Eagle's Mere, 9.27; Pottstown, 9.15; and Lancaster, 9.02. Excessive rains occurred on the 18th and 19th, which caused heavy freshets along the Susquehanna, that carried away railroad bridges and rafts of lumber.

Wind.—Prevailing direction, west.—*Under direction of the Franklin Institute, Philadelphia; T. F. Townsend, Sergeant, Signal Corps, assistant.*

SOUTH CAROLINA.

The monthly mean temperature for the state is over 2.0 higher than the mean of November in either 1887 or 1888. The average monthly rainfall for the state was over one inch in excess of that for November in either of the two preceding years.

SUMMARY.

Temperature.—Monthly mean temperature, 54.8; maximum, 84, at Saint Matthew's, 1st; minimum, 18, at Spartanburgh, 30th; range for state, 66.

Precipitation.—Monthly average for the state, 3.84; greatest monthly, 7.28, at Charleston; least monthly, 0.66, at Chester.

Wind.—Prevailing direction, west.—*Hon. A. P. Butler, Columbia, director; J. W. Cronk, Sergeant, Signal Corps, assistant.*

TENNESSEE.

The month of November was in many respects an abnormal one in its meteorological features. While the temperature was about the normal, the rainfall was excessive and the percentage of cloudiness was much above the normal. The snowfall was much in excess of the usual amount for this month.

SUMMARY.

Temperature.—The mean temperature was 47.8, the normal for the past seven years. The highest local monthly mean was 51.9, at Cog Hill, and the lowest was 44.2, at Rugby and Nunnely. The highest temperature observed was 80, on the 1st, at Savannah; and the lowest was 19, on the 30th, at Rugby, the first and last days of the month showing the extremes of temperature. The maximum temperature was, with two or three exceptions, recorded on the 1st, and the minimum, with a few exceptions, on the 29th. The daily ranges of temperature were generally less than usual for November.

Precipitation.—The average precipitation was 6.62, being the greatest November average during the past seven years, the next greatest being 6.39, in 1886. This amount is 2.50 above the November mean for the past seven years. Of this amount the eastern division received an average of about 5.75, the middle and western divisions each a little more than 6.75. There were fourteen days of general rains, including snowfall. The greatest monthly rainfall, 9.83, was reported at Trenton. This was the greatest local amount reported in November during the past seven years, the next greatest being 8.89, at Memphis, in 1886. The greatest local daily rainfall was 3.07, reported at Knoxville on the 8th; the next greatest was 2.83, at Trenton, on the 18th.

Wind.—Prevailing directions, north and west.—*J. D. Plunket, M. D., Nashville, director; H. C. Bate, Signal Corps, assistant.*

TEXAS.

SUMMARY.

Temperature.—The mean temperature over the state ranged from 36, at Fort Elliott, to 65, at Brownsville; the highest temperature was 85, at Brownsville, on the 21st; at Cuero, on the 24th; and at College Station, on the 25th; the lowest was 17, at Fort Elliott, on the 29th.

Precipitation.—The precipitation during the month was heaviest over the eastern portion of the state, where, at Tyler, it exceeded 10.00, and decreased with marked regularity westward to the one hundred and second meridian, west of which the amount did not exceed 1.00.—*D. D. Bryan, Galveston, director; I. M. Cline, Sergeant, Signal Corps, assistant.*

NOTES AND EXTRACTS.

EQUINOCTIAL STORMS.

[Prepared by Assistant Professor H. A. HAZEN, by order of the Chief Signal Officer, to meet the numerous demands made upon this office for information relative to equinoctial storms.]

There have come to the Signal Office, from time to time, inquiries regarding the existence of storms about the 21st of March and 21st of September of each year. There also seems to be a fairly well-grounded belief in the minds of many intelligent persons that the so-called equinoctial storms, or storms influenced, if not generated, by the seeming passage of the sun across the equator, have a real existence. Others have gone still farther and have considered that the equinoctial points of the planets have an important bearing upon terrestrial weather. When it is considered that the equinoxes are wholly imaginary points in the sky, or the intersections of two imaginary lines, the equator and the path of the sun, we must conclude at once that the apparent presence of the sun at either of these points can have absolutely no effect upon

our weather. It might be thought that somehow the lengthening day at the spring equinox and the corresponding shortening one in the fall might affect the weather. However, not only are these directly contrary to each other and therefore incapable of producing like effects, but also the increase or diminution is only two and one-half minutes daily, and the action is a continuous one for weeks before and after the equinox, so that on all accounts it is impossible for us to consider that there can be any effect whatever from this cause.

There still remains this consideration, that possibly there is a recurring storm period about the 21st of March and 21st of September which may be entirely independent of the equinoxes. This question, though entirely different from the previous one, has been carefully investigated by Prof. R. H. Scott, of London. He collected all the severe storms that passed over Great Britain for fourteen years, and found that out of forty-five storms in March not one occurred on the 21st, and out of eighteen storms in September, only one occurred on the 21st.

Taking intervals of three days and five days he found—

Months.	Three days.			Five days.		
	17-19	20-22	23-25	14-18	19-23	24-28
March.....	5	3	2	8	5	4
September.....	1	2	2	3	2	6
Total.....	6	5	4	11	7	10

These figures show very plainly, especially in the five day intervals, that storms are much more frequent just before and after the equinoxes than near them. This whole discussion will be found in Quarterly Journal, Royal Meteorological Society of England, 1884, page 236.

It seemed advisable to make a rather thorough search in the records of this office for the past sixteen years in order to establish the occurrence or non-occurrence of such storms in the United States. It was thought at the outset that the elements most likely to give the best results were (1) wind, (2) pressure, (3) precipitation, (4) storms.

1st. *Wind*.—Four stations were selected in the United States, Omaha, Saint Louis, Pittsburgh, and Washington, in an east and west direction and five stations, Marquette, Milwaukee, Louisville, Nashville, and Vicksburg, in a north and south direction. The daily wind movements from the 16th-26th of each month, at these stations, were worked up separately and in two groups. The first group included the years 1873-'80, and the second the years 1881-'88. The curves for the four stations and the five stations agreed very remarkably, and showed that practically the oscillations could be considered as applied to the whole country from the Rocky Mountains to the Atlantic. The two periods, 1873-'80 and 1881-'88, however, showed almost directly opposite phases each to each. Afterward, at the suggestion of the Chief Signal Officer, all the winds at 7 a. m., above fourteen miles per hour, for the whole country from the Atlantic to the Pacific, were counted up. The number of observations each day in this last reckoning was not far from 2,000, or 22,000 for the eleven days. As will be seen, this curve, especially in March, agrees almost exactly with the previous curve for the total wind movement at nine stations, and we may conclude that the result would not be materially altered if the number of stations were indefinitely increased.

2d. *Pressure*.—In the same manner the observations of pressure were worked up for the four stations above for the whole period, 1873-'88.

3d. *Rainfall*.—The total rainfall for the days, 16-26 of March and September, was also computed for all the stations. This gives nearly 2,000 observations of rainfall for each day, or 22,000 for the eleven days. The curves for the periods, 1873-'80 and 1881-'88, unlike those for wind, were almost identical in both months.

4th. *Storms*.—All the storms whose centres could be identified upon the Signal Service maps were counted for the same days and periods, and in taking the sum for the whole period, 1873-'88, the 2d order of means was computed, thus serving to smooth out the irregularities. The curves for the two periods were nearly identical, though not as regular in September as in March.

The following is a brief description of the curves (see chart v) :

- (A) Daily movement of wind at four stations, 1873-'80, March.
- (B) Daily movement of wind at five stations, 1873-'80, March.
- (C) Daily movement of wind at four stations, 1881-'88, March.
- (D) Daily movement of wind at five stations, 1881-'88, March.
- (E) Daily movement of wind at nine stations, 1873-'88, March.
- (F) Total number of times wind was above fourteen miles per hour, 1873-1889, March.
- (G) Daily movement of wind at nine stations, 1873-'80, September.
- (H) Daily movement of wind at nine stations, 1881-'88, September.
- (I) Daily movement of wind at nine stations, 1873-'88, September.
- (K) Total number of times wind was above fourteen miles per hour, 1873-1889, September.
- (L) Oscillations in pressure, four stations, 1873-'88, March.
- (M) Oscillations in pressure, four stations, 1873-'88, September.
- (N) Total rainfall, all stations in United States, 1874-'81, March.
- (O) Total rainfall, all stations in United States, 1882-'89, March.
- (P) Total rainfall, all stations in United States, 1874-'89, March.
- (Q) Total rainfall, all stations in United States, 1874-'89, September.
- (R) Number of storm centres each day of March, 1873-'80.
- (S) Number of storm centres each day of March, 1881-'88.
- (T) Number of storm centres each day of March, 1873-'88.
- (U) Number of storm centres each day of September, 1873-'88.

A study of these curves shows the following:

1st. (A) and (B): that the wind in general is very much higher before and after the March equinox than at it.

2d. (C) and (D): that the wind is lower before and after the March equinox than on that date.

3d. (E) and (F): that while the wind is a little lower before and after, yet there are two dates on which it is almost as high as at the March equinox.

4th. (G) (H) (I) and (K): that during the September equinox there is a tendency to less wind.

5th. (L) and (M): that the pressure is either rising or at a maximum during the equinoxes.

6th. (N) (O) and (P): that the precipitation reaches a maximum on March

20th, and has a rapid diminution from that date. Also, curve (N) has two maximum dates, the 16th and 20th.

7th. (Q): that at the September equinox there is nearly a minimum amount of precipitation.

8th. (R) (S) (T): that there is a maximum number of storms on March 8th, and a secondary maximum on March 21st.

9th. (U): that a maximum occurs on September 9th and there is almost a minimum for the whole month on September 21st.

In general, the only curves which indicate a preponderance of storm action during the March equinox are (C) and (D), and these are offset by (A) and (B), which are of the same nature but directly opposite in phases. All the March curves except (A) and (B) show a tendency to increasing storm action on the 20th and 21st, though in most cases there is an equal increase earlier in the month.

All the September curves show a tendency to diminished storm action at the time of the equinox. The conclusion is inevitable, that the observations do not show a preponderance of storm action during the equinoxes.

Meteorological record of Army post surgeons, voluntary, and other co-operating observers, November, 1889.

Stations.	Temperature. (Fahrenheit.)			Precip'n.	Stations.	Temperature. (Fahrenheit.)			Precip'n.
	Max.	Min.	Mean.			Max.	Min.	Mean.	
<i>Alabama.</i>	0	0	0	<i>Ins.</i>	<i>Arkansas—Cont'd.</i>	0	0	0	<i>Ins.</i>
Bermuda *†	76	22	54.2	6.20	El Dorado †	71	21	46.2	7.48
Butler	82	24	53.5	5.74	Fort Forrest City †	75	24	50.1	6.29
Citronelle †	75	20	51.6	6.33	Fulton †	68	18	44.5	6.25
Columbiana †	75	20	51.6	6.33	Heber	68	18	44.5	16.25
Decatur (1) †	76	22	49.4	4.88	Helena (1) †	76	22	48.8	5.85
Decatur (2) †	72*	22	50.7	5.30	Hot Springs	72	23	50.9	5.83
Double Springs	72	27	48.0	7.99	Lead Hill	76	20	44.1	5.10
Elkmount †	80	30	57.2	7.47	Little Rock B'ks.	73	22	47.9	11.26
Eufaula	76	22	53.4	3.59	Lonoke	73	25	50.1	9.60
Evergreen †	78	20	48.0	6.52	Malvern †	77	32	63.5	12.34
Fayette C. H. †	76	27	54.6	2.75	Monticello †	76	26	50.2	8.07
Fort Deposit †	78	23	51.0	4.13	Newport (1) †	72	22	46.4	10.17
Gadsden †	76	26	53.0	4.67	Newport (2) †	77	21	45.2	7.69
Greensborough †	76	22	50.8	2.38	Ozoeola †	72	22	46.4	13.30
Livingston (1) †	76	20	52.4	4.16	Ozoeola †	77	21	45.2	7.69
Livingston (2) †	76	20	51.6	6.89	Pine Bluff †	67	19	42.5	1.34
Marion †	80	23	55.2	5.60	Prescott †	74	28	49.6	6.95
Mt. Vernon B'ks.	76	26	56.0	5.80	Russellville †	72	26	48.5	0.41†
Pine Apple	80	26	56.0	4.06	Stuttgart †	73	24	46.6	11.25
Selma (1) †	78	25	49.6	5.45	Texaskana †	72	21	46.8	7.80
Tuscumbia (1)	80	20	49.6	6.83	Washington †	78	28	51.6	8.03
Tuscumbia (2) †	75	21	52.0	6.21	Winslow †	74	22	48.4	7.68
Union Springs	75	24	54.4	7.02	British Columbia.	69	17	41.1	5.84
Uniontown.	72	22	46.4	7.02	New Westminster.	60	31	44.5	5.74
Valley Head †	50	22	34.3	8.15	<i>California.</i>				
<i>Alaska.</i>	51	24	37.1	4.75	Alcade *	70	40	53.8	1.50
Juneau.....					Alcatraz Island	74	48	57.5	3.45
Killisnoo.....					Almaden †	69	42	55.6	2.73
<i>Arizona.</i>					American Hill*	70	38	51.7	9.10
Antelope Valley.....			0.13		Anaheim †	84	45	61.8	0.30
Ash Creek.....			0.60		Angel Island	82	43	58.5	3.40
Ash Springs.....			0.15		Aptos *	80	40	54.6	2.09
Banghart's.....	81	20	48.7	0.00	Athlone *	75	38	56.8	2.33
Benson *.....	76	31	54.5	0.20	Auburn *	80	39	56.5	2.36
Bisbee.....				0.36	Bakersfield *	80	40	54.4	4.85
Buckeye.....				0.10	Barstow †	75	41	57.3	0.22
Casa Grande*.....	94	48	69.6	0.22	Beaumont.	75	27	52.5	0.70
Cedar Springs.....				2.85	Belmont *.....	72	47	57.3	0.67
Cooley's Springs †				0.00	Benicia Barracks	75	38	51.9
Dragon.....				1.	Berendo *	79	40	54.9	3.11
Dos Cabezos.....				0.50	Berkeloy.....	76	40	56.3	2.26
Flagstaff.....	57	9	35.6	0.47	Boca *	74	43	56.3	2.39
Florence †.....	84	32	57.7	0.80	Borden.....	74	10	41.7	4.55
Fort Apache.....	69	16	42.4	0.00	Boulder Creek *	80	36	56.0	1.69
Fort Bowie.....	70	27	49.8	0.14	Brentwood*	78	28	50.2	9.56
Fort Huachuca.....	75	23	50.2	0.19	Brighton*	77	36	60.2	3.44
Fort Lowell.....	92	26	56.2	0.81	Byron*.....	80	40	59.2	3.60
Fort McDowell.....	84	31	56.2	0.85	Caetus*.....	74	36	55.4	2.86
Fort Mojave.....	75	32	55.9	0.05	Caliente*.....	90	54	71.5	?
Fort Verde.....	73	20	47.0	0.00	Calistoga*.....	68	47	58.3	1.05
Gila Bend*.....	74	42	58.7	0.50	Castroville*.....	90	29	54.4	4.10
Holbrook*.....	70	15	39.5	0.00	Centreville*.....	72	40	57.6	2.03
Lochiel.....	73	26	47.5	0.83	Chico.....	80	46	45.4	3.44
Maricopa*.....	80	42	60.2	0.00	Cisco.....	75	40	54.7	2.59
Pantano*.....	80	37	55.2	0.47	Colgrove.....	57	28	41.0	9.54
Peoria.....	78	34	55.6	0.20	Colfax *.....				1.62
Sachs's Ranch.....				0.50	Colton *.....	70	38	51.8	9.60
San Carlos.....	81	27	51.4	0.20	Corning*.....	82	40	58.1	1.26
Signal †.....	77	32	55.8	0.20	Crescent City.....	80	36	55.9	3.26
Strawberry †.....				0.20	Davisville*.....				7.12
Texas Hill*.....	82	37	56.6	0.05	Delano *.....	72	38	56.5	3.04
Tip Top †.....				0.00	Delta *.....	72	42	56.7	0.56
Tombstone.....	74	28	51.0	0.12	Downey *.....	75	37	52.5	10.03
Tucson (1) †.....	82	32	56.2	0.32	Dunnigan*.....	82	45	61.5	1.33
Tucson (2) †.....	75	43	55.1	0.00	Dunsmuir.....	69	45	55.0	3.59
Walnut Grove.....				1.00	Edgewood*.....	65	35	47.0	11.65
Walnut Ranch.....				0.13	El Dorado.....	55	23	41.1	2.35
Wilcox*.....	79	30	55.3	0.02	Elmira*.....	73	40	57.1	6.32
Williams.....	54	12	32.3	0.00	El Verano *.....	80	40	58.2	4.20
Winslow †.....	72	16	41.2	0.00	Emigrant Gap*.....	78	32	55.1	5.70
Yuma.....	76	45	61.0	0.00	Esperanza*.....	60	30	43.7	11.41
<i>Arkansas.</i>					Evergreen.....	68	40	53.2	3.79
Arkansas City †.....				5.56	Farmington*.....				2.40
Camden †.....	75	25	48.0	9.18	Felton *.....	74	36	54.5	3.22
Conway.....	71	26	45.7	13.17	Ferndale.....	76	28	54.9	4.68
Dallas.....	68	20	48.2	4.12	Florence *.....				5.43
Dardanelle.....				9.87	Folsom*.....	89	43	61.2
Dayton.....	70	32	51.5	2.00	Fort Bidwell.....	75	42	57.0	4.18
Devall's Bluff.....	86	20	47.4	1.34		60	20	38.9	2.20