

MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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INTRODUCTION.

The REVIEW for December, 1895, is based on reports from 2,737 stations occupied by regular and voluntary observers, classified as follows: 149 from Weather Bureau stations; 35 from U. S. Army post surgeons; 2,395 from voluntary observers; 32 from Canadian stations; 96 received through the Southern Pacific Railway Company; 30 from U. S. Life-Saving stations; international simultaneous observations are received from a few stations and used together with trustworthy newspaper extracts and special reports.

The WEATHER REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe. Unless otherwise specifically noted, the text is written by the Editor, but the statistical tables are furnished by Mr. A. J. Henry, Chief of the Division of Records and Meteorological Data. A special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada.

CLIMATOLOGY OF THE MONTH.

GENERAL CHARACTERISTICS.

The current month has been characterized by a remarkable series of severe storms in the North Atlantic, affecting both the coasts of Europe and America. An equally remarkable series of storms prevailed in the North Pacific, affecting not only the coasts of Washington, British Columbia, and Alaska, but also the coast of Japan. A series of remarkable rains, with high winds and resulting floods in the rivers, occurred in Kansas, Missouri, and Texas. The average pressure was above normal on the Atlantic and Pacific coasts, but decidedly below normal in the Dakotas, Manitoba, and Alberta. Temperature was above normal in the latter region, but below in the Rocky Mountain Plateau and Pacific Slope and Gulf States. Precipitation was decidedly above normal on the coasts of Washington and Oregon, as also from Texas to the Lake Region, and was at several stations in this region the greatest on record.

ATMOSPHERIC PRESSURE.

[In inches and hundredths.]

The distribution of mean atmospheric pressure reduced to sea level, as shown by mercurial barometers, not reduced to standard gravity, and as determined from observations taken daily at 8 a. m. and 8 p. m. (seventy-fifth meridian time), is shown by isobars on Chart II. That portion of the reduction to standard gravity that depends on latitude is shown by the numbers printed on the right-hand border.

The mean pressures during the current month were highest in the Rocky Mountain Plateau Region and southeastward to southern Texas. A ridge of moderate high pressure extended from New Jersey and eastern New York southwestward to the Gulf of Mexico. The highest were: Salt Lake City, 30.36;

Idaho Falls, 30.33; Winnemucca, 30.31; Carson City, 30.27; Lander, 30.25. The lowest mean pressures were in the Canadian Provinces. The lowest were: Swift Current, 29.83; Calgary and Minnedosa, 29.85; Battleford, 29.87; Edmonston and Qu'Appelle, 29.88; Winnipeg, 29.89.

As compared with the normal for December, the mean pressure was in excess along the Atlantic, Pacific, and Gulf coasts and over the Rocky Mountain Plateau Region. The greatest excesses were: Philadelphia and Harrisburg, 0.16; Halifax, 0.15; Sydney, 0.14; Salt Lake City, 0.12. The greatest deficits were: Swift Current, 0.30; Calgary, 0.27; Minnedosa, 0.25; Qu'Appelle, 0.24; Winnipeg and Williston, 0.21.

As compared with the preceding month of November, the pressures, reduced to sea level, show a decided rise in California, Utah, and Arizona, and a decided fall in Manitoba, Saskatchewan, and Athabasca. The greatest rises were: Fresno, 0.17; Independence and Sacramento, 0.15; San Francisco, Red Bluff, and Salt Lake City, 0.14. The greatest falls were: Qu'Appelle, 0.18; St. John's, Edmonston, and Minnedosa, 0.17; Williston, 0.16.

AREAS OF HIGH AND LOW PRESSURE.

By Prof. H. A. HAZEN.

The month of December was remarkable for the fewness of the high areas which crossed the country and the very great number of low areas. Of the former, there were but three, with a total duration of twelve days, but of lows there were fourteen, with a duration of forty-seven days. The velocity of the highs was 20 miles per hour, that of the lows was nearly 32 miles per hour. The accompanying table exhibits some of the facts relating to the movement of each high and low, and Charts IV and I give the tracks of their centers. Chart I shows that the general tendency of the lows has been to take a rather high latitude, though there have been a few severe Gulf storms.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.										
I.....	1, a. m.	54	109	7, a. m.	33	83	Miles. 3,110	Days. 6.0	Miles. 518	Miles. 21.6
II.....	6, p. m.	55	107	10, a. m.	33	83	1,600	3.5	457	19.0
III.....	15, a. m.	51	88	17, p. m.	41	88	1,305	2.5	482	20.1
Sums.....							5,915	12.0	1,457
Average of 3 paths.....									486	20.2
Average of 12 days.....									493	20.6
Low areas.										
I.....	1, a. m.	36	93	3, a. m.	47	61	1,905	2.0	903	37.6
II.....	3, p. m.	47	84	6, a. m.	49	55	1,985	2.5	794	33.1
III.....	4, a. m.	48	139	8, a. m.	48	60	3,390	4.0	847	35.3
IV.....	8, a. m.	38	94	12, a. m.	47	55	2,570	4.0	642	26.7
V.....	8, p. m.	49	136	15, p. m.	47	57	4,715	7.0	674	24.1
VI.....	11, p. m.	55	114	14, p. m.	49	84	1,375	3.0	458	19.1
VII.....	14, a. m.	49	126	18, a. m.	49	89	2,290	4.0	558	23.2
VIII.....	17, a. m.	33	106	21, a. m.	44	85	2,015	4.0	504	21.0
IX.....	19, a. m.	48	137	23, a. m.	51	61	3,480	4.0	870	36.2
X*.....	23, a. m.	54	117							
Xa.....	23, p. m.	28	100	25, p. m.	51	89	1,645	2.0	322	34.2
XI.....	25, a. m.	53	117	26, p. m.	43	56	1,160	1.5	773	32.2
XII.....	25, p. m.	33	89	27, p. m.	50	68	1,720	2.0	360	35.8
XIII.....	26, p. m.	53	119	29, p. m.	51	83	1,740	3.0	580	24.2
XIV.....	28, a. m.	88	103	31, p. m.	52	65	3,100	3.5	1,240	51.7
Sums.....							32,930	46.5	10,525
Mean of 14 paths.....									752	31.3
Mean of 46.5 days.....									709	29.5

* Coalesced with Xa.

HIGH AREAS.

I.—The highest pressure of the month, 30.84, was noted on the first day to the north of Montana. The central high pressure moved rapidly southward to Texas, where it remained nearly stationary for two days and then moved east, reaching the Florida coast on the 7th, a. m. During the progress of this high the pressure remained far above the normal in Montana, but with no motion. The lowest temperature of the month accompanied this high, —24°, at Have on the 2d, a. m. A notable cold wave, with a fall in temperature of 30°, at Pittsburg on the 3d, a. m., and at Boston p. m. of the same day, was due in part to the cold air drawn from this high into the rear of low No. I.

II.—This high first appeared north of Montana on the 6th, p. m. Like No. I, its motion was southward, reaching Missouri on the 9th. It was last noted in southern Illinois on the 10th, a. m. During its progress an area of high pressure remained stationary in the middle Plateau Region. On the 8th, p. m., a ridge of high pressure connected the two highs. It may be said that No. II was gradually absorbed by the rather permanent high in the Plateau Region.

III.—The pressure continued high and without motion in the Plateau Region till the 14th, a. m. High area No. III appeared to the north of Lake Superior on the 15th, a. m. The first intimation of the presence of No. III came from the winds which began to blow from the northwest, though there was a high area in the southeast, which was the lower part of a ridge of stationary high pressure trending southwest and northeast. The pressure at White River rose 0.22 in the next twelve hours; at Rockliffe it rose 0.52 in twenty-four hours. Area No. III moved toward the south of east, and disappeared in the Atlantic off the New England Coast on the 17th, p. m. After reaching the Atlantic a high pressure area remained nearly stationary until the 27th, forming one of the notable features of the weather during the month. The pressure continued high and without motion from the 16th to the end of the month in the Plateau Region, with one or two slight additions of high pressure from the Pacific Ocean. The position of this permanent high pressure area in the Plateau Region, the lingering of high pres-

sure off the Atlantic Coast, and the high temperature over nearly the whole country were the prominent features of the month.

LOW AREAS.

I.—The month opened with a trough of low pressure extending from Texas to Lake Superior, with a special slight depression in Arkansas. This trough moved northeast and disappeared in the Gulf of St. Lawrence on the 3d, a. m. A maximum velocity of 38 miles per hour was noted at Eastport on the 2d, p. m. The heaviest rainfall in twelve hours was 1.64 inch at Halifax on the 3d, a. m.

II.—First noted to the north of Lake Superior on the 3d, p. m. It moved to the south of east, reaching the Atlantic on the 5th, p. m. Then it moved very rapidly to Newfoundland in the next twelve hours. A wind velocity of 52 miles per hour was reported at Eastport on the 6th, a. m. The precipitation attending this storm was very small, though widely distributed in the interior; on reaching the coast the rain increased, 1.17 inch being reported from St. Johns on the 6th, a. m.

III.—This storm was first noted off the north Pacific Coast on the 4th, a. m. Its motion was nearly due east, and it reached the Gulf of St. Lawrence on the 8th, a. m. The highest wind reported was 46 miles per hour at Duluth on the 7th, a. m.

IV.—First noted in southwest Arkansas on the 8th, a. m. It reached the Atlantic Coast of north Florida in two days, then turned northeast and reached Newfoundland on the 12th, a. m. A wind of 65 miles per hour was reported from New York, N. Y., on the 11th, a. m., and one of 68 miles at Block Island on the 11th, p. m., but this was partly brought about by the proximity of low No. V in Kentucky.

V.—First noted off the north Pacific Coast on the 8th, p. m. Its apparent motion was east and southeast, reaching the south Atlantic Coast on the 12th, p. m., then it turned northeast and reached Newfoundland on the 15th, p. m. A wind of 68 miles was reported at Kittyhawk on the 13th, p. m. This low was notable for the length of its path and for the meager rainfall throughout its course.

VI.—First noted to the north of Montana on the 11th, p. m. Its path lay to the north of telegraph stations of observation and disappeared on the 14th, p. m., to the north of Lake Superior.

VII.—First noted off the north Pacific Coast on the 14th, a. m., where it was a very severe storm. A wind of 55 miles was reported from Fort Canby on the 14th, p. m., and at the same time a rainfall of 0.92 inch in twelve hours was reported from Seattle. The path of No. VII was eastward and it disappeared over Lake Superior on the 18th, a. m. A cold wave followed in the rear of this storm over the region west of the Mississippi River. A fall in temperature of 32° was reported at Helena on the 16th, a. m., and at Pueblo on the 17th, a. m.

VIII.—Originated in New Mexico on the 17th, a. m. Its course was northeastward for four days and disappeared in Michigan. Very heavy precipitation attended or preceded this storm as it moved northward, though almost none was noted on the Gulf. At Springfield, Ill., 6.66 inches fell between 17th, a. m., and 20th, a. m., and 5.06 inches at Chicago during the same time. It is a little remarkable that with all this rainfall the violence of the storm rapidly diminished and it had entirely disappeared on the 21st.

IX.—First noted off north Pacific Coast on the 19th, a. m. Its course was eastward, largely beyond stations of observation, and it disappeared in the Gulf of St. Lawrence on the 23d, a. m. A wind of 48 miles was reported at Buffalo on the 22d, a. m.

X.—A depression had existed to the north of Montana for several days, but it did not appear to move till the 23d, a. m.,

when a pressure of 28.88 was reported from Edmonton. In twenty-four hours the lowest pressure was in Manitoba. This storm cannot be traced farther, but it may have influenced or coalesced with No. Xa.

Xa.—First noted in southern Texas on the 23d, p. m. Its motion was very rapid north-northeast, and it was last noted to the north of Lake Superior on the 25th, p. m. A widely extended cold wave followed in the wake of this storm and continued behind low area No. XII. The heaviest rainfall was 1.52 inch in twelve hours at Kansas City, which is in marked contrast to the precipitation accompanying low No. VIII, though the two storms had almost exactly the same trajectory.

XI.—First noted to the north of Montana on the 25th, a. m. This storm either filled up in South Dakota on the 26th, p. m., or was absorbed by No. XIII. Only traces or very light rains accompanied it.

XII.—A trough-like depression extending from the Gulf of Mexico to Lake Huron was left by area No. Xa. On 25th p. m., the map shows a slight concentration of this trough in Mississippi. Over 2.50 inches of rain in twenty-four hours fell at Meridian. This storm moved rather rapidly in a northeast direction and was last noted at the mouth of the St. Lawrence on the 27th, p. m. Abundant rainfall characterized the onward progress of this depression. The highest wind of the month, 72 miles, was reported from New York, N. Y., on the 27th, a. m. The same velocity was again reported on the 31st, a. m. A continuation of the cold wave accompanying No. Xa caused a fall of 36° in twenty-four hours at Parkersburg. This was the most widely extended and united cold wave of the month in the eastern portion of the United States.

XIII.—This low was first noted to the north of Montana on the 26th, p. m. Its course was a little south of east, and it was last noted to the north of Lake Superior on the 29th, p. m. It was followed by a severe cold wave in the Missouri Valley and middle Slope, a fall of 34° in twenty-four hours and to 4° being reported at Cheyenne on the 28th, p. m., and one of 34° and to -2° at Moorhead on the 29th, a. m. A wind of 38 miles was felt at Marquette on the 28th, a. m., and at Duluth on the 29th, a. m. Almost no precipitation attended this low, though the pressure reached 29.00 near its center on the 27th, a. m.

XIV.—First noted in Colorado on the 28th, a. m., within a trough extending to and including No. XIII in Minnesota. Its course was southeast, reaching the Gulf of Mexico the next morning. Thence it moved northeast, reaching the mouth of the St. Lawrence on the 31st, p. m. The lowest pressure of the month, 28.84, was reported from Quebec on the 31st, a. m. Rather heavy rains attended this storm.

LOCAL STORMS.

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

No local storms, properly so called, were reported during December; the numerous cases of high winds are given under that heading.

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 temperature published in Table I, for the regular stations of the Weather Bureau, is the simple mean 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 IV for 29 stations selected out of 82 that maintain continuous thermograph records.

The distribution of the monthly mean temperature of the air over the United States and Canada is shown by the dotted isotherms on Chart II; the lines are drawn over the high irregular surface of the Rocky Mountain Plateau, 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, 67.8; Jupiter, 64.4; Tampa, 59.2; Port Eads, 58.4; Corpus Christi, 56.9. The lowest mean temperatures were: In Canada: Edmonton, 14.9; Battleford, 6.5; White River, 11.2; Winnipeg, 8.2; Minnedosa, 8.1; Qu'Appelle, 8.8. In the United States: St. Vincent, 10.2; Moorhead, 14.4; Williston, 16.0.

As compared with the normal for December, the mean temperatures for the current month were deficient throughout the Rocky Mountain Plateau Region, the Pacific Coast, and the South Atlantic and Gulf States, but were in excess throughout Canada, the Lake Region, the Middle States, and New England. The greatest excesses were: Pierre, 6.0; Minnedosa, 5.6; Medicine Hat, 5.4; Chatham, 5.3; Williston, 5.0. The greatest deficits were: Salt Lake City, 8.1; Santa Fe, 6.8; Winnemucca, 5.0; Pensacola, 4.3; Phoenix, 4.2; Lander, 4.0.

Considered by districts the mean temperatures for the current month show departures from the normal as given in Table I. The greatest positive departure was: North Dakota, 3.5. The greatest negative departures were: Middle Plateau, 4.7; Southern Plateau, 4.2.

The years of highest and lowest mean temperatures for December are shown in Table I of the REVIEW for December, 1894. The mean temperature for the current month was not the highest on record at any regular station of the Weather Bureau. It was the lowest on record at: Tampa, 59.2; Salt Lake City, 26.4; Fresno, 43.6; San Francisco, 48.6; Point Reyes Light, 48.0.

The maximum and minimum temperatures of the current month are given in Table I. The highest maxima were: 86, Los Angeles (frequently); 81, Jupiter (26th); 80, Jacksonville (2d), Tampa (1st), Key West (26th), Yuma (12th), San Luis Obispo (11th). The lowest maxima were: 38, St. Vincent (15th); 40, Dubuque (17th); 41, Idaho Falls (20th); 42, Minneapolis (17th); 43, Moorhead (28th); 44, Williston (27th). The highest minima were: 52, Key West (14th); 39, Jupiter (14th), San Francisco (30th), Point Reyes Light (frequently). The lowest minima were: -24, Havre (2d); -22, St. Vincent (26th); -18, Bismarck (2d); -17, Moorhead, (2d).

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: Northfield, 61; Nantucket, 59; Vineyard Haven, 62; Buffalo, 63; Fresno, 71; Carson City, 65; Roseburg, 66; Port Angeles, 64; Tatoosh Island, 60. The minimum temperatures were the lowest on record at: Columbia, 10; Fresno, 6; Eureka, 0.

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: Carson City, 44; Lander and Pueblo, 43; Denver and El Paso, 42; Jacksonville, St. Vincent, Huron, Rapid City, and San Luis Obispo, 41. Among the extreme monthly ranges the largest values were: Havre, 84; Northfield, 74; Columbia, Mo., 69; Rapid City, 67; Bismarck, Huron, Pueblo, 66. The smallest values were: San Francisco, 21; Point Reyes