

6 ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean atmospheric pressure for June, 1891, as determined from observations taken daily at 8 a. m. and 8 p. m. (75th meridian time), is shown on Chart II by isobars. The departure of the mean pressure for June, 1891, obtained from observations taken twice daily at the hours named, from that determined from hourly observations, varied at the stations named below, as follows:

Station.	Departure.	Station.	Departure.
Duluth, Minn.....	+ .007	Chicago, Ill.....	.000
Lynchburgh, Va.....	+ .004	Saint Louis, Mo.....	.000
Cleveland, Ohio.....	+ .004	Memphis, Tenn.....	-.001
New York City.....	+ .006	Saint Paul, Minn.....	-.001
Key West, Fla.....	+ .007	Bismarck, N. Dak.....	-.002
Eastport, Me.....	+ .008	Denver, Colo.....	-.004
Boston, Mass.....	+ .008	Fort Assiniboine, Mont.....	-.004
Atlanta, Ga.....	+ .008	Salt Lake City, Utah.....	-.007
Wilmington, N. C.....	+ .009	Santa Fé, N. Mex.....	-.009
Albany, N. Y.....	+ .010	El Paso, Tex.....	-.015
Pittsburg, Pa.....	+ .010	San Francisco, Cal.....	-.015
Jacksonville, Fla.....	+ .011	Yuma, Ariz.....	-.020

The mean pressure was highest along the north Pacific coast between the 40th and 45th parallels, where it was slightly above 30.00, and it was 30.00 at Port Huron, Mich., Augusta, Ga., and Titusville, Fla. The mean pressure was lowest over the west part of the southern plateau region, where it was below 29.75, and it was below 29.80 in the British Possessions north of Montana. The mean pressure for June is generally highest east of the Mississippi and south of the Ohio rivers, where it is above 30.05, and lowest over the west part of the southern plateau, where it is below 29.80.

A comparison of the pressure chart for June, 1891, with that of the preceding month shows that there was a general decrease in mean pressure, except on the Pacific coast between the 40th and 45th parallels, and thence over north Oregon and south Washington. The greatest decrease in pressure occurred from the west Gulf coast northward between the Mississippi River and the Rocky Mountains to the British Possessions, where it was more than .15. The greatest increase in pressure, .01, was noted at Walla Walla, Wash., and Eureka, Cal.

The mean pressure was below the normal, except in the Lake region and the Saint Lawrence Valley. The greatest departure below the normal pressure occurred on the eastern slope of the Rocky Mountains, and thence southeastward to the south Atlantic and Florida coasts, over the south part of the southern plateau region, and on the north and south Pacific coasts, where it was more than .05. In the Lake region and Saint Lawrence Valley the departure above the normal pressure was less than .05.

The monthly barometric range at each station of the Signal Service is given in the table of Signal Service data.

HIGH AREAS.

The table at the end of this chapter shows the principal features of the high and low areas of the month.

Six well-defined high areas appeared, the average number noted for the corresponding month of the last seventeen years being 5.8. Of the high areas traced for the current month, two were apparently off-shoots of the Pacific area of high pressure, two advanced from the British Northwest Territory, one first appeared on the middle-eastern slope of the Rocky Mountains, and one apparently developed in the upper Mississippi valley. One of the high areas from the Pacific coast moved east-northeast to Manitoba, and the other southeastward to Indian Territory, where it was central the evening of the 30th. Two high areas reached the Atlantic coast, one of which moved southeast from the British Northwest Territory and the other eastward from the middle slope of the Rocky Mountains. The following is a brief description of the high areas referred to:

I.—Advanced from the British Northwest Territory and the morning of the 4th was central north of Lake Superior; it remained over the Lake region until the evening of the 7th,

and passed thence to Virginia by the evening of the 8th; on the 9th the centre moved off the middle Atlantic coast, and the pressure was high from Nova Scotia to Virginia. The highest pressure attending this high area, and the highest reported for the month, was 30.54, at White River, Ont., the morning of the 5th. Light frost was reported the morning of the 4th in upper Michigan, the morning of the 5th in the lower lake region, and the mornings of the 6th and 8th in north New England. The greatest abnormal temperature fall in 12 hours, 24°, was noted at Dubuque, Iowa, on the 4th.

II.—Appeared over Wyoming the morning of the 10th, moved eastward to the west part of the lower lake region by the morning of the 12th, and passed thence southeast to the Virginia coast by the morning of the 14th, with highest pressure, 30.22, at Port Huron, Mich., the morning of the 12th.

III.—Appeared off the Oregon coast the morning of the 15th and moved thence north of east to Manitoba by the morning of the 17th, after which its course cannot be determined. The highest pressure noted in connection with this high area was 30.24, at Fort Buford, N. Dak., and Qu'Appelle, N. W. T., the morning of the 16th.

IV.—Appeared over the upper Mississippi valley the morning of the 23d, moved to the west part of the lower lake region on that date, and passing thence southward was last located over east Kentucky the morning of the 26th, the highest pressure noted during its course being 30.20, at Port Huron, Mich., the morning of the 24th. The greatest abnormal fall in temperature in 12 hours, 24°, was reported at Duluth, Minn., on the 23d.

V.—Advanced from the British Northwest Territory and was central over Manitoba the morning of the 25th, whence it moved eastward north of the Lake region and disappeared during the 27th, the highest pressure reported being 30.32, at Port Arthur, Ont., the morning of the 26th.

VI.—Was central off the north Pacific coast on the 28th and moved thence eastward to west Montana by the morning of the 29th, and thence southeastward to Indian Territory by the evening of the 30th, its rate of advance, 39 miles per hour, being the most rapid of any high area noted for the current month. The highest pressure reported during the passage of this high area was 30.38, at Olympia, Wash., the morning of the 28th.

LOW AREAS.

Ten low areas, or general storms, whose course could be plotted for three or more consecutive twice-daily observations appeared during the month, the average number traced for the corresponding month of the last nineteen years being 9.1. As usual in June the low areas of the current month were generally ill-defined and of small energy, with tracks confined to the region lying west of the Mississippi and north of the Ohio rivers. June is generally marked by numerous severe local storms from the Alleghany to the Rocky Mountains, their occurrence being most frequent in the states of the middle and upper Mississippi and lower Missouri valleys. The more important local storms of the current month will be referred to under this heading, and described under the heading "Local storms." Of the low areas traced three first appeared on the southeast slope of the Rocky Mountains, three in the region lying between the middle Missouri valley and the Rocky Mountains, three over the middle plateau region, and one on the north Pacific coast, and the tracks converged toward the Great Lakes and the Saint Lawrence Valley. Numbers I, IV, IX, and X were apparently off-shoots of the southern plateau area of low pressure. The low area which appeared off the north Pacific coast traversed the continent in six and one-half days and passed off the Nova Scotia coast on the 24th. The average rate of advance of the low areas, 22 miles per hour, was somewhat less than usual for June.

From the 5th to the 8th, and 29th and 30th, low pressure prevailed north of Montana; on the 10th an area of low pres-

sure moved northeast from north Texas to the upper Mississippi valley, and on the 17th and 18th an area of low pressure was central near Chesapeake Bay.

The following is a description of the low areas whose tracks appear on Chart I:

I.—Was apparently an off-shoot of the southern plateau area of low pressure, and on the morning of the 1st was central over the east part of the middle plateau, whence it moved northeast to Nebraska by the evening of the 2d, and thence southeast, and apparently dissipated over the north part of the Ohio Valley the night of the 3d. The storm decreased in energy after advancing east of the middle Missouri valley, the lowest pressure, 29.46, being noted at Montrose, Colo., the morning of the 1st, and at Cheyenne, Wyo., the evening of the 1st. Rain fell generally in advance of the storm-centre, the rain-area extending eastward to New England by the 3d. Thunder and hail storms occurred in the middle Missouri valley on the 1st, in the upper Mississippi valley and the Lake region on the 2d, and in the upper Mississippi valley, the Lake region, and Ohio Valley on the 3d. A severe wind storm occurred at Saint Louis, Mo., the evening of the 3d, during which a velocity of 59 miles per hour was reached for ten minutes.

II.—Was central northeast of Lake Huron the morning of the 1st, whence it passed east-northeast to the region north of the Gulf of Saint Lawrence by the morning of the 2d, the lowest pressure, 29.58, being noted at Father Point, Quebec, the evening of the 1st. Rain fell in the lower Saint Lawrence valley on the 1st, and fog was reported along the New England and Nova Scotia coasts on the 1st and 2d.

III.—Appeared over west Texas on the 5th and passed thence northeast to southeast Kansas, thence east over south Missouri, and apparently dissipated in the middle Mississippi valley during the 7th, the lowest pressure reported being 29.82, at Abilene, Tex., the evening of the 5th. Rain fell from the middle and southeast slopes of the Rocky Mountains to the Mississippi River on the 5th; on the 6th the rain-area extended to the middle Atlantic coast, and on the 7th rain fell in the middle Mississippi valley, and from the lower Mississippi valley northeastward to the middle Atlantic coast. Severe thunder-storms occurred in Texas on the 5th, thunder and hail storms in the lower Ohio valley on the 6th, and thunder-storms with very heavy rainfall in Louisiana and the east Gulf states on the 7th.

IV.—Was apparently an off-shoot of the southern plateau area of low pressure and was central over east Utah the evening of the 8th, whence it moved northeast to the region north of Lake Superior by the 10th, and thence to the lower Saint Lawrence Valley by the evening of the 11th, its rate of progress, 31 miles per hour, being the greatest noted for the current month. The lowest pressure reported in connection with this low area was 29.38, at Salt Lake City, Utah, the evening of the 8th. On the 9th rain fell from north Minnesota to Washington. During the 10th a low area advanced from north Texas to the middle Mississippi valley, and, in conjunction with number IV, caused general rain from the Great Lakes over the east Gulf states. On the 11th rain fell in areas east of the Mississippi River and the upper lake region. Local storms occurred in Missouri and Arkansas on the 10th, and in the lower lake region and Saint Lawrence Valley on the 11th.

V.—Apparently originated over the plateau region, and the evening of the 12th was central over southeast Montana. It remained nearly stationary over North Dakota during the 13th and 14th, with wind velocity exceeding 50 miles per hour in North and South Dakota, and moved thence over Lake Superior and north of the Saint Lawrence Valley to the Gulf of Saint Lawrence by the evening of the 16th, the lowest pressure, 29.36, being noted at Fort Buford, N. Dak., the morning of the 13th. Rain fell in the Red River of the North and middle Missouri valleys on the 12th, there were small areas of light rain in the central valleys on the 13th and 14th, and light rain in the extreme northwest on the 14th. On the 15th rain

fell from the Lake region to the Rocky Mountains, and on the 16th rain fell in areas in the Lake region, the Saint Lawrence Valley, and the Maritime Provinces. Local storms occurred in Minnesota and the Dakotas on the 12th, in the Dakotas on the 13th, from the west part of the Lake region to the middle Missouri valley on the 14th, a well-defined tornado being reported at Milwaukee, Wis., in the afternoon, in Indiana and Ohio on the 15th, and in the lower lake region and middle Atlantic states on the 16th, a notable storm of this date being the one which visited Bergen Point, N. J., opposite Staten Island.

VI.—This low area had the slowest movement of any plotted for the current month, its average rate of advance being but 11 miles per hour. It appeared central over west Kansas the morning of the 16th, and, moving east-northeast, apparently dissipating over the north-central Ohio valley the night of the 19th, the lowest pressure, 29.52, being noted at Keokuk, Iowa, the evening of the 18th. Rain was general from the Mississippi River to the Rocky Mountains and in the upper lake region on the 16th. On the 17th the rain-area extended eastward to the Atlantic coast states, and a cyclonic area of small energy formed near Chesapeake Bay, whence it apparently passed to sea by the morning of the 18th. On the 18th rain prevailed generally east of the lower Missouri valley, and along the middle and east Gulf coasts, and on the 19th the rain-area extended from the Lake region to the east Florida coast. Local storms occurred in the Missouri and middle Mississippi valleys, and excessive rainfall in parts of the west Gulf states on the 16th; local storms in the lower Missouri and middle and lower Mississippi valleys, and excessive rainfall in the middle and east Gulf states on the 17th; and local storms in the Ohio Valley, Missouri, Arkansas, and the west part of the Lake region on the 19th.

VII.—Appeared off the north Pacific coast the morning of the 17th, reached Manitoba on the 20th, and moving thence south of east passed off the Nova Scotia coast during the 24th, its average rate of advance east of the 115th meridian being but 15 miles per hour. Rain fell in Washington on the 17th. During the 18th the rain-area extended eastward over Montana, and light rain continued in that region during the 19th and 20th. Rain fell from the west part of the Lake region to the lower Mississippi valley on the 21st. On the 22d rain fell from the Lake region eastward over New England and southward to the south Atlantic coast, and fog was reported on the middle Atlantic and south New England coasts. On the 23d rain fell in the Atlantic coast states, and fog was reported along the New England coast. On the 24th the rainfall was confined to the Canadian Maritime Provinces. The lowest pressure during the passage of this low area was 29.36, at Calgary, N. W. T., the evening of the 17th. On the 17th the wind velocity exceeded 50 miles per hour on the south Washington coast. On the 21st excessive rainfall occurred in Wisconsin, and a severe local storm was reported at Cairo, Ill. Local storms were also reported on this date in the lower Missouri and Ohio valleys and Tennessee. On the 22d thunder-storms occurred in the upper Ohio valley and thence to the Atlantic coast.

VIII.—Was first located over north Texas the morning of the 19th, whence it moved northeast to Indiana by the evening of the 20th, after which it apparently recurved northward and united with number VII. The lowest pressure, 29.46, was reported at Fort Sill, Okla. T., the morning of the 19th, and at Abilene, Tex., and Fort Sill the evening of the 19th. Rain fell east and northeast of the storm-centre on the 19th, and on the 20th the rain-area extended from the middle Mississippi valley to the middle Atlantic coast. Excessive rainfall was reported in Ohio the morning of the 20th, and wind velocities of 30 to 38 miles per hour were noted in the middle Mississippi valley. Severe local storms occurred in Arkansas and south Missouri on the 19th, and in Arkansas, Kentucky, and Illinois on the 20th.

IX.—Was apparently an off-shoot of the southern plateau

area of low pressure, and was central over west South Dakota the evening of the 22d, whence it advanced to east Manitoba by the evening of the 23d, and passed thence north of the region of observation, its course being influenced by high area IV, which occupied the Lake region and Ohio Valley on the 23d and 24th. The passage of this storm was unattended by general rain, save in the Valley of the Red River of the North. The lowest pressure observed was 29.46, at Bismarck, N. Dak., the morning of the 23d. Local storms with exceptionally heavy rainfall occurred in northwest Iowa on the 23d and 24th, and the wind velocity exceeded 40 miles per hour in North and South Dakota on the 23d.

X.—Was apparently an off-shoot of the southern plateau area of low pressure, and the morning of the 26th was central over east Wyoming, whence it passed to Manitoba by the 27th,

and thence slowly east-southeast to the region north of Lake Huron by the evening of the 29th, after which it apparently dissipated. The lowest pressure noted during the passage of this low area was 29.36, at Minnedosa, Man., the evening of the 27th. Rain fell in the middle Missouri valley on the 26th, from Kansas to the Lake region on the 27th, in the Lake region, the middle and lower Ohio valleys, and the extreme northwest on the 28th, and generally in the Lake region, the middle Ohio valley, Tennessee, and the east Gulf states on the 29th. Local storms occurred in Colorado on the 25th, heavy rains in Nebraska and Kansas on the 26th, severe local storms with exceptionally heavy rain from Kansas to Wisconsin on the 27th, severe local storms from Kansas over the middle Ohio valley on the 28th, and in the states of the middle Mississippi valley on the 29th.

Tabulated statement showing principal characteristics of areas of high and low pressure.

Barometer.	First observed.		Last observed.		Duration.	Velocity per hour.	Maximum pressure change and maximum abnormal temperature change in twelve hours and maximum wind velocity.											
	Date.	Lat. N.	Long. W.	Lat. N.			Long. W.	Station.	Rise.	Date.	Station.	Fall.	Date.	Station.	Direction.	Miles per hour.	Date.	
High areas.	°	°	°	°	Days.	Miles.		Inch.										
I.....	4	48	97	39	73	5.5	10	Fort Sully, S. Dak.....	.46	3	Dubuque, Iowa.....	24	4	Chicago, Ill.....	ne.	35	5	
II.....	10	43	105	38	77	4.0	19	Salt Lake City, Utah.....	.48	0	Saint Vincent, Minn.....	15	6	Sault de Ste. Marie, Mich.....	nw.	23	11	
III.....	15	47	106	51	97	1.5	21	Port Arthur, Ont.....	.30	16	Duluth, Minn.....	22	16	Pueblo, Colo.....	n.	36	16	
IV.....	23	42	88	37	83	3.0	12	White River, Ont.....	.30	23	do.....	24	23	Kitty Hawk, N. C.....	ne.	34	24	
V.....	25	50	97	48	82	2.0	15	Winnipeg, Man.....	.32	25	Portland, Me.....	19	25	Port Huron, Mich.....	ne.	34	26	
VI.....	29	48	126	35	97	2.0	39	Minnedosa, Man.....	.32	25	Santa Fé, N. Mex.....	12	29	Rapid City, S. Dak.....	nw.	36	29	
Mean.....						3.0	19	Pueblo, Colo.....	.34	29		19				34		
Low areas.									Fall.			Rise.						
I.....	1	38	109	42	90	2.5	21	Cheyenne, Wyo.....	.26	1	Milwaukee, Wis.....	15	3	Saint Louis, Mo.....	w.	59	3	
II.....	1	48	77	51	62	1.0	31	Father Point, Quebec.....	.34	2	Chatham, N. B.....	10	1	Montreal, Quebec.....	sw.	32	2	
III.....	5	35	100	37	91	1.5	17	Saint Louis, Mo.....	.18	5	Kansas City, Mo.....	12	6	Chicago, Ill.....	e.	44	6	
IV.....	8	42	111	49	70	3.0	31	Fort McKinney, Wyo.....	.38	8	Duluth, Minn.....	18	8	Huron, S. Dak.....	se.	56	9	
V.....	12	45	106	48	60	4.0	29	Father Point, Quebec.....	.26	16	Kansas City, Mo.....	18	10	Huron, S. Dak.....	se.	56	13	
VI.....	16	38	100	41	86	3.5	11	Saint Louis, Mo.....	.16	17	Sioux City, Iowa.....	15	16	Cairo, Ill.....	sw.	42	16	
VII.....	17	52	114	44	66	6.5	15	Calgary, N. W. T.....	.48	17	Olympia, Wash.....	16	16	Pensacola, Fla.....	sw.	42	17	
VIII.....	19	33	101	40	87	1.5	25	Abilene, Tex.....	.28	18	Kansas City, Mo.....	10	20	Springfield, Mo.....	nw.	38	20	
IX.....	22	45	103	52	97	1.0	25	Denver, Colo.....	.34	22	Cheyenne, Wyo.....	23	22	Bismarck, N. Dak.....	se.	48	23	
X.....	26	45	104	48	83	3.5	18	Saint Vincent, Minn.....	.40	26	Omaha, Nebr.....	14	27	Sioux City, Iowa.....	se.	52	26	
Mean.....						2.8	22		.31			15				51		

NORTH ATLANTIC STORMS FOR JUNE, 1891 (pressure in inches and millimetres; wind-force by Beaufort scale).

The paths of the storms that appeared over the west part of the north Atlantic Ocean during June, 1891, are shown on Chart I. These paths have been determined from international observations by captains of ocean steamships and sailing vessels received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

Severe storms are unusual in the middle latitudes of the north Atlantic Ocean in June, and those of tropical or sub-tropical origin generally recurve far to the eastward of the American coast and seldom acquire destructive strength. The storms of the current month about corresponded in number and character with those previously traced for June, and no storms appeared in the vicinity of the West Indies.

On the 1st a storm of small energy was central between Bermuda and the Grand Banks, whence it advanced to the southwest edge of the Grand Banks by the 2d, recurved to south of Nova Scotia by the 3d, moved southeast to about the 42d parallel by the 4th, thence to the east edge of the Grand Banks by the 5th, and disappeared north of the region of observation by the 6th, the lowest pressure, about 29.60 (752), being noted on the 5th and 6th. From the 6th to the 11th the pressure remained high along the Atlantic coast. On the 1st a storm was central west of the British Isles, with pressure about 29.40 (747) and fresh gales. On the 2d a storm appeared central northeast of the Azores, with pressure below 29.40

(747), whence it passed to southwest of Ireland by the 3d; during the 4th and 5th this storm remained central west and southwest of Ireland, and by the 7th had advanced over the Bay of Biscay. A second storm was central southwest of Ireland on the 9th, whence it apparently passed east over the Bay of Biscay. Following the passage of these storms high pressure continued over and near the British Isles during the second decade of the month.

On the 9th a storm was central east of the Grand Banks, whence it passed northward and disappeared north of the region of observation after the 10th. This storm was attended by the lowest pressure noted for the month, the barometer falling to about 29.00 (736) on the 10th, when the storm was central northeast of the Grand Banks. On the 12th a storm which was the continuation of low area IV was central on the west coast of the Gulf of Saint Lawrence; it passed south of Newfoundland during the 13th and 14th, and thence moved northeastward and disappeared north of the region of observation after the 15th. On the 17th a storm which was a continuation of low area V was central south of Newfoundland, whence it passed northeast and disappeared north of the region of observation. On the night of the 17th a storm of small energy apparently developed near Chesapeake Bay, whence it passed east-northeast to east of the Grand Banks by the 20th, and thence northeastward beyond the region of observation. Low pressure continued over mid-ocean until the 24th, on which