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INTRODUCTION.

This REVIEW treats generally the meteorological conditions of the United States and Canada for June, 1887, and is based upon reports of regular and voluntary observers of both countries. Descriptions of the storms which occurred over the north Atlantic Ocean during the month are also given, and their approximate paths shown on chart i, on which also appears the distribution of icebergs and field ice reported. In tracing the centres of the paths of these storms, data from the reports of two hundred and twenty-one vessels have been used. Very severe weather was reported off the coast of the United States from the 12th to the 16th, and unusually strong summer gales were experienced over, and to the eastward of, the Banks of Newfoundland from the 15th to the 17th, inclusive. Dense fog prevailed in the trans-Atlantic routes during a considerable portion of the month.

On chart i for this month are traced the paths of ten areas of low pressure, which number is one more than the average for June during the last fourteen years.

The month has been decidedly warmer than the average June over the northern portions of the country from Dakota eastward to the lower lake region. In Florida, along the immediate Gulf coast, and in the northern plateau region, the mean temperature was from 2° to 4° colder than the average. In all other parts of the country the temperature differed but slightly from the June normal.

Large deficiencies in the monthly precipitation are shown over the central valleys and upper lake region, while a marked excess occurs along the Gulf and south Atlantic coasts and in Florida.

The most severe local storms of the month occurred from the 19th to 22d in the middle Atlantic states.

In the preparation of this REVIEW the following data, received up to July 20, 1887, have been used, viz., the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and thirty-three Signal Service stations and twenty-two Canadian stations, as telegraphed to this office; one hundred and seventy-four monthly journals and one hundred and sixty-three monthly means from the former and twenty-two monthly means from the latter; two hundred and sixty-five monthly registers from voluntary observers; sixty monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs furnished by the publishers of "The New York Maritime Register;" monthly weather reports from the local weather services of Alabama, Dakota, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New England, New Jersey, North Carolina, Ohio, Oregon, South Carolina, and Tennessee; and of the Central Pacific Railway Company; trustworthy newspaper extracts, and special reports.

ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean pressure for June, 1887, determined from the tri-daily telegraphic observations of the Signal Service, is shown by isobarometric lines on chart ii, from which it will be seen that the pressure was greatest on the north Pacific coast, where the mean for the month at stations in Washington Territory amounted to 30.05. As in the preceding month, the region of low mean pressure embraces the Rocky Mountain districts, but the southern part extends further westward, reaching the central and southern Pacific coasts. The region of least pressure is indicated by the isobar for 29.7, which includes parts of California, Nevada, and Arizona. Over the Rocky Mountain districts and California the barometric means generally range from 29.7 to 29.9. From the one hundredth meridian eastward to the Atlantic coast there is a gradual increase of pressure from 29.9 to 30.0, or slightly above.

As compared with the mean pressure for May, deficiencies are shown over much the greater part of the country, the only exceptions being the north Pacific coast, the upper and central portions of the Mississippi valley, the Ohio Valley, Tennessee, and the east Gulf states, where there is a slight excess, generally less than .03. The deficiencies are greatest over California and the central and southern Rocky Mountain districts, where they range from .10 to .13.

The departures from the normal pressure for the various stations are given in the tables of miscellaneous meteorological data; they are also graphically exhibited on chart iv by lines connecting stations of normal or equal abnormal values. In Washington Territory, and over the country east of the ninety-fifth meridian to the north of the thirty-fifth parallel, the mean pressure for June is above the normal; the departures are less than .05, except in the northern part of the upper lake region, in the Saint Lawrence Valley, New England, and the Canadian Maritime Provinces, where they range from .05 to .13, being greatest over Nova Scotia. In all other districts the mean pressure is below the normal. Along the Gulf coast the deficiencies range from .01 to .05; in the central and southern Rocky Mountain districts, and over the region to the north of Montana, the deficiencies range from .05 to .15.

BAROMETRIC RANGES.

The monthly barometric ranges at the various Signal Service stations are also given in the table of miscellaneous data. The ranges were greatest over New England, the upper lake region, northern slope, northern and middle plateau districts; they were least in the southern districts. The following are some of the extremes:

Greatest.	Inch.	Least.	Inch.
Fort Custer, Mont	1.00	Key West, Fla	0.27
Spokane Falls, Wash	0.98	Brownsville, Tex	0.27
Eastport, Me	0.87	Los Angeles, Cal	0.27
Alpena, Mich	0.85	New Orleans, La	0.28
Poplar River, Mont	0.85	San Diego, Cal	0.28
Boisé City, Idaho	0.83	Rio Grande City, Tex	0.29
Mackinaw City, Mich	0.82	Corpus Christi, Tex	0.32

AREAS OF HIGH PRESSURE.

Five areas of high pressure were observed within, or near, the limits of the United States during the month of June, 1887. Generally they were less clearly defined than the areas of high pressure of the preceding month; they were also observed in higher latitudes, and moved with less energy. One of these areas was traced from the Pacific to the Atlantic coasts. The general direction of movement was easterly until near the Atlantic coast, where their courses changed to the southward.

I.—The month opened with areas of high pressure on the north Pacific coast and in the extreme northeast, over the Maritime Provinces. The latter area disappeared quickly to the southeast, and therefore was not enumerated as one of the principal high areas traced during the month. The high area on the north Pacific coast remained in that region during the 1st and 2d; by midnight of the latter date its centre had moved eastward to Montana, and the cold area was apparently moving southeastward over the eastern Rocky Mountain slope on the morning of the 3d. The pressure decreased within the limits of this area while it passed eastward to the upper Mississippi valley and it became greatly extended, finally disappearing to the north of the Lake region during the 4th, but was followed immediately by the appearance of high area number ii north of the Gulf of Saint Lawrence. At nearly all stations on the eastern slope of the Rocky Mountains, and at many in the Mississippi, Missouri, and Ohio valleys, the lowest temperatures of the month occurred on the 1st and 2d, during the prevalence of this area of high pressure.

II.—This area moved directly southward, causing cool easterly winds along the Atlantic coast. It was east of New England on the 6th and off Cape Hatteras on the 7th, after which it passed to the permanent high area over the north Atlantic.

III.—This area of high pressure apparently formed in the upper Missouri valley on the 7th, when it was bounded by an isobar of 30.0, inclosing portions of Dakota, Montana, and Minnesota. It moved slowly eastward north of the Lake region during the 9th and 10th, attended by increasing pressure, and, at the same time, becoming greatly enlarged. The northerly winds caused by this area of high pressure extended southward to the Gulf, and they were strong on the Atlantic coast, the maximum velocity ranging from thirty-two miles on the New England coast to forty-one on the middle Atlantic, and to forty-two at Hatteras. After reaching the upper Saint Lawrence valley it was forced to the southwestward, and on the morning of the 13th it was central in the upper Ohio valley. It then moved north and east over the Lake region and Saint Lawrence Valley on the 14th, attended by generally fair or clear weather east of the Mississippi. On the 14th the direction again changed to the southeast, the centre passing over Nova Scotia, from which point it again moved southwestward, following the coast until reaching the south Atlantic states, where it disappeared by a gradual decrease of pressure during the 16th. The minimum temperatures of the month occurred in the middle, south Atlantic, and east Gulf states between the 11th and 15th.

IV.—This area of high pressure appeared to the west of Washington Territory on the afternoon of the 15th, the previous telegraphic report indicating the advance of an area of high pressure from the Pacific. After remaining almost stationary over Oregon and Washington Territory from the 16th to the 20th, it passed to the east of the Rocky Mountains, and extended southward over the central valleys; when central over western Dakota, the barometric pressure was 30.3, and no marked changes had occurred while crossing the mountains. The flow of air southward apparently caused rapid reduction in pressure as the central area approached the Mississippi Valley, and during its transit over this region it was lost as a high area. It reappeared at the 7 a. m. report of the 25th over Pennsylvania. It was forced northwestward from the coast and passed to the vicinity of Georgian Bay, where it gathered force and passed southeastward over the middle Atlantic states to the Atlantic, disappearing on the 30th. In the Lake region and central Ohio valley the lowest temperatures of the month occurred on the 24th and 25th.

V.—The history of this high area, in part, belongs to the succeeding month. It remained almost stationary from the 26th until the close of the month central near the coast of Oregon.

AREAS OF LOW PRESSURE.

Although ten areas of low pressure have been traced on chart i the month is notable for the absence of barometric disturbances. Only one feeble depression passed over the United States east of the Rocky Mountains. Disturbances were not observed on the Pacific coast to the west of the land during the month, while several low areas moved northward over the plateau regions, in some cases causing severe storms on the coast. A great portion of the month was marked by continued low pressure over the Rocky Mountain regions, where, during many days, the barometer ranged from .2 to .4 of an inch below the normal. These extended areas of low pressure did not possess sufficient energy to generate a defined motion of translation. The tracks of centres of two areas in this portion of the country are only approximately given, as in many cases the extended barometric troughs left uncertain the correct location of the centre.

The following table shows the latitude and longitude in which each area of low pressure was first and last observed and the average hourly velocity of each:

Areas of low pressure.	First observed.		Last observed.		Average progress in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
	° ′	° ′	° ′	° ′	
No. I	40 00	107 00	33 00	100 00	40.0
II	38 00	86 00	42 00	65 00	23.0
III	35 00	117 00	37 00	109 00	18.0
IV	50 00	68 00	48 00	56 00	26.0
V	38 00	116 00	39 00	107 00	23.0
VI	37 00	109 00	47 00	102 00	19.0
VII	53 00	70 00	50 00	58 00	25.0
VIII	32 00	114 00	39 00	120 00	26.0
IX	52 00	102 00	49 00	84 00	29.0
X	49 00	108 00	53 00	101 00	20.0

Mean hourly progress, 24.9 miles.

I—This area of low pressure was apparently forced to the southeast by the area of high pressure which extended over the northern plateau region during the 1st. It was well defined at the first telegraphic report of the month but disappeared when central over northern Texas at the close of the 1st day of the month, causing no change in the weather conditions east of the Mississippi. This absence of energy and rapid disappearance was probably due to the development of low area number ii to the east of, and near, the primary low area.

II.—On chart number i it will be observed that the centre of this area of low pressure was first located in the lower Ohio valley while the storm-track extends far to southwestward. The prolongation of this storm-track is intended to indicate the probable origin of this area, although its centre was not placed to the west of Louisville. This storm was very light and although the rain area attending it included the region east of the Mississippi the amount of precipitation was generally light and local. It passed northward over the lower lakes, the course changing to easterly after reaching Georgian Bay, and then passed over New England during the 3d without causing any unusual disturbance on the coast.

III.—On the morning of the 3d the barometric pressure was low over Arizona and southern California, while at the same report an area of high pressure extended from Dakota to Idaho. This high area moved to the east, while the depression passed northward to Oregon, where it was central on the morning of the 4th. During its passage to the northward light rains occurred on the Pacific coast as far south as Los Angeles, Cal., and while passing eastward general rains occurred at the northern and central Rocky Mountain stations. Over the eastern slope of the Rocky Mountains this area of low pressure ex-

tended to the northward, forming a barometric trough which extended from the Rio Grande River to Manitoba, while a secondary disturbance apparently passed far to the north. The more clearly defined low area remained central over Colorado and disappeared without causing any change in the meteorological conditions of the regions to the east of the mountain slope. The barometric pressure remained low until the 7th, but not enough energy was developed to cause a motion of translation.

IV.—This area of low pressure was at no time central within the limits of the stations of observation. It was observed on the morning of the 8th central in the lower Saint Lawrence valley, and it passed with uniform velocity to the eastward, apparently increasing in force.

V.—As in the case of area of low pressure number iii, this area also developed in the southern plateau region, and, after moving slowly to the northeast, remained central in the Rocky Mountain region until it finally disappeared on the 10th, forty-eight hours after it was first located. When the centre reached its most northerly latitude a secondary disturbance was formed to the north of Montana, but neither of these depressions could be traced to the east of the central valleys. Number v disappeared on the 10th, when the telegraphic reports indicated that there was a slight westerly movement of the surface atmosphere in that region.

VI.—This low area developed sixteen hours after the disappearance of the area of low pressure traced as number v, only one telegraphic report separating the two areas, and they probably form a single depression. The barometer continued low over the entire Rocky Mountain region during the greater part of the month, and the tracks of the centres of these slight disturbances have been located and traced with a view of indicating in a graphic manner the prevailing areas of low pressure in the Rocky Mountain districts for the month. Number vi remained almost stationary from the 11th until the 16th, and during a greater part of this period it was a well-defined disturbance which threatened the populated districts, but it passed northeastward over Minnesota and did not affect the weather conditions of the Lake region.

VII.—This storm was observed at midnight of the 15th moving eastward to the north of Quebec. It passed eastward with considerable energy, causing high winds in the Maritime Provinces and brisk winds, with showers, in New England on the 16th. The centre of disturbance is only approximately given for each of the tri-daily reports of the 16th. It passed over the north Atlantic, attended by dangerous gales, on the 17th.

VIII.—This slight depression was central south of Arizona on the 19th. It apparently moved in a northwesterly direction, following the mountain range of southern California. The telegraphic reports are not of sufficient number to enable one to satisfactorily trace the barometric disturbances which pass over the plateau regions. Generally during the past three months, numerous areas of low pressure have apparently originated over the southern plateau regions, and, after passing northward in rear of an area of high pressure, they pass to the east of the mountain range and influence the weather conditions of the Atlantic.

IX.—This is the only depression of the month observed as first central in the region north of Montana. Although traced to the eastward north of the Lake region this storm did not develope sufficient energy to cause marked changes in the weather of the United States. It moved eastward with almost uniform velocity until it reached longitude 78° W., where it apparently retreated or remained nearly stationary, while its area became more extended. When this area of low pressure was central north of the Lake region general rains occurred southward to the Ohio Valley, and fresh to brisk westerly winds were reported from the lake stations.

X.—This area of low pressure probably originated over Nevada, but is first noted as central in Montana on the morning of the 26th. It moved to the northeast from Montana and passed beyond the stations of observation during the 27th, it being last observed far to the north of Minnesota.

NORTH ATLANTIC STORMS DURING JUNE, 1887.

[*Pressure in inches and millimetres; wind-force by Beaufort scale.*]

The paths of the depressions that have appeared over the north Atlantic Ocean during the month are determined, approximately, from international simultaneous observations furnished by captains of ocean steamships and sailing vessels; abstracts of ships' logs and other data collected by the Signal Service agencies at the ports of New York, Boston, and Philadelphia; reports received through the co-operation of the "New York Herald Weather Service;" and from other miscellaneous data received at this office up to July 21, 1887.

Thirteen depressions are traced, of which one traversed the ocean from coast to coast; two appeared to the northward of the West Indies; two passed eastward over Newfoundland; one apparently originated southwest of the British Isles and moved northward, and eight developed over mid-ocean. The general direction of movement of these depressions was east-northeast to the eastward of the thirtieth meridian, while to the westward of that longitude their course of direction was diversified.

With the exception of rather strong summer gales to the westward of the twenty-fifth meridian during the second decade of the month, the general character of the weather over the north Atlantic Ocean was settled and seasonable. From the 12th to the 16th strong north to east winds were reported in the Gulf Stream south of the fortieth parallel; from the 14th to the 17th, inclusive, the severest weather of the month prevailed to the eastward and southward of Newfoundland; on the 24th moderate to strong gales were encountered over mid-ocean, and on the 29th fresh gales were experienced to the southward of the Banks. The lowest barometer reading reported in the trans-Atlantic routes was 29.30 (744.2), on the 15th, in N. 42° 53′, W. 57° 31′. During the second and third decades of the month the barometer was almost continuously high over the eastern portion of the ocean south of the fifty-fifth parallel; to the southward of the fortieth parallel high pressure prevailed, except off the coast of the United States from the 10th to the 16th, and in the vicinity of the Azores from the 22d to the 25th, inclusive.

In June, 1886, fourteen depressions were traced, of which one was traced across the ocean; five were continuations of areas of low pressure traced on the North American continent; four originated over the ocean east of the thirty-sixth meridian, and four developed between the coast of North America and the forty-second meridian. Two very violent and destructive cyclones moved from the Carribean Sea into the Gulf of Mexico; the remaining depressions traced were, as a rule, of slight depth, and their passage was unaccompanied by atmospheric disturbances of unusual violence.

As compared with the corresponding month of previous years, the depressions which appeared during June, 1887, were possessed of the average summer strength, and while no tropical storms appeared over the Caribbean Sea their absence during this month is not unusual.

The following are brief descriptions of the depressions traced:

1.—The presence of this storm off the southwest extremity of Ireland was shown by reports of the 1st; by the 2d the centre of disturbance had moved north, after which it disappeared beyond the region of observation. This depression had baro-