

III.—The presence of a low area over the west part of the Gulf of Mexico was indicated by reports of the 3d, and by the evening of the 4th the storm was apparently central southeast of the mouth of the Rio Grande River, whence it moved northward, passing near and west of Galveston, Tex., the evening of the 5th, and thence east of north, uniting over Arkansas during the 7th with low area II which had advanced from the northwest. At 9.30 p. m., 75th meridian time, the barometer read 29.24 at Galveston, Tex., having fallen .38 inch in $1\frac{1}{2}$ hour. From this time the barometer rose and the wind shifted suddenly from southeast to southwest.

Light rain fell on the west Gulf coast the night of the 3d; heavy rain fell in that region on the 4th; on the 5th the area of heavy rain extended over the lower Mississippi valley; and on the 6th and 7th very heavy rainfalls were reported in the Mississippi Valley south of Tennessee.

A storm of wind and rain began at Galveston, Tex., the night of the 4th and continued during the 5th, and low-lying sections of the city were inundated by a storm-wave. On the 5th and 6th destructive local storms occurred in the west Gulf states and the lower Mississippi valley. At Baton Rouge, La., the state penitentiary was wrecked and ten convicts killed and a number injured. Many other houses were destroyed or damaged at that place.

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

The paths of storms that appeared over the west part of the north Atlantic Ocean in August, 1891, are shown on Chart I. These paths have been determined from reports of shipmasters received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

The normal distribution of atmospheric pressure over the north Atlantic Ocean in August favors the passage of storms in high latitudes, and gales of destructive violence are seldom encountered along the trans-Atlantic steamship routes during that month.

In the West Indies the month marks the height of the cyclone season, and records of past years show that storms of this class have averaged about two per month in August. These storms generally recurve over the Gulf of Mexico or off the southeast coast of the United States, and in a number of instances have been attended by enormous loss of life and property.

The most important storm of the current month was the cyclone which visited Martinique, W. I., the night of the 18th. A second storm of marked strength passed east of Bermuda on the 27th. In the middle latitudes unsettled weather attended the passage of areas of low pressure of moderate strength during the first and second decades of the month, the only storms of marked energy being noted over the eastern part of the ocean and the British Isles after the 20th.

The month opened with low pressure over the Gulf of Saint Lawrence and Newfoundland and northwest of the British Isles, and high pressure over mid-ocean. The pressure continued low over the western part of the ocean, and the morning of the 4th two storm-centers appeared, one, a continuation of low area I, off the Virginia coast, and the other, which apparently developed south of Newfoundland on the 3d, was central on the east Newfoundland coast. Low area I moved slowly eastward until the 7th, after which date it probably recurved northward and united with an area of low pressure which occupied the region north of the Gulf of Saint Lawrence. Low pressure continued north of Newfoundland until the 14th; on the 11th low area II passed into that region from the lower Saint Lawrence valley, and on the 13th low area III moved northeast over north Newfoundland. The continued low pressure over the Gulf of Saint Lawrence and Newfoundland during the first half of the month indicated an unusual westward and southward position of the Iceland area of low pressure. During the 7th and 8th there was a transfer of low pressure eastward over mid-ocean. During the 2d and 3d a storm passed eastward over the north part of the British Isles, and the pressure remained low over the North Sea until the 5th. From the 10th to 13th a storm moved from mid-ocean in high latitudes over the north part of the British Isles and disappeared over the North Sea. The night of the 15th low area IV moved off the southeast New England coast, and passing thence northeastward disappeared north of Newfoundland after the 17th. On the 18th low area V moved eastward over the Canadian Maritime Provinces and the Gulf of Saint Lawrence, and on the 19th was central over south Newfoundland. The morning of the 20th this storm was central over the Banks of Newfoundland, whence it moved northeast and passed north of the region of observation after the 21st. On the 21st and 22d low pressure prevailed over the Gulf of Saint Lawrence under the influence of low area VI which passed northeast over Labrador. During the greater part of the second and the first half of the third decades of the month low pressure continued over mid-ocean, and on the 25th pressure falling to about 29.25 (743) and whole gales were reported along the trans-Atlantic steamship routes near the 20th meridian. During the last half of the month low pressure prevailed over the British Isles. On the 21st a destructive storm occurred over the English Channel attending the passage of an area of low pressure which had advanced from the northwest. On the 26th a severe storm moved eastward over the north part of the British Isles, with heavy gales

and pressure falling to 28.70 (729) at Leith, Scotland. On the 29th low area IX passed northeastward over the Gulf of Saint Lawrence, and by the 31st this storm had apparently reached mid-ocean, where the pressure fell below 29.00 (737) and strong to whole gales were reported.

MARTINIQUE CYCLONE OF AUGUST 18, 1891.

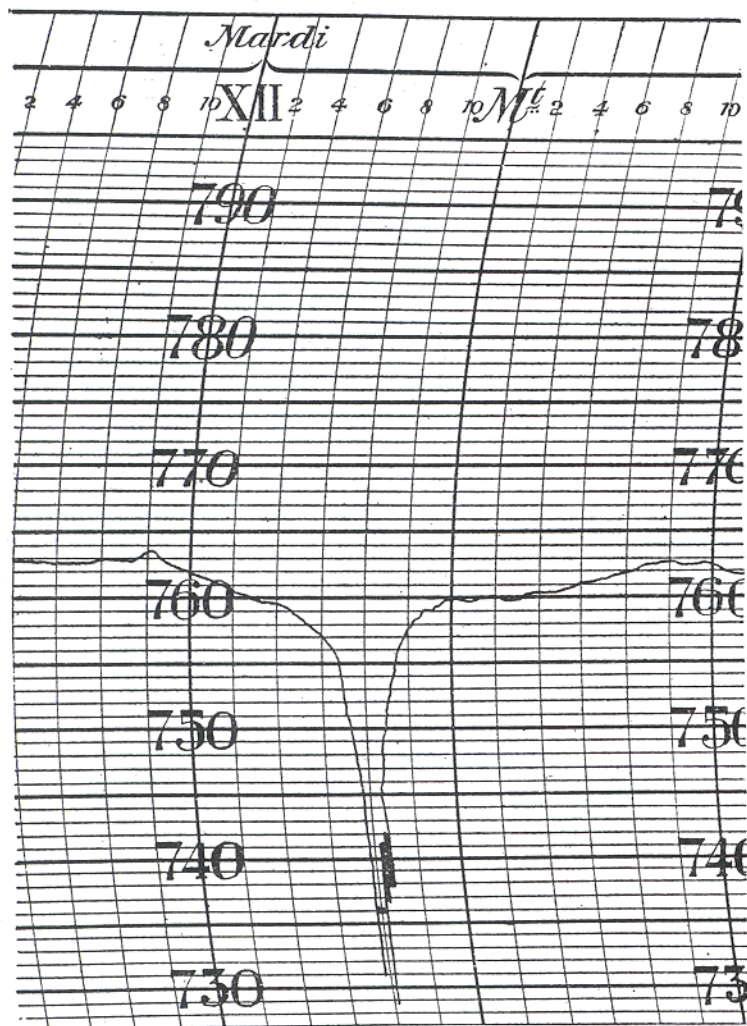
The night of the 18th one of the most disastrous of the type of storms known as West India cyclones devastated the Island of Martinique, in the Windward West Indies. At Martinique the storm continued four hours, from 6 to 10 p. m., and the center passed that place between 7 and 8 p. m., apparently traveling in a west-northwest direction at a speed of about 11 miles per hour. During the day a fresh north-northeast breeze had prevailed at Martinique, with rapidly falling barometer and wind increasing in force. The storm struck the east side of the island about 6 p. m., and in its passage over the island the destruction was less complete on the elevated plains. The wind veered from ene. to sse., and was most destructive from the latter point. Incessant lightning, unaccompanied by thunder, continued throughout the storm, and at its conclusion two distinct shocks of earthquake occurred at intervals of about five seconds. It is stated that in the vicinity of Caraval Rock at 10 a. m. two immense waves passed from the direction of Saint Lucia, the sea in the vicinity being quite calm. Another notable feature was the deafness experienced by every person in Martinique during the passage of the storm. The loss of life at Martinique is reported at 700; many persons were injured; property was destroyed to the value of about \$10,000,000; and all vessels about the island, some 50 sail of all classes, were wrecked. The commander of the S. S. "Esk" reports that he sailed from Barbados for Saint Lucia at 5.35 p. m., 17th, with northeast to east-northeast winds of force 3 to 4, and barometer at 30.17 (766); arrived at Saint Lucia at 6 a. m., 18th, with wind east-northeast, force 4, and barometer 30.19 (767); arrived at Saint Pierre, Martinique, at 1 p. m., with wind north-northeast, force 4, and barometer 30.10 (764); and left Martinique for Dominica, Windward Islands, at 2.35 p. m., with wind northeast, force 5, and barometer 30.07 (764). During the passage to Dominica northeast and east gales attaining hurricane force, heavy rain, violent squalls, and high seas from east-northeast were experienced, and the barometer fell to 29.96 (761) from 5 to 6 p. m. At Dominica the gale continued from east-northeast to east at force 10 to 11 until midnight, when the wind shifted to east-southeast, and from that point to southeast by 6 a. m. of the 19th, with slowly rising barometer and wind moderating in force.

Pursuing a west-northwest course the storm passed north of Grand Turk, Turks Islands, W. I., about midnight of the 21st. During the afternoon of the 21st there were indications of a cyclone approaching. In the evening the barometer fell steadily until 11.20 p. m., when it remained stationary at 29.21 (742) until midnight, after which it began to rise. From the force and changes of the wind it appeared that a cyclone had passed north of the islands, the vortex being probably 100 miles, or less, distant. During the afternoon there had been frequent rain squalls and a marked increase in the force of the wind. At 10.15 p. m. the first and only heavy gust of wind occurred, after which the wind decreased in force until midnight, at which time it again increased from the west. At 12.20 a. m., 22d, the wind was west by south and increasing in force; at 12.50 a. m. it was about west-southwest, and at 8 a. m. it was blowing from the southeast with heavy rain. At Grand Turk three persons were drowned, and the loss to property was confined to small houses and sailing vessels. From Grand Turk the storm-center passed to the Bahama Islands, a south hurricane being reported over Crooked Island, Bahamas, the evening of the 22d. During the 23d, 24th, and 25th a ridge of high barometer occupied the ocean off the south Atlantic coast of the United States, the pressure at Bermuda being 30.20 (767)

and above. This distribution of pressure had the apparent effect of preventing the cyclone from making the usual recurve to the north and northeast, and reports at hand indicate that it moved westward with diminished energy over extreme south Florida during the 24th, and passed thence into the Gulf of Mexico, where it probably dissipated, although reports indicate the presence of a cyclonic disturbance over the central and east Gulf until after the 29th. Early warning was received of the passage of this storm over the Windward Islands by telegrams to this office from Mr. Jos. Ridgeway, the observer at Saint Thomas.

The following diagram of a self-registering Richard barometer is of especial interest and value, inasmuch as it indicates the pressure changes attending the passage of the storm-center over Saint Pierre, Martinique.

Record of a self-registering Richard barometer, Saint Pierre, Martinique, August 18, 1891 (in millimeters).



Mr. Léon Sully, in a report accompanying the diagram, states that from 8.10 to 8.40 p. m. this barometer vibrated excessively, but a good aneroid barometer recorded every difference of pressure, and the passage of the center over Saint Pierre was clearly marked at 28.98 (736). The other minima (due to rapid oscillations varying in time from 2 to 3 seconds to 2 to 3 minutes) indicated clearly the passage of secondary whirls, rendered evident by the terrific noise of tiles and broken roofs; this fact was corroborated on the following day by the appearance of certain broken trees which could not have been bent in the way they were except by a strong gyratory movement. Moreover, in certain places in the country

there were long lanes or paths where the destruction was greater than elsewhere.

A second storm of tropical or subtropical origin advanced from the southeastward toward Bermuda during the 26th and passed east of that island during the 27th. By the morning of the 28th it had passed north of the 35th parallel, after which it apparently united with low area IX which occupied the Gulf of Saint Lawrence the morning of the 29th. For two days preceding the passage of this storm over the latitude of Bermuda the wind had been northeast, force 1 to 3, at that island. At 7 a. m., 27th, the wind was northeast, force 6; by 8 a. m. the wind had shifted to northwest, force 6, and it continued to blow from that point, with heavy rain squalls, until noon, when it shifted to west-northwest, to west at 3 p. m., to west-southwest at 6 p. m., and to southwest at 9 p. m. The barometer fell steadily to 29.60 (752) at 12.30 p. m., after which it began to rise. No damage was caused to shipping or buildings at Bermuda.

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

The paths of storms that appeared over the north Atlantic Ocean during September, 1891, are shown on Chart I. These paths have been determined from observations by shipmasters received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

Severe storms were encountered along the trans-Atlantic steamship routes; two storms of marked energy advanced from the sub-tropical region north of the West Indies; and

cyclonic disturbances appeared over the Gulf of Mexico during the second and third decades of the month.

On the 1st a storm of great energy was central northwest of the British Isles, whence it moved slowly eastward over the North Sea by the 3d, with violent gales and heavy rain in Great Britain and Ireland. On the 6th a storm appeared central northeast of the Bahamas, whence it moved rapidly northward to the east New England coast the evening of the 7th, and passed thence northeastward over Newfoundland during the early part of the 8th. During the 7th this storm was

attended by gales of hurricane force at sea, and at night by destructive wind and heavy rain over Nova Scotia. From the 6th to 12th low pressure continued over mid-ocean. On the 11th a cyclonic disturbance was central over the east part of the Gulf of Mexico, with heavy rain and high wind on the east Gulf coast. By the morning of the 12th the storm was central near extreme western Florida, after which it apparently dissipated. On the 14th a storm which apparently developed off the south Atlantic coast was central about midway between Bermuda and the North Carolina coast, whence it passed rapidly to Newfoundland by the 15th, and thence northwest of the British Isles by the 18th, with fresh to strong gales along the steamship routes.

On the 18th a cyclonic disturbance was indicated south of western Cuba. On the 19th the cyclone center was apparently located west-southwest of Havana, and on the 20th it was central over the middle Gulf, with high winds and heavy rain on the central and west Gulf coasts, and thunderstorms over the east Gulf. On the 18th a cyclone appeared northeast of the Windward Islands, whence it moved slowly northwestward and passed east of Bermuda about midnight of the 21st. Recurring eastward, the storm-center reached the 40th parallel in about longitude W. 45° on the 25th, where it apparently recurved northward and united with an area of low pressure which was central over Newfoundland on the 26th. The influence of this storm was felt at Bermuda from the 19th to 23d. On the 19th the wind at that place was northeast, force 2 to 4, with barometer falling to 29.88 (759) at 9 p. m. On the 20th the wind shifted from northeast to north-northeast, force 5, at noon, with pressure 29.71 (755) and to north at midnight, force 5 to 6, pressure 29.40 (747). On the 21st the wind shifted from north to north-northwest at 8 a. m., force 5 to 6, and pressure 29.21 (742), and to northwest at 2 p. m., force 5 to 6, pressure 29.15 (740). The barometer continued to fall until midnight, when it read 28.95 (735), with wind northwest, force 6 to 7, after which it rose to 29.55 (751) by midnight of the 22d, and to 29.90 (759) by 9 p. m. of the 23d, with wind shifting from northwest to north-northwest and diminishing in force. On the 21st a Spanish brig loaded with mahogany lumber was wrecked on the southwest shore of the island; the crew was saved. Trees were blown down; but little damage was caused to buildings.

During the last decade of the month the pressure continued low over mid-ocean, with periods of heavy gales, and on the 27th the pressure fell below 29.00 (737) in that region, and strong to whole gales continued until the close of the month. Heavy storms were reported in Great Britain on the 21st and 22d, and the pressure continued low over the British Isles from the 26th until the close of the month. On the 25th a disturbance was central over the west part of the Gulf of Mexico, with high winds along the west Gulf coast, and the evening of

that date it was apparently central south of the mouth of the Rio Grande River.

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

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

October usually marks the commencement of the stormy season in the middle latitudes of the north Atlantic Ocean. The north Atlantic area of high pressure contracts, the Iceland area of low pressure extends its limits southward, with a decrease in central pressure, and storms which advance from the west part of the north Atlantic or from the American continent have a comparatively unobstructed path to the middle and north coasts of Europe. Storms of tropical origin are not uncommon in October. West India cyclones of October generally appear over the Caribbean Sea and recurve over or near extreme western Cuba or the east part of the Gulf of Mexico. In the last 18 years 9 storms of marked energy have advanced northward from the Caribbean Sea in October.

The north Atlantic storms of the current month were exceptionally severe, more especially those of the first and second decades of the month. During the first decade a storm of tropical origin advanced from southeast of Bermuda and reached the Newfoundland coast the night of the 5th; cyclonic areas were noted over the east and west parts of the Gulf of Mexico; very heavy gales were encountered over mid-ocean; and unsettled and stormy weather prevailed over the British Isles. In the second decade two energetic storms of tropical origin traversed the western part of the ocean; exceptionally severe weather was encountered over mid-ocean during the first half of the decade; and destructive storms occurred over the British Isles. In the third decade a heavy storm passed along the middle Atlantic and New England coasts and thence over the Canadian Maritime Provinces. Over the middle and eastern parts of the ocean the weather was comparatively settled after the 20th.

On the 1st a storm of considerable energy was central north-east of the Windward Islands, whence it moved northwest-

ward and the morning of the 4th was central west of Bermuda. During the 4th and 5th the path recurved to the north and northeast. The center of disturbance reached Nova Scotia the night of the 5th, and moving thence east-northeast apparently joined the Iceland area of low pressure by the 8th. This storm passed south of Bermuda the night of the 3d-4th, attended by heavy north-northeast to east and south gales, and pressure falling to 28.97 (736) at 8 p. m. of the 3d at Bermuda. Gales of force 10 to 11 attended the recurve of this storm to the northeast, and during the 7th and 8th, when central over mid-ocean, the pressure fell below 29.00 (737), and terrific gales were encountered along the trans-Atlantic steamship routes.

On the 1st a dispatch was received from Havana, Cuba, stating that a slight disturbance was seemingly developing to the southwest. During the next four days a cyclonic disturbance was indicated over the west part of the Gulf of Mexico. On the 6th a cyclonic area was apparently central south of western Cuba; by the 7th this storm had reached southern Florida, moving northeastward. Moving slowly northeastward off the Atlantic coast, the center reached Nova Scotia on the 14th, and moving thence east-northeast, was central south of Iceland on the 18th, and probably passed thence to the British Isles by the 21st. On the 11th, when central off Hatteras, this storm was apparently joined by a cyclonic area from the east part of the Gulf of Mexico. From the 11th to the 14th the passage of this storm was attended by the heaviest gales of the month along the middle Atlantic and New England coasts, and at points from the Carolinas to the southeast New England coast the maximum wind velocity exceeded 70 miles per hour, causing disasters to shipping and damage to property. The very high winds reported are a notable feature of this storm, inasmuch as the barometric depression was slight, the lowest reading being about 29.50 (749) the morning of the 14th. The barometric gradient was, however, very steep to the northward of the center during the 13th and 14th.

On the 5th and 6th the pressure fell below 29.00 (737) in a cyclonic area west of the British Isles, and on the 6th destructive gales prevailed over Ireland and along the west and south

coasts of Great Britain. The Bermuda storm above referred to apparently united with this low area by the 8th. Under the influence of the Iceland area of low pressure, which had apparently assumed a position more to the eastward than usual, and of areas of low pressure which advanced from the ocean, low pressure and stormy weather continued over the British Isles until the 23d. On the 13th and 14th immense damage was caused to coast and inland property in England, Ireland, and the south of Scotland, and gales of destructive violence continued during the 15th and 16th.

The presence of a cyclonic area over the east part of the Caribbean Sea was indicated by reports of the 13th to 15th. During the 15th the path apparently recurved northward over or near San Domingo, and the morning of the 17th the center was located east of the Bahamas, whence it moved north-northeast and reached the south coast of Newfoundland on the 20th. On the 17th gales of hurricane force were encountered east-northeast of the Bahamas. The night of the 17th a strong southeast gale set in at Bermuda. On the 18th, at 10 a. m., the barometer fell to 29.30 (744) at Bermuda, and during the day the wind was southeast to southwest and reached force 11, causing considerable damage. The storm-center passed west of Bermuda about 7 p. m. of the 18th. During the 19th there was an apparent decrease in energy, and during the 20th the path recurved westward and the storm united with low area V, which was moving down the Saint Lawrence Valley.

On the 25th low area VIII had advanced north of Newfoundland, and on the 28th low area VII had reached the east Newfoundland coast, whence it apparently moved eastward to mid-ocean by the close of the month.

Normal monthly temperatures, the average for the several districts, and the normal for any district may be found by adding

the mean, over the period, of the observations from the middle and north

On the 21st a cyclonic area was indicated north of the Windward Islands, whence it moved northward without evidence of marked energy and apparently united with low area X over the Gulf of Saint Lawrence after the 24th. From the 22d to the close of the month the pressure continued low over the British Isles, and on the 28th the readings were 29.10 (739) in Ireland. During the 25th a storm (low area X) passed northeastward over Labrador, and thence north of the region of observation. On the 27th a storm, which was probably a continuation of low area X, was central over mid-ocean in high latitudes, and by the 28th this storm-center had advanced near the Irish coast, after which it apparently moved northward. During the 27th a storm (low area XI) moved northeastward over the Gulf of Saint Lawrence, and the morning of the 28th was central north of the Banks of Newfoundland, whence it passed east-northeast to mid-ocean, where the pressure continued low until the close of the month. During the 28th a storm (low area XII) moved over the south part of the Gulf of Saint Lawrence, and on the 29th was central north of the Grand Banks, whence it advanced to mid-ocean by the close of the month. Reports of the 29th and 30th indicated the presence off the North Carolina and Virginia coasts of a storm of limited energy.