GENERAL NOTES. (By the EDITOR.)

NOMENCLATURE.

The great diversity in the usage of meteorological terms by the daily press and meteorological observers, makes it desirable to state that in the WEATHER REVIEW we shall endeavor to uniformly adhere to the following usages:

The terms "high" and "low" will refer to areas in which barometric pressure is decidedly above or below that of the surrounding country without reference to any normal values and without implying any specific peculiarity as to winds or weather.

The word "storm" will refer to a disturbance of the ordinary average conditions or to unusual phenomena, and unless specifically qualified may include any or all meteorological disturbances, such as wind, rain, snow, hail, thunder, etc. This word may be qualified by some peculiarity, *i. e.*, sandstorm or duststorm, (such as the "simoom"), hot wind (such as the "khamsin" or "fohn" or "chinook"), cold windstorm (such as the "norther" and the "pamperos"), cold rainstorm and snowstorm (such as the "blizzard").

A hurricane or "typhoon" is a large stormy area, often several hundred miles in diameter, within which violent winds circulate around a center. The center of a hurricane or "typhoon" is a comparatively calm region, where even the clouds break away and the rain ceases, whereas the center of a thunderstorm is the region of greatest intensity of wind, rain, or lightning.

A tornado is a very much smaller region, usually less than two miles in diameter, within which even more violent winds prevail. In the typical tornado these violent winds circulate about a central axis, rapidly ascending at the same time and forming a funnel-shaped cloud whose base is at the average cloud level; but many destructive winds have been classed as tornadoes which are not circulating about such a funnel-shaped cloud or vertical axis but which are either blowing straight ahead on the earth's surface, as in the "derecho" or straight line wind, or which have a quasi-rotation around a horizontal axis, as in the blast that accompanies the front of a "norther" or the gust in front of the heavy rain of a thunderstorm. We shall endeavor, as far as possible, to separate the true tornado, which is rare, from the numerous destructive winds, squalls, and gusts which are popularly called tornadoes, hurricanes, cyclones, tourbillons, and other high-sounding names.

The term "whirlwind" is applied to any revolving mass of air, and includes at one extreme the hurricane, and at the other extreme the dust-whirl of our street corners.

A "cyclone" is a mass of air circulating around a center; the lower portion of the air near the earth's surface has a vorticose movement in towards a center, while the upper layers have a movement out from a center; the line joining the upper and lower centers is the axis of the cyclone; the direction of rotation is the same in both upper and lower layers; in the northern hemisphere this rotation is said to be in a negative direction, or opposite to the diurnal motion of the sun in azimuth, and opposite to the movement of the hands of a watch lying with its face uppermost.

An "anticyclone" is a mass of air also circulating around a center, but the lower layer of air has a movement out from a center and the direction of rotation is opposite to that of a cyclone, being positive in the northern hemisphere.

The terms "cyclone" and "anticyclone" do not describe phenomena that can be observed by one observer or at a single station, they should, therefore, not be used in the description of local phenomena; they represent generalizations based upon the charting and study of winds and clouds observed at many stations, and should only be used when the nature of the rotation of the winds has been clearly demonstrated or can be safely inferred.

The terms "cyclonic winds," "cyclonic system," and "cyclonic rotation" are equivalent to "cyclone." The outer portion of a cyclone generally has feeble winds and fair weather; therefore a hurricane, tornado, or whirlwind is only a small part of a cyclone.

METEOROLOGICAL PHENOMENA.

The meteorological phenomena for August have illustrated some interesting principles in the dynamics of the atmosphere, among which the following may be mentioned:

A. The general circulation of the atmosphere over America and the Pacific and Atlantic oceans is to be conceived of as essentially consisting of the tropical system of trades below and return-trades above; some of this latter air descends to the earth's surface at the northern limit of the trade-wind region, after which one part of this moves northeastward with the westerly winds of the temperate zone. The descent of these large masses of air is the distinguishing feature of the areas of high pressure that pass over the United States. We must consider this air as not only flowing northward with the anti-trade, but as having some easterly motion left over after leaving the tropical regions. Accordingly, when the air in its slow descent reaches the surface of the earth at latitude 40° to 50°, it has a tendency to move toward the east while the centrifugal force imparted by the rotating earth drives it southward. Thus the prominent characteristic observed on the southeastern border of an area of high pressure consists in the cold, dry, northwesterly wind pushing its way southward and displacing the warm, moist winds at the surface. The phenomena attending the slow downward settling of this air from some moderate elevation in the atmosphere are analogous, no matter whether a very large or a very small horizontal area is involved in the operation. If the horizontal extent be very small and the descent begins at low altitude and the rate of descent be rapid, then the dynamic warming of the atmosphere may give rise to such phenomena as the fohn, the chinook, and the hot winds of Texas and Kansas. If, however, the horizontal extent be considerable and the descent begins higher up and the rate of descent be slow, then the descending air cools by radiation faster than it warms up by compression, so that we have the ordinary cool, clear atmosphere and deep blue sky of our high areas.

B. The horizontal movement that we observe as a westerly wind at the surface of the earth must be considered as the result of the movement of air descending along an inclined path until it strikes and presses down upon and spreads out over the earth's surface; the attending phenomena of pressure and motion can be closely imitated by the flow of water down a gentle slope to the earth's surface. The general motion of the mass of descending air being from the west relative to the earth's surface, it follows that the greater part of the mass continues to flow along the surface from that direction, but a small part is pushed west and north. Since the pressure gradient from the region of highest pressure at sea-level toward the south and east increases the eastward movement, but toward the north and west it diminishes this movement, therefore, on the latter side of the high the winds are light and from the southeast, but on the opposite side they are stronger and from the northwest.

C. The rate of descent with time is slower on the south and east side, but more rapid on the north and west side of the high area, consequently the cooling by radiation is less effective on the latter side; therefore, the temperatures at the earth's surface are relatively high on the northwest side and low on the southeast side of the central high. Therefore, the north and west winds on the southeast side being both stronger and cooler underrun the warm air which they displace, producing atmospheric rolls about horizontal axes rather than whirls about vertical axes, and giving rise to local storms characterized by the rapid elevation and mixture of masses of warm air and cold air; sometimes the formation of cloud and rain is so rapid and generous that special ascending currents are formed under the larger cumuli, thus breaking up the continuity of the horizontal roll and introducing here and there violent local whirls on the advancing front of the lower, denser air. These are the characteristic features of the norther and the blizzard of the winter season and of the thunderstorm, tornado, and local rain of the summer season, which latter frequently occur on the fronts of the masses of air flowing out from the areas of descending air. The descending areas do not appear as areas of high pressure on our weather maps unless they are of considerable horizontal extent; when they are small, on the other hand, a self-registering barometer almost always reveals at least a temporary sudden rise, showing that small descending masses have been stopped and had their inertia or kinetic energy converted into pressure by the resistance of the earth's surface.

D. The warmer southeasterly winds on the northwest side of the central high pressure rise up gently over the cooler air that lies in front of them, and by a gradual cooling, due to the combined influence of expansion and radiation, they eventually produce the broad areas of general cloud and rain whose buoyancy, due to latent heat and solar radiation, produces an upward suction with its resulting winds and isobars, and develops a region of low pressure. Thus it comes about that the low pressures characterize regions of ascending air and the high pressures characterize descending air, although the extremes observed in areas of high and low pressure could not possibly have been produced by the general circulation of the atmosphere, properly so-called, but only by the concurrent action of both general and special circulations.

E. We thus recognize that the numerous local thunderstorms that have occurred in August are illustrations of the rapid and almost adiabatic, dynamic cooling that attends the uplifting of warm, moist air by its semi-rotation about a horizontal axis at the front of an advancing high area; on this basis it has oftentimes been possible to predict their occurrence, both individually and in groups. As a rule, the conflict between the denser air on the west and the lighter air on the east results in pushing the latter northward and the former southward at the immediate line of contact, so that a thunderstorm is preceded by southeast to southwest winds; clear sky or light clouds prevail until the line of conflict is near at hand, then the clouds and their motions show us that the southerly wind is being pushed up, forming a roll or a series of cumulus clouds which then flow off as southwest overflow in the cirrus region. Although this overflow moves from the west or southwest, yet it must not necessarily be considered as a part of the greater westerly current that is about to supervene; it is simply the southeast air raised from the earth's surface and overflowing toward the north in a thin, broad, horizontal sheet; the markings and characteristic forms of the cirri and cirro-cumuli formed in this overflow show that in general it is descending, and that it is thrown into minor waves and whirls by the motions and resistances of the strata immediately above and below it. A short calm follows the south wind and then comes the outflowing surface squall, then the heavy rain or hail, with thunder and lightning under the thickest or tallest and largest cumulus cloud; then comes clear, blue sky with high temperature, revealing the existence of a belt of rapidly descending air, and, after a short time, a dry, cool, west or northwest wind, representing the wave of slowly descending air that is pushing eastward against the southerly wind.

The height of the cumuli and also the amount of rain and hail that comes from them depend upon the relative moisture, temperature, and density of the two masses of opposing air, that is to say, upon the height at which the same density is attained in the two masses. The greater this height, so much the higher must the easterly air be raised before the western can flow under it, and so much the greater volume of air to be elevated and of cloud and rain to be precipitated.

NORTHERS OF VERA CRUZ.

The daily weather maps show that when storms approach the coasts of California, Oregon, and Alaska, the low pressure that belongs to the Bering Sea and the west side of the Rocky Mountains first induces easterly winds and a *high* on the eastern slope of the Rockies, then a *low* develops on the eastern slope to the south of this *high*, and after moving southeast for a while it turns into a northeastward course. Similar analogous phenomena occur when a *low* approaches the western slope of the Appalachian range; we see, first, easterly winds over the Atlantic States, with a slight rise in pressure, then a *low* develops a little farther south; the western *low* fills up while the eastern *low* deepens; the storm-center can not be traced across the mountains, but is properly said to have been transferred from the west side to the east.

Similarly, a hurricane approaching the west coast of Mexico from the Pacific Ocean first induces a norther to descend over Texas and the Gulf. The daily weather maps often show that northers push southward from Texas when pressure is low over Mexico, and that subsequently the norther, by causing a large area of cloud and rain in the southern part of the Gulf, gives opportunity for a cyclonic whirl to originate in that region; evidently, therefore, a storm-center in the Gulf may be either a direct result of the norther, or it may be a transfer of the Pacific storm-center across the Mexican Cordilleras.

It is important for the protection of the United States that we should understand when whirlwinds in the Gulf actually originate in the southern portion of that region as a sequel to a norther, and when they represent those that have existed long before in the Pacific Ocean.

In the northern hemisphere the approach of a storm of any kind, whether hurricane, tornado, thunderstorm, rainstorm, or norther, is generally indicated by the appearance of the horizon, the clouds, and the sky. In the case of the near approach of a hurricane, a thin veil of haze over the whole sky thickens into a milk white sheet, and eventually into a dark gray cloud which Poey has named the "pallium." But if the observer is at a great distance, this pallium appears on the horizon as a pure white homogeneous cloud-bank, which steadily rises in altitude if the storm-center is approaching the observer, or which merely skirts the horizon if the storm is moving past him at a great distance. Similarly, the front of an advancing norther is marked by an advancing cumulus, possibly with light rain surmounted by a small extent of haze or pallium; in front of this are comparatively warm southerly winds and a slight barometric depression; in the rear of the cloud are cold, dry, northerly winds and steadily rising barometer. The approach of an extensive area of rain is often marked by similar appearances. The observer sees at a distance in the west, the northwest, or southwest, low in the horizon, a bank of clouds of a light tint or even white, and whose internal movements (if they can be distinguished) are usually toward his right hand as he looks at the clouds, so that the actual movement is toward the northeast approximately, and he sees that the eastern advance of the cloud line has no direct simple connection with the northeast movement of the individual cloud masses.

These general ideas, which were familiar to us in 1871, and occasionally appear in the earlier press reports and MONTHLY WEATHER REVIEW, are abundantly illustrated by the special studies of Dr. G. Batturoni, of Vera Cruz, who has occupied himself for some time with the study of northers at that place.

According to Batturoni, one often sees to the north of Vera Cruz a sky covered by an arch or veil of clouds rising 5° or 6° above the horizon to the northwest and the northeast, and possibly even to the southeast. This I interpret as apparently showing that the flow of cold air from the north at first passes east of Vera Cruz by reason of the smaller resistance offered by the central Gulf region, and only after a day or two will it extend its influence westward to that port and the adjoining coast of Mexico. Batturoni states that on the occasion of the heavy norther of 1892, Feb. 7–9, he saw the cloud-bank in the north and east on the 8th; the records showed that the norther had begun at Frontera in Tabasco on the morning of the 7th (200 miles east-southeast of Vera Cruz), and that it began at Tampico about 4 a. m. of Feb. 9 (200 miles north-northwest of Vera Cruz), but it did not begin at the latter place until 8.30 a. m. of the 9th. Thus, the cloud-bank gave him, as it were, 36 hours or more notice of the norther.

It would appear from this that a norther may prevail in the central portion of the Gulf of Mexico and southward to Tabasco and westward to Tampico before its front has reached Vera Cruz, which is in the curved part of the coast between these two regions; the front of the norther then slowly closes in and finally reaches Vera Cruz. Apparently the southward flow of the cold air takes place more rapidly down the central portion of the Gulf than along the coast, so that it reaches Frontera, in Tabasco, before it reaches Tampico. Having thus inclosed a region of quiet air between the front of the norther and the Mexican Cordilleras, the denser air can only slowly prevail over the lighter and the farther slow progress of the norther towards Vera Cruz depends upon the rate at which this quiet air can be pushed up and flow away.

Batturoni distinguishes two classes of northers:

I. Northers that come from the United States down to Vera Cruz, these have the following characteristics:

(*a*) The barometer ordinarily falls 0.25, and often 0.30, before the advance of the north wind.

(*b*) The temperature falls to 66° or even 54°.

(*c*) The humidity varies from 52° to 68° per cent.

(*d*) The wind changes from southeast to north, and generally in making this change it veers round through the west.

(*e*) Three days beforehand, at sunset, the northeast portion of the horizon is of a copper red, which extends through north to west, and the clouds have a peculiar appearance, such that we can be sure of a storm prevailing in the United States on that day or the next, and a norther in Vera Cruz within 48 hours after that.

(*f*) In the interior of the Mexican coast a cold, persistent rain prevails during the prevalence of the norther on the coast, with a diminishing and weak north wind.

(*g*) The duration of this class of northers is longer than of the second class.

As an example of this class of northers Batturoni gives that of Feb. 7–9, 1892.

II. The northers that begin and die away on the Gulf coast of Mexico and whose characteristics are—

(*a*) The sky is invariably perfectly clear and the stars peculiarly brilliant.

(*b*) The day preceding the norther, the sky is covered by a veil of stratus reaching to within 5° or 6° of the horizon all around us, the mountains on the west of Vera Cruz (*e. g.*, Orizaba and Pirote) still have the summits perfectly clear and the smallest details are visible, but the lower portions are hidden by clouds; to the north of Vera Cruz, or the north-northwest, the low mountains toward the coast are hidden by haze and mist; to the south the mountains are clear up to the very advent of the norther, when they begin to be veiled from top to bottom; from north to east and southeast or south-southeast, the day before the norther, a compact belt of clouds of about 2° in width is formed along the sea horizon and is a certain sign of a norther within 24 hours, the darker and more decided the belt, the stronger will be the wind.

(*c*) At first the clouds all flow from the southeast, the same as the wind below, but the upper clouds, which are generally cirrus, forming a belt or arch whose summit is in the north or northwest, and very rarely in the east, move very slowly from the northwest.

(*d*) The southeast wind increases as the norther approaches, and generally veers to the south, whence it blows quite strong, and then backs to the southeast and eventually to the north-northeast, where it settles, or even to the north-northwest if the storm is greatly developed.

(*e*) The wind begins with a velocity of 8 or 10 miles, and sometimes attains 30 miles or more; it blows without interruption during the first 24 hours, veering during the night to west-northwest and returning the next day about 10 a. m. to the north, repeating the same diurnal variation for a number of days.

(*f*) Mosquitoes and other insects become more troublesome as the southeast wind continues up to the moment of the bursting of the norther, when they disappear; sea birds seek shelter near the coast.

(*g*) The barometer sometimes falls 0.2 inch before the norther; at other times it stands below its normal reading 0.10 or 0.15 inch, in which case the norther lasts longer.

(*h*) The temperature during the two days preceding the norther rises from 81° F. to 88° or 89°, but falls to 70° or 71° as soon as the north wind begins.

(*i*) The hygrometer shows a relative humidity varying between 64 and 72 per cent during these northers.

(*j*) As we go back from the coast the weather is fine.

(*k*) The duration of northers of the second class is less than for the first class.

(*l*) The fall of temperature attending the second class is less than for the first class.

As illustrating this latter type of northers, Batturoni enumerates the following four cases:

(1) The norther of February 9, 1892, at Vera Cruz: The norther began at 8.30 a. m., or four and a half hours after it struck Tampico, and twenty-six hours after reaching Frontera. He seems to suggest that these northerly winds represent the western side of an advancing cyclone which was formed in the Gulf, and in this case moved from Frontera to Tampico in such a way that the northerly winds did not extend down to Vera Cruz until some time after the center had passed Tampico.

(2) The norther of September, 1892, having a maximum wind velocity of 10 meters per second, or 25 miles per hour: This was felt simultaneously and with the same force at Tampico and Vera Cruz. After twenty-four hours the wind passed to the west, and similarly every night for eight days, returning to the north about 9 or 10 o'clock every morning. It blew with a velocity of 8, 6, and 4 meters, successively, until it became very feeble, but frequently increasing and always threatening to become very violent again.

(3) The norther of September 23–25, 1892, he thinks may not have been felt at the American ports. This norther began at Tampico September 25, 11 a. m. The bad weather commenced at Vera Cruz on the 24th and lasted until the 27th; the maximum wind was on the 25th, lasting more than six hours, the winds always blowing in whirls.

In the southern part of Mexico, even in Oaxaca, on the south side of the plateau of the Mexican Cordilleras, the wind was terrible and disastrous. Batturoni says it was a true cyclone as to violence and nature.

He also says that at Pachuca it was a true hurricane. [Apparently he uses the words "cyclone" and "hurricane" to indicate the violence of the wind, and not in a strictly technical sense.]

Batturoni gives a diagram of this storm, which, however, seems only to indicate the fact that some sort of whirling, gusty squalls prevailed for 100 miles off the coast from Tampico to Tuxtlas (and inward to Pachuca, latitude 20° 2′, longitude 98° 6′, a little north of the City of Mexico), and to Vallenacional (in the northern part of Oaxaca, latitude 17° 9′, longitude 19° 1′, but still on the northern edge of the Mexican Cordilleras). In general there is no evidence that this storm passed over the mountains and down the Pacific slope.

(4) On July 11, 1893, Batturoni writes that the "cyclone of July 7th, in Iowa [he means the tornado of July 6th] was followed by violent wind, rain, and lightning on the 8th at Vera Cruz. The storm came first from the south, then southeast, then north, then northwest, and prevailed simultaneously to the south-southeast and northwest of the station. Rain continued until 5 a. m. of the 11th; the rainfall was 2.42 from 1. a. m. to 5. a. m., with north wind and lightning. The rainfall from the evening of the 8th till 6 a. m. of the 11 th exceeded 9 inches."

"On the 9th, at 10 a. m., he announced that the storm at Vera Cruz was a consequence of a cyclone in the region between Nevada, Nebraska, and Texas, and subsequently learned of the tornado near Des Moines, Iowa."

The presence of the typical cloud, of which he had spoken before, and which remained persistently in the horizon at the northwest one-quarter west, enabled him to foretell the weather (violent north wind with rain) two or three days in advance. He concludes that that cloud is coincident with the American cyclones [tornadoes] north of the Mexican frontier. The storm was also felt severely for a distance of 100 miles around Vera Cruz. The barometer was low for two or three days before the storm, but the temperature did not rise.

PROCEEDINGS OF THE METEOROLOGICAL CONGRESS HELD AT CHICAGO AUGUST 21–24, 1893.

(By OLIVER L. FASSIG, Secretary.)

Monday, August 21, at 10 a. m. the congresses of the Department of Science and Philosophy of the Congress Auxiliary of the Columbian Exposition were formally opened at the Memorial Art Institute of Chicago with an address of welcome by the President, Mr. C. C. Bonney, followed by responses from representatives of the various special congresses. At the close of this general session the different divisions met in rooms assigned to them, the Division of Meteorology, Climatology, and Terrestrial Magnetism meeting in room XXXI, in which the regular sessions were held daily from 10 a. m. to 2 p. m. from August 21 to August 24.

The chairman of the congress not being able to be present in person the first day, Prof. F. H. Bigelow, representing Prof. Mark W. Harrington, opened the session at 11 a. m. of the 21st with a few words of welcome and a statement of the objects of the congress.

The congress had no legislative authority. The main purpose, as previously announced, was to collect together a series of memoirs "outlining the progress and summarizing the present state of our knowledge of the subjects treated," and to print them in full in the English language.

The meetings, while thus making the reading and discussion of papers a matter of secondary importance, were by no means lacking in interest or profit to those who were present. But few of the papers could be read in full, owing to their great number and the absence of many of the authors. In all about 130 papers were read by title, in abstract or in full, forming a most valuable collection of memoirs prepared by writers of authority in their respective lines of research.

Among so many papers of merit, a simple list of which would occupy several pages, individual mention can not be fairly attempted.

While the papers were read in general session, they were assigned, in the printed program, to various sections according to the subject, each section being placed in charge of a responsible chairman.

Section A, Prof. C. A. Schott, U. S. Coast Survey, and Mr. H. H. Clayton, U. S. Weather Bureau, chairmen. The papers of this section are devoted to instruments, their history and relative merits, and to methods of observation, especially to methods of observing in the upper air.

Section B, Prof. Cleveland Abbe, U. S. Weather Bureau, chairman. This section is the most extensive in its scope, dealing mostly with questions in dynamic meteorology; much attention is given to the study of thunderstorm phenomena in various countries.

Section C, Prof. F. E. Nipher, Washington University, chairman, comprises a series of sketches of the climate of different portions of the globe.

Section D, Major H. H. C. Dunwoody, U. S. Army, chairman, is devoted to the discussion of the relation of the various climatic elements to plant and animal life.

Section E, Lieut. W. H. Beehler, U. S. Hydrographic Office, chairman, deals with questions relating to marine meteorology, particularly to ocean storms and their prediction, methods of observation at sea, and international co-operation. During the reading of a paper on the work of the Hydrographic Office of the Navy, Lieut. Beehler had on exhibition a fine bust of Lieut. Maury by the sculptor Valentine, of Richmond, Va.

Section F, Prof. Charles Carpmael, Director of the Canadian Meteorological Service, and Mr. A. Lawrence Rotch, Director of the Blue Hill Observatory, chairmen, comprises papers relating to the improvement of weather services and especially to the progress of weather forecasting.

Section G, Prof. F. H. Bigelow, U. S. Weather Bureau, chairman, deals with problems of atmospheric electricity and terrestrial magnetism and their cosmical relations.

Section H, Prof. Thomas Russell, of the U. S. Lake Survey, chairman, has to do with rivers and the prediction of floods.

Section I, Oliver L. Fassig, Librarian U. S. Weather Bureau, chairman, is devoted to historical papers and to bibliography, with special reference to the history of meteorology in the United States.

Prof. Mark W. Harrington, Prof. F. H. Bigelow, Capt. P. Pinheiro, of Rio Janeiro, and Lieut. W. H. Beehler successively presided over the meetings. The printed program distributed at the sessions of the congress contains a list of all papers presented. Copies of this may be obtained from the secretary upon application.

At the close of the last session a resolution was offered calling for recommendations by the congress relating to (*a*) international co-operation in observations of auroras, (*b*) simultaneous (Greenwich noon) observations daily at all stations on land and sea, in addition to observations at other times, (*c*) investigation of the earth's magnetic polar current and the exact determination of the solar rotation. As the congress had no legislative authority, it was agreed to hold a special session for the consideration of these questions after adjournment, on the following day.

Preparations have been begun for the printing of the papers, and an effort will be made to complete the work at an early date.