

ward through a window about 10 feet from the eye, up a long, wide, flat valley, running northerly and southerly between two ranges of the Balsam Mountains. The air current, at a height of about 4,000 feet, was from a westerly direction, and a continuous procession of small cumuli was floating across the field of view, projected upon the window panes, which afforded an excellent opportunity for observing both the progressive and the proper motion of the clouds.

It was first noticed that one of the cumuli was fast changing in shape, and that its summit was continually falling and being replaced by another summit rising from behind. As that cloud drifted out of the field of view and others came in sight, they were all seen to be changing in the same manner. Then it was noticed that the entire fronts of the clouds were falling and their rear portions rising; next that the horizontal, easterly motion of the tops of the clouds across the window panes was much more rapid than the vertical motions of the fronts and rears, and finally that the lower edges were nearly stationary.

Then it was perceived that all these apparent motions were the resultant of the progressive motion of the clouds, and a motion of gyration round an axis. There was not sufficient vertical motion of any cloud, as a whole, to be noticeable, and it was obvious that the axis was within the cloud, and that each cloud substantially filled a cross section of a horizontal air roll which was "end on" to the observer. The gyratory velocity was moderate, and on the first day it was several minutes before all the motions mentioned had been noticed and correlated in the mind. The period of observation lasted about half an hour, and as the progressive motion was tolerably brisk (from 15 to 20 miles an hour probably) and as several clouds were constantly within the field of view, hundreds of them must have been seen. No cloud was observed that did not have the gyratory motion.

On going out of doors to ascertain how far the field of rolls extended, it was seen that the clouds in the whirls were all to leeward of a large, standing, nocturnal cloud, hanging over "Platt's Balsam," the summit of which is 6,500 feet above sea level, and 3,800 feet above the floor of the valley, and that they all evaporated before reaching the high range of mountains on the other side of the valley. The clouds observed through the window were at least two miles from the standing cloud.

The coincidence in size of the clouds and the cross sections of the rolls seemed at first thought to indicate that the whirls were effective in condensing the clouds, but the better opinion seemed to be that these rolls, while drifting over the Balsam Mountains, tore off from the standing cloud as much as they could contain in cross section, and carried it along rolling over and over as described.

Possibly the air rolls themselves were formed at the ridge of the "Balsams," where the standing cloud was formed. A half hour's observation on the second occasion under identical circumstances, as far as could be perceived, verified the observations above described. The weather was fair and no other clouds were visible. Similar standing clouds at the same place, with fragments blown away to leeward, were frequently seen afterward, but no revolving clouds were seen at any other time.

The similarity in size, shape, and motion of the clouds indicated a succession of parallel, horizontal air rolls of tolerably uniform dimensions following one another closely. The clouds were all considerably south of the zenith, and nothing could be seen of the longitudinal dimensions of the rolls.

LONG RANGE SEASONAL PREDICTIONS FOR OREGON.

By B. S. PAGUE, Local Forecast Official.

In the REVIEW for March, page 166, we called attention to the general prediction of summer weather made by Mr. B. S.

Pague, Local Forecast Official at Portland, Oreg. We now reprint from the Weather Map for 8 a. m. eastern time, or 5 a. m. Pacific time, October 29, 1896, published at the Weather Bureau station at Portland, Oreg., the following synopsis and general forecast, indicating the approach of the winter season:

WEATHER SYNOPSIS AND GENERAL FORECASTS.

The first winter storm of the season has made its appearance, and from now until the summer type appears in the spring of 1897, it is more probable that rain will fall than that fair weather will prevail. In 1895 the first winter type of storms appeared on November 12 and continued to prevail until June 13, 1896, when the summer type appeared. The winter is distinguished from the summer by the movement of the high and low areas; in the winter type the lows move from the north southward along the coast line to Vancouver Island, or lower, thence eastward; while the low is moving in this way the high pressure areas move from the ocean on the southwest of California to about Cape Mendocino, thence eastward to about Great Salt Lake, where they remain stationary and gradually dissipate. In the summer type the low areas move eastward about the latitude of Sitka and the areas of high pressure move northward to about the latitude of Vancouver Island, thence eastward; when they reach the summit of the Rocky Mountains, northeast of Spokane, then very warm weather prevails; when the highs are moving along the coast cooler weather prevails. In winter warmer weather, caused by dynamic heating, prevails when the highs are central about Great Salt Lake. The areas of low pressure follow each other in quick succession, and the more rapid their appearance the more frequent the rain. Continuous rain is not the idea, but rather the summer or dry season is past, and the winter or rainy season is present.

NOTES CONCERNING THE WEST INDIA HURRICANE OF SEPTEMBER 29-30, 1896.

By A. J. HENRY, Chief of Division of Records and Meteorological Data (dated November 10).

[CONTINUED FROM THE SEPTEMBER REVIEW.]

As stated in the September REVIEW (page 317 of this volume), the violence of the storm of the above date was not uniform throughout its entire course. There seems to have been two distinct periods of unusual violence separated by a period during the afternoon of the 29th when the winds exhibited but little destructive power.

Evidences of unusually violent winds were observed on every hand throughout the storm's course in the States of Florida and Georgia. In the counties of Levy, Alachua, Lafayette, Suwannee, Columbia, Bradford, and Baker, Fla., the destruction of pine timber was enormous, the monetary loss from that source alone being estimated at \$1,500,000. During the early part of the storm the trees were torn up by the roots, but as the force of the wind increased they were broken and twisted off and thrown forward in a confused mass.

At Jacksonville, a little south and east of the storm's path, the self-registers show the maximum wind velocity, 70 miles per hour, to have occurred coincidently with the minimum of pressure. Violent winds continued for an hour and a half after the occurrence of the barometric minimum. The average velocity during the continuance of the storm, or from 9.10 a. m. to 12 noon, was 52 miles per hour, rising during a portion of the time to 63 miles, which velocity was maintained continuously for an hour.

The self-registers at Savannah indicate quite clearly that that city was in or very near the center of the storm's path. The barograph curve is exceedingly interesting. It is of the V-type characteristic of thunderstorms and tornadoes. The fall was quite slow at first but increased rapidly as the center of the disturbance approached. The fall from noon to 12.45 p. m. was .45 inch, almost all of which had been recovered by 2 p. m. Unfortunately the electrical recording apparatus of the anemometer was disabled at about 12.15 p. m., and the highest velocity can not therefore be obtained. The average velocity during the 28 minutes the recording apparatus failed to register was 75 miles per hour, a velocity

somewhat greater than at Jacksonville. The duration of the storm at Savannah was about 2 hours, and the average velocity during that time was 55 miles per hour.

The storm passed to the westward of Charleston, and though the wind at that station attained a velocity of 62 miles per hour for five minutes, but little damage was done. A velocity of 50 miles per hour prevailed continuously from 1.10 to 2.10 p. m., and an average hourly velocity of 44 miles prevailed from 12.45 to 3.30 p. m. The total fall in pressure amounted to but .4 inch, all of which had been recovered by 7 o'clock p. m.

North of Charleston the storm winds appeared to diminish in strength. There are no Weather Bureau stations directly in the path pursued by the storm between Charleston and Richmond, although it must have passed within 30 or 40 miles of the Weather Bureau station at Raleigh. The wind register at the last-named place showed a maximum velocity of only 26 miles, and the greatest hourly velocity was but 23 miles. At Charlotte, about 120 miles west-southwest, the maximum velocity was also 26 miles. Here a gust preceded the storm proper by about an hour, the wind in the interval being almost calm. The greatest hourly velocity at Charlotte was 20 miles.

A maximum velocity of 34 miles per hour was recorded at Lynchburg, Va., another station on the western side of the storm's path, and the greatest hourly velocity was 26 miles. At Norfolk on the eastern side, and at about the same distance from the storm center, a maximum velocity of 38 miles was registered ten minutes later than the time of maximum velocity at Lynchburg. While the maximum velocity at Norfolk was but slightly greater than at Lynchburg, the velocity of the wind on the average for the six hours ending midnight of the 29th was exactly twice as great as at Lynchburg. No safe conclusion can be drawn from this fact, however, since the ratio of the wind velocity at Lynchburg to that of Norfolk is about as the numbers 4 to 10.

The storm center evidently passed slightly to the westward of Washington. The wind gradually increased in violence, reaching a maximum velocity of 66 miles per hour for five minutes at 11.15 p. m., and maintaining an average velocity of 56 miles from 10.40 p. m. to 11.40 p. m. The wind was remarkable for this locality both on account of its duration and the high velocity attained. The trees in the city and suburbs suffered greatly, although in sheltered places little damage was done. At the Dalecarlia Reservoir (a sheet of

water a little less than an eighth of a mile wide) the effect of the increased velocity of the wind, caused by passing over a water surface, is plainly seen. The north bank of the reservoir is lined with a grove of pine trees about 6 inches in diameter. Probably 80 per cent of the trees on the northern edge of the reservoir were broken off 10 to 15 feet above ground, while the destruction at some distance inland from the water was not more than about 5 per cent.

The wind at Baltimore, 40 miles east-northeast of Washington, was less violent than at the last-named place, the maximum velocity for five minutes being but 36 miles per hour.

At Harrisburg, Pa., the winds were even more violent for a short period than at Washington. The maximum velocity of 72 miles per hour occurred at 1.10 a. m., two hours, lacking five minutes, later than at Washington. This would give the storm a rate of progression of over 50 miles per hour, somewhat greater than the average velocity over the entire course.

The greatest average hourly velocity at Harrisburg was 47 miles for one hour and 45 miles for two hours.

Instrumental records of wind velocity between Harrisburg and Lake Ontario are wanting, but from reports of damages by wind at intermediate points it is inferred that there was a decided lull in the violence of the storm while passing through northern Pennsylvania and central New York, followed by a renewal of activity in Cayuga and Cortland counties, New York. It passed thence to the St. Lawrence Valley as an ordinary rain and wind storm.

Comparison of the relative wind velocities on the two sides of the hurricane can not well be made. The number of self-registering wind instruments in the storm's path was quite small, and moreover there is considerable uncertainty regarding the exact position of the area of lowest pressure. Local differences of anemometer exposure also prevent comparison of wind velocities except under the most favorable circumstances. The maximum velocities recorded near the center of the storm as at Jacksonville, Savannah, Washington, and Harrisburg were the highest ever known.

It may also be interesting to note that though the storm passed northward through nearly 15° of latitude its easting was but 3.5°. The general course of West India hurricanes after passing the lower latitudes is northeasterly. In the present case the pressure distribution to the eastward seemed to give the storm a more northerly direction of motion.

NOTES BY THE EDITOR.

FORMS OF CLOUDS.

On several occasions the Editor has stated that there is probably no peculiar form of motion that is possible for a gas that may not be found illustrated in some meteorological phenomenon and many of these forms are visibly illustrated in the ordinary clouds themselves. Numerous students of cloud forms have, during the past two hundred years, described the great cumulus clouds, from whose tops there stream forward a haze which stretches many miles in the approximate direction toward which the thunderstorm is moving. In the early part of the present century the study of these overflows was a favorite topic with Espy, Daniell, Dalton, and other observers. This overflow from the top of the cloud is mechanically similar to the gentler overflow of any current of air on itself when it has risen higher than its position of equilibrium. Similar overflow currents are frequently to be observed in the rivers and the oceans, and there, as well as in the atmosphere, we may observe the phenomena,

due to the fact that two currents are flowing in nearly opposite directions while the boundary surface between them becomes mechanically unstable and is, therefore, thrown into a great variety of curves, waves, and breakers. When the horizontal motions of upper and lower layers are strongly opposed to each other and especially when there is a thin stratum of intervening quiet air the median layer is thrown into a movement like that of a series of horizontal rolls which remain stationary if the upper and lower winds are equal, but ordinarily move along slowly in the direction of the stronger current. As they advance their movements sometimes become slower until finally the rotary motion practically ceases and the clouds, having diminished to a very small size, glide smoothly and slowly as if along down a gently inclined plane. If the descent is rapid, the clouds dwindle away and disappear more rapidly, but if it is very slow, they may extend for a hundred miles as a sheet of the most delicate cirrus or cirro-cumulus, or if they are lower down, alto-cumulus. Sometimes we lose