

running over the levee. No one knows how long the water had been over the levee, for the rainstorm had been so intense and the electrical storm so terrific that it appears that no one had ventured out to note conditions.

The residential lowland district was under water before any one knew it, house pets giving first alarm by cries and scrambling for places of safety. People stepping out of bed found water ankle deep, and more, already in their homes, and the flood soon became waist deep. Ceilings were opened and refuge taken in lofts, and daylight found many people marooned on housetops awaiting rescue.

By 7:30 a. m. a crevasse was made in the levee some distance above the residential district, and the flood filled in rapidly, water running into residence windows by 10 a. m., and reaching the eaves of many homes by

2 p. m., when the flood crest stood highest of record at this station, 39.1 feet.

The lowland residential district embraces about 4 square miles, and about 1,500 inhabitants were subjected to overflow waters. After the levee broke many head of live stock drowned in their stalls, at hitching posts, in wire entanglements, in hobbles and lariated, while many head of other animals were washed away.

While there are but 11 known dead, many are missing and can not be accounted for by any reasoning other than that they have been drowned and buried in drift and river débris. Losses can only be estimated. The reckoning embraces losses within the city limits, probably reaching half a million dollars affecting live stock, municipal properties, and homes and home furnishings, while the item of clean-up expenses will run into thousands of dollars.

RAINFALL OF COLOMBIA, SOUTH AMERICA.

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[Weather Bureau, Washington, D. C., May 28, 1922.]

In this REVIEW 50:146 announcement was made of the proposed establishment of a meteorological service in the Republic of Colombia. In view of the fact that exceedingly few series of meteorological observations are available for that country, it has seemed advisable at this time to make an inventory of such as are available and publish it in the interest of all concerned. As the title of this note suggests, rainfall only will be considered. Temperature observations are likewise very few in number, but the geographic position of Colombia, together with the known rate of decrease in temperature with altitude, make the deficiency in observational material less serious than in the case of precipitation.

Precipitation measurements varying in length from 1 to 10 years are available for but 10 stations, and 6 of these are along the Pacific Railroad from Buenaventura to Cali on the Cauca River, a distance of 108 miles. For these latter only the annual totals are available.

The rainfall of Colombia is almost wholly of the convective type and is clearly associated with the declination of the sun as the latter successively crosses parallels of latitude on its northward progress at the vernal equinox and on its return journey southward at the autumnal equinox. The rainy seasons, of which there are two in the zone between the Equator and say 8° north or south latitude, separated by relatively dry seasons, are coincident with the time of zenith sun at midday. The first wet season occurs in the months of April, May, and June and the second in September, October, and November. In latitudes more distant from the Equator the two wet and the two relatively dry seasons merge into a well-defined wet and dry season, respectively, of varying length and without sharp lines of demarkation between the two. On the Pacific coast of Colombia, however, rain falls almost daily and there is no dry season; in other localities there is considerable rain in the so-called dry season.

The annual totals in inches are presented for the 10 stations in Table 1.

TABLE 1.—Annual rainfall in Colombia, South America (inches and hundredths).

| Years. | Buenaventura. ⁴ | San Jose. ⁴ | Caldas. ⁴ | Palmar. ⁴ | Lomitas. ⁴ | Yumbo. ⁴ | La Manueleta (Cauca Valley). ⁴ | Medellin. ⁵ | Bogota. ⁶ | Patomines* on Rio Neche. |
|------------------------|----------------------------|------------------------|----------------------|----------------------|-----------------------|---------------------|---|------------------------|----------------------|--------------------------|
| Elevation (feet). | Sea-level. | 600 | 2,560 | (?) | ..... | (?) | 3,500 | 5,2167 | 8,612 | ..... |
| 1849..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 74.40 | ..... |
| 1881..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 54.25 | ..... |
| 1882..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 35.97 | ..... |
| 1883..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 30.35 | ..... |
| 1900..... | ..... | ..... | ..... | ..... | ..... | ..... | 39.97 | ..... | ..... | ..... |
| 1901..... | ..... | ..... | ..... | ..... | ..... | ..... | 45.21 | ..... | ..... | ..... |
| 1902..... | ..... | ..... | ..... | ..... | ..... | ..... | 33.80 | ..... | ..... | ..... |
| 1903..... | ..... | ..... | ..... | ..... | ..... | ..... | 56.38 | ..... | ..... | ..... |
| 1904..... | ..... | ..... | ..... | ..... | ..... | ..... | 37.74 | ..... | ..... | ..... |
| 1905..... | ..... | ..... | ..... | ..... | ..... | ..... | 33.79 | ..... | ..... | ..... |
| 1906..... | ..... | ..... | ..... | ..... | ..... | ..... | 39.96 | ..... | ..... | ..... |
| 1907..... | ..... | ..... | ..... | ..... | ..... | ..... | 47.80 | ..... | ..... | ..... |
| 1908..... | ..... | ..... | ..... | ..... | ..... | ..... | 54.94 | ..... | ..... | ..... |
| 1909..... | ..... | ..... | ..... | ..... | ..... | ..... | 55.13 | ..... | ..... | ..... |
| 1910..... | 323.96 | 270.00 | 57.08 | 34.06 | ..... | ..... | 48.60 | ..... | ..... | ..... |
| 1911..... | 248.66 | 277.37 | 46.66 | 25.41 | 33.34 | ..... | ..... | ..... | ..... | ..... |
| 1912..... | 265.10 | 400.88 | 54.56 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1913..... | 234.90 | 296.10 | 50.11 | ..... | ..... | 37.73 | ..... | ..... | ..... | 143.6 |
| 1914..... | 262.58 | ..... | 31.09 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1900-1910 ¹ | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 62.63 | ..... |
| 1875-1879 ² | ..... | ..... | ..... | ..... | ..... | ..... | 44.66 | ..... | ..... | ..... |

¹ 11 months.
² 5-year mean.
³ 11-year mean.
⁴ *Bul. Amer. Mus. Nat. His.* 36: 79-83. The distribution of bird life in Colombia, Frank M. Chapman.
⁵ *Met. Zeit.* 3: 419.
⁶ *Signal Service International Bulletin*, 1880-1884.

Remarks on Table 1.—Buenaventura is the sea-level terminus of the Pacific Railroad of Columbia; San Jose is distant therefrom 23 miles and in the region of heavy tropical rains. The station Caldas, 51 miles from the coast, is in a relatively arid pocket or basin shut off from the prevailing westerly winds by a mountain ridge which apparently robs the winds of their moisture. The stations Palmar and Lomitas are apparently on the Pacific slope; the details are missing, however, and the reason for the relatively small rainfall is not known.

The record for La Manuelita was made on the sugar estate of Mr. Charles J. Eder about 5 miles northwest of Palmyra.

TABLE 2.—Mean monthly precipitation (inches).

| Stations. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. | Annual. |
|----------------|----------|-----------|--------|--------|------|-------|-------|---------|------------|----------|-----------|-----------|---------|
| Bogota..... | 3.04 | 3.62 | 3.97 | 7.98 | 6.79 | 3.99 | 2.71 | 2.71 | 2.22 | 8.01 | 7.75 | 4.44 | 57.13 |
| La Manuelita.. | 3.19 | 3.10 | 4.16 | 6.09 | 5.37 | 2.93 | 1.50 | 1.45 | 2.98 | 5.81 | 4.72 | 3.29 | 44.53 |
| Medellin..... | 2.16 | 2.52 | 5.27 | 6.93 | 7.76 | 6.61 | 4.13 | 5.12 | 6.42 | 7.38 | 5.87 | 12.68 | 62.63 |

Seasonal distribution.—Table 2 contains the monthly averages for the stations, Bogota, on the high table-land; La Manuelita, in the upper Cauca Valley; and Medellin, the capital of the Department of Antioquia. The latter is the largest of the inhabited departments of the Republic; its capital is situated at the junction of at least four mountain ranges at an elevation of about 5,000 feet. It is an example of those cases where the pause in the wet season is not well marked, there being fairly heavy rains in July and August. La Manuelita at a less elevation and slightly nearer to the Equator has two wet and two dry seasons, although not sharply defined. The rains of Bogota show a slight diminution in July, August, and September and in a less degree in January and February.

Finally, Table 3 gives the monthly amounts for Bogota and Pato mines in Antioquia. The record of the latter is for a single year only, but it illustrates the variable nature of wet and dry seasons. The dry season in the particular year here given was confined to the two months February and March.

TABLE 3.—Monthly precipitation (inches) for Bogota and Pato mines.

| Year. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. | Annual. |
|-------------------------|----------|-----------|--------|--------|------|-------|-------|---------|------------|----------|-----------|-----------|---------|
| BOGOTA. | | | | | | | | | | | | | |
| 1848 ¹..... | ..... | ..... | ..... | ..... | 7.80 | 3.07 | 3.19 | 3.23 | 4.76 | 7.80 | 15.75 | 9.61 | ..... |
| 1849 ¹ | 5.47 | 3.35 | ..... | 12.72 | 8.50 | 4.84 | 4.06 | 6.02 | 1.97 | 10.39 | 7.79 | 5.39 | 74.40 |
| 1850 ¹ | 5.32 | 5.08 | 3.11 | 6.26 | 5.79 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 1880 ²..... | ..... | 10.12 | 9.61 | 7.28 | 2.24 | 1.97 | 2.40 | 2.09 | 5.67 | 3.98 | 2.87 | ..... | ..... |
| 1881 ²..... | ..... | 5.32 | 1.02 | 9.54 | 4.25 | 2.64 | 1.30 | 1.61 | 2.80 | 9.80 | 10.71 | 4.68 | 54.25 |
| 1882 ²..... | ..... | 3.50 | 3.50 | 2.56 | 3.94 | 3.15 | 2.13 | 2.76 | ..... | 5.83 | 5.59 | 1.93 | 35.91 |
| 1883 ² | 4.13 | 2.05 | 1.26 | 2.19 | 4.53 | ..... | 2.80 | 1.89 | ..... | 8.11 | 2.80 | 2.17 | 39.35 |
| 1884 ² | 2.95 | 2.44 | 4.25 | 5.94 | 5.47 | 8.03 | 3.54 | 1.06 | 2.20 | 8.46 | ..... | ..... | ..... |
| Means..... | 3.04 | 3.62 | 3.97 | 7.98 | 6.79 | 3.99 | 2.71 | 2.71 | 2.22 | 8.01 | 7.75 | 4.44 | 57.13 |

PATO MINES, ON RIO NECHE, ANTIOQUIA.

| | | | | | | | | | | | | | |
|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1913..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 17.4 | 20.3 | 15.7 | 18.6 | 7.8 | ..... |
| 1914..... | 8.7 | 1.8 | 0.6 | 8.8 | 18.8 | 14.4 | 10.7 | ..... | ..... | ..... | ..... | ..... | 143.6 |

¹ *Annuaire de la Societe Meteorologique de France* 1: 269-272. 1853.
² *International Bulletin Sig. Ser.* 1880-1884.

In the *Industrial and Commercial Handbook of Colombia* ¹ Trade Commissioner P. L. Bell has collected considerable information of a nonstatistical character on

¹ Department of Commerce, *Special Agents Series No. 206*, Colombia.

the rainfall of that country which briefly summarized is as follows:

Caribbean coast country.—A tropical low-lying coast region, dry and semiarid from the peninsula of Goajira as far as Santa Marta, with the rainfall and vegetation increasing from Barranquilla and Cartagena until the region of the Atrato River is reached, where extreme tropical conditions prevail and the rainfall is as heavy as anywhere in the Tropics, being equal to that of Panama. * * *

The Santa Marta region receives slightly more moisture than Rio Hacha (to the east in the Goajiro country), but not enough to mature crops, irrigation having to be resorted to in the banana district south of Santa Marta harbor. The average precipitation in this latter region does not exceed 14 inches. The Caribbean coast in the region of Barranquilla and Cartagena receives more rainfall than Santa Marta, but still not sufficient to mature crops very well, there being frequent years of extreme drought lasting from October to May. The annual average precipitation is about 26 inches.

Interior.—Farther south along the ranges of the central Andes, in the region of Medellin, the climate changes. There are two wet and two dry seasons, the former occurring during April, May, and June and during November and December. Still farther south along this range, as at Manizales, elevation 7,000 feet, the seasons and the amount of rainfall, the latter averaging about 60 inches per annum, are the same but the temperature is lower and may be called ideal. * * *

In the Cauca Valley conditions are about the same as for the second zone, with two wet and two dry seasons, the climate being called semitropical and the temperature averaging 76°.

Pacific coast.—Along the Pacific coast and the western slope of the Cordillera and the small northern range of coast hills, rains are incessant and very heavy, equaling the fall in the Atrato region and that of Panama. At the Pacific port of Buenaventura it rains every day, and the annual precipitation is more than 160 inches. This heavy rainfall on the coast diminishes farther south and in the neighborhood of Tumaco is reduced to the normal amount of 60 inches per annum on the average.

METEOROLOGICAL NOTES ON CANTON, CHINA.

By GEORGE D. HUBBARD.

[Oberlin College, Oberlin, Ohio, Apr. 5, 1922.]

The Freeman Meteorological Observatory, founded in 1918, is located on the campus of the Canton Christian College, 23° 06' N., 113° 19' E., about 1,200 feet from the Canton River. This river is subject to tides at Canton, although about 80 miles from the sea. The shelter is 30 feet above mean river level and consists of a 30-foot-square mat shed which has open sides to a height of 3 feet from the ground and a sloping double roof of palm leaves supported on a bamboo frame. In this shelter are the air thermograph, soil thermograph, barograph, and hygograph, each making continuous records, and the thermometers and psychrometer for current measurements of air temperature and humidity. Outside the shelter are an evaporation pan, a still well, and an anemometer for measurement of evaporation, a standard rain-gauge, and a thermometer suspended 18 inches underground in a bamboo tube.

On the roof of one of the college buildings are a wind vane and an anemometer and electric sunshine recorder, which are connected to a register in the physics laboratory. There is also provided a tide-well with a continuous-record register. Summaries of the daily observations of all the instruments are published monthly in a four-page leaflet which can be had by any service offering a reasonable exchange.

The author has obtained the records for 1919 and 1920 and herewith presents a summary of monthly totals and averages of six or eight of the elements, which is about half of the items covered by the observatory.