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AVERAGE ANNUAL RAINFALL OF PORTO RICO, W. I.

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In the latter part of 1898 a station of the first order of the United States Weather Bureau was established in the city of San Juan, the capital of the newly acquired tropical island of Porto Rico. In the following year substations to the number of 30 or more were established over the island, at which the daily extremes of temperature, the amount of rainfall, the direction of the wind, and the general state of the weather were recorded daily. These substations were from time to time increased in number, and at the present time weather records are available for more than 50 localities for periods varying from 1 to 11 years. At 4 stations the observations antedate the American occupation: At San Juan extending back to 1870, at Canóvanas and at Mayagüez to 1889, and at Luquillo to 1896.

All of these records are now being reduced, under the direction of the Chief of the Weather Bureau, in the preparation of a report upon the climate of Porto Rico. The present paper is confined to a brief preliminary survey of the average monthly and seasonal rainfall of the island, and to some of the more marked variations from what may, for the present, be regarded as normal values.

The island of Porto Rico is the smallest and easternmost of the Greater Antilles and lies between 18° and 18°30' north latitude, and between 65°40' and 67°15' longitude west from Greenwich. The island is nearly rectangular in form, with an east-west length of about 100 miles and an average width of about 35 miles.

As local topography is one of the principal factors in the control of rainfall distribution, it is unfortunate that there is

not available even a rough attempt at a topographic chart of the island. Such maps as there are show the location of a mountain range, the principal watershed, extending across the greater portion of the island from east to west, a little to the south of the central line; also a shorter east-west range, the Luquillo Mountains, in the extreme northeast portion of the island. From these two systems numerous spurs extend, mostly northward, cutting up the island into a complex system of hills and valleys, with the hundreds of small streams for which the island is noted. The mountain peaks of the Luquillo Range and the main divide rise to elevations of 3,000 to 3,500 feet. The main divide has an average elevation of, perhaps, 2,000 feet, while the main spurs will average from 1,000 to 1,500 feet. The lowlands are found only along the coast, forming a narrow strip along the north, east, and west coasts, with a broader belt along the south coast. The localities for which rainfall records are here given range in elevation from sea level to 2,600 feet, with an average altitude of 640 feet. Fifteen of the 44 stations enumerated have elevations between 1,000 and 2,600 feet.

In the accompanying table the average rainfall is shown for months, seasons, and for the entire year, the length of the records varying from 5 to 20 years. The geographical distribution of rainfall over the island is shown more clearly by means of the seasonal and annual charts forming figs. 1 to 6.

Attention is directed only to the more important and striking characteristics of the rainfall distribution. The average annual rainfall for the island, as a whole, is 77 inches. The

Average monthly and seasonal precipitation (in inches) for the period 1899-1909 in Porto Rico, W. I.

Stations.	Number of years.	Elevation in feet.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Winter.	Spring.	Summer.	Autumn.	Year.
1. Adjuntas.....	9	1,700	3.85	1.21	4.03	5.53	8.79	7.48	7.94	12.10	11.03	12.78	8.73	4.91	9.97	18.35	27.58	32.54	86.44
2. Alto de la Bandera.....	5	2,600	3.26	3.89	4.54	5.54	9.14	7.16	6.56	12.64	13.56	14.46	9.49	4.96	12.06	19.22	26.36	37.62	95.19
3. Aguadilla.....	11	35	2.11	2.08	3.04	4.55	9.76	12.02	8.78	9.19	9.37	8.72	8.06	2.61	6.80	17.35	29.99	26.15	80.29
4. Aguirre.....	11	10	1.58	1.04	1.76	1.87	4.29	7.78	5.55	6.20	6.83	7.22	4.23	1.93	4.55	7.92	19.53	18.28	50.28
5. Aibonito.....	5	2,000	3.93	4.32	4.70	3.33	7.42	4.81	4.10	6.50	7.42	6.68	7.69	4.51	12.76	15.45	15.41	21.79	65.41
6. Arecibo.....	7	290	3.36	3.08	4.07	3.95	5.49	4.24	4.89	5.36	4.89	5.42	8.09	6.19	12.65	13.51	14.49	18.41	59.04
7. Bacupey (near Arecibo).....	5	1,000	3.24	4.65	4.44	5.76	8.17	5.35	3.91	9.11	8.58	6.76	10.28	8.17	16.06	16.37	18.37	26.62	77.42
8. Barros.....	15	2,000	5.72	3.32	5.48	4.39	10.52	4.74	5.61	4.61	7.91	8.67	8.89	7.96	16.40	19.89	14.96	25.47	76.72
9. Cayaman.....	11	75	4.41	2.52	4.14	4.64	8.53	6.22	7.50	9.31	7.93	6.92	8.53	6.48	13.36	15.30	22.93	25.28	75.87
10. Canóvanas.....	11	250	4.18	2.27	3.31	3.48	4.86	7.85	8.07	7.34	7.21	7.78	6.65	4.87	11.32	11.65	22.26	21.64	67.87
11. Canóvanas.....	20	20	1.82	2.62	3.61	4.74	6.41	7.13	10.46	8.69	6.03	6.30	9.93	7.54	15.34	14.76	26.28	25.16	79.54
12. Carmelita (1).....	7	1,500	3.17	3.06	5.86	6.60	10.86	7.64	7.25	12.26	13.52	14.86	12.53	4.26	10.49	23.32	27.15	40.91	101.87
13. Carmelita (2).....	7	2,500	4.52	4.04	6.78	7.09	12.23	7.50	7.73	13.24	14.11	16.09	13.11	6.36	14.92	26.05	28.47	43.30	112.74
14. Cayey.....	11	1,300	3.44	2.61	3.26	4.04	5.32	8.35	6.87	8.03	7.17	7.44	7.33	4.82	10.57	12.62	23.25	21.94	68.36
15. Cidra.....	11	1,800	6.00	4.09	5.21	4.51	6.82	8.65	8.79	10.02	6.48	6.78	7.46	7.43	17.52	16.54	28.36	20.72	83.14
16. Coamo.....	8	800	3.42	1.48	1.77	3.80	4.26	5.90	3.58	5.97	5.26	6.81	6.43	4.04	8.95	9.83	15.16	18.50	52.43
17. Cozaj.....	11	600	4.84	4.04	4.64	5.53	6.30	8.28	7.15	8.02	7.38	9.14	8.66	6.79	15.67	16.47	21.45	25.18	78.78
18. Fajardo.....	11	15	3.71	2.24	3.37	4.12	5.47	7.23	6.09	5.96	7.63	8.74	9.61	5.16	11.11	12.96	19.25	25.96	69.33
19. Guanica.....	8	15	1.28	0.70	1.74	2.56	4.00	4.37	1.94	4.08	4.86	6.01	4.94	1.29	3.27	6.30	10.59	12.20	87.16
20. Guayama.....	9	17	1.84	1.16	2.58	2.37	5.29	7.94	6.11	4.96	6.95	8.20	5.35	2.02	5.02	9.86	19.01	20.50	54.39
21. Humacao.....	11	80	4.16	2.32	3.95	5.09	9.40	10.17	7.99	9.55	10.69	9.58	8.37	5.17	11.65	18.44	27.71	28.59	86.39
22. Isabela.....	11	250	3.14	2.72	2.77	4.17	5.70	4.82	3.39	6.06	5.85	5.59	8.66	5.42	11.34	12.64	14.27	19.60	67.85
23. Isolina.....	11	1,400	4.78	4.21	6.34	6.46	12.28	7.24	5.89	8.79	11.25	8.75	10.35	8.52	17.51	25.08	21.92	30.35	94.86
24. Juana Diaz.....	11	200	0.94	0.64	1.63	2.64	4.66	5.66	4.23	5.87	6.75	8.68	5.86	1.79	3.37	8.93	15.76	21.29	49.35
25. Lares.....	7	1,400	2.94	3.72	5.24	7.53	10.50	8.68	8.12	10.16	9.09	10.43	10.21	5.71	12.37	23.27	26.96	29.73	92.33
26. Las Marias.....	9	1,000	3.14	2.65	6.19	6.94	14.08	10.56	10.18	13.14	13.55	12.17	10.71	4.46	10.25	27.21	33.88	36.43	107.77
27. Luquillo (1).....	9	500	7.22	3.04	6.99	10.60	14.99	13.57	15.15	11.56	11.83	15.39	16.22	9.47	19.73	31.87	40.88	43.44	135.32
28. Luquillo (2).....	9	1,200	8.21	3.39	6.54	11.97	14.94	13.75	14.58	11.14	12.24	13.94	15.23	9.36	20.96	39.75	39.45	42.41	126.57
29. Manati.....	11	85	3.76	3.46	4.95	4.92	4.85	5.05	6.09	5.65	6.84	6.59	9.86	7.43	14.65	14.72	16.79	23.29	69.45
30. Mayaguez.....	11	40	4.33	3.11	3.97	3.30	7.20	10.71	7.66	7.99	9.16	11.13	8.10	5.30	12.74	14.47	26.99	25.39	81.96
31. Mayaguez.....	15	20	2.05	1.65	2.90	4.51	7.60	7.66	6.62	9.87	8.87	7.99	8.25	2.81	6.54	15.01	27.15	23.11	71.81
32. Morovis.....	9	375	5.25	3.38	6.38	5.74	8.35	5.63	6.39	11.06	8.61	10.01	8.62	7.70	16.33	20.47	23.08	27.24	87.12
33. Ponce.....	11	50	1.09	0.69	1.36	1.99	3.17	5.48	3.47	5.25	5.75	7.46	3.81	1.12	3.81	6.54	14.20	17.02	40.67
34. Rio Blanco.....	6	150	5.04	5.33	6.36	5.85	10.56	12.58	10.96	12.17	13.36	12.18	10.99	7.30	18.16	22.77	35.71	36.53	113.17
35. Rio Piedras.....	8	75	3.90	3.07	4.16	4.31	6.23	6.68	6.25	8.47	7.69	5.94	7.04	7.07	14.04	14.70	21.40	20.67	70.81
36. San German.....	11	200	2.24	2.29	3.69	5.74	5.81	6.17	5.49	7.41	6.38	9.06	8.90	3.94	8.47	15.24	19.07	24.43	63.21
37. San Lorenzo.....	10	200	3.19	2.40	4.25	4.54	6.98	12.94	9.58	8.00	10.04	9.43	7.04	5.08	10.67	16.77	30.22	26.51	83.17
38. San Juan.....	11	82	4.52	2.10	3.17	3.85	4.79	6.20	6.47	7.44	6.36	6.11	7.57	5.40	12.02	11.81	20.11	20.04	63.88
39. Santa Isabel.....	9	22	1.24	0.75	1.31	1.59	4.95	4.40	3.67	3.80	5.86	6.59	4.65	2.16	4.15	7.85	11.67	16.80	40.67
40. Utuado.....	9	1,900	3.45	0.48	3.00	5.35	11.32	8.57	5.07	8.75	10.53	10.13	10.32	4.68	8.47	19.65	22.99	31.28	81.79
41. Utuado (San Salvador).....	9	1,500	3.33	2.22	4.80	5.24	9.60	5.94	5.49	7.71	11.11	8.53	10.64	5.29	11.34	19.64	18.94	30.28	80.19
42. Vieques (Island).....	11	45	3.51	2.38	2.61	3.24	4.06	5.68	5.05	5.75	7.12	7.07	5.26	2.98	8.87	10.01	18.48	19.45	53.81
43. Yabucoa.....	8	100	4.64	3.63	3.76	4.41	8.16	10.13	7.06	9.66	12.32	10.36	8.50	5.05	13.32	16.35	26.85	31.18	87.76
44. Yauco.....	11	200	2.13	0.99	2.61	3.19	4.43	5.28	3.87	5.84	5.70	6.82	5.33	1.76	4.88	10.28	14.99	17.85	48.06
Means.....			3.67	2.63	4.00	4.70	7.59	7.57	6.81	8.31	8.68	8.99	8.54	5.14	11.44	16.39	22.69	26.20	77.30
Maximum average.....			8.21	5.82	6.73	11.27	14.98	13.75	15.15	13.24	14.11	16.08	16.23	9.47	20.96	32.75	40.28	43.44	135.57
Minimum average.....			0.94	0.46	1.31	1.59	3.17	4.24	1.94	3.80	4.35	5.43	3.81	1.12	3.81	6.54	10.39	15.20	37.16

Maxima and minima are given in black figures.

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C O N T E N T S .
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<u>Average annual rainfall.</u>	1-4
Variability of rainfall	12-
Max. rainfall in 24 hrs.	60-
Ann. frequency of days + stated amts. rainfall.	76-
Local storm of S. 6-7, 1910.	68-
Normal temperature of Porto Rico,	28-
Mean mo'ly. + ann'temp.	20-
Earthquakes felt in P.R. 1899-1910,	36, 44, 52.

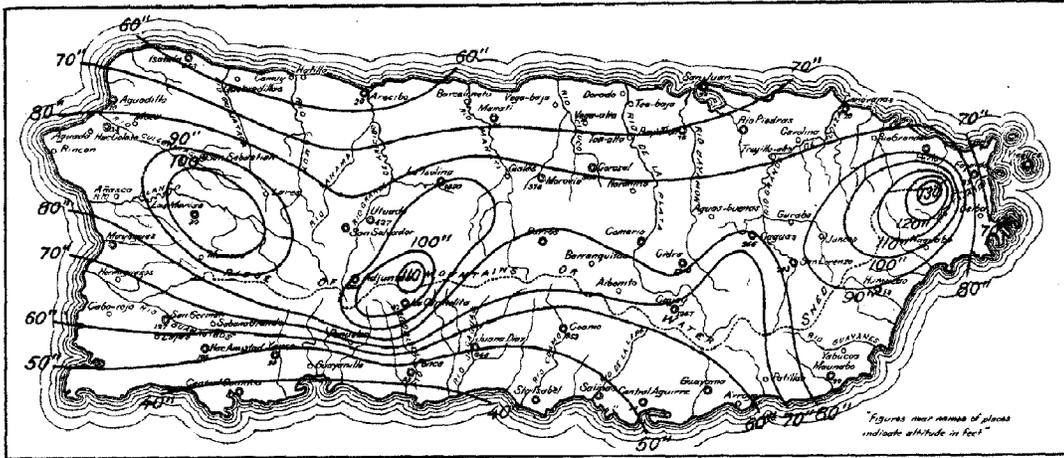


FIG. 1.—Porto Rico mean annual rainfall, 1899-1909.

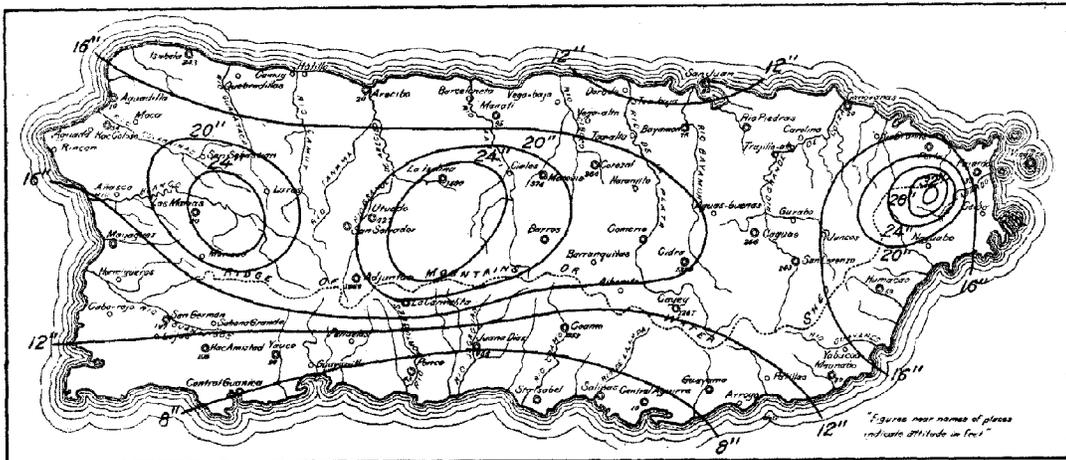


FIG. 2.—Porto Rico mean spring rainfall, 1899-1909 (March-May).

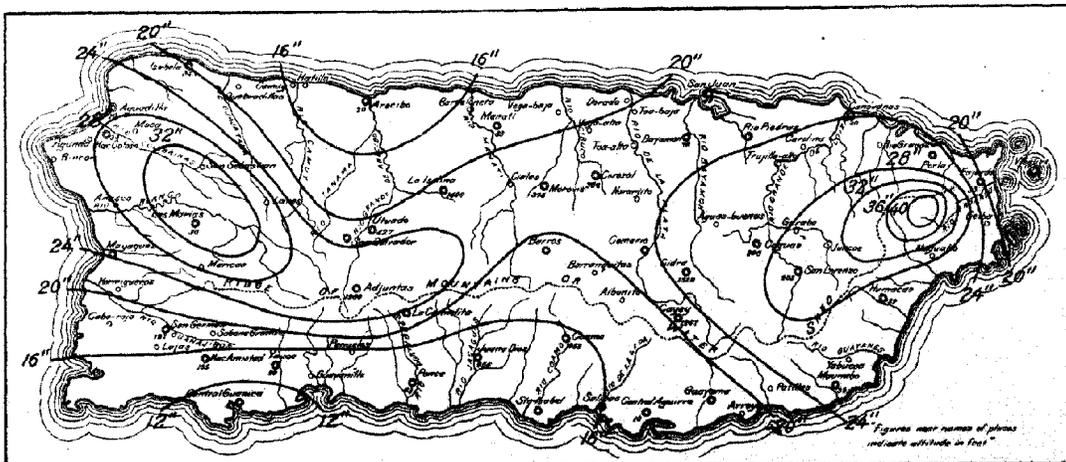


FIG. 3.—Porto Rico mean summer rainfall, 1899-1909 (June-August).

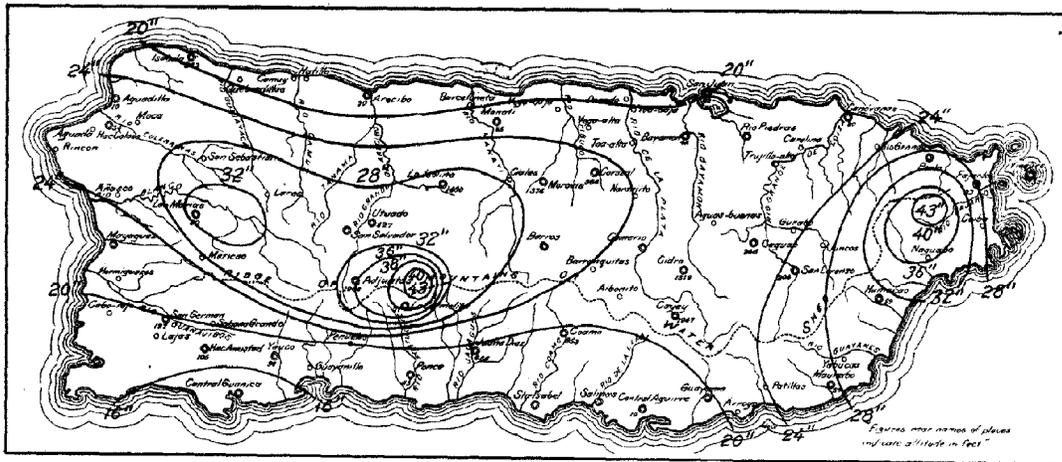


FIG. 4.—Porto Rico mean autumn rainfall, 1899–1909 (September–November).

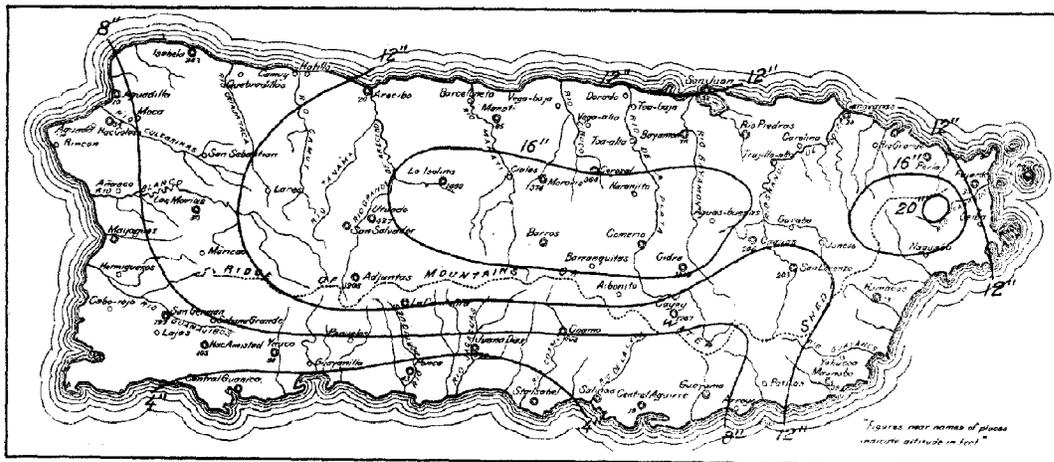


FIG. 5.—Porto Rico mean winter rainfall, 1899–1909 (December–February).

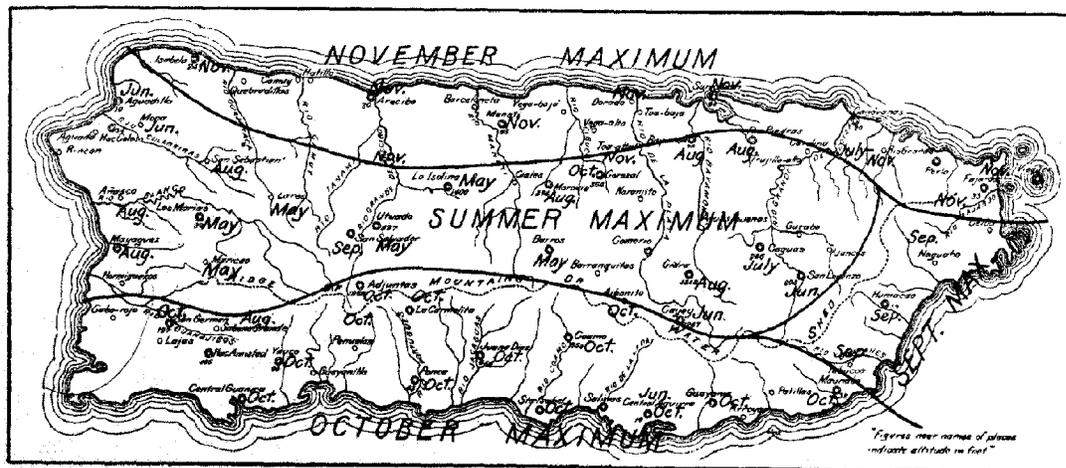


FIG. 6.—Map showing the month of maximum rainfall in Porto Rico, W. I.

amounts vary from a minimum of 37 inches along the south coast—an area devoted largely to the cultivation of sugar cane—to a maximum of 136 inches on the eastern slope of the Luquillo Mountains in the northeast portion of the island, within the area of the proposed Luquillo National Forest Reserve. This range gives rise to a large number of little streams which water the extensive coffee and sugar plantations of the surrounding country. At stations along and near the south coast the average annual rainfall is about 45 inches; along the north coast, the region of the citrus fruits and pineapples, the average fall is about 65 inches. Along the east and west coasts the near-by mountains and hills cross the path of the prevailing winds and we find, in consequence, a heavier rainfall, with an average of 75 inches for the west coast and 85 inches for the east coast. Owing to similar favorable topographic conditions we find the rainfall considerably heavier in the interior of the island than along the north and south coasts, only a few miles distant.

There are three well-defined centers of heavy rainfall on the island: (1) The Luquillo Range, a heavily wooded and inaccessible region in the northeast; (2) the mountains about Adjuntas, near the south-central part of the island, a region of coffee plantations; (3) a group of peaks in the west-central part, among which nestle the towns of Maricao, Las Marias, San Sebastian, and Lares, also a region of rich coffee plantations. In all of these centers the average annual rainfall exceeds 100 inches (see fig. 1).

The rainfall of the north side of the island differs from that of the south side not only in being greater in quantity but also in being more certain to fall in amounts sufficient for all the needs of plant growth at all seasons of the year. On the south side periods of 4 or 5 weeks with little or no rain are of frequent occurrence, while periods of 2 to 3 months with less than an inch of rainfall are not uncommon.

The scheme of irrigation now being provided for along the south coast will, in great measure, remedy the evils of an irregular and insufficient rainfall. In the mountains, but a few miles distant, there is an abundant water supply, available at all seasons of the year, which can be carried to the cane fields at comparatively small cost. At the present time it is costing the planters from \$25 to \$50 per acre per year to pump ground water for irrigating their cane fields.

There are no well-defined wet and dry seasons on the island. The winter rains (fig. 5) are comparatively light, with a minimum in February at practically all stations having a record of more than 7 or 8 years. From February there is a steady increase in the rainfall through May. From May to November there is no uniformity in the variations. For the island, as a whole, the maximum is reached in October (see fig. 4), though the amounts from May to November are so nearly alike that a period of heavy rains may readily throw the maximum from one month into another, even with a record of 10 years or more. This was abundantly illustrated by the heavy rains of November, 1909, increasing the average value for the month in many localities to such an extent as to change the maximum from October to November. Charting the time of maximum rainfall (see fig. 6) we find a rough division of the island into three areas: South of the main divide the maximum occurs almost without exception in October; along the north coast it occurs in November; in the interior and on the west coast it falls in the summer months, from May to August. On the east coast it occurs in September.

In the seasonal distribution there is a progressive increase in the amount of rainfall, for the island as a whole, though the statement does not apply to individual stations (see figs. 2 to 5). The figures are: Winter, 11 inches; spring, 16 inches; summer, 23 inches; and autumn, 26 inches, making up the total of 77 inches for the average annual amount for the island.

AVERAGE ANNUAL RAINFALL OF PORTO RICO.

Continued.

THE VARIABILITY OF RAINFALL IN PORTO RICO.

In the Climatological Report for December, 1909, and for January, 1910, the average monthly and annual rainfall is published for all stations in Porto Rico having a rainfall record of five or more years. In the following tables the average monthly and annual number of days with a rainfall of 0.01 inch or more, and the greatest and least monthly and annual amounts of rainfall during the entire period of observation, are shown.

Along the southern coast the average annual number of days with rain varies from 75 to 100; along the western and northern coasts, and generally in the interior of the Island, the average is about 175, and along the eastern coast the average exceeds 200. On the eastern slope of the Luquillo Mountains, in the northeastern portion of the Island, rain occurs nearly 300 days per year, while the greatest number recorded in any one year was 341 in 1900. For the Island as a whole rain occurs, on the average, on 169 days of the year, while the monthly frequency varies from 10 to 14 during the winter and spring months, and from 15 to 17 from May to November.

AVERAGE NUMBER OF DAYS WITH RAIN (0.01 inch or more).

Table with columns: Stations, No. of years, and monthly rainfall days (January to December) plus Annual. Lists various stations like Adjuntas, Aguadilla, etc., with their respective rainfall day counts.

GREATEST AND LEAST MONTHLY AND ANNUAL RAINFALL.

(In inches and tenths.)

Table with columns: Stations, and monthly rainfall (January to December) plus Annual. Lists various stations with their greatest and least monthly and annual rainfall values.

NOTE.— T. represents a monthly rainfall of 0.05 or less.

[Continued.]

THE RAINFALL OF PORTO RICO.

(Continued.)

THE GREATEST RAINFALL IN 24 CONSECUTIVE HOURS.

The Climatological Report for December, 1909, contains a general discussion of the average monthly and annual rainfall of the Island of Porto Rico; the tabular statement of monthly and annual averages for all stations having a record of five or more years will be found in the Report for January, 1910. A second contribution to the subject of Rainfall in Porto Rico was published in the Report for February, 1910, and contains a table showing the greatest and least monthly amounts of rainfall at all stations named in the table of average monthly values, and also a table showing the average number of days with rain of 0.01 inch or more, at the same stations. The table herewith contains a record of the greatest amount of rain recorded in any period of 24 consecutive hours at 62 stations in Porto Rico. The observations cover periods varying from one year to eleven years, with an average length of period of about eight years. Observations are, as a rule, made at about 6 o'clock in the afternoon; hence the amounts of rainfall recorded refer approximately to the 24-hour period from sundown to sundown.

The amounts of rainfall recorded in the table, being extreme values covering a series of years, naturally vary greatly from month to month, and according to the geographical position of the station. The most interesting fact revealed in the table is the maximum amount recorded during each month for the entire period of eleven years: The amounts vary from 3.50 inches in February, 1908, at Añasco, on the west coast, to 23.00 inches, at Adjuntas, on the main divide. The rainfall of 23.00 inches occurred in 23 hours on August 9, 1899, Adjuntas being in the path of the center of a hurricane of great intensity. The nearest approach to this record of 23.00 inches within a period of 24 consecutive hours is that of 17.00 inches on July 8, 1901, near Luquillo, on the eastern slope of El Ynnque, the highest peak of the Luquillo range, on the northeastern coast of Porto Rico. April, July, August, September, and November, all show records in excess of 10 inches in 24 hours. There is no obvious geographical grouping of these excessive amounts of rainfall: The heavier rains are apparently as likely to occur in the regions of light rainfall as in the regions of greater and more frequent rains. The hurricane of August, 1899, the heavy rains of May 10-13 and November 10-13, 1909, and the severe local storm of September 6-7, 1910, were responsible for a large proportion of the excessive amounts recorded. Only the total amounts recorded during a period of 24 hours are shown in the accompanying table. In most cases these amounts fell in much less time, and the actual period would show a much greater rate of fall. Some of the more remarkable rates of fall for shorter periods will be given in a later number of the Climatological Report.

Computing the average values of the excessive rainfalls recorded in the table for each month, we find again that the

smallest amounts occur in the month of February (1.80 inches) and the largest in the month of August (6.36 inches); next to August, the month of most frequent excessive rains is November, with an average amount of 5.08 inches. The average value for the heaviest 24-hour rainfalls recorded during the entire year for the Island as a whole is 7.65 inches.

GREATEST RAINFALL IN 24 CONSECUTIVE HOURS.

Stations.	No. of years.*	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
Adjuntas	9	2.3	1.2	2.5	3.6	3.1	5.9	2.4	23.0	10.0	3.0	4.9	1.9	23.0
Adjuntas, Alto de la Bandera	5	1.1	2.0	1.8	2.2	2.9	1.9	2.2	4.5	2.9	3.5	3.7	2.4	4.5
Aguadilla	4	2.4	1.0	3.1	2.0	2.0	3.6	2.0	7.0	1.4	1.7	2.7	1.4	7.0
Aguadilla, Hac. Coloso	10	2.0	2.4	5.0	2.0	3.4	3.4	4.4	6.0	4.3	3.9	5.7	1.8	6.0
Aguas Buenas	1	1.6	1.7	1.8	1.5	1.8	2.0	2.0	1.6	1.7	3.6	2.6	2.7	3.6
Aguirre	10	0.7	0.8	1.7	2.2	4.5	4.5	4.3	7.0	3.5	4.0	9.0	2.0	9.0
Aibonito	5	1.4	1.3	1.1	2.4	3.4	2.0	2.6	4.1	4.1	3.8	7.4	1.4	7.4
Añasco	4	0.7	3.5	2.1	2.2	2.3	2.2	2.3	2.3	2.3	1.7	1.5	4.6	4.6
Arcoibo	7	4.2	2.7	4.0	2.2	2.0	2.7	2.3	8.0	2.1	2.0	8.0	4.0	8.0
Bacupey, Hac.	4	1.2	2.0	1.2	2.2	2.0	1.9	2.6	2.6	2.8	2.9	5.2	4.5	5.2
Barros	7	4.8	2.0	2.4	4.2	4.1	2.8	5.8	1.5	6.1	2.6	6.8	4.0	6.8
Bayamon	11	3.2	1.4	5.3	6.3	2.5	3.0	2.3	6.1	4.7	2.6	3.4	3.7	6.3
Cabo Rojo	2	1.8	1.4	1.6	2.6	1.2	3.0	2.4	1.1	2.4	1.7	2.7	1.3	3.0
Caguas	11	4.0	2.0	1.4	7.0	5.6	8.0	5.3	5.0	6.0	5.0	3.3	2.0	8.0
Caguayan	20	3.1	2.5	4.5	6.8	6.0	4.2	6.3	8.1	3.1	3.4	5.8	6.4	8.8
Carmelita (A)	7	1.7	1.7	3.8	5.4	4.0	4.0	3.7	6.8	3.5	5.7	9.9	3.5	9.9
Carmelita (B)	6	2.1	1.5	4.0	3.8	3.8	3.6	2.0	8.0	4.6	6.1	6.0	3.9	8.0
Cayey	10	1.6	2.0	3.0	4.3	2.5	6.8	4.5	11.6	6.5	2.7	7.6	1.7	11.6
Cidra	9	2.5	2.4	3.0	1.9	2.6	4.9	4.3	10.0	2.3	4.1	5.6	4.3	10.0
Coamo	6	8.1	1.7	2.0	2.4	3.0	4.0	4.4	10.0	5.0	1.9	4.0	5.0	10.0
Comerio and Falls	3	2.1	3.1	2.0	0.6	2.4	1.5	3.6	5.7	3.3	1.4	3.4	2.9	5.7
Corozal	9	2.3	2.8	2.3	3.2	2.4	2.6	2.3	7.0	2.3	2.8	3.8	3.4	7.0
Culebra	2	3.6	1.3	2.0	1.1	3.5	1.3	1.6	3.2	2.1	1.8	4.3	0.7	4.3
Destino, Hac.	2	0.9	0.1	0.6	0.5	2.7	4.0	1.9	5.0	2.1	2.6	6.4	5.0	5.0
Dorado	2	1.8	1.5	1.4	0.8	2.0	1.7	1.0	3.0	0.6	2.9	0.5	1.3	3.5
Fajardo	11	3.8	1.7	2.2	8.4	3.4	4.0	7.6	5.0	6.5	4.4	5.4	2.5	8.4
Guánica	7	1.0	0.9	2.5	2.0	6.2	4.9	3.1	6.2	4.1	3.2	3.7	1.7	6.2
Guayama	9	0.7	1.4	3.5	3.9	4.4	6.4	3.3	3.7	3.5	3.3	10.6	1.3	10.6
Huacabo	10	2.0	2.7	2.0	6.6	7.8	4.8	5.5	5.0	6.2	4.5	10.4	2.8	10.4
Isabela	10	5.4	3.1	2.0	4.0	3.4	2.7	1.4	11.3	3.4	2.5	4.5	5.0	11.3
Isolina	11	3.7	3.4	5.8	5.2	5.2	3.8	3.8	8.0	5.8	6.6	4.7	4.4	8.0
Jajuya	1	1.5	0.8	0.7	1.7	1.0	0.6	1.5	5.6	1.2	1.5	0.9	0.4	5.9
Juana Diaz	8	2.0	1.8	2.2	2.1	4.4	4.2	3.0	11.2	3.5	5.3	4.1	3.6	11.2
Juncos	1	0.4	0.3	1.0	0.7	4.5	1.2	2.0	4.2	0.6	0.8	1.0	0.4	4.5
Lajas	3	1.0	0.7	0.5	1.6	3.3	6.0	2.0	11.2	5.3	2.7	2.4	2.1	11.2
Las Marias	8	3.8	2.7	3.1	2.5	3.8	4.3	3.1	3.6	4.2	4.5	6.4	2.4	6.4
Lares	7	1.2	1.8	2.4	2.7	3.7	3.4	2.4	3.2	4.6	3.2	5.0	3.6	5.0
Luquillo, Hac. Perla (A & B)	6	2.5	1.7	2.8	12.2	5.1	9.1	17.0	9.0	8.0	4.5	9.3	5.0	17.0
Manati	11	2.0	2.4	9.3	3.1	2.9	2.8	3.8	9.5	3.7	3.1	0.0	7.5	9.5
Maricao	3	1.0	1.9	1.5	2.2	3.3	1.8	2.8	3.0	2.0	3.6	6.5	1.5	6.5
Manabo	10	2.1	1.9	2.8	3.2	7.3	4.2	2.6	4.0	2.6	4.8	9.5	2.0	9.5
Mayagüez	11	1.8	2.4	2.3	4.1	4.1	4.0	2.8	8.4	6.2	2.8	4.1	2.2	8.4
Morozón	6	2.2	1.3	8.3	2.4	4.4	1.8	1.9	8.0	5.3	4.4	4.4	2.2	8.3
Naguabo	1	0.7	1.3	0.5	1.0	2.6	2.1	0.9	3.2	2.0	1.7	8.3	0.6	8.3
Peñuelas	2	0.7	1.3	1.6	2.7	2.0	2.4	0.9	3.7	1.6	1.1	1.5	1.1	3.7
Ponce	9	1.5	0.9	1.9	1.8	2.2	4.8	4.6	10.0	3.2	3.3	5.0	1.3	10.0
Potón, Hac.	1	0.4	0.1	0.4	1.8	3.9	3.4	1.6	2.9	1.6	1.8	3.6	0.2	3.9
Rio Blanco	6	1.4	2.2	2.1	1.8	5.8	6.1	4.2	6.9	5.6	4.9	7.0	2.2	7.0
Rio Piedras	8	2.4	1.8	3.2	5.4	3.2	2.4	3.0	3.5	2.5	2.3	2.7	2.8	5.4
Sabana Grande	1	2.5	1.2	0.3	1.3	1.9	2.2	1.9	5.5	0.8	3.1	4.0	1.4	5.5
San Germán	9	0.9	2.2	3.0	2.7	3.3	6.8	2.2	8.6	2.5	4.0	5.8	2.0	8.6
San Juan	11	3.1	2.7	2.1	5.4	4.8	2.6	4.0	6.3	3.8	3.6	3.0	4.3	6.3
San Juan de Tierra	2	0.9	0.5	0.8	3.3	0.9	2.1	1.8	5.2	2.7	2.3	2.0	0.8	5.2
San Sebastián	2	2.8	1.9	1.8	2.4	2.7	3.0	1.9	2.2	4.4	3.1	2.4	2.0	3.1
Sau Lorenzo	9	2.0	2.0	4.1	8.3	4.0	5.6	7.2	8.0	5.3	4.5	5.0	2.4	8.3
Santa Isabel	8	1.1	0.7	1.0	1.8	5.5	3.8	5.4	3.8	6.4	4.1	5.3	2.4	6.4
Utado	4	2.8	0.8	5.6	3.0	5.2	3.0	2.7	10.0	8.5	4.6	6.4	3.0	10.0
Utado San Salvador	9	2.0	2.0	2.4	2.4	3.7	2.8	3.6	4.2	9.9	3.0	6.4	3.4	9.9
Vega Baja	1	.....	0.9	1.2	0.5	1.6	1.6	1.4	0.9	.....	.....	2.2	.....	2.2
Vieques	11	1.5	1.8	1.6	8.0	4.1	2.1	6.0	8.0	10.0	4.0	6.3	1.0	10.0
Yabucoa, Central Ingenio	5	2.2	1.0	1.4	2.0	4.8	2.7	1.9	3.2	5.2	5.4	12.9	1.4	12.9
Yanco	10	1.8	1.6	2.3	4.1	7.1	8.0	3.0	8.0	2.9	2.8	2.5	2.0	8.0
Greatest and year..	.....	8.1	3.5	9.3	12.2	7.8	9.1	17.0	23.0	10.0	6.6	12.9	7.5	23.0
	.....	1901	1908	1901	1900	1909	1902	1901	1899	1901	1901	1909	1906	1899
Average	.....	2.2	1.8	2.5	3.7	3.6	3.6	3.4	6.4	3.9	3.3	5.2	2.5	7.6

* Periods covered end not later than 1909.
 * For less than one year.
 † In 23 hours, during hurricane.

THE ANNUAL FREQUENCY OF DAYS WITH STATED AMOUNTS OF RAINFALL.

(With Table.)

As the manner in which rain falls is a matter of considerable importance in the successful growing of crops, the records of forty stations in Porto Rico have been analyzed with reference to the frequency of occurrence of stated amounts of rain. The rainfall is measured daily—generally at about 6 p. m.; hence the amounts recorded are for periods of twenty-four hours from sunset to sunset. The daily amounts were tabulated into groups as indicated in the accompanying table. The divisions represent intervals of 0.10 inch up to half an inch; 0.25 inch between 0.50 inch and 1.00 inch; 0.50 inch between 1.00 inch and 2.00 inches, and all amounts exceeding two inches were placed in the last group. For instance, San Juan has an average of 209 days in the course of the year upon which rain falls to the extent of 0.01 inch or more. These 209 days represent the following average distribution: On 96 days the amounts recorded were 0.10 inch or less; on 32 days the amounts were between 0.11 inch and 0.20 inch; on 14 days, between 0.51 inch and 0.75 inch; and on 3 days the amounts exceeded 2.00 inches, etc.

In general the form of the curve representing the frequency of the stated amounts of rainfall is very much the same for all stations. There is a maximum frequency for the smallest amount (0.01 inch to 0.10 inch) and a rapid falling off in frequency for each succeeding amount to half an inch, and then a slow decrease to the last group. For the Island as a whole the average number of days per year with a rainfall of 0.01 inch or more is 165. There are 55 days with amounts varying from 0.01 inch to 0.10 inch, or 33 per cent of the total number; there are 28 days with amounts varying from 0.11 inch to 0.20 inch, or 17 per cent of the total number. These two groups, comprising amounts from 0.01 inch to 0.20 inch, make up 50 per cent of the entire number of days with rain. The rate of decrease for larger amounts is very much slower. One rain in four exceeds half an inch; one rain in ten exceeds one inch; while 3 per cent of all daily rainfalls exceed two inches in amount.

The differences between stations are mostly in the percentage of frequency of the smallest group—amounts of less than 0.10 inch. At Caguas, for example, 61 per cent of all daily rains are in amounts of 0.10 inch or less; at San Juan, 46 per cent; at Ponce, 30 per cent; at Lares, 9 per cent. Lares and Las Marias differ from all other stations in having a higher percentage of frequency for the second group (0.11 inch to 0.20 inch) than for the first. The number representing the frequency of the first group (0.10 or less) for Caguas

is phenomenally large, namely, 160 out of a total annual frequency of 262. This ratio is not equaled at any other station on the Island, the nearest approach being 96 in a total of 209 for San Juan, followed by 96 in 230 at La Carmelita (A). Caguas has as many days with rain as Luquillo, which is the wettest region on the Island, although the annual rainfall at Caguas is but 68 inches, as compared with 136 inches at Luquillo. Large differences are also shown for neighboring stations. La Carmelita (A) and (B) are stations upon the same plantation, but differing in elevation by about 1,000 feet. The percentage of frequency for amounts from 0.01 inch to 0.10 inch for station (A), which has an elevation above sea-level of 1,500 feet, is 42, while that for (B), with an elevation of 2,500 feet, is but 30. For amounts between 0.11 inch to 0.20 inch the percentages are respectively 13 and 15.

AVERAGE ANNUAL FREQUENCY OF DAYS WITH STATED AMOUNTS OF RAINFALL.

Stations.	No. of years.	.01 to .10 inch.	.11 to .20 inch.	.21 to .30 inch.	.31 to .40 inch.	.41 to .50 inch.	.51 to .75 inch.	.76 to 1.00 inch.	1.01 to 1.50 inches.	1.51 to 2.00 inches.	Over 2.00 inches.	Annual number of days with rain.
Adjuntas	9	44	19	14	14	10	16	11	13	7	5	151
Aguirre	10	50	21	13	8	7	8	6	6	3	5	125
Albionito	5	44	41	17	13	10	12	8	6	4	4	158
Añasco	4	19	17	13	10	9	16	13	13	8	3	141
Aguadilla (Coloso)	10	37	26	15	12	12	16	14	12	6	5	155
Arecibo (City)	7	39	39	15	12	9	11	8	6	3	4	138
Arecibo (Jobos)	4	70	35	19	15	10	15	10	12	5	5	196
Barros	6	47	26	19	11	11	13	10	9	5	6	157
Bayamón	10	79	34	21	15	12	16	10	9	4	4	204
Caguas	9	160	32	18	13	6	11	9	6	4	3	262
Canóvanas	20	70	37	25	15	10	13	10	9	4	5	198
Cayey	9	61	33	21	12	9	13	7	6	3	4	169
Cidra	4	56	34	19	15	8	11	9	10	3	5	170
Coamo Springs	6	23	15	7	6	5	7	7	9	3	3	87
Corozal	9	35	28	21	16	11	13	10	10	6	4	154
Fajardo	10	70	36	21	14	10	14	7	7	4	4	187
Guánica	8	15	12	6	6	5	7	4	4	2	3	62
Guayama	9	59	25	16	8	6	12	7	6	3	4	146
Humacao	10	49	27	25	17	13	17	12	10	4	6	180
Isabela	10	32	27	15	10	8	12	6	7	3	4	124
Isolina	10	48	50	22	13	13	19	11	11	6	8	186
Juana Diaz	8	17	11	9	7	5	8	5	8	3	4	77
La Carmelita (A)	7	96	30	19	14	12	20	11	15	4	9	230
La Carmelita (B)	7	70	34	23	19	12	23	17	14	8	8	228
Lares	7	12	19	17	16	12	18	16	16	5	8	139
Las Marias	8	21	25	19	12	12	21	15	15	8	9	155
Luquillo (La Perla)	6	74	43	31	21	17	24	15	17	9	11	262
Maoní	10	76	28	18	16	10	13	9	6	4	5	185
Maunabo	10	50	34	23	18	14	18	10	9	6	5	199
Mayagüez	10	67	27	17	13	11	18	10	13	5	5	186
Ponce	9	24	16	10	5	4	8	4	2	3	4	80
Rio Piedras	8	30	26	22	14	9	14	7	9	4	4	210
San Germán	9	23	18	14	11	9	14	9	10	6	4	118
San Juan	11	96	32	21	15	9	14	7	9	3	3	209
San Lorenzo	9	95	35	25	16	9	14	8	11	3	7	233
Santa Isabel	8	22	16	10	7	6	9	3	4	2	4	83
Utua (San Salvador)	9	64	30	19	12	9	18	9	10	5	6	184
Vieques	7	28	32	15	12	6	11	5	5	2	2	123
Yabucoa (C. Ingenio)	5	76	43	31	16	15	18	12	7	4	6	226
Yauco	9	37	16	12	8	6	10	7	4	4	5	107
Average frequency entire Island	8	55	28	18	13	10	14	9	9	4	5	165
Average percentage of frequency (entire Island)	33	17	11	8	6	6	6	6	2	3	—	—

*100 per cent.

THE LOCAL STORM OF SEPTEMBER 6-7, 1910, IN PORTO RICO.

During the night of September 6-7, 1910, a wind and rain-storm of considerable intensity passed over the northeastern portion of the Island of Porto Rico. The damage to property was comparatively small, and was confined almost entirely to the north coast east of San Juan, and to the east coast from Fajardo to Maunabo. In San Juan and the suburbs of Santurce and Rio Piedras the high wind and torrential rains played havoc with telephone and telegraph wires; the electric lighting and power system was temporarily put out of service, plunging the city into intense darkness and causing great confusion and alarm.

During the morning and afternoon of the 6th there were indications of the approach of a tropical storm in the appearance of the sky, the steadily increasing northeast wind and slowly falling barometer, though the center was evidently at a considerable distance to the south of the Island.* The wind increased to a gale and the rain fell in torrents, creating the impression in and about San Juan that the hurricane was upon us. As communication with the rest of the Island was cut off during the early stages of the storm, this impression deepened into conviction. The limited extent of the storm was not realized until the following day, when news came from other parts of the Island showing normal weather conditions over more than two-thirds of Porto Rico.

As the storm was unusual in character, the cooperative observers of the U. S. Climatological Service were called upon for more detailed information concerning weather conditions on the 6th and 7th. San Juan was within the area of greatest violence, and an excellent opportunity was afforded to study the character and progress of the storm by means of the self-recording instruments in the local office of the Weather Bureau.

During the early morning of the 6th the sky was comparatively free from clouds, a few strato-cumulus moving from the northeast, while a fresh northeast wind was blowing with a velocity above the normal. By 9 a. m., the time of the local a. m. observation, the sky was about three-fourths covered, five-tenths strato-cumulus moving rapidly from the northeast and about two-tenths alto-stratus from the southwest. By 10 a. m. the entire sky was overcast and practically remained so until the close of the following day, preventing further observation of the upper clouds. Rain began about 9 a. m., continued to noon, began again at 3 p. m. and continued with only occasional interruptions to about 4 a. m. of the 7th. From 6 p. m. to 8 p. m. the rain fell in torrents. The wind and the lower clouds continued steadily from the northeast, with increasing velocity, until about 8 p. m., when a maximum wind velocity of 72 miles per hour was recorded by the register in the office of the Weather Bureau. The barometer indicated a pressure very nearly normal for the season in the early morning of the 6th and until about 10 a. m. During the early afternoon the pressure fell but little, allowing for the usual diurnal variation, but the barometer did not respond to the usual diurnal rise from 4 to 5 p. m. At 5.45 p. m. the barometer stood at 29.93 (reduced to sea level) having remained nearly stationary for two hours; a sudden and rapid fall now began to a minimum of 29.76 at 7.20 p. m.; the barometer then rose even more rapidly to 29.92 at about 8.15 p. m., and then followed the usual diurnal rise to a normal pressure of 29.98 at 10.30 p. m. The entire period of the fall and rise in the barometer was about two hours and a half. At about 8.30 p. m. the wind began to veer from northeast to east, and later to east-southeast, while the velocity steadily

decreased to about 30 miles per hour by midnight, although between 1 and 2 a. m. of the 7th the velocity again rose to a maximum of 50 miles per hour, without, however, being accompanied by any marked variation from the normal course of the barometer. Thunder and lightning were reported by observers in all parts of the Island during the night of the 6-7th.

Reports from substations indicated that the storm was confined to a comparatively small portion of the Island along and near the east coast, and along the north coast from Fajardo to a few miles west of San Juan, and extended southward to Caguas, about twenty miles inland. Brisk to high northeast winds, occasionally rising to hurricane force, prevailed over practically the entire storm area during the afternoon and night of the 6th; the maximum velocity occurred generally between 7 p. m. and 8 p. m., with a secondary maximum between midnight and 2 o'clock in the morning of the 7th. The reports indicated a velocity along the east and northeast coast fully as high as the maximum recorded at San Juan. Most of the damage throughout the storm area was caused by the phenomenally heavy rains, which washed the cane fields and raised the rivers to unprecedented flood heights; several bridges along the east coast were destroyed. The rainfall at some stations broke all previous records for intensity during short intervals. There were two areas of excessive rainfall, one with Naguabo as a center with a fall of about 18 inches in 12 hours, the other with Comerio as a center with a fall of about 13 inches in 12 hours. Along the north coast from San Juan to Fajardo the rainfall was from 6 to 7 inches. At Caguas, between Naguabo and Comerio, the total rainfall was about 5 inches. Over fully two-thirds of the Island the cooperative observers reported that the weather conditions were about normal during the entire day. Some trees were uprooted in several localities within the storm area, but comparatively little damage was done to fruit trees by the high winds.

There was no conclusive evidence of an atmospheric whirl in the position of the uprooted trees and broken branches, a point to which special attention was called in the request for information. The steady northeast direction of the wind in all portions of the storm area indicated a disturbance more in the nature of a squall moving from east to west than a local cyclonic storm; the rapid fall and rise of the barometer at San Juan was distinct evidence, however, in favor of a whirl. The utter darkness which prevailed just preceding and during the storm made it impossible to observe the cloud movements. The existence of a current from the southwest as observed at the 9 a. m. observation indicated a general condition favorable to the production of local disturbances of wind and heavy rain, and it is possible that a cyclonic whirl existed at some distance above the surface of the earth.

Further study of the general weather conditions which prevailed over the West Indies at the time will doubtless reveal more fully the nature of the storm which passed over the eastern portion of Porto Rico.

Further details of wind and rainfall in connection with the storm are given below.

HEAVY RAINS OF THE 6-7th (IN INCHES).

Bayamón.....	4.67	Comerio Falls.....	12.80	Naguabo.....	19.11
Caguas.....	6.50	Corozal.....	12.87	Ponce.....	4.09
Canóvanas.....	5.45	Culebra.....	5.69	Rio Blanco.....	14.85
Cayey.....	5.43	Fajardo.....	6.81	Rio Piedras.....	6.63
Central Ingénio.....	10.54	Humacao.....	15.62	San Juan.....	6.55
Cidra.....	9.40	Maunabo.....	10.68	Vieques.....	6.75

ACCUMULATED AMOUNTS OF RAINFALL FOR SUCCESSIVE PERIODS INDICATED, AT SAN JUAN.

Minutes.....	5	10	15	20	25	30	35	40	45	50	60	80	100
Inches.....	0.28	0.25	0.40	0.34	0.66	0.95	1.17	1.45	1.71	1.95	2.61	3.98	4.18

GREATEST RAINFALL AT SAN JUAN IN ANY PERIOD AS INDICATED.

Time.....	5 min.	10 min.	15 min.	30 min.	1 hr.	2 hrs.	24 hrs.
Inches.....	0.43	0.91	1.51	2.09	3.43	4.21	6.40*

*Time of precipitation as actually recorded, 13 hrs. 10 min.

*Later advices from Washington located the center of a tropical disturbance in the eastern portion of the Caribbean Sea, about 400 miles to the southeast of the Island of Porto Rico.

NORMAL TEMPERATURE OF PORTO RICO, W. I.*

Porto Rico, in common with most of the islands of the tropics lying within the limits of the trade winds, has a warm but equable and comfortable climate. The small geographical extent of the Island, the moderate elevation above sea-level, and a constant wind, give to it a uniform temperature characteristic of marine climates. The Island is about 100 miles long from east to west, with an average width of 40 miles, while the mean elevation is perhaps 600 feet to 800 feet above sea-level. There is a narrow shelf of low land along the east and west coasts, and a broader belt along the north and south coasts. The hills and mountains of the interior rise abruptly from the coastal plain to elevations varying from a few hundred to 3,500 feet. Of the forty-three stations named in the accompanying table of average temperatures twenty are on the low coastal plain. The remaining stations have an average elevation of about 1,000 feet, of which twelve range in elevation between 1,000 feet and 2,500 feet.

Carefully made daily temperature observations extending over a period of five years in the tropics, where changes are small, will yield an average annual value which is within a fraction of a degree of true normal value. In Porto Rico the record of observations made under the auspices of the U. S. Weather Bureau began toward the close of the year 1898, and therefore covers a period of over eleven years. The average length of record per station is about eight years; only a few of the stations enumerated in the accompanying table have a record of less than five years, while many of them have been in continuous operation since 1899.

In considering temperatures of the atmosphere it is essential to bear in mind that observations are always made in the shade. This is a matter of special importance in discussing observations made in the tropics, where the contrast between shade and sunshine is so much more marked than in higher latitudes.

MEAN MONTHLY AND ANNUAL TEMPERATURES.

The simplest expression for the temperature of a region is its mean annual temperature for a series of years. The mean annual temperature for the Island of Porto Rico as a whole is 76.3°, a comfortable and healthful temperature when accompanied, as it usually is in Porto Rico, by the fresh winds of the northeast trades and a relatively high percentage of overcast skies. The stations on the coastal plain have a somewhat higher mean temperature—about 78° along the north, west and south coasts, and about 79° along the east coast. At inland stations the mean temperature is below 76°, varying from 76° to 72°, according to elevation above sea-level and other local conditions. The lowest temperatures are found, as usual, at the higher elevations—at stations from 2,000 feet to 2,500 feet above sea-level on the main divide, a range of mountains crossing Porto Rico from east to west a little south of the center of the Island.

The average annual temperature of the Island has varied but little from the normal during the past eleven years. In 1901, the warmest year of the period, the average was 1.3° above the normal, and in 1907, the coolest year, 0.9° below. During the current year (1910) the temperature continues decidedly below normal to the present time—May. The departures from year to year are indicated by the following figures:

1899....0.5 degree below normal.	1905....Normal.
1900....0.9 degrees above normal.	1906....0.2 degree below normal.
1901....1.3 degrees above normal.	1907....0.9 degree below normal.
1902....0.5 degree above normal.	1908....0.2 degree below normal.
1903....0.4 degree above normal.	1909....0.3 degree below normal.
1904....0.3 degree below normal.	

The average difference between the highest and lowest mean annual temperatures for all stations is 2.3°—at coast stations it is 2.0°, and at inland stations it is 2.8°.

AVERAGE WINTER AND SUMMER TEMPERATURES.

To those accustomed to the strong climatic contrasts of middle latitudes the difference between winter and summer temperatures in Porto Rico seems small and insignificant. While the figures do not show marked change, the contrast is nevertheless very decided, as registered by the factor of personal comfort.

January is, on the whole, the coolest month, with a general average of 73.0°, while the month of August is, on the whole, the warmest, with an average of 79.0°. The difference between the mean temperature of July, August, September and October are, however, very slight, and are probably due to differences in the rate of the wind movement, or to variations in the amount of cloudiness.

During the winter months the mean daily temperature is 75° to 76° along the immediate coast, decreasing to 74° over most of the coastal plain. At inland stations the mean temperature ranges between 72° and 68°, depending upon the elevation of the station above sea-level.

During the summer and early fall the mean temperature along the coast is 80° to 81°, although it frequently rises to 82° or 83° along the east coast. At elevated inland stations the mean summer temperature varies from 74° to 76°. A fairly constant difference of 6° to 8° is maintained between the mean temperature of coast stations and the higher inland stations throughout the year.

AFTERNOON AND EARLY MORNING TEMPERATURES.

While the mean daily temperature does not vary greatly from month to month, the differences between the afternoon and early morning temperatures, or the daily range as it is called, is comparatively large. At stations on the immediate coast, like San Juan, or on the smaller islands, like Culebra and Vieques, the diurnal range is influenced by uniform ocean temperatures and is quite small, from 10° to 11°. At all inland stations—and practically all the towns of Porto Rico are two or more miles from the coast—the mean daily range is from 20° to 25°, according to local topography. At stations along or near the coast the average daily maximum temperature is 87° (varying between 84° in winter and 89° in summer); the average daily minimum is 70° (varying between 66° in winter and 73° in summer). At inland stations the average daily maximum is 84° (with limits of 81° in winter and 87° in summer) and the average daily minimum is 65° (with limits of 61° in winter and 68° in summer).

AVERAGE DAILY MAXIMUM AND MINIMUM TEMPERATURES.
(Degrees Fahrenheit.)

Stations.	January.		July.		Year.		Range.
	Max.	Min.	Max.	Min.	Max.	Min.	
Coast: San Juan.....	80	70	86	75	84	73	11
Fajardo.....	85	68	88	75	86	72	14
Ponce.....	85	64	90	72	88	69	19
Mayaguez.....	86	62	90	68	88	65	23
Inland: Albouto.....	76	58	84	68	86	62	19
Barros.....	77	58	86	67	82	63	19
Cayey.....	81	59	88	68	85	63	22
Cosmo.....	86	62	91	70	89	66	23
Lares.....	83	58	90	64	87	62	25

The temperatures quoted in the preceding paragraphs are average values, and express the normal march of temperature from day to day and from month to month during a series of years, and the normal variations during the course of the day. In the middle and higher latitudes, especially in regions far removed from the coast, such average values usually differ widely from the figures representing actual temperatures experienced upon any particular day; in the lower latitudes, and especially upon the smaller islands like Porto Rico, large departures from normal conditions are exceptional and the figures representing average values do not differ greatly from those expressing the actual temperatures experienced from day to day.

*For table of mean monthly and annual temperatures, see Report for March.

MEAN MONTHLY AND ANNUAL TEMPERATURE OF PORTO RICO, W. I.

The figures representing the mean monthly and annual temperature in the accompanying table are based upon daily readings of the maximum and minimum thermometers made by cooperative observers of the U. S. Weather Bureau during the period from 1899 to the close of 1909. The average period of observation for the 43 stations named in the table is 8 years; most of the records cover a period of 9 or 11 years, while there is none for a period of less than 3 years. Of the total of 43 stations, 20 are situated along or near the coast, at elevations under 200 feet; of the inland stations, 12 range in elevation from 1,000 to 2,500 feet, while the average elevation for all inland stations is about 1,000 feet.

The mean temperature for the Island as a whole for the entire period of observation was 76.4° F. The difference between the mean temperature of the winter and summer

months is not large, ranging between 73.2° for January and 79.1° for August. The mean annual temperature of the coast stations is between 78° and 79°. There is a gradual decrease in temperature from the coast toward the crest of the main divide, which crosses the Island from east to west a little south of the central line; here the mean annual temperature is about 72°. The difference between the mean temperature of the coast stations and that of the central mountain region is about 7° or 8° throughout the year.

The average annual temperature for the Island has varied from a maximum of 78° in 1900, to a minimum of 75.9° in 1907, showing a range of only 2.1°. The variation in the mean monthly temperature is also very small, ranging from about 2° for the summer months to about 4° for the winter months.

MEAN MONTHLY AND ANNUAL TEMPERATURE IN PORTO RICO, W. I.

(In degrees Fahr.)

Stations.	Elevation—feet.	Number of years.	January.	February*	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Adjuntas	1,700	8	68.7	68.8	68.6	70.4	72.7	73.4	73.3	74.5	74.2	73.2	72.3	70.1	71.8
Alto de la Bandera	2,575	3	69.4	69.4	70.0	73.2	73.2	74.7	74.4	75.9	73.7	73.1	71.3	70.3	72.2
Aguadilla (Coloso)	31	10	74.2	73.8	73.9	79.0	77.8	78.7	79.0	79.4	79.2	78.6	76.6	75.1	76.9
Aguirre	10	10	76.2	75.9	75.9	78.0	80.0	80.4	80.5	81.4	81.3	80.7	79.5	77.2	79.0
Alibonito	2,060	5	67.0	67.6	68.8	70.8	72.3	74.2	75.7	76.1	75.0	74.6	71.1	68.0	71.8
Añasco	25	4	75.5	74.6	75.2	76.2	78.2	78.8	78.8	78.9	78.6	79.0	77.8	75.3	77.3
Arecibo	20	8	72.7	72.7	73.3	74.7	77.5	78.7	78.8	79.0	79.0	78.6	77.3	74.4	76.6
Bacupey and Jobos	1,000	4	70.4	70.4	71.1	72.6	74.5	75.6	77.1	77.4	76.7	76.4	76.4	72.6	74.0
Barros	2,000	7	68.5	68.6	69.3	71.2	73.5	75.6	76.2	76.3	74.5	73.8	72.3	70.4	72.5
Bayamón	75	11	73.7	74.1	74.5	76.1	77.9	78.5	78.9	79.3	79.6	78.9	77.8	75.2	77.0
Caguas	250	11	71.8	72.1	72.7	75.2	77.6	78.4	78.3	78.8	78.5	77.1	75.6	72.7	75.8
Candóguas	20	11	75.0	75.8	76.5	78.4	80.1	80.5	80.0	80.9	80.7	79.8	78.0	75.7	78.6
Carmelita A.	1,550	7	70.8	71.0	70.8	71.9	73.5	74.5	75.4	75.9	75.1	74.8	73.9	72.4	73.3
Cayey	1,300	10	70.3	71.0	71.2	73.9	75.3	77.1	78.3	78.2	77.0	76.6	74.4	72.2	74.5
Cidra	1,300	10	70.0	71.1	70.6	72.9	74.4	74.8	76.1	76.4	73.4	74.9	73.9	71.0	73.5
Coamo	850	7	73.4	74.4	75.4	76.8	77.4	78.6	80.5	81.1	79.5	79.0	77.9	75.9	77.5
Comerio	600	4	76.4	71.1	71.4	74.0	77.6	77.6	78.2	78.3	73.1	77.6	75.2	73.2	75.4
Corozal	600	11	72.7	73.4	72.9	75.0	76.9	78.0	78.5	78.7	79.1	78.6	76.9	74.3	76.3
Culebra	50	3	76.1	75.8	77.3	77.7	79.6	81.0	81.2	81.3	81.4	80.6	78.9	77.1	79.0
Fajardo	15	11	77.0	76.6	76.8	78.4	80.4	80.9	81.6	82.3	81.4	80.7	79.6	77.2	79.4
Güánica	50	8	73.8	74.5	75.3	76.2	77.8	79.9	79.0	79.5	79.6	78.8	76.9	74.9	77.2
Huimaco	60	4	72.6	72.6	74.2	75.6	78.0	78.8	79.2	79.5	79.2	78.5	76.9	74.3	76.6
Isabela	250	11	75.2	75.2	75.5	76.9	78.2	79.4	80.4	80.2	79.8	79.3	78.4	76.3	77.9
Isolina	1,400	11	71.2	71.8	71.5	73.2	74.9	76.5	77.2	77.3	76.8	75.9	74.8	72.1	74.5
Juans Díaz	200	10	76.1	76.0	76.9	78.0	78.8	79.9	80.9	80.9	80.9	80.0	79.0	77.7	78.8
Lajas	105	3	74.0	76.5	75.8	76.6	78.5	78.8	79.6	79.4	79.0	77.8	75.9	73.9	77.1
Lares	1,425	7	70.8	70.9	71.8	73.4	75.3	76.6	77.0	77.4	76.7	76.2	74.7	71.8	74.4
Las Marias	1,000	9	72.5	72.8	72.8	73.8	75.7	76.9	77.3	77.7	77.3	76.5	75.8	73.3	75.3
Luquillo A.	460	8	73.8	74.4	74.8	76.9	79.1	79.3	79.6	80.6	80.0	78.9	77.3	75.6	77.5
Manatí	85	11	73.8	74.4	74.7	76.4	78.4	79.6	80.2	80.7	80.1	79.1	77.2	74.7	77.5
Maricao	1,400	3	70.7	69.2	69.8	70.6	72.4	73.6	74.3	75.1	74.9	74.7	73.0	70.9	72.4
Mannabo	40	10	76.6	76.7	77.1	79.0	80.2	81.7	82.2	83.0	81.0	81.4	79.7	77.9	79.7
Mayagüez	20	10	74.4	74.7	75.1	76.4	78.1	78.9	79.2	79.5	79.6	79.2	77.7	75.8	77.4
Morovis	375	8	72.7	72.6	72.4	75.4	77.0	77.8	78.1	78.7	78.1	77.5	76.2	72.8	75.8
Ponce	50	10	75.1	75.0	75.8	77.5	79.1	80.2	80.3	81.2	80.7	80.1	78.8	76.5	78.3
Río Blanco	250	6	73.6	74.2	74.7	76.2	77.7	78.6	79.4	79.5	79.1	78.6	77.3	75.2	77.0
San Germán	200	9	73.9	74.4	74.5	75.8	77.6	78.8	80.0	80.1	80.2	79.5	77.9	75.7	77.3
San Juan	105	11	75.3	75.4	75.5	77.2	78.4	80.2	80.2	80.6	80.7	80.1	78.4	76.4	78.2
San Lorenzo	300	8	72.9	72.7	73.6	76.2	78.0	78.8	78.8	79.4	79.0	78.0	76.7	73.7	76.5
Santa Isabel	22	9	74.7	74.9	75.6	77.3	78.8	79.9	80.4	81.0	80.5	80.0	78.3	75.7	78.1
Utúado (San Salvador)	1,500	9	70.4	70.2	70.3	71.9	73.9	75.2	75.5	75.7	75.4	75.0	73.2	70.9	73.1
Yaguajay	45	11	76.1	76.3	76.9	77.8	79.7	80.1	81.1	81.3	81.0	80.7	78.9	76.8	78.8
Yauco	200	10	73.8	74.0	74.4	76.7	79.2	80.0	80.0	79.5	79.1	77.3	75.2	72.4	77.4
Normal			73.2	73.3	73.7	75.4	77.2	78.2	78.8	79.1	78.5	78.0	76.5	74.2	76.4

* Elevation changed to 350 feet during last two years of record.

**RECORD OF EARTHQUAKE SHOCKS REPORTED
AS FELT IN PORTO RICO, W. I., 1899-1910.**

STATION AND YEAR.	DATE.	REMARKS.	STATION AND YEAR.	DATE.	REMARKS.
			Carmelita (A), La:		
			1903	April 1	6 a. m.
			1904	July 4	10 p. m.
			1904	Dec. 13	9.15 p. m.
			1905	Dec. 26	8.45 p. m.
			1906	Sept. 26	Strong; 9.30 a. m.
			1906	Oct. 13	3.30 a. m.
			1906	Oct. 20	4.10 p. m.
			1907	Jan. 27	About 11 a. m.
			1907	July 5	4 a. m.
			1908	Aug. 13	4 a. m.
			1908	Sept. 5	Two; about 12.15 p. m.
			1908	Oct. 30	About 6 a. m.
			1909	Feb. 17	Rather stronger than usual, 2.55 a. m.; light, 3.05 a. m.
			Cayey	1901	Aug. 20
				1901	Dec. 9
				1902	May 22
				1902	Nov. 30
				1903	Oct. 9
				1906	Sept. 27
				1907	Aug. 17
				1907	Aug. 29
				1908	Sept. 5
				1909	Feb. 17
				1910	Mar. 3
				1910	Apr. 15
			Cidra	1899	Aug. 8
				1900	June 25
				1900	Oct. 2
				1901	Oct. 22
				1901	Dec. 9
				1903	July 27
				1908	Sept. 5
				1909	Feb. 17
			Coamo	1906	Sept. 27
			Come'o F'ls.	1900	Feb. 13
			Corozal	1903	Feb. 19
				1903	Oct. 9
				1906	Oct. 12
				1907	Jan. 28
			Culebra	1909	Feb. 17
			Farjardo	1901	Dec. 24
				1902	June 7
				1906	Sept. 27
				1906	Dec. 3
			Guánica Centrale:		
				1903	July 27
			Humacao	1900	Oct. 2
				1901	Oct. 22
				1901	Dec. 24
				1902	June 7
				1903	July 27
				1903	Oct. 9
				1905	Dec. 26
				1906	Sept. 13
				1906	Nov. 13
				1907	Aug. 17
				1908	Sept. 6
				1909	Feb. 17
			Ingénio (Central), near Yabucoa:		
				1906	Sept. 6
				1906	Oct. 20
				1909	Feb. 17
				1910	Apr. 15

Continued.

**RECORD OF EARTHQUAKE SHOCKS REPORTED
AS FELT IN PORTO RICO, W. I., 1899-1910.**

[Continued from May Issue.]

STATION AND YEAR.	DATE.	REMARKS.	STATION AND YEAR.	DATE.	REMARKS.
Isabela.....1899	Aug. 13	Evening.	Naguabo....1909	Feb. 17	2.45 a. m.
1899	Dec. 7	4.21 p. m.	Morovis....1906	Sept. 27	Two strong; 10.47 a. m.
1900	Feb. 13	Two; at 9.01 and 10.03 p. m.	1806	Sept. 30	Light; at night.
1906	Oct. 20	4.20 p. m.	Peñuelas ...1907	Sept. 16	Light.
1906	Nov. 18	7.30 p. m.	Ponce .....1901	Aug. 3	4.30 a. m.
1907	Aug. 30		1903	Dec. 20	Strong but of short duration; 3.21 a. m.
1908	May 9	11 p. m.	1904	Mar. 14	Strong; 6.30 a. m.
1908	Sept. 5		1904	Dec. 14	9.05 p. m.
Isolina, La.. 1899	July 10	About 10.30 (?)	1905	Dec. 26	Strong; 8.25 p. m.
1899	Sept. 4	10.45 p. m.	1906	Oct. 13	3.25 a. m.
1900	Feb. 13	Two; 9.15 and 10.08 p. m.	1908	Aug. 4	6.20 a. m.; slight damage.
1900	Oct. 1	9 p. m.	1908	Aug. 13	Very strong; some damage to walls of postoffice building; movement apparently vertical; 4.07 a. m.
1900	Oct. 2	Two shocks about 9.45 p. m.	1908	Oct. 31	Two strong; 6 and 8 a. m.
1900	Oct. 29	Slight; 5 a. m.	1909	Feb. 17	Strong.
1900	Oct. 30	Slight.	1909	Mar. 7	11 a. m.
1900	Nov. 16	3 a. m.	Rio Blanco..1909	Feb. 17	Two hard shocks; 3 a. m.
1900	Dec. 6	3.45 a. m.	Rio Piedras..1902	Nov. 30	Lasted about 30 seconds; 7.00 (?)
1901	Jan. 16	6.45 a. m.	1906	Sept. 27	Lasted about 40 seconds, apparently east-west; 10.45 a. m.
1901	May 7		San Germán.1901	June 1	Slight; 9.35 a. m.
1901	Aug. 3	Two rather severe; 4.20 a. m.	1901	Dec. 9	7.15 a. m.
1902	May 19	1.15 p. m.	1902	Sept. 2	
1904	July 2	9.20 p. m.	1906	Jan. 18	About 8 seconds; 6.15 a. m.
1905	Apr. 3	10 a. m.	1906	Sept. 27	About 12 seconds; number of buildings damaged; 10.45 a. m.
1906	June 15	5.30 p. m.	1908	Aug. 4	About 6 seconds; 6.45 a. m.
1906	Sept. 27	10.15 a. m.	San Juan....1899	Mar. 22	4.24 p. m. at Puerta de Tierra.
1907	Jan. 28	10.25 a. m.	1900	Oct. 2	7.18 p. m.; 5 seconds.
1907	Aug. 30	12 noon.	1900	Oct. 29	Slight; 4.20 a. m.
1907	Nov. 10	9.45 p. m.	1901	Oct. 22	Sharp, 2 or 3 seconds; 10.24 a. m.
Juana Diaz..1901	Oct. 22	11.25 a. m.	1901	Dec. 9	6.30 a. m.
1902	Jan. 5	6.05 p. m.	1903	June 16	By seismograph; 7.25 a. m.
1902	Nov. 30	8 p. m.	1903	Dec. 31	Slight; 5.29 a. m.
1906	Sept. 27	10.40 a. m.	1906	Sept. 27	Short, sharp vibrations apparently east-west; bay agitated but no wave; 10.47.30 to 10.48.20 a. m.
1906	Oct. 20	3.40 p. m.	1906	Oct. 3	Light; 3.16.50 p. m.
1909	Feb. 17	About 2 or 3 a. m.	1906	Oct. 20	Slight; 4.10 p. m.
Lajas.....1899	July 10	Strong; 8 p. m. and 2 a. m.	1906	Oct. 31	Slight; 11.07 p. m.
Lares.....1904	July 2	10.05 p. m.	1906	Dec. 14	Slight; 2.58 a. m.
1905	Dec. 26	8.30 a. m.	1907	Aug. 17	Short, sharp; 4 a. m.
1906	Oct. 20	4.03 p. m.	1907	Aug. 30	Light; 12.15 p. m.
Manatí.....1900	Feb. 13		1907	Sept. 4	Light; 10.40 a. m.
1900	Dec. 6	3.50 a. m.	1909	Feb. 17	Sharp; 2.50 a. m.
1901	Dec. 9	7 a. m.	1910	Apr. 15	5.25 p. m.
1902	Mar. 12	3.53 (?)	San Lorenzo.1901	Oct. 22	
1905	Dec. 26	8.40 p. m.	Santa Isabel.1901	Dec. 9	7.25 a. m.
1906	Sept. 27	10.42 (?); lasted 30 seconds.	1906	Sept. 27	
1906	Oct. 6	Light; 4.03 (?)	1910	Apr. 15	Light; 5.20 p. m.
1909	Feb. 17	2.50 a. m.	Toa Baja...1900	Oct. 2	
1910	Jan. 25				
Maricao....1907	Sept. 4	11 a. m.			
1908	Sept. 5				
1909	Feb. 17	Light.			
Maunabo...1900	Oct. 2	Two.			
1901	Oct. 23	11.07 (?)			
1903	Oct. 9				
1903	Oct. 22				
1904	Sept. 26				
1909	Aug. 31	Light; 5.45 a. m.			

Continued

**RECORD OF EARTHQUAKE SHOCKS REPORTED
AS FELT IN PORTO RICO, W. I., 1899-1910.**

[Continued from June Issue.]

STATION AND YEAR.	DATE.	REMARKS.
Utuado (San Salvador):		
1901	Aug. 3	
1901	Aug. 16	
1901	Aug. 5	
1901	Dec. 9	
1902	Jan. 19	
1902	May 19	
1903	Feb. 18	8.30 p. m.
1904	July 2	9.45 p. m.
1904	Dec. 13	9 p. m.
1905	May 13	9 p. m.
1906	Feb. 4	9 a. m.
1906	June 12	5.45 p. m.
1906	Sept. 27	Strong.
1907	July 5	
1907	Aug. 22	Light.
1907	Aug. 30	Light.
1907	Sept. 4	Light.
1908	Sept. 4	
1909	Feb. 17	3 a. m.
Vega Baja		
1906	Sept. 27	10.30 a. m.
1908	July 31	Three slight, between 6 and 7 a. m.
1908	Aug. 12	3.40 a. m.
1908	Sept. 5	Quite severe; 11.45 a. m.
1908	Dec. —	About 2 a. m.
Vieques.		
1899	Jan. 1	About 4 seconds; 5.30 p. m.
1900	Oct. 2	Pretty sharp, lasted about 3 seconds.
1901	Oct. 5	Moderate.
1901	Oct. 29	Moderate.
1902	May —	Two slight during month.
1902	June —	Three slight during month.
1903	Feb. 24	Light; 3.30 p. m.
1903	Oct. 9	8 p. m.
1903	Nov. 3	
1905	Mar. 15	
1906	June 21	3.30 p. m.

Vieques—Continued.

1906	Sept. 27	Strong.
1909	Nov. 2	Light.
Yauco		
1899	July 10	Two.
1901	Aug. 13	Strong, 3 or 4 seconds; 4.30 a. m.
1901	Dec. 9	Moderate, 3 seconds; 7.15 a. m.
1906	Sept. 27	Two slight; 10.30 a. m.
1909	Feb. 17	3 a. m.

The list of Porto Rican earthquakes published in the May, June and current numbers of the Climatological Report contains only such brief notes as have incidentally been reported to the local office of the U. S. Weather Bureau in San Juan during the past ten years by the cooperative observers of the Bureau. The time of occurrence noted in the list is presumably 60th meridian time, as that is the time in general use in Porto Rico, but no great degree of accuracy can be claimed for the reported times, as there are but few standardized clocks in Porto Rico. During the ten years covered by the record only one earthquake of moderate intensity was experienced, namely, that of the 27th of ~~August~~^{Sept.}, 1906. The time of occurrence of this shock was accurately noted by the observer of the U. S. Weather Bureau at San Juan, who was at his desk facing the clock at the instant that the shock began. There were short, sharp vibrations, apparently from east to west, judged from the movement of the doors. The seismograph at the U. S. Geodetic Survey station on the Island of Vieques indicated heavy shocks from 10.20 a. m., to 10.22 a. m., local time, and light shocks for twenty minutes longer. At the office of the U. S. Weather Bureau in San Juan the shocks were heavy from 10.47.35 a. m., to 10.48 a. m., 60th meridian time, and light for twenty seconds longer. No great amount of damage was done to buildings in San Juan. Walls were cracked in some buildings, and in a few instances mortar fell from the ceilings, but no one was injured.

The severest local earthquake within the memory of living Porto Ricans was that of 1867, which caused a great amount of damage to buildings in San Juan, and drove practically all residents of the city into the suburb of Santurce, or into the interior of the Island. Additional shocks, but less severe, occurred at intervals during the succeeding months of December January, February and March, while lighter shocks were experienced for a still longer period of time.