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CLIMATOLOGICAL DATA FOR NORTHERN AND WESTERN TROPICAL SOUTH AMERICA

BY
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SUPPLEMENTS TO THE MONTHLY WEATHER REVIEW

During the summer of 1913 the issue of the system of publications of the Department of Agriculture was changed and simplified so as to eliminate numerous independent series of bureau bulletins. In accordance with this plan, among other changes, the series of quarto bulletins—letters from A to Z—and the octavo bulletins—numbered from 1 to 44—formerly issued by the U. S. Weather Bureau have come to their close.

Contributions to meteorology such as would have formed bulletins are authorized to appear hereafter as Supplements of the MONTHLY WEATHER REVIEW. (Memorandum from the Office of the Assistant Secretary, May 18, 1914.)

These supplements comprise those more voluminous studies which appear to form permanent contributions to the science of meteorology and of weather forecasting, as well as important communications relating to the other activities of the U. S. Weather Bureau. They appear at irregular intervals as occasion may demand, and contain approximately 100 pages of text, charts, and other illustrations.

Owing to necessary economies in printing, and for other reasons, the edition of SUPPLEMENTS is much smaller than that of the MONTHLY WEATHER REVIEW. SUPPLEMENTS will be sent free of charge to cooperating meteorological services and institutions and to individuals and organizations cooperating with the bureau in the researches which form the subject of the respective supplements. Additional copies of this SUPPLEMENT may be obtained from the Superintendent of Documents, Washington, D. C., to whom remittances should be made.

The price of this SUPPLEMENT is 10 cents.

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CLIMATOLOGICAL DATA FOR NORTHERN AND WESTERN TROPICAL SOUTH AMERICA

By W. W. Reed

(Prepared under the direction of the Chief, Climatological Division, Weather Bureau, Washington, D. C.)

INTRODUCTION

The territory for which meterological data are presented includes the tropical region of South America outside of Brazil. Figure 1 shows how far the outposts of meteorological investigations have been advanced from north and west toward the interior of the continent.

In Dutch Guiana (Surinam), British Guiana, and Venezuela the collection and publication of weather records has been systematized in each under the direction of a central office and the network of stations has been developed to such an extent that it is possible to give a fairly comprehensive view of the prevailing weather conditions over their various parts. In other countries there has been little or no coordination of efforts to determine climatic conditions, vast areas still remaining almost entirely unexplored. However, there are many stations in and west of the Andes Mountains at which records of all or nearly all the meteorological elements have been kept for rather long series of years. These stations are irregularly distributed over the territory and lie at elevations ranging from about sea level to 15,000 feet; consequently a fairly accurate estimate of the temperature at least can be made for any point when its elevation is known.

Meteorological data for stations in Brazil, Paraguay, Argentina, and Chile near the eastern borders of Peru and eastern and southern Bolivia have been included to give some indication of conditions in those areas. However, the information added in this way is, unfortunately, very scant.

The sources from which data were obtained are found in the footnotes following the climatic tables. Effort has been made to give full credit to the institutions and the individuals whose labors have resulted in valuable contributions to the climatology of this region of the earth. In this connection it is opportune to refer those interested in further research, especially in the line of descriptive text, to Bibliography on the Climate of South America, by Margaret M. Welch, published as Supplement No. 18, Monthly Weather Review.

Throughout this present paper temperatures are expressed in degrees Fahrenheit (°F.), relative humidity in percentage of saturation, cloudiness on the scale 0–10, precipitation in inches, and wind velocity in miles per hour.

GENERAL CONDITIONS

The northern and western portions of tropical South America embrace the vast area of about 2,350,000 square miles and present such differences in topography that there are marked contrasts in the meteorological conditions in different parts of the territory. Some of the most important of these differences will be set forth very briefly in the following general survey.

Figure 1 will serve as a reference to accompany this summary of general conditions except in the matter of precipitation, in which case use must be made of the maps giving location of stations in the subdivisions discussed later.

Temperature.—In Table 1 are found the mean monthly and annual temperatures at selected coast stations arranged according to latitude. The data for the Brazilian stations—Belem, Fortaleza, Pernambuco, Bahia, and Rio de Janeiro—are presented to show the differences in conditions prevailing on the eastern and western coasts in the same latitude.

The mean annual temperature is about 80° along the northern coast, the eastern coast as far south as Pernambuco, and probably on the western coast southward to the Equator. In the southern half of the tropical zone there is a remarkable difference in temperature conditions on the opposite coasts of the continent. At Trujillo, Peru (8° S.), the mean annual temperature is 69° and there is a decided annual march in temperature, the mean for January and February being 77° and that for June 63°—conditions similar to those found on the eastern coast far to the south at Florianopolis in latitude 27° 30′ S.—while at Pernambuco, also in latitude 8° S., the values are 80° for annual mean and 82° and 77° for the extreme months. Reference to the table will show the same contrast between Callao, Peru, and Antofagasta, Chile, on the western and Bahia and Rio de Janeiro, Brazil, on the eastern coast. Discussion of the causes of this remarkable difference in temperature will be given with the presentation of temperature data for Peru.

Temperatures at interior stations with elevation less than 250 feet (Table 2) are practically the same for the greater part of this region; the mean annual temperature is about 82° and there is generally but little difference in the means for the extreme months. The highest annual normal is 83.4°, at Maracaibo, and the lowest is 78°, at Piura and Guayaquil. The values for the two stations last named show that the influence causing the difference in temperature at coast stations on opposite sides of the continent, noted in the preceding paragraph, makes itself felt to some considerable distance inland from the Pacific. The data for Manaos and Quixeramobim, Brazil, are given to show the annual means in the warmest regions of that country.

Table 3 contains temperature means for selected stations at elevations from 3,500 to 15,000 feet, arranged in three arbitrary divisions. In the lower levels (3,500 to 5,500 feet) annual means may be assumed to range between 70° and 65°; in the middle levels (7,500 to 9,500 feet) they are remarkably uniform, if we may judge by the range from 57° to 58° for the four stations well distributed from north to south; in the upper levels (11,000 to 15,000 feet) the means appear to lie for the most part between 50° and 40°.

Temperature extremes may be given roughly as follows: Along the northern coast and in the Orinoco Valley, highest 95° to 100°, lowest about 65°; along the Peruvian coast, highest 85° to 90°, lowest 50° to 55°; in the Andean region, highest 70° to 80°, lowest (in southern Peru) ranging down with increasing elevation from 32° at La Joya (4,140 feet) to −8° and −10° at Vincocaya (14,350 feet) and Cailloma (13,000 feet), respectively.

Relative humidity.—Table 4 contains data on mean relative humidity for selected stations in four different regions of tropical South America. In the north, annual means are 79 per cent along the coast and about 70 to 75 per cent in the Orinoco Valley, with a well-defined annual march paralleling that of precipitation. In the wet months the means range from 80 to 85 per cent and in the dry months generally from 70 to 75 per cent, but there is probably a large area in interior Venezuela where the extremes have an unusual range similar to that found at Calabozo (81 per cent in July, 57 per cent in March). In Peru there is a well-marked decrease in the annual mean from about 80 per cent on the coast to 70 per cent at Piura, 35 miles inland. It is seen that the annual means at Callao and Lima, where the total annual rainfall is less than 2 inches, exceed those for Cayenne, Georgetown, and Maracaibo, where the annual rainfall normals are 126, 90, and 21 inches, respectively. Stations in the Andean region show wide difference in relative humidity generally fairly well related to difference in precipitation.

Precipitation.—In the northern region of South America from French Guiana westward rainfall is generally abundant. In the Guianas the annual means range from 70 to 125 inches along the coast, to from 50 to 150 inches at inland stations. With advance into Venezuela there is a considerable decrease in the amount of precipitation in the inland region, which is, however, well watered with 40 to 70 inches annually, and a most decided decrease along the coast and in its immediate vicinity, with annual means generally below 30 inches and even below 12 inches at two stations on the western half of the coast. In northern Colombia precipitation probably averages 30 inches a year. It varies from moderate to excessive in the middle of the western half of this country, where we find the extremes of about 40 inches at Bogota and 280 to 330 inches on and near the middle coast.

From Ecuador southeastward to Bolivia the area of heavier precipitation lies east of the Andes, and the contrast between the amounts received there and those on the coast and its vicinity is very remarkable. In western Ecuador the mean annual precipitation is moderate (40 inches), but in the eastern region it appears to be excessive (El Puyo, 150 inches). Immediately south of the Gulf of Guayaquil begins the so-called rainless region, which extends along the entire Peruvian coast and into Chile, ending, it may be said, with the southern limit of the Atacama Desert, at about latitude 28° S. This arid area, in which the total yearly precipitation is generally less than 2 inches, is about 70 miles wide in northern Peru and widens southward to about three times that distance to include southern Bolivia (Oruro). Immediately inland from this strip the mean annual precipitation increases to about 30 inches, and there is further increase toward Brazil, with maxima reaching over 100 inches in northeastern Peru (Iquitos), 75 inches in northern Bolivia (Cobija), and about 50 inches in the southeastern part of that country (Corumba, Brazil).

In Table 5 there are given precipitation data for stations in each subdivision selected to show range of mean annual precipitation and to indicate in a general way the annual march.

Annual march of precipitation in this region presents two types—that with double wave (two maxima and two minima) prevailing in the Guianas and westward to the Pacific Ocean and that with single wave prevailing from Ecuador to Bolivia. The periods of maximum and minimum rainfall in these areas vary considerably and there are some interesting exceptions to the general rule. These details will be presented in the discussion of precipitation in the several subdivisions.

Precipitation records for several stations with long series of observations are given in Table 31.

Winds.—The northeast trade winds prevail throughout the year along nearly all of the northern coast of South America. At Cayenne, French Guiana, and at Belem, near the mouth of the Amazon, the winds are from northeast and east, and it is very probable that these directions prevail in the Guiana highland and in the valley of the Orinoco. Southeast and south winds prevail on the southern coast of Peru (Mollendo); at Lima there is a shift to south-southwest, and from Guayaquil northward to southwest. The southeast trade winds which blow parallel to the Peruvian coast are first met at a distance of about 50 miles offshore; at the coast stations the sea breeze, well developed in some places, alternates with the nightly land breeze from the high mountains near by. In the Andean region the prevailing wind directions are controlled almost entirely by local conditions; some stations are said to have none other than local winds. The moist easterly winds from the Atlantic Ocean continue to advance until they meet the barrier erected by the lofty cordilleras near the western coast of the continent, and consequently reach extensive areas in the eastern parts of the Andean Republics.

TABLE 1.—*Mean temperatures (°F.) at coast stations near sea level, tropical South America*

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
North of 9° N.														
Port of Spain [1]	8	78.1	78.2	78.6	79.6	80.5	80.0	79.7	80.2	80.8	80.3	79.8	78.8	79.6
Colon [2]	6	79.3	79.2	79.8	80.5	79.8	79.4	79.4	79.3	79.5	79.0	78.1	79.0	79.3
9° N. to 0°														
Georgetown	41	79.0	78.9	79.6	80.2	80.2	79.6	79.8	80.6	81.2	81.2	80.5	79.6	80.0
Paramaribo	26	78.0	78.0	78.5	79.1	79.1	78.9	79.2	80.6	81.7	81.4	80.6	79.1	79.5
Cayenne	23	79.2	79.6	79.6	80.0	79.9	79.8	80.2	81.6	82.6	82.7	81.6	80.2	80.6
0° to 10° S.														
Belem [3 4]	10	79.2	78.8	79.2	79.6	80.2	80.0	79.5	79.6	79.5	79.7	80.2	80.1	79.6
Fortaleza [5 6]	8	81.2	80.6	80.2	80.1	79.6	78.8	78.7	78.7	79.9	81.1	81.2	81.8	80.2
Trujillo [7]	4	77.2	77.0	74.3	72.0	68.0	63.0	64.0	64.2	63.7	67.5	68.7	72.0	69.3
Pernambuco [6 8]	10	82.2	82.0	82.2	81.4	79.5	78.0	76.7	77.1	78.9	80.5	81.2	82.0	80.1
10° to 20° S.														
Callao	2	69.8	71.0	71.4	70.6	67.6	66.4	63.6	63.0	63.0	65.2	66.1	69.4	67.2
Bahia [6 9]	11	80.2	80.4	80.3	79.4	77.5	75.0	74.5	74.8	75.8	77.4	78.4	78.8	77.7
Mollendo	10	72.6	73.3	71.9	69.2	66.3	64.0	62.0	61.6	62.2	64.4	67.8	70.7	67.2
South of 20° S.														
Rio de Janeiro [6]	39	78.4	78.7	77.2	74.6	71.3	69.2	68.4	69.2	69.8	71.3	73.9	76.7	73.2
Antofagasta	6	69.5	69.8	67.8	64.4	62.0	58.0	56.7	57.4	58.8	60.9	63.7	66.9	63.0

[1] U. S. Weather Bureau station. Monthly Weather Review, 1926, p. 159.
[2] Monthly Weather Review, 1923, p. 133.
[3] Belem or Para.
[4] Contribuição ao estudo do clima do Brasil. Henrique Morize.
[5] Fortaleza or Ceara. Data for the suburban station at Porongaba.
[6] Boletim de normaes. Directoria de Meteorologia, Rio de Janeiro.
[7] Means are probably for the hours 8 a. m., 2 p. m., and 8 p. m.
[8] Pernambuco or Recife.
[9] Bahia or San Salvador. Data for the suburban station at Ondina.

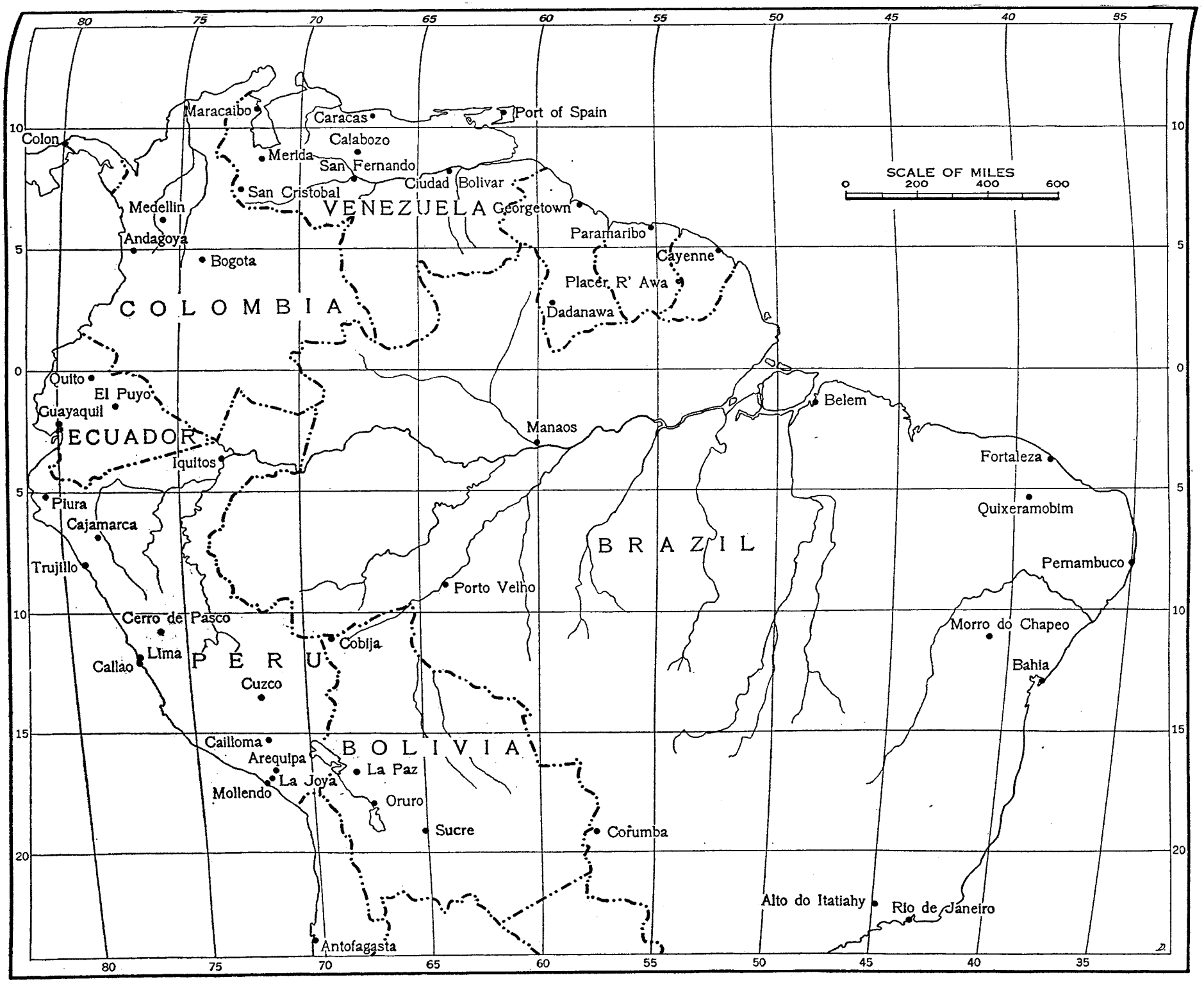

SCALE OF MILES
0 200 400 600
VENEZUELA
COLOMBIA
ECUADOR
PERU
BRAZIL
BOLIVIA
Maracaibo
Caracas
Port of Spain
Colon
Calabozo
Merida
San Fernando
Ciudad Bolivar
San Cristobal
Medellin
Georgetown
Andagoya
Paramaribo
Bogota
Cayenne
Placer, R' Awa
Dadanawa
Quito
El Puyo
Guayaquil
Belem
Manaos
Iquitos
Fortaleza
Piura
Quixeramobim
Cajamarca
Trujillo
Pernambuco
Porto Velho
Cerro de Pasco
Morro do Chapeo
Coblja
Lima
Callao
Bahia
Cuzco
Cailloma
Arequipa
La Paz
La Joya
Mollendo
Oruro
Sucre
Corumba
Alto do Itatiahy
Rio de Janeiro
Antofagasta

TABLE 2.—*Mean temperatures (°F.) at interior stations with low elevation,*[1] *tropical South America*

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Maracaibo [2]	9	81.4	81.8	82.8	84.0	84.6	85.0	85.3	85.6	84.6	82.4	82.0	81.8	83.4
Ciudad Bolivar	5	79.2	80.5	81.5	82.8	82.8	80.8	80.6	81.6	83.2	83.0	82.2	80.0	81.5
Andagoya	8	82.0	81.9	82.0	82.4	81.8	81.6	81.4	81.4	81.5	81.7	81.0	81.0	81.6
Dadanawa	9	82.2	81.8	82.8	82.7	81.6	80.6	81.0	82.4	83.7	84.6	84.8	82.4	82.6
Guayaquil	3	78.8	79.5	79.4	80.2	79.1	77.3	75.0	76.6	77.6	76.4	77.0	80.3	78.1
Manaos [3]	9	81.7	81.8	81.1	81.2	81.3	81.4	81.8	82.9	83.9	84.0	83.6	82.3	82.2
Quixeramobim [3]	24	84.1	82.6	81.7	81.2	80.4	79.9	80.2	81.5	83.1	84.2	84.6	84.6	82.3
Piura [4]	2	81.3	83.2	83.2	81.7	77.4	74.1	73.4	73.8	74.9	74.6	75.3	78.0	77.5
Porto Velho [5]	1	79.2	80.2	82.2	81.1	80.6	77.0	81.1	81.7	84.0	81.5	81.9	79.3	80.8

[1] From 20 to 250 feet, except Quixeramobim (679 feet).
[2] The position of this station on the passage from Lake Maracaibo to the Gulf of Venezuela evidently has no moderating effect on temperature. The contrast with the mean annual temperatures of 79.3° at Colon, 79.6° at Port of Spain, and 81.0° at Willemstad, Curaçao is remarkable.
[3] See footnote 6 under Table 1.
[4] See footnotes under Table 27.
[5] See footnote 5 under Table 28.

TABLE 3.—*Mean temperatures (°F.) at elevated stations, tropical South America* [1]

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Elevation 3,500–5,500 feet														
Caracas	16	65.8	66.6	67.6	69.4	70.8	69.4	68.9	69.3	69.8	69.6	68.4	66.4	68.5
Morro do Chapeo, Brazil [2] [3]	5	68.4	69.9	70.5	68.7	65.3	63.1	62.3	62.5	64.8	68.7	69.4	70.1	67.0
La Joya	9	65.7	67.4	66.1	64.4	62.0	61.0	60.7	61.8	63.2	62.9	63.7	65.0	63.7
Medellin	5	70.9	71.6	70.9	70.7	70.9	70.7	70.5	70.7	70.5	69.4	69.1	69.8	70.5
Merida	9	64.8	66.0	66.2	67.8	68.2	67.8	67.9	68.2	68.2	67.2	66.1	65.2	67.0
Elevation 7,500–9,500 feet														
Alto do Itatiahy, Brazil [3] [4]	6	56.8	56.6	55.5	53.2	52.3	48.8	49.1	50.0	53.7	53.7	54.1	55.0	53.2
Arequipa	13	58.0	58.2	57.9	58.0	57.8	57.2	57.2	57.4	58.1	57.8	57.2	58.3	57.8
Bogota	2	57.6	57.8	58.2	57.8	57.9	57.4	56.1	56.4	56.5	56.8	56.5	56.6	57.1
Cajamarca	3	58.5	59.7	60.4	59.7	57.9	53.4	55.8	56.8	57.4	58.6	59.7	60.6	58.2
Quito	7	57.2	57.2	57.2	57.1	57.0	56.8	56.6	57.2	57.8	58.0	57.2	57.0	57.2
Elevation 11,000–15,000 feet														
Cuzco	4	54.2	53.6	53.6	52.4	52.2	49.8	48.1	51.0	53.2	54.3	55.3	53.9	52.6
Cailloma	17	43.8	43.4	42.9	40.8	36.7	33.7	33.4	35.3	38.6	41.2	43.4	44.0	39.8
Cerro de Pasco	3	44.1	43.2	44.1	44.1	42.6	41.0	40.5	43.9	41.0	41.7	42.3	42.4	42.6

[1] For further data on elevations see tables following maps of subdivisions.
[2] Elevation, 3,543 feet.
[3] Boletim de normaes, Directoria de Meteorologia, Rio de Janeiro.
[4] Elevation, 7,480 feet.

TABLE 4.—*Mean monthly and annual relative humidity at selected stations, northern and western tropical South America*

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Northern coast region														
Cayenne	8	82	80	81	80	84	82	80	76	73	74	78	81	79
Georgetown	12	79	78	76	77	81	82	81	80	78	78	79	82	79
Maracaibo	8	78	78	72	76	79	80	77	78	82	86	84	79	79
Orinoco Valley														
Ciudad Bolivar	7	71	68	68	68	71	77	80	77	74	78	76	77	74
Calabozo	5	62	60	57	63	73	79	81	80	80	80	77	70	72
Coastal region of Peru														
Piura	2	68	65	68	62	66	72	80	78	80	70	68	68	70
Callao	2	84	85	84	85	85	84	84	83	85	84	80	82	84
Mollendo	5	80	80	77	75	76	74	75	80	82	79	79	80	78
Lima	3	79	77	78	80	79	88	86	85	85	82	82	80	82
Andean region														
Bogota	2	71	66	72	72	73	71	72	68	69	75	76	75	72
Quito	2	76	78	79	80	77	72	61	58	63	71	72	78	72
Arequipa	4	73	72	67	58	46	42	42	48	44	46	51	61	54
Sucre	6	70	69	69	68	53	48	50	52	56	60	59	64	60

TABLE 5.—*Mean monthly and annual precipitation at selected stations, northern and western tropical South America*

Stations	Length of record, in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
French Guiana														
Cayenne	51	14.37	12.28	15.83	18.86	21.89	15.51	6.93	2.76	1.22	1.34	4.61	10.71	126.31
Dutch Guiana														
Nieuw Nickerie	14	5.28	5.42	5.46	5.73	10.25	9.83	9.78	5.33	2.25	1.28	2.49	6.27	69.37
Paramaribo	63	8.62	7.01	8.50	9.13	12.24	11.57	8.74	5.83	2.68	2.72	4.84	8.54	90.42
Placer R'Awa	11	11.98	12.30	13.56	12.62	14.29	12.06	9.23	4.46	4.22	2.84	3.29	8.84	109.69
British Guiana														
Eupukari	4	1.51	1.10	1.62	4.43	8.37	12.09	9.26	5.17	1.39	0.39	0.36	1.09	46.78
New Amsterdam	22	6.60	4.80	4.99	5.77	10.95	11.88	9.47	6.78	1.97	2.14	3.43	8.59	77.37
Georgetown	46	8.50	5.95	6.77	6.35	11.25	11.87	10.00	6.47	3.05	2.54	5.88	11.75	90.38
Morowhanna	22	8.95	5.87	5.12	6.80	12.40	16.87	13.84	11.66	7.33	7.39	10.02	14.61	120.86
Look Out	17	10.39	6.66	8.14	8.29	17.93	19.23	15.32	10.60	6.35	4.97	9.95	16.75	134.58
Potaro Road	20	13.43	10.40	12.41	13.57	18.46	20.05	16.73	10.22	5.99	4.44	7.74	14.10	147.54
Venezuela														
La Guaira	5	0.31	0.23	0.83	0.23	0.50	0.84	1.01	1.09	1.35	1.70	1.50	1.77	11.36
Maracaibo	11	0.02	0.02	0.25	0.61	2.39	2.11	1.87	2.09	3.03	4.94	3.12	0.46	20.91
Caracas	35	0.84	0.35	0.61	1.50	2.83	4.24	4.25	4.32	4.03	4.04	3.40	1.74	32.15
San Cristobal	4	0.70	0.38	2.03	3.45	6.38	8.78	10.19	4.87	6.42	5.89	2.17	2.84	54.10
Merida	11	2.75	1.63	3.66	6.90	10.95	7.20	4.62	6.20	6.17	10.44	8.26	3.05	71.83
Colombia														
Cartagena	12	0.00	0.01	0.07	0.55	3.39	5.06	2.80	4.96	5.20	8.78	4.46	0.36	35.64
Bogota	31	2.22	2.28	3.67	5.24	4.23	2.10	1.80	1.93	2.34	5.49	5.13	3.10	39.53
Medellin	15	2.70	3.27	3.36	6.53	7.89	5.44	4.13	4.68	6.16	7.02	5.07	2.53	58.78
Titiribi	4	2.82	4.17	4.00	7.91	9.48	9.27	6.63	7.66	8.48	10.13	6.86	3.02	80.43
Puerto Berrio	3	2.68	5.89	6.00	9.69	16.76	12.89	8.93	13.64	14.74	18.61	9.79	3.24	122.86
Zaragoza	8													217.32
Andagoya	12	24.10	20.18	18.86	26.01	24.28	25.13	23.61	25.80	25.88	21.67	23.09	20.50	279.11
Buenaventura	7	17.90	12.33	11.34	25.60	28.40	23.76	22.35	26.66	27.93	34.66	28.08	21.64	280.65
Anori	8													281.06
San Jose	4													314.78
Buena Vista	3	20.51	14.58	17.85	31.60	30.77	27.29	38.23	25.98	30.86	26.78	35.41	30.87	330.73
Ecuador														
Ambato	14	1.98	1.64	2.18	2.52	2.17	0.73	0.91	0.73	0.88	1.88	1.43	1.43	18.53
Guayaquil	3	9.92	9.75	7.51	5.22	2.11	0.75	0.41	0.00	0.11	0.43	0.27	1.94	38.42
Quito	14	4.16	3.36	5.23	7.25	5.00	1.57	0.81	1.24	2.66	3.91	4.01	3.88	43.08
El Puyo	4	12.40	13.82	12.56	11.69	15.55	14.80	10.55	10.20	10.31	13.58	12.76	13.23	151.45
Peru														
La Joya	5	0.01	0.01	T.	T.	T.	T.	0.00	T.	0.00	0.00	T.	T.	0.02
Mollendo	10	0.04	0.07	T.	0.03	0.07	0.05	0.04	0.18	0.19	0.10	0.06	0.02	0.85
Trujillo	2-4	0.14	0.49	0.28	0.04	0.01	0.02	0.08	0.00	0.02	T.	0.06	0.03	1.17
Lima	18	0.02	0.01	0.02	0.03	0.10	0.24	0.35	0.41	0.39	0.19	0.10	0.04	1.90
Arequipa	14	1.34	1.63	0.49	0.14	0.01	0.03	0.07	0.00	T.	0.01	0.01	0.19	3.92
Vincocaya	1-2	3.00	3.78	2.60	0.01	0.01	0.00	0.00	0.00	0.08	0.00	0.27	0.53	10.08
Cailloma	17	5.31	5.98	5.33	1.62	0.37	0.20	0.06	0.22	0.58	1.10	1.09	4.23	26.09
Morococha	4-7	6.53	6.77	5.97	3.16	1.66	0.50	0.49	2.03	2.07	2.82	3.21	4.06	39.30
Iquitos		10.24	9.84	12.24	6.50	10.00	7.44	6.57	4.61	8.70	7.24	8.42	11.46	103.26
La Merced	3	16.14	18.61	14.02	16.38	10.66	5.63	5.71	7.43	9.17	8.96	11.99	17.14	141.84
Bolivia														
Oruro	4	0.51	0.43	0.55	0.12	0.08	0.00	0.00	0.00	0.04	0.04	0.12	0.24	2.13
La Quiaca (Argentina)		3.27	2.36	2.01	0.28	0.00	0.00	0.04	0.00	0.00	0.20	1.06	2.13	11.35
La Paz	5	3.86	4.53	2.60	1.46	0.47	0.08	0.16	1.10	0.79	1.30	1.54	4.29	21.18
Sucre	32	6.34	4.68	3.74	1.77	0.28	0.08	0.16	0.16	0.79	1.42	2.40	4.37	26.19
Corumba (Brazil)	8	6.54	6.24	4.84	4.87	3.33	1.88	0.28	1.34	2.28	4.00	5.95	7.47	49.02
Cobija	2	7.88	8.64	14.96	7.28	2.32	1.06	0.51	1.46	2.78	9.36	6.22	11.54	74.01

CLIMATIC CONDITIONS IN THE SEVERAL SUBDIVISIONS

As previously stated, there are more or less extensive areas in each of the subdivisions in which no meterological work has been accomplished; conditions in such regions must, therefore, be appraised from data for contiguous territory, due regard being given to topography, and from the generalized statements relative to climate gathered from various sources.

FRENCH GUIANA

Climatic conditions at Cayenne are typical of the coastal region and fairly representative of the hinterland, except that in the latter region temperatures are more moderate and precipitation probably heavier with increase in elevation toward the Tumac Humac mountains (1,250 to 2,500 feet), forming the southern boundary.

The characteristic feature of the climate of Cayenne is the difference between the dry season beginning in July and ending in November and the wet season during the remainder of the year. Contrasting the months of October and November, the middle of the dry season, with March, April, May, and June, the wettest months, we find respective average values as follows: Mean temperature, from daily extremes, 82.6° and 79.9°; highest recorded temperature, 97° and 92°; mean daily relative humidity, 74 and 82 per cent; mean relative humidity at 3 p. m., 67 and 77 per cent; mean monthly precipitation, 1.28 and 18.02 inches; mean monthly number of rainy days, 5 and 24.

The prevalence of east winds from May to December, overlapping the dry season, and the faint development, in February, of the secondary minimum of amount and frequency of precipitation are of sufficient interest to be noted here.

Records for Cayenne for the periods 1890–91 and 1893–1914 were published currently in Annales du Bureau Central Météorologique de France.

TABLE 6.—*Cayenne, French Guiana*

Stations	Length of record, in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Temperature														
Mean maximum	23	84.0	84.4	84.6	85.1	85.3	86.2	87.6	89.6	90.9	90.7	88.5	86.0	86.9
Mean minimum	23	74.3	74.8	74.7	75.0	74.5	73.4	72.9	73.6	74.3	74.7	74.7	74.5	74.3
Mean	23	79.2	79.6	79.6	80.0	79.9	79.8	80.2	81.6	82.6	82.7	81.6	80.2	80.6
Mean, minimum, 3 p. m., 9 p. m.	8	78.6	78.8	78.8	79.3	78.8	78.6	78.8	79.9	80.6	80.6	79.9	79.2	79.3
Highest	23	91	93	92	92	92	93	93	96	97	97	95	93	97
Lowest	23	67	68	66	65	68	69	68	68	70	68	68	68	65
Relative humidity														
Mean, 9 a. m., 3 p. m., 9 p. m.	8	82	80	81	80	84	82	80	76	73	74	78	81	79
Mean, 3 p. m.	8	78	76	77	76	79	75	72	67	66	68	71	76	73
Cloudiness														
Mean, 3 observations	8	6.5	6.2	6.7	6.2	6.9	5.9	5.1	4.3	3.9	4.0	4.8	5.5	5.5
Precipitation														
Mean [1]	51	14.37	12.28	15.83	18.86	21.89	15.51	6.93	2.76	1.22	1.34	4.61	10.71	126.31
Maximum in 24 hours [2]	22	16.44	14.76	10.20	23.47	8.78	5.83	6.62	2.66	1.63	3.74	5.43	6.00	23.47
Mean number of days with rain	24	23	19	23	22	27	24	19	10	5	5	13	19	209
Wind														
Prevailing direction	25	ne.	ne.	ne.	ne.	e.	e.	e.	e.	e.	e.	e.	e.	e.
Mean number of days with thunderstorm [3]	21	0.1	0.2	0.1	0.2	0.4	0.4	0.8	0.3	0.1	0.3	0.4	0.1	3.4
Mean number of days with fog	19	0.1	0.0	0.1	0.1	0.3	0.3	0.0	0.0	0.0	0.1	0.0	0.2	1.2

[1] Monthly values for 28 years, a practically unbroken series for the period 1844–1870, are given by Raulin in Actes de l'Académie Nationale des Sciences, Belles-Lettres, et Arts de Bordeaux, série 3, vol. 36, p. 504. Values for 1890–1912 appear in Annales du Bureau Central Météorologique de France. The means given here are those published in the West Indies Pilot (British Admiralty), Vol. II, 1920.

[2] Gage overflowed in April, 1906; the actual amount exceeded that recorded.

[3] Days with distant thunder not included.

DUTCH GUIANA

From the averages for the two stations at which observations have been made it appears that the region north of the Guiana highland, north of 5° north latitude, has a mean annual temperature of 80° to 82°. Monthly means are lowest in January and February (78° to 80°) and highest in September and October (81.5° to 84°). Between Paramaribo, on the coast, and Placer L. en F. de Jong, 75 miles inland, there is a very considerable difference in day temperatures; at the former station the mean daily maximum ranges from 85° in the first months of the year to 90° in September and October, while at the latter the corresponding values are 90° and 96.5°. Mean daily minimum temperatures are very uniform through the year, departing only slightly from 72°. At Paramaribo temperatures as high as 95° are rare; at Placer L. en F. de Jong, however, such temperatures may be expected in any month of the year, and the six-year record contains readings of 100° or more in each of the months from August to December, inclusive. In the cooler months at the beginning of the year temperatures sometimes fall below 65°, but not so low as 60°.

In the Guiana highland temperatures moderate with increasing elevation and in much of that region conditions will probably approximate those found at El Peru, Venezuela (720 feet), as follows: Annual mean daily maximum, 86°; annual mean daily minimum, 70°; monthly extremes, 90° to 95° and 60° to 65°.

In the northeastern quarter of the country the mean annual precipitation is about 90 inches; west of this region there is a moderate decrease in rainfall, and at Nieuw Nickerie, in the extreme northwest, the annual normal falls slightly below 70 inches. The annual mean of 110 inches at Placer R'Awa, in the southeast, indicates that the heavy rainfall reported from interior French Guiana continues westward over part, if not all, of southern Dutch Guiana.

The double wave in the annual march of precipitation is well defined in the monthly normals for most of the stations. We note a very decided contrast between the chief maximum in May–June, when the monthly normals average from 10 to 13 inches, and the chief minimum in September–October, when the normals are generally below 3 inches. The secondary maximum occurs in December or January and the secondary minimum in February.

The data for Placer L. en F. de Jong were compiled from the Meteorologisch Jaarboek, Koninklijk Nederlandsch Meteorologisch Instituut, 1897–1902; those for the remaining stations from Meteorologische Waarnemingen in Suriname en Curaçao, 1906–1918, and supplemental records furnished by Director Stahel, of the agricultural experiment station, Paramaribo.

TABLE 7.—*Temperature data for Dutch Guiana (°F.)*

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean maximum temperature												
Paramaribo	26	84.4	84.7	84.9	85.5	85.3	85.3	86.0	88.3	90.0	90.0	88.5	86.2	86.6
Placer L. en F. de Jong	6	89.6	90.0	89.6	90.9	90.3	91.4	91.8	94.1	96.1	97.2	95.2	91.8	92.3
		Mean minimum temperature												
Paramaribo	26	71.6	71.2	72.1	72.7	72.9	72.5	72.3	73.0	73.4	72.9	72.7	72.0	72.4
Placer L. en F. de Jong	6	70.9	70.0	72.0	71.6	72.5	72.0	71.1	71.1	71.2	71.1	70.9	71.1	71.3
		Mean temperature (maximum + minimum ÷ 2)												
Paramaribo	26	78.0	78.0	78.5	79.1	79.1	78.9	79.2	80.6	81.7	81.4	80.6	79.1	79.5
Placer L. en F. de Jong	6	80.2	80.0	80.8	81.2	81.4	81.7	81.4	82.6	83.6	84.2	83.0	81.4	81.8
		Mean temperature, 8 a. m., 2 p. m., 6 p. m.[1]												
Paramaribo	26	78.6	78.8	79.3	79.9	79.7	79.3	79.9	81.3	82.4	82.0	81.3	79.2	80.1
		Highest temperature												
Paramaribo	26	91	89	91	92	94	92	94	94	94	98	99	93	99
Placer L. en F. de Jong	6	98	96	94	96	97	96	97	101	100	103	101	100	103
		Lowest temperature												
Paramaribo	26	62	63	62	62	65	67	62	68	67	67	67	64	62
Placer L. en F. de Jong	6	63	63	66	64	66	68	68	67	65	67	66	67	63

[1] 8 a. m., 2 p. m., 7 p. m. during the period 1899–1904.

TABLE 8.—*Relative humidity, cloudiness, and wind data for Dutch Guiana*

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean relative humidity, 8 a. m., 2 p. m., 6 p. m.[1]												
Paramaribo	26	84	84	84	84	84	84	85	82	79	80	83	87	83
		Mean relative humidity, 2 p. m.												
Paramaribo	19	80	78	79	79	81	80	77	72	69	69	73	79	76
		Mean cloudiness												
Paramaribo	20	5.7	5.7	6.1	6.0	6.3	6.1	5.5	5.0	4.6	4.6	5.0	5.7	5.5
Placer L. en F. de Jong	6	3.8	2.9	4.5	3.8	3.8	3.2	3.4	2.4	2.0	2.5	2.8	4.1	3.3
		Prevailing wind direction												
Paramaribo	6	ne.	ne.	ne.	ne.	ne.	ne.	ne.	e.	ne.	ne.	ne.	ne.	ne.
		Mean wind force (Beaufort scale 0–12)												
Paramaribo	20	3.2	3.3	3.3	3.2	3.0	2.8	2.9	3.1	3.1	3.2	3.2	3.0	3.1

[1] See note under temperature table.

TABLE 9.—*Precipitation data for Dutch Guiana*

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean precipitation (in inches)												
Nieuw Nickerie	14	5.28	5.42	5.46	5.73	10.25	9.83	9.78	5.33	2.25	1.28	2.49	6.27	69.37
Caledonie	17	6.31	4.53	5.25	7.76	10.03	11.59	9.85	5.38	2.64	2.90	3.55	6.32	76.11
Paramaribo	63	8.62	7.01	8.50	9.13	12.24	11.57	8.74	5.83	2.68	2.72	4.84	8.54	90.42
Albina	4	12.24	10.30	8.83	11.28	10.87	7.09	7.76	5.83	1.91	3.46	5.70	9.06	94.33
Republiek	17	6.90	5.42	6.73	10.16	11.74	11.24	8.57	6.15	3.16	2.75	4.57	8.28	85.67
Kapoeri	4	5.90	2.93	5.10	7.20	11.63	12.66	10.29	6.84	1.99	4.38	2.83	8.43	80.18
Placer L. en F. de Jong	17	7.28	7.68	8.94	10.67	11.81	9.65	8.62	5.87	2.09	2.52	4.21	6.50	85.84
Kabelstation	13	8.27	5.78	7.96	10.16	12.69	12.56	8.99	5.73	2.15	3.06	4.80	8.09	90.24
Dam	11	8.02	6.33	7.44	9.77	13.70	10.83	9.20	5.59	3.03	2.27	2.91	7.80	86.89
Placer R'Awa	11	11.98	12.30	13.56	12.62	14.29	12.06	9.23	4.46	4.22	2.84	3.29	8.84	109.69
		Maximum precipitation in 24 hours												
Paramaribo	20	2.76	7.95	3.90	5.39	3.82	3.86	2.52	3.15	1.38	2.52	3.15	3.19	7.95
		Mean number of days with precipitation												
Paramaribo	20	21	18	21	21	26	27	25	19	11	11	15	22	237
		Mean number of days with thunderstorm												
Paramaribo	13	1	0	3	3	8	9	10	8	4	5	5	4	60
Placer L. en F. de Jong[1]	6	9	3	11	11	16	20	20	15	10	11	12	13	151

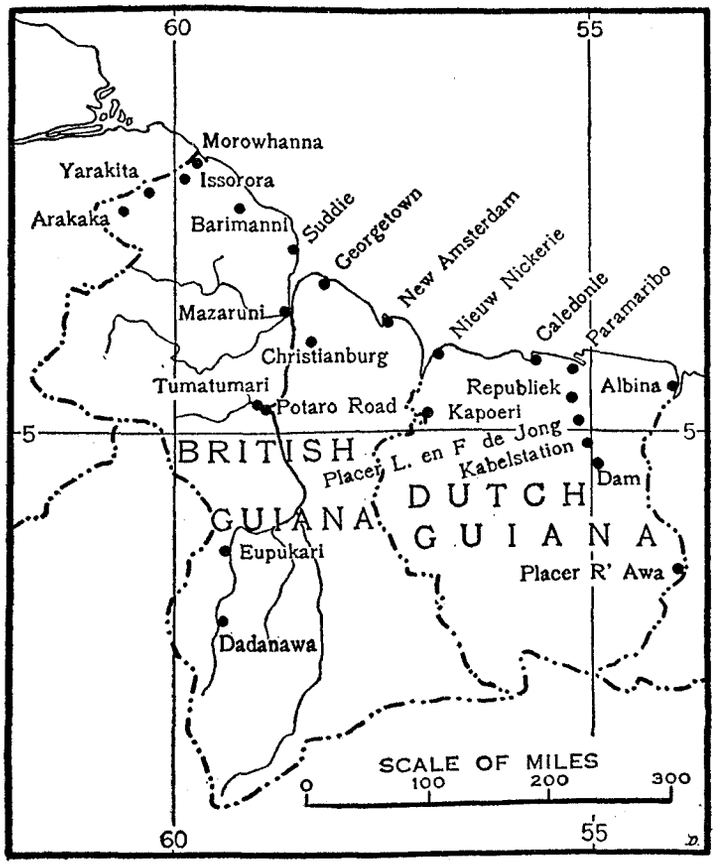
[1] Distant thunder most frequent; the symbol for thunderstorm is not found very often in the printed records.

BRITISH GUIANA

The Report of the Botanic Gardens and their Work and the Report of the Department of Science and Agriculture (Georgetown), covering the greater part of the period from 1896 to 1925, furnished the material for the tables. The distribution of rainfall stations is very good, and since we have temperature records for points on and near the coast and rather far distant in the interior to indicate extreme conditions, it is possible to consider the climate of this country as a whole.

The extremes for mean annual temperature are 78° at Mazaruni, near the coast, where conditions are influenced by the proximity of three large rivers, and 83° at Dadanawa, a river station nearly 300 miles from the sea. The temperature march is of the Northern Hemisphere type, with monthly means lowest in January or February and, in general, highest in September or October (Mazaruni, 77° and 80°; Dadanawa, 82° and 85°).

The contrasting effects of marine and continental exposures are finely illustrated in the maximum temperatures at Georgetown on the one hand and at Eupukari and Dadanawa on the other. On the coast the mean daily maxima in the coolest and warmest months are 83.5° and 87°, respectively, and the highest readings rarely exceed 90°, while at the two interior stations the corresponding means are 90° and 94° to 97°, and temperatures of 100° or more are likely to occur in any month of the year.



Minimum temperatures show marked uniformity throughout the year and over the entire country; the annual means are 75° at coast stations and 72° in the interior, exclusive of the unexplored highlands, and the extreme records rarely fall more than 5° below these values.

The amount of rainfall received yearly is over 100 inches in the coastal region bordering Venezuela and in a large central area, and generally 80 to 90 inches elsewhere, except in the southern third of the territory where the annual normals are much smaller, 50 to 60 inches. The extreme annual averages are 77 inches at New Amsterdam and 147 inches at Potaro Road. The contrast in yearly means at the neighboring stations, Georgetown and Look Out, 90 and 134 inches, respectively, is a feature of interest.

The march of precipitation presents the double wave, but in form somewhat different from that found in Dutch Guiana. The chief maximum occurs in the period from May to July and the secondary, generally nearly equally well pronounced except in the south, comes in December. As in Dutch Guiana, the chief minimum occurs in September–October along the eastern half of the coast and in most of the region toward the southwest; in contrast to this it appears in February–March at a number of stations located mainly in the coastal region adjoining Venezuela.

TABLE 10.—*Temperature data for British Guiana (°F.)*

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean maximum temperature												
Georgetown	41	83.6	83.4	84.1	84.7	84.9	84.6	84.9	86.3	86.9	86.7	86.5	84.4	85.0
New Amsterdam	11	85.5	85.9	86.1	86.5	86.3	86.5	87.0	88.1	89.8	90.1	89.2	87.2	87.4
Mazaruni	10	82.7	83.2	83.8	84.6	84.0	83.7	84.2	85.6	87.0	87.2	86.4	83.2	84.6
Eupukari	4	90.2	91.0	91.0	93.3	90.2	90.5	90.9	93.0	94.0	94.4	93.8	90.5	91.9
Dadanawa	9	92.5	92.1	93.2	92.3	90.4	89.4	90.4	92.4	94.3	96.6	96.2	92.7	92.7
		Mean minimum temperature												
Georgetown	41	74.4	74.4	75.0	75.6	75.4	74.7	74.7	74.9	75.6	75.6	75.4	74.9	75.0
New Amsterdam	11	74.2	74.0	74.3	74.6	74.5	74.7	74.5	74.6	75.3	75.3	75.1	73.8	74.6
Mazaruni	10	71.2	71.0	71.2	71.9	72.7	72.7	72.0	72.1	73.0	73.4	72.8	72.0	72.2
Eupukari	4	71.1	70.9	71.0	71.8	71.4	72.1	71.9	71.8	73.0	72.9	72.4	71.0	71.8
Dadanawa	9	71.9	71.4	72.5	73.1	72.7	71.9	71.6	72.5	73.1	72.7	73.4	72.1	72.4
		Mean temperature												
Georgetown	41	79.0	78.9	79.6	80.2	80.2	79.6	79.8	80.6	81.2	81.2	80.5	79.6	80.0
New Amsterdam	11	79.8	80.0	80.2	80.6	80.4	80.6	80.8	81.4	82.6	82.7	82.2	80.5	81.0
Mazaruni	10	77.0	77.1	77.5	78.2	78.4	78.2	78.1	78.8	80.0	80.3	79.6	77.6	78.4
Eupukari	4	80.6	81.0	81.0	82.6	80.8	81.3	81.4	82.4	83.5	83.6	83.1	80.8	81.8
Dadanawa	9	82.2	81.8	82.8	82.7	81.6	80.6	81.0	82.4	83.7	84.6	84.8	82.4	82.6
		Highest temperature												
Georgetown	17	88	88	88	90	88	88	90	90	90	92	91	89	92
New Amsterdam	11	91	90	90	92	92	91	90	93	95	97	98	95	98
Mazaruni	10	86	87	91	90	90	89	88	90	92	92	91	91	92
Eupukari	4	99	96	99	100	100	98	100	100	103	99	98	96	103
Dadanawa	4	98	101	99	98	96	97	95	100	100	103	100	102	103
		Lowest temperature												
Georgetown	17	68	70	70	71	71	70	70	70	71	71	70	70	68
New Amsterdam	11	68	69	70	70	71	70	71	70	71	71	72	70	68
Mazaruni	10	62	65	65	67	66	68	68	68	68	69	69	68	62
Eupukari	4	68	66	67	69	68	68	66	68	68	71	69	67	66
Dadanawa	4	66	68	68	68	70	69	68	70	70	70	70	69	66

TABLE 11.—*Relative humidity, sunshine, and wind data for British Guiana*

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean relative humidity 7 a. m., 1 p. m., 6 p. m.												
Georgetown	12	79	78	76	77	81	82	81	80	78	78	79	82	79
Mazaruni	10	85	83	83	81	86	87	87	86	84	84	86	88	85
Eupukari [1]	3	81	81	79	79	84	86	84	84	77	74	79	81	81
		Mean relative humidity 1 p. m.												
Georgetown	12	73	71	70	70	74	75	73	71	67	67	69	75	71
Mazaruni	10	79	77	76	75	80	81	83	79	75	76	79	83	79
		Mean cloudiness 7 a. m., 1 p. m., 6 p. m.												
Georgetown	10	6.5	6.2	6.7	6.4	6.6	6.8	6.4	6.2	5.8	6.0	6.3	7.0	6.4
Mazaruni	9	4.6	4.1	4.2	4.1	5.0	4.7	4.9	4.8	4.0	4.5	4.5	4.9	4.5
		Mean duration of sunshine (hours per day)												
Georgetown	34	6.2	6.7	6.3	6.6	5.9	5.7	7.0	7.7	8.3	7.8	7.1	6.0	6.8
Mazaruni	8	5.3	5.9	5.1	5.7	4.9	4.8	5.5	5.9	6.6	6.3	6.0	4.8	5.6
		Prevailing wind direction												
Georgetown	11	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.
Mazaruni	12	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.
		Mean wind velocity (miles per hour)												
Georgetown	10	8.2	8.5	8.9	8.6	7.3	6.2	5.5	5.6	6.5	6.6	6.5	7.2	7.1
		Mean number of days with fog												
Georgetown [2]	23	0.1	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.9
		Mean number of days with thunderstorm												
Georgetown	11	0.0	0.1	0.1	0.1	0.5	1.0	2.5	3.8	2.3	2.5	1.0	0.2	4.1

[1] Record for 1 p. m. very much broken; values for September and October in one year only.
[2] British Admiralty Pilot, West Indies Pilot, Vol. II. Seventh edition. 1920.

TABLE 12.—*Precipitation data for British Guiana*

Stations	Length of record, in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean precipitation (in inches)												
New Amsterdam	22	6.60	4.80	4.99	5.77	10.95	11.88	9.47	6.78	1.97	2.14	3.43	8.59	77.37
Georgetown [1]	46	8.50	5.95	6.77	6.35	11.25	11.87	10.00	6.47	3.05	2.54	5.88	11.75	90.38
Look Out [2]	17	10.39	6.66	8.14	8.29	17.93	19.23	15.32	10.60	6.35	4.97	9.95	16.75	134.58
Suddie	18	7.41	4.72	5.09	4.77	12.60	11.50	9.93	7.08	2.84	4.04	7.04	11.84	88.86
Morowhanna	22	8.95	5.87	5.12	6.80	12.40	16.87	13.84	11.66	7.33	7.39	10.02	14.61	120.86
Issorora	17	8.79	5.37	4.88	5.83	10.72	16.80	14.84	12.82	9.30	9.50	10.22	12.98	122.05
Yarakita	14	7.56	3.44	3.47	5.00	10.03	13.46	11.79	9.86	7.39	7.24	8.74	11.24	99.22
Barimanni	23	7.89	4.79	4.37	5.47	13.94	15.60	13.04	11.00	6.34	6.50	9.22	12.28	110.44
Arakaka	24	6.87	4.32	4.60	6.00	10.06	10.94	10.66	8.24	5.41	5.92	7.12	9.38	89.52
Mazaruni	26	7.77	5.21	6.03	8.38	13.83	12.74	11.25	8.21	5.96	5.36	7.46	11.31	103.51
Christianburg	15	6.65	4.76	6.04	8.23	12.45	12.54	13.54	8.84	5.48	5.34	5.06	8.46	97.39
Tumatumari	11	8.80	6.93	8.26	10.51	14.60	15.89	12.88	8.51	3.50	4.45	5.90	10.24	110.47
Potaro Road	20	13.43	10.40	12.41	13.57	18.46	20.05	16.73	10.22	5.99	4.44	7.74	14.10	147.54
Eupukari	4	1.51	1.10	1.62	4.43	8.37	12.09	9.26	5.17	1.39	.39	.36	1.09	46.78
Dadanawa	9	1.34	2.00	2.26	5.56	7.84	13.61	10.44	8.14	2.56	1.65	1.06	2.05	58.51
		Maximum precipitation in 24 hours												
Georgetown [3]	73	6.80	5.45	6.00	8.32	5.07	4.15	4.25	3.13	5.07	4.45	5.22	6.80	8.32
		Mean number of days with precipitation												
New Amsterdam	6													165
Georgetown	41	18	16	16	16	22	24	22	15	8	8	12	20	197
Mazaruni	12	18	11	14	13	21	25	23	20	15	15	15	23	213

[1] Means for the period 1880–1925. These hold for the botanical gardens.
[2] This station is located on the eastern bank of the Essequibo River a few miles west of Georgetown.
[3] Extremes for 21 years for June, July, August, and October. In none of these month was the 24-hour precipitation as great as 5 inches during the periods 1846–1856, 1864–1925.

VENEZUELA

The much-diversified surface of Venezuela may be divided into the following regions: (1) The coastal plain, surrounding Lake Maracaibo and the narrow coast region along the Caribbean Sea; (2) the mountainous regions of the Sierra Nevada de Merida, extending from the region of San Cristobal northeast to the vicinity of Barquisimeto, and of the parallel ranges of the Maritime Andes, broken east of Caracas, extending along the coast to the Gulf of Paria, west of Trinidad; and (3) the Orinoco Basin, comprising four-fifths of the territory of the Republic and containing the llanos, grassy plains, in the north and densely forested hilly or mountainous areas in the south.

In the northern half of the country the network of rainfall stations is sufficiently close to give adequate information on precipitation, and the stations recording

meteorological data other than precipitation are also well distributed, presenting conditions for levels from the coast up to an elevation of over 5,000 feet. Unfortunately, there are no data for the southern half of the territory nor for the immediately adjacent areas of Colombia or Brazil.

The data for Maracaibo (20 feet), Ciudad Bolivar (125 feet), Calabozo (328 feet), Caracas (3,420 feet), Merida (5,384 feet) have been compiled from records furnished by the Director of the Meteorological Service, Sr. Luis Ugueto, Cajigal Observatory, Caracas; those for El Peru (720 feet) are taken from an article by C. E. P. Brooks in the Quarterly Journal of the Royal Meteorological Society, October, 1923. Precipitation data for the substations appear in current numbers of Climatological Data, West Indies and Caribbean Service, United States Weather Bureau, San Juan, P. R.

At elevations of 350 feet or lower the mean annual temperature is 81.5° to 83.5°, at the moderate elevation of 700 feet (El Peru) it is 77.5°, while at the high stations of Caracas and Merida there is a fall to 68.5° and 67°, respectively. The temperature march is a modification of the Northern Hemisphere type. In general the chief minimum occurs in January; the maxima, which are about equal, in April–May and August–October, separated by the secondary minimum which appears at all stations except Maracaibo. Maximum temperatures above 90° have been recorded in all months of the year at all of the lower stations and in all months except December and January at El Peru, but readings of 100° or above have been noted only at Maracaibo. The highest temperatures recorded at the elevated stations of Caracas and Merida are 91° and 85°, respectively. The lowest temperatures in the regions near sea level are slightly below 70°, while those for the mountain stations fall to about 50° or 45°.

The mean annual relative humidity derived from observations at 6 a. m., noon, and 9 p. m. is about 73 per cent in the interior valleys and 79 per cent at the highest elevations and on the Gulf of Maracaibo. The lowest means are generally found in March, when the mean temperature has risen to the annual value and precipitation is still little above the minimum, and the highest in the period from July to November. The extreme means are 57 per cent in March at Calabozo and 86 per cent in October at Maracaibo.

There is abundant sunshine in all sections of the Republic; the mean daily duration is about 7 hours and the mean annual total nearly 2,600 hours. The decrease in sunshine from the January–February maximum to the May–June minimum is considerable, especially at Calabozo, where the means for February and June are 9.6 and 4.6 hours, respectively.

The mean annual precipitation is very light, less than 15 inches, at points on the middle and western Caribbean coasts, and not much heavier, 20 to 25 inches, at points in the northwest in the vicinity of Lake Maracaibo. Over the remainder of the northern half of the country the annual means are generally from 35 to 55 inches. In the eastern division the increase in rainfall toward the south is moderate, but toward the southeast it is probably very considerable, judging from the means of 120 inches at Morowhanna and 90 inches at Arakaka, two stations in northern British Guiana. In the middle and western divisions there are abrupt increases in precipitation due to increased elevation which stand out clearly in comparing the mean for La Guaira (11 inches) with those for Caracas (32 inches) and Valencia (51 inches) and the mean for Maracaibo (21 inches) with that of Merida (72 inches). In general the march of precipitation is as follows: Minimum from January to April, then a more or less rapid increase to the maximum from June to August, which is followed by a rather gradual decrease. At the period of minimum rainfall mean monthly amounts fall below 1 inch at nearly all stations and to zero at several stations in central and western divisions. The period of maximum precipitation falls in June, July, and August for the eastern and middle divisions and in October for the northwestern region, while at some stations in the western interior there are two maxima, one in April or May and another in October. The contrast between the dry and the wet seasons is fairly well marked in all regions and very decided at some western interior stations, where the difference in extreme monthly means is 9 inches or more, with the exceptional range from zero in January and February to 12 inches in August at San Fernando de Apure. No data are available as to the number of rainy days.

The prevailing wind direction is north to east, except at the elevated station of Merida, in the western highland, where it is southwest.

In the temperature tables which follow the stations are arranged according to elevation above sea level; in the precipitation table according to latitude from north to south, in three arbitrary divisions—eastern, middle, and western.

TABLE 13.—*Temperature data for Venezuela* (° *F.*) [1]

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean maximum temperature												
Maracaibo	9	88.2	88.7	89.6	90.7	91.0	91.6	92.3	92.7	91.2	87.8	87.3	87.4	89.9
Ciudad Bolivar	5	87.4	89.4	91.0	91.9	91.2	88.2	88.0	89.6	91.2	91.0	90.0	87.3	89.7
Calabozo	5	90.3	91.8	92.7	91.0	88.7	86.2	84.2	85.3	86.4	87.1	88.5	89.2	88.4
El Peru	9	83.1	84.1	85.7	87.7	87.5	87.5	85.4	86.5	87.3	86.5	85.6	83.3	85.7
Caracas	16	75.4	76.8	78.1	79.0	80.1	77.4	77.2	78.3	79.3	78.8	77.0	75.2	77.8
Merida	9	72.9	73.9	73.8	75.4	75.9	75.6	76.6	76.8	77.0	74.8	73.6	73.2	75.0
		Mean minimum temperature												
Maracaibo	9	74.5	74.8	75.9	77.4	78.3	78.3	78.3	78.4	78.1	77.0	76.6	76.1	77.0
Ciudad Bolivar	5	71.4	71.6	72.0	73.8	74.3	73.4	73.2	73.6	75.2	75.0	74.3	72.7	73.4
Calabozo	5	73.0	74.1	75.7	76.3	75.9	74.1	73.2	73.4	73.8	74.3	73.9	73.4	74.3
El Peru	9	68.0	68.2	68.5	70.0	70.7	70.1	69.6	69.9	70.1	70.1	69.8	69.5	69.5
Caracas	16	56.1	56.5	57.2	59.9	61.5	61.5	60.6	60.3	60.4	60.4	59.7	57.6	59.3
Merida	9	56.7	58.1	58.5	60.1	60.6	59.9	59.2	59.5	59.5	59.7	58.6	57.2	59.0
		Mean temperature (maximum+minimum÷2)												
Maracaibo	9	81.4	81.8	82.8	84.0	84.6	85.0	85.3	85.6	84.6	82.4	82.0	81.8	83.4
Ciudad Bolivar	5	79.2	80.5	81.5	82.8	82.8	80.8	80.6	81.6	83.2	83.0	82.2	80.0	81.5
Calabozo	5	81.6	83.0	84.2	83.6	82.3	80.2	78.7	79.4	80.1	80.7	81.2	81.3	81.4
El Peru	9	75.5	76.2	77.1	78.9	79.1	77.8	77.5	78.2	78.7	78.3	77.7	76.4	77.6
Caracas	16	65.8	66.6	67.6	69.4	70.8	69.4	68.9	69.3	69.8	69.6	68.4	66.4	68.5
Merida	9	64.8	66.0	66.2	67.8	68.2	67.8	67.9	68.2	68.2	67.2	66.1	65.2	67.0
		Highest temperature												
Maracaibo	9	93	94	96	102	97	98	97	98	97	95	92	92	102
Ciudad Bolivar	7	92	93	96	97	95	94	93	93	96	94	94	91	97
Calabozo	5	94	96	95	97	97	94	92	93	92	92	92	92	97
El Peru	9	89	90	91	93	93	94	91	93	92	95	92	89	95
Caracas	16	83	88	91	88	89	85	84	86	85	86	84	83	91
Merida	9	79	82	81	81	83	82	85	83	83	83	80	78	85
		Lowest temperature												
Maracaibo	9	68	70	71	74	73	73	72	73	72	71	72	71	68
Ciudad Bolivar	7	66	66	67	68	70	69	67	69	68	70	68	68	66
Calabozo	5	68	67	71	72	70	70	70	70	70	69	67	68	67
El Peru	9	59	62	62	63	65	61	62	61	65	62	62	64	59
Caracas	16	47	46	45	51	52	53	52	53	53	54	51	47	45
Merida	9	52	52	53	54	56	55	54	54	54	55	53	52	52

[1] Means and extremes are for the following periods: Maracaibo, 1915–1923; Ciudad Bolivar, 1917–1923; Calabozo, 1919–1923; El Peru, 1910–1921; Caracas, 1908–1923; Merida, 1915–1923.

TABLE 14.—*Relative humidity, sunshine, and wind data for Venezuela*

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean relative humidity (6 a. m., noon, 9 p. m.), per cent.												
Maracaibo	8	78	78	72	76	79	80	77	78	82	86	84	79	79
Ciudad Bolivar	7	71	68	68	68	71	77	80	77	74	78	76	77	74
Calabozo	5	62	60	57	63	73	79	81	80	80	80	77	70	72
Caracas [1]	16	78	77	76	77	78	81	80	80	81	82	82	80	79
Merida	9	76	75	77	79	81	80	78	78	78	81	81	80	79
		Mean daily duration of sunshine (in hours)												
Maracaibo	8	8.5	8.4	8.0	6.1	5.7	6.6	7.9	7.9	6.9	5.9	6.6	7.8	7.2
Calabozo	5	8.3	9.6	9.0	7.3	5.4	4.6	5.1	6.0	6.6	7.4	8.0	7.8	7.1
Caracas	16	7.6	7.8	7.5	6.4	6.4	6.4	7.3	7.4	7.2	6.8	6.9	6.7	7.0
Merida	9	7.6	7.5	6.1	5.5	4.9	5.1	6.0	6.3	6.3	5.5	6.5	7.5	6.2
		Prevailing wind direction												
Maracaibo [2]	6	n.	n.	n.	n.	----	----	----	----	----	----	----	----	n.
Ciudad Bolivar	5	ne.	ne.	ene.	ne.	ene.	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.
Calabozo	5	e.	e.	e.	e.	e.	e.	ne.	e.	e.	e.	e.	e.	e.
Caracas [3]	13	e.	e.	e.	e.	e.	e.	e.	e.	e.	e.	e.	e.	e.
Merida	7	sw.	sw.	sw.	sw.	sw.	sw.	sw.	ne.	ne.	sw.	sw.	sw.	sw.
		Mean wind velocity (miles per hour)												
Caracas [4]	20	6.9	8.0	8.8	7.9	7.8	8.5	7.8	6.5	6.2	6.2	6.3	6.7	7.3

[1] Mean of observations at 6 a. m., noon, 6 p. m., and 12 p. m.
[2] North to east winds at 6 a. m., and 9 p. m., and south-southeast winds at noon from May to December, inclusive.
[3] West winds at 6 p. m. from October to May, inclusive.
[4] Wind velocity shows a steady decrease in late years; the annual mean for the period 1914–1923 is 5.2 miles per hour. No information relative to the elevation of the anemometer is available.

TABLE 15.—*Mean monthly and annual precipitation for Venezuela (in inches)* [1]

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Eastern division														
Rio Caribe	5	2.55	0.70	2.01	0.57	1.51	5.07	4.96	4.03	4.13	2.24	2.59	4.77	35.70
Maturin	5	1.43	0.69	0.45	0.94	2.41	8.34	8.80	3.99	4.13	4.50	3.62	3.99	43.29
Ciudad Bolivar	9	0.49	0.21	0.22	0.96	2.69	5.45	6.33	7.00	3.02	3.46	3.35	1.97	35.15
El Peru	11	3.94	2.95	2.17	3.07	5.91	7.83	7.01	7.13	4.53	3.50	3.54	4.17	55.75
Middle division														
La Guaira	5	0.31	0.23	0.83	0.23	0.50	0.84	1.01	1.09	1.35	1.70	1.50	1.77	11.36
Caracas	35	0.84	0.35	0.61	1.50	2.83	4.21	4.25	4.32	4.03	4.04	3.40	1.74	32.15
Cumana	5	0.28	0.10	0.33	0.00	0.25	0.64	1.61	3.37	2.71	1.83	2.04	1.01	14.17
Valencia	5	0.00	0.14	0.84	1.75	4.27	9.00	7.51	8.07	7.25	8.23	1.83	2.02	50.91
Ocumare del Tuy	5	2.50	0.94	0.56	0.51	2.53	6.83	6.10	4.05	4.16	5.01	3.09	4.80	41.17
Barcelona	5	0.48	0.25	0.10	0.15	1.38	4.47	5.97	4.86	4.09	3.16	2.13	1.13	28.17
Zaraza	5	0.52	0.08	0.00	0.33	3.67	6.88	7.91	5.61	4.24	4.54	2.48	1.21	37.47
Calabozo	7	0.02	0.00	1.20	2.34	4.94	6.57	8.97	8.09	6.07	5.19	3.69	0.07	47.15
San Fernando de Apure	5	0.00	0.00	1.04	1.87	5.46	7.05	9.21	12.13	8.65	7.67	1.65	0.36	55.09
Western division														
Coro	5	0.25	0.30	0.61	0.03	0.41	0.34	0.76	1.03	1.58	2.96	1.46	1.33	11.06
Maracaibo	11	0.02	0.02	0.25	0.61	2.39	2.11	1.87	2.09	3.03	4.94	3.12	0.46	20.91
Carora	5	0.00	0.35	1.05	1.57	2.52	0.84	1.45	2.13	2.61	5.59	4.63	0.99	23.73
Barquisimeto	5	0.30	0.09	0.70	0.82	2.12	2.87	3.75	2.23	1.27	3.04	1.32	1.68	20.19
Trujillo	5	0.83	2.03	4.58	4.60	3.42	2.36	2.43	3.24	3.80	4.92	4.10	1.80	38.11
Merida	11	2.75	1.63	3.66	6.90	10.95	7.20	4.62	6.20	6.17	10.44	8.26	3.05	71.83
San Cristobal	4	0.70	0.38	2.03	3.45	6.38	8.78	10.19	4.87	6.42	5.89	2.17	2.84	54.10

[1] Means are for the following periods: Ciudad Bolivar, 1917–1925; El Peru, 1910–1921; Caracas, 1891–1925; Calabozo, 1919–1925; Maracaibo, 1915–1925; Merida, 1915–1925; remaining stations, 1921–1925.

COLOMBIA

In this country, where the land rises from a tropical sea to the snow line at 16,000 feet, there is such a wide range in temperature, and the amount and distribution of precipitation is so influenced by topography that, within certain limits, all varieties of climate are to be encountered. The following paragraph abstracted from Colombia: A Commercial and Industrial Handbook, issued by the United States Department of Foreign and Domestic Commerce (1921), fitly describes the four temperature zones of the western region; the unexplored eastern region, drained by the Orinoco and the Amazon, is said to be extremely tropical:

The coasts, both Caribbean and Pacific, are very hot; the region of the foothills is still hot, with conditions shading to semitropical in the upper levels between 3,000 and 4,000 feet; in the low ranges of the mountains, up to 6,000 feet, temperatures are mild; in the higher ranges and on the high plateaus, all above 6,000 feet, the climate is cool, with occasional frosts above 9,000 feet.

From the scant material available for Table 17 it appears that in low inland regions, as probably on the coasts, the mean annual temperature is about 82° and that the extreme records are about 100° for the maximum and 65° for the minimum, while at the elevation of nearly 9,000 feet (Bogota) the corresponding values are 55°, 75°, and 40°. With respect to temperature, there is no change of season; the difference in the extreme monthly means is very small, 2° or less.

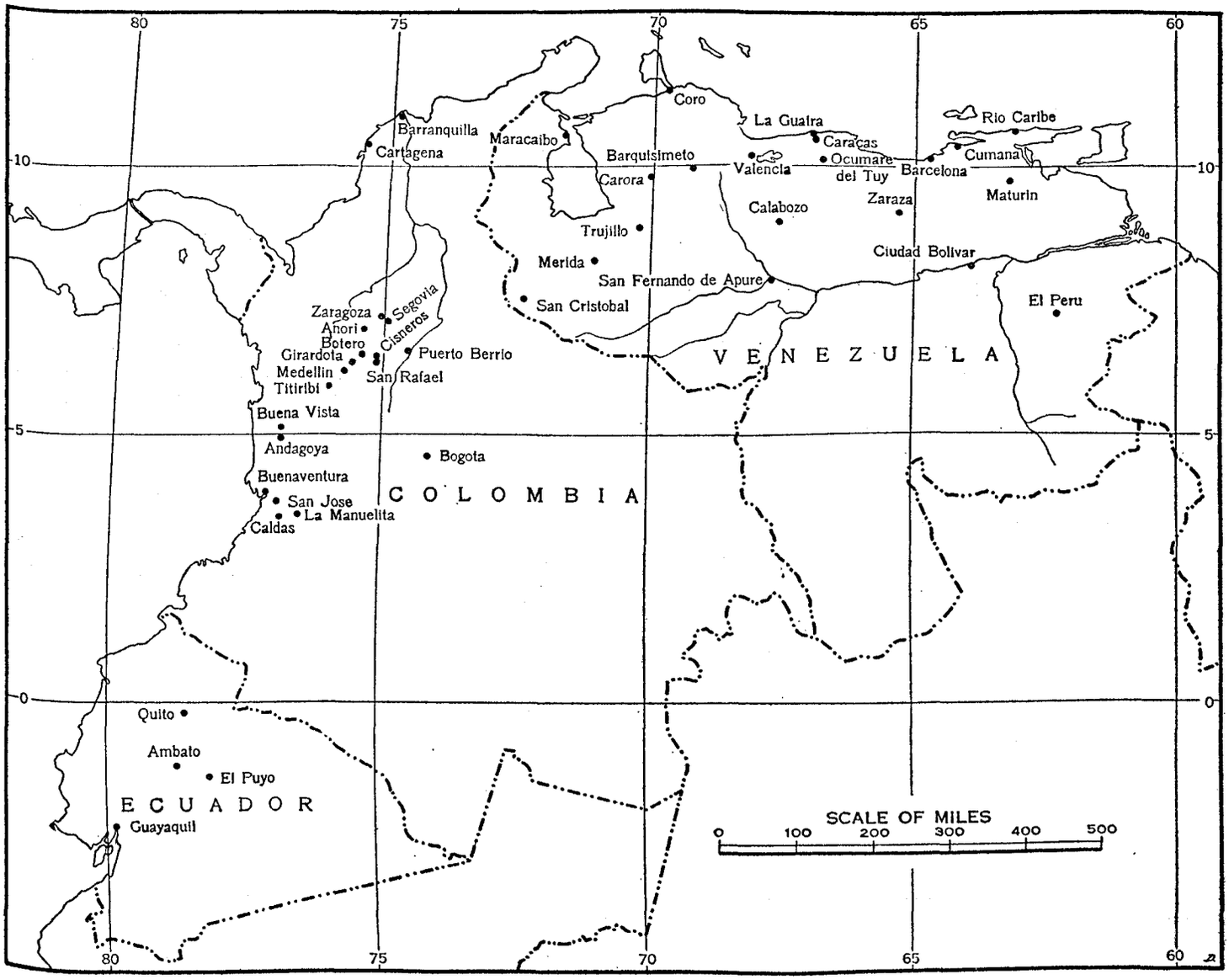


TABLE 16.—*Elevation of stations above sea level, in feet*

Venezuela:[1]	
Barquisimeto	1,857
Calabozo	328
Caracas	3,420
Carora	1,432
Ciudad Bolivar	125
El Peru	720
Maracaibo	20
Merida	5,384
Ocumare del Tuy	689
San Cristobal	2,707
Trujillo	2,625
Valencia	1,568
Colombia:	
Andagoya	250
Anori	5,036
Antioquia	2,297
Barranquilla	13
Bogota	8,678
Botero	3,520
Buenaventura	39
Caldas	256
Cartagena	16
Medellin	5,046
Puerto Berrio	426
San Jose	382
Titiribi	5,092
Zaragoza	587
Ecuador:	
Ambato	8,596
El Puyo	3,215
Guayaquil	40
Quito	9,350

[1] Stations in Venezuela not listed here lie at elevations less than 100 meters (328 feet).

Along the extreme eastern part of the Caribbean coast the average amount of rainfall received yearly is reported to be less than 20 inches; on the middle coast (Barranquilla and Cartagena) it is 30 to 35 inches, while toward the west there is a marked increase to 160 inches (estimated) in the region adjacent to Panama. Tropical forests indicate heavy precipitation in the western coastal region; Buenaventura, the only station in this region, has an average yearly fall of 280 inches. We find in the interior an extremely wide range in annual rainfall, which is well illustrated by the values for the stations with the longer series of observations: 40 inches at Bogota, 59 inches at Medellin, 217 inches at Zaragoza, and 280 inches at Andagoya. Shorter series give exceptionally high annual means for Buena Vista (331 inches), San Jose (315 inches), and Anori (281 inches).

The double wave appears in the march of precipitation even at stations with very short records. From Medellin northward the chief maximum in October is but little more pronounced than the secondary in May or June, but the chief minimum in December or January is in

rather marked contrast to that in July; south of Medellin there is much less uniformity in the march, but the general character of the same remains unchanged. At Cartagena the extreme monthly means in inches are 0 and 9, at Medellin 2 and 4, at Bogota 2 and 5, at Segovia 4 and 16, at Andagoya 19 and 26, and at Buenaventura 11 and 35 inches.

TABLE 17.—*Temperature data for Colombia* (° *F.*)

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean maximum temperature												
Andagoya [1]	8	89.6	89.3	89.6	89.8	89.2	89.2	89.3	89.2	89.5	89.6	88.2	88.0	89.2
Bogota, 2 p. m.[2]	2	66.2	66.6	65.3	64.0	64.2	63.3	61.5	62.6	63.0	63.1	63.0	62.8	63.8
		Mean minimum temperature												
Andagoya [1]	8	74.5	74.5	74.5	75.0	74.5	74.1	73.6	73.6	73.5	73.8	73.7	74.0	74.1
Bogota, 6 a. m.[3]	2	48.9	48.9	51.1	51.6	51.6	51.4	50.5	50.2	50.0	50.4	50.0	50.4	50.4
		Mean temperature												
Andagoya [1]	8	82.0	81.9	82.0	82.4	81.8	81.6	81.4	81.4	81.5	81.7	81.0	81.0	81.6
Puerto Berrio [3]	----	79.3	79.2	78.6	78.3	78.6	78.8	78.4	78.4	78.4	78.6	78.8	79.2	78.8
Medellin [4]	5	70.9	71.6	70.9	70.7	70.9	70.7	70.5	70.7	70.5	69.4	69.1	69.8	70.5
Bogota [2]	2	57.6	57.8	58.2	57.8	57.9	57.4	56.1	56.4	56.5	56.8	56.5	56.6	57.1
		Highest temperature												
Andagoya [1]	8	96	95	98	97	96	100	100	98	100	99	95	96	100
Medellin [4]	5	----	----	----	----	----	----	----	----	----	----	----	----	89
Bogota, 2 p. m.[2]	2	72	72	74	74	72	69	66	70	70	70	72	68	74
		Lowest temperature												
Andagoya [1]	8	68	71	70	70	72	70	70	70	70	69	68	66	66
Medellin [4]	5	----	----	----	----	----	----	----	----	----	----	----	----	56
Bogota, 6 a. m.[2]	2	40	44	47	46	46	48	47	44	44	43	45	46	40

[1] Monthly Weather Review, 1926, p. 376.
[2] Anales del Observatorio Nacional de San Bartolomé, Bogota.
[3] Handbuch der Klimatologie (Hann), third edition, II Band, p. 382.
[4] Meterologische Zeitschrift, 1886, p. 419.

TABLE 18.—*Medellin and Bogota, Colombia* [1]

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean relative humidity [2]												
Medellin	5	69	70	72	74	75	73	69	69	73	77	77	72	72
Bogota	2	71	66	72	72	73	71	72	68	69	75	76	75	72
		Mean relative humidity 2 p. m.												
Bogota	2	52	46	55	56	57	56	58	53	54	59	60	60	56
		Prevailing wind direction												
Bogota	2	w.	w.	w.	w.	s.	s.	s.	s.	s.	w.	w.	w.	w.
		Mean wind velocity (miles per hour)												
Bogota	2	3.6	3.6	3.7	3.2	3.7	4.6	4.8	4.9	4.3	3.1	2.8	3.0	3.8
		Mean number of days with thunderstorm												
Medellin	4	0.8	1.8	4.7	3.2	2.5	2.5	1.5	4.7	3.3	3.7	2.8	0.0	31.5
Bogota	4	0.2	1.5	4.8	4.5	3.8	0.2	0.2	0.5	1.5	8.2	5.8	5.2	36.4
		Mean number of days with fog												
Bogota [3]	2	16	22	18	8	6	2	1	1	4	2	6	4	90

[1] See references under preceding tables.
[2] Medellin, mean of observations at 8 a. m. and 5 p. m.; Bogota, mean of observations at 6 a. m., 2 p. m., and 8 p. m.
[3] In summer the "*paramitos*," cold, wet fogs from the mountains, unexpectedly spread a gray cover the city and afterwards lift just as quickly as they came.—Hann's Handbuch der Klimatologie (3d edition), II Band, p. 366.

TABLE 19.—*Precipitation data for Colombia*

Stations	Length of record, in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean precipitation (in inches)												
Barranquilla [1]	4	0.00	0.04	0.00	0.02	1.38	5.32	1.46	2.91	6.65	9.96	4.21	0.00	31.95
Cartagena [2]	12	0.00	0.01	0.07	0.55	3.39	5.06	2.80	4.96	5.20	8.78	4.46	0.36	35.64
Zaragoza [1]	8	----	----	----	----	----	----	----	----	----	----	----	----	217.32
Segovia [3] [4]	20	4.00	4.07	5.16	8.61	14.61	14.17	11.51	11.41	13.40	15.82	13.53	7.78	124.07
Anori [1]	8	----	----	----	----	----	----	----	----	----	----	----	----	281.06
Cisneros [5]	3	2.96	6.35	6.17	10.32	18.12	12.76	14.32	15.91	18.40	21.90	12.53	3.04	142.78
Antioquia [1] *	2	----	----	----	----	----	----	----	----	----	----	----	----	37.72
Botero [5]	3	2.74	3.71	4.16	10.37	14.74	16.83	11.82	18.64	16.83	14.72	7.75	3.41	125.72
San Rafael [5]	3	3.49	5.30	6.17	12.43	14.51	8.57	6.17	14.76	9.28	15.81	7.18	1.90	105.57
Puerto Berrio [5]	3	2.68	5.89	6.00	9.69	16.76	12.89	8.93	13.64	14.74	18.61	9.79	3.24	122.86
Girardota [5]	3	2.10	3.20	3.09	8.52	9.36	8.15	7.24	7.49	8.99	9.58	5.82	1.61	75.15
Medellin [4]	15	2.70	3.27	3.36	6.53	7.89	5.44	4.13	4.68	6.16	7.02	5.07	2.53	58.78
Titiribi [5]	4	2.82	4.17	4.00	7.91	9.48	9.27	6.63	7.66	8.48	10.13	6.86	3.02	80.43
Buena Vista [5]	3	20.51	14.58	17.85	31.60	30.77	27.29	38.23	25.98	30.86	26.78	35.41	30.87	330.73
Andagoya [6]	12	24.10	20.18	18.86	26.01	24.28	25.13	23.61	25.80	25.88	21.67	23.09	20.50	279.11
Bogota [7]	31	2.22	2.28	3.67	5.24	4.23	2.10	1.80	1.93	2.34	5.49	5.13	3.10	39.53
Buenaventura [7]	7	17.90	12.33	11.34	25.60	28.40	23.76	22.35	26.66	27.93	34.66	28.08	21.64	280.65
San Jose [8]	4	----	----	----	----	----	----	----	----	----	----	----	----	314.78
Caldas [8]	5	----	----	----	----	----	----	----	----	----	----	----	----	47.90
La Manuelita [8]	11	3.19	3.10	4.16	6.09	5.37	2.92	1.50	1.46	2.98	5.81	4.78	3.20	44.59
		Maximum precipitation in 24 hours												
Andagoya	12	7.34	5.90	8.11	6.22	5.41	6.80	3.36	5.14	6.04	6.24	4.67	4.35	8.11
		Mean number of days with precipitation												
Cartagena [9]	12	0	----	----	1	6	7	5	8	7	9	5	1	49
Medellin	5	12	10	18	19	21	20	15	19	19	22	21	13	209
Andagoya	12	26	21	23	25	26	24	26	27	27	24	27	27	303
Bogota	6	6	7	13	20	17	16	18	16	13	20	16	15	177

[1] Data given by Bruno Franze in Die Niederschlagsverhältnisse von Südamerika, Petermann's Mitteilungen, Ergänzungsheft Nr. 195.
[2] Annales du Bureau Central Météorologique de France. 1892–1903.
[3] La Saluda.
[4] Climatological Data. West Indies and Caribbean Service. U. S. Weather Bureau. San Juan, Porto Rico, July, 1925.
[5] Data forwarded by O. L. Fassig, U. S. Weather Bureau, San Juan, P. R.
[6] Climatological Data for Andagoya, Colombia. P. C. Day. Monthly Weather Review, 1926, p. 377.
[7] Noticia del nuevo observatorio, San Bartolomé de Bogota, Simon Sarasola. Numero 1, Notas geofisicas y meteorológicas publicadas por el Observatorio Nacional de San Bartolomé de Bogota.
[8] Distribution of Bird Life in Colombia, Frank M. Chapman. Bulletin of the American Museum of Natural History, Vol. XXXVI, 1917, p. 79.
[9] Less than 0.5 in February and March.
* The station Antioquia lies 25 miles northwest of Medellin.

ECUADOR

The coastal region of Ecuador is much cooler than that of Colombia; the three-year record for Guayaquil gives a mean annual temperature of 78° and an extreme maximum of 89°. Contrary to what might be expected in this tropical region, temperatures are lowest in the dry season from June to November, inclusive, the extreme monthly means being 75° in July in contrast to 80° in December and April. A small branch of the cold Peruvian current, described later in the discussion of temperatures along the coast of Peru, washes the southern coasts of Ecuador and brings a considerable lowering of temperature in the winter of the Southern Hemisphere.

On the high plateau temperatures are very uniform throughout the year; the following values will represent very closely average conditions at Quito (9,350 feet) in any month: Mean maximum, 69°; mean minimum, 45°; mean, 57°; highest, 77°; and lowest, 37°.

Unfortunately, no records are available for the wide interval between these levels; temperature conditions there may be judged by reference to the climatic zones noted for Colombia and the data given for Peruvian stations similarly located.

TABLE 20.—*Temperature data for Ecuador* (° *F.*)

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean maximum temperature												
Guayaquil [1]	3	82.4	82.2	82.0	83.4	82.8	80.8	79.9	81.3	81.5	80.6	81.3	84.7	81.9
Ambato [2]	5	70.5	69.4	69.8	70.3	68.2	66.7	65.1	65.7	67.3	70.3	72.0	69.8	68.5
Quito [3]	7	67.8	68.5	67.5	67.3	67.5	68.5	69.8	70.5	70.7	71.2	69.6	68.7	68.9
		Mean minimum temperature												
Guayaquil	3	75.2	76.8	76.8	77.0	75.4	73.8	70.2	72.0	73.8	72.3	72.7	75.9	74.3
Ambato	5	48.9	48.2	48.0	49.1	48.7	47.3	46.2	45.1	46.2	47.3	46.8	48.2	47.5
Quito	7	46.6	45.9	46.8	46.9	46.6	45.0	43.9	43.9	44.8	44.8	44.8	45.3	45.4
		Mean temperature (maximum+minimum÷2)												
Guayaquil	3	78.8	79.5	79.4	80.2	79.1	77.3	75.0	76.6	77.6	76.4	77.0	80.3	78.1
Ambato	5	59.7	58.8	58.9	59.7	58.4	57.0	55.6	55.4	56.8	58.8	59.8	59.0	58.1
Quito	7	57.2	57.2	57.2	57.1	57.0	56.8	56.6	57.2	57.8	58.0	57.2	57.0	57.2
		Mean temperature 7 a. m., 2 p. m., 9 p. m.												
Guayaquil [4]	3	79.3	79.3	79.7	80.4	78.8	77.4	75.4	76.1	77.2	76.6	78.4	80.2	78.2
Ambato	5	58.5	57.9	58.1	58.1	57.2	55.8	54.5	54.5	55.8	57.7	58.5	58.1	57.1
Ambato [5]	2	59.7	58.3	58.3	58.8	58.3	55.9	55.0	55.0	55.8	57.6	58.8	59.2	57.7
Quito	3	55.2	55.0	55.0	55.0	55.2	55.0	54.9	55.4	55.8	55.8	55.4	55.0	55.2
Quito [5]	2	55.2	54.7	54.9	54.9	54.9	54.0	54.1	55.2	55.4	54.7	54.3	54.5	54.7
		Highest temperature												
Guayaquil	3	88	89	88	88	86	84	88	88	86	86	89	88	89
Ambato	5	81	82	79	79	76	74	75	77	75	78	81	78	82
Quito	4	78	75	78	74	75	74	74	79	75	78	74	74	79
		Lowest temperature												
Guayaquil	3	73	73	68	74	69	66	66	67	69	68	70	72	66
Ambato	5	37	36	32	40	39	33	32	34	35	34	33	33	32
Quito	4	36	37	40	41	38	37	38	38	36	38	35	36	35

[1] Boletín Mensual del Observatorio Meteorológico del Colegio Nacional "San Vicente," Guayaquil. 1896-1899. The data given here are based on a period of record somewhat longer than that noted in the British Admiralty Pilot, South American Pilot, Part III, first edition. 1915.

[2] Observaciones y estudios meteorológicas y climatéricos. Nicolas G. Martinez. Boletín No. 1, Sección de Meteorología. Ambato. 1917. See footnote 2 under precipitation table.

[3] Zur Meteorologie des Aquators, III. Meteorologie des Hochtales von Quito. Hann. (Sitzungsberichte der Kaiserl. Akademie der Wissenschaften in Wien. Mathem.-naturw. Klasse IIa, 124, Band 1. und 2. Heft. 1915.) Also Meteorologische Zeitschrift, 1894, p. 37, and 1905, p. 477, and the reference under footnote 2 above as supplementary.

[4] Means of observations at 7 a. m., 3 p. m., and 9 p. m.

[5] Means for 24 hours.

North of Ecuador lies the rainy coast of Colombia and south of it stretches the arid coast of Peru; no data are at hand to show the transition from one extreme to the other, but it appears that the region of abundant precipitation extends southward to the Equator and that the desert region has a rather sharply defined limit near the Peruvian border. The mean annual amount of 40 inches at Guayaquil is probably a fair approximation to that received over the southern coastal region. The annual means for Ambato (19 inches) and Quito (43 inches) indicate light to moderate rainfall on the plateaus and that for El Puyo (151 inches) shows the change to abundant or excessive precipitation east of the Andes Mountains.

At Guayaquil a wet season (January to April, inclusive) and a dry season are well defined; in January and February the mean monthly rainfall is 10 inches, while practically no rain falls in August or September. At Ambato and Quito, in the high plateau region, there is a considerable decrease in rainfall from March–May to June–September, with extreme monthly values of 7 inches in April and less than 1 inch in July at Quito. The average amount of rain received monthly at El Puyo, east of the Andes, varies from 15 inches in May and June to 10 inches in August and September.

The annual march of precipitation does not show the double wave found from the Guianas westward to Colombia unless we make a nice distinction and see a secondary minimum in the values for February at Ambato and Quito.

Conditions in northeastern Peru must be judged from observations at Iquitos extending over the extremely short period of one year. At this point the temperature means for the warmest season (November–February) and the coolest season (June–July) are, respectively, 78° and 74°. It is probable that the mean yearly precipitation is over 100 inches in most of the area drained by the Amazon River. As in the mountains to the west, the midyear is the drier season.

TABLE 21.—*Relative humidity, sunshine, and wind data for Ecuador*

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean relative humidity 7 a. m., 2 p. m., 9 p. m.												
Ambato [1]	5	74	76	75	76	76	76	75	75	73	74	72	73	75
Quito	2	75	78	77	79	76	70	60	58	62	68	70	77	71
Quito [2]	2	76	78	79	80	77	72	61	58	63	71	72	78	72
		Mean relative humidity 2 p. m.												
Quito	2	50	53	57	58	55	45	36	33	38	43	46	52	48
		Mean cloudiness.												
Guayaquil	1	7.0	8.1	8.1	7.0	7.0	7.3	5.7	7.0	7.0	7.6	7.0	8.0	7.0
Ambato	5	7.6	7.5	7.9	7.9	7.9	7.5	8.1	7.9	7.7	7.4	7.1	7.4	7.7
Quito	3	6.4	6.6	7.5	7.4	6.7	5.4	4.2	3.8	5.6	6.2	5.8	6.5	6.0
		Mean duration of sunshine (in hours).												
Ambato [3]	3	4.4	3.9	2.6	4.4	3.2	2.9	3.0	3.9	3.3	4.4	5.0	4.7	3.8
Quito [3]	3	5.9	5.6	4.2	4.5	4.6	5.3	5.8	7.4	5.7	5.8	6.1	5.6	5.6
		Prevailing wind direction.												
Guayaquil	3	----	ne.	----	nw.	sw.	sw.	sw.	sw.	sw.	sw.	sw.	sw.	sw.
Ambato	2	se.	se.	se.	se.	se.	se.	se.	se.	se.	se.	se.	se.	se.
Quito [4]	----	----	----	----	----	----	----	----	----	----	----	----	----	----
		Mean wind velocity (miles per hour).												
Guayaquil	3	2.9	2.9	3.4	3.1	2.9	2.9	3.4	3.4	4.0	4.7	4.0	3.1	3.4
Ambato	3	2.7	2.2	2.5	2.2	2.2	2.2	2.9	2.9	2.7	2.7	2.7	2.9	2.6
Quito	6	3.1	3.2	3.1	3.1	3.4	4.3	5.2	5.8	5.1	3.9	3.6	3.3	3.9
		Mean number of days with thunderstorm.												
Ambato [5]	5	5	7	2	4	1	----	----	----	1	6	9	3	40
Quito	7	7	7	12	16	13	8	4	5	7	13	10	7	99
		Mean number of days with fog.												
Quito	4	2.2	1.3	1.4	2.0	2.5	0.7	0.2	0.8	0.5	1.2	1.9	3.3	18.0

[1] The annual variation in relative humidity is very small at Ambato, due to nearness to the river and to irrigation; this is not the case at Quito—Martinez. See footnote 2 under temperature table.

[2] Mean for 24 hours.

[3] The mountains reduce the duration of possible sunshine from 12 hours to about 11.5 hours.—Martinez.

[4] Quito has local winds only. The prevailing direction is north-northeast by day and south-southwest during the night.—Hann.

[5] Less than 0.5 from June to August, inclusive.

TABLE 22.—*Precipitation data for Ecuador*

Stations	Length of record, in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean precipitation (in inches) [1]												
Guayaquil	3	9.92	9.75	7.51	5.22	2.11	0.75	0.41	0.00	0.11	0.43	0.27	1.94	38.42
Ambato [2]	14	1.98	1.64	2.18	2.52	2.17	0.73	0.91	0.73	0.88	1.88	1.43	1.43	18.53
Quito	14	4.16	3.36	5.23	7.25	5.00	1.57	0.81	1.24	2.66	3.91	4.01	3.88	43.08
El Puyo [3]	4	12.40	13.82	12.56	11.69	15.55	14.80	10.55	10.20	10.31	13.58	12.76	13.23	151.45
		Mean number of days with precipitation												
Guayaquil [4]	3	20	12	13	9	5	2	2	0	----------	1	----------	5	70
Ambato	7	14	15	15	19	17	12	16	15	11	14	10	12	170
Quito	7	14	12	20	23	20	9	6	10	12	17	13	15	171

[1] See references under temperature table.
[2] Observations at Ambato or the neighboring stations, "La Liria" and "Quinta Normal." Martinez combines these records in his work previously cited.
[3] This station lies at the eastern foot of the Andes. The data are from Niederschlagsverhältnisse von Südämerika, Bruno Franze. Petermann's Mitteilungen, Ergänzungheft Nr. 195.
[4] Less than 0.5 in September and November.

PERU

The distribution of meteorological stations from north to south and from the coast to high elevations makes possible a rather satisfactory survey of the climates found in western Peru. The most important records are those for Mollendo (80 feet), Piura (180 feet), Lima (512 feet), La Joya (4,140 feet), Arequipa (8,040 feet), Cuzco (11,319 feet), Cailloma (12,992 feet), and El Misti (19,200 feet).

In the temperature tables stations are arranged according to elevation above sea level. There we find that the mean temperature along the coast is about 70° in contrast to 78° at Guayaquil, Colombia; at low elevation some distance from the coast the mean is higher, probably 75° or more, as at Piura; with increasing elevation the mean falls to 61° at 4,000 feet, 56° at 8,000 feet, 51° at 11,000 feet, about 40° at 14,000 feet, and to 18° at 19,000 feet.

The temperature march is of the Southern Hemisphere type, with maximum occurring in the period from November to March, inclusive, and the minimum in that beginning with June and ending with August. Up to the elevation of at least 1,300 feet (Ica) the difference between the extreme monthly means averages 13° and the year may well be divided into temperature seasons; at higher levels this difference is generally much smaller, and especially so at Arequipa, where it is less than 3°.

While temperatures of 95° or above are rather frequent at Piura, about 30 miles from the sea, the highest readings on the coast rarely exceed 90°. At La Joya the maximum closely approaches 90°, at Arequipa it is slightly above 80°, at Cerro de Pasco (14,000 feet) about 70°. A short, fragmentary record indicates that the highest value for El Misti is slightly above 50°. From sea level up to the altitude of 500 feet the lowest records are about 50°. In the elevated regions in the south we have the following extremes: 32° at La Joya and Jauja (11,300 feet), 20° (about) at Cerro de Pasco (14,300 feet) and Puno (12,500 feet), and −10° (about) at Cailloma and Vincocaya (14,000 feet). At the last two stations freezing temperatures have been recorded in all months of the year and subzero temperatures in the midwinter season.

In the statement of general conditions at the beginning of this paper attention was called to the contrast between mean temperatures on the Peruvian and Brazilian coasts as shown in Table 1. Reference to that table shows that the abnormally low mean annual temperature at Trujillo, for example, is due in large part to the fact that from May to December the monthly mean temperatures there are below 70° and from June to September 63° to 64°. In January and February the temperature difference Pernambuco-Trujillo is not very large, 5°, but from May to October it averages 13.5°.

The charts showing surface temperatures of the Atlantic, Indian, and Pacific Oceans (Official No. 59, 1903) issued by the London Meteorological Office give the following values for the vicinities of Trujillo and Pernambuco, respectively: February, 74° and 80°; May, 69° and 80°; August, 68° and 78°; and November, 64° and 80°. These sea temperatures closely approximate the corresponding air temperatures found in Table 1.

The abnormally low air temperatures on the Peruvian coast are directly attributable to the coldness of the coastal water caused in part by the Peruvian current and in part by upwelling near the shores to replace water carried westward by the oceanic circulation.

The cold current, that part of the great west-wind drift of the southern ocean deflected northward west of southern South America, enters the region of the trade winds in the vicinity of the Tropic of Capricorn and then moves northwestward to the vicinity of the Equator before turning westward to merge its waters with those of the south equatorial stream. The extent to which it carries cold water northward in months representing the extreme seasons appears from the following sea temperatures along the meridian of 85° west in February and August, respectively: 40° S., 62° and 52°; 30° S., 70° and 62°; 20° S., 70° and 65°; and 10° S., 78° and 67°. It is interesting to note that the seasonal change in water temperature is the same at the first and last positions and that there is an equal change, 77° to 64°, in the air temperature at Trujillo (8° S.). Between the meridian of 85° W. and the coast of Peru the sea surface isotherms make a sharp bend northward and show the considerable effect of the upwelling of colder water from lower ocean strata.

Along the so-called rainless coast of Peru the annual amount of precipitation, based on records at four stations, averages 0.90 inch. This condition of aridity extends inland over the coastal lowland and, in the extreme south at least, is to be found in part of the mountainous area. The extreme yearly normals for the regions just mentioned are 0.02 inch at La Joya and 4.16 inches at Arequipa. The data in Table 25 indicate that while the greater part of the mountain section receives a moderate amount of rain, 25 to 45 inches during the year, there are regions in which the fall is light, as, for example, at Huanuco and Vincocaya (about 10 inches), and others in which it is excessive, as at La Merced (142 inches).

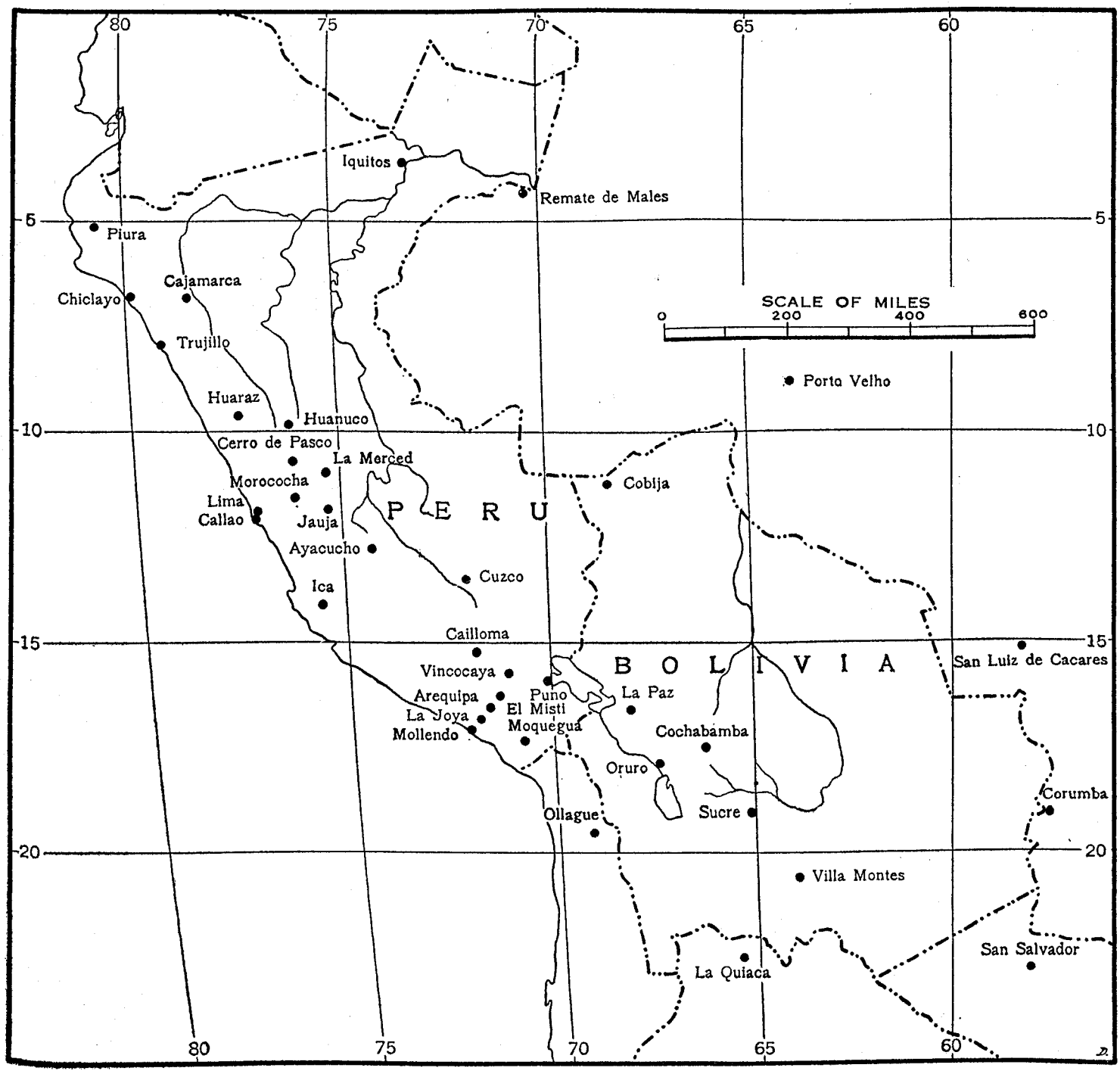


TABLE 23.—*Elevation of stations above sea level, in feet*

Peru:	
Arequipa	8, 040
Ayacucho	8, 911
Cailloma	12, 992
Cajamarca	9, 232
Callao [1]	
Chiclayo [1]	
Cerro de Pasco	14, 272
Cuzco	11, 319
El Misti	19, 200
Huanuco	6, 273
Ica	1, 319
Iquitos	348
Jauja	11, 318
La Joya	4, 140
La Merced	2, 460
Peru—Continued.	
Lima	512
Mollendo	80
Moquegua	4, 485
Piura	180
Puno	12, 539
Trujillo	203
Vincocaya	14, 360
Bolivia:	
Cobija	500
Cochabamba	8, 448
Corumba (Brazil)	381
La Paz	12, 001
La Quiaca (Argentina)	11, 358
Ollague (Chile)	12, 126
Oruro	12, 185
Porto Velho (Brazil)	249
San Luiz de Cacares (Brazil)	387
Sucre	9, 344

[1] Near sea level.

Normal monthly precipitation is generally less than 0.50 inch over the dry area; the highest monthly means exceed 0.50 inch only at Piura, Arequipa, and Moquegua and are found in the first three months of the year. Outside the desert area precipitation shows a rather uniform annual march; it is much lighter in the cool (midyear) season than in the wet. Except at La Merced, where conditions are exceptional, the monthly averages are generally below 1 inch from May to September, inclusive, and even below 0.25 inch in June and July, while in January and February they lie between 4 and 9 inches.

The aridity of the Peruvian (and Chilean) coasts is sometimes explained by stating that the cordilleras of the Andes set up an impassable barrier to moist easterly winds and that the wind circulation over the Pacific Ocean parallels the coasts. It is known that the trade-wind circulation is drawn toward the heated continent, especially during the day, and that there is much cloudiness and rather high relative humidity along the coast of Peru (see data for Callao, Mollendo, and Lima in Table 24); why, then, is this region practically rainless? The question is fully answered by Dr. Julius Hann in his Lehrbuch der Klimatologie (third edition), Vol. I, page 175, as follows:

Cool ocean currents, flowing from higher to lower latitudes, diminish precipitation in their vicinity since the moist air over them has a temperature lower than that corresponding to the latitude. The air is warmed over the land and thereby the saturation deficit is increased. In addition, these cool currents are accompanied by winds blowing in the same direction, from higher to lower latitudes, which thus at the same time have a tendency to reduce rainfall rather than to produce it.

The cool ocean currents of the inner subtropical and tropical circulation on the eastern side of oceanic areas of pressure maximum cause striking deficiency in rainfall on the continental coasts washed by them. This is most marked on the western coasts of South Africa and South America, which are washed by the mightiest of these cool currents. The western coast of South America north of the point where the westerly drift bends northward and flows toward lower latitudes becomes more and more arid until the extreme condition of aridity is reached in northern Chile and Peru. This is connected with the fact that the negative temperature anomaly becomes greater and greater the farther the current pushes into lower latitudes, as the temperature of the water rises very slowly. The arid region does not end until the cold current leaves the coast.

Even when south and southwest winds prevailing on the coast bring moist sea air over to the land rain seldom occurs, since the land in such low latitudes is strongly heated (there is, as a matter of fact, an increase in temperature toward the interior even up to a considerable elevation above sea level), and with the higher temperature of the land the cool sea air has a greater saturation deficit.

TABLE 24.—*Temperature data for Peru (°F.)*

Stations	Length of record, in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean maximum temperature												
Callao [1]	2	75.4	77.2	75.6	75.6	72.7	70.7	68.5	67.1	67.5	70.0	71.6	74.5	72.1
Mollendo [2]	10	79.1	79.6	78.3	75.6	71.8	69.4	66.8	66.3	67.2	70.0	73.9	77.2	72.9
Lima (Unanue) [3]	10	80.1	81.9	81.5	77.0	71.6	66.7	65.1	64.9	65.8	68.4	71.6	75.9	72.5
La Joya [2]	9	77.1	78.4	78.0	77.1	76.3	76.2	76.6	77.3	79.0	78.0	78.1	77.5	77.5
Arequipa [2]	13	66.9	67.1	67.1	67.1	67.8	68.0	67.1	67.1	67.5	68.3	68.6	68.1	68.2
Cuzco [2]	4	64.2	63.4	64.2	65.6	65.0	64.1	62.8	65.5	66.2	67.0	68.2	64.5	66.7
Puno [2]	2	58.1	57.4	59.6	60.9	59.9	56.6	55.6	58.4	58.8	60.6	62.6	61.2	59.1
Cailloma [4]	17	58.3	56.8	56.5	55.8	54.5	53.4	52.7	55.2	58.1	60.8	62.8	61.0	57.2
Vincocaya [2]	3	55.8	55.7	54.9	55.9	53.1	51.7	51.0	54.2	55.9	57.8	59.8	58.0	55.3
El Misti (summit), 1 p. m. [2]	2	27.2	26.1	25.1	24.1	21.6	21.4	23.4	24.3	23.6	27.5	30.3	27.0	25.1
		Mean minimum temperature												
Callao [1]	2	64.4	64.8	67.3	65.7	62.6	62.1	58.6	58.8	58.6	60.3	60.6	64.4	62.4
Mollendo [2]	10	66.0	67.0	65.5	62.7	60.8	58.5	57.1	56.8	57.2	58.8	61.8	64.2	61.4
Lima (Unanue) [3]	10	66.6	67.5	65.8	63.3	60.1	58.3	57.2	56.7	56.5	57.6	59.5	63.1	61.0
La Joya [2]	9	54.3	56.4	54.2	51.6	47.7	45.9	44.8	46.2	47.5	47.8	49.3	52.4	49.8
Arequipa [2]	13	49.2	49.4	48.7	48.2	47.6	47.3	47.2	47.4	47.9	47.0	46.4	48.4	47.9
Cuzco [2]	4	44.2	43.7	43.1	41.1	39.3	35.6	33.4	36.6	40.3	41.6	42.4	43.3	40.4
Puno [2]	2	39.6	39.2	39.6	36.6	32.9	31.0	30.0	31.9	34.3	37.4	38.8	39.2	35.9
Cailloma [4]	17	29.3	30.0	29.3	25.7	18.9	14.0	14.0	15.4	19.2	21.7	23.9	27.0	22.4
Vincocaya [2]	3	26.7	29.8	27.4	21.9	13.7	9.4	7.7	10.7	15.7	18.2	16.6	20.0	18.2
El Misti (summit), 5 a. m. [2]	2	17.6	17.6	15.9	14.2	10.7	10.0	9.9	9.6	9.0	13.3	15.8	16.5	13.3

TABLE 24—*Temperature data for Peru (°F.)*—Continued

Stations	Length of record, in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean temperature (maximum+minimum÷2)												
Callao [1]	2	69.8	71.0	71.4	70.6	67.6	66.4	63.6	63.0	63.6	65.2	66.1	69.4	67.2
Mollendo [2]	10	72.6	73.3	71.9	69.2	66.3	64.0	62.0	61.6	62.2	64.4	67.8	70.7	67.2
Lima (Unanue) [4]	10	73.4	74.7	73.6	70.2	65.8	62.5	61.2	60.8	61.2	63.0	65.6	69.5	66.8
La Joya [2]	9	65.7	67.4	66.1	64.4	62.0	61.0	60.7	61.3	63.2	62.9	63.7	65.0	63.7
Arequipa [2] [5]	13	58.0	58.2	57.9	58.0	57.8	57.2	57.2	57.4	58.1	57.8	57.2	58.3	57.8
Cuzco [2]	4	54.2	53.6	53.6	52.4	52.2	49.8	48.1	51.0	53.2	54.3	55.3	53.9	52.6
Puno [2]	2	48.8	48.2	49.6	48.7	46.4	43.8	42.8	45.1	46.6	49.0	50.7	50.2	47.5
Cailloma [4]	17	43.8	43.4	42.9	40.8	36.7	33.7	33.4	35.3	38.6	41.2	43.4	44.0	39.8
Vincocaya [2]	3	41.2	42.8	41.2	38.9	33.4	30.6	29.4	32.4	35.8	38.0	38.2	39.0	36.7
El Misti (summit), 5 a. m., 1 p. m. [2]	2	22.4	21.8	20.5	19.2	16.2	15.7	16.6	17.0	16.3	20.4	23.0	21.8	19.2
		Mean temperature (reduced, etc.)												
Callao [6]	2	68.9	70.2	70.9	69.8	66.9	65.5	63.0	62.4	62.4	64.2	65.1	68.5	66.6
Chiclayo [7]	4	76.1	78.3	77.4	73.2	68.9	63.5	64.0	64.6	65.1	65.5	68.0	72.9	69.8
Mollendo [6]	4	70.7	71.1	70.2	68.0	65.5	62.2	60.1	59.9	60.6	62.4	66.2	68.9	65.5
Trujillo [7]	4	77.2	77.0	74.3	72.0	68.0	63.0	64.0	64.2	63.7	67.5	68.7	72.0	69.3
Lima (Unanue) [6]	6	71.1	73.4	72.9	70.0	66.0	62.1	60.6	60.6	61.3	61.9	65.8	69.8	66.3
Lima [8]	8	72.9	73.9	72.5	69.1	64.2	60.6	60.1	59.4	60.1	62.4	65.1	69.6	65.8
Ica [7]	3	76.6	77.0	76.1	71.8	68.0	62.8	60.4	61.7	64.4	66.7	70.9	74.3	69.2
La Joya [6]	4	63.1	65.3	63.5	61.7	59.2	58.6	58.5	59.7	61.9	60.6	62.1	62.6	61.4
Arequipa [9]	31	56.8	56.3	56.5	56.5	56.1	54.5	54.5	55.2	56.7	56.3	56.3	57.2	56.1
Cajamarca [7]	3	58.5	59.7	60.4	59.4	57.9	53.4	55.8	56.8	57.4	58.6	59.7	60.6	58.2
Jauja [7]	3	50.9	52.9	53.8	50.9	51.8	48.6	49.6	51.0	52.0	52.5	53.6	53.2	51.7
Cuzco [6]	----	51.4	51.6	51.6	51.1	50.0	47.7	46.4	49.3	50.5	51.8	52.7	52.2	50.5
Puno [10]	2	48.2	47.4	48.4	47.8	45.6	43.4	42.4	44.8	46.4	49.0	50.6	50.1	47.0
Cerro de Pasco [7]	3	44.1	43.2	44.1	44.1	42.6	41.0	40.5	43.9	41.0	41.7	42.3	42.4	42.6
Vincocaya [6]	----	39.6	39.4	39.2	37.9	34.9	30.6	30.9	34.9	37.9	41.0	42.6	39.7	37.4
El Misti (summit) [11]	2	21.2	20.9	19.4	17.8	14.6	14.4	14.9	14.5	14.6	18.7	21.0	20.4	17.7
Iquitos [12]	1	77.5	78.3	76.3	77.0	75.6	74.3	74.1	76.3	76.3	77.2	78.4	77.9	76.6
		Highest temperature												
Callao	3	82	83	82	80	76	76	77	75	72	73	75	80	83
Chiclayo	4	86	93	90	89	85	80	80	83	88	81	82	84	93
Mollendo	10	90	90	89	84	82	78	74	77	76	78	80	84	90
Trujillo	4	91	91	92	86	84	76	83	81	82	82	86	91	92
Lima (Unanue) [13]	6	87	88	90	86	88	85	76	74	77	77	85	86	90
Ica	3	91	91	95	90	88	86	87	86	86	86	90	90	95
La Joya	9	85	85	86	88	87	88	88	88	88	86	88	87	88
Arequipa	13	78	74	78	79	78	78	77	74	75	74	79	82	82
Cajamarca	3	77	77	77	76	72	77	77	77	75	80	80	81	81
Jauja	3	67	68	72	76	75	77	72	75	74	75	72	70	77
Cuzco [14]	14	75	79	76	74	76	76	76	75	80	79	80	80	80
Puno	4	67	70	71	72	72	69	69	73	66	72	73	70	73
Cailloma	17	72	73	71	69	70	73	66	70	72	73	82	78	82
Cerro de Pasco	3	66	59	66	67	67	63	63	68	64	67	69	69	69
Vincocaya	3	67	64	65	65	63	61	58	61	63	63	65	70	70
El Misti (summit)	3	49	44	40	52	38	41	38	44	43	43	48	44	52
Iquitos (3 p. m.) [12]	1	----	----	----	----	----	----	----	----	90	----	----	----	90
		Lowest temperature												
Callao	3	63	64	63	59	58	54	54	54	55	55	57	59	54
Chiclayo	4	61	67	60	58	55	50	54	50	54	54	54	54	50
Mollendo	10	61	61	59	57	55	50	50	51	52	53	56	58	50
Trujillo	4	62	64	63	57	50	55	55	54	56	54	57	58	50
Lima (Unanue) [13]	6	57	60	59	57	51	50	52	49	52	54	53	54	49
Ica	3	62	61	60	57	47	43	43	45	46	48	48	56	43
La Joya	9	44	49	44	42	34	34	33	32	32	37	38	43	32
Arequipa	13	40	42	38	40	40	36	38	39	39	39	38	39	36
Cajamarca	3	41	46	45	49	47	36	38	38	41	40	38	43	36
Jauja	3	39	40	38	36	39	32	32	36	36	37	42	32	32
Cuzco [14]	14	35	36	38	32	32	28	28	28	32	31	33	36	28
Puno	4	34	33	32	25	23	24	20	20	21	30	30	30	20
Cailloma	17	10	18	5	5	−2	−4	+10	−5	5	10	10	5	−10
Cerro de Pasco	3	26	25	25	23	22	21	20	22	20	18	20	22	18
Vincocaya	3	15	19	16	9	0	−8	−2	1	4	3	5	1	+8
El Misti (summit)	3	0	----	----	2	4	2	0	1	0	1	4	1	0
Iquitos (9 a. m.) [12]	1	----	----	----	----	----	----	66	----	----	----	----	----	66

[1] Geographische Mitteilungen (Petermann), 1903, p. 110.
[2] Peruvian Meteorology (Bailey) in Annals of the Astronomical Observatory of Harvard College, Vol. XXXIX, Part I, Vol. XLIX, Part I, and Vol. LXXXVI, Part III. Réseau Mondial, 1910–1918.
[3] Boletín de la Sociedad Geográfica de Lima, 1892–1898 and 1920, p. 147.
[4] Boletín de la Sociedad Geográfica de Lima, 1896–1915.
[5] Monthly Weather Review, 1922, p. 8, gives monthly values for 1892–1920.
[6] Meteorologische Zeitschrift, 1907, p. 275. Reduction to true mean.
[7] Boletín de la Dirección de Fomento, Peru. 1909–1912. Formula not given; it is probable that the means are derived from observations at 8 a. m., 2 p. m. and 8 p. m.
[8] 24-hour mean. Observatorio Meteorológico, Facultad de Ciencias.
[9] 24-hour mean by reduction. Réseau Mondial, 1918.
[10] Mean of observations at 8 a. m., 2 p. m., and 8 p. m.
[11] 24-hour mean from broken records obtained by thermograph; value for April interpolated.
[12] Zeitschrift der österreichischen Gesellschaft für Meteorologie, Band VIII, p. 269.
[13] Range in extreme temperature much greater than at the Observatorio Meteorológico.
[14] Peruvian Meteorology and Boletín de la Dirección de Fomento, listed above; also Boletín Meteorológico del Colegio Salesiano, Cuzco.

TABLE 25.—*Relative humidity, cloudiness, and wind data for Peru*

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean relative humidity												
Callao [1]	2	84	85	84	85	85	84	84	83	85	84	80	82	84
Mollendo [2]	5	80	80	77	75	76	74	75	80	82	79	79	80	78
Lima [3]	3	79	77	78	80	79	88	86	85	85	82	82	80	82
La Joya [2]	5	68	66	65	60	52	42	40	44	45	45	52	58	53
Arequipa [2]	4	73	72	67	58	46	42	42	48	44	46	51	61	54
Cuzco [2]	3	76	78	76	75	68	58	57	70	68	68	73	77	70
Puno [2]	2	69	78	75	65	51	51	50	51	56	49	51	58	59
Vincocoya [2]	2	80	81	80	67	64	60	55	51	55	56	54	61	64
		Mean relative humidity 2 p. m.												
Mollendo	5	77	78	75	72	75	72	72	77	80	75	75	77	75
La Joya	5	50	50	48	45	40	33	30	33	32	35	39	43	40
Arequipa	4	64	65	57	47	39	38	37	40	39	36	46	55	47
Cuzco	3	65	62	63	54	52	44	44	50	57	56	63	67	56
Puno	2	63	72	69	56	41	44	44	44	48	40	42	50	51
Vincocoya	2	65	70	62	40	33	26	22	32	37	44	44	48	44
		Mean cloudiness												
Callao [1]	2	6.1	5.4	4.3	5.3	5.7	7.7	8.7	8.2	7.8	6.3	5.4	5.5	6.4
Mollendo [2]	5	7.0	6.8	6.2	7.0	8.2	8.1	8.6	9.2	9.3	8.8	8.3	7.5	7.9
Lima [4]	6	5.9	5.6	4.8	4.7	6.2	8.2	8.9	9.1	8.6	7.9	6.5	6.0	6.0
La Joya [2]	5	6.7	7.1	5.9	4.8	3.4	2.9	2.4	3.0	3.1	4.0	5.0	5.9	4.5
Arequipa [2]	4	8.2	8.1	6.5	4.0	3.5	2.8	2.7	3.0	3.5	4.3	4.8	6.4	4.8
Cuzco [2]	3	6.3	6.3	6.0	5.4	4.4	3.7	3.7	4.0	4.9	5.4	5.6	6.8	5.2
Puno [2]	2	7.5	7.8	7.2	5.2	2.5	3.0	2.3	3.2	4.3	6.3	6.5	7.4	5.3
Vincocoya [2]	2	7.8	8.3	7.0	5.6	4.1	3.5	3.3	3.4	4.8	4.8	4.1	5.2	5.2
		Prevailing wind direction												
Mollendo	5	se.	se.	se.	se.	se,s.	se.	s.	se,s.	se.	se.	se,s.	se.	se.
Lima [4] [5]	5	ssw.	ssw.	ssw.	ssw.	ssw.	ssw.	ssw.	ssw.	ssw.	ssw.	ssw.	ssw.	ssw.
La Joya	5	s.	s.	s.	s.	s.	se.	se.	s.	s.	s.	s.	s.	s.
Arequipa	4	w.	sw.	sw.	sw.	ne.	ne.	ne.	ne.	sw.	w.	sw.	w.	sw.
Cuzco	5	nw.	nw.	nw.	nw.	nw.	nw.	nw.	nw.	nw.	nw.	nw.	nw.	nw.
		Mean wind velocity (miles per hour)												
Lima [4]	5	4.5	4.5	3.6	3.1	2.9	3.4	3.6	4.3	5.7	5.4	5.1	5.4	4.3
Arequipa	4	4.8	5.8	5.0	5.4	5.7	6.3	6.7	6.2	6.4	6.1	6.5	5.8	5.9

[1] Mean of observations at 9 a. m., 3 p. m., and 6 p. m.
[2] Mean of observations at 8 a. m., 2 p. m., and 8 p. m.
[3] Data for Escuela Nacional de Agricultura; formula not given but mean is probably derived from three observations daily.
[4] Observatorio "Unanue."
[5] Also south-southeast in January and September.

TABLE 26.—*Precipitation data for Peru*

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean precipitation (in inches)												
Piura [1]	4–6	0.24	T.	0.68	0.02	0.00	0.00	0.00	0.00	0.03	0.02	0.00	0.02	1.01
Chiclayo [2]	3–4	0.01	0.08	0.46	0.00	0.00	T.	0.00	0.00	0.06	0.05	0.02	T.	0.68
Trujillo [2]	2–4	0.14	0.49	0.28	0.04	0.01	0.02	0.08	0.00	0.02	T.	0.06	0.03	1.17
Callao [3]	3	0.02	0.03	T.	0.02	0.02	0.05	0.46	0.18	0.07	0.11	0.02	0.01	0.99
Lima [4]	18	0.02	0.01	0.02	0.03	0.10	0.24	0.35	0.41	0.39	0.19	0.10	0.04	1.90
Ica [3]	2–4	0.06	0.14	0.15	0.07	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.46
Arequipa [5]	34	1.21	1.71	0.60	0.15	0.02	0.01	0.03	0.01	0.00	0.02	0.03	0.37	4.16
La Joya [5]	5	0.01	0.01	T.	T.	T.	T.	0.00	T.	0.00	0.00	T.	T.	0.02
Mollendo [5]	10	0.04	0.07	T.	0.03	0.07	0.05	0.04	0.18	0.19	0.10	0.06	0.02	0.85
Moquegua [2]	2–4	1.57	0.59	0.11	0.00	0.00	0.05	0.10	0.00	0.00	0.00	0.00	0.00	2.42
Cajamarca [2]	2–4	5.26	8.56	8.42	3.63	1.61	0.67	0.42	0.21	2.41	4.77	3.41	5.67	45.04
Huaraz [2]	1–2	4.12	5.54	4.02	3.75	0.66	0.00	0.01	0.68	0.21	3.00	1.93	2.60	26.52
Huanuco [2]	2–4	1.76	1.58	2.80	0.76	0.56	0.23	0.25	0.16	0.35	1.45	1.33	1.64	12.87
Cerro de Pasco [2]	3–5	4.68	4.18	3.66	3.35	2.34	0.90	1.15	1.24	2.73	3.44	3.39	3.79	34.85
La Merced [6]	3	16.14	18.61	14.02	16.38	10.66	5.63	5.71	7.43	9.17	8.96	11.99	17.14	141.84
Jauja [2]	2–4	4.49	3.66	3.29	0.98	0.02	0.23	T.	0.58	0.53	1.22	1.46	3.11	19.57
Morococha [7]	4–7	6.53	6.77	5.97	3.16	1.66	0.50	0.49	2.03	2.07	2.82	3.21	4.06	39.30
Ayacucho [2]	2–4	8.08	6.01	4.08	3.10	0.76	0.27	0.09	0.59	0.42	1.50	1.01	3.61	20.46
Cuzco [8]	12	6.49	5.44	4.41	1.96	0.56	0.20	0.15	0.43	0.97	2.67	2.90	5.48	31.66
Cailloma [9]	17	5.31	5.98	5.33	1.62	0.37	0.20	0.06	0.22	0.58	1.10	1.09	4.23	26.09
Vincocaya [5]	1–2	3.00	3.78	2.60	0.01	0.01	0.00	0.00	0.00	0.08	0.00	0.27	0.53	10.08
Puno [2] [5]	3	7.75	7.54	4.94	3.42	0.96	0.01	0.43	0.85	1.76	5.09	2.27	2.90	37.92
Iquitos [10]	----	10.24	9.84	12.24	6.50	10.00	7.44	6.57	4.61	8.70	7.24	8.42	11.46	103.26
Remate de Males (Brazil) [11]	15	13.89	10.50	14.05	10.60	9.53	5.38	4.91	5.57	6.07	9.16	8.74	12.57	110.99

TABLE 26.—*Precipitation data for Peru*—Continued

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Maximum precipitation in 24 hours												
Lima	9	----	----	----	----	----	----	----	----	----	----	----	----	0.20
La Merced	3	5.43	5.83	3.86	3.98	4.17	3.07	2.56	2.13	3.15	3.86	2.72	4.25	5.83
Remate de Males (Brazil) [12]	10	3.42	5.12	6.02	3.86	3.50	2.74	1.93	4.49	2.05	6.18	4.61	7.91	7.91
		Mean number of days with precipitation [13]												
Lima [14]	9	2	1	2	4	9	18	22	25	21	13	7	4	128
Arequipa [15]	8	9	9	5	2	----	----	----	----	----	1	1	2	31
Mollendo [16]	10	0	1	0	----	1	1	1	1	3	2	1	1	12
La Merced	3	24	21	17	22	16	9	11	13	15	15	16	22	203
Cuzco	9	22	21	20	12	4	4	2	6	7	14	13	17	144
Remate de Males (Brazil) [12]	10	18	14	16	15	15	12	12	12	12	16	15	17	173

[1] See footnotes special table for this station.
[2] Boletín de la Dirección de la Fomento. Peru.
[3] Boletín de la Sociedad Geográfica de Lima. 1897–1900.
[4] Composite record. Observatorio "Unanue" and Observatorio Meteorológico.
[5] Peruvian Meteorology. See footnotes to temperature tables. Arequipa. Smithsonian Miscellaneous Collections. Vol. 79. 1927.
[6] Boletín de la Sociedad Geográfica de Lima. 1896–1898.
[7] Compiled from several sources. See The Andes of Southern Peru. (Bowman), p. 174.
[8] See footnote 14 under temperature table.
[9] See footnote 4 under temperature table.
[10] Météorologie du Bresil (Carlos de Carvalho), p. 216.
[11] Justificação das Normaes de Chuva da Rede Pluviometrica Brasiliera. (Torres.)
[12] Boletim de Normaes. Directoria de Meteorologia. Brazil.
[13] These values are not strictly comparable, the minimum amount of rain considered appreciable probably varying from "trace" to 0.04 inch.
[14] Mist (*garua*) very frequent from June to October, inclusive.
[15] Less than 0.5 from May to September, inclusive.
[16] Less than 0.5 in April.

TABLE 27.—*Piura, Peru* [1]

	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Temperature														
Mean maximum [2]	2	94.1	95.4	94.3	93.2	88.5	85.3	83.8	84.7	87.1	86.9	88.7	90.5	89.4
Mean 2 p. m.	2	91.0	92.3	90.7	90.7	87.3	83.1	81.7	83.3	85.6	85.1	86.4	88.5	87.1
Mean minimum	2	71.6	74.1	75.7	72.7	67.5	65.1	65.1	64.4	64.2	64.2	64.2	67.5	68.0
Mean, 2 p. m., minimum	2	81.3	83.2	83.2	81.7	77.4	74.1	73.4	73.8	74.9	74.6	75.3	78.0	77.5
Mean, 7 a. m., 2 p. m., 9 p. m.[3]	5	81.0	83.1	82.6	79.5	76.3	72.3	71.6	71.8	71.4	71.1	73.9	77.9	76.0
Highest [2] [3]	5	98	99	99	98	95	95	94	90	92	92	93	97	99
Lowest [3]	5	65	68	66	61	58	57	56	57	59	60	58	59	56
Relative humidity														
Mean, 7 a. m., 2 p. m, 9 p. m	2	68	65	68	62	66	72	80	78	80	70	68	68	70
Mean, 2 p. m	2	52	48	51	46	48	56	67	62	57	52	47	49	53
Cloudiness														
Mean, 3 observations	2	6.0	7.9	6.5	4.4	2.5	4.2	3.9	3.4	3.8	4.2	3.8	3.0	4.5

[1] August, 1904–June, 1906, Deutsche Ueberseeische Meteorologische Beobachtungen (Deutsche Seewarte), Heft XIV, p. 15, and Heft XV, p. 3. 1909–1912 (broken), Boletin de la Direccion de Fomento (Peru).
[2] In the Meteorologische Zeitschrift, 1917, p. 33. F. von Kerner omits from consideration maximum temperatures reported to him on the ground that they are "unnaturally high," due, as he supposes, to "poor exposure of the thermometer." The description of the station given in the first reference above indicates that the 2 p. m. readings are not subject to his criticism and that the mean from tridaily observations can be accepted. The considerable difference in temperature conditions at Chiclayo and Piura is probably explainable by the difference in distance from the coast.
[3] Composite record for two stations separated by a few miles.

BOLIVIA

The surface of Bolivia is divided into two distinct regions, namely, the mountains (*sierra*) of the west and the low plain (*montaña*) in the east. In the western division the climate is cool or cold, according to elevation, and we have two climatic regions, *tierra templada* and *tierra fria;* in the eastern division, rising from not over 300 feet at the Brazilian border to about 3,000 feet at the foot of the Andes, the climate is tropical to semitropical, and this part of the territory is called *tierra caliente.*

The stations in the elevated central and southwestern region and in the adjacent portions of Chile (Ollague) and Argentina (La Quiaca) lie between the levels of 8,500 and 12,000 feet above sea level. The extremes of mean annual temperature within these limits are 54° at Sucre and 48° at Ollague. The change in monthly mean temperature from midwinter to midsummer (July to December) is only about 8° in central Bolivia, but along the southwestern and southern borders it appears to be about 20° (36° to 56°). At Sucre the recorded temperature extremes are 82° and 25°; at La Quiaca, 87° and 3°.

In the lowlands of the north and east where the elevation is 500 feet or less the mean annual temperature is probably between 75° and 80°; the highest readings of the thermometer exceed 95° and probably even 100° in some regions (San Luiz de Cacares, Brazil, 105°), while the lowest are about 40°. The months of May, June, and July are considerably cooler than the remainder of the year.

The arid region of western South America extends over the southwestern part of the country. The mean annual rainfall is 2 inches at Oruro and Ollague, Chile, and 11 inches at La Quiaca, Argentina. From La Paz southeast to Paraguay the amount of precipitation received annually is from 20 to 30 inches, and in the area east of the mountains there is a further increase to 75 inches or more at the north and to 50 inches at the south.

In all parts of this territory the year is divided into rainy and dry seasons. During the cool months of the mid year no rain falls in the southwest, and even in the period of maximum precipitation, beginning in December and ending in March, the monthly maximum is only 0.50 inch. Over a middle belt extending from northwest to southeast (La Paz to Villa Montes) the dry season begins in April and ends in November. The following extremes will show the character of the seasonal change: La Paz, 0.10 inch in June and 4 inches in December and February; Sucre, 0.10 inch in June and 6 inches in January; and Villa Montes, zero from May to September and 7 inches in December and January. The well-watered eastern lowlands have a shorter dry season, beginning in May and ending in September. Here the contrast between the seasons is heightened; in July, the driest month, the average precipitation is 0.50 inch or less, an amount very small in comparison with 15 inches in March at Cobija or even with 7 to 8 inches in the wettest months at stations farther south.

TABLE 28.—*Temperature data for Bolivia (° F.)*

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean maximum temperature [1]												
San Luiz de Cacares, Brazil	8	90.7	89.2	90.5	90.1	86.5	85.3	89.4	90.9	93.4	93.6	92.5	90.5	90.2
Cobija	2	86.7	85.6	83.7	85.1	81.3	81.7	84.4	88.9	90.7	88.2	88.3	85.6	85.8
Sucre	5	62.8	61.5	63.7	63.3	62.4	61.2	61.2	64.6	66.9	65.1	67.8	66.0	63.9
La Paz [2]	4	63.5	62.2	62.1	61.5	60.4	57.7	59.0	60.6	62.6	63.7	65.8	64.4	62.0
Ollague, Chile [3]	3	66.2	64.8	66.2	64.2	60.1	54.1	54.9	57.0	59.4	63.5	63.5	65.8	61.6
La Quiaca, Argentina	11	70.7	71.2	70.7	69.1	63.7	61.3	60.1	64.0	68.9	72.1	73.2	73.6	68.2
		Mean minimum temperature [1]												
San Luiz de Cacares, Brazil	8	72.0	71.8	71.8	70.2	64.2	59.4	58.3	60.1	66.4	69.6	70.9	71.4	67.2
Cobija	2	69.8	70.7	69.8	69.6	63.7	63.0	61.9	63.1	67.1	68.7	69.1	69.3	67.1
Sucre	5	47.7	47.7	47.5	45.1	39.6	37.8	37.4	40.1	44.2	46.0	47.8	48.9	44.2
La Paz [2]	4	43.7	43.5	42.8	39.9	36.9	34.0	34.2	34.7	37.2	40.6	42.8	43.3	39.5
Ollagué, Chile [4]	3	46.2	43.5	40.6	31.6	25.3	20.5	14.9	23.2	31.3	41.2	45.3	49.1	34.4
La Quiaca, Argentina	11	39.9	40.6	38.3	31.3	21.4	15.1	15.6	20.5	26.2	31.1	36.5	39.4	29.7
		Mean temperature (maximum+minimum÷2) [1]												
Porto Velho, Brazil [5]	1	79.2	80.2	82.2	81.1	80.6	77.0	81.1	81.7	84.0	81.5	81.9	79.3	80.8
San Luiz de Cacares, Brazil	8	81.4	80.5	81.2	80.6	75.4	72.4	73.8	75.5	79.9	81.6	81.7	81.0	78.8
Cobija	2	78.2	78.2	76.8	77.4	72.5	72.4	73.2	76.0	78.9	78.4	78.7	77.4	76.4
Sucre	5	55.4	54.6	55.6	54.2	51.0	49.5	49.3	52.4	55.6	55.6	57.3	57.4	54.0
La Paz [6]	6	53.2	52.3	54.7	50.4	47.8	45.3	45.3	47.3	48.9	52.5	54.0	53.2	50.4
Ollague, Chile [7]	3	56.2	54.2	53.4	47.9	42.7	37.3	34.9	40.1	45.4	52.4	54.4	57.4	48.0
La Quiaca, Argentina	11	55.3	55.9	54.5	50.2	42.6	38.2	37.8	42.2	47.6	51.6	54.8	56.5	48.9
		Mean temperature 7 a. m., 2 p. m., 9 p. m., 9 p. m. [1]												
Porto Velho, Brazil [5]	4	80.8	81.3	81.5	81.7	80.6	80.6	81.7	83.3	85.1	83.5	82.8	81.7	82.0
San Luiz de Cacares, Brazil [8]	8	78.6	77.9	78.1	77.2	72.3	69.1	67.6	71.8	76.8	78.8	79.0	80.1	75.6
Cobija	2	76.1	75.9	74.8	74.9	70.8	70.7	71.0	73.1	76.4	76.0	76.3	75.6	74.3
Sucre	6	55.0	54.6	56.5	55.0	51.3	50.0	49.3	52.7	55.9	55.8	57.6	57.0	54.2
La Paz [9]	3	51.6	51.3	50.7	49.1	46.9	44.1	44.6	45.9	48.4	50.4	52.7	52.2	49.0
Ollague, Chile	3	50.4	48.6	47.5	43.5	38.8	37.0	37.2	39.9	42.6	47.7	48.0	50.4	44.3
La Quiaca, Argentina [10]	----	54.5	54.3	53.4	51.3	42.8	37.2	37.4	42.1	48.0	51.4	54.0	54.7	48.4
		Highest temperature [1]												
Porto Velho, Brazil [5]	4	93	94	95	95	93	95	93	96	98	96	94	92	98
San Luiz de Cacares, Brazil	8	99	98	96	98	95	94	96	101	105	105	103	101	105
Cobija	2	93	90	90	91	90	88	91	95	97	97	94	92	97
Sucre	6	80	75	82	78	72	72	74	78	77	77	79	78	82
La Paz [11]	4	75	75	69	69	69	67	67	66	70	73	74	75	75
La Quiaca, Argentina	11	83	87	84	78	75	75	76	78	82	85	83	86	87
		Lowest temperature [1]												
Porto Velho, Brazil [5]	4	72	72	72	72	57	63	61	56	67	72	70	70	56
San Luiz de Cacares, Brazil	8	61	63	60	58	39	39	41	42	47	51	57	58	39
Cobija	2	67	66	61	64	49	50	53	52	58	60	61	59	49
Sucre	6	40	41	38	37	29	27	25	30	29	33	40	41	25
La Laz [11]	4	37	37	38	33	29	27	27	27	29	32	36	36	27
La Quiaca, Argentina	11	26	30	23	14	8	3	4	6	9	9	23	27	3

[1] Reference to sources of data given under table for precipitation.
[2] Peterman's Geographische Mitteilungen, 49 Band (1903), p. 280.
[3] Mean at 2 p. m.
[4] Mean at 7 a. m.
[5] Contribuição ao estudo do clima do Brasil (p. 13). Henrique Morize. Rio de Janeiro, 1922, and the reference under footnote 1 under precipitation table. De Carvalho points out that the means given by Morize are evidently too high, being derived from observations at 6:30 a. m., 11 a. m., 3 p. m., and 6:30 p. m., and thinks that the means from observations at 6:30 a. m. and 3 p. m. in the year 1911 should be taken as the better approximation to the true mean.
[6] Estudio sobre la climatología de La Paz. Victor E. Marchant. La Paz, 1906.
[7] Mean of observations at 7 a. m. and 2 p. m.
[8] By the formula (maximum+minimum+7 a. m.+9 p. m.)÷4.
[9] Hann's Handbuch der Klimatologie, II Band (third edition), p. 382. The formula is not given, but the means are in all probability reductions to true 24-hour values.
[10] Means for 24 hours. Reduction from Boletín Mensual, Oficina Meteorológica Nacional, República Argentina for the year 1923.
[11] Boletín del Observatorio Meteorológico (Colegio de San Calixto), Sociedad Geográfica de La Paz. 1897–1903.

TABLE 29.—*Relative humidity, cloudiness, and wind data for Bolivia*

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual.
		Mean relative humidity 7 a. m., 2 p. m., 9 p. m.[1]												
San Luiz de Cacares Brazil [2]	2	82	86	86	86	86	82	76	70	68	72	82	86	80
Cobija	2	88	90	91	90	89	86	82	78	78	84	86	88	86
Sucre	6	70	69	69	68	53	48	50	52	56	60	59	64	60
La Quiaca, Argentina [3] [4]	8	64	61	62	52	41	40	36	33	36	47	53	59	49
		Mean relative humidity 2 p. m.												
San Luiz de Cacares [2]	2	63	70	68	64	66	58	44	43	45	51	66	70	59
Cobija	2	72	77	80	77	72	67	58	52	52	64	67	72	68
Sucre	5	53	52	52	48	34	33	36	33	39	42	43	48	43
		Mean cloudiness												
San Luiz de Cacares [2]	2	7.9	7.8	7.8	6.4	6.0	4.8	4.2	5.0	6.6	7.0	7.8	8.3	7.5
Cobija	2	7.4	7.8	8.0	7.6	6.0	5.7	4.3	5.2	6.1	6.8	6.8	7.4	6.6
Sucre	3	8.1	8.7	7.8	5.8	3.0	4.1	4.0	3.5	5.0	7.2	7.2	8.3	6.1
La Paz	6	6.0	7.3	5.8	4.8	2.6	2.0	2.3	3.4	4.3	5.5	6.3	7.1	4.8
Ollague, Chile	3	3.8	4.4	2.5	1.8	0.9	2.2	2.3	2.0	2.1	2.4	2.3	2.8	2.5
La Quiaca [5]	----	5.8	5.4	4.5	2.9	2.2	1.8	2.3	2.8	2.9	3.7	4.3	5.4	3.8
		Mean duration of sunshine (hours per day)												
La Paz [6]	4	4.5	4.3	5.4	7.0	9.0	10.8	9.1	8.3	8.3	7.5	6.2	5.7	7.1
		Prevailing wind direction												
San Luiz de Cacares	8	ne.	ne.	ne.	ne.	ne.	n.	s.	s.	ne.	ne.	ne.	n.	ne.
Sucre	6	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.	ne.
La Paz [6]	6	se.	se.	sse.	sse.	wnw.	wnw.	wnw.	nw.	ne,s.	se.	n,se.	se.	se.
Ollague	2	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.
La Quiaca [3]	8	n.	n.	n.	n.	s.	w.	w.	s.	n.	n.	n.	n.	n.
		Mean wind velocity (miles per hour)												
Sucre	4	5.1	5.4	5.8	5.3	5.2	4.7	4.9	5.5	6.7	6.9	6.5	6.0	5.7
		Mean number of days with thunderstorm												
San Luiz de Cacares	8	1	2	1	0	1	1	1	1	1	3	3	1	16
Cobija	2	4	5	6	10	1	1	1	2	4	9	8	4	55
Sucre	6	10	8	8	6	3	1	2	2	8	12	15	12	87
Ollague [7]	3	3	2	1	----	0	0	0	0	----	0	0	2	9
		Mean number of days with fog												
San Luiz de Cacares	8	2	1	2	7	2	2	1	1	0	1	1	1	18
Sucre [8]	6	18	18	16	16	6	4	4	2	5	12	12	14	127
La Paz [9]	----	----	----	----	----	----	----	----	----	----	----	----	----	143

[1] References to sources of data given under table for precipitation.
[2] Boletim Meteorologico, Directoria de Meteorologia. Brazil. 1918–19.
[3] Boletin Mensual. Oficina Meteorológica Nacional, República Argentina. 1916–1923.
[4] 24-hour mean by reduction.
[5] Climate of the Argentine Republic. W. G. Davis. Buenos Aires. 1910.
[6] See footnote 2 under temperature table.
[7] Less than 0.5 in April and September.
[8] Chiefly low fog. The annual averages for the period 1915–1918 are: Fog, 28; low fog, 83; wet fog, 31.
[9] Hann's Handbuch der Klimatologie, II Band (third edition), p. 373.

TABLE 30.—*Precipitation data for Bolivia*

Stations	Length of record in years	January	February	March	April	May	June	July	August	September	October	November	December	Annual
		Mean precipitation (in inches)												
Porto Velho, Brazil [1]	4	12.36	8.74	13.98	8.50	3.74	0.71	0.24	1.22	2.80	8.07	11.18	14.65	86.19
Cobija [2]	2	7.88	8.64	14.96	7.28	2.32	1.06	0.51	1.46	2.78	9.36	6.22	11.54	74.01
San Luiz de Cacares, Brazil [3]	8	7.90	8.20	5.71	3.79	2.00	0.71	0.22	0.81	1.91	4.32	7.18	7.49	50.05
Corumba, Brazil [3]	8	6.54	6.24	4.84	4.87	3.33	1.88	0.28	1.34	2.28	4.00	5.95	7.47	49.02
San Salvador, Paraguay [4]	10	7.06	8.87	5.87	5.77	4.82	2.78	1.37	1.09	2.60	5.86	5.89	5.72	57.70
Villa Montes [5]	13	7.09	4.13	4.92	1.97	0.00	0.00	0.00	0.00	0.00	2.16	2.36	6.80	29.52
La Paz [6]	5	3.86	4.53	2.60	1.46	0.47	0.08	0.16	1.10	0.79	1.30	1.54	4.29	21.18
Cochabamba [6]	4	4.21	3.50	2.48	0.43	0.43	0.28	0.20	0.16	0.67	0.59	1.26	3.98	18.19
Oruro [6]	4	0.51	0.43	0.55	0.12	0.08	0.00	0.00	0.00	0.04	0.04	0.12	0.24	2.13
Sucre [7]	32	6.34	4.68	3.74	1.77	0.28	0.08	0.16	0.16	0.79	1.42	2.40	4.37	26.19
Ollague, Chile [8]	5	0.80	0.98	0.06	0.00	0.00	0.00	0.00	0.02	0.04	T.	0.24	0.20	2.34
La Quiaca, Argentina [9]	----	3.27	2.36	2.01	0.28	0.00	0.00	0.04	0.00	0.00	0.20	1.06	2.13	11.35
		Maximum precipitation in 24 hours												
San Luiz de Cacares [3]	8	4.29	3.63	3.15	2.33	2.36	2.44	0.38	1.06	2.74	3.71	3.55	2.25	4.29
Corumba [3]	8	2.50	2.72	2.76	3.15	2.05	2.54	0.43	1.42	2.36	2.77	4.09	3.15	4.09
La Paz [6]	5	1.02	2.01	1.14	0.67	0.63	0.14	0.35	0.13	1.10	0.79	1.57	1.38	2.01
Sucre [10]	6	1.96	1.93	1.91	2.20	0.16	0.32	0.55	0.20	0.65	0.79	1.38	1.77	2.20
Ollague [8]	3	0.47	1.57	0.20	0.00	0.00	0.00	0.00	0.12	0.20	T.	0.50	0.35	1.57
		Mean number of days with precipitation												
Cobija [2]	2	18	19	22	20	8	4	4	4	6	17	15	22	159
San Luiz de Cacares [3]	8	17	16	16	9	6	3	2	3	7	10	14	17	120
Corumba [3]	8	11	9	9	7	5	4	2	3	5	7	8	10	80
La Paz [6]	6	18	20	16	12	3	1	3	3	8	10	14	18	126
Cochabamba [11]	2	17	14	16	2	4	2	1	2	6	4	7	14	89
Oruro [6]	4	13	11	14	3	2	0	0	0	1	1	3	6	54
Sucre [12]	9	19	16	11	6	1	1	2	2	5	10	10	14	97
Ollague [13]	3	4	4	1	0	0	0	0	----	----	0	1	1	12
La Quiaca [14]	11	12	9	7	2	0	0	0	0	1	1	5	9	46

[1] Météorologie du Brésil (p. 222). Carlos de Carvalho.
[2] Meteorologische Zeitschrift, 1911, p. 416, and 1912, p. 430. Deutsche Ueberseeische Meteorologische Beobachtungen (Deutsche Seewarte), Heft XIX, p. 3, and Heft XX, p. 3.
[3] Boletim de Normaes, Directoria de Meteorologia. Brazil.
[4] Data forwarded from Oficina Meteorológica Argentina, Buenos Aires.
[5] Petermann's Mitteilungen, Ergänzungheft Nr. 195. Die Niederschlagsverhältnisse von Südamerika. Bruno Franze.
[6] Die Niederschlagsverhältnisse von Südamerika. (Ergänzungheft 157, Petermann's Geographische Mitteilungen). E. L. Voss.
[7] Réseau Mondial, 1918.
[8] Anuario Meteorológico de Chile (Santiago de Chile), 1913, 1915, 1916.
[9] Boletín Mensual (1923), Oficina Meteorológica Nacional, Argentina. Buenos Aires.
[10] Boletín Mensual, Observatorio Meteorológico, Sucre. 1915–1920 and 1923.
[11] Meteorologische Zeitschrift, 1888, p. 197, and reference.
[12] Revista del Instituto Médico, Sucre. 1912–1914 and reference under footnote 9 above.
[13] Less than 0.5 in August and September.
[14] Historia y Organizacion, Servicio Meteorológico Argentino. Walter G. Davis. Buenos Aires. 1914.

MONTHLY AND ANNUAL RECORDS OF PRECIPITATION FOR SELECTED STATIONS

Table 31 gives monthly and annual records of precipitation for a few stations with rather long series of observations. These data are presented to set forth the variability in rainfall from month to month and from year to year. Mean and extreme values for each month and for the year are added to the record.

The precipitation records for Andagoya, Colombia, are given in the Monthly Weather Review, 1926, p. 377, and those for Arequipa, Peru, in the World Weather Records, Smithsonian Miscellaneous Collections, vol. 79, p. 1411.

TABLE 31.—*Precipitation—Monthly and annual totals, means, and extremes (in inches)*

CAYENNE, FRENCH GUIANA

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec	Annual
1890	33.72	16.60	21.35	23.21	20.77	8.28	7.35	1.10	1.30	0.18	1.36	13.49	148.71
1891	22.54	16.52	12.27	13.06	-----	12.25	4.97	-----	0.08	0.00	0.71	3.21	------
1892	14.09	14.21	37.64	20.94	10.79	10.59	8.19	2.20	0.55	0.32	2.36	12.91	134.79
1893	-----	-----	-----	-----	-----	-----	8.46	2.07	0.59	0.00	2.23	13.22	------
1894	21.49	13.13	5.98	6.66	17.11	16.28	11.01	3.15	0.31	1.43	11.13	10.32	118.00
1895	6.13	3.18	8.89	4.23	21.06	14.59	6.63	0.61	0.43	0.60	2.63	9.53	78.51
1896	15.89	21.40	20.67	18.88	10.97	13.62	4.48	3.18	1.93	3.98	3.00	4.91	122.91
1897	4.85	6.02	5.62	20.57	46.04	11.56	4.92	3.83	2.06	2.49	6.99	15.49	130.44
1898	22.01	13.67	19.03	36.37	34.94	17.40	3.44	1.56	0.09	1.20	2.91	9.90	162.52
1899	12.51	3.60	9.11	2.92	9.30	14.34	7.27	0.15	0.62	0.78	1.18	2.48	64.26
1900	11.33	8.20	15.74	16.78	17.90	5.58	8.33	1.75	0.26	1.35	2.13	4.68	94.03
1901	3.24	4.55	36.83	10.68	19.72	3.37	3.73	4.06	1.59	0.20	-----	10.70	------
1902	17.39	15.96	22.59	17.68	18.76	14.85	8.39	2.26	1.77	2.13	3.35	3.35	128.48
1903	5.81	5.68	6.11	23.30	27.74	11.68	7.80	0.61	0.54	0.06	0.18	5.28	94.79
1904	21.30	7.09	49.27	23.44	45.46	29.94	17.73	0.51	1.07	4.29	3.31	14.36	217.77
1905	13.78	11.74	16.48	46.57	28.52	20.32	9.19	2.32	0.45	1.12	4.78	23.14	178.41
1906	21.69	6.95	18.33	88.10	31.11	26.21	5.04	9.50	2.15	0.12	4.21	10.65	224.06
1907	34.93	47.77	36.75	56.26	30.71	23.23	8.39	5.79	2.60	0.47	6.89	16.54	270.33
1908	10.31	14.41	15.04	22.60	37.84	12.32	5.30	5.53	0.55	3.03	2.80	10.71	140.44
1909	9.06	13.07	11.61	20.04	25.51	9.13	5.91	2.64	0.00	0.20	1.38	8.23	106.78
1910	16.97	11.46	15.39	18.27	26.54	23.82	8.78	2.87	0.32	0.47	11.22	8.07	144.18
1911	18.27	11.61	20.00	20.98	17.20	12.13	8.42	1.18	0.08	2.40	6.61	5.43	124.31
1912	-----	-----	-----	7.48	23.42	15.31	8.19	2.40	0.32	0.32	3.27	10.63	------
1913	15.83	1.14	8.94	14.76	21.18	20.59	13.15	1.56	0.67	2.74	2.20	7.18	109.94
1914	6.04	11.12	12.54	10.39	23.98	10.00	7.56	1.28	2.20	0.77	6.93	16.02	108.83
1915	14.45	16.95	4.19	16.04	14.59	7.62	6.23	1.32	0.93	0.38	4.20	14.15	101.05
1916	13.30	5.54	14.96	4.32	26.67	20.87	4.91	7.90	0.56	2.70	3.41	10.89	116.03
1917	14.52	28.04	9.35	24.18	24.03	6.69	4.65	2.64	-----	0.00	3.96	20.66	------
1918	14.65	24.54	29.24	-----	-----	15.48	5.26	1.06	1.02	1.38	10.41	9.64	------
1919	17.42	28.54	33.03	16.82	19.30	18.40	9.05	0.48	0.80	0.00	1.15	-----	------
1920	15.89	10.91	8.81	6.83	-----	25.68	5.83	0.44	1.11	0.28	0.63	2.58	------
Mean [1]	14.37	12.28	15.83	18.86	21.89	15.51	6.93	2.76	1.22	1.34	4.61	10.71	126.31
Greatest	34.93	47.77	49.27	88.10	46.04	29.94	17.73	9.50	2.60	4.29	11.22	23.14	270.33
Least	3.24	1.14	4.19	2.92	9.30	3.37	3.44	0.15	0.00	0.00	0.18	2.48	64.24

[1] For a period of 51 years. See climatological table for this station.

PARAMARIBO, DUTCH GUIANA [2]

1896	4.47	3.20	8.22	6.24	13.64	13.03	5.32	5.24	3.18	2.28	8.09	6.54	79.45
1897	1.86	3.55	1.89	8.95	14.86	13.30	8.20	5.37	4.80	2.93	15.72	7.82	89.25
1898	6.13	7.31	12.98	14.27	9.20	13.77	5.59	3.07	0.55	0.20	1.86	4.80	79.73
1899	6.76	1.55	7.02	1.43	4.74	12.20	5.83	2.33	0.85	1.83	2.52	1.95	49.01
1900	9.33	12.90	11.72	9.69	14.57	8.28	3.43	5.26	3.25	5.98	5.45	4.50	94.36
1901	3.03	4.20	10.12	10.69	11.49	10.09	7.19	8.08	3.98	4.63	7.57	8.93	90.00
1902	7.36	21.72	9.01	20.38	9.56	16.57	12.06	6.25	2.28	2.28	7.39	6.89	121.75
1903	2.44	5.49	17.93	16.64	13.05	15.94	7.07	7.53	2.36	1.63	1.18	6.81	98.07
1904	6.28	6.73	18.86	11.91	13.48	11.04	12.83	1.44	2.27	4.15	6.50	10.94	106.43
1905	4.74	5.71	2.94	14.42	13.19	17.87	12.33	2.59	1.52	2.69	4.80	12.54	95.34
1906	6.27	1.03	6.83	14.12	12.10	7.18	6.75	5.12	2.80	4.02	5.71	4.67	76.60
1907	7.03	9.37	12.65	23.00	17.87	11.89	9.93	3.53	4.09	2.94	2.33	10.26	114.89
1908	5.72	12.65	5.24	5.71	13.67	10.32	11.46	8.64	2.47	0.97	4.92	6.81	88.58
1909	3.35	6.17	7.90	6.59	11.91	8.55	7.72	9.87	0.32	3.46	4.57	3.65	74.06
1910	14.91	4.70	2.76	5.20	7.48	15.39	2.93	7.05	2.85	3.32	7.59	4.34	78.52
1911	8.94	13.32	13.34	8.49	11.19	15.73	7.37	3.94	2.06	2.82	7.18	1.82	96.20
1912	0.85	0.24	2.67	4.98	15.80	12.81	8.68	10.63	0.80	3.82	6.67	5.34	73.29
1913	12.33	1.43	5.53	1.20	3.87	17.17	11.80	6.12	3.17	2.70	4.70	16.32	86.34
1914	0.32	5.07	5.08	11.43	19.92	10.33	9.04	3.42	3.34	2.63	3.49	5.25	79.32
1915	5.84	14.03	4.84	12.78	14.43	11.34	7.77	4.17	1.08	1.23	5.35	11.44	94.30
1916	14.89	5.11	9.61	2.59	11.29	7.78	11.61	7.88	2.80	4.67	4.35	12.89	95.47
1917	11.62	4.26	12.23	4.82	6.85	5.50	12.20	10.04	4.21	2.10	5.84	4.80	84.47
1918	4.59	7.02	11.03	17.80	9.79	12.83	13.95	6.70	1.83	5.70	1.44	9.05	101.73
1919	4.82	1.07	13.07	7.75	23.88	11.35	11.61	4.28	6.62	3.67	2.50	9.89	100.51
1920	10.04	4.04	1.73	3.21	8.69	13.92	11.20	4.17	5.50	6.33	5.53	5.67	80.03
1921	6.25	1.61	4.63	9.46	3.02	11.05	12.71	7.61	4.38	4.10	5.17	12.79	82.78
1922	7.98	4.17	4.62	9.39	11.87	15.47	5.46	8.98	4.80	3.01	7.74	12.08	95.57
1924	5.00	1.85	1.59	2.56	7.65	12.55	14.99	11.58	4.10	4.68	3.68	10.66	80.89
1925	3.68	6.46	6.63	1.04	7.40	11.21	8.55	10.68	4.54	0.80	0.95	5.59	67.53
Mean [3]	8.62	7.01	8.50	9.13	12.24	11.57	8.74	5.83	2.68	2.72	4.84	8.54	90.42
Greatest	14.81	14.03	18.86	23.00	23.88	17.87	14.99	11.58	6.62	6.33	15.72	16.32	121.75
Least	0.32	0.24	1.59	1.04	3.02	5.50	2.93	1.44	0.32	0.20	0.95	1.82	49.01

[2] August–December, 1898, is the record at Burnside-Coronie, on the coast about 100 miles to the west.

[3] Means for 63 years ,1847–1854 and 1864–1918.

TABLE 31.—*Precipitation—Monthly and annual totals, means, and extremes (in inches)*—Continued

GEORGETOWN, BRITISH GUIANA [4]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1889	8.45	3.07	1.83	12.10	11.09	23.23	19.38	11.21	4.54	1.88	10.38	16.36	123.52
1890	25.11	14.56	2.38	20.11	17.91	13.17	10.90	5.71	3.18	0.16	2.97	9.47	125.63
1891	19.14	10.09	8.42	3.06	12.17	5.14	9.07	5.57	0.53	3.63	0.46	32.38	109.66
1892	9.15	20.72	9.43	12.93	7.78	24.38	11.40	8.05	5.73	1.20	5.06	12.14	128.03
1893	11.73	12.91	17.18	4.39	14.72	13.68	15.50	7.74	4.80	1.13	8.49	22.97	135.24
1894	7.68	9.41	4.88	6.53	7.08	12.11	10.21	4.04	0.91	2.63	10.85	9.02	85.35
1895	16.45	1.60	5.80	2.83	11.58	9.32	9.65	4.89	0.45	2.98	9.73	7.28	82.56
1896	2.40	2.19	4.57	4.47	14.27	18.93	10.13	6.47	1.59	4.03	1.80	10.18	81.03
1897	1.75	2.40	2.51	3.96	12.61	14.60	13.69	6.35	4.21	8.29	16.16	7.99	94.52
1898	9.25	3.77	22.73	13.63	10.61	13.61	11.69	7.19	4.88	3.28	3.25	17.97	121.86
1899	12.60	3.21	4.05	1.24	2.13	7.30	15.48	1.96	2.36	0.75	0.27	1.35	52.70
1900	13.91	10.69	6.51	8.41	9.84	10.35	9.73	5.01	1.12	2.00	4.45	6.92	88.94
1901	0.92	1.15	5.14	3.13	11.25	12.15	7.24	10.23	7.18	3.48	6.74	14.27	82.88
1902	12.53	6.62	17.67	6.95	6.76	10.44	9.58	6.00	3.71	2.29	6.65	5.16	94.36
1903	5.24	2.76	8.06	10.17	16.94	22.05	7.83	5.48	7.56	0.02	4.18	14.14	104.43
1904	10.56	2.63	12.17	12.98	8.22	7.47	8.95	1.84	2.72	1.08	1.92	15.21	85.75
1905	3.81	5.34	4.83	4.07	11.12	10.58	7.84	4.25	4.31	2.14	3.92	15.49	77.70
1906	2.39	4.19	3.71	13.81	13.89	10.20	14.07	10.96	2.31	1.93	7.03	11.02	95.51
1907	15.14	9.77	17.24	10.13	19.12	11.61	6.75	5.21	1.91	0.42	6.57	5.37	109.24
1908	3.71	3.68	7.74	4.15	14.21	6.87	13.45	10.40	6.89	3.09	6.51	9.04	89.74
1909	7.90	11.96	11.28	4.52	11.70	12.18	14.62	6.96	1.95	5.65	2.90	16.33	107.95
1910	8.09	7.95	10.00	7.86	10.81	14.74	11.17	14.76	6.60	2.72	3.76	3.00	101.46
1911	10.17	9.13	14.04	8.43	11.13	12.08	9.63	4.00	0.55	4.02	2.30	2.41	87.89
1912	1.23	0.46	1.28	6.26	9.08	8.21	11.24	8.17	1.57	1.89	4.03	16.45	69.87
1913	18.18	2.41	7.64	2.09	5.00	9.67	13.71	5.80	4.29	3.96	2.64	15.03	90.42
1914	1.79	2.46	2.34	4.22	18.37	9.25	5.37	4.40	5.18	4.80	4.81	6.50	69.49
1915	6.41	13.38	0.95	5.73	17.65	9.16	8.47	5.06	0.66	1.20	4.52	5.83	79.02
1916	5.91	5.12	2.96	2.76	11.86	10.28	7.94	9.35	1.29	2.84	16.76	11.45	88.52
1917	10.53	2.86	2.84	1.87	7.97	12.48	9.56	6.47	4.52	5.46	11.73	12.81	89.10
1918	8.47	3.41	13.88	7.45	15.59	8.70	10.12	4.54	0.10	0.19	7.06	9.18	88.69
1919	4.60	0.45	9.11	10.76	23.38	7.11	7.71	5.57	1.53	0.78	4.60	8.56	84.16
1920	16.40	6.38	1.93	1.12	4.78	11.54	6.84	5.53	2.85	1.22	3.80	12.27	74.66
1921	4.81	0.48	3.45	8.56	1.20	21.15	12.73	3.52	3.42	8.87	20.74	15.31	104.24
1922	6.37	3.60	1.88	0.60	11.20	14.58	7.45	12.32	4.02	3.31	14.62	22.09	102.04
1923	6.19	4.29	1.92	1.60	4.91	11.54	3.76	7.76	3.57	3.26	5.15	26.57	80.52
1924	4.16	2.85	0.28	1.69	12.87	15.85	8.36	12.66	6.42	5.19	4.63	11.22	86.18
1925	3.70	2.21	14.82	4.29	5.96	7.84	8.67	6.54	3.04	0.87	0.53	4.78	63.25
Mean [4]	8.50	5.95	6.77	6.35	11.25	11.87	10.00	6.47	3.05	2.54	5.88	11.75	90.38
Greatest	25.11	20.72	22.73	20.11	23.38	24.38	19.38	14.76	7.56	8.87	20.74	32.38	135.24
Least	0.92	0.45	0.28	0.60	1.20	5.14	3.76	1.84	0.10	0.02	0.27	1.35	52.70

[4] For the 46-year period, 1880–1925.

POTARO ROAD, BRITISH GUIANA

1905	14.52	9.21	15.98	21.09	24.38	23.07	20.41	6.72	3.14	3.08	12.09	20.40	174.09
1906	7.87	6.27	9.72	23.61	24.68	17.56	24.15	6.32	4.54	3.88	7.39	8.01	144.00
1908	12.46	13.44	15.38	23.98	26.89	20.64	14.60	9.97	6.09	2.03	6.93	6.08	158.49
1909	6.71	18.18	17.55	12.06	15.76	13.31	10.59	11.78	6.44	11.90	2.21	12.49	138.98
1910	21.03	15.59	11.99	11.07	12.16	17.66	14.07	12.59	3.34	2.50	12.33	5.64	139.97
1911	14.17	16.01	16.19	13.35	22.93	17.89	12.32	10.04	1.89	6.91	4.25	8.45	144.40
1912	4.60	0.38	0.99	4.02	20.58	29.56	20.49	15.55	12.04	5.16	3.28	16.82	133.47
1913	18.20	7.22	16.63	14.81	11.42	21.45	25.72	6.05	5.22	5.64	5.65	13.03	151.04
1914	9.04	12.77	6.32	17.12	26.85	18.15	10.50	10.53	5.10	4.82	7.40	16.07	144.67
1915	15.71	14.99	5.00	12.10	18.77	14.75	13.60	6.57	6.07	0.00	6.01	12.84	126.41
1916	15.93	9.70	11.89	3.22	16.89	21.94	12.12	13.10	3.35	3.31	12.69	18.10	142.24
1917	14.28	5.81	20.21	10.41	13.65	12.78	10.81	12.28	13.75	4.23	8.02	18.34	144.57
1918	22.28	29.44	33.07	19.56	29.54	16.64	20.53	5.86	4.61	2.90	9.58	11.83	205.84
1919	10.17	3.63	14.99	21.58	21.63	15.97	20.70	8.71	5.10	0.00	9.10	15.48	147.06
1920	17.10	6.83	7.13	12.20	14.48	21.81	26.22	10.00	7.43	4.05	6.83	13.59	147.67
1921	9.36	2.56	15.02	23.59	4.22	29.29	19.09	7.26	8.50	9.73	12.20	17.22	158.04
1922	12.85	10.04	7.21	8.90	20.30	26.95	12.56	11.38	6.76	3.81	15.82	20.11	156.69
1923	19.49	9.68	7.60	7.32	19.60	26.48	19.39	9.66	1.00	2.91	6.17	11.45	140.75
1924	9.80	7.38	2.77	4.06	12.84	16.05	11.69	18.96	14.25	7.22	4.77	20.53	130.32
1925	13.10	8.95	12.51	7.33	11.68	19.14	15.12	11.10	0.81	4.62	2.08	15.61	122.05
Mean	13.43	10.40	12.41	13.57	18.46	20.05	16.73	10.22	5.99	4.44	7.74	14.10	147.54
Greatest	22.28	29.44	33.07	23.98	29.54	29.56	26.22	18.96	14.25	11.90	15.82	20.53	205.84
Least	4.60	0.38	0.99	3.22	4.22	12.78	10.50	5.86	0.81	0.00	2.08	5.64	122.05

CARACAS, VENEZUELA

1891	0.74	0.16	0.63	1.91	2.13	1.78	6.50	2.73	3.80	4.41	3.24	1.68	29.71
1892	1.31	1.30	1.45	3.78	7.30	6.30	7.65	4.84	3.77	5.43	3.49	0.75	47.37
1893	0.16	0.34	0.03	1.15	5.38	2.80	8.39	1.69	5.75	5.98	3.13	3.63	38.43
1894	0.93	0.61	0.20	0.00	1.67	1.20	2.40	5.03	3.91	2.55	3.11	2.09	23.70
1895	2.40	0.14	0.54	0.70	1.77	5.39	2.20	2.57	3.70	4.62	5.28	1.58	30.89
1896	0.52	0.01	0.19	4.54	4.33	4.66	1.44	2.75	1.31	2.54	5.04	2.13	29.46
1897	1.60	0.15	0.00	0.21	3.11	3.90	4.96	3.64	1.52	5.48	3.16	3.08	30.81
1898	0.63	0.00	2.69	0.70	0.94	3.10	4.22	5.94	4.07	3.13	4.14	0.48	30.04
1899	0.61	0.17	0.08	0.00	0.00	4.57	2.50	3.48	3.99	4.48	2.32	1.88	24.08
1900	0.87	0.18	1.95	0.78	0.57	3.48	7.29	5.53	3.47	5.56	4.31	0.00	33.99
1901	0.65	0.02	0.04	0.04	1.52	3.03	7.36	4.65	2.97	5.57	5.08	1.50	32.43
1902	2.43	0.00	0.00	0.60	3.32	4.92	3.73	2.97	7.01	2.07	1.06	2.69	30.80
1903	0.17	0.00	0.00	1.12	2.01	4.28	5.15	6.10	2.60	4.80	3.24	3.31	32.78
1904	0.63	0.13	3.98	6.44	1.57	3.76	2.87	4.87	3.26	2.95	1.44	0.48	32.38
1905	0.38	0.10	0.39	4.13	6.38	2.43	4.59	4.64	4.28	2.33	6.28	1.96	37.89
1906	0.06	0.24	0.00	0.16	3.74	7.08	4.97	4.07	4.36	5.27	2.20	3.70	35.85
1907	3.91	0.29	2.72	0.34	4.23	3.39	7.15	3.20	1.87	4.14	3.17	0.38	34.79
1908	0.00	0.04	0.02	1.96	2.44	3.58	2.64	4.48	7.48	4.48	2.30	1.62	31.04
1909	1.68	0.18	0.07	4.90	1.92	3.31	3.82	6.20	1.36	5.02	3.82	5.60	37.88
1910	1.54	2.33	0.98	1.42	5.97	5.26	1.18	3.75	2.27	1.99	3.41	1.15	31.25
1911	0.06	1.00	0.25	1.57	3.66	6.02	6.06	6.88	1.75	2.41	3.37	1.54	34.57
1912	0.07	0.00	0.00	0.13	1.06	4.42	5.50	4.32	3.41	1.77	3.19	1.23	25.10
1913	1.77	0.03	0.54	0.00	2.11	3.08	2.49	3.56	4.47	2.89	3.46	1.75	26.15
1914	0.00	0.00	0.04	0.23	3.18	5.16	1.36	2.36	1.70	2.86	1.86	0.97	19.72
1915	0.77	1.89	0.00	4.86	2.07	5.09	3.03	4.65	4.35	4.73	0.93	0.22	32.59
1916	0.46	1.33	0.55	0.13	1.74	3.17	4.99	6.65	7.39	2.30	5.74	1.65	36.10

TABLE 31.—*Precipitation—Monthly and annual totals, means, and extremes (in inches)*—Continued

CARACUS, VENEZUELA—Continued

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1917	0.61	0.58	0.25	2.06	1.35	7.58	6.11	3.06	3.55	2.39	1.15	4.01	32.70
1918	0.54	0.56	0.50	1.17	3.98	4.90	5.50	4.93	1.31	4.20	1.85	0.42	29.86
1919	0.00	0.01	0.91	4.45	1.26	4.83	2.52	4.04	4.26	3.78	4.85	0.18	31.09
1920	0.09	0.05	0.24	0.00	3.64	5.57	3.88	3.13	8.25	1.73	3.09	0.64	30.31
1921	0.99	0.01	1.32	0.67	2.33	9.06	3.74	5.82	5.97	5.58	5.78	3.57	44.84
1922	1.32	0.16	0.28	0.03	5.11	2.76	1.62	3.10	4.32	5.36	4.44	1.87	30.37
1923	1.23	0.00	0.24	0.37	2.64	1.77	3.06	2.72	2.99	5.45	2.44	2.55	25.46
1924	0.09	0.06	0.00	1.78	2.38	2.93	5.98	6.07	9.61	9.10	5.98	0.31	44.29
1925	0.23	0.07	0.39	0.25	2.14	3.97	1.94	6.80	5.12	4.08	1.67	0.43	27.09
Mean	0.84	0.35	0.61	1.50	2.83	4.24	4.25	4.32	4.03	4.04	3.40	1.74	32.15
Greatest	3.91	2.33	3.98	6.44	7.30	9.06	8.39	6.88	9.61	9.10	6.28	5.60	47.37
Least	0.00	0.00	0.00	0.00	0.00	1.20	1.18	1.69	1.31	1.73	0.93	0.00	19.72

BOGOTA, COLOMBIA [5]

1894	5.40	1.73	3.21	8.54	4.74	2.11	1.55	1.85	0.81	7.35	3.54	3.23	44.06
1895	1.41	0.08	0.20	5.17	1.98	0.74	1.43	1.41	0.28	6.12	5.19	2.28	26.29
1896	3.97	2.72	2.24	13.12	4.65	1.02	0.65	3.53	3.01	4.20	6.61	4.32	50.04
1897	4.59	0.96	3.62	2.28	8.39	0.00	0.65	1.87	2.92	7.36	7.94	5.51	46.09
1898	2.78	4.78	5.09	3.86	4.08	2.56	1.78	1.93	2.97	6.11	3.91	1.08	40.93
1899	1.66	0.77	5.07	2.94	2.89	2.47	1.67	0.83	2.68	4.72	9.70	1.15	36.55
1900	5.13	3.52	3.95	3.61	5.31	1.20	1.28	2.15	1.55	8.33	4.48	0.16	40.67
1901	0.72	1.94	2.28	1.85	2.93	0.63	2.22	4.22	1.63	7.64	8.37	2.28	36.71
1902	4.42	1.47	6.23	3.45	2.05	0.93	0.39	0.98	1.98	3.29	4.23	1.07	30.49
1903	1.19	1.57	1.24	4.01	3.05	4.22	0.40	4.09	1.59	2.52	5.88	4.16	33.92
1904	1.85	2.71	6.32	6.89	4.62	0.87	1.36	1.20	1.38	6.09	1.35	1.06	35.70
1905	2.51	0.59	1.90	4.42	3.81	1.91	0.92	0.59	3.78	5.01	7.82	5.72	38.98
1906	0.77	2.79	2.29	7.04	4.27	3.21	1.85	1.34	0.44	5.35	3.91	1.96	35.22
1907	1.15	4.48	8.15	7.61	3.55	2.41	2.71	1.49	2.91	4.15	3.57	2.68	44.86
1908	2.99	2.12	4.73	3.52	1.37	1.29	1.52	2.18	3.12	10.54	4.20	4.72	42.30
1909	1.57	4.57	0.35	4.48	5.45	2.79	3.45	2.30	1.86	4.37	3.48	2.13	36.80
1910	5.20	2.05	8.60	3.13	9.50	3.35	4.50	1.23	3.12	8.24	3.12	4.83	56.87
1911	1.86	5.12	3.61	7.06	4.18	1.98	1.38	0.73	0.24	1.82	3.46	1.43	32.87
1912	2.05	2.30	2.11	4.11	2.08	1.05	1.82	4.48	2.30	3.93	7.57	3.51	37.31
1913	0.78	1.34	3.12	9.62	3.94	1.84	0.68	0.72	7.10	5.00	5.41	3.31	42.86
1914	1.16	1.19	0.92	6.77	0.85	0.87	0.51	1.57	0.55	5.36	8.46	4.04	32.25
1915	1.64	3.41	1.14	5.32	5.36	2.62	1.95	4.50	0.19	5.12	-----	-----	------
1916	1.77	1.26	4.92	5.98	1.34	4.33	1.73	-----	1.93	5.51	3.15	-----	------
1917	3.98	2.40	4.72	7.83	7.56	2.68	1.54	3.82	1.77	2.91	6.10	3.31	48.62
1918	2.40	2.36	3.58	9.41	3.90	0.91	0.75	0.71	1.34	6.57	7.24	0.67	39.84
1919	2.20	1.18	1.73	5.08	2.91	2.09	2.76	2.24	3.94	2.56	4.72	4.41	35.82
1920	1.10	2.68	2.28	2.24	7.87	1.69	3.50	1.65	3.07	9.09	1.50	3.23	39.90
1921	-----	4.09	9.37	5.43	7.40	3.46	2.72	1.10	4.25	7.48	2.32	4.96	------
1922	0.08	4.06	6.54	3.35	4.29	5.98	4.02	0.32	1.30	4.25	4.68	3.78	42.65
1923	0.27	0.44	1.97	2.78	3.63	1.13	2.10	2.16	0.72	3.41	2.29	4.48	25.38
1924	0.00	0.13	2.15	1.66	3.17	2.83	1.87	0.81	7.83	5.85	9.77	4.39	40.46
Mean	2.22	2.28	3.67	5.24	4.23	2.10	1.80	1.93	2.34	5.49	5.13	3.10	39.53
Greatest	5.40	5.12	9.37	13.12	9.50	5.98	4.50	4.50	7.83	10.54	9.77	5.72	56.87
Least	0.00	0.08	0.20	1.66	0.85	0.00	0.39	0.32	0.19	1.82	1.35	0.16	25.38

[5] 1894–1915 from table given by Lleras. Contribución a la Meteorología Colombiana, Proceedings of the Second Pan American Scientific Congress, Vol. II, p. 754. 1916–1922 from Noticia del nuevo observatorio, San Bartolome de Bogota, by Sarasola, which gives record for 1866–1885 also. 1923–24 from Anales del Observatorio Nacional de San Bartolome. The record for 1866–1895 appears also in World Weather Records, Smithsonian Miscellaneous Collections, vol. 79, p. 1131.

TABLE 31.—*Precipitation—Monthly and annual totals, means, and extremes (in inches)*—Continued

BUENAVENTURA, COLOMBIA [6]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1910	32.25	10.87	14.19	55.26	29.29	29.10	24.11	23.10	24.99	29.20	30.20	21.40	323.96
1911	13.71	16.67	9.82	35.21	19.67	19.03	29.38	19.07	25.48	19.58	24.34	16.50	248.46
1912	14.11	12.32	13.70	20.02	26.19	17.32	19.29	21.57	29.02	39.36	29.14	23.06	265.10
1913	20.40	12.50	12.67	17.61	16.92	24.04	21.02	18.63	24.04	32.01	26.32	8.77	234.93
1914	11.82	8.09	10.64	16.03	39.75	27.20	18.03	28.23	32.22	29.00	26.16	15.69	262.86
1915	12.81	9.14	8.43	14.62	35.57	22.70	21.12	20.01	35.49	48.08	29.49	39.39	305.85
1916	20.20	16.73	9.96	20.45	31.40	26.93	23.50	47.03	24.26	45.37	30.91	26.79	323.53
Mean	17.90	12.33	11.34	25.60	28.40	23.76	22.35	26.66	27.93	34.66	28.08	21.64	280.65
Greatest	32.25	16.73	14.19	55.26	39.75	29.10	29.38	47.03	35.49	48.08	30.91	39.39	323.96
Least	11.82	8.09	8.43	14.62	16.92	17.32	18.03	18.63	24.04	19.58	24.34	8.77	234.93

[6] The record for Andagoya, Colombia, is given in the Monthly Weather Review, 1926, p. 377. At that station the extreme monthly amounts for the period 1915–1925 were 48.47 inches in September, 1923, and 8.55 inches in March, 1919, while the extreme annual totals were 317.05 inches in 1917 and 237.71 inches in 1919.

SUCRE, BOLIVIA

1883	4.95	7.05	3.85	0.13	0.14	0.00	0.82	0.02	1.18	0.47	4.89	3.69	27.19
1884	2.41	6.66	2.63	1.34	0.32	0.00	0.00	0.91	0.32	0.35	1.49	7.62	24.05
1885	6.70	3.24	4.03	3.07	0.14	0.60	0.43	0.42	2.57	2.78	2.36	3.36	29.70
1886	11.05	2.70	3.57	0.39	0.00	0.00	0.04	0.32	0.32	1.13	2.91	8.28	30.71
1887	9.35	4.90	2.89	1.97	1.33	0.00	1.81	0.00	1.94	2.65	2.85	2.04	31.73
1888	10.39	3.23	2.31	2.65	0.08	0.00	0.24	0.00	0.29	0.48	2.13	3.82	25.62
1889	3.90	6.29	1.70	2.60	0.06	0.00	0.00	0.00	0.73	3.28	3.28	1.99	23.83
1890	1.67	5.90	4.45	3.35	0.02	0.00	0.00	0.00	0.87	1.86	1.94	11.50	31.56
1891	6.44	5.70	2.46	1.78	0.00	0.00	0.12	0.00	0.55	1.27	3.73	5.26	27.31
1892	4.29	6.79	1.06	1.34	0.02	0.95	0.00	0.13	1.77	1.01	4.29	3.92	25.57
1893	8.88	3.01	8.65	1.37	0.20	0.32	0.00	0.24	0.33	0.22	1.04	4.53	28.79
1894	7.06	4.67	4.11	1.70	0.09	0.00	0.01	0.00	0.50	1.33	3.11	3.13	25.71
1895	8.95	6.13	4.58	3.46	0.20	0.00	0.05	0.53	0.18	1.33	1.43	4.80	31.64
1896	6.44	3.73	2.25	0.79	0.00	0.03	0.06	0.16	0.54	0.79	1.96	3.69	20.44
1897	5.36	4.43	5.97	4.06	0.00	0.79	0.25	0.23	0.93	1.38	2.85	4.28	30.53
1910	2.42	3.58	3.59	0.00	0.73	0.00	0.00	0.00	0.05	0.57	0.50	3.85	15.29
1911	4.76	8.88	4.70	1.93	0.14	0.20	0.87	0.39	0.39	0.73	1.89	0.62	25.50
1912	11.56	6.94	2.65	0.63	0.00	0.08	T.	0.00	T.	0.00	3.63	3.57	29.06
1913	5.87	5.19	3.13	0.49	0.00	0.00	T.	0.08	0.08	2.03	2.39	2.78	22.04
1914	5.74	4.27	0.87	T.	1.57	0.00	0.00	T.	1.02	1.50	2.18	3.87	21.02
1915	-----	2.74	2.57	0.67	0.00	T.	0.69	0.00	0.89	4.45	3.43	7.60	------
1916	6.75	5.30	2.11	4.23	0.02	0.02	0.12	0.14	0.32	1.86	2.32	3.39	26.58
1917	6.97	7.51	2.07	1.57	0.00	0.00	0.35	0.26	1.01	1.36	5.12	3.11	29.33
1918	11.81	5.04	1.30	4.31	0.04	0.32	0.00	0.08	2.82	1.63	2.09	5.22	34.66
Mean [7]	6.34	4.68	3.74	1.77	0.28	0.08	0.16	0.16	0.79	1.42	2.40	4.37	26.19
Greatest	11.81	8.88	8.65	4.31	1.57	0.95	1.81	0.91	2.82	4.45	5.12	11.50	34.66
Least	1.67	2.70	0.87	0.00	0.00	0.00	0.00	0.00	T.	0.00	0.50	0.62	15.29

[7] For a period of 32 years. See Réseau Mondial, 1918.

BIBLIOGRAPHY

The sources of data given in connection with text and tabular matter are too numerous to be reprinted here; however, one work has been of such value in the preparation of this paper that special mention of it is not to be omitted. In his Handbuch der Klimatologie (Stuttgart. 1910) Dr. Julius Hann presents in addition to the usual text and tabular matter special descriptions of the climates of the important cities of tropical South America.

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