

mus. A study of curves showing hourly distribution of rainfall at several stations shows most of the rain falling in the afternoon, with the maximum at 3 p. m.

Western coast of South America.—For the western coast of South America three rainfall types are presented. The first is in the area comprised by the region whose southern boundary is about 4° south latitude, and the northern boundary of which is the Isthmus of Panama. The region has a moderately heavy rainfall with a well-marked double maximum (Bogota). The distribution is controlled by the oscillation of the equatorial rain belt, the maxima occurring when the sun is near the zenith and the minima when the sun is farthest north and south.

The latitudes of the southeast trades along the west coast have the second type. This region extends from about 4° south to 30° south latitude and is essentially rainless. The winds from the east descend the western slopes of the Andes as dry, hot winds, having dropped all of their moisture on the eastern slopes. More prevalent still is a southerly⁶ wind blowing parallel to the coast. This wind blowing over the cool Humboldt Current carries but a small amount of moisture, and becomes drier still as it draws nearer the Equator. South of latitude 30° the rainfall is controlled by the prevailing westerlies. Here under the régime of these moisture-laden winds the annual amounts are heavy. The northern part (Valdivia) of this region has a well-marked maximum in June and July (winter) with the maximum of cyclones. The southern part (Evangelista) does not have this maximum, the distribution being fairly uniform throughout the year. The westerlies in these latitudes, popularly designated as the "roaring forties" and the "brave west winds,"⁷ bring a procession of frequent and severe storms throughout the entire year.

Northeastern South America and the basin of the Amazon.—The rainfall of this region is controlled by the trades and the seasonal shifting of the thermal equator. The monthly distribution of rainfall at Georgetown, Paramaribo, and Cayenne is very similar, although the annual total at Cayenne is larger, possibly, on account of its greater exposure to the northeast winds. The maximum occurs during the spring with the maximum monthly amount in May.

Rainfall is plentiful throughout the entire Amazon Basin. The prevailing winds in this region during the greater part of the year are from the east-northeast. These winds are moist when they enter the region, and the forested Amazon being virtually at times an inland sea, the atmospheric moisture is maintained or increased by evaporation. The seasonal maximum throughout the central part of the basin occurs about a month earlier than in northeastern Brazil and in the Guianas. It is interesting to note that the monthly distribution at Manaus is somewhat analogous to that at Cayenne.

Eastern South America, Brazil, Argentina, Paraguay, and Uruguay.—The northern part of this region is under the régime of the southeast trade. On-shore winds from the southeast and an elevated coast line give Pernambuco and stations in this region a heavy rainfall with a primary maximum during the winter when the trades are strong-

est, and a secondary convectional maximum in summer when the doldrums are south.

Southern Brazil (Sabara and Rio de Janeiro), Bolivia, Paraguay, and the interior of Argentina are subject to a summer convectional maximum occurring when the doldrums are farthest south.

As we reach the latitudes of the westerlies along the Argentine littoral we find that the annual rainfall is well distributed throughout the year, March being somewhat more moist than the other months, and a suggestion of an annual minimum occurring during July. Over the estuary of the Plate thunderstorms are fairly frequent during the warmer season, averaging about 7 per month during December and January.

Going westward from the Argentine coast there is a rapid decrease in the annual rainfall, and the Provinces at the foot of the eastern slope of the Andes (San Juan) are almost as arid as that part of the west coast in the latitudes of the southeast trade.

The southern tip of the continent is well watered on both coasts. Two factors account for the moderate heavy precipitation of southeastern Patagonia, namely, the lowering of the Andean cordillera,⁸ and the frequent cyclonic storms of these latitudes.

The graphs and discussion presented herewith have not covered the varied complexity of all rainfall types found in Latin America. Only the most essential of the rainfall types have been included and an attempt has been made to show some of the climatic controls governing these types.

RAINFALL MAP OF SOUTH AFRICA.

By J. R. SUTTON.

[Excerpts from a paper presented before the Royal Society of South Africa, Oct. 20, 1920. Reprinted from *Nature*, London, Dec. 16, 1920, p. 522.]

A contribution to the study of the rainfall map of South Africa. The monthly and annual rainfalls for 567 stations in South and East Africa are given, and the results shown graphically in 13 maps. The isohyets form a system which moves to and fro across the Equator, following the sun with a lag of a month or more. Corresponding with the general movements of the main isohyetal system are the winter rains of the southwest, which advance inland as the summer rains retreat, and vice versa. The paper concludes with a short bibliography of special studies of South African rainfall.

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RAINFALL IN GUATEMALA AND SALVADOR IN THE YEARS
1908 TO 1920.¹

By KARL SAPPER.

[Abstracted from *Meteorologische Zeitschrift*, Sept., 1921, pp. 279-281.]

The author has made an attempt to bring together and unify the climatological data of the Republics of Salvador and Guatemala, in which countries the war practically disrupted meteorological work. The following table summarizes the available rainfall records gathered together from various sources.—C. L. M.

⁶ R. DeC. Ward, *Climate of South America*, *Bulletin of the American Geographical Society*, 1903-352, pp. 353-390.

⁷ R. DeC. Ward, *Climate*, G. P. Putnam's Sons, New York, 1911, p. 113-114.

⁸ R. DeC. Ward, *Climate of South America*, *Bulletin of the American Geographical Society*, 1903, 35:359.

¹ *Regenfall in den Republiken Guatemala und El Salvador in den Jahren 1908 bis 1920*.