THE RELATION OF RAINFALL TO CONFIGURATION.

By CARLE SALTER, Joint Director of the British Rainfall Organization.

[The Institution of Water Engineers, London, 1919.]

The author has treated the subject on the basis of the average annual rainfall at selected stations of the British Rainfall Organization, having an average computed from 35 to 40 years continuous observations. In cases where no averages of that duration were available a shorter term was used after correction by comparison with one or more adjacent long-term records.

The closeness of the network of rainfall stations in Great Britain permits the study of the precipitation-altitude relation in much greater detail than elsewhere for an equal area, although this important advantage is offset somewhat by lack of topographic contrast except in the west of Scotland and in Wales.

The great majority of the averages used were for altitudes below 1,000 feet.

For the purpose of discussion the author classifies rainfall according to the different circumstances under which air is forced to ascend. In this respect he follows Curtis.[1] In brief these different circumstances may be grouped under three heads, viz.: (1) Convectional, (2) cyclonic, and (3) orographic.

It would seem to the writer that there is more or less overlapping in groups 2 and 3, and that for regions where the dominant weather control is cyclonic, as on the west coast of Europe and North America, the rainfall should be classed as cyclonic rather than orographic.

The configuration of the land it is pointed out by the author only slightly affects the distribution of convectional rains, these being very largely local and more apt to occur in low-lying districts than in mountain regions. While the region of convective rains in the United States is largely without surface relief of importance, yet there is a district in the southwest—New Mexico and Arizona—largely mountainous where convective rains prevail during July and August. These rains are mostly confined to the higher altitudes; I would, therefore, hesitate to say that configuration affects but slightly the distribution of convective rains. It may be that by reason of the extreme dryness of the air in that region the rain is evaporated before reaching the lowlands.

[1] U. S. Department of Agriculture, Forestry Division, Bulletin No. 7, 1893, Forest Influences, pp. 187, 188.

With regard to the second class—cyclonic rains—the author concludes that there is probably some general updraft of air near the center of cyclonic systems, but that the rainfall directly associated with such updraft is usually slight. The more general and heavier rain in association with cyclonic systems is probably due to the interaction of two great air currents at different temperatures which cross one another's path and, further, "they are very much more widespread than convectional thunderstorm rains and, if true to type, are absolutely independent of land configuration." Why the rains produced by the interaction of the two great currents should be independent of land configuration is not clear to the reviewer.

Since the bulk of the elevated land in Great Britain is near the west coast, the best examples of orographic rains are found in that region. The influence of a background of elevated land upon the rainfall at sea level to the windward is noticeable on the west and south coast as compared with the east coast.

Examples are given to illustrate the fact, for it seems to be duly authenticated not only in Great Britain but also in other lands that the relatively high rainfall of valley bottoms having steep sides may be attributed to the altitude of the sides rather than the bottoms, and this is particularly true in the case of valleys transverse to the direction of the rain winds.

The average rate of increase of rainfall in windward slopes per 100 feet increase in altitude varies within wide limits. In the simple case of rising land facing the sea the increase may be from 1.5 to 2 inches per 100 feet increase in altitude, but this rate may be reduced to a smaller figure when the slope of the land is reduced. The author finds in the case of fairly steep ridges that the maximum rainfall occurs slightly on the leeward side of the crest regardless of the altitude of the spot on which it falls.

On leeward slopes of high land rainfall diminishes steadily. For the Pennines it was found, broadly speaking, that annual rainfall decreases 1 inch per 100 feet above 1,000 feet, increasing to 2 inches per 100 feet below 500 feet of altitude; other slopes gave greater irregularity in the decrease per 100 feet, probably due to the effect of local conditions.—*A. J. H.*

STORM RAINFALL OF EASTERN UNITED STATES.

By the Engineering Staff of the Miami Conservancy District Techincal Reports, Part V.

[Dayton, Ohio. 1917, pp. 309 with 114 figs.]

This report consists of a critical analysis of the voluminous mass of excessive rainfall data contained in the manuscript records of the United States in the archives of the United States Weather Bureau in Washington, D. C. For the purpose of studying seasonal and geographical distribution, frequency and cyclic variation of great rain storms the 25 year period 1892–1916 was selected, and 160 great storms were found in this period. The limiting condition for any one of these storms was that it must include records from at least five stations each having a three-day precipitation equaling or exceeding 6 inches. These storms were divided into two groups, northern and southern storms, and a chronological list is given in Tables 4 and 5. The procedure adopted consisted of the following steps: (1) assembling the rainfall data; (2) selecting the greatest one-day, two-day rainfall, and so on; (3) plotting the rainfalls on a large-scale map; (4) drawing the isohyetals; (5) measuring the areas within the isohyetals; (6) computing the average depth within the isohyetals; (7) drawing on coordinate paper the time-area-depth curves using as coordinates the area in square miles and the average depth of rainfall over the corresponding area. Much stress was laid upon the determination of the time-area-depth relations in these storms and also on the question how great a rainfall may be expected in the northeastern United States? An interesting conclusion from a purely climatological standpoint drawn from this study was that the variations in total annual rainfall in Eastern United States depend chiefly upon the occurrence of great storms. While the report was prepared from the engineering standpoint it contains, nevertheless, many results of great interest to climatologists and other students of rainfall statistics.—*A. J. H.*