Thus we might continue our inquiry into the climate of San Jose. Gathering the facts from any one section of a table such as I have prepared for that city is very easy.

COMPARISON OF CLIMATES

As suggested above, the recording of weather types for any one station will usually require the use of but a part of the whole range of types in the complete classification Obviously the greater the range of climatic conditions at a given station the larger will be the section of the classification needed.

When we wish to *compare* stations (entries in the table being made with various types and colors of figures corresponding to the stations and months or seasons) it may or may not be necessary to prepare the complete form of table for 720 types. It would be necessary, for instance, in comparing certain low-latitude desert stations with certain high-latitude interior continental stations. It would not be necessary in comparing stations having very similar climates. For instance, if we compare conditions at St. Paul, Minn., at 6:40 a. m. during January, 1907, with those that prevailed at St. Louis, Mo., at the same time, we need five temperature groups (T_0 to T_{-4}, inclusive) and three relative humidity groups (H_0 to H_{+2}, inclusive) only. If, however, we compare afternoon conditions during July at San Francisco, Calif., with those existing at Fresno in the same State at the same time, we require a much larger section of the table; in fact all the humidity classes and the six upper temperature groups are necessary, as is shown in Table III, where I have made such comparison, using data for the three-year period, 1905–1907.

Various possibilities of applying graphic methods to the depicting of weather types based on the classification here proposed, will occur to the reader, though space does not permit of their discussion here.

CONCLUSION

The writer believes that, from a set of weather-type frequency numbers such as those presented here for San Jose (at least if frequency percentages be derived from records for several years) the degree of suitability of a climate for health, pleasure, certain industrial and agricultural operations and many other purposes, can be ascertained to greater advantage than by any other known method; and, further, that some such analysis of the original observations is necessary to an adequate conception of a climate.

WEATHER TYPES IN THE CLIMATES OF MEXICO, THE CANAL ZONE, AND CUBA[1]

By J. ELMER SWITZER, Ph. D.

[Indiana University, Bloomington, Ind., December, 1923]

This study of the frequency of weather types in the climate of certain cities in Mexico, the Canal Zone, and Cuba is an effort to determine the actual weather experienced by the inhabitants of these stations within the Tropics.

As a more systematic attempt is made to develop this part of the world, the problem of adjustment by white man to the conditions of tropical climate will become more and more important. The frequency of unfavorable types of weather at given stations and the frequency of interruptions in the sequence by a more favorable type will become significant in a greater degree, since the development of the vast resources of the Tropics depends upon the ability of progressive peoples to live and work in the climatic conditions found there. Thus it seems that a study of the weather conditions to be encountered from day to day is appropriate.

An effort is made to group the different elements together into the weather types which seem to affect man most and to determine the frequency of each in the climate of the nine stations for which the necessary data were available, and to determine also in some degree the sequences of the various types. The stations are located as follows: Colon and Balboa Heights at the Atlantic and Pacific termini, respectively, of the Canal Zone; Vera Cruz, Progreso, and Matamoros, on the east coast of Mexico; Salina Cruz and Manzanillo, on the west coast; Mexico City, on the plateau; and Habana, Cuba. They range in latitude from about 9° N. to about 26° N. All are near sea-level except Mexico City, which has an elevation of about 7,000 feet above mean sea level.[2]

Certain arbitrary classifications of weather types are made. All days with mean temperatures (generally taken as (max.+min.)/2) over 68° F. are classed as "hot," those with mean temperatures between 50° F. and 68° F. are considered "moderate," while those with mean temperatures between 32° F. and 50° F. are designated as "cool." If the wind during the day reached a maximum velocity of 25 miles per hour for a five-minute period or longer, the day is considered "windy." Days with 0.01 inch or more of rain are called rainy days. By combining these factors, the following nine weather types are adopted: Hot-rainy, hot-fair-and-windy, hot-fair-and-quiet, moderate-rainy, moderate-fair-and-windy, moderate-fair-and-quiet, cool-rainy, cool-fair-and-windy, cool-fair-and-quiet. Three additional types would be used where the mean temperature of the day was below 32° F.; i. e., cold-snowy, cold-fair-and-windy, cold-fair-and-quiet. In the stations considered in this paper the last three types were not feund.

It is recognized at the outset that this classification does not include many items it would be desirable to include, but with the present practices of compiling and recording data, even the above designated information is difficult to obtain.

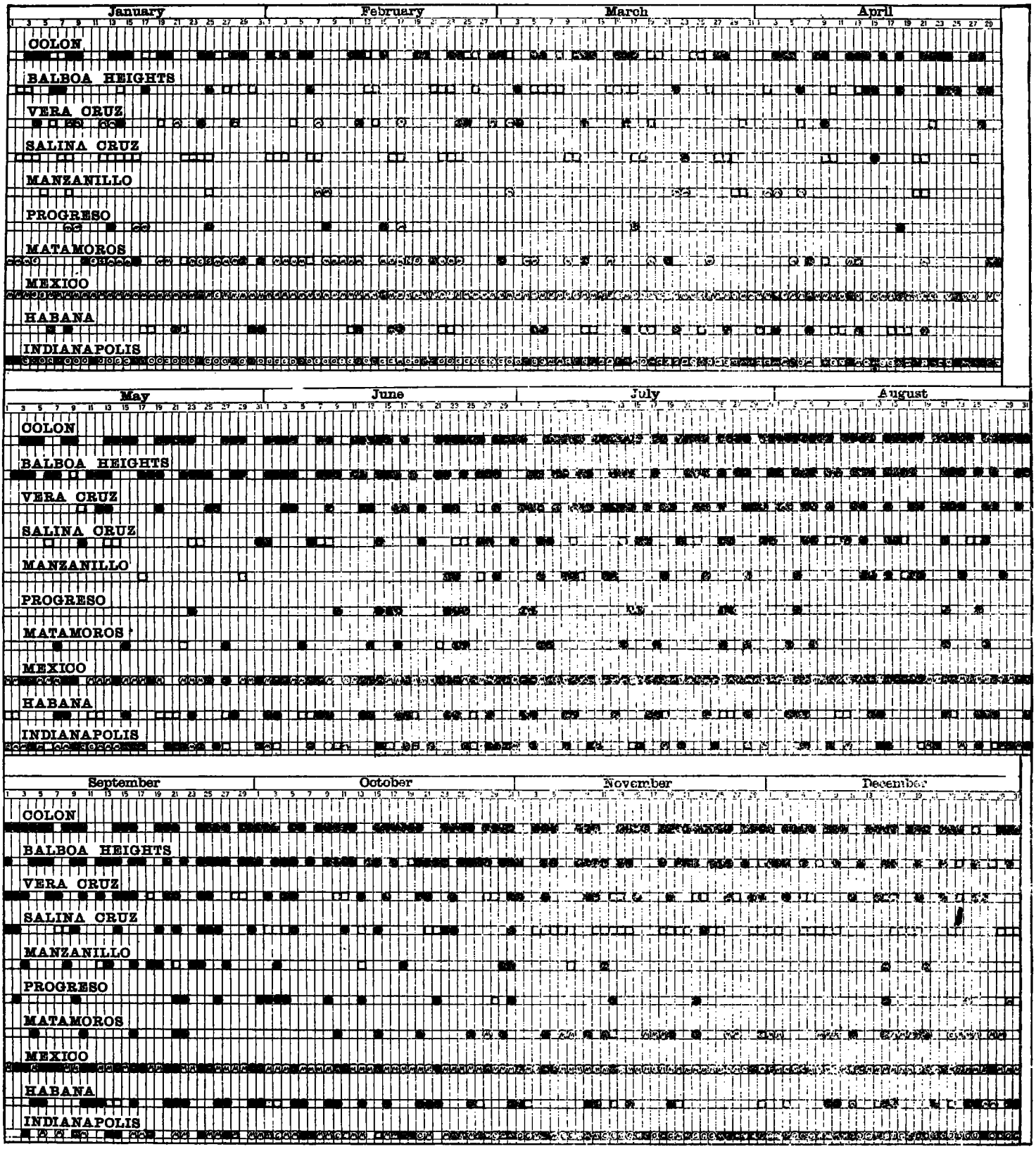
The weather type each day during the five-year period 1917–1921, inclusive, was determined and charted for each of the nine stations[3] in the following way: The temperature of the day was indicated by color; red representing hot days; green, moderate days, and blue, cool days. A windy day was indicated by a square, and a quiet day by a circle. A rainy day was indicated by shading the circle or square, and an open circle or square stood for a fair day. The averages of each type were obtained by counting the whole number of times a type occurred each month for the five-year period and computing the average number of recurrences per year for that month. These were plotted on the accompanying chart as nearly as possible in proportion to their frequency of occurrence, as computed by 10-day periods.

[1] Presented before Association of American Geographers and American Meteorological Society, Cincinnati, Ohio, Dec. 27, 1923. See Bull. Am. Metl. Soc., January, 1924, vol. 5, pp. 9–11.

[2] Grateful acknowledgment is due, for their aid in the pursuit of this study, to the following people: To Maj. Z. Kirkpatrick, chief hydrographer of the Canal Zone; Sr. J. C. Jones, director Meteorologico Central, Tacubaya, Mexico; Sr. José Millás, director Observatorio Nacional, Cuba; and to Mr. P. C. Day, meteorologist in charge, Climatological Division, U. S. Weather Bureau, for the detailed data furnished; Dr. O. L. Fassig, meteorologist of Porto Rico; and J. F. Brennan, of Jamaica, for further data furnished but not incorporated in this paper; Dr. Charles F. Brooks for his helpful suggestions in securing and compiling the data.

[3] The data for Manzanillo are available for only a two-and-a-half-year period, for Habana for four years. Data are lacking for the following other stations: At Vera Cruz for February, 1918; at Salina Cruz for May and June, 1920; at Balboa Heights for April and October, 1918; and for Colon in April, 1917.

SUCCESSION OF WEATHER TYPES, AVERAGES 1917-1921.



ALL OPEN SPACES ARE HOT-FAIR-QUIET DAYS ALL DAYS HOT UNLESS OTHERWISE DESIGNATED

● RAINY DAYS ○ QUIET DAYS □ WINDY DAYS ∩ MODERATE TEMPERATURE ◦ COOL TEMPERATURE ◦ COLD TEMPERATURE

The weather types at the low latitude coast stations are given in Tables A and B. They show a marked contrast in the sequence of weather types on the east and west coasts. Even in the narrow neck of land of the Canal Zone the difference is quite apparent. Colon (Cristobal) at the Carribean terminus of the canal has hot-rainy days well distributed throughout each month, while Panama (Balboa Heights) at the Pacific extremity is dominated by hot-fair-quiet or hot-fair-windy days from January to April, inclusive. The total number of hot-rainy days is nearly one and one-half times as many at Colon as at Panama. The difference in the two stations is further emphasized by the fact that during the "rainy season," from May to November, inclusive, at Colon only four times in two years was the sequence of hot-rainy-days interrupted by three or more successive fair days, while at Balboa Heights such interruptions occurred 17 times during the same period. At Colon, from July to September, 50 otherwise successive rainy days each year are interrupted by a single fair day not more than four or five times, while at Balboa Heights a 20-day rainy period is usually interrupted by at least two successive fair days and one or two single fair days. The average rainfall for Colon is 127.9 inches; for Balboa Heights it is 69.4 inches.

TABLE A.—*The average number of days each weather type occurred per month at the extremities of the Panama Canal during the five-year period, 1917–1921*

COLON (CRISTOBAL), LATITUDE 9° 21′ N.

Type	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Hot-rainy [1]	14.0	12.6	10.4	16.0	18.4	22.8	25.0	26.0	19.6	19.2	22.6	22.6
Hot-fair-windy	6.2	4.4	5.1	0.8	0.6	0.2	0.2	0.2	0.2	0.2	0.2	1.0
Hot-fair-quiet	10.8	11.0	15.5	13.2	12.0	7.0	5.8	4.8	10.2	11.6	7.2	7.4

PANAMA (BALBOA HEIGHTS), LATITUDE 8° 56′ N.

Hot-rainy	4.6	1.2	2.1	9.7	16.8	19.0	6.8	18.8	20.0	17.0	18.4	11.0
Hot-fair-windy	5.0	8.4	10.4	4.2	1.0	0.4	0.6	0.2	0.0	0.2	0.4	1.2
Hot-fair-quiet	21.4	18.4	18.5	16.0	13.2	10.6	23.6	12.0	10.0	13.8	11.2	18.8

TABLE B.—*The average number of days per month each weather type occurred during the five-year period 1917—1921 at Salina Cruz, Manzanillo, Vera Cruz, and Progreso.*

SALINA CRUZ, LATITUDE 16° 9′ N.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Hot-rainy	0.2	0.4	0.2	0.4	2.8	7.2	8.6	9.2	8.6	7.4	1.2	0.0
Hot-fair-windy	15.2	7.6	8.2	4.6	5.6	3.5	4.6	4.8	3.2	5.6	18.2	16.6
Hot-fair-quiet	15.0	19.8	22.6	25.0	21.6	19.3	17.8	17.0	18.2	18.0	10.6	14.4
Moderate-fair-quiet	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

VERA CRUZ, LATITUDE 19° 11′ N.

Hot-rainy	1.8	1.7	3.0	1.8	6.6	13.4	20.2	15.6	15.2	9.9	7.0	4.4
Hot-fair-windy	3.2	4.2	1.4	1.6	1.4	0.4	0.0	0.2	2.8	4.2	5.8	6.4
Hot-fair-quiet	16.6	20.2	23.8	25.8	23.0	16.2	10.6	15.2	15.0	16.4	17.0	16.4
Moderate-rainy	0.6	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.0
Moderate-fair-windy	3.2	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.2
Moderate-fair-quiet	4.4	2.4	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6

PROGRESO, LATITUDE 21° 11′ N.

Hot-rainy	2.2	1.4	1.4	0.6	1.2	6.8	5.0	4.8	4.8	6.4	3.0	1.0
Hot-fair-windy	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.2	0.2	0.0	0.0
Hot-fair-quiet	24.4	26.0	29.4	29.2	29.8	23.0	26.0	27.2	26.0	24.4	27.0	29.4
Moderate-fair-windy	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Moderate-fair-quiet	4.2	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2

MANZANILLO, LATITUDE 19° 0′ N.

Hot-rainy	0.0	0.0	0.0	0.0	0.0	3.6	8.6	6.6	9.0	3.0	1.0	0.0
Hot-fair-windy	3.0	0.5	3.0	2.0	2.0	1.0	1.2	1.0	2.0	2.0	1.0	0.0
Hot-fair-quiet	28.0	25.5	25.0	20.0	29.0	25.4	21.2	23.4	19.0	26.0	28.0	31.0
Moderate-fair-quiet	0.0	2.0	3.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

[1] More rainy days were also windy than there were hot-windy-days.

The difference in the weather of the two coasts is further illustrated by a comparison of the sequence of types at Vera Cruz with those at Salina Cruz and Manzanillo, (Table B.) At Salina Cruz, during the seven months of November to May, inclusive, hot-rainy days occur an average of but five times. At Manzanillo, during the period for which the data were available (June, 1919, to December, 1921), rain occurred but once between November 1 and June 19. At Vera Cruz, on the east coast, though dominated by hot-fair-quiet days for the same period, has more than twice as many hot-rainy days as has both the above-mentioned Pacific coast stations. While hot-fair-windy days occur more frequently at the Pacific coast stations, yet of these Salina Cruz has a much greater number than any other station. A few moderate-fair-quiet days occur at Manzanillo, but at Salina Cruz only three such days occurred in the five-year period. On the other hand, Vera Cruz has all three of the moderate temperature types, and more than one-fourth of the days of January have the moderate types.

Progreso, Yucatan (Table B), differs much from the types given above. Hot-fair-quiet days may be said to prevail throughout the year. The sequence is interrupted slightly by moderate-fair-quiet days in January and February, and by hot-rainy days which reach a maximum in June, and again in October. Progreso seldom has as many as four successive rainy days and has more than two such days only about a dozen times per year. From November to May, more than 92 per cent of all the days are hot-fair-quiet.

TABLE C.—*The average number of days per month each weather type occurred during the five-year period 1917–1921 at Matamoros; Habana, Cuba; and Mexico City*

MATAMOROS, LATITUDE 26° N.

Type	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Hot-rainy	0.0	0.4	1.0	2.8	4.2	6.2	6.6	2.8	6.6	6.8	3.8	0.8
Hot-fair-windy	1.0	1.8	1.2	1.4	0.8	1.2	0.2	0.0	0.2	0.2	1.6	0.8
Hot-fair-quiet	6.0	7.0	18.4	20.8	25.4	22.6	24.3	28.2	23.0	22.8	13.8	10.0
Moderate-rainy	3.0	2.2	1.6	1.0	0.2	0.0	0.0	0.0	0.0	0.6	1.6	2.2
Moderate-fair-windy	0.6	0.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.8
Moderate-fair-quiet	13.8	14.0	7.4	2.2	0.4	0.0	0.0	0.0	0.2	0.6	7.0	13.6
Cool-rainy	1.6	0.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.8
Cool-fair-windy	1.6	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4
Cool-fair-quiet	3.4	1.2	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.6

MEXICO CITY, LATITUDE 19° 26′

Hot-rainy	0.0	0.0	0.0	0.6	2.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Hot-fair-windy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hot-fair-quiet	0.0	0.0	0.0	3.0	5.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0
Moderate-rainy	1.2	1.0	2.0	5.4	5.4	15.0	23.4	22.0	15.6	7.6	2.4	1.4
Moderate-fair-quiet	26.2	26.8	29.0	21.0	18.4	13.0	7.6	9.0	14.4	23.4	25.4	23.4
Cool-rainy	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2
Cool-fair-quiet	2.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	6.0

HABANA, CUBA, LATITUDE 23° 9′ N.

Hot-rainy	3.2	2.8	4.8	4.2	5.5	9.2	8.5	11.5	14.5	11.0	8.0	7.0
Hot-fair-windy	4.0	4.0	5.8	8.8	7.8	4.8	3.2	2.8	3.8	2.8	3.5	3.5
Hot-fair-quiet	16.0	14.5	18.0	17.0	17.8	16.0	19.0	16.8	12.2	17.8	18.0	16.0
Moderate-rainy	2.5	1.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5
Moderate-fair-windy	1.8	1.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Moderate-fair-quiet	3.5	3.8	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5

Matamoros is the only station studied that has an appreciable number of days of the cool weather types (Table C). It lies just without the Tropics and serves to emphasize the effect of location according to latitude. The cool types of weather begin in November and reach a maximum (21 per cent) in January, one-fourth of which are cool-rainy days. During the winter months about one-half the days are moderate-fair-quiet, one fourth are hot-fair-quiet, the remainder are divided among the other seven types and give great variety to the

weather. The "rainy season," from June to October, has hot-rainy days about one-third the time and hot-fair-quiet days the remainder.

The effect of altitude is clearly shown by the weather types of Mexico City (Table C). Although about the same latitude as Manzanillo and Vera Cruz, Mexico City is dominated almost entirely by the moderate temperature types. From October to April, inclusive, four-fifths of all the days are moderate-fair-quiet. A few hot-rainy days and about three times as many hot-fair-quiet days occur between the middle of April and the middle of June. At no other time does the average temperature of the day reach 68° F. Moderate-rainy days occupy about two-thirds of the time from May to September, inclusive. The increased cloudiness and evaporation are probably the largest factors in maintaining moderate temperatures during the summer season. Mexico City would appear to have almost ideal weather for a winter resort of the Northern Hemisphere.

TABLE D.—*The mean annual rainfall at the different stations and the average number of rainy days for each station during the five-year period 1917–1920*

Station	Inches rainfall	Number of rainy days
Colon	127.9	229.0
Balboa Heights (Panama)	69.4	154.4
Vera Cruz	68.0	90.0
Salina Cruz	39.4	46.0
Manzanillo	26.0	32.0
Progreso	17.2	37.4
Matamoros	36.6	58.6
Mexico City	23.1	126.8
Habana, Cuba	51.7	80.0

Habana serves to compare the weather types of an insular location with those of continental stations of similar latitude (Table C). The frequency of hot-fair-windy days, with a maximum in April or May, shows a resemblance to the west-coast stations. The distribution of hot-rainy days throughout the year, with a maximum in late summer, is like that of a modified eastern coast climate of low latitude. Unlike the sequences at most stations on the continent, no one type occurs on many successive days. Three or four successive hot-rainy days occur but about five times per year, and hot-fair-quiet days, which exceed all others in number, seldom occur on more than 10 successive days.

The average annual rainfall and the average number of rainy days is given in Table D, from which many interesting comparisons may be made. For example, Balboa Heights has about the same annual rainfall as Vera Cruz, yet has one and seven-tenths times as many hot-rainy days. Mexico City has about one-third as much rainfall as either Balboa Heights or Vera Cruz, yet has three-fifths as many rainy days as the former and one and four-tenths times as many as the latter. Progreso, with 75 per cent as much rainfall as Mexico City, has but 29 per cent as many rainy days.

From the above comparisons and many more that might be made, it seems evident that, for these stations, annual and seasonal rainfall, temperature, and wind velocity and direction data do not give an adequate conception of the weather conditions experienced. May not some combination of the weather elements into types of weather units be found that would more adequately depict the weather and climatic conditions under which the people live, work, and find their recreation?

TORNADOES IN ALABAMA

By WELBY R. STEVENS

[Weather Bureau Office, Montgomery, Ala., April 25, 1925]

A list has been made of tornadoes that have been reported in Alabama since 1794. All available records have been searched in an attempt to make this list as complete as possible, although completeness is not claimed, due to lack of information, especially in the early years. Prior to 1871 the list follows that of Finley, almost without exception, and while his work was evidently the result of much labor and as complete as possible at the time, in view of the sparsely settled nature of the State up to the first half of the last century, many tornadoes must have escaped notice. Advantage was also taken of the valuable Special Paper No. 1 of the Alabama Weather Service: Record of the Weather from 1701 to 1885, by Capt. W. H. Gardner, Mobile, Ala., which, however, contains little information about tornadoes. The following sources have been used in the tabulation: Report on the Character of Six Hundred Tornadoes, and Tornado Studies for 1884, by John P. Finley, U. S. Signal Service, Bulletins and Special Papers of the Alabama Weather Service, and the succeeding Climatological Data, Alabama Section, of the Weather Bureau, Annual Reports of the Chief Signal Officer, U. S. Army, and of the Chief U. S. Weather Bureau, THE MONTHLY WEATHER REVIEW since 1876, and correspondence and original records on file at the Montgomery, Ala., Weather Bureau Office. Many sections of the State are still thinly populated, and doubtless many tornadoes in recent years have occurred without coming to notice, but certainly the most severe ones since the establishment of the Signal Service in 1871 appear. The list, Table No. 1, shows the county in which the tornado occurred, the date and time of occurrence, direction in which the tornado moved, number killed, number injured, and amount of property damage, where these data could be obtained.

TABLE 1.—*Tornadoes reported in Alabama: Earliest record to April 1, 1925.*

Number on chart in figures	County	Date	Time	Direction of path	Number of persons—		Property loss
					Killed	Injured	
1		1794 Aug. —					
2	Morgan	1822 Apr. 16	5 p	NE			
3	Chilton	1823		E. 10° N.			
4	Morgan	Apr. 6	9 p	NE			
5	Pickens	1824					
6	Tuscaloosa	1829 Apr. 25					
7	Calhoun	1830 May 1					
8	Morgan	1834 June 16	4.30 p	NE			
9	Blount	1840		E. 20° N.			
10	Etowah			E. 20° N.			
11	Blount	Mar. 10	6 p	E.			
12	Jefferson	Mar. 16	do	NE			
13	Mobile	Mar. 24	7 p	S. 80° E.			