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DISTRIBUTION OF RELATIVE HUMIDITY AND DEW POINT IN THE SOUTHWESTERN UNITED STATES

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ABSTRACT

This report consists of three basic parts. In the first, average monthly values of relative humidity are presented for between one and four hours of the day at 126 weather observing stations in the southwestern United States, including all of Arizona, New Mexico, Colorado, Utah, and Nevada, and parts of California, Texas, Idaho, and Wyoming. The nature, accuracy, and import of these data are discussed briefly. It is shown that the month with lowest average humidities varies systematically from March in central Texas to August in northern Nevada, antedating the westward movement of the Atlantic high pressure system, with its moist unstable air. In the second section, the distribution of dew point over the Southwest is discussed. High values are found on the windward sides of most of the larger mountain ranges, near bodies of water, and in heavily irrigated farmland; low values are concentrated at higher elevations and in the dry desert regions bounded by the Sierra Nevada Mountains to the west and the Rocky Mountains to the east. Hourly data for Arizona indicate that the diurnal variation of dew point is small, with a tendency for the lowest values to occur in the midafternoon in dry regions and in the early morning in moist regions, i.e., those with a surface snow cover or with considerable crop irrigation. The final section outlines a method of estimating the mean relative humidity from the mean temperature. Ordinary linear regression techniques are used, with a correction added to account for the systematic geographical distribution of regression errors.

The main purpose of this report is to present monthly mean values of relative humidity and dew point for the southwestern United States based on all available data through 1957. The region covered is bounded roughly by 120° W longitude on the west, by the northern borders of Nevada, Utah, and Colorado on the north, by the eastern border of Colorado and 100° W longitude in Texas on the east, and by the United States-Mexico border on the south. Relative humidity data were gathered for a grand total of 126 locations in this area, with periods of record ranging from two months to almost forty years. Because, in quite a few cases, data were available at more than one location within a given city (usually at an airport and city office), a total of only 91 cities are represented. These are indicated in Figure 1. Three cities, Pocatello, Idaho; Cheyenne, Wyoming, and Abilene, Texas, lie outside of the boundaries indicated above.

I. RELATIVE HUMIDITY.

A. Nature of the data. The basic data for this study consisted of all available values of monthly mean relative humidity at 116 locations for the period between January, 1918, and December, 1957, and at 12 locations before that time, back to January, 1891. The primary sources of data were: (a) the United States Department of Agriculture's "Report of the Chief of the Weather Bureau" for the period from 1891 through 1942, and (b) the United States Department of Commerce's State "Climatological Data" for the period from 1918 through 1957. The first reference is an excellent source of climatological data of all types for the earlier years, in many respects surpassing the second reference in reliability and convenience.

Because of the large diurnal variation of relative humidity, it was necessary to pay careful attention to the times of observation. Before July, 1937, these were normally 0600 MST[1], local noon, and 1800 MST. The noon readings were not begun until January, 1918, so that this month served as a convenient starting point for determining the means at most locations. From July, 1937, through June, 1939, observations were taken at 0530 MST, local noon, and 1730 MST. In July, 1939, the noon reading was changed to 1130 MST and a 2330 MST reading was added. The latest change occurred in July, 1957, when the observation times became 0000, 0600, 1200, and 1800 MST, thus reverting to the pre-1937 hours. Between 1937 and 1948 many of the city Weather Bureau offices were closed and moved to the local airport.

As a result of the time and location changes, two basic periods for determining average relative humidities were set up. The first, running from January, 1918, through June, 1937, generally produced means for 0600 MST, local noon, and 1800 MST.

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[1] Mountain standard time.

The second, from January or July, 1939, through December, 1957, gave means for 0530, 1130, 1730, and 2330 MST. There were a few deviations from these standard times; for example, Wagon Wheel Gap, Colorado, reported at 0900 MST and Ajo and Cottonwood (Clemenceau), Arizona, at 0730 and 1500 MST.

B. Data adjustments. In order to make the data comparable among stations, two adjustments were made, one for the period of record and the other for the time of observation.

1. Adjustment for the period of record. Most locations reported only during part of the basic periods, occasionally as little as one year. In the event that a record was less than fifteen years in length, an attempt was made to make it more representative of the basic period in which it lay by comparing it with the record of the nearest station with no missing data. The method of correction was very simple. The average monthly humidities at the two locations at a particular time of day, say in the morning, were first computed using only those years when both stations reported. These values were then compared with the full-period mean at the comparison station and adjusted accordingly. For example, if Phoenix and Roosevelt had average humidities of 54 and 52 percent, respectively, at 0600 MST in October for comparable periods, and the long-term mean at Phoenix was 58 percent, then Roosevelt's long-term mean would be estimated as 52 + 4 = 56 percent.

This procedure did not take into account the possibility that the ratio of anomalies between stations might not be one to one. In other words, no attempt was made to check whether the deviation of a short-period mean from the long-period mean at a given station differed from that at other stations. The same anomaly was assumed to exist at all locations surrounding the comparison station.

Occasionally humidities were recorded at one observation time less often than at others. This was especially true for the 2330 MST observation during the later years. In this case the short-period mean was corrected by comparing it with the short- and long-period means for the 0530 MST observation at the same station. Similarly, if the

1130 MST or noon observation was deficient, it was adjusted by comparison with the 1730 or 1800 MST value, or vice versa.

Of the roughly 3700 corrections that were made, over sixty percent had a magnitude of no more than three relative humidity percentage units, while almost ninety percent were no greater than five units. In general, the absolute value of the correction increased as the period of record decreased, as might be expected. Hence, the mean values for stations with less than three years of data should be looked upon as order-of-magnitude estimates only.

2. Adjustment for the time of observation. In order that the pre-1937 data might be comparable with those after 1939, whenever possible the observations were reduced to the standard times of 0000, 0600, 1200, and 1800 MST. To do this, use was made of average hourly relative humidity values extracted from series 30 of the U. S. Weather Bureau's "Climatography of the United States" series (2) for eleven first-order Weather Bureau airport stations in the southwest (Phoenix, Arizona; Burbank, Fresno, Los Angeles, and San Diego, California; Denver and Pueblo, Colorado; Albuquerque, New Mexico; Amarillo and El Paso, Texas; and Salt Lake City, Utah). The mean hourly values were estimated for each month from grouped data representing the frequency distribution of hourly relative humidity values based on a four to five year period. Since all that was required for this study was an idea of the diurnal variation of relative humidity, it did not matter too much if these computed means, which were based on a rather short period of record, deviated slightly from the true means, as long as they all deviated in the same direction. These data are summarized in Figure 2, which shows the diurnal variation of the mean annual relative humidity for each station. Further comment on this figure will be reserved for a later section.

The reduction to one of the standard hours was accomplished by making use of the following formula:

$$RH_x = RH_y + (A/A') (RH'_x - RH'_y),$$

where the unprimed values refer to the station whose relative humidity, RH_x, at the time x is being estimated from (a) its observed relative humidity, RH_y, at the time y, (b) the corresponding values for the nearest of the above named first-order stations (primed values), and (c) the change in relative humidity between morning and afternoon at the two stations (A and A'). The latter factors were introduced to take into account differences in the amplitude of the diurnal variation of relative humidity between the two stations. They required at least two observations per day taken at an interval of about twelve hours. As a result, it was not possible to determine the relative humidity at the nearest standard hour when a station reported only once a day or when two observations were taken but within less than six hours. Also, no extrapolation was attempted when x - y had a magnitude greater than three hours. Since this extrapolation was rarely for more than one hour, the errors arising from it are probably negligible, particularly at 0000 and 0600 MST when the relative humidity is changing very slowly (Figure 2). Care was taken in this procedure to use mountain standard time in all of the time zones.

In some cases the nearest first-order station was not the best to use in estimating the standard hour humidity. This was particularly true on the west coast where the climate of the stations lying on the immediate coast is modified tremendously by the adjacent ocean currents and land-sea breezes and, as a result, is much different from that farther inland (compare the curves for Los Angeles and San Diego with that for Fresno in Figure 2). Generally, similarity in longitude, rather than latitude, was used in selecting the comparison station.

In one case extrapolation was not attempted, even though all of the necessary data were available. This was at Mt. Wilson in southern California, which shows the characteristics of high elevation stations (e.g., higher relative humidity in the afternoon than in the morning) and is not comparable with any of the first-order stations.

C. Results. The final corrected relative humidities are listed in Tables I-VII of the Appendix. Also included are the station elevation, the period of record, and the estimated mean dew point at 0600 MST. The latter will be considered in the following section. In general, the values given for stations whose period of record was less than three years are questionable and may be subject to large errors, even though they agree with those at nearby stations. Although the initial data were checked for obvious errors, such as the daytime average humidity being larger than that at night, it is possible that many minor errors, due especially to faulty equipment and adding mistakes, were overlooked. For the stations with longer records these should tend to cancel out, but for the stations with short records they may yield inaccurate results. Also, the extrapolation to the standard hours may have introduced other errors which are probably greatest for the 1200 and 1800 MST values, since at these hours the relative humidity is changing most rapidly (see Figure 2). No statistical analysis of these various sources of error was attempted; however, it is believed that the average relative humidity values for the stations with records longer than ten years in length should be correct to within two or three percentage units. Values for stations with three years or less of data may be in error by five percentage units and possibly more.

An attempt was made to construct mean relative humidity maps for the southwest on the basis of the data given in the tables. However, it soon became evident that such maps would have questionable reliability because of (a) the lack of data over large areas, particularly southeastern Utah, (b) the extreme dependence of relative humidity on elevation, and (c) the lack of a well-defined pattern. Therefore, they are not included here. Instead, a comparison of the annual and diurnal variations of relative humidity at various representative stations will be presented.

As mentioned earlier, the data used in Figure 2, which shows the diurnal variation of mean annual relative humidity, were drawn from the Weather Bureau's "Climatography of the United States" series (2). Although these means were determined from a shorter period of record than those given in the Appendix tables, they were available for all hours and, hence, should give a better picture of the diurnal variation than means for only four hours.

In general, the maximum relative humidity tends to occur near the time of minimum temperature (i.e., betwee 0430 and 0630 MST) at all stations. It is reported earliest (0400 MST or 0300 PST[1]) at the immediate coastal stations, Los Angeles and San Diego, and at the "mile-high" station, Denver. The time of minimum relative humidity correlates well with the time of maximum temperature, varying from 1330 MST at Los Angeles to 1630 MST at Fresno. The early occurrence of the minimum at Los Angeles is related to the onset of the sea breeze near midday, which tends to bring a quick halt to the normal afternoon decrease of humidity.

The driest stations at all hours are El Paso, Albuquerque, and Phoenix, generally in that order. Los Angeles and San Diego are the most humid, except in the early morning between about 0430 and 0900 MST when the highest values are found at Fresno. This latter station, which is located in the San Joaquin Valley between the Sierra Nevada range to the east and the coast range to the west, is subjected to a high frequency of morning radiation fog during December and January. As is typical of valley locations, Fresno also has the largest diurnal variation of relative humidity, recording an average maximum of 82.7 percent (the highest of all the stations) near 0630 MST and an average minimum of 40.1 percent near 1630 MST. The minimum is comparable to that at Salt Lake City. San Diego has the smallest diurnal range, followed closely by Los Angeles. The range at these stations is barely greater than one-half of that at Fresno.

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[1] Pacific Standard Time.

It is interesting to note the sharp drop in humidity and the lag in the time of the maximum and minimum, especially the latter, in the seventeen miles between the Los Angeles International Airport and the Burbank Airport, three and fourteen miles inland, respectively, from the coast.

Figure 2 refers to the annual mean relative humidity. For the individual months, there is a very slight tendency for the maximum to occur about an hour earlier in summer than in winter, but only at the inland stations. There is an even slighter tendency for the minimum to occur earlier in autumn and winter than in spring and summer.

Figures 4 to 9 show the annual variation of the mean monthly relative humidity at various stations in the southwest. These means were computed by averaging the mean hourly humidity values at the four observation times, 0000, 0600, 1200, and 1800 MST, for those stations at which these data are available. In the figures the stations are grouped according to the month of minimum relative humidity. This parameter was selected over several others (e.g., mean relative humidity, annual range, month of maximum, etc.) because it appeared to be of the greatest physical significance and to have the most consistent areal distribution, as is indicated in Figure 3 and Table 1. Figure 3 also gives the annual mean relative humidity and the annual range at each station. At locations with both city and airport offices, the two records have been combined unless marked differences exist, in which cases the values for the airport stations have been entered in parentheses. As an aid in the anlysis and the plotting of Figures 4-9, some of the major areas in Figure 3 have been subdivided into sections whose boundaries were established partly on the basis of topographical features, but mainly on the basis of the annual range of relative humidity.

In general, there is a lag in the month of minimum relative humidity from March in the southeast corner of the region under consideration (western Texas) to August

Table 1

Areal distribution of month of minimum relative humidity.

Area in Figure 3	Month of Minimum
I	March
II	April
III	May
IV	June
V	July
VI	August
VII	September
VIII	November

in the northwest corner (northern Nevada). This phenomena is probably tied up closely with the movements of the subtropical highs of the Pacific and Atlantic Oceans, the western edge of the latter providing most of the moisture for the summertime thunderstorm activity in the area. Two small regions do not conform with the general pattern. One is located on the lee side of the Rockies, where the lowest humidities occur in September, a month of transition from the convective showers of summer to the cyclonic precipitation of winter. It should be mentioned here that all of the stations in area IV (June minimum) have a secondary minimum in the fall, usually in September. The other nonconforming area is coastal southern California, which has its lowest humidities in November, probably because in the late fall land-water temperature contrasts are too weak to support a vigorous sea-breeze circulation and the storm tracks are still too far north to produce more than infrequent rainy spells.

II. DEW POINT.

A. Nature of the data. From the mean relative humidity at 0600 MST and the mean minimum temperature it was possible to estimate the mean dew point at 0600 MST for each month at each station for which data were available. This procedure involves two sources of error which, fortunately, act in opposite directions. The first results from the assumption that the minimum temperature occurs at 0600 MST. It actually occurs more nearly at the time of maximum relative humidity, which is usually between 0400 MST and 0600 MST (see Figure 2). However, during this period the humidity never changes by more than about four percentage units on the average. Since a small error in relative humidity results in an even smaller error in dew point (assuming the minimum temperature to be correct), it is estimated that the latter could rarely exceed 2°F. Also, since, for a fixed temperature, the dew point increases as the relative humidity increases, the use of a submaximum relative humidity and the minimum temperature to compute the dew point would result in the latter being too low. Thus, this source of error yields dew points which in some cases may be too low by 2°F.

The second source of error results from the exponential relation between temperature and vapor pressure and the use of mean temperatures and humidities to compute mean dew points. The extent of this error, which is a function of the variance of dew point and is always positive, was investigated at six first-order Weather Bureau stations in Arizona. At these stations, Flagstaff, Winslow, Prescott, Phoenix, Tucson, and Yuma, temperature, relative humidity, and dew point data were available for eight hours of each day for a four to eight year period. For each station the mean monthly dew point for each hour was computed by two methods. First, the exact value was determined directly from the observations. Then an approximate value was computed using the mean monthly temperature and relative humidity. The difference between the two, averaged for all six stations, is given for each month and hour in Table 2.

There are several interesting features in this table:

a. The smallest average errors occur in all months between 0020 and 0620 MST, never exceeding 2.2°F.

b. The largest average errors occur in all months between about 1420 and 1720 MST, earliest in winter and latest in summer.

c. Between about 1620 and 0920 MST the largest average errors occur in July, while during the middle part of the day the maximum errors tend to occur in March and April.

d. For the day as a whole, the largest average error occurs in July (2.9°F), followed in order by April, March, June, and September.

e. For the day as a whole, the smallest average error occurs in the late fall and early winter (1.6°F in January) and in May.

f. For the year as a whole, the largest average error occurs at 1520 MST (3.7°F), with a range of 72 individual values (twelve for each of the six stations) from 1 to 6°F.

Table 2

Average error (°F) involved in estimating the mean dew point from the mean relative humidity and the mean temperature. Numbers in parentheses give the range of errors among the six Arizona stations. Based on hourly data from Flagstaff, Winslow, Prescott, Phoenix, Tucson, and Yuma, Arizona.

	Hour (MST)								
Month	0020	0320	0620	0920	1220	1520	1820	2120	Day
Jan.	0.8	1.0	1.0	1.2	2.5	3.0	2.0	1.3	1.6
Feb.	1.2	1.3	0.8	1.8	2.8	3.7	2.7	1.5	2.0
Mar.	2.0	1.3	1.3	2.3	3.7	4.5	3.5	2.2	2.6
Apr.	2.0	1.5	1.5	2.5	3.8	4.5	4.0	2.5	2.8
May	1.7	1.2	1.2	2.0	2.5	2.5	2.7	1.8	1.9
June	2.0	1.5	1.7	2.3	2.7	3.7	3.7	2.2	2.5
July	2.2	1.7	1.5	2.5	3.5	4.3	4.3	3.0	2.9
Aug.	1.3	1.0	0.5	1.8	2.7	3.5	3.5	2.2	2.1
Sept.	1.3	1.3	1.3	2.0	3.2	4.0	3.2	2.2	2.3
Oct.	1.7	1.0	1.3	1.8	2.7	3.3	2.3	1.8	2.0
Nov.	1.3	1.2	0.8	1.8	3.0	3.5	1.7	1.5	1.9
Dec.	1.3	1.2	1.0	1.3	2.5	3.3	2.0	1.5	1.8
Year	1.6 (0-3)	1.3 (0-3)	1.2 (0-2)	2.0 (0-4)	3.0 (1-5)	3.7 (1-6)	3.0 (1-5)	2.0 (0-4)	2.2

g. For the year as a whole, the smallest average error occurs at 0620 MST (1.2°F), the individual errors never exceeding 2°F.

There is no pattern among the individual stations; the largest average errors occurred at Tucson (2.7°F) and Prescott (2.5°F) and the smallest at Phoenix (1.6°F) and Flagstaff (1.8°F).

It is point (g) above that is most important for this study. The result that the error resulting from determining the mean dew point using the mean relative humidity and mean temperature never exceeded 2°F at 0620 MST gives reasonable assurance that the approximation involved is not drastic in the early morning hours. Also, this positive error appears to be of the same general order of magnitude as the negative error resulting from the noncoincidence of the minimum temperature with the 0600 relative humidity. Thus the two should tend to cancel one another and, assuming that the minimum temperatures and relative humidities are correct, the derived dew points should not be off by more than about 2°F. However, since the listed relative humidities are subject to some uncertainty, it is probable that the maximum error is closer to 4°F.

B. Results. The distribution of the estimated mean 0600 MST dew point for January, April, August, and October is shown in Figures 10-13. Since dew point is a reasonably conservative quantity and is less dependent on local effects than relative humidity, these figures should be quite accurate in regions of sufficient data. The general similarity of the patterns for the four months precludes the necessity of presenting those for the rest of the year.

In general, areas of high dew point are found on the windward side of mountains or near bodies of water, while areas of low dew point are located at high elevations and on the leeward side of mountains. In particular, the following regions are characterized by dew points which are above average for their latitude.

a. The Gulf Coast of Texas and the western Great Plains. The inflow of moisture from the Gulf of Mexico is evidently strong enough to keep the dew point relatively high as far north as southern Wyoming on the leeward slopes of the Rocky Mountains. The highest observed dew points in the southwest are reported along the immediate Gulf Coast, with average monthly values near 70°F found in this region in mid-summer. Even in January the dew points are higher here than they are in the Rocky Mountains and the Great Basin in August.

b. Coastal southern California and the Imperial Valley. Dew points in this area are consistently high through the year, varying from about 40°F in winter to 60°F in summer. The primary source of moisture, the Pacific Ocean, is augmented by extensive inland agricultural activity. Because of the normal stability of the air and the presence of the San Bernardino Mountains a short distance inland, most of the moisture is trapped near the surface. This is partially indicated by data for Mt. Wilson, which, at an elevation of 5709 feet, has an average annual dew point about twenty degrees lower than that for Burbank (737 feet), only sixteen (horizontal) miles away. This difference is about four times too large to be explained by the difference in elevation. The effect of the mountains in producing a convergence or accumulation of moisture near their base is shown by the lower dew points offshore on Santa Catalina Island than on the mainland.

c. The Salt River Valley of Arizona. The high dew points in this region, especially in summer, are due partly to its location on the windward side of the Mogollon Plateau and partly to very intensive agricultural activity. The summer dew point are quite comparable to those in western Texas and coastal southern California. The highest observed daily values in this region are near 72°F.

d. The Colorado Plateaus. This area of relatively high dew points may not be as extensive as indicated. Lack of data prevents placing any great confidence in the analysis, which was drawn as smoothly as possible. There is definitely a tongue of high dew points extending northward along the western slopes of the Rocky Mountains to about central Colorado. To the west of this tongue there is an area of low dew point associated with subsidence on the leeward side of the Wasatch

Range of Utah. But the boundary between the two is indeterminate. In the analysis presented here it has been placed in the vicinity of the upper Colorado River.

e. The Great Salt Lake Valley. The combination of upslope motion on the windward side of the Wasatch Range, agricultural activity, and evaporation from the Great Salt Lake combine to produce this sector of relatively high dew point. In summer there are indications that some of the moisture is derived from the Pacific Ocean via the southern edge of the Sierra Nevada Mountains. This may also be true in other seasons of the year but to a lesser extent. Maximum average dew points in this region are ten to twenty degrees lower than those found further south but about ten degrees higher than those found to the east and west.

f. San Joaquin Valley. Because of its location on the fringe of the area of primary interest in this study, this region is not well defined. However, it definitely does exist, being bounded very sharply on the east by the Sierra Nevada Range. To the west its border probably coincides with the Diablo Range; however, it may extend into the Pacific Ocean. Toward the southern extremity of the Sierras a tongue of moist air extends from the coast across the northern part of the Mohave Desert into southern Nevada.

g. Rio Grande Valley. A relatively minor tongue of moist air extends up the Rio Grande River to about Santa Fe, New Mexico. Moderately high dew points in this region are the result of evaporation from the river, irrigation, and an upslope flow of moisture from the Gulf of Mexico. The latter is particularly intense in summer.

Excluding the high mountain ranges of the southwest, which because of their elevation are regions of low dew point, there are two particularly arid sections. The largest and most extreme of these covers most of central Nevada which even in midsummer has average dew points below freezing. The second lies in the Mohave Desert of southern California. Both of these regions are cut off from the primary moisture sources for the southwest. In summer they are too far west on the continent to be affected by the flow of moisture from the Gulf of Mexico. In winter, storms moving in from the Pacific Ocean lose most of their moisture on the windward slopes of the coast and Sierra Nevada ranges, leaving very little for the parched desert lands further inland. However, both regions receive their heaviest precipitation in winter, central Nevada from storms moving southward on the leeward side of the Sierra Nevadas and the Mohave Desert from Pacific storms that have formed or intensified unusually far south, advancing into the area from the southwest.

No attempt was made to estimate mean dew points at times other than 0600 MST. However, a general picture of the diurnal variation for most of the southwest may be obtained from the data for the six Arizona stations used in the previously discussed error study. Figure 14 shows the diurnal variation of dew point for these stations for six months of the year. There are several interesting facts which may be derived from this figure. Among these are the following:

a. There is no really clear-cut and universal diurnal variation of dew point. In most cases the range is small, usually not exceeding 5°F.

b. In practically all months and at most stations the lowest dew points tend to occur in the midafternoon, although in a number of cases there is a secondary minimum in the early morning. The primary minimum is related to the spreading of the surface moisture through a rather deep layer of the atmosphere during the daylight hours when turbulent mixing is at a maximum. The secondary minimum, on the other hand, is associated with the formation of dew on the ground in the early morning hours when the air is near saturation.

c. At Flagstaff in winter the highest dew points are recorded in the afternoon, probably because daytime temperatures are often high enough to melt some of the normal snow cover, hence increasing the moisture content of the air and raising the dew point. At night some of this moisture may recondense as ice if the temperature falls below 10 or 15°F.

d. At Phoenix, which normally has the highest dew points, particularly in winter, there is an insignificant diurnal variation, except possibly in August. This may reflect the tendency for the daytime evaporation of irrigation water to offset the normal midafternoon drop in the dew point. This suggests that in regions with an adequate surface water supply (e.g., reservoirs, snow fields, and heavily irrigated farmlands) the dew point will reach a maximum in the midafternoon and a minimum in the early morning, i.e., the trend will be the opposite of that found in most desert areas.

III. ESTIMATION OF RELATIVE HUMIDITY.

As part of the punched card climatological program of the Institute of Atmospheric Physics, a series of climatic summaries has been prepared for 113 cooperative weather stations in Arizona. Most of these summaries contain, among other information, estimated values of the mean monthly relative humidity at 0600 and 1800 MST. Since, as far as it is known, the particular method of estimation has not been used before, it will be described briefly in the following paragraphs.

The basic assumption of the method is that the dew point temperature, T_d, varies linearly with the air temperature, T. Both temperatures are expressed in absolute units. Symbolically, this means that

$$T_d = aT \tag{1}$$

where a is a constant. Actually, the relationship should be closer to the form

$$T_d = b_1 T^{1/2}$$

if physical reasoning is used. However, the range of temperatures involved is small compared to the absolute magnitudes, so that no accuracy is lost by using the simpler form.

If latent heat of condensation is assumed to be independent of temperature, then according to Holmboe, Forsythe, and Gustin (1),

$$\log e_s = 8.4051 - 2353/T$$
$$\log e = 8.4051 - 2353/T_d \quad ,$$

where e_s is the saturation vapor pressure at temperature T and e is the actual vapor pressure or the saturation vapor pressure at temperature T_d. Logarithms to the base ten are used.

Defining the relative humidity (approximately) as one hundred times the ratio of the actual vapor pressure to the saturation vapor pressure at temperature T, then

$$R = 100e/e_s \quad \text{and}$$
$$\log R = 2 + \log e - \log e_s = 2 + 2353(1/T - 1/T_d),$$

but, by equation (1), $T_d = aT$, so that

$$\log R = 2 + 2353(a - 1)/aT = 2 + bT^{-1} \tag{2}$$

where $b = 2353(a - 1)/a$. (3)

The development could stop with equation (2); however, since it is convenient to use temperature units of degrees Fahrenheit, note that

$$T - 273 = 5(t - 32)/9 \quad \text{or} \quad T = 5t/9 + 255$$

where t is the temperature in degrees Fahrenheit. Equation (2) then becomes

$$\log R = 2 + b(5t/9 + 255)^{-1} = 2 + (b/255)\ [5t/9(255) + 1]^{-1} \tag{4}$$

The quantity $5t/9(255)$ has a maximum value of about 0.2 and is therefore normally much less than one. Hence, the bracketed quantity may be approximated by the first two terms in the bincmial expansion

$$(1 + x)^{-1} = 1 - x + x^2 - x^3 + x^4 - \ldots,$$

where $x = 5t/9(255)$. Therefore,

$$\log \hat{R} = 2 + (b/255)\ [1 - t/9(51)] = (2 + b/255) - [b/9(51)\ (255)]t$$

$$\text{or} \qquad \log \hat{R} = c - dt, \tag{5}$$

where

$$c = 2 + b/255 \text{ and } d = b/9(51)(255)$$

and the $\wedge$ over R indicates that it is an estimated value. The constants and a could be determined from observed data using equations (1) and (3). For example, the average annual value of a for the six Arizona first-order Weather Bureau stations is 0.968 at 0620 MST and 0.932 at 1820 MST. These correspond, respectively, to values of b of 77.8 and 171.7, of c of 2.305 and 2.673, and of d of 0.000665 and 0.001467.

However, this method does not give any indication about how good an approximation equation (5) is to the actual relative humidity. Therefore, it is better to use the least squares technique to evaluate the regression coefficients c and d, since this method yields a measure of the goodness of fit, i.e., the correlation coefficient. For this purpose, for each month the average 0600 and 1800 MST relative humidities at all Arizona stations for which they are available were correlated, respectively, with the average minimum and maximum temperatures. The failure of the times of these extremes to coincide exactly with 0600 and 1800 MST has no great bearing on the problem, although the resulting regression coefficients may be quite different from those given above. These coefficients and the correlation coefficients for each month are listed in Table 3.

In general, the best results, i.e., the highest correlations, were obtained for the winter and summer months of high humidity and the poorest results for the spring and fall months of low humidity. The standard error of estimate, not shown in the table, averages about six percentage units of relative humidity, ranging from about four to eight percentage units. It has no systematic variations, since the months with the best correlations between temperature and relative humidity are also the months of greatest variance of these variables.

In using equation (5) to estimate the mean monthly relative humidity at stations for which only temperature data are available, it is convenient to plot it on semi-log paper, with relative humidity on the logarithmic scale. When this is done for

Table 3

The regression coefficients c and d in the expression log $\hat{R} = c - dt$, relating the estimated average relative humidity, $\hat{R}$, in percent, to the average temperature, t, in degrees Fahrenheit. At 0600 MST, the temperature is the average minimum; at 1800 MST, it is the average maximum. Also given is the correlation coefficient, r, between the common logarithm of the relative humidity and the temperature. All coefficients were determined from data for 22 Arizona stations.

	Hour					
	0600 MST			1800 MST		
Month	c	d	r	c	d	r
January	1.936	0.00415	-0.71	2.142	0.00894	-0.87
February	1.956	0.00425	-0.78	2.174	0.00963	-0.87
March	1.960	0.00519	-0.80	2.232	0.01135	-0.82
April	1.974	0.00582	-0.77	2.219	0.01122	-0.82
May	1.988	0.00659	-0.74	2.168	0.01076	-0.74
June	1.935	0.00533	-0.61	2.032	0.00826	-0.55
July	2.097	0.00500	-0.83	2.596	0.01142	-0.84
August	2.090	0.00394	-0.80	2.434	0.00931	-0.82
September	1.995	0.00350	-0.70	2.157	0.00723	-0.70
October	1.988	0.00458	-0.78	1.986	0.00562	-0.64
November	1.943	0.00488	-0.75	2.016	0.00643	-0.72
December	1.941	0.00402	-0.73	2.049	0.00664	-0.75

each set of constants in Table 3 a series of 24 straight lines results, one for each of the two hours in each of the twelve months. It is then merely necessary to enter these graphs with the average maximum or minimum temperature and read off the estimated average 0600 or 1800 MST relative humidity for a particular month.

While these estimates are probably fairly accurate, they may be improved upon by noting that the errors of estimation at the stations from whose data the regression constants were evaluated have a definite geographical pattern. This pattern may be analyzed to give errors of estimate for any station in the area for either hour and for any month. As an example, Figure 15 shows the deviations of the observed relative humidities for April at 0600 MST from the values estimated using equation (5). In practice only the State of Arizona was considered. However, here the error analysis has been extended to all of the southwest, using the data for the stations listed in the Appendix, in order to bring out more clearly the geographical distribution of errors. When these deviations from regression, denoted by e, are taken into account, equation (5) becomes

$$\hat{R} = \exp\,[2.3(c - dt)] + e$$

which is the expression used to estimate the monthly 0600 and 1800 MST relative humidity at 91 cooperative weather observing stations in Arizona. The first term on the right was evaluated from the graphical representation of equation (5) using the constants of Table 3; the second term was determined for each station, hour, and month from analyzed state maps of the deviations from regression, i.e., deviations from equation (5).

Figure 15 has a definite climatological interpretation insofar as it delineates regions of moisture deficit and surplus in the southwest. Thus, a station on the southern California coast recording the same average 0600 MST temperature in April as a town in central Arizona might be expected to have an average relative humidity more than twenty percentage units higher than the Arizona town.

The same would be true for a city in southern Texas, another region of moisture surplus (relative to central Arizona). On the other hand, most of the Mohave Desert, southern Nevada, and the central Rocky Mountains have a moisture deficit.

For the year as a whole, the regression equation relating the logarithm of the average annual relative humidity (the mean of the 0600 and 1800 MST values) to the average annual temperature has the following form:

$$\log \hat{\bar{R}} = 2.042 - 0.00621\ \bar{t} \qquad (6)$$

The correlation coefficient between the two quantities is 0.90; the standard error of estimate of the relative humidity is about $\pm$ 3.4 percent. This equation, derived from Arizona data, was applied to all first-order Weather Bureau stations in the United States, Alaska, Canada, and Mexico, using the average of the highest and lowest reported mean annual relative humidities for $\bar{R}$.

The distribution of the errors of regression is shown in Figure 16. Largest positive values, exceeding forty percentage units, are found in the Caribbean Sea and the Atlantic and Pacific Oceans, with Ponape Island (not shown in the figure) in the South Pacific recording the largest positive deviation, 50.9 percentage units. Negative errors of regression are found in the southern Great Basin, the Rocky Mountain system, the Chihuahuan Desert of Mexico, and northern Alaska (off the map). Point Barrow, Alaska, with a value of -16.4 percentage units, has the largest negative deviation. In the eastern United States, where the pattern appears to be disturbed only by the Great Lakes, the Mississippi River, and the Appalachian Mountains, values range from about twelve percentage units along the northern border to over thiry-five units in southern Florida.

From the figure and equation (6) it is possible to estimate the mean annual relative humidity at any point in the country given its mean annual temperature. This estimate should be better than that derived from a map of mean annual humidity, because the latter varies greatly both horizontally and vertically, while the regression deviations are relatively insensitive to changes in topography, these changes being taken into account mainly by variations in the mean annual temperature.

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APPENDIX.

TABLE I. Mean Relative Humidity (RH) and Dew Point (DP) for Arizona

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ajo	9/1919-	RH	0600	57	57	49	45	35	32	48	60	53	49	49	59
(1770')	4/1932		1200	41	39	34	28	22	19	34	39	34	33	33	42
			1800	40	37	31	25	20	18	30	35	31	34	36	45
		DP	0600	26	30	30	33	33	39	55	59	53	41	31	29
Bisbee	11/1932-	RH	0600	50	52	46	42	38	40	59	68	62	57	48	52
(5350')	3/1937		1200	34	39	32	28	27	29	44	50	44	42	34	37
			1800	33	32	26	22	22	26	42	47	42	39	30	34
		DP	0600	16	20	21	24	28	37	49	51	46	35	22	20
Clemenceau	7/1920-	RH	0600	57	58	52	47	43	40	52	59	55	54	54	61
(3460')	12/1936		1200	47	45	38	33	29	28	36	38	38	36	39	48
			1800	46	43	34	30	26	25	36	40	37	40	43	52
		DP	0600	17	22	23	27	32	37	51	52	45	34	24	20
Flagstaff	1/04-2/12	RH	0600	79	80	79	75	67	58	73	85	80	75	77	79
(6915')	8/22-6/37		1800	65	57	46	35	27	22	42	50	42	41	51	63
		DP	0600	10	13	17	21	24	27	43	45	36	25	16	11
Flagstaff	1/1944-	RH	0600	73	72	70	68	59	52	66	78	68	71	63	70
(6937')	12/1949		1200	47	43	39	30	25	22	30	39	29	35	34	45
			1800	56	50	42	34	24	22	39	44	37	41	46	54
			0000	69	67	60	59	47	41	56	68	59	64	58	64
		DP	0600	8	11	15	19	21	25	40	42	32	24	11	8
Flagstaff Airport	1/1950-	RH	0600	81	81	79	74	63	57	76	85	76	78	78	80
(6998')	12/1957		1200	54	50	41	33	26	21	33	38	28	33	37	52
			1800	62	56	44	36	26	20	43	44	36	39	44	58
			0000	77	74	63	61	50	38	65	70	57	59	65	72
		DP	0600	7	11	16	21	24	28	44	46	35	25	15	10

TABLE I. Mean Relative Humidity (RH) and Dew Point (DP) for Arizona (Contd)

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fort Grant (4851')	1/1891-7/1891	RH	0600	58	60	55	50	39	38	58					
			1800	43	44	40	32	25	24	38					
		DP	0600	20	23	26	28	30	37	52					
Grand Canyon Airport (6367')	3/1937-6/1939	RH	0600	60	64	66	63	55	55	74	84	73	60	56	58
			1800	53	53	45	31	23	22	41	47	41	40	42	53
		DP	0600	8	13	16	23	27	34	49	51	42	26	14	10
McNary (7251')	1/1935-4/1936	RH	0600	70	74	72	67	64	66	85	84	78	74	67	72
			1200	50	55	48	42	38	42	68	64	52	44	41	50
			1800	64	69	56	51	43	50	74	72	64	62	58	66
		DP	0600	8	11	15	18	22	29	44	43	36	26	14	11
Payson (5004')	9/1948-4/1952	RH	0600	70	70	64	59	50	46	60	67	59	60	57	68
			1200	47	44	39	31	26	21	30	37	33	37	35	49
			1800	54	48	39	32	24	22	38	38	36	41	44	54
			0000	66	67	55	50	42	35	54	55	52	55	50	64
		DP	0600	10	14	14	18	19	24	41	44	33	22	11	11
Phoenix (1096')	1/1918-6/1939	RH	0600	66	67	59	48	41	37	53	61	58	58	62	70
			1200	33	35	27	21	17	16	28	33	28	25	28	36
			1800	34	33	25	19	15	14	24	29	28	30	36	41
		DP	0600	28	32	33	33	37	42	58	61	53	41	33	29
Phoenix Airport (1119')	7/1939-12/1957	RH	0600	75	71	63	54	43	39	53	62	57	60	67	72
			1200	46	38	31	25	19	17	29	35	28	30	31	42
			1800	44	36	27	21	15	15	24	29	27	32	39	44
			0000	68	59	48	42	33	30	42	49	47	52	59	64
		DP	0600	27	30	32	34	36	40	57	60	51	40	31	29

TABLE I. Mean Relative Humidity (RH) and Dew Point (DP) for Arizona (Contd)

Station (elevation)	Period of Record	Element	Hour (MST)	Month											
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Oak Knoll (5495')	7/1920-12/1930	RH	0600	73	75	65	55	44	36	57	68	64	65	65	77
			1800	51	48	40	33	23	17	39	46	40	39	44	58
		DP	0600	13	16	18	19	19	22	42	44	35	25	17	15
Prescott Airport (5019')	1/1944-9/1957	RH	0600	73	71	63	57	47	39	60	70	59	61	67	73
			1200	49	42	31	24	19	15	29	37	25	29	34	45
			1800	50	40	31	25	18	16	33	38	29	34	41	49
			0000	67	62	50	44	35	29	51	56	46	49	56	62
		DP	0600	13	17	18	23	25	29	47	50	38	28	19	17
Roosevelt (2250')	10/1916-11/1916	RH	0600										56	56	
			1200										34	34	
			1800										40	41	
		DP	0600										39	30	
Sierra Ancha (5100')	9/1936-6/1938	RH	0600	60	66	58	50	45	41	55	71	60	57	58	62
			1200	42	48	42	33	30	28	36	44	39	36	38	46
			1800	53	53	45	31	24	24	42	51	43	46	51	55
		DP	0600	18	23	23	26	30	34	47	53	46	35	24	22
Tucson Univ. of Arizona (2423')	9/1919-12/1954	RH	0600	70	68	55	49	39	36	53	66	59	58	57	69
			1200	38	35	28	22	18	19	28	37	31	27	30	40
			1800	43	38	29	22	16	18	31	37	34	34	39	49
		DP	0600	26	28	27	30	30	36	55	59	50	38	27	27
Tucson Davis-Monthan AFB (2562')	12/1932-9/1948	RH	0600	65	64	57	43	34	32	53	70	59	54	54	65
			1200	38	35	27	19	16	16	28	38	33	27	29	39
			1800	40	35	26	19	13	14	27	38	33	32	35	45
			0000	60	53	45	32	24	24	43	57	48	45	48	60
		DP	0600	23	25	28	30	29	37	55	60	55	37	33	27

TABLE I. Mean Relative Humidity (RH) and Dew Point (DP) for Arizona (contd)

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tucson Airport (2564')	10/1948-12/1957	RH	0600	63	60	52	42	33	32	57	64	49	50	52	61
			1200	37	29	23	17	14	13	30	34	24	25	25	35
			1800	35	30	21	16	12	12	31	34	25	27	32	38
			0000	56	48	39	32	26	25	47	51	38	40	47	54
		DP	0600	24	27	26	28	28	35	57	59	47	37	28	26
Winslow Airport (4885')	1/1933-11/1936	RH	0600	80	76	62	58	52	42	62	74	69	70	70	80
			1200	57	44	30	25	21	17	29	35	34	34	40	50
			1800	56	38	29	24	20	18	30	36	32	33	42	52
		DP	0600	14	18	18	24	28	31	49	52	42	30	18	15
Winslow Airport (4899')	10/1948-12/1957	RH	0600	71	71	59	49	44	37	58	65	56	56	66	72
			1200	46	41	27	20	16	13	24	29	25	28	34	46
			1800	44	38	24	19	15	13	27	30	25	29	38	46
			0000	64	58	43	39	34	28	46	49	42	45	54	63
		DP	0600	11	18	17	21	25	28	47	48	38	26	18	14
Yuma (147')	1/1918-6/1950	RH	0600	58	58	55	56	53	53	60	67	64	60	52	57
			1200	33	29	24	22	20	19	28	32	28	27	26	34
			1800	32	29	22	18	16	16	24	30	27	30	32	38
			0000	50	48	42	36	34	33	44	50	48	48	46	50
		DP	0600	28	32	34	39	43	50	62	65	57	44	32	29
Yuma Airport (203')	7/1950-12/1957	RH	0600	57	51	47	44	38	35	47	56	57	52	49	53
			1200	34	26	20	16	18	14	24	29	26	25	22	33
			1800	31	23	14	14	10	11	20	24	24	25	25	31
			0000	49	42	36	36	33	28	35	42	43	42	42	46
		DP	0600	29	30	32	36	39	43	60	64	59	45	33	30

TABLE II. Mean Relative Humidity (RH) and Dew Point (DP) for New Mexico

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Agri. College (3909')	10/1920-6/1948	RH	0600	66	67	56	48	49	51	66	70	70	68	66	70
			1800	44	38	28	25	23	24	36	42	40	42	43	47
		DP	0600	15	19	20	23	31	40	54	54	46	34	20	18
Albuquerque Univ. of N.M. (5198')	2/1919-3/1931	RH	0600	74	66	60	54	53	48	62	68	66	64	68	76
			1800	50	39	31	26	26	22	33	38	34	35	42	54
		DP	0600	15	18	21	26	33	38	50	50	43	31	21	17
Albuquerque TWA Airport (5105')	2/1933-6/1937	RH	0600	77	71	66	60	60	56	69	74	74	74	72	78
			1200	43	36	33	26	26	24	34	36	37	37	39	45
			1800	45	34	31	24	22	22	33	39	37	39	47	53
		DP	0600	14	16	20	26	34	40	52	52	45	33	19	16
Albuquerque Airport (5315')	8/1939-12/1957	RH	0600	69	64	55	51	47	42	59	66	56	60	61	68
			1200	48	40	31	27	25	22	32	36	32	33	39	48
			1800	49	38	30	23	22	19	31	35	30	34	38	48
			0000	64	55	46	39	38	33	48	54	44	48	51	60
		DP	0600	13	16	18	25	32	38	51	53	42	32	19	15
Anton Chico (5500')	1/1945-11/1946	RH	0600	65	67	60	59	61	62	80	79	77	68	56	58
			1200	42	33	31	27	28	21	32	34	35	29	26	27
			1800	52	42	37	31	31	22	44	41	40	40	39	43
			0000	68	59	52	55	55	54	67	72	64	64	54	55
Carrizozo (5420')	2/1941-4/1948	RH	0600	64	64	55	53	49	49	66	67	67	62	60	64
			1200	46	30	26	23	20	22	30	31	31	30	33	36
			1800	48	38	29	22	22	23	37	38	37	36	44	49
			0000	62	56	46	40	37	40	55	57	54	55	54	64
		DP	0600	14	16	17	23	30	37	48	48	42	30	16	14

TABLE II. Mean Relative Humidity (RH) and Dew Point (DP) for New Mexico (contd)

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Clayton (5025')	2/1941-3/1944	RH	0600	59	63	61	65	63	67	71	72	70	62	55	54
			1200	35	35	29	33	29	35	37	34	35	32	26	31
			1800	46	40	35	34	34	35	45	36	39	34	39	43
			0000	57	58	56	58	58	64	67	66	60	54	55	53
		DP	0600	7	11	15	26	35	45	51	50	42	28	12	7
Clayton Airport (4974')	4/1944-12/1957	RH	0600	67	67	70	69	73	69	75	78	73	69	67	67
			1200	47	43	39	40	42	38	41	41	39	39	40	42
			1800	60	51	44	42	45	39	48	47	43	49	56	59
			0000	68	69	69	69	74	70	73	75	70	68	67	68
		DP	0600	10	13	19	27	38	45	52	52	44	32	18	13
Crownpoint (6978')	2/1941-4/1948	RH	0600	67	64	55	45	41	38	53	61	51	59	62	66
			1200	52	43	39	29	24	25	31	36	30	33	39	42
			1800	59	48	38	27	26	21	35	40	30	40	50	56
			0000	67	61	50	40	38	35	47	57	44	53	58	64
		DP	0600	11	13	14	17	23	29	42	44	33	27	17	12
El Morro Natl. Mon. CAA APT (7218')	1/1942-5/1948	RH	0600	81	85	79	72	65	62	80	87	82	77	77	78
			1200	55	49	45	35	28	23	33	39	33	34	45	49
			1800	66	58	47	38	31	25	44	53	40	43	56	60
			0000	81	81	72	61	54	49	69	78	67	73	74	74
		DP	0600	7	13	16	21	24	30	45	46	39	26	13	9
Engle CAA Airport (4848')	2/1941-5/1948	RH	0600	73	63	56	52	49	52	71	75	66	66	63	68
			1200	45	34	28	24	21	25	35	34	34	31	33	37
			1800	49	34	27	23	23	23	36	38	37	35	38	45
			0000	66	53	43	38	40	43	57	60	54	55	52	63
		DP	0600	17	17	19	23	30	39	53	54	45	33	20	17

TABLE II. Mean Relative Humidity (RH) and Dew Point (DP) for New Mexico (contd)

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Farmington (5300')	1/1942-5/1948	RH	0600	79	80	71	62	58	54	63	73	70	69	76	76
			1200	58	43	37	26	22	17	32	35	33	31	39	54
			1800	62	46	36	24	24	19	35	39	36	44	52	62
			0000	80	73	61	50	49	45	53	61	58	66	70	75
		DP	0600	10	16	18	23	28	33	45	47	38	28	17	12
Fort Stanton (6150')	1/1891-10/1893	RH	0600	60	57	55	52	45	51	70	72	73	65	65	70
			1800	50	40	30	25	20	26	44	45	47	47	54	62
		DP	0600	9	10	14	18	22	32	44	43	38	25	16	12
Las Vegas Hilands Univ. (6435')	1/1942-5/1948	RH	0600	64	67	58	64	66	62	78	81	76	71	62	60
			1200	44	39	36	34	34	25	35	37	38	31	35	37
			1800	56	49	39	35	36	29	46	53	47	50	51	52
			0000	65	64	56	58	62	56	71	75	66	67	58	60
		DP	0600	6	11	12	22	30	38	47	48	39	28	12	7
Mogollon Airport (6566')	1/1942-6/1947	RH	0600	79	75	66	55	56	53	76	85	81	74	71	74
			1200	39	35	35	24	20	16	31	40	37	31	33	34
			1800	60	42	36	23	21	18	46	54	42	43	49	56
			0000	78	68	60	48	45	38	67	77	67	68	69	71
		DP	0600	14	16	17	20	26	32	45	48	42	30	19	16
Raton Airport (6384')	2/41-8/53 11/55-12/57	RH	0600	72	70	67	67	69	67	76	83	77	72	70	71
			1200	45	42	36	33	35	33	34	38	33	33	37	40
			1800	53	46	40	41	38	35	45	49	45	44	50	51
			0000	68	62	61	59	65	62	69	76	67	64	63	64
		DP	0600	3	7	12	20	30	36	46	47	37	25	13	4
Rodeo (4118')	2/1941-5/1948	RH	0600	65	64	55	49	40	40	64	70	63	62	61	65
			1200	39	38	30	23	20	20	34	35	34	33	31	40
			1800	39	36	26	21	18	18	32	38	34	35	36	40
			0000	60	58	46	37	31	31	56	61	54	54	55	62
		DP	0600	17	19	20	22	25	34	52	53	44	34	21	19

TABLE II. Mean Relative Humidity (RH) and Dew Point (DP) for New Mexico (contd)

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Roswell	1/1918-	RH	0600	69	65	57	54	61	64	72	72	76	74	70	71
(3638')	6/1937		1200	42	39	31	27	32	31	38	38	42	40	40	44
	1/1939-		1800	40	34	26	22	28	26	36	37	40	40	41	42
	5/1947		0000	63	55	44	42	47	49	58	60	62	64	60	61
		DP	0600	14	16	18	26	38	46	53	52	47	34	21	17
Roswell	6/1947-	RH	0600	70	67	58	56	58	61	72	74	75	75	66	70
Airport	12/1957		1200	42	38	26	29	27	28	37	36	38	38	34	39
(3633')			1800	49	38	24	24	25	24	37	37	37	44	41	47
			0000	63	55	45	42	48	49	60	61	60	63	57	60
		DP	0600	17	20	22	29	40	48	57	56	50	38	23	19
Santa Fe	1/1918-	RH	0600	70	70	66	60	58	52	65	71	69	67	66	70
(7013')	6/1937		1200	50	49	41	34	32	28	37	39	39	39	43	51
			1800	55	48	39	32	31	28	41	44	41	44	51	59
		DP	0600	11	15	19	22	29	35	45	47	39	28	18	12
Santa Fe	1/1939-	RH	0600	74	73	68	63	61	56	71	76	68	69	68	71
Airport	5/1948		1200	51	45	39	32	30	25	31	36	39	37	37	49
(6494')			1800	58	49	40	30	28	24	37	42	41	43	49	56
			0000	70	66	59	53	52	48	59	68	57	62	62	68
		DP	0600	10	15	16	24	30	36	48	48	39	29	16	11
Socorro	1/1942-	RH	0600	72	63	55	47	47	50	66	71	67	61	61	67
CAA Airport	12/1946		1200	45	32	28	24	24	24	31	34	32	30	34	39
(4760')			1800	51	34	27	21	21	22	34	36	35	33	40	47
			0000	65	54	46	39	38	41	52	59	55	52	53	60
		DP	0600	15	17	18	22	30	39	52	52	44	30	18	15

TABLE II. Mean Relative Humidity (RH) and Dew Point (DP) for New Mexico (contd)

Station (elevation)	Period of Record	Element	Hour (MST)	Month Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tucumcari (4086')	1/1942-5/1948	RH	0600	71	69	64	61	70	65	69	75	71	71	65	70
			1200	40	39	33	31	39	29	36	38	34	37	36	37
			1800	51	44	34	30	40	29	38	42	40	41	46	50
			0000	65	62	54	53	59	53	59	68	63	62	60	65
		DP	0600	15	17	21	30	42	48	54	56	48	36	20	17

TABLE III. Mean Relative Humidity (RH) and Dew Point (DP) for Colorado and Wyoming

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Alamosa Airport (7541')	4/1949-11/1957	RH	0600	78	77	74	73	72	71	79	86	82	76	75	75
			1200	59	52	39	33	32	26	36	40	33	35	45	53
			1800	64	55	42	38	37	28	42	46	39	42	54	63
		DP	0600	-7	-2	7	18	26	32	41	41	31	18	3	-6
Cheyenne, Wyoming (6146')	1/1918-8/1935	RH	0600	61	65	67	72	74	70	68	70	68	66	62	61
			1200	46	48	48	47	46	40	37	38	39	43	45	49
			1800	54	56	53	51	50	44	42	43	43	50	55	57
		DP	0600	4	6	13	21	30	38	42	43	33	23	13	6
Cheyenne, Wyoming Airport (6144')	1/1939-12/1957	RH	0600	62	65	69	73	75	72	70	70	67	66	63	60
			1200	47	49	47	46	46	40	33	35	35	39	43	46
			1800	57	55	54	51	52	46	43	42	41	47	56	56
			0000	63	65	70	73	75	70	68	68	63	64	63	59
		DP	0600	3	6	12	21	30	38	44	44	33	23	12	5
Colorado Springs Col. College (6109')	1/1893-9/1894	RH	0600	68	68	66	69	72	70	68	73	67	69	71	66
			1800	49	42	41	38	41	37	44	51	41	45	49	55
		DP	0600	8	9	15	24	33	40	44	44	36	26	18	7
Colorado Springs Airport (6210')	4/1949-11/1957	RH	0600	59	63	62	66	67	64	66	69	64	60	56	55
			1200	44	42	41	42	40	33	31	34	32	34	38	36
			1800	51	48	43	45	42	37	42	44	38	41	49	46
			0000	58	60	62	64	68	61	64	67	60	61	59	57
		DP	0600	5	9	14	24	33	40	46	47	37	25	12	5

TABLE III. Mean Relative Humidity (RH) and Dew Point (DP) for Colorado and Wyoming (contd)

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Denver (5329')	1/1918-6/1937	RH	0600	61	62	63	65	66	62	62	65	64	63	61	61
			1200	42	42	40	39	38	32	32	34	34	37	41	44
			1800	48	46	42	40	40	34	37	39	37	42	46	52
		DP	0600	9	12	17	26	35	42	49	48	39	29	18	12
Denver Airport (5298')	7/1939-12/1957	RH	0600	62	65	65	66	68	65	63	66	62	61	61	59
			1200	44	43	39	39	38	33	30	32	31	34	38	39
			1800	52	50	43	42	43	36	36	36	35	38	48	49
			0000	61	63	62	63	66	62	59	59	56	57	60	58
		DP	0600	5	9	15	24	33	40	45	45	36	25	14	6
Durango (6552')	1/1906-5/1914	RH	0600	84	81	73	68	65	63	77	82	77	70	78	84
			1800	61	51	38	30	25	21	38	43	37	38	53	63
		DP	0600	8	12	17	21	25	30	44	44	35	23	17	9
Grand Junction (4647')	1/18-6/37 1/39-3/46	RH	0600	82	76	63	60	52	42	51	56	56	64	72	82
			1200	54	48	38	34	26	21	26	32	30	35	44	57
			1800	60	48	36	29	24	18	25	29	30	38	47	60
			0000	78	68	59	50	44	32	41	47	49	65	68	71
		DP	0600	11	16	21	27	32	35	46	47	39	28	21	13
Grand Junction Airport (4860')	9/1946-12/1957	RH	0600	82	77	67	59	51	44	47	55	50	58	73	76
			1200	66	60	42	35	27	23	26	32	28	34	49	61
			1800	71	63	40	30	24	20	25	28	26	35	54	67
			0000	81	74	60	49	43	35	39	44	39	51	67	74
		DP	0600	9	16	20	26	31	34	42	45	36	28	19	13
Montrose (5820')	1/1891-10/1893	RH	0600	80	75	70	69	55	44	49	63	63	67	78	83
			1800	67	61	44	39	25	15	29	35	38	42	43	61
		DP	0600	7	13	18	25	29	28	36	41	33	24	17	10

TABLE III. Mean Relative Humidity (RH) and Dew Point (DP) for Colorado and Wyoming (contd)

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pike's Peak (14134')	9/1892-9/1894	RH	0600	89	74	85	84	80	70	76	82	76	70	79	77
			1800	76	67	79	80	74	72	75	90	74	76	74	76
Pueblo (4746')	1/1918-6/1937	RH	0600	68	67	64	65	67	64	67	72	66	65	67	70
			1200	43	40	36	32	34	29	31	34	33	33	38	45
			1800	46	40	35	32	34	30	35	37	34	36	44	52
		DP	0600	8	10	16	25	36	42	49	50	39	26	16	9
Pueblo Airport (4804')	7/1939-5/1954	RH	0600	70	69	69	69	70	66	69	74	70	67	71	69
			1200	43	40	36	38	36	32	32	33	33	30	36	40
			1800	54	45	39	38	36	31	38	41	36	37	48	52
			0000	68	65	61	62	63	59	60	66	60	58	67	65
		DP	0600	6	11	17	26	37	44	50	49	39	27	15	7
Pueblo Airport (4644')	6/1954-12/1957	RH	0600	71	72	71	71	74	69	70	73	67	70	71	68
			1200	48	47	41	41	40	36	32	34	32	36	42	41
			1800	48	47	42	41	36	34	36	35	34	40	50	47
			0000	68	67	65	64	65	62	59	60	54	60	67	65
		DP	0600	8	12	18	28	38	45	50	50	39	29	17	8
Wagon Wheel Gap (9400')	1/1914-9/1926	RH	0900	72	70	65	55	52	50	68	74	69	65	72	74
		DP	0900	-14	-11	0	4	10	13	25	28	19	9	1	-14

TABLE IV. Mean Relative Humidity (RH) and Dew Point (DP) for Utah and Idaho

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cedar City (5850')	7/1899-12/1900	RH	0600	60	57	51	48	44	35	37	46	48	56	56	63
			1800	46	40	31	28	24	21	27	26	26	32	38	49
		DP	0600	8	11	13	18	24	27	34	37	31	24	15	9
Ft. Duchesne (4990')	1/1891-9/1891	RH	0600	80	80	68	58	43	35	34	50	57			
			1800	72	64	45	30	22	17	17	26	28			
		DP	0600	-5	1	12	17	18	18	24	32	26			
Milford Airport (5033')	8/1948-12/1957	RH	0600	87	86	74	71	64	55	56	59	56	67	79	83
			1200	69	66	45	35	28	27	26	27	25	37	48	63
			1800	71	67	53	33	26	24	25	25	26	38	54	67
			0000	86	79	62	55	55	43	42	44	46	57	70	79
		DP	0600	9	16	18	24	29	33	40	40	29	23	16	11
Modena (5462')	1/1918-6/1940	RH	0600	84	80	74	67	59	46	52	62	58	65	74	83
			1200	60	52	38	32	28	19	27	30	27	32	38	58
			1800	66	56	40	32	26	20	24	29	26	34	48	64
			0000	81	70	63	55	50	34	37	47	48	57	71	77
		DP	0600	10	14	18	22	25	26	37	40	30	23	15	12
Ogden P. H. (4400')	7/1948-8/1948	RH	0600							50	56				
			1200							27	31				
			1800							24	28				
			0000							41	47				
		DP	0600							39	40				
Pocatello, Idaho, (4528')	1/1918-6/1937	RH	0600	81	79	72	68	62	58	50	54	58	66	75	79
			1200	71	67	54	44	35	31	25	28	32	44	58	69
			1800	73	66	52	41	32	26	22	24	28	43	60	72
		DP	0600	13	16	21	25	30	36	38	39	32	26	21	18

TABLE IV. Mean Relative Humidity (RH) and Dew Point (DP) for Utah and Idaho (contd)

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pocatello, Idaho, Airport (4467')	1/1939-5/1949	RH	0600	85	81	77	71	70	64	57	54	62	72	81	83
			1200	75	70	55	44	40	38	29	29	34	49	65	75
			1800	75	70	53	41	37	32	24	25	34	47	67	76
			0000	83	76	68	60	57	52	40	40	48	58	77	81
		DP	0600	12	16	22	27	33	37	42	39	34	29	23	16
Pocatello, Idaho, Airport (4449')	6/1949-12/1957	RH	0600	85	82	79	75	69	66	54	57	60	72	81	84
			1200	77	73	60	46	41	39	28	29	34	49	64	77
			1800	78	72	60	41	36	32	21	22	28	45	64	79
			0000	83	79	73	61	58	52	38	39	43	60	75	82
		DP	0600	9	14	20	27	32	37	39	39	31	27	21	14
Salt Lake City (4430')	1/1918-6/1935	RH	0600	76	73	64	60	55	47	45	48	52	59	66	75
			1200	64	60	48	42	34	27	27	29	33	40	51	64
			1800	70	62	47	40	32	24	25	27	31	44	57	69
		DP	0600	16	18	22	27	32	36	42	43	36	29	22	18
Salt Lake City Airport (4254')	1/1939-12/1957	RH	0600	83	80	73	71	66	62	54	55	60	70	78	82
			1200	69	64	51	42	35	32	26	27	29	42	56	69
			1800	75	67	53	42	34	28	24	25	31	48	67	77
			0000	82	78	71	64	60	54	45	47	53	66	77	81
		DP	0600	13	19	22	29	34	39	44	43	36	30	22	18

TABLE V. Mean Relative Humidity (RH) and Dew Point (DP) for Nevada

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Carson City (4630')	1/1891-12/1904	RH	0600	79	78	71	66	64	61	53	61	65	72	74	77
			1800	56	54	39	35	33	29	22	25	29	36	48	62
		DP	0600	14	18	21	24	28	32	34	36	31	25	19	15
Elko Airport (5079')	8/1948-12/1957	RH	0600	84	84	84	81	76	71	57	55	60	71	79	84
			1200	74	66	56	41	37	32	24	23	29	41	56	71
			1800	73	65	57	40	35	28	20	20	27	37	56	73
			0000	84	82	77	68	65	53	38	37	45	59	75	82
		DP	0600	5	13	19	24	28	33	34	31	23	21	14	11
Ely Airport (6263')	1/39-12/48 2/53-12/57	RH	0600	79	81	77	75	66	57	51	53	55	69	76	79
			1200	62	57	50	41	31	27	22	22	24	39	49	58
			1800	62	60	49	39	32	24	23	24	26	41	52	61
			0000	76	78	70	64	58	46	39	41	43	60	73	76
		DP	0600	4	10	15	21	24	26	31	30	23	20	13	8
Las Vegas Airport (1884')	12/1940-12/1948	RH	0600	59	57	46	42	30	26	32	34	32	44	48	57
			1200	41	33	25	20	17	14	19	22	17	25	28	38
			1800	36	30	20	18	13	10	16	18	15	24	30	36
			0000	50	44	34	30	20	18	23	25	22	35	39	49
		DP	0600	17	20	21	27	27	29	40	40	32	28	18	18
Las Vegas Airport (2167')	1/1949-12/1957	RH	0600	61	53	42	36	31	23	30	32	30	39	48	57
			1200	39	29	22	16	14	9	15	17	16	20	25	35
			1800	37	26	18	14	10	8	12	15	14	20	28	34
			0000	53	41	33	28	24	18	22	24	23	32	42	49
		DP	0600	21	23	22	27	29	29	42	42	33	29	23	22
Reno (4569')	1/1918-6/1937	RH	0600	77	75	69	65	63	60	52	52	58	66	71	78
			1200	64	56	42	36	31	27	22	22	27	36	48	66
			1800	55	51	39	33	28	25	19	20	24	32	43	58
		DP	0600	15	18	20	23	28	34	36	34	30	26	20	16

TABLE V. Mean Relative Humidity (RH) and Dew Point (DP) for Nevada (contd)

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Reno Airport (4417')	7/1939-12/1957	RH	0600	82	81	78	75	76	77	76	75	78	80	83	84
			1200	63	56	43	35	32	28	22	22	28	40	51	64
			1800	58	49	37	30	29	24	19	18	23	35	49	62
			0000	77	75	65	60	57	47	46	46	58	68	75	79
		DP	0600	12	17	19	23	30	35	40	37	33	25	19	15
Tonopah (6090')	1/1918-6/1937	RH	0600	66	67	61	53	48	39	34	39	37	47	52	66
			1200	62	57	47	36	31	23	22	26	26	36	43	60
			1800	55	52	40	32	28	21	19	21	21	32	41	56
		DP	0600	14	17	19	21	26	30	33	35	26	23	17	15
Winnemucca (4308')	1/1918-6/1937	RH	0600	85	85	77	72	67	61	47	50	58	69	77	84
			1200	67	60	47	38	32	28	20	23	28	35	53	69
			1800	66	58	42	33	27	24	17	19	26	35	50	67
		DP	0600	13	19	21	25	30	34	34	33	27	23	18	14
Winnemucca (4294')	7/1939-8/1949	RH	0600	81	80	76	73	66	62	46	44	56	66	79	83
			1200	67	56	46	38	32	32	20	19	26	39	56	65
			1800	68	57	42	33	30	27	17	16	25	38	56	65
			0000	79	76	65	58	53	49	32	31	42	58	76	79
		DP	0600	12	17	20	25	30	35	34	30	27	22	18	15
Winnemucca Airport (4304')	9/1949-12/1957	RH	0600	82	79	80	71	68	61	46	45	53	69	79	85
			1200	64	60	49	38	37	30	20	19	24	42	50	65
			1800	64	56	47	33	32	25	16	17	22	41	53	65
			0000	79	75	68	58	58	47	30	30	38	58	71	81
		DP	0600	13	19	22	24	30	35	35	30	26	24	19	16

TABLE VI. Mean Relative Humidity (RH) and Dew Point (DP) for California

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Backus Ranch	1/1945-	RH	0600	73	71	70	59	51	39	33	44	51	57	67	74
(2645')	6/1948		1800	42	37	38	37	27	23	19	20	23	35	41	44
		DP	0600	21	25	28	32	35	35	38	43	40	33	26	24
Bakersfield	2/1940-	RH	0600	87	82	77	72	61	53	49	52	56	65	75	86
Airport	12/1957		1200	67	58	49	44	36	31	27	30	33	42	51	68
(494')			1800	64	53	42	35	26	21	19	21	26	35	50	68
			0000	82	76	66	59	47	38	33	36	44	55	68	81
		DP	0600	32	36	37	41	43	44	47	47	44	40	36	34
Beaumont	1/1942-	RH	0600	65	72	76	85	83	81	66	65	62	59	57	60
(2589')	7/1953		1200	43	45	47	44	39	37	25	26	26	30	31	41
			1800	49	48	48	48	39	33	26	28	30	36	40	48
			0000	64	72	78	87	82	80	63	72	67	63	57	60
		DP	0600	25	28	31	38	42	44	45	45	41	33	28	25
Bishop	9/1948-	RH	0600		61	51						51	55	59	68
Airport	12/1957		1200	44	33	24	22	18	13	13	15	17	24	29	40
(4112')			1800	44	32	23	20	17	14	16	13	16	24	36	46
			0000	62	50	41	40	41	31	34	30	36	45	55	61
		DP	0600		14	15						29	23	16	15
Blythe	1/1942-	RH	0600	54	45	38	36	32	28	41	45	35	36	41	50
CAA Airport	12/1946		1800	33	25	19	14	12	10	19	23	19	20	24	31
(390')		DP	0600	21	21	22	27	29	32	50	52	39	28	20	21
Brawley	1/1909-	RH	0600	66	64	60	58								
(-119')	12/1909		1800	41	36	33	28	23	23	28	33	27	29	33	40
		DP	0600	26	28	34	38								

TABLE VI. Mean Relative Humidity (RH) and Dew Point (DP) for California (contd)

Station	Period of		Hour	Month											
(elevation)	Record	Element	(MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Burbank Airport (737')	1/1942-12/1957	RH	0600	73	74	78	83	82	85	84	81	77	77	68	72
			1200	52	47	46	53	54	55	47	48	44	46	41	46
			1800	55	50	50	53	51	51	44	45	47	53	47	52
			0000	68	68	71	76	76	77	77	77	74	72	61	64
		DP	0600	32	34	39	43	46	50	54	53	50	44	35	34
El Centro (-37')	1/1948-6/1948	RH	0600	74	72	68	67		56						
			1800	51	44	43	37		25						
		DP	0600	30	34	37	42		50						
Fresno (376')	1/1918-6/1937	RH	0600	88	85	83	77	68	59	49	52	61	70	76	88
			1200	75	66	57	44	36	32	27	29	34	44	56	75
			1800	65	55	45	34	24	20	15	17	23	33	47	67
		DP	0600	35	38	39	41	43	44	45	45	44	42	36	35
Fresno Chandler Field (287')	7/1939-8/1949	RH	0600	95	89	86	82	70	66	64	66	75	81	87	93
			1200	78	68	57	48	39	35	33	36	38	48	62	79
			1800	70	58	46	36	28	22	21	23	28	40	58	75
			0000	89	82	74	70	54	49	50	51	60	67	78	89
		DP	0600	37	38	40	43	43	48	52	51	50	45	39	36
Fresno Airport (343')	9/1949-12/1957	RH	0600	92	92	90	88	78	70	63	69	73	79	87	92
			1200	76	67	58	51	44	36	35	37	38	47	61	77
			1800	71	60	48	38	30	22	19	21	27	38	59	75
			0000	90	88	79	72	58	49	40	46	55	67	80	90
		DP	0600	34	38	40	45	46	49	51	51	47	43	37	36
Imperial (-66')	1/1942-12/1947	RH	1300	51	46	36	34	26	25	32	35	30	32	35	45
			1800	40	34	33	27	23	22	27	32	27	28	32	40

TABLE VI. Mean Relative Humidity (RH) and Dew Point (DP) for California (contd)

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Independence (3960')	1/1895-11/1924 1/42-11/44	RH	0600	62	58	53	46	40	38	39	37	36	49	51	60
			1200	47	42	33	26	22	17	16	21	22	32	40	45
			1800	44	39	28	22	19	16	18	18	20	28	33	42
		DP	0600	14	16	18	22	24	30	37	32	25	25	16	14
Indio Date Garden (11')	1/1942-12/1946	RH	0800	66	62	54	45	40	36	46	48	46	46	48	62
		DP	0800	27	30	32	36	39	42	55	55	47	37	27	27
Keeler Ranch (3620')	1/1891-12/1893	RH	0600	58	62	52	43	31	30	32	37	33	44	52	56
			1800	37	37	25	23	19	19	24	27	25	29	37	38
		DP	0600	23	27	28	27	26	31	40	45	34	32	28	22
Long Beach (34')	1/1942-1/1943	RH	0600	82		84	84	83	86	86	87	83	81	77	80
			1200	61		51		56	62	59	66	58	56	48	52
			1800	65		57	62	56	62	62	68	66	61	57	64
		DP	0600	40		44	47	50	54	58	58	55	51	43	41
Los Angeles (420')	1/1918-6/1937	RH	0600	61	71	73	79	83	86	85	86	81	73	56	60
			1200	46	53	51	55	59	60	56	57	55	49	37	45
			1800	54	58	56	58	61	60	57	59	60	59	50	55
		DP	0600	34	37	40	44	48	52	55	55	53	46	37	35
Los Angeles (316')	3/1940-12/1957	RH	0600	65	67	73	79	81	85	84	85	79	74	59	62
			1200	51	48	49	54	56	58	52	55	52	51	41	47
			1800	53	52	54	57	58	58	55	56	56	59	48	53
			0000	70	70	72	76	77	78	80	80	77	74	62	62
		DP	0600	34	36	41	45	49	53	57	57	53	48	37	35

TABLE VI. Mean Relative Humidity (RH) and Dew Point (DP) for California (contd)

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Los Angeles Airport (129')	9/1948-12/1957	RH	0600	77	76	82	84	83	85	86	87	87	83	74	72
			1200	55	54	55	62	62	64	62	64	63	59	49	52
			1800	66	66	66	68	67	69	69	71	71	72	67	67
			0000	76	76	78	81	81	82	84	84	85	81	75	74
		DP	0600	36	38	43	47	50	53	57	57	55	49	40	37
Mt. Wilson (5709')	10/1942-6/1948	RH	0530	46	50	54	50	45	36	23	29	36	39	39	45
			1730	52	56	59	57	51	42	31	36	33	44	42	51
		DP	0530	16	17	24	25	28	28	25	31	31	26	21	18
Needles CAA Airport (913')	1/1942-6/1948	RH	0600	53	51	42	37	29	27	33	38	37	40	43	56
			1800	35	30	21	18	14	12	17	22	20	24	31	38
		DP	0600	23	27	28	29	30	35	48	50	40	31	25	26
Palm Springs (455')	1/1948-6/1948	RH	1730	56	41	34	29	28	24						
Sandberg (4522')	12/1939-12/1957	RH	0600	63	65	68	71	68	57	39	43	45	54	52	61
			1200	59	57	58	53	46	35	25	25	27	39	43	55
			1800	61	58	58	54	46	36	26	28	31	43	47	58
			0000	61	65	65	67	59	48	38	39	43	52	51	60
		DP	0600	23	23	27	32	36	39	38	39	38	34	26	24
San Diego (87')	1/1918-6/1937	RH	0600	71	80	80	83	83	87	88	88	86	80	68	71
			1200	56	65	64	69	70	73	73	73	72	65	53	56
			1800	66	69	67	69	71	73	73	75	74	72	64	67
		DP	0600	38	42	44	47	51	55	58	60	57	50	42	39

TABLE VI. Mean Relative Humidity (RH) and Dew Point (DP) for California (contd)

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
San Diego Airport (38')	7/1939-12/1957	RH	0600	77	77	79	81	80	83	86	86	86	81	72	73
			1200	57	54	56	61	61	65	66	66	63	60	51	54
			1800	64	61	61	64	64	66	66	67	69	68	62	64
			0000	77	76	78	78	78	80	83	84	83	80	74	75
		DP	0600	39	41	44	47	51	55	59	60	58	51	42	39
Santa Barbara CAA Airport (9')	1/1942-6/1948	RH	0600	87	84	80	84	82	87	89	91	89	82	78	83
			1800	67	65	63	66	63	66	68	69	69	69	62	69
		DP	0600	35	37	38	42	45	48	53	53	52	45	37	37
Santa Catalina Avalon (0')	9/1948-5/1953	RH	0600	70	75	73	78	79	83	69	64	61	60	57	68
			1200	62	63	63	68	68	68	56	54	51	52	52	58
			1800	66	67	64	67	65	70	54	53	52	55	54	66
		DP	0600	38	39	38	43	44	49	49	48	48	39	38	38
Silver Lake CAA Airport (920')	7/1942-12/1945	RH	0600	62	60	49	40	34	35	29	30	33	46	54	62
			1800	36	35	22	16	14	15	14	17	16	24	32	40
		DP	0600	20	24	25	28	32	39	42	41	36	33	24	22

TABLE VII. Mean Relative Humidity (RH) and Dew Point (DP) for Texas

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Abilene (1736')	1/1918-6/1937	RH	0600	74	70	67	68	77	76	72	71	79	78	76	74
			1200	43	40	34	35	42	41	36	37	42	45	43	40
			1800	53	46	39	38	46	43	39	39	49	54	56	55
		DP	0600	26	27	34	43	54	60	63	62	58	47	36	28
Abilene Airport (1764')	7/1939-12/1957	RH	0600	76	74	67	73	78	77	72	72	75	78	74	74
			1200	52	51	41	44	50	46	41	41	42	47	44	48
			1800	58	53	42	45	50	45	42	42	46	53	55	58
			0000	71	69	60	66	75	70	61	61	65	71	69	69
		DP	0600	24	28	32	44	53	61	63	62	56	47	34	26
Amarillo (3667')	1/1918-6/1937	RH	0600	72	70	67	69	74	74	73	74	78	76	72	72
			1200	51	47	42	40	46	43	40	43	46	46	48	51
			1800	53	46	40	38	45	42	40	44	50	52	54	56
		DP	0600	16	17	23	32	44	52	56	55	51	39	26	17
Amarillo Airport (3595')	4/1941-12/1957	RH	0600	72	73	68	69	75	74	73	76	77	76	71	73
			1200	49	49	39	41	46	42	42	41	43	46	44	47
			1800	57	51	41	40	45	42	45	44	46	52	53	57
			0000	69	67	61	62	72	68	66	67	69	68	64	67
		DP	0600	15	18	22	32	42	50	55	55	49	37	23	16
Big Spring Airport (2533')	1/1932-6/1935	RH	0600	77	73	71	70	74	74	71	72	83	83	79	79
			1200	40	38	31	33	36	40	36	38	46	49	44	41
			1800	54	47	38	35	37	42	41	40	55	60	59	56
		DP	0600	24	24	31	40	49	58	60	60	58	46	33	24
Big Spring Airport (2574')	6/1941-10/1953	RH	0600	78	73	65	67	72	72	68	67	72	75	73	74
			1200	49	47	36	37	42	41	40	40	42	45	43	45
			1800	54	46	35	36	38	38	40	39	44	48	50	53
			0000	68	65	53	59	64	63	55	56	60	63	65	67
		DP	0600	24	26	31	40	50	58	60	60	56	46	32	24

TABLE VII. Mean Relative Humidity (RH) and Dew Point (DP) for Texas (contd)

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Del Rio (1019')	7/1918-6/1937	RH	0600	81	77	73	74	80	82	80	77	83	84	81	82
			1200	49	48	43	43	50	49	46	41	49	52	48	50
			1800	53	46	39	38	47	44	45	39	49	53	54	58
		DP	0600	35	37	44	50	60	66	67	67	65	55	43	36
Del Rio Airport (1096')	7/1939-8/1957	RH	0600	78	75	68	73	79	79	75	75	79	80	75	79
			1200	58	54	46	49	54	54	47	46	51	54	50	53
			1800	56	49	39	41	45	45	40	42	48	51	54	56
			0000	70	65	59	61	70	66	60	60	67	68	67	69
		DP	0600	36	38	42	52	61	67	67	67	65	56	42	38
El Paso (3841')	1/1918-7/1937	RH	0600	58	55	47	40	42	42	58	63	62	59	60	64
			1200	36	33	25	20	20	21	32	36	36	35	35	41
			1800	36	30	22	17	17	18	30	34	34	35	37	42
		DP	0600	19	22	23	27	35	44	54	55	49	37	26	22
El Paso Airport (3957')	1/1943-12/1957	RH	0600	63	55	45	42	40	43	58	62	58	58	55	61
			1200	42	35	27	25	22	24	37	36	34	34	33	40
			1800	40	32	23	20	18	20	30	33	33	34	33	39
			0000	57	45	36	32	31	32	48	50	48	48	46	53
		DP	0600	20	21	21	27	34	43	54	54	48	38	23	21
Lubbock Airport (3248')	6/1948-12/1957	RH	0600	76	74	68	72	76	75	76	77	84	83	76	75
			1200	51	49	37	42	45	42	46	44	48	50	43	45
			1800	60	49	38	41	44	40	45	44	48	56	52	57
			0000	70	68	59	62	72	67	65	66	71	72	68	67
		DP	0600	16	20	24	37	47	56	59	58	53	43	25	23
Midland Airport (2863')	11/1953-12/1957	RH	0600	75	68	58	67	70	73	73	73	73	77	72	74
			1200	43	41	30	33	37	38	42	41	41	43	39	40
			1800	48	41	30	32	35	40	42	42	43	48	47	49
			0000	67	61	48	54	62	62	62	62	63	67	64	63
		DP	0600	25	26	27	39	50	58	61	60	54	47	32	26

TABLE VII. Mean Relative Humidity (RH) and Dew Point (DP) for Texas (contd)

Station (elevation)	Period of Record	Element	Hour (MST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pampa (3214')	6/1948-8/1948	RH	0600						75	75	79				
			1200						47	46	46				
			1800						45	48	50				
			0000						71	73	72				
		DP	0600						54	57	57				
San Angelo Airport (1952')	9/1949-12/1957	RH	0600	77	74	69	72	77	77	73	73	77	80	75	75
			1200	53	48	41	45	46	45	41	42	45	46	44	48
			1800	54	49	39	42	44	43	40	40	45	51	51	54
			0000	71	66	59	63	71	65	61	60	65	70	68	68
		DP	0600	30	33	36	46	55	62	62	63	58	50	38	32
Wink CAA Airport (2807')	1/1942-5/1948	RH	0600	78	73	59	63	64	67	66	69	75	77	74	76
			1200	38	33	26	26	32	29	31	38	38	38	37	37
			1800	49	38	27	26	33	32	40	42	42	44	47	48
			0000	69	61	48	51	54	57	57	59	66	69	64	67
		DP	0600	22	26	28	36	45	56	58	59	54	47	34	24

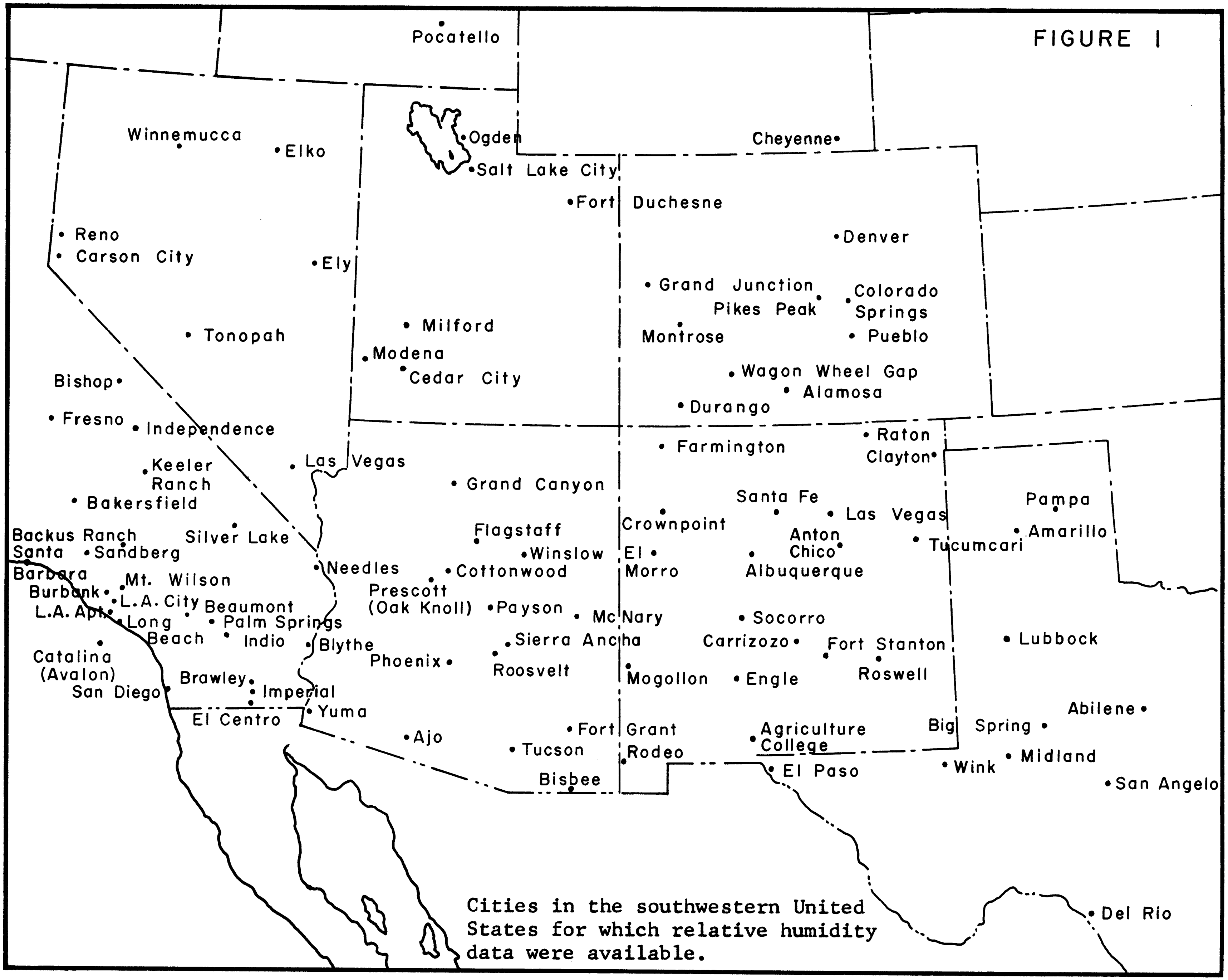


FIGURE I

Cities in the southwestern United States for which relative humidity data were available.

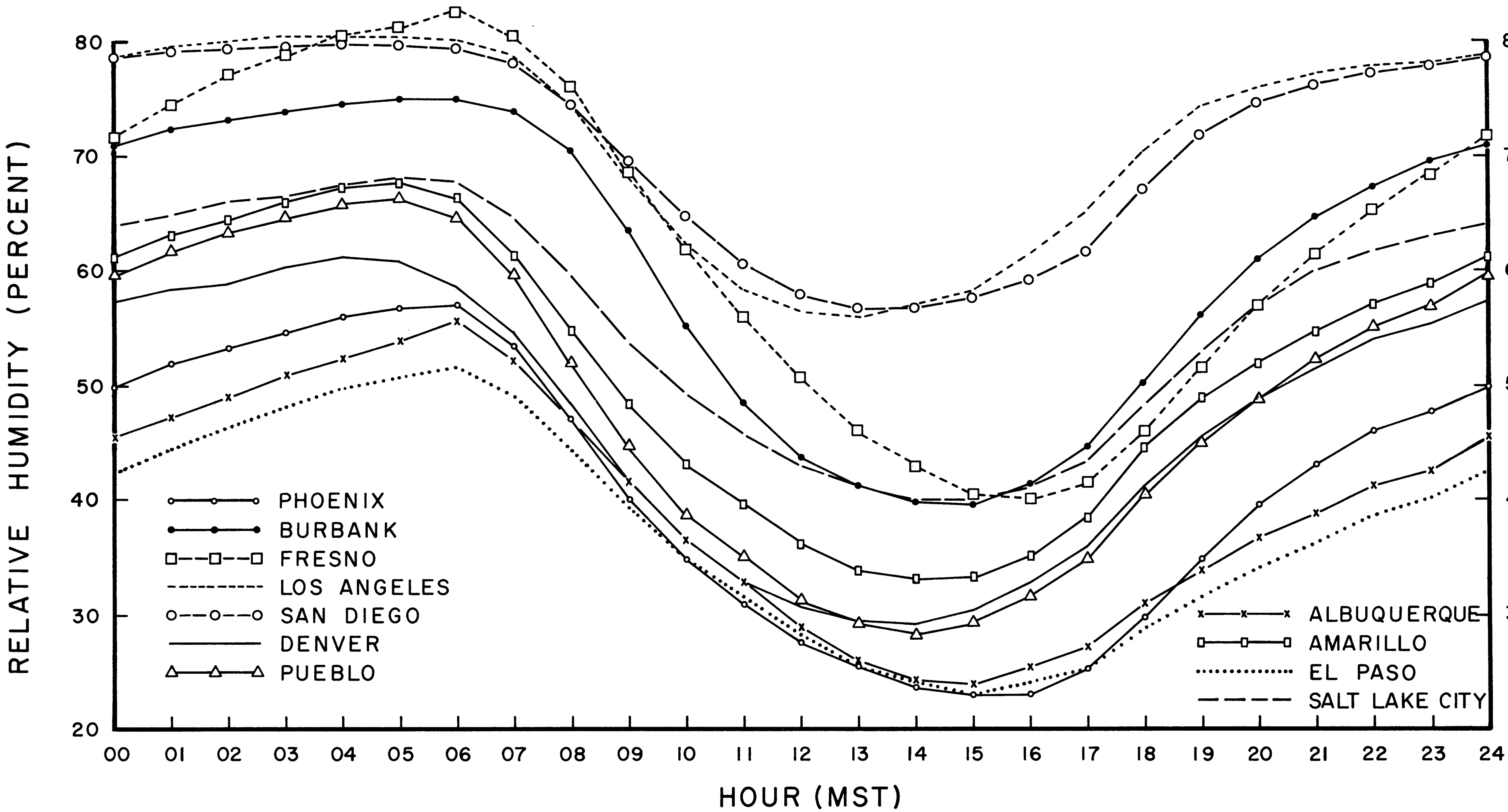
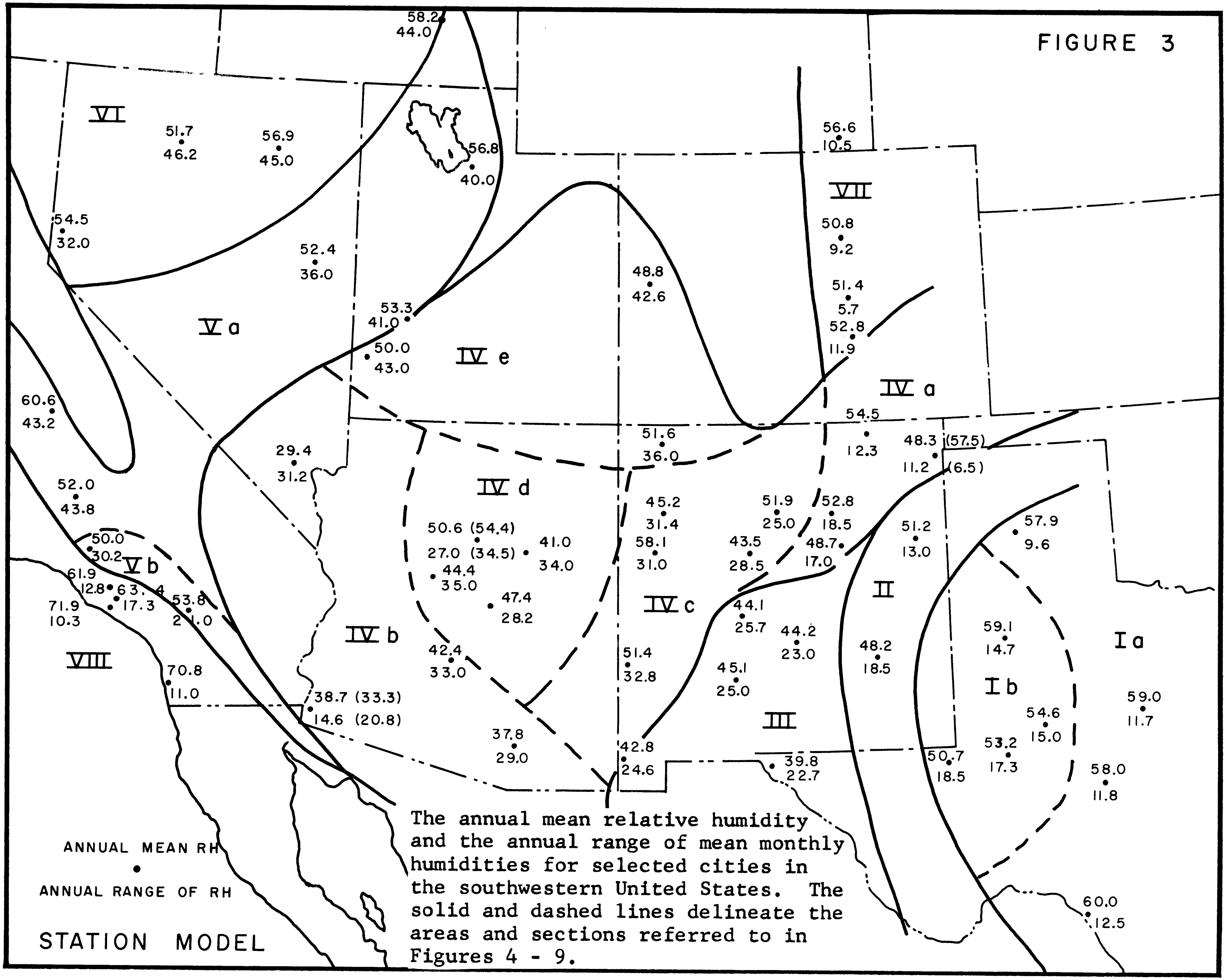


Figure 2 Diurnal variations of the mean annual relative humidity at eleven first order Weather Bureau stations in the southwestern United States.

FIGURE 3



The annual mean relative humidity and the annual range of mean monthly humidities for selected cities in the southwestern United States. The solid and dashed lines delineate the areas and sections referred to in Figures 4 - 9.

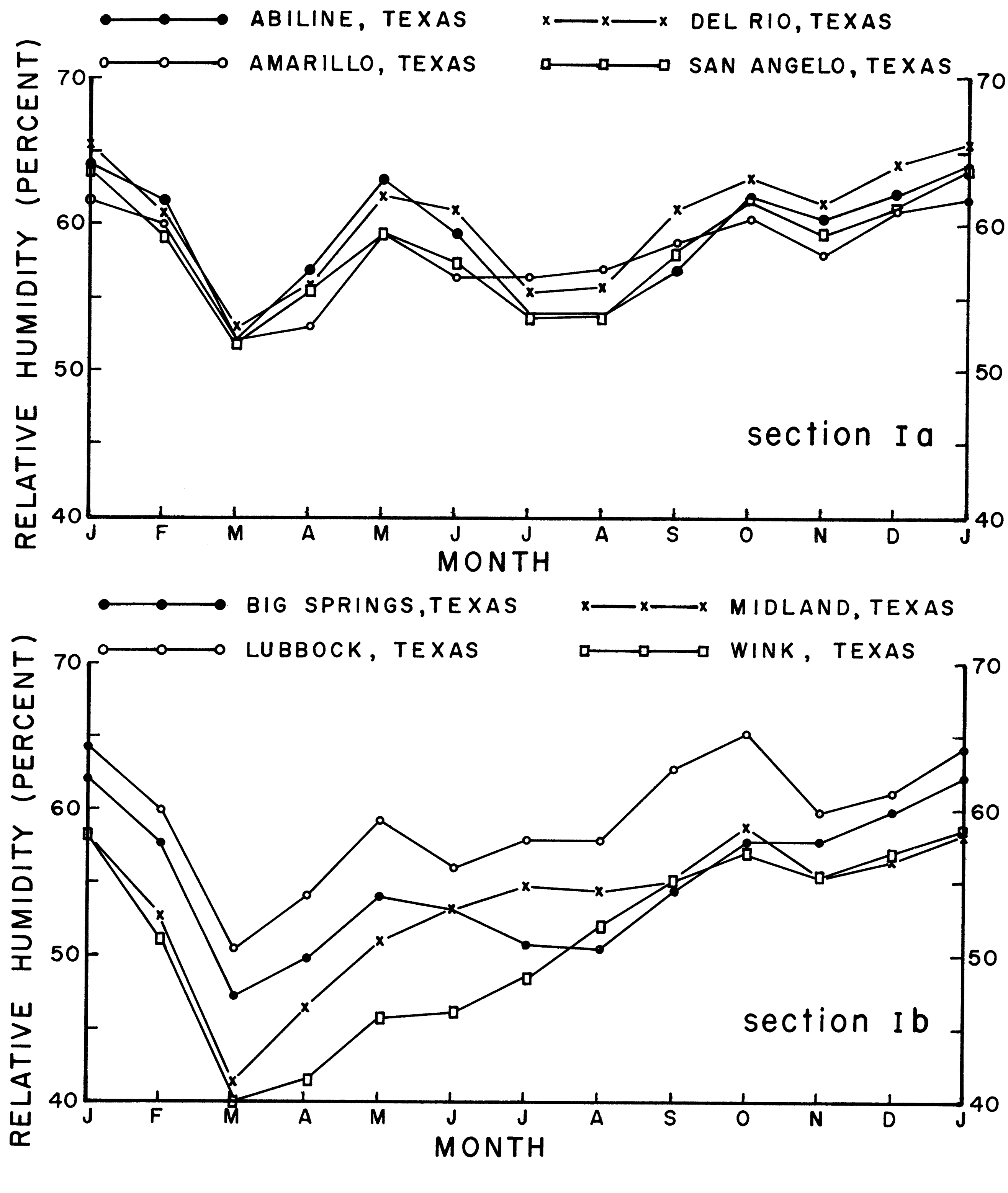


Fig. 4 Annual variation of relative humidity at stations with lowest average humidities in March (sections Ia and Ib).

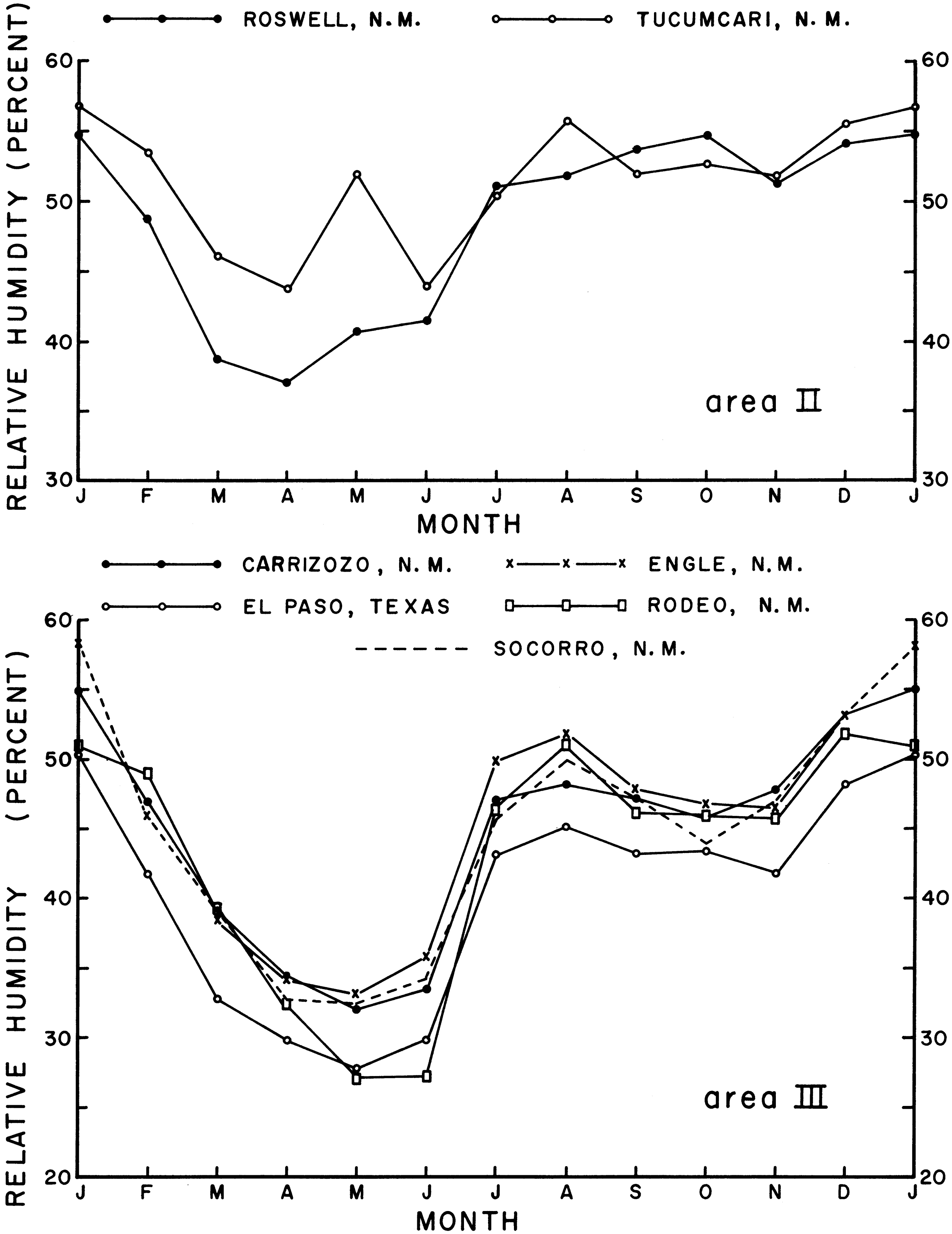


Fig. 5 Annual variation of relative humidity at stations with lowest average humidities in April (area II) and May (area III).

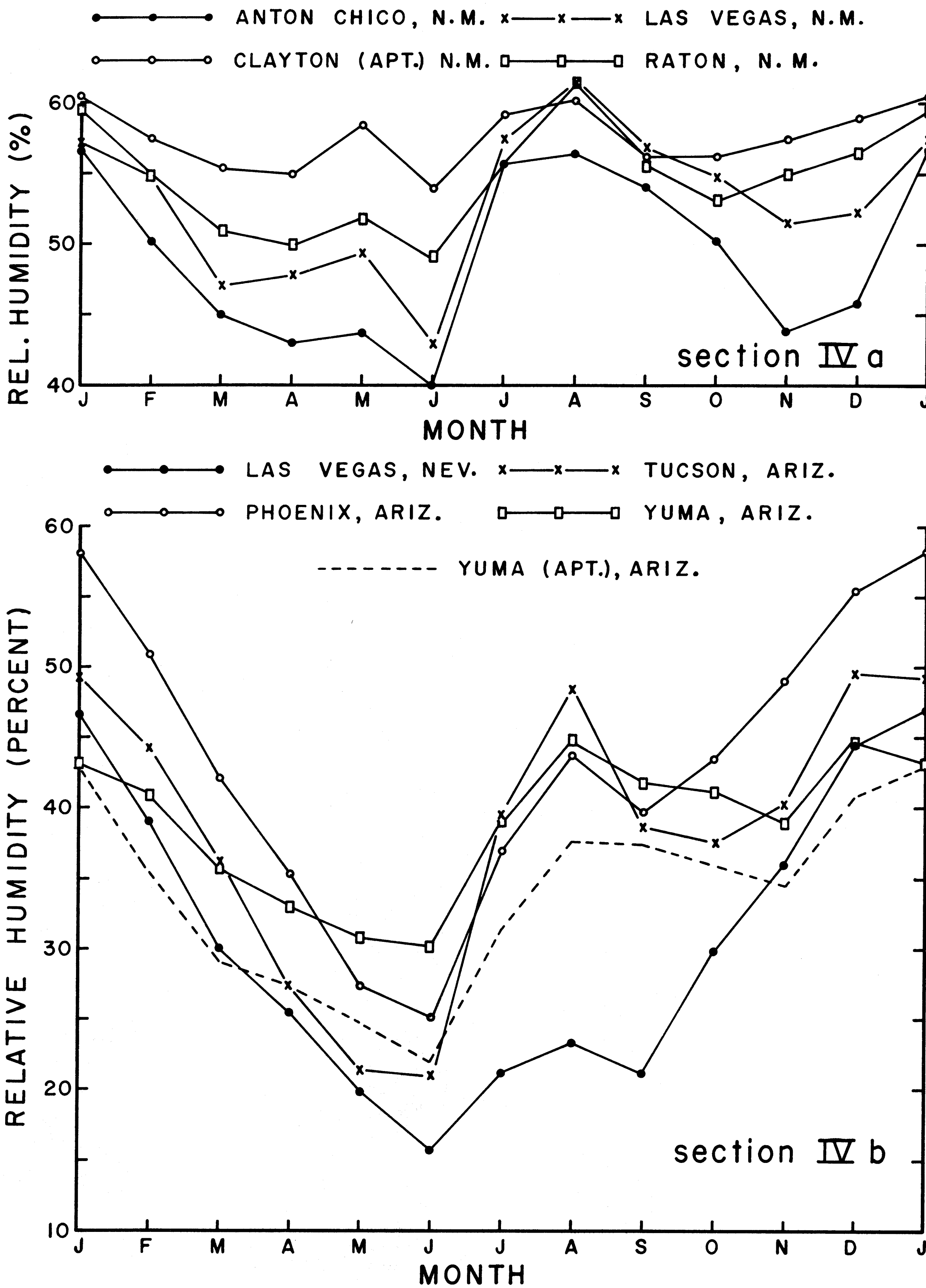


Fig. 6a Annual variation of relative humidity at stations with lowest average humidities in June (sections IVa and IVb).

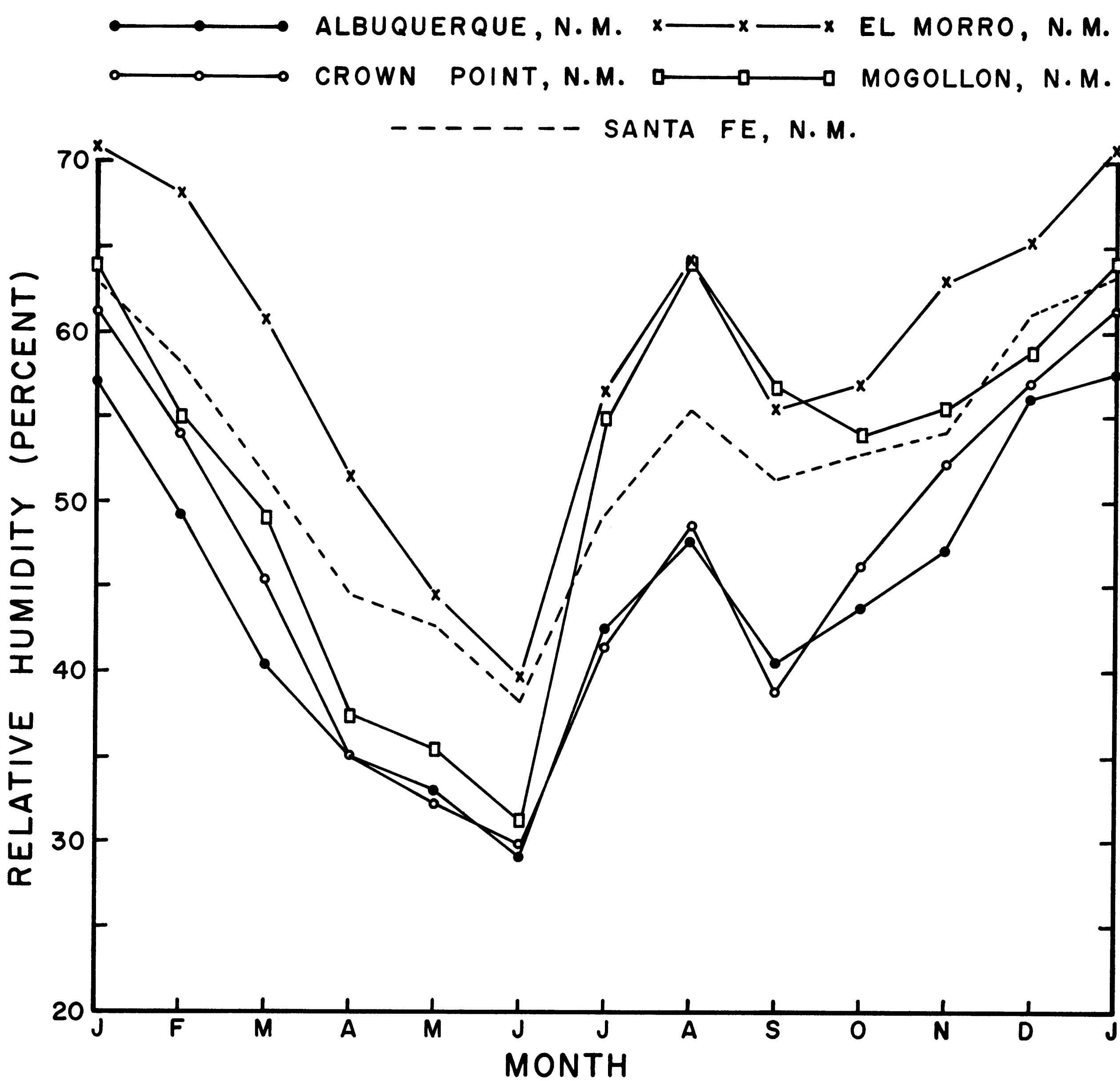


Fig. 6b Annual variation of relative humidity at stations with lowest average humidities in June (section IVc).

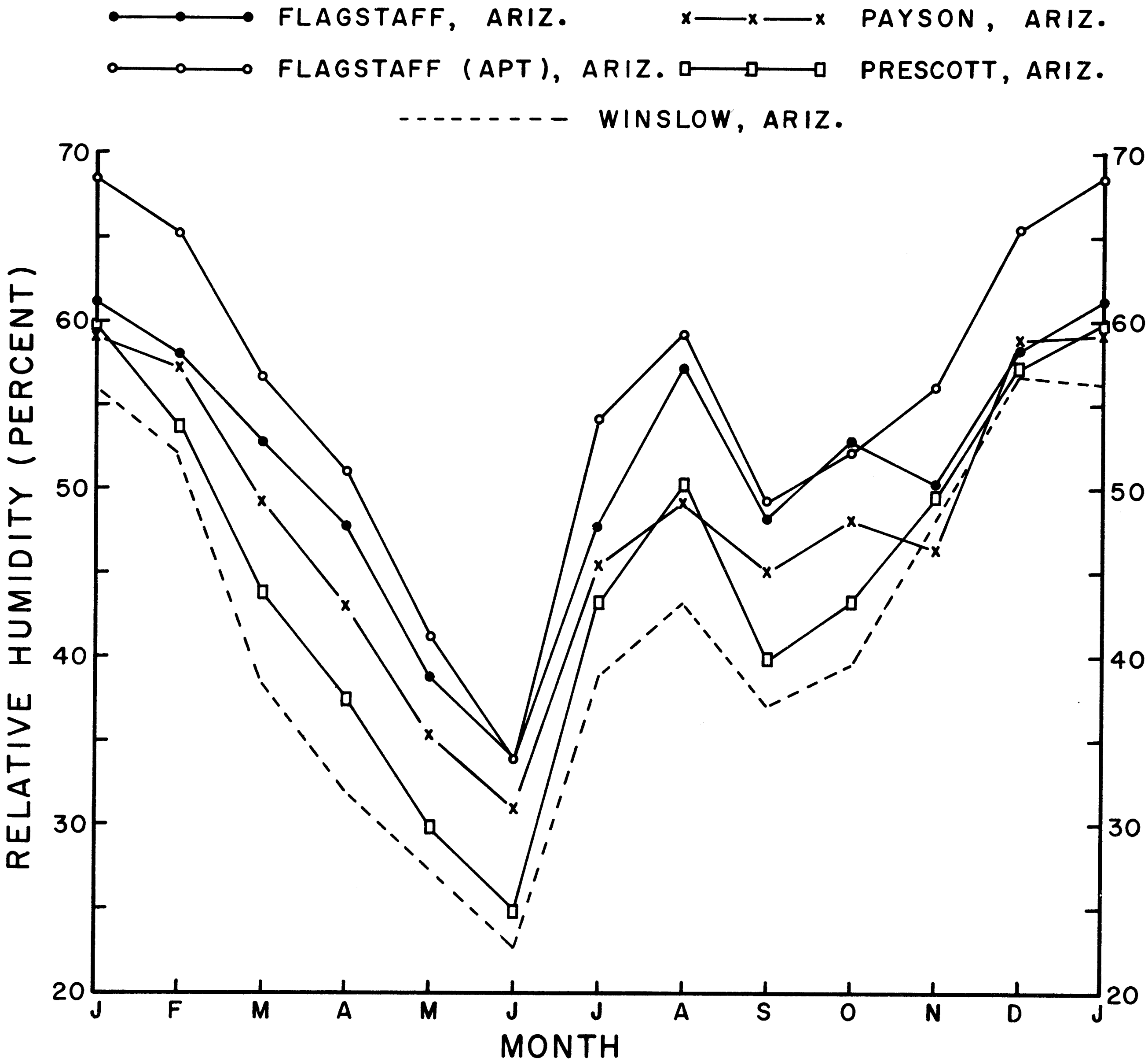


Fig. 6c Annual variation of relative humidity at stations with lowest average humidities in June (section IV d).

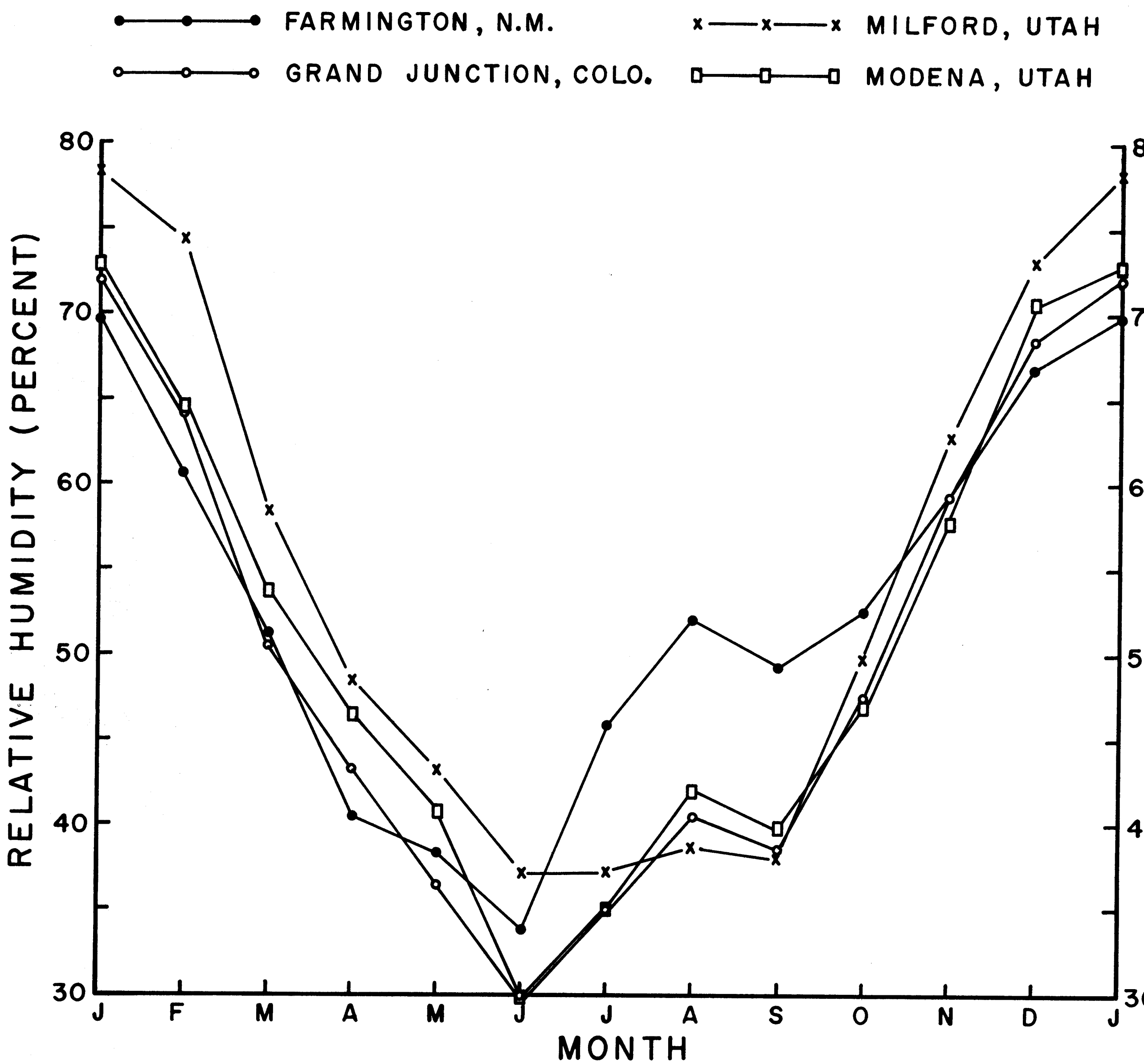


Fig. 6d Annual variation of relative humidity at stations with lowest average humidities in June (section IVe).

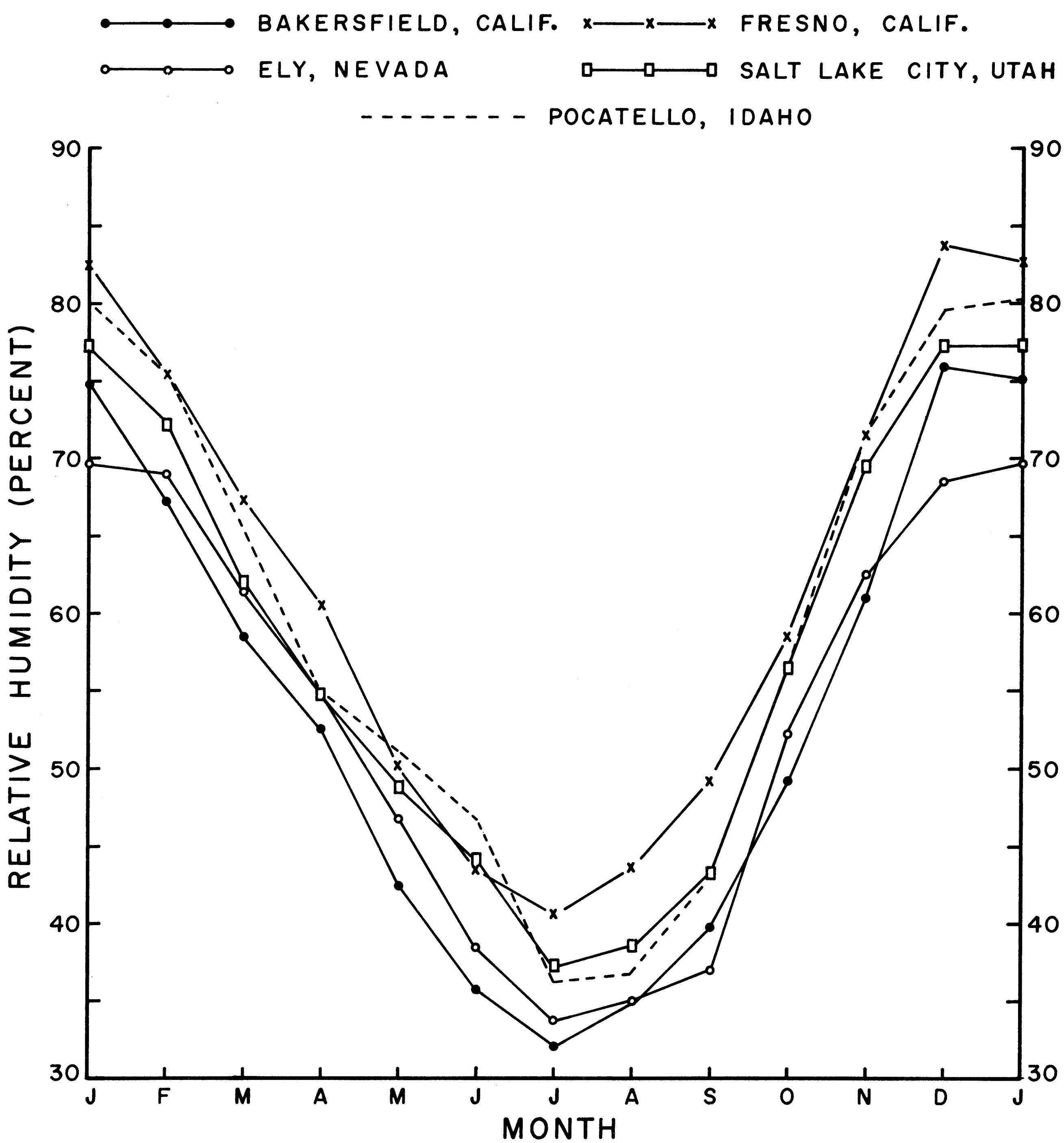


Fig. 7 Annual variation of relative humidity at stations with lowest average humidities in July (section V a).

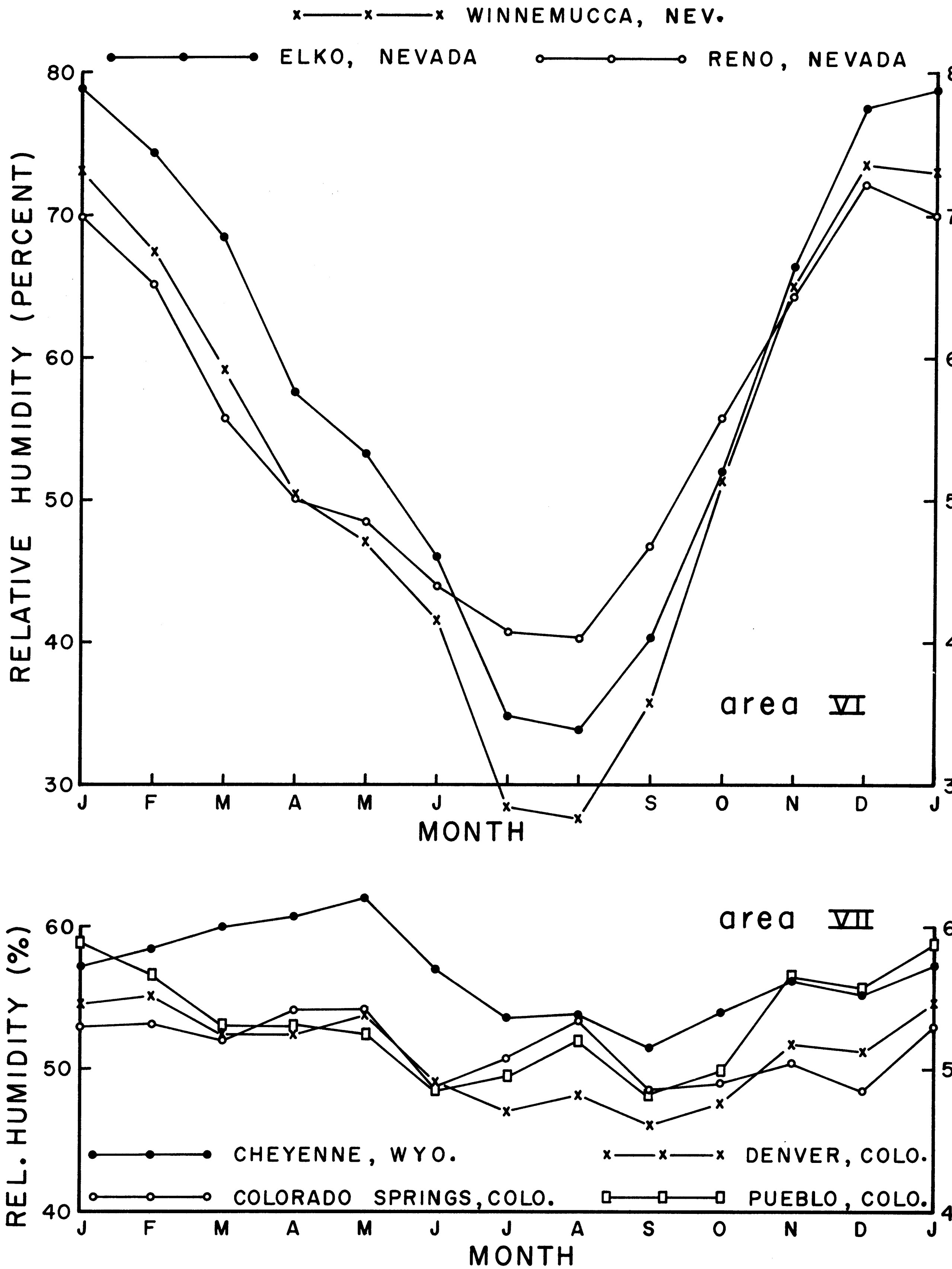
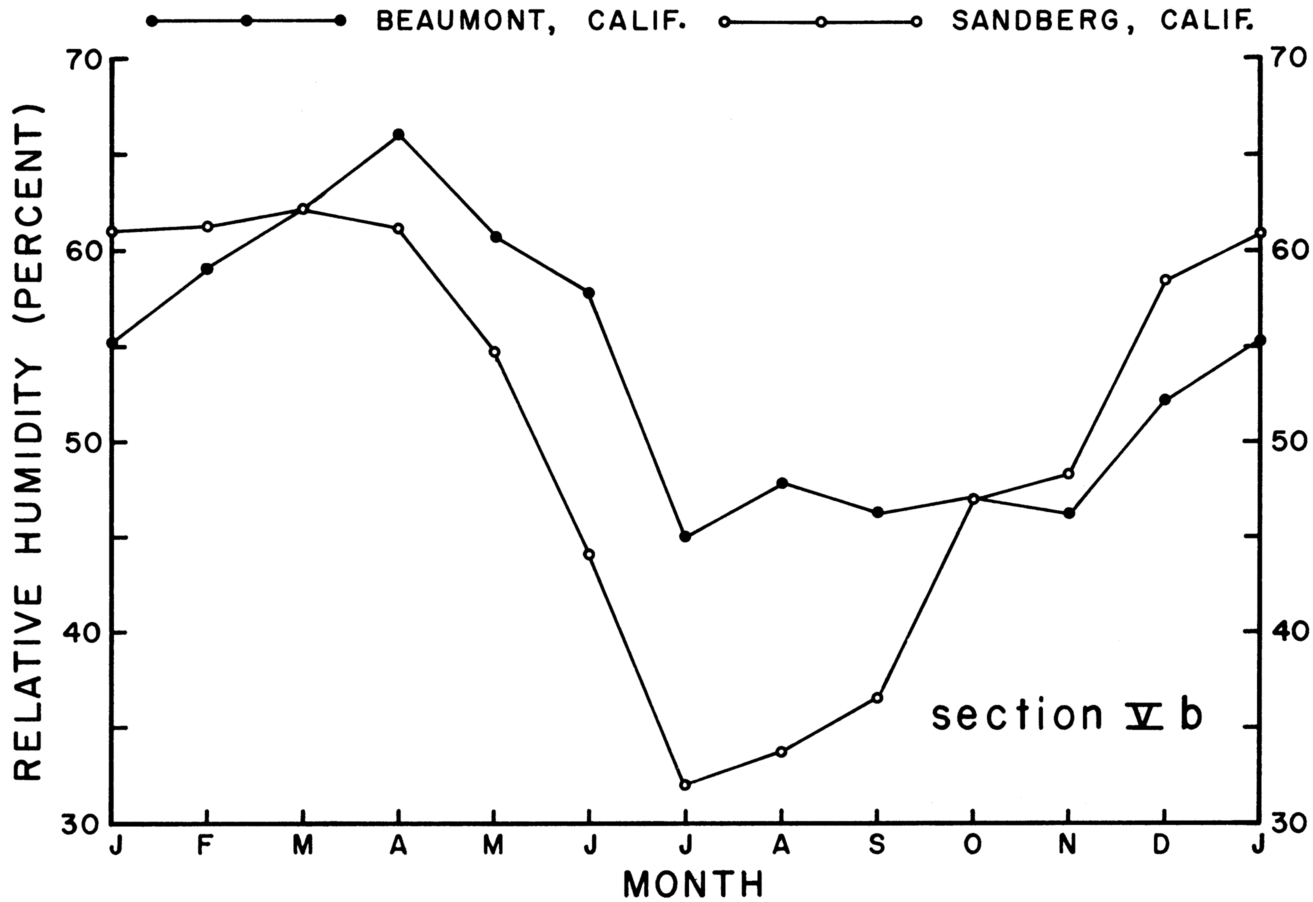


Fig. 8 Annual variation of relative humidity at stations with lowest average humidities in August (area VI) and September (area VII).



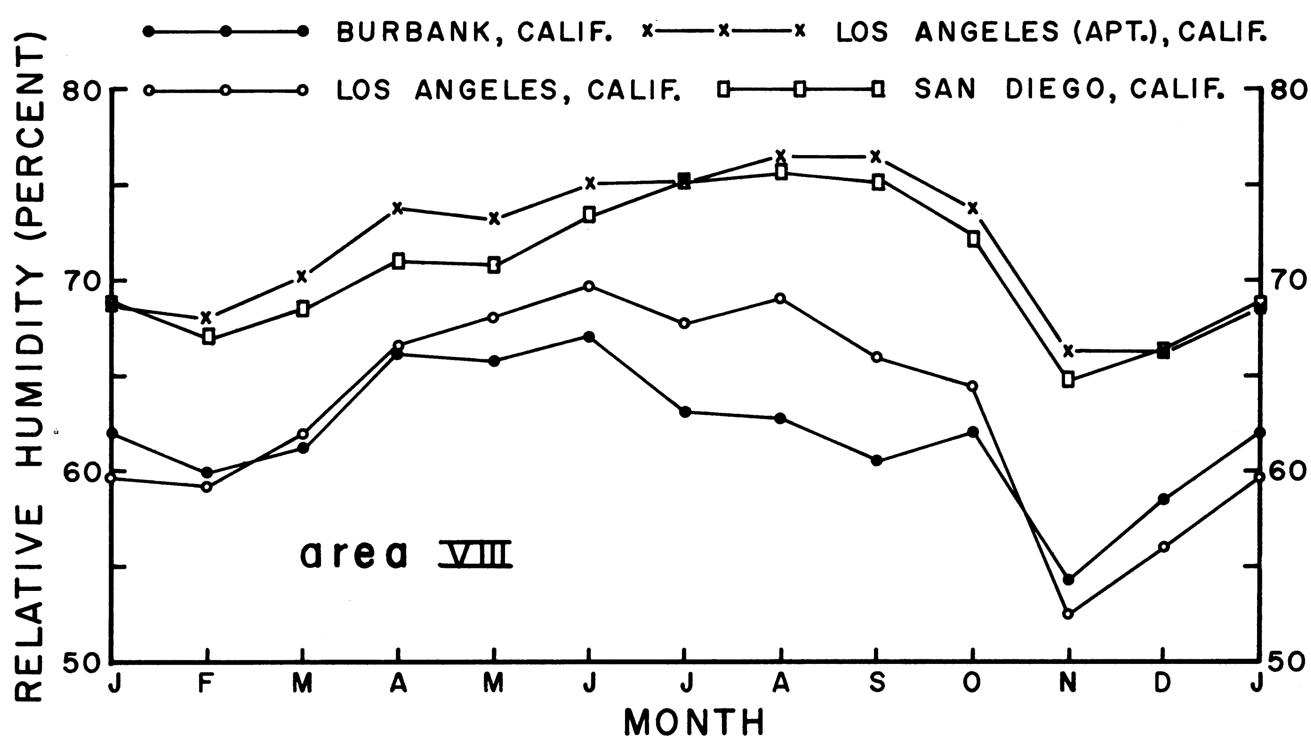
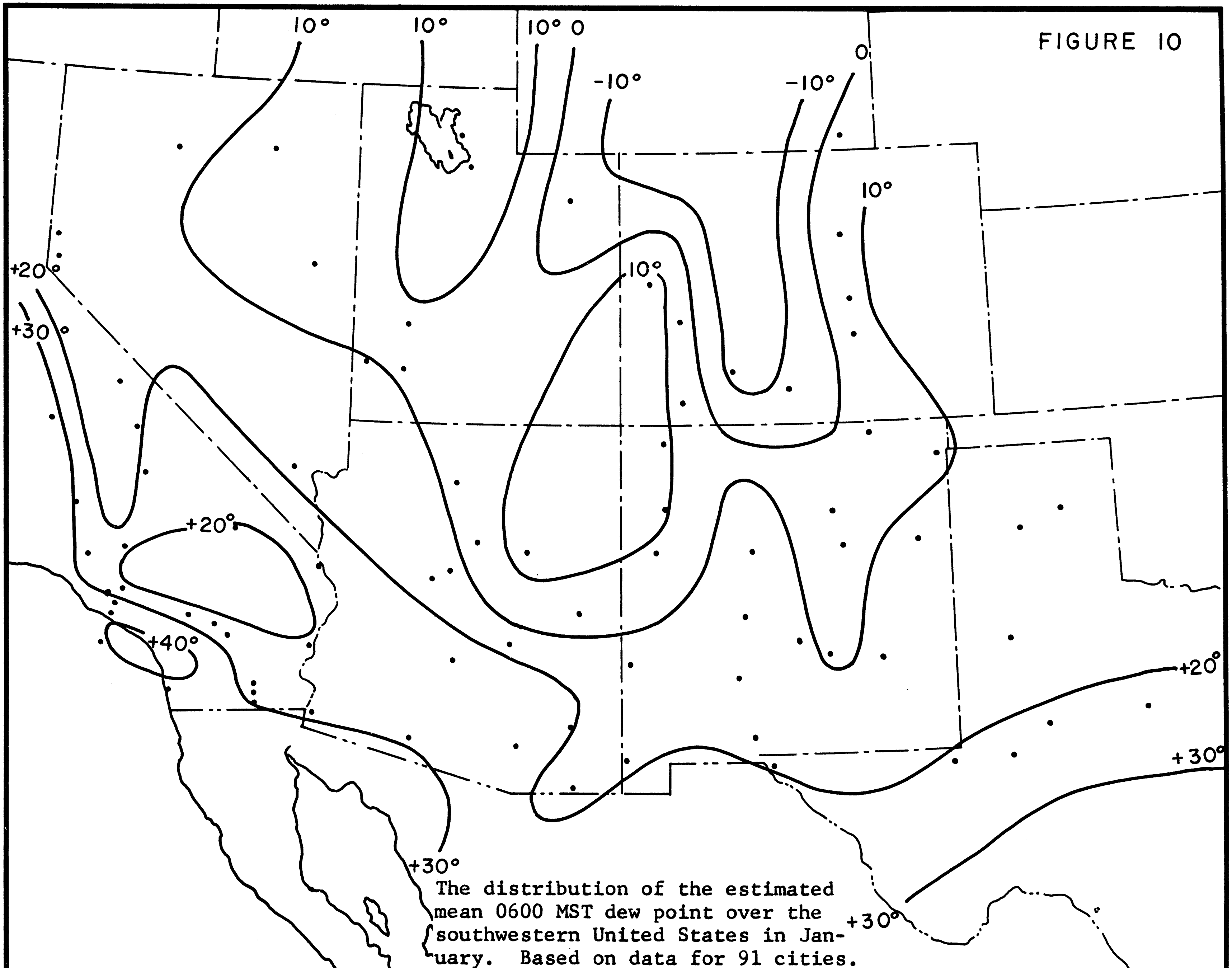
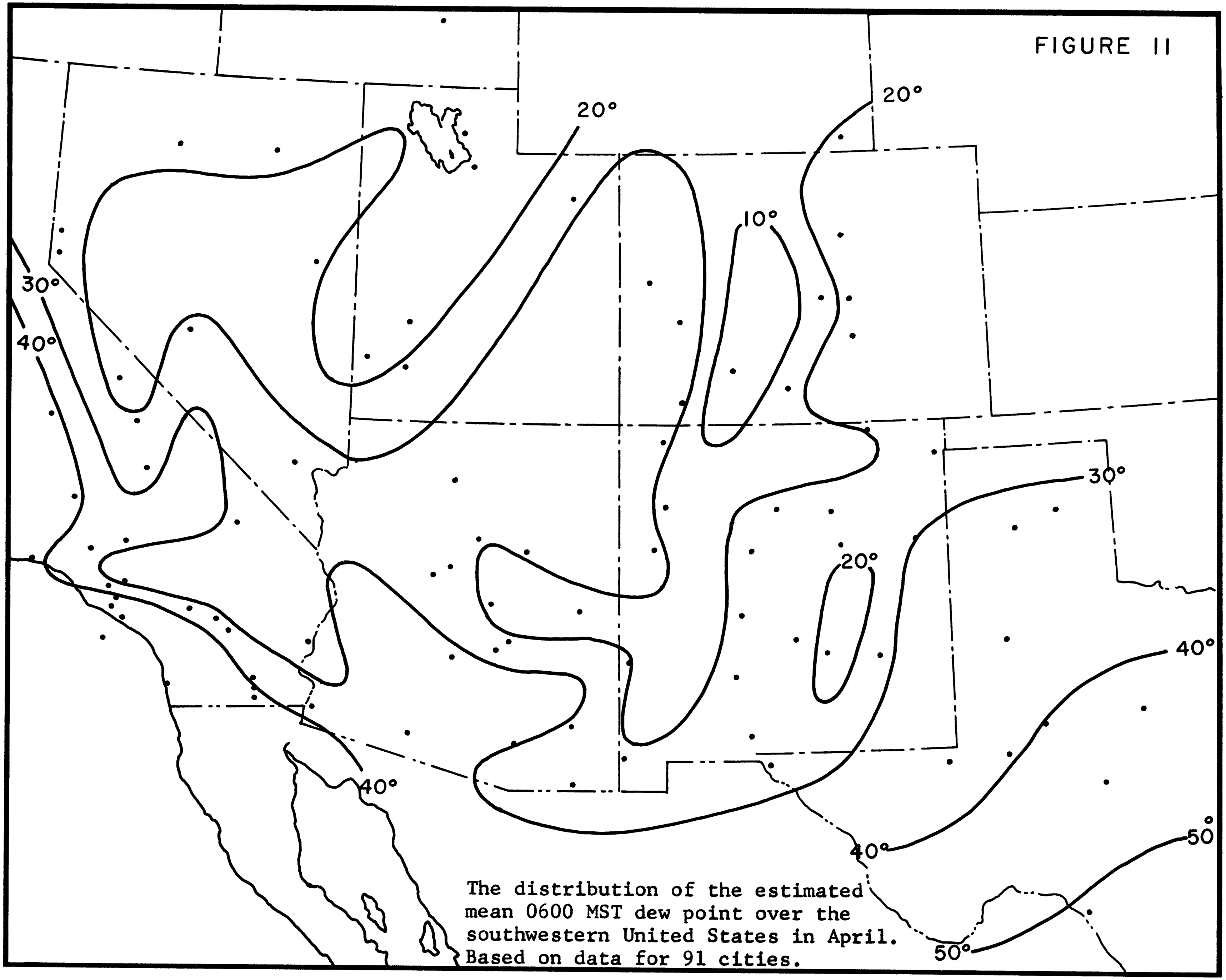


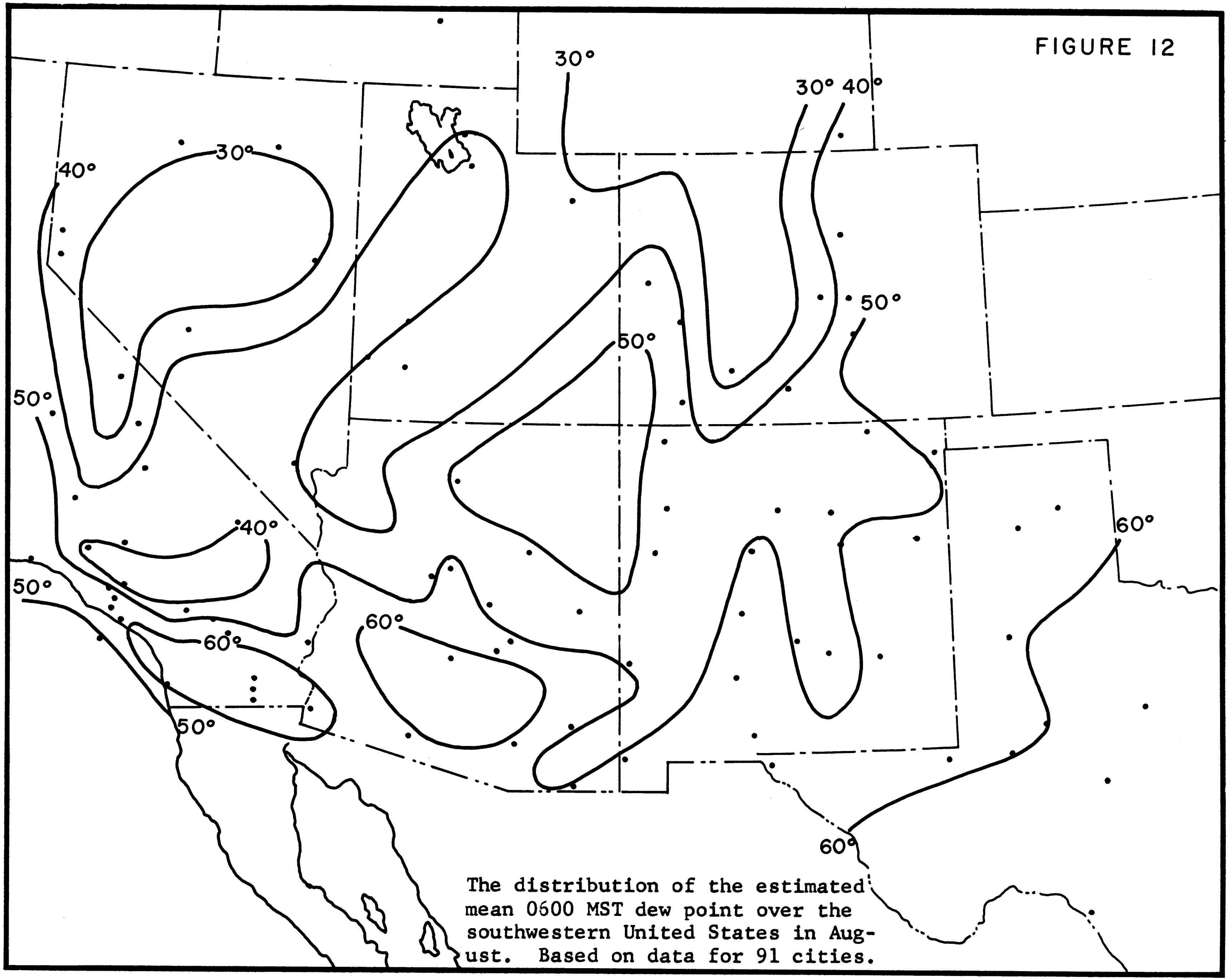
Fig. 9 Annual variation of relative humidity at stations with lowest average humidities in July (section Ⅴ b) and November (area Ⅷ).



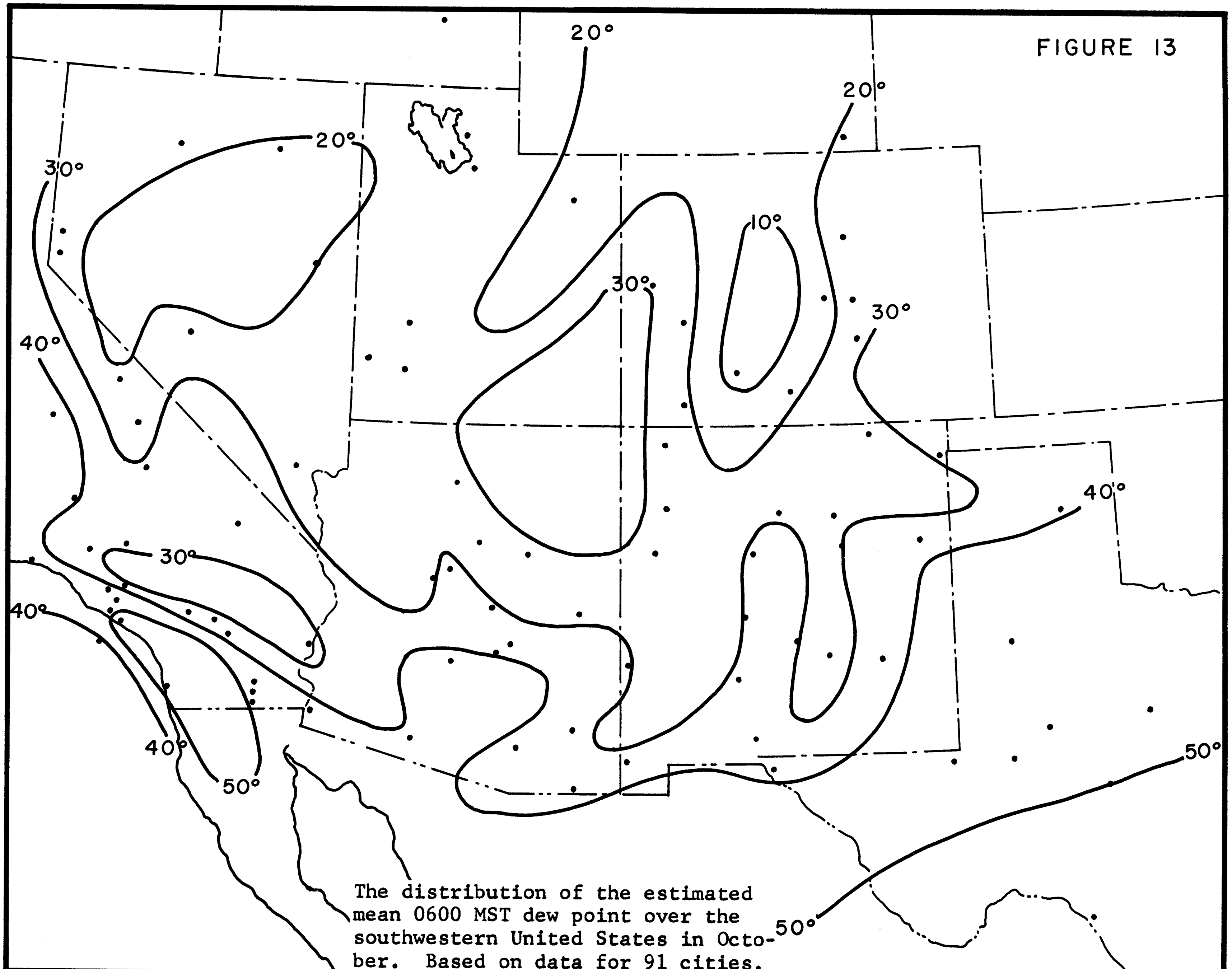
The distribution of the estimated mean 0600 MST dew point over the southwestern United States in January. Based on data for 91 cities.



The distribution of the estimated mean 0600 MST dew point over the southwestern United States in April. Based on data for 91 cities.



The distribution of the estimated mean 0600 MST dew point over the southwestern United States in August. Based on data for 91 cities.



The distribution of the estimated mean 0600 MST dew point over the southwestern United States in October. Based on data for 91 cities.

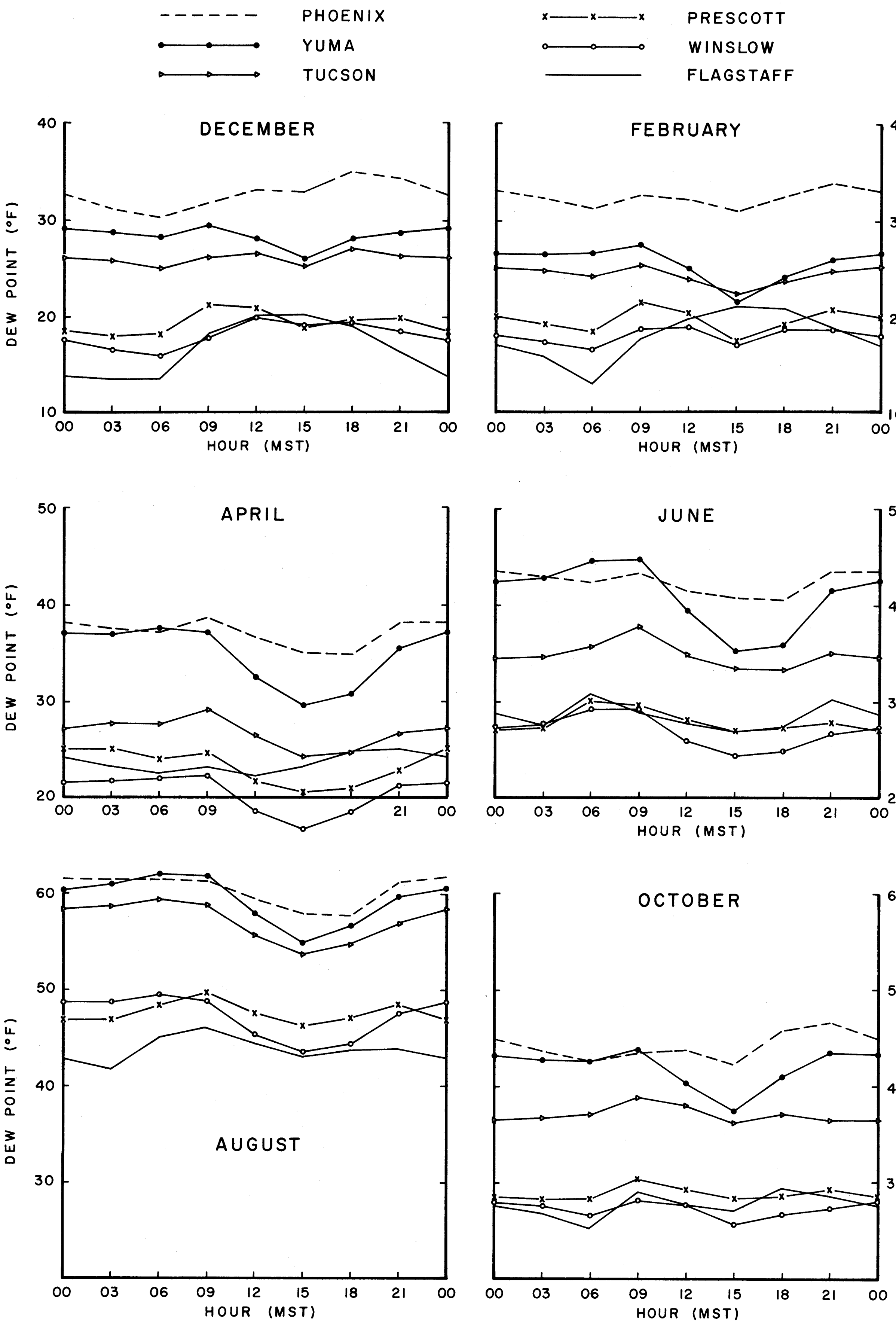
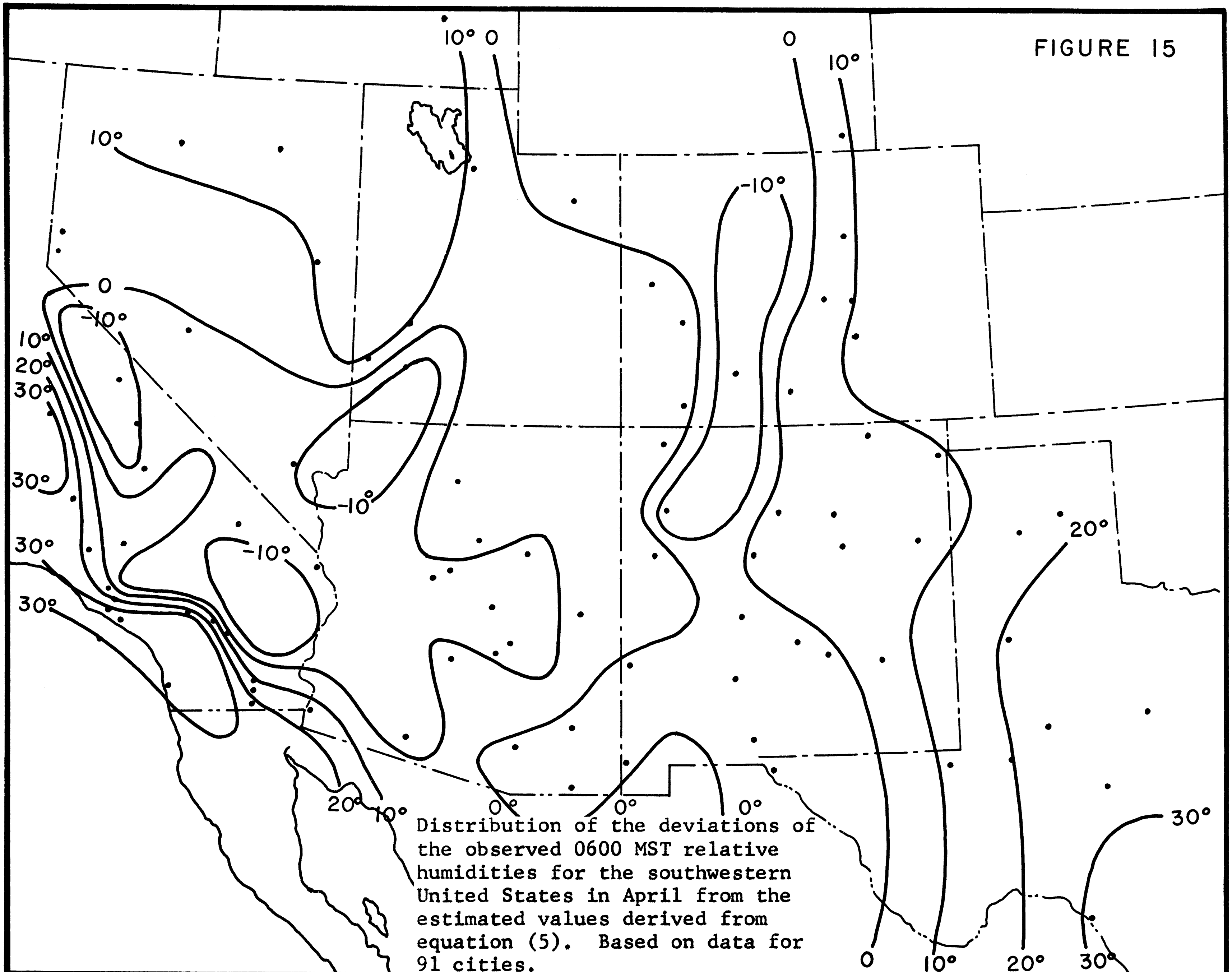
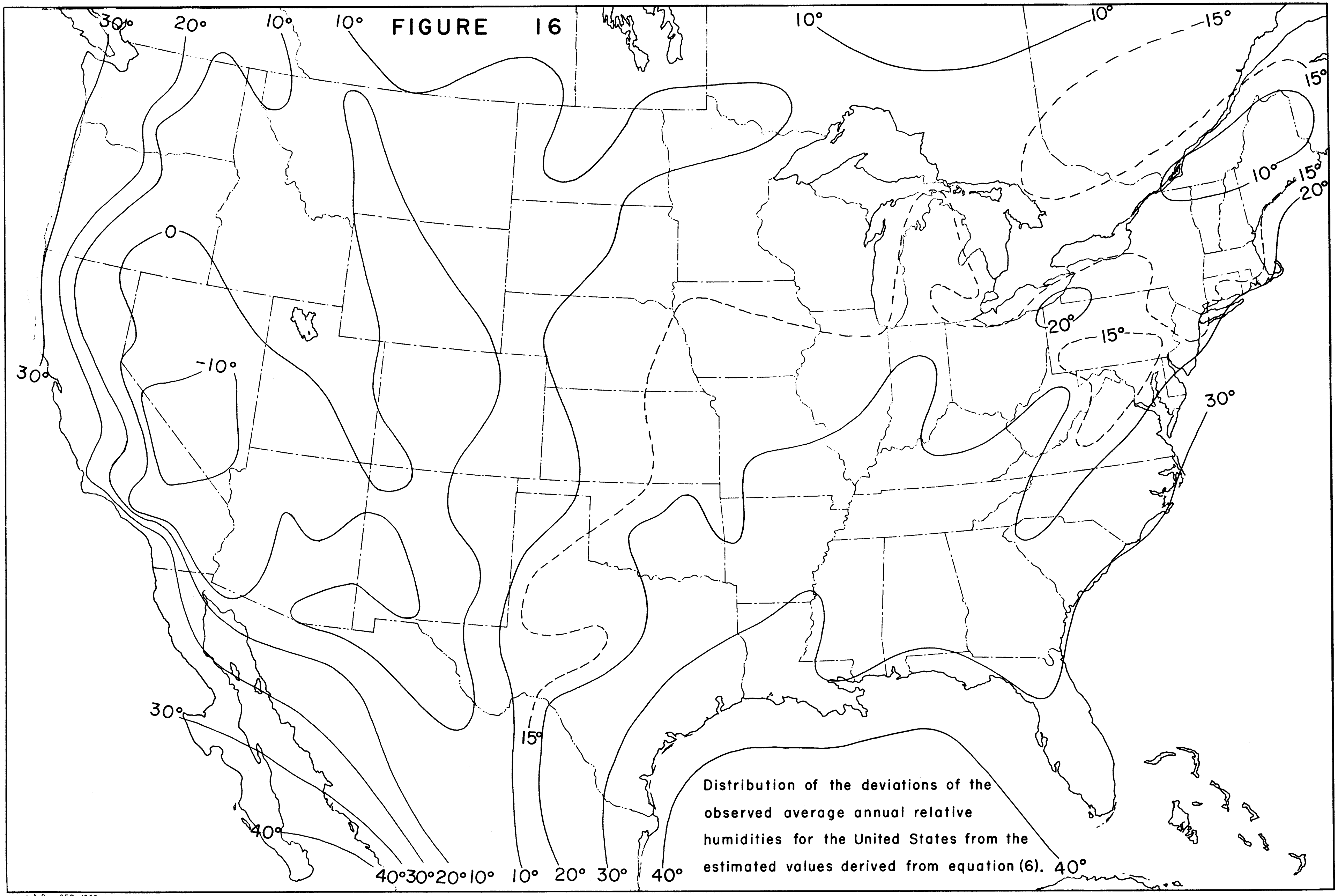


Figure 14 Diurnal variation of surface dew point at Flagstaff, Winslow, Prescott, Phoenix, Tucson, and Yuma, Arizona. Based on data for four to eight years.

FIGURE 15



Distribution of the deviations of the observed 0600 MST relative humidities for the southwestern United States in April from the estimated values derived from equation (5). Based on data for 91 cities.



Distribution of the deviations of the observed average annual relative humidities for the United States from the estimated values derived from equation (6).