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A LONG-RANGE TEMPERATURE FORECAST

By
C. G. ABBOT
Research Associate, Smithsonian Institution

(Publication 4471)

CITY OF WASHINGTON
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GENERAL COMMENTS

I quote the opening paragraph of my recent paper "A Long-Range Forecast of United States Precipitation" [1]: "A hidden family of harmonic regular periods exists in weather. The periodic members of this family persist with unchanged lengths for scores of years. By determining their average forms and amplitudes for intervals of a thousand months, successful forecasts may be made for years to come; or backcasts may be made for former years and compared to former events. Agreement of such backcasts with the records warrants confidence in future forecasts."

In the publication cited correlation coefficients ranging between +52 and +69 percent were found over the interval 1950-58 between prediction and observation. Positive coefficients of correlation, as I will show, also subsist between temperature forecasts and events for the same interval. Examples appear herein as figures 1, 2, 3.

While *very nearly normal weather* must obviously average closer to the normal values than to my forecasts, the case is quite different for extremes of weather. Extremes in precipitation range from 50 to 200 percent away from the normals. It is to be able to anticipate weather of this unusual kind that good forecasts are financially valuable. As an example I give the following computations based on tables 10 and 14 of Publication 4390:

Cincinnati results from table 10

From 108 months, 1950-58, from forecast, 27%	mean departures from normal,	29%
From 56 months within 25% of normal, from forecast, 26%	do.	14%
From 52 months over 25% from normal, from forecast, 27%	do.	47%
From 20 months over 48% from normal, from forecast, 31%	do.	58%

[1] Smithsonian Misc. Coll., vol. 139, No. 9, Publ. 4390, Mar. 23, 1960.

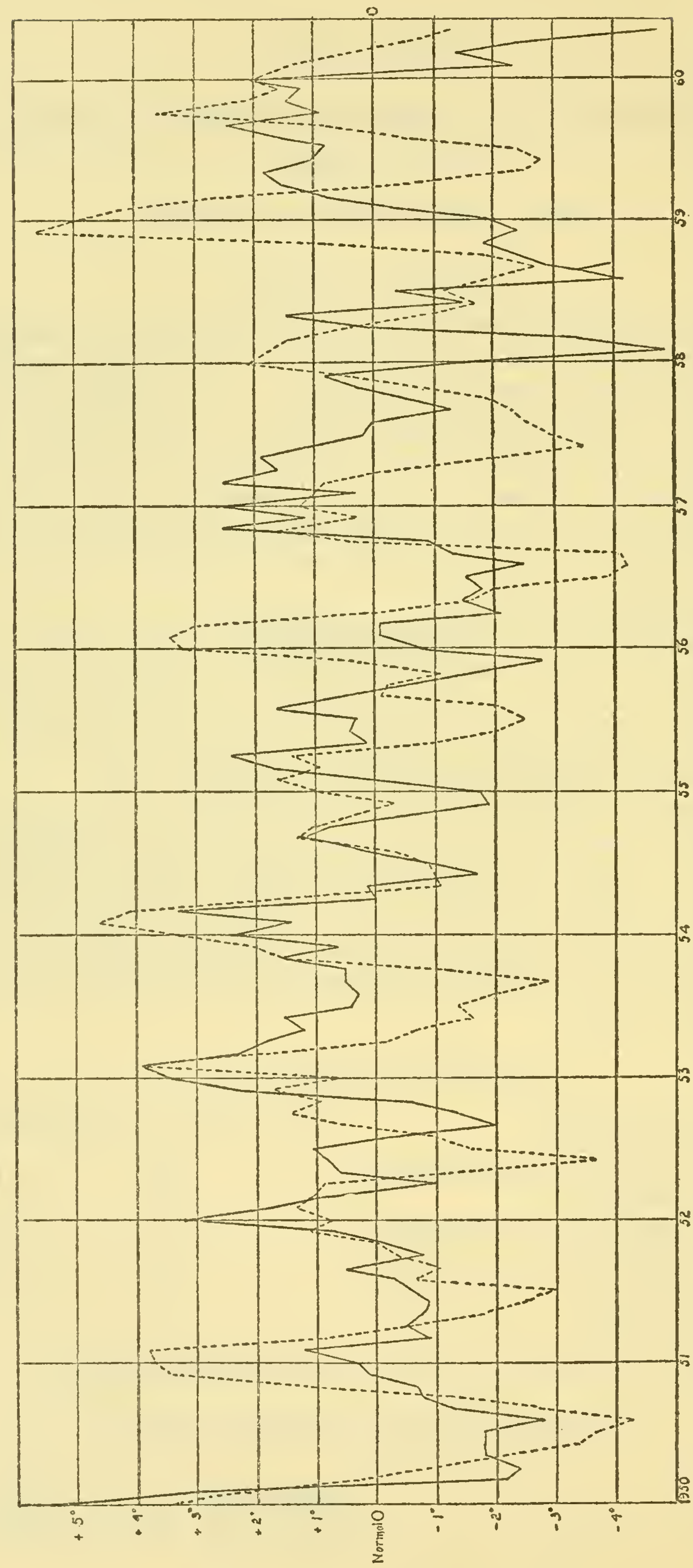


FIG. 1.—Washington temperatures. Dotted lines, forecast; solid lines, observed. Although amplitudes differ, features are seldom displaced a month. Forecast from records for 1870-1956, with 3-month smoothing.

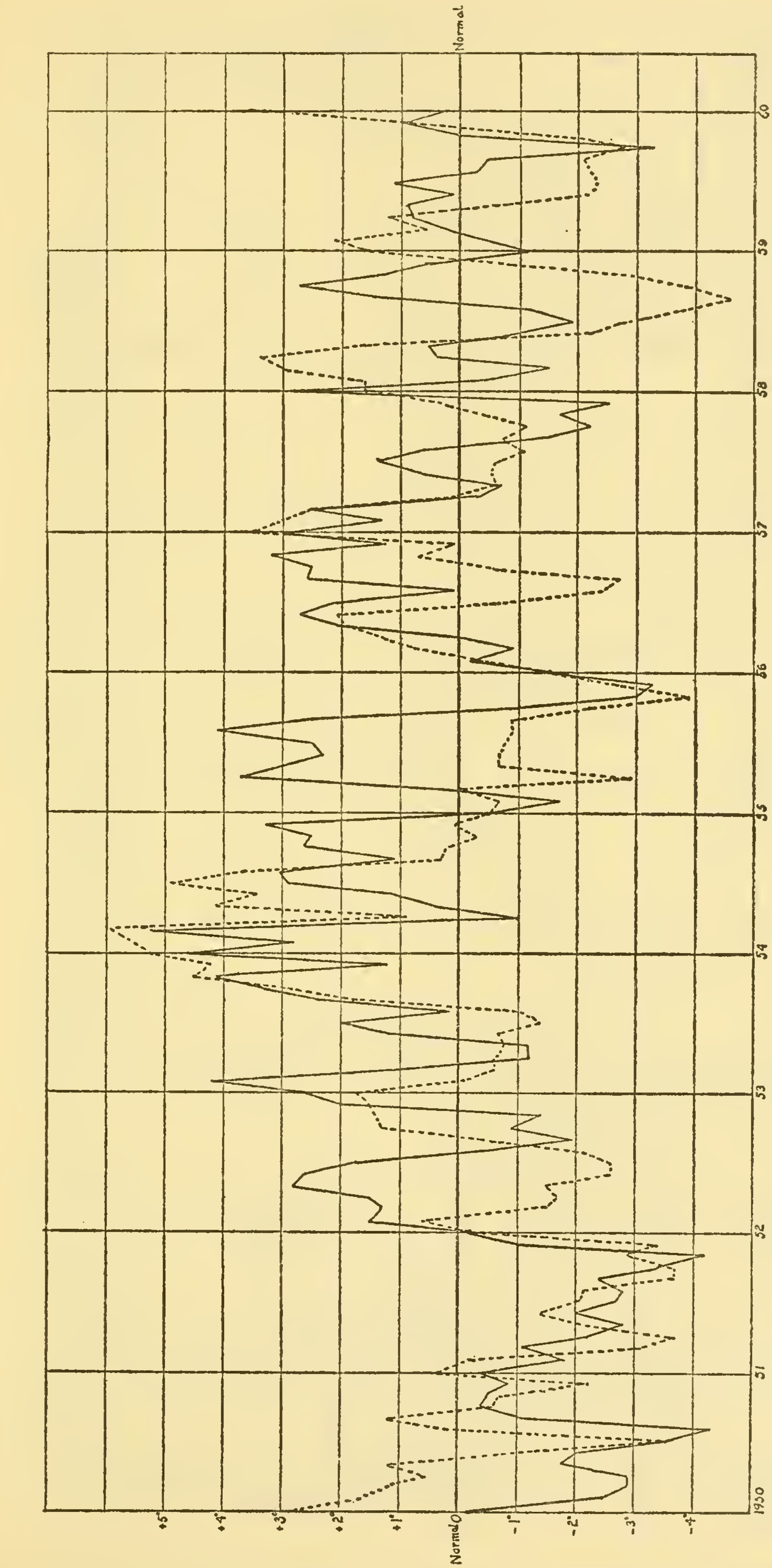


FIG. 2.—Omaha temperatures. Dotted lines, forecast; solid lines, observed. Note 1951, 1952-54, 1954-56, 1957, the great swings predicted. Based on records for 1870 through November 1956, with 3-month smoothing.

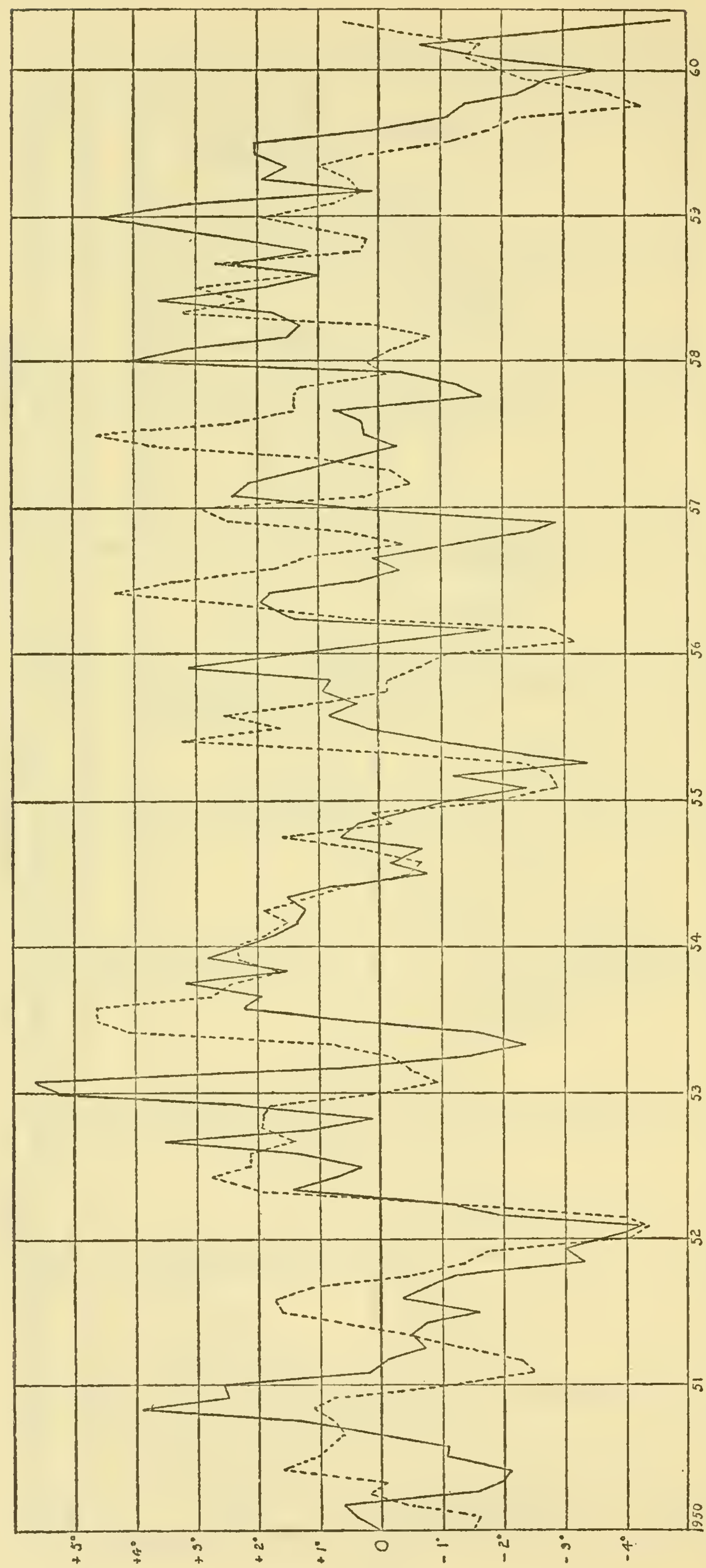


FIG. 3.—Salt Lake City temperatures. Dotted lines, forecast; solid lines, observed. Though amplitudes differ, note check of great swings, with features seldom displaced. Forecast from records for 1870-1956, with 3-month smoothing.

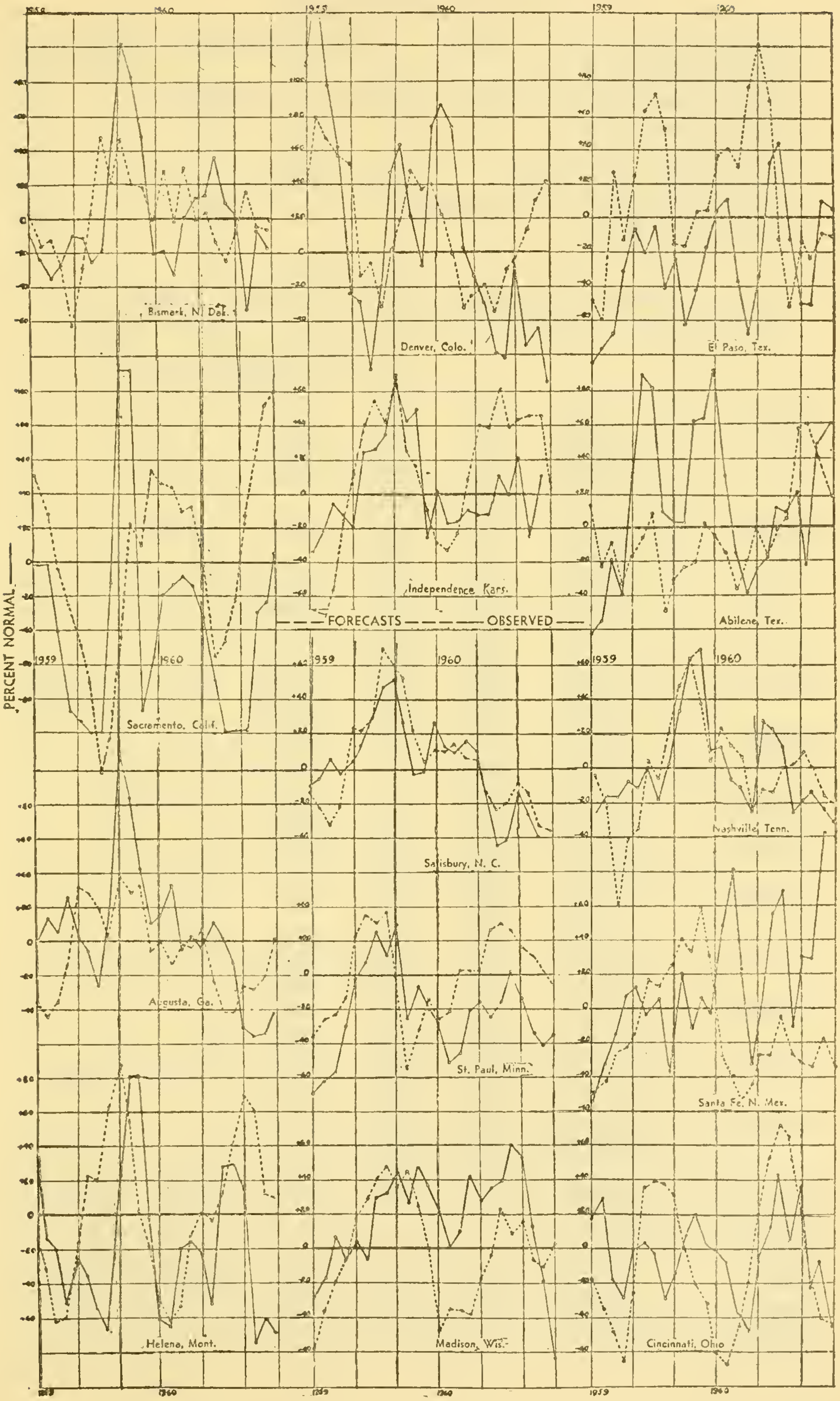


FIG. 4.—Precipitation forecast (dotted lines) and observed (solid lines) from records of 1870-1956.

Cincinnati results from table 14

From 27 four-month periods, 1950-58, from forecast, 26.6%	mean departures from normal,	25%
From 14 periods within 25% from normal, from forecast, 27.7%	do.	13%
From 13 periods over 25% from normal, from forecast, 23%	do.	38%
From 6 periods over 38% from normal, from forecast, 27.5%	do.	47%

TABLE 1.—*Forecasts of precipitation 1950-58 and 1959-60. Departures from normal (1950-58) and percent average deviation from mean departures*

		Groups of deviation from normal				
Station	Interval	0-25	26-50	51-75	76-100	>100
Abilene	1950-58	13±25	36±39	61±34	84±21	....
	1959-60	11±29	37±25	58±60	......	....
Augusta	1950-58	12±23	37±36	58±51	81±70	....
	1959-60	10±31	34±38	......	......	....
Bismarck	1950-58	11±24	34±31	66±57	97±44	....
	1959-60	9±24	36±31	......	......	....
Cincinnati	1950-58	13±24	39±30	56±44	80±17	....
	1959-60	18±19	39±35	64±48	......	....
Denver	1950-58	13±33	39±34	61±30	......	....
	1959-60	13±35	38±38	60±37	......	....
El Paso	1950-58	12±19	40±43	65±32	90±51	112±97
	1959-60	13±37	34±55	65±73	......	....
Helena	1950-58	12±21	35±31	58±40	82±21	....
	1959-60	12±36	......	59±49	......	....
Independence ..	1950-58	13±26	37±33	59±42	81±45	....
	1959-60	13±18	38±30	63±37	......	....
Madison	1950-58	13±27	35±36	64±28	......	....
	1959-60	13±37	39±32	......	......	....
Nashville	1950-58	12±23	35±25	63±30	100±42	....
	1959-60	11±16	37±26	......	......	....
Sacramento	1950-58	11±47	37±43	62±52	80±51	108±55
	1959-60	14±53	37±67	59±56	......	....
Salisbury	1950-58	12±24	33±31	60±36	......	....
	1959-60	17±15	33±17	61±19	......	....
Santa Fe	1950-58	11±37	39±45	61±57	81±54	135±103
	1959-60	17±33	35±41	......	......	....
St. Paul	1950-58	11±29	35±44	77±69	......	....
	1959-60	11±32	30±28	......	......	....
Mean	1950-58	12±27	37±36	62±43	86±42	118±85
Mean/12	1950-58	1	3	5	7	10
A.D./27	1950-58	1	1.3	1.6	1.6	3.0
Mean	1959-60	13±30	36±36	61±47	% above 75	87±89
Mean/13	1959-60	1	3	5	" "	7
A.D./30	1959-60	1	1.2	1.6		3.0

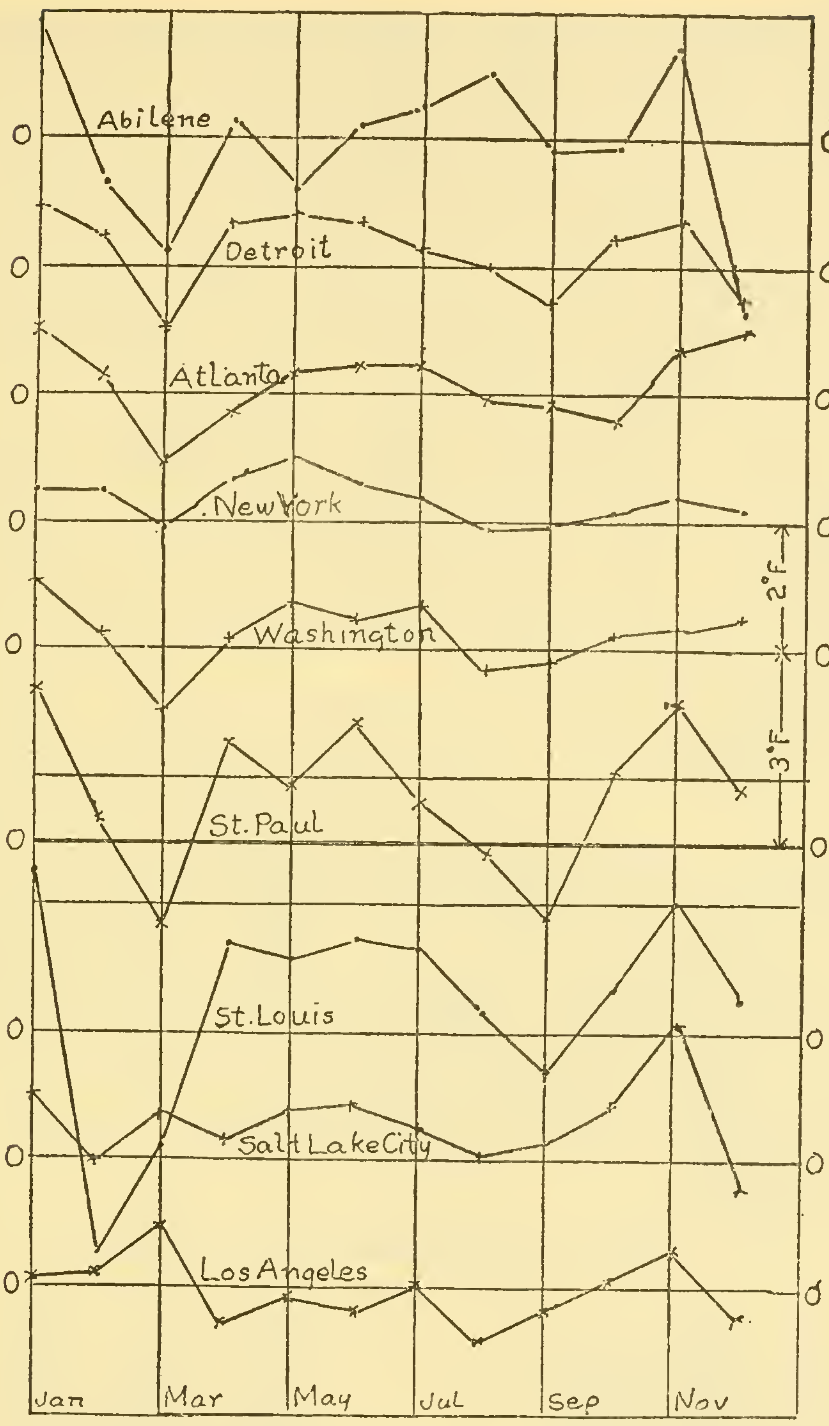


FIG. 5.—Normal temperatures, sunspots few minus sunspots many.

In table 1 I compare an analysis for 14 stations over the interval 1950-58 with an analysis for the same stations for the interval 1959-60. The mean results for the two intervals are almost identical. They show that forecasts three years after the last month (November 1956) used in their basis are just as good as earlier forecasts. Further support for this thesis will be found by inspection of figure 4.

These results show about as good agreement of forecasts with observed precipitation for extreme departures as for usual departures.

This recommends my forecasts to those whose interests demand foreknowledge of wide departures from the normal. A second recommendation arises from the fact, which may be verified by inspection of figures 1, 2, 10, and 11 of Publication 4390, that large trends in departures from normal precipitation, continuing over several years, may be tolerably forecasted. Third, as far as time has elapsed, results remain encouraging. In figure 4 and table 1 I give evidence that during the 24 months of 1959 and 1960, three years after November 1956, (the latest record used in the forecast) a strong correlation (about 50 percent) between forecast and event was observed.

In preparing temperature forecasts or precipitation forecasts, as explained in my paper "A Long-Range Forecast of United States Precipitation," it is necessary to compute new monthly normals from the published records. These new normals relate respectively to the years when the Wolf sunspot numbers are greater, and to the years when they are less than 20.

To illustrate the need for taking account of sunspot frequency in normals of weather records, and to show interesting features of the difference between stations in their relations to sunspot frequency, I give figure 5. It shows the difference in percentage of normal temperature between times of sunspots less and more than 20 Wolf numbers for the 12 months of the year. There is a partial similarity among the graphs, but Salt Lake City and Los Angeles behave rather differently from the other eight. It will be noted that ranges of 2° or even 3° F. occur for some cities, which are ignored in usual monthly normals where sunspot frequency is neglected.

The following dates may be used to separate SS > 20 and SS < 20 groups of months:

TABLE 2.—*Intervals of high and low sunspot numbers* [2]

SS > 20	
July 1857-Aug. 1865	Mar. 1868–Apr. 1875
Jan. 1880–July 1886	May 1891–Nov. 1898
July 1903–Mar. 1910	Jan. 1915–July 1921
Apr. 1925–May 1931	Mar. 1935–May 1942
Mar. 1945–Jan. 1953	May 1955–(May 1962)
SS < 20	
Jan. 1854–June 1857	Sept. 1865–Feb. 1868
May 1875–Dec. 1879	Aug. 1886–Apr. 1891
Dec. 1898–June 1903	Apr. 1910–Dec. 1914
Aug. 1921–Mar. 1925	June 1931–Feb. 1935
June 1942–Feb. 1945	Feb. 1953–Apr. 1955

[2] Table 2 and remarks thereon, unfortunately omitted from Publ. 4390, are here quoted from "Solar Energy," vol. 2, No. 1, June 1958.

In the use of tables of periods in weather for forecasting beyond 1957, it is necessary to make extrapolations from the preceding tables of dates. This is done (of course with marginal uncertainty) by averaging the intervals (given above) in months SS>20 and SS<20, and assuming that future intervals will be approximately the same as these averages. The uncertainty will usually not lead to important errors of forecasts, for generally the curves representing SS > 20 and SS < 20 for the periods are similar for a given period and differ but a few months, or even not at all, in phases. I use for future dates: for SS > 20, 84 months, for SS < 20, 52 months.

To avoid being misled by sudden large jumps between consecutive monthly departures, the departures from these new normals are smoothed by 3-month consecutive means. Owing to unpredictable lags in the phases of the harmonic periods, it is necessary, as explained in the paper just cited, to divide the record data into special groups, depending on the time of the year, the prevalence of sunspots, and the secular march of time. This requires that 220 tables should be computed for the forecast of temperature at each station, just as in the precipitation forecasts of Publication 4390.

This large task requires electronic computation. It was done for the 10 temperature stations and for the 32 precipitation stations by Jonathan Wexler of Tempe, Ariz. In order to avoid new procedure in programming the electronic computer for temperature, I directed him to convert recorded temperatures, published in Fahrenheit degrees, into absolute temperatures Fahrenheit by adding 491.7° minus 32°, or 459.7°. Departures from the monthly normals were then computed in percentages, as was done with the precipitation values.

For instance, the normal temperature for June at Detroit for years of sunspots greater than 20 Wolf numbers is 67.8° F. Subtracting 32° and adding 491.7° it becomes 527.5° abs. F. The observed temperature of Detroit for June 1950 was 68.1° F. Similar steps make it 527.8° abs. F. Its ratio to normal June temperature is $527.8 \div 527.5 = 1.0006$. All this rearranging was done with the electronic computer. In the subsequent computations we used the differences from 1.0000 as far as the fourth decimal place. These differences ranged for the most part between +150 and −80, corresponding to a range of 2.3 percent of the absolute temperature, or about 11.5° F.

Readers interested in further details of the method are referred to my paper "A Long-Range Forecast of United States Precipitation" (Publication 4390) and other references cited therein. Temperature forecasts are somewhat less satisfactory than the precipitation forecasts. For while the range of percentages of normal precipitation goes from 0 to 1,000 or more, the entire range of absolute temperature is only about 2.3 percent. The *accidental* fluctuations of temperature bear a much larger proportion to range than the accidental fluctuations of precipitation. Hence, correlation coefficients between forecasted and observed temperature, though always positive, are always smaller than those between forecasted and observed precipitation. While the 32 cities forecasted for precipitation, 1950 to 1958, all yielded positive correlation coefficients with the events ranging between 50 and 70 percent, the correlations on temperature for 10 cities, forecasted 1950 to 1958, ran as follows: Detroit +16 percent; Los Angeles +22 percent; Atlanta +32 percent; and the other 7 stations all ranged between +40 and +50 percent.

My forecasts of temperature and precipitation rest on one fact and one assumption. The fact is that a harmonic family of regular periods exists in solar radiation and in weather. The assumption is that if this family of periods is individually and quantitatively determined from weather records, 1870 to 1956, the mean course of these periods will be followed approximately through subsequent years. This assumption may indeed prove wrong when unusual disturbances occur in atmospheric conditions—for example, the volcanoes of Krakatoa and Katmai; the furious bombing during the world wars; atomic bomb tests; the hurricane Donna of September 1960. But tests such as figures 1, 2, 3, 10, 11 of Publication 4390, and those of temperature in this paper, show that generally the assumption is justified. As yet it has not been explained why displacements between forecasts and events in features of weather by 1, 2, or 3 months occasionally are observed. If this difficulty can be overcome, much higher coefficients of correlation will be found between forecasts and events. I plan an investigation of possible causes of this defect.

There is one important difference between my forecasts of precipitation and of temperature. The amplitude of the principal features in precipitation changes was found for all stations to be so nearly the same in forecasts and events that no adjustments were made. Not so with temperature. For all the 10 cities the *amplitudes* of the features of change were obviously *greater in the forecasts* than in the events. I cannot explain why this is so. The forecasts would have been left woefully wrong unless this discrepancy had been corrected.

To make this correction for *scale*, I carefully plotted for each city the curves of forecast and event from 1950 through 1958. Then I measured as best I could the depths of obviously corresponding large depressions of the two curves, and determined their average ratio of amplitudes in forecasts and observations for about a half dozen principal depressions. These ratios, in terms of event divided by forecast, were for most cities between 0.70 and 0.75. Using these average ratios of amplitude of features, I reduced all the forecasts to approximately the same scale of amplitude as the events.

There remained still another correction, but one not puzzling like that for scale. As many have pointed out, temperatures have gradually risen in parts of the United States for a great many years. It would have been quite wrong to make forecasts of temperature for 1950 through 1967 without allowing for this well-established change of *level*. Hence I took the ratio of the sum of monthly departures from normal after correcting for scale, as forecasted from 1950 through 1959, and divided by the corresponding sum for the event. This gave a correction to lift the forecasts bodily by amounts ranging from 0.11 to 0.37 percent for the different cities. Expressed in degrees of temperature, these corrections of *level* range from 0.5° to 1.9° F.

Having by these two necessary corrections adjusted the forecasts to terms justly comparable with the events, I computed the correlation coefficients mentioned above.

RESULTS OF THE INVESTIGATION

First of all, to inspire confidence in the method, which, as I have said, is substantially the same for temperature as for precipitation, I give in figure 4 for 14 of the 32 stations of Publication 4390 a comparison of forecasts and events on precipitation for the 24 months of 1959 and 1960. This interval is several years beyond the latest month, November 1956, used in the basis of the forecasts. Table 1, above, gives for 1959 and 1960 an analysis of the monthly values of forecasts and events in percentage departures from the normal monthly precipitation to be found in column B, table 9, of Publication 4390.

Twelve other precipitation stations gave almost as good correlation as these fourteen stations, except that more cases of displacement of features by one, two, or three months occurred between forecasts and events. Such displacements, frequently noted in my former papers, are as yet impossible to forecast. This is the main defect of my forecasts. It is true that the *amplitudes* of features frequently differ between forecasts and events, but if the main features occur *when predicted,* the moderate difference of amplitudes is not a very serious defect. If one could predict *when* phases of prominent features would be displaced, the correlation between forecasts and events in precipitation would rise from being 40 to 70 percent to lie between 70 and 90 percent.

I have computed the correlation coefficient in precipitation between forecasts and events, 1959 through 1960, combining the results referred to in table 1 for 14 stations. Just as the mean temperatures for the decade 1950 to 1960 differ generally between 0.5° and 2.0° F. from those of the mean values 1870 to 1956, so, too, the mean values of precipitation 1950 to 1961 differ from the mean values 1870 to 1956. Before computing the general correlation coefficients, 1950-58 and 1959-60, for the 14 stations, I have corrected these differences of *level* by lifting or lowering the forecasts bodily. These differences range from zero to 17 percent among the 14 stations. This done, the general correlation coefficient between forecasts and events for the 336 months during 1959 and 1960 available at the time of computing from official records resulted as +47.0 percent.

I am not aware that anyone has ever before predicted the monthly precipitation at 14 definite cities over 2 years of time (in my case 1959-1960) and has achieved a correlation coefficient as high as +47 percent for 24 months, 3 years after the last month used in the basis of his forecast. It seems to me that this marks an important and encouraging advance in long-range forecasting.

Figure 4 shows graphically the results tabulated in table 1. I call attention to cases of displacements of obviously common features in forecasts and events that occurred, and remark that such displacements must obviously have pulled down the value of the correlation coefficient which, notwithstanding, reached +47 percent. These cases are: Cincinnati, 3 months May 1959–April 1960; El Paso, 2 months about June 1960; Helena, 2 months about October 1959 and 2 months about September 1960; Sacramento, 2 months about January 1960.

NUMERICAL TABULATIONS

I was assisted in these tabulations by Mrs. Lena Hill and Mrs. Isobel Windom. Miss M. A. Neill assisted in reading proof. With the electronic computer, Jonathan Wexler furnished 3-month means of absolute temperatures, covering the years 1870 through 1956. We continued them through 1959. Subtracting 459.7°, we expressed them in ordinary Fahrenheit degrees. There were two sets of monthly normals computed covering 1870 through 1956: A for the years when Wolf sunspot numbers were less than 20, B for the years when Wolf sunspot numbers exceeded 20. The dates included in these two categories are given in table 2 and accompanying quotation from the journal "Solar Energy."

Table 3 gives these two sets of normal temperatures in both absolute and ordinary Fahrenheit, applying to the years 1870 through 1956.

TABLE 3.—*Normal monthly temperatures from records 1870-1956 absolute and usual Fahrenheit*

	Category A Wolf sunspot numbers < 20				Category B Wolf sunspot numbers > 20			
	Abilene. 1				Atlanta. 2			
	Absolute		Usual		Absolute		Usual	
	A	B	A	B	A	B	A	B
Jan.	504.9°	503.2°	45.2°	43.5°	504.1°	503.1°	44.4°	43.4°
Feb.	506.9	507.6	47.2	47.9	505.8	505.5	46.1	45.8
Mar.	514.3	516.1	54.6	56.4	511.8	512.9	52.1	53.2
Apr.	524.6	524.3	64.9	64.6	520.7	521.0	61.0	61.3
May	531.2	532.0	71.5	72.3	529.6	529.3	69.9	69.6
June	539.7	539.5	80.0	79.8	536.6	536.2	76.9	76.5
July	543.0	542.5	83.3	82.8	538.6	538.2	78.9	78.5
Aug.	542.9	541.9	83.2	82.2	537.5	537.6	77.8	77.9
Sept.	535.5	535.7	75.8	76.0	532.8	533.0	73.1	73.3
Oct.	525.4	525.5	65.7	65.8	522.4	522.8	62.7	63.1
Nov.	514.1	512.6	54.4	52.9	512.1	511.4	52.4	51.7
Dec.	505.0	505.7	45.3	46.0	505.1	504.1	45.4	44.4

	Detroit. 3				Los Angeles. 4			
	Absolute		Usual		Absolute		Usual	
	A	B	A	B	A	B	A	B
Jan.	485.8°	484.8°	26.0°	25.1°	515.2°	515.1°	55.5°	55.4°
Feb.	485.9	485.4	26.2	25.7	516.2	516.0	56.5	56.3
Mar.	492.6	494.5	32.9	34.8	518.4	517.5	58.7	57.8
Apr.	506.3	505.6	46.6	45.9	519.6	520.2	59.9	60.5
May	518.0	517.2	58.3	57.5	522.4	522.6	62.7	62.9
June	528.2	527.5	68.5	67.8	526.0	526.4	66.3	66.7
July	532.8	532.5	73.1	72.7	530.5	530.5	70.8	70.8
Aug.	530.5	530.5	70.8	70.8	530.7	531.6	71.0	71.9
Sept.	523.2	523.8	63.5	64.1	529.5	529.9	69.8	70.2
Oct.	512.5	512.1	52.8	52.4	525.6	525.6	65.9	65.9
Nov.	499.8	499.1	40.1	39.4	522.2	521.5	62.5	61.9
Dec.	488.9	489.4	29.2	29.7	516.8	517.3	57.1	57.6

	New York. 5				Omaha. 6			
	Absolute		Usual		Absolute		Usual	
	A	B	A	B	A	B	A	B
Jan.	491.8°	491.3°	32.1°	31.6°	483.4°	480.6°	23.7°	20.9°
Feb.	491.8	491.3	32.1	31.6	486.1	485.4	26.4	25.7
Mar.	498.7	498.8	39.0	39.1	495.7	497.6	36.0	37.9
Apr.	509.4	508.7	49.7	49.0	512.6	510.5	52.9	50.8
May	520.6	519.6	60.9	59.9	522.7	522.1	63.0	62.4
June	529.3	528.7	69.6	69.0	532.9	531.6	73.2	71.9
July	534.4	534.0	74.7	74.3	537.9	537.2	78.2	77.5
Aug.	532.6	532.7	72.9	73.0	535.0	534.8	75.3	75.1
Sept.	526.4	526.5	66.7	66.8	525.5	526.5	65.8	66.8
Oct.	516.3	516.2	56.6	56.5	514.9	513.8	55.2	54.1
Nov.	504.9	504.5	45.2	44.8	499.6	497.6	39.9	37.9
Dec.	494.7	494.5	35.0	34.8	487.1	486.7	27.4	27.0

TABLE 3—*continued*

	Category A, Wolf sunspot numbers < 20				Category B, Wolf sunspot numbers > 20			
	Salt Lake City. 7				St. Louis. 8			
	Absolute		Usual		Absolute		Usual	
	A	B	A	B	A	B	A	B
Jan.	488.8°	487.8°	29.1°	28.1°	493.6°	491.1°	33.9°	31.4°
Feb.	492.9	493.0	33.2	33.3	495.0	494.5	35.3	34.8
Mar.	501.3	500.6	41.6	40.9	502.8	504.6	43.1	44.9
Apr.	509.7	509.4	50.0	49.7	516.6	515.2	56.9	55.5
May	518.2	517.5	58.5	57.8	526.5	525.6	66.8	65.9
June	527.5	526.7	67.8	67.0	536.0	534.5	76.3	74.8
July	536.2	535.7	76.5	76.0	540.3	539.0	80.6	78.3
Aug.	534.3	534.3	74.6	74.6	537.7	537.4	78.0	77.7
Sept.	524.4	524.2	64.7	64.5	529.7	530.3	70.0	70.6
Oct.	512.8	512.0	53.1	52.3	519.0	518.3	58.3	58.6
Nov.	501.2	499.1	41.5	39.4	506.2	504.2	46.5	44.5
Dec.	490.9	491.4	31.2	31.7	495.3	494.8	35.6	35.1
	St. Paul. 9				Washington. 10			
	Absolute		Usual		Absolute		Usual	
	A	B	A	B	A	B	A	B
Jan.	474.0°	471.6°	14.3°	11.9°	495.3°	494.3°	35.6°	34.6°
Feb.	476.5	476.2	16.8	16.4	495.8	495.5	36.1	35.8
Mar.	488.1	489.6	28.4	29.9	502.7	503.6	43.0	43.9
Apr.	506.3	504.8	46.6	45.1	514.0	513.9	54.3	54.2
May	518.5	517.6	58.8	57.9	524.6	523.9	64.9	64.2
June	528.3	526.5	68.6	66.8	532.8	532.4	73.1	72.7
July	533.1	532.4	73.3	72.7	537.2	536.5	77.5	76.8
Aug.	529.7	529.9	70.0	70.2	534.5	534.8	74.8	75.1
Sept.	519.9	521.1	60.2	61.4	528.2	528.3	68.5	68.6
Oct.	509.2	508.1	49.5	48.4	517.2	517.0	57.5	57.3
Nov.	493.4	491.2	33.7	31.5	506.1	505.8	46.4	46.1
Dec.	479.8	479.0	20.1	19.3	496.8	496.4	36.1	36.7

The same 27 harmonic periods were evaluated for temperature forecasts that were used for precipitation forecasts (see Publ. 4390). As stated above, atmospheric changes required division of the monthly temperature records, 1870 through 1956, into 220 groups. Each period was determined in form and amplitude by employing these groups as was described in Publication 4390 and other papers cited therein. Thereby a table of 216 months, 27 columns wide, was formed to cover the interval 1950 through 1967. The columns were added together across the table to make a single column of temperature forecasts for each city for the years 1950 through 1967. This column was designated "Σ." A parallel column designated "Obs" contained the observed temperatures of 108 months, 1950 through 1959. Both columns were representative, not of absolute Fahrenheit degrees of temperature, but of percentages of the normals A and B of table 3. One might regard them as flowing functions, $1+X$ and $1+Y$, times the normal temperatures A and B, where X and Y are flowing variables, each ranging from -80 to $+150$ ten-thousandths.

Taking the mean $1+X$ and the mean $1+Y$, used as multipliers of the normals A and B, these normals could be transferred into new normals suited to the atmospheric conditions prevailing from 1950 through 1959. By assumption these new normals were usable in the forecasts from 1960 through 1967. But, as stated above, it was found that neither in *scale* nor in *level* did the new normals from X agree with the new normals from Y. To make the Σ values fairly comparable with the Obs values, a *scale* correction to Σ was first determined. This was done as stated above by plotting Σ and Obs from 1950 through 1959, and obtaining the mean ratio of amplitudes of some half-dozen principal obviously common features of the two curves. After this adjustment of scale a level correction to Σ was computed. This was the ratio of the sums of scale-corrected Σ to the unchanged Obs for the years 1950 through 1959. Applying it, the two variables became justly comparable. As thus reconciled, the new final normal absolute temperatures were tabulated, and then they were reduced to ordinary Fahrenheit by subtracting 459.7°. In this form the new normals, which are assumed to be suited to the atmospheric conditions 1950 through 1967, are given in table 4.

Subtracting the new normals from the two reconciled columns of Σ and Obs we obtained the monthly march of Obs from 1950 through 1959, and that of Σ from 1950 through 1967. The march Σ after 1960 represents the forecast of chief interest. But the comparative marches of Σ and Obs 1950 through 1959 gives the evidence on which a judgment of the probable value of the forecast 1960 through 1967 principally depends.

For convenient general views of the predicted march of temperature, I give in table 6 4-month mean values of the forecasted departures from normal 1950 through 1967, together with 4-month means of the observed departures from normal 1950 through 1959. From a comparison of these 10 years a judgment may be formed of the worth of the forecast after 1959.

As further evidence of the value of the forecast I give in table 7 the average discrepancy between forecast and event 1950 through 1959 and the average algebraic mean difference to show that the corrections for scale and level combined closely reconciled forecast and event.

TABLE 4.—*Normal temperature corrected for scale and level to suit interval 1950 through 1959*

	Abilene		Atlanta		Detroit		Los Angeles		New York	
	A	B	A	B	A	B	A	B	A	B
Jan.	45.8°	44.1°	45.2°	44.1°	27.2°	26.2°	56.8°	56.7°	33.9°	33.4°
Feb.	47.8	48.5	46.9	46.6	27.3	26.8	57.8	57.6	33.9	33.4
Mar.	55.2	57.0	52.8	54.0	33.9	35.9	60.0	59.1	40.8	40.9
Apr.	65.5	65.2	61.8	62.1	47.8	47.0	61.2	61.8	51.6	50.7
May	72.1	72.9	70.7	70.4	59.5	58.7	64.1	64.2	62.8	61.8
June	80.6	80.4	77.7	77.3	69.7	69.0	67.6	68.0	71.6	70.0
July	84.0	83.5	79.7	79.3	74.3	73.9	72.1	72.1	76.7	76.3
Aug.	83.9	82.9	78.6	78.7	72.0	72.0	72.3	73.2	74.9	74.0
Sept.	76.4	76.5	73.9	74.1	64.7	65.3	71.1	71.5	68.6	68.7
Oct.	66.3	66.4	63.5	63.9	54.0	53.6	67.2	67.2	58.5	58.4
Nov.	55.0	53.5	53.2	52.5	41.2	40.5	63.8	63.1	47.1	46.7
Dec.	45.9	46.6	46.2	45.2	30.3	30.8	58.4	58.9	36.7	36.6

	Omaha		Salt Lake City		St. Louis		St. Paul		Washington	
	A	B	A	B	A	B	A	B	A	B
Jan.	23.9°	21.1°	29.3°	28.3°	34.5°	32.0°	15.0°	12.6°	37.5°	36.5°
Feb.	26.6	25.9	33.4	33.5	35.4	35.4	17.5	17.2	38.1	37.7
Mar.	36.2	38.1	41.9	41.2	43.7	45.5	29.1	30.6	44.9	45.8
Apr.	53.2	51.1	50.3	50.0	57.5	56.1	47.4	45.9	56.3	56.2
May	63.3	62.7	58.8	58.1	67.4	66.5	59.6	58.7	66.9	66.3
June	73.5	72.2	68.1	67.3	76.9	75.4	69.4	67.6	75.1	74.7
July	78.5	77.8	76.8	76.3	81.2	79.9	74.2	73.5	79.5	78.8
Aug.	75.6	75.4	74.9	74.9	78.6	78.3	70.8	71.0	76.8	77.1
Sept.	66.1	67.1	65.0	64.8	70.6	71.2	61.0	62.2	70.5	70.6
Oct.	55.5	54.4	53.4	52.6	59.9	59.2	50.3	49.2	59.5	59.3
Nov.	40.1	38.1	41.8	39.6	47.1	45.1	34.4	32.2	48.3	47.0
Dec.	27.6	27.2	31.4	31.8	36.2	35.7	20.8	20.0	39.0	38.5

TABLE 5.—*Forecast of temperature departures from normal 1950 through 1959 from 3-month running means*

	Abilene, Tex.			Atlanta, Ga.			Detroit, Mich.			Los Angeles, Calif.			New York, N. Y.		
	Forecast Fahr.	Observed	O-F Δ	Forecast Fahr.	Observed	O-F Δ	Forecast Fahr.	Observed	O-F Δ	Forecast Fahr.	Observed	O-F Δ	Forecast Fahr.	Observed	O-F Δ
1950															
Jan.	+3.2°	+2.9°	—0.3°	+3.5°	+5.4°	+1.9°	+2.6°	+2.8°	+0.2°	—1.5°	—3.5°	—2.0°	+2.0°	+4.0°	+2.0°
Feb.	+1.4	+1.7	+0.3	+0.6	+3.9	+3.3	+1.0	—0.2	—1.2	—0.6	—2.5	—1.9	+2.2	+1.5	—0.7
Mar.	+0.7	+0.2	—0.5	—1.5	—0.9	+0.6	+0.5	—3.9	—4.4	+0.8	—0.2	—1.0	+0.5	—2.2	—2.7
Apr.	+1.2	—1.1	—2.3	—0.1	—1.6	—1.5	+0.6	—4.1	—4.7	+0.4	—0.5	—0.9	—1.5	—3.3	—1.8
May	+2.7	—0.9	—3.6	+2.8	—0.3	—3.1	+0.1	—2.5	—2.6	—0.6	—0.9	—0.3	—3.2	—2.5	+0.7
June	+1.5	—1.3	—2.8	+2.0	+0.3	—1.7	+0.3	—1.5	—1.8	—0.8	—0.8	0.0	—2.1	—1.2	+0.9
July	+0.9	—2.4	—3.3	+1.2	—1.3	—2.5	—0.5	—1.0	—0.5	—1.4	—0.8	+0.6	—3.5	—1.7	+1.8
Aug.	—1.4	—2.7	—1.3	+0.3	—2.4	—2.7	0.0	—2.5	—2.5	—0.6	—1.3	—0.7	—2.1	—1.5	+0.6
Sept.	—0.1	—0.1	0.0	—1.1	—1.0	+0.1	+0.7	—0.6	—1.3	—0.2	—0.9	—0.7	—1.8	—1.3	+0.5
Oct.	—0.7	+0.9	+1.6	—2.8	—1.9	+0.9	+0.9	—1.3	—2.2	+0.8	+0.1	—0.7	—1.1	—0.2	+0.9
Nov.	+0.1	+0.6	+0.5	+2.9	—2.5	—5.4	+0.5	—2.2	—2.7	+1.3	+2.0	+0.7	+1.1	+0.5	—0.6
Dec.	—1.9	—1.0	+0.9	—1.5	—2.8	—1.3	+0.3	—2.5	—2.8	+2.5	+0.9	—1.6	+3.2	+0.9	—2.3
1951															
Jan.	—1.0°	—0.7°	+0.3°	—2.7°	—0.8°	+1.9°	+0.2°	—0.9°	—1.1°	+2.7°	+0.3°	—2.4°	+3.3°	+1.5°	—1.8°
Feb.	—2.3	—0.2	+2.1	—2.0	+0.4	+2.4	+0.8	+1.0	+0.2	+2.4	—0.4	—2.8	+2.7	+2.3	—0.4
Mar.	—1.4	—0.7	+0.7	—1.5	—0.7	+0.8	+0.6	0.0	—0.6	+0.9	—0.6	—1.5	+0.5	+1.7	+1.2
Apr.	—1.6	—0.8	+0.8	—3.9	—1.1	+2.8	—0.5	+0.1	+0.6	—0.2	—0.5	—0.3	—0.1	+0.7	+0.8
May	—1.8	—0.6	+1.2	—2.0	—0.7	+1.3	—1.6	—0.6	+1.0	—0.4	—1.3	—0.9	—1.3	—0.1	+1.2
June	—0.6	+0.6	+1.2	+0.1	—0.1	—0.2	0.0	—0.6	—0.6	—1.4	—0.6	+0.8	—0.8	+0.1	+0.9
July	+1.3	+1.6	+0.3	—1.5	+0.8	+2.3	—0.2	—1.7	—1.5	—1.6	—0.8	+0.8	—1.9	—1.4	+0.5
Aug.	+1.1	+2.2	+1.1	+1.5	+0.5	—1.0	—0.3	—2.4	—2.1	—1.4	—0.6	+0.8	—0.3	—0.1	+0.2
Sept.	—0.5	+2.4	+2.9	—0.6	+1.1	+1.7	—0.6	—1.3	—0.7	—1.2	—0.2	+1.0	—0.9	—0.7	+0.2
Oct.	—2.6	—0.2	+2.4	—0.7	—1.4	—0.7	+0.2	—2.5	—2.7	—1.2	0.0	+1.2	—1.1	—1.5	—0.4
Nov.	0.0	0.0	0.0	—1.2	—0.6	+0.6	—0.7	—2.2	—1.5	—0.6	—1.4	—0.8	—0.1	—0.2	—0.1
Dec.	—0.5	+1.8	+2.3	—0.2	+0.7	+0.9	+0.1	—1.6	—1.7	+0.4	—3.3	—3.7	+1.8	+0.7	—1.1

(continued)

TABLE 5.—*continued*

	Abilene, Tex.			Atlanta, Ga.			Detroit, Mich.			Los Angeles, Calif.			New York, N. Y.		
	Forecast Fahr.	Observed	O-F Δ	Forecast Fahr.	Observed	O-F Δ	Forecast Fahr.	Observed	O-F Δ	Forecast Fahr.	Observed	O-F Δ	Forecast Fahr.	Observed	O-F Δ
1952															
Jan.	0.0°	+4.2°	+4.2°	+1.5°	+3.1°	+1.6°	+1.2°	+1.1°	—0.1°	+0.7°	—2.4°	—3.1°	+2.1°	+2.8°	+0.7°
Feb.	—0.8	+2.6	+3.4	+1.8	+1.5	—0.3	+1.3	+1.3	0.0	+0.2	—2.0	—2.2	+1.8	+1.8	0.0
Mar.	—1.3	—0.5	+0.8	0.0	—0.3	—0.3	+1.8	+1.0	—0.8	—0.4	—1.1	—0.7	+1.6	+1.8	+0.2
Apr.	—1.1	—1.9	—0.8	—0.1	—0.5	—0.4	+1.1	—0.3	—1.4	—0.8	—0.7	+0.1	—0.7	0.0	+0.7
May	+0.1	0.0	—0.1	—1.0	+2.0	+3.0	—0.5	+1.7	+2.2	—1.2	—0.2	+1.0	—1.8	+1.0	+2.8
June	+0.9	+0.9	0.0	+1.2	+3.1	+1.9	—2.8	+1.4	+4.2	—2.1	+0.1	+2.2	—2.7	+1.7	+4.4
July	+0.6	+3.4	+2.8	+0.5	+2.4	+1.9	—3.5	+1.8	+5.3	—1.6	—0.4	+1.2	—2.4	+1.2	+3.6
Aug.	+3.5	+2.0	—1.5	+0.3	—0.2	—0.5	—2.1	+0.3	+2.4	—0.7	+1.3	+2.0	+0.3	+1.7	+1.4
Sept.	+2.5	+1.0	—1.5	+0.6	—4.3	—4.9	—1.9	—2.4	—0.5	—0.4	+1.1	+1.5	+1.0	—1.4	—2.4
Oct.	+1.9	—1.8	—3.7	+1.3	—4.5	—5.8	—1.3	—1.4	—0.1	—0.6	—0.5	+0.1	+1.1	—0.7	—1.8
Nov.	+2.2	—1.9	—4.1	+1.6	—4.7	—6.3	—0.7	+0.1	+0.8	—1.8	—2.3	—0.5	+0.9	—0.2	—1.1
Dec.	+2.2	+1.5	—0.7	+1.6	+0.5	—1.1	+0.3	+3.4	+3.1	—0.9	—1.0	—0.1	+2.0	+2.6	+0.6
1953															
Jan.	+0.1°	+2.3°	+2.2°	—0.7°	+0.7°	+1.4°	—0.1°	+4.3°	+4.4°	+0.7°	+0.7°	0.0°	+2.6°	+3.4°	+0.8°
Feb.	+4.4	+4.6	+0.2	+2.8	+1.7	—1.1	+1.3	+4.4	+3.1	+0.8	+1.3	+0.5	+2.1	+3.6	+1.5
Mar.	+2.8	+1.5	—1.3	—0.9	0.0	+0.9	—0.7	+1.9	+2.6	—0.1	—0.9	—0.8	+0.3	+1.9	+1.6
Apr.	+2.8	+1.1	—1.7	—2.6	+0.7	+3.3	—1.7	0.0	+1.7	—1.0	—1.2	—0.2	+0.2	+0.3	+0.1
May	+2.1	+1.6	—0.5	—3.8	+0.3	+4.1	—2.8	—1.0	+1.8	—1.6	—1.2	+0.4	—0.4	—0.4	0.0
June	+0.3	+2.3	+2.0	—4.6	+0.7	+5.3	—3.3	0.0	+3.3	—1.0	+0.6	+1.6	—1.8	—0.5	+1.3
July	—1.1	+1.5	+2.6	—3.3	0.0	+3.3	—1.7	+0.8	+2.5	—1.0	+0.1	+1.1	—2.2	—0.1	+2.1
Aug.	—4.3	—0.1	+4.2	—2.4	—0.8	+1.6	—1.4	+0.3	+1.7	—0.7	+0.1	+0.8	—1.5	0.0	+1.5
Sept.	—5.3	0.0	+5.3	—2.6	—0.3	+2.3	+0.7	+1.5	+0.8	+0.1	—0.2	—0.3	—1.2	+0.8	+2.0
Oct.	—4.9	—0.3	+4.6	—3.5	—0.5	+3.0	—0.1	+1.9	+2.0	+1.6	+0.3	—1.3	+0.2	+1.4	+1.2
Nov.	—2.1	—1.5	+0.6	—1.5	—0.9	+0.6	+1.4	+3.1	+1.7	+2.6	+0.8	—1.8	+1.6	+2.5	+0.9
Dec.	—2.0	—1.5	+0.5	+0.1	—1.0	—1.1	+0.6	+1.9	+1.3	+2.1	—0.2	—2.3	+1.9	+1.4	—0.5

1954															
Jan.	+0.1°	+1.9°	+1.8°	—0.9°	+0.2°	+1.1°	+2.1°	+2.9°	+0.8°	+1.7°	+1.7°	0.0°	+2.0°	+2.6°	+0.6°
Feb.	+1.3	+2.3	+1.0	+2.2	+1.1	—1.1	+2.5	+1.6	—0.9	+1.5	+0.7	—0.8	+2.1	+1.4	—0.7
Mar.	+4.4	+3.9	—0.5	+2.5	+2.4	—0.1	+2.7	+2.7	0.0	+1.6	+1.0	—0.6	+3.3	+2.7	—0.6
Apr.	+4.2	—0.1	—4.3	+0.7	—0.8	—1.5	—1.1	—1.2	—0.1	+1.6	—1.2	—2.8	+0.9	—0.6	—1.5
May	+4.0	+0.5	—3.5	+1.7	—0.8	—2.5	+0.5	—0.5	—1.0	+0.7	—0.2	—0.9	+0.6	—1.1	—1.7
June	+1.8	0.0	—1.8	+0.9	—1.3	—2.2	+2.1	—2.1	—4.2	—1.1	+1.4	+2.5	+0.9	—2.2	—3.1
July	+2.3	+2.1	—0.2	+4.3	+2.2	—2.1	+4.7	+0.1	—4.6	—1.3	+1.8	+3.1	+1.2	—1.9	—3.1
Aug.	+2.4	+3.0	+0.6	+4.5	+3.3	—1.2	+4.2	—1.3	—5.5	+0.2	+2.3	+2.1	+0.2	—2.1	—2.3
Sept.	+1.4	+2.4	+1.0	+5.2	+2.9	—2.3	+3.2	—0.3	—3.5	+1.1	+0.2	—0.9	+2.3	—0.8	—3.1
Oct.	+1.0	+1.7	+0.7	+2.6	+0.3	—2.3	+2.1	+0.3	—1.8	+0.8	+0.1	—0.7	+2.3	—0.2	—2.5
Nov.	+0.2	+1.4	+1.2	+1.7	—1.8	—3.5	—1.1	—0.1	+1.0	+0.3	—0.8	—1.1	+1.7	0.0	—1.7
Dec.	—0.8	+0.9	+1.7	0.0	—2.6	—2.6	—1.3	—0.4	+0.9	+0.3	—1.0	—1.3	—0.4	—1.7	—1.3
1955															
Jan.	—1.1°	+0.8°	+1.9°	+1.8°	—1.2°	—3.0°	+0.8°	+3.3°	+2.5°	0.0°	—1.4°	—1.4°	—0.9°	—1.2°	—0.3°
Feb.	—1.8	+0.4	+2.2	+0.6	+0.8	+0.2	+1.0	+4.0	+3.0	—0.7	—0.9	—0.2	—0.9	—0.8	+0.1
Mar.	—1.9	+1.9	+3.8	+0.3	+2.7	+2.4	+1.6	+6.5	+4.9	—1.4	+0.2	+1.6	—0.5	+0.8	+1.3
Apr.	—3.4	—2.4	+1.0	+2.2	+3.3	+1.1	—0.7	+3.6	+4.3	—0.8	+0.1	+0.9	—0.8	+1.0	+1.8
May	+1.0	+1.3	+0.3	+0.5	+0.7	+0.2	+1.2	+2.9	+1.7	—0.9	—0.8	+0.1	—0.9	+0.2	+1.1
June	+2.7	—0.2	—2.9	—1.0	—0.7	+0.3	+1.5	+2.5	+1.0	—1.5	—1.4	+0.1	—0.5	+1.8	+2.3
July	+1.5	—0.9	—2.4	+0.1	—1.1	—1.2	+2.0	+2.7	+0.7	—1.9	—0.3	+1.6	—2.0	+1.1	+3.1
Aug.	+0.5	+0.4	—0.1	—0.5	+0.8	+1.3	+1.0	+2.9	+1.9	—1.8	+1.1	+2.9	—1.6	+2.5	+4.1
Sept.	+0.1	+0.6	+0.5	—0.4	+0.2	+0.6	+0.6	+1.7	+1.1	—1.0	+0.7	+1.7	—1.1	+0.9	+2.0
Oct.	—0.5	+0.4	+0.9	—0.3	—0.9	—0.6	0.0	—0.4	—0.4	—0.5	—0.4	+0.1	—0.8	—0.9	—0.1
Nov.	—2.4	—0.4	+2.0	—1.6	—1.9	—0.3	0.0	—1.6	—1.6	—0.2	—2.7	—2.5	—0.5	—2.7	—2.2
Dec.	—3.3	—0.8	+2.5	—0.5	—2.1	—1.6	—0.6	—2.0	—1.4	—0.2	—2.0	—1.8	+0.3	—3.3	—3.6

(continued)

TABLE 5.—*continued*

	Abilene, Tex.			Atlanta, Ga.			Detroit, Mich.			Los Angeles, Calif.			New York, N. Y.		
	Forecast Fahr.	Observed	O-F Δ	Forecast Fahr.	Observed	O-F Δ	Forecast Fahr.	Observed	O-F Δ	Forecast Fahr.	Observed	O-F Δ	Forecast Fahr.	Observed	O-F Δ
1956															
Jan.	—3.2°	—0.9°	+2.3°	+0.9°	+0.1°	—0.8°	+1.0°	—0.6°	—1.6°	+0.3°	—2.7°	—3.0°	+2.1°	—1.2°	—3.3°
Feb.	—1.4	—0.1	+1.3	+2.0	+0.6	—1.4	+1.6	—0.7	—2.3	+0.1	—1.3	—1.4	+1.8	—0.1	—1.9
Mar.	—1.5	—0.4	+1.1	+3.0	+1.1	—1.9	+2.7	—1.2	—3.9	—0.9	—2.1	—1.2	+2.2	—0.7	—2.9
Apr.	—0.9	+1.1	+2.0	+0.3	+0.3	0.0	+1.2	—2.7	—3.9	—2.0	—0.5	+1.5	+0.6	—3.5	—4.1
May	—0.1	+2.2	+2.3	—1.0	+0.1	+1.1	+0.7	—1.3	—2.0	—1.4	—0.4	+1.0	—0.4	—2.4	—2.0
June	+1.3	+3.4	+2.1	+0.6	+0.5	—0.1	—1.1	—1.6	—0.5	—2.9	+0.5	+3.4	+0.9	—1.7	—2.6
July	+2.3	+2.8	+0.5	+0.1	+0.4	+0.3	—1.3	—0.8	+0.5	—1.7	+0.1	+1.8	—1.9	—1.5	+0.4
Aug.	+3.7	+2.2	—1.5	+0.4	—0.2	—0.6	—1.9	—2.8	—0.9	—1.0	+1.1	+2.1	—1.9	—2.0	—0.1
Sept.	+2.8	+2.6	—0.2	—0.7	+0.2	+0.9	—2.4	—0.7	+1.7	+0.9	+1.0	+0.1	—2.1	—1.7	+0.4
Oct.	+1.1	+1.1	0.0	0.0	—1.1	—1.1	—1.0	—0.3	+0.7	+1.9	+2.8	+0.9	+0.5	—1.3	—1.8
Nov.	—0.8	+1.4	+2.2	+1.3	+2.7	+1.4	0.0	+2.8	+2.8	+2.2	+1.7	—0.5	+1.1	+1.7	+0.6
Dec.	+1.8	+0.2	—1.6	—1.0	+2.9	+3.9	—1.5	—0.2	+1.3	+1.7	+0.9	—0.8	—0.6	+0.3	+0.9
1957															
Jan.	+1.0°	+2.3°	+1.3°	0.0°	+3.6°	+3.6°	—1.1°	+1.8°	+2.9°	+2.3°	+0.1°	—2.2°	+1.2°	+0.3°	—0.9°
Feb.	+0.6	+0.7	+0.1	—1.1	—0.4	+0.7	+0.8	+0.5	—0.3	+3.1	—0.2	—3.3	+2.1	+0.5	—1.6
Mar.	—0.4	—0.3	+0.1	—2.9	—2.6	+0.3	—0.3	+2.3	+2.6	+3.5	0.0	—3.5	+1.4	+2.8	+1.4
Apr.	—1.3	—3.6	—2.3	—3.4	+2.2	+5.6	—0.7	+0.3	+1.0	+3.2	—0.4	—3.6	+0.9	+1.8	+0.9
May	—0.5	—3.6	—3.1	—5.0	+0.4	+5.4	—1.6	—0.2	+1.4	+1.7	—0.5	—2.2	—1.6	+2.5	+4.1
June	—0.8	+0.4	+1.2	—2.5	+0.5	+3.0	—1.8	—1.2	+0.6	—0.4	+0.2	+0.6	—2.5	+3.1	+5.6
July	+2.2	+0.7	—1.5	—0.8	—0.3	+0.5	—2.5	—1.0	+1.5	—1.1	+0.4	+1.5	—1.9	+1.3	+3.2
Aug.	+3.7	—1.4	—5.1	+2.6	+0.8	—1.8	—2.8	—1.6	+1.2	—1.5	—0.2	+1.3	—3.3	+1.6	+4.9
Sept.	+3.1	—1.6	—4.7	+2.2	—0.8	—3.0	—2.2	—2.0	+0.2	—1.0	—1.4	—0.4	—3.1	—0.3	+2.8
Oct.	+1.3	—3.9	—5.2	+0.7	—4.5	—5.2	—3.7	—1.3	+2.4	—0.6	—2.2	—1.6	—1.5	+1.1	+2.6
Nov.	+0.6	—1.7	—2.3	+0.3	+1.2	+0.9	—3.0	+0.4	+3.4	—0.4	—0.7	—0.3	+0.5	+2.1	+1.6
Dec.	+1.1	—0.9	—2.0	—0.5	+1.5	+2.0	—0.9	+1.4	+2.3	—1.0	+0.5	+1.5	+1.0	+2.2	+1.2

1958															
Jan.	+0.6°	—0.8°	—1.4°	—1.5°	—5.2°	—3.7°	+0.3°	+0.2°	—0.1°	+0.6°	+2.0°	+1.4°	+2.9°	—0.7°	—3.6°
Feb.	—1.7	—1.1	+0.6	—2.3	—8.8	—6.5	—0.3	—0.7	—0.4	+1.5	+2.4	+0.9	+3.8	—2.2	—6.0
Mar.	—0.9	—5.9	—5.0	—0.8	—4.2	—3.4	+0.8	0.0	—0.8	+1.0	+1.3	+0.3	+2.5	—1.3	—4.8
Apr.	—0.4	—4.7	—4.3	+0.1	+0.3	+0.2	+0.7	+0.8	+0.1	+0.1	+1.1	+1.0	+1.1	—0.4	—1.5
May	+1.3	—1.1	—2.4	+2.0	+0.3	—1.7	+0.7	—0.9	—1.6	—0.8	+1.9	+2.7	+1.0	—1.4	—2.4
June	+1.3	+0.2	—1.1	—0.5	—0.3	+0.2	—1.2	—2.3	—1.1	—1.4	+0.3	+1.7	—0.8	—0.9	—0.1
July	+0.1	+1.0	+0.9	—0.2	—0.5	—0.3	—1.6	—2.5	—0.9	—1.6	—0.3	+1.3	—3.0	—0.8	+2.2
Aug.	—2.0	+0.1	+2.1	—1.3	+0.2	+1.5	—0.8	—1.1	—0.3	—1.6	—0.3	+1.3	—1.4	+1.3	+2.7
Sept.	—1.6	—1.1	+0.5	—2.5	—0.1	+2.4	—0.5	0.0	+0.5	—1.0	+2.3	+3.3	—2.3	—0.7	+1.6
Oct.	—3.3	—1.1	+2.2	—4.2	—1.9	+2.3	—0.6	+1.1	+1.7	—0.2	+2.4	+2.6	—1.5	—0.2	+1.3
Nov.	—3.1	—1.9	+1.2	—1.2	+4.0	+5.2	+0.9	+3.4	+2.5	+1.7	—3.2	—4.9	+1.1	—2.4	—3.5
Dec.	—1.5	—2.1	—0.6	+1.9	—2.6	—4.5	+2.1	+1.2	—0.9	+1.8	+2.4	+0.6	+3.3	—2.1	—5.4
1959															
Jan.	+0.1°	—2.3°	—2.4°	+3.3°	—1.9°	—5.2°	+4.2°	+0.1°	—4.1°	+1.6°	+2.1°	+0.5°	+4.5°	—3.2°	—7.7°
Feb.	—0.2	—1.4	—1.2	+1.0	+1.1	+0.1	+3.0	—2.5	—5.5	+1.2	+2.6	+1.4	+3.6	—1.3	—4.9
Mar.	—0.4	—1.6	—1.2	+1.0	—2.8	—3.8	+2.5	—1.3	—3.8	—0.3	+2.3	+2.6	+3.1	+0.1	—3.0
Apr.	—1.5	—0.5	+1.0	+1.3	+0.8	—0.5	+1.3	+0.2	—1.1	—1.6	+3.2	+4.8	+1.1	+1.6	+0.5
May	—2.1	—0.6	+1.5	+0.5	+1.7	+1.2	+0.7	+1.0	+0.3	—2.5	+2.1	+4.6	—1.0	+2.2	+3.2
June	—2.6	—1.2	+1.4	+0.1	—0.7	—0.8	—0.3	+1.6	+1.9	—2.0	+2.0	+4.0	—1.2	+2.5	+3.7
July	—0.4	—1.7	—1.3	—0.6	—0.2	+0.4	—0.7	+4.7	+5.4	—2.0	+1.8	+3.8	—2.2	+1.3	+3.5
Aug.	+0.5	—1.0	—1.5	+1.1	+1.8	+0.7	+0.2	+2.3	+2.1	—2.6	+3.9	+6.5	—1.4	+2.7	+4.1
Sept.	+0.6	—0.1	—0.7	+2.1	—0.8	—2.9	+0.4	+1.7	+1.3	—0.8	+1.9	+2.7	—1.8	+1.7	+3.5
Oct.	—2.0	—2.5	—0.5	+2.5	+0.9	—1.6	+1.3	—1.1	—2.4	0.0	+2.8	+2.8	+1.4	+0.2	—1.2
Nov.	—1.4	—2.4	—1.0	+0.2	—0.7	—0.9	+0.5	—0.4	—0.9	+0.9	+2.8	+1.9	+1.4	+0.2	—1.2
Dec.	—0.4	—1.3	—0.9	—1.6	+1.0	+2.6	+0.7	+1.0	+0.3	+0.8	+1.0	+0.2	—0.8	+0.5	+1.3

(continued)

TABLE 5.—*continued*

	Omaha, Nebr.			Salt Lake City, Utah			St. Louis, Mo.			St. Paul, Minn.			Washington, D. C.		
	Fore-cast Fahr.	Ob-served	O-F Δ	Fore-cast Fahr.	Ob-served	O-F Δ	Fore-cast Fahr.	Ob-served	O-F Δ	Fore-cast Fahr.	Ob-served	O-F Δ	Fore-cast Fahr.	Ob-served	O-F Δ
1950															
Jan.	+3.5°	—0.5°	—4.0°	—2.1°	—0.2°	+1.9°	+3.2°	+3.9°	+0.7°	+0.6°	—1.8°	—2.4°	+3.8°	+5.2°	+1.4°
Feb.	+1.8	—2.7	—4.5	—2.3	+0.2	+2.5	+1.5	+0.8	—0.7	—1.4	—4.1	—2.7	+2.3	+2.8	+0.5
Mar.	+1.3	—3.2	—4.5	—1.1	+0.3	+1.4	—0.1	—2.9	—2.8	—1.7	—5.2	—3.5	+0.2	—2.2	—2.4
Apr.	+0.5	—3.4	—3.9	—0.4	—1.9	—1.5	—0.3	—2.8	—2.5	—1.2	—6.0	—4.8	—1.0	—3.1	—2.1
May	+1.2	—2.1	—3.3	—0.6	—2.2	—1.6	—1.1	—1.5	—0.4	+1.0	—3.8	—4.8	—2.6	—2.0	+0.6
June	—1.0	—2.4	—1.4	+1.2	—2.4	—3.6	—2.7	—1.0	+1.7	+0.7	—2.2	—2.9	—3.9	—1.8	+2.1
July	—0.6	—4.0	—3.4	+0.5	—1.5	—2.0	—2.8	—3.4	—0.6	—1.0	—2.0	—1.0	—4.2	—1.8	+2.4
Aug.	—0.3	—4.7	—4.4	+0.3	—1.5	—1.8	—1.8	—4.3	—2.5	—0.9	—2.0	—1.1	—4.9	—2.9	+2.0
Sept.	+1.3	—1.4	—2.7	+0.2	+1.0	+0.8	—0.9	—1.1	—0.2	+0.6	+0.3	—0.3	—3.1	—1.4	+1.7
Oct.	—0.7	—0.7	0.0	+0.4	+2.0	+1.6	+0.1	—1.4	—1.5	0.0	—0.1	—0.1	—1.5	—0.9	+0.6
Nov.	—0.6	—0.7	—0.1	+0.8	+3.6	+2.8	+1.0	—2.3	—3.3	—0.8	—2.6	—1.8	+2.2	+0.4	—1.8
Dec.	—2.0	—2.4	—0.4	+0.4	+2.4	+2.0	+2.7	—3.8	—6.5	—0.6	—4.9	—4.3	+3.9	+0.1	—3.8
1951															
Jan.	+0.4°	—0.6°	—1.0°	—2.1°	+2.5°	+4.6°	+0.7°	—1.7°	—2.4°	+0.6°	—3.2°	—3.8°	+4.2°	+0.3°	—3.9°
Feb.	—0.2	—2.0	—1.8	—3.3	0.0	+3.3	+0.5	—1.2	—1.7	—0.9	—3.9	—3.0	+4.3	+1.2	—3.1
Mar.	—1.2	—3.3	—2.1	—3.1	—0.4	+2.7	—1.4	—2.7	—1.3	—1.9	—4.0	—2.1	+1.0	+0.2	—0.8
Apr.	—2.4	—4.0	—1.6	—2.2	—1.0	+1.2	—3.2	—2.5	+0.7	—2.2	—3.4	—1.2	—0.7	—0.7	0.0
May	—2.6	—3.1	—0.5	—0.1	—0.8	—0.7	—3.8	—1.8	+2.0	—0.5	—1.1	—0.6	—2.3	—1.0	+1.3
June	—1.7	—2.3	—0.6	—0.3	—1.1	—0.8	—4.4	—0.9	+3.5	—2.1	—0.3	+1.8	—2.9	—0.9	+2.0
July	—2.4	—3.0	—0.6	+1.2	—1.9	—3.1	—4.2	—1.3	+2.9	—3.0	—2.5	+0.5	—3.4	—0.7	+2.7
Aug.	—2.5	—3.1	—0.6	+1.4	—0.7	—2.1	—2.8	—2.2	+0.6	0.0	—3.4	—3.4	—0.8	—0.3	+0.5
Sept.	—4.2	—2.7	+1.5	+0.6	—1.2	—1.8	—1.3	—1.7	—0.4	+0.3	—3.1	—3.4	—1.3	+0.4	+1.7
Oct.	—4.2	—3.8	+0.4	—1.1	—1.6	—0.5	0.0	—3.5	—3.5	—1.2	—4.3	—3.1	—0.4	—1.0	—0.6
Nov.	—3.2	—4.4	—1.2	—3.1	—3.4	—0.3	0.0	—2.2	—2.2	—3.5	—3.5	0.0	+1.0	+0.9	—0.1
Dec.	—1.1	—3.6	—2.5	—3.5	—3.0	+0.5	+1.0	—0.6	—1.6	—1.8	—3.2	—1.4	+1.4	+0.6	—0.8

1952															
Jan.	+0.1°	+0.5°	+0.4°	−5.0°	−4.0°	+1.0°	+2.2°	+3.0°	+0.8°	+0.9°	+1.2°	+0.3°	+0.8°	+3.1°	+2.3°
Feb.	+0.7	+1.3	+0.6	−5.5	−4.6	+0.9	+2.3	+2.4	+0.1	+1.6	+0.8	−0.8	+1.4	+1.7	+0.3
Mar.	−1.7	+1.1	+2.8	−2.7	−3.8	−1.1	+0.2	+0.5	+0.3	0.0	+2.3	+2.3	+1.1	+0.7	−0.4
Apr.	−1.9	−1.8	+0.1	−1.7	−1.3	+0.4	−1.6	−1.3	+0.3	−1.4	−0.1	+1.3	+0.8	−1.1	−1.9
May	−1.7	+2.2	+3.9	+1.0	+1.6	+0.6	−3.2	+2.5	+5.7	−0.3	+2.1	+2.4	−2.9	+0.4	+3.3
June	−2.9	+2.3	+5.2	+2.5	+0.4	−2.1	−3.3	+3.7	+7.0	−2.0	+0.7	+2.7	−4.2	+0.7	+4.9
July	−3.0	+1.4	+4.4	+1.9	0.0	−1.9	−2.3	+3.5	+5.8	−2.0	+0.5	+2.5	−1.8	+1.0	+2.8
Aug.	−2.4	−0.7	+1.7	+1.8	+1.0	−0.8	−0.2	+0.6	+0.8	−1.5	−0.5	+1.0	−0.6	−0.3	+0.3
Sept.	−0.5	−2.2	−1.7	+1.1	+3.2	+2.1	+0.2	−1.4	−1.6	−0.2	−1.8	−1.6	+0.6	−2.2	−2.8
Oct.	+1.4	−1.2	−2.6	+1.6	+0.9	−0.7	+1.5	−0.5	−2.0	+0.9	−0.4	−1.3	+1.6	−1.5	−3.1
Nov.	+1.6	−1.6	−3.2	+1.7	−0.1	−1.8	+2.0	+0.1	−1.9	+1.4	+0.7	−0.7	+2.0	+0.3	−1.7
Dec.	+1.7	+0.9	−0.8	+1.7	+2.2	+0.5	+2.8	+2.6	−0.2	+3.3	+3.7	+0.4	+2.0	+2.2	+0.2
1953															
Jan.	+2.1°	+2.4°	+0.3°	+0.3°	+5.0°	+4.7°	+3.2°	+3.6°	+0.4°	+2.9°	+2.8°	−0.1°	+0.6°	+3.3°	+2.7°
Feb.	−0.2	+4.0	+4.2	−1.6	+5.4	+7.0	+1.9	+4.9	+3.0	0.0	+2.4	+2.4	+4.0	+3.6	−0.4
Mar.	−0.6	+0.9	+1.5	−1.2	+0.4	+1.6	+0.8	+1.5	+0.7	−1.0	−1.1	−0.1	+2.0	+2.2	+0.2
Apr.	−0.5	−1.5	−1.0	−0.8	−2.8	−2.0	+0.3	0.0	−0.3	−1.1	−1.7	−0.6	−1.7	+1.6	+3.3
May	−1.0	−1.5	−0.5	+0.3	−3.7	−4.0	−0.9	+0.2	+1.1	−2.8	−2.0	+0.8	−0.9	+1.0	+1.9
June	−0.8	+0.9	+1.7	+4.1	−1.9	−6.0	−1.1	+2.4	+3.5	−0.8	−0.2	+0.6	−1.9	+1.4	+3.3
July	−1.6	+1.7	+3.3	+4.9	+0.3	−4.6	−0.1	+2.6	+2.7	−0.7	+0.7	+1.4	−1.7	+0.3	+2.0
Aug.	−1.2	+0.8	+2.0	+5.1	+1.9	−3.2	−0.2	+1.8	+2.0	+2.0	+0.6	−1.4	−2.5	+0.2	+2.7
Sept.	+2.0	+2.1	+0.1	+2.5	+1.6	−0.9	+2.1	+2.4	+0.3	+2.8	+3.4	+0.6	−3.3	−0.5	+2.8
Oct.	+3.2	+3.0	−0.2	+2.2	+2.8	+0.6	+4.3	+2.5	−1.8	+6.4	+4.2	−2.2	−1.7	+0.4	+2.1
Nov.	+5.1	+3.9	−1.2	+1.2	+1.2	0.0	+4.1	+2.5	−1.6	+7.8	+4.4	−3.4	+1.7	+1.4	−0.3
Dec.	+4.8	+1.0	−3.8	+1.9	+2.5	+0.6	+3.6	+1.1	−2.5	+5.6	+5.4	−0.2	+2.3	+0.4	−1.9

(continued)

TABLE 5.—*continued*

	Omaha, Nebr.			Salt Lake City, Utah			St. Louis, Mo.			St. Paul, Minn.			Washington, D. C.		
	Fore-cast Fahr.	Ob-served	O-F Δ	Fore-cast Fahr.	Ob-served	O-F Δ	Fore-cast Fahr.	Ob-served	O-F Δ	Fore-cast Fahr.	Ob-served	O-F Δ	Fore-cast Fahr.	Ob-served	O-F Δ
1954															
Jan.	+5.9°	+4.4°	—1.5°	+2.1°	+2.0°	—0.1°	+1.9°	+3.5°	+1.6°	+5.7°	+3.8°	—1.9°	+3.7°	+2.3°	—1.4°
Feb.	+6.4	+2.6	—3.8	+1.6	+1.5	—0.1	+0.5	+1.8	+1.3	+2.8	+3.0	+0.2	+5.0	+1.2	—3.8
Mar.	+6.6	+5.0	—1.6	+1.2	+1.0	—0.2	—0.2	+4.1	+4.3	+2.8	+4.3	+1.5	+4.4	+3.1	—1.3
Apr.	+1.0	—1.3	—2.3	+1.6	+0.9	—0.7	—0.8	—0.5	+0.3	—1.0	—2.7	—1.7	+1.7	—0.1	—1.8
May	+2.1	+0.1	—2.0	+0.6	+1.2	+0.6	+2.2	+0.5	—1.7	+0.3	—1.8	—2.1	—1.3	—0.1	+1.2
June	+3.8	+0.8	—3.0	—0.6	+0.4	+1.0	+1.9	+0.1	—1.8	+1.4	—1.4	—2.8	—1.1	—1.7	—0.6
July	+5.5	+2.6	—2.9	—1.0	—1.1	—0.1	+2.6	+2.4	—0.2	+3.2	+0.5	—2.7	—0.9	—0.9	0.0
Aug.	+4.0	+2.9	—1.1	—1.4	—0.1	+1.3	+3.3	+3.1	—0.2	+3.3	—0.3	—3.6	—0.4	0.0	+0.4
Sept.	+0.2	+0.8	+0.6	—0.4	—1.0	—0.6	+2.4	+1.7	—0.7	+2.3	—1.4	—3.7	+1.5	+1.1	—0.4
Oct.	+0.2	+2.3	+2.1	+1.3	+0.3	—1.0	+2.2	+1.3	—0.9	+1.8	+0.1	—1.7	+1.1	+0.7	—0.4
Nov.	—0.3	+2.3	+2.6	—0.8	0.0	+0.8	+1.8	+0.2	—1.6	+1.2	+1.4	+0.2	+0.4	—0.6	—1.0
Dec.	—0.3	+3.1	+3.4	—0.3	—2.3	—2.0	+1.2	+0.1	—1.1	+1.0	+2.0	+1.0	—0.4	—2.0	—1.6
1955															
Jan.	—0.5°	—0.6°	—0.1°	—2.5°	—6.2°	—3.7°	—0.8°	+0.1°	+0.9°	—0.8°	—0.2°	+0.6°	+1.0°	—1.3°	—2.3°
Feb.	—0.8	—1.9	—1.1	—3.7	—7.5	—3.8	—0.9	+0.7	+1.6	—3.5	—2.3	+1.2	+1.7	—0.1	—1.8
Mar.	0.0	+0.1	+0.1	—3.8	—6.5	—2.7	—2.4	+2.3	+4.7	—2.9	0.0	+2.9	+1.0	+1.6	+0.6
Apr.	—3.3	+3.4	+6.7	—3.3	—3.7	—0.4	—2.9	+3.2	+6.1	—2.9	+2.5	+5.4	+1.6	+2.2	+0.6
May	—0.8	+2.6	+3.4	+1.4	—2.3	—3.7	—1.1	+1.8	+2.9	+1.2	+4.0	+2.8	—1.3	—0.2	+1.1
June	—0.8	+2.0	+2.8	+3.0	—1.1	—4.1	+0.1	+0.8	+0.7	+0.2	+3.4	+3.2	—2.3	+0.3	+2.6
July	—0.9	+2.2	+3.1	+1.2	—0.1	—1.3	—1.2	+0.8	+2.0	+1.0	+3.4	+2.4	—2.9	+0.3	+3.2
Aug.	—1.0	+3.8	+4.8	+2.3	+0.2	—2.1	—2.0	+2.9	+4.9	—1.5	+3.4	+4.9	—2.4	+1.5	+3.9
Sept.	—1.0	+2.2	+3.2	—0.1	+0.6	+0.7	—0.6	+1.6	+2.2	—1.9	+2.4	+4.3	—0.1	+0.5	+0.6
Oct.	—2.6	—1.3	+1.3	—0.6	—1.2	—0.6	—0.7	—0.1	+0.6	—2.0	—1.5	+0.5	—0.2	—0.8	—0.6
Nov.	—4.4	—3.2	+1.2	—0.5	+0.5	+1.0	—1.8	—1.6	+0.2	—2.9	—4.1	—1.2	—0.2	—1.1	—0.9
Dec.	—3.8	—3.5	+0.3	—1.2	+3.0	+4.2	—0.9	—1.8	—0.9	—2.4	—4.5	—2.1	+0.5	—2.8	—3.3

1956															
Jan.	—1.6°	—1.5°	+0.1°	—1.6°	+1.8°	+3.4°	+0.1°	—0.3°	—0.4°	—0.5°	—3.0°	—2.5°	+3.6°	—1.0°	—4.6°
Feb.	+0.7	—0.4	—1.1	—4.1	+0.5	+4.6	+0.5	+0.2	—0.3	+0.5	—2.0	—2.5	+3.8	—0.2	—4.0
Mar.	+1.0	—1.1	—2.1	—3.8	—2.1	+1.7	+0.9	+0.2	—0.7	+2.5	—3.4	—5.9	+3.4	—0.1	—3.5
Apr.	+1.5	—0.3	—1.8	0.0	+1.1	+1.1	+0.9	—0.1	—1.0	+2.7	—3.1	—5.8	0.0	—2.2	—2.2
May	+2.2	+1.8	—0.4	+2.0	+1.5	—0.5	—1.0	+0.5	+1.5	+2.5	+0.4	—2.1	—2.0	—1.7	+0.3
June	+2.4	+2.4	0.0	+4.3	+1.5	—2.8	—0.7	+0.4	+1.1	+0.4	+0.8	+0.4	—2.3	—1.8	+0.5
July	—0.7	+1.8	+2.5	+3.2	+0.1	—3.1	—1.5	0.0	+1.5	—1.9	+0.9	+2.8	—4.5	—1.6	+2.9
Aug.	—2.7	—0.2	+2.5	+1.4	0.0	—1.4	—0.7	—0.5	+0.2	—2.9	—2.3	+0.6	—4.9	—2.5	+2.4
Sept.	—3.1	+2.3	+5.4	+0.8	—0.2	—1.0	+0.7	+2.2	+1.5	—1.8	+1.1	+2.9	—4.6	—1.4	+3.2
Oct.	—0.7	+2.2	+2.9	—1.0	—1.3	—0.3	+2.1	+2.0	—0.1	—0.5	+1.7	+2.2	+0.4	—1.1	—1.5
Nov.	+0.8	+4.0	+3.2	0.0	—2.5	—2.5	+1.6	+3.2	+1.6	+0.1	+4.3	+4.2	+2.8	+3.4	+0.6
Dec.	+0.2	+1.1	+0.9	+2.5	—3.0	—5.5	+0.2	—0.5	—0.7	+0.3	+1.0	+0.7	+0.3	+1.1	+0.8
1957															
Jan.	+1.9°	+2.7°	+0.8°	+2.8°	+0.8°	—2.0°	+0.6°	+0.8°	+0.2°	+1.5°	+1.5°	0.0	+1.4°	+2.4°	+1.0°
Feb.	+3.5	+1.1	—2.4	—0.2	+2.2	+2.4	+1.6	—0.7	—2.3	+3.3	+3.0	—0.3	+1.2	+0.1	—1.1
Mar.	+1.9	+2.2	+0.3	—1.0	+1.8	+2.8	—1.1	+1.1	+2.2	+3.7	+1.5	—2.2	+0.4	+2.4	+2.0
Apr.	+0.2	—0.6	—0.8	—0.8	—0.2	+0.6	—3.2	—0.7	+2.5	+1.7	—0.3	—2.0	—0.1	+1.4	+1.5
May	—0.7	—1.0	—0.3	+0.5	—1.0	—1.5	—4.0	+0.1	+4.1	+1.2	—0.3	—1.5	—2.4	+2.0	+4.4
June	—0.7	+0.3	+1.0	+3.5	—0.9	—4.4	—3.0	+0.1	+3.1	—1.0	+0.3	+1.3	—4.0	+1.0	+5.0
July	—0.7	+1.1	+1.8	+4.6	—0.1	—4.7	—2.6	+0.5	+3.1	—1.0	+0.9	+1.9	+3.2	+0.1	—3.1
Aug.	—1.3	+0.3	+1.6	+2.2	0.0	—2.2	—0.9	—0.5	+0.4	—1.5	0.0	+1.5	—2.8	—0.1	+2.7
Sept.	—0.9	—1.8	—0.9	+1.1	+0.3	—0.8	—1.3	—2.1	—0.8	—2.0	—1.4	+0.6	—2.7	—1.5	+1.2
Oct.	—1.3	—2.5	—1.2	+1.0	—2.0	—3.0	—1.2	—2.9	—1.7	—2.1	—1.2	+0.9	—3.2	—0.6	+2.6
Nov.	—0.5	+1.5	+2.0	+1.0	—1.5	—2.5	—0.2	—0.2	0.0	+0.4	+1.7	+1.3	+0.2	+1.2	+1.0
Dec.	+0.3	+4.2	+3.9	—0.5	—0.5	0.0	+1.7	+0.9	—0.8	+1.4	+5.2	+3.8	+0.8	+0.8	0.0

(continued)

TABLE 5—*concluded*

	Omaha, Nebr.			Salt Lake City, Utah			St. Louis, Mo.			St. Paul, Minn.			Washington, D. C.		
	Fore-cast Fahr.	Ob-served	O-F Δ	Fore-cast Fahr.	Ob-served	O-F Δ	Fore-cast Fahr.	Ob-served	O-F Δ	Fore-cast Fahr.	Ob-served	O-F Δ	Fore-cast Fahr.	Ob-served	O-F Δ
1958															
Jan.	+1.8°	+2.6°	+0.8°	—0.2°	+3.8°	+4.0°	+1.0°	—1.9°	—2.9°	+2.8°	+4.4°	+1.6°	+2.4°	—1.9°	—4.3°
Feb.	+1.8	—0.8	—2.6	—0.7	+2.9	+3.6	—0.5	—6.0	—5.5	+2.1	+3.5	+1.4	+1.9	—4.4	—6.3
Mar.	+3.4	—2.7	—6.1	—1.5	+1.2	+2.7	+0.1	—6.0	—6.1	+2.8	+1.0	—1.8	+1.6	—3.5	—5.1
Apr.	+3.8	+0.1	—3.7	—0.5	+1.0	+1.5	—0.4	—2.9	—2.5	+1.5	+2.2	+0.7	+0.3	0.0	—0.3
May	+1.8	+0.2	—1.6	+1.4	+2.8	+1.4	—0.4	—1.6	—1.2	+1.3	—0.1	—1.4	—1.2	+1.7	+2.9
June	—2.5	—0.3	+2.2	+1.9	+3.3	+1.4	—2.5	—2.6	—0.1	—0.7	—1.7	—1.0	—2.0	—1.6	+0.4
July	—3.1	—2.2	+0.9	+2.8	+1.6	—1.2	—3.5	—2.7	+0.8	—0.3	—2.3	—2.0	—1.4	—3.6	—2.2
Aug.	—4.2	—1.3	+2.9	+0.7	+0.7	0.0	—2.8	—1.8	+1.0	+0.4	—0.7	—1.1	—2.2	—4.2	—2.0
Sept.	—5.2	+1.2	+6.4	+2.5	+2.1	—0.4	—2.5	—0.7	+1.8	—2.7	+1.6	+4.3	—3.1	—0.5	+2.6
Oct.	—4.4	+2.4	+6.8	+3.0	+0.8	—2.2	+3.2	+0.7	—2.5	—2.7	+2.7	+5.4	—2.1	—0.1	+2.0
Nov.	—3.3	+2.0	+5.3	+2.1	+2.1	0.0	—1.9	—0.6	+1.3	—2.0	+1.1	+3.1	+1.5	—1.3	—2.8
Dec.	—0.9	+0.3	+1.2	+1.1	+3.1	+2.0	+2.0	—2.5	—4.5	—0.1	—0.9	—0.8	+3.2	—2.5	—5.7
1959															
Jan.	+1.8°	—1.3°	—3.1°	+0.1°	+4.1°	+4.0°	+4.1°	—3.6°	—7.7°	+1.2°	—2.0°	—3.2°	+5.8°	—2.0°	—7.8°
Feb.	+2.4	—0.7	—3.1	+0.4	+2.9	+2.5	+3.9	—1.7	—5.6	+1.3	+0.3	—1.0	+4.7	—0.4	—5.1
Mar.	+0.7	0.0	—0.7	—0.2	+1.5	+1.7	+2.5	+0.4	—2.1	+1.8	+1.6	—0.2	+2.9	+0.9	—2.0
Apr.	+1.4	+0.5	—0.9	+0.1	—0.2	—0.3	+0.9	+1.3	+0.4	+0.2	+2.2	+2.0	—0.8	+1.3	+2.1
May	—0.5	+0.6	+1.1	+0.6	+1.1	+0.5	—0.3	—0.1	+0.2	—2.0	+2.1	+4.1	—2.7	+1.6	+4.3
June	—2.9	—0.2	+2.7	—0.2	+1.8	+2.0	—0.3	+1.6	+1.9	—1.7	+2.0	+3.7	—3.3	+0.9	+4.2
July	—2.6	+0.8	+3.4	—2.0	+1.7	+3.7	+0.2	+0.7	+0.5	—2.0	+2.8	+4.8	—2.8	+0.8	+3.6
Aug.	—2.5	—0.6	+1.9	—2.5	—0.2	+2.3	—0.2	+0.3	+0.5	—0.5	+2.0	+2.5	—0.7	+1.5	+2.2
Sept.	—2.4	—0.8	+1.6	—3.2	—1.3	+1.9	+1.2	+0.6	—0.6	—3.0	0.0	+3.0	+1.0	+2.5	+1.5
Oct.	—3.2	—3.6	—0.4	—5.4	—1.7	+3.7	+1.2	—1.9	—3.1	—3.3	—3.7	—0.4	+4.1	+0.8	—3.3
Nov.	—1.8	—0.2	+1.6	—4.8	—2.5	+2.3	+0.1	—0.5	—0.6	—2.8	—0.4	+2.4	+3.3	+2.3	—1.0
Dec.	+0.4	+0.7	+0.3	—3.0	—2.8	+0.2	+0.3	+0.6	+0.3	—1.6	+2.8	+4.4	+1.9	+1.2	—0.7

TABLE 5a—*Forecast of temperature departures from normal 1960 through 1967 from 3-month running means*

1960	Abilene, Tex.	Atlanta, Ga.	Detroit, Mich.	Los Angeles Calif.	New York, N. Y.	Omaha, Nebr.	Salt Lake City, Utah	St. Louis, Mo.	St. Paul, Minn.	Washington, D. C.
Jan.	—1.8°	0.0°	+1.2°	+0.7°	+1.5°	+3.3°	—2.7°	+1.4°	+1.3°	+2.1°
Feb.	+0.1	—0.7	+1.5	+0.8	+1.6	+1.8	—2.0	—2.9	+2.8	+1.6
Mar.	—1.2	—2.0	+0.4	+1.4	+2.4	+2.1	—2.4	+0.5	+3.3	+0.3
Apr.	—0.2	—2.3	+0.9	+1.5	+1.9	—0.4	—1.0	—1.6	+3.2	—0.9
May	+0.3	—1.5	+0.7	+0.8	+0.7	—1.3	+0.2	—2.6	+2.4	—1.6
June	+1.9	+2.1	+0.3	+0.6	+0.9	—0.8	+2.7	—2.1	+1.5	—1.2
July	+1.5	+2.6	—1.3	+0.4	—1.8	—3.1	+3.3	—2.1	+1.2	—0.8
Aug.	+2.2	+1.9	—1.6	+0.3	—1.2	—4.1	+2.2	—2.7	+0.5	—1.9
Sept.	+1.4	+1.2	—0.3	—0.1	—0.4	—3.7	+0.9	—1.2	—2.1	+0.2
Oct.	+0.9	+0.1	+0.3	—0.2	+0.8	—1.2	—0.4	+0.3	—0.6	+1.6
Nov.	+0.2	0.0	+1.4	+0.5	+2.7	+1.0	—0.6	+0.8	+0.1	+4.2
Dec.	+0.4	—2.4	+1.8	+1.2	+1.7	+1.7	—1.7	+1.2	+1.8	+3.6
1961										
Jan.	—0.9°	—2.6°	+1.6°	+1.9°	+3.2°	+1.8°	—2.2°	+1.2°	+0.8°	+2.4°
Feb.	—0.4	+1.7	+1.8	+1.5	+2.5	+2.8	—2.3	+1.6	+1.8	+2.0
Mar.	+0.2	—0.3	+1.3	+0.5	+0.8	+2.0	—2.1	+0.8	+1.8	+1.7
Apr.	+1.8	+1.3	+1.2	—0.7	+1.1	+1.8	—0.7	+1.1	+2.2	+1.3
May	+3.2	+2.4	—0.3	—1.8	—0.1	+2.8	+1.5	+2.2	+3.8	—2.6
June	+4.6	+4.1	—0.2	—2.6	+0.1	+4.0	+2.7	+1.5	+3.7	—2.1
July	+3.3	+3.0	—0.8	—1.8	—2.1	+2.7	+4.0	+1.4	+1.7	—1.3
Aug.	+3.6	+1.6	—0.3	—0.4	—1.1	+1.7	+3.0	+1.3	—0.4	—2.3
Sept.	+3.2	+1.9	—1.0	+0.1	—0.9	+1.1	+1.8	+0.4	—1.7	—1.0
Oct.	+2.8	—0.6	—0.8	+1.0	—0.5	+1.5	—0.1	—0.7	—0.6	—0.1
Nov.	+0.7	+0.2	0.0	+0.9	+1.0	+1.3	—3.0	—0.6	—1.1	+3.4
Dec.	—2.4	+1.1	+1.1	+0.6	+2.3	+1.5	—5.1	+0.1	—0.6	+4.2

(*continued*)

TABLE 5a.—*continued*

	Abilene, Tex.	Atlanta, Ga.	Detroit, Mich.	Los Angeles, Calif.	New York, N. Y.	Omaha, Nebr.	Salt Lake City, Utah	St. Louis, Mo.	St. Paul, Minn.	Washington, D. C.
1962										
Jan.	−3.1°	+2.4°	+2.5°	+1.2°	+3.2°	+3.2°	−5.4°	+0.5°	+0.7°	+5.5°
Feb.	−2.0	+2.8	+3.9	+0.7	+3.5	+3.6	−4.2	+1.6	−1.4	+4.3
Mar.	−1.1	+3.5	+3.3	−0.1	+1.7	+2.4	−2.8	−0.1	+0.4	+3.8
Apr.	−1.9	+1.1	+1.1	−0.3	0.0	−0.3	−0.7	−1.3	−1.4	−0.6
May	−0.1	−0.4	−0.2	−0.5	−1.9	−1.3	+0.7	−1.1	−0.8	−3.7
June	+2.2	+1.5	−0.5	+0.2	−1.0	+0.1	+1.1	−2.5	−1.5	−2.6
July	+1.9	+3.6	−0.9	+0.1	−0.4	+0.6	+2.2	−1.8	+0.9	−3.6
Aug.	+2.8	+0.4	+0.2	−0.1	−0.7	+1.3	+0.2	−1.7	−0.4	−2.1
Sept.	+2.6	−1.1	+0.4	−0.5	−0.9	+0.2	+0.7	−3.0	−2.2	−2.4
Oct.	+0.4	+0.7	−0.7	+1.0	−0.6	−1.4	+0.2	−1.7	−3.2	−0.8
Nov.	−0.5	+0.2	−0.7	+1.1	0.0	−3.2	+1.3	+0.4	+6.1	−0.7
Dec.	+0.3	+1.5	−0.6	+1.6	+0.8	−4.1	+0.9	+0.8	−2.2	−1.1
1963										
Jan.	−0.5°	−1.5°	−0.1°	+1.5°	−1.3°	−1.9°	0.0°	+0.6°	−1.4°	−1.2°
Feb.	+0.9	−1.4	−1.2	+1.5	−0.8	−0.2	−1.8	−0.6	−1.2	−1.5
Mar.	+0.5	−2.5	−0.4	+0.5	+0.2	+0.9	−0.7	−2.3	−1.8	−1.4
Apr.	+1.0	−2.5	−0.7	−0.4	+0.4	+2.9	0.0	−0.8	+0.2	−0.5
May	+1.2	−4.8	0.0	−0.9	−0.4	+3.8	+1.9	−2.1	+0.4	−1.2
June	+1.1	−4.4	−0.6	−1.6	−1.3	+2.8	+2.7	−1.9	−0.1	−2.5
July	−2.5	−3.8	−2.8	−1.2	−2.7	+0.2	+5.2	−3.1	−2.4	−3.4
Aug.	−4.2	−2.9	−2.9	−0.6	−2.9	−2.0	+5.1	−5.4	−0.5	−3.3
Sept.	−4.2	−3.2	−2.5	+0.2	−1.9	−2.8	+5.1	−5.0	+2.0	−2.7
Oct.	−3.5	−1.7	+0.9	+0.9	−0.4	−2.9	+2.0	−2.3	−2.4	−2.1
Nov.	−1.9	−0.7	+0.9	+1.8	+0.1	−2.5	+0.5	−0.1	−0.3	−0.3
Dec.	−0.1	+1.0	+0.9	+2.4	+0.8	−1.7	−2.0	+1.3	−1.5	+1.0

1964										
Jan.	+1.0°	+2.0°	+1.2°	+2.2°	−0.2°	0.0°	−1.5°	+2.9°	+0.5°	+0.8°
Feb.	+1.8	+4.3	+1.9	+1.1	0.0	+1.4	−3.0	+4.1	+1.7	+0.8
Mar.	+2.4	+3.9	+1.5	−1.7	−0.3	+1.8	−2.1	+4.3	+1.5	+1.0
Apr.	+1.7	+1.6	+0.5	−1.3	0.0	+3.9	−1.9	+3.3	+2.8	+0.4
May	−1.0	−0.5	−0.9	−1.2	+1.0	+1.6	0.0	+0.4	+1.4	+1.2
June	−2.9	−2.6	+0.7	−1.0	+0.9	+1.4	+1.1	−1.1	+4.1	−0.5
July	−4.5	−2.0	+1.5	−1.7	+0.3	+1.3	+0.5	−1.7	+5.9	−0.2
Aug.	−3.4	−0.5	+4.0	−0.9	−0.3	+0.7	+2.3	−1.3	+5.9	−0.6
Sept.	−1.0	+0.3	+2.6	−0.5	−0.8	+1.0	+0.2	+1.1	+7.9	−0.7
Oct.	+1.2	+2.2	+2.9	−0.2	+1.1	+0.7	−1.0	+1.7	−4.2	+0.2
Nov.	+1.1	+1.2	+1.4	+0.2	−0.1	+1.1	+0.8	+1.2	+0.7	−0.4
Dec.	+1.4	+2.2	+1.7	+0.6	+1.9	+0.8	−0.2	+1.6	+0.2	−3.8
1965										
Jan.	+1.8°	+3.2°	+1.3°	+0.2°	+1.6°	+0.7°	−2.3°	+1.5°	−2.1°	+4.7°
Feb.	+1.7	+2.9	+1.6	−0.4	+2.1	+2.4	−2.0	+1.7	−0.8	+5.2
Mar.	+0.6	+2.0	+0.9	−0.5	+1.2	+0.7	−3.2	−0.1	−1.8	+3.2
Apr.	+0.3	+0.4	+0.3	−0.1	+0.4	−0.3	−3.0	−0.9	−0.4	+2.6
May	−2.1	+0.7	−0.3	+0.3	+1.7	−1.3	−1.9	+0.5	−2.1	+1.2
June	+0.6	0.0	−0.8	−0.2	+0.9	−0.8	−0.4	−0.4	−3.1	−1.0
July	+1.2	−2.6	−2.1	−0.1	+0.9	−2.1	+2.8	−2.1	−1.9	−4.0
Aug.	+1.0	−4.6	−3.1	−0.2	−2.3	−2.3	+3.1	−3.5	−2.4	−5.1
Sept.	−0.9	−2.5	−5.0	+1.6	−3.7	−3.0	+3.3	−4.0	−1.7	−4.4
Oct.	−0.6	−0.9	−4.1	+1.8	−2.4	−2.6	+3.6	−2.9	−4.2	−1.6
Nov.	−0.2	+1.7	−3.9	+2.0	−0.6	−3.0	+0.8	−0.6	−1.5	+0.5
Dec.	+0.4	+3.3	−3.7	+1.2	+0.4	−1.9	+0.6	+0.5	−1.4	+1.7

(continued)

TABLE 5a.—*concluded*

1966	Abilene, Tex.	Atlanta, Ga.	Detroit, Mich.	Los Angeles, Calif.	New York, N. Y.	Omaha, Nebr.	Salt Lake City, Utah	St. Louis, Mo.	St. Paul, Minn.	Washington, D. C.
Jan.	—0.5°	+2.2°	—4.2°	+1.7°	+0.4°	—2.0°	—0.7°	+1.0°	—0.4°	+3.1°
Feb.	+0.1	+3.3	—0.8	+0.6	+1.5	—2.1	—2.5	+1.5	+0.3	+2.9
Mar.	—2.7	—1.4	—0.7	—0.4	+3.5	—1.7	—2.8	+0.1	—1.8	+0.4
Apr.	—1.2	—2.4	—0.2	—1.6	+2.7	+1.1	—1.2	+0.8	0.0	+3.8
May	—1.0	—5.0	—0.9	—2.1	—0.3	—0.5	+0.2	+0.8	+0.1	+1.1
June	—1.6	—7.8	—1.1	—2.2	—0.3	—1.4	+2.1	+0.7	—0.1	—1.1
July	—0.7	—5.5	—1.5	—2.4	—2.4	—0.2	+4.8	+0.8	—0.6	—3.6
Aug.	—1.7	—4.7	—1.5	—2.3	—2.3	+0.5	+4.2	+0.2	—0.5	—2.1
Sept.	—0.4	—2.2	—1.6	—0.9	—2.5	—0.8	+0.2	—1.9	+0.6	—2.1
Oct.	—0.9	+0.9	+0.2	—0.1	+0.6	+0.7	—0.4	—0.2	+4.8	—0.9
Nov.	—1.1	+3.1	—0.8	+0.8	+0.8	+1.7	—2.3	—0.1	+3.8	+0.8
Dec.	—1.6	—0.2	+0.5	+0.2	+3.4	—0.8	—1.6	+1.0	+2.7	+2.5
1967										
Jan.	—0.9°	—0.8°	+0.4°	+1.0°	+3.2°	+1.9°	—2.0°	+0.7°	+0.6°	+3.1°
Feb.	—1.0	—1.9	—0.1	+1.3	+0.2	+3.5	—1.1	+1.1	+0.9	+2.6
Mar.	+0.7	—0.9	—0.6	+0.7	+1.4	+3.9	+0.2	+0.4	+2.0	+0.6
Apr.	+1.0	—0.5	—1.6	+0.3	—1.6	+1.0	+2.2	—1.0	—0.1	—2.5
May	+2.3	—2.1	—2.4	+0.2	—1.7	+1.0	+4.0	—2.9	—0.8	—3.0
June	+2.5	—1.9	—1.0	+0.8	—0.8	+0.4	+3.5	—2.1	+0.4	—1.8
July	+1.0	—2.2	—2.1	—0.8	—2.6	—0.6	+4.5	—2.5	—0.5	—2.4
Aug.	—0.4	—4.2	—1.9	—2.0	—2.7	—2.3	+2.4	—3.4	—0.2	—1.3
Sept.	—0.6	—3.0	—1.4	—3.2	—3.1	—3.5	—0.4	—2.4	—0.8	—2.6
Oct.	—1.1	—0.6	—0.5	—2.0	—1.6	—2.5	—2.2	—1.3	0.0	—1.4
Nov.	—1.7	+1.6	+0.6	—0.8	+0.8	—1.0	—4.6	—0.6	+0.7	+2.0
Dec.	0.0	+2.9	+2.3	+0.1	+3.8	+0.3	—2.0	+0.3	+0.1	+2.3

As further evidence in justification of this method of very long-range forecasting of temperatures, I give table 8 (p. 37) showing the relative percent numbers of cases when forecasts and events lay on the same and on opposite sides of normal.

As in Publication 4390, I give United States maps (pp. 38-46) showing the 4-month mean departures from normal of the forecast 1960 through 1967. The number of stations is too small to warrant further general comment as to temperatures of the whole country, but a partial view of this may be perceived in these maps. Numbers relate to names as in table 8.

TABLE 6—*Four-month mean temperatures 1950-67 predicted on the level of normals 1950-59*
All based on 3-month running mean data

	Abilene, Tex.			Atlanta, Ga.			Detroit, Mich.			Los Angeles, Calif.			New York, N. Y.		
	Pred.	Obs.	Δ	Pred.	Obs.	Δ	Pred.	Obs.	Δ	Pred.	Obs.	Δ	Pred.	Obs.	Δ
1950															
I	+1.6°	+0.9°	−0.7°	+0.6°	+1.7°	+1.1°	+1.2°	−1.2°	−2.4°	−0.2°	−0.7°	−0.5°	+0.8°	0.0°	−0.8°
II	+0.9	−1.8	−2.7	+1.6	−0.3	−1.9	0.0	−1.9	−1.9	−0.8	−1.0	−0.2	−2.7	−1.7	+1.0
III	−0.6	+0.1	+0.7	−0.6	−2.0	−1.4	+0.6	−1.6	−2.2	+1.1	+0.5	−0.6	+0.3	0.0	−0.3
1951															
I	−0.8	−0.6	+0.2	−2.5	−0.5	+2.0	+0.3	0.0	−0.3	+1.4	−0.3	−1.7	+1.6	+1.6	0.0
II	+0.2	+1.0	+0.8	−0.5	+0.1	+0.6	−0.5	−1.3	−0.8	−1.2	−0.8	+0.4	−1.1	−0.4	+0.7
III	−0.9	+1.0	+1.9	−0.7	0.0	+0.7	−0.2	−1.9	−1.7	−0.6	−1.2	−0.6	−0.1	−0.4	−0.3
1952															
I	−0.8	+1.1	+1.9	+0.8	+1.0	+0.2	+1.4	+0.8	−0.6	−0.1	−1.5	−1.4	+1.2	+1.8	+0.6
II	+1.3	+1.6	+0.3	+0.2	+1.8	+1.6	−2.2	+1.3	+3.5	−1.4	+0.2	+1.6	−1.6	+1.4	+3.0
III	+2.2	−0.3	−2.5	+1.3	−1.1	−2.4	−0.9	−0.1	+0.8	−0.9	−0.7	+0.2	+1.2	+0.1	−1.1
1953															
I	+2.5	+2.4	−0.1	−0.4	+0.8	+1.2	−0.3	+2.6	+2.9	+0.1	0.0	−0.1	+1.3	+2.3	+1.0
II	−0.8	+1.3	+2.1	−3.5	0.0	+3.5	−2.3	0.0	+2.3	−0.1	−0.1	0.0	−1.5	−0.3	+1.2
III	−4.6	−0.8	+3.8	−1.9	−0.7	+1.2	+0.6	+2.1	+1.5	+1.8	+0.2	−1.6	+0.6	+1.5	+0.9
1954															
I	+2.5	+2.0	−0.5	+1.1	+0.7	−0.4	+1.6	+1.5	−0.1	+1.6	+0.5	−1.1	+2.1	+1.5	−0.6
II	+3.4	+1.4	−2.0	+2.8	+0.8	−2.0	+2.9	−0.9	−3.8	−0.4	+1.3	+1.7	+0.7	−1.8	−2.5
III	+0.4	+1.6	+1.2	+2.4	−0.3	−2.7	+0.7	−0.1	−0.8	+0.6	−0.4	−1.0	+1.5	−0.7	−2.2
1955															
I	−2.0	+1.4	+3.4	+1.2	+1.4	+0.2	+0.7	+4.4	+3.7	−0.7	−0.5	+0.2	−0.8	0.0	+0.8
II	+1.6	+0.1	−1.5	−0.2	−0.1	+0.1	+1.4	+2.8	+1.4	−1.5	−0.3	+1.2	−1.2	+1.4	+2.6
III	−1.5	0.0	+1.5	−0.7	−1.2	−0.5	0.0	−0.6	−0.6	−0.5	−1.1	−0.6	−0.5	−1.5	−1.0
1956															
I	−1.8	−0.1	+1.7	+1.5	+0.5	−1.0	+1.6	−1.3	−2.9	−0.6	−1.6	−1.0	+1.7	−1.4	−3.1
II	+1.8	+2.8	+1.0	+0.5	+0.2	−0.3	−0.9	−1.6	−0.7	−1.8	+0.3	+2.1	−0.8	−1.9	−1.1
III	+1.2	+1.3	+0.1	−0.1	+1.2	+1.3	−1.2	+0.4	+1.6	+1.7	+1.6	−0.1	−0.3	−1.1	−0.8
1957															
I	0.0	+0.2	+0.2	−1.8	+0.7	+2.5	−0.3	+1.2	+1.5	+3.0	−0.1	−3.1	+1.4	+1.4	0.0
II	+1.2	−1.0	−2.2	−1.4	+0.4	+1.8	−2.2	−1.0	+1.2	−0.3	0.0	+0.3	−2.3	+2.1	+4.4
III	+1.5	−2.0	−3.5	+0.7	−0.5	−1.2	−2.4	−0.4	+2.0	−0.8	−0.9	−0.1	−0.8	+1.3	+2.1

II	+0.2	0.0	—0.2	0.0	—0.1	—0.1	—0.7	—1.7	—1.0	—1.4	—0.3	+1.1	—1.0	—0.4	+0.6
III	—2.4	—1.5	+0.9	—1.5	—0.2	+1.3	+0.5	+1.4	+0.9	+0.6	+1.0	+0.4	+0.2	—1.4	—1.6
1959															
I	—0.5	—1.4	—0.9	+1.6	—0.7	—2.3	+2.8	—0.9	—3.7	+0.2	+2.5	+2.3	+3.1	—0.7	—3.8
II	—1.2	—1.1	+0.1	+0.3	+0.6	+0.3	0.0	+2.4	+2.4	—2.3	+2.4	+4.7	—1.4	+2.2	+3.6
III	—0.8	—1.6	—0.8	+0.1	+0.1	0.0	+0.7	+0.3	—0.4	+0.2	+2.1	+1.9	0.0	+0.6	+0.6
1960															
I	—0.8			—1.2			+1.0			+1.1			+1.8		
II	+0.5			+1.3			—0.5			+0.5			—0.4		
III	+0.7			—0.3			+0.8			+0.4			+1.2		
1961															
I	+0.2			0.0			+1.5			+0.8			+1.9		
II	+3.7			+2.8			—0.4			—1.6			—0.8		
III	+1.1			+0.6			—0.2			+0.6			+0.7		
1962															
I	—2.0			+2.4			+2.7			+0.4			+2.1		
II	+1.7			+1.3			—0.4			—0.1			—1.0		
III	+0.7			+0.3			—0.4			+0.8			—0.2		
1963															
I	+0.5			—2.0			—0.6			+0.8			—0.4		
II	—1.1			—4.0			—1.6			—1.1			—1.8		
III	—2.4			—1.1			0.0			+1.3			—0.4		
1964															
I	+1.7			+3.0			+1.3			+0.1			—0.1		
II	—2.9			—1.4			+1.3			—1.2			+0.5		
III	+0.7			+1.5			+2.2			0.0			+0.5		
1965															
I	+1.1			+2.1			+1.0			—0.2			+1.3		
II	+0.2			—1.6			—1.8			0.0			+0.3		
III	—0.3			+0.4			—4.2			+1.6			—1.6		
1966															
I	—1.1			+0.4			—1.5			+0.1			+2.0		
II	—1.2			—5.7			—1.2			—2.2			—1.3		
III	—1.0			+0.4			—0.4			0.0			+0.6		
1967															
I	0.0			+1.0			—0.5			+0.8			+0.8		
II	+1.3			—2.6			—1.8			+0.4			—1.9		
III	—0.8			+0.2			+0.2			—1.5			0.0		

(continued)

TABLE 6.—*concluded*

	Omaha, Nebr.			Salt Lake City, Utah			St. Louis, Mo.			St. Paul, Minn.			Washington, D. C.		
	Pred.	Obs.	Δ	Pred.	Obs.	Δ	Pred.	Obs.	Δ	Pred.	Obs.	Δ	Pred.	Obs.	Δ
1950															
I	+1.8°	—2.4°	—4.2°	—1.5°	—0.4°	+1.1°	+1.1°	—0.2°	—1.3°	—0.9°	—4.3°	—3.4°	+1.3°	+0.7°	—0.6°
II	—0.2	—3.3	—3.1	+0.4	—1.9	—2.3	—2.1	—2.5	—0.4	0.0	—2.5	—2.5	—3.9	—2.1	+1.8
III	—0.5	—1.3	—0.8	+0.4	+2.2	+1.8	+0.7	—2.2	—2.9	—0.2	—1.8	—1.6	+0.4	—0.4	—0.8
1951															
I	—1.1	—2.5	—1.4	—2.7	+0.3	+3.0	—0.8	—2.0	—1.2	—1.1	—3.6	—2.5	+2.2	+0.2	—2.0
II	—2.3	—2.9	—0.6	+0.5	—1.1	—1.6	—3.8	—1.5	+2.3	—1.4	—1.8	—0.4	—2.4	—0.7	+1.7
III	—3.2	—3.6	—0.4	—1.8	—2.3	—0.5	—0.1	—2.0	—1.9	—1.5	—3.5	—2.0	+0.2	+0.2	0.0
1952															
I	—0.7	+0.3	+1.0	—3.7	—3.4	+0.3	+0.8	+1.2	+0.4	+0.3	+1.0	+0.7	+0.5	+1.1	+0.6
II	—2.5	+1.3	+3.8	+1.8	+0.8	—1.0	—2.2	+2.6	+4.8	—1.4	+0.7	+2.1	—2.4	+0.4	+2.8
III	+1.0	—1.0	—2.0	+1.5	+1.5	0.0	+1.6	+0.2	—1.4	+1.4	+0.5	—0.9	+1.5	—0.3	—1.8
1953															
I	+0.2	+1.4	+1.2	—0.8	+2.0	+2.8	+1.5	+2.5	+1.0	+0.2	+0.6	+0.4	+1.2	+2.7	+1.5
II	—1.2	+0.5	+1.7	+3.6	+0.8	—2.8	—0.6	+1.8	+2.4	—0.6	—0.2	+0.4	—1.8	+0.7	+2.5
III	+3.8	+2.5	—1.3	+1.9	+2.0	+0.1	+3.3	+2.1	—1.2	+5.6	+4.4	—1.2	—0.2	+0.4	+0.6
1954															
I	+5.0	+2.7	—2.3	+1.6	+1.3	—0.3	+0.4	+2.2	+1.8	+2.6	+2.1	—0.5	+3.7	+1.6	—2.1
II	+3.8	+1.6	—2.2	—0.6	+0.1	+0.7	+2.5	+1.5	—1.0	+2.0	—0.8	—2.8	—0.9	—0.7	+0.2
III	0.0	+2.1	+2.1	0.0	—0.8	—0.8	+2.0	+0.8	—1.2	+1.6	+0.5	—1.1	+0.6	—0.2	—0.8
1955															
I	—1.1	+0.2	+1.3	—3.3	—6.0	—2.7	—1.8	+1.6	+3.4	—2.5	0.0	+2.5	+1.3	+0.6	—0.7
II	—0.9	+2.6	+3.5	+2.0	—0.8	—2.8	—1.0	+1.6	+2.6	+0.2	+3.5	+3.3	—2.2	+0.5	+2.7
III	—3.0	—2.0	+1.0	—0.6	+0.7	+1.3	—1.0	—0.5	+0.5	—2.3	—1.9	+0.4	0.0	—1.0	—1.0
1956															
I	+0.4	—0.8	—1.2	—2.4	+0.3	+2.7	+0.6	0.0	—0.6	+1.3	—2.9	—4.2	+2.7	—0.9	—3.6
II	+0.3	+1.4	+1.1	+2.7	+0.8	—1.9	—1.0	+0.1	+1.1	—0.5	0.0	+0.5	—3.4	—1.9	+1.5
III	—0.7	+2.4	+3.1	+0.6	—1.8	—2.4	+1.2	+1.7	+0.5	—0.2	+2.0	+2.2	—0.3	+0.5	+0.8
1957															
I	+1.9	+1.4	—0.5	+0.2	+1.2	+1.0	—0.5	+0.1	+0.6	+2.5	+1.4	—1.1	+0.7	+1.6	+0.9
II	—0.8	+0.2	+1.0	+2.7	—0.5	—3.2	—2.6	0.0	+2.6	—0.6	+0.2	+0.8	—3.1	+0.7	+3.8
III	—0.6	+0.4	+1.0	+0.6	—0.9	—1.5	—0.2	—1.1	—0.9	—0.6	+1.1	+1.7	—1.2	0.0	+1.2
1958															
I	+2.7	—0.2	—2.9	—0.7	+2.2	+2.9	—0.1	—4.2	—4.1	+2.3	+2.8	+0.5	+1.5	—2.4	—3.9
II	—2.0	—0.9	+1.1	+1.7	+2.1	+0.4	—2.3	—2.2	+0.1	+0.2	—1.2	—1.4	—1.7	—1.9	—0.2

1959															
I	+1.6°	−0.4°	−2.0°	+0.1°	+2.1°	+2.0°	+2.8°	−0.9°	−3.7°	+1.1°	+0.5°	−0.6°	+3.1°	0.0°	−3.1°
II	−2.1	+0.2	+2.3	−1.0	+1.1	+2.1	−0.2	+0.6	+0.8	−1.5	+2.2	+3.7	−2.4	+1.2	+3.6
III	−1.8	−1.0	+0.8	−4.1	−2.1	−2.0	+0.7	−0.3	−1.0	−2.7	−0.3	+2.4	+2.6	+1.7	−0.9
1960															
I	+1.7			−2.0			−0.6			+2.4			+0.8		
II	−2.3			+2.1			−2.4			+1.4			−1.4		
III	−0.6			−0.4			+0.3			−0.2			+2.4		
1961															
I	+2.1			−1.8			+1.2			+1.6			+1.8		
II	+2.8			+2.8			+1.6			+1.9			−2.1		
III	+1.3			−1.6			−0.2			−1.0			+1.6		
1962															
I	+2.2			−3.3			+0.2			−0.4			+3.2		
II	+0.2			+1.0			−1.8			−0.4			−3.0		
III	−2.1			+0.8			−0.9			−0.4			−1.2		
1963															
I	+0.4			−0.6			−0.8			−1.0			−1.2		
II	+1.2			+3.7			−3.1			−0.6			−2.6		
III	−2.5			+1.4			−1.5			+0.6			−1.0		
1964															
I	+1.8			−2.1			+3.6			+1.6			−0.8		
II	+1.2			+1.0			−0.9			+4.3			0.0		
III	+0.9			−0.1			+1.4			+1.2			+0.7		
1965															
I	+0.9			−2.6			+0.6			−1.3			+3.9		
II	−1.6			+0.9			−1.4			−2.4			−2.2		
III	−2.6			+2.1			−1.8			−2.2			−1.0		
1966															
I	−1.2			−1.8			+0.8			−0.5			+2.6		
II	−0.4			+2.8			+0.6			−0.3			−1.4		
III	+0.2			−1.0			−0.3			+0.7			+0.1		
1967															
I	−2.6			−0.2			+0.3			+0.8			+0.9		
II	−0.4			+3.6			−2.7			−0.3			−2.1		
III	−1.7			−2.3			−1.0			0.0			+0.1		

TABLE 7.—*Four-month means of forecast, 1950 through 1958, summed separately, plus and minus, and compared regarding mean algebraic and arithmetical values*

+	−	$\Delta \div 30 = a$		$\Sigma \div 30 = b$	
		Abilene, Tex.			
21.8°	20.1°	+1.7°	0.06°	41.9°	±1.4°
		Atlanta, Ga.			
19.6	19.6	0.0	0.00	39.2	±1.3
		Detroit, Mich.			
25.7	24.2	+1.5	0.05	49.9	±1.6
		Los Angeles, Calif.			
19.2	13.7	+5.5	0.18	32.9	±1.1
		New York, N. Y.			
22.1	24.0	−1.9	0.06	46.1	±1.5

+	−	$\Delta \div 30 = a$		$\Sigma \div 30 = b$	
		Omaha, Nebr.			
30.9°	25.5°	+5.4°	0.18°	56.4°	±1.9°
		Salt Lake City, Utah			
22.2	26.0	−3.8	0.13	48.2	±1.6
		St. Louis, Mo.			
25.5	22.8	+2.7	0.09	48.3	±1.6
		St. Paul, Minn.			
24.6	26.2	−1.6	0.05	50.8	±1.7
		Washington, D. C.			
26.2	22.6	+3.6	0.12	48.8	±1.6

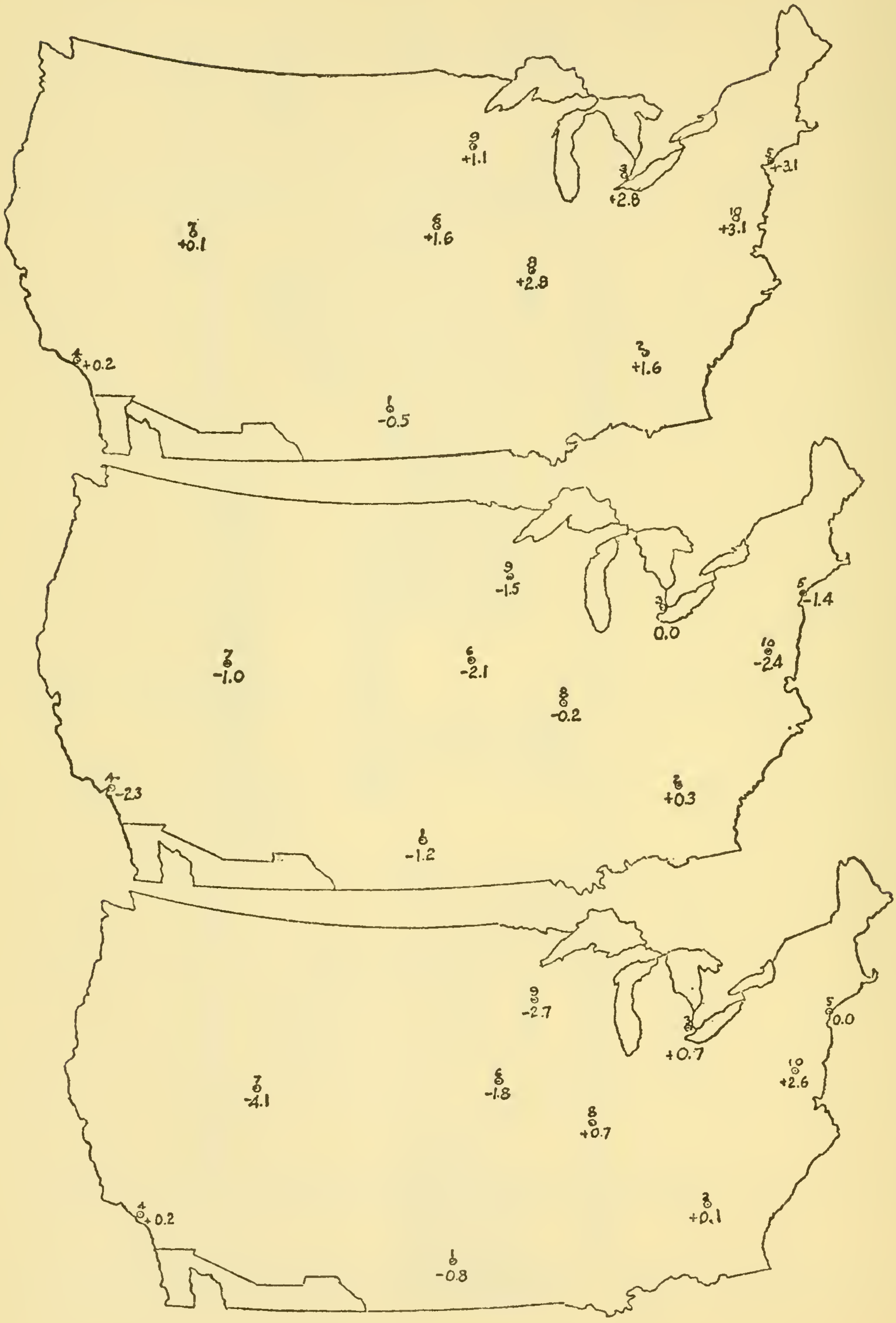
Mean, $\frac{\Sigma a}{10} = +0.03$

Mean, $\frac{\Sigma b}{10} = +1.5$

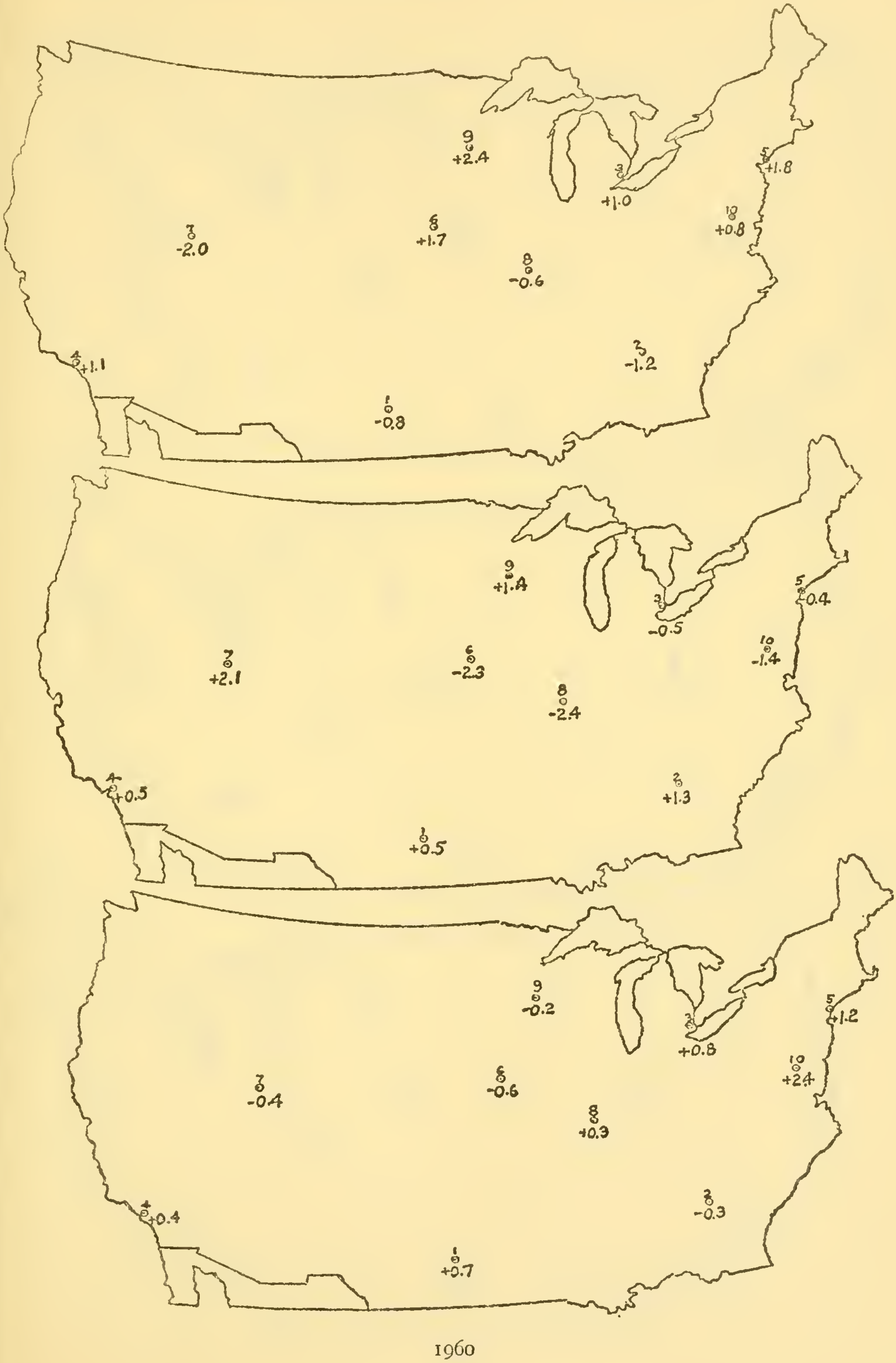
TABLE 8.—*The same and opposite signs of percentages of departure from normal of forecasts and events, 1950 through 1959*

	Percent same	Percent opposite		Percent same	Percent opposite
Abilene, Tex., 1	70	30	Omaha, Nebr., 6	60	40
Atlanta, Ga., 2	61	39	Salt Lake City, Utah, 7	67	33
Detroit, Mich., 3	61	39	St. Louis, Mo., 8	63	37
Los Angeles, Calif. 4	60	40	St. Paul, Minn., 9	68	32
New York, N. Y., 5	56	44	Washington, D. C., 10	64	36

Means: Same 63, opposite 37.


+1.1
+2.8
+3.1
+0.1
+1.6
+3.1
+2.8
+0.2
+1.6
-0.5
-1.5
0.0
-1.4
-1.0
-2.1
-2.4
-0.2
-2.3
+0.3
-1.2
-2.7
+0.7
0.0
-4.1
-1.8
+2.6
+0.7
+0.2
+0.1
-0.8

1959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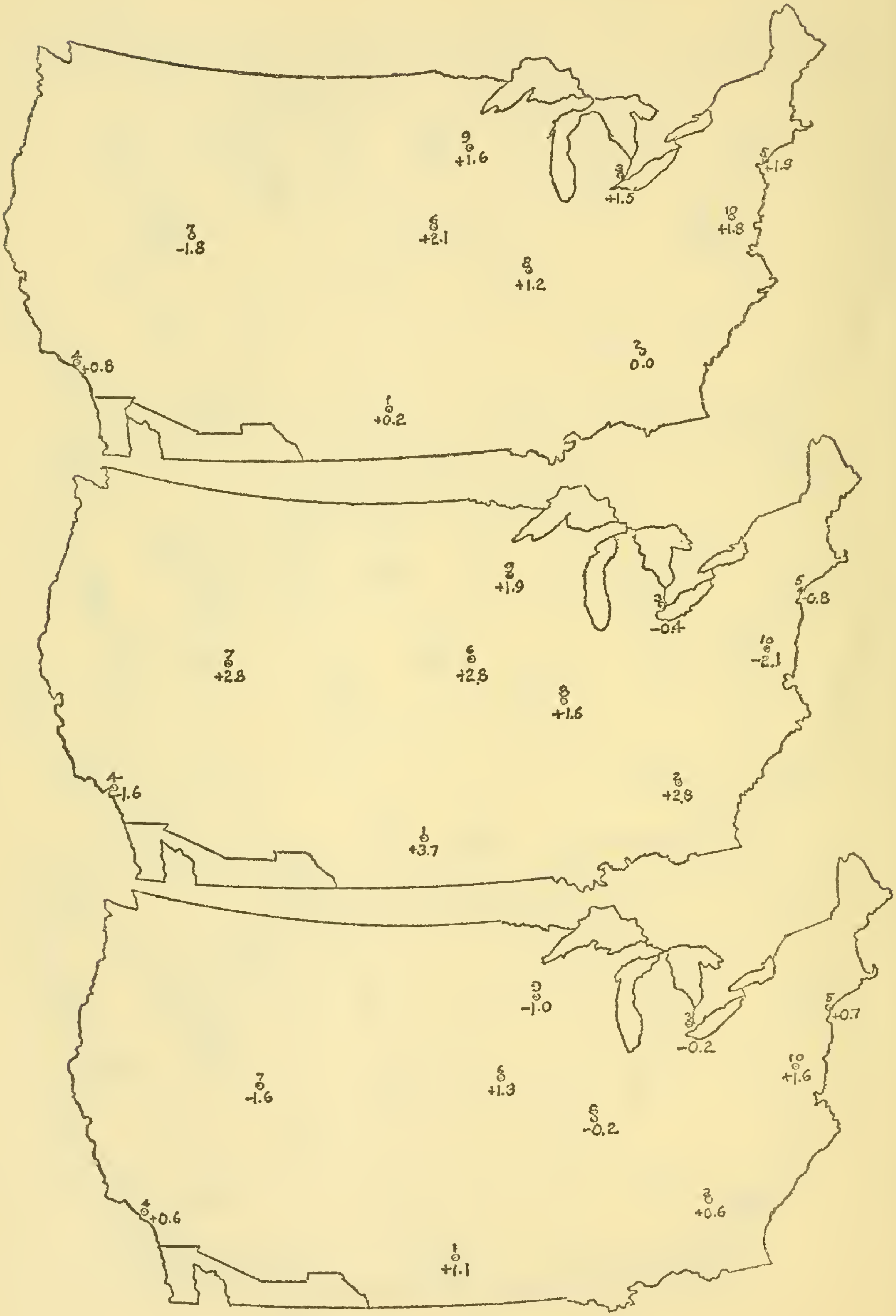
+2.4
3
+1.0
5
+1.8
10
+0.8
7
-2.0
6
+1.7
8
-0.6
4
+1.1
2
-1.2
1
-0.8
9
+1.4
3
-0.5
5
0.4
10
-1.4
7
+2.1
6
-2.3
8
-2.4
4
+0.5
2
+1.3
1
+0.5
9
-0.2
3
+0.8
5
1.2
10
+2.4
7
-0.4
6
-0.6
8
+0.3
4
+0.4
2
-0.3
1
+0.7

1960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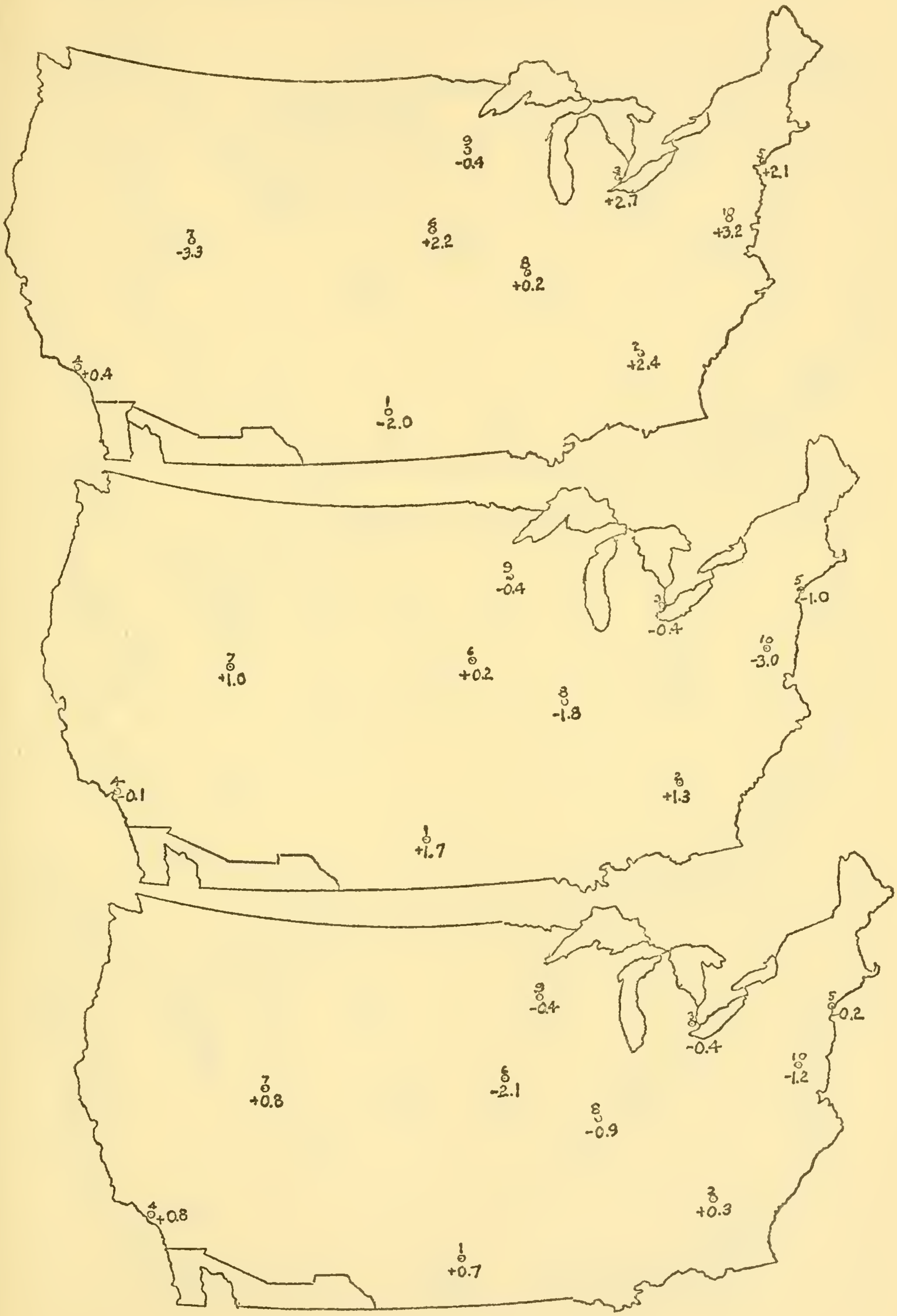
3 +1.5
5 +1.9
10 +1.8
7 -1.8
6 +2.1
8 +1.2
4 +0.8
2 0.0
1 +0.2
9 +1.9
3 -0.4
5 -0.8
10 -2.1
7 +2.8
6 +2.8
8 +1.6
4 -1.6
2 +2.8
1 +3.7
9 -1.0
3 -0.2
5 +0.7
10 +1.6
7 -1.6
6 +1.3
8 -0.2
4 +0.6
2 +0.6
1 +1.1

1961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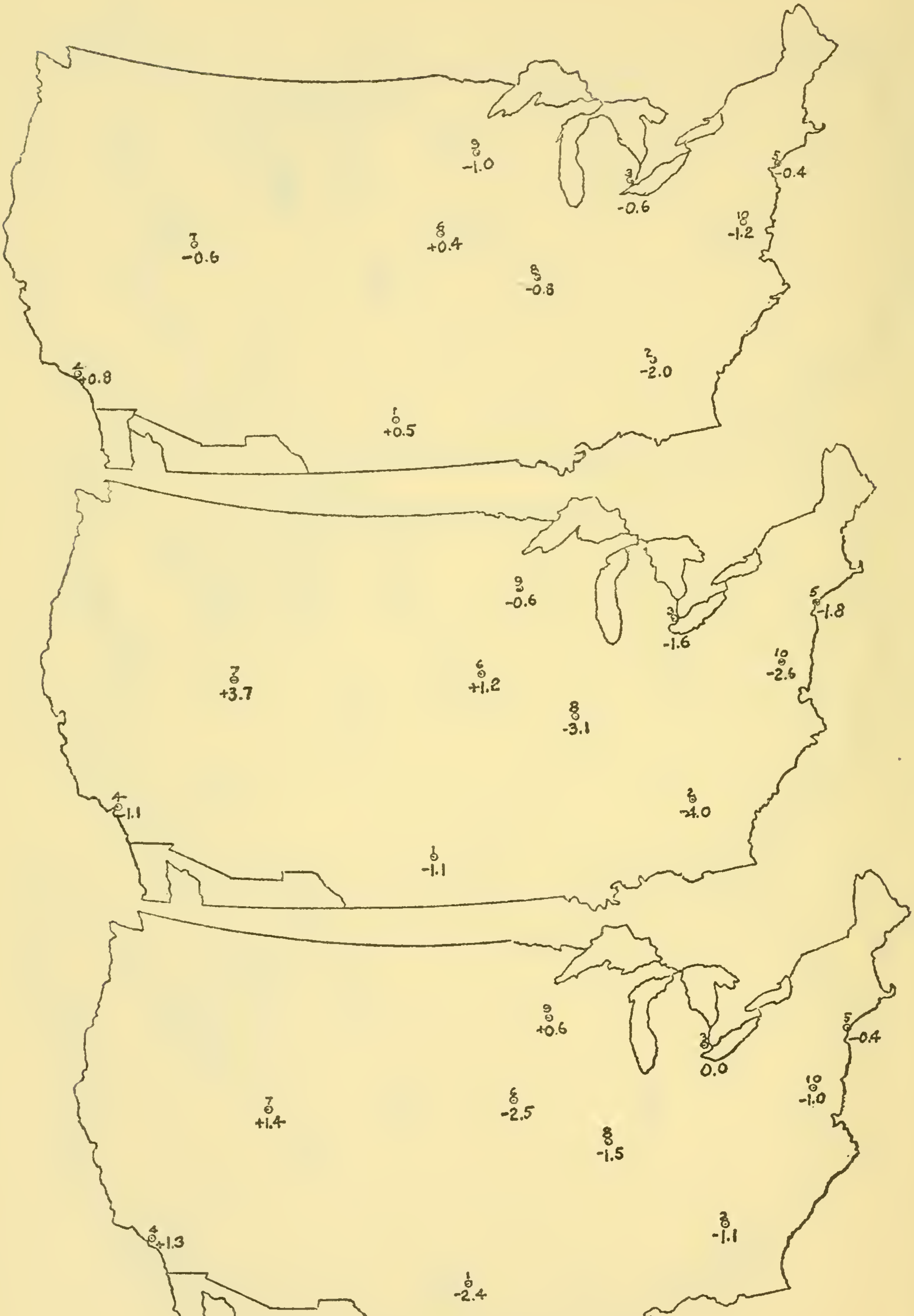
3 +2.7
5 +2.1
10 +3.2
7 -3.3
6 +2.2
8 +0.2
2 +2.4
4 +0.4
1 -2.0
9 -0.4
3 -0.4
5 -1.0
10 -3.0
7 +1.0
6 +0.2
8 -1.8
2 +1.3
4 -0.1
1 +1.7
9 -0.4
3 -0.4
5 0.2
10 -1.2
7 +0.8
6 -2.1
8 -0.9
2 +0.3
4 +0.8
1 +0.7

1962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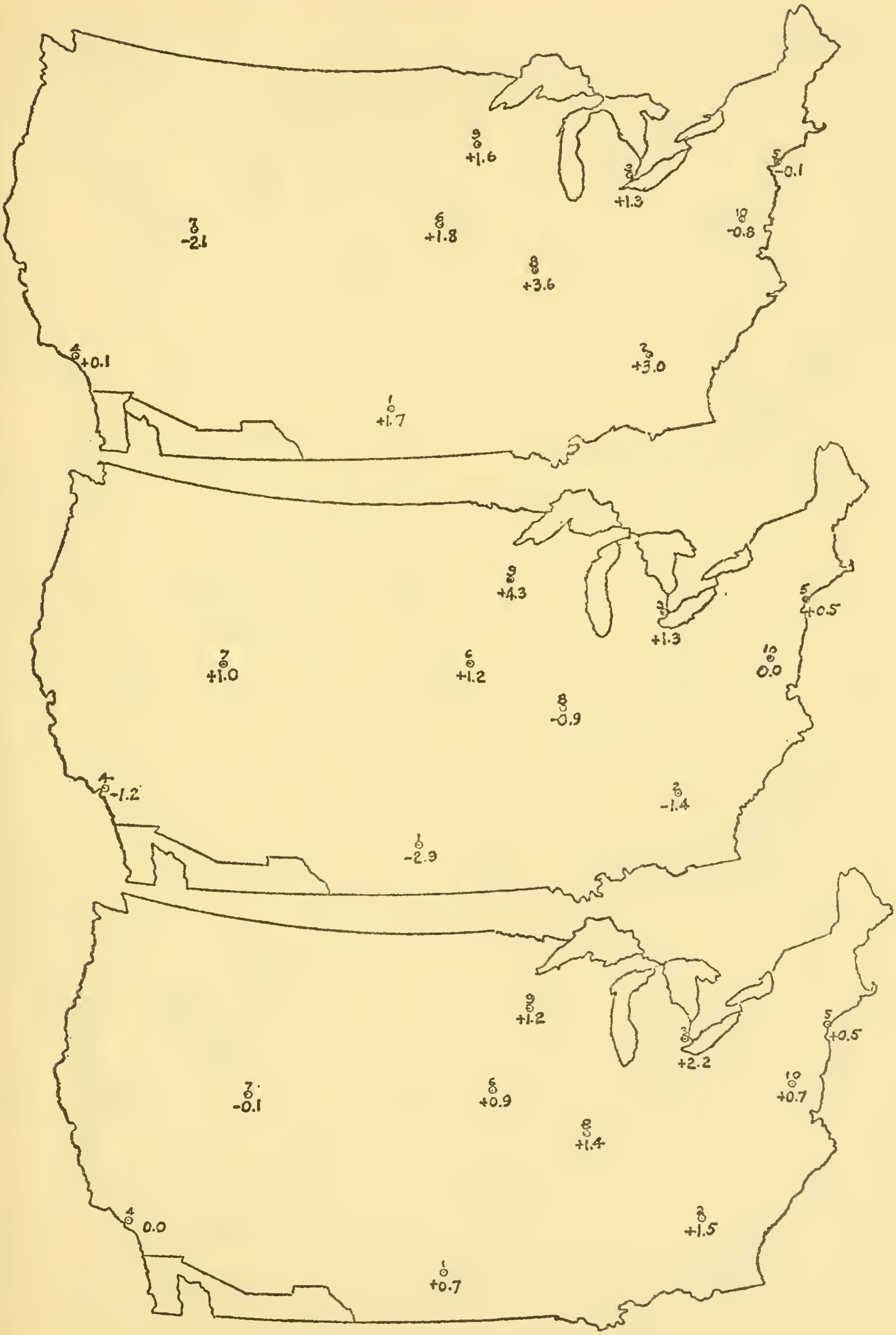
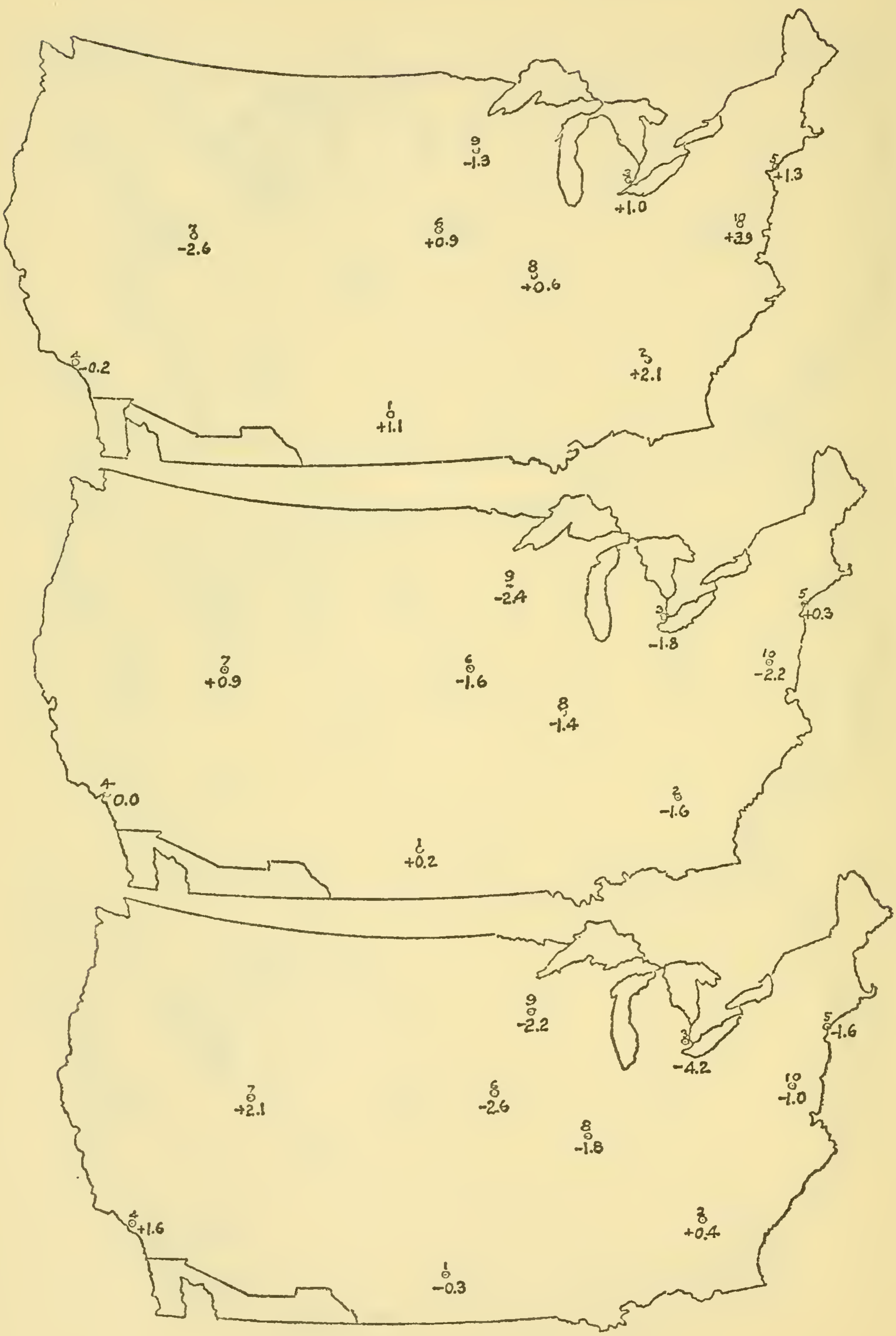
5 -0.4
7 -0.6
6 +0.4
10 -1.2
8 -0.8
4 +0.8
2 -2.0
1 +0.5
9 -0.6
5 -1.8
3 -1.6
10 -2.6
7 +3.7
6 +1.2
8 -3.1
4 -1.1
2 -4.0
1 -1.1
9 +0.6
5 -0.4
3 0.0
10 -1.0
7 +1.4
6 -2.5
8 -1.5
4 +1.3
2 -1.1
1 -2.4

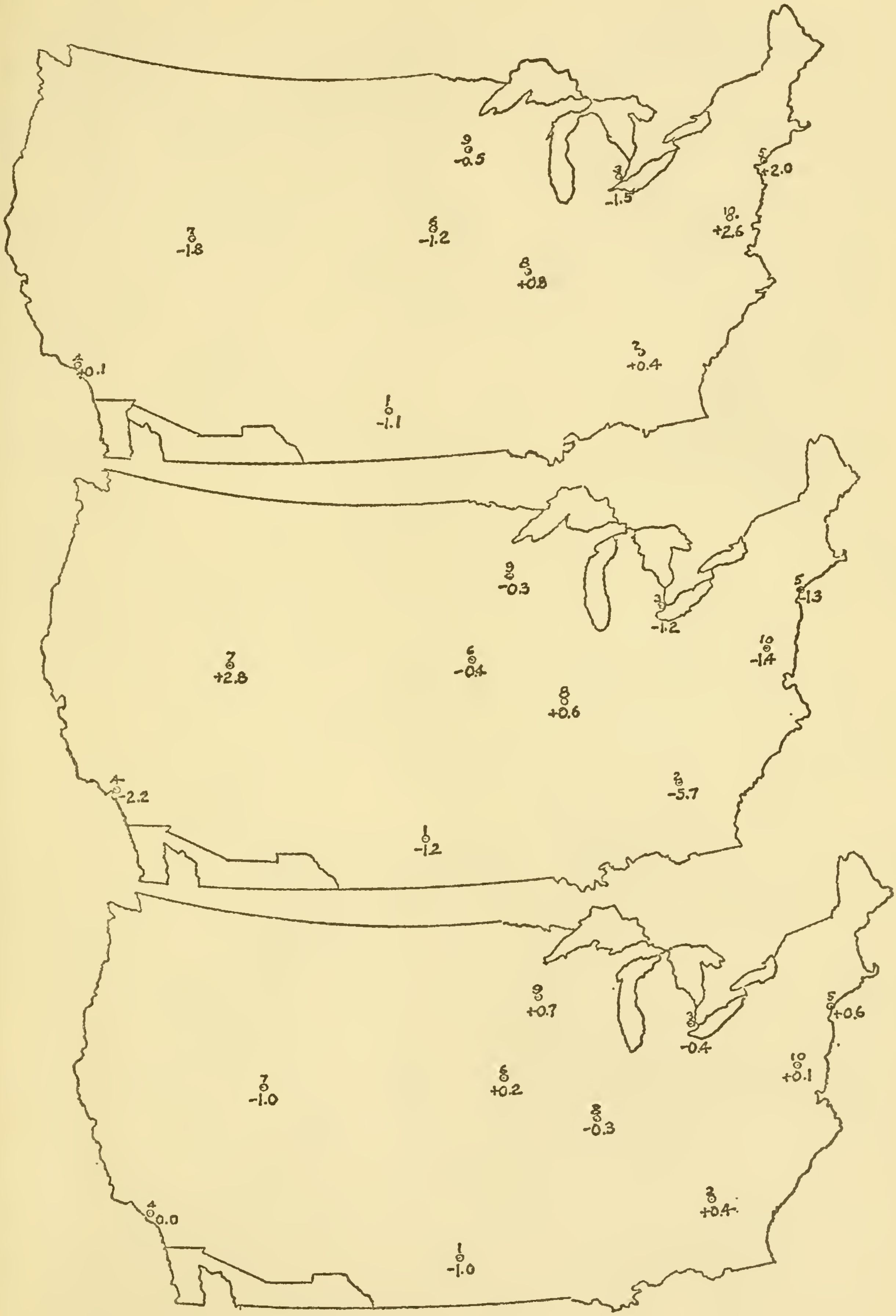
1963


+1.6
-0.1
+1.3
-2.1
+1.8
-0.8
+3.6
+0.1
+3.0
+1.7
+4.3
+0.5
+1.3
+1.0
+1.2
0.0
-0.9
-1.2
-1.4
-2.9
+1.2
+0.5
+2.2
-0.1
+0.9
+0.7
+1.4
0.0
+1.5
+0.7

1964


9
-1.3
3
+1.0
5
+1.3
7
-2.6
6
+0.9
10
+3.9
8
+0.6
4
-0.2
2
+2.1
1
+1.1
9
-2.4
3
-1.8
5
+0.3
7
+0.9
6
-1.6
10
-2.2
8
-1.4
4
0.0
2
-1.6
1
+0.2
9
-2.2
3
-4.2
5
-1.6
7
+2.1
6
-2.6
10
-1.0
8
-1.8
4
+1.6
2
+0.4
1
-0.3

1965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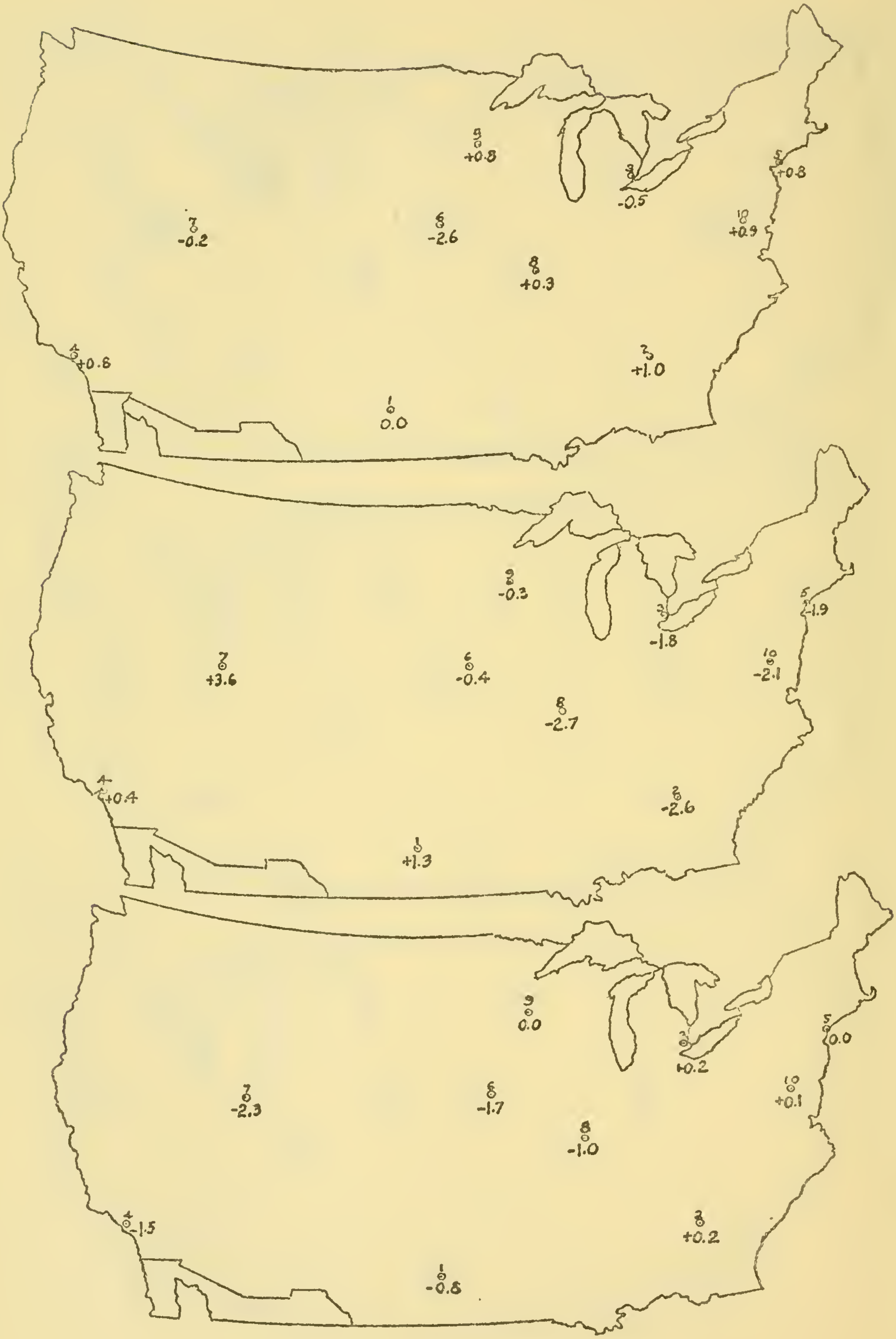
3 -1.5
5 +2.0
7 -1.8
6 -1.2
10 +2.6
8 +0.8
2 +0.4
4 +0.1
1 -1.1
9 -0.3
5 13
3 -1.2
10 -1.4
7 +2.8
6 -0.4
8 +0.6
4 -2.2
2 -5.7
1 -1.2
9 +0.7
5 +0.6
3 -0.4
10 +0.1
7 -1.0
6 +0.2
8 -0.3
2 +0.4
4 0.0
1 -1.0

1966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3 -0.5
5 +0.8
7 -0.2
6 -2.6
10 +0.9
8 +0.3
4 +0.8
2 +1.0
1 0.0
9 -0.3
3 -1.8
5 -1.9
7 +3.6
6 -0.4
10 -2.1
8 -2.7
4 +0.4
2 -2.6
1 +1.3
9 0.0
3 +0.2
5 0.0
7 -2.3
6 -1.7
10 +0.1
8 -1.0
4 -1.5
2 +0.2
1 -0.8

1967