THE WEATHER AND CIRCULATION OF NOVEMBER 1964

Contrasting Weather Regimes Related To Long-Wave Progression

ROBERT R. DICKSON

Extended Forecast Division, National Meteorological Center, U.S. Weather Bureau, Washington, D.C.

1. INTRODUCTION

Reversal of mid-tropospheric circulation features from October to November continued the non-persistent trend exhibited by the circulation this fall. In the United States this resulted in the reversal of October's temperature patterns and in the inception of precipitation in the northeastern quarter of the Nation where areas of severe drought had developed.

2. MONTHLY CIRCULATION

Progression of planetary waves characterized the evolution of the circulation between October and November of this year. A comparison of November's monthly mean 700-mb. map (fig. 1) with its counterpart for October [1] reveals, indeed, that this progression proceeded to the point where November's wave pattern was nearly a complete reversal of that for October. This change in the circulation is also documented by the 700-mb. height anomaly maps accompanying the above-noted circulation patterns. Thus from October to November there was little evidence of persistence, a condition characteristic of this transitional season of normally increasing zonal westerlies [2].

An outstanding feature of November's mean circulation was the strong blocking ridge extending from the Bering Sea northward to the pole (fig. 1). The accompanying above-normal 700-mb. heights which dominated the polar region (fig. 2) were reminiscent of August and September of this year. This trend of recent months (October excepted) has interrupted the long-standing condition of below normal 700-mb. heights in polar areas extending back to the late summer of 1963. A peculiar aspect of this polar blocking ridge is the complete absence of above normal mean 1000–700-mb. thicknesses in the area. Perhaps this is due to the rather limited extent of southerly anomalous flow associated with the blocking and to the cold condition of the lower troposphere in the Bering Sea area, source region of the anomalous flow.

As is frequently the case, the blocking ridge was associated with relatively short wavelengths in the Pacific, with mean troughs located along the Asiatic Coast, in the mid-Pacific, and along the west coast of the United States. The anomalous depths of the troughs near Japan and west of the Hawaiian Islands are also characteristic of blocking in northern portions of the Pacific. The deep trough near the Philippines was the site of four typhoons and two tropical storms during November. Of these, typhoon Louise which originated east of the Philippines on November 15 was of major proportions, striking the Islands with 165-kt. winds and inflicting extensive damage and loss of life. An added feature of the Pacific blocking was the replacement of the usual, extensive wind speed maximum in mid-Pacific by two weaker maxima, one near each continent (fig. 3).

Over the United States the relatively small height departures from normal in both the western trough and eastern ridge are suggestive of the continuing evolution of circulation features during the month (i.e., the lack of persistence) which has been so characteristic of this fall season. The fall evolution is summarized in figure 2 which shows the location of anomaly centers on monthly mean 700-mb. maps prepared at 15-day intervals. The rather remarkable eastward motion of both negative and positive centers from September through November is apparent. Also, over North America, the fanlike flow over western portions converges in the east to produce the strongest 700-mb. wind speed maximum of the Hemisphere in the trough in the vicinity of Nova Scotia (fig. 3).

Elsewhere in the Hemisphere, the greatest anomaly of mean height during November occurred in the trough extending from the Red Sea northeastward to the Tamyr Peninsula (fig. 2) where heights were as much as 410 ft. below normal. This deep trough, and to a lesser extent the ridge to its west, were among the few circulation features which persisted during the month, as is shown by half-monthly circulation maps (figs. 4a and 5a). The Pacific circulation changed from a high-index flow early in the month to a mature block during the last half of November. Over North America, the trough and associated negative height anomaly migrated from the west coast during the first half-month to the Great Lakes Region while the ridge to its east moved from the Great Lakes area eastward off the coast.

3. TEMPERATURE

Accompanying the change of circulation features from October to November was an equally impressive reversal of temperature pattern over the United States. November's mean temperature anomaly (fig. 6) with cold in the West and warm in the East was in sharp contrast to

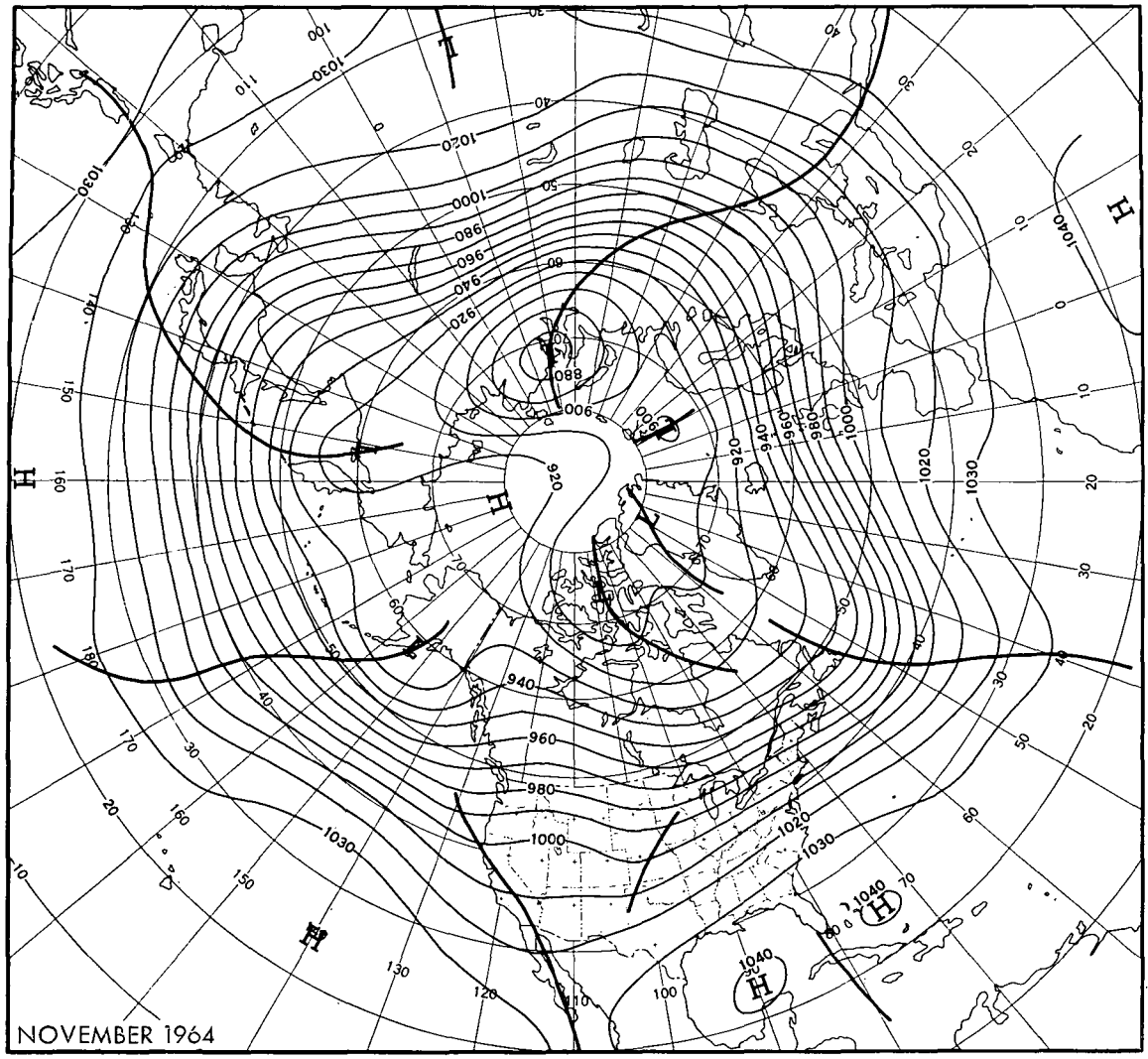

FIGURE 1.—Mean 700-mb. contours (tens of feet) drawn at intervals of 100 ft. for November 1964.

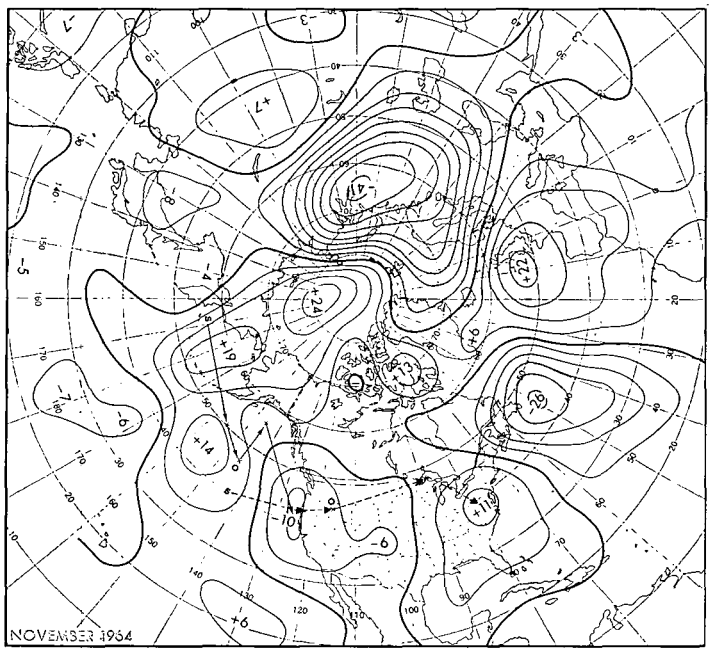

FIGURE 2.—Mean 700-mb. height departures from normal for November 1964 drawn at intervals of 50 ft. with centers in tens of feet and zero isopleth heavy. Dashed lines give past positions of selected 30-day mean height anomaly centers at 15-day intervals with September and October positions labeled S and O, respectively.

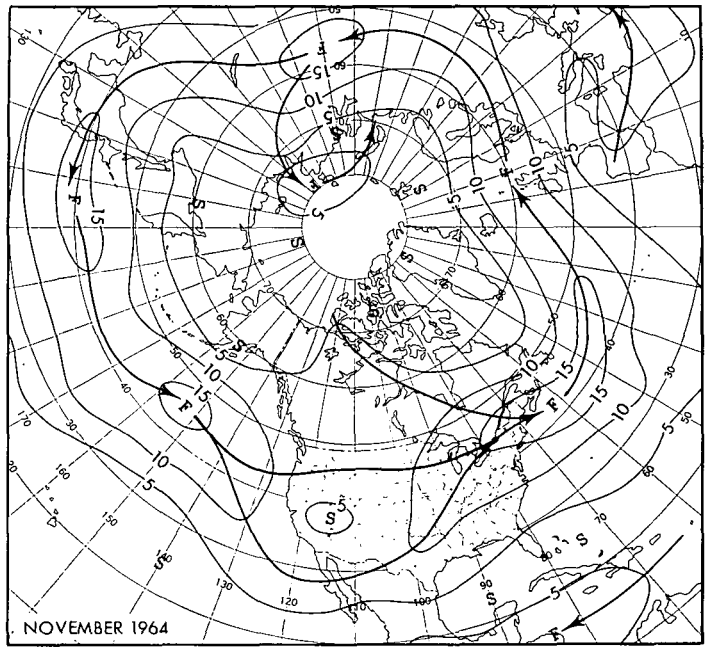

FIGURE 3.—Mean isotachs (meters per second) at 700 mb. for November 1964. Heavy solid arrows indicate principal axes of maximum speed.

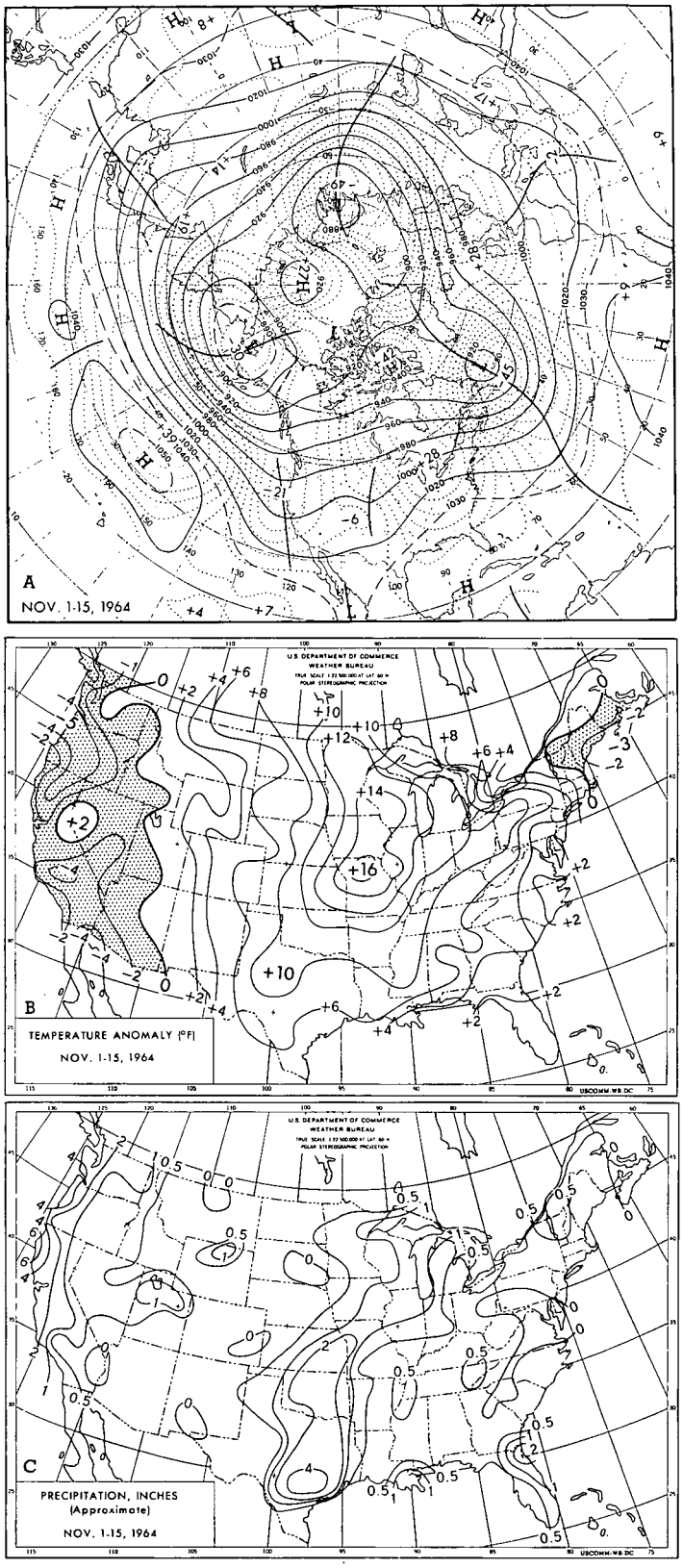

FIGURE 4.—November 1–15, 1964. (A) Mean 700-mb. height and departure from normal (both in tens of feet); (B) departure of average temperature from normal (°F.); and (C) total precipitation (in.).

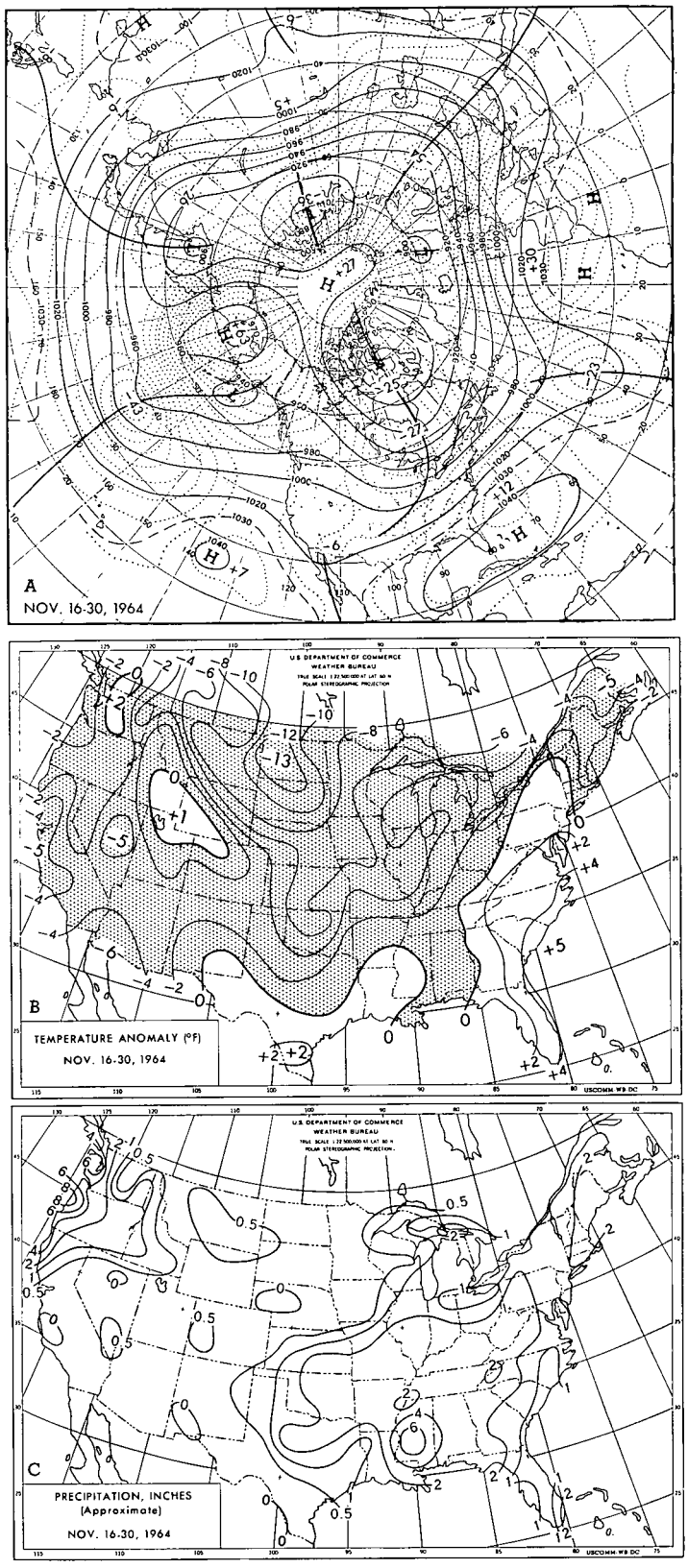

FIGURE 5.—November 16–30, 1964. (A) Mean 700-mb. height and departure from normal (both in tens of feet); (B) departure of average temperature from normal (°F.); and (C) total precipitation (in.).

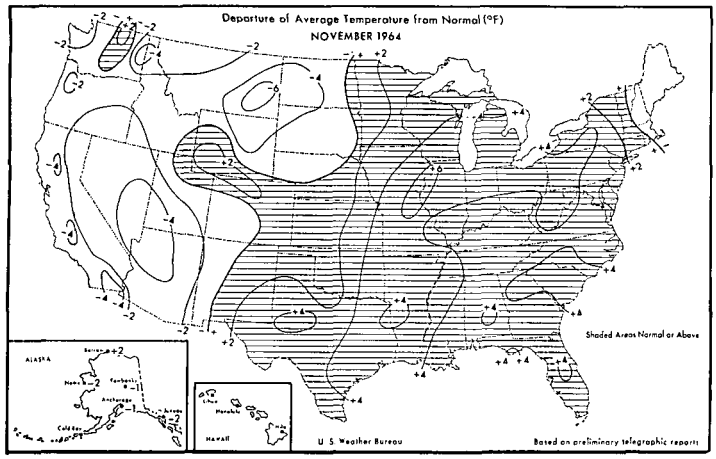

FIGURE 6.—Departure of average surface temperature from normal (°F.) for November 1964 (from [3]).

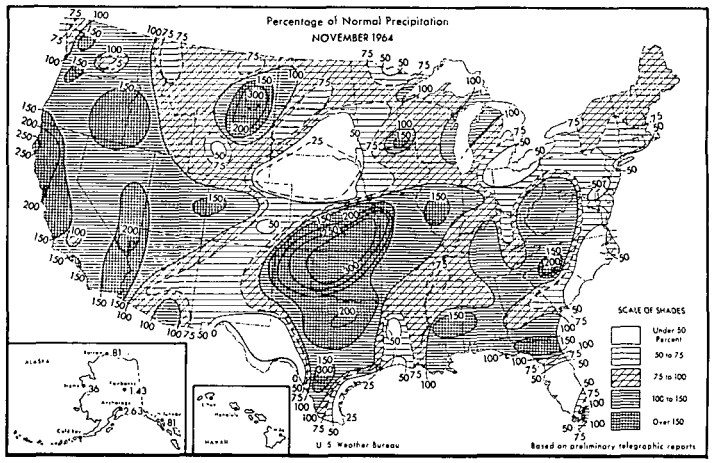

FIGURE 7.—Percentage of normal precipitation for November 1964 (from [3]).

October's pattern [1] of warm in the West and cold in the East.

November's mean temperature anomaly over the United States was in good accord with the mean circulation anomaly (fig. 2) with heights below normal in the West and above normal in the East. Inasmuch as the monthly mean circulation pattern was made up by an eastward progression of circulation features during the month, the temperature pattern displayed a similar progression. Cold air, confined to the Western States during early November (fig. 4b) covered most of the Nation west of the Appalachians during the last half of the month (fig. 5b) as the west coast mean trough progressed to the Great Lakes and blocking became entrenched over the Bering Straits. The strong northerly flow over western North America (fig. 5a) resulting from these circulation developments produced impressive results. Half-monthly mean temperatures, well above normal during early November over central portions of the country, plunged to as much as 13° below normal during the second half of the month. Daily temperatures which had risen to record warmth for so late in the season at several mid-Nation locations during early November, plunged to record cold for so early in the season at neighboring stations toward the month's end. On November 30 record-breaking cold for the month was reported at Springfield, Ill. (−3° F.), St. Louis, Mo. (1° F), Norfolk, Nebr. (−15° F.), Aberdeen, S. Dak. (−27° F.), and St. Paul, Minn. (−17° F.); the record at Bismarck, N. Dak. (−29° F.) came a day earlier.

4. PRECIPITATION AND DROUGHT

With the transition of circulation features from October to November, the dry conditions prevalent across much of the Nation during October were alleviated to some extent during November. The development of November's mean trough in the West and mean ridge in the East (fig. 1) with accompanying southerly anomalous flow in mid-Nation (fig. 2) brought abundant precipitation to much of the West and from the Southern Plains to the Great Lakes (fig. 7). Along most of the east coast north of Florida, however, the prevalence of an upper-level ridge with enhanced northerly wind components resulted in relatively dry conditions. Inherent in the eastward progression of circulation features during November was the eastward spreading of precipitation from a Southern Plains-Upper Great Lakes axis early in the month (fig. 4c) to envelop most of the eastern half of the Nation later in November (fig. 5c).

Despite some relief during late November, stations in southern New England and eastern New York reported the 7th or 8th consecutive month with below normal precipitation. Record low precipitation for November was observed at Charleston, S.C. (0.52 in.) while the total lack of precipitation at El Paso, Tex., was one of seven such November occurrences reported at that location. In Ohio, Cleveland reported the driest November since 1924 while Dayton experienced the seventh consecutive month with subnormal precipitation. Record numbers of consecutive days with no measurable precipitation were observed at Cairo, Ill. (48 days) and Greensboro, N.C. (21 days). Aberdeen, S. Dak. experienced a sequence of 54 such days.

The cool, wet weather in the West brought record November snowfall totals to Prescott, Ariz. (8 in.), Boise, Idaho (7.3 in.), and Sheridan, Wyo. (25.8 in.), and the second highest total of record to Grand Junction, Colo. (12.1 in.). New 24-hr. snowfall accumulation records were established at Prescott, Ariz. (8 in.), Boise, Idaho (4.5 in.), and Muskegon, Mich. (9.1 in.).

REFERENCES

1. J. F. O'Connor, "The Weather and Circulation of October 1964—An Unusually Dry Month," *Monthly Weather Review*, vol. 93, No. 1, Jan. 1965, pp. 59–66.
2. J. Namias, "The Annual Course of Month-to-Month Persistence in Climatic Anomalies," *Bulletin of the American Meteorological Society*, vol. 33, No. 7, Sept. 1952, pp. 279–285.
3. U.S. Weather Bureau, *Weekly Weather and Crop Bulletin, National Summary*, vol. LI, No. 49, Dec. 7, 1964.

U.S. GOVERNMENT PRINTING OFFICE:1965