

# THE WEATHER AND CIRCULATION OF OCTOBER 1965

## Long-Wave Progression and Temperature Reversal

ROBERT R. DICKSON

Weather Bureau, Environmental Science Services Administration, Washington, D.C.

### 1. INTRODUCTION

From September to October the upper-level circulation over the United States underwent a complete reversal bringing marked changes to both temperature and precipitation patterns. This reversal occurred in conjunction with progression of a mean trough into the eastern Pacific replacing a previous blocking ridge of record-breaking proportions in that area.

### 2. MEAN CIRCULATION

The meridional nature of the mean circulation, which was so pronounced in September [1], continued into October 1965 as can be seen in figures 1 and 2. This, however, was not an instance of a persistent circulation regime. On the contrary, reference to figure 3 reveals pronounced changes in the mean height anomaly between September and October. In fact, over much of the Arctic, the Pacific, and the United States there was a reversal of both the height anomaly sign and the nature of the circulation between the two months. This change was effected by progression of most long-wave features in the Pacific and in North America. Thus, September's mid-Pacific trough moved to the eastern Pacific in October, replacing a strong blocking ridge by a deep trough with heights well below normal. Similarly, September's eastern Pacific ridge progressed to western North America replacing a mean trough which, in turn, pushed eastward to the September mean ridge position along the east coast.

Progression of mean circulation features in the Pacific has continued since late summer with August's trough and ridge moving from 165° E. and 160° W., respectively (at 50° N.), to October positions as shown in figure 1. This sequence of events is quite similar to that discussed in a seasonal sense by Namias [2] who attributed the longevity of the mean trough, in part, to favorable water temperature contrasts which develop in conjunction with the eastward motion of the mean trough.

In contrast to the progressive nature of the circulation over the Pacific and North America from September to October, most circulation features over Europe and Asia retrograded during this period. This appears to have been, at least in part, a wavelength readjustment in response to the loss of the trough which was in the eastern Atlantic in September. Retrogression of a mean trough to a position west of Spain where it deepened

significantly was noteworthy in that such deepening is frequently associated with increasing upper-level heights in the vicinity of Great Britain and it was here that a blocking ridge developed during October. To the east of this blocking ridge, mean heights dropped markedly from September to October (fig. 3) as the mean trough retrograded to a position extending from the eastern Mediterranean to the Kara Sea. Elsewhere the eastern Asiatic ridge intensified and the low-latitude portion of the Asiatic coastal trough remained quite active. The latter feature helped maintain a strong central Pacific ridge throughout the month.

### 3. TEMPERATURE

In view of the reversal of circulation regime over the United States from September to October it is not surprising that the temperature pattern also underwent a radical change. As a strong ridge became established over the West during October, the low temperatures of the previous month gave way to above normal values over most of the western half of the Nation (fig. 4). Most extreme change was in the Northern Plains where temperatures which were 12° F. or more below normal in September increased to 4° to 5° F. above normal in October. Over a substantial part of the Northern Plains mean temperatures during October exceeded those during September for the first time of record. In California monthly mean temperatures were among the highest of record and in southern California frequent Santa Ana winds brought a record number of days with temperatures of 90° F. or more. With October's mean trough located along the east coast, strong anomalous flow from the northwest (fig. 2) brought below normal temperatures to most of the eastern half of the Nation. This too was a reversal of the warm conditions experienced during September.

As September's warm ridge in the eastern Pacific was replaced by a deep trough in the Gulf of Alaska many Alaskan interior stations experienced the coldest October of record with monthly mean temperatures from 7° to 12° F. below normal.

### 4. PRECIPITATION

As was the case with temperature, the radically changing circulation regime from September to October brought substantial changes in the precipitation distribution. Whereas much of the Nation had been relatively wet during

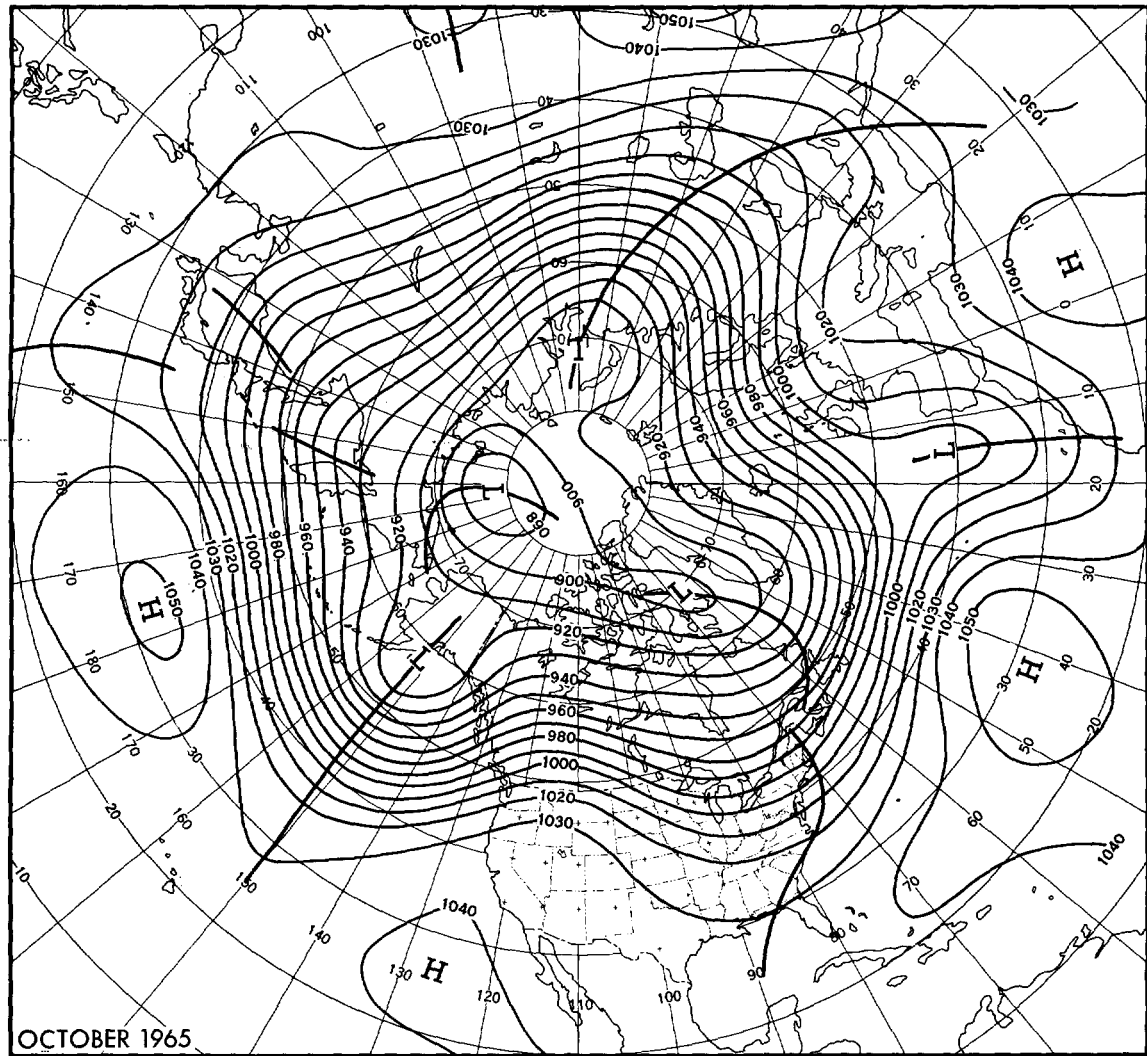


FIGURE 1.—Mean 700-mb. contours (tens of feet), October 1965.

September, the prevalence of ridge conditions in the West (figs. 1 and 2) favored little precipitation over most of that region during October (fig. 5). In fact at widely scattered locations, including Glasgow, Mont., Idaho Falls, Idaho, Sheridan and Casper, Wyo., and San Diego, Calif., precipitation either equaled or established the record October minimum. Precipitation over the Central and Southern Plains was related to the easterly anomalous flow observed in the region (fig. 2) suggestive of low-latitude troughs which traversed the southern Rockies during the period. Precipitation west of the Appalachians was associated with strong cyclonic curvature and sub-normal heights to the north and a deeper than normal trough to the south. Relatively light precipitation along the eastern seaboard from Norfolk, Va. to Portland, Maine appears to have been a rain shadow effect of the strong westerly flow perpendicular to the Appalachian Mountains (figs. 1 and 2). Thus, drought conditions worsened in northeastern coastal areas. Elsewhere in the northeastern drought area, generally near normal

precipitation was observed but drought conditions were not substantially altered.

Heaviest precipitation in the Nation during the month was observed in parts of southeastern Florida where Fort Lauderdale received more than 42 in. of rain and Pompano Beach recorded 36.5 in. These are both station records for any month of the year and grossly exceed previous record monthly totals of near 25 in.

In Alaska, interior locations were dominated by cold, dry Arctic air and experienced one of the driest Octobers of record. Conversely, in response to the active Gulf of Alaska Low southeastern Alaska recorded one of its wettest Octobers.

## 5. VARIABILITY WITHIN THE MONTH

Weekly distributions of temperature and precipitation, accompanied by appropriate 5-day mean 700-mb. maps, are shown in figures 6 through 9. As is frequently the case, this series represents the recurrence during the month

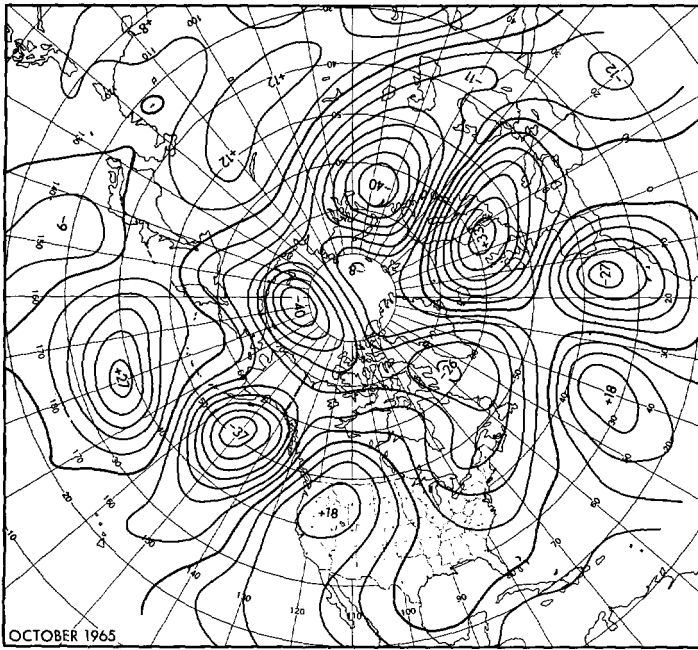


FIGURE 2.—Departure of mean 700-mb. heights from normal (tens of feet), October 1965.

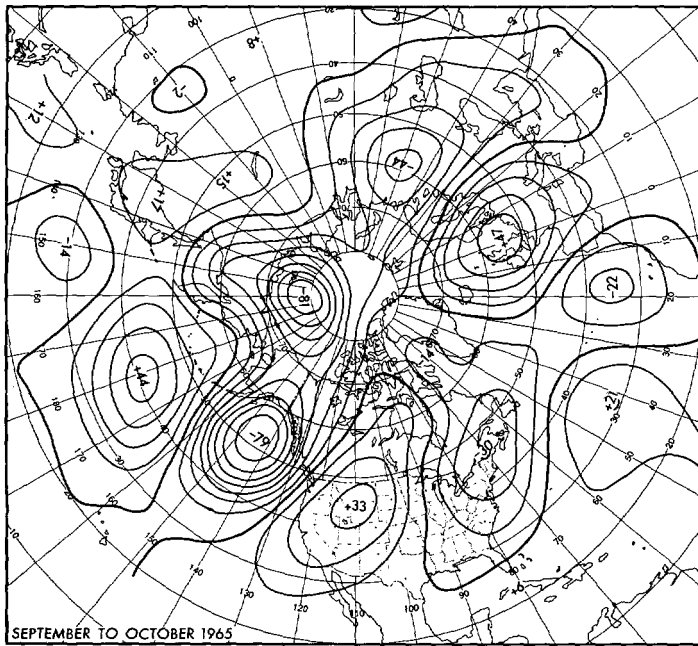


FIGURE 3.—Change in monthly mean 700-mb. height anomaly (tens of feet), from September to October 1965.

of the dominant monthly mean circulation pattern (figs. 1 and 2). Early in October (fig. 6A) this dominant pattern was well established with a strong ridge in the West and a deep trough in the East. By October 12–16 (fig. 7A) however, zonal flow predominated throughout most of the hemisphere and an upper trough had moved into the West. This change culminated during the October 16–20 period (not shown) in an upper-level pattern diametrically opposed to that which prevailed during the month.

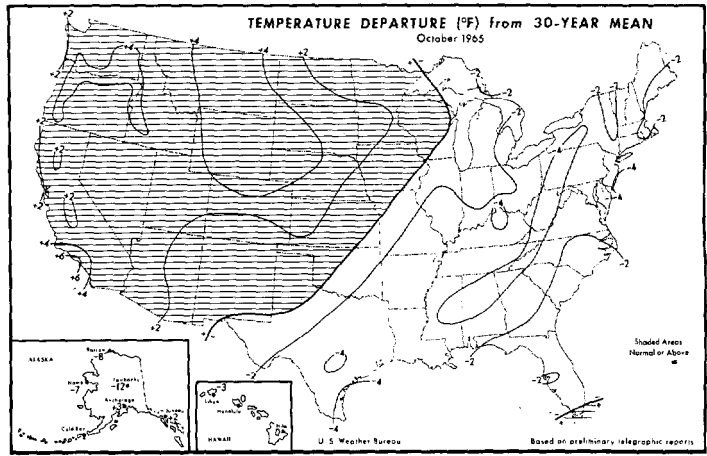


FIGURE 4.—Surface temperature departure from normal (°F.), October 1965 (from [3]).

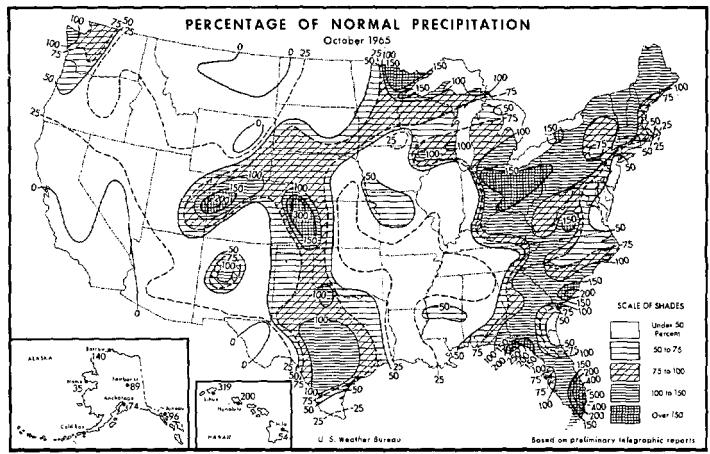


FIGURE 5.—Percentage of normal precipitation, October 1965 (from [3]).

During this period, a deep trough was located from the Southern Rockies to the Northern Plains while a closed upper High was established over Maryland. Reference to figures 8A and 9A reveals, however, that this was a very transient circulation pattern and that the dominant monthly regime was quickly re-established.

The weekly temperature patterns (figs. 6B–9B) reflect quite well this early- and late-period agreement with the monthly mean, with the alternate regime of mid-month spreading warm air across the Nation. As the first cold outbreak of the month swept across the East during the first week of October, temperatures dropped to record lows for so early in the season at several stations from Richmond northward. With the return of a deep east coast trough at the end of the month, record cold returned to the East with freezing temperatures reaching almost to the Gulf Coast. Lowest temperatures for so early in the season were observed during this outbreak at scattered locations east of the Mississippi River from the Gulf Coast States northward. These include record low temperatures for October at Lansing, Mich. on October 28; at Toledo,

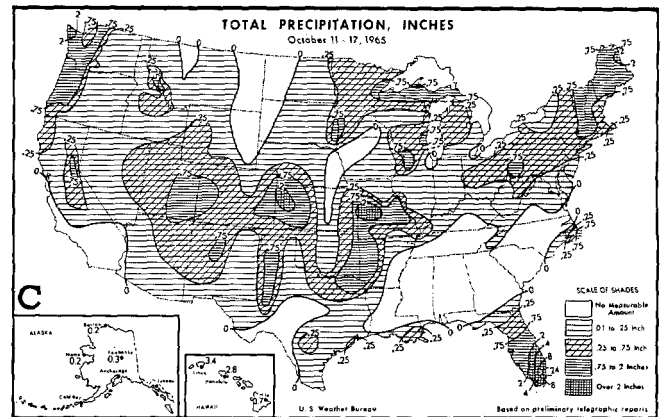
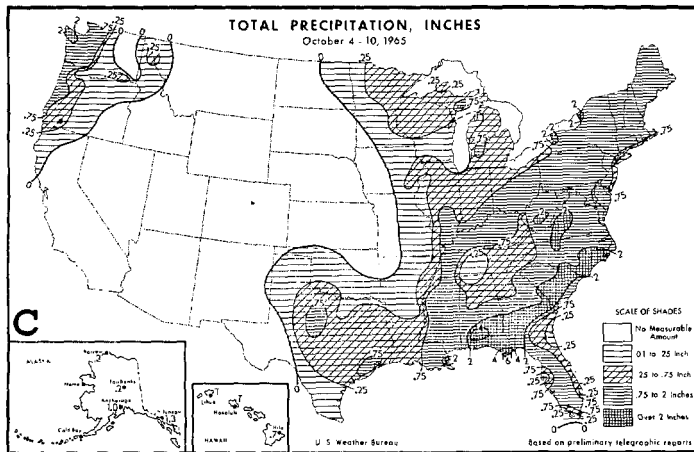
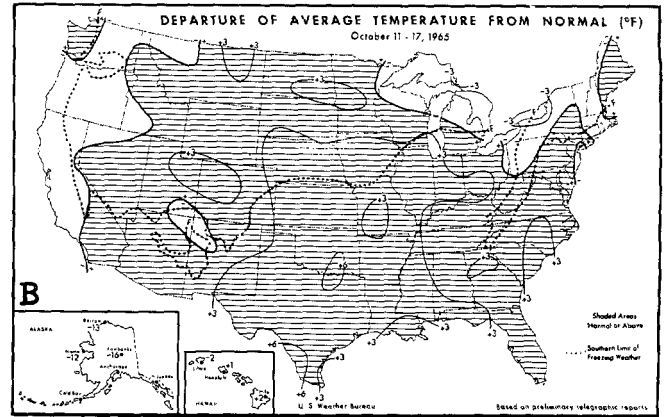
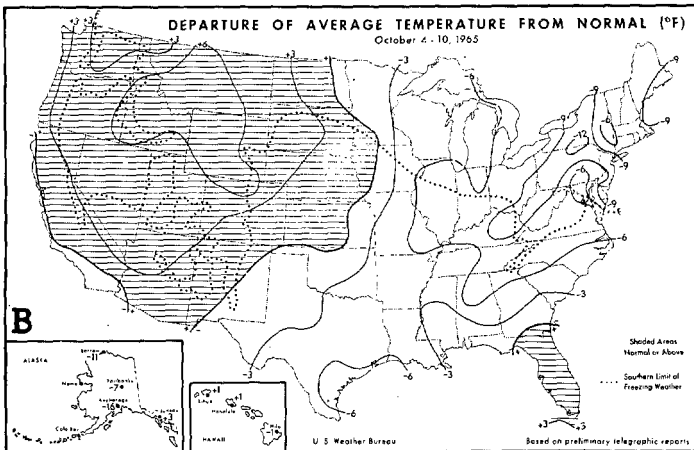
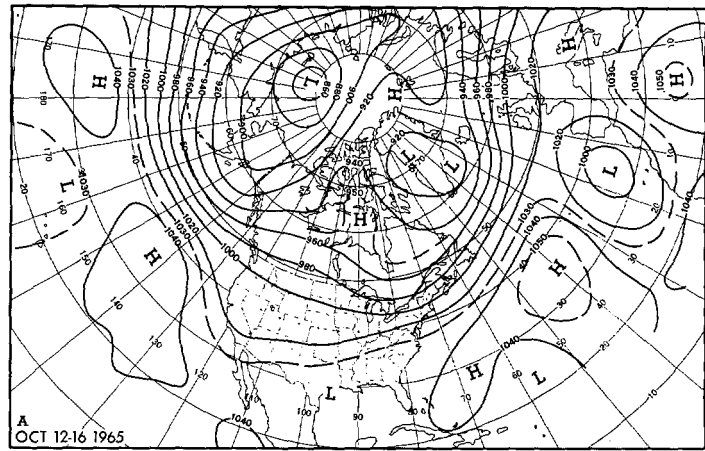
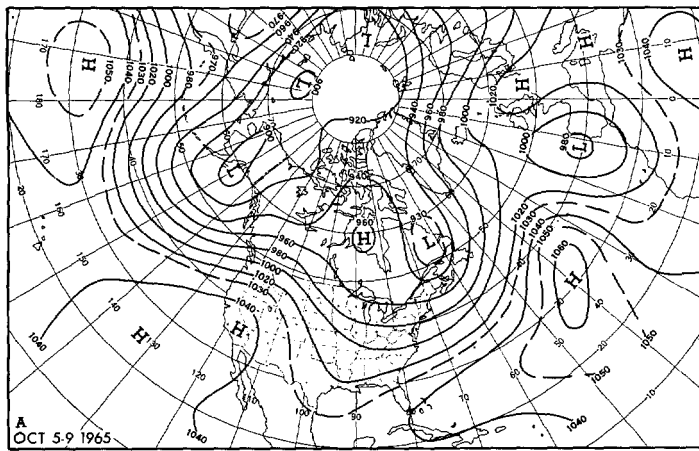


FIGURE 6.—Week of October 4-10, 1965: (A) 700-mb. contours (tens of feet), October 5-9; (B) surface temperature departure from normal (°F.); (C) total precipitation (in.); (B) and (C) from [3].

FIGURE 7.—Week of October 11-17, 1965: (A) 700-mb. contours (tens of feet), October 12-16; (B) and (C) same as figure 6.

Ohio and Pittsburgh, Pa. on October 29, and at Lynchburg and Norfolk, Va. on October 30.

The western warmth was also most extreme early and late in the month. Highest temperatures for so late in the season were reported during the October 7-9 period from scattered stations in northern California, Oregon, Nevada, and Arizona, and again after the 20th from locations in Oregon and California.

Much of the precipitation during the month was associated with two low-latitude upper Lows. The first formed in Texas early in the month and subsequently moved northeastward bringing rains to the South and the East (fig. 6C). The second low-latitude Low developed in Arizona during the out-of-phase regime of mid-month and slowly moved northeastward and eastward contributing to the precipitation depicted on figures 7C and 8C. Thus, the relatively heavy monthly total precipitation observed in Colorado and Kansas was associated with the mid-month circulation regime which was out of phase with the dominant regime of the month.

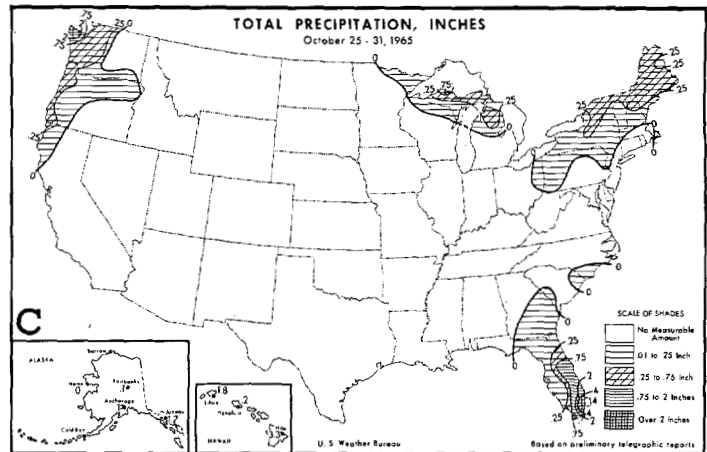
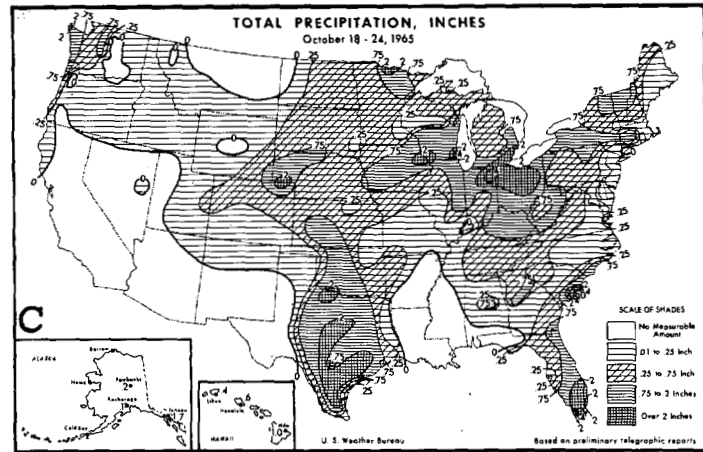
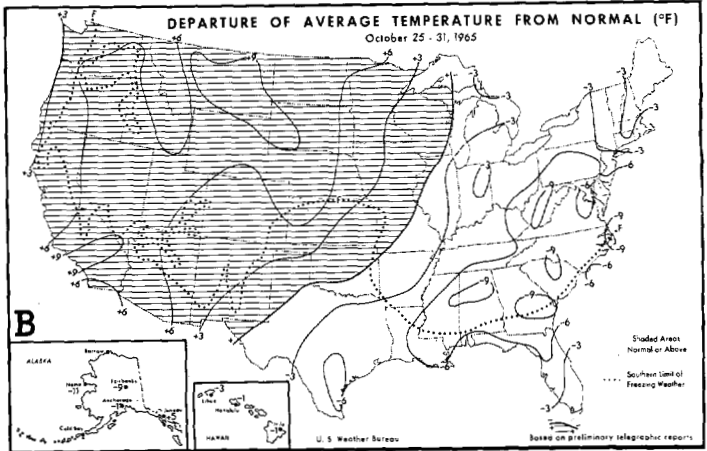
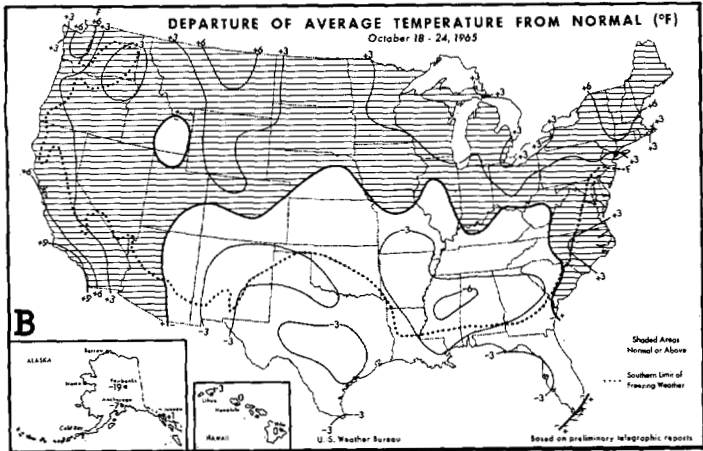
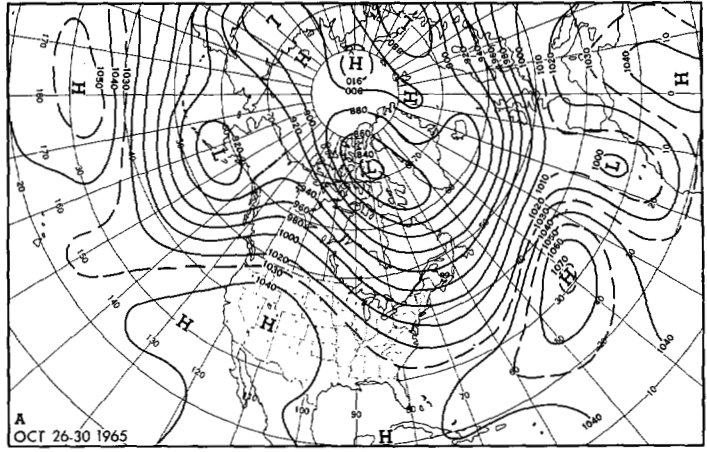
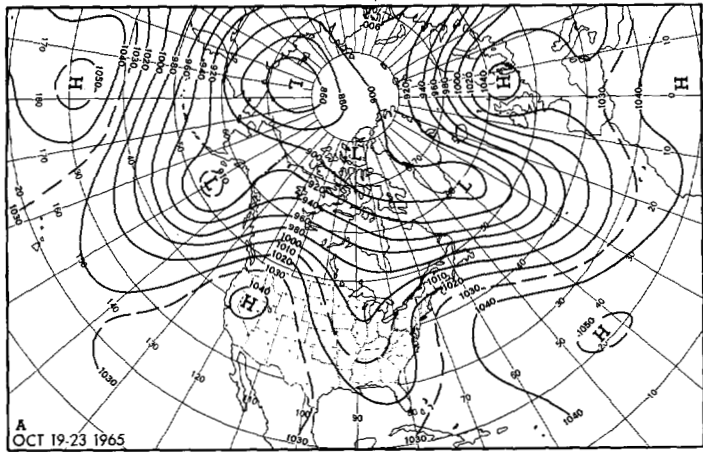


FIGURE 8.—Week of October 18–24, 1965: (A) 700-mb. contours (tens of feet), October 19–23; (B) and (C) same as figure 6.

FIGURE 9.—Week of October 25–31, 1965: (A) 700-mb. contours (tens of feet), October 26–30; (B) and (C) same as figure 6.

Three typhoons, Bess, Della, and Carmen, traversed the western Pacific on September 27–October 4, October 1–10, and October 13–19, respectively. Each storm was first located southwest of the strong western Pacific ridge, which persisted throughout the month, and recurved east of Japan. In the Atlantic, hurricane Elena was first located south of the strong High shown on figure 7A and subsequently recurved near 30° N., 60° W. A cyclone also was reported in the Bay of Bengal from October 6 to 8.

REFERENCES

1. L. P. Stark, "The Weather and Circulation of September 1965—Prolonged Cooling in the West Related to Retrogression," *Monthly Weather Review*, vol. 93, No. 12, Dec. 1965, pp. 800–804.
2. J. Namias, "Recent Seasonal Interactions Between North Pacific Waters and the Overlying Atmospheric Circulation," *Journal of Geophysical Research*, vol. 64, No. 6, June 1959, pp. 631–646.
3. U.S. Weather Bureau, *Weekly Weather and Crop Bulletin, National Summary*, vol. 52, Nos. 41–45, Oct. 11, 18, 25, Nov. 1, 8, 1965.