

# THE WEATHER AND CIRCULATION OF DECEMBER 1966

## Blocking Over North America

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### 1. INTRODUCTION

December was a month of marked circulation variability over North America. As the circulation over the Pacific area changed from low to high index, the opposite trend prevailed over North America bringing a strongly blocked circulation during the latter part of the month.

### 2. MEAN CIRCULATION

As was the case in November [1], the mean upper-level circulation during December (figs. 1, 2) displayed amplified waves over much of the Northern Hemisphere. An exception, however, was the Pacific region where the intense blocking ridge of November gave way to increasing

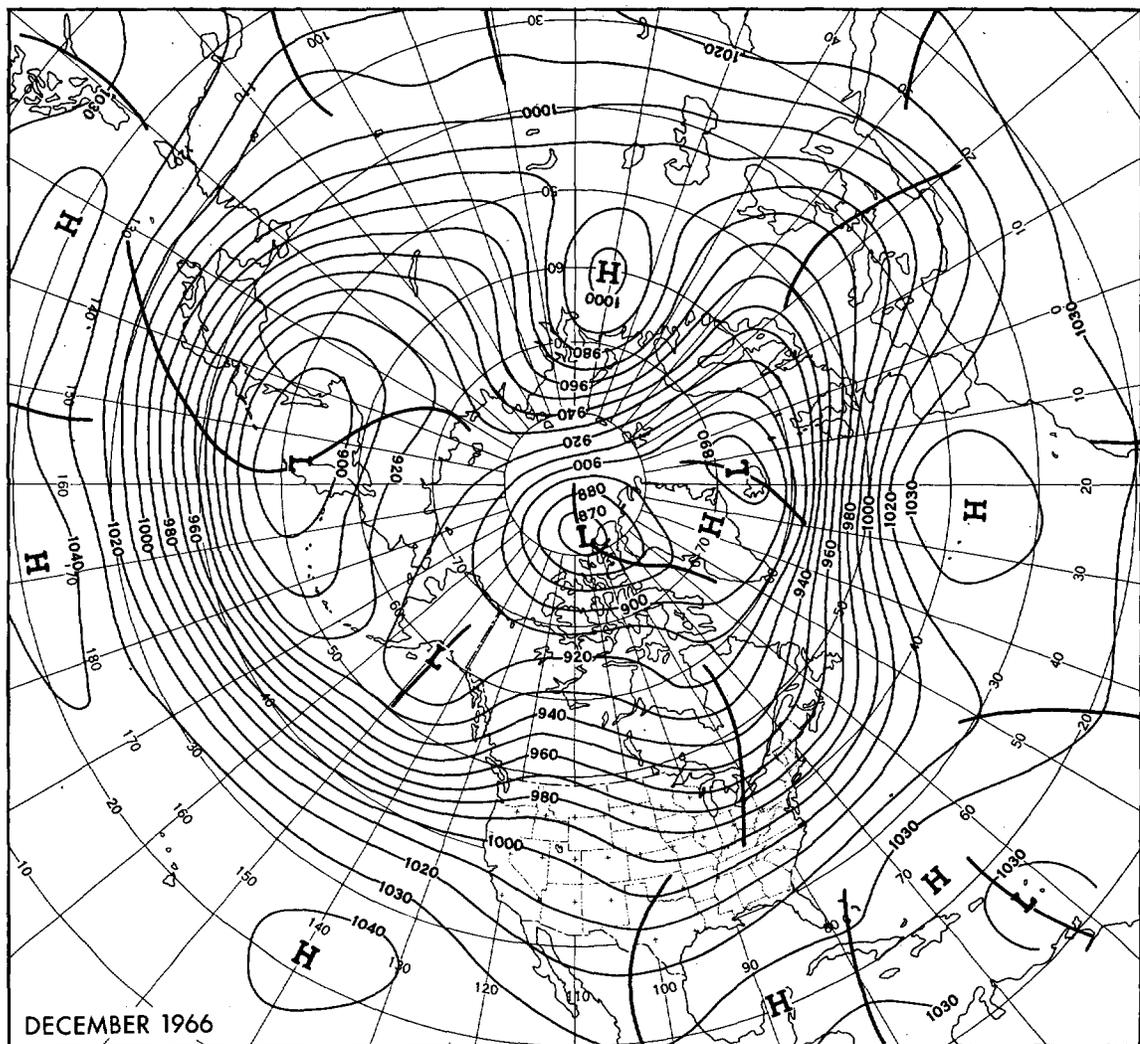


FIGURE 1.—Mean 700-mb. contours (tens of feet), December 1966.

midlatitude westerlies. With remnants of the blocking ridge stretching from the Bering Straits northwestward to a highly amplified ridge near the Ural Mountains, extremely cold air was transported to the Asiatic coast, stimulating vigorous cyclonic systems which moved across the Pacific.

While temperate latitude westerlies were increasing in the Pacific the opposite trend was taking place over North America where upper-level heights rose above normal over most of Canada and dropped below normal across the United States. This was essentially a reversal of the previous month's anomaly pattern over North America.

Over the Atlantic, a strongly confluent flow developed between the very cold northwesterly flow from Canada and the warm southwesterlies of the western Atlantic. This was associated with an intense upper wind maximum near Great Britain and decreasing heights over northern latitudes of the Atlantic.

### 3. TEMPERATURE

The confluence zone which had contained the cold air in Canada during November [1] broke down during December as a strong ridge in western Canada coupled with a blocking ridge over Hudson Bay deflected cold air masses into the United States. Comparison of the observed temperature for December (fig. 3) with its counterpart for November [1] reveals that the cooling trend encompassed virtually the entire Nation except for the extreme Northeast and Northwest. Reference to figure 2 indicates that the warmth of both of these regions was

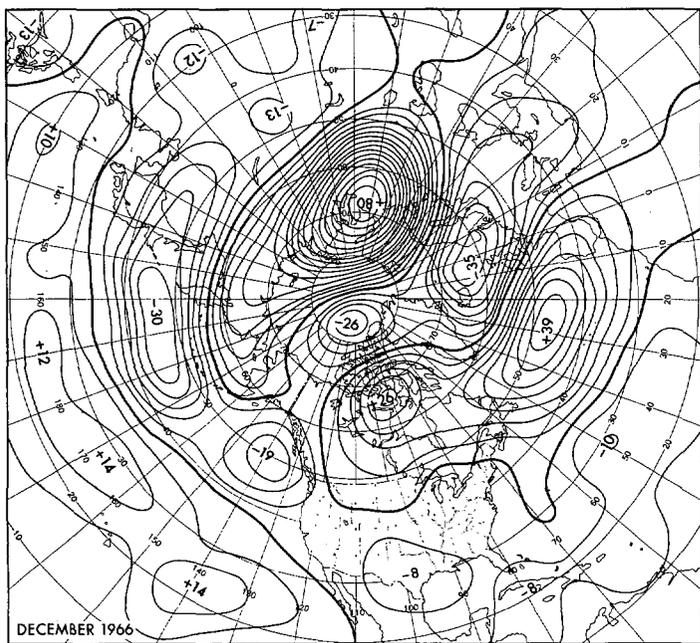


FIGURE 2.—Departure of mean 700-mb. heights from normal (tens of feet), December 1966.

associated with greater-than-normal flow components from the relatively warm oceans.

### 4. PRECIPITATION

Above normal precipitation occurred over much of the area west of the Rockies this month (fig. 4) in response to the deep upper trough over the eastern Pacific (figs. 1 and 2). At Ely, Nev., record precipitation for the month (2.11 in.) was observed.

Easterly anomalous flow coupled with below normal heights over the eastern third of the Nation is indicative of the displaced storm track with widespread precipitation which accompanied this blocking situation. This continued a wet spell of four or more months at such locations as Rochester, N.Y., and Concord, N.H., and brought record-breaking December snowfall to a number of locations including Roanoke, Va. (17.9 in.), Lynchburg, Va. (22.6 in.), Reading, Pa. (27.1 in.), Allentown, Pa. (28.4 in.), and Burlington, Vt. (36.2 in.).

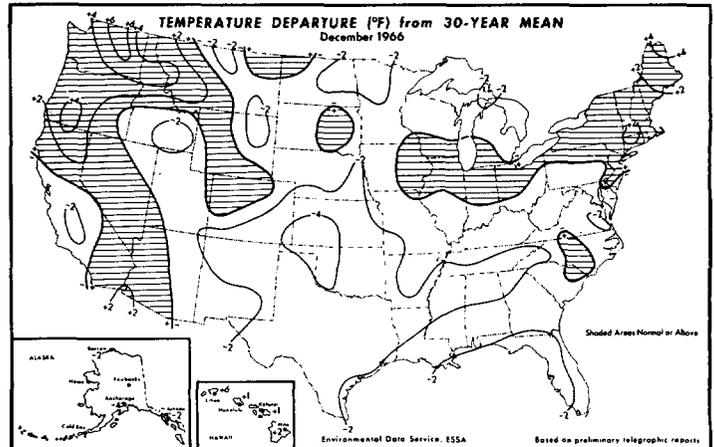


FIGURE 3.—Surface temperature departure from normal ( $^{\circ}$  F.) December 1966 (from [2]).

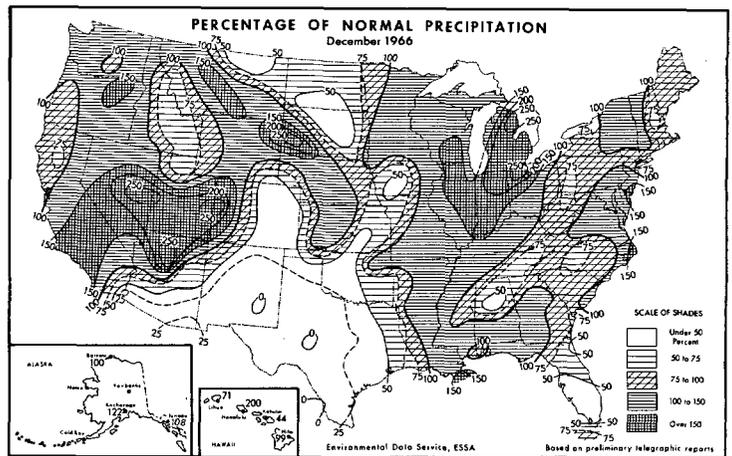


FIGURE 4.—Percentage of normal precipitation, December 1966 (from [2]).

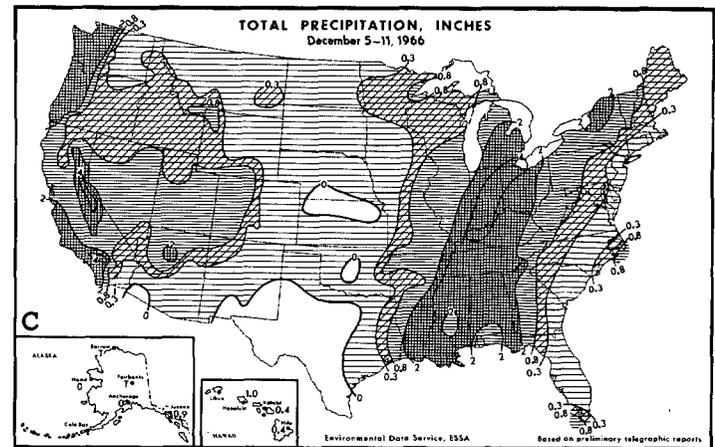
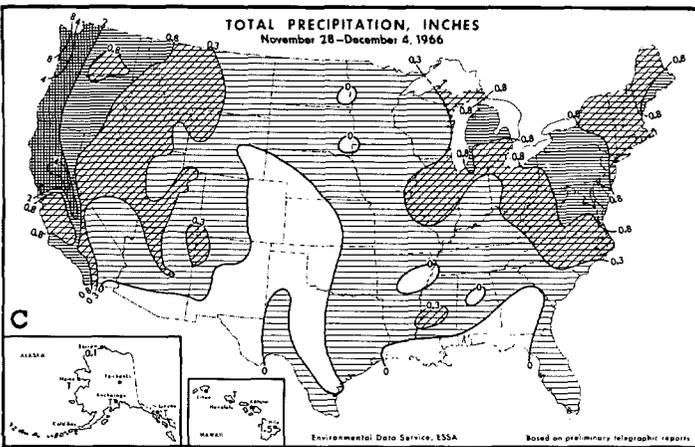
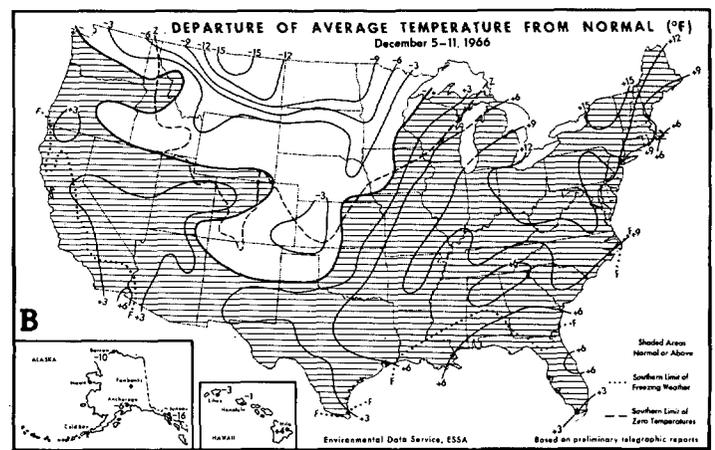
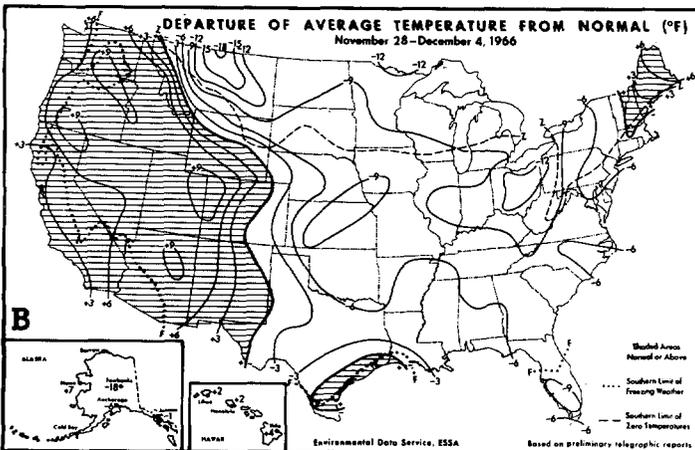
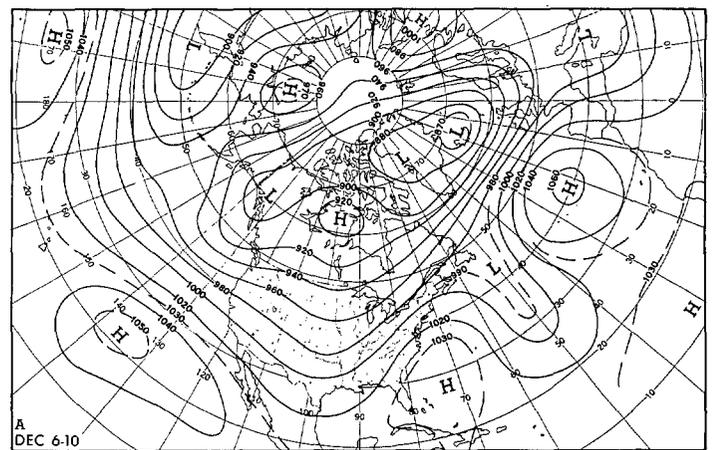
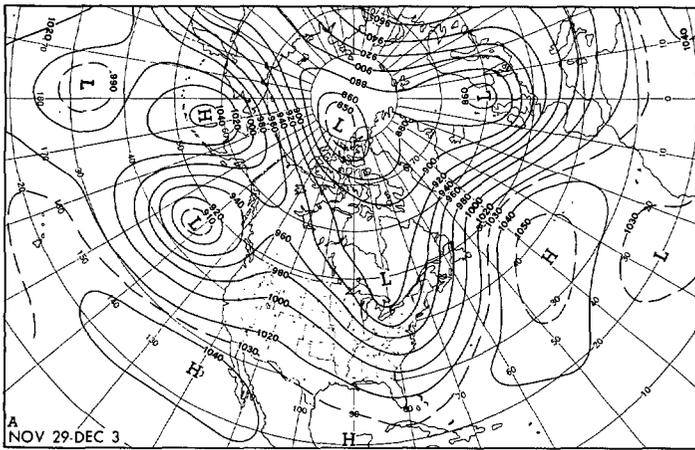


FIGURE 5.—Week of November 28–December 4, 1966: (A) 700-mb. contours (tens of feet), November 29–December 3; (B) Surface temperature departures from normal ( $^{\circ}$  F.); (C) Total precipitation (in.). (B) and (C) from [2].

FIGURE 6.—Week of December 5–11, 1966; (A) 700-mb. contours (tens of feet), December 6–10; (B) and (C) same as figure 5.

Under the influence of a relatively deep mean trough to the east and northerly anomalous flow, the Southern Plains remained quite dry this month. This was the third consecutive dry month in the Southern Plains and the Southern Plateau. Here the 3-month precipitation deficit by January 1, 1967 exceeded 2 in. over a large

area and ranged to 6.9 in. at Waco, Tex. Farther north, where the anomalous flow became easterly and southerly, substantial precipitation occurred (fig. 4).

Despite the marked change in mean upper-level circulation east of the Rockies from November to December, the precipitation pattern during the two months was

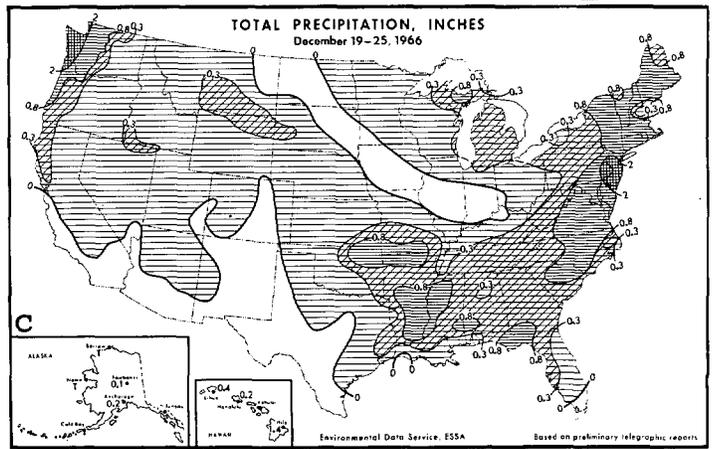
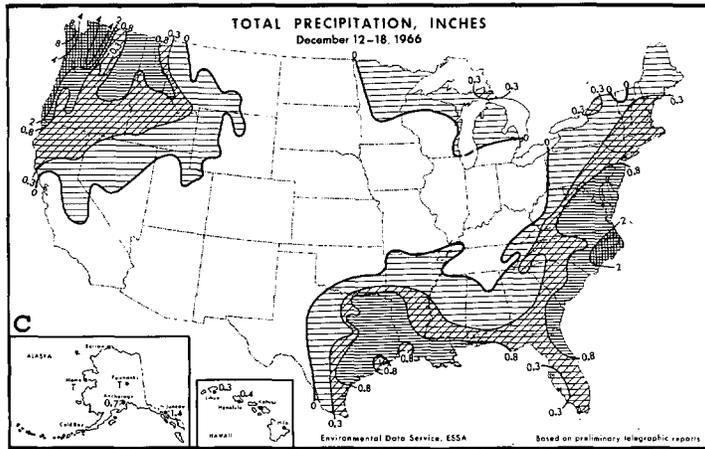
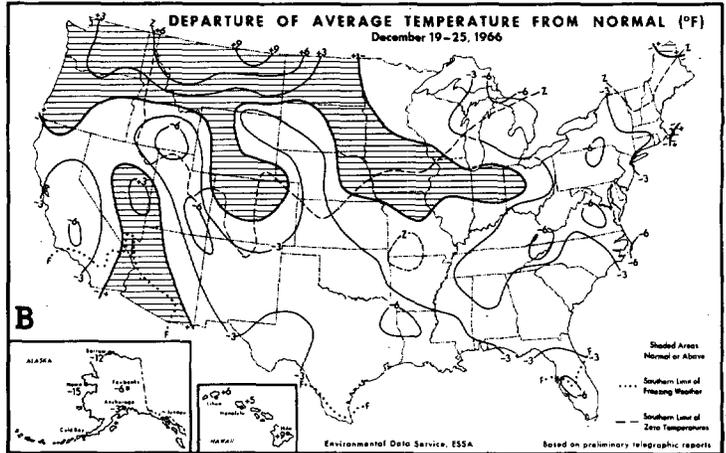
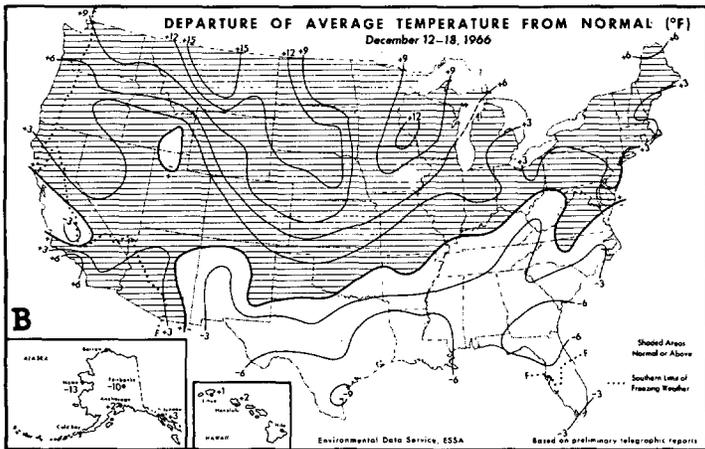
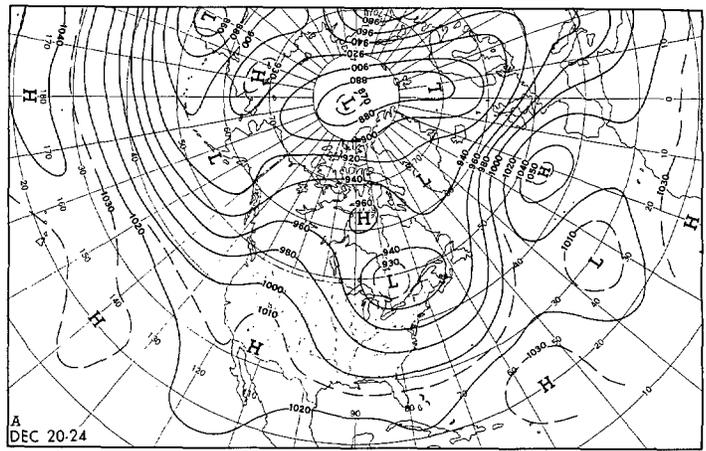
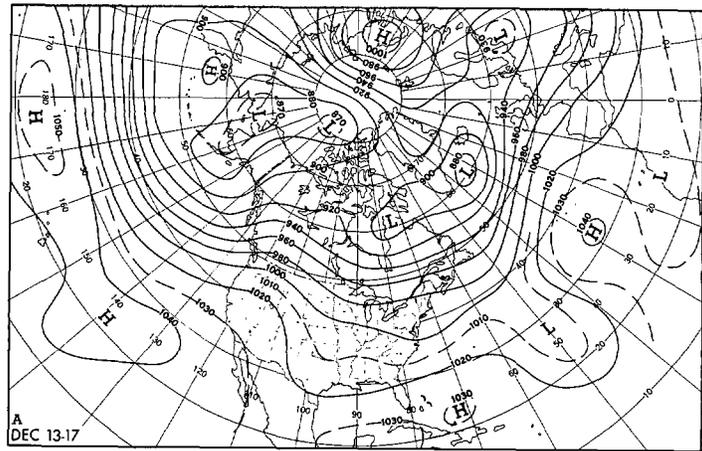


FIGURE 7.—Week of December 12–18, 1966; (A) 700-mb. contours (tens of feet), December 13–17; (B) and (C) same as figure 5.

FIGURE 8.—Week of December 19–25, 1966; (A) 700-mb. contours (tens of feet), December 20–24; (B) and (C) same as figure 5.

quite similar. As noted by Wagner [1], November precipitation in the Great Lakes region resulted from transitory systems not appreciably affecting the mean flow pattern.

5. VARIABILITY WITHIN THE MONTH

Weekly distributions of temperature and precipitation accompanied by appropriate 5-day mean 700-mb. maps

are shown in figures 5 through 9. This series of maps provides an excellent example of the breakdown of an extreme blocking regime and represents a month of transition with little persistence of any circulation state until the latter part of the month. The blocking High over the Bering Sea early in this month (fig. 5) migrated northward, joining with a pre-existing Eurasian block by mid-month (fig. 7). In its wake, increasing westerlies

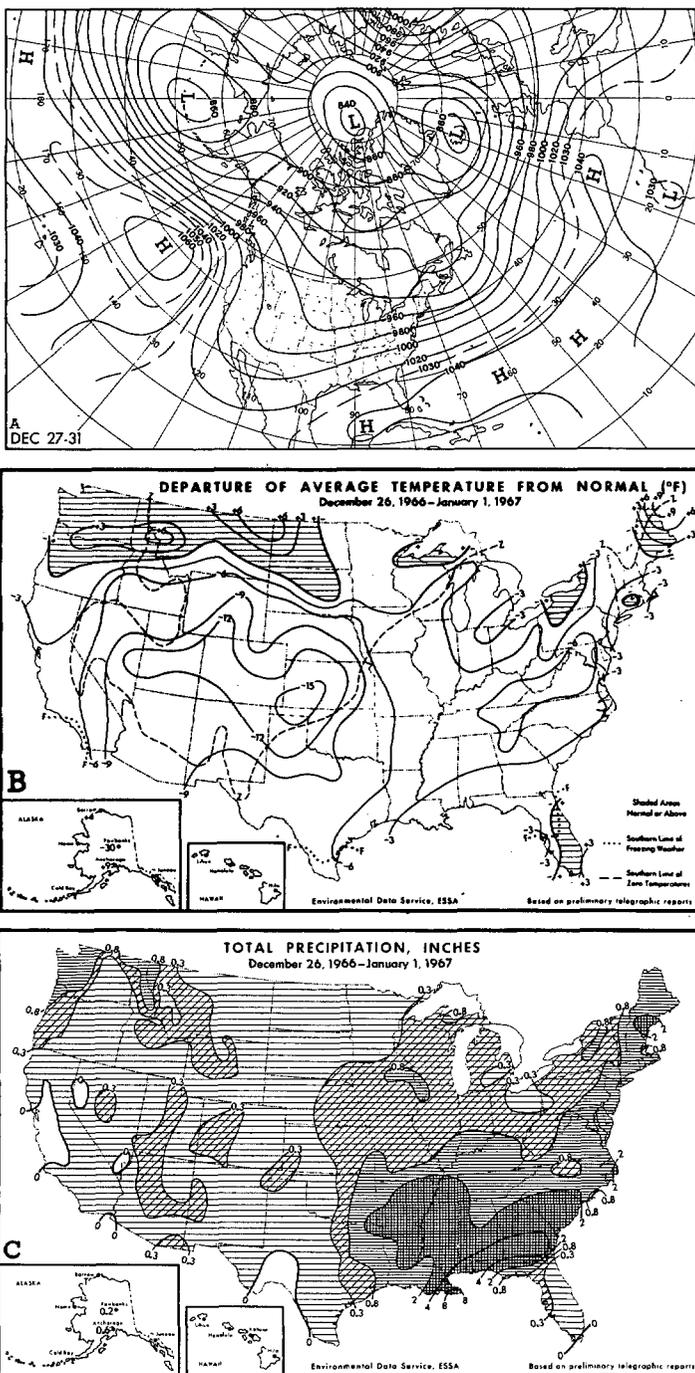


FIGURE 9.—Week of December 26, 1966–January 1, 1967; (A) 700-mb. contours (tens of feet), December 27–31; (B) and (C) same as figure 5.

and strongly deepening cyclones returned to the Pacific.

This change in circulation over the Pacific was associated with marked changes over the United States. As the Pacific westerlies increased, a portion of the eastern Pacific trough was thrust inland (fig. 6). This brought relatively heavy precipitation to the West and to much of the East in advance of the mean trough. During this week, flooding was reported from parts of the Interior Valley of southern California and in Ohio, Indiana, Illinois, and Tennessee. After an initial influx of cold air east of the Rockies (fig. 5), movement of the upper-level trough to mid-Nation brought strong southerly wind components and above normal temperatures to much of that area. On December 9 and 10 record December temperatures were observed at widespread locations including Syracuse, N.Y. ( $70^{\circ}$  F.), Boston, Mass. ( $70^{\circ}$  F.), Wilmington, Del. ( $72^{\circ}$  F.), and Trenton, N.J. ( $72^{\circ}$  F.).

By the time mid-Pacific deepening reached its peak (fig. 7), the upper westerlies over North America had retreated northward flooding most of the United States with warm maritime air. Only in the South did cold air prevail, associated with a trough which had been by-passed by the main westerly current. Precipitation during this period was mainly confined to the far Northwest where strong southerly flow components still existed and to the South and East in connection with the by-passed trough.

During the final two weeks of the month (figs. 8, 9) blocking prevailed over North America and was associated with a storm track, south of normal, widespread cold air, and extensive precipitation over the United States. One Low moving through the Gulf States and thence north-eastward along the east coast brought record or near record 24-hr. December snowfall totals to the Middle and North Atlantic coastal regions on December 24–25.

#### REFERENCES

1. A. J. Wagner, "The Weather and Circulation of November 1966—A Mild Month with Two Intense Midwestern Storms and a Record Early Cold Spell," *Monthly Weather Review*, vol. 95, No. 2, Feb. 1967, pp. 89–97.
2. Environmental Data Service, ESSA, *Weekly Weather and Crop Bulletin*, vol. 53, Nos. 49–52, Dec. 5, 12, 19, 26, 1966; and vol. 54, Nos. 1, 2, Jan. 2, 9, 1967.