

THE WEATHER AND CIRCULATION OF FEBRUARY 1966

Strong Blocking Over the Atlantic

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1. MEAN CIRCULATION

Unusually strong blocking dominated the mean circulation of the Arctic, the Atlantic, and northern Eurasia this month (figs. 1, 2). The most outstanding feature of the blocking regime was a deep mean Low in the Atlantic, where the height anomaly at 700 mb. reached -720 ft., the largest negative departure of record for February. Eastward from the Low a zonally-oriented trough, and associated band of negative height anomalies, extended across northern Eurasia, Kamchatka, and the Beaufort Sea to northern Canada. This trough nearly encircled the Arctic, where the circulation was anticyclonic with one blocking High over eastern Greenland and another High near the New Siberian Islands.

The shift of blocking Highs toward the Eurasian sector of the hemisphere from January positions over Alaska and Davis Strait resulted in a northward shift of the westerlies from subtropical to temperate latitudes over much of the western sector of the hemisphere. This marked the last phase of the January index cycle [1], shown by the graph of 5-day zonal indices (0° westward to 180°) in figure 3. The temperate index (35° - 55° N.) rose sharply to well above normal levels the first week of February while the subtropical index (20° - 35° N.) dropped to about normal. Index fluctuations of smaller amplitude continued through February, accompanied by pronounced oscillations of the 5-day circulation from week to week.

At middle latitudes the Atlantic trough was more than a thousand miles east of the normal location near the North American coast. The European ridge and the Mediterranean trough were also observed east of their usual positions. Over Asia fast westerly flow with little wave amplitude prevailed.

The axis of maximum 700-mb. winds was usually far south from the western Atlantic eastward across Eurasia (fig. 4), and wind speeds averaged as much as 16 m.p.s. faster than normal in the Atlantic. Storms traveled south of customary paths into the deep Atlantic Low where sea level pressure for the month was 26 mb. below normal.

The western Pacific trough was very strong near Kam-

chatka where numerous storms deepened in a favorable thermal field and moved rapidly into the Bering Sea. Wind speed departures south of the Kamchatka Low were as large as in the Atlantic (+16 m.p.s.), but here the mean jet was well north of normal. A strong ridge separated the western Pacific trough from an additional trough which extended from Hawaii to the Gulf of Alaska. Wavelength adjustment to the extra Pacific trough is suggested by the location of the trough in Texas (fig. 1), several hundred miles eastward from the usual position near Baja California.

Although the Rocky Mountain ridge was about normally located it was weaker than usual in northwestern Canada. The trough over Hudson Bay was apparently cut off from troughs farther south by the extension of blocking over southeastern Canada from Greenland.

2. AVERAGE WEATHER

Temperature anomalies in the United States reflected the January to February retreat of blocking from North America. Warming by one or more temperature classes (of five) occurred at 40 of 100 representative stations, while 41 remained unchanged and 19 were cooler. Almost without exception the stations where cooling took place were near or west of the Rocky Mountains, while all but one of the stations where warming occurred were east of the Divide.

In general, the pattern of average temperature anomalies for February (fig. 5) conformed rather closely to the corresponding height anomaly pattern of figure 2. Compared with normal both temperatures and heights were lowest in New Mexico and western Texas, and highest over Washington and the Upper Great Lakes. Unusual snow cover caused temperatures to be lower than specified from circulation alone in South Dakota, western Nebraska, and parts of the southern Rockies and southern Appalachians. In the Ohio Valley temperatures were also below normal, contrary to indications of warmer conditions by the distribution of height anomalies. Apparently the dense, cold surface air mass extending into that area from Canada was too shallow to show up at the 700-mb level. Departures from normal of monthly mean thickness (1000-700 mb.) there were more than 100 ft. below normal.

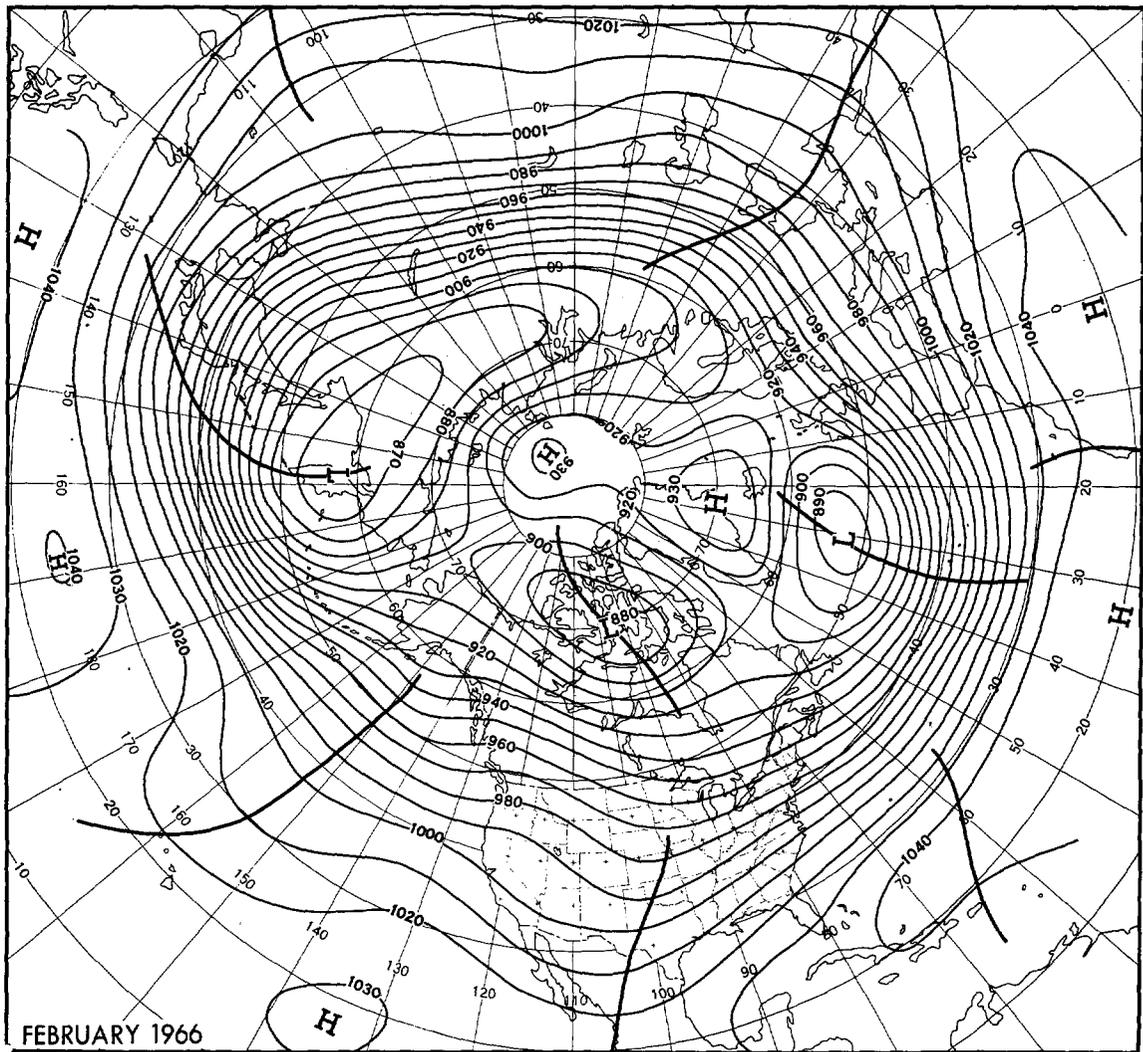


FIGURE 1.—Mean 700-mb. contours (tens of feet), February 1966.

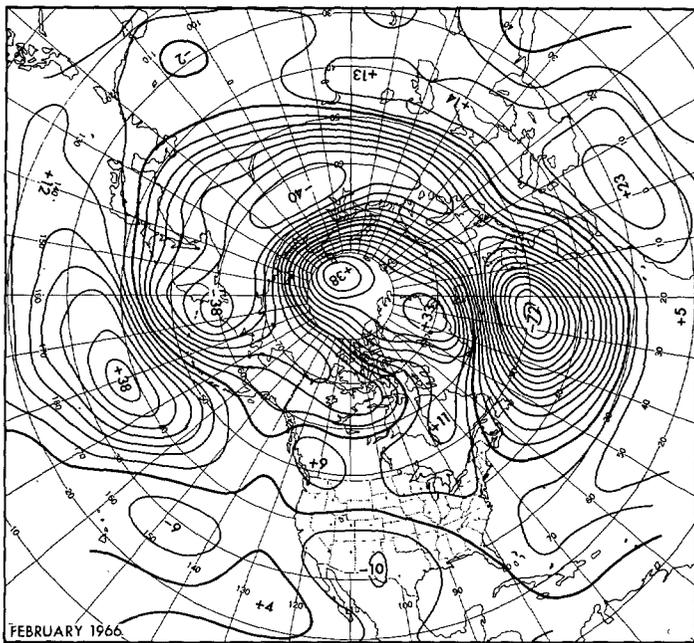


FIGURE 2.—Departure of mean 700-mb. heights from normal (tens of feet), February 1966. Negative anomaly in the Atlantic was the strongest of record for February.

Precipitation amounts were generally normal or greater over the eastern half of the country and the southern Rockies but less than normal elsewhere. Heaviest precipitation occurred over the Southeast where cold polar air masses were overrun by mean southwesterly flow from the Gulf of Mexico (fig. 1), and the anomalous flow (fig. 2) was southerly. Totals for the month (fig. 6) were more than 8 in. from southeastern Louisiana, where Baton Rouge reported its wettest February, to western Georgia. Much of the Northeast drought area received more than 4 in. and surface water shortages were no longer considered critical at the end of the month. Over the western half of the country orographic effects showed clearly in the precipitation pattern. North-south zones with more than an inch along the Pacific coast and over the Rockies alternated with areas of less than an inch east of the Sierra and Cascade Ranges, and east of the Divide.

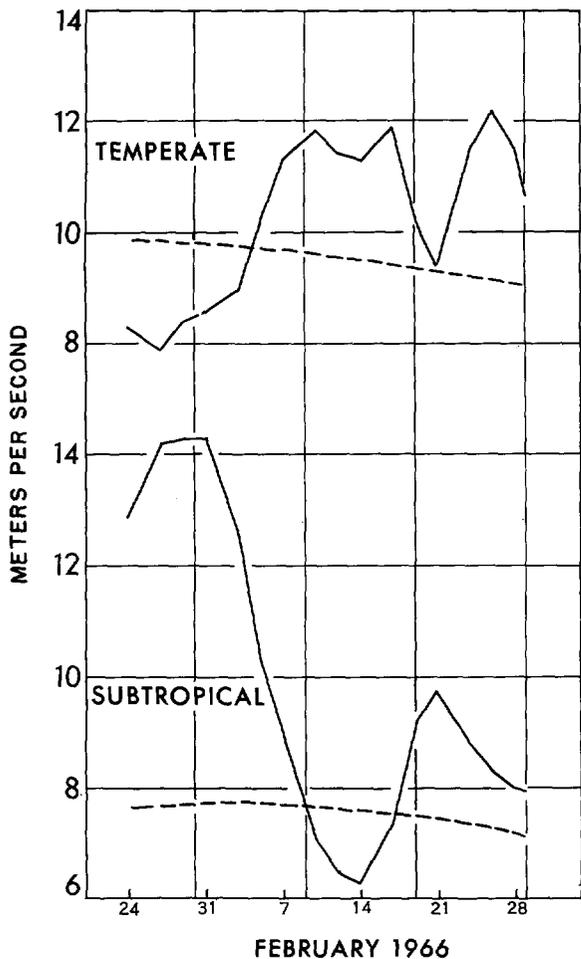


FIGURE 3.—Variation of 5-day average wind speed (zonal index, meters per second) at 700 mb. for the western half of the Northern Hemisphere, 35°–55° N. and 20°–35° N. from late January through February. Solid lines connect values at the middle of 5-day periods, dashed lines the normal. The pronounced index cycle which began in January ended in February.

3. VARIATIONS WITHIN THE MONTH

Temperatures varied considerably from week to week over the United States. For example, the weekly temperature average increased 28° F. at Evansville, Ind., and declined 17° F. at Ely, Nev., from the first week of February to the second. At International Falls, Minn., the weekly average fell from +16° F. the second week to -19° F. the third, then rose to +10° F. the last week of the month. These temperature changes were associated with large variations in the circulation.

During the first week the principal blocking High was centered near the Pole (fig. 7A, B) and the westerlies were shifting rapidly northward in the Pacific. A deep trough extended northeastward from Hawaii, and there was a strong ridge over the Rocky Mountains. Average flow east of the ridge was mostly northwesterly across the United States. Remnants of an earlier blocking High over Labrador continued to inhibit eastward progress of the western Atlantic trough.

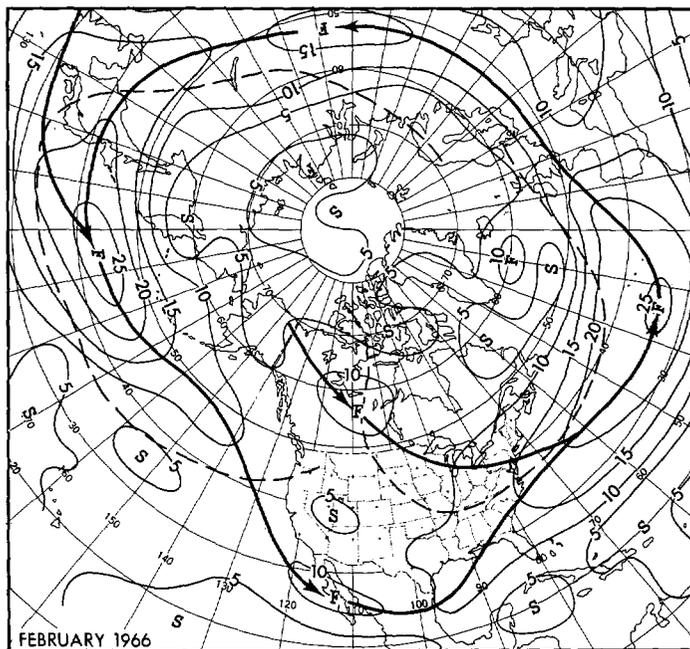


FIGURE 4.—Mean 700-mb. isotachs (meters per second), February 1966. Solid arrows indicate principal axes of maximum west wind speed and dashed lines the normal. Maxima were up to 16 m.p.s. faster than normal in both oceans.

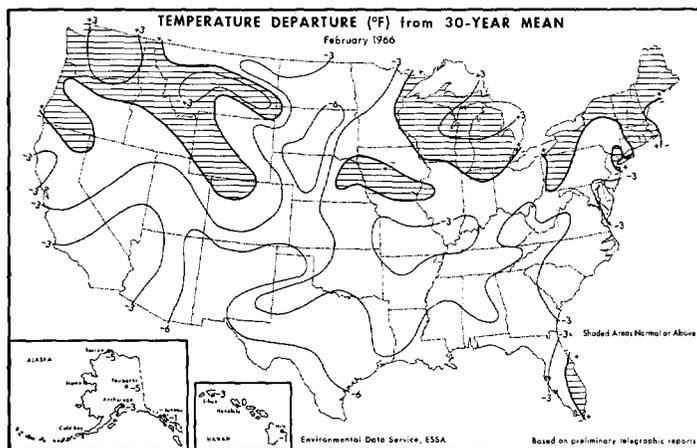


FIGURE 5.—Surface temperature departure from normal (°F.) February 1966 (from [2]).

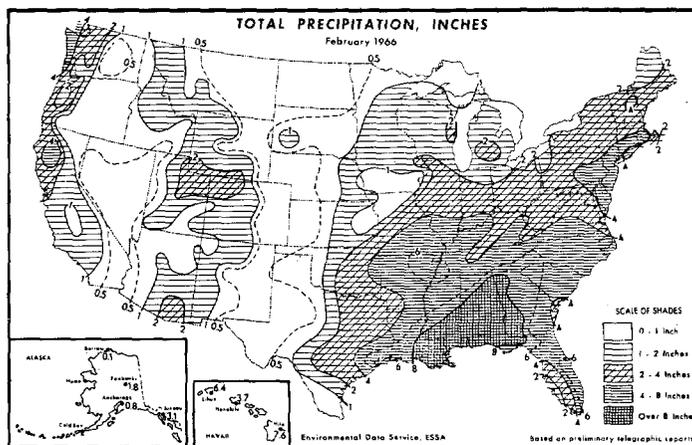


FIGURE 6.—Total precipitation (in.) February 1966 (from [2]).

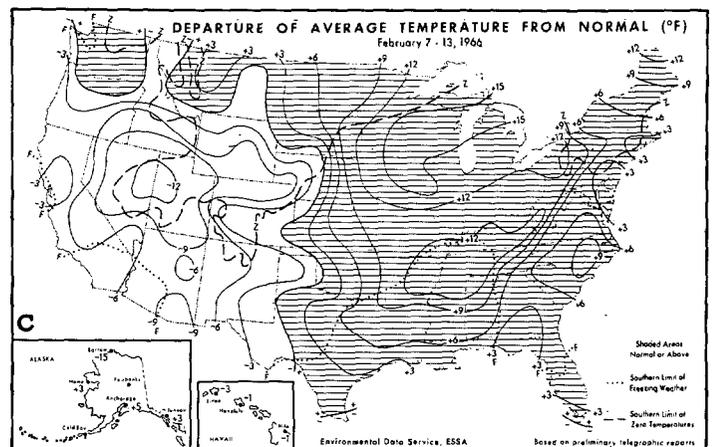
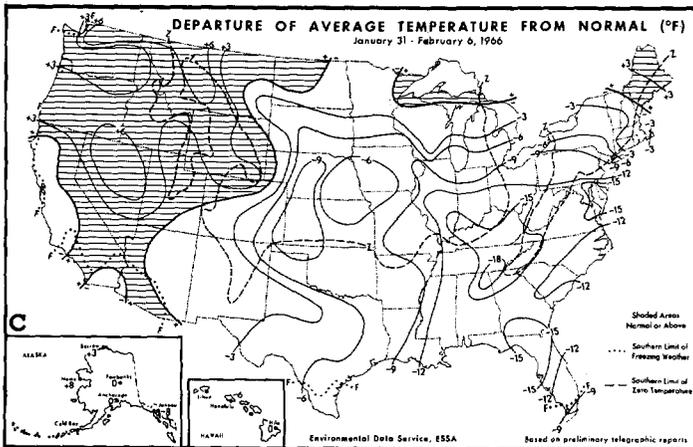
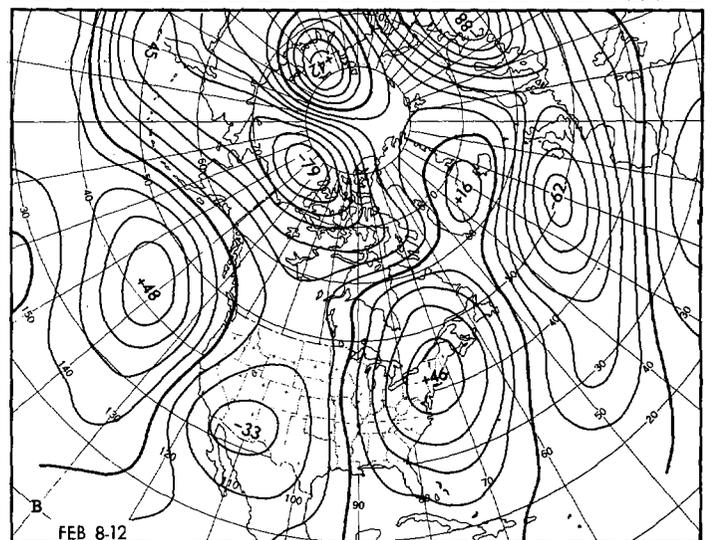
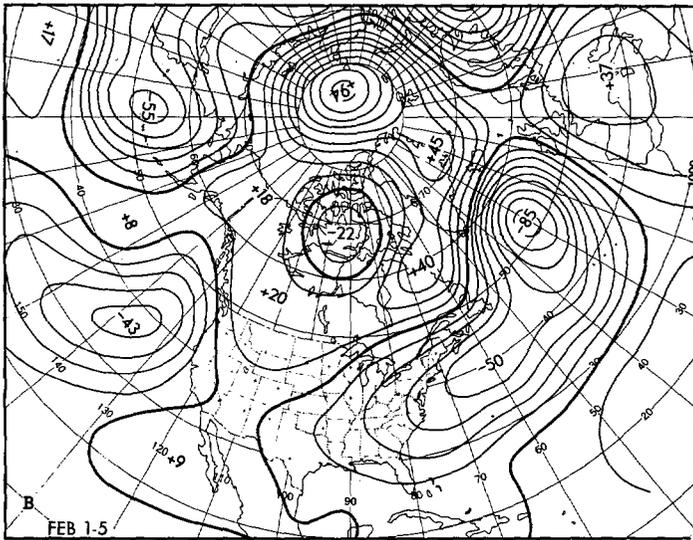
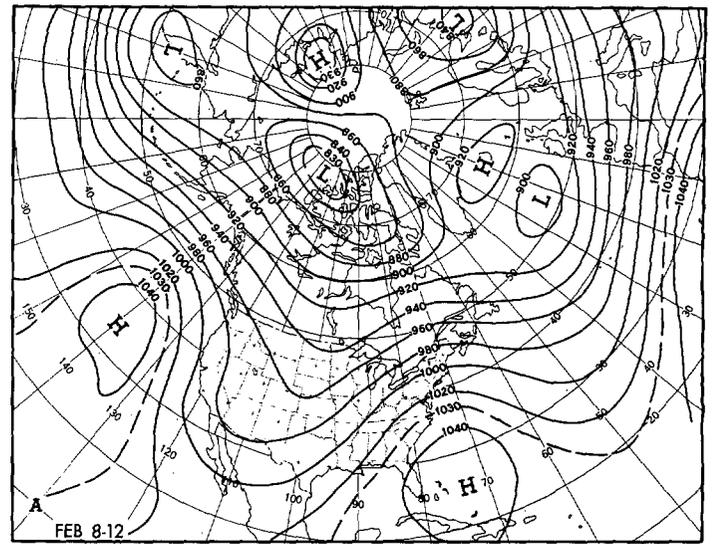
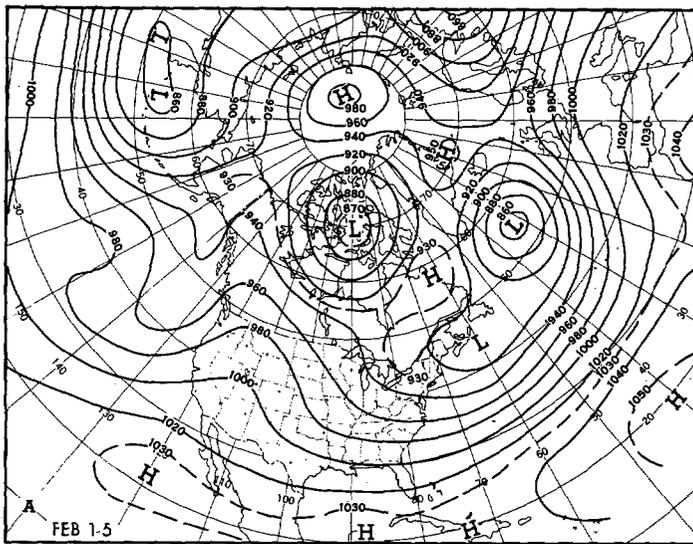


FIGURE 7.—(A) 700-mb. contours and (B) 700-mb. height departure from normal (both in tens of feet), February 1-5, 1966; (C) Surface temperature departure from normal (°F.), January 31-February 6, 1966. (C) from [2].

FIGURE 8.—(A) 700-mb. contours and (B) 700-mb. height departure from normal (both in tens of feet), February 8-12, 1966; (C) Surface temperature departure from normal (°F.), February 7-13, 1966. (C) from [2].

Average temperatures were unseasonably high over the Northwest but generally lower than normal elsewhere (fig. 7C). Negative departures in the Southeast, augmented by unusual snow cover, ranged from 12° to 15° F. for the week.

Precipitation was heaviest along the Pacific Coast east of the approaching mean trough. Elsewhere in the country substantial amounts were mostly limited to a strip along the path of a storm which emerged from the southern Rockies early in the week. The storm moved almost directly eastward, leaving up to a foot of new snow from eastern Missouri to southern Ohio.

Striking amplification of the circulation took place from the first week to the next (fig. 8A, B). The eastern Pacific trough moved inland as far as the Central Plains and joined northward to a Low near Victoria Island. Ridges built strongly behind and ahead of this trough so that 5-day mean heights a week apart increased as much as 800 ft. off the western and eastern coasts of the United States. Little evidence of blocking remained over the Pacific and North America, though blocking was still active in the eastern Atlantic.

Surface temperature response to the altered circulation was impressive. In southeastern Tennessee the weekly departure rose from -18° F. to +12° F.; in eastern Nevada an opposite change of -18° F. was observed. For the first time in more than a month temperatures were above freezing in the Northern Plains and Great Lakes Region. In the East and South the long cold spell was broken as warm southerly flow quickly melted abnormal snow cover. The snow line retreated northward from Kentucky to Canada and from northern Georgia to central Pennsylvania.

Heavy precipitation fell in the southern Rockies and over the eastern half of the country in association with the mean trough. Much of the South received weekly totals of 4 to 8 in. and parts of the drought area in the Northeast had more than 2 in. The upper flow and surface temperature pattern were favorable to the development of severe storms. Thunderstorms, hail, and tornadoes were reported in Oklahoma and Mississippi, in association with a Colorado-type storm moving from the Panhandle Region through the Central and Northern Plains. Tornadoes were also reported in Georgia, North Carolina, and Virginia ahead of a later storm which moved northward west of the Appalachians during the weekend. Considerable flooding occurred in the Midwest, parts of the Central Plains, and the Southeast from rainfall, snowmelt, ice jams, or a combination of these. It was the wettest week in 15 months in southeastern Oklahoma and the wettest in more than 2 years in Pennsylvania.

From the second week to the third the blocking High near Iceland grew stronger and spread northwestward across Greenland (fig. 9A, B). At the same time the mean Low near Victoria Island moved to Hudson Bay and a strong zonal trough connection was made toward the Atlantic Low. The western Atlantic ridge flattened and

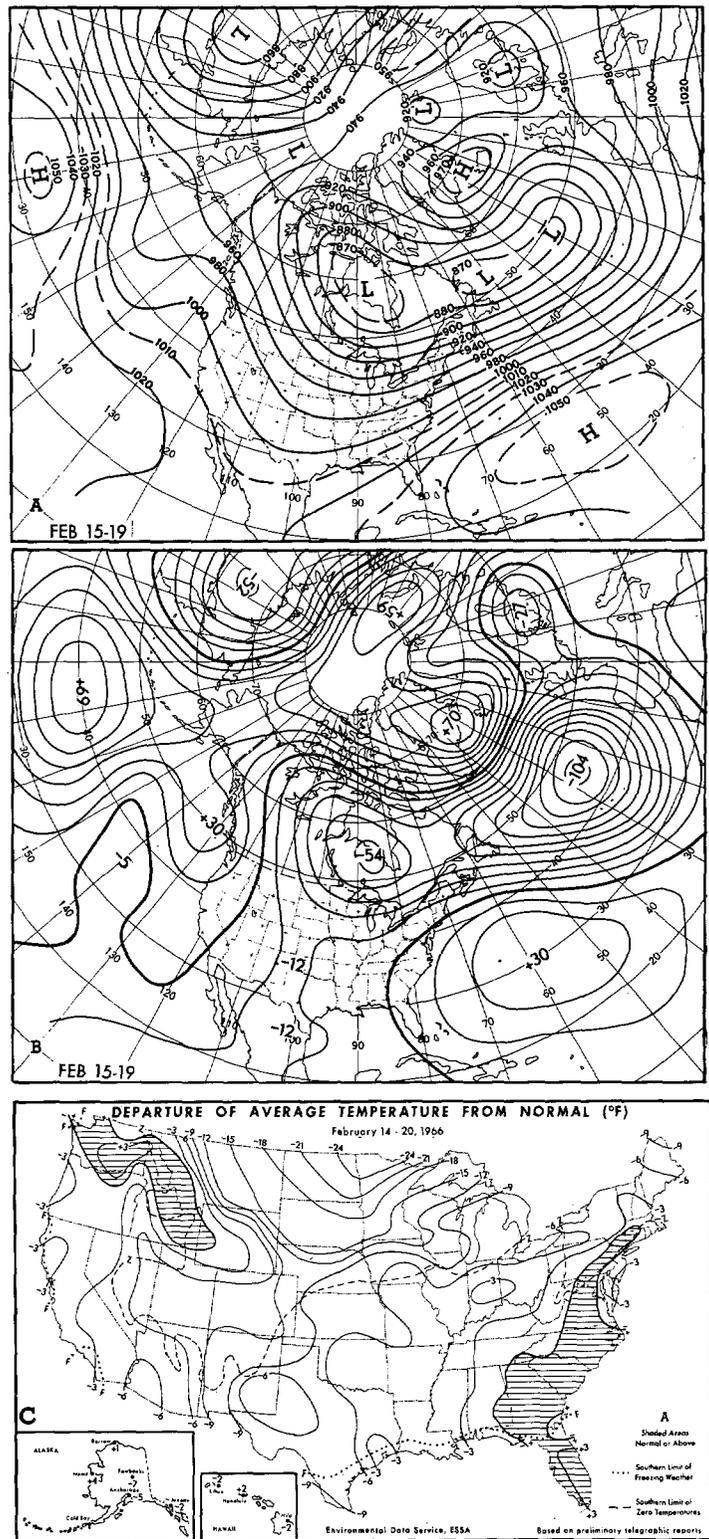


FIGURE 9.—(A) 700-mb. contours and (B) 700-mb. height departure from normal (both in tens of feet), February 15-19, 1966; (C) Surface temperature departure from normal (°F.); February 14-20, 1966. (C) from [2].

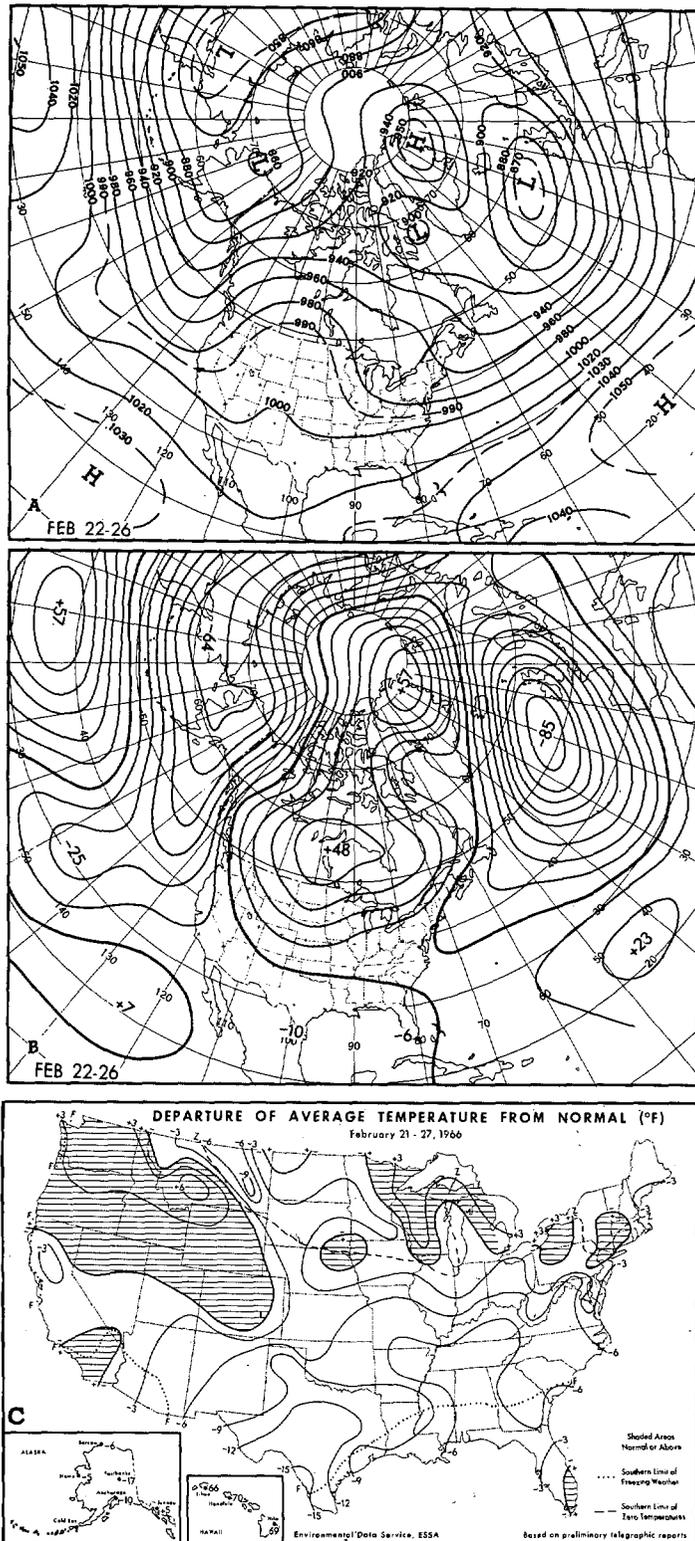


FIGURE 10.—(A) 700-mb. contours and (B) 700-mb. height departure from normal (both in tens of feet), February 22–26, 1966; (C) Surface temperature departure from normal (°F.), February 21–27, 1966. (C) from [2].

moved eastward while the trough over North America progressed to the Great Lakes and became more sharply tilted. The eastern Pacific ridge diminished at subtropical latitudes but remained strong farther north so that cold northwesterly flow not only continued over the West but spread much farther eastward. Consequently, temperatures east of the Divide were much lower this week. At International Falls, Minn., daily temperatures did not rise above 0°F. for 6 days. Below-zero minima were reported in 17 States and a 4-week warm spell was ended in northern New England. Of the two Arctic Highs that protruded into the country from western Canada, the second was much the larger, with sea level pressure of more than 1048 mb. near Lake Winnepeg on the last day of the week.

With the return of cold dry air there was much less precipitation this week. Amounts of more than 1 in. were confined to the Southeast where two weak waves crossed from the Gulf of Mexico to the Atlantic. Flooding was sustained by additional rain in parts of the Southeast but general improvement in flood conditions was noted elsewhere.

The blocking High shifted from Denmark Strait to northeastern Greenland from the third to the final week (fig. 10A, B). At temperate latitudes the wave train continued to progress from the eastern Pacific to the western Atlantic but the subtropical waves moved very little. Several features of the resulting pattern were out of phase including a trough north of a ridge in the eastern Pacific, a ridge north of a trough in west-central North America, and confluence over the eastern States.

This circulation with 700-mb. heights mostly above normal except over the southern tier of States and Alaska, led to general warming except in the Southern Plains and the Southeast. It was the coldest week of the month over most of Texas and weekly temperature averages decreased from the previous week eastward through the South and Middle Atlantic States. This was the third straight week of heavy precipitation in the Southeast and parts of the northeastern drought area received more than 2 in. of additional water.

REFERENCES

1. J. W. Posey, "The Weather and Circulation of January 1966—A Temperature Pattern Reversal Associated with an Index Cycle," *Monthly Weather Review*, vol. 94, No. 4, Apr. 1966, pp. 275–282.
2. Environmental Data Service, ESSA, *Weekly Weather and Crop Bulletin*, vol. 53, Nos. 6–10, Feb. 7, 14, 21, 28, and Mar. 7, 1966.