

WEATHER AND CIRCULATION OF FEBRUARY 1974

A Month with Record Fast Zonal Westerlies

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1. Mean circulation

The mean 700-mb flow at mid-latitudes was fast and of low amplitude in February 1974 (Figs. 1, 2, and 3). Wind speed maxima over the eastern Pacific and the western Atlantic both exceeded normal by more than 10 m sec^{-1} . While fast winds over western portions of the Atlantic and the Pacific were a continuation of similar conditions in January (Wagner, 1974) the mean westerlies over the eastern Pacific accelerated and moved

northward in February. This accompanied the retrogression of a blocking ridge from Alaska which not only reopened the storm track into the Gulf of Alaska, but also intensified the baroclinic zone near Alaska by intense cold air advection (Fig. 4.) Thus, the mid-latitude westerlies in February were supported by an augmented supply of zonal available potential energy from the east coast of Asia to the mid-Atlantic. The mean wind profile for the Western Hemisphere reveals a striking con-

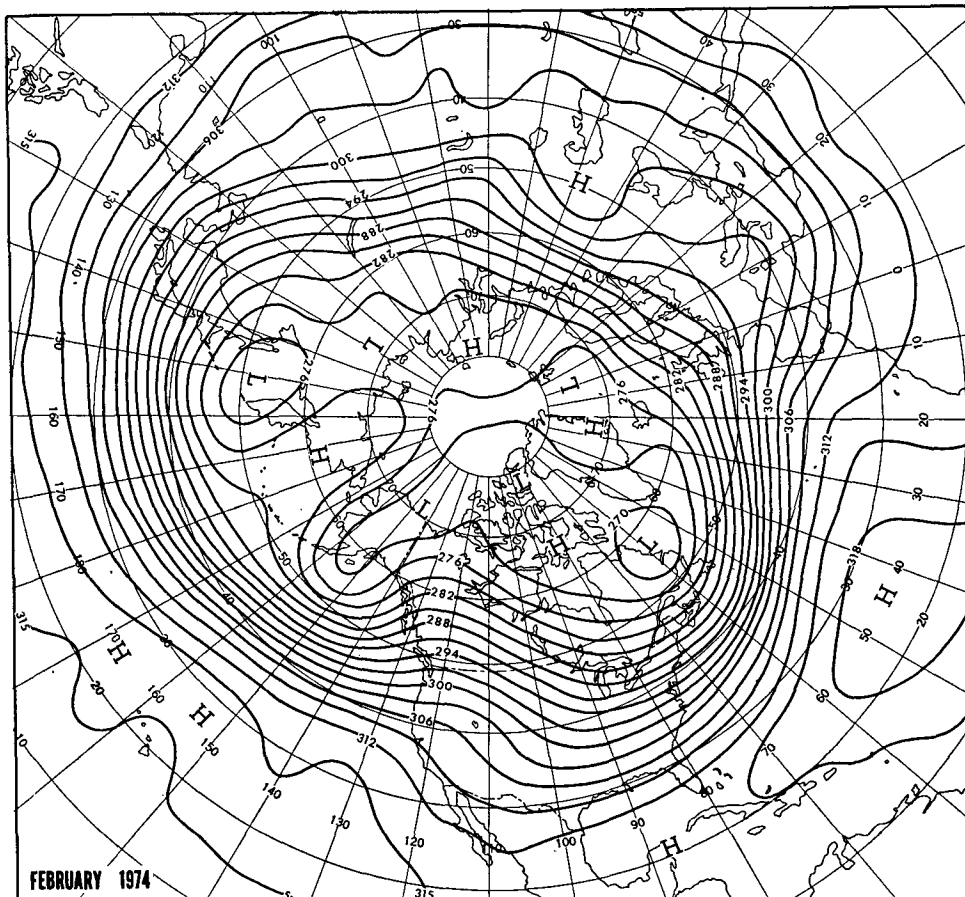


FIG. 1. Mean 700-mb height contours (dekameters) for February 1974.

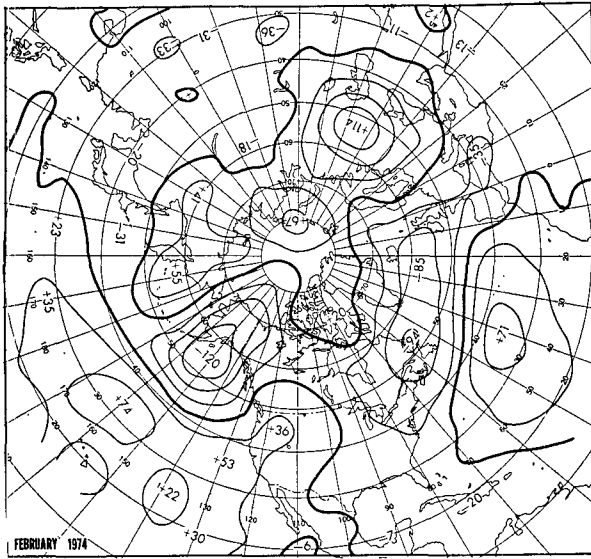


FIG. 2. Departure from normal of mean 700-mb height (m) for February 1974.

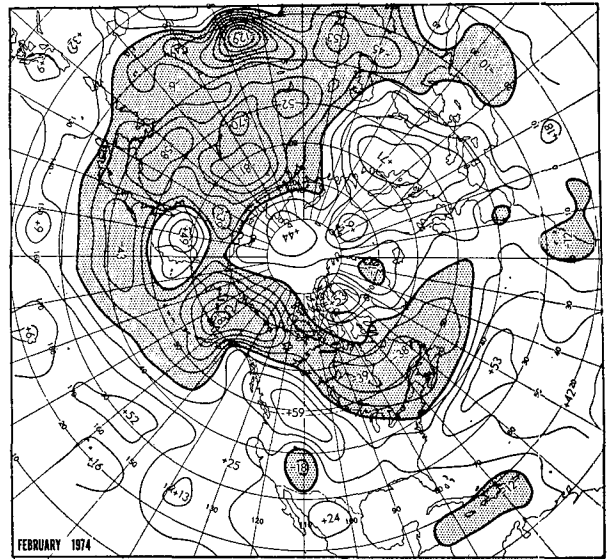


FIG. 4. Departure from normal of mean 1000- to 700-mb thickness (m) for February 1974.

centration of mean flow kinetic energy from 32N to 55N latitude (Fig. 5). The zonal index for the Western Hemisphere was 13.3 m sec^{-1} —the highest February value since tabulations began in 1949 and second only to the 13.9 m sec^{-1} observed in January 1972 (Wagner, 1972).

Acceleration of the mean flow over the eastern Pacific together with the development of a new trough in the Gulf of Alaska resulted in the progression of the long waves in the vicinity of North America. This brought a mean ridge to the West and a mean trough to the East, reversing the sign of the 700-mb height anomaly over most of the country from that of the previous month.

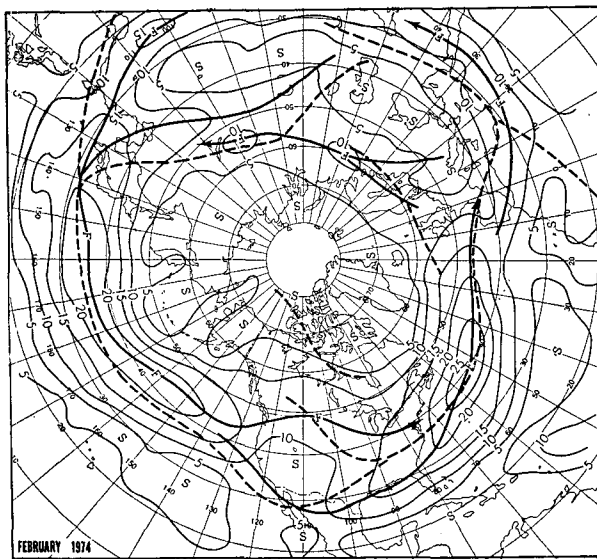


FIG. 3. Mean 700-mb geostrophic wind speed (m sec^{-1}) for February 1974. Solid arrows show the observed axes of maximum wind speed, and dashed lines show the normal.

The mean low over the Atlantic continued strong as did the mean ridge over Europe. The latter, however, progressed to 50E longitude—the locus of a normal 700-mb trough in February—as a mean trough developed over the western Mediterranean Sea. Retrogression of the blocking ridge from Alaska to northeastern and northcentral Asia depressed the westerlies well south of normal over Asia and brought below normal heights to mid-latitudes of Asia.

2. Temperature

Progression of a mean ridge to the Northwest coupled with the occurrence of fast westerly flow across the mountains in that area gave above normal temperatures to most of the western half of the nation (Fig. 6). The central and southern Rocky Mountains, affected by stronger than normal northerly flow (Fig. 2), were cooler than normal, as were portions of California. Largest temperature departures in the central Rocky Mountains occurred in an area of persistent, anomalous snow cover.

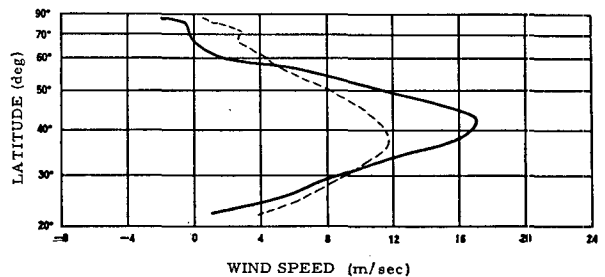


FIG. 5. Mean 700-mb geostrophic zonal wind speed profile for the Western Hemisphere for February 1974 (solid line); dashed line is normal.

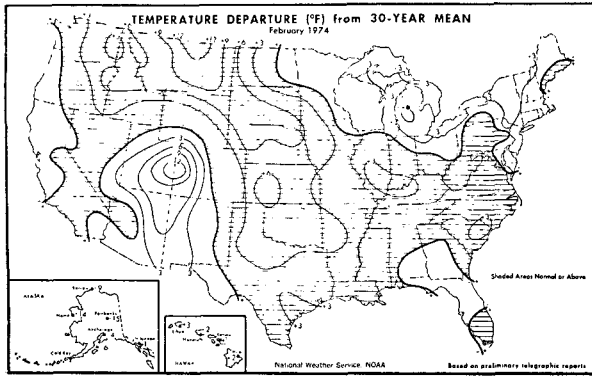


FIG. 6. Departure from normal of average surface temperature (°F) for February 1974 (from National Oceanic and Atmospheric Administration and Statistical Reporting Service, 1974).

Progressions of the mean trough in the East brought subnormal temperatures from the Great Lakes to New England. Weakness of the western Canada ridge coupled with fast westerly flow along the Canadian border limited cold air penetration in the East. Temperatures in the Southeast, however, dropped to near normal from the record breaking warmth of the previous month (Wagner, 1974).

Strong cold air advection between the deep Gulf of Alaska trough and the north-eastern Siberian ridge brought below normal temperatures to most of Alaska with departures up to 15F in the interior. Monthly mean temperature departures of 1° to 3° above normal accompanied dry weather in the Hawaiian Islands.

3. Precipitation

Precipitation exceeded normal in the Northwest in advance of the deep Gulf of Alaska trough and also over much of the eastern half of the country (Fig. 7). The precipitation distribution in the latter area was quite striated, having been influenced by a variety of storm tracks accompanying the broad mean trough. The middle and north Atlantic coast states, west of a deep

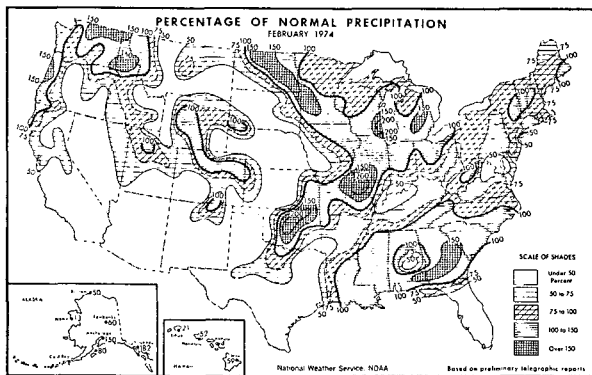
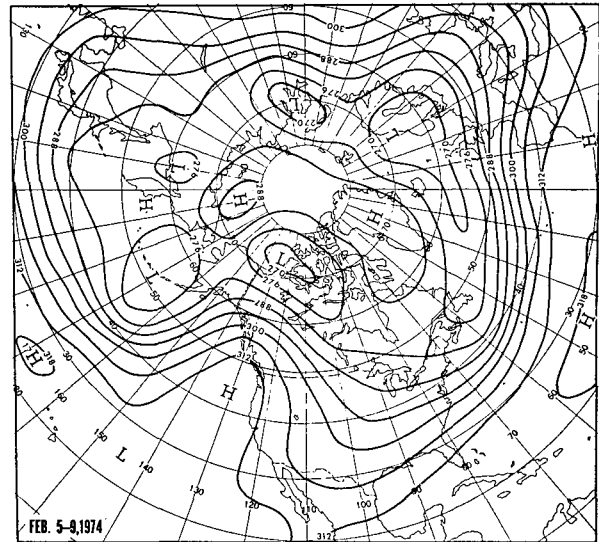
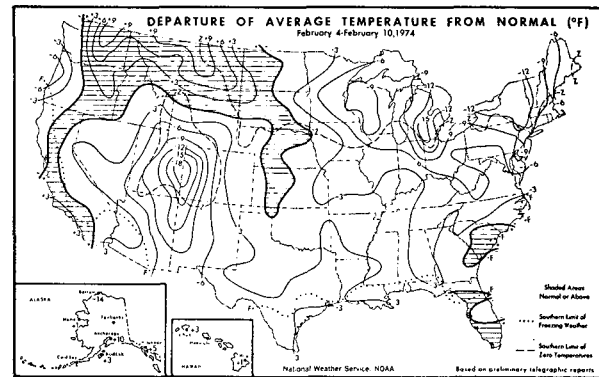


FIG. 7. Percentage of normal precipitation for February 1974 (from National Oceanic and Atmospheric Administration and Statistical Reporting Service, 1974).

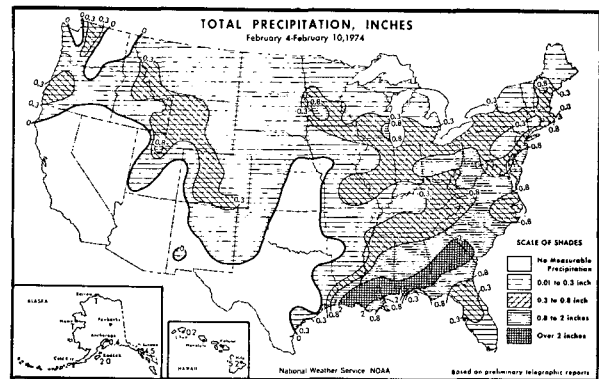
mean trough, reported subnormal precipitation. Most parts of the Great Plains, the Southwest, and the Great



(A)

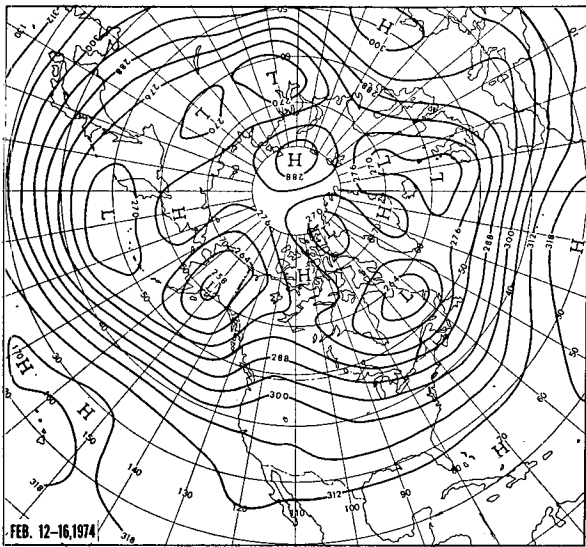


(B)

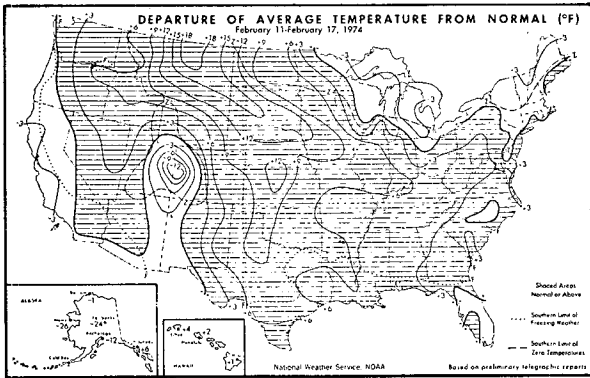


(C)

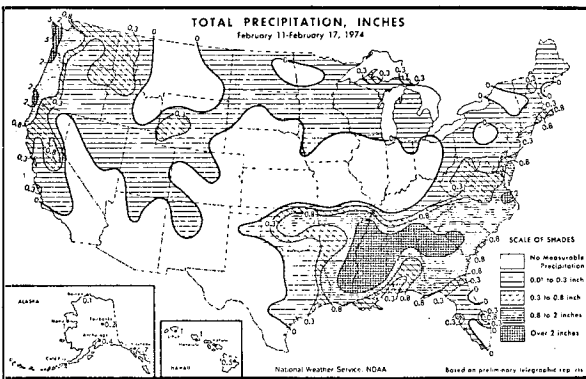
FIG. 8. (A) Mean 700-mb contours (dam) for 5-9 February 1974; (B) departure from normal of average surface temperature (°F) and (C) total precipitation (inches) for week of 4-10 February 1974 (from National Oceanic and Atmospheric Administration and Statistical Reporting Service, 1974).



(A)



(B)



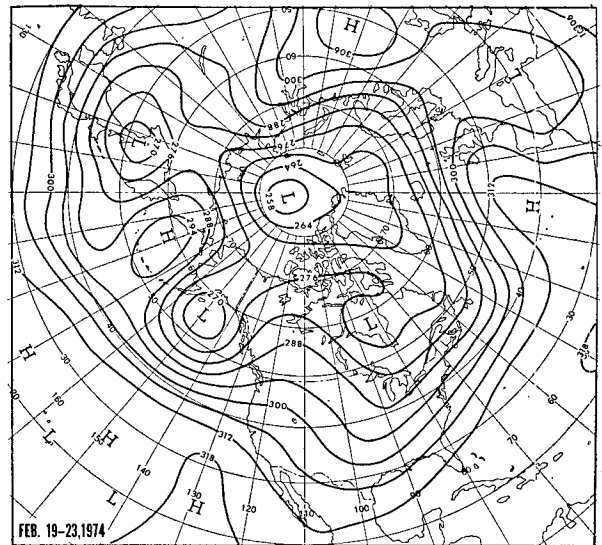
(C)

FIG. 9. Same as Fig. 8, (A) for 12-16, February 1974, (B) and (C) for week of 11-17 February 1974.

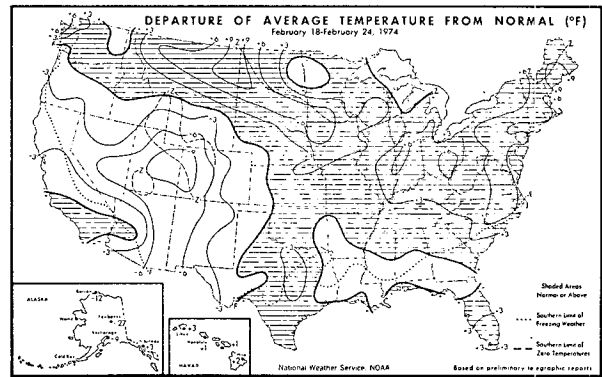
Basin, near and to the east of the mean ridge, were also relatively dry; it was one of the driest Februaries on record in portions of this area.

The deep Gulf of Alaska trough brought greater than normal precipitation to the southern edge of Alaska

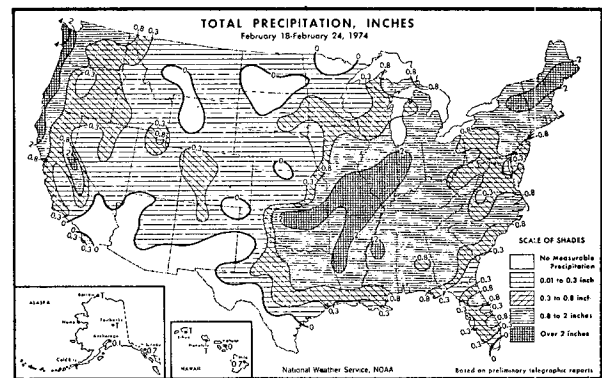
southeastward from Anchorage, but dry weather prevailed elsewhere in that state. Mean 700-mb heights were above normal near the Hawaiian Islands and precipitation was scant; Kahului, with only 0.12 inch of rain, had its driest February of record.



(A)

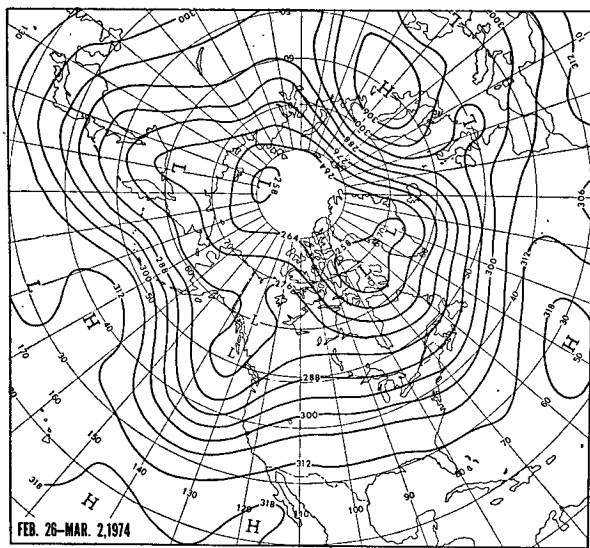


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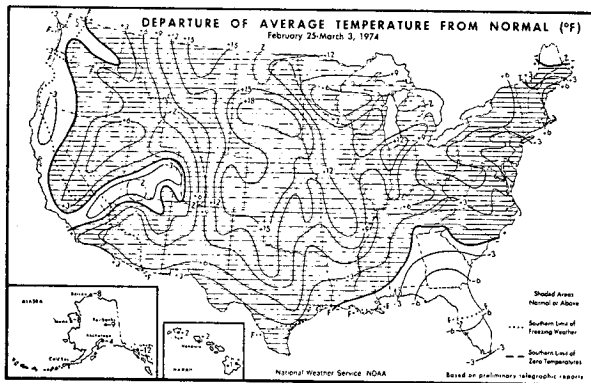


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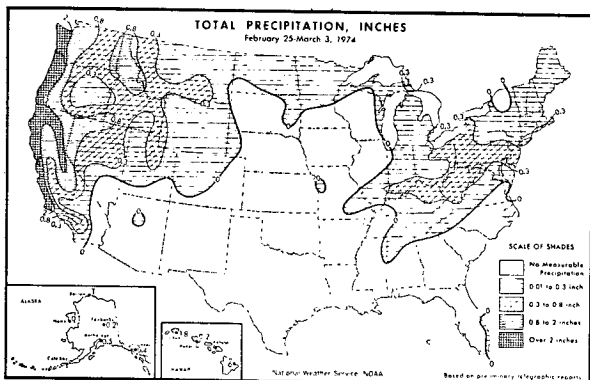
FIG. 10. Same as Fig. 8, (A) for 19-23 February 1974, (B) and (C) for 18-24 February 1974.



(A)



(B)



(C)

FIG. 11. Same as Fig. 8, (A) for 26 February–2 March 1974, (B) and (C) for week of 25 February–3 March 1974.

4. Variability within the month

a. February 4–10

Early in the month a strong ridge along the West Coast, coupled with deep troughs over the Mississippi

Valley and near Newfoundland, advected cold air over most of the country (Fig. 8). The only extensive area of above normal temperatures was over northern portions of the Rocky Mountains and Great Plains. Precipitation was also extensive this week with the greatest totals in the vicinity of the eastern trough.

b. February 11–17

The mean 700-mb wave pattern progressed and flattened over North America as a deep trough moved to the Gulf of Alaska (Fig. 9). The increasing westerly flow brought warming to most of the Nation. Substantial precipitation was limited to the Pacific Northwest, in advance of the mean trough, and in the Southeast where a wave cyclone traversed the mean trough.

c. February 18–24

The Gulf of Alaska low remained strong this week and warm air continued to cover most of the country (Fig. 10). Cold air was observed over central and southern portions of the West to the rear of a deepening trough in the middle of the country. Substantial precipitation continued along the northwest coast; it was also observed over much of the eastern half of the country near the deepening mean trough.

After a long period of blocking at high latitudes, heights dropped below normal and a mean 700-mb low dominated the Arctic for the first week since early January. This was largely a response to the amplifying ridge over the eastern Atlantic which drove the westerlies and the associated storm track northeastward to the fringe of the Arctic.

d. February 25–March 3

The longwave pattern at mid-latitudes over the Pacific amplified strongly this week (Fig. 11A). As the east Pacific trough built southward heights rose over the central United States, and the previous trough there was propelled rapidly to the East Coast. This produced the warmest week of the month for the country as a whole, but brought the coldest temperatures since December to parts of the Southeast where cold air settled southward behind the progressing trough. An extensive area of precipitation was observed in the strong southwesterly flow over the West. In most of the rest of the country this was the driest week of the month.

REFERENCES

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- Wagner, A. J., 1972: Weather and circulation of January 1972—A month with record strong midlatitude westerlies. *Mon. Wea. Rev.*, 100, 322–328.
- , 1974: Weather and circulation of January 1974—Another January with rapid midmonth warming. *Mon. Wea. Rev.*, 102, 324–331.