WEATHER AND CIRCULATION OF DECEMBER 1974
Continued Warm Across Much of the Country

ROBERT E. TAUBENSEE

National Meteorological Center, National Weather Service, NOAA, Washington, D. C. 20233

1. Mean circulation

Strong westerly 700 mb flow continued to sweep across the mid-latitude North Pacific Ocean during December 1974 (Figs. 1, 2, and 3) as it had in November (Dickson, 1975). The presence of a well-developed mean trough over the central North Pacific during December, however, contributed to a southward shift of the band of fast zonal flow and the axis of maximum wind speed moved south of normal. Helping to maintain this intense westerly flow was a continuation of a north-south thermal contrast across the ocean (Fig. 4). This thermal gradient generally strengthened in December, particularly along the east coast of Asia.

The mean 700 mb flow over North America basically exhibited little change from the November pattern. Over the United States the western ridge retrograded to the Pacific coast and the Great Plains trough deepened somewhat.

Intense westerly 700 mb flow was generated over Great Britain as a mean low developed east of Greenland and the subtropical ridge over the eastern Atlantic Ocean built strongly northeastward. Mean 700 mb wind

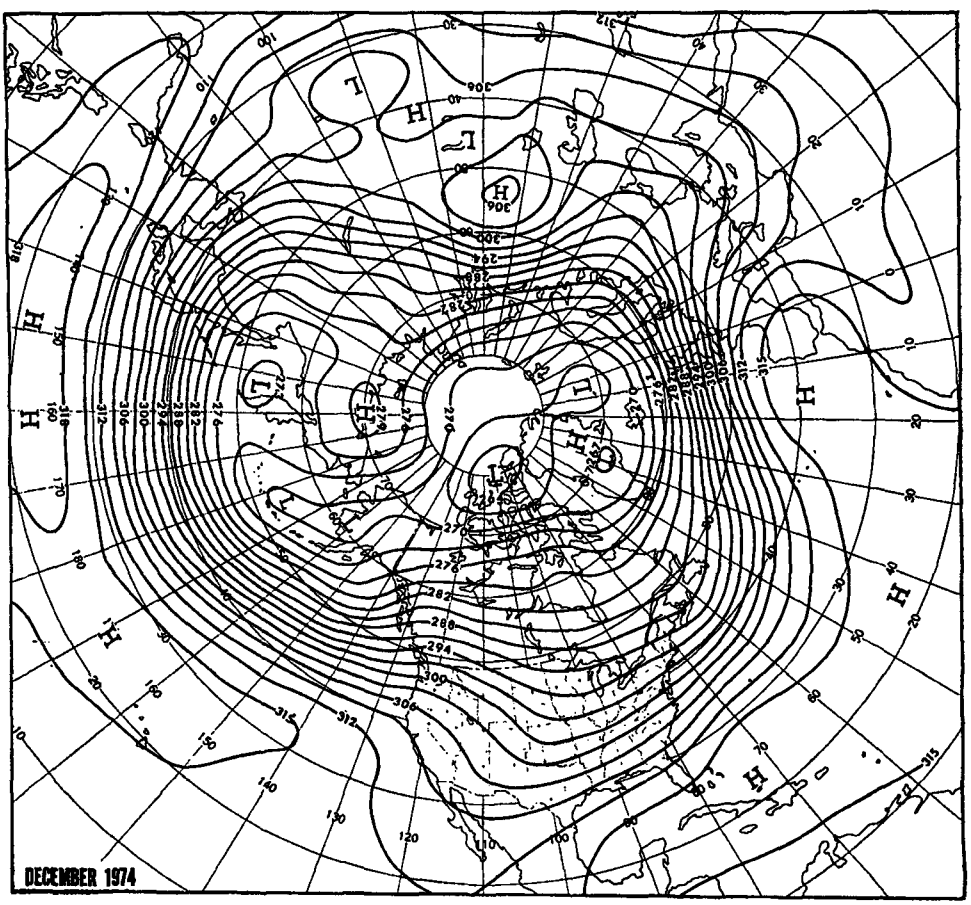


FIG. 1. Mean 700 mb height contours (dekameters) for December 1974.

speeds over Great Britain averaged more than twice their normal value.

A 700 mb blocking high became established northeast of the Caspian Sea in December. This high dominated the circulation over much of Asia, leading to an essentially complete reversal of the anomalous height pattern from November to December over much of the region. Strong 700 mb mean northwesterly flow over central and northern Asia drove cold air southeastward to the Asian coast, thereby helping to strengthen the thermal contrast over the Pacific Ocean.

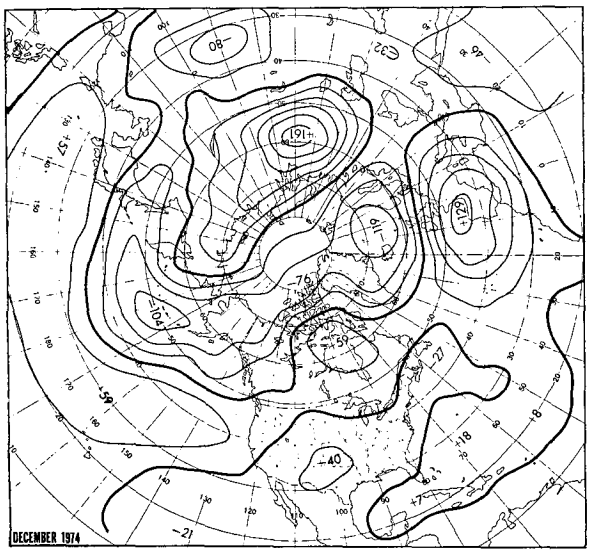


FIG. 2. Departure from normal of mean 700 mb height (m) for December 1974.

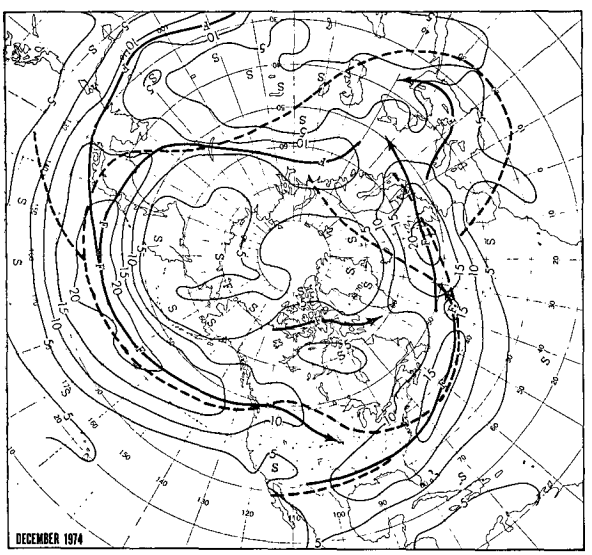


FIG. 3. Mean 700 mb geostrophic wind speed (m/s) for December 1974. Solid arrows indicate observed axes of maximum wind speed and dashed lines, the normal.

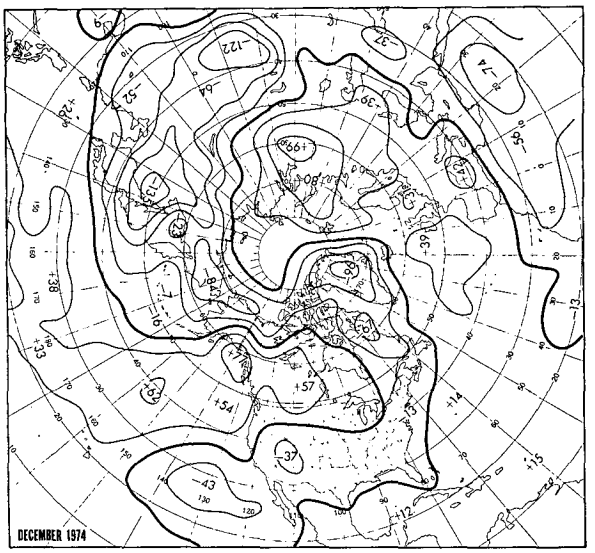


FIG. 4. Departure from normal of mean 1000 to 700 mb thickness (m) for December 1974.

2. Temperature

Mean surface temperatures averaged warmer than normal across the northern half of the country as well as in much of the East during December (Fig. 5). A lack of well developed northwesterly flow over Canada was again a contributing factor to this warmth, as it had been in November. Mean northwesterly 700 mb flow contributed to cooler than normal temperatures over the southwestern quadrant of the country. Below normal temperatures also accompanied the southern part of the Great Plains trough.

The well developed central Pacific-Alaska trough coincided with below normal temperatures over much of Alaska. Southeasterly flow to the east of the trough, however, was apparently sufficiently strong to produce warmer than normal temperatures in the southeastern part of the state. This Alaskan temperature pattern

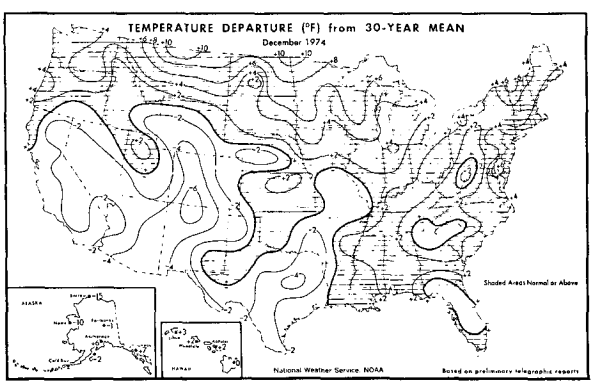


FIG. 5. Departure from normal of average surface temperature (°F) for December 1974 (from National Oceanic and Atmospheric Administration and Statistical Reporting Service, 1975).

agreed well with the mean 1000-700 mb thickness anomaly that was observed over the area (Fig. 4). The relatively strong 700 mb subtropical ridge which extended across the southern Pacific was associated with generally above normal temperatures in the Hawaiian Islands.

3. Precipitation

A variety of storm paths throughout December contributed to a rather complex precipitation pattern across the United States (Fig. 6). In general, near normal to heavier than normal precipitation predominated eastward from the mean 700 mb trough. In the West, prevailing northwesterly 700 mb flow was associated with significantly lighter than normal precipitation in parts of the Great Plains and Rocky Mountains.

A somewhat depressed storm track across the North Pacific was linked with lighter than normal precipitation over all but the southern coast of Alaska. Station reports from the Hawaiian Islands indicated below normal precipitation in the northern part of the state with above normal amounts in the south where the subtropical ridge was not as strong.

4. Weekly variability

a. December 2–8

A broad 700 mb ridge extended across much of North America, contributing to warmer than normal weekly mean surface temperatures over much of the United States westward from the Great Plains (Figs. 7A and 7B). Meanwhile, most of the eastern half of the country experienced below normal temperatures as cold cP air was transported into the region by mean 700 mb northwesterly flow. This cold air produced record daily minima at a number of eastern cities during the week, particularly on 5 December. The coldest reported temperature in the Nation that morning occurred at Elkins, W. Va., where a temperature of −9°F established an early season record cold temperature for the station.

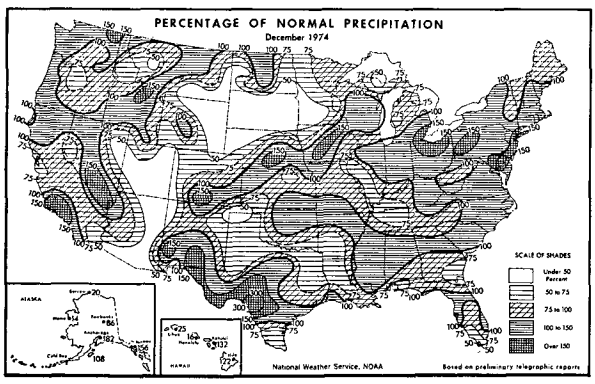
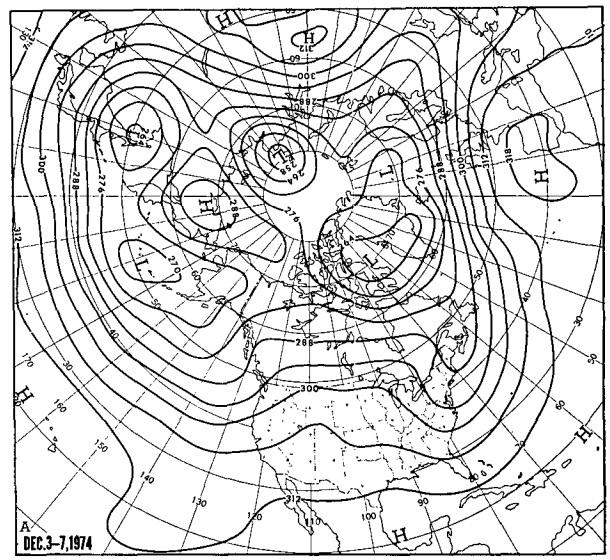
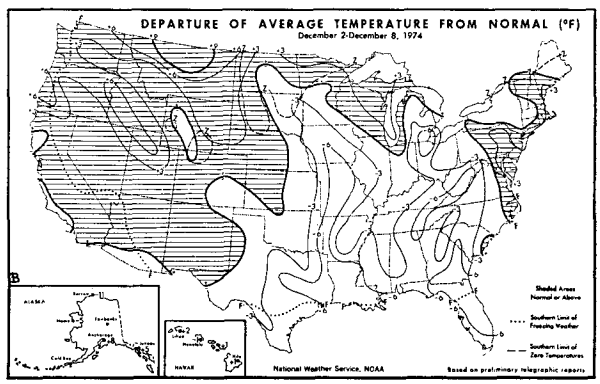


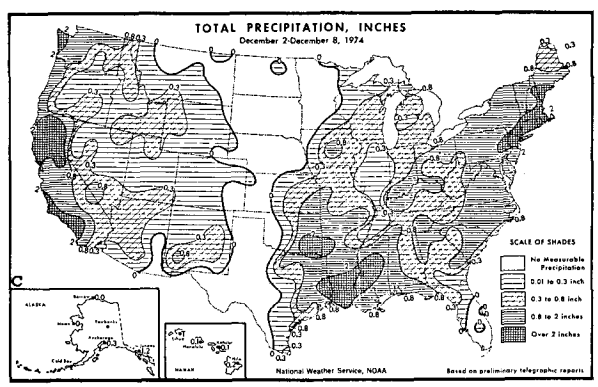
FIG. 6. Percentage of normal precipitation for December 1974 (from National Oceanic and Atmospheric Administration and Statistical Reporting Service, 1975).



(a)



(b)



(c)

FIG. 7. (A) Mean 700 mb contours (dam) for 3–7 December 1974; (B) departure from normal of average surface temperature (°F); and (C) total precipitation (inches) for week of 2–8 December 1974 (from National Oceanic and Atmospheric Administration and Statistical Reporting Service, 1974).

Cyclonic activity from an eastern Pacific trough brought precipitation to most of the area west of the Rocky Mountains, while downstream rainshadow effects helped to keep part of the Great Plains dry (Fig. 7C). Precipitation related to the mean 700 mb trough along the East Coast came principally from two separate storms, one at the beginning of the week and the other at the end. The first storm, already in progress over the East on 1 December, deepened rapidly and soon became a major early season winter storm. By the time the storm moved into the Gulf of St. Lawrence on 4 December, it had brought 15 to more than 20 inches of snow to parts of Michigan, Ohio, and the central Appalachians. Notable snow amounts included a total of 19.3 inches at Detroit, Mich., the heaviest storm total there since April 1886, and a 24 h snowfall of 12.2 inches at Cleveland, Ohio, a new December record for the station. Strong easterly winds accompanying the storm caused tidal flooding and some beach erosion along the northern part of the East Coast.

b. December 9–15

Retrogression of the mean 700 mb wave pattern occurred over the United States in conjunction with the filling of the east Pacific mean trough (Fig. 8A). A mean ridge was now located near the West Coast, while, downstream, a broad trough prevailed over the East with an extension into the southern Great Plains.

Strong zonal flow over the eastern Pacific helped to spread relatively warm mP air across the northern half of the country (Fig. 8B). Conversely, relatively cool air dropped into the trough over the southern Plains and gave below normal temperatures to much of the South.

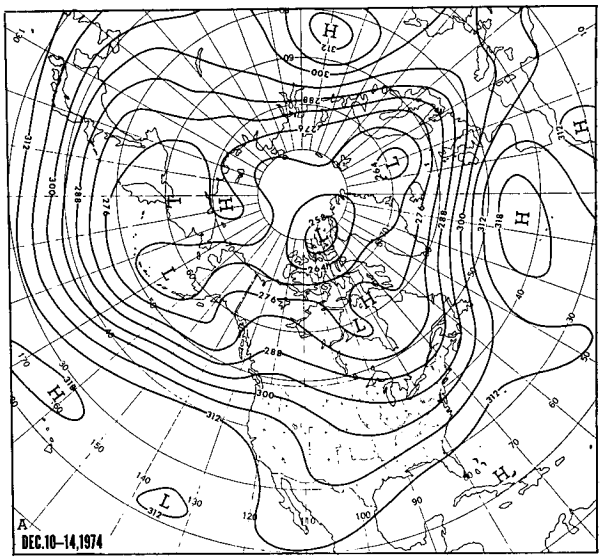
Fast-moving Pacific systems brought precipitation into the northwestern part of the country (Fig. 8C) but the Southwest dried out in response to mean northwesterly flow aloft. Widespread precipitation accompanied the mean 700 mb trough over the eastern United States.

c. December 16–22

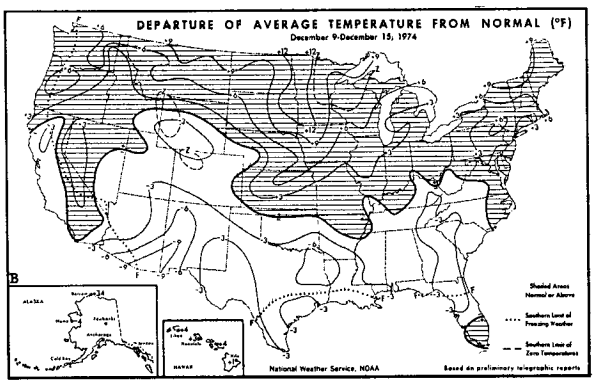
The mean 700 mb ridge near the West Coast was somewhat flatter this week, and was accompanied by stronger zonal flow (Fig. 9A). Downstream, the southern Plains trough moved eastward, leading to a well-developed mean trough over the Mississippi Valley.

Increased westerly 700 mb flow along the West Coast continued to spread warmer than normal mP air into the country, much of which now experienced above normal temperatures (Fig. 9B). Cooler air associated with the trough over the Mississippi Valley continued to bring below normal temperatures to the Southeast.

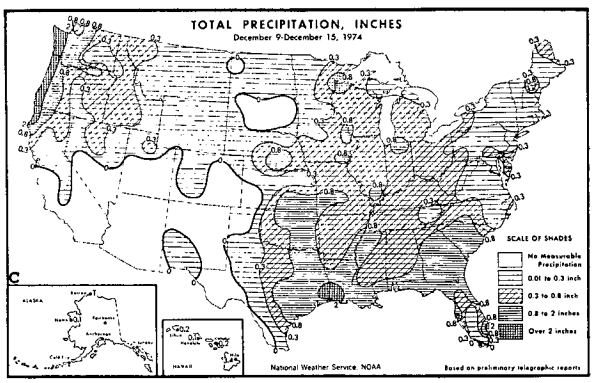
Progression of the mean 700 mb trough from Texas into the Mississippi Valley was accompanied by an expansion of the area of no precipitation throughout the southwestern United States (Fig. 9C). Precipitation amounts in the Northwest were somewhat heavier this week in response to strengthened onshore flow. An early period coastal storm contributed some precipitation in the vicinity of the eastern United States trough.



(a)



(b)

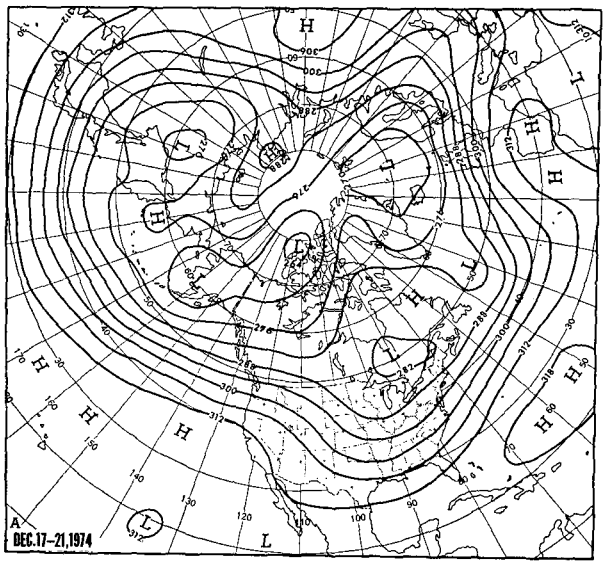


(c)

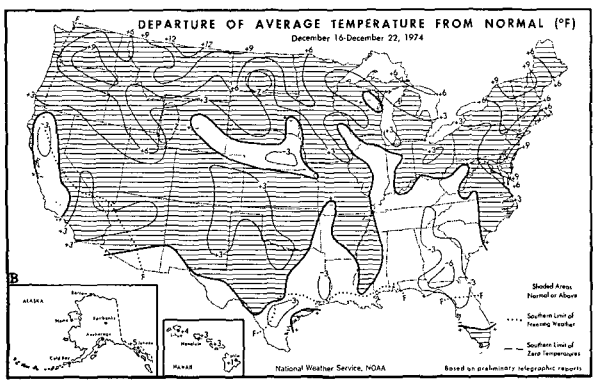
FIG. 8. Same as Fig. 7., (A) for 10–14 December 1974, (B) and (C) for week of 9–15, December 1974.

d. December 23–29

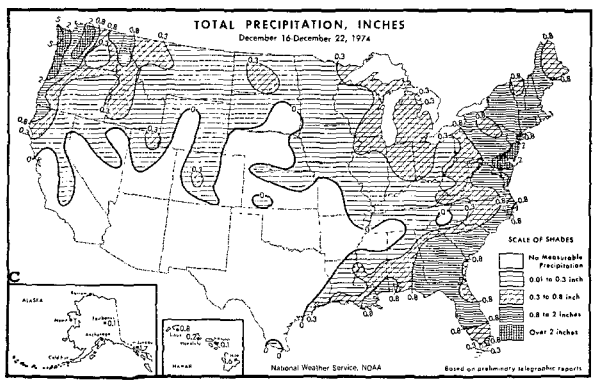
Weakening and retrogression of the subtropical 700 mb ridge over the eastern Pacific was accompanied by the retrogression of a sharp trough to the Southwest (Fig. 10A). Downstream, a mean ridge became established over the East Coast. This ridge represented a



(a)

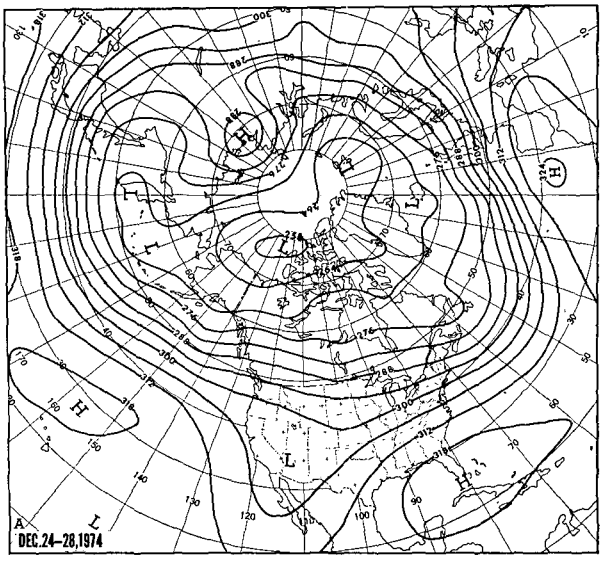


(b)

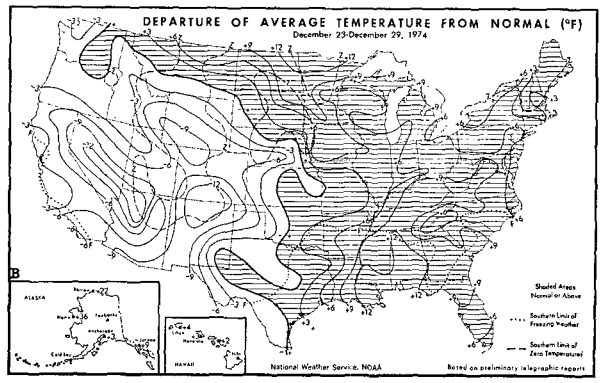


(c)

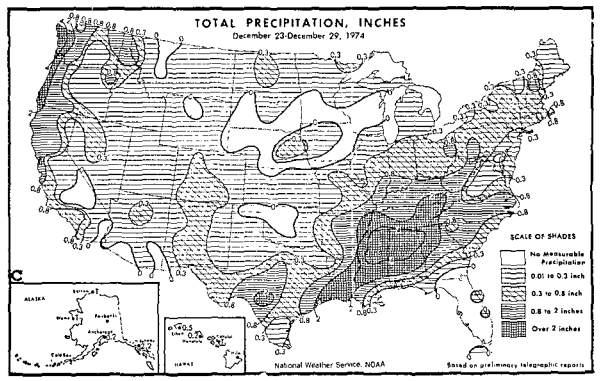
FIG. 9. Same as Fig. 7., (A) for 17–21 December 1974, (B) and (C) for week of 16–22 December 1974.



(a)



(b)



(c)

FIG. 10. Same as Fig. 7 (A) for 24–28 December 1974, (B) and (C) for week of 23–29 December 1974.

retrogression of part of the subtropical ridge from the western Atlantic.

Surface temperatures reacted quickly to the change in the mean 700 mb circulation. Mean temperatures cooled to well below normal values over much of the West (Fig. 10B), while strong warming accompanied the East Coast ridge.

Mean southerly flow to the west of the well-developed eastern United States ridge transported moist air from the Gulf of Mexico into the East Gulf Coast region, where some weekly precipitation totals exceeded 4 inches (Fig. 10C). Precipitation returned to parts of the Southwest, in response to the mean 700 mb trough, but ridging along the East Coast generally lessened precipitation amounts in that area.

REFERENCES

Dickson, Robert R., 1975: Weather and circulation of November 1974—Biweekly amplification of the circulation pattern. *Mon. Wea. Rev.*, **103**, 170–174.

National Oceanic and Atmospheric Administration, U. S. Department of Commerce, and Statistical Reporting Service, U. S. Department of Agriculture, 1974 and 1975: *Weekly Weather and Crop Bulletin*, **61**, Nos. 50–52: 10, 17, and 24 December 1974; and **62**, No. 1: 7 January 1975.