Weather and Circulation of November 1973
A Month with Large Variability

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1. Mean circulation

The 700-mb mean circulation during November 1973 was highly amplified (Figs. 1 and 2); most major anomaly centers around the hemisphere had magnitudes of about two standard deviations. Over most of the hemisphere the wave phase was approximately the same as in October (Wagner, 1973). The amplifying Aleutian Ridge not only displaced the normal November Bering Straits Low, but also extended in strength to the Arctic. Mean 700-mb westerlies were quite weak over the mid-Pacific but exceeded normal in the flanking troughs (Fig. 3). Vigorous mean flow from the south across northeastern Siberia contributed to warmer than normal mid-tropospheric temperatures over much of the Arctic.

The intensifying trough along the west coast of North America sloped from the northwest to the southeast, transporting momentum of the westerlies southward over the United States where a fast, low amplitude mean flow was observed. This was in contrast to October's mean flow which had a strong mean ridge over the Great Lakes (Wagner 1973). The strength of the westerlies over Canada declined during November

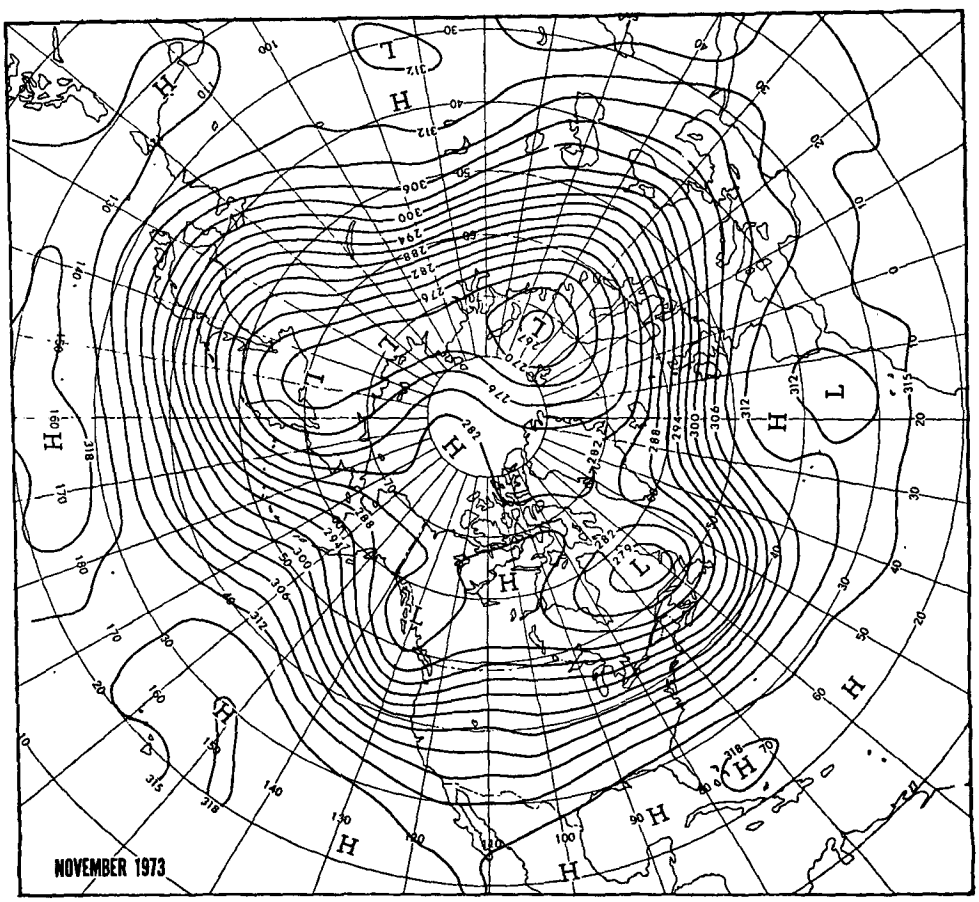


FIG. 1. Mean 700-mb height contours (dekameters) for November 1973.

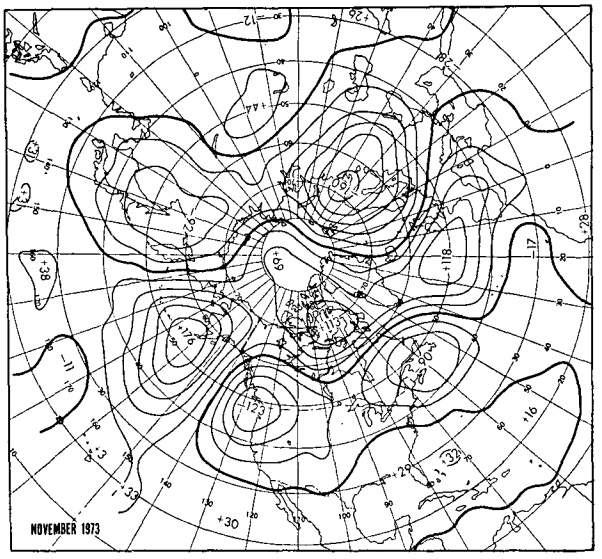


FIG. 2. Departure from normal of mean 700-mb height (meters) for November 1973.

as a strong High formed west of Hudson Bay. This weakening flow led to retrogression of mid latitude portions of the east coast trough while low latitude portions progressed in the strengthening flow that prevailed there.

Although a strong eastern Atlantic mean ridge persisted at middle latitudes, falling heights to the north resulted in a confluent flow pattern and strengthening westerlies over the North Sea. Heights increased strongly over western Europe to the south of this wind speed maximum. To a large extent, the wave pattern over Eurasia persisted from October with troughs

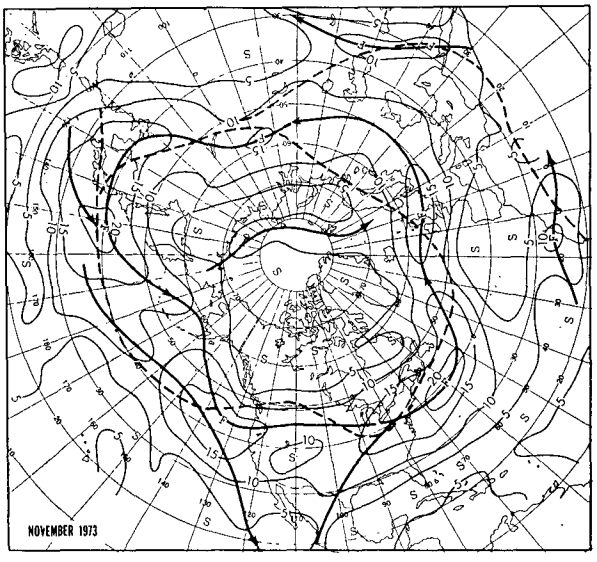


FIG. 3. Mean 700-mb geostrophic wind speed (meters per second) for November 1973. Solid arrows show the observed axes of maximum wind speed, and dashed lines show the normal.

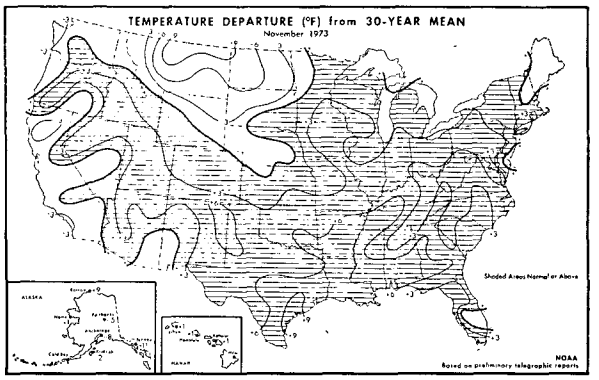


FIG. 4. Departure from normal of average surface temperature (°F) for November 1973 (from National Oceanic and Atmospheric Administration and Statistical Reporting Service, 1973).

intensifying over both eastern Europe and the Asia coast.

2. Temperature

The fast upper level westerlies that prevailed across the United States during November largely contained the continental polar air north of the border. Maritime air masses and warmer than normal temperatures dominated most of the nation (Fig. 4) yielding the warmest November in several years in much of the South and East. Some of the western Canadian cold air reached the West Coast via advection about the mean sea level Low near Vancouver Island; some moved over the northern Great Plains behind transient storm systems.

Good conditions in the strong Alaskan ridge together with anomalous flow from the north produced below normal average temperatures over most of that State. Above normal temperatures were confined to the northern and western fringe of the State where warm air advection prevailed.

3. Precipitation

The fast westerly flow across the United States was accompanied by frequent storm systems and widespread

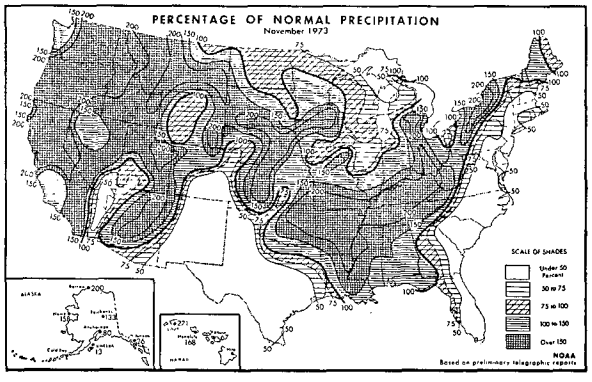
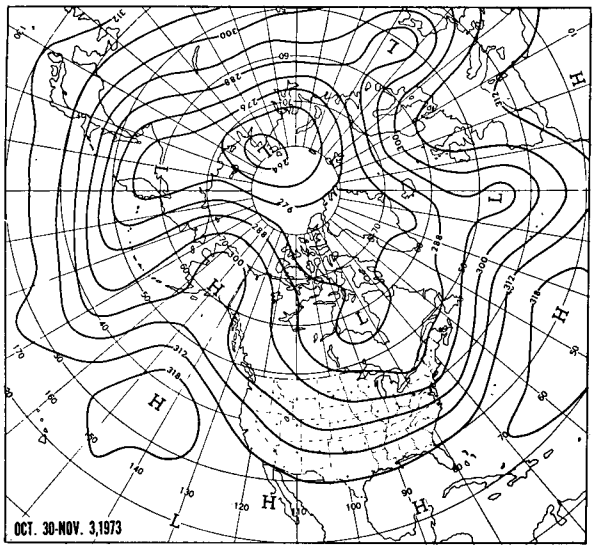
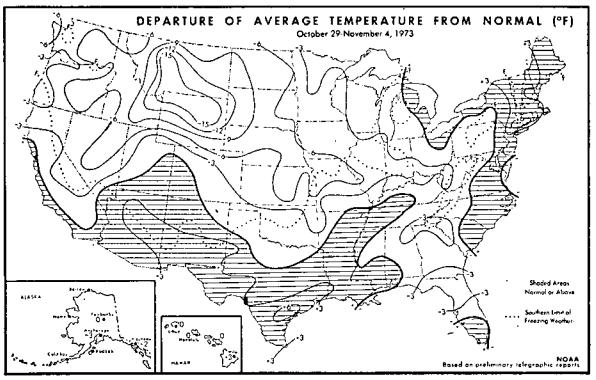


FIG. 5. Percentage of normal precipitation for November 1973 (from National Oceanic and Atmospheric Administration and Statistical Reporting Service, 1973).

(A)



(B)



(C)

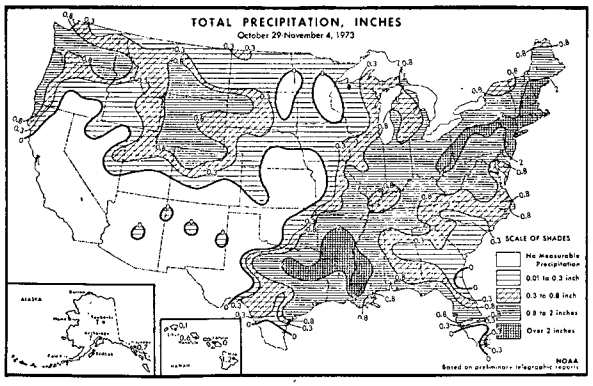
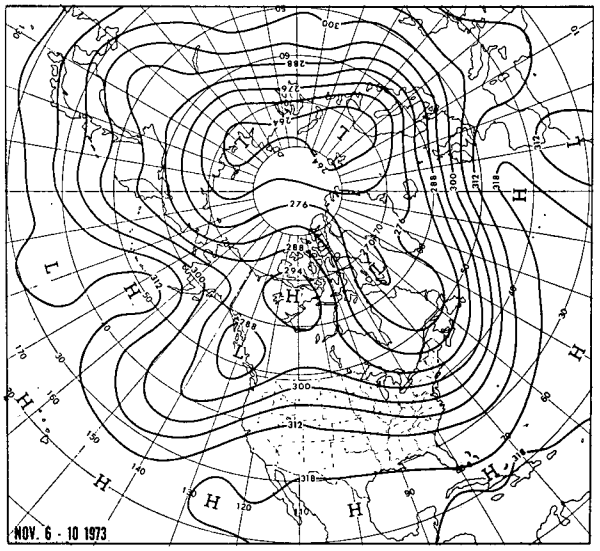


FIG. 6. (A) Mean 700-mb contours (dekameters) for 30 October–3 November 1973; (B) departure from normal of average surface temperature (°F) and (C) total precipitation (inches) for week of 29 October–4 November 1973 (from National Oceanic and Atmospheric Administration and Statistical Reporting Service, 1973).

above normal precipitation (Fig. 5). Heaviest totals relative to normal occurred east of the strong West Coast trough and between the Great Plains trough and the Appalachian Mountains. This was one of the wettest Novembers of record over much of the Northwest. Rain shadows were observed to the lee of both the Appalachian and the southern Rocky Mountains. In

(A)



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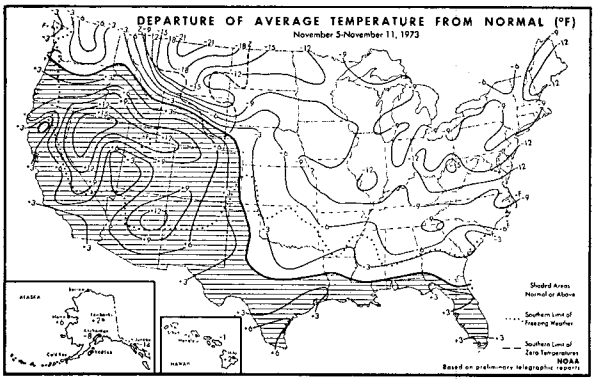

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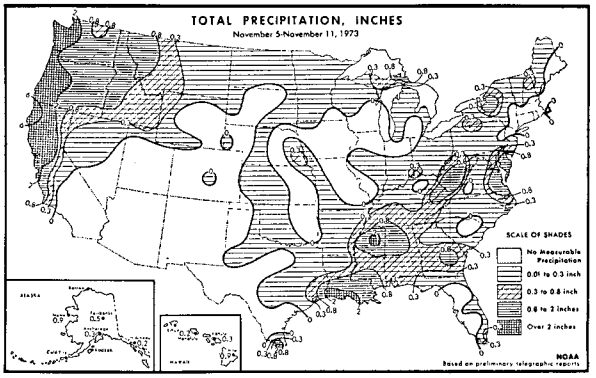


FIG. 7. Same as Fig. 6, (A) for 6–10 November 1973, (B) and (C) for week of 5–11 November 1973.

the former area some stations reported the driest November in several years.

Stronger than normal northerly wind components at 700-mb brought subnormal precipitation to the south Alaska coast; Kodiak reported only 13% of the normal November precipitation. Elsewhere in that State precipitation ranged from near normal in the interior to well above normal in western portions where southwesterly mean flow was observed. South of the amplified east Pacific ridge (Figs. 1 and 2) most stations in Hawaii reported above normal precipitation. Amounts at both Hilo and Lihue were more than twice the November normal.

4. Variability within the month

Weekly distributions of temperature and precipitation accompanied by appropriate 5-day mean 700-mb maps are shown in Figs. 6–10. The upper level flow and associated temperature pattern over the United States were quite variable this month, responding largely to the variable nature of the east Pacific trough.

a. October 29–November 4

Early in the month a strong ridge extended from the east Pacific to Alaska and mean troughs were found over the Great Plains and near the East Coast (Fig. 6). Strong northerly flow between Hudson Bay and Alaska drove cold air southward over much of the United States with most extreme departures over the northern Great Plains. Precipitation was widespread with greatest totals associated with the mean troughs over the middle and eastern United States.

b. November 5–11

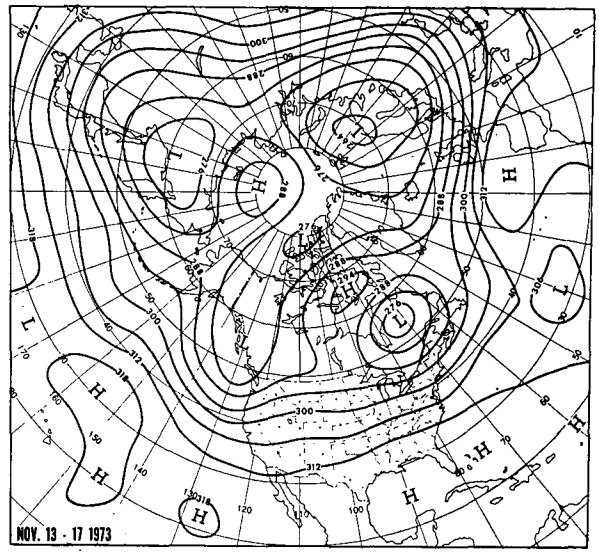
Progression of a mean trough to the eastern Pacific brought a mean ridge to the Great Plains, driving the previous continental trough off the East Coast (Fig. 7). This strongly warmed the West and cooled the East. Progression of the Alaskan ridge into western Canada continued the cold regime over the northern Great Plains.

The developing east Pacific trough brought substantial precipitation to the Northwest this week. In the East weak lows and associated cold fronts produced precipitation at most locations.

c. November 12–18

Although the wave phase over the United States was about the same as in the previous week (Figs. 7 and 8) there were some important circulation changes. The east Pacific trough assumed a negative tilt, transporting westerly momentum southward over the United States; and the northwest Canadian ridge progressed to northern Hudson Bay. These changes largely eliminated the advection of cold air from Canada to the United States and spread relatively warm air across the Nation.

(A)



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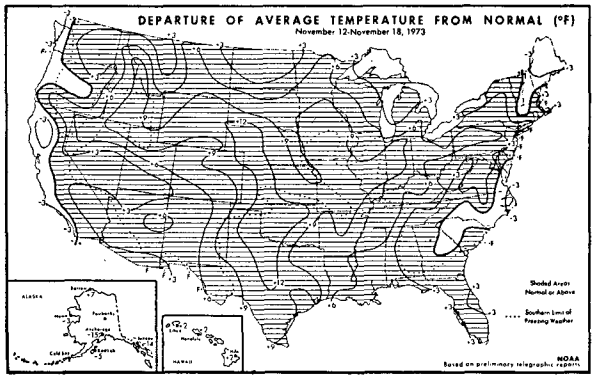

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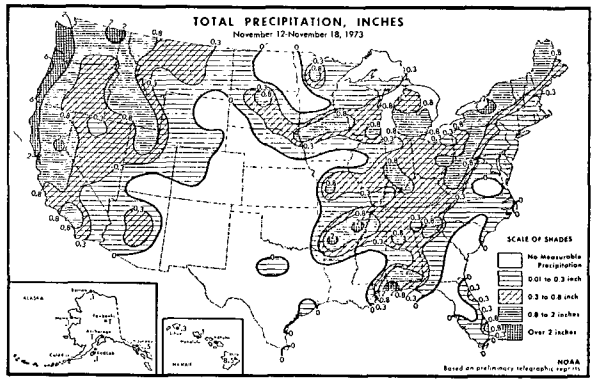
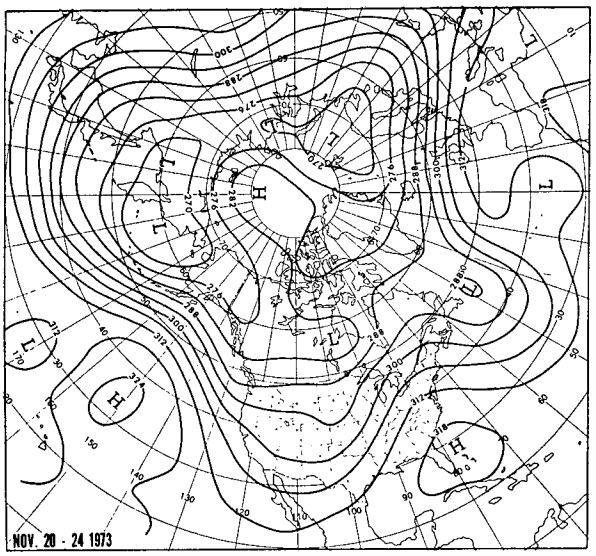


FIG. 8. Same as Fig. 6, (A) for 13–17 November 1973, (B) and (C) for week of 12–18 November 1973.

Frequent storm systems moving in the augmented westerlies brought extensive precipitation; there was, however, a precipitation—free area to the lee of the Rockies.

(A)



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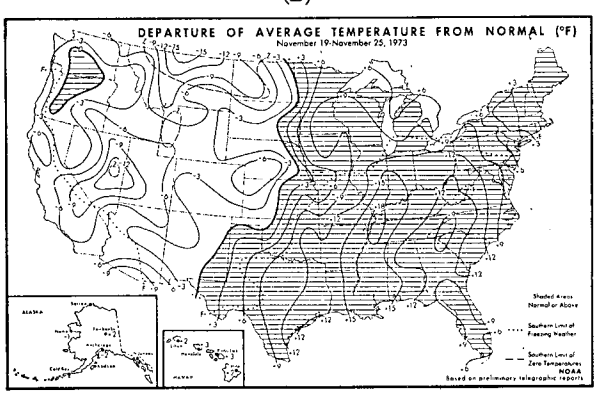

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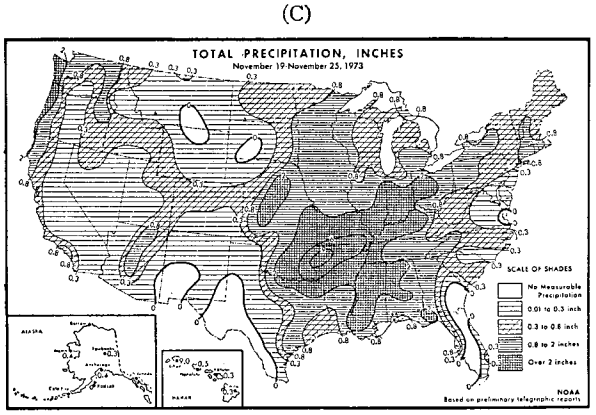
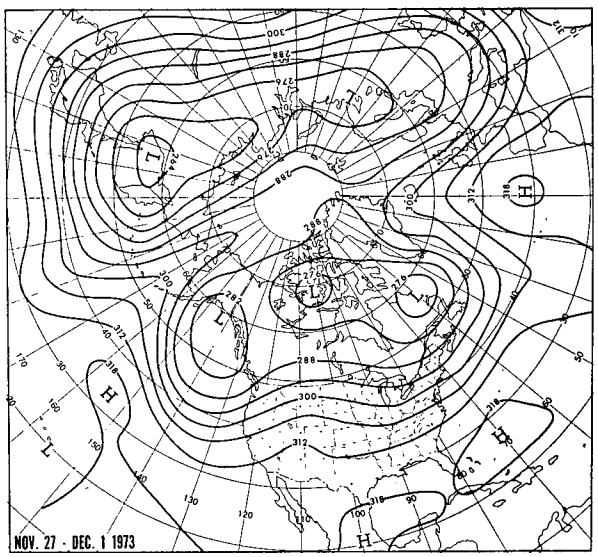


FIG. 9. Same as Fig. 6, (A) for 20–24 November 1973, (B) and (C) for week of 19–25 November 1973.

d. November 19-25

Progression of the mean 700-mb wave pattern resulted in mean ridges over the east Pacific and the eastern United States and a mean trough over the Great Plains (Fig. 9). As the mean trough progressed to the Great Plains and deepened in the south the ridge to its east amplified. This amplified wave pattern brought below normal temperatures to the West, and much above normal temperatures to the East; and

(A)



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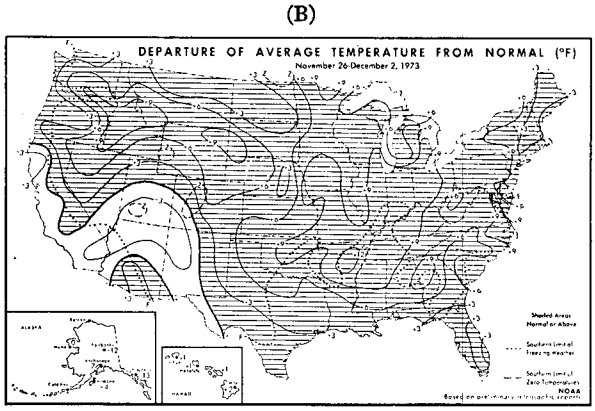

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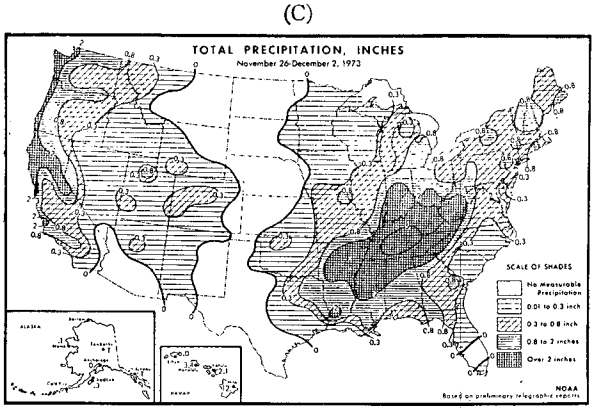

FIG. 10. Same as Fig. 6, (A) for 27 November–1 December 1973 (B) and (C) for week of 26 November–2 December 1973.

spread precipitation across the Nation. Heaviest precipitation occurred over the Mississippi and Ohio Valleys in advance of the deep Great Plains trough. Tornadoes were observed this week in Arkansas, Texas, Missouri, Alabama and Georgia.

e. November 26–December 2

Long wave retrogression led to a re-establishment of the east Pacific trough and a phase reversal from the previous week over the United States (Fig. 10). While increasing southwesterly flow along the West Coast brought warming temperatures to the West, the eastern half of the Nation remained warm in the flat flow that prevailed there. As was the case at mid-month (Fig. 8), weakness of the western Canadian ridge coupled with fast westerlies across the United States limited cold air advection from Canada. Most of the precipitation east of the Mississippi River occurred with a deepening Low which moved out of the lower Mississippi Valley during the first half of the week bringing an outbreak of tornadoes to Tennessee. The West continued wet with the re-establishment of the coastal trough.

REFERENCES

National Oceanic and Atmospheric Administration, U. S. Department of Commerce, and Statistical Reporting Service, U. S. Department of Agriculture, 1973: *Weekly Wea. and Crop Bull.*, 60, Nos. 45–48, 5, 12, 19, and 26 November and Nos. 49 and 50, 3 and 10 December.

Wagner, A. J., 1973: Weather and Circulation of October 1973—Generally Mild and Dry Except for Heavy Rains in Eastern Portions of the Great Plains. *Mon. Wea. Rev.*, **102**, 91–97.

PAPERS TO APPEAR IN FORTHCOMING ISSUES

ARTICLES

On the Stability of the N Cycle Scheme of Lorenz—M. ISRAELI AND D. GOTTLIEB, Dept. of Applied Mathematics, Massachusetts Institute of Technology, Cambridge, Mass.

Pressure-Wind Relationships in the Equatorial Surface Westerlies—BERNHARD LETTAU, Dept. of Atmospheric Science, State University of New York, Albany.

A Study of the Role of Radiational Cooling in a Planetary Boundary Layer—M. K. MAK, Laboratory for Atmospheric Research, University of Illinois, Urbana.

A Multiple Structured Frontal Zone-Jet Stream System as Revealed by Meteorologically Instrumented Aircraft—M. A. SHAPIRO, National Center for Atmospheric Research, Boulder, Colo.

Seasonal Rainfall in Southwestern Australia and the General Circulation—PETER B. WRIGHT, Climatic Research Unit, University of East Anglia, Norwich, England.

Temporal Variations in Seasonal Rainfalls in Southwestern Australia—P. B. WRIGHT, Climatic Research Unit, University of East Anglia, Norwich, England.

NOTES AND CORRESPONDENCE

Comment on "Anomalous Gradient Winds: Existence and Implications"—COLLEEN LEARY, Environmental Research and Technology, Inc., Lexington, Mass.

Reply—H. MICHAEL MOGIL, National Severe Storms Forecast Center, NOAA, Kansas City Mo., AND RONALD L. HOLLE, Experimental Meteorology Laboratory, NOAA, Coral Gables, Fla.

PICTURE OF THE MONTH—A Jet Stream Cirrus Shield—CARL O. ERICKSON, National Environmental Satellite Service, NOAA, Washington, D. C.

WEATHER AND CIRCULATION OF DECEMBER 1973—A Wet Month Over Much of the Country—ROBERT E. TAUBENSEE, National Weather Service, NOAA, Suitland, Md.