WEATHER AND CIRCULATION OF APRIL 1975

Stormy with Record Cold

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1. Mean circulation

In April the fast, zonal flow which had prevailed over most of the western part of the Northern Hemisphere throughout the winter and early spring (Wagner, 1975; Dickson, 1975; and Taubensee, 1975) broke down into a more amplified pattern (Fig. 1). The Pacific subtropical ridge moved eastward somewhat from its March position and became more amplified (Figs. 1 and 2). As a result, a strong trough formed in the Great Basin as vorticity maxima crossing the Pacific were driven southeastward into this area.

The deepening trough in the West forced the trough which had been over the lower Great Plains (Taubensee, 1975) eastward to the western Atlantic, where it phased with the strong trough over eastern Canada (Fig. 1). A full-latitude ridge built over the Mississippi Valley and central Canada; the northern portion over Hudson Bay constituted a strong block with 700 mb heights averaging 91 m above normal (Fig. 2). Strong cyclonic activity and the associated deep mean troughs over the Great Basin and south of Nova Scotia (Figs. 1 and 2) were important factors related to the development of this block, as well as to amplification of the ridge over the eastern Atlantic.

These features of the mean circulation had a profound influence on the April circulation over the United States. The 700 mb wind maximum normally located near the northern United States was completely absent, while the wind maximum over the southern part of the country was stronger than normal, and close to the usual position (Fig. 3). Mean 700 mb winds averaged 19 m s^{-1} east of Cape Hatteras; this was twice the normal strength in that area. A second 700 mb wind maximum between the Canadian blocking High and the Polar Low dipped sharply southeastward over the northeastern United States into the strongly amplified western Atlantic trough.

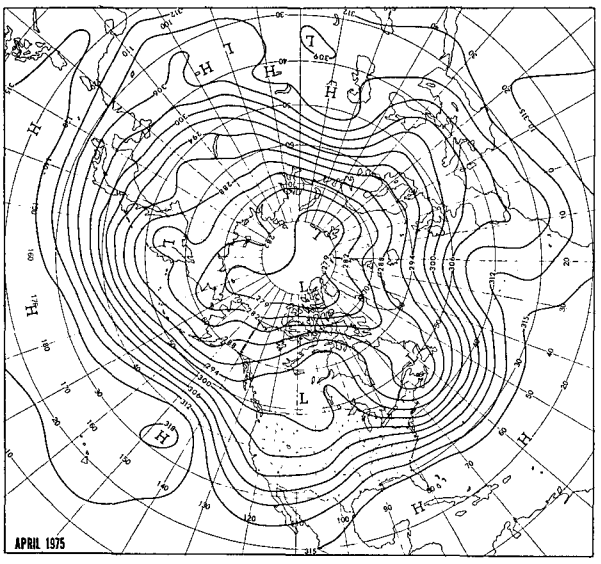


FIG. 1. Mean 700 mb height contours (dekameters) for April 1975.

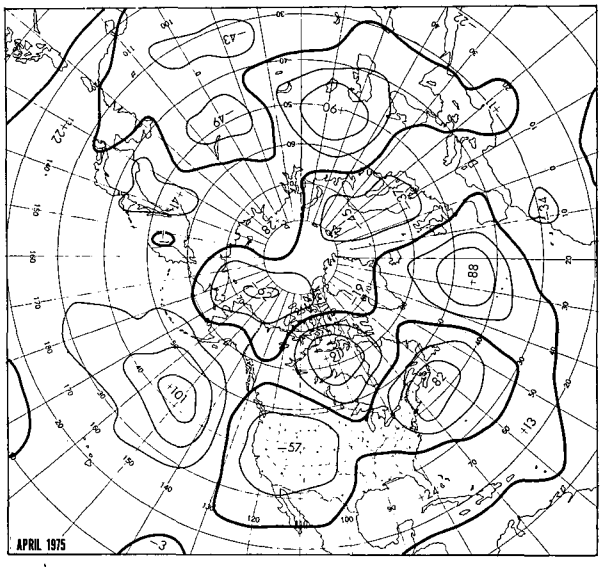


FIG. 2. Departure from normal of mean 700 mb height (m) for April 1975.

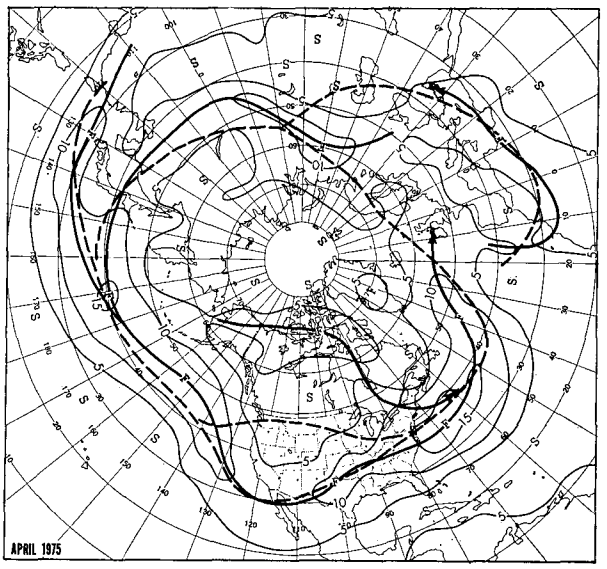


FIG. 3. Mean 700 mb geostrophic wind speed (m s^{-1}) for April 1975. Solid arrows are observed axes of maximum wind speed; dashed lines show the normal.

The block over Canada and amplified ridges over the eastern Atlantic and western Russia were associated with greater than normal mean thickness, while cold weather and frequent storminess prevailed in the southern branches of the westerlies over the United States and southern Europe (Figs. 3 and 4).

Circulation changes over the western part of the Northern Hemisphere during the past few months can be summarized by a consideration of the mid-latitude zonal wind speed. The April profile, with relatively

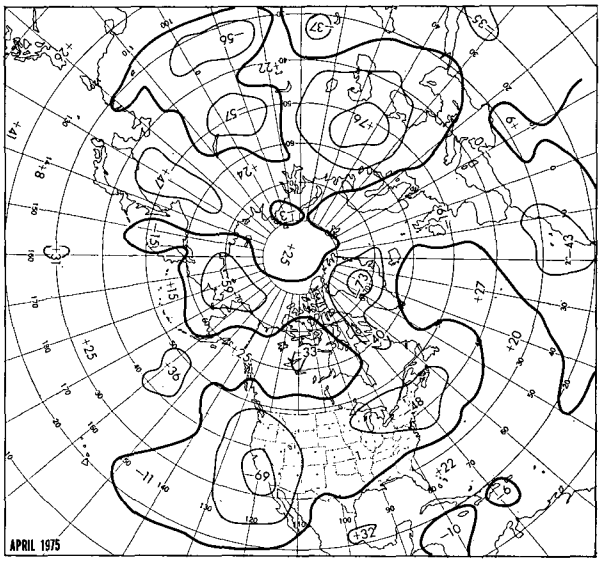
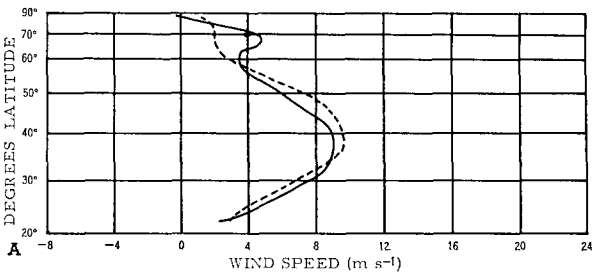


FIG. 4. Departure from normal of mean 1000 to 700 mb thickness (m) for April 1975.



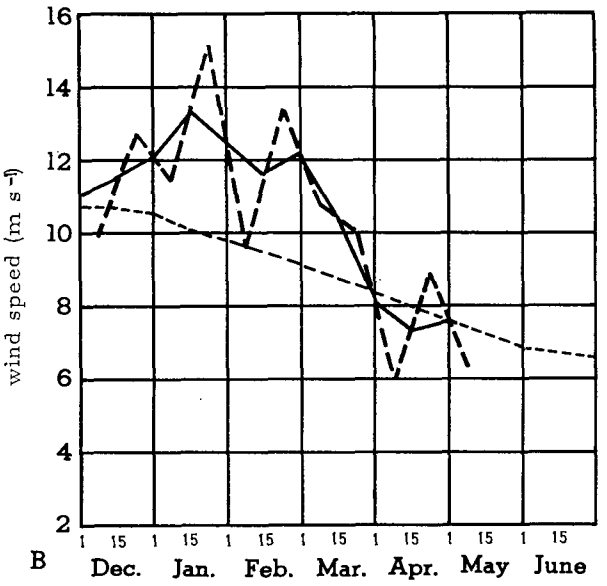


FIG. 5. (A) Mean 700 mb geostrophic zonal wind speed profile for the Western Hemisphere for April 1975 (solid line); dashed line is normal. (B) Mean 700 mb geostrophic mid-latitude zonal wind speed (35–55°N) for the Western Hemisphere for winter and spring 1974–1975. Solid line connects 30 d means, long dashes connect 15 d means, and short dashes are normal.

strong winds at low latitudes and weak winds at middle latitudes (Fig. 5A) contrasts markedly with the noticeably peaked mid-latitude 700 mb wind profile typical of most of the preceding winter (Fig. 4 of Wagner, 1975). The 700 mb mid-latitude zonal index dropped sharply from March to April, with most of the decrease occurring between the last half of March and the first half of April (Fig. 5B) in connection with a major storm over the northeastern United States during the first week of April.

In some respects, this series of developments may be considered as an index cycle similar to those discussed by Namias (1950), but with significant differences also. The years studied by Namias typically had the major decline in mid-latitude westerlies sometime during February with a recovery about 4 to 6 weeks later toward the end of March. In 1975, a significant decline in the mid-latitude westerlies to a weaker than normal value did not occur until early April and considerable

TABLE 1. Record and near-record monthly mean temperature observed during April 1975.

Station	Temperature (°F)	Anomaly (°F)	Remarks
Medford, Oreg.	45.1	−5.1	Coldest April
San Francisco, Calif.	50.6	−4.7	Coldest April since 1928
Reno, Nev.	39.9	−6.9	Coldest April since 1888
Ely, Nev.	34.1	−7.2	Coldest April
Flagstaff, Ariz.	36.2	−5.9	Coldest April
Yuma, Ariz.	63.5	−7.7	2nd coldest April
Phoenix, Ariz.	62.6	−5.1	3rd coldest April
Tucson, Ariz.	57.9	−7.6	2nd coldest April
Winslow, Ariz.	47.5	−6.2	Equaled coldest April
Wendover, Utah	43.8	−7.0	Coldest April
Milford, Utah	39.5	−7.7	Coldest April since 1922
Grand Junction, Colo.	46.4	−5.3	4th coldest April
Sheridan, Wyo.	36.5	−7.1	2nd coldest April
Pocatello, Ida.	39.9	−5.4	2nd coldest April since 1911
Great Falls, Mont.	30.9	−12.5	Coldest April
Helena, Mont.	32.9	−9.8	Coldest April
Billings, Mont.	37.1	−7.5	Coldest April
Glasgow, Mont.	35.9	−6.9	Coldest April since 1907
Williston, N. D.	34.7	−7.7	Coldest April since 1920 4th coldest on record
Duluth, Minn.	31.0	−7.6	2nd coldest April
Rockford, Ill.	42.5	−5.7	3rd coldest April
Detroit, Mich.	40.9	−6.8	Coldest April since 1907
Cleveland, Ohio	41.8	−6.5	Coldest April since 1926
Youngstown, Ohio	40.9	−6.8	Coldest April
Erie, Pa.	38.8	−6.0	Coldest April since 1874
Albany, N. Y.	40.7	−6.2	4th coldest April

recovery occurred during the latter half of the month (Fig. 5B).

2. Temperature

The depressed westerlies across the southern United States (Figs. 1 and 3) were associated with colder than normal weather over almost the entire Nation except for small areas along the Gulf Coast and southern Florida (Figs. 4 and 6). More than half the country averaged in excess of 4°F below normal, with some of the greatest negative anomalies over the West and the Northeast where the flow had a strong northerly component (Fig. 1). Many stations in these areas reported one of the coldest Aprils on record (Table 1).

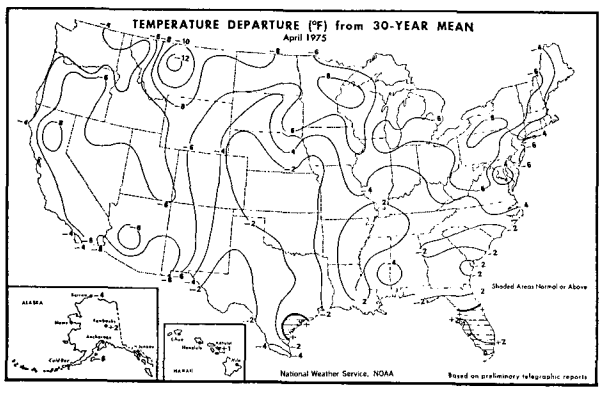


FIG. 6. Departure from normal of average surface temperature (°F) for April 1975 (from National Oceanic and Atmospheric Administration and Statistical Reporting Service, 1975).

The cold weather was noteworthy both for its strength and its persistence, particularly during the first half of the month. Cleveland, Ohio, reported a record 12 consecutive April days with minimum temperatures below freezing between the 3rd and the 14th. The extreme record cold at Great Falls, Mont., was 4.6°F colder than the previous record low April monthly mean temperature. Unusually deep snow cover of up to 2 ft during the first half of the month was connected with the cold weather over the northern Great Plains and northern Mississippi Valley.

3. Precipitation

The cold weather was associated with heavier than normal precipitation over much of the country (Fig. 7). However, portions of the southern and central Great Plains just east of the Rocky Mountains received less than half their normal amount, and southern Florida was still in the grip of a winter and spring drought, a frequent occurrence the past several years. West Palm Beach had its driest January–April period on record, and Ft. Myers had its driest October–April, with a total cumulative rainfall of only 5.34 inches, 10.40 inches less than normal.

An extensive area consisting mainly of the northern border states received from one and one-half to more

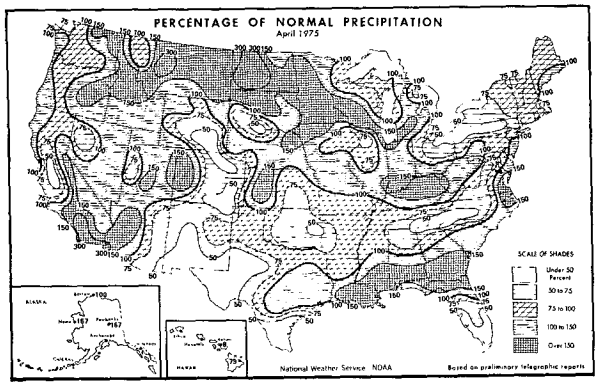


FIG. 7. Percentage of normal precipitation for April 1975 (from National Oceanic and Atmospheric Administration and Statistical Reporting Service, 1975).

than three times the normal April precipitation. Helena and Great Falls, Mont., reported their wettest April on record, with much of the precipitation falling as snow. Minneapolis, Minn., also had its wettest April, and Grand Junction, Colo., and Flint, Mich., recorded the snowiest April. There were a record 23 cloudy days at Huron, S. D., and 17 days with measurable precipitation there tied the record.

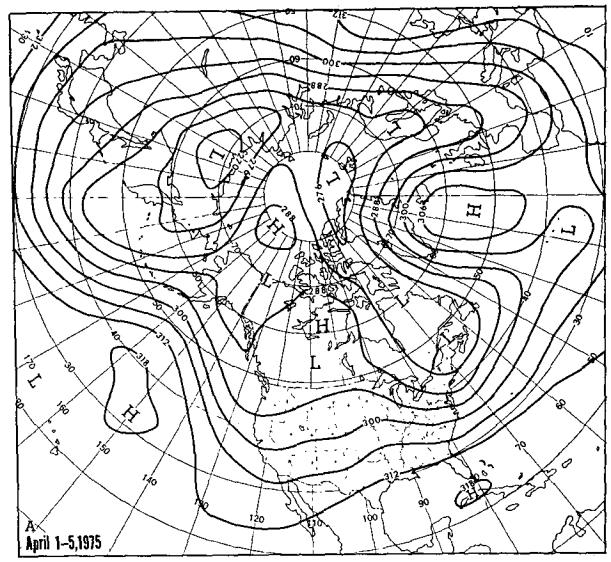
Flooding occurred at a number of widely separated places during the month. Areas along the Red River of the North, parts of central Michigan, the lower Ohio Valley, and streams from eastern Texas to northern Florida were all affected at various times during the month.

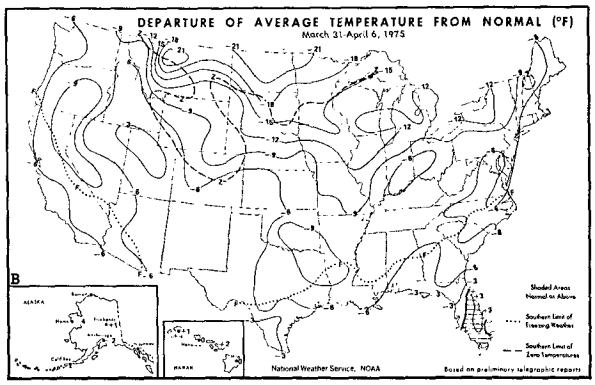
4. Weekly variability

a. March 31–April 6

The 700 mb circulation during the last week of March (Taubensee, 1975) persisted through the first week of April (Fig. 8A), although with a slight retrogression of most systems at middle latitudes. The circulation pattern flattened somewhat over the eastern Pacific and western United States, but continued to amplify from eastern North America to Europe. The area of blocking over Canada also became more pronounced. The circulation pattern was actually quite similar to the monthly pattern (Fig. 1).

As might be expected, the associated temperature anomaly pattern was also similar to the monthly pattern (Figs. 6 and 8B), only more extreme. Temperatures were below normal over the entire country except for southern Florida, and most of the north-central section averaged more than 9°F below normal for the week. Record cold for April and for so late in the season was observed over a wide area (Table 2). Portions of North Dakota and Montana averaged 21°F below normal during the first week of April, and the daily temperature at Great Falls, Mont., averaged 36°F and 35°F below normal on 5 and 6 April, respectively.





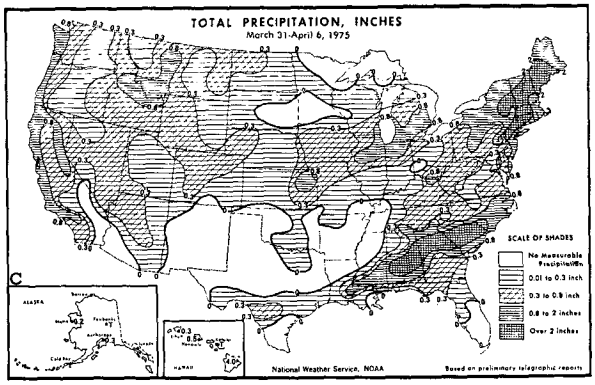


FIG. 8. (A) Mean 700 mb contours (dam) for 1–5 April, 1975; (B) departure from normal of average surface temperature (°F); and (C) total precipitation (inches) for week of 31 March–6 April, 1975 (from National Oceanic and Atmospheric Administration and Statistical Reporting Service, 1975).

Precipitation fell over most of the country, with heaviest amounts over the Southeast and New England in connection with one of the severest winter-type storms to affect the Northeast in several years (Fig.

TABLE 2. Record and near-record monthly and seasonal low temperatures observed during April 1975.

Station	Temperature (°F)	Date	Remarks
Bismark, N. D.	−12	1	Lowest so late in season
	−10	2	Lowest so late in season
	−7	3	Lowest so late in season
Williston, N. D.	−14	1	Lowest for month
	−15	2	Lowest for month
Winslow, Ariz.	16	2	Lowest for month
Grand Junction, Colo.	11	2	Lowest so late in season
Pueblo, Colo.	2	2	Equaled lowest for month
Denver, Colo.	−2	2	Lowest for month
Cheyenne, Wyo.	−8	2	Lowest so late in season
North Platte, Neb.	10	2	Lowest so late in season
	7	3	Lowest so late in season
Omaha, Neb.	5	3	Lowest so late in season
Concordia, Kans.	14	3	Equaled lowest so late
Wichita, Kans.	15	3	Equaled lowest so late
Topeka, Kans.	10	3	Lowest so late in season
Ft. Smith, Ark.	22	3	Lowest so late in season
Waco, Tex.	27	3	Lowest so late in season
Des Moines, Iowa	9	3	Lowest so late in season
Sioux City, Iowa	−2	3	Lowest for month
Huron, S. D.	−2	3	Lowest so late in season
Internation Falls, Minn.	−5	4	Lowest so late in season
Duluth, Minn.	−5	4	Lowest for month
St. Cloud, Minn.	−2	4	Lowest so late in season
Waterloo, Iowa	4	4	Lowest for month
Moline, Ill.	9	4	Lowest for month
Rockford, Ill.	9	4	Lowest for month
Chicago, Ill. (Midway)	16	4	Lowest for month
Seattle, Wash.	29	5	Lowest for month
Great Falls, Mont.	−6	6	Lowest for month
Havre, Mont.	−14	6	Lowest for month
Youngstown, Ohio	20	22	Lowest so late in season
Binghamton, N. Y.	22	22	Lowest so late in season
Bridgeport, Conn.	29	22	Lowest so late in season
Concord, N. H.	18	29	Lowest so late in season
Albuquerque, N. M.	25	19	Lowest so late in season
	27	30	Lowest so late in season
Alamosa, Colo.	10	30	Lowest so late in season

8C). A weak low moving from the southern Plains began to deepen rapidly as it crossed the Ohio Valley, producing near-record heavy snow from northern Illinois across lower Michigan, where 17 inches fell at Flint, Mich.

The storm continued to intensify crossing New York and southern New England the next day and produced record low April sea-level pressures at Hartford, Conn., Providence, R. I., Worcester, Mass., and Boston, Mass. The lowest value reported by a first-order station was 28.66 inches at Worcester, Mass. Deep snows fell just north of the center, with unofficial depths up to 56 inches reported in the higher elevations of Vermont. Mount Washington, N. H., received 5.85 inches precipitation within 3 days, although only 8 inches of snow was added to the depth on the ground owing to winds which ranged up to 140 mph.

Gale force winds were observed over a wide area from New England southward to Virginia over a 4-day period as the storm moved slowly eastward and maintained its intensity for an unusually long time. Even though the low filled somewhat during this period, a high centered over Hudson Bay increased in intensity, thereby maintaining the pressure gradient. Peak gusts in excess of 60 mph were observed at many localities from New York to southern Virginia. New York City's Central Park Observatory had a record April peak gust of 60 mph on the 3rd, and Trenton, N. J., had a record fastest mile of 47 mph on the 4th. Peak gusts of over 60 mph were observed both days in the Washington, D. C., area, with considerable damage to trees, power lines, and even buildings. In the Northern Virginia area, utilities suffered the most damage since Hurricane Hazel in October 1954. An interesting side effect of the storm was that most of the water was pushed out of the Potomac River into Chesapeake Bay and the Atlantic Ocean, resulting in the exposure of mudflats and the grounding of boats.

b. April 7–13

The main features of the planetary circulation affecting North America remained about stationary, although a complex cut-off low formed in the western United States (Fig. 9A). The weather continued colder than normal over the country, although with somewhat less extreme anomalies than the previous week in most places (Figs. 8B and 9B).

Precipitation was widespread over all but the Northeast and parts of the Northwest, where northerly flow components prevented much moisture from entering (Figs. 9A and 9C). Early in the week a severe spring blizzard hit the northern Rocky Mountains and northern Great Plains. Great Falls, Mont., had measurable snowfall on 9 of the first 10 days of April.

The strong blocking high over south-central Canada prevented the usual eastward motion of the storm system in the West, forcing the center northward into South Dakota, where it filled. Later in the week, cyclonic activity slipped eastward in the southern branch of the westerlies, producing heavy rains and flooding across southern Alabama and northern Florida (Fig. 9C).

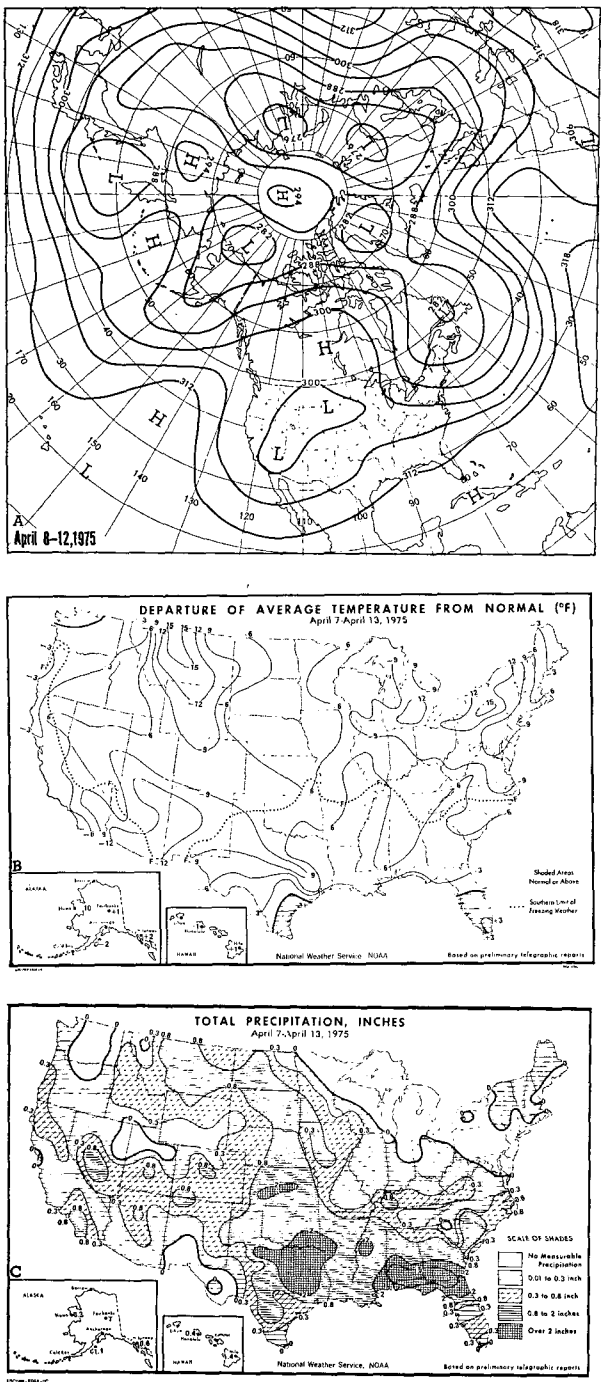


FIG. 9. Same as Fig. 8; (A) for 8–12 April 1975, (B) and (C) for week of 7–13 April 1975.

c. April 14–20

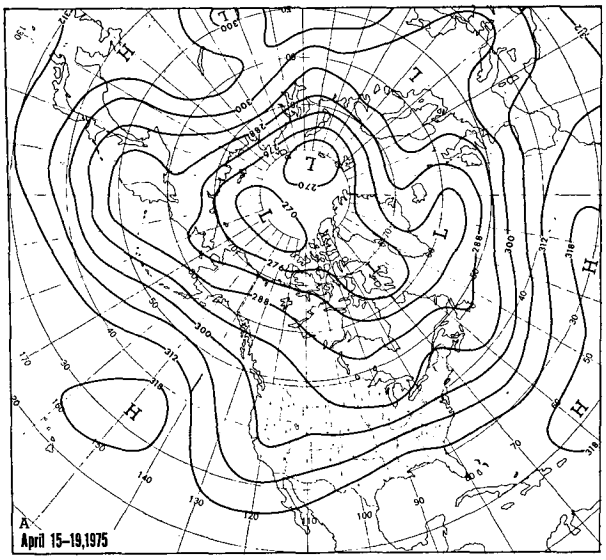
The circulation flattened markedly over the western part of the Northern Hemisphere although the ridge over the eastern Pacific and the trough in the Southwest retained considerable amplitude (Fig. 10A). The strongest westerlies continued across the southern United States, although the blocking in Canada weakened considerably.

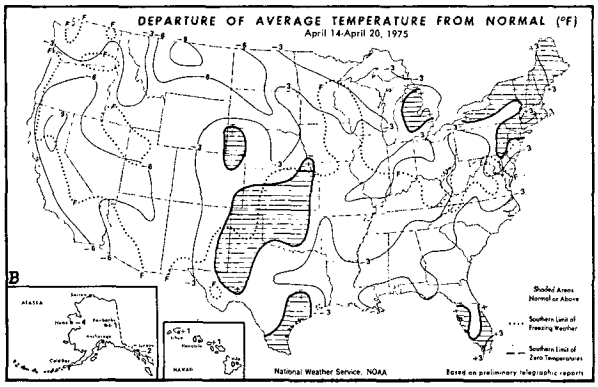
As a result, temperatures moderated over most of the United States, though still remaining below normal over much of the area (Fig. 10B). The weak ridge over New England was associated with slightly warmer than normal temperatures in that area. Greatest negative temperature anomalies were again located in areas with northerly flow components in the far West and over the northern Great Plains (Figs. 10A and 10B). Cooler than normal temperatures were also observed over the Southeast and were probably related to heavy precipitation in that area (Fig. 10C), even though a weak ridge occurred there (Fig. 10A).

Flooding continued over southern Alabama and Georgia, and also occurred from heavy showers and thunderstorms near the path of a deep storm which moved through the Great Lakes area toward the end of the week (Fig. 10C). Flint, Mich., reported 2.69 inches within a single calendar day on the 18th, a new April record. The worst floods since 1947 occurred in the Lansing area. Fortunately most of the snow from the storm early in the month had melted before the rains, but saturated ground contributed to a large runoff.

d. April 21–27

The westerlies strengthened with further flattening of the flow across the Pacific, although a mean trough remained near the West Coast of North America (Fig. 11A). Despite the redevelopment of blocking over central Canada, the westerlies weakened and moved northward over the eastern United States, while a sub-





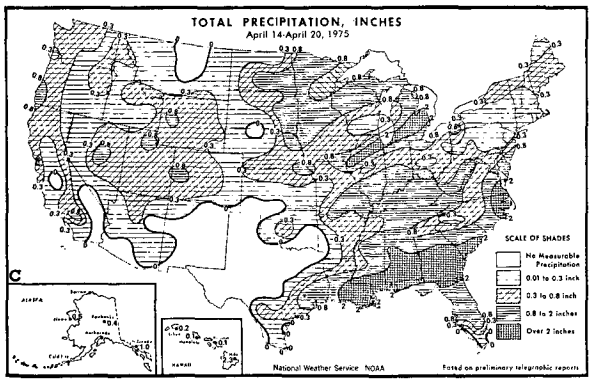
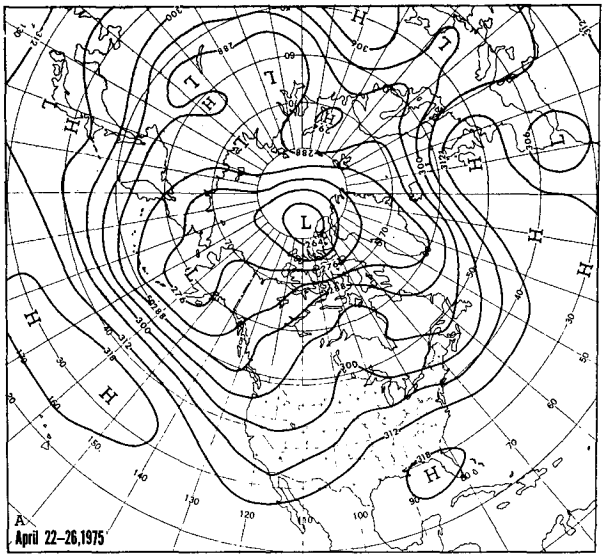


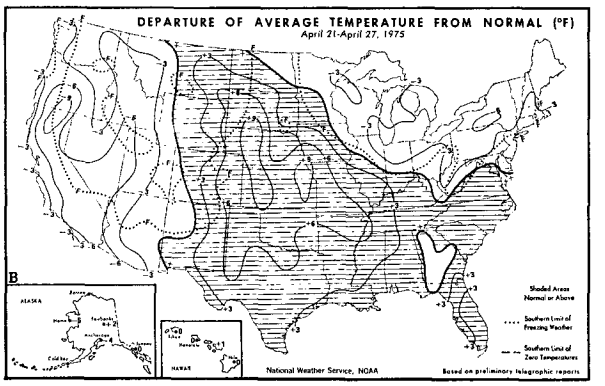
FIG. 10. Same as Fig. 8; (A) for 15–19 April 1975, (B) and (C) for week of 14–20 April 1975.

tropical high cell formed over the eastern Gulf of Mexico.

For the first time in more than a month, warmer than normal weather was observed over a substantial part of the United States (Fig. 11B). Temperatures in the central Great Plains were as much as 9°F above normal as tropical air moved as far north as South Dakota. The strong trough in the West and northwesterly flow into the Northeast from the renewed Canadian block kept these areas as much as 6°F colder than normal, however.

Precipitation was heavy in the vicinity of cyclonic activity in the West and also from the central Great Plains eastward to the Atlantic Coast (Fig. 11C).





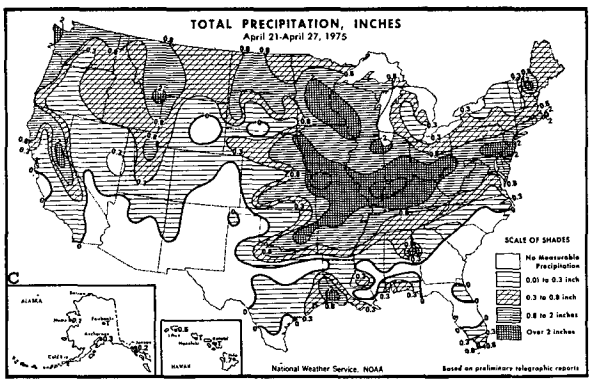


FIG. 11. Same as Fig. 8; (A) for 22–26 April 1975, (B) and (C) for week of 21–27 April 1975.

Tornadoes and severe thunderstorms occurred over Missouri and Illinois, and torrential rains produced severe flooding along streams in the lower Ohio Valley. Evansville, Ind., reported 5.04 inches of rainfall within a 48 h period on 23–25 April.

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