

WEATHER AND CIRCULATION OF MAY 1977

Record or Near-Record Warmth in the Midwest
for the Second Consecutive Month

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A deep mean 700 mb trough over the Bering Sea, surmounting a strong mid-latitude ridge, brought fast Pacific westerlies this month (Figs. 1-3). This drove a deep mean trough to the west coast of North America and a strong mean ridge to the interior where it merged with a retrograding ridge to the south. The high values of both height and thickness in central North America

(Figs. 2 and 4) were extreme—roughly equivalent to the July normals. To the south of this amplified ridge, a deep trough was observed over western Cuba. In the Pacific Northwest, the progressive trough replaced an April mean ridge (Wagner, 1977).

Over the Atlantic, as was the case in the Pacific, a deep mean trough occurred to the north of a moderately strong subtropical ridge and middle-latitude westerlies

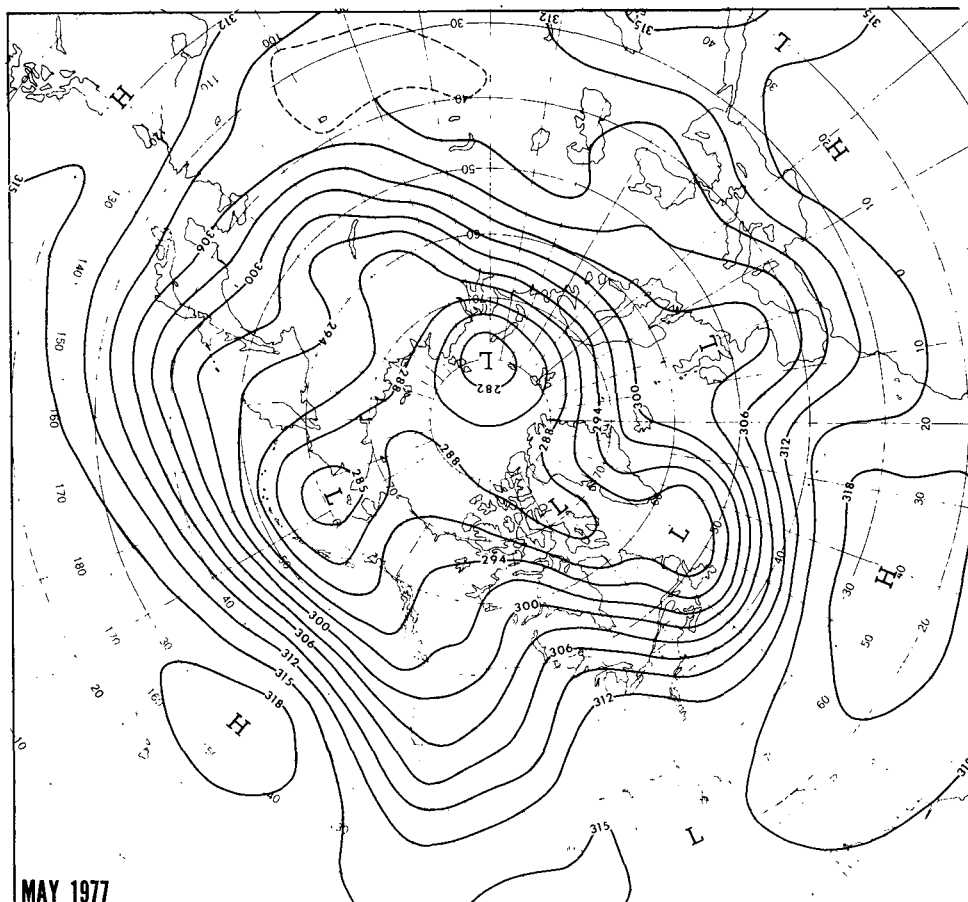


FIG. 1. Mean 700 mb height contours (dekameters) for May 1977.

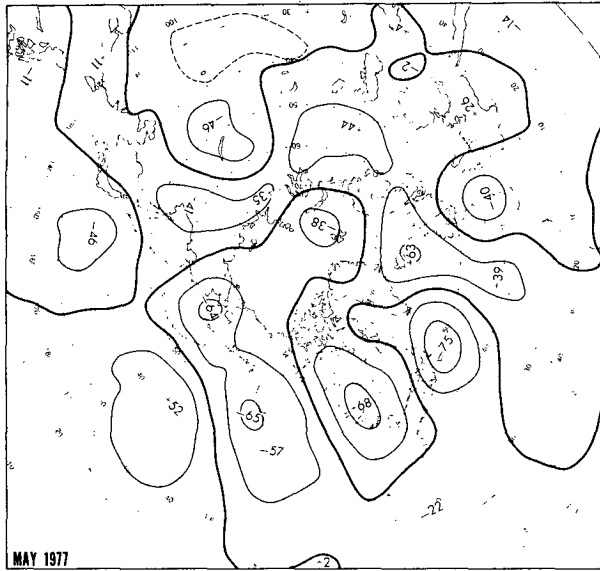


FIG. 2. Departure from normal of mean 700 mb height (m) for May 1977.

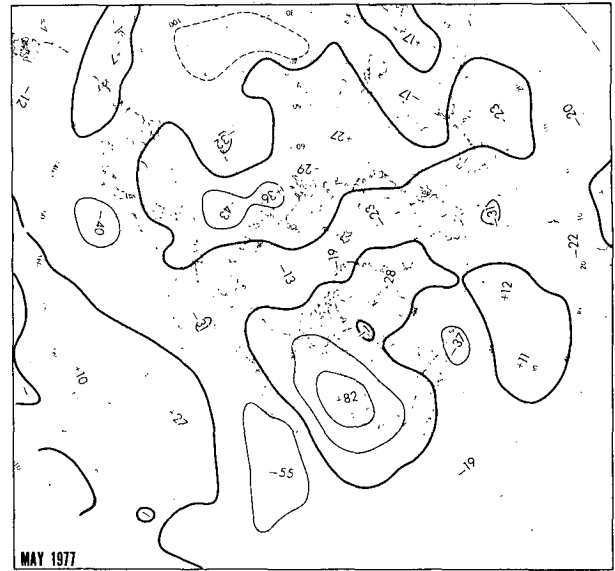


FIG. 4. Departure from normal of mean 1000-700 mb thickness (m) for May 1977.

substantially exceeded normal. The strong westerlies split over the eastern Atlantic with one branch moving north of an Icelandic blocking ridge and the other plunging southeastward to a deep mean trough over Spain. The mean ridge previously located over central Asia retrograded to near the Caspian Sea and a trough formed to its east—unusually far inland from the east coast of Asia for May. Between this trough and the deep trough east of Japan a mean ridge extended from Korea to the Arctic coast. The location and latitudinal extent of this mean ridge were also very unusual. Near

the Pole a deep mean low was observed at 70°E, somewhat west of its April position.

2. Temperature

Extensive cloudiness due to the West Coast trough, together with the advection of cool, maritime air brought below normal mean temperatures to regions west of the Continental Divide (Fig. 5). In some of this area, the cool temperatures of May followed near record warmth in April.

The strong mean ridge over the Midwest, together with an enhanced southerly flow to its west, produced above normal temperatures at most locations east of the Divide. Over much of the Midwest and along the eastern edge of the northern and central Great Plains, May mean temperatures were at or near record highs (Table 1) for the second consecutive month.

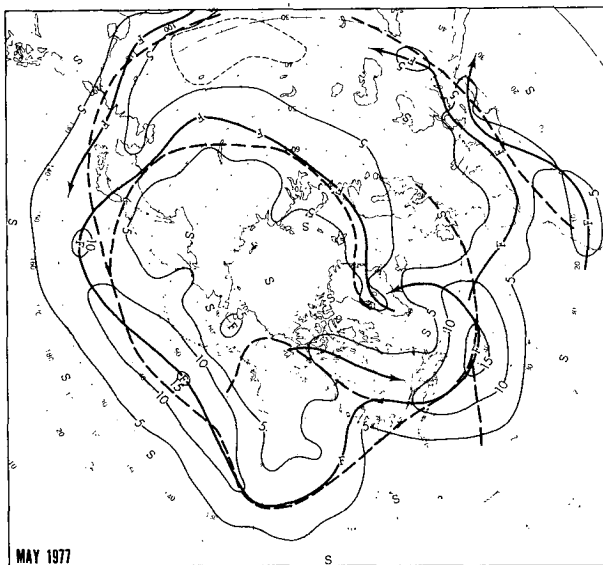


FIG. 3. Mean 700 mb geostrophic wind speed ($m s^{-1}$) for May 1977. Solid arrows indicate observed axes of maximum wind speed and dashed lines, the normals.

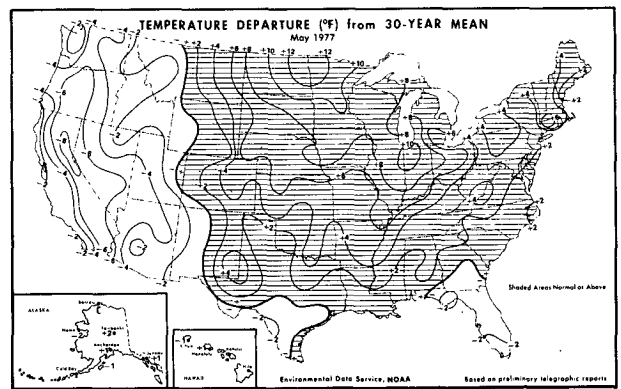


FIG. 5. Departure from normal of average surface air temperature (°F) for May 1977 (from National Oceanic and Atmospheric Administration and Statistical Reporting Service, 1977).

TABLE 1. Record and near-record monthly mean temperatures observed during May 1977.

Station	Temperature (°F)	Anomaly (°F)	Remarks
Fargo, N. D.	66.5	+11.9	Warmest May
South Bend, Ind.	68.7	+10.3	Warmest May
Rockford, Ill.	68.2	+ 9.4	Warmest May
Chicago, Ill.	69.3	+ 9.3	Warmest May
Grand Rapids, Mich.	65.8	+ 8.7	Warmest May
Ft. Wayne, Ind.	67.9	+ 8.3	Warmest May
Duluth, Minn.	57.4	+ 8.0	Warmest May
Moline, Ill.	68.9	+ 7.8	Warmest May
Muskegon, Mich.	67.3	+ 7.8	Warmest May
Milwaukee, Wisc.	61.3	+ 7.1	Warmest May
Minneapolis, Minn.	66.9	+ 9.8	2nd warmest May
Rochester, Minn.	64.5	+ 8.3	2nd warmest May
Evansville, Ind.	72.0	+ 6.3	2nd warmest May
Sioux Falls, S. D.	66.8	+ 9.1	3rd warmest May
Houghton Lake, Mich.	60.3	+ 7.5	3rd warmest May
Akron, Ohio	65.7	+ 7.9	4th warmest May

Temperatures averaged below normal in western Alaska near the deep mean trough and above normal in most of the remainder of the state. Temperatures were generally a little above normal in Hawaii under the influence of a strong subtropical high.

3. Precipitation

The deep West Coast mean trough brought greater than normal precipitation amounts to most locations west of the Divide (Fig. 6) providing some relief from the long-standing drought. It was the wettest May of record over much of the Great Basin and second wettest at Red Bluff, Calif. (Table 2).

Elsewhere, greater than normal precipitation totals were largely confined to the northern and central Great Plains and the upper Mississippi Valley—an area of relatively strong southwesterly flow between the western trough and the Midwest ridge. A few stations in this area reported record monthly totals (Table 2).

Storm systems, moving out of the central Great Plains, were steered almost due north about the strong Midwest ridge, rather than along the normal track through central Michigan. Most locations from central Texas to New England received only meager precipitation and some stations reported one of the driest Mays of record (Table 2).

Greater than normal precipitation in the East was largely confined to areas peripheral to the massive ridge. Rainfall at Miami, almost 10 inches more than normal, accompanied a relatively deep mean low to the southwest.

The deep low over the Bering Sea gave above normal precipitation to much of the Southern half of Alaska. A notable exception was the southeastern coast where the westerlies were weaker than normal. Precipitation

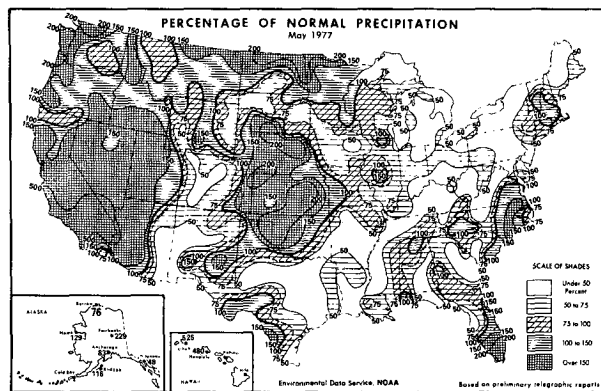


FIG. 6. Percentage of normal precipitation for May 1977 (from National Oceanic and Atmospheric Administration and Statistical Reporting Service, 1977).

also exceeded normal in much of Hawaii, located to the south of a strong subtropical ridge.

4. Weekly variability

a. 2-8 May

At the beginning of the month, the long waves over much of the Northern Hemisphere were already about in phase with what was to be the mean for the month (Figs. 7 and 1). Near North America this represented a phase reversal from conditions at the end of April due to progression.

The rainfall and cool air accompanying the western trough were a welcome relief from the dry, warm conditions of April. East of the Divide, a mean ridge with moderately strong westerlies brought warm temperatures and widespread precipitation. A rather deep low moving across the northern Great Plains at midweek was accompanied by an outbreak of 39 tornadoes in the Nation's midsection, with 14 occurring in Missouri.

TABLE 2. Record and near-record monthly precipitation totals observed in May 1977.

Station	Amount (Inches)	Anomaly (Inches)	Remarks
Salt Lake City, Utah	4.76	+3.27	Wettest May
Ely, Nev.	3.26	+2.26	Wettest May
Milford, Utah	1.89	+1.28	Wettest May
Red Bluff, Calif.	3.21	+2.31	2nd wettest May
Wichita, Kans.	8.85	+5.25	Wettest May
Fargo, N. D.	7.30	+5.01	Wettest May
Topeka, Kans.	7.83	+3.82	5th wettest May
Beckley, W. Va.	1.03	-2.75	Driest May
Jackson, Miss.	0.74	-3.64	2nd driest May
Akron, Ohio	1.05	-2.82	2nd driest May
Burlington, Vt.	0.29	-2.72	2nd driest May
Milwaukee, Wisc.	0.90	-1.98	3rd driest May (tied)
Abilene, Tex.	0.44	-3.22	4th driest May
Columbus, Ohio	0.95	-3.15	4th driest May (tied)
Ft. Wayne, Ind.	1.04	-2.81	Driest since 1925

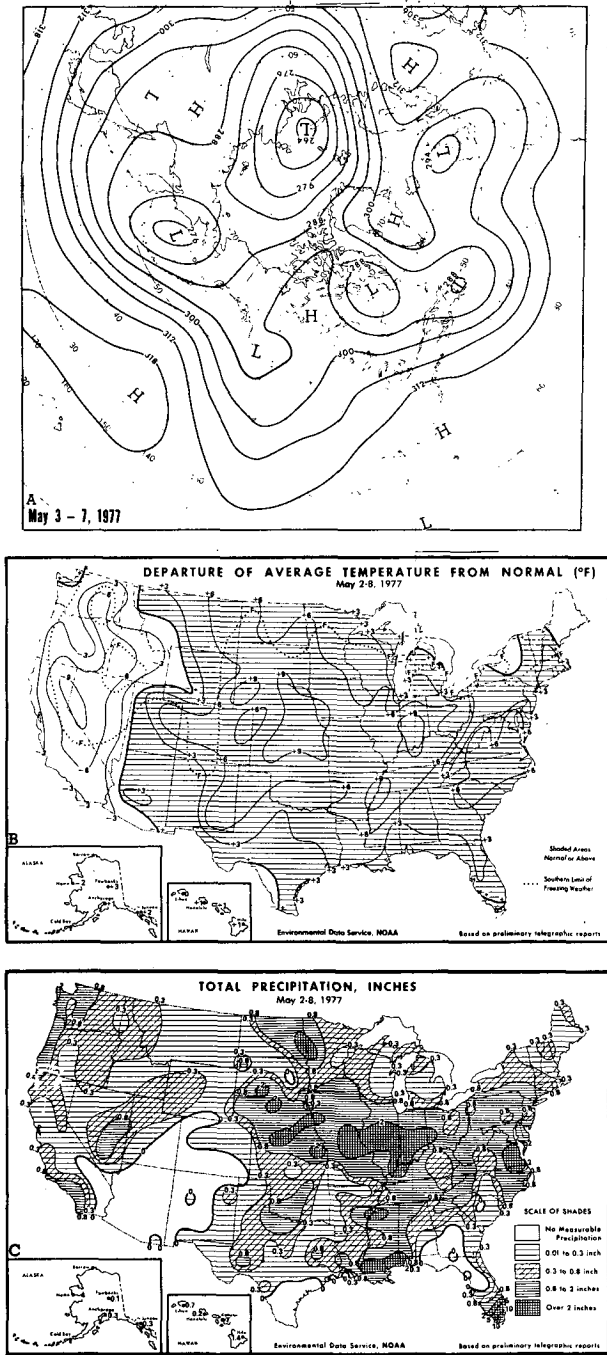


Fig. 7. (A) Mean 700 mb contours (dam) for 3-7 May 1977; (B) departure from normal of average surface air temperature (°F) and (C) total precipitation (inches) for week of 2-8 May 1977 (from National Oceanic and Atmospheric Administration and Statistical Reporting Service, 1977).

An upper trough, which had moved across the southern Rocky Mountains, deepened and became stationary over the central Gulf of Mexico early in the week, helping to produce heavy rain over southern Florida. Miami received 11.51 inches of rain on 4 May, about three-quarters of the monthly total.

b. 9-15 May

While the western mean trough remained deep and about stationary, the eastern ridge retrograded and strongly amplified this week (Fig. 8). This resulted in the retrogression and marked deepening of the western Atlantic trough.

The persistent western trough kept the weather cool and relatively wet west of the Divide. However,

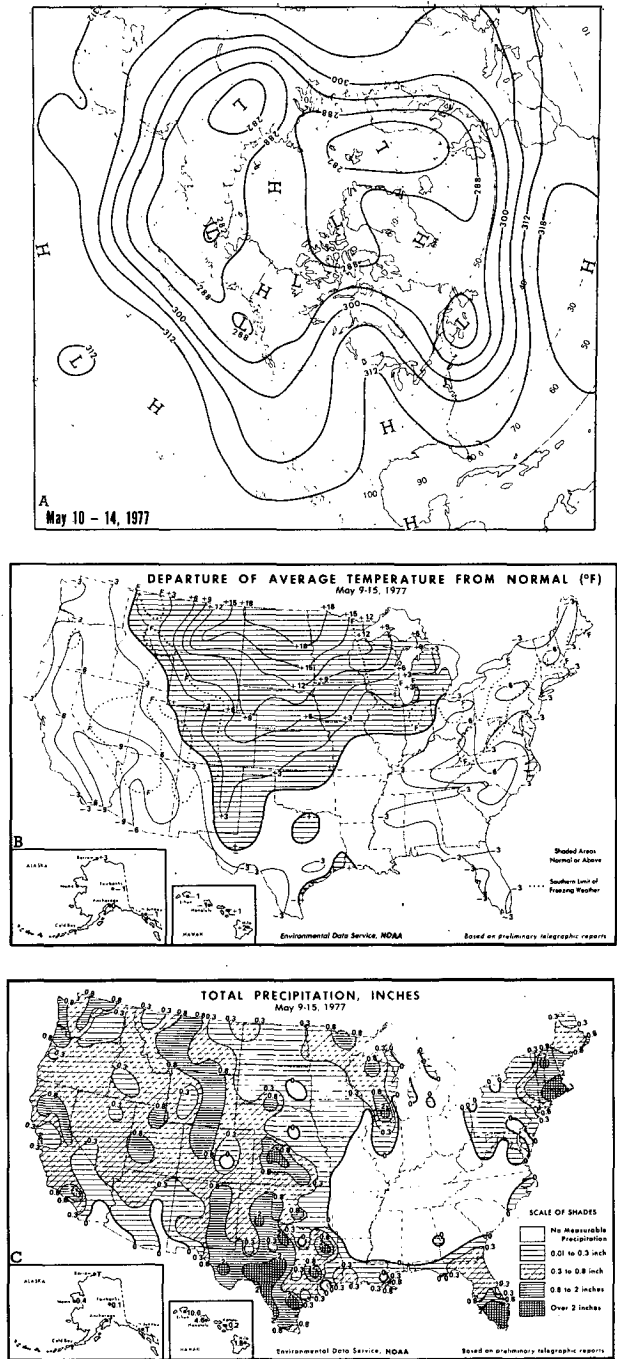


Fig. 8. As in Fig. 7 except for (A) 10-14 May 1977 and (B) and (C) week of 9-15 May 1977.

temperatures in the East and South—to the east of the retrograding ridge—dropped below normal and a large area between this ridge to the Atlantic trough received no precipitation at all. A deep upper low, dislodged from the Hudson Bay area toward the end of the previous week, was driven southeastward over New England early this week by the amplifying mid-continent ridge. It was accompanied at the surface by a

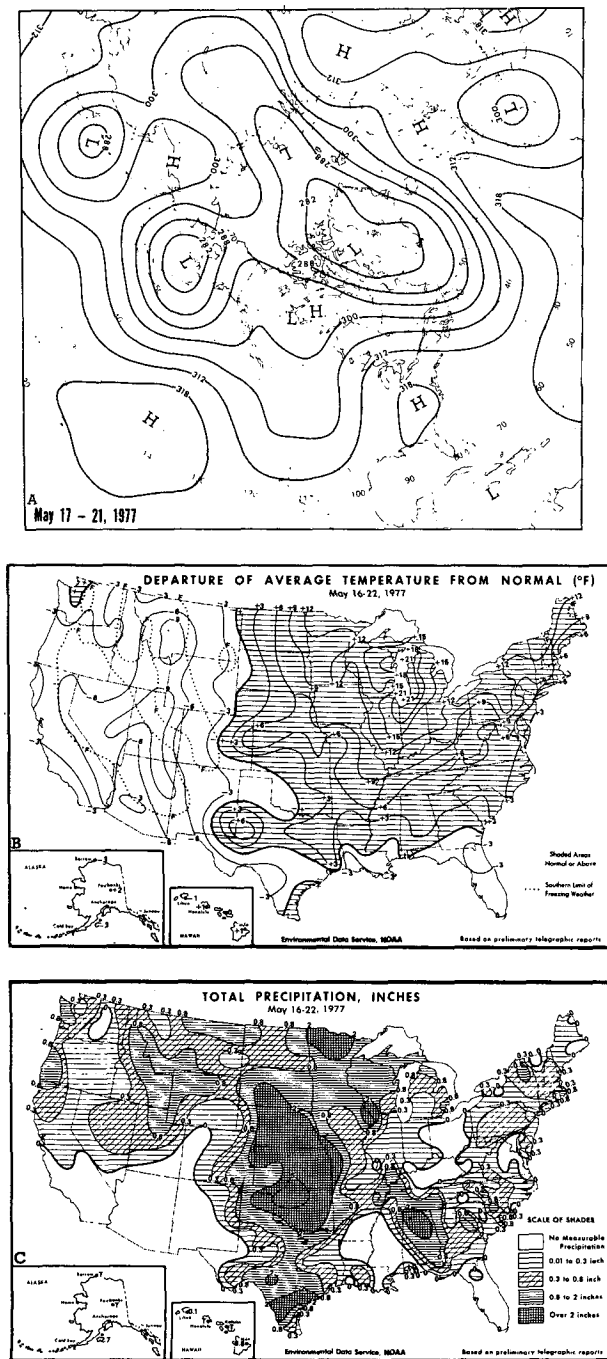


FIG. 9. As in Fig. 7 except for (A) 17-21 May 1977 and (B) and (C) week of 16-22 May 1977.

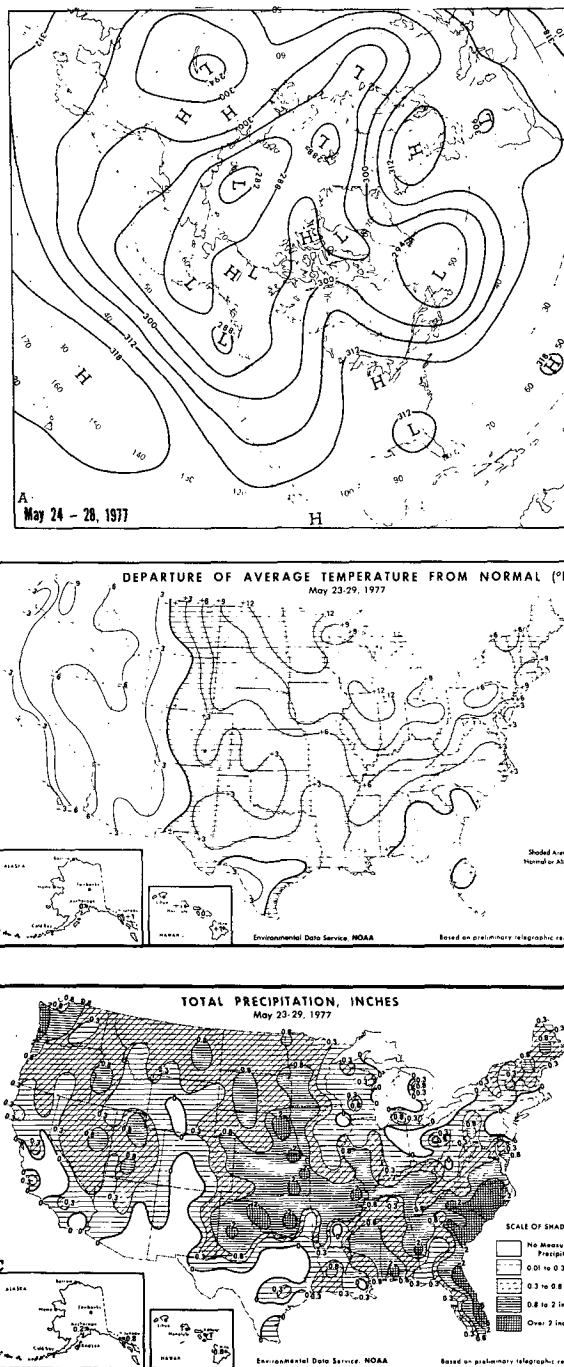


FIG. 10. As in Fig. 7 except for (A) 24-28 May 1977 and (B) and (C) week of 23-29 May 1977.

deepening low and a severe late season snowstorm in the Northeast. Worcester, Mass., which had only once before received a measurable amount (0.5 inch) of snow in May, set a new May monthly snowfall record of 12.7 inches on the 9th and 10th. Cold air plunging southward behind this storm dropped temperatures to the thirties in the Carolinas—coldest for so late in the season at several locations.

c. 16-22 May

Wave features in the vicinity of North America progressed and weakened this week (Fig. 9). This spread cool air across the Rocky Mountains and warm air to the East Coast. While record low temperatures for so late in the season were set in parts of the Southwest, record high temperatures for so early were established in portions of the Midwest and Northeast on several days. Mt. Washington reported a record high temperature for May, 66°F, on 22 May.

Precipitation was widespread, with heaviest amounts observed over the Great Plains to the east of the upper level mean trough. Precipitation remained quite light over much of the eastern third of the country.

d. 23-29 May

The trough-ridge couplet over the United States retrograded a bit this week and a mean low formed over Georgia, to the south of the mean ridge (Fig. 10). Below normal temperatures were generally confined to

areas west of the Divide, while warm air covered most of the country to the east. Lowest temperatures for so late in the season occurred in parts of the Northwest this week. While precipitation was widespread, greatest amounts occurred near the low in the Southeast and with slowly moving cold fronts in the central Great Plains. A low-pressure area moved on a rather unusual path—westward from Lake Winnipeg—on 28 and 29 May.

Ava, first tropical storm of the season in the east Pacific, formed south of Baja California on 27 May. After moving westward and then northward, Ava dissipated near 18°N, 108°W on 30 May.

REFERENCES

- National Oceanic and Atmospheric Administration, U. S. Department of Commerce, and Statistical Reporting Service, U. S. Department of Agriculture, 1977: *Weekly Weather and Crop Bulletin*, 64, Nos. 19-23 (10, 17 and 24 May, and 1 and 8 June 1977).
- Wagner, A. James, 1977: Weather and Circulation of April 1977—generally mild and wet but continued drought in the west. *Mon. Wea. Rev.*, **105**, 933-939.