

WEATHER AND CIRCULATION OF NOVEMBER 1976

Record Cold over the South and Midwest for the Second Consecutive Month

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As was the case in October, the November mean 700 mb circulation had deep troughs over the central Pacific and near the east coasts of both Asia and North America, along with strong mean ridges over the west Pacific and near the west coast of North America (Figs. 1 and 2). Strong baroclinic zones off the east coasts of Asia and North America (Fig. 3) contributed to the development of intense storms and strong wind maxima to their east (Fig. 4).

Over most of the remainder of the mid-latitude Northern Hemisphere, the previous highly amplified wave pattern reverted to a more westerly regime with no latitudinally extensive troughs or ridges. This drove relatively warm air across northeastern Europe and northwestern Asia replacing a cold October regime. To the south of the flattening flow pattern a deep trough persisted over the western Mediterranean, while to the north the polar low intensified.

The subtropical jet stream at 200 mb continued strong across northern Mexico and the southern United

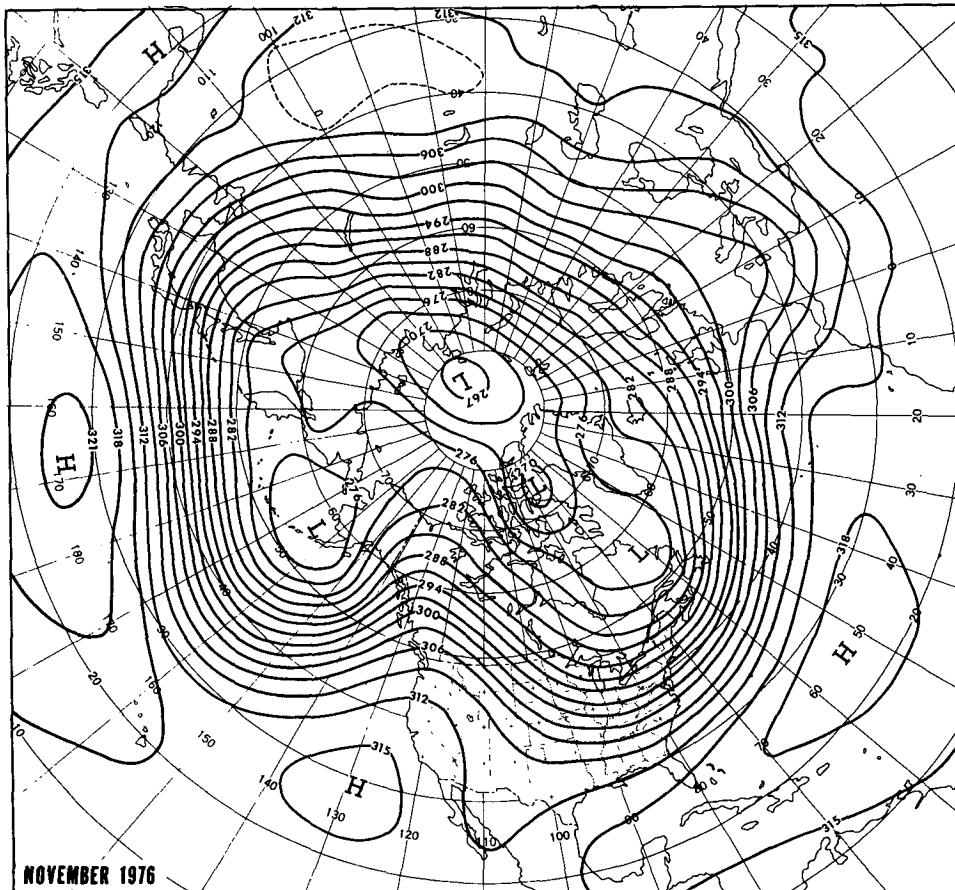


FIG. 1. Mean 700 mb height contours (dam) for November 1976.

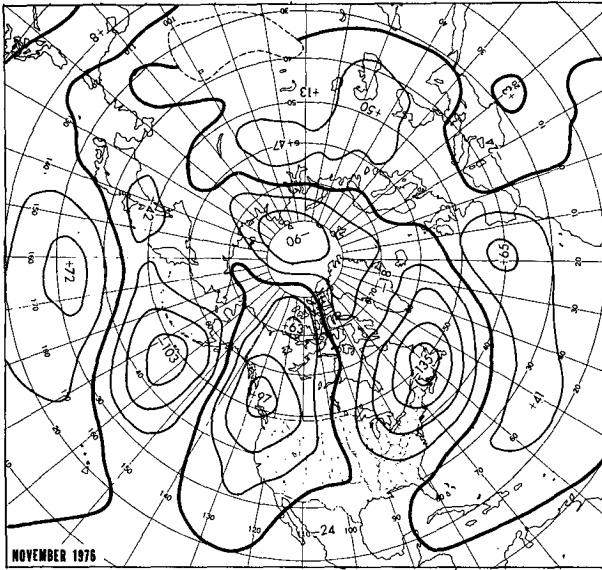


FIG. 2. Departure from normal of mean 700 mb height (m) for November 1976.

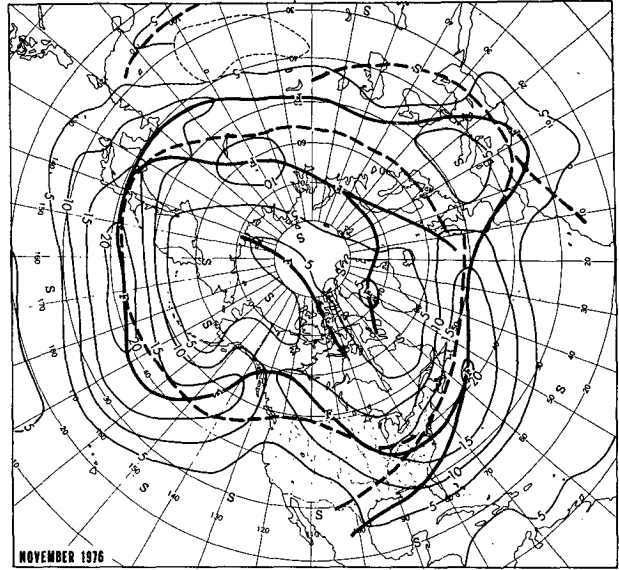


FIG. 4. Mean 700 mb geostrophic wind speed ($m s^{-1}$) for November 1976. Solid arrows indicate observed axes of maximum wind speed and dashed lines, the normal.

States but moved south of its October position (westward from Texas) as the western ridge strengthened.

2. Temperature

As would be expected from the persistent flow pattern over North America, November's mean temperature anomaly pattern (Fig. 5) was quite similar to that of October (Wagner, 1977). The strong ridge over western North America combined with a deep east coast trough to advect cold air to most areas east of the

Continental Divide. For the second consecutive month record low mean temperatures were observed in most of the South and Midwest (Table 1). At a number of locations the previous coldest November occurred in 1880. Warmer than normal mean temperatures were mostly confined west of the Divide near the strong 700 mb ridge.

November mean temperatures were generally well above normal over Alaska where the southerly flow was relatively strong (Figs. 1 and 2). The deep mean trough over the central Pacific brought below normal temperatures to most of the Hawaiian Islands.

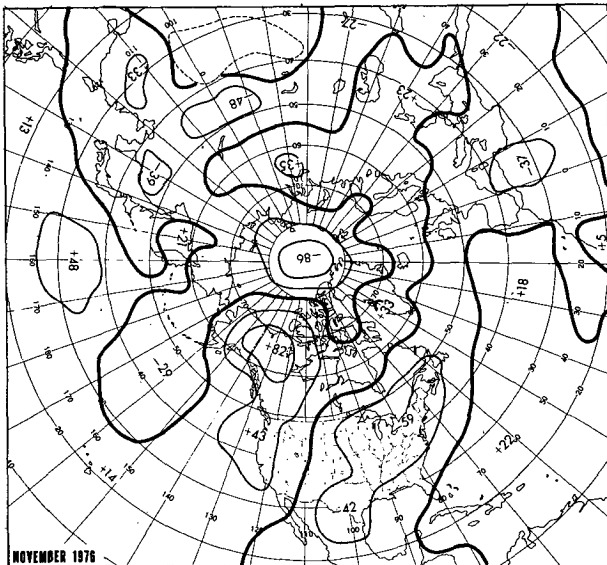


FIG. 3. Departure from normal of mean 1000-700 mb thickness (m) for November 1976.

3. Precipitation

The broad expanse of northwesterly mean flow between the west coast ridge and the east coast trough

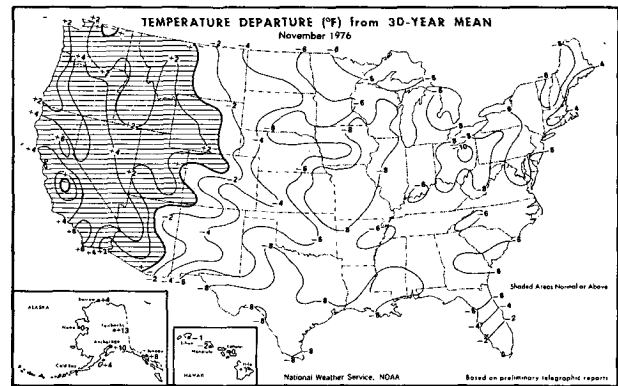


FIG. 5. Departure from normal of average surface air temperature ($^{\circ}F$) for November 1976 (from National Oceanic and Atmospheric Administration and Statistical Reporting Service, 1976).

TABLE 1. Record and near-record monthly mean temperatures observed during November 1976.

Station	Temperature (°F)	Anomaly (°F)	Remarks
El Paso, Tex.	44.8	-6.8	Coldest November
Austin, Tex.	51.6	-7.5	Coldest November
Corpus Christi, Tex.	57.3	-7.6	Coldest November
Brownsville, Tex.	60.8	-7.3	Coldest November
Port Arthur, Tex.	52.5	-7.7	Coldest November
New Orleans, La.	53.0	-8.3	Coldest November
Shreveport, La.	49.3	-6.9	3rd coldest November
Fort Smith, Ark.	42.0	-8.4	Coldest November
Jackson, Miss.	47.2	-8.1	Coldest November
Meridian, Miss.	46.4	-7.8	Coldest November
Montgomery, Ala.	48.0	-7.0	Coldest November
Tallahassee, Fla.	53.3	-5.6	2nd coldest November
West Columbia, S. C.	47.8	-6.0	Coldest November
Charlotte, N. C.	44.1	-6.9	Coldest November
Raleigh, N. C.	42.5	-7.5	Coldest November
Greensboro, N. C.	41.8	-6.5	Coldest November
Lynchburg, Va.	40.8	-6.2	Coldest November (tied)
Nashville, Tenn.	40.9	-7.5	Coldest November
Louisville, Ky.	39.5	-5.5	4th coldest November
Columbia, Mo.	34.8	-9.1	Coldest November
St. Joseph, Mo.	34.5	-7.8	Coldest November
Springfield, Mo.	38.2	-7.3	2nd coldest November
Tulsa, Okl.	43.1	-6.3	Coldest November
Topeka, Kan.	35.4	-7.5	Coldest November
Waterloo, Iowa	26.6	-8.5	Coldest November
Moline, Ill.	30.1	-9.1	Coldest November
Rockford, Ill.	28.1	-9.5	Coldest November
Cairo, Ill.	40.6	-7.7	2nd coldest November
Chicago, Ill.	32.8	-7.6	Coldest November*
Evansville, Ind.	38.7	-6.2	Coldest November
Fort Wayne, Ind.	33.5	-6.7	Coldest November
Dayton, Ohio	35.2	-6.6	Coldest November
Cincinnati, Ohio	34.9	-8.9	Coldest November
Youngstown, Ohio	32.4	-7.9	Coldest November
Akron, Ohio	33.2	-7.5	Coldest November
Madison, Wisc.	28.1	-6.6	4th coldest November
Milwaukee, Wisc.	29.5	-7.0	2nd coldest November
Detroit, Mich.	33.5	-6.5	Coldest November*
Houghton Lake, Mich.	28.2	-6.2	2nd coldest November
Muskegon, Mich.	33.1	-6.1	2nd coldest November
Erie, Pa.	34.2	-5.9	Coldest November
Trenton, N. J.	40.8	-5.5	Coldest November**
Worcester, Mass.	34.6	-5.3	2nd coldest November
Concord, N. H.	31.7	-6.3	4th coldest November
Buffalo, N. Y.	34.1	-5.7	Coldest November*

* Since 1880.
** Since 1917.

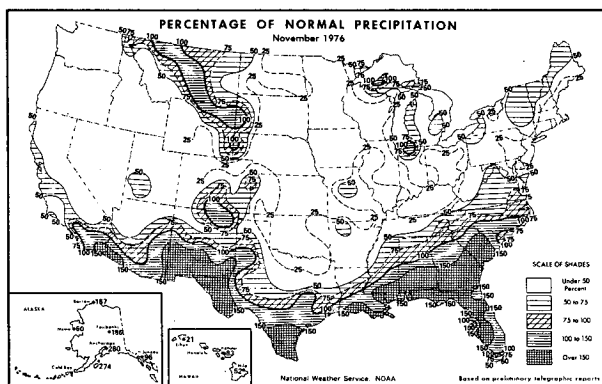


FIG. 6. Percentage of normal precipitation for November 1976 (from National Oceanic and Atmospheric Administration and Statistical Reporting Service, 1976).

kept precipitation below normal over most of the country this month (Fig. 6). It was one of the driest Novembers of record over much of the northeastern quarter of the country and in parts of the Northwest (Table 2). Greater than normal precipitation was concentrated along the southern border of the United States where a series of deep upper troughs traversed the country. It was the third wettest November of record at Tallahassee, the snowiest month of record at El Paso (12.7 inches) and the snowiest November at Buffalo (31.3 inches). The latter came mainly from a lake effect snowstorm on 29-30 November.

Strong southerly flow east of the deep Aleutian low brought heavy precipitation to Alaska's south coast. It was the wettest month of record at Kodiak and Valdez, and the wettest November at Yakutat (Table 2). Elsewhere in Alaska, both normal November precipitation and departures this month were generally small. Hawaii, located west of the deep central Pacific trough, was relatively dry this month.

4. Variability within the month

a. 1-7 November

The amplified wave pattern, characteristic of the month as a whole, was in existence this first week of the month (Fig. 7). Temperatures averaged below normal over the eastern half of the country as cold air masses were driven southward by the enhanced northwesterly flow over central Canada. Lowest temperatures

TABLE 2. Record and near-record precipitation totals observed in November 1976.

Station	Amount (inches)	Anomaly (inches)	Remarks
Olympia, Wash.	1.37	-6.61	Driest November
Stampede Pass, Wash.	4.94	-7.52	2nd driest November
Pendleton, Ore.	0.19	-1.31	3rd driest November
Pocatello, Id.	0.01	-1.04	Driest November
Salt Lake City, Utah	0.03	-1.28	4th driest November
Aberdeen, N. D.	0.01	-0.61	Driest November
Duluth, Minn.	0.19	-1.54	4th driest November
Rochester, Minn.	0.11	-0.91	4th driest November
Madison, Wisc.	0.11	-1.76	2nd driest November
Houghton, Lake, Mich.	0.75	-1.78	2nd driest November
Omaha, Neb.	0.03	-1.08	Driest November (tied)
Topeka, Kan.	0.04	-1.22	3rd driest November
Waterloo, Iowa	0.06	-1.44	2nd driest November
Des Moines, Iowa	0.10	-1.32	4th driest November
Springfield, Mo.	0.23	-2.11	2nd driest November
Rockford, Ill.	0.38	-1.99	2nd driest November
Akron, Ohio	0.62	-1.88	3rd driest November
Youngstown, Ohio	0.94	-2.03	Driest November
Trenton, N. J.	0.31	-2.94	Driest November
N. Y. (Central Park) N. Y.	0.34	-3.42	Driest November
Bridgeport, Conn.	0.36	-3.47	Driest November
Worcester, Mass.	0.67	-3.99	2nd driest November
Concord, N. H.	0.75	-3.21	2nd driest November
Tallahassee, Fla.	10.44	+7.63	3rd Wettest November
Kodiak, Alaska	14.79	+9.38	Wettest Month
Valdez, Alaska	20.59	+14.92	Wettest Month
Yakutat, Alaska	42.73	+27.93	2nd wettest November

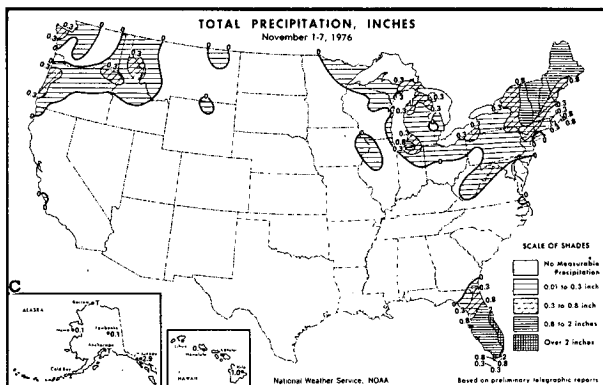
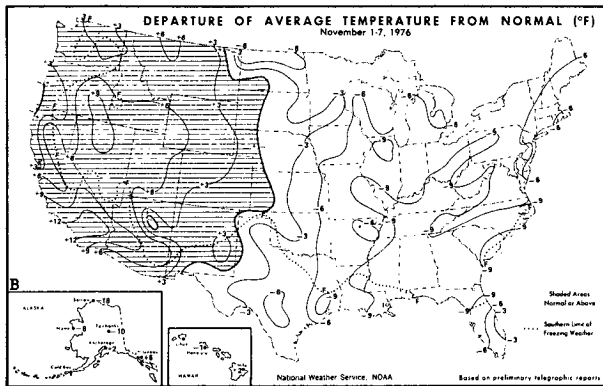
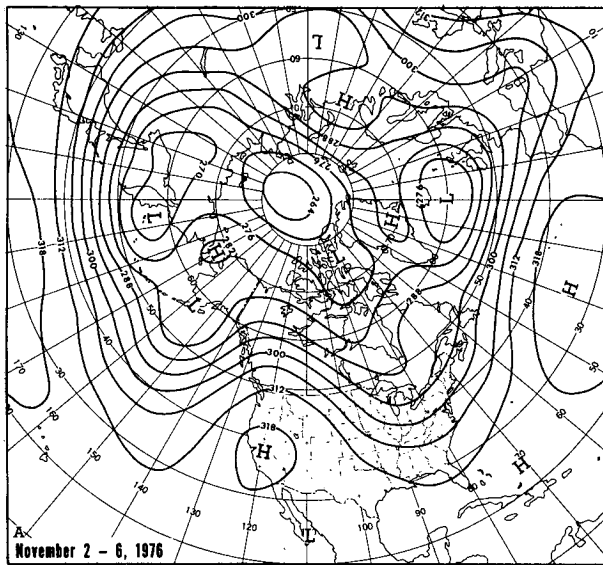


FIG. 7. (A) Mean 700 mb contours (dam) for 2-6 November, 1976, (B) departure from normal of average surface air temperature ($^{\circ}$ F) and (C) total precipitation (inches) for week of 1-7 November 1976 (from National Oceanic and Atmospheric Administration and Statistical Reporting Service, 1976).

for so early in the season were observed at a few stations in the Southeast on 6 November.

Temperatures averaged above normal near the western 700 mb ridge as well as over western portions of the Great Plains. Relatively fast westerlies across

southwest Canada contributed to the Great Plains warmth. Highest temperatures for so late in the season were observed at several stations in the Great Basin this week and a record high for the month (85° F) was observed at Las Vegas, Nev., on 3 November.

Precipitation was sparse and generally light except over southern Florida, which was affected by a deep trough aloft that crossed the Gulf of Mexico.

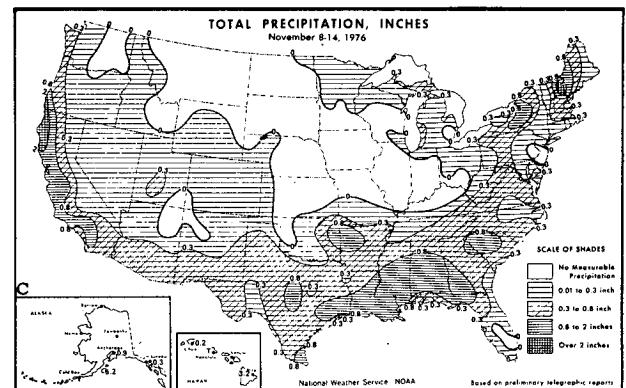
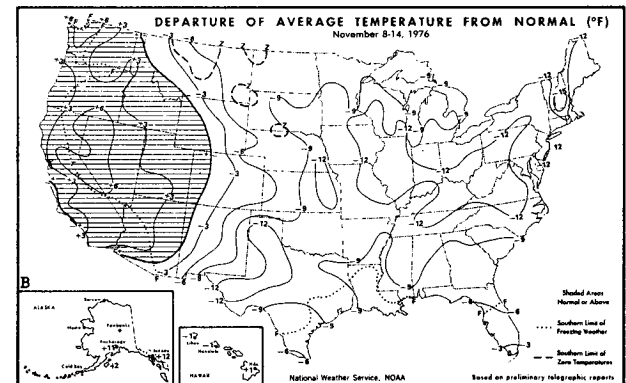
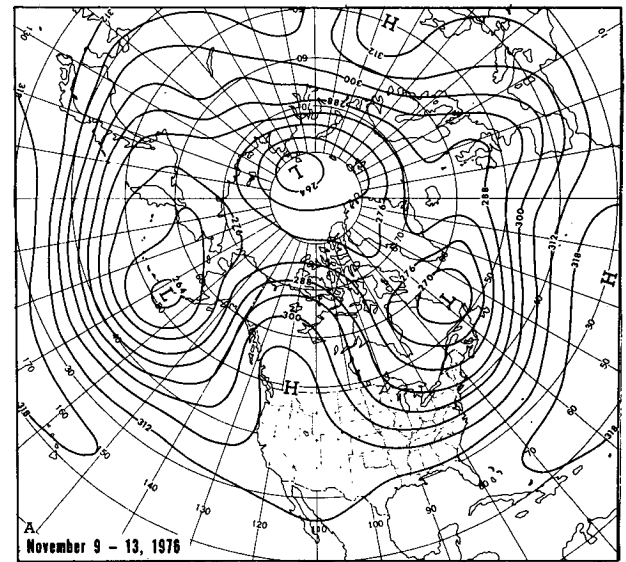


FIG. 8. As in Fig. 7 except for (A) 9-13 November 1976 and (B) and (C) week of 8-14 November 1976.

Typhoon Louise, east of the Phillipines on 1 November, moved northward and became a frontal low southeast of Japan on 8 November.

b. 8-14 November

The wave pattern over North America amplified this week increasing both the extent and the extremity

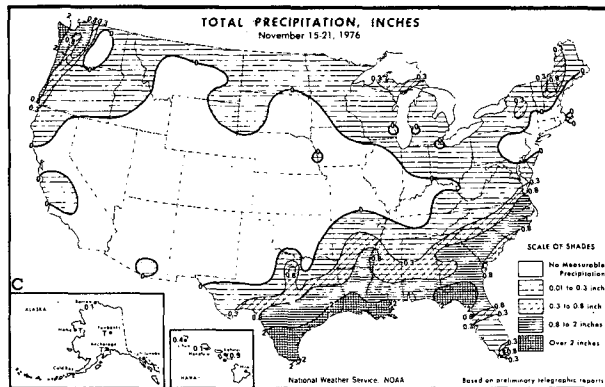
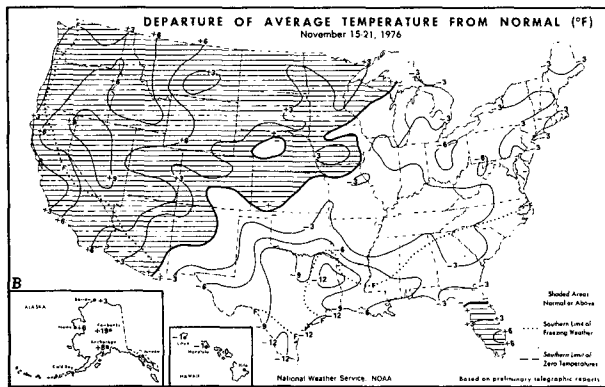
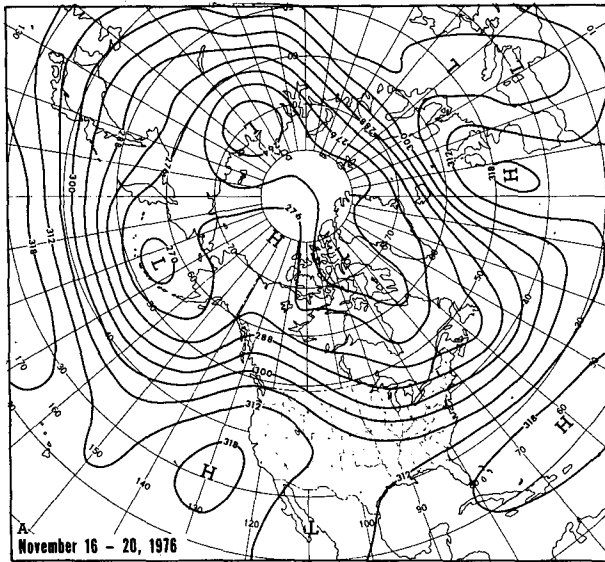


FIG. 9. As in Fig. 7 except for (A) 16-20 November 1976 and (B) and (C) week of 15-21 November 1976.

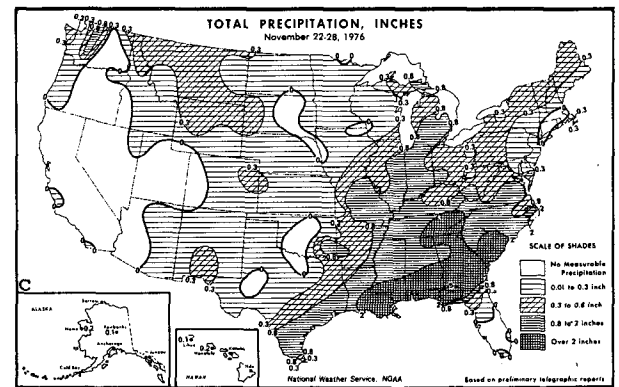
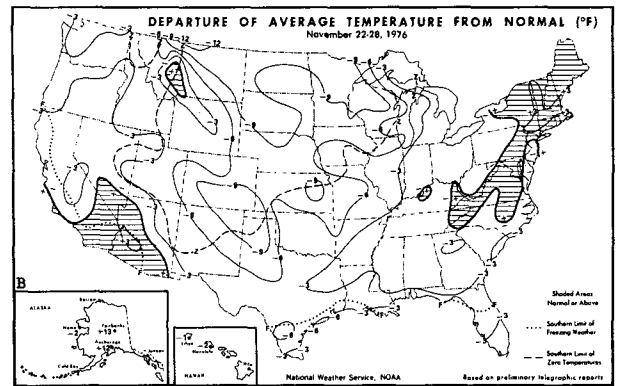
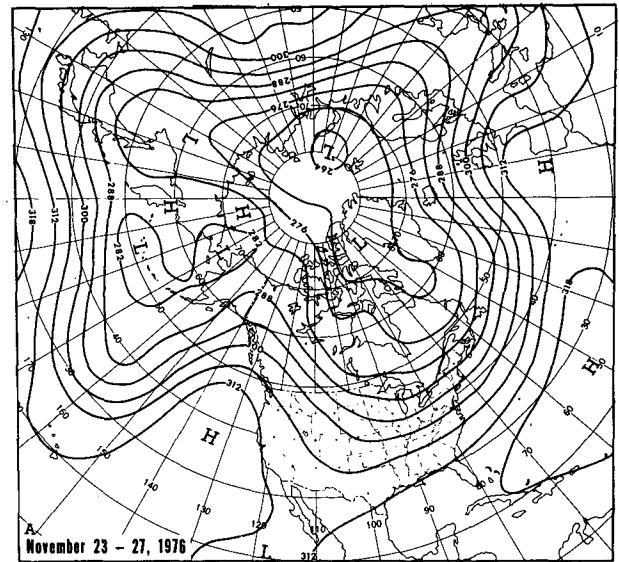


FIG. 10. As in Fig. 7 except for (A) 23-27 November 1976 and (B) and (C) week of 22-28 November 1976.

of the cold air east of the Divide (Fig. 8). Lowest temperatures for so early in the season were recorded throughout most of the middle and south Atlantic Coast States and at a few locations in northern Texas.

TABLE 3. Record monthly temperature extremes observed during November 1976.

Station	Temperature (°F)	Date	Remarks
Las Vegas, Nev.	85	3	Highest for month (equalled)
Clayton, N. M.	-10	27	Lowest for month
Grand Island, Neb.	-11	28	Lowest for month
Grand Junction, Colo.	-2	28	Lowest for month
Amarillo, Tex.	0	28	Lowest for month
Kansas City, Mo.	1	28	Lowest for month
St. Joseph, Mo.	-2	29	Lowest for month
Fort Smith, Ark.	8	29	Lowest for month
Shreveport, La.	16	29	Lowest for month
Austin, Tex.	20	29	Lowest for month
Meridian, Miss.	16	29	Lowest for month
Alexandria, La.	18	30	Lowest for month
Baton Rouge, La.	21	30	Lowest for month
Port Arthur, Tex.	22	30	Lowest for month

As the western upper level high moved northward, increasing westerlies to its south brought a deep, precipitation producing upper trough across the southern tier of states.

Tropical Storm Marge formed on 8 November near the Philippines; it was downgraded near southern Japan on 11 November.

c. 15–21 November

The wave pattern flattened over North America this week, spreading above normal temperatures across the mountains to the upper Great Lakes, while cold weather continued in the south and east (Fig. 9). Highest temperatures for so late in the season were observed in much of the Pacific Northwest early in the week.

The strengthening ridge off the west coast drove a deepening trough southward over Mexico where it persisted throughout most of the week. Precipitation occurred across the South in connection with this trough and the final stages of an earlier short wave.

Increasing westerlies along the northwest coast made this the wettest week of the month there.

A frontless surface trough, moving off the middle and north Atlantic coast, deepened unusually on 18 November. It was accompanied by a deep upper trough with cold air aloft and 500 mb wind speeds up to 67 m s^{-1} (130 kt) from the northwest to the west of the upper trough.

d. 22–28 November

The wave train over North America amplified and retrograded this week (Fig. 10). With the mean ridge off the West Coast and the mean trough extending from Texas to the Great Lakes, weekly mean temperatures dropped below normal in the West and rose above normal in the Northeast—both for the first time this month. Lowest temperatures for so early in the season were observed on 27–30 November in portions of the central and southern Great Plains and the Gulf Coast region and new record lows for the month were reported at many locations (Table 3).

The retrograde mean trough position brought widespread precipitation east of the Divide and the wettest week of the month to much of the East.

A lake-effect snow storm struck portions of western New York on 29–30 November, depositing up to 4 ft of snow in parts of southern Erie County. Near-blizzard conditions prevailed on 30 November at Buffalo, where a total of 21.7 inches of snow fell during the 2-day storm period.

REFERENCES

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- Wagner, A. James, 1977: Weather and Circulation of October 1976: Record Cold over the South and Midwest. *Mon. Wea. Rev.* **105**, 123–129.