

WEATHER AND CIRCULATION OF FEBRUARY 1979 Near-Record Cold over the Northeast Quarter of the Country

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1. Mean circulation

A strong, omega-type blocking ridge over the Bering Strait was a prominent feature of the mean 700 mb circulation for February (Figs. 1 and 2). This was the third consecutive month with high-latitude blocking and represents a western migration of the main site of blocking from the Norwegian Sea in December and northwestern Canada in January (Taubensee, 1979; Wagner, 1979). The

blocking ridge, together with deep mean troughs over north central Asia and the Canadian archipelago and a mean ridge over the Norwegian Sea, was part of a pronounced wavenumber 2 circulation regime at high latitudes in February.

With mean 700 mb heights below normal over much of east Asia, northwesterly flow and the accompanying advection of cold air across the Asia

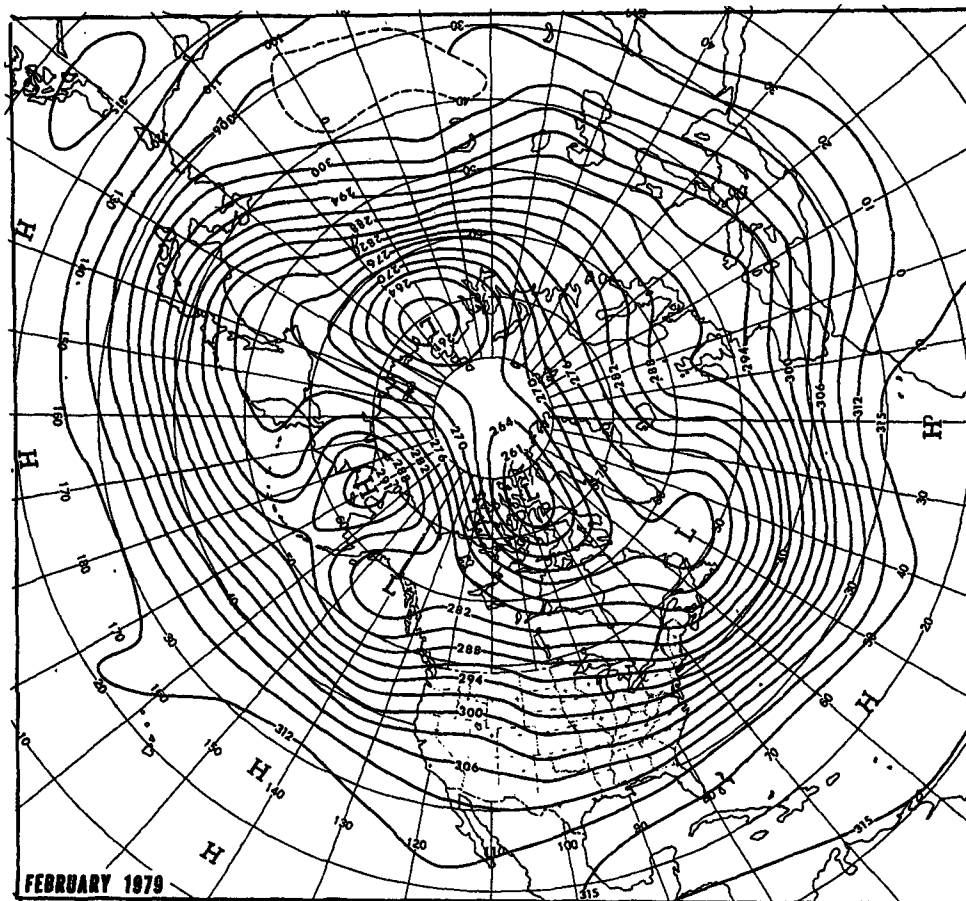


FIG. 1. Mean 700 mb height contours (dam) for February 1979.

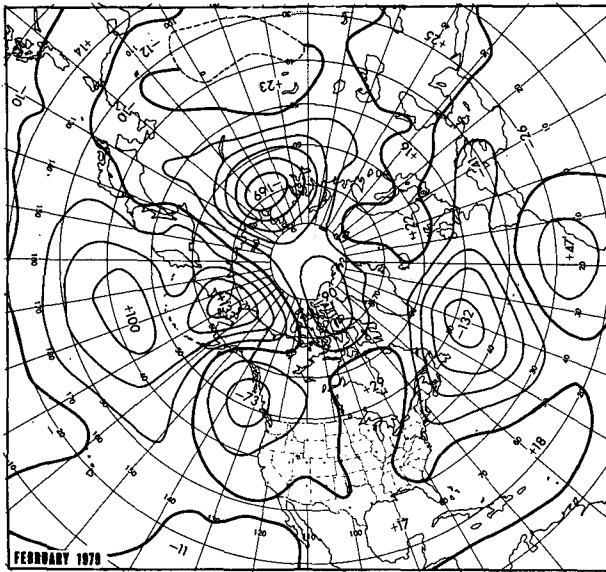


FIG. 2. Departure from normal of mean 700 mb height (m) for February 1979.

coast were subnormal (Figs. 2 and 3). This resulted in a weakening of the coastal baroclinic zone and associated cyclogenesis, and a weakening and retrogression of the coastal trough. The extent of the area covered by positive height anomalies over the Pacific and adjacent land was unusually large this month.

Retrogression of the Asia coastal trough and the weakening of the Pacific westerlies were accompanied by the retrogression of the east Pacific ridge to the extent that it phased with the emerging blocking ridge to the north (Figs. 1, 2 and 4).

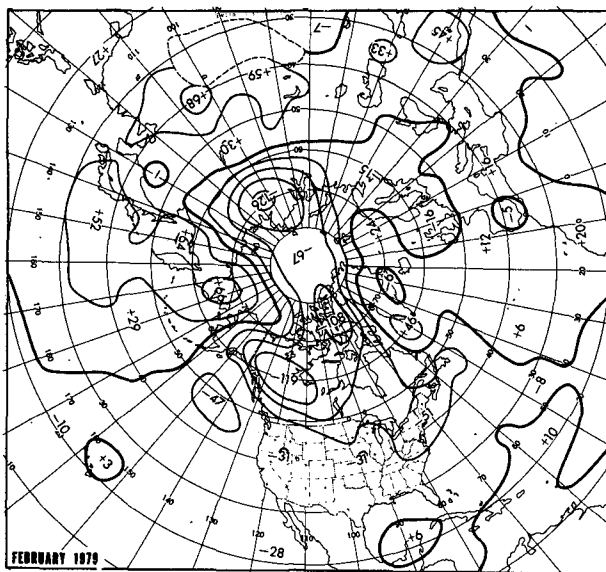


FIG. 3. Departure from normal of mean 1000-700 mb thickness (m) for February 1979.

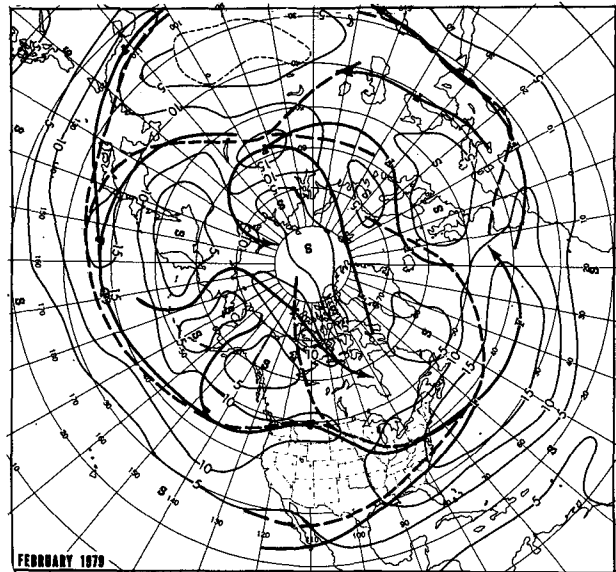


FIG. 4. Mean 700 mb geostrophic wind speed ($m s^{-1}$) for February 1979. Solid arrows indicate observed axes of maximum wind speed and dashed lines, the normal.

This led to the formation of a deep monthly mean trough near the west coast of North America, the first such trough since the preceding September.

The trough previously located over the central United States moved off the east coast and deepened markedly as it interacted with a weakening and progressive blocking ridge to the north. Although the subtropical westerlies along the southern border of the United States declined this month, there was a compensating increase over the Atlantic and the mean value for the Western Hemisphere remained above normal. The strong westerly current proceeded from the Atlantic across the Mediterranean and Black Seas and south of the intense low over north Asia.

2. Temperature

Strong northwesterly flow between the Bering Strait ridge and the deep trough over the Canadian archipelago advected extremely cold air southward this month (Fig. 3). This, together with the southward displacement of the snowline east of the Continental Divide and the deep trough off the east coast, produced very low mean temperatures over much of the nation east of the Divide (Fig. 5). It was one of the coldest Februaries of record from eastern portions of the Great Plains through the Midwest to the middle and north Atlantic Coast States (Table 1). Cold weather in February contributed to record-low mean temperatures for November through February at Helena, MT, Sheridan, WY, and Rapid City, SD, and for the December through February period at Grant Junction, CO,

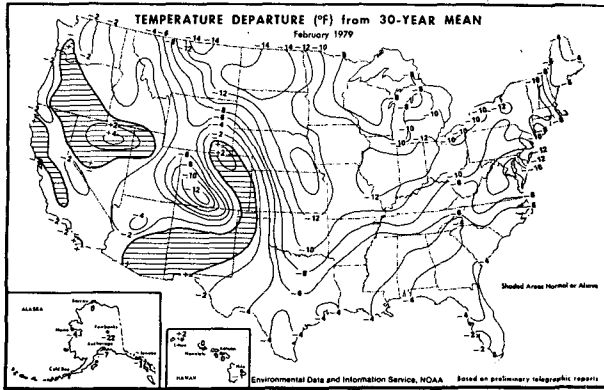


FIG. 5. Departure from normal of average surface air temperature for February 1979 (from National Oceanic & Atmospheric Administration and Economics, Statistics and Cooperatives Service, 1979).

Grand Island, NB and Rochester, MN. Increasing westerly flow across the west coast gave moderating temperatures to most areas west of the Continental Divide. Western Colorado, with an early and durable deep snowcover, was a notable exception.

Temperatures were generally below normal in Alaska, located just east of a strong ridge. In Hawaii, both mean 700 mb heights and surface air temperatures were mostly near normal.

3. Precipitation

Increasing westerlies accompanying the development of the west coast trough brought above normal precipitation to most areas west of the Continental Divide this month. (Fig. 6). In keeping with the recent scarcity of west coast troughs, this was the first month since the previous September with most of the Pacific Northwest relatively wet.

Changing wave phase brought a drying trend from the central Great Plains through the Midwest to interior New England as a central United States trough gave way to troughs off each coast. Storms moving in the moderately fast westerlies near the southern border and then northeastward along the east coast gave above normal precipitation to much of the South and East. Frequent storms near the northern border together with the occasional overrunning of shallow surface ridges by the upper level westerlies also produced relatively wet conditions from the Divide to the upper Great Lakes. The combination of cold and wet weather east of the Divide yielded one of the snowiest Februaries of record in the middle Atlantic States and at a few other locations (Table 2).

The strong ridge west of Alaska produced very dry conditions in that state. In Hawaii, south of the Pacific westerlies, precipitation was well above

normal. Hilo reported not only a record February precipitation total (45.55 inches) but also precipitation records from 45 min to 72 h on February 19-20.

TABLE 1. Record and near-record monthly mean temperatures observed during February 1979.

Station	Temperature (°F)	Anomaly (°F)	Remarks
Fort Wayne, IN	14.8	-12.8	Coldest February and coldest month
Lynchburg, VA	27.9	-10.9	Coldest February
Muskegon, MI	14.5	-10.1	Coldest February
Wichita, KS	19.2	-14.2	2nd coldest February
Sioux City, IA	9.2	-14.2	2nd coldest February
Grand Island, NB	13.8	-13.9	2nd coldest February
Indianapolis, IN	18.8	-11.9	2nd coldest February
Evansville, IN	24.6	-11.3	2nd coldest February
Wilkes-Barre, Scranton, PA	16.0	-11.3	2nd coldest February and 3rd coldest month
Erie, PA	14.1	-11.1	2nd coldest February
Burlington, VT	7.5	-11.1	2nd coldest February
South Bend, IN	16.3	-10.0	2nd coldest February
Cincinnati (Abbe Obs.), OH	23.5	-10.9	2nd coldest February
Trenton, NJ	23.6	-9.8	2nd coldest February
Albany, NY	14.4	-9.1	2nd coldest February
Moline, IL	13.2	-12.5	3rd coldest February
Des Moines, IA	13.8	-10.4	3rd coldest February
Parkersburg, WV	24.4	-10.3	3rd coldest February
Wichita Falls, TX	38.1	-7.8	3rd coldest February
Buffalo, NY	14.9	-9.5	4th coldest February
Houghton Lake, MI	10.4	-7.8	4th coldest February
Concord, NH	15.1	-7.5	4th coldest February
St. Cloud, MN	5.1	-8.2	Coldest February since 1936

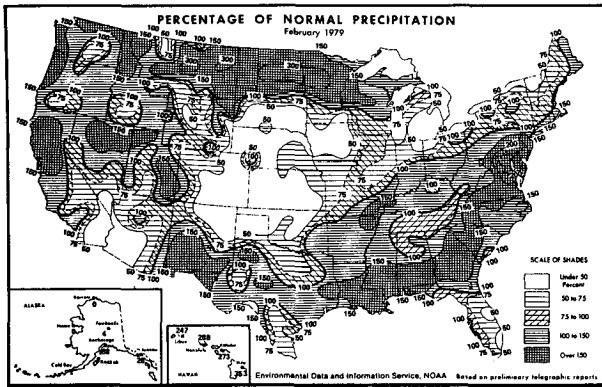


FIG. 6. Percentage of normal precipitation for February 1969 (from National Oceanic & Atmospheric Administration and Economics, Statistics and Cooperatives Service, 1979).

4. Variability within the Month

a. 29 January–4 February

By the first of the month the Pacific westerlies were already weak and a strong 700 mb high was approaching the Bering Strait, the mean location of blocking for the month (Fig. 7). East of a still-strong east Pacific ridge, a deep trough moved over the southwestern United States, while further downstream an intense west Atlantic low progressed south of a weakening blocking high. Strong subtropical westerlies were observed from Baja California across the Atlantic to southern Europe.

TABLE 2. Record and near-record total monthly precipitation and snowfall observed in February 1979.

Station	Amount (inches)	Anomaly (inches)	Remarks
Hilo, HI	45.32	+32.65	Wettest February
New Orleans, LA	12.44	+7.63	2nd Wettest February
Greensboro, NC	16.3	—	Greatest February snowfall
Bismarck, ND	25.6	—	Greatest February snowfall
Washington, DC	30.6	—	2nd Greatest February snowfall
Richmond, VA	19.5	—	2nd Greatest February snowfall
Indianapolis, IN	18.0	—	3rd Greatest February snowfall
Williston, ND	14.1	—	3rd Greatest February snowfall
Norfolk, VA	12.7	—	3rd Greatest February snowfall
Lynchburg, VA	19.2	—	Greatest February snowfall since 1886

Enhanced northerly flow between the east Pacific–northeast Siberia ridge and the deep troughs to the east, together with strong and southward displaced westerlies across the nation, spread below

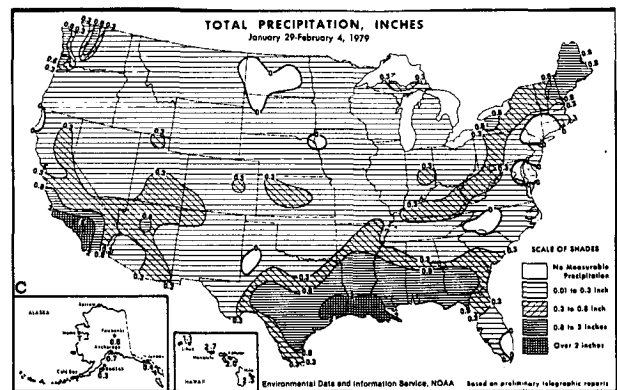
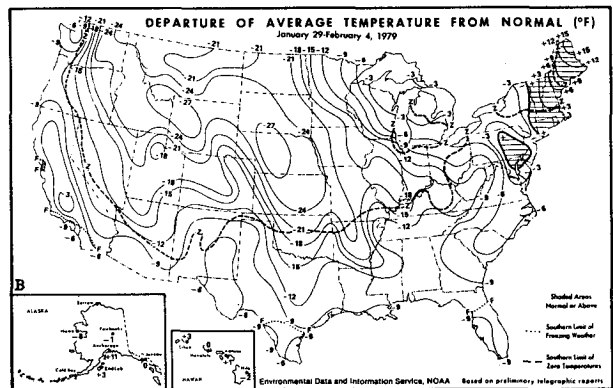
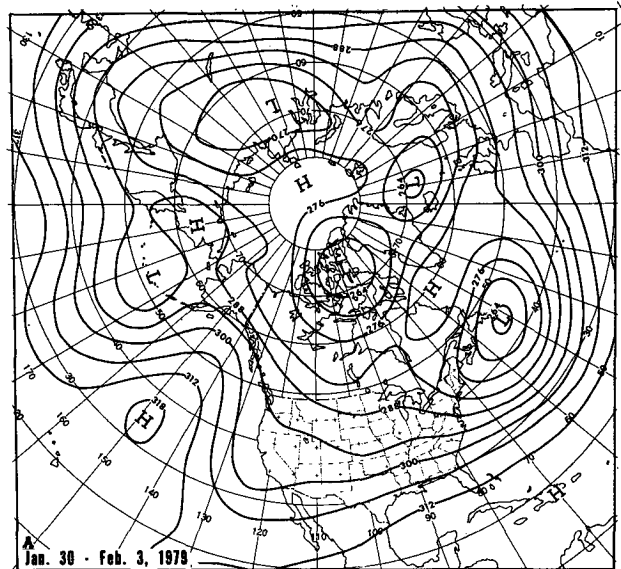


FIG. 7. (A) Mean 700 mb contours (dam) for 30 January–3 February 1979, (B) departure from normal of average surface air temperature (°F) and (C) total precipitation (inches) for week of 29 January–4 February 1979 (from National Oceanic & Atmospheric Administration and Economics, Statistics and Cooperatives Service, 1979).

normal temperatures over most of the country this week. Weekly mean temperatures were more than 27°F below normal in some areas.

Storm systems moving in the fast westerlies along the southern border gave heavy precipitation to parts of the Southwest as well as the Gulf Coast.

b. 5–11 February

As the blocking ridge intensified over the north central Pacific, a deep trough formed over the Gulf of Alaska and a warm ridge was driven over the western United States (Fig. 8). Elsewhere around the Hemisphere there was a good deal of persistence from the previous week. The advection of arctic air continued across northwestern Canada to most of the United States east of the Divide. Record-low temperatures for February were observed on 11 February at Erie, PA (−17°F), Youngstown, OH (−13°F) and Atlantic City, NY (−8°F); the temperature at Erie was also an all-time record low at that location. Lowest temperature for so late in the season (−8°F) was observed at Richmond, VA on 10 February.

Movement of a mean ridge to the California coast produced the driest week of the month in the Southwest. Increasing westerlies along the northwest coast, however, brought a substantial increase in precipitation there. Precipitation was also fairly heavy near the Gulf Coast as a storm track continued there. A major ice storm spread across northern Georgia and parts of the Carolinas on 6 and 7 February. Athens, GA observed 0.5–1.5 inches of glaze on trees and power lines and Columbia, SC reported several million dollars of storm damage.

c. 12–18 February

The central Pacific blocking ridge continued strong with troughs deepening near both edges of the Pacific (Fig. 9). As the Gulf of Alaska trough developed southward, the downstream flow from the United States to western Europe became more wavelike, and the subtropical westerlies decreased in strength. Short-term amplifications of the waves in the flow over the eastern Atlantic and eastern Europe contributed to the strengthening blocking high east of Iceland.

Southwesterly flow in advance of the west coast trough spread warm air across most areas west of the Continental Divide. East of the Divide, however, temperatures remained well below normal despite the northward migration of the westerlies and the progression of a ridge to the northern Great Plains. This was largely due to the continued southeastward thrust of cold air east of the Bering Strait ridge and to the anomalous southward displacement of the snow boundary between the Rocky and Appalachian

Mountains. Record-low temperatures for February were observed on 12 February at Burlington, VT (−30°F) and on 18 February at Syracuse, NY (−26°F); both temperatures equaled the all-time lows at those locations. Despite the low weekly mean temperatures which prevailed there, a record-

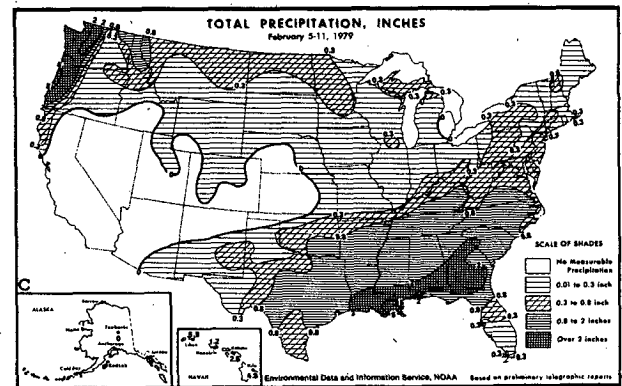
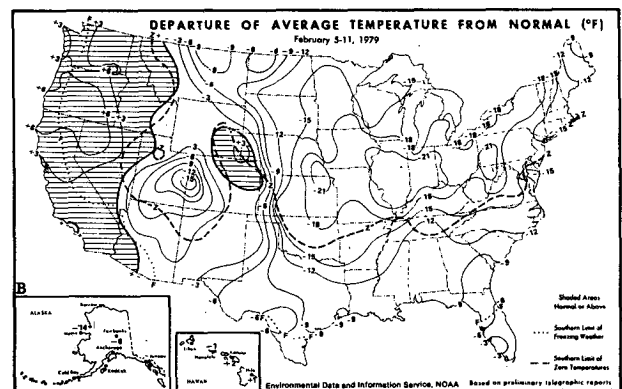
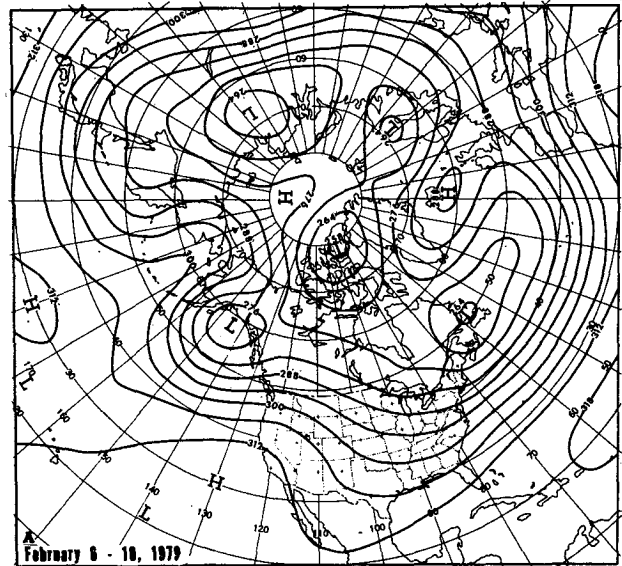


FIG. 8. As in Fig. 7 except (A) 6–10 February 1979 and (B) and (C) week of 5–11 February 1979.

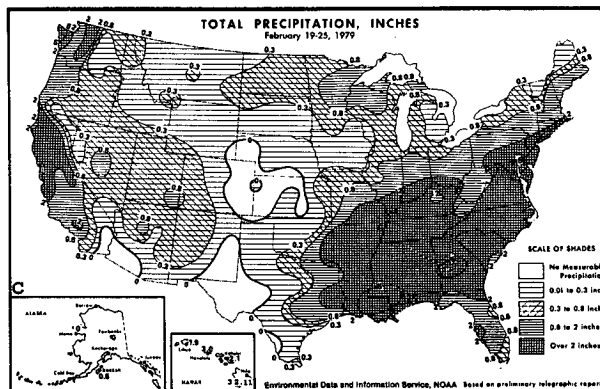
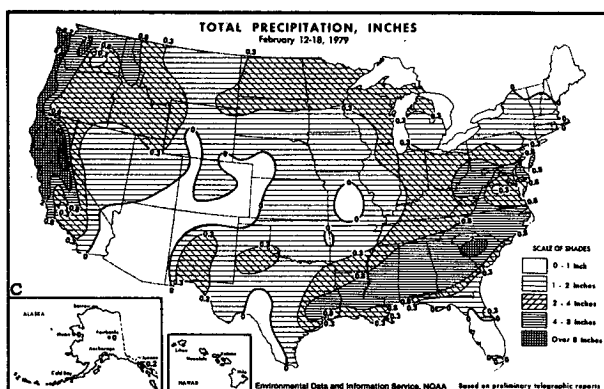
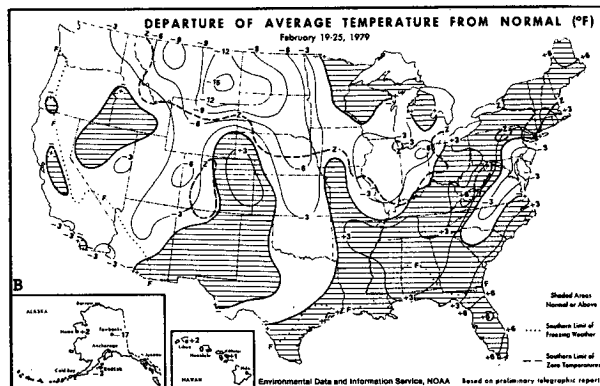
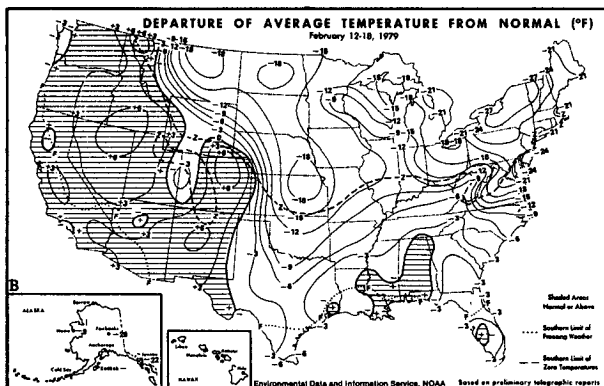
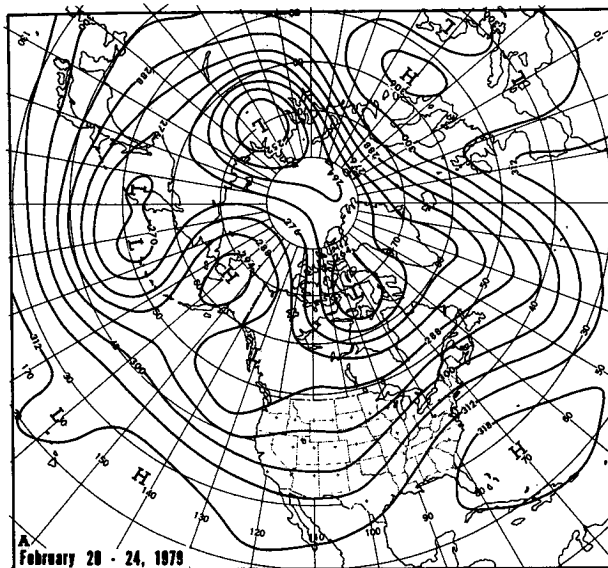
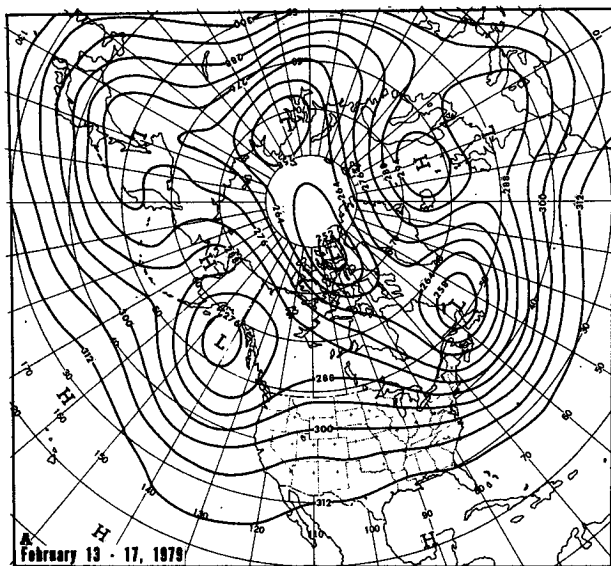


FIG. 9. As in Fig. 7 except (A) 13-17 February 1979 and (B) and (C) week of 12-18 February 1979.

FIG. 10. As in Fig. 7 except (A) 20-24 February 1979 and (B) and (C) week of 19-25 February 1979.

high temperature for February (92°F) was observed at Wichita Falls, TX on 14 February.

It was a wet week along the west coast, in advance of the deep coastal trough. Elsewhere, moderately heavy precipitation occurred over the Southeast, mainly in connection with a storm moving across the northern Gulf of Mexico late in the week.

This storm gave unusually heavy snow from Atlanta through the Carolinas this week; its subsequent development is discussed in the next section.

A storm system moving in the westerlies south of the Atlantic blocking ridge gave strong winds and heavy snow to Great Britain. Several towns and cities in eastern England, Scotland and Wales were

isolated and thousands of travelers were stranded. Waves generated by this storm caused flooding on the southern coast of England as well as in Spain and Portugal.

d. 19–25 February

Circulation about the Pacific blocking ridge strengthened and assumed more of an omega shape this week as a trough deepened east of Kamchatka (Fig. 10). Although northern portions of the trough along the west coast of the United States remained anchored by the blocking ridge, southern portions moved east of the Divide and the mean ridge progressed to the east coast. Confluence of the flow about this ridge with a cold air current from the northwest contributed to an increase in strength of the westerlies across northern portions of the Atlantic and to the progression of the previous Atlantic blocking ridge.

One of the heaviest snowfalls of record occurred along the middle Atlantic Coast this week. A deepening storm system moved northeastward along the south and middle Atlantic Coast on 18 and 19 February as a massive, extremely cold high pressure area slid off the Northeast Coast early in the week after having dominated the entire eastern half of the country. Significant factors influencing the duration and intensity of the snowfall appear to include an upper level trough which overtook the storm from the west, the strength of the easterly flow on the southern flank of the cold high and the thermodynamic instability of this modified cold air.

Storm snowfall totals exceeded a foot from northern Virginia to northern New Jersey; some of the greatest amounts were: Washington, DC, 18.7 inches; Baltimore, MD, 20 inches; Wilmington, DE, 16.5 inches and Atlantic City, NJ, 17.1 inches. By the end of the storm snow depth exceeded 2 ft at Andrews Air Force Base and Patuxent Naval Air Station in Maryland and at Dover, DE.

Heavy snow, accompanied by strong wind at some locations, closed airports from Atlanta to New York City. In Delaware a state of emergency was declared as power supply to several communities was disrupted and blowing snow blocked most roads in the state. Snow depth reached 26 inches at Dover and drifts to 8 ft were reported at Rehoboth Beach. A limited state of emergency was declared in New Jersey where snow depths of 18–24 inches were observed over southern half of the state, and

drifts 15 ft high were reported. At Washington, DC the storm snowfall total of 18.7 inches was a record 24 h amount for February and the second greatest 24 h amount for any month. Strong winds accompanying the snow led to 3–5 ft drifts and many roads were blocked. It was the worst snowstorm in 15 years in south central Pennsylvania where Harrisburg received 14 inches of snow.

The winds also moved ice from Delaware Bay to the Atlantic Coast of peninsular Delaware and Maryland. Similarly, ice was driven from Chesapeake Bay to the ocean beaches of Tidewater, VA, where slabs of ice formed walls up to 12 ft high.

As mean 700 mb heights fell west of the Divide, temperatures returned to near normal at most locations there. Temperatures remained well below normal in the northern Great Plains, but movement of the mean ridge to the East Coast brought a rapid rise to above normal temperatures over much of the eastern half of the country. By the end of the week very little remained of the near-record snowfall of a few days earlier. Its effect in retarding the increase in mean air temperatures, however, is quite apparent on Fig. 10B.

Heavy precipitation occurred over much of the eastern half of the country between the Great Plains trough and the East Coast ridge. A series of upper troughs and associated surface systems moving from the east Pacific to the Great Plains also made this a wet week for most locations west of the Divide.

A deep trough aloft just west of the Hawaiian Islands produced heavy rains early in the week at most locations there. Flooding and extensive damage occurred along the windward coast of the Island of Hawaii where Hilo observed record rainfall amounts for all intervals from 45 min to 72 h; these included 3.08 inches in 1 h, 22.30 inches in 24 h and 28.64 inches in 48 h.

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