

## WEATHER AND CIRCULATION OF FEBRUARY 1981 Continued Widespread Drought

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### 1. Mean circulation

February 1981 was a transitional month during which most of the persistent and amplified 700 mb long-wave features that had controlled January's weather (Wagner, 1981) were rapidly changing. This resulted in a general loss of amplitude in monthly mean circulation features around the hemisphere (Figs. 1 and 2).

As the advection of cold air to the middle latitudes of the Pacific declined, so also did the magnitude of

the baroclinic zone and the strength of the zonal westerlies in that region (Figs. 3 and 4). The Pacific mean trough weakened and retrograded, as did the downstream ridge over western North America and the trough near the eastern seaboard of North America. Pronounced anticyclogenesis took place over the western Atlantic and the axis of the mean westerlies jumped northward.

Strong cold air advection continued near Greenland and fast zonal flow persisted across northern portions of the Atlantic to the north of a subtropical

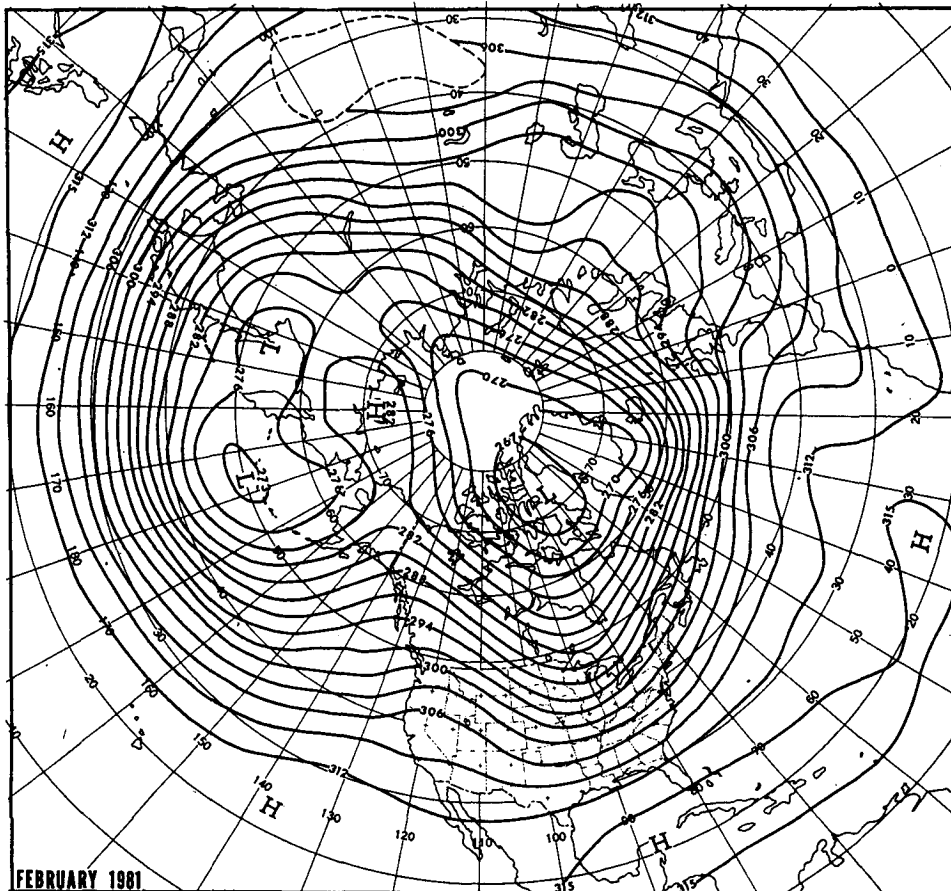


FIG. 1. Mean 700 mb height contours (dam) for February 1981.

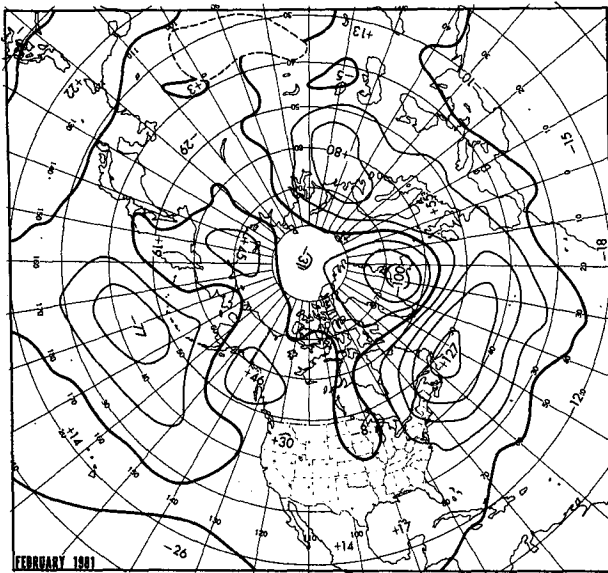


FIG. 2. Departure from normal of mean 700 mb height (m) for February 1981.

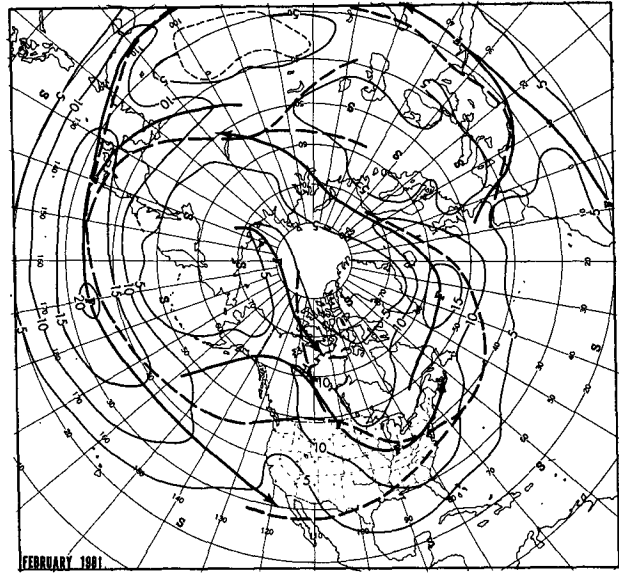


FIG. 4. Mean 700 mb geostrophic wind speed ( $m s^{-1}$ ) for February 1981. Solid arrows indicate observed axes of maximum wind speed and dashed lines, the normal.

ridge of striking east-west dimension. The strong westerlies moved across northern portions of Europe and west Asia, spreading relatively warm air across those regions and greatly weakening the previous European trough. A weaker branch of the 700 mb westerlies moved through the still strong southern portion of that trough. The strong mean ridge which had dominated central Asia during January weakened as a new mean ridge emerged near the Urals.

## 2. Temperature

As noted earlier, February 1981 was a month of transition from the persistent regime of January. As will be seen later, this transition involved rapid fluctuations of major circulation features. The monthly mean height and temperature anomalies, being the residuals of highly dissimilar regimes involved in these fluctuations, were not as well matched in a synoptic-climatological sense as they usually are in steadier months.

Above-normal mean temperatures were observed over most of the country (Fig. 5). This widespread warmth was related to the presence of a moderately strong ridge over the west, coupled with a change toward southerly wind components over the north-

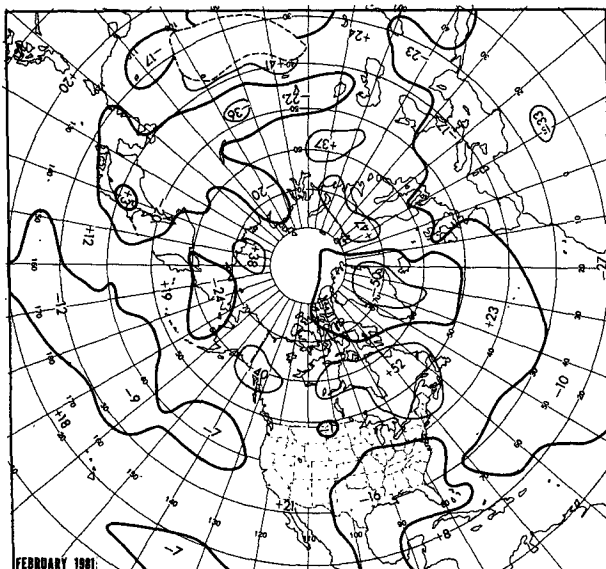


FIG. 3. Departure from normal of mean 1000-700 mb thickness (m) for February 1981.

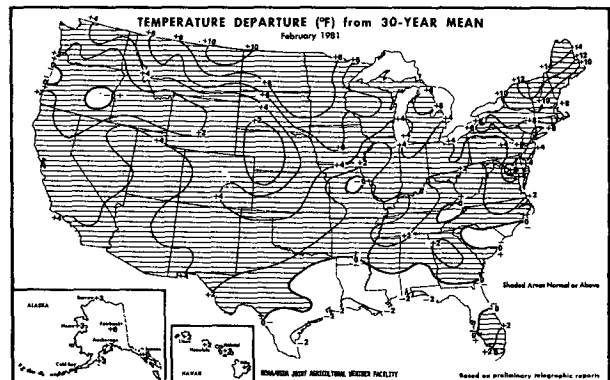


FIG. 5. Departure from normal of average surface air temperature ( $^{\circ}F$ ) for February 1981 (from National Oceanic and Atmospheric Administration and Economics and Statistics Service, 1981).

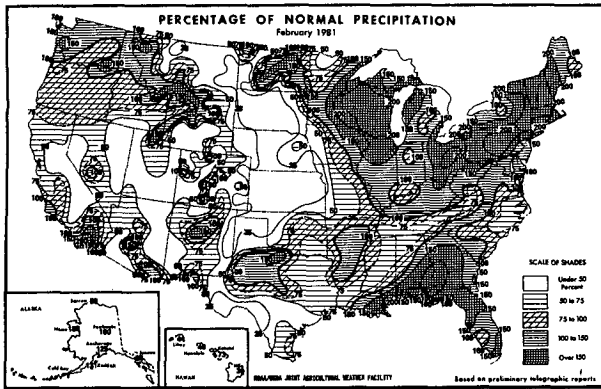


FIG. 6. Percentage of normal precipitation for February 1981 (from National Oceanic and Atmospheric Administration and Economics and Statistics Service, 1981).

eastern states and the deamplification of the ridge over western Canada. The latter development, mainly a feature of the last half of February, brought extremely warm air across the north-central part of the country.

A moderately strong subtropical ridge over Hawaii produced warm weather in that State, while relatively strong southerly wind components yielded above-normal mean temperatures in Alaska.

3. Precipitation.

Retrogression of the mean trough over eastern North America brought above-normal precipitation to much of the country east of the Mississippi River (Fig. 6). The streaked nature of the precipitation is related to the storm tracks that prevailed. In the Northeast, where the mean flow had an anomalously strong component from the southeast, record February precipitation was reported at Wilkes-Barre/Scranton, PA, Worcester, MA and Concord NH.

Much of the Great Plains, situated between the western mean ridge and the Great Lakes trough,

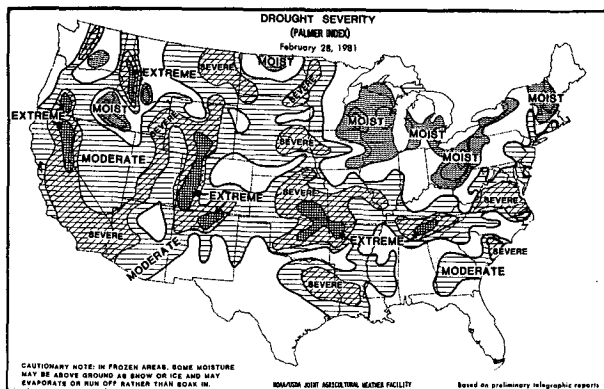


FIG. 7. Palmer Drought Severity Index, 28 February 1981 (from National Oceanic and Atmospheric Administration and Economics and Statistics Service, 1981).

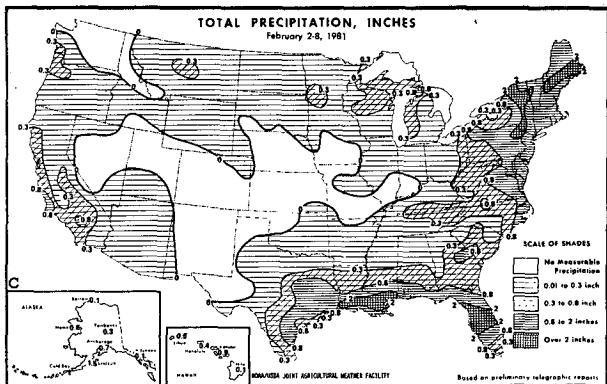
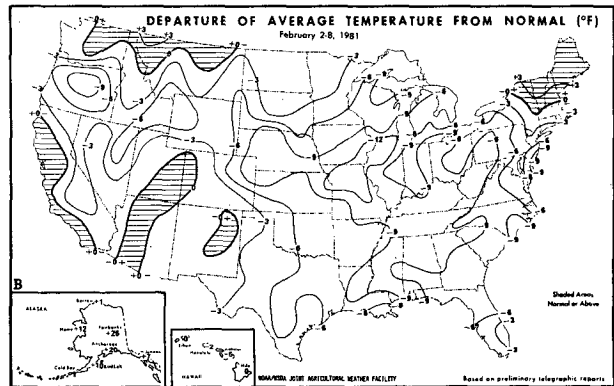
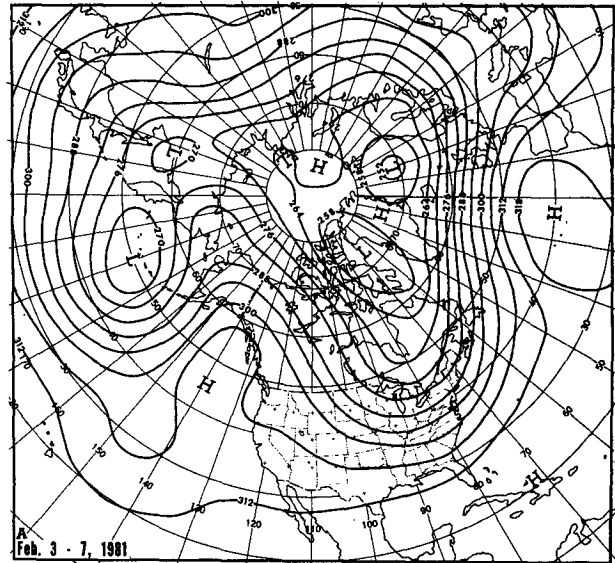
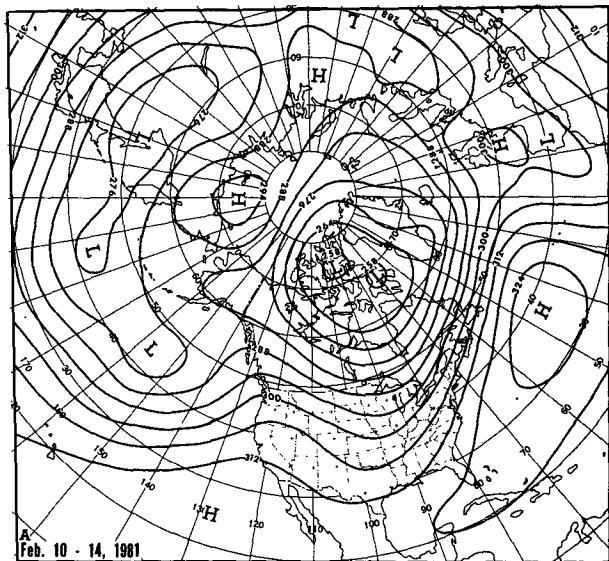


FIG. 8. (A) Mean 700 mb contours (dam) for 3-7 February 1981; (B) departure from normal of average surface air temperature (°F) and (C) total precipitation (inches) for week of 2-8 February 1981 (from National Oceanic and Atmospheric Administration and Economics and Statistics Service, 1981).

remained dry. Relatively dry weather also prevailed in the vicinity of the western upper level ridge. Thus, while the drought (Wagner, 1981) was alleviated in many areas east of the Mississippi River, it became



southerly flow, received above-normal precipitation this month. Exceptions included the north coast, shielded by the Brooks Range, and southeastern Alaska under a strong mean ridge. A moderately strong mean ridge over Hawaii also limited rainfall in that State.

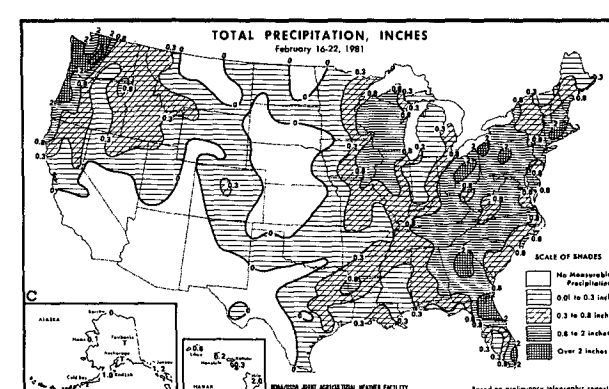
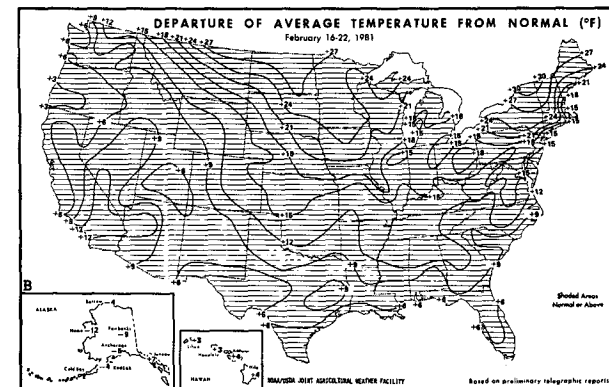
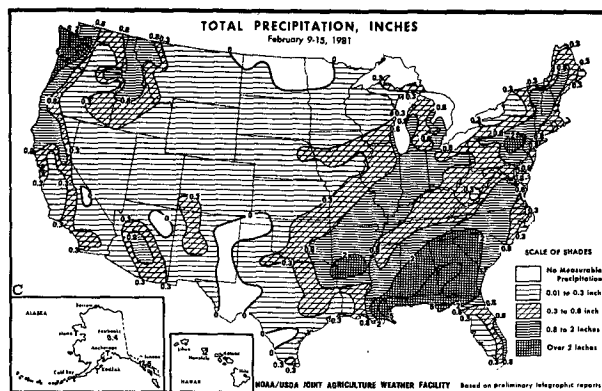
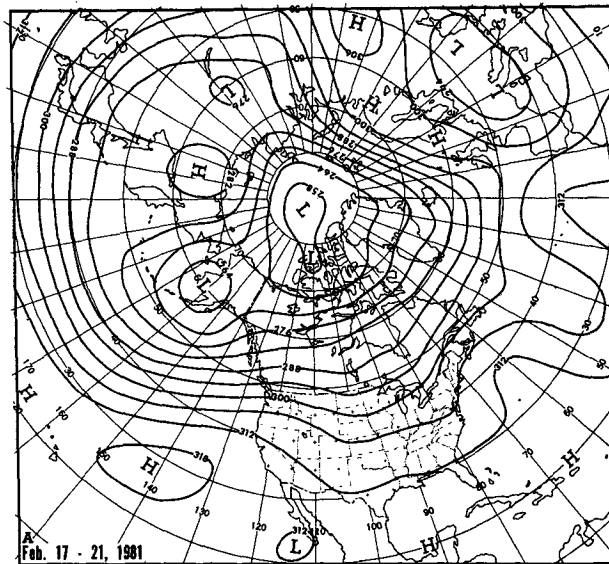
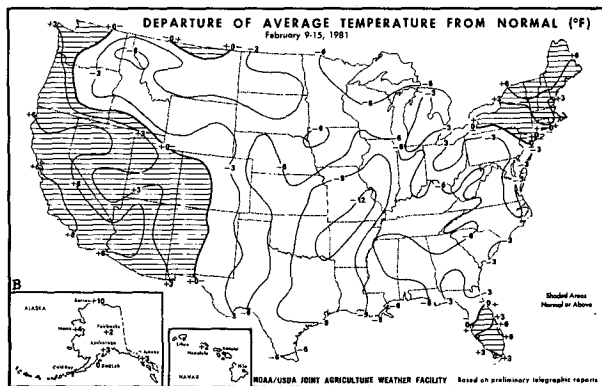


FIG. 9. As in Fig. 8 except for (A) 10-14 February 1981, and (B) and (C) week of 9-15 February 1981.

more severe in the Great Plains, in much of the West, and in the zone of sparse precipitation over Tennessee. The Palmer Drought Severity Index at the end of February, shown in Fig. 7, can be compared with that at the end of January (see Wagner, 1981).

Most of Alaska, affected by stronger-than-normal

FIG. 10. As in Fig. 8 except for (A) 17-21 February 1981, and (B) and (C) week of 16-22 February 1981.

TABLE 1. Record-high temperatures observed during February 1981.

Station	Temperature (°F)	Date	Remarks
Caribou, ME	51	11	Record high for February
Caribou, ME	52	18	Record high for February
Caribou, ME	52	19	Equaled record high for February
Caribou, ME	52	22	Equaled record high for February
Caribou, ME	52	23	Equaled record high for February
Burlington, VT	62	19	Record high for February
Syracuse, NY	69	19	Record high for February
Providence, RI	72	18	Highest temperature for so early
Rochester, MN	63	17	Record high for February
Sioux Falls, IA	70	17	Equaled record high for February
Phoenix, AZ	88	19	Equaled record high for February
Winnemucca, NV	74	19	Record high for February
Fresno, CA	75	22	Equaled record high for February
Fresno, CA	79	23	Record high for February

4. Variability within the month

a. 2-8 February

Most of the midlatitude long-wave features at 700 mb over the Northern Hemisphere retrogressed from late January to early February. Participating in this development, a strong mean ridge moved over the northeast Pacific, and a deep mean trough retrogressed to the Great Lakes (Fig. 8A). Enhanced north-to-south transport between these two latitudinally extensive features spread quite cold air over most of the country (Fig. 8B). Record low temperatures for the date were reported from several locations in the vicinity of the Great Lakes and along the middle Atlantic Coast; two of the more extreme values were -26°F at Sault Ste. Marie, MI and -21°F at Marquette, MI.

The troughs over the Great Lakes and the southern Great Plains continued the trend toward increased precipitation east of the Mississippi (Fig. 8C) that began at the end of January. Dry weather continued from the Great Basin through the middle Mississippi Valley.

b. 9-15 February

Retrogression of long waves apparently continued at high latitudes as a strong mean high developed north of northeastern Siberia and a deep mean low moved to Baffin Island (Fig. 9A). At midlatitudes, both the Atlantic ridge and the East Coast trough continued their westward motion, while a deepening trough over the east Pacific was associated with a strengthening ridge over the western United States.

Despite the rapidly strengthening westerlies over North America, outflow from the Arctic between the Baffin Island low and the ridge to its west was strong early in the week. An extremely cold Arctic air mass entering the United States at that time was largely responsible for the extensive area of below-normal mean temperatures observed east of the Continental

Divide (Fig. 9B). Extreme daily temperatures this week included -33°F at International Falls, MN and -23°F at Duluth, MN. Temperatures averaged above normal near the growing western ridge as well as over the Northeast and southern Florida to the east of the mean trough.

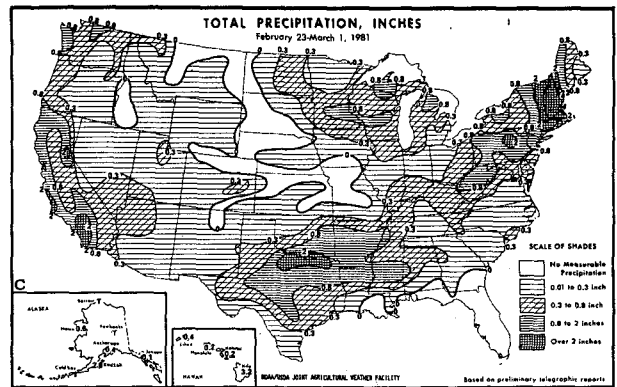
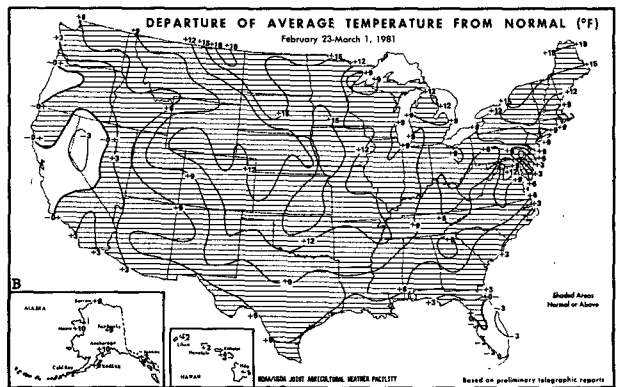
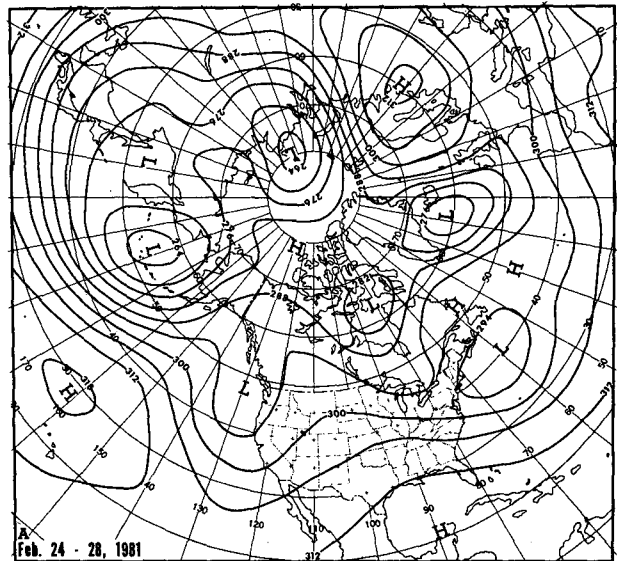


FIG. 11. As in Fig. 8 except for (A) 24-28 February 1981 and (B) and (C) week of 23 February-1 March 1981.

Relatively heavy precipitation occurred over much of the eastern third of the country in advance of the mean trough and along the north Pacific Coast where the westerlies increased markedly (Fig. 9C). Most of the eastern precipitation was associated with a rapidly intensifying storm which moved from the Texas Panhandle to the Great Lakes at midweek in advance of a cold outbreak. The cold high involved strengthened notably as it moved from the southern Great Plains through the Midwest to New England, producing all time record-high sea level pressures from South Carolina to New England and from Kentucky and Ohio to the East Coast.

#### c. 16–22 February

The transition from ridge to trough in the Gulf of Alaska was completed this week as cyclonic vorticity was advected over that area to the east of a strong upper level ridge (Fig. 10A). Elsewhere in the vicinity of North America a deep trough was observed over the Canadian Arctic while strong ridges occurred over the east Pacific and off the East Coast, separated by a pair of troughs over the United States.

Between the deep lows to the north and the strong ridges to the south, a fast westerly flow was generated which spread very warm air of maritime origin across the country (Fig. 10B) in place of the cold regime of the previous two weeks. Warming over the Northeast was augmented by southerly flow east of the mean trough. Weekly temperatures were twenty or more degrees above normal over both the north-central states and the Northeast, and record high temperatures for February were reported from both areas (Table 1).

Significant precipitation was again concentrated along the north Pacific Coast, where the westerlies

were strong, and over much of the area east of the Mississippi River in connection with the pair of mean troughs (Fig. 10C).

#### d. 23 February–1 March

Mean 700 mb features over the Pacific retrograded this week, and a new mean trough developed off the West Coast (Fig. 11A). This led to the movement of a ridge to the central states and a rather deep trough to the western Atlantic. In conjunction with the latter, a strengthening ridge over eastern Canada began to take on blocking characteristics.

Although the western Canadian ridge began to reintensify, the effects of the previous influx of maritime air were still apparent, and cold air masses driven southward over the United States were not very cold. Under the further influence of a West Coast trough and a central ridge, warm weather persisted over most of the country (Fig. 11B).

Precipitation was widespread (Fig. 11C). Heaviest amounts occurred in New England in connection with a strongly deepening low moving slowly to the south of the developing blocking ridge. Other areas of significant precipitation occurred in California to the east of the deep mean trough and in south-central portions of the country, where upper level vorticity advection occurred at the end of the month.

#### REFERENCES

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- Wagner, A. J., 1981: Weather and Circulation of January 1981—Record warmth in the West, record cold in the Southeast and widespread severe drought. *Mon. Wea. Rev.*, **80**, 920–928.