

WEATHER AND CIRCULATION OF OCTOBER 1980 A Decisive End to the Heat Wave

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1. Mean circulation

The Asiatic coastal trough was almost stationary from September to October and deepened seasonally (Figs. 1 and 2 and Taubensee, 1980). In conjunction with a strong baroclinic field this contributed to intense cyclogenesis and increasing westerlies across the Pacific (Figs. 3 and 4). Mean speeds in the 700 mb wind maximum south of the Aleutians increased by more than 40% from September to October.

Within the context of a near-stationary Asiatic

coastal trough this substantial increase in the westerlies resulted in progression of the wave train over the Pacific bringing a deep mean trough to the east Pacific and a strong mean ridge inland over western North America. The former feature deepened most strongly near the location of a pool of warm surface water that had accumulated during late summer and early fall under a persistent and strong upper level ridge. In response to the move-

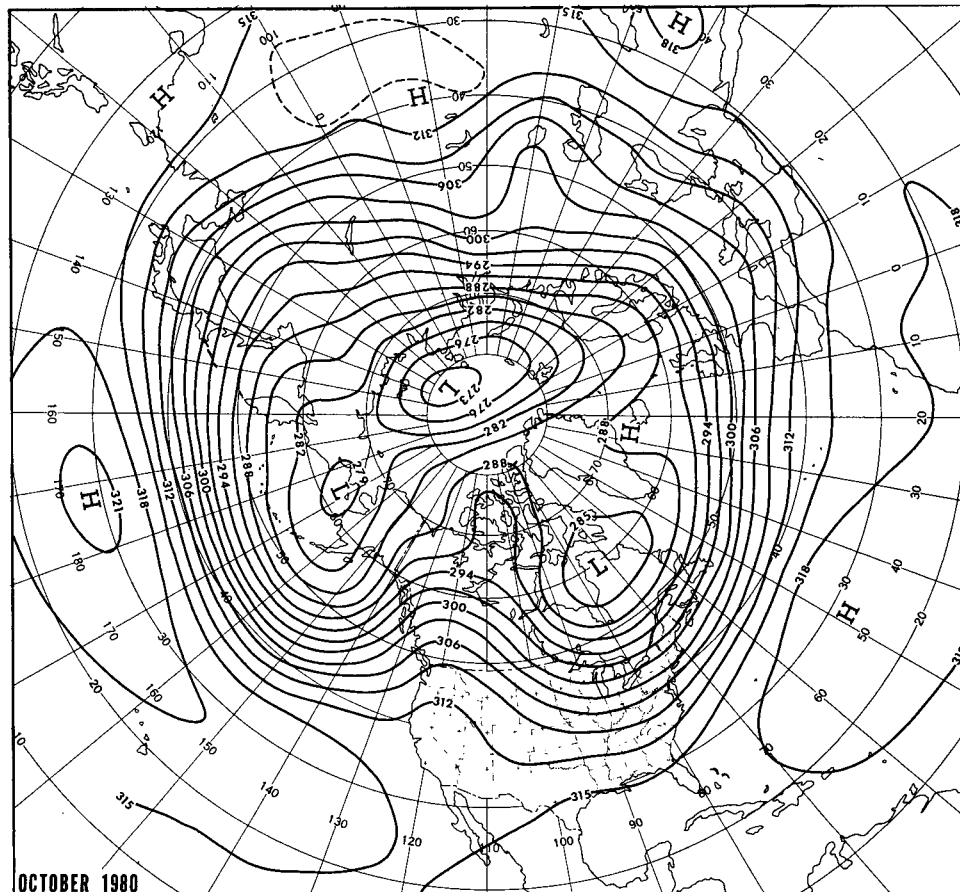


FIG. 1. Mean 700 mb height contours (dam) for October 1980.

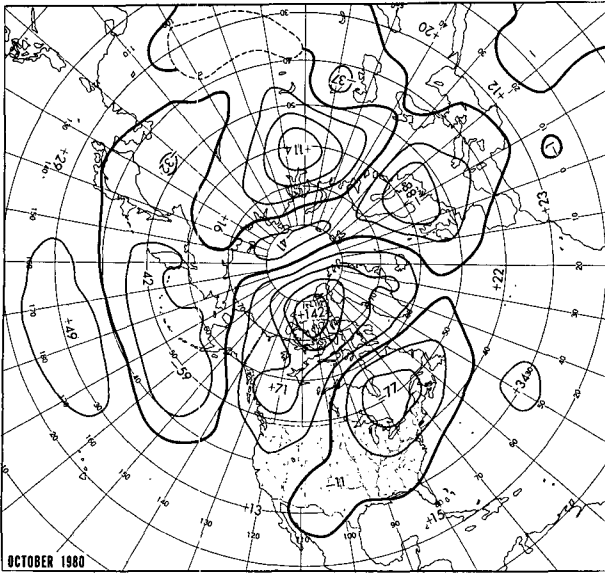


FIG. 2. Departure from normal of mean 700 mb height (m) for October 1980.

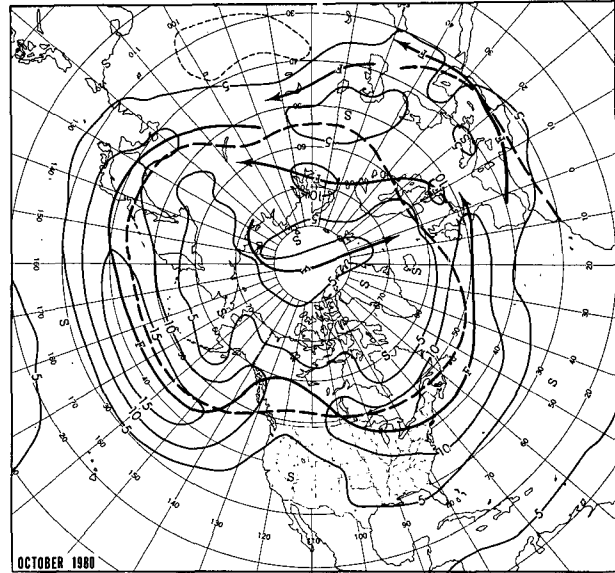


FIG. 4. Mean 700 mb geostrophic wind speed ($m s^{-1}$) for October 1980. Solid arrows indicate observed axes of maximum wind speed and dashed lines, the normal.

ment of the strong ridge over western North America, the mean trough over eastern North America deepened to the south demolishing the previously persistent “heat-wave” ridge that had overlain the area (Taubensee, 1980). As suggested by the mean height anomaly map (Fig. 2), anticyclonic vorticity was advected northward in advance of both this trough and the Aleutian trough to support a strong ridge over the Canadian archipelago.

Downstream from North America, the subtropical high over the Atlantic retrograded and a mean ridge

built west of Great Britain. To the east, a latitudinally extensive ridge over Europe was replaced by a latitudinally extensive trough, and a massive ridge built over western Asia.

2. Temperature

Stronger than normal northerly wind components over central North America, between the strong western ridge and the deep eastern troughs (Fig. 2), brought relatively cold air to most of the country east of the Continental Divide and to parts of the Southwest (Fig. 5). This provided a decisive end to the heat wave that had affected parts of the nation east of the Divide since June. It was one of the

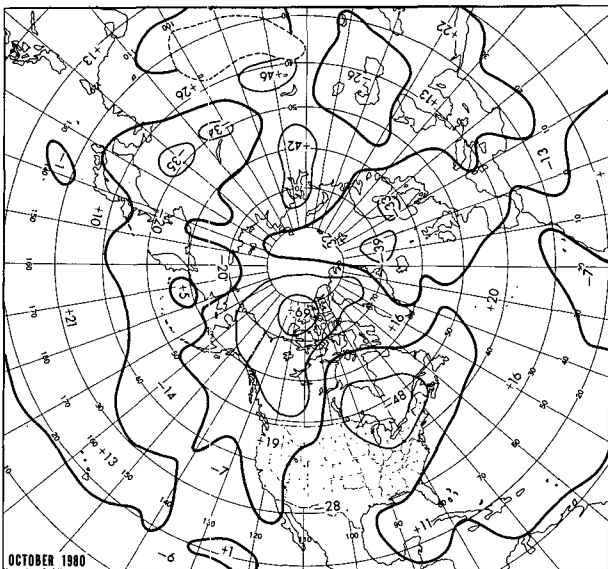


FIG. 3. Departure from normal of mean 1000–700 mb thickness (m) for October 1980.

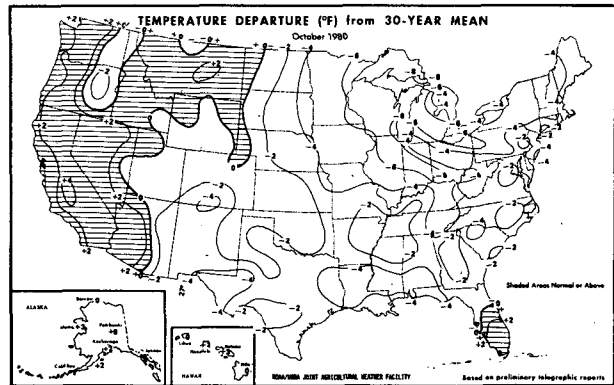


FIG. 5. Departure from normal of average surface air temperature ($^{\circ}F$) for October 1980 (from National Oceanic and Atmospheric Administration and Economics, Statistics and Cooperatives Service, 1980).

coldest Octobers of record in Michigan, Wisconsin and northern Illinois. Above-normal mean temperatures were largely confined to the western quarter of the country near the mean ridge location.

Enhanced southerly wind components produced above-normal mean temperatures over most of Alaska. To the south, Hawaii, near a somewhat stronger than normal subtropical ridge, experienced near to above-normal temperatures.

3. Precipitation

Storm systems moving from the Intermountain Region through the eastern trough produced most of the significant precipitation this month (Fig. 6). Precipitation was substantially subnormal along the north and central Pacific Coast where the westerlies were subnormal, as well as over and east of the southern Rocky Mountains to the south of the prevailing storm track. It was also relatively dry in parts of both the Midwest and the Southeast, areas largely bypassed by storms. It was the wettest October of record at Rapid City, SD, the second wettest at Topeka, KA, and the second driest at Pueblo, CO. Record October snowfall was observed at Grand Island, NE, Des Moines, IA, and Detroit, MI.

Stronger-than-normal southerly flow yielded above-normal precipitation amounts over southern Alaska and near to below normal elsewhere in that state. Rainfall in Hawaii, near a fairly strong mean ridge, was generally subnormal.

4. Variability within the month

a. 29 September–5 October

Already by early October the wave phase over North America which was to characterize the month had become established (Fig. 7A). A strong upper level ridge over western North America and a deep trough in the East combined to bring warm weather

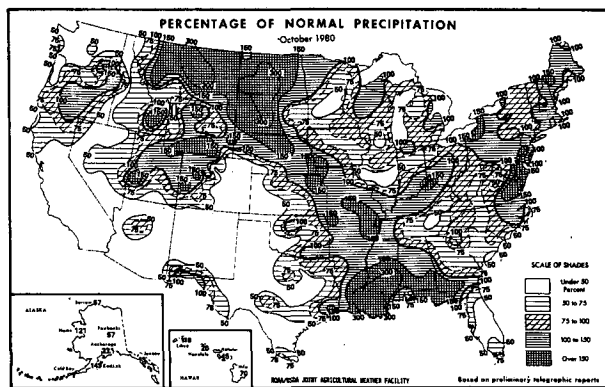


FIG. 6. Percentage of normal precipitation for October 1980 (from National Oceanic and Atmospheric Administration and Economics, Statistics and Cooperatives Service, 1980).

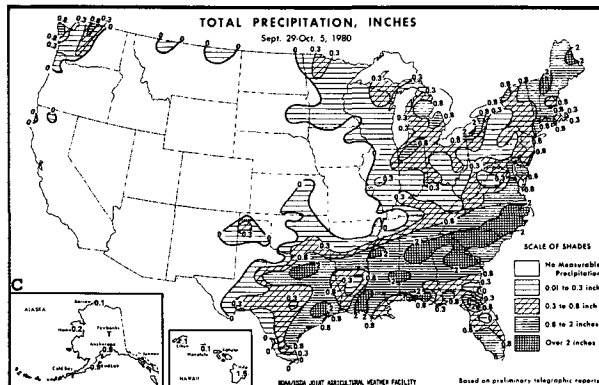
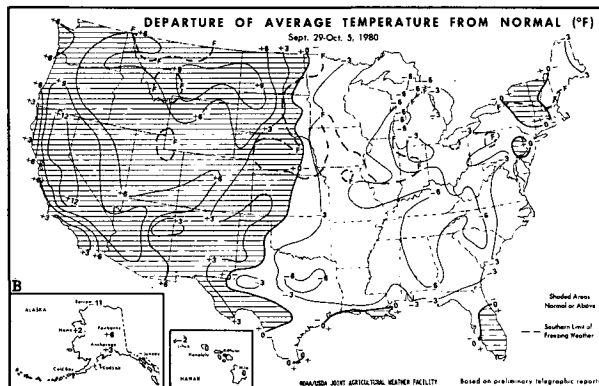
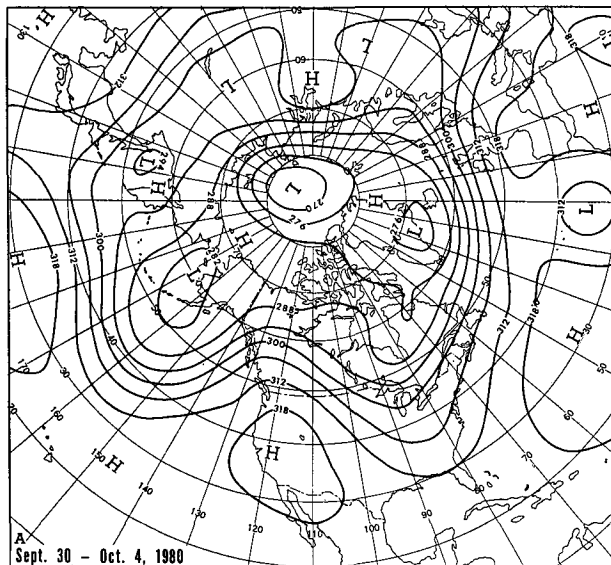


FIG. 7. (A) Mean 700 mb contours (dam) for 30 September–4 October; (B) Departure from normal of average surface air temperature (°F) and (C) total precipitation (inches) for week of 29 September–5 October 1980 (from National Oceanic and Atmospheric Administration and Economics, Statistics and Cooperatives Service, 1980).

to the western half of the United States and cold weather to the eastern half (Fig. 7B). This effectively completed the transition, which began at the end of

TABLE 1. Record temperatures observed in October 1980.

Station	Date	Temperature (°F)	Remarks
Astoria, WA	2	85	highest for month
Seattle, WA	5	82	highest for so late
Walla Walla, WA	7	90	highest for month
Eugene, OR	2	94	highest for month
	5	92	highest for so late
Medford, OR	2	99	highest for month
	5	97	highest for so late
	6	93	highest for so late
	7	92	highest for so late
Pendleton, OR	5	92	highest for month
	6	86	highest for so late
	7	87	highest for so late
Fresno, CA	2	101	highest for so late
	4	102	highest for so late
Mt. Shasta, CA	2	93	highest for month
Red Bluff, CA	4	107	highest for month
Boise, ID	22	20	lowest for so early
Pocatello, ID	10	21	lowest for so early
Winnemucca, NV	5	91	highest for so late
	6	91	highest for so late
	8	89	highest for so late
Phoenix, AZ	1	107	highest for so late
	2	107	highest for so late
Tucson, AZ	2	101	highest for so late
	3	99	equalled highest for so late
Billings, MT	7	89	highest for so late
	8	87	highest for so late
Havre, MT	7	90	highest for so late
Kalispell, MT	8	80	highest for so late
Albuquerque, NM	17	26	lowest for so early
Midland, TX	29	27	lowest for so early
International Falls, MN	7	83	highest for so late
Sault Ste. Marie, MI	7	22	lowest for so early
	14	20	lowest for so early
Dayton, OH	6	27	lowest for so early
Nashville, TN	6	31	lowest for so early
	9	90	highest for so late
Tallahassee, FL	13	39	lowest for so early
Providence, RI	10	26	lowest for so early

September (Taubensee, 1980), from the "heat-wave" circulation regime. Record-high temperatures for the month or highest temperatures for so late in the season were observed at several locations in the West during this period (Table 1). Significant precipitation was concentrated in the South where weak lows moved through the deep southern portion of

the upper trough, and in New England in advance of the trough (Fig. 7C).

b. 6-12 October

The mean waves in the vicinity of North America kept about the same phase as the previous week, but dampened somewhat (Fig. 8A). The resultant mean

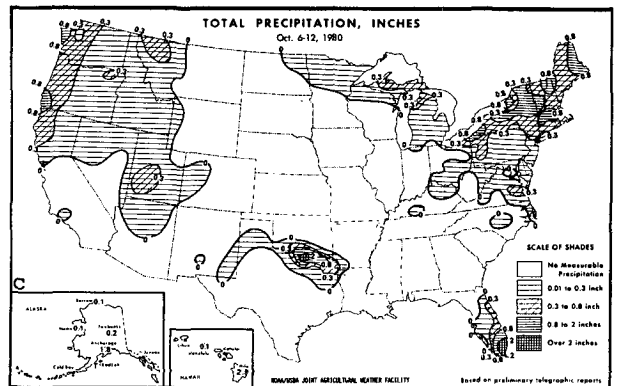
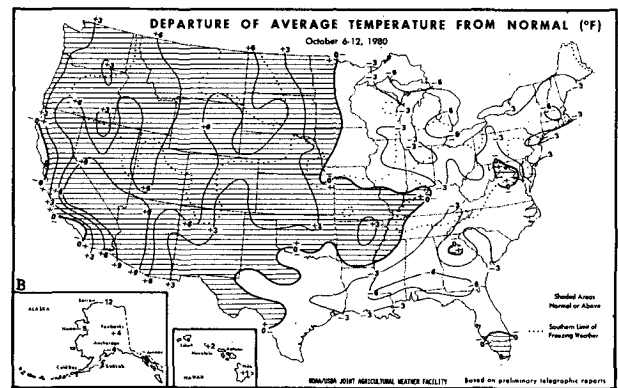
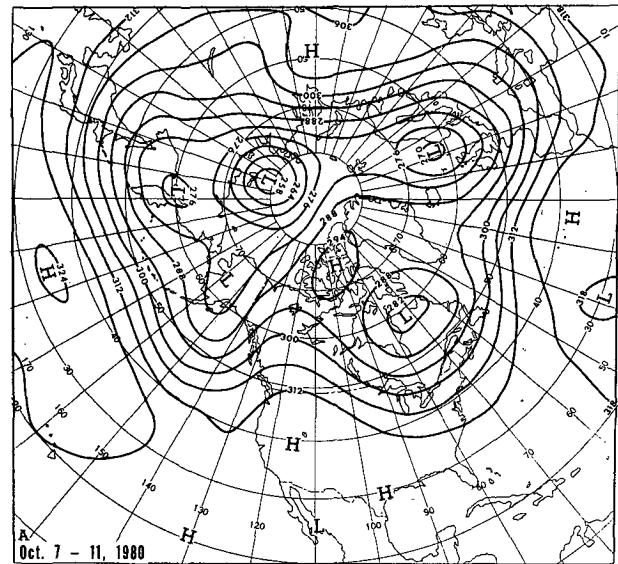


FIG. 8. As in Fig. 7 except for (A) 7-11 October 1980 and (B) and (C) week of 6-12 October 1980.

temperature pattern was also similar to the previous week, but with less extremes (Fig. 8B). There were again, however, several reports of record-high October temperatures and record highs for so late in the season from several western locations (Table 1). Precipitation increased over the West, as the Pacific mean trough moved closer to the West Coast, and continued in the vicinity of the northeastern mean trough (Fig. 8C).

c. 13-19 October

The mean waves at middle latitudes progressed over the Pacific and North America this week producing a reversal of wave phase over the United States (Fig. 9A). This was accompanied by a near reversal of temperature anomalies as cold air moved over the West and warm air covered much of the eastern half (Fig. 9B). Significant precipitation was mostly located near or east of the progressive mean trough (Fig. 9C) and was largely associated with a rapidly intensifying storm system that moved out of the Intermountain Region and across the southern Great Plains to Minnesota. Record-low sea level pressure for October was observed at Huron, SD, on 16 October in connection with this storm.

d. 20-26 October

The mean waves at midlatitudes continued to progress around most of the hemisphere bringing a ridge to the far western United States and a trough to the middle (Fig. 10A). The western ridge phased with a retrograding high-latitude blocking ridge over the Canadian archipelago producing, in conjunction with the trough to the east, an extensive outflow of cold air from Canada to the United States (Fig. 10B). Heaviest precipitation amounts were mostly near and in advance of the central trough (Fig. 10C). A strongly deepening storm system moved up the East Coast at the end of the week providing most of the week's precipitation there and producing record low October sea level pressures at both Albany, NY, and Burlington, VT.

e. 26 October-2 November

The ridge over the western United States remained almost stationary and amplified this week (Fig. 11A). However, as the blocking ridge to the north continued to move westward, the westerlies increased strongly over southwest Canada and the trough to the east progressed. While the increased westerlies across the northern Rockies in the United States moderated temperatures over the northern Great Plains (Fig. 11B), the temperature distribution elsewhere changed little.

Heaviest precipitation occurred in the Southeast in connection with a series of weak frontal lows that moved through the southern portion of the mean

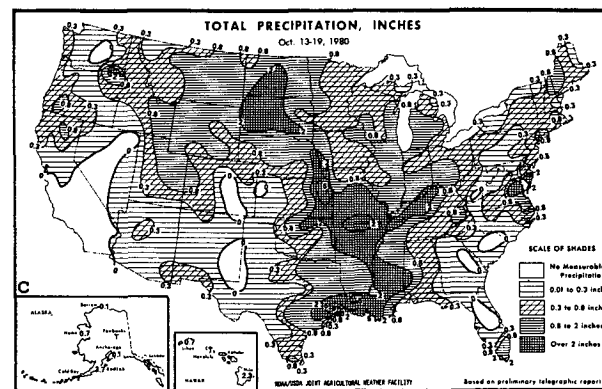
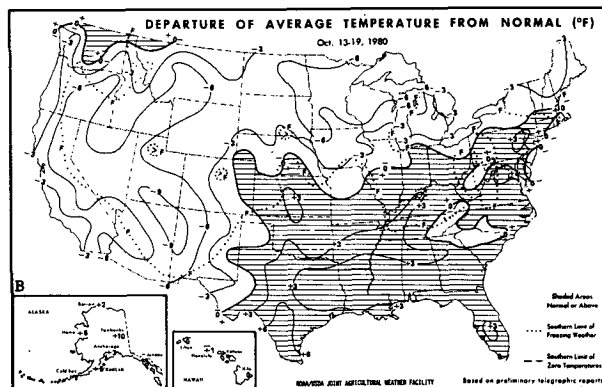
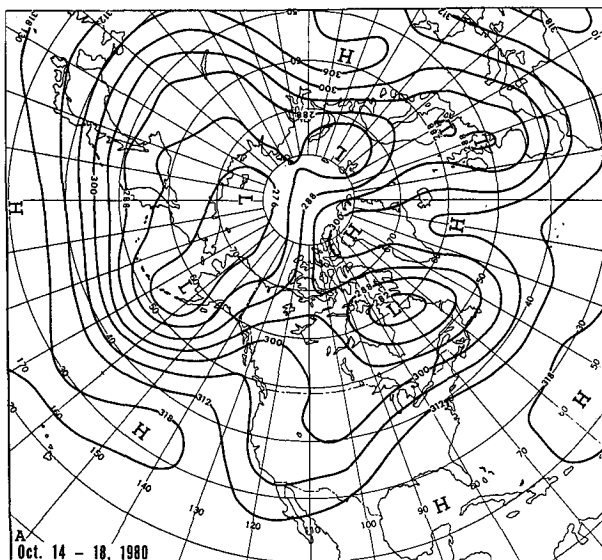


FIG. 9. As in Fig. 7 except for (A) 14-18 October 1980 and (B) and (C) week of 13-19 October 1980.

trough (Fig. 11C). Precipitation totals increased along the northwest coast as the Pacific mean trough again approached the coast. Record snowfall for so early in October (6.6 inches) was observed at Grand Island, NE, on 27 October. On the same day Des Moines, IA reported a record 24 hour snowfall for October of 7.4 inches.

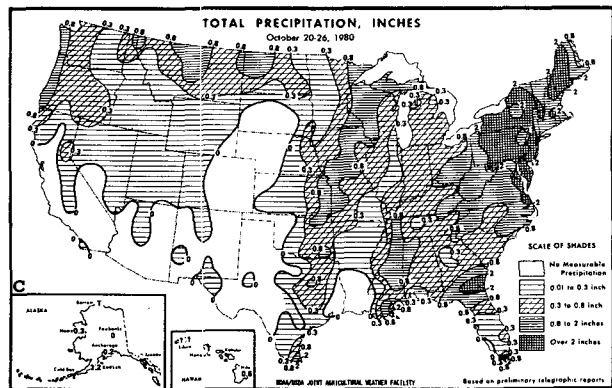
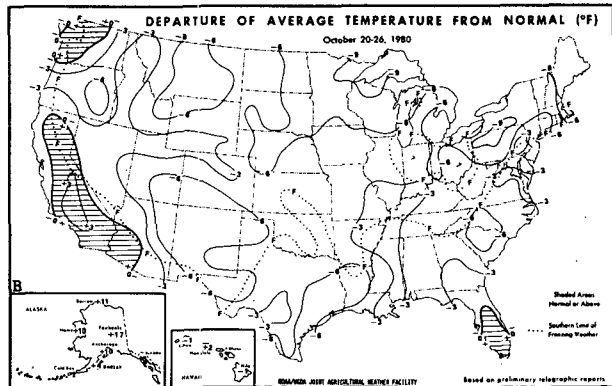
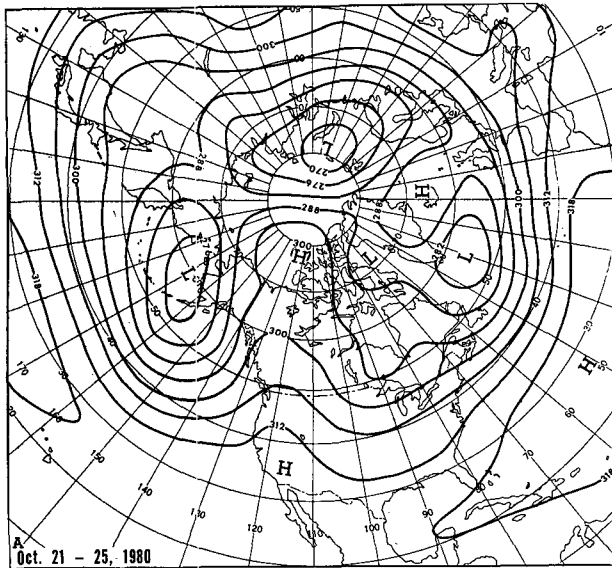


FIG. 10. As in Fig. 7 except for (A) 21–25 October 1980 and (B) and (C) week of 20–26 October 1980.

5. Tropical activity

Ivan, the only Atlantic tropical storm of the month, formed on 6 October near 30°N latitude and 30°W longitude under a mid-tropospheric mean trough cut off from the westerlies. It initially moved southwestward, became a hurricane on 7 October

and thereafter moved toward the northwest, north and northeast before dwindling to frontal low status on 12 October.

As was the case in the Atlantic, only one tropical storm, Newton, was observed in the tropical east Pacific this month. After forming south of Baja Cali-

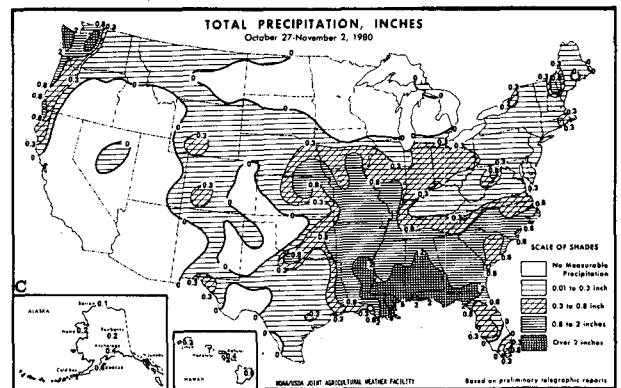
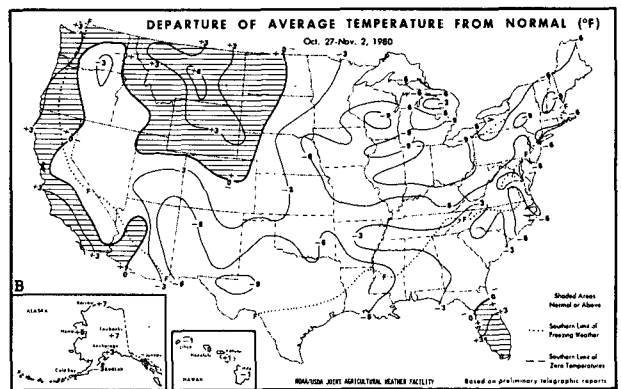
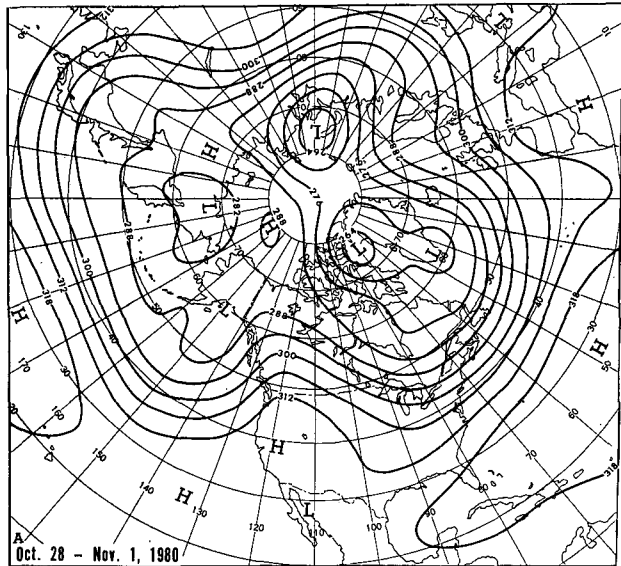


FIG. 11. As in Fig. 7 except for (A) 28 October–1 November 1980 and (B) and (C) week of 27 October–2 November 1980.

fornia, on 28 October, Newton was downgraded to a tropical depression the following day.

In the west Pacific, Typhoon Vernon, a carry-over storm from September, was southeast of Japan on 1 October. Moving northward and northeastward, Vernon was downgraded to a tropical storm and then a frontal low on 4 October.

Four tropical storms, two of which became typhoons, formed over the west Pacific during October. Tropical Storm Wynne formed on 4 October near 6°N latitude, 152°E longitude and became a typhoon south of Japan four days later. After recurving over the South China Sea on the 12th, Wynne brushed the southern tip of Japan and then moved northeastward just off the south coast of Japan before becoming absorbed in the circulation about an intense frontal low east of Japan on the 15th.

Tropical Storm Alex formed south of Japan on 13

October but was downgraded the next day as it was swept northward in advance of Typhoon Wynne. Tropical Storm Betty formed well east of the Philippines on 29 October, became a typhoon the following day and was still moving westward at the end of the month. The final tropical storm of the month, Cary, formed over the South China Sea on 30 October.

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- Taubensee, Robert E., 1980: Weather and Circulation of September 1980—Heat wave end late in the month. *Mon. Wea. Rev.*, **108**, 2100–2106.