

## WEATHER AND CIRCULATION OF AUGUST 1979— Early Stages of Two Destructive Atlantic Hurricanes

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### 1. Mean circulation

The mean 700 mb flow pattern was highly amplified north of 50°N this month (Figs. 1 and 2). The mean troughs over northeastern Siberia and eastern Canada, as well as the mean ridges over Alaska and the Taymyr peninsula, were of exceptional strength and were associated with major temperature anomalies (Fig. 3). The latter ridge occurred in a normal trough location.

A strong subtropical high was located over the

west Pacific, west of its July position (Wagner, 1979). An enhanced band of westerlies between this high and the trough to the north split into two branches as it moved eastward through the downstream ridge (Figs. 1 and 4). The southern branch of this wind stream moved into a moderately deep trough along the west coast of the United States. Over the United States, the ridge over the Southwest was weaker than normal and vorticity maxima were driven inland from time to time. The east coast trough was also weaker than normal as the sub-

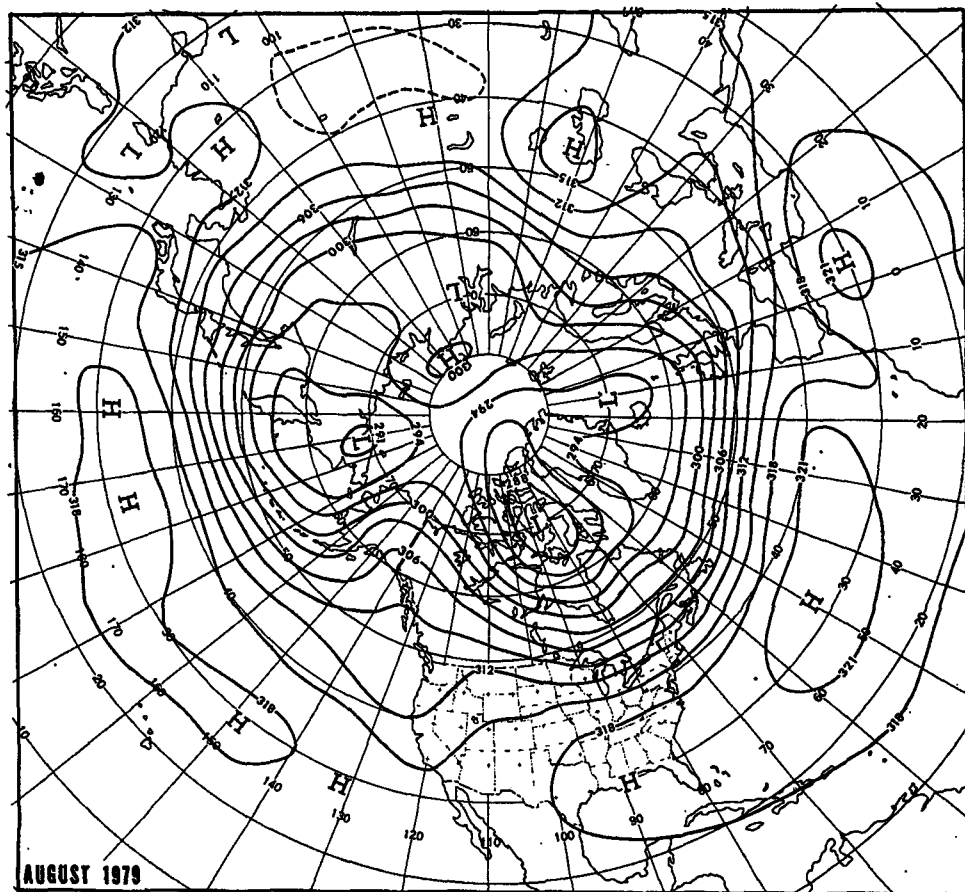


FIG. 1. Mean 700 mb height contours (dam) for August 1979.

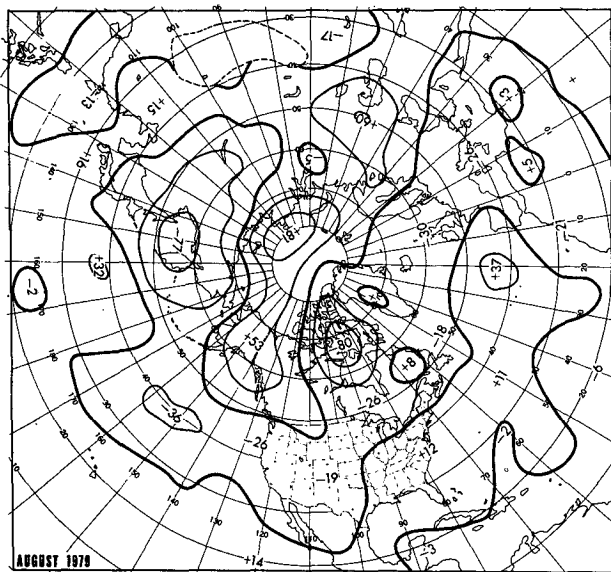


FIG. 2. Departure from normal of mean 700 mb height (m) for August 1979.

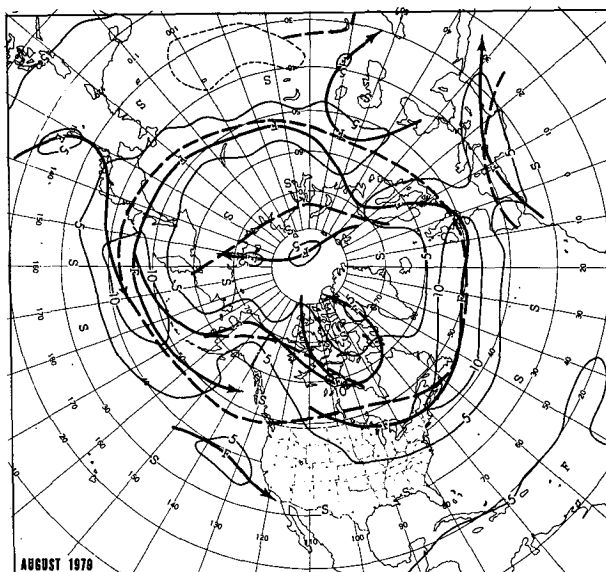


FIG. 4. Mean 700 mb geostrophic wind speed ( $m s^{-1}$ ) for August 1979. Solid arrows indicate observed axes of maximum wind speed and dashed lines, the normal.

tropical ridge was well developed from the southeastern United States to the eastern Atlantic. Strong winds to the north of this ridge moved through an amplified wave pattern over Europe.

### 2. Temperature

The strong outflow of cold air from central Canada aided by cloudy weather in the South produced below normal mean temperatures over much of the country east of the Continental Divide (Fig. 5). A major exception was the central Atlantic Coast

where the subtropical ridge intruded more strongly than normal. Below normal temperatures were also observed over much of the central and southern Plateau region where the upper level ridge was weaker than normal and precipitation and cloudiness were enhanced. An extensive area of warm weather occurred over the far west in advance of the deep coastal trough. Mean temperatures were well above normal under the strong Alaskan ridge. In Hawaii temperatures were generally near normal.

### 3. Precipitation

Precipitation amounts exceeded normal over most of the West as vorticity maxima moving inland from the coastal trough interacted with moist air

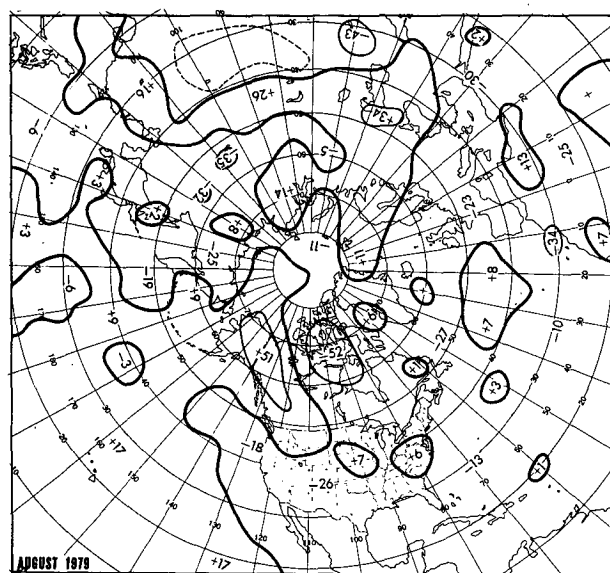


FIG. 3. Departure from normal of mean 1000-700 mb thickness (m) for August 1979.

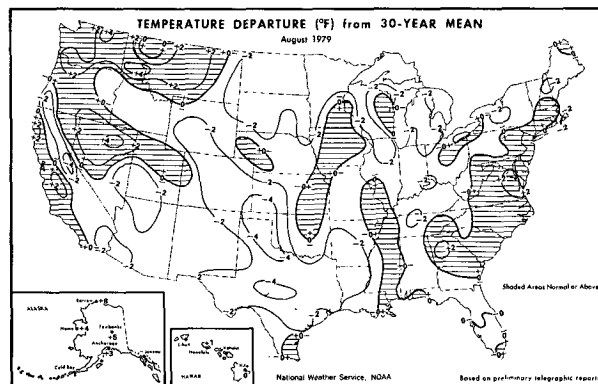


FIG. 5. Departure from normal of average surface air temperature ( $^{\circ}F$ ) for August 1979 (from National Oceanic and Atmospheric Administration and Economics, Statistics and Cooperatives Service, 1979).

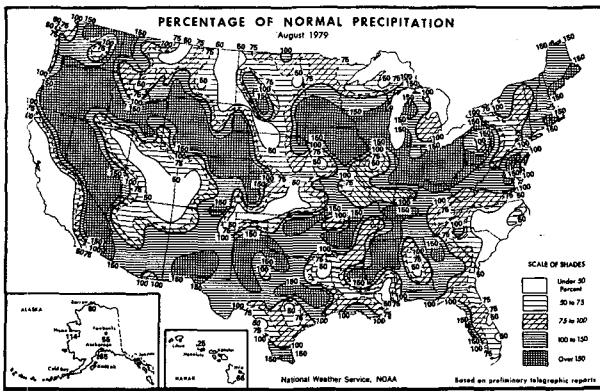


FIG. 6. Percentage of normal precipitation for August 1979 (from National Oceanic and Atmospheric Administration and Economics, Statistics and Cooperatives Service, 1979).

from the south (Fig. 6). Eastward penetration of migratory troughs, coupled with relatively strong moisture advection across the south central states and the frequent passage of cold fronts from Canada, also produced above normal precipitation in most areas east of the Continental Divide. The Southeast, under a strong subtropical ridge, was an exception.

It was the wettest August of record in parts of the upper Midwest and at Denver, Colorado and the second driest August of record at Greensboro, North Carolina (Table 1).

Areas under and east of the Alaskan ridge were relatively dry this month while the western part of the state, under strong southerly flow, received bountiful rainfall. Hawaiian rainfall was subnormal as the subtropical ridge was displaced 4–5° latitude closer than normal to the Islands.

4. Variability within the month

a. 30 July–5 August

Early in the month the mean 700 mb flow over the United States was quite weak (Fig. 7). Sub-

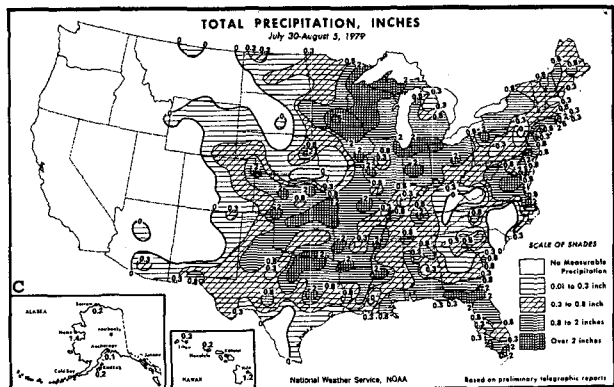
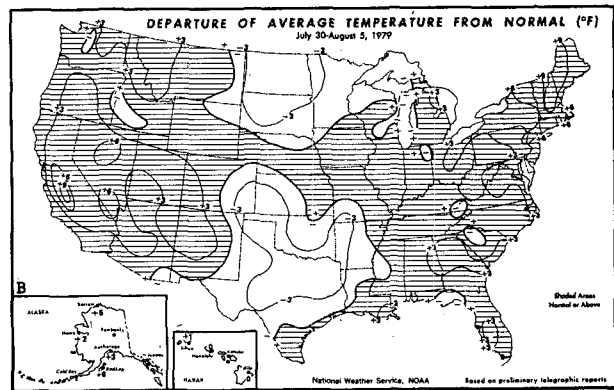
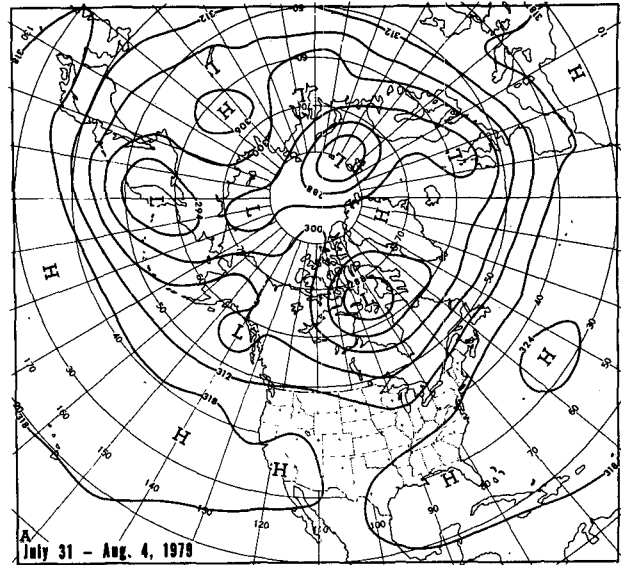


TABLE 1. Record and near-record monthly rainfall totals observed during August 1979.

Station	Amount (inches)	Anomaly (inches)	Remarks
Rochester, MN	9.52	+5.93	wettest August
Columbus, OH	8.63	+5.77	wettest August
South Bend, IN	8.30	+5.04	wettest August
Denver, CO	5.85	+4.56	wettest August and 6th wettest month
Pendleton, OR	1.40	+1.06	2nd wettest August
Boise, ID	1.81	+1.51	2nd wettest August
Vicksburg, MS	7.44	+3.85	5th wettest August
Indianapolis, IN	6.09	+3.29	6th wettest August
Greensboro, NC	1.13	-3.17	2nd driest August

FIG. 7. (A) Mean 700 mb contours (dam) for 31 July–4 August; (B) departure from normal of average surface air temperature (°F) and (C) total precipitation (inches) for week of 30 July–5 August 1979 (from National Oceanic and Atmospheric Administration and Economics, Statistics and Cooperatives Service, 1979).

normal temperatures, as well as the heaviest rainfall totals, were mostly concentrated in the vicinity of a mean trough sloping from the Great Lakes to west Texas. It was quite warm under the strong south-

TABLE 2. Extreme daily temperatures observed during August 1979.

Location	Temperature (°F)	Date	Remarks
Las Vegas, NV	116	1,3	record high for August
Salt Lake City, UT	104	4	record high for August
Winslow, AZ	103	2	equaled record high for August
Casper, WY	102	5	record high for August
Lander, WY	101	5	record high for August
Albuquerque, NM	101	2	equaled record high for August
Muskegon, MI	36	16	record low for August
Hatteras, NC	56	18	record low for August

western ridge and in advance of the Great Lakes trough.

On various days this week record high temperatures for the month were equaled or exceeded at several locations from Arizona and New Mexico northward to Wyoming (Table 2).

*b. 6-12 August*

The high-latitude wave pattern near North America amplified this week as troughs deepened near the Aleutians and over Hudson Bay and a ridge built strongly over western Canada (Fig. 8). Over the United States the mean trough in the north progressed to the western Atlantic as the surrounding westerly winds increased. Southern portions of the trough filled in response to deepening off the West Coast.

Changes in both temperature and precipitation from the previous week were minimal. However, the amplified wave pattern to the north and the increased westerly flow near the Great Lakes spread cool air from the Dakotas to New England. The swath of generally heavy precipitation from Minnesota to the middle Atlantic Coast was largely due to a low-pressure area, and associated cold front, moving in the southern fringes of a strong jet stream over southern Canada. This storm produced 14 tornadoes in Wisconsin on 9 August.

*c. 13-19 August*

The longwave pattern in the vicinity of North America remained highly amplified this week as a trough deepened along the West Coast and a ridge progressed to mid-continent (Fig. 9). A massive and cold polar high, thrust southward from north-

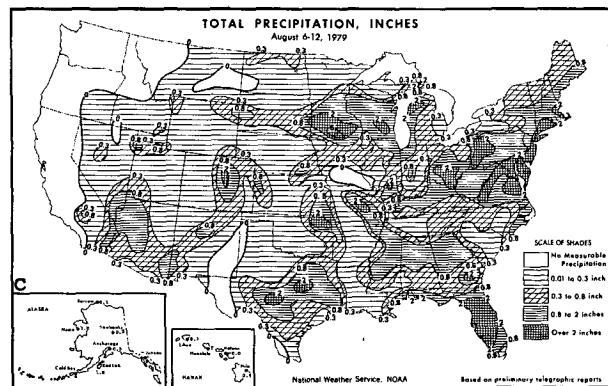
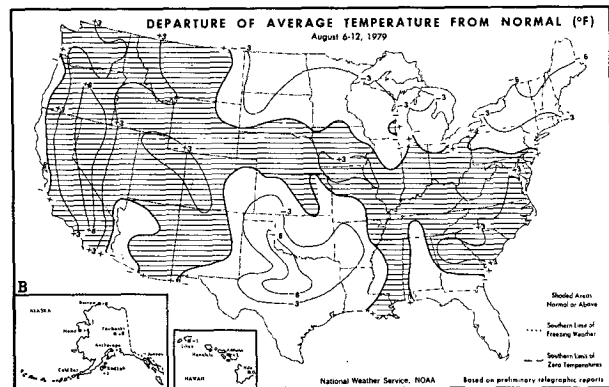
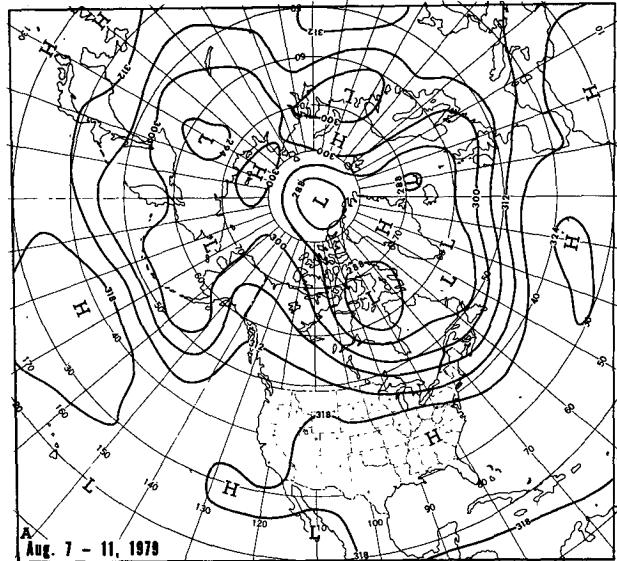


FIG. 8. As in Fig. 7 except for (A) 7-11 August 1979 and (B) and (C) week of 6-12 August 1979.

western Canada at the end of the previous week, affected most of the country from the eastern slopes of the Rocky Mountains to the East Coast. Record-low temperatures for August were observed at Muskegon, Michigan and Hatteras, North Carolina (Table 2) and a killing frost was reported in the vicinity of Houghton Lake, Michigan. Under the

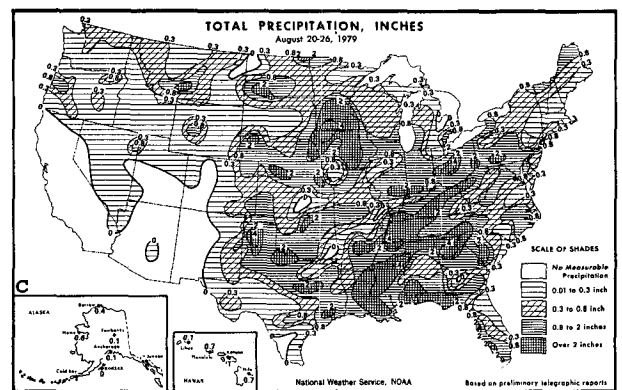
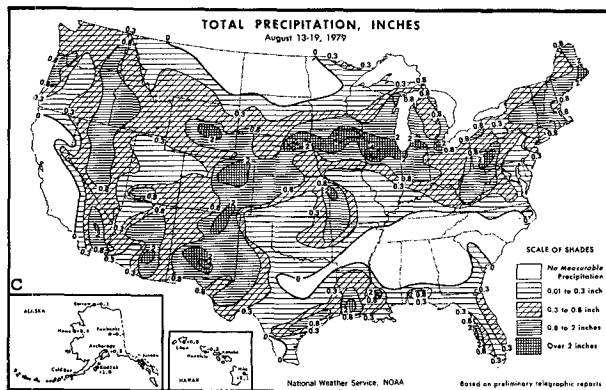
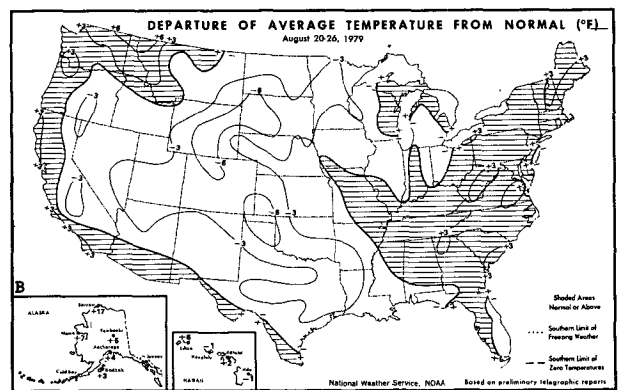
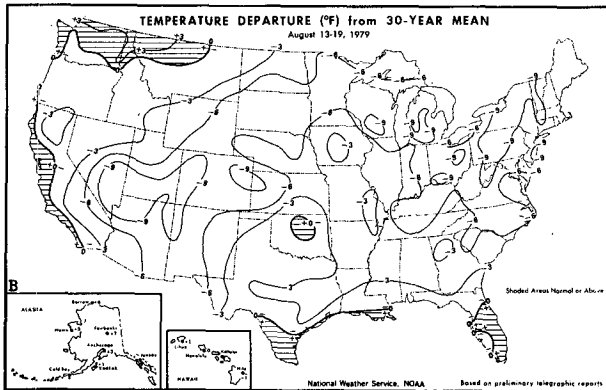
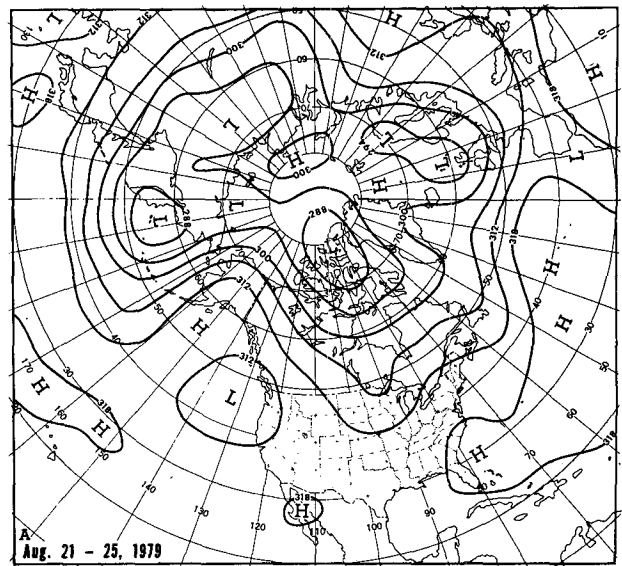
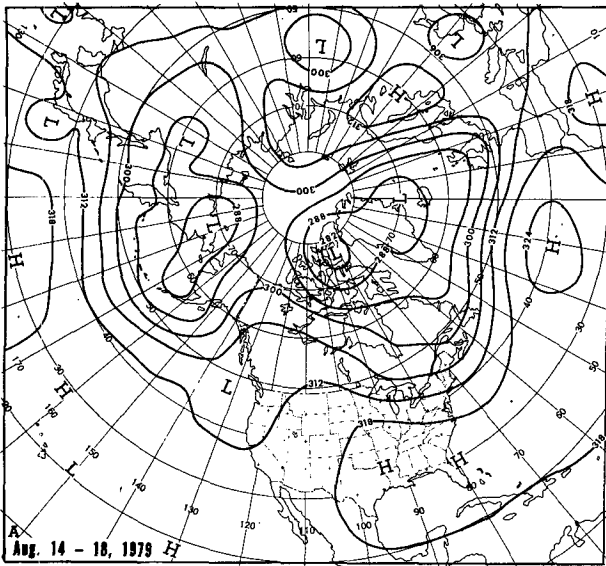


FIG. 9. As in Fig. 7 except for (A) 14-18 August 1979 and (B) and (C) week of 13-19 August 1979.

FIG. 10. As in Fig. 7 except for (A) 21-25 August 1979 and (B) and (C) week of 20-26 August 1979.

influence of the deep west coast trough, cloudy and cool weather also prevailed over most of the West.

Relatively heavy precipitation occurred over much of the West as vorticity maxima moved inland from the coastal trough. This significantly contributed to the control of forest fires in the Northwest. East of the Divide, precipitation accompanied both the

leading edge of the early period cold outbreak and later transient lows.

An unusually intense and rapidly deepening storm in the vicinity of Great Britain on 14 August disrupted an international yacht race; 17 persons were reported killed and 21 boats sank or were abandoned. This was the same storm that produced several tornadoes in Wisconsin on 9 August, having

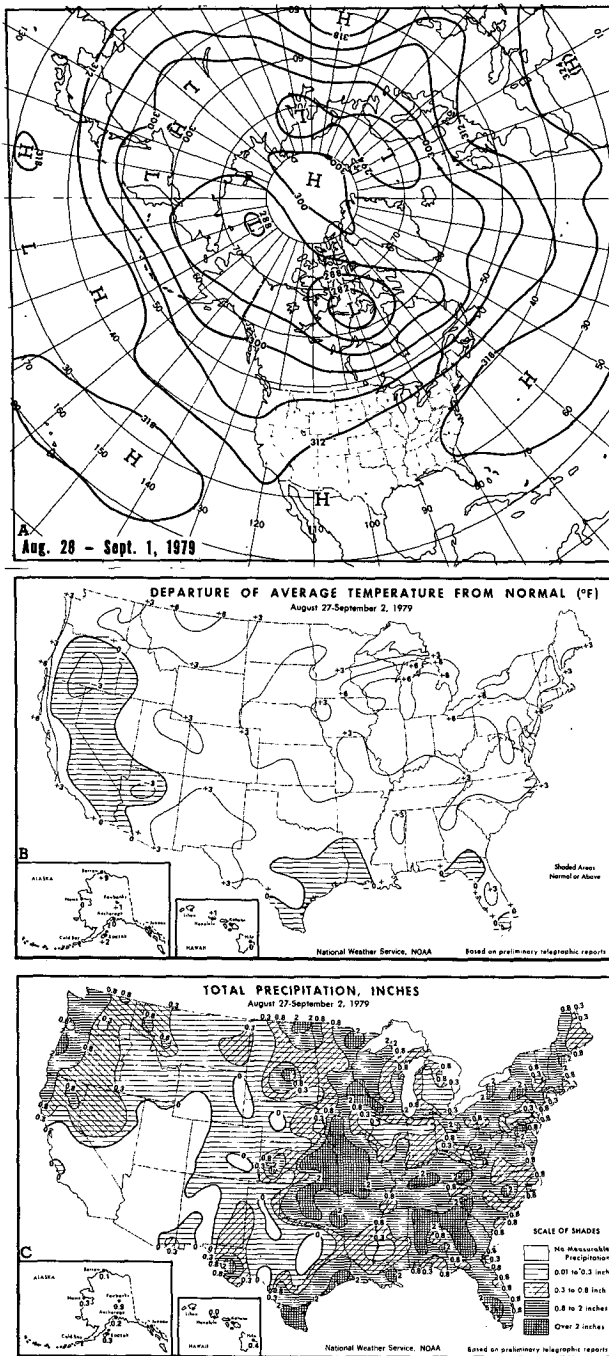


FIG. 11. As in Fig. 7 except for (A) 28 August–1 September 1979 and (B) and (C) week of 27 August–2 September 1979. (Note that areas of subnormal temperature have been shaded, in error, on Fig. 11 B.)

rapidly crossed the Atlantic in the southern fringes of a strong jet stream.

*d. 20–26 August*

With the retrogression of a strong mean ridge to Alaska, the Canadian trough built southward across

Hudson Bay to the Mississippi Valley and a moderately strong ridge developed along the East Coast (Fig. 10). The West Coast trough, largely by-passed by the westerlies, remained about stationary. The combination of cold air advection and cloudy weather continued the cold regime over much of the country west of the Mississippi River. To the east, however, the emerging ridge produced above normal mean temperatures.

Heaviest precipitation amounts were observed near and east of the mean trough. Several tornadoes occurred in the Great Plains on 21 August and in Florida on 23 August.

*e. 27 August–2 September*

The circulation pattern over and near North America deamplified markedly this week and above normal temperatures were observed at most locations (Fig. 11). An exception was the interior of the Far West where proximity to a fairly deep coastal trough continued the cool, wet weather for yet another week. East of the Continental Divide frequent transient waves in the westerlies were accompanied by widespread but not heavy precipitation.

**5. Tropical activity**

After a long spell of inactivity, two Atlantic storms formed during the last few days of the month which were to become extremely destructive in the United States as well as the islands to the southeast. Tropical Storm David formed east of the Lesser Antilles (near 12°N, 46°W) on 27 August. It was a hurricane the following day and moved to the WNW through the Martinique Passage to the island of Hispaniola by the end of the month. Considered one of the strongest storms of the century, David had sustained winds up to ~130–140 kt with gusts to approximately 150 kt. During August, strong winds, heavy rains and storm tides associated with the hurricane caused extensive crop damage to Guadeloupe, Martinique, Dominica, Puerto Rico, the Dominican Republic and Haiti; preliminary estimates exceed \$550 million. In this early portion of David's existence over 1100 people were killed, mostly as a result of flooding in the Dominican Republic.

On the last day of the month two additional storms reached tropical storm strength. Elena formed in the Gulf of Mexico, south of the Texas-Louisiana border, while Frederic formed a bit east of David's genesis area. Frederic was to become a destructive Gulf of Mexico storm.

There were only two tropical storms in the tropical eastern Pacific this month, both of which reached hurricane strength. Enrique was of tropical storm or hurricane strength from 18–23 August; Fefa, from 21–24 August. Neither storm approached land.

Typhoon Hope, which formed in the west Pacific late in July (Wagner, 1979), struck Hong Kong on 2 August with torrential rains and gusts to 114 kt. Five persons were reported dead and damage was apparently not extensive despite news indications that this was the strongest storm to hit Hong Kong since Rose in 1971.

Tropical Storm Irving formed east of the Philippines on 11 August and became a typhoon two days later. The storm moved northward and was downgraded as it crossed Korea on 17 August. The final storm of the month was Judy which formed well east of the Philippines on 17 August and became a typhoon the next day. This storm had several

changes of course during its lifetime before dwindling to tropical storm strength on 24 August as it grazed the China coast near 30°N. It was further downgraded two days later as it approached Korea.

#### REFERENCES

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