

# WEATHER AND CIRCULATION OF SEPTEMBER 1972

## Another August–September Reversal

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### 1. MEAN CIRCULATION

The vigorous polar vortex that has been an important feature of the 700-mb circulation over Canada for the past several months continued anomalously deep as it expanded and moved slightly southwestward during September (figs. 1, 2). The midlatitude portion of the Atlantic 700-mb ridge progressed to a position just west of the British Isles, where monthly mean heights were as much as 106 m above normal. To the south, a negative height anomaly center that had been west of Gibraltar also strengthened.

Over the remainder of the Northern Hemisphere, there were pronounced circulation changes. The building of heights west of the British Isles was associated with

sharply falling heights over eastern Europe and western Russia, where a strong ridge had produced one of the hottest summers on record. The monthly mean 700-mb height anomaly decreased by 128 m between August and September in that area (fig. 3). The remains of the warm ridge that had prevailed there during the summer were deflected southeastward toward the Caspian and Aral Seas. Monthly mean 700-mb heights rose strongly over the polar basin and northeast Asia, while heights fell in the vicinity of Japan and across the central Pacific at midlatitudes.

Although the 700-mb wind maximum was close to its normal position, the decrease in the midlatitude zonal westerlies to values of only 10–12 m/s (4–6 m/s below

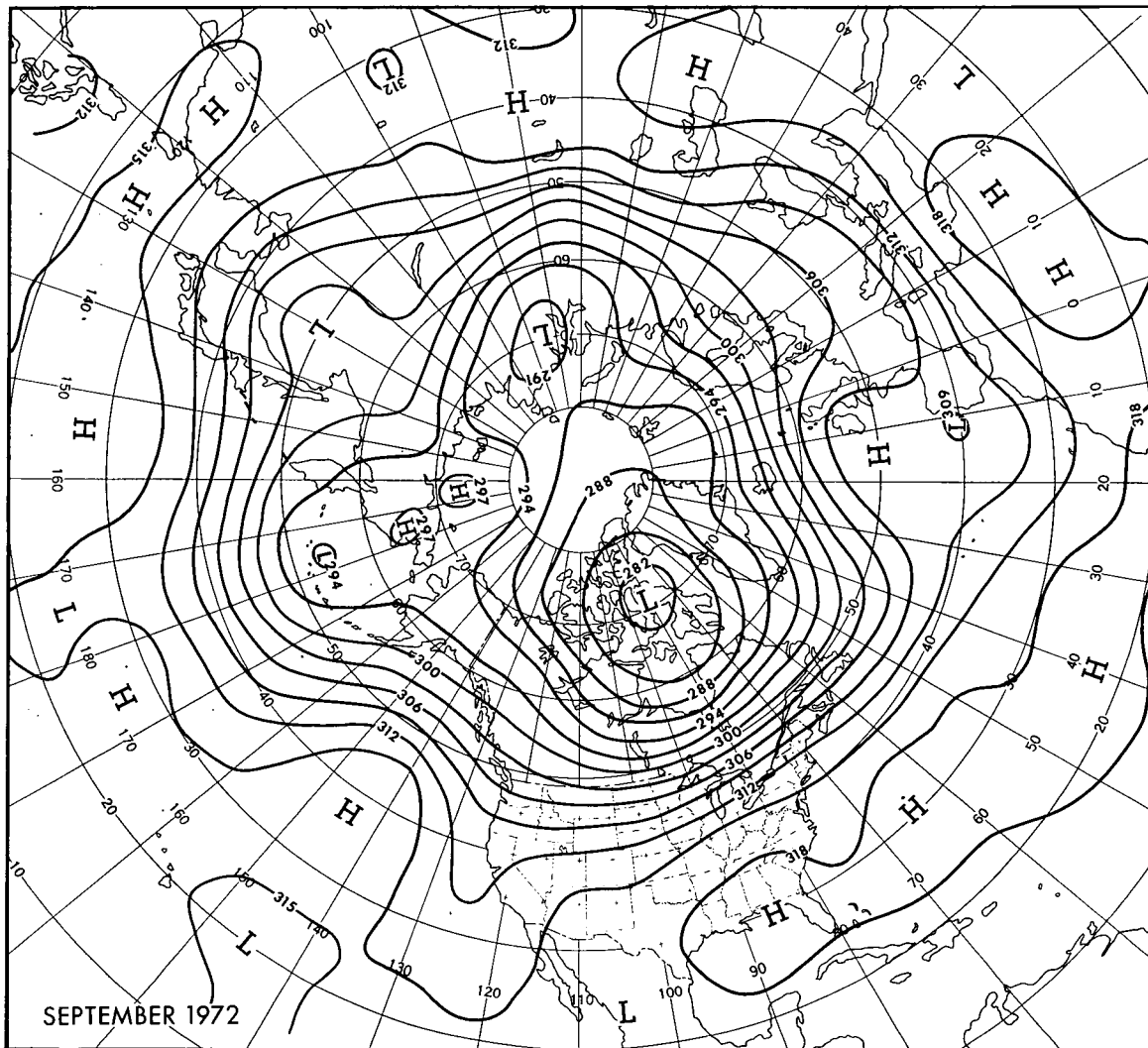


FIGURE 1.—Mean 700-mb contours in dekameters (dam) for September 1972.

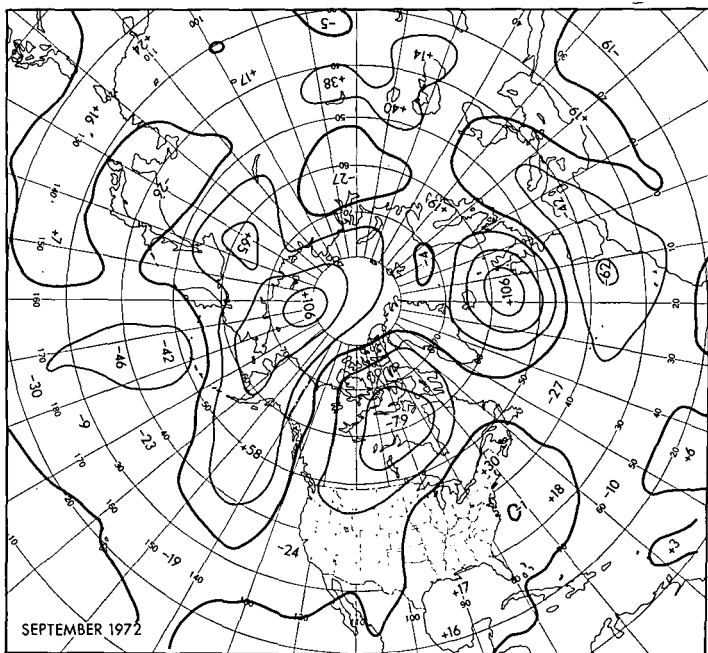


FIGURE 2.—Departure from normal of mean 700-mb height in meters (m) for September 1972.

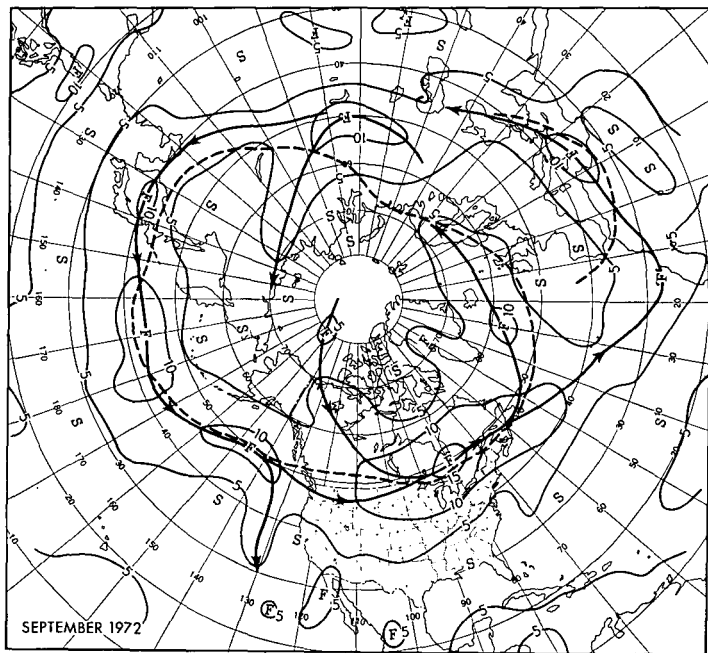


FIGURE 4.—Mean 700-mb geostrophic wind speed (m/s) for September 1972. Solid arrows show the observed axes of maximum wind speed, and dashed lines show the normal.

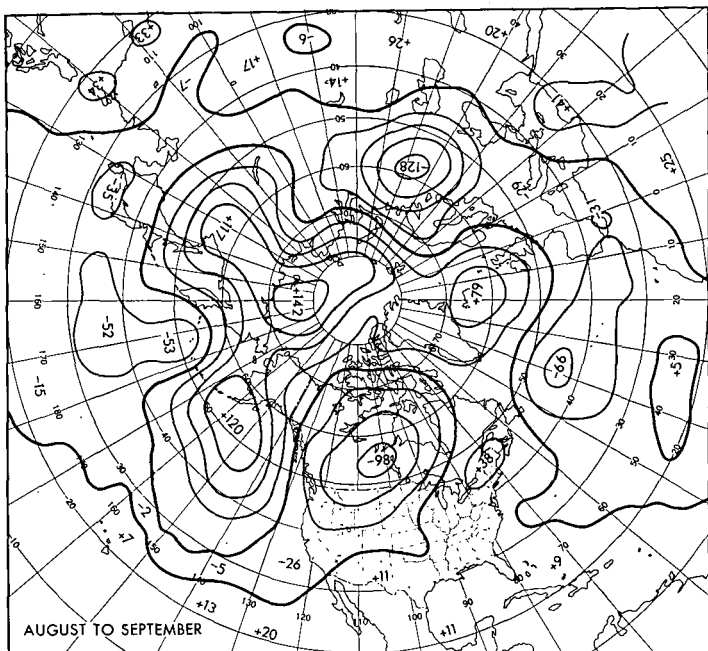


FIGURE 3.—Mean 700-mb height anomaly change (m) from August to September 1972.

normal) over the Pacific Ocean (fig. 4) may have contributed to the retrogression of the planetary waves in the region from the central Pacific to North America—a rather unusual occurrence in the early fall when the westerlies are normally increasing rapidly in strength.

The trough that had been near 170°W in August moved westward about 15° longitude, while the strong ridge that had been over western North America retrograded to the eastern Pacific and Gulf of Alaska. (See fig. 3 and compare figs. 1 and 2 with figs. 1 and 2 of Dickson 1972.)

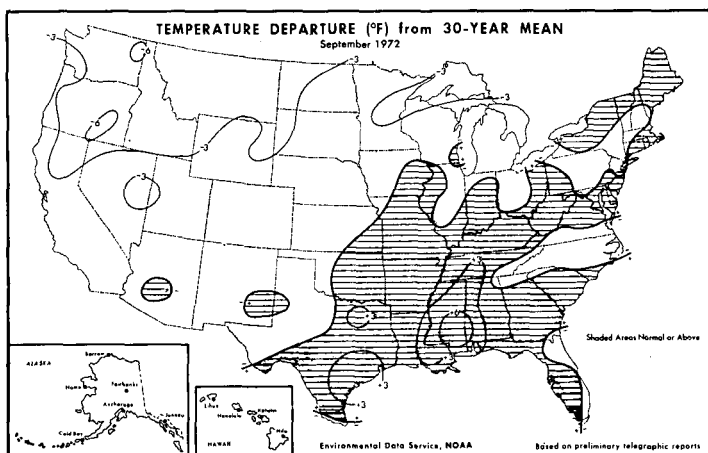


FIGURE 5.—Departure from normal of average surface temperature (°F) for September 1972 (from Environmental Data Service and Statistical Reporting Service 1972).

The southwestward motion of the Canadian Low and retrogression of the trough that had been over eastern North America led to a marked change in the weather over the United States. This reversal in circulation and temperature patterns over the United States was remarkably similar in its large-scale aspects to those occurring in 1970 and 1971 (Taubensee 1970, 1971), although the details and magnitudes of the changes were different.

## 2. TEMPERATURE

The September mean temperature anomaly pattern (fig. 5) was similar to the height anomaly pattern (fig. 2). The coldest weather was observed in the northwest quadrant of the Nation, where frequent air masses of

Canadian and North Pacific origin kept temperatures from 3° to 6°F below normal. Warmer than normal weather was nearly all confined to the southeastern third of the country, with greatest anomalies near the gulf coast.

The generally small amplitude of the anomalous flow (fig. 2) and considerable variability of circulation regimes within the month prevented any new monthly mean temperature records from being set. However, the average temperature at a number of stations came close to the record. Medford and Salem, Oreg., had their fourth coldest September on record, and at Salem this was the coldest September since 1911. This month tied the record for warmth at Pensacola, Fla.; while, at 5.0° F. above normal, it was the fifth warmest September on record at Jackson, Miss., and the warmest since 1926. At Meridian, Miss., only the last day of the month averaged below normal, and daily record high temperatures were set or equaled on 7 days. The strong subtropical ridge over the southeast (fig. 1) was an effective buffer to prevent polar air from reaching the gulf coast until the last day of September.

A strong component of flow from the north (figs. 1, 2) kept temperatures in most of Alaska below normal after the first week of the month, and by the last week of September the growing season had ended in most of the agricultural areas.

### 3. PRECIPITATION

Most of the Nation had normal or greater precipitation during the month, except for small portions of the far Southwest, the Northern Great Plains, the mid-Atlantic coast, and a more extensive area of the Southeast (fig. 6). The dryness over the latter area was beginning to hurt some crops, although it was favorable for those ready for harvest. Several stations in Florida and Georgia had one of the driest Septembers on record, with monthly rainfall deficits of 4–6 in. (table 1). The normal tropical activity of early fall that makes September the wettest month of the year at many Florida locations was almost entirely absent this year in that area.

The trough near the west coast and the associated instability and lifting of the atmosphere produced an extensive area of more than twice-normal precipitation in the Great Basin (figs. 1, 6). An anomalous southerly component of 700-mb flow (fig. 2) between this trough and the ridge over the southeast brought copious moisture into the middle of the country. Frontal activity and convective storms near the boundary between the cold air over the Northwest and warm air over the Southeast led to heavy precipitation at a number of localities, particularly in the Great Lakes area. Several stations reported one of their wettest Septembers (table 1), and others reported records for shorter periods of time. Torrential rain of 3.68 in. in 24 hr and a new record of 0.85 in. in 5 min were associated with a tornado near Chicago's Midway Airport. Thunderstorms were observed on 10 days, including 4 days with severe weather at Madison, Wis. A total of 3.77 in. within a 24-hr period at Duluth, Minn.,

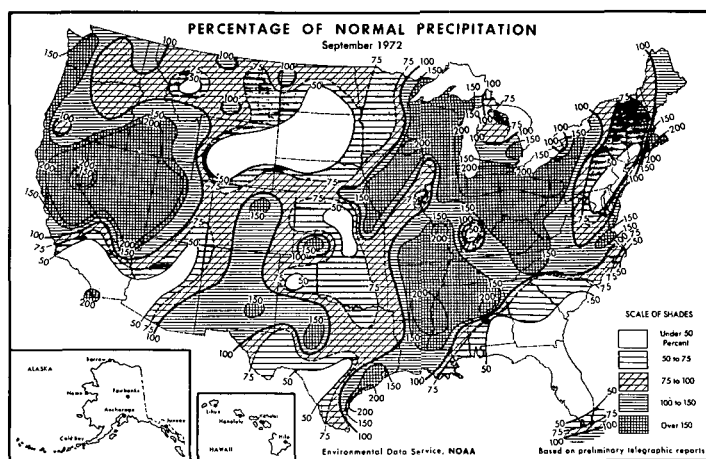


FIGURE 6.—Percentage of normal precipitation for September 1972 (from Environmental Data Service and Statistical Reporting Service 1972).

TABLE 1.—Record and near-record precipitation observed during September 1972

Location	Amount Anomaly		Remarks
	(in.)	(in.)	
Daytona Beach, Fla.	0.42	-6.58	Driest Sept.
Fort Myers, Fla.	2.33	-6.17	Do.
Lakeland, Fla.	0.81	-5.74	2d driest Sept., driest since 1921
Tampa, Fla.	1.28	-5.61	3d driest Sept.
Tallahassee, Fla.	0.11	-5.40	Driest Sept., measurable rain only 2 days
Savannah, Ga.	0.36	-4.89	Driest Sept.
Helena, Mont.	0.08	-0.87	4th driest Sept., driest since 1932
Mount Shasta, Calif.	0.41	-0.46	14 out of last 16 mo below-normal precipitation, only half normal precipitation since Jan. 1
Fort Wayne, Ind.	6.75	+4.08	2d wettest Sept., wettest since 1933
Toledo, Ohio	8.10	+5.97	Wettest Sept.
Milwaukee, Wis.	7.57	+4.85	3d wettest Sept.
Rochester, Minn.	7.06	+3.96	Do.
Colorado Springs, Colo.	4.13	+3.06	2d wettest Sept.
Dodge City, Kans.	27.15	+12.80	2d wettest growing season (Apr.-Sept.)

set off another flash flood there and brought the 1972 annual precipitation surplus to 11.49 in. Even though tropical activity was absent from the western gulf coast, parts of the Texas coast had more than twice-normal precipitation from convective activity triggered by a weakening polar front that stalled near the coast.

Hawaii was generally drier than normal, particularly on the windward slopes, since below-normal heights and troughs in the westerlies to the north and west interrupted or weakened the trade winds during much of the month (figs. 1, 2).

### 4. TROPICAL ACTIVITY

As previously mentioned, no tropical storms or even active easterly waves affected the Southeast and gulf coast areas. The dearth of Atlantic hurricanes continued through September, normally the peak month, as abnormally cold water in the tropical North Atlantic (Dickson 1972) and a generally unfavorable circulation pattern with westerly anomalous flow (fig. 2) prevailed.

Three tropical storms (Betty, Carrie, and Dawn) and

another neutercane (Charlie) were active in the western and central Atlantic. Betty, which had been of hurricane intensity during August, spent all her life in the westerlies. Carrie, which formed the last day of August, moved northward a short distance off the mid-Atlantic coast and produced torrential rains of up to 10 in. within 6 hr over coastal New England. While gale winds did some damage along the New England coast, very little rain and no wind damage occurred more than 100 mi inland. Dawn followed an irregular path off the southeast U.S. coast and was briefly a hurricane on September 8. Satellite pictures and coastal reports indicated that Dawn was a rather dry storm, and she dissipated near the Georgia coast while giving a few very light showers early on September 13.

Neutercane Charlie formed near the Gulf Stream over the west-central Atlantic on September 18 and a few days later became an "explosively deepening" extratropical storm near Iceland.

An unusual storm that displayed some tropical characteristics brought gales and flood-producing rains to the lower Chesapeake Bay and the Virginia Capes on the 21st of September. A drifting barge damaged the Chesapeake Bay Bridge-Tunnel, and severe local flooding occurred in the Virginia Beach area.

Three tropical storms were observed in the eastern Pacific. Hyacinth was of hurricane force but weakened and dissipated very close to San Diego on September 6. Moisture from the storm's circulation contributed to the rainfall in California and the Great Basin. In the latter half of September, Iva and June moved westward at low latitudes without recurving or affecting any land areas.

Two typhoons occurred over the western Pacific. Helen struck the main Japanese island of Honshu on September 16 and became extratropical the next day. A few days later, Ida recurved well to the east without affecting land.

## 5. WEEKLY VARIABILITY

### September 4-10

During the first full week of the month, generally fast westerlies across the northern United States brought a succession of Highs and Lows with the usual frontal activity (fig. 7). Due to the low amplitude of the circulation pattern, no extremes were observed. Most of the country was cool, with greatest weekly temperature anomalies of 3°-6°F below normal over the Midwest and mid-Atlantic States. The Southern Great Plains and southern Mississippi Valley remained a few degrees above normal as cold fronts were unable to penetrate with any force.

Precipitation was distributed over most of the country, with greatest amounts in the central part of the Nation. A few heavy thundershowers occurred in these areas. Heavy rains along the New England coast from tropical storm Carrie fell mostly on September 3 and so are not reflected in figure 7C.

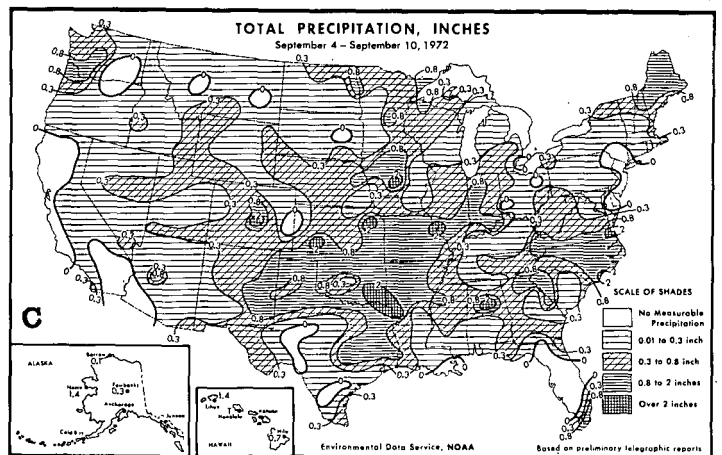
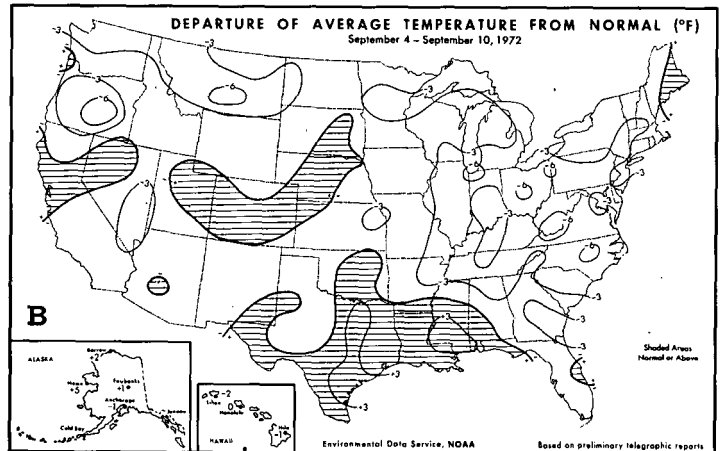
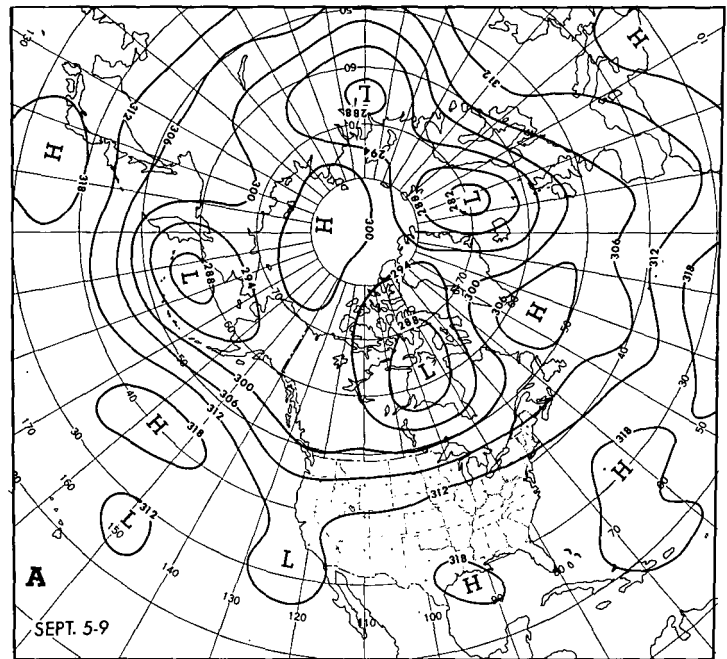


FIGURE 7.—(A) mean 700-mb contours (dam) for Sept. 5-9, 1972; (B) departure from normal of average surface temperature (°F) and (C) total precipitation (in.) for week of Sept. 4-10, 1972 (from Environmental Data Service and Statistical Reporting Service 1972).

### September 11-17

The intense 700-mb Low that had been east of Kamchatka weakened as the blocking High over the Arctic

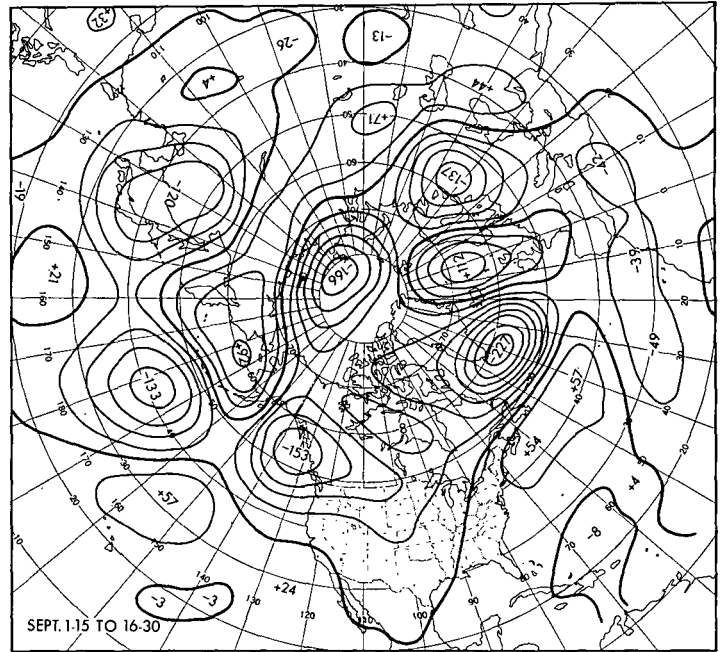
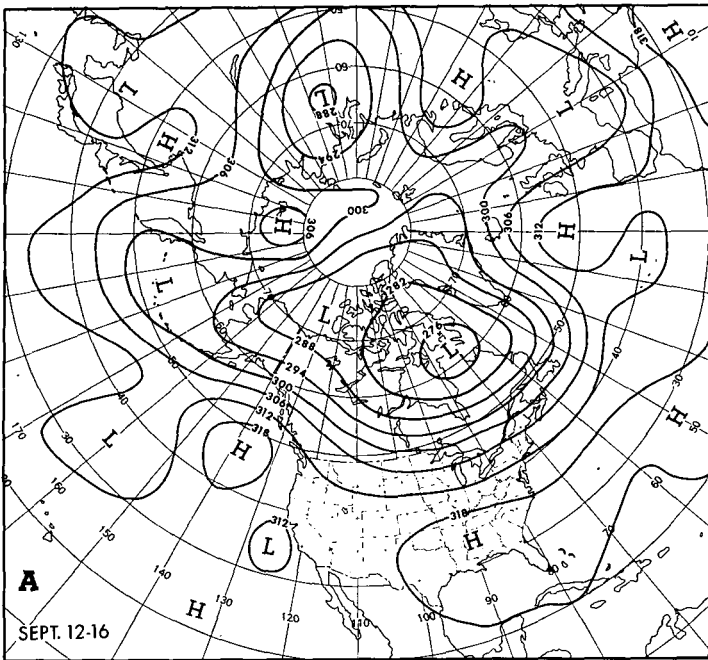


FIGURE 9.—Mean 700-mb height change (m) from Sept. 1-15 to 16-30, 1972.

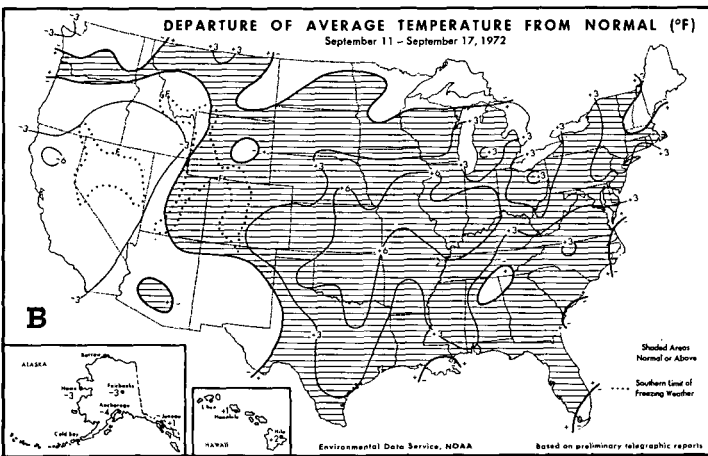


TABLE 2.—Monthly and seasonal temperature records established during September 1972

Location	Temperature (° F)	Date	Remarks
Daytona Beach, Fla.	64	3	Lowest so early in season
Jacksonville, Fla.	62	3	Do.
Norfolk, Va.	51	11	Do.
Savannah, Ga.	97	17	Highest so late in season
Tampa, Fla.	96	19	Do.
Valentine, Nebr.	98	18	Equaled highest so late
Grand Island, Nebr.	100	18	Warmest day of yr
Aberdeen, S. Dak.	98	19	Tied warmest day of yr
Rapid City, S. Dak.	40	2	Lowest so early in season
	22	26	Do.
Burns, Oreg.	17	25	Do.
Eugene, Oreg.	32	27	Do.
Astoria, Oreg.	95	2	Highest so late in season, highest for Sept.
	33	27	Lowest so early in season, equaled lowest for Sept.
Olympia, Wash.	25	27	Lowest for Sept.
Seattle, Wash.	35	27	Do.
Topeka, Kans.	30	30	Do.
Oklahoma City, Okla.	37	30	Equaled lowest so early
Wichita Falls, Tex.	41	30	Do.
Fairbanks, Alaska	11	30	Lowest for Sept.

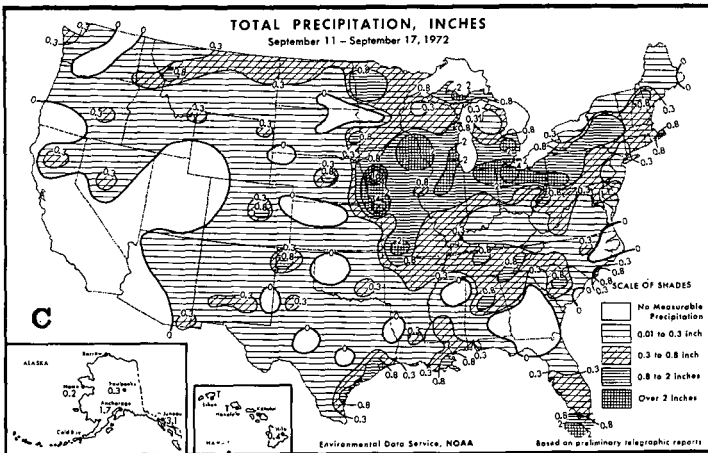


FIGURE 8.—Same as figure 7, (A) for Sept. 12-16, 1972; (B) and (C) for week of Sept. 11-17, 1972.

Ocean contracted somewhat and moved toward the Siberian coast. The eastern Pacific 700-mb ridge amplified and moved northeastward to a position just off the west coast of North America (fig. 8A). Heights continued to fall over Alaska and Canada, but the subtropical ridge strengthened over the southeastern conterminous United

States, resulting in strong westerlies from the Aleutians across southern Canada to the east coast of North America. A blocking ridge that had been south of Greenland progressed to a position near 20°W longitude, driving the trough that had been near the British Isles inland to central Europe.

The strengthened subtropical ridge over the southern United States and lack of a full-latitude, 700-mb ridge over western North America resulted in above-normal temperatures over most of the country (fig. 8B). Greatest weekly anomalies of more than 6°F above normal were observed over the Central Great Plains and middle

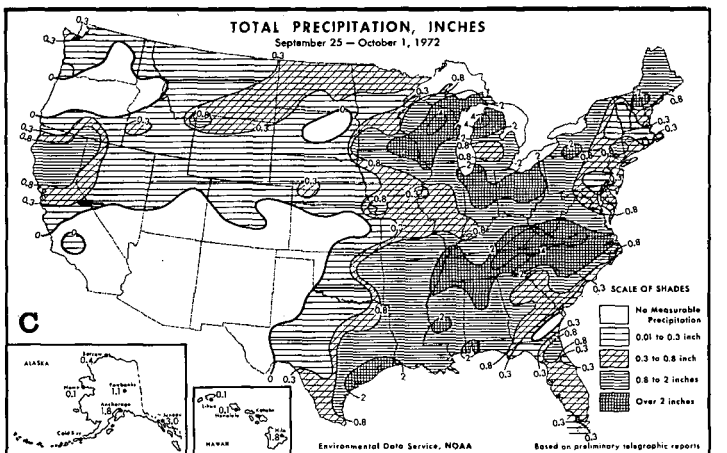
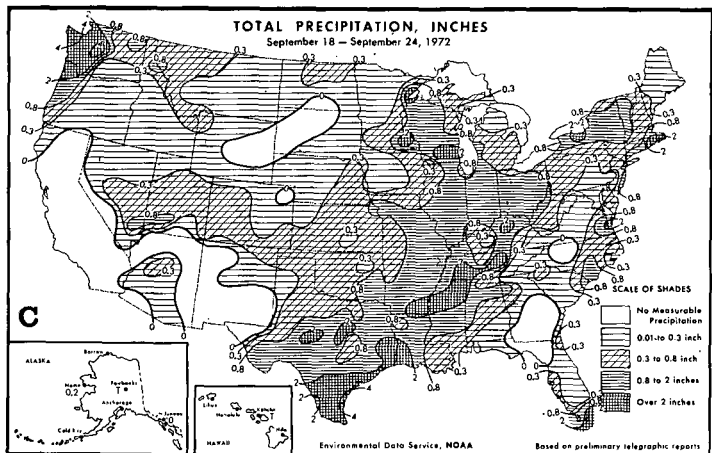
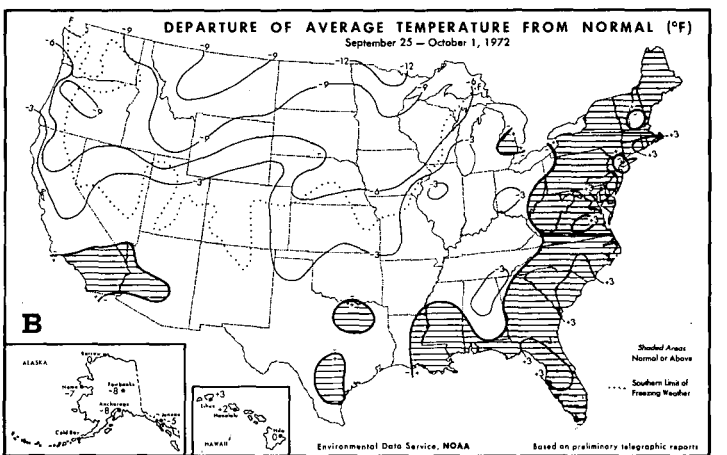
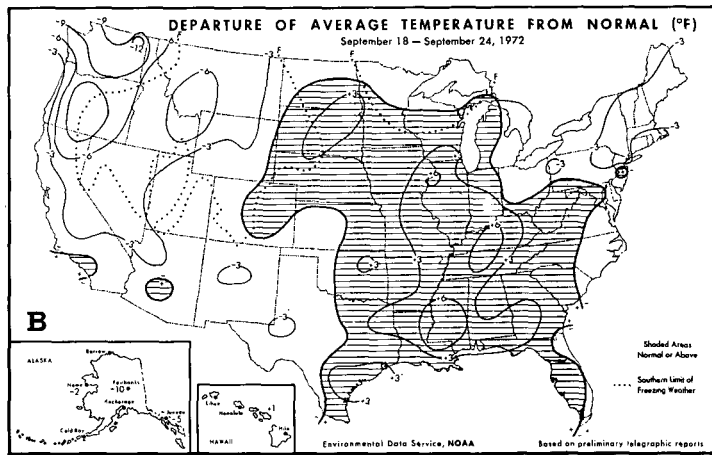
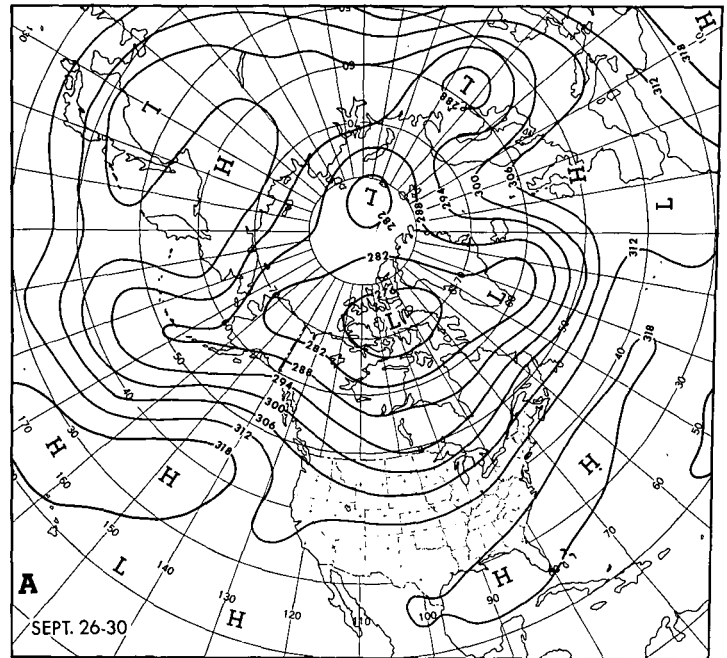
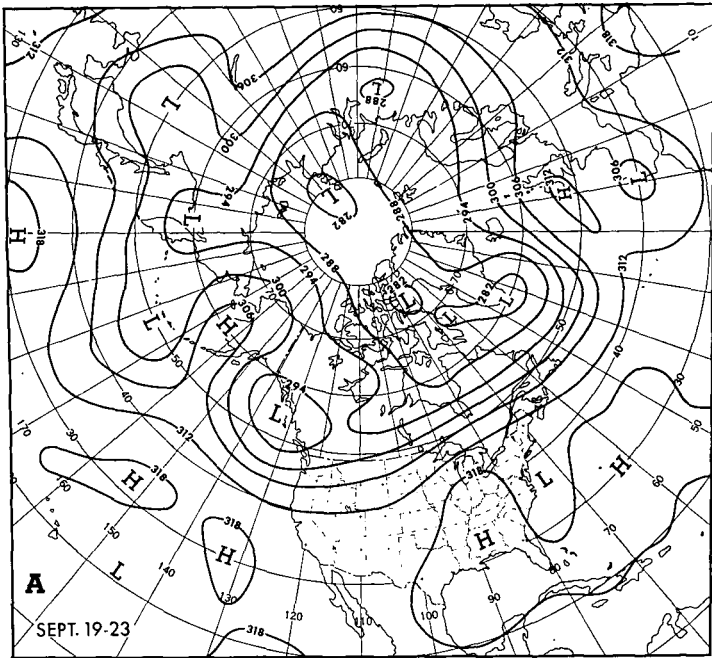


FIGURE 10.—Same as figure 7, (A) for Sept. 19-23, 1972; (B) and (C) for week of Sept. 18-24, 1972.

FIGURE 11.—Same as figure 7, (A) for Sept. 26-30, 1972; (B) and (C) for week of Sept. 25-Oct. 1, 1972.

Mississippi Valley. Temperatures over the Great Basin and west coast averaged around 3°-4°F below normal as the strong eastern Pacific ridge (fig. 8A) advected inland cool air of Pacific origin. Most of Alaska became cooler than normal under the influence of northerly flow from the Arctic Ocean.

Excessively heavy rains fell over portions of the Midwest from eastern Nebraska to northern Ohio (fig. 8C). A number of localities in western Iowa had more than 10 in., and one measurement of 21 in. was considered reliable. Record high stages were measured on some small rivers and streams in the area. Later in the



week, damaging hail occurred in another section of Iowa as frontal activity near the northern boundary of the warm, humid air continued. The Far Southwest and portions of the Great Plains and Southeast were rainless for the week, and this condition was favorable for harvest operations.

### September 18-24

There were some rather dramatic changes in 700-mb mean heights at middle and high latitudes of the Northern Hemisphere between the first and last halves of September (fig. 9). The block that had been over the Arctic Ocean completely collapsed, and 700-mb heights rose across northern and central Asia to the Bering Sea. The main band of westerlies moved south over the Pacific, with troughs being established near the Asian coast, over the central Pacific, and just off the west coast of North America, in the areas of greatest 700-mb height falls (figs. 9, 10A). An even greater change of 277 m occurred near the southern tip of Greenland, where a midlatitude blocking ridge was replaced by a deep center of cyclonic activity during the second half of the month.

The deepening west coast trough (fig. 10A) brought lower temperatures to much of the west while high temperatures persisted over the south and the Ohio Valley (fig. 10B). Several stations from the eastern Great Plains to the south Atlantic coast reported their highest temperature of the year or highest so late in the season (table 2).

Increasing cyclonic activity over the Pacific Northwest coast heralded the start of the fall rainy season, with over 4 in. falling during the week at many localities (fig. 10C). At higher elevations, much of the precipitation fell as snow. Stampede Pass, Wash., measured 11.7 in. within a 24-hr period and 5 in. remained on the ground the morning of the 20th. Both the 24-hr total and the monthly total of 26.7 in. were new records for September.

Increasing southerly flow between the southeastern 700-mb ridge and the deepening trough near the west coast brought copious amounts of gulf moisture into the central part of the country (fig. 10C). Especially heavy convective activity occurred near the Texas coast and in portions of Minnesota and Wisconsin. Flash floods hit Duluth, Minn., when up to 5 in. of rain fell in that area.

An unusual coastal storm also flooded Virginia Beach, Va., with heavy rains and high tides.

### September 25-October 1

Collapse of a small blocking ridge over Alaska and further increase in the westerlies over the central and eastern Pacific led to progression of the deep east Pacific trough into central North America (figs. 10A, 11A). As a consequence, the cold air moved into the middle of the United States and intensified its grip on the Pacific Northwest (fig. 11B). Weekly mean temperatures were 9°-12°F below normal along the northern border states and in Oregon, and many stations in these areas and in the Southern Plains States reported record cold for September or for so early in the season (table 2).

Precipitation occurred over most of the country except for the Southwest and portions of the Columbia River Basin (fig. 11C). Heaviest amounts were observed over the eastern third of the Nation. Wisconsin again had considerable convective activity with some rainfall totals in excess of 4 in. there and over Michigan. Another area extending from the Tennessee Valley across the Southern Appalachian Mountains to the North Carolina coast had from 2 to 5 in. of rainfall. The combination of cold and precipitation resulted in the first substantial snow of the season over the Northern Rocky Mountains, where as much as 13 in. fell at Miles City, Mont.

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