THE WEATHER AND CIRCULATION OF OCTOBER 1958[1]

A Month Characterized by a Pronounced Index Cycle

JAMES F. ANDREWS

Extended Forecast Section, U. S. Weather Bureau, Washington, D. C.

1. MONTHLY MEAN CIRCULATION

The average circulation pattern at 700 mb. for October 1958 (fig. 1) bore a rather strong resemblance to the normal for this time of year. Such differences as did exist were related primarily to the intensity of the individual trough-ridge systems making up the planetary wave pattern. In addition, blocking over central Canada, so prevalent during September [1], tended to shear the trough in eastern North America and to displace the high-latitude portion eastward to a position extending from the coast of western Greenland to Labrador. 700-mb. heights over the North Atlantic associated with this trough were as much as 250 feet below normal (Inset, Chart XI). Blocking in central Canada could also be related to the appearance of a high-latitude ridge in that area, while the major ridge over North America extended from western Canada southward, close to its normal position (fig. 1). Strong ridging in mid-Pacific was associated with a large area of positive anomaly, in marked contrast to September [1] when 700-mb. heights in the same area were slightly below normal. The Low centered over the North Pole in September deepened strongly in October as it moved to the Pacific side of the Pole. The negative anomaly (−420 ft.) associated with this polar vortex was the largest anomaly of either sign to appear on the mean 700-mb. map for October.

Of interest is the fact that the zonal index, a measure of the net geostrophic west wind flow from 55° to 35° N. in the Western Hemisphere, continued above normal during October. This index, as derived from the monthly mean 700-mb. charts, has not been below normal since mid-spring 1958 [2] (table 1). It is important to note, however, that while the indices for August and September were both well above their normal values, October's index was only slightly above normal. This was related to a pronounced index cycle which occurred during October and interrupted, at least temporarily, the extended period of fast westerlies.

2. THE INDEX CYCLE

The index cycle which occurred is shown graphically by figure 2, which gives the time variation of the 5-day mean 700-mb. zonal index plotted thrice-weekly at the middle day of each period. It is evident from the graph that the mid-latitude westerlies did not fall below normal until just after mid-October and remained below normal until the end of the month. Thus, consideration of selected aspects of the general circulation on a 15-day basis should portray characteristics commonly associated with the high and low stages of an index cycle [3].

TABLE 1.—*Monthly mean values of 700-mb. zonal index (in meters per second) in the Western Hemisphere during 1958*

Month	Index	Normal	Anomaly
April	7.9	8.3	−0.4
May	8.0	7.7	+0.3
June	7.3	6.9	+0.4
July	7.8	7.2	+0.6
August	8.6	6.8	+1.8
September	9.3	7.8	+1.5
October	9.8	9.5	+0.3

Let us examine first the 15-day mean 700-mb. charts and height departures from normal for both halves of October (fig. 3). The zonal indices for these half-months were 11.3 m. p. s. and 8.3 m. p. s. Note particularly the strong zonal character of the flow pattern and anomaly fields in the Western Hemisphere during the first half of the month. In addition, strongest cyclonic activity was confined to the higher middle latitudes, and the meridional exchange of energy was kept to a minimum. Now contrast this flow pattern with that for the latter half of the month. Note the change to more meridional flow and the appearance of two strong positive anomaly centers over Canada and the North Atlantic. Concomitant with these anomaly centers was the extensive band of negative anomaly at lower latitudes, extending from the eastern Pacific to the Atlantic. Cyclonic activity then was much more frequent at lower latitudes, with several storms developing in the Gulf of Mexico. These disturbances moved very slowly up the mean trough along the Atlantic Coast (Chart X), being blocked by high pressure to the north. A particularly vigorous storm with pressures as low as 980 mb. developed in the central Atlantic, remaining stationary between latitudes 35° and 40° N. on the 23d and 24th.

The height change chart (fig. 3C) shows at a glance the magnitude of the circulation reversal which occurred near the middle of October. Greatest changes were in the North Atlantic and over Europe, where height changes

[1] See Charts I-XVII following p. 424 for analyzed climatological data for the month.

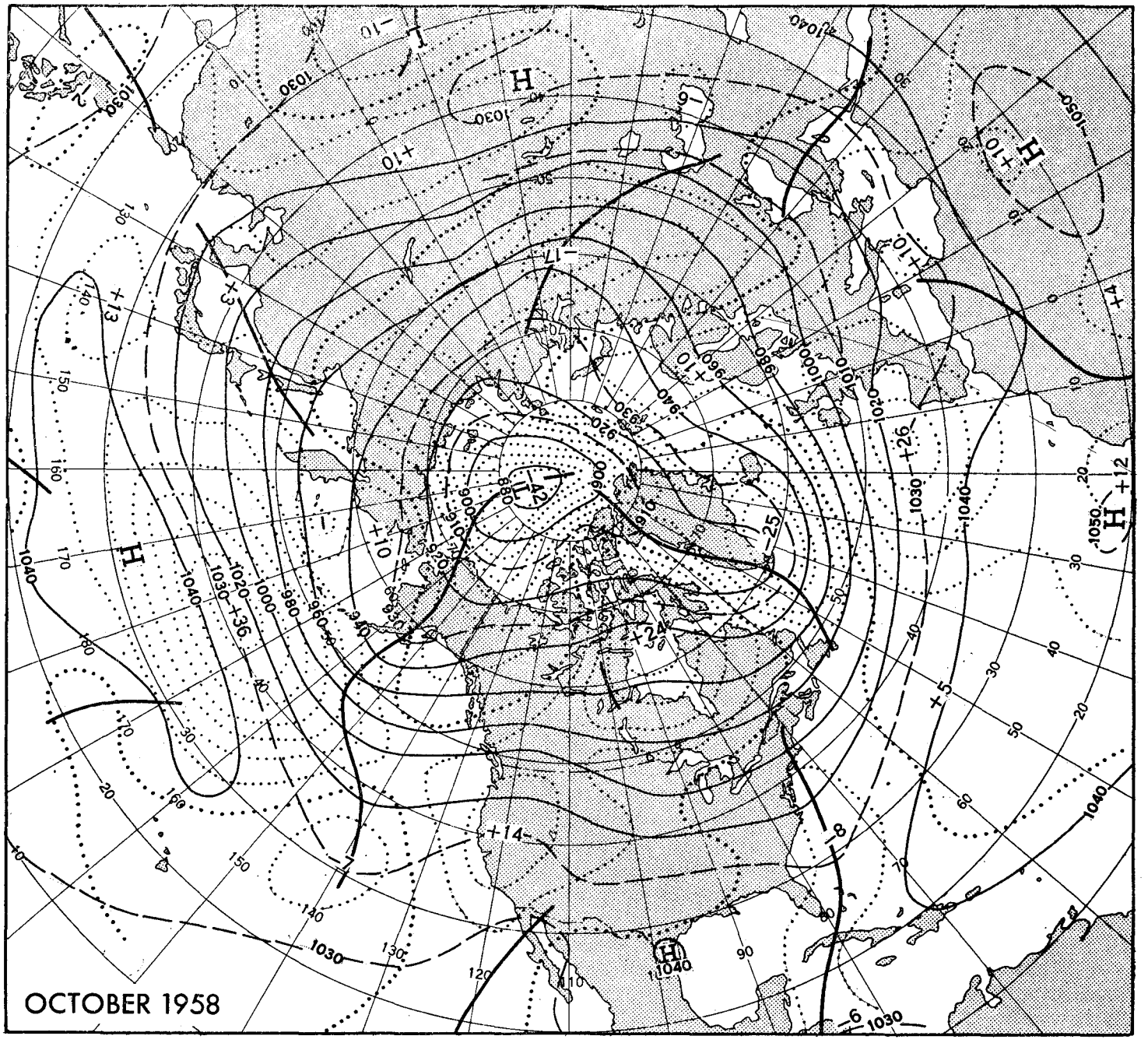


Figure 1.—Mean 700-mb. height contours (solid) and departures from normal (dotted) (both in tens of feet) for October 1958. Important circulation features in North America were stronger than normal ridge in the West, deeper than normal trough in the East, and blocking in Canada.

of as much as +780 ft. and −750 ft. occurred, respectively. These pronounced height changes were related to a complete reversal of the planetary trough-ridge system in those areas. Readjustments in the circulation also occurred downstream, with the Asiatic coastal trough deepening as it retrograded, while at the same time the polar low deepened and shifted its influence more toward northern Siberia. Deepening of the eastern Pacific trough was accompanied by height changes of as much as −560 ft. In North America 700-mb. heights rose over nearly all of Canada, while almost the entire United States experienced a change in the opposite sense.

488761—59——3

Both the +400-ft. anomaly in Canada and the +520-ft. anomaly in the Atlantic (fig. 3B) were related to two strong blocks which appeared during the latter half of October. Tracks of the overlapping 5-day mean anomaly centers associated with these blocks are shown in figure 4. Note that the Canadian anomaly attained maximum intensity (+950 ft.) at 60° N., while the Atlantic anomaly reached its maximum (+850 ft.) at 55° N. The change in intensity of these anomaly vortices as they moved meridionally was in agreement with previous studies. Klein [4] has shown that the average annual pressure variability tends to be greatest near 60° N. over eastern Canada

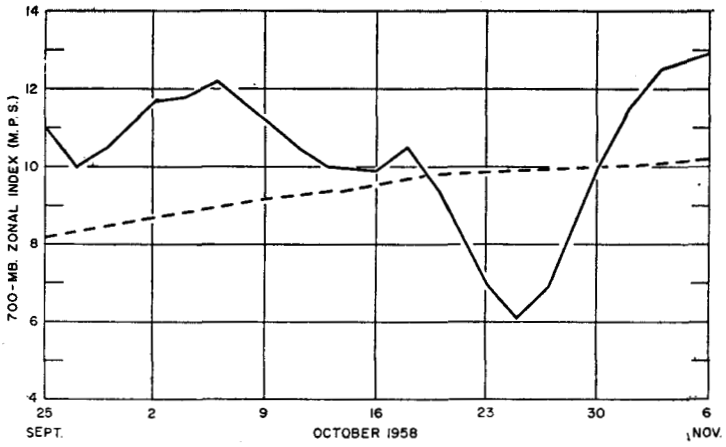


FIGURE 2.—Time variation of temperate-latitude zonal index (average strength of zonal westerlies in meters per second between 35° N. and 55° N.) at 700 mb. over the Northern Hemisphere from 0° westward to 180° longitude. Solid line connects 5-day mean zonal index values (plotted thrice weekly at middle of 5-day periods) and dashed line gives normal values. Pronounced index cycle is evident.

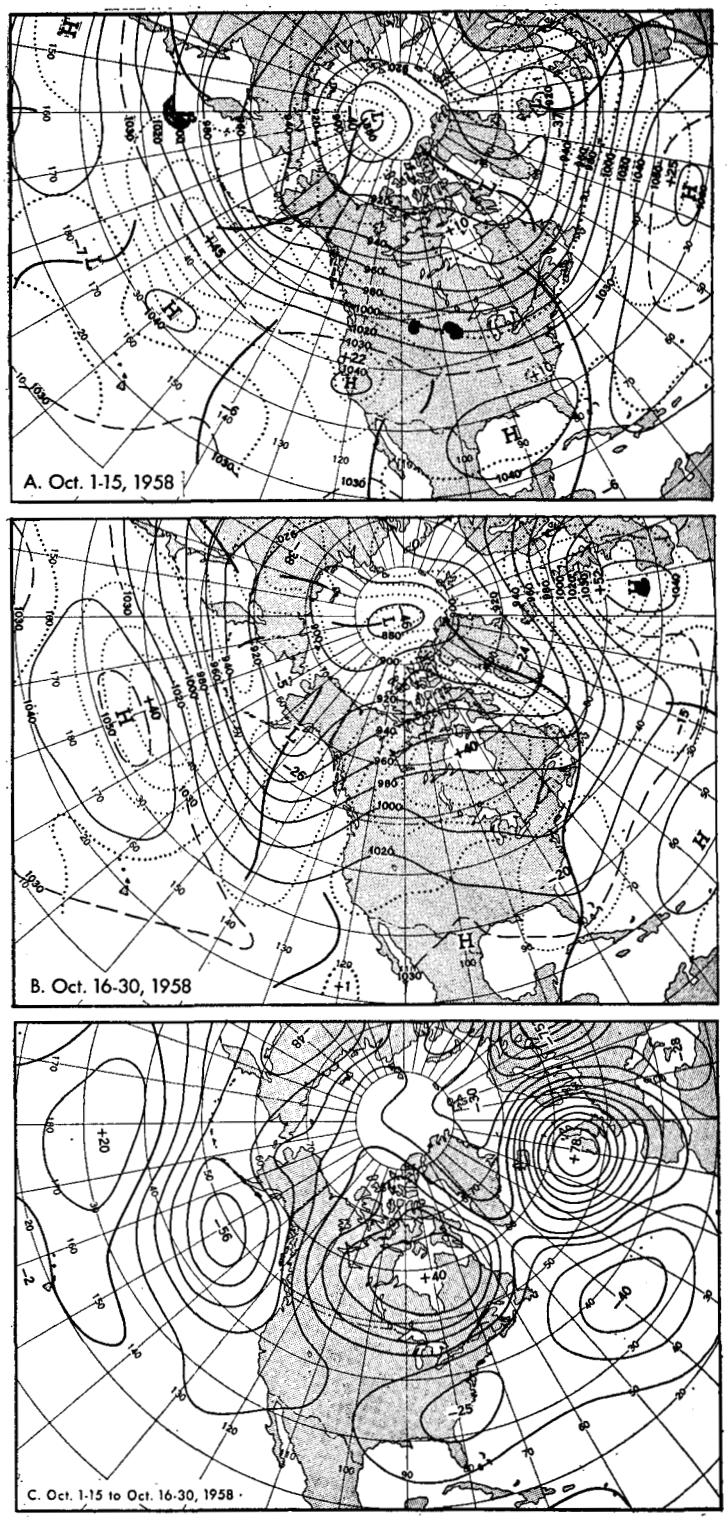


FIGURE 3.—Fifteen-day mean 700-mb. height contours (solid) and departures from normal (dotted) (both in tens of feet) for (A) October 1–15, 1958, and (B) October 16–30, 1958. (C) Height change (tens of feet) from (A) to (B). Onset of blocking in Canada and the North Atlantic accompanied major changes in the circulation.

and near 55° N. over the Atlantic. Recently published charts showing the standard deviation of 500-mb. heights by months [5], indicate the greatest pressure variability during October is usually between 50° and 55° N. in eastern Canada and near 55° N. in the Atlantic. Both of these studies, however, were made without regard to sign (cyclone or anticyclone). Clapp [6], working with 5-day mean anomaly vortices for cyclones and anticyclones separately, found similar results. It would appear then that the growth and decay of these two positive anomaly vortices followed quite well the statistical averages. As might be expected, they reached their greatest strength when the zonal index was at a minimum (figs. 2, 4).

Further manifestations of the October index cycle are evident in the relative positions of the primary west wind axis at 700 mb. for both halves of the month (fig. 5). The fast westerlies of early October are implicit in the small latitudinal variation of the jet. With the onset near mid-month of blocking over Canada, the primary westerly jet split into two branches, one passing far north over Canada, the other over the Florida Peninsula. A marked northward displacement of the westerlies occurred in the Atlantic in connection with blocking in that area. Note also that the relative position of the Pacific jet remained nearly stationary during both halves of the month (fig. 5), with even stronger wind speeds prevailing during the latter half (not shown). Thus, the Pacific circulation remained of a high index character throughout the month.

Finally, a study of the 700-mb. zonal wind speed profiles for the Western Hemisphere for the two 15-day periods (fig. 6) reveals characteristics quite typical of an index cycle. For instance, note the sharply peaked profile with maximum wind speeds in excess of 14 m. p. s. for October 1–15. Contrast this with the rather blunt profile for the period October 16–30, with middle-latitude wind speeds considerably weaker. Furthermore, both the polar and subtropical westerlies were stronger during the

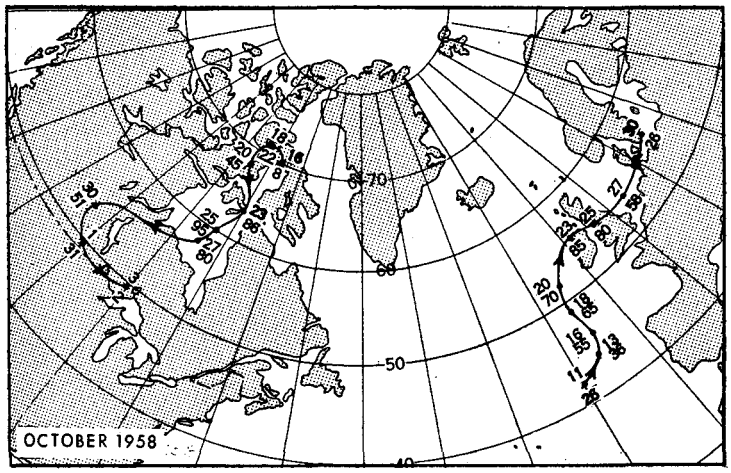


FIGURE 4.—Tracks of two prominent 700-mb. 5-day mean positive anomaly centers during October and early November 1958. Top number is middle day of period; lower number, intensity of center (tens of feet). Strong blocking was associated with these persistent anomaly centers.

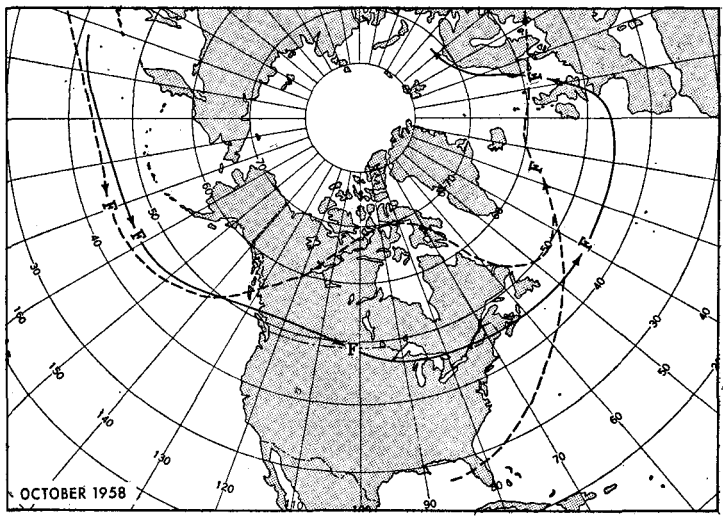


FIGURE 5.—Position of primary 700-mb. jet axes for October 1–15, 1958 (solid) and October 16–30, 1958 (dashed). Northward displacement of the mean westerlies over North America and the Atlantic near mid-October was an important feature of the circulation.

latter period, thus tending to conserve the total momentum of the westerlies [3].

Shorter-period means bring into even sharper focus the contrasting flow patterns associated with high and low index. In figure 7 is shown the 5-day mean 700-mb. charts observed at the times of highest and lowest zonal index. Important differences between the two charts are similar to those observed between the two 15-day mean charts (fig. 3), but are even more striking. Note the pronounced zonal flow and confluent nature of the circulation with high index. This is in sharp contrast with the cellular, difluent, and meridional flow pattern observed under low index.

Similar differences are also apparent on the corresponding sea level charts shown in figure 8. Note, in particular, the extensive high pressure area over Canada with center over Hudson Bay. Other outstanding differences were the appearance in the period October 23–27 of a strong anticyclone over Great Britain and a cyclone in mid-Atlantic. In general, sea level pressures (and 700-mb. heights) at time of low index were higher at high latitudes and lower at low latitudes than during high index. Extreme values of the daily zonal index during the month were 13.1 m. p. s. on October 1 and 7 and 5.7 m. p. s. on October 27.

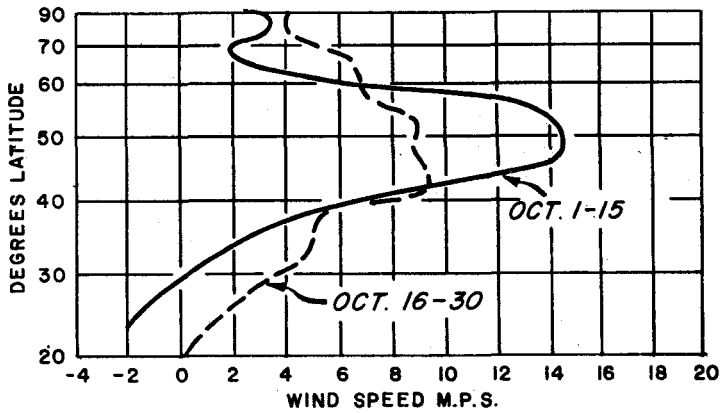


FIGURE 6.—Mean 700-mb. zonal wind speed profiles in the Western Hemisphere (0° westward to 180°) for October 1–15, 1958 (solid) and October 16–30, 1958 (dashed). Note diminution of temperate westerlies and increase in both the polar and subtropical westerlies after mid-month.

3. UNITED STATES WEATHER

Unusually fine fall weather prevailed over most of the Nation during October with few extremes observed. East and south of a line from New Mexico to New York temperatures averaged below normal, while west and north of this line temperatures were above the normal (Chart I–B). In general the pattern of 700-mb. height departure from normal (fig. 1) appears well correlated with the temperature anomaly pattern. However, in the middle of the country, despite near normal 700-mb. heights, temperatures ranged from 2° to 3° F. above normal in the Upper Mississippi Valley and western Lakes Region to as much as 6° F. below normal in southern Texas (Chart I–B). This apparent discrepancy can be related to stronger than normal northerly anomalous flow advecting polar airmasses from an abnormally warm source region in central Canada. These airmasses were associated with polar anticylcones (Chart IX) and were cooled (relative to normal) as they moved southward. In southern Texas part of the unseasonable coolness was a result of dynamic cooling associated with heavy precipitation.

Some of the coldest weather occurred early in the month when a deepening storm, moving in late September from the northern Plains to northeastern Canada, swept cold polar air into the country as far south as northern Florida.

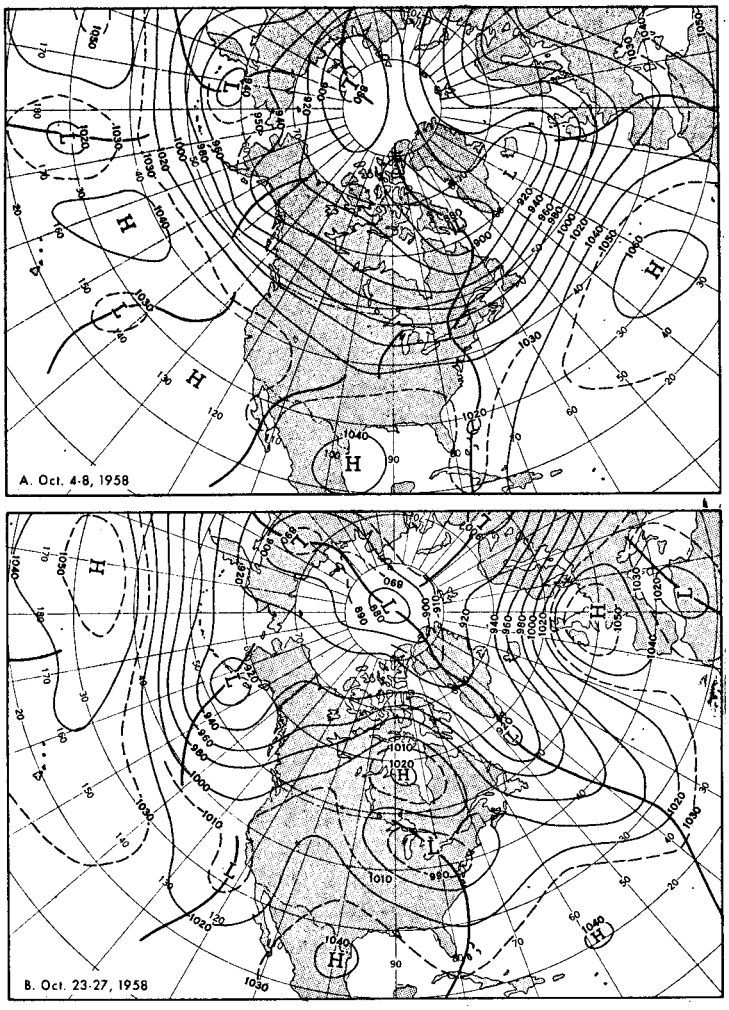


FIGURE 7.—Five-day mean 700-mb. contours (tens of feet) for (A) October 4–8, period of highest zonal index in October 1958; and (B) October 23–27, period of lowest zonal index in October 1958. Note change from zonal to meridional flow.

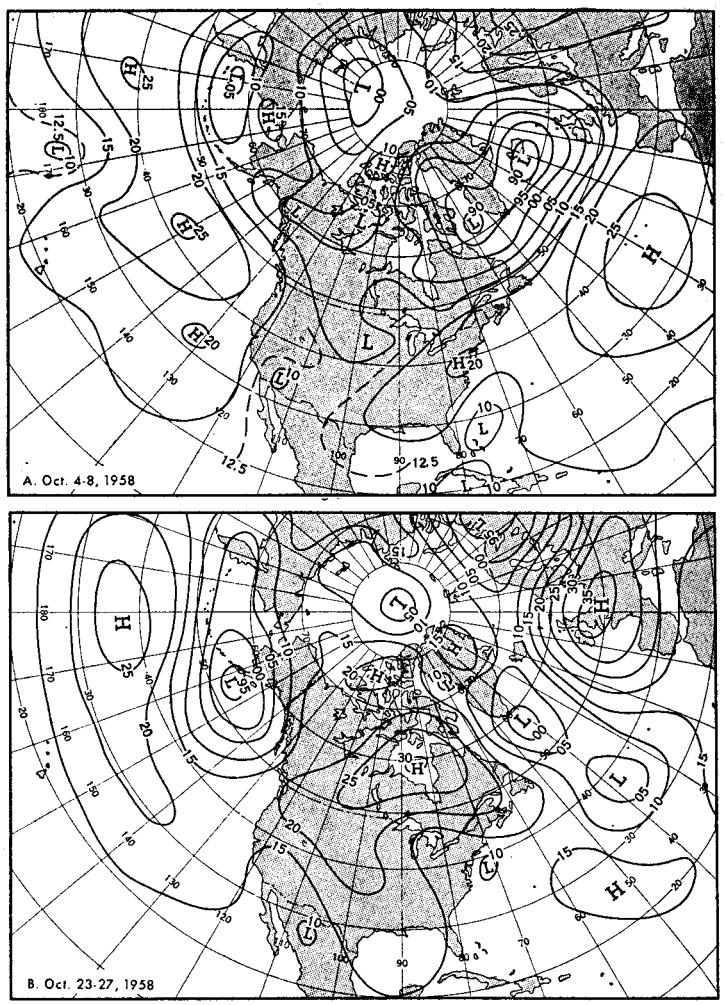


FIGURE 8.—Five-day mean sea level charts to correspond with Figure 7. Isobars are drawn for every 5 millibars (except intermediate lines, dashed) and are labeled with last 2 digits only.

For the week ending October 6, temperatures averaged below normal from the Continental Divide to the Atlantic coast, with the exception of central and southern Florida. From Texas through the Ohio Valley temperatures averaged 9° F. or more below normal, and they were as much as 12° F. below normal in Arkansas. The first killing frost of the season occurred during this period in many sections from the Dakotas to New England and brought the growing season to an end as much as three weeks ahead of normal. Temperatures of freezing or below on the 6th in parts of New York and Pennsylvania were the lowest ever reported for so early in the season. Milder weather with above normal temperatures set in over most of the nation after this early cold snap, but subnormal temperatures prevailed once again late in the month. For the week ending November 3 temperatures averaged as much as 12° F. below normal through southern Texas. Much of this unseasonable coolness was related to an extended period of cloudiness and precipitation which kept daytime maximum temperatures as much as 25° to 30° F. below normal, while minimum temperatures were only 10° to 15° F. below normal. In addition 700-mb. heights were below normal, while at the surface northerly winds persisted from a massive slow-moving high pressure area over the Great Plains (Chart IX).

The unseasonable warmth throughout the West was associated with a stronger than normal upper-level ridge with 700-mb. heights as much as 140 ft. above normal (fig. 1). Greatest temperature departures were observed in California and Arizona, with several California cities

TABLE 2.—*Selected California cities reporting record warmth during October 1958.*

City	Mean temperature (° F.)	Anomaly	Years of record
Sacramento	68.5	+4.7	82
San Francisco (airport)	63.4	+4.0	30
Burbank	72.1	+7.0	28
Los Angeles (city office)	74.0	+7.4	81
Los Angeles (airport)	72.5	+9.1	27
San Diego	70.9	+5.9	86

establishing monthly mean temperature records for October. Some of these are listed in table 2. This abnormally warm weather has persisted now for several months in California, particularly along the coast. Although the October warmth appears to be well related to the mean circulation patterns for that month, another contributing factor would appear to be the above normal sea surface temperatures for waters along the coast, a point discussed in some detail in the previous article of this series [1].

Across the nation as a whole the warmest weather occurred during the week ending October 20, with only the extreme Northeast, south Atlantic coast, and Rio Grande Valley experiencing below normal temperatures. Greatest departures, as much as +12° F., were observed throughout the northern Plains and Rockies at a time when the mean upper-level ridge reached its greatest strength. An all-time October heat record for San Diego, Calif. was established with 98° F. on the 17th. At Los Angeles, Calif., a temperature of 104° F. on the 16th equalled their record for October. In addition to these extremes, many daily temperature records, too numerous to mention, were established during this period in cities from the northern Plains to the Pacific coast. Abundant sunshine accompanied the warmth throughout the West with Sacramento, Calif. receiving 99 percent of the possible sunshine for October, the highest in 54 years of record there (Chart VII-B). A sharp cold front moving into the Northwest on the 18th and 19th brought an abrupt end to the unseasonable warmth in that area. The deepening storm system (Chart X) was accompanied by strong winds, with gusts as high as 85 m. p. h. near Glasgow, Mont., and by heavy snows in the Big Horn Mountains of Wyoming and the Black Hills of South Dakota. (See adjoining article by Kibler and Rogers.)

October was an unusually dry month over much of the United States, with a vast area from the Appalachian Mountains to the Pacific coast receiving substantially less than the normal amount of precipitation (Chart III-B). In portions of the central Plains, Rocky Mountain States, and central California, there was no measurable precipitation at all. This was only the second October in the last 68 in which no precipitation fell at Oklahoma City, Okla.; while only one other October (1933) was completely without precipitation at Grand Island, Nebr. Dry weather has persisted throughout parts of the central Plateau since May 1958, only 14 percent of the normal precipitation having fallen at Salt Lake City, Utah during the period May to October, the driest such period since records were started there in 1874. The combination of little precipitation and sunny skies over much of the country produced excellent harvesting weather.

Near to above normal amounts of precipitation were confined mostly to the Atlantic coast, the far Southwest, and portions of the Lakes Region and northwestern border States (Chart III-B). Heaviest amounts fell in Texas with as much as 5 times the normal amount in the extreme south. At Brownsville, 17.12 inches of rain fell, the largest amount that has ever been recorded there for any October during 87 years of record. Corpus Christi, Tex., with 8.43 inches of precipitation, also established a record for the month. Twice the normal amount of precipitation fell along the immediate coast from North Carolina to Connecticut. At Boston, Mass., the total precipitation since the first of the year was the greatest amount for a corresponding period in 87 years of record.

October's precipitation pattern was for the most part quite well related to the monthly mean circulation. A stronger than normal ridge over western North America and a deeper than normal trough near the Atlantic coast (fig. 1) is a flow pattern most frequently associated with a "dry map" for most of the country. This circulation, along with northerly anomalous flow, tends to prevent penetration of moisture into the country, thus inhibiting precipitation. Moderate to heavy amounts of rainfall along the Atlantic coast were directly related to proximity to the mean trough and to storm systems moving northward along the coast (Chart X).

The heavy rains that occurred in the Southwest are more difficult to relate to the monthly mean circulation patterns; however, small variations in flow at lower latitudes are quite often associated with extreme weather anomalies. The most likely explanation seems to be that this precipitation was associated with the trough over Baja California and stronger than normal easterly anomalous flow at the surface (Inset, Chart XI) and 700 mb. (fig. 1). In addition, southeasterly flow from the Gulf of Mexico advected moist tropical airmasses northward, with resultant heavy precipitation as they overran cool polar airmasses. In order to refine this explanation, a composite mean 700-mb. chart was prepared including only those days (16) on which precipitation was general in the Southwest. This chart (not shown) strongly resembled the 700-mb. height and anomaly fields on the monthly chart, with one exception. The composite chart for days with precipitation showed the High located over the central Gulf of Mexico, more in accordance with what one might expect, whereas the high cell on the monthly mean 700-mb. chart (fig. 1) was over southern Texas where record-breaking rains occurred.

Precipitation along the northwestern border was related, for the most part, to trailing fronts from storm centers moving through Canada. These storms, steered by the mean flow at 700 mb. (fig. 1), were also associated with precipitation in the Lakes Region. Note in Chart X the complete absence of migratory cyclones over much of the United States during October. As determined by Klein [7] there are, on the average, three primary cyclone tracks affecting North America during October. Two of these were in evidence, one through Canada, the other off the Atlantic coast. Absence of the third track, from Nevada to the Lakes Region, was strongly related to the northwesterly flow and precipitation deficiency throughout most of the nation.

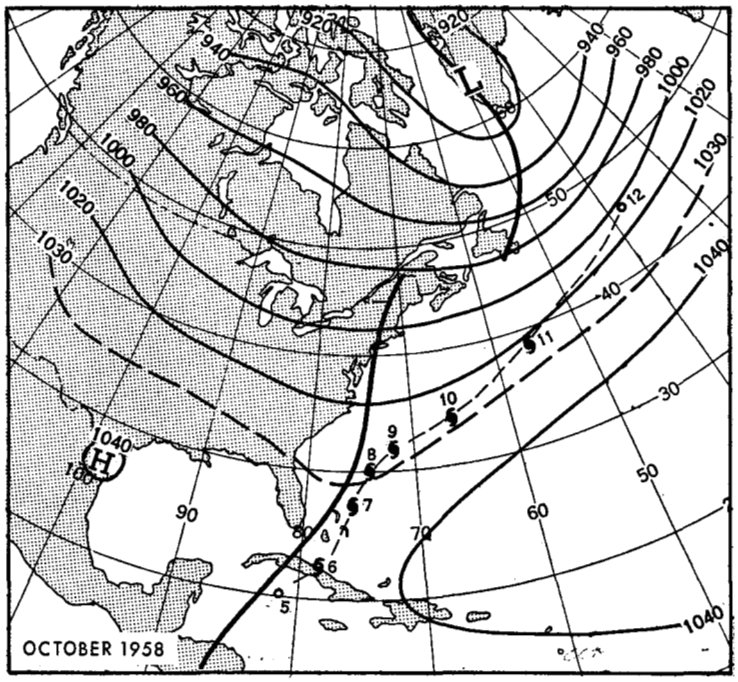


FIGURE 9.—Track of hurricane Janice superimposed upon mean 700-mb. height contours for October (same as fig. 1). Positions shown are for 1200 GMT on dates indicated, while symbols along track define stage of development. Steering of Janice by the mean circulation is well indicated.

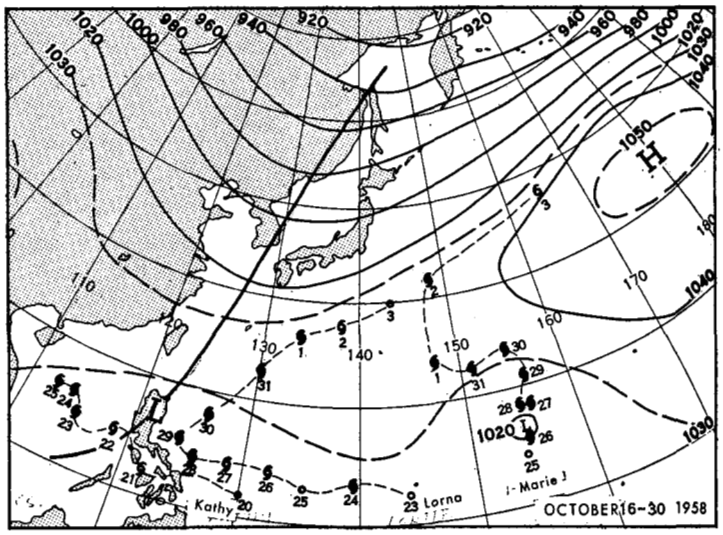


FIGURE 10.—Tracks of Pacific typhoons for October 1958 (1200 GMT positions) superimposed upon mean 700-mb. height contours for October 16–30, 1958.

4. TROPICAL STORM ACTIVITY

ATLANTIC

Hurricane Janice was the only tropical storm to develop in the Atlantic during October 1958. This is less than the normal number of such storms given by the 70-year average [8], and represents a continuation of the trend of recent years of less than normal tropical storm activity. Janice's track, superimposed upon the monthly mean 700-mb. contours (same as fig. 1), is shown in figure 9. As reported by Sumner [9]:

> Hurricane Janice developed on October 5 as a tropical depression in a strong easterly wave located south of Cuba, which at 1600 GMT was near 20.7° N., 81.7° W. or 175 miles south-southeast of Havana. The depression formed in a large area of heavy squalls and rough seas that had, during the previous three days, drifted westward from the area south of Ciudad Trujillo, Dominican Republic. Ship and commercial aircraft reports from the squally area in the vicinity of Haiti showed winds of 50 m. p. h. but no signs of a circulation. Upon reaching the longitude of western Cuba the depression developed a circulation which moved northeastward across Cuba at a forward speed of about 15 m. p. h. and over the Bahama Islands area some 150 miles to the east of Miami. Late on October 6 the storm developed hurricane intensity. During October 7 and 8 the forward movement slowed to about 7 m. p. h. On the 9th the speed accelerated as the storm moved northeastward over the North Atlantic passing about 300 miles southeast of Cape Race, Newfoundland, on the afternoon of October 11, at which time movement had increased gradually to about 44 m. p. h.

While Janice caused no damage along the southeastern United States coast, some 20 inches of rain in Jamaica resulted in floods which destroyed homes, disrupted communications, and caused severe crop damage. There was also some loss of life in the Bahama Islands and the Greater Antilles.

Janice's track was strongly related to the mean circulation patterns for October. Note how the storm moved northward in the mean trough (fig. 9) until, after it passed 30° N., it was swept rapidly northeastward by fast mid-latitude westerlies. The 15-day mean 700-mb. chart (fig. 3A) shows a similar strong relationship, while the 5-day mean charts (figs. 7A, 8A) show the flow patterns during the early history of Janice's development.

PACIFIC

Three typhoons were observed in the Pacific during October 1958, all during the latter half of the month. This is rather unusual inasmuch as the frequency of these storms normally decreases quite rapidly in October, particularly during the latter half. The tracks of these storms, superimposed on the half-monthly mean 700-mb. map for October 16–30 are shown in figure 10.

Typhoon Kathy was first observed on October 20 as a tropical depression a short distance east of the Philippine Islands. The storm, gradually developing as it moved westward in the subtropical easterly flow, crossed the middle Philippines on the 21st, reaching typhoon intensity early on the 23d in the South China Sea. The forward motion was by then slowed considerably and the storm filled and lost its identity early on the 26th, never reaching the south China coast. The path taken by Kathy followed quite closely the mean trajectory of unrecurved typhoons [7, 10.]

Typhoon Lorna first appeared early on October 23 as a tropical depression a short distance south of Guam. Moving westward in the easterlies, the storm underwent a rather unusual history of development. According to aircraft reconnaissance the storm increased rapidly in intensity to reach full typhoon strength early on the 24th. Within 24 hours however, the storm weakened considerably and was reported as a tropical depression on the 25th.

Gradual intensification occurred thereafter until the storm once again became a full typhoon on the 28th. Slow recurvature followed, and, although strong winds raked the Philippines, Lorna's eye did not penetrate the Islands proper. As the storm sped northward into the westerlies, steered by the mean flow (fig. 10), it followed rather closely the mean trajectory for recurved typhoons [10.]

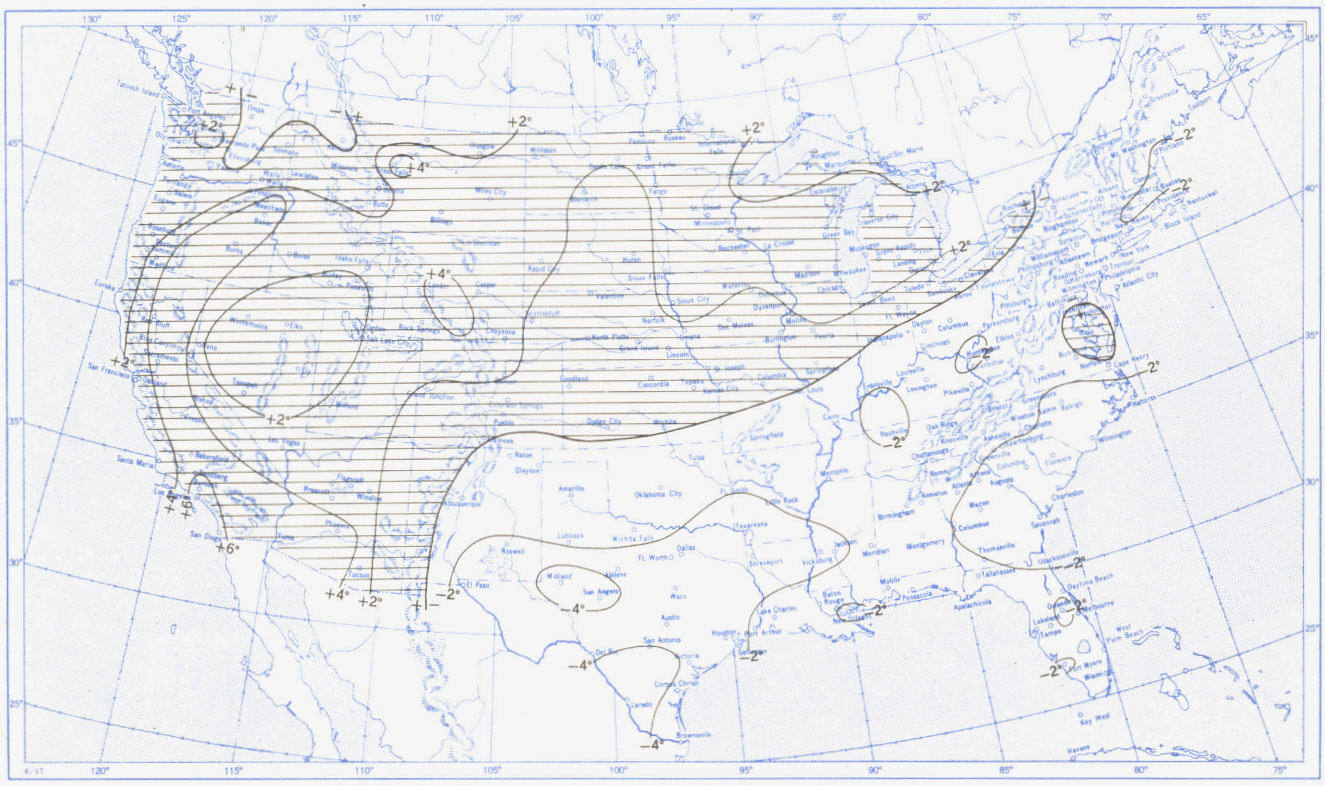
Typhoon Marie was first observed on October 25 as a tropical depression near 13.5° N., 155.0° E. This storm developed rapidly to typhoon intensity within 24 hours and moved slowly northward until the 30th. From October 30 to November 1 the storm took a westerly path as it was blocked temporarily by a high pressure area to the north. On November 1 Marie recurved and accelerated rapidly northward in response to eastward motion of a short-wave trough in the westerlies.

REFERENCES

1. E. M. Ballenzweig, "The Weather and Circulation of September 1958," *Monthly Weather Review*, vol. 86, No. 9, Sept. 1958, pp. 359–367.
2. J. F. Andrews, "The Weather and Circulation of May 1958—Reversal from a Long-Period Regime," *Monthly Weather Review*, vol. 86, No. 5, May 1958, pp. 177–185.
3. J. Namias, "The Index Cycle and Its Role in the General Circulation," *Journal of Meteorology*, vol. 7, No. 2, April 1950, pp. 130–139.
4. W. H. Klein, "A Hemispheric Study of Daily Pressure Variability at Sea Level and Aloft," *Journal of Meteorology*, vol. 8, No. 5, Oct. 1951, pp. 332–346.
5. U. S. Navy Weather Research Facility and The University of Wisconsin, Department of Meteorology, *Normal 500 mb. Charts for the Northern Hemisphere—Annual, Seasonal, and Monthly, with Monthly Standard Deviations*, November 1957.
6. P. F. Clapp, The Practical Application of the Barotropic Vorticity Equation to Extended Forecasting, Unpublished manuscript, U. S. Weather Bureau, September 1954.
7. W. H. Klein, "Principal Tracks and Mean Frequencies of Cyclones and Anticyclones in the Northern Hemisphere," U. S. Weather Bureau, *Research Paper* No. 40, 1957.
8. E. M. Ballenzweig, Principal Tracks and Mean Frequencies of Tropical Storms of the North Atlantic, unpublished manuscript, U. S. Weather Bureau, 1958.
9. H. C. Sumner, "North Atlantic Tropical Storms 1958," *Mariners Weather Log*, vol. 3, No. 1, Jan. 1959.
10. H. F. Hawkins, Typhoon Tracks in the Western Pacific Area, unpublished manuscript, U. S. Weather Bureau, July 1945.

Chart I. A. Average Temperature (°F.) at Surface, October 1958.

B. Departure of Average Temperature from Normal (°F.), October 1958.



A. Based on reports from over 900 Weather Bureau and cooperative stations. The monthly average is half the sum of the monthly average maximum and monthly average minimum, which are the average of the daily maxima and daily minima, respectively.

B. Departures from normal are based on the 30-yr. normals (1921-50) for Weather Bureau stations and on means of 25 years or more (mostly 1931-55) for cooperative stations.

Chart II. Total Precipitation (Inches), October 1958.

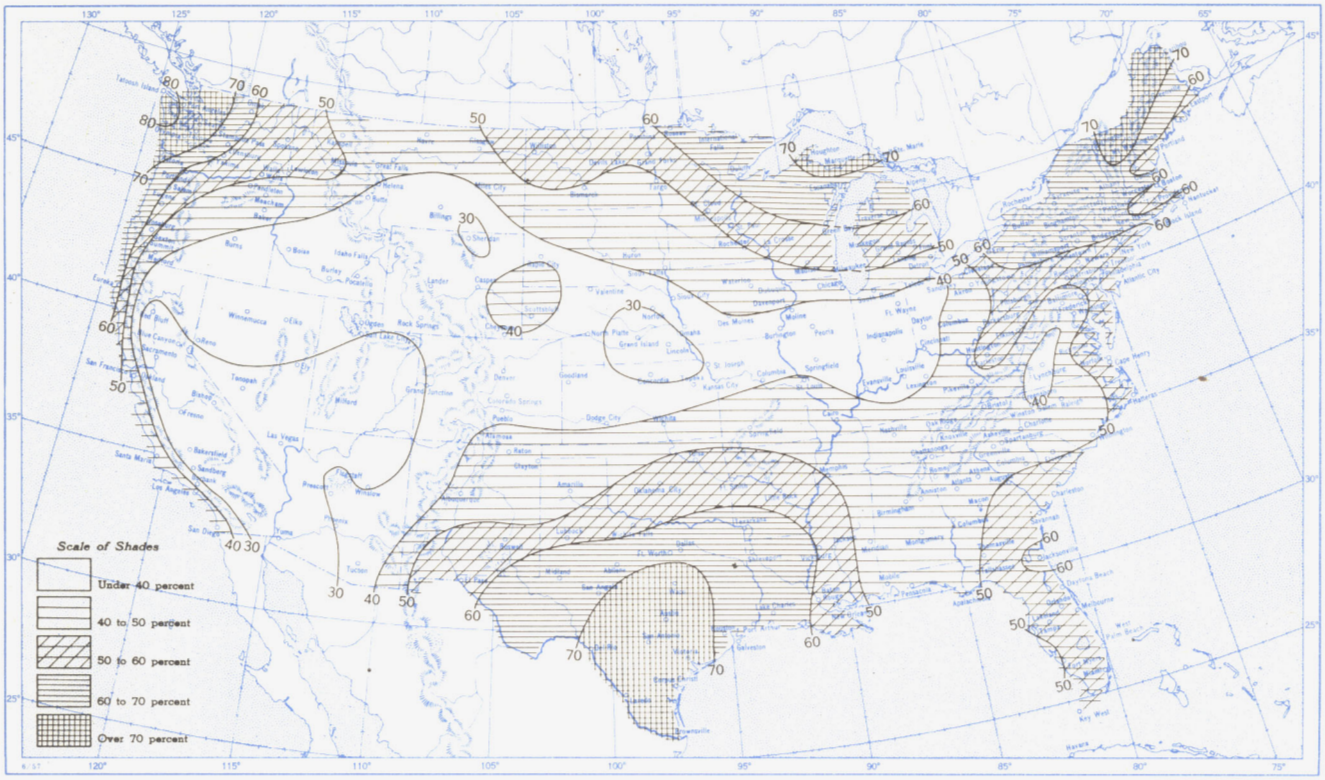
Based on daily precipitation records at about 800 Weather Bureau and cooperative stations.

Chart III. A. Departure of Precipitation from Normal (Inches), October 1958.

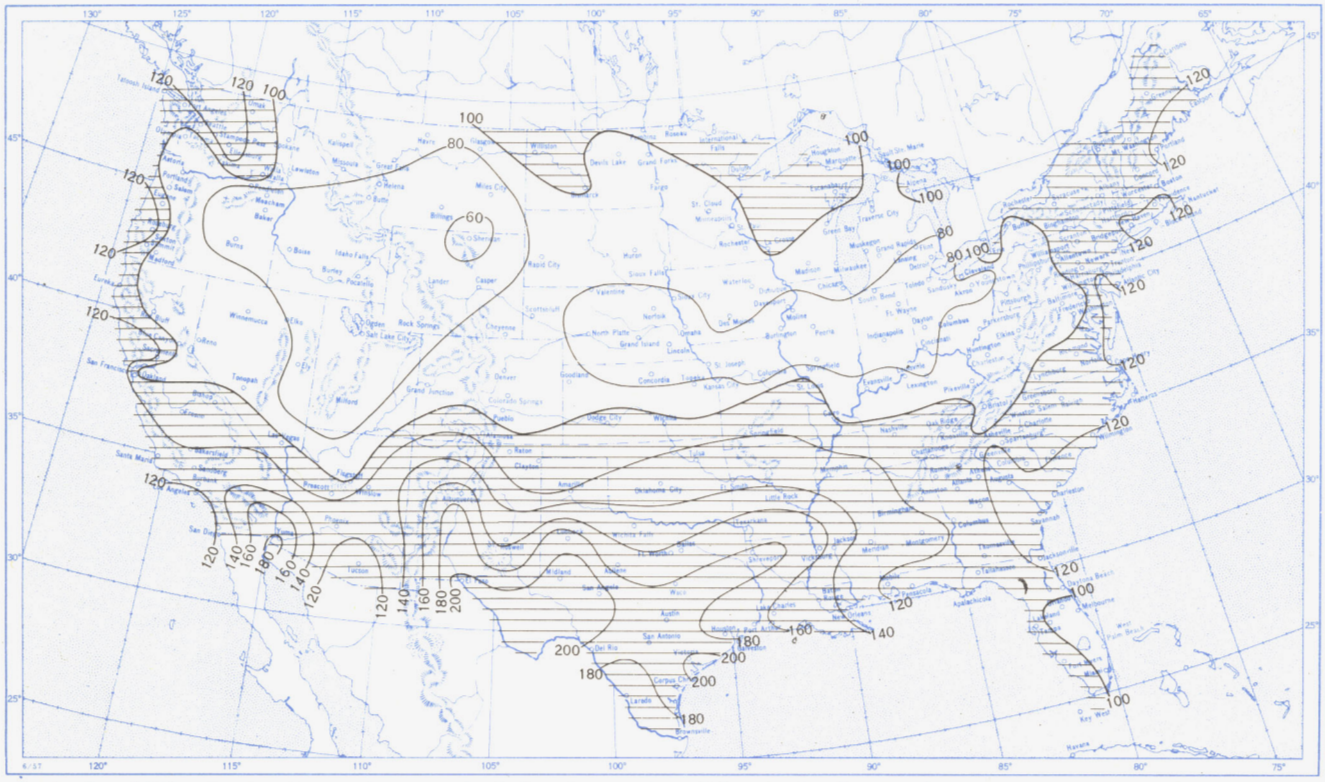
B. Percentage of Normal Precipitation, October 1958.

Normal monthly precipitation amounts are computed from the records for 1921-50 for Weather Bureau stations and from records of 25 years or more (mostly 1931-55) for cooperative stations.

Chart VI. A. Percentage of Sky Cover Between Sunrise and Sunset, October 1958

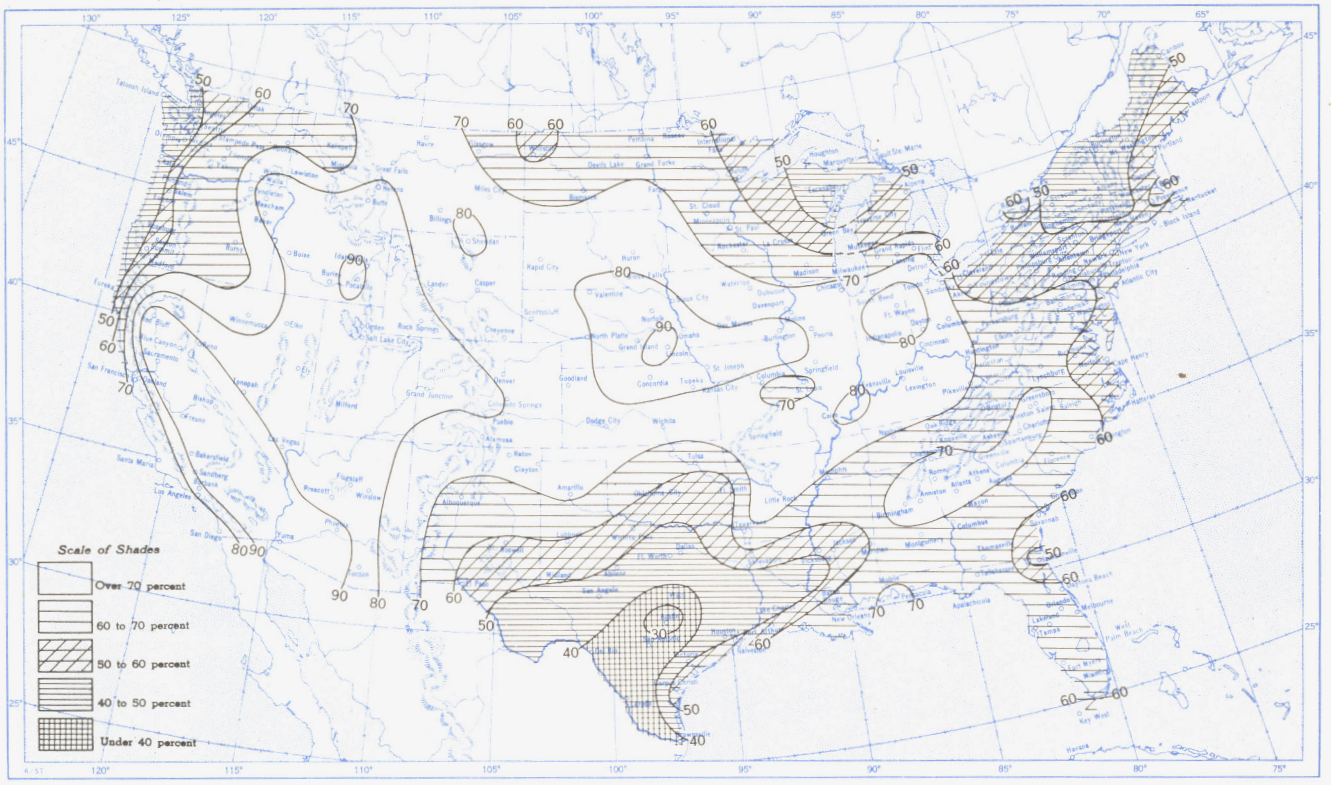


B. Percentage of Normal Sky Cover Between Sunrise and Sunset, October 1958.

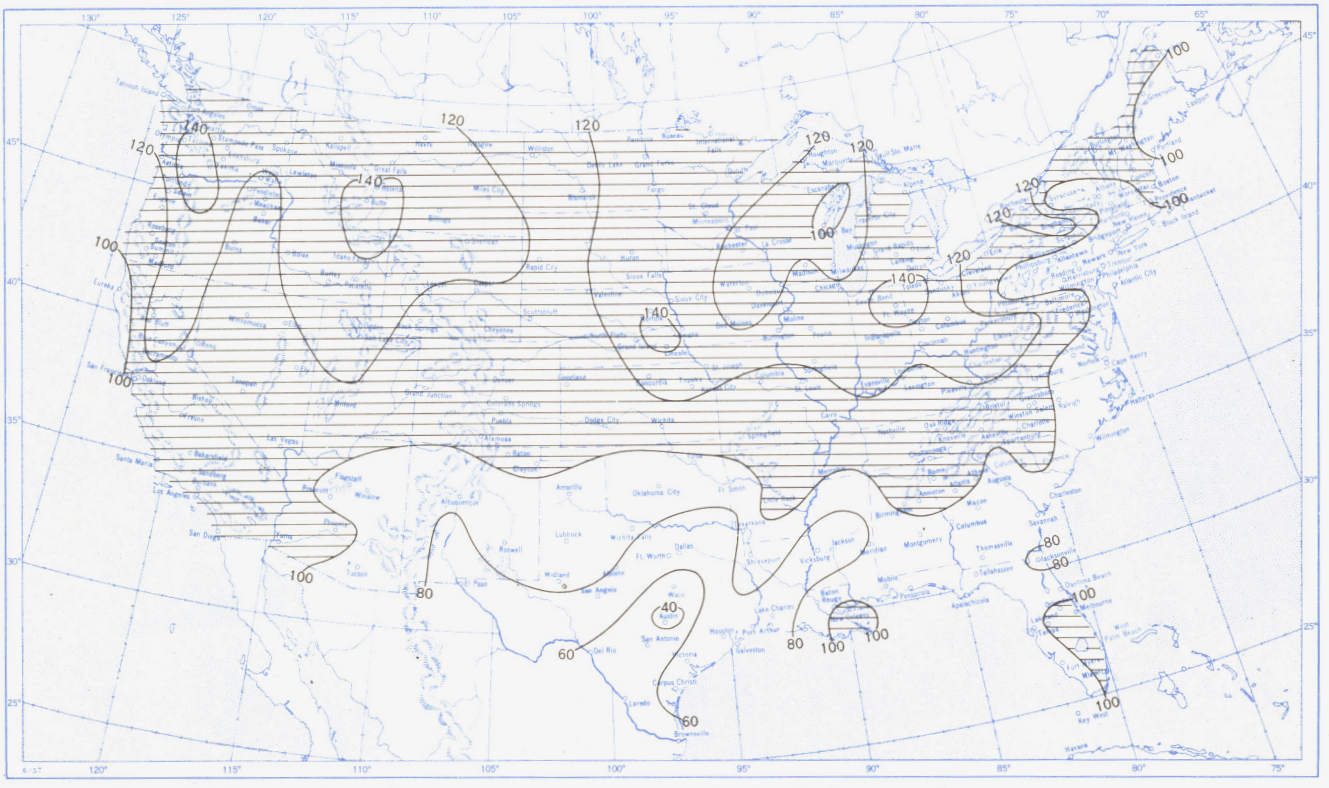


A. In addition to cloudiness, sky cover includes obscuration of the sky by fog, smoke, snow, etc. Chart based on visual observations made hourly at Weather Bureau stations and averaged over the month. B. Computations of normal amount of sky cover are made for stations having at least 10 years of record.

Chart VII. A. Percentage of Possible Sunshine, October 1958.



B. Percentage of Normal Sunshine, October 1958.



A. Computed from total number of hours of observed sunshine in relation to total number of possible hours of sunshine during month. B. Normals are computed for stations having at least 10 years of record.

Chart VIII. Average Daily Values of Solar Radiation, Direct + Diffuse, October 1958. Inset: Percentage of Mean Daily Solar Radiation, October 1958. (Mean based on period 1951-55.)

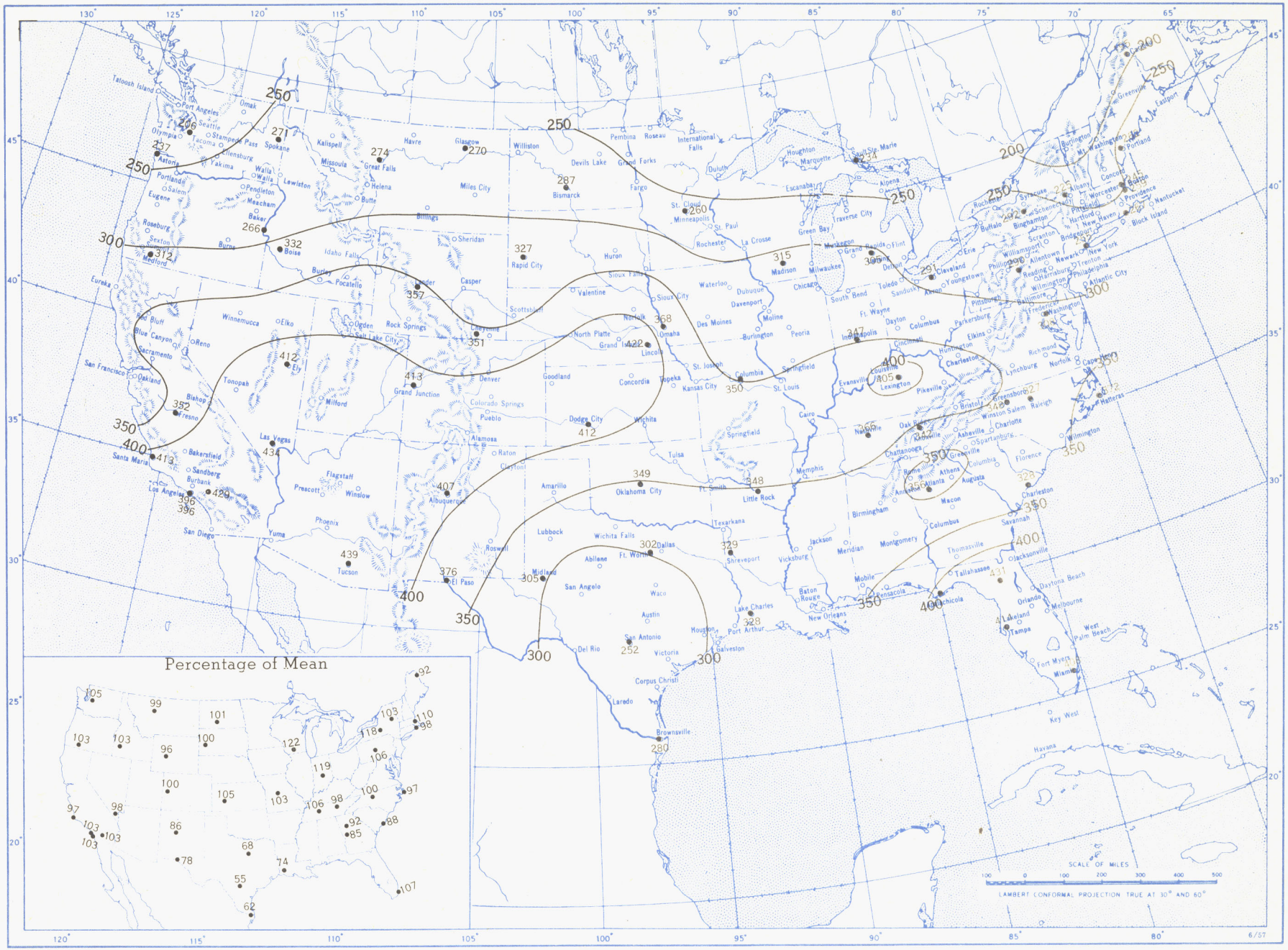
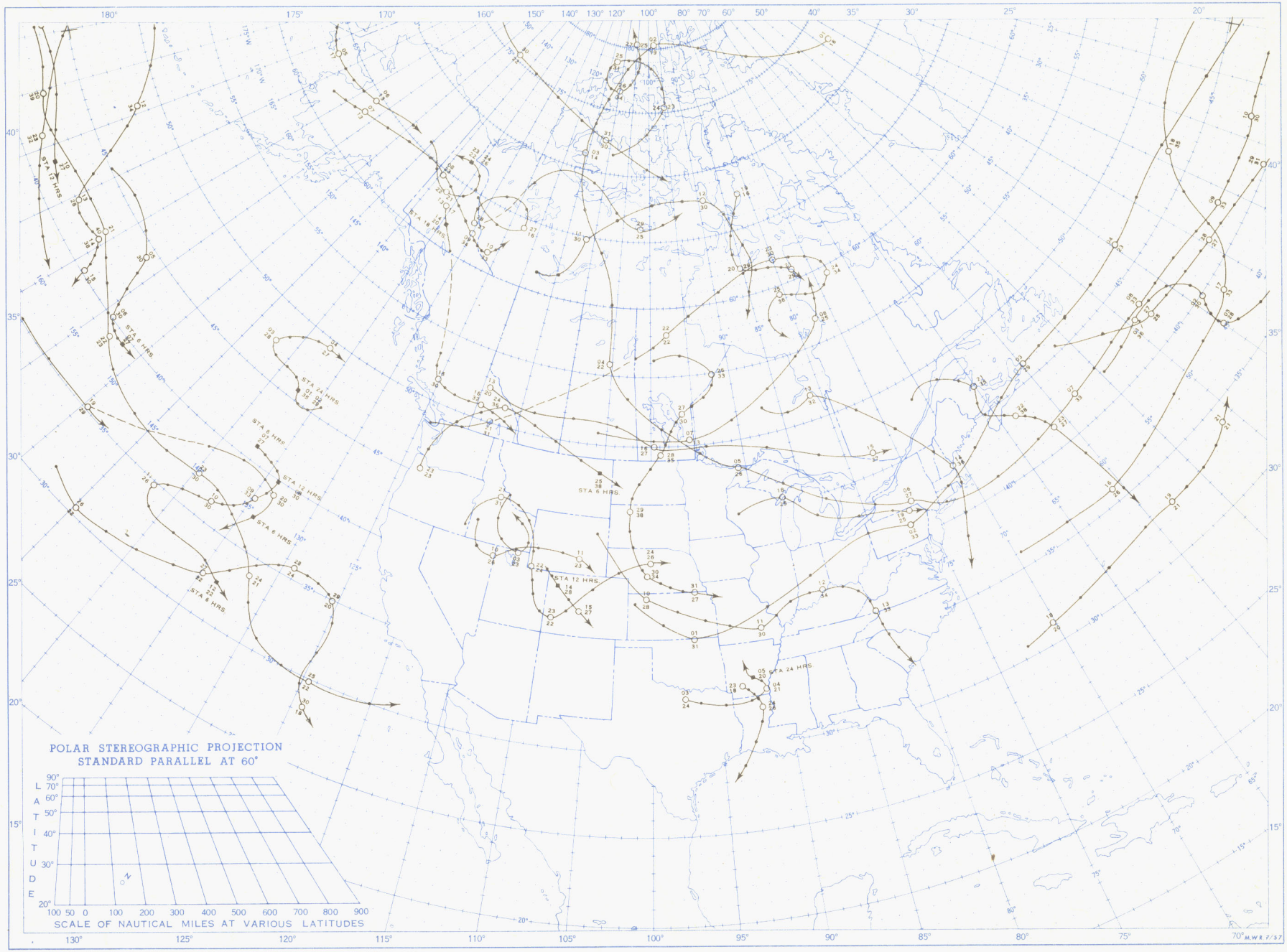


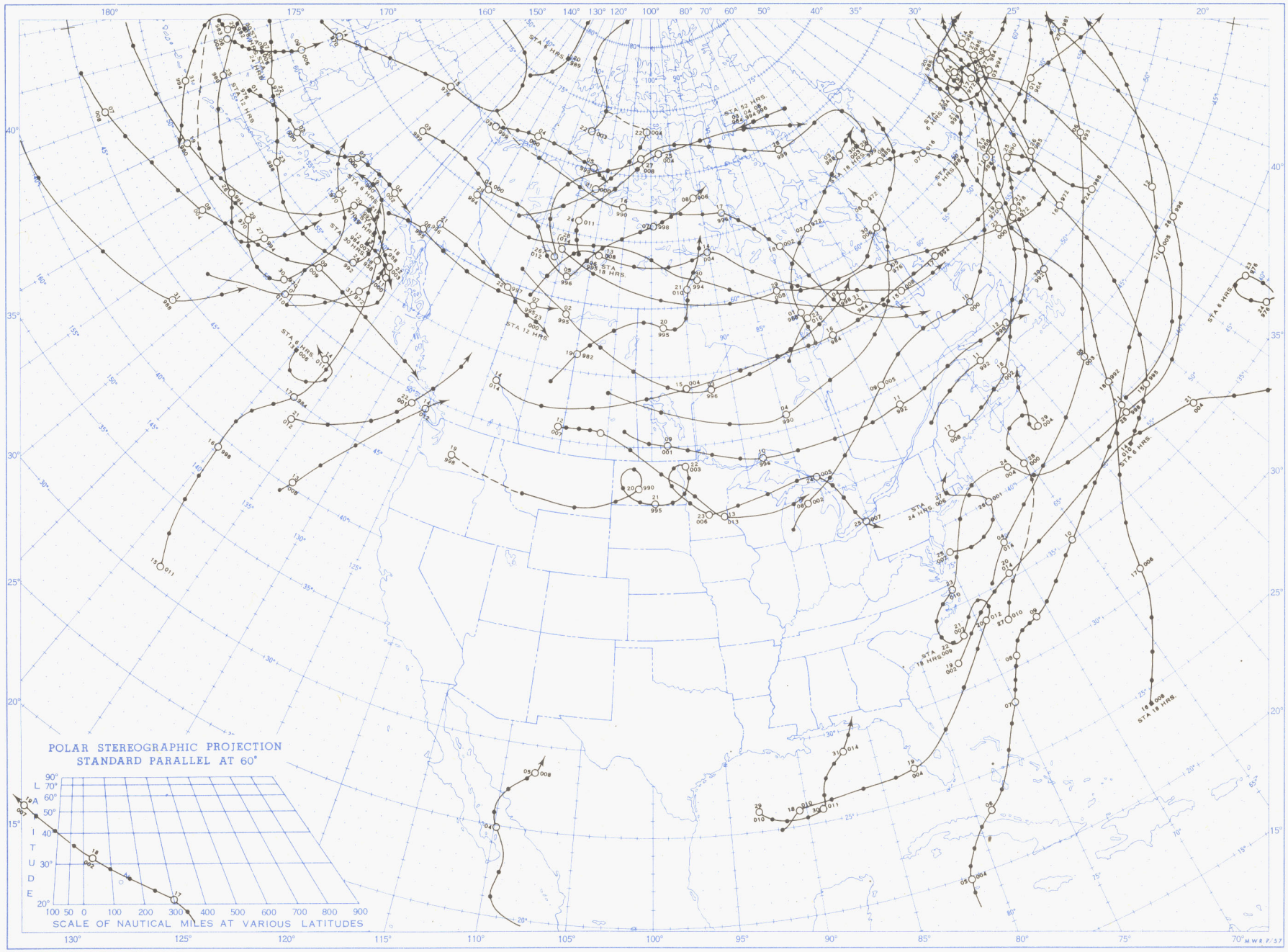
Chart shows mean daily solar radiation, direct + diffuse, received on a horizontal surface in langleys (1 langley = 1 gm. cal. cm.$^{-2}$). Basic data for isolines are shown on chart. Further estimates are obtained from supplementary data for which limits of accuracy are wider than for those data shown. The inset shows the percentage of the mean based on the period 1951-55.

Chart IX. Tracks of Centers of Anticyclones at Sea Level, October 1958.



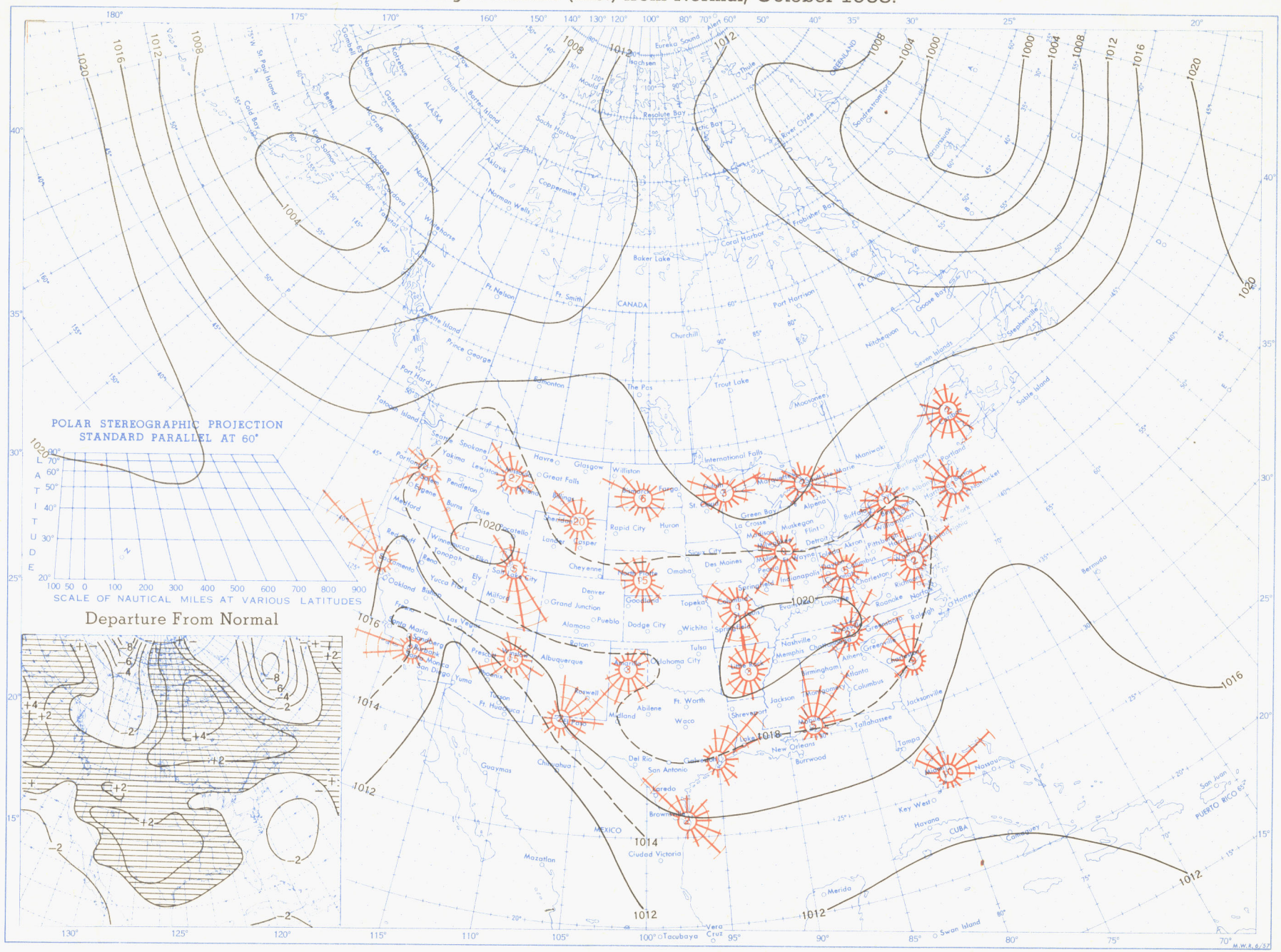
Circle indicates position of center at 7:00 a. m. E. S. T. Figure above circle indicates date, figure below, pressure to nearest millibar. Dots indicate intervening 6-hourly positions. Squares indicate position of stationary center for period shown. Dashed line in track indicates reformation at new position. Only those centers which could be identified for 24 hours or more are included.

Chart X. Tracks of Centers of Cyclones at Sea Level, October 1958.



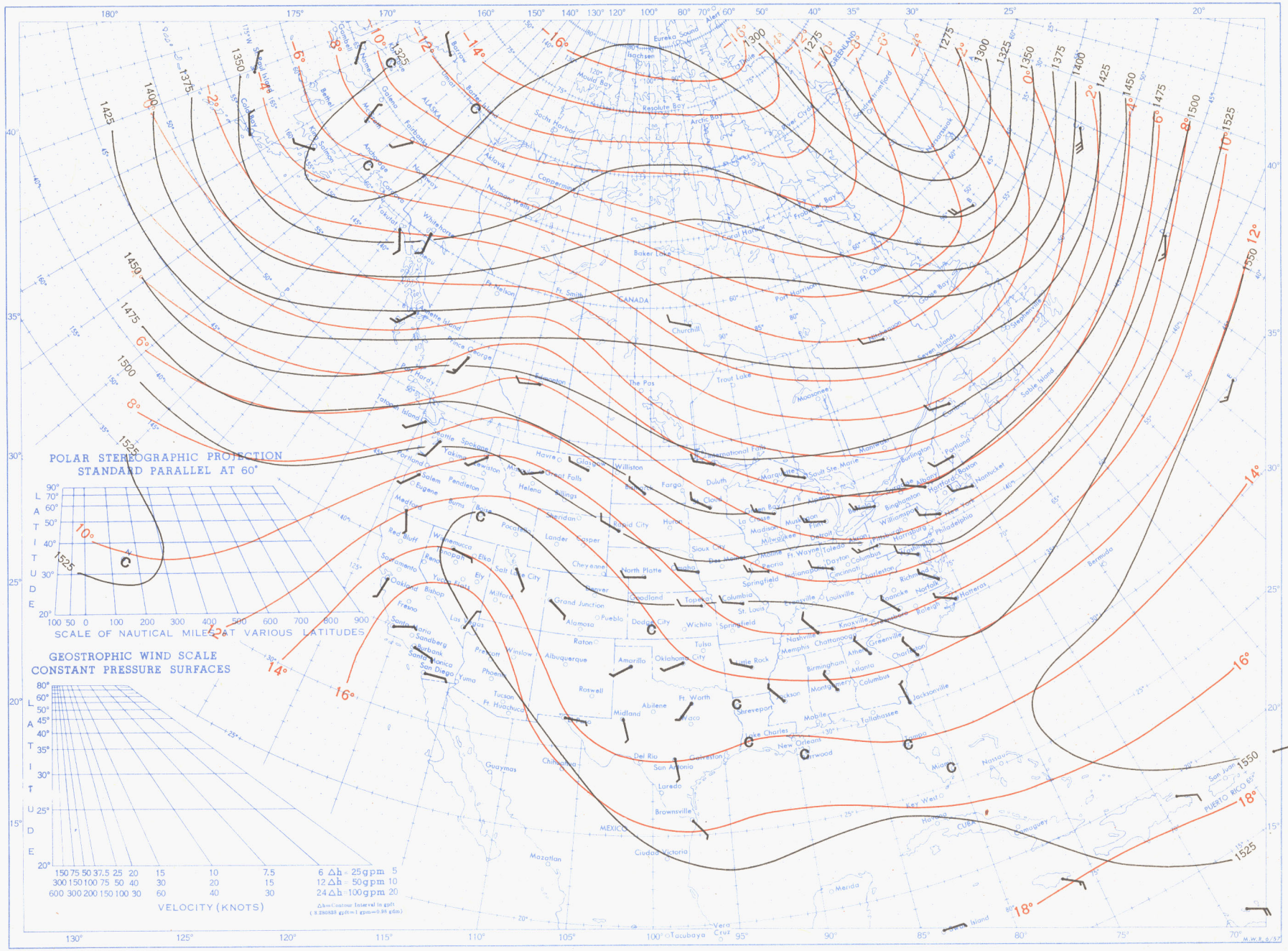
Circle indicates position of center at 7:00 a. m. E. S. T. See Chart IX for explanation of symbols.

Chart XI. Average Sea Level Pressure (mb.) and Surface Windroses, October 1958. Inset: Departure of Average Pressure (mb.) from Normal, October 1958.



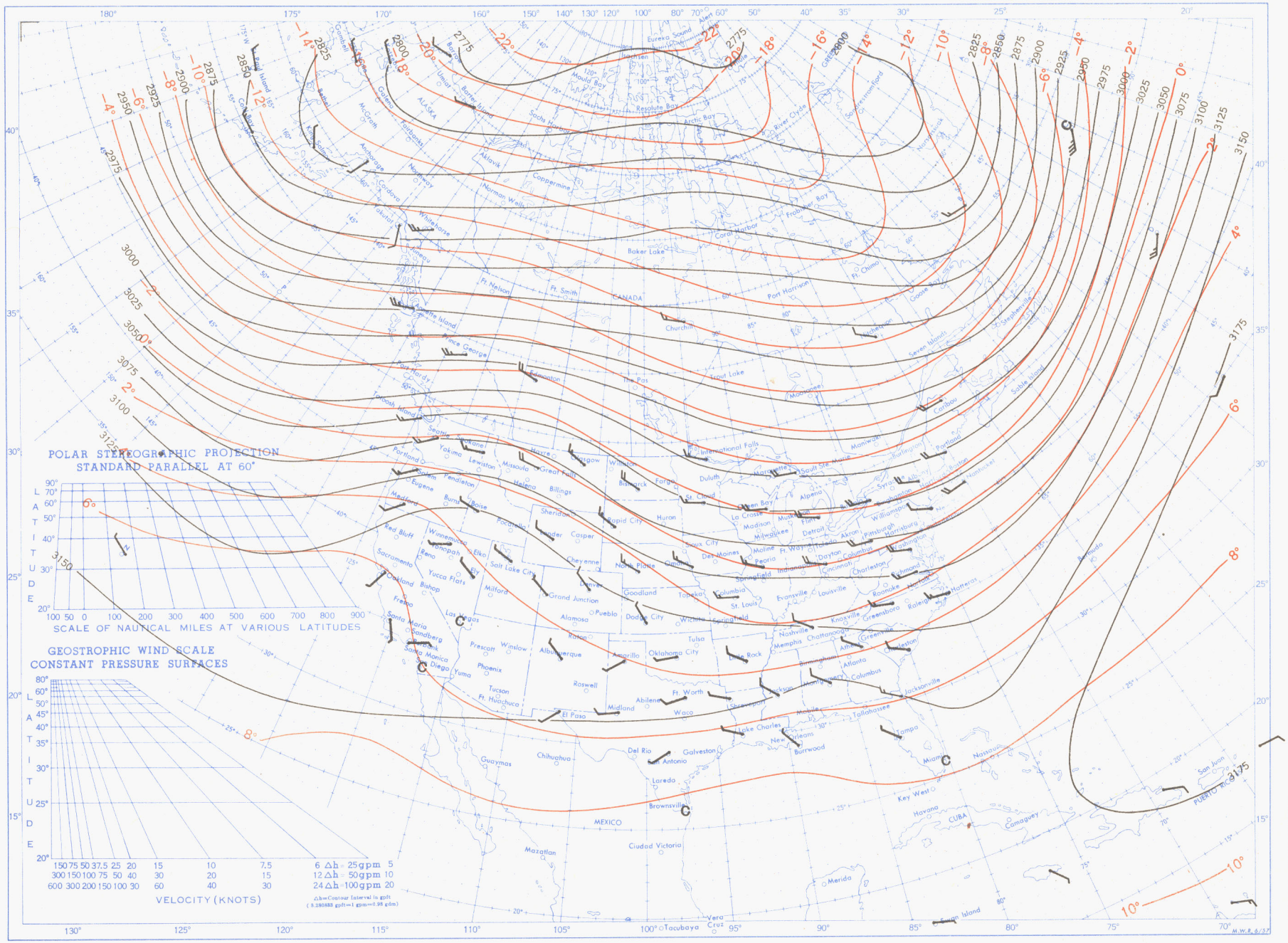
Average sea level pressures are obtained from the averages of the 7:00 a.m. and 7:00 p.m. E.S.T. readings. Windroses show percentage of time wind blew from 16 compass points or was calm during the month. Pressure normals are computed for stations having at least 10 years of record and for 10° intersections in a diamond grid based on readings from the Historical Weather Maps (1899-1939) for the 20 years of most complete data coverage prior to 1940.

Chart XII. 850-mb. Surface, 1200 GMT, October 1958. Average Height and Temperature, and Resultant Winds.



Height in geopotential meters (1 g.p.m. = 0.98 dynamic meters). Temperature in °C. Wind speed in knots; flag represents 50 knots, full feather 10 knots, and half feather 5 knots. All wind data are based on rawin observations.

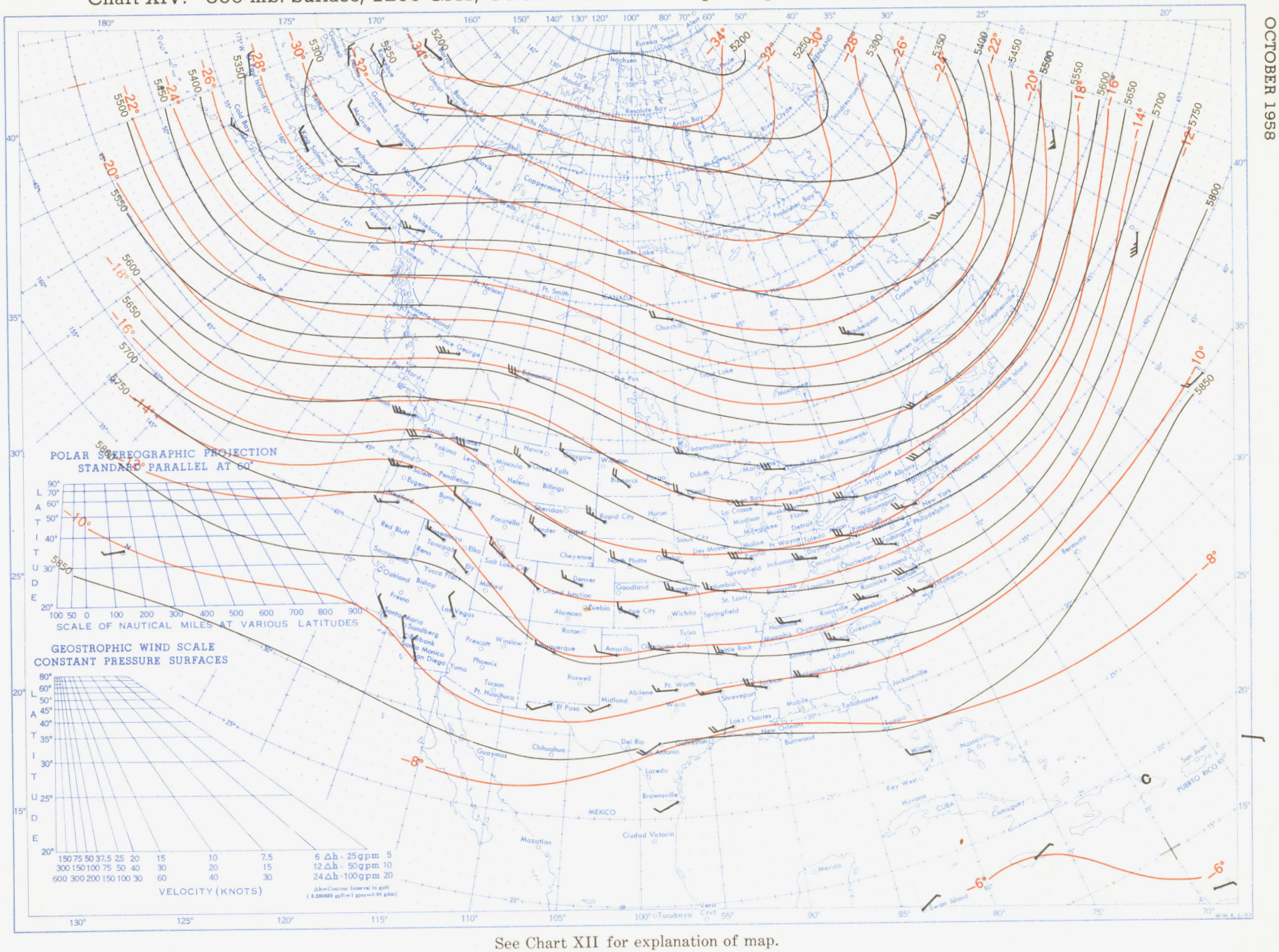
Chart XIII. 700-mb. Surface, 1200 GMT, October 1958. Average Height and Temperature, and Resultant Winds.



See Chart XII for explanation of map.

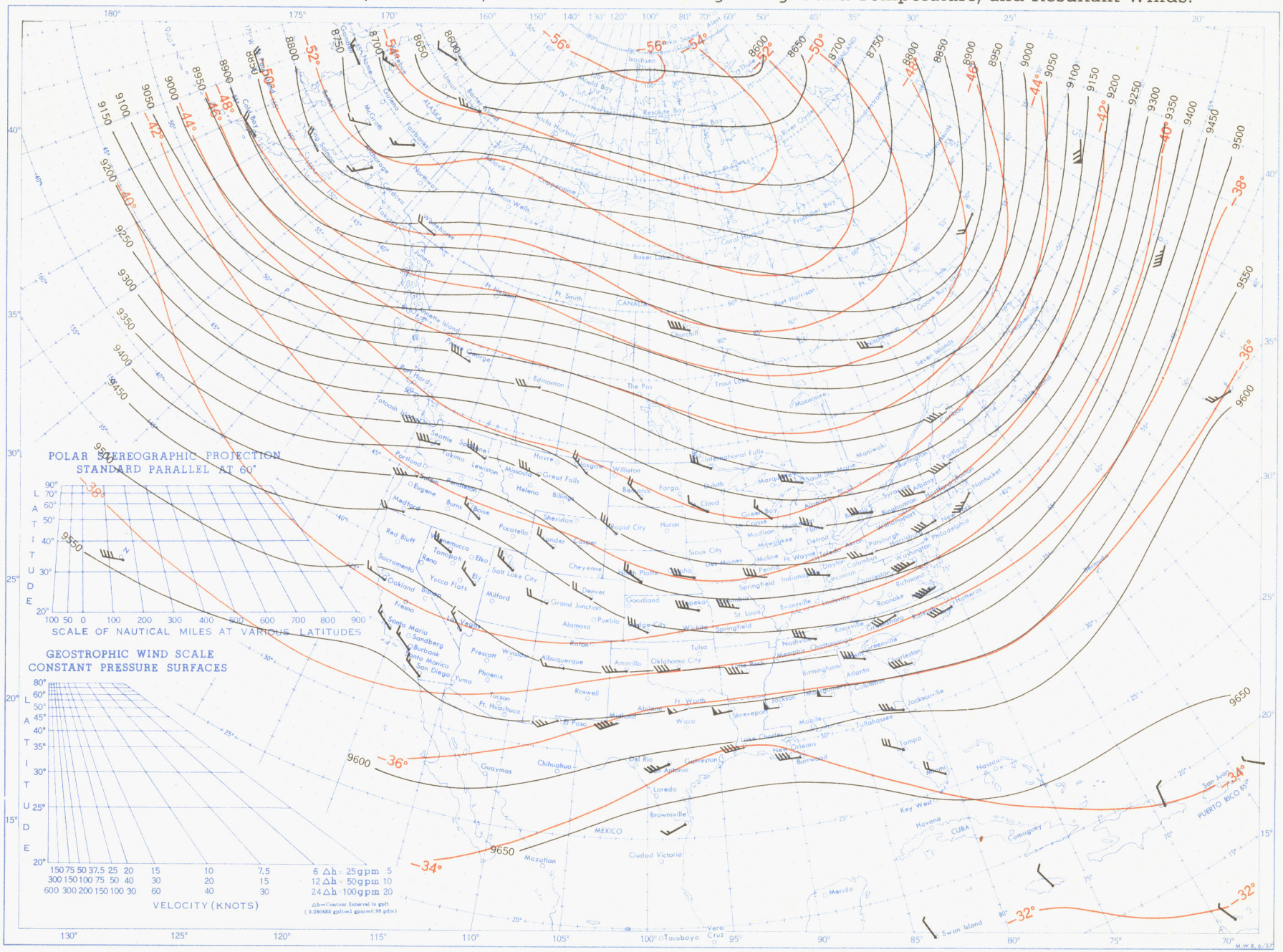
OCTOBER 1958

Chart XIV. 500-mb. Surface, 1200 GMT, October 1958. Average Height and Temperature, and Resultant Winds.



See Chart XII for explanation of map.

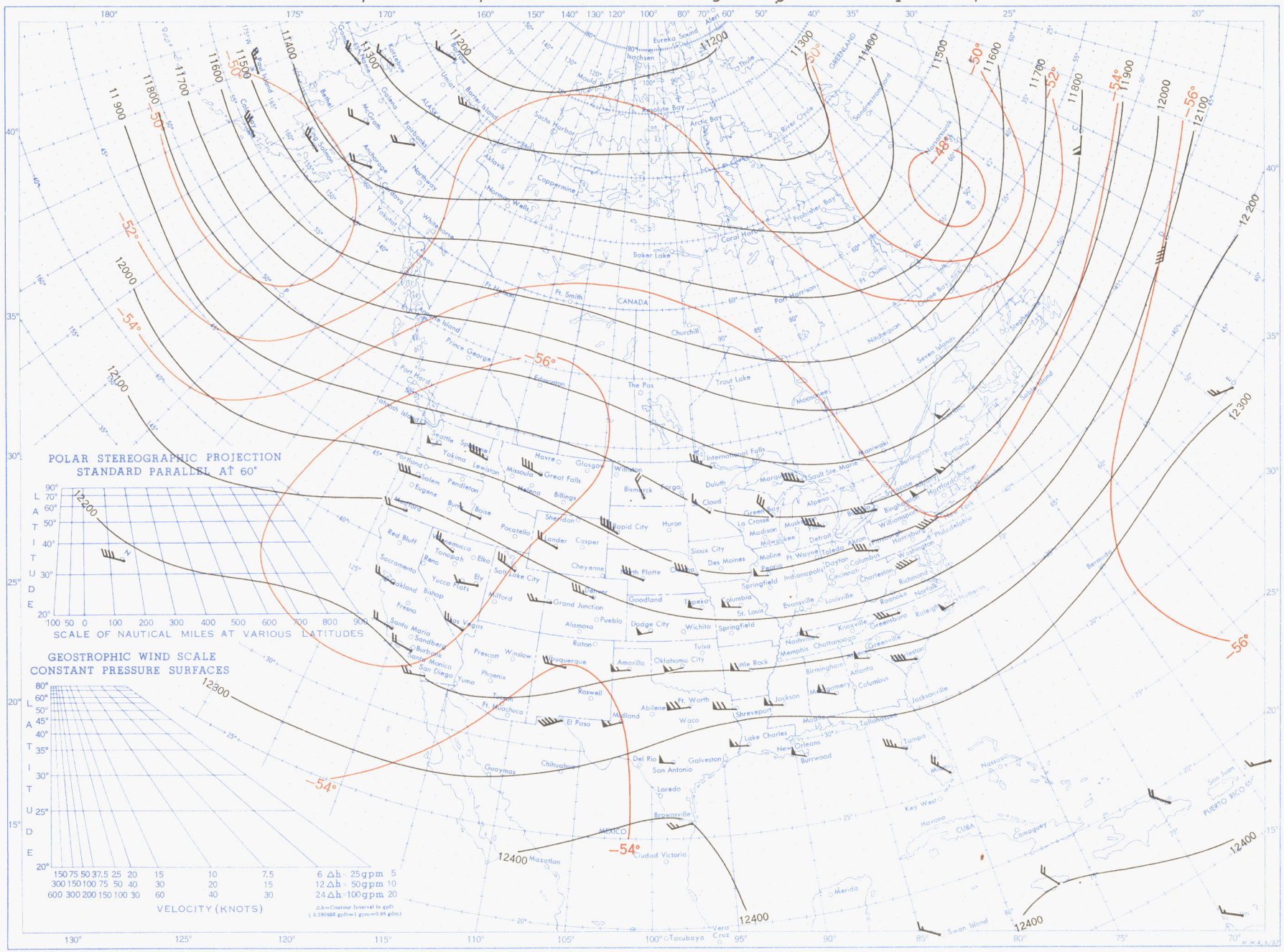
Chart XV. 300-mb. Surface, 1200 GMT, October 1958. Average Height and Temperature, and Resultant Winds.



See Chart XII for explanation of map.

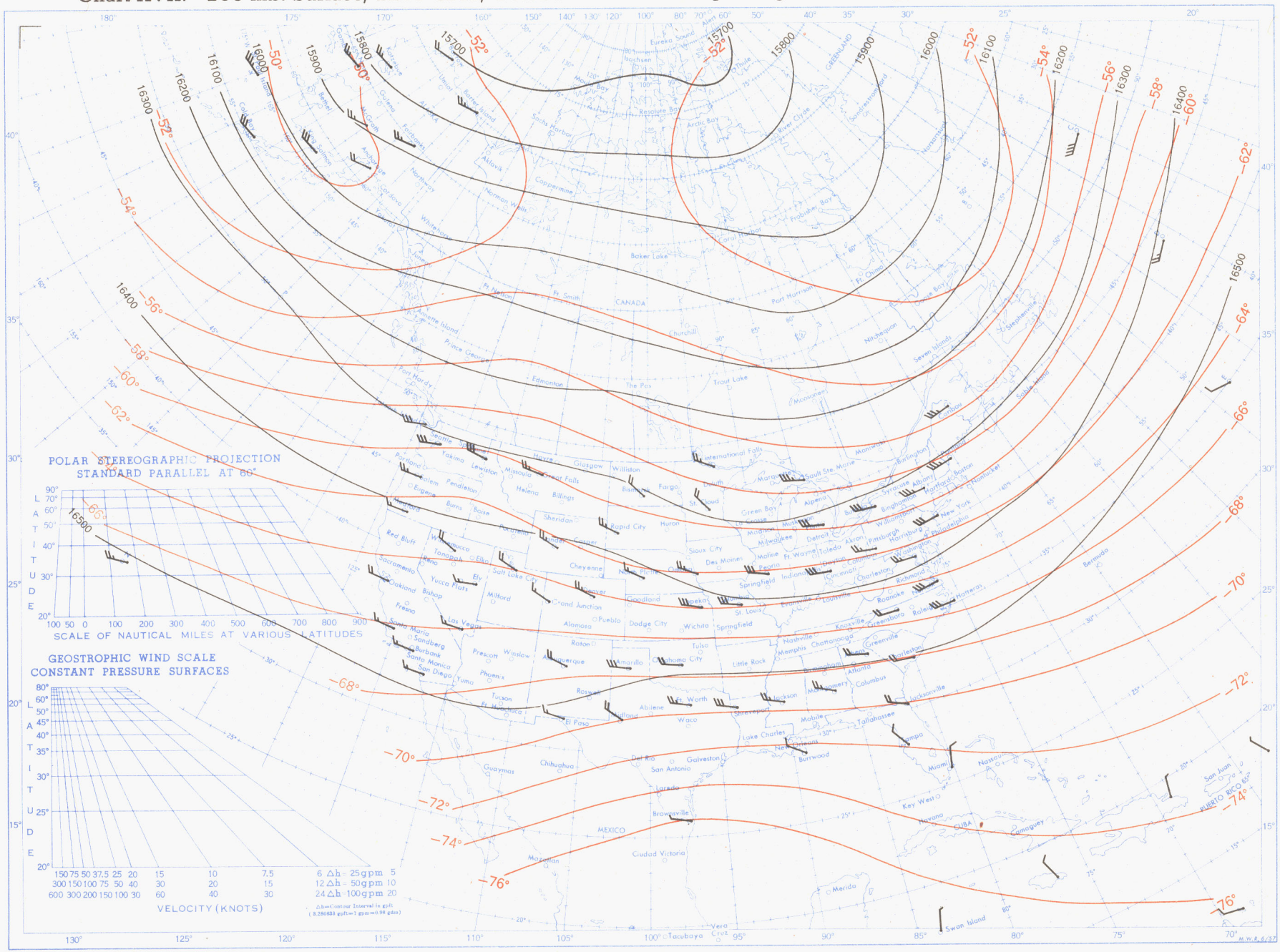
OCTOBER 1958

Chart XVI. 200-mb. Surface, 1200 GMT, October 1958. Average Height and Temperature, and Resultant Winds.



See Chart XII for explanation of map.

Chart XVII. 100-mb. Surface, 1200 GMT, October 1958. Average Height and Temperature, and Resultant Winds.



See Chart XII for explanation of map.