THE WEATHER AND CIRCULATION OF JANUARY 1958[1]

Low Index with Record Cold in Southeastern United States

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1. HIGHLIGHTS

January 1958 was characterized by a major southward migration of the upper-level westerlies into the subtropics (an index cycle) in the Western Hemisphere. Near mid-month an almost record-breaking blocking anticyclone consolidated in Davis Strait, causing a succession of "northeasters" to stagnate off New England. These conditions persistently deployed cold polar air into the southeastern United States.

Florida was probably the hardest hit section, with at least seven active cold fronts replenishing the cold air and bringing exceptionally heavy rains, and even some snow, to northern and central sections. This added up to one of the most disastrous Januarys for a large portion of Florida's economy. The citrus output was reduced by millions of boxes; damage to citrus trees may require 2 or 3 years to repair; dead pasture grasses, in addition to the cold and wet weather, killed hundreds of head of cattle; and tourist trade income was sharply reduced.

The same anomalous circulation regime brought much above normal temperatures to parts of New England as persistent easterly flow brought relatively mild maritime air inland. This was associated with the heaviest precipitation of record in some places; e. g., Boston reported 9.54 inches for the month, more than double the normal amount.

Persistent ridge conditions aloft in the western portions of North America produced above normal temperatures from the Central Plains and Upper Mississippi Valley westward to the Pacific coast, with many places enjoying the second or third warmest January of record. For example, Glasgow, Mont., reported this was the only January that temperatures did not fall below zero, and Meacham, Oreg., had the warmest January on record.

Fogginess was much above normal in the Great Central Valley of California due to the persistence of a strong Great Basin anticyclone. Sacramento, Calif., reported 19 days of heavy fog or 3 times the normal, and Red Bluff, Calif., reported 8 days of fog, equal to the normal for a whole winter.

At low latitudes there were many other interesting highlights attributable to the fact that the Western Hemisphere jet stream was depressed far south of its normal location. Swan Island in the Caribbean reported 3 "northwesters" with fresh to strong winds 3 to 5 days after passage. In the Pacific, practically all Hawaiian stations reported below normal precipitation, with Hilo recording a total of only 2.91 inches, or 11 inches below normal.

2. GENERAL CIRCULATION

The 700-mb. mean circulation for the month (fig. 1) was quite similar to that of January 1956 [1] except for one major difference, the absence of a block in the Bering Sea this January. This difference may have been, at least in part, responsible for the difference in temperature anomalies in the northern Plains between the 2 years. This January temperatures averaged well above normal, whereas in 1956 temperatures were below normal.

Three noteworthy abnormalities developed in the mean circulation over the Western Hemisphere this January:

1. A trough deepened in the east-central Pacific with 700-mb. mean heights over 500 feet below normal about 700 miles south of Kodiak, Alaska (fig. 1), and sea level pressures 20 mb. below normal (Chart XI inset). The abnormally deep trough in this position maintained a persistent ridge aloft, and an associated Great Basin High at the surface, in the western United States. This east-central Pacific trough represented a marked eastward displacement of the trough normally just off the eastern Asiatic littoral. In addition a stronger than normal subtropical anticyclone in the western Pacific, directly south of a slightly deeper than normal Low in Kamchatka, resulted in a stronger than normal confluence of westerlies near southern Japan. Vorticity maxima which developed along the strong Japanese baroclinic zone continually propagated eastward to maintain the east-central Pacific trough and center of action. (Note the 986-mb. Low just south of Kodiak on the monthly mean sea level map, Chart XI.)

2. The second noteworthy abnormality was the block in the Davis Strait where monthly mean 700-mb. heights averaged 520 feet above normal (fig. 1). This block predominated during the second half of the month, when it developed to near record proportions.

3. The third abnormality was the center of below normal heights in the southeastern United States, which persisted through the entire month and was accompanied by northerly surface flow on the average over the eastern, and particularly the southeastern, United States. The stronger

[1] See Charts I-XVII following p. 40 for analyzed climatological data for the month.

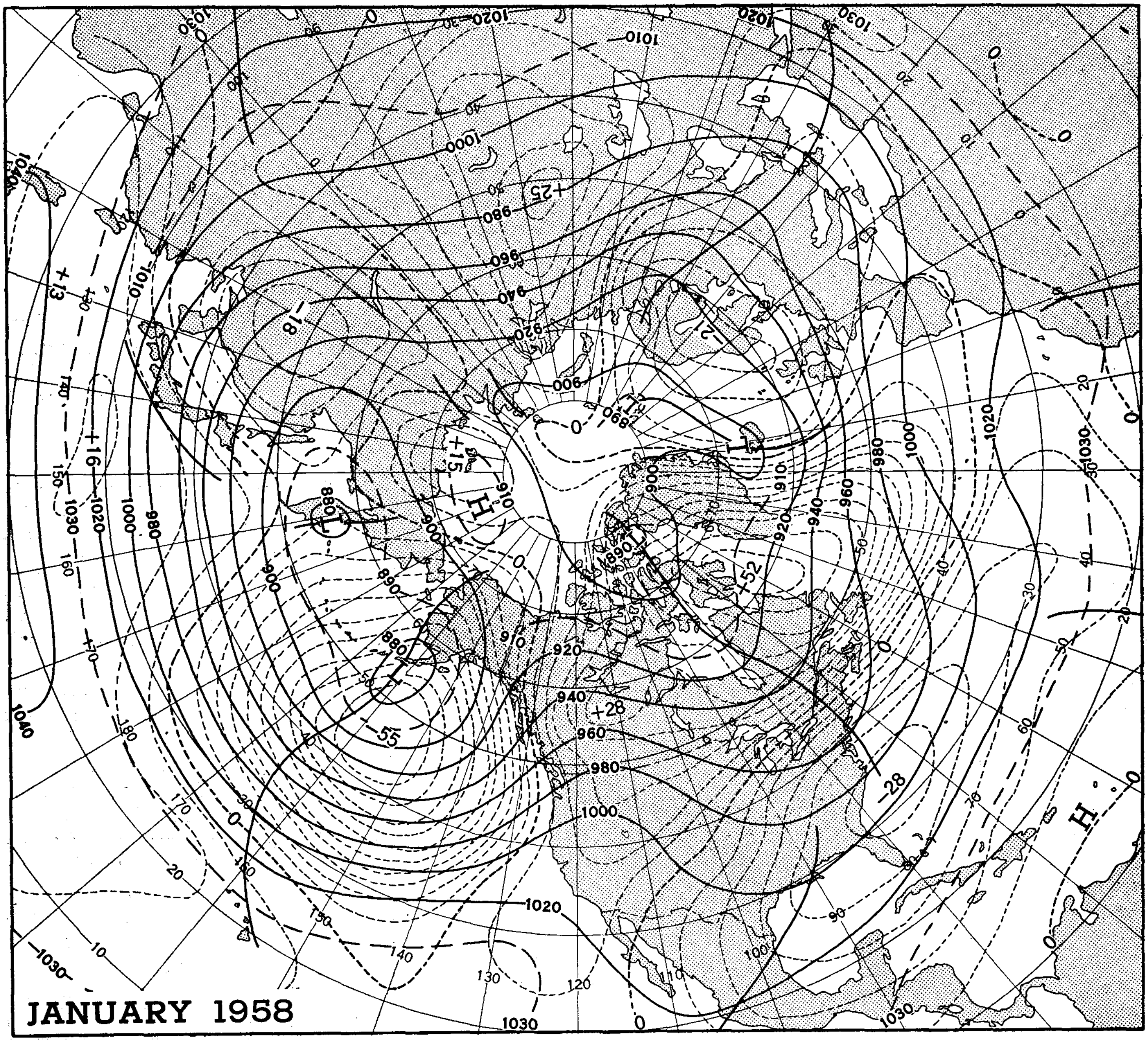

FIGURE 1.—Monthly mean 700-mb. contours for January 1958 labeled in tens of feet, and height departures from normal (short dashed lines at 50-ft. intervals, with centers labeled in tens of feet and zero isopleth heavier). Trough lines (heavier solid lines) connect minimum latitudes of contours.

than normal westerlies between 25° N. and 40° N., particularly in the eastern Pacific (fig. 2), may have forced the strongly sheared and positively tilted trough, which normally extends from the St. Lawrence Valley southwestward across Baja California in January, eastward to the middle Atlantic coast and southwestward across the northwestern Gulf of Mexico. This contributed to the strong negative height anomaly over the southeastern United States. This anomaly, coupled with the blocking in the Davis Strait, was of great importance in determining the monthly weather regime in the eastern half of the United States.

An abrupt change in the circulation took place near the middle of the month when the zonal westerlies in the Western Hemisphere (fig. 3) began to decline at an increasing rate about January 11. At this time continuation and intensification of a strong index cycle [2] was indicated by rapid anticyclogenesis in the Davis Strait area. This is more clearly illustrated by figure 4, which shows the two 15-day averages which constituted the monthly mean 700-mb. circulation. The negative height departures from normal for both halves of the month were quite similar in the eastern Pacific and the southeastern United States. However, the biggest change occurred in the Greenland-Davis Strait area where below normal heights in the first half of the month were replaced by a tremendous block averaging over 1,000 feet above normal in the second half. This block resulted from a consolidation of the two positive height anomaly centers observed on the first 15-day mean map (fig. 4A) as the Atlantic center retrograded to the Davis Strait and combined with the northeastward-moving center from the Alberta-Montana area. This consolidation was closely associated with an intensification and retrogression of below normal conditions in the southern and eastern United States.

On a 5-day mean basis, the Davis Strait block reached its maximum intensity at 700 mb. of about 1,500 feet above normal in the January 18–22 period. On a hemispheric basis, this was probably second in intensity only to the record anomaly of +1,600 feet in the same area during the 5-day period February 19–23, 1947.

3. CHANGE IN CIRCULATION FROM DECEMBER, AND ONSET OF INDEX CYCLE

The circulation during the previous month, December 1957, was one of high index and abnormal warmth in the United States [3], except for one major cold wave which produced the first severe winter freeze in Florida early in the month. In addition, December was characterized by the fact that the mean westerlies in the Western Hemisphere were stronger and farther north than normal, while a strong positive height anomaly (or block) persisted just off Newfoundland. Both of these circumstances have been recognized as conditions antecedent to an index cycle, according to Namias [2], provided that a reservoir of Arctic air in the polar regions is sufficiently great. Thickness anomaly charts during the last week of December (not shown) indicated that this reservoir of cold air was quite extensive and intense over Canada. Although late December is somewhat early for the beginning of a major index cycle, and although such a development would seem to conflict with the stronger persistence found between December and January than between any other pair of months [4], nevertheless the recognized prerequisite conditions seemed to be fulfilled at this time. Furthermore, a recent precedent for a strong index cycle this early in the winter was set in January 1956 [1], although that case represented persistence of low index from its preceding December.

Figure 3 shows the variation with time of overlapping 5-day mean 700-mb. wind speeds for both the temperate westerlies and subtropical westerlies during December 1957 and January 1958. It can be seen that about December 20 the subtropical westerlies started to increase, while the temperate westerlies went into decline. This was the start of a major prolonged index cycle which continued through the entire month of January with no recovery evident at month's end. The extensive cold outbreak which swept southward across the United States in the first days of January was one of the early manifestations of this developing index cycle.

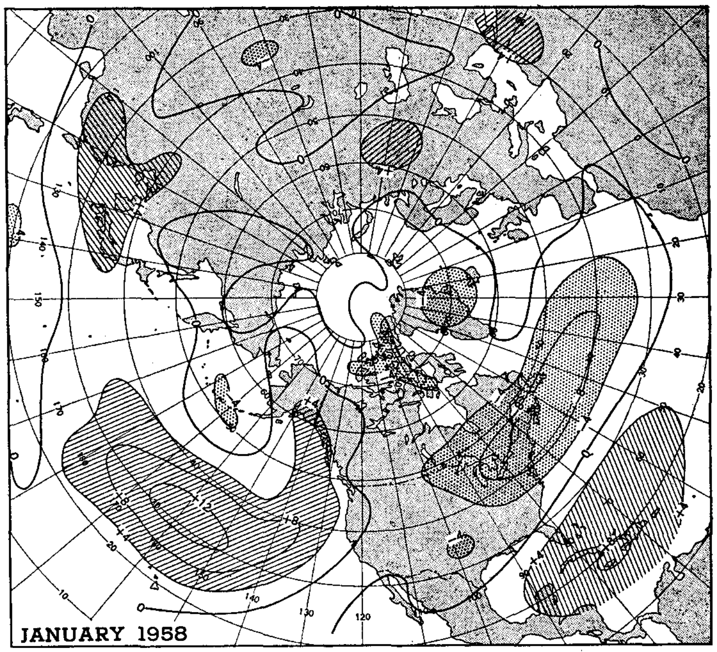

FIGURE 2.—Departure from normal of monthly mean 700-mb. wind speed (meters per second) for January 1958. Hatched areas indicate more than 4 m. p. s. above normal; dotted areas, more than 4 m. p. s. below normal.

Figure 5 shows how the latitudinal profile of 15-day mean westerly wind speeds in the Western Hemisphere changed with time. The high speeds in temperate latitudes during the last 15 days of December declined sharply by the last half of January. The sharp peak of near 14 meters per second at about 32° N. in the latter half of January presents a striking contrast to the peak speed of similar magnitude at a much higher latitude during the latter half of December; i. e., the hemispheric jet axis migrated about 15° southward during the period.

Another graphical illustration of the startling behavior of the circulation associated with this index cycle is given in figure 6. Starting with the last above normal peak wind speed of about 16 m. p. s. on the 20th of December 1957 near 47° N., the 700-mb. hemispheric jet axis migrated southward until the early days of January when the axis reached 40° N. For the remainder of the first half of the month an attempt at a recovery occurred during which time warmer air progressed across the United States and confined the below normal temperatures to the Southeast. Referring back to figure 3, it can be seen that although both temperate and subtropical westerlies averaged near normal during this period, the subtropical westerlies were continuing a steady trend upward. The fact that the westerlies averaged near normal during the first half of January could be misleading as to the state of the circulation, since the steadily rising subtropical westerlies indicated continued intensification of the index cycle, while the temperate westerlies were undergoing an abortive attempt at recovery.

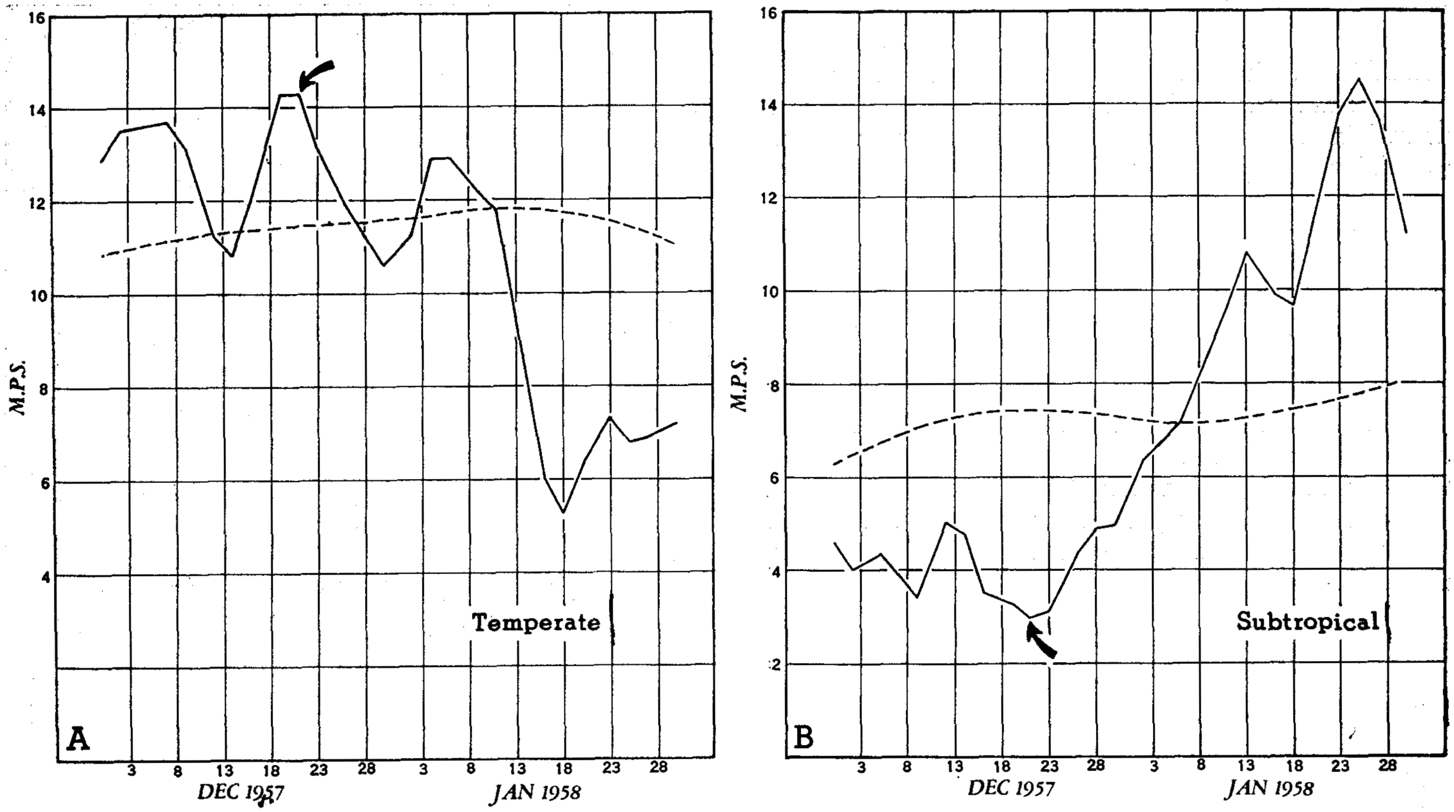

FIGURE 3.—Time variation over the Western Hemisphere of 5-day averages of 700-mb. westerlies (m. p. s., solid lines) and the normal values (dashed) for (A) 35°–55° N. (temperate) and (B) 20°–35° N. (subtropical.) Heavy arrows indicate start of index cycle.

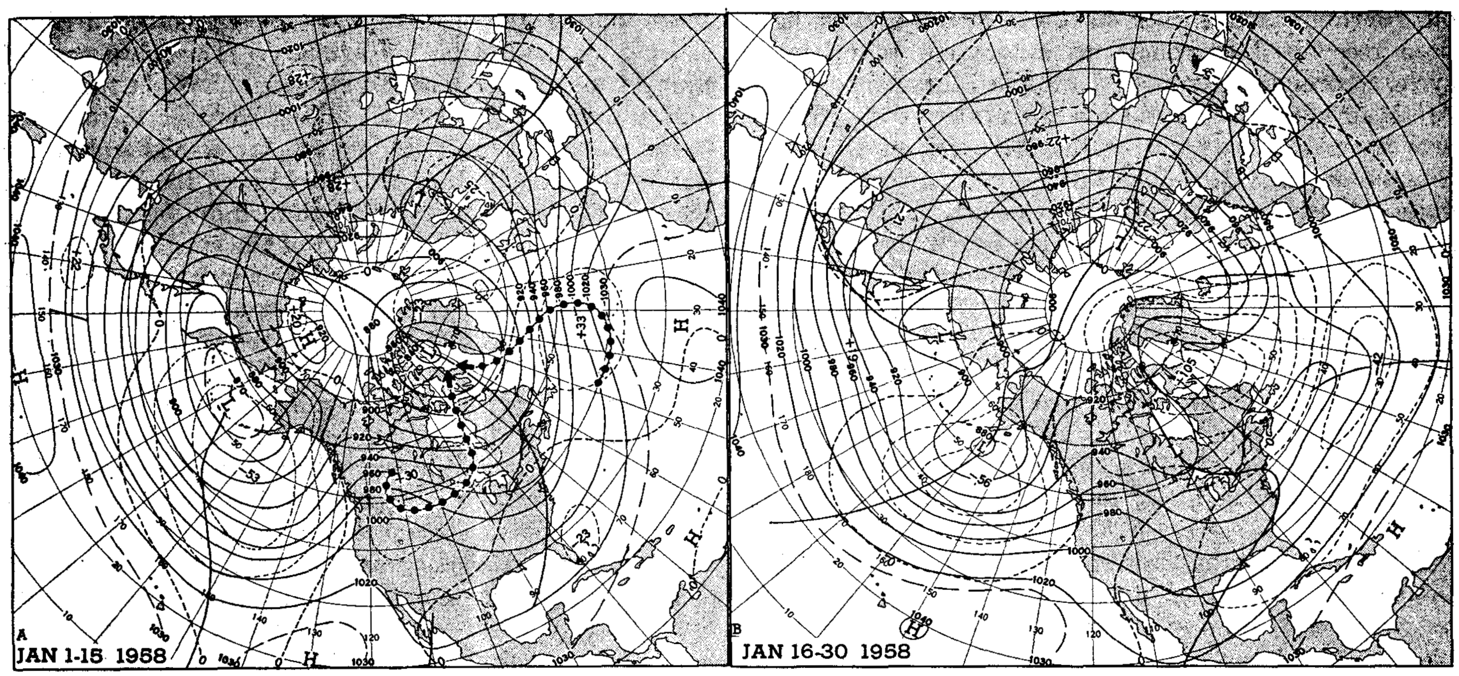

FIGURE 4.—15-day mean 700-mb. contours for the two halves of January 1958 with height departures from normal superimposed as dashed lines (every 200 ft.). Heavy dotted tracks represent smoothed paths of 5-day mean positive anomaly centers on (A) which consolidated to form Davis Strait block on (B).

Thus, during the middle weeks of January, multiple axes of strong westerlies (fig. 6) diminished at middle and higher latitudes as the jet axis in the lower latitudes continued to increase in strength, reaching a peak speed, and perhaps a record value, of 17.1 m. p. s. for two successive overlapping 5-day mean maps at 33° N. near the end of the month.

To complete the picture of this month's circulation, figure 7 shows the mean 200-mb. contours with mean isotachs and jet axes superimposed. At this level the jet stream was located in the northern Gulf of Mexico, in contrast to the previous month when it was located through Tennessee. The jet axis was split over the Atlantic, with the northern branch reflecting the influence of the Atlantic block primarily in the first part of the month, and the southern branch responding to the southward migration of the mid-latitude westerlies in the second half of the month. Two well-defined speed maxima existed in the Northern Hemisphere, one of about 71 m. p. s. off southern Japan, and another of about 53 m. p. s. in the Gulf of Mexico.

4. CYCLONE AND ANTICYCLONE TRACKS IN THE UNITED STATES

Two types of storms dominated the monthly weather picture. Undoubtedly the most important were the "Gulf" types, some of which moved northeastward along an inland path, but the majority became "northeasters" following a more normal track northeastward off the Atlantic coast, as shown in Chart X. The monthly mean sea level map (Chart XI) shows a trough off the east coast, reflecting the path of many deepening storms, in agreement with the position of the mean 700-mb. trough along the east coast in figure 1. The Low on the mean sea level chart southeast of Nova Scotia reflects the stagnation of the deep daily Lows in this area which had such a strong influence on the weather in the northeastern United States.

A weak trough on the monthly mean sea level chart from Alberta through southeastern Montana reflects a secondary locus of "Alberta" type disturbances which were generally weak and tended to fill as they moved eastward and southeastward. Due to the influence of blocking conditions in eastern Canada, these storms failed to recurve northeastward and deepen in the usual fashion.

The strong High on the mean sea level chart in the western United States, averaging about 1024 mb. for the month, reflects the relative absence of surface cyclonic systems of any consequence crossing the western Plateau, and also the frequency of daily anticyclones in this area (Chart IX). No single preferred anticyclone path appeared in the eastern United States, with Canadian Highs tending to "glance" eastward north of the Great Lakes toward Labrador in the latter part of the month, and another favored locus lying across the northern Gulf of Mexico (Chart IX).

Tracks of major Pacific cyclonic systems for the most part turned northward before striking the west coast of

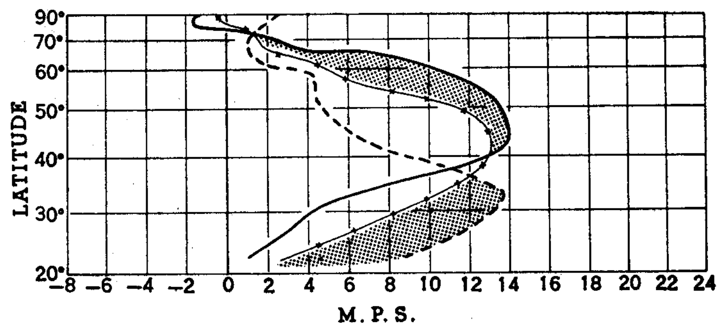

FIGURE 5.—15-day mean 700-mb. westerly wind profiles in the Western Hemisphere for the last half of December 1957 (heavy solid), January normal (thin solid), and last half of January 1958 (dashed), with above normal speeds shaded.

North America and contributed to the strong center of action south of Kodiak, Alaska. On the daily 500-mb. charts there was a predominant tendency for cyclonic vorticity maxima, after crossing the west coast, to drop southeastward through Nevada, New Mexico, and northern Texas, where surface cyclonic activity was intensified or regenerated along the polar front in the northwestern Gulf of Mexico. This persistent tendency is, of course, reflected in the location of the monthly mean trough aloft in the northwestern Gulf. The jet maximum at 200 mb. in the Gulf of Mexico (fig. 7) reflects the preference of this region as a locus of vorticity centers and sea level cyclones.

5. INDIVIDUAL STORMS

During the first week in January a strong cold anticyclone crossed the United States producing below normal temperatures east of the Plains. Progress of this cold High was retarded on the 3d by the worst winter storm in Miami's weather history. This storm formed near Cuba and hit southeastern Florida, with winds gusting to 70 m. p. h. and 3 to 5 inches of rain. This activity was related to the very early stages of the index cycle.

On the 5th and 6th another low-latitude storm in northern Mexico caused flooding rains of 6 inches or more in the lower Rio Grande Valley and 7 inches of snow in extreme western Texas and eastern New Mexico. This cyclone moved across the northern Gulf and up the Atlantic seaboard with heavy rains enroute. At Nantucket early on the 8th this storm deepened to a record low barometer of about 960 mb., with winds of hurricane force near the center and heavy snows along a 50-mile belt from Virginia northward. Storrs, Conn., for example, collected 17 inches of snow, a new record.

Persistent northerly winds along the east coast in the storm's wake drove down weekly average temperatures 10° to 13° below normal over Florida and the Southeast during the second week, and damaged citrus as temperature minima ranged from the low 20's to the 30's on the 9th.

Another storm formed in southern Texas on the 12th and moved slowly to southern New England on the 14th

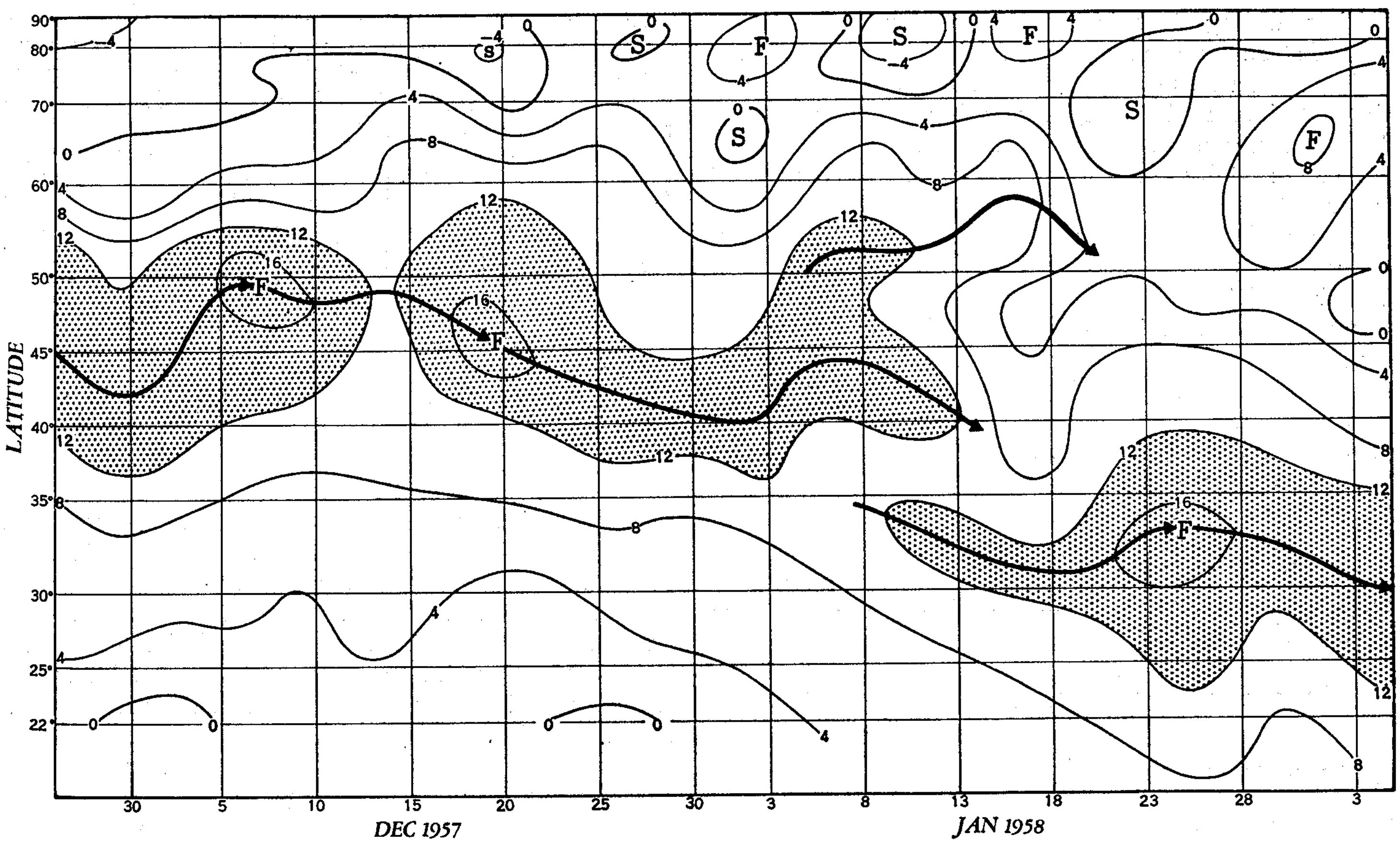

FIGURE 6.—Time-latitude section of 700-mb. 5-day mean wind speeds (m. p. s.) for December 1957 and January 1958, averaged over 5° of latitude around Western Hemisphere. The 5-day averages were computed three times weekly and plotted at middle day of period. Axes of maximum westerlies are indicated by heavy solid lines, and speeds over 12 m. p. s. are shaded. F indicates high speed centers, and S, slow centers.

after having spread heavy precipitation throughout the entire eastern United States. During this period a polar High moved eastward across southern Canada instead of along the more normal path southeastward across the middle Mississippi Valley. Another high center located near northwestern Hudson Bay on the 16th, intensified rapidly and drifted northeastward into Baffin Bay. It reached the record intensity of 1066 mb. on the 18th, eclipsing the previous record high of 1064 mb. in this area in January 1956 [1]. This High stalled the Texas storm near New England, resulting in almost continuous precipitation in that area until the 19th. (Another article in this issue, by Martin and Bucci, gives a detailed comparison of these two storms.) Persistent northerly surface flow due to the stationary storm in the Northeast again produced below normal temperatures east of the Ohio and lower Mississippi Valleys, with maximum negative temperature departures in the extreme Southeast for the third consecutive week. In Maine, temperatures were much above normal during this week due to the persistent easterly flow of mild maritime air resulting from the stalled Low and the block over Labrador.

In the latter part of this week a frontal system crossed the western United States into the central Plains and developed another low-latitude disturbance over the Southwest, causing beneficial snows in the western portions of the central and lower Great Plains on the 18th and 19th, where some sections had been without precipitation since mid-November. This system brought heavy precipitation to practically the entire eastern United States from the 20th to the 22d and one of the heaviest snows of record at Kansas City and Columbia, Mo.

This was quickly followed by another storm emerging from northeastern New Mexico into the northern Gulf on the 24th, reaching southern New England on the 26th, and producing 1 to 2 inches of rain along the Gulf and Atlantic Coasts. This cyclone was also blocked near New England, similar to the storm of mid-month, by a High moving across southern Canada to Labrador. This system caused a damaging tornado at Cochran, Ga., on the 24th, and snow and sleet as far south as northern Louisiana and Mississippi.

On the last days of the month a storm was moving eastward through Oklahoma producing heavy snow in northeastern Missouri and Illinois.

6. TEMPERATURE AND PRECIPITATION

Some of the salient abnormalities of the weather have already been discussed in connection with the circulation anomalies. In general the temperature regime over

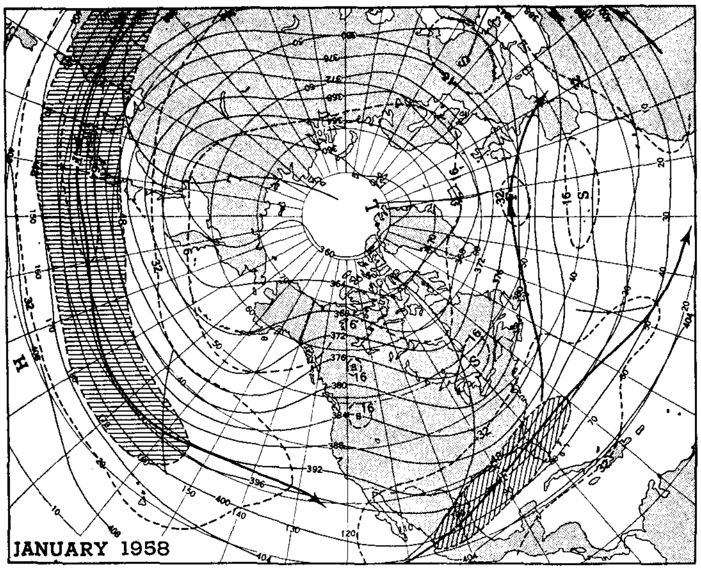

FIGURE 7.—Monthly mean 200-mb. contours (solid, hundreds of feet) and isotachs (dashed, m. p. s.) for January 1958. Heavy solid arrows indicate average position of the jet stream. (Hatching in areas with over 48 m. p. s.).

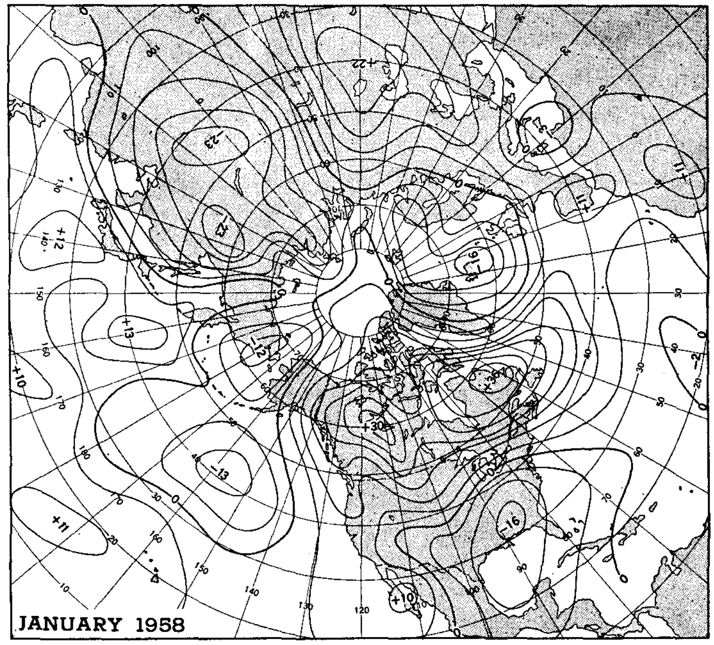

FIGURE 8.—Monthly mean departure from normal of 1000–700-mb. thicknesses for January 1958, drawn at 50-foot intervals, with centers labeled in tens of feet. Heavy solid lines are zero departures.

North America is well illustrated by the departures from normal of the monthly mean 1000–700-mb. thicknesses (fig. 8). Canada was completely dominated by above-normal thicknesses, with two distinct centers in the overall pattern. The western center, averaging about 16F.° above normal, was sustained by the advection of mild maritime Pacific air in the stronger than normal southwesterly flow between the great planetary trough south of Kodiak, Alaska, and the ridge in western North America which persisted throughout the month.

The above-normal thickness center in Laborador, also averaging about 16F.° above normal for the month, developed and was sustained mostly in the second half of the month by advection of mild Atlantic maritime air by the strong southerly and southeasterly flow which developed in conjunction with the strong blocking in the Davis Strait (fig. 4B).

Although the thickness departure isolines in figure 8 might suggest that the thermal field was reversed in the northern United States and southern Canada, only in eastern Canada in the latter half of the month were the departures large enough to reverse the actual thermal field. For example, in the 5-day period January 18–22, the actual thickness at Frobisher, N. W. T., was greater than in Maine, and the mean thickness lines (not shown) were oriented from the Gulf of St. Lawrence northwestward, with colder air to the southwest. This helped to produce the abnormal retrogressive steering of surface Lows from the Maritime Provinces northwestward toward northern Hudson Bay (Chart X).

The temperature regime over the United States conformed closely to the height and thickness departures. Temperatures in the Southeast averaged 6 to 8 F.° below normal for the month (Chart I–B), with shorter averages, particularly for the second week, even more extreme. Most places in the extreme Southeast experienced their second coldest January of record (exceeded only in 1940). Elsewhere the Southeast had its coldest January in 10 years.

New England temperatures ranged from near normal in the south to 10° above normal in Maine due to the prevailing maritime trajectory, with the "January Thaw" arriving in most places in southern New England on schedule. The upper Mississippi Valley, Northern Plains, northern Rockies, and much of the western United States also experienced abnormally warm weather due to the persistent transport of mild Pacific maritime air resulting from the tenacious planetary wave pattern in western North America and the eastern Pacific, together with foehn effects in the lee of the northern Rockies. Marquette, Mich., reported the warmest January since 1934; Rapid City, S. Dak., was above normal on 30 days of the month; Havre, Mont., had no temperatures below zero and only one warmer January since 1879; and Los Angeles, Calif., had the warmest January on record.

Precipitation amounts (Chart III–B) were also spectacular in certain areas due to the persistent anomalies in the circulation. Above normal amounts fell in three principal areas: most of the Atlantic seaboard, the Southern and Central Plains, and most of the west coast. The eastern edge of the above normal precipitation in the West conformed closely to the position of the persistent planetary ridge line aloft, which terminated the moist ascending southwesterly currents from the eastern

Pacific. Practically no snow occurred at lower elevations in the West since continental polar air was contained farther north by the strong ridge. For example, Olympia, Wash., reported no snow for the month, this having happened only once before, in 1945.

The tracks of vorticity maxima aloft, southeastward across New Mexico and Texas, produced disturbances through this area which resulted in beneficial heavy precipitation, particularly on the 5th and 6th. Southern Texas also experienced extremely heavy amounts and some flooding in the Rio Grande Valley. Corpus Christi, Tex., reported a total of 10.78 inches, the greatest on record and almost twice the next highest on record, accompanied by flooding on the 5th and 23d. Laredo, Tex., reported the second largest total since 1875. Heavy snow occurred in northern Missouri on the 20th and 21st, with Columbia reporting 10.4 inches, which together with nearly 4 inches from another storm on the 31st, added up to the greatest January total since 1906.

With the main storm track extending across Florida and northeastward just off the Atlantic coast, and with the jet stream and its associated speed maximum in the Gulf of Mexico, the whole Atlantic seaboard was vulnerable to heavy precipitation. Southern Florida had one of the wettest Januarys on record, and Charleston, S. C., reported the most rainfall of any January since 1929. Relatively lighter amounts occurred in the middle portion of the Atlantic seaboard, probably due to the coastal indentation north of Hatteras providing a measure of remoteness from the path of migratory cyclones.

Stagnation of storms off New England, due to the blocking to the north, resulted in record or near record amounts of precipitation at many stations; e. g., Burlington, Vt., reported 33.7 inches of snow, the most on record for any month. Boston's 9.54 inches of precipitation proved to be the greatest January amount in 88 years of record, producing some flooding of rivers. In addition Boston recorded 17 days with precipitation, 1 day less than the record.

7. THE TROPICAL PACIFIC

All Hawaiian stations reported precipitation below normal, probably due in part to the weakness or absence of the trades associated with the strongly developed planetary center of action to the north. Although the southern edge of the Pacific trough at 700 mb. retrograded west of the islands in the last part of the month, it possessed very little of the sharpness usually associated with a heavy rain producer. In any event this month's rainfall anomalies in Hawaii were more characteristic of February when a major index cycle is more likely to be in command of the Western Hemisphere, tending to bear out the idea that the southward migration of the westerlies, which began in late December this winter, is closely linked to the suppression of rainfall in Hawaii.

Another noteworthy occurrence in the Pacific during the month was typhoon Ophelia. Ophelia was first detected as a disturbance near 5°N., 174°E. on January 6. Traveling westward at about 12 knots, it hit Jaluit, Marshall Islands, on the 7th with winds over 125 knots and high water destroying over 95 percent of the buildings. Sixteen persons were reported dead or missing. Continuing westward at about 12 knots, it passed within 20 miles of Truk, Eastern Caroline Islands, on the 10th and 11th, yielding 3.42 inches of rain. Veering more to the northwest, it slowly made its way in the direction of the Philippine Islands but sharply recurved on the 17th at about 13°N., a few hundred miles east of the islands, where it dissipated. Figure 1 shows the extensive high pressure ridge in the western Pacific with its axis along the 18th parallel, which prevented the typhoon from penetrating into the westerlies.

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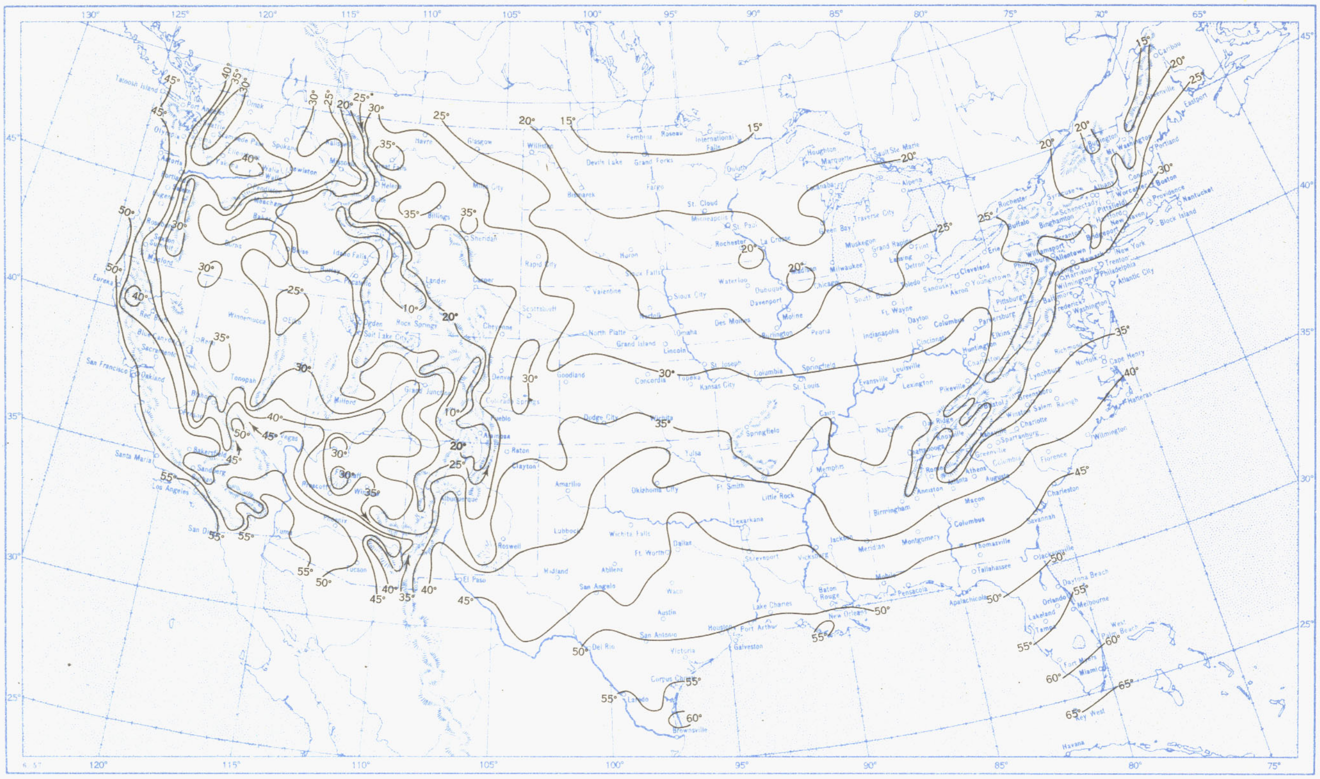
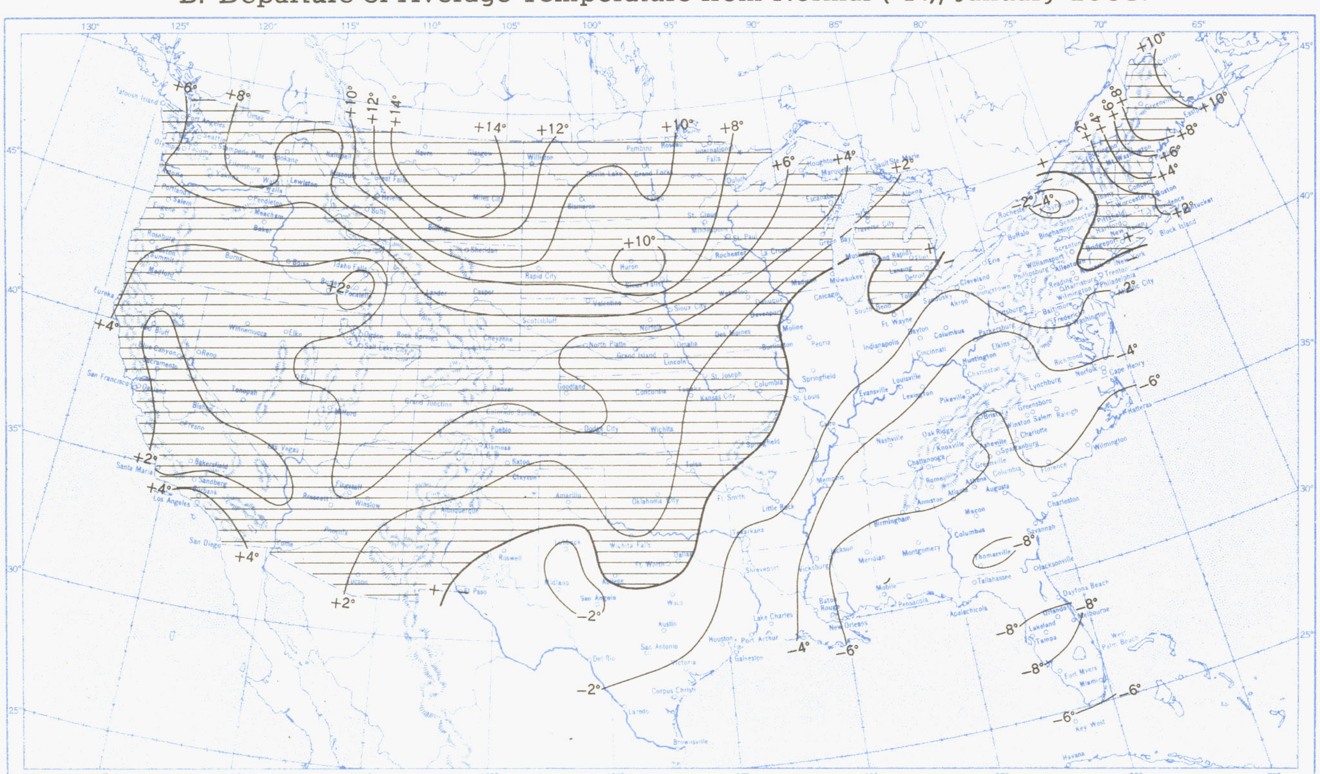
3. C. R. Dunn, "The Weather and Circulation of December 1957—High Index and Abnormal Warmth in the United States," *Monthly Weather Review*, vol. 85 No. 12, Dec. 1957, pp. 409–416.
4. J. Namias, "The Annual Course of Month-to-Month Persistence in Climatic Anomalies," *Bulletin of the American Meteorological Society*, vol. 33, No. 7, Sept. 1952, pp. 279–285.

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

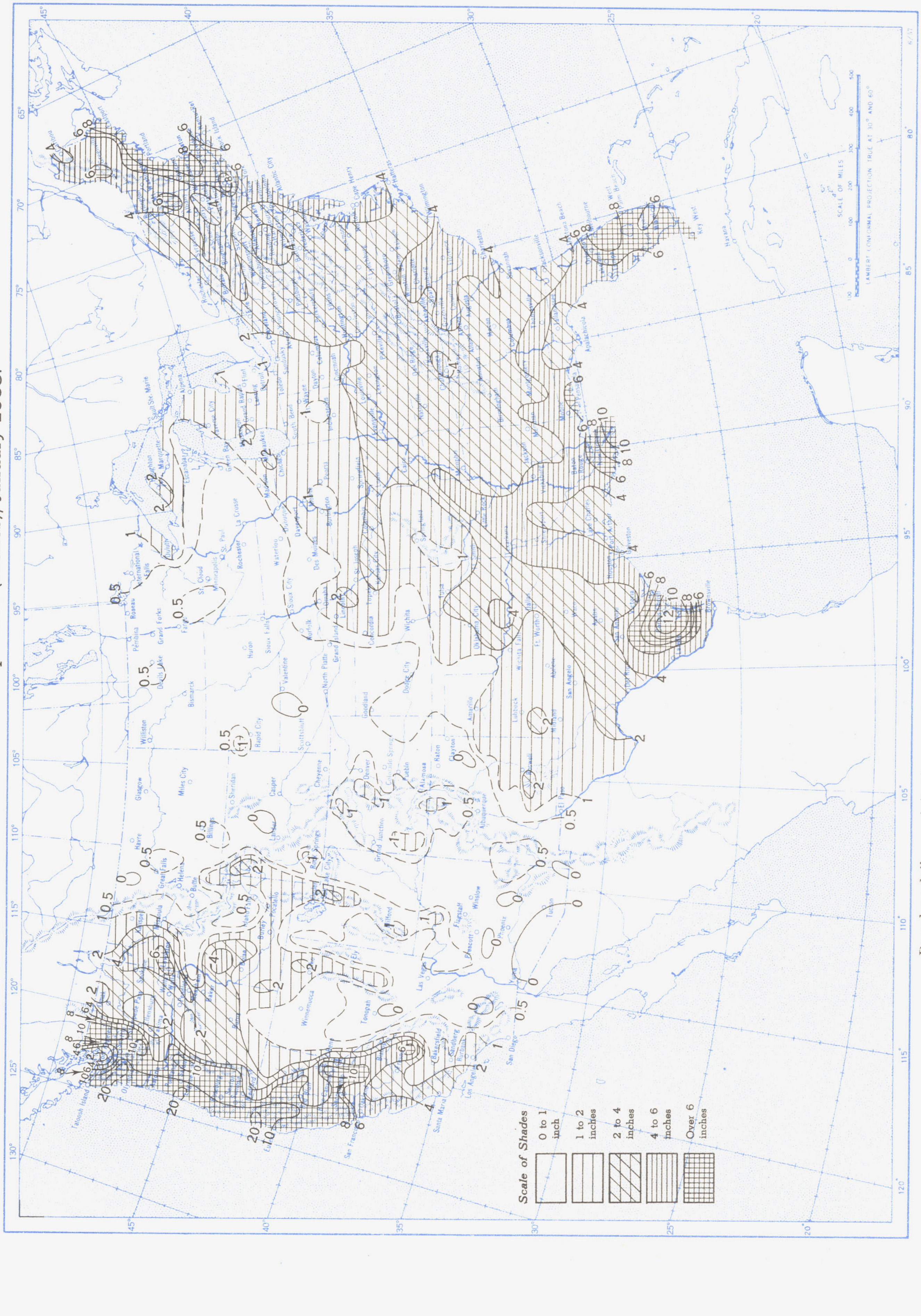


B. Departure of Average Temperature from Normal (°F.), January 1958.



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.

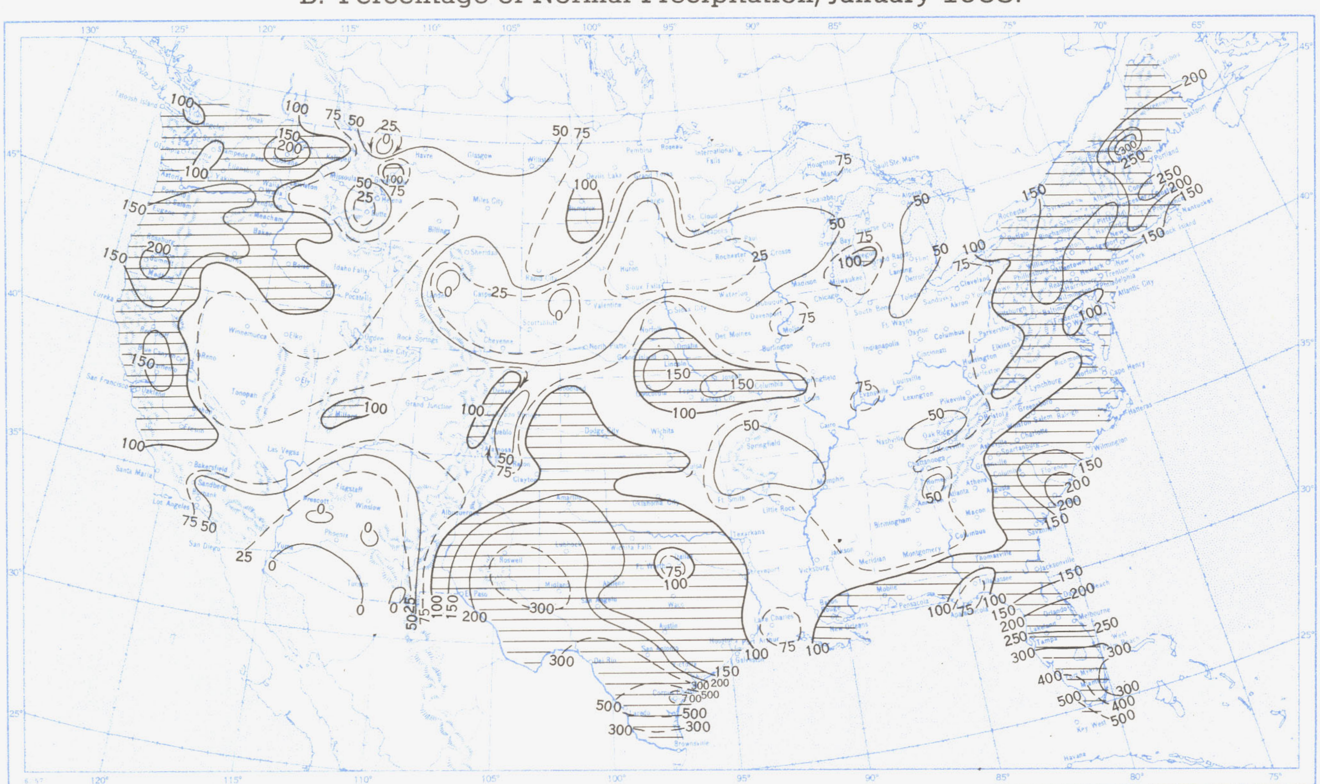
Chart II. Total Precipitation (Inches), January 1958.



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

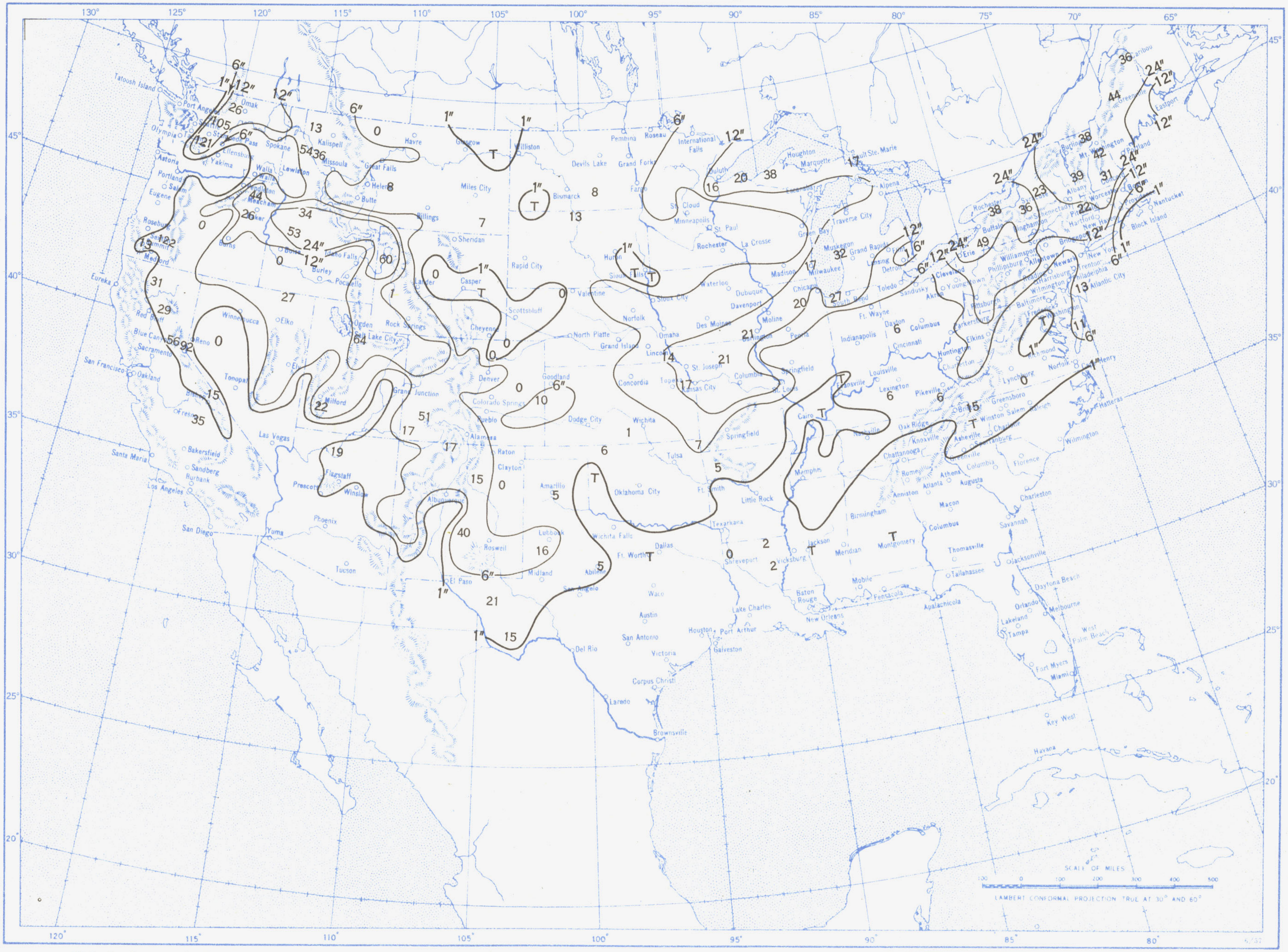
Chart III. A. Departure of Precipitation from Normal (Inches), January 1958.

B. Percentage of Normal Precipitation, January 1958.



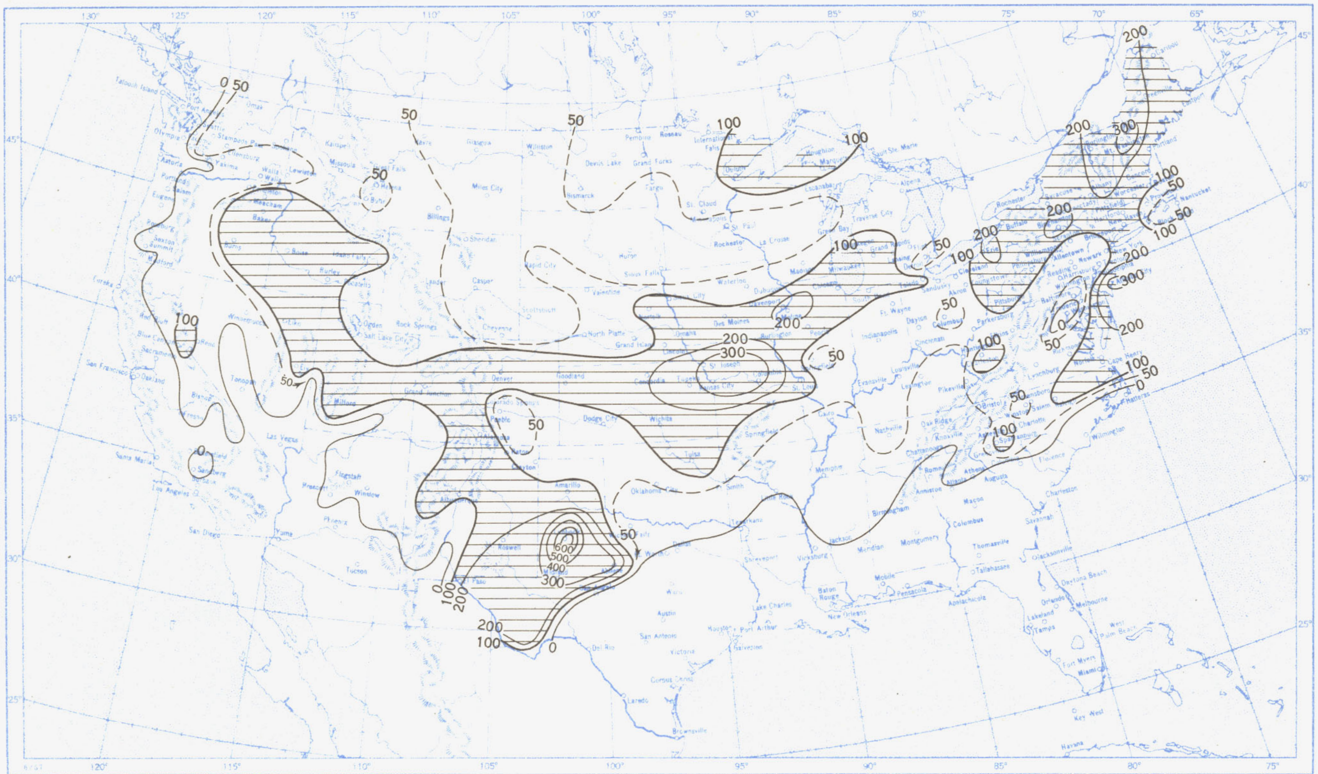
Normal monthly precipitation amounts are computed from the records for 1921-50 for Weather Bureau stations and from records of 25 years or more (mostly 1931-55) for cooperative stations.

Chart IV. Total Snowfall (Inches), January 1958.

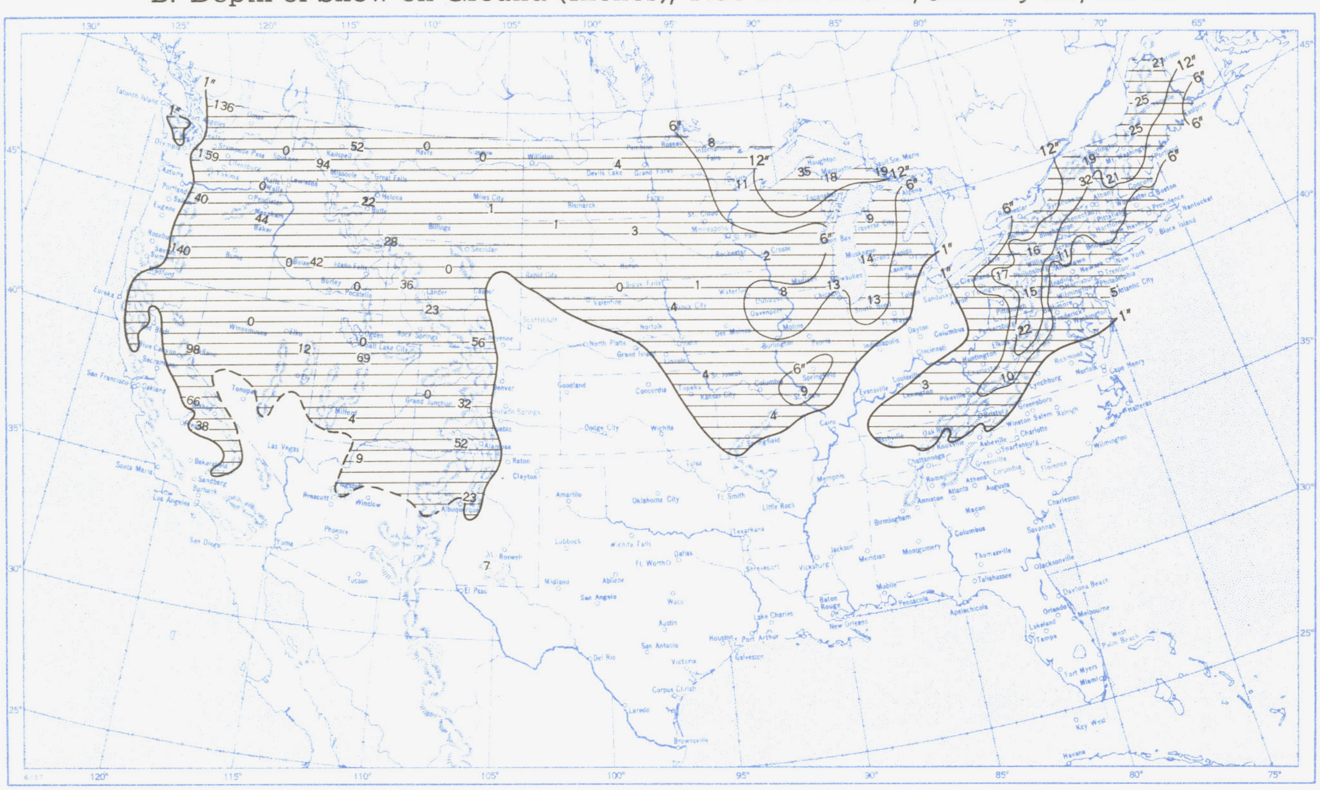


This is the total of unmelted snowfall recorded during the month at Weather Bureau and cooperative stations. This chart and Chart V are published only for the months of November through April although of course there is some snow at higher elevations, particularly in the far West, earlier and later in the year.

Chart V. A. Percentage of Normal Snowfall, January 1958.

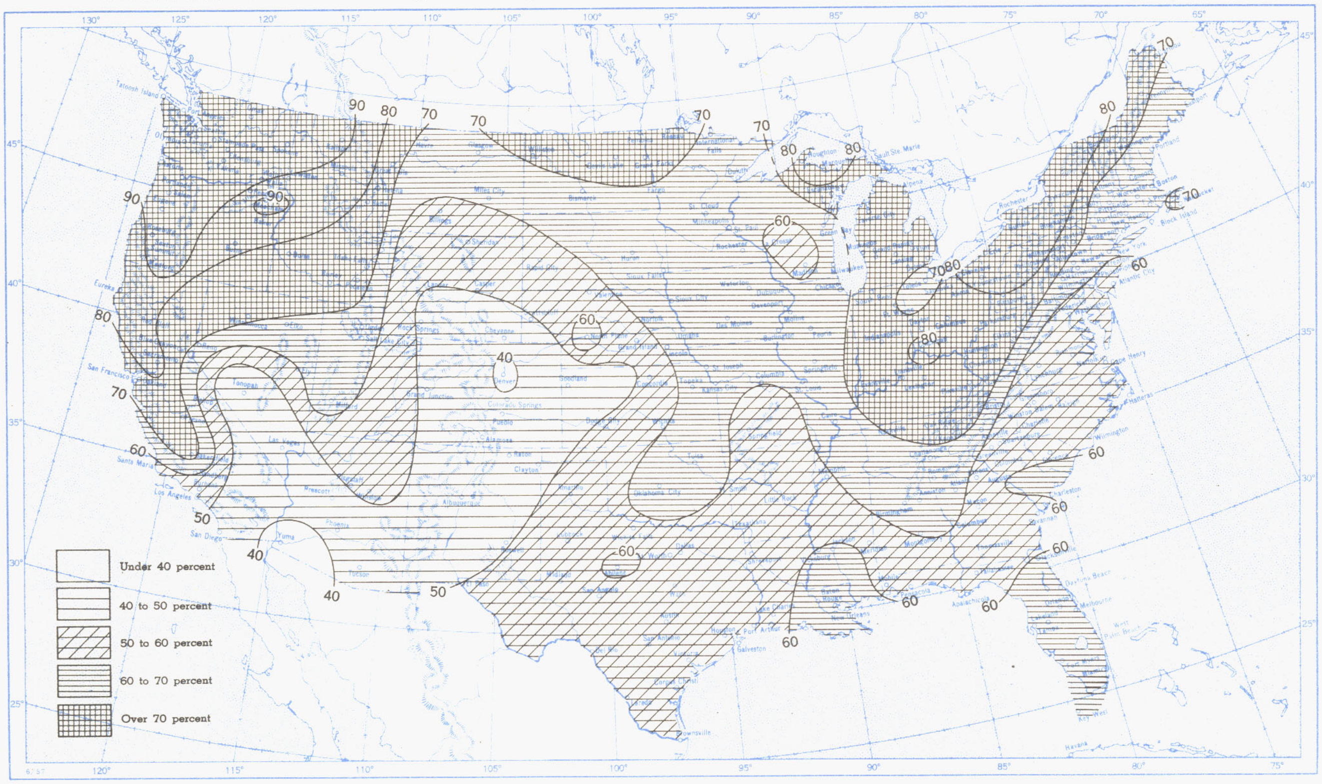


B. Depth of Snow on Ground (Inches), 7:00 a. m. E. S. T., January 27, 1958.

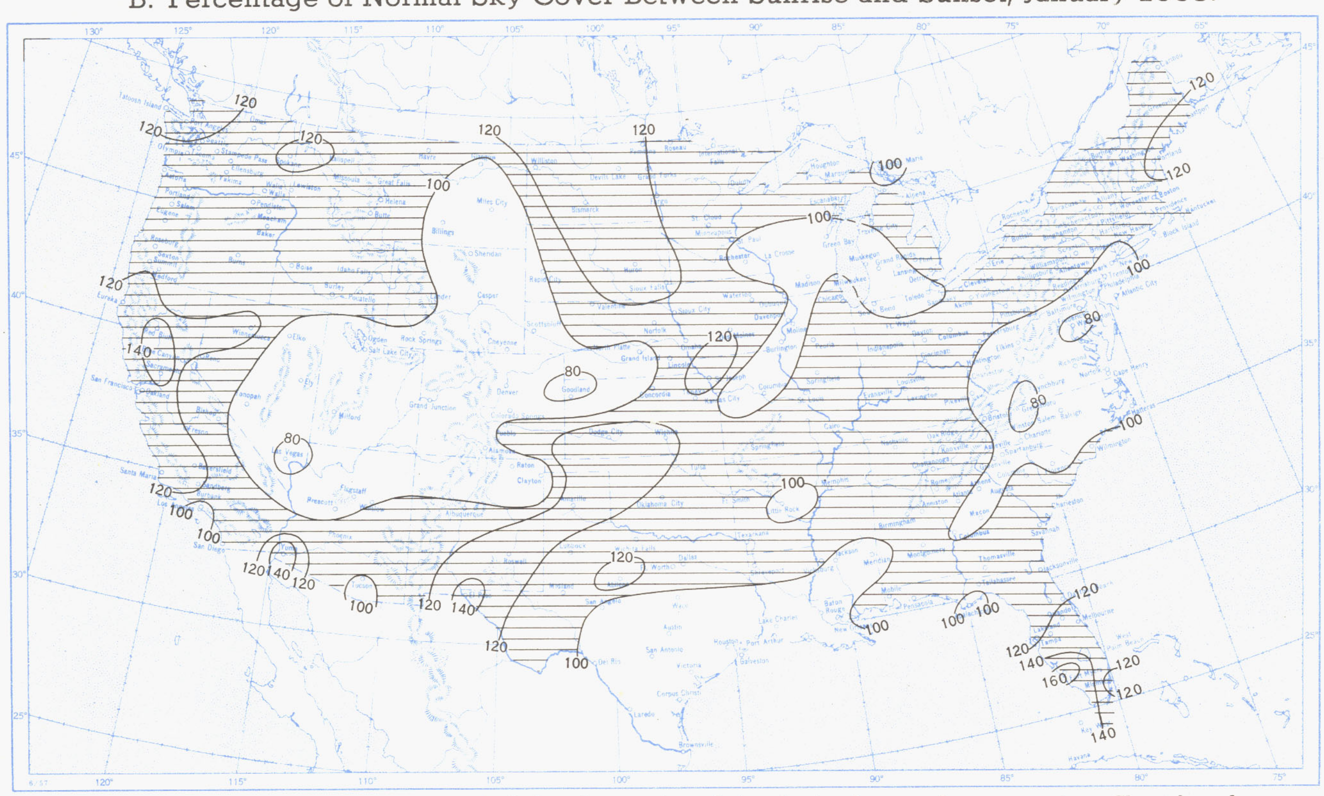


A. Amount of normal monthly snowfall is computed for Weather Bureau stations having at least 10 years of record.
B. Shows depth currently on ground at 7:00 a. m. E. S. T., of the Monday nearest the end of the month. It is based on reports from Weather Bureau and cooperative stations. Dashed line shows greatest southern extent of snowcover during month.

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

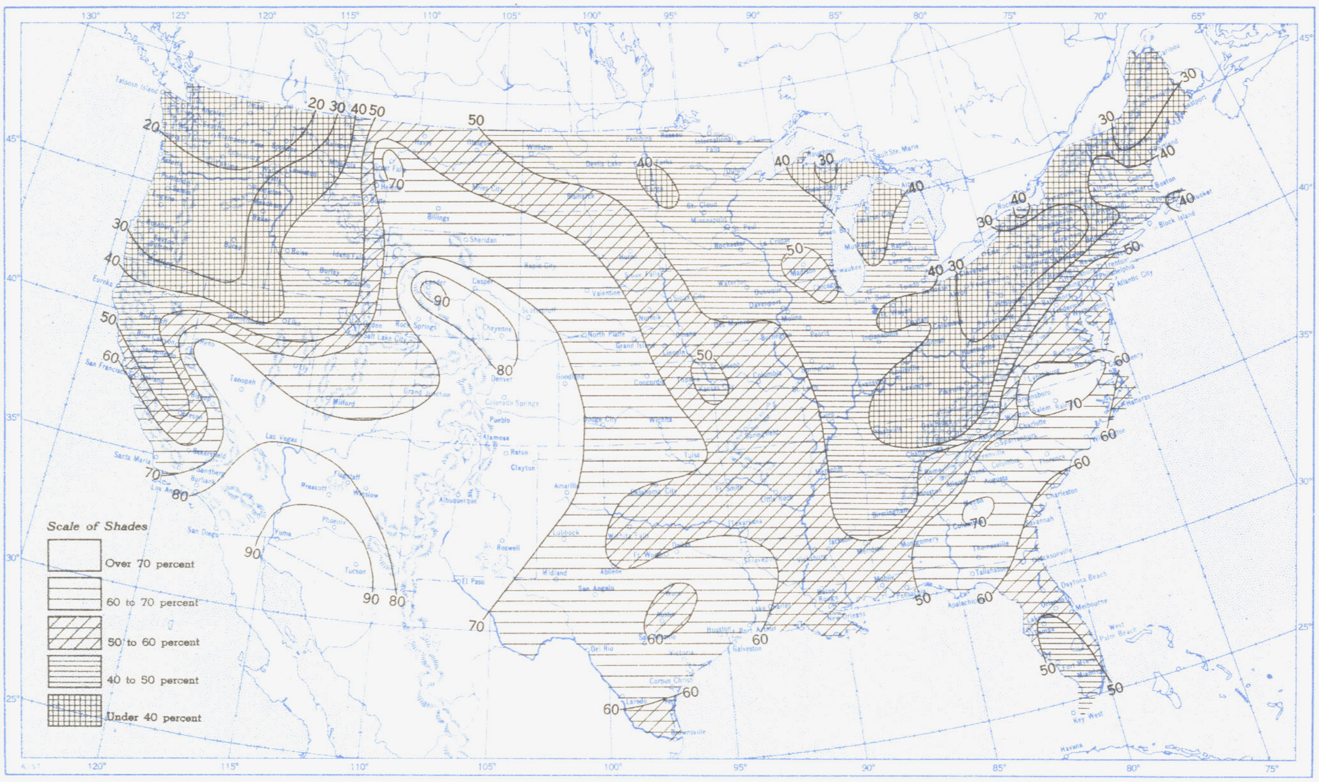


B. Percentage of Normal Sky Cover Between Sunrise and Sunset, January 1958.

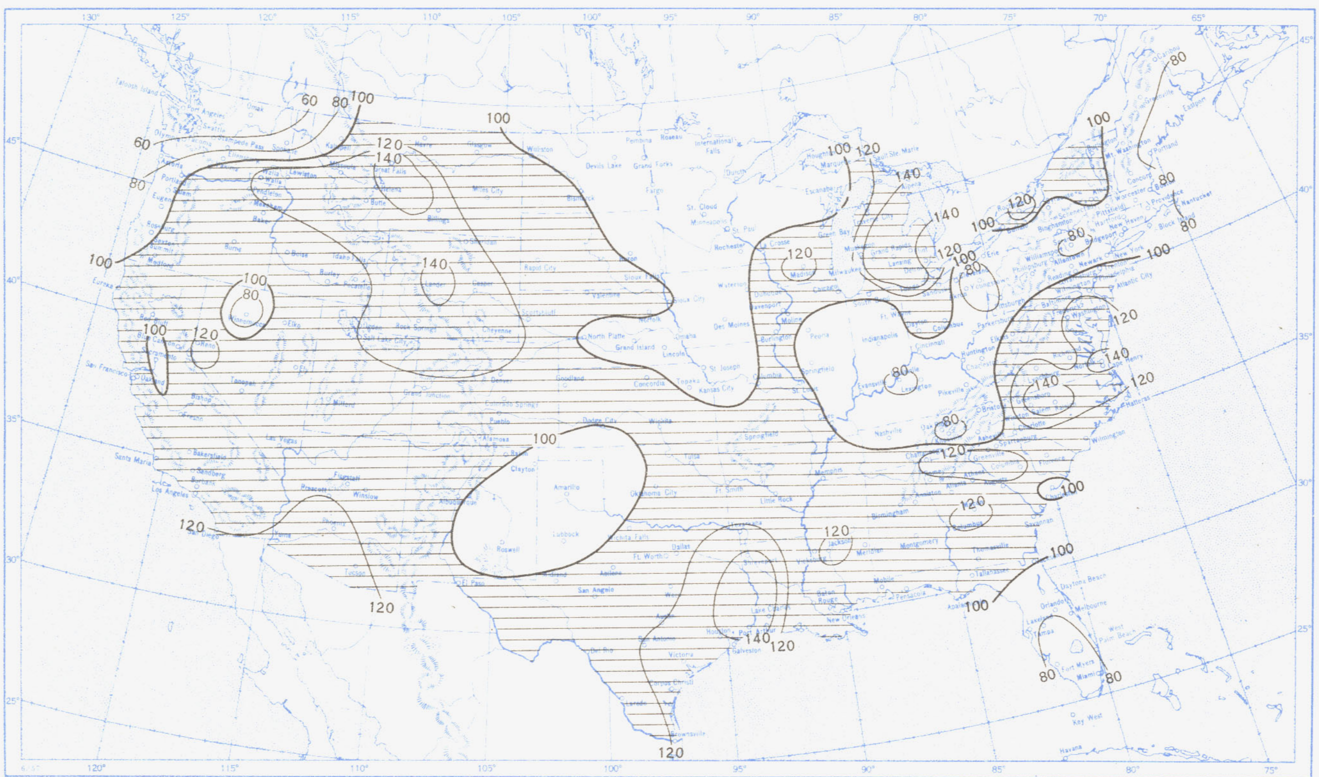


A. In addition to cloudiness, sky cover includes obscuration of the sky by fog, smoke, snow, etc. Chart based on visual observations made hourly at Weather Bureau stations and averaged over the month. B. Computations of normal amount of sky cover are made for stations having at least 10 years of record.

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



B. Percentage of Normal Sunshine, January 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, January 1958. Inset: Percentage of Mean Daily Solar Radiation, January 1958. (Mean based on period 1951-55.)

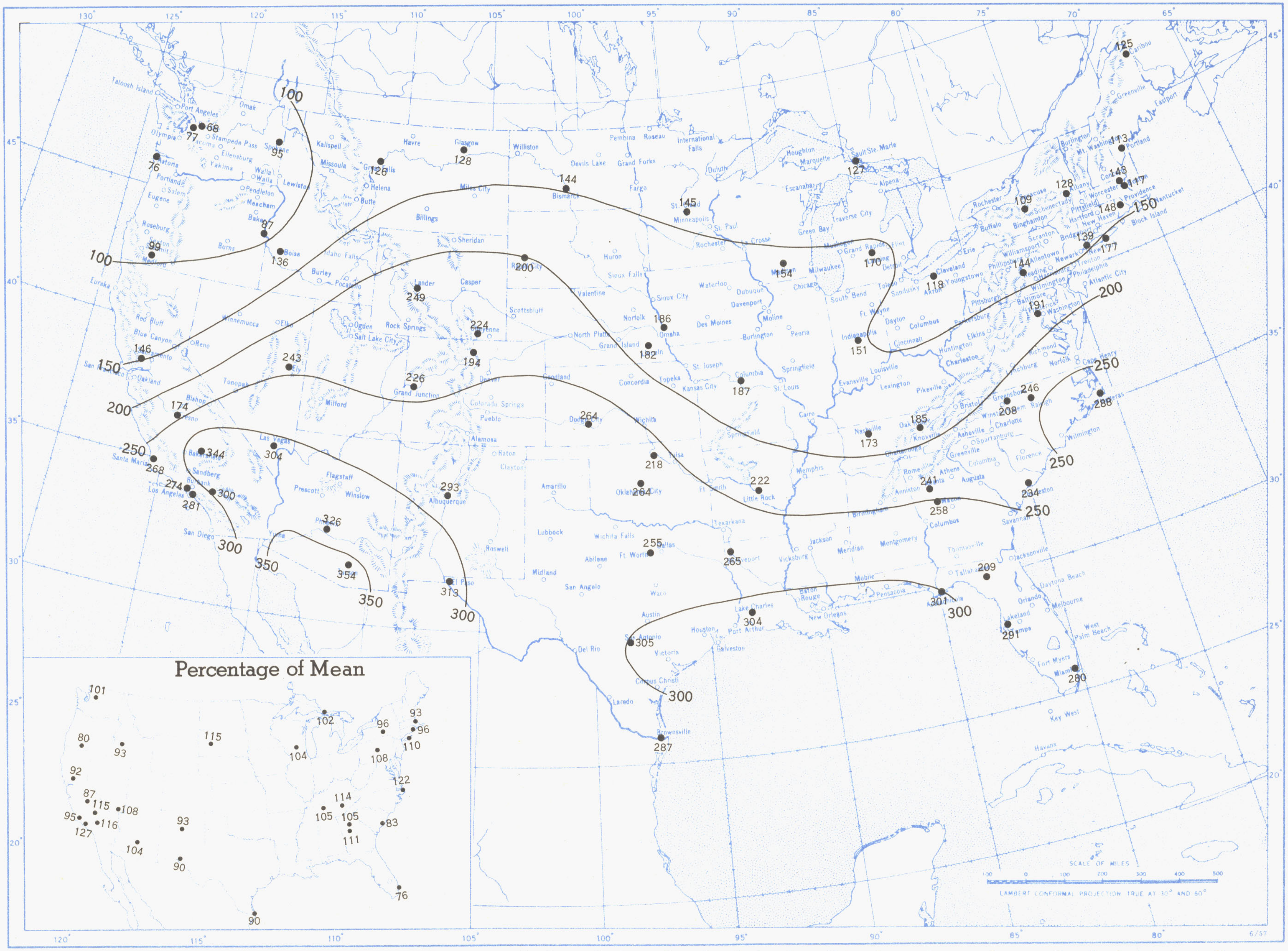
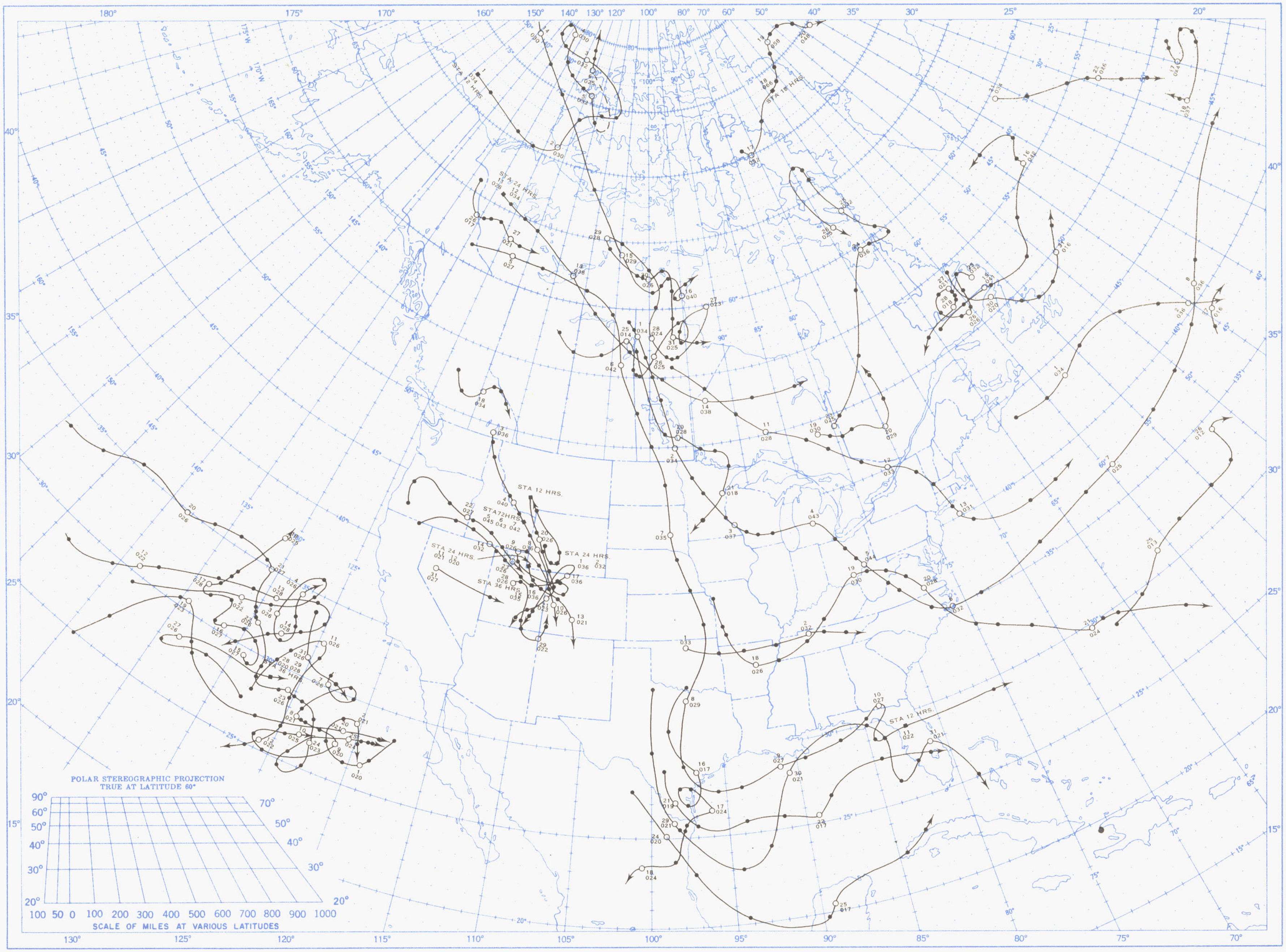


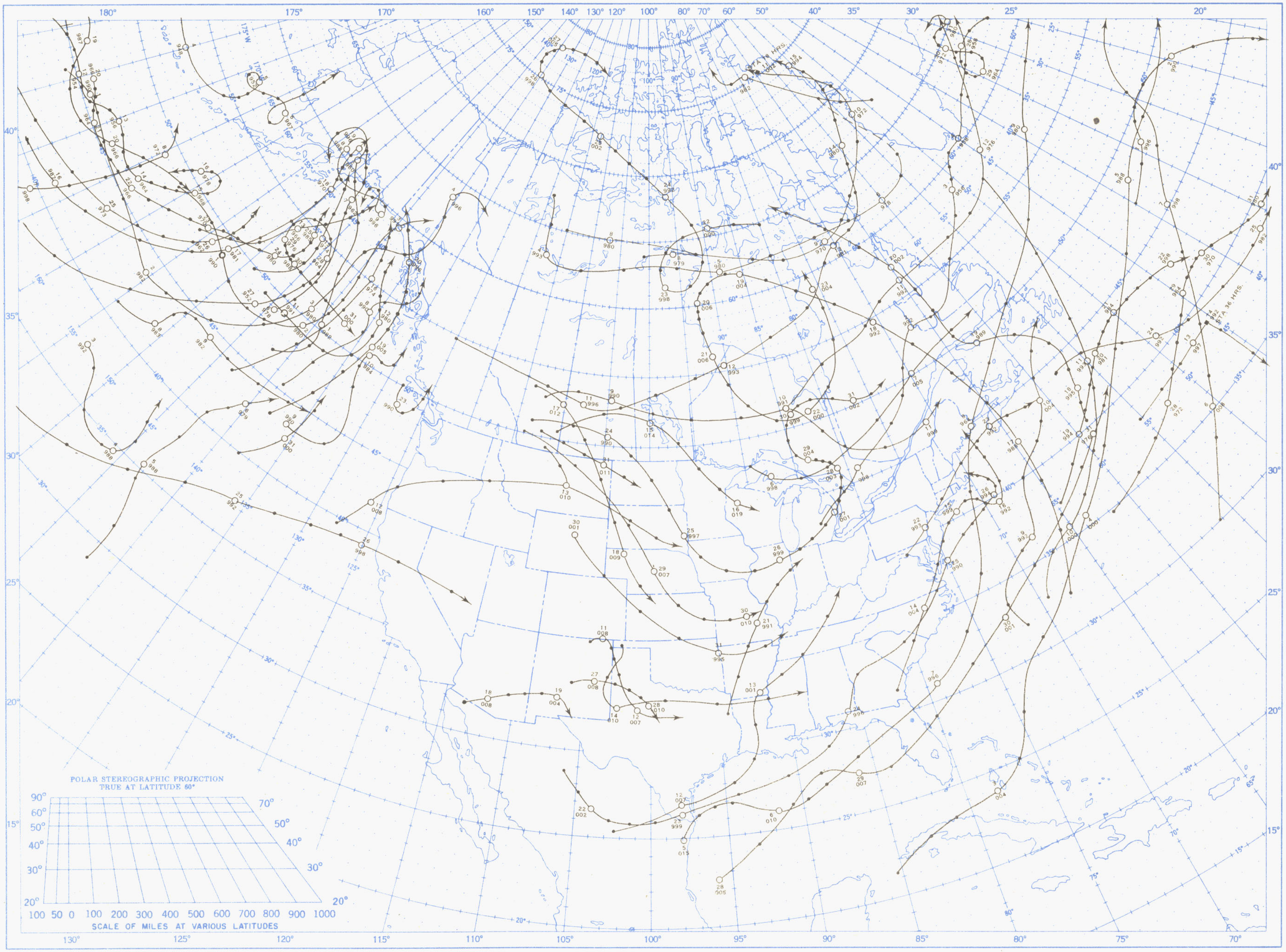
Chart shows mean daily solar radiation, direct + diffuse, received on a horizontal surface in langleys (1 langley = 1 gm. cal. cm.$^{-2}$). Basic data for isolines are shown on chart. Further estimates are obtained from supplementary data for which limits of accuracy are wider than for those data shown.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

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



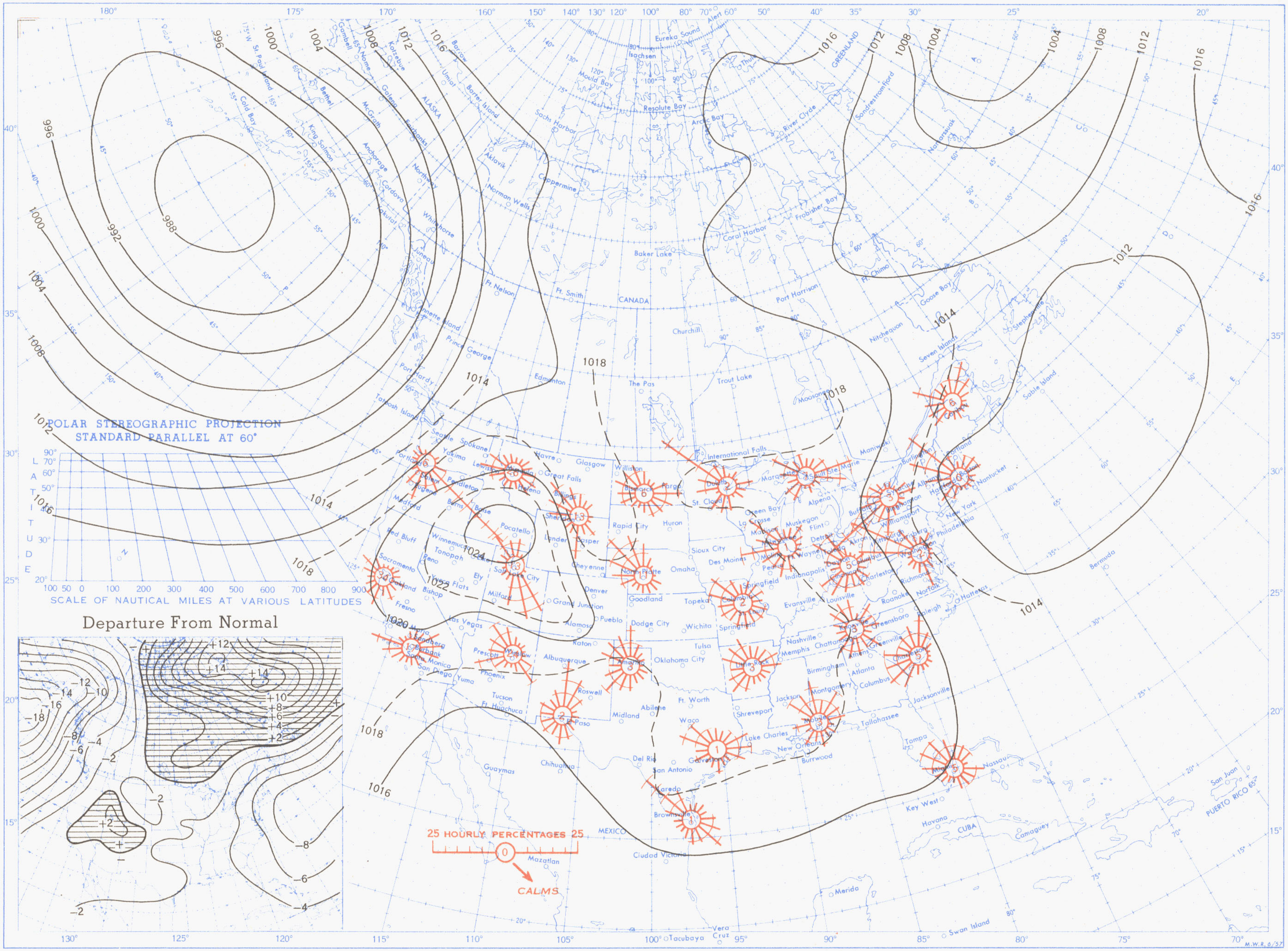
Circle indicates position of center at 7:00 a. m. E. S. T. Figure above circle indicates date, figure below, pressure to nearest millibar. Dots indicate intervening 6-hourly positions. Squares indicate position of stationary center for period shown. Dashed line in track indicates reformation at new position.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

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



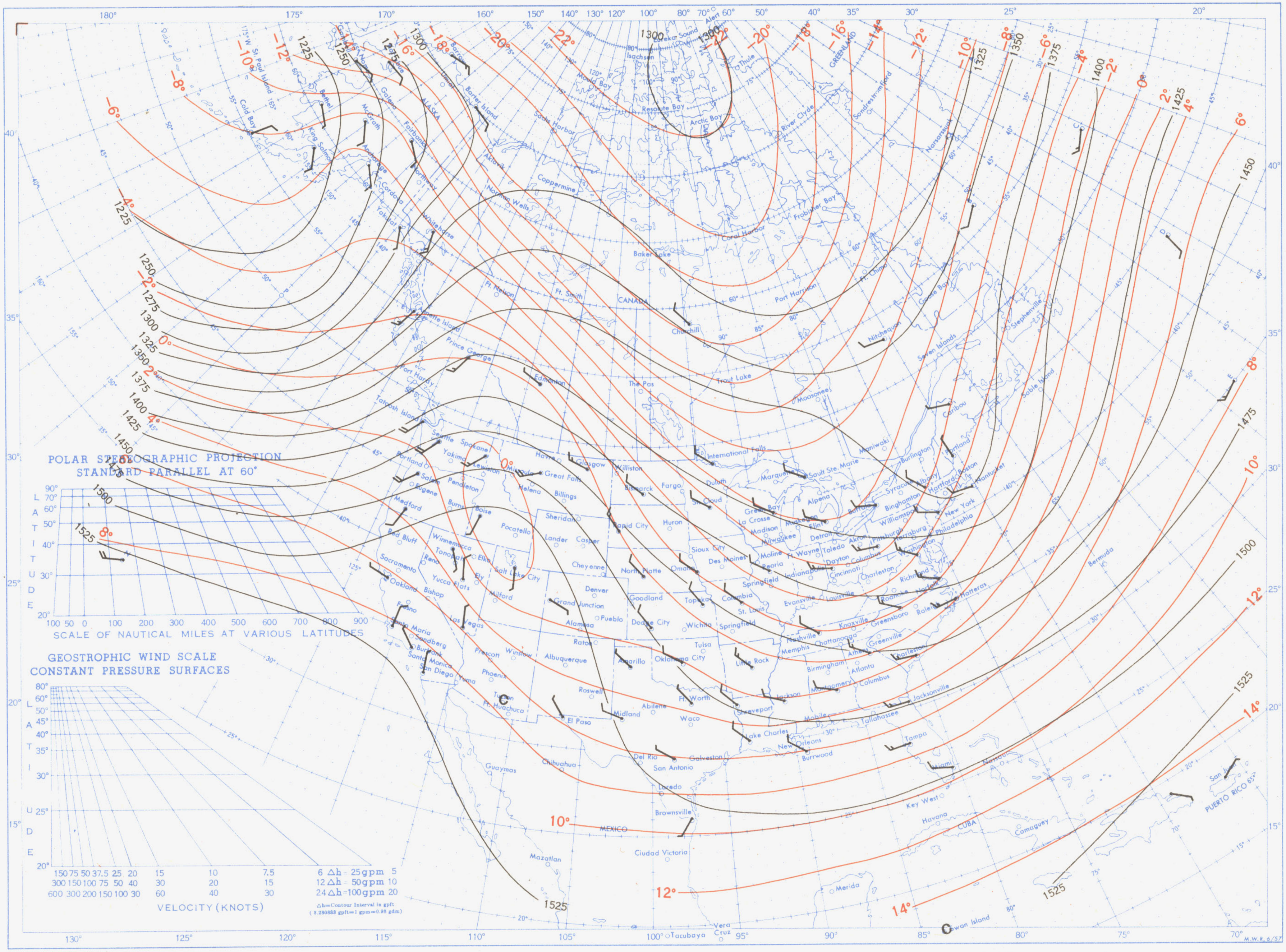
Circle indicates position of center at 7:00 a. m. E. S. T. See Chart IX for explanation of symbols.

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



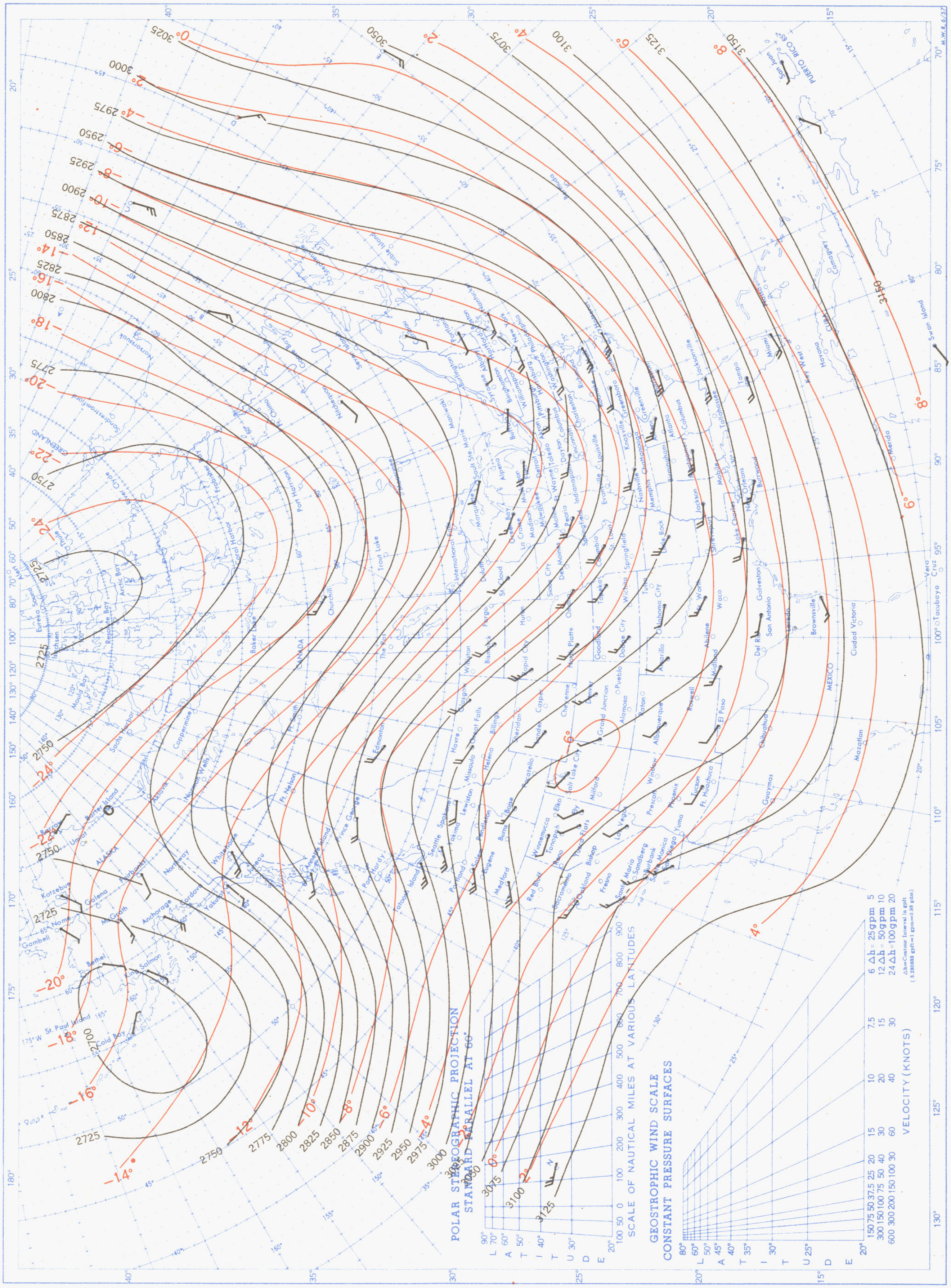
Average sea level pressures are obtained from the averages of the 7:00 a.m. and 7:00 p.m. E.S.T. readings. Windroses show percentage of time wind blew from 16 compass points or was calm during the month. Pressure normals are computed for stations having at least 10 years of record and for 10° intersections 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, January 1958. Average Height and Temperature, and Resultant Winds.



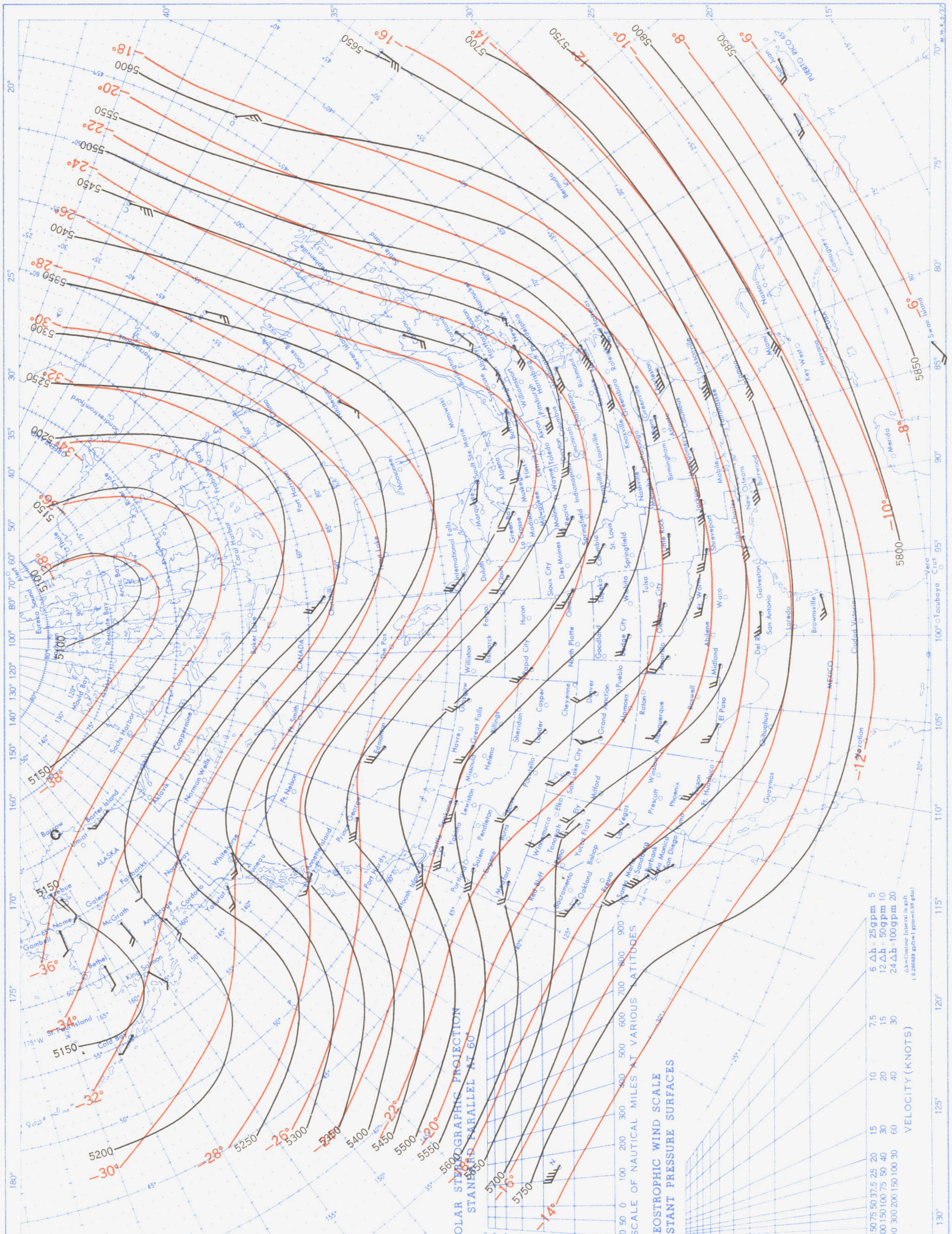
Height in geopotential meters (1 g.p.m. = 0.98 dynamic meters). Temperature in °C. Wind speed in knots; flag represents 50 knots, full feather 10 knots, and half feather 5 knots. All wind data are based on rawin observations.

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



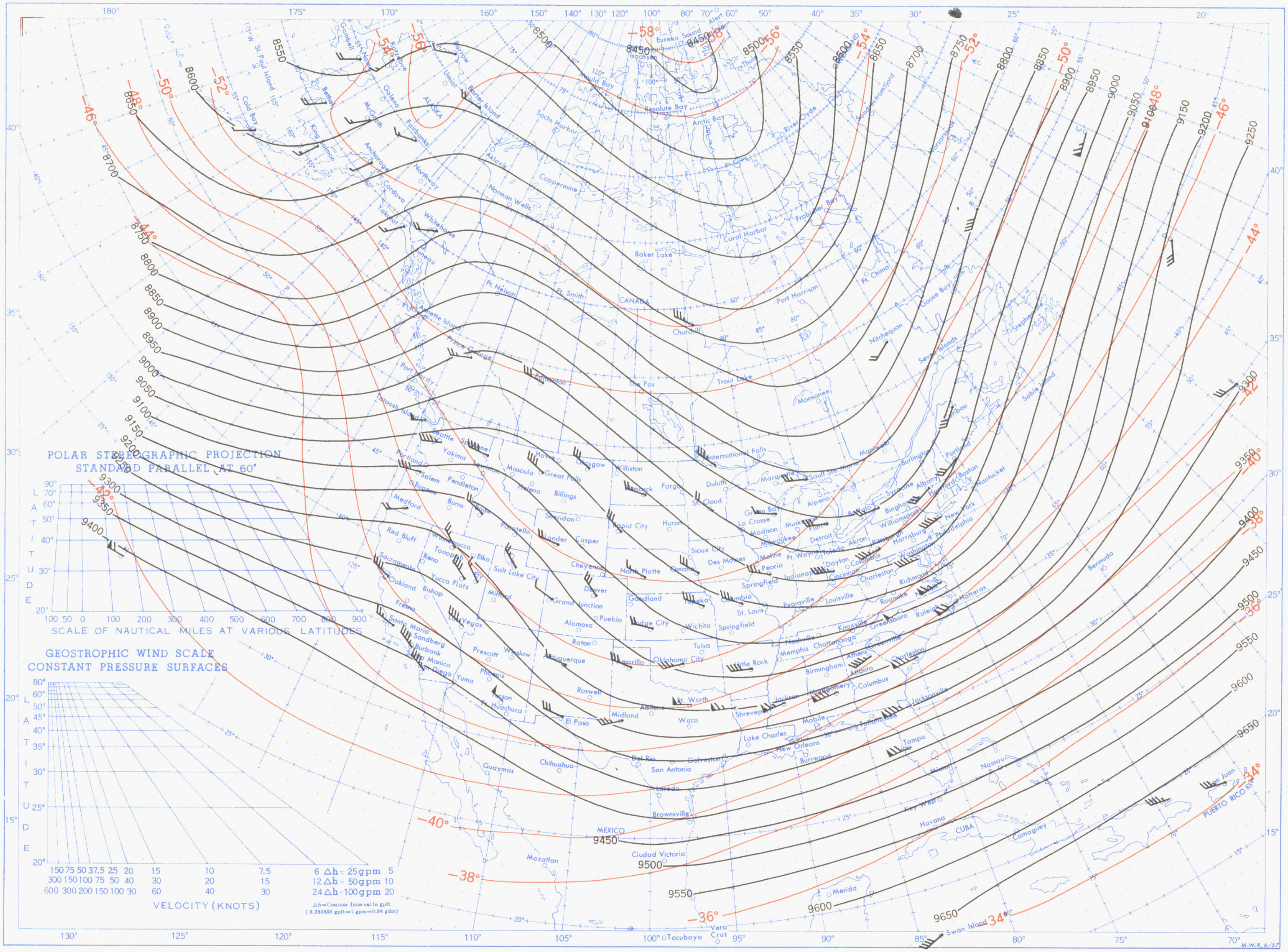
See Chart XII for explanation of map.

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



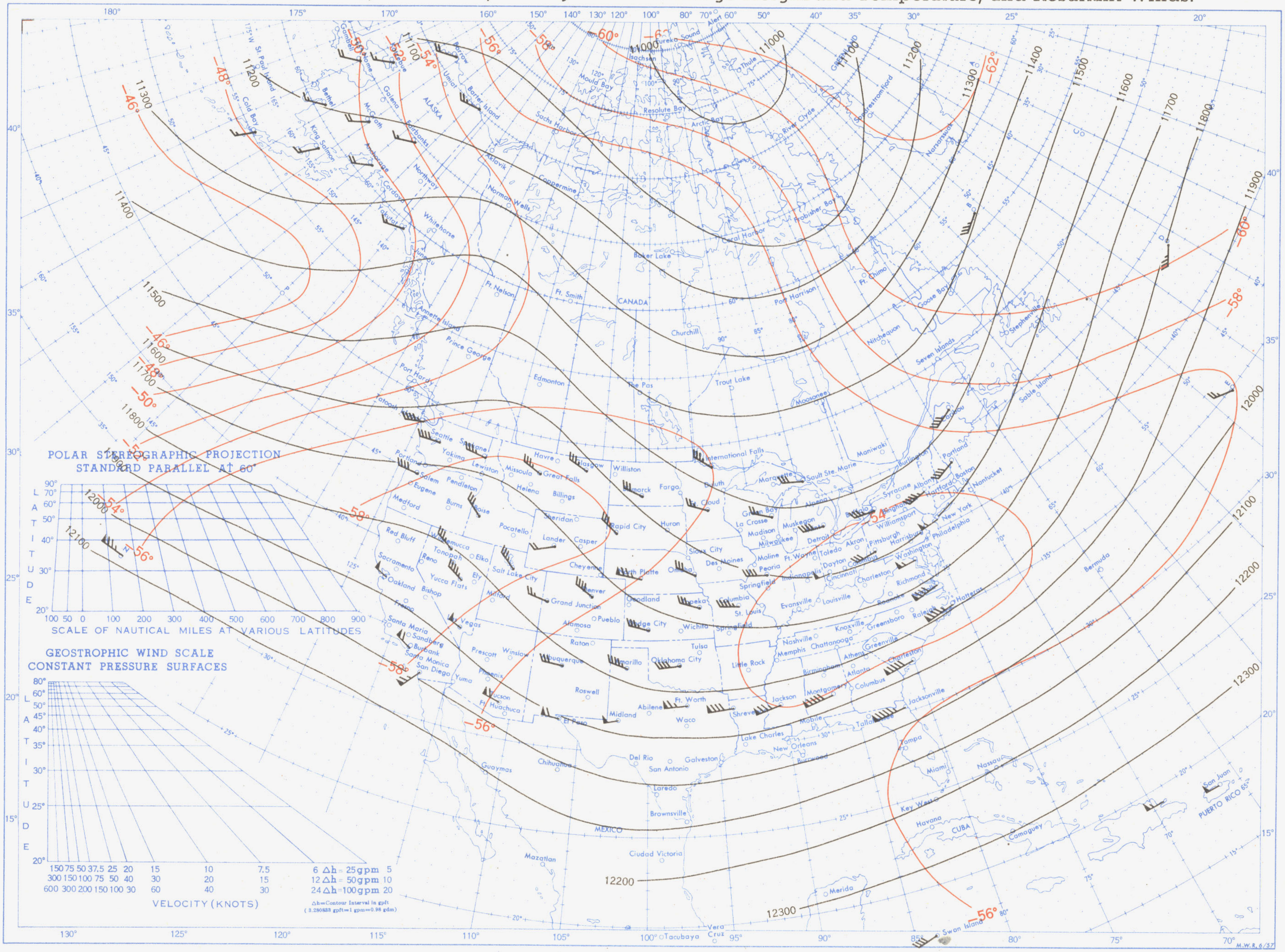
See Chart XII for explanation of map.

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



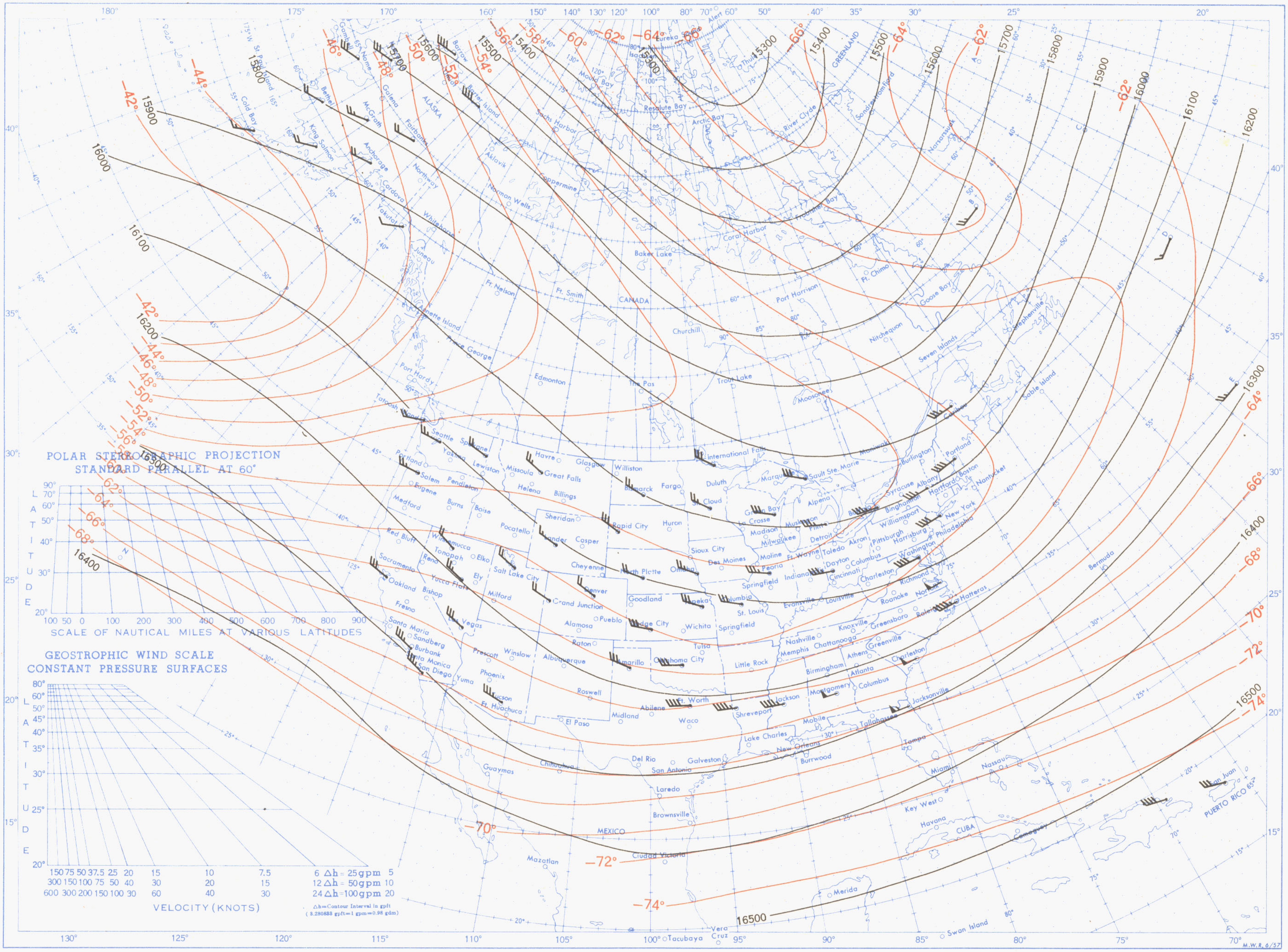
See Chart XII for explanation of map.

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



See Chart XII for explanation of map.

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



See Chart XII for explanation of map.