# THE WEATHER AND CIRCULATION OF FEBRUARY 1953 [1]

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## THE CIRCULATION

The monthly mean 700-mb. circulation over the Northern Hemisphere for February 1953 (fig. 1), featured the existence of three planetary troughs in the main band of westerlies at middle latitudes. These were located in the west-central Pacific, eastern Europe, and North America. Although the latter trough consisted of two pieces, it may be considered essentially as a single trough extending from Baffin Island through eastern Canada and the Great Lakes to Lower California. This trough, in combination with the ridges to either side, was responsible for a large part of the weather over the United States

[1] See Charts I–XV following page 52 for analyzed climatological data for the month.

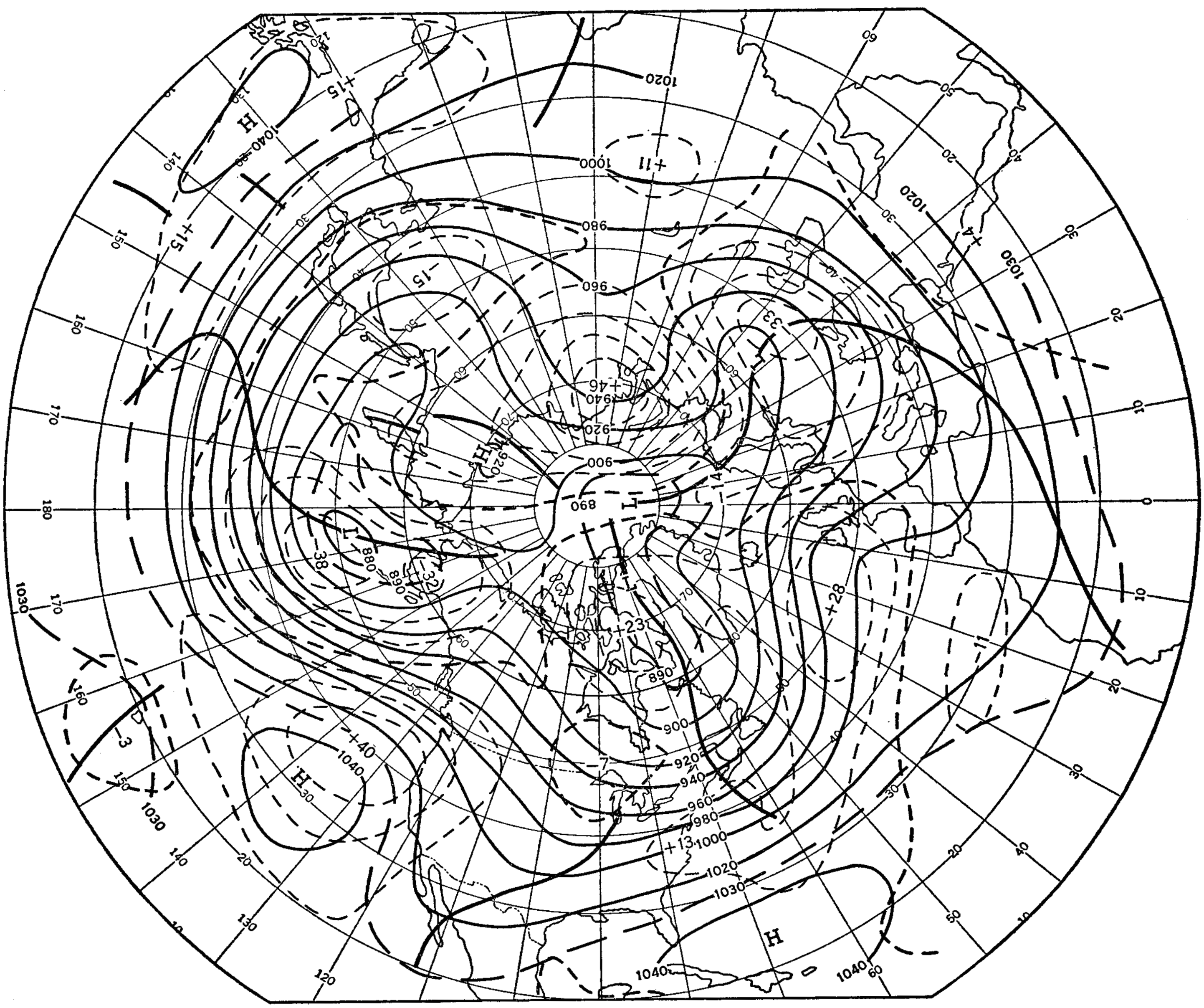



FIGURE 1.—Mean 700-mb. height contours and departures from normal (both labeled in tens of feet) for January 27–February 25, 1953. Of special interest is the strong gradient in eastern Pacific resulting from the well-developed Aleutian Low and Pacific High.

during the month. Other features of the broad scale circulation which directly influenced this month's weather are the strong Aleutian Low, with 700-mb. heights 380 feet below normal and surface pressures 9 mb. below normal, and the well developed Pacific High off the west coast of the United States, with 700-mb. heights 400 feet above normal and sea level pressures 10 mb. greater than normal (Chart XI, Inset). The combination of these two features was associated with a strong belt of west-southwesterly winds across the Pacific at middle latitudes at the 700-mb. level (fig. 2). This jet reached a maximum speed of 56 m. p. h. as an average for the month, and was the primary cause for the preponderance of Pacific air masses over the United States.

Over North America, 700-mb. heights were mostly above normal, with greatest positive departures along the west and east coasts of the United States and in extreme northeastern Canada. Negative departures occurred in the region from the southern Hudson Bay to the upper Mississippi Valley and over Alaska and northwestern Canada. Areas of maximum cyclonic activity over North America (fig. 3A) coincided quite closely with areas of greatest negative departures from normal at 700 mb., while principal anticyclonic activity (fig. 3B) was located near areas of greatest positive departure from normal.

A very interesting feature of the global circulation was the long persistence of above normal heights in the northern Atlantic and below normal heights in Europe and Russia. This condition developed as early as November 1952 when heights averaged 420 feet above normal in the vicinity of Southern Greenland and 300 feet below normal over Europe [1]. During December, the situation remained essentially unchanged with heights reaching 490 feet above normal near southern Greenland and 150 feet below normal over Europe [2]. It was during January that the greatest difference in anomalies occurred. Heights averaged 450 feet above normal west of Great Britain and 330 feet below normal over northwestern Russia, a difference of 880 feet. How this contributed to the European flood was discussed in last month's article [3]. February saw a continuation of this anomalous situation, although not to such an extent as during previous months. Heights averaged 280 feet above normal in the northeastern Atlantic and 330 feet below normal over southwestern Russia. The strong blocking ridge in the North Atlantic was accompanied by fairly slow winds, with speeds along the jet axis averaging approximately one-half the corresponding value in the Pacific (fig. 2).

The circulation at the 200-mb. level (fig. 4) reflects the 700-mb. flow pattern quite closely over North America, showing one major trough extending from Baffin Island southward to the Great Lakes area and then southwestward through Lower California. Two pronounced ridges appear, one extending from western Canada south-southwestward to the eastern Pacific and the other in the northeastern Atlantic. An unusually strong gradient occurred in the western Pacific near Japan where the maximum wind in the jet stream averaged approximately 190 m. p. h. for the month. The average strength of the jet maximum in this area is approximately 122 m. p. h. during the month of January [4]. Since the gradient in this area

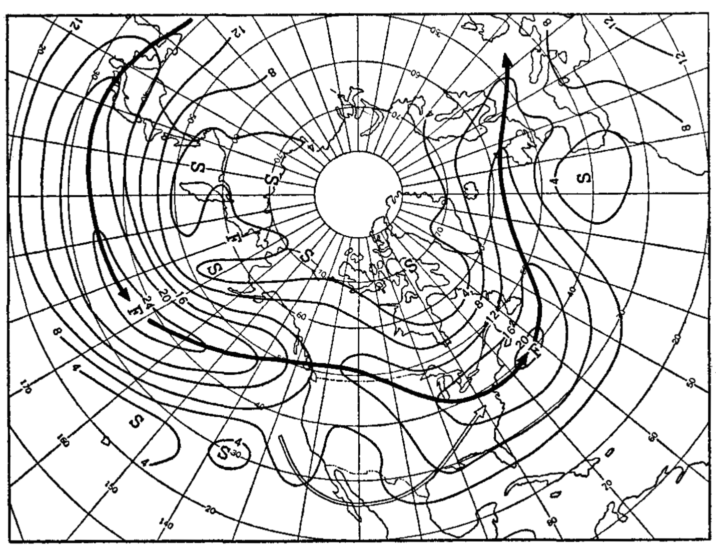


FIGURE 2.—Mean geostrophic wind speed (in meters per second) at 700 mb. for January 27–February 25, 1953. Heavy arrowed lines delineate primary and open arrowed line secondary zones of maximum wind speed. Note apparent split in "jet" across North America.

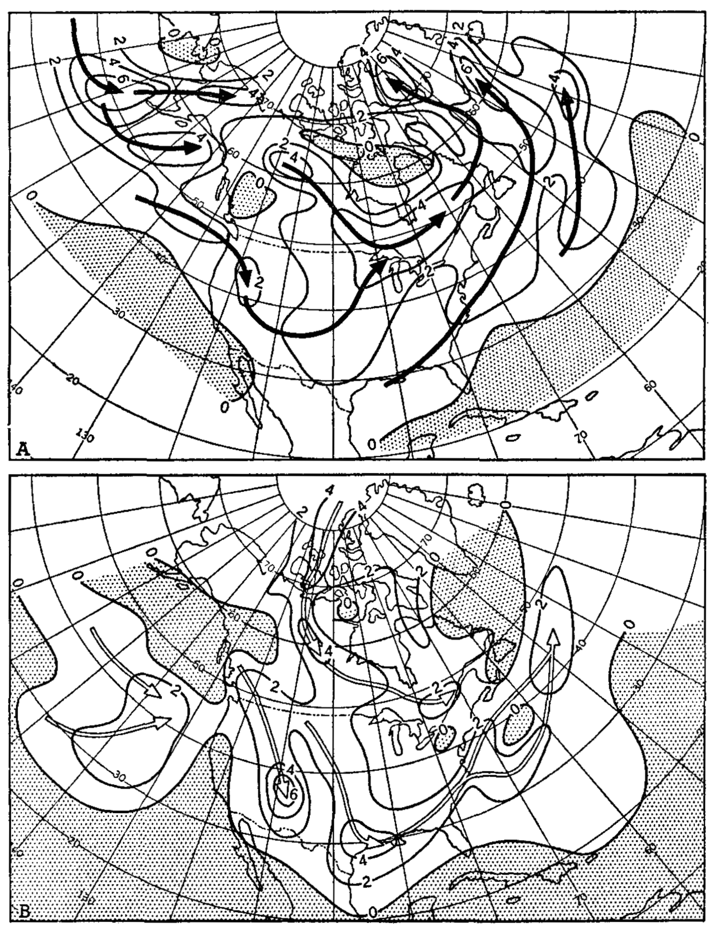


Figure 3.—Geographic frequency of cyclonic (A) and anticyclonic (B) passages (within squares of size 5° at 45° N.) during February 1953. Well defined cyclone tracks are indicated by solid arrows and anticyclone tracks by open arrows. All data derived from Charts IX and X.

varies only slightly from January to February [5], it appears that the speed of the jet was roughly 50 percent greater than normal during February and even stronger than observed in January 1953 [3].

Comparing figures 2 and 4, it is seen that the axes of maximum wind speed at 700 and 200 mb. were fairly similar in location except over the western part of North America, where the jet stream was split at 700 mb. The jet at 200 mb. in the southwestern United States corresponded to the weaker wind stream at 700 mb., while the stronger 700-mb. branch, located over southwestern Canada, had no counterpart at 200 mb. Some light can be thrown on this difference by considering the actual tracks of Highs and Lows (fig. 3) and the relative vorticity field at 700 mb. (fig. 5). Greatest cyclonic vorticity over North America was located in the vicinity of James Bay, with branches extending northwestward into western Canada, northeastward through Quebec and Labrador, and southwestward through the United States to the Gulf of California. Alaska and extreme northern Canada also were dominated by cyclonic vorticity. Elsewhere over North America anticyclonic vorticity prevailed. Principal storm tracks (fig. 3A) paralleled quite closely the axes of greatest cyclonic vorticity, while surface High activity was pronounced in the areas of anticyclonic vorticity. Thus it is seen that the storm path and area of cyclonic vorticity in western Canada corresponded to and was located to the north of the 700-mb. jet across southwestern Canada, while the storm path from the southwestern United States to southern Hudson Bay was located to the north of the 200-mb. jet across the southern United States. This may imply that the northerly storm path consisted principally of Lows shallow in comparison with those in the southerly storm path.

## TEMPERATURE AND PRECIPITATION

Temperatures averaged above normal over most of the country during February (Chart I). Negative departures from normal were generally small and confined mostly to the southern border States, sections of the Pacific Coast, and central Rocky Mountain States. The concentration of positive temperature anomalies in northern and negative anomalies in southern sections resulted from a preponderance of polar Pacific air masses over the United States during the month. The same air mass originating in the Pacific may result in above normal temperatures in northern and below normal in southern sections of the country since normal temperatures are considerably higher in the southern as contrasted with the northern border States. Figure 3B shows that most of the anticyclones entering the United States originated in the Pacific, while polar continental Highs were deflected southeastward into eastern Canada seldom entering the United States. Greatest positive temperature anomalies (+8° F. or more) were observed along the northern border States. Foehn activity resulting from the strong belt of westerlies emanating in the Pacific (fig. 2) was responsible for the warmth in the Northern Plains east of the Rockies, while less than normal northerly components of flow (fig. 1) prevented polar continental air from entering the Northeast in normal amounts. Greatest negative temperature departures observed during the month (approximately 2° below normal) occurred in portions of the Gulf Coast States and in the San Joaquin Valley of California.

Precipitation in the United States during the month was greater than normal in more than half the country (Chart III). This could be expected with a major trough aloft located over the central United States and a corresponding area of below normal pressures at the surface (Chart XI, Inset). Actually, two distinct bands of above normal precipitation occurred in line with a split in the path of the principal cyclone track (fig. 3A). One band extended from eastern Texas northeastward through the Middle

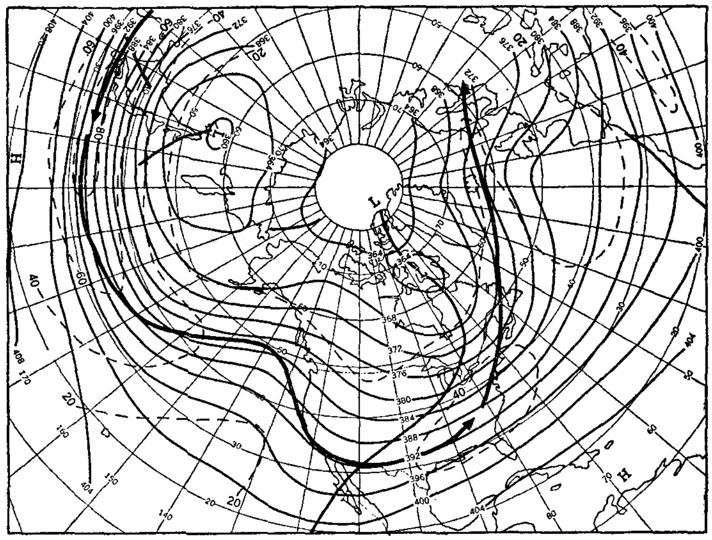


FIGURE 4.—Mean 200-mb. contours (labeled in hundreds of feet) and isotachs (at intervals of 20 m. p. s.) for January 27–February 25, 1953. Solid arrow indicates average "jet" which reached a value of near 190 m. p. h. east of Japan.

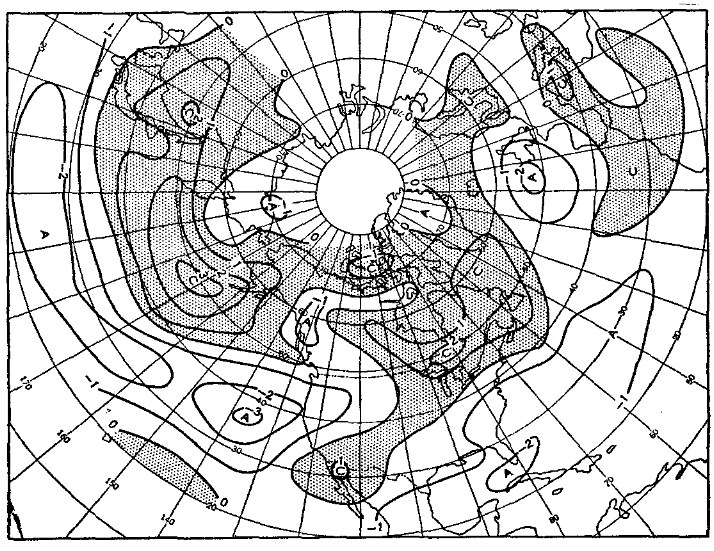


FIGURE 5.—Mean relative geostrophic vorticity at 700 mb. (in units of $10^{-5}$ sec$^{-1}$) for January 27–February 25, 1953. Areas of cyclonic vorticity are shaded and labeled "C" at centers of maximum vorticity. Areas of maximum anticyclonic vorticity are labeled "A".

Atlantic States,[2] while the other ran from the Pacific Northwest through the Plains into the Great Lakes region. Less than normal precipitation was general in an area extending from west Texas to New England, which was located between the two major storm paths through the United States. Precipitation was also generally subnormal throughout the southwestern United States. This deficiency was especially marked in California, where an intense and widespread drought affected the State from January 21 to the end of February. In most of California less than 25 percent of normal precipitation fell during the month of February, and in some sections no measurable amounts were recorded (Chart III). For the State as a whole total precipitation during the month averaged only 13 percent of normal. This dry region was produced by a combination of several factors. Most notable perhaps was the prevalence of stronger than normal northeasterly flow at sea level (Chart XI and inset) and northerly flow at 700 mb. (fig. 1). As a result of this flow California was dominated by dry continental air masses and moisture from the southwest Pacific was unable to penetrate the State. Not only did the prevailing flow originate in a dry source region, but it also underwent strong anticyclonic curvature, thereby producing further drying through subsidence. Figure 5 shows that practically all of California was dominated by anticyclonic vorticity at 700 mb., while Chart XI shows that a strong extension of the Pacific High protruded into the State on the monthly mean sea level maps. As a result the principal storm track and jet stream from the Pacific crossed the west coast of North America well to the north (figs. 2 and 3). In fact only one cyclone traversed California all month long (Chart X).

## WEATHER HIGHLIGHTS

The first third of the month saw a continuation of the record-breaking warmth that had persisted throughout January [4]. The strong westerlies in the Pacific discussed previously resulted in a predominance of relatively mild Pacific air and a minimum of polar continental air over the States. Individual station records for warmth continued to be set in the northern Great Plains and northern Rocky Mountain areas. Salt Lake City recorded a maximum of 65° on February 3, the highest temperature ever recorded there so early in the year. On the 6th, a cold front which had moved eastward from the Pacific came in contact with moist tropical air, producing thunderstorms in the southeastern quarter of the country and a destructive tornado at Hammond, La.

During the remainder of the month, conditions approached more normal winter weather for the first time this season. Cooling occurred first in the West and Southwest and then spread eastward, affecting southern sections first. A storm moving southeastward from Montana to Kansas created gale winds and dust storms on the 15th and 16th, with winds as high as 55 m. p. h. and dust extending to a height of 14,000 feet in western and south-central Kansas, with somewhat similar conditions in eastern Colorado and parts of Oklahoma and Texas. In this area, inadequate moisture during the fall and winter of 1952–53 had left the soil dry and loose. Another storm moved in from the Pacific on the 17th, deepened over Utah on the 18th, becoming a true "Colorado Low" on the 19th. It then moved northeastward through the Plains and Great Lakes regions on the 20th and 21st. High winds associated with this Low caused dust storms that, in many sections of the lower Great Plains, were the worst since the 1930's. Elsewhere, this storm assumed blizzard proportions, leaving heavy snowfall and high drifts throughout sections of the central and northern Great Plains.

[2] For a detailed description of one of these storms, see adjoining article by Jones and Roe.

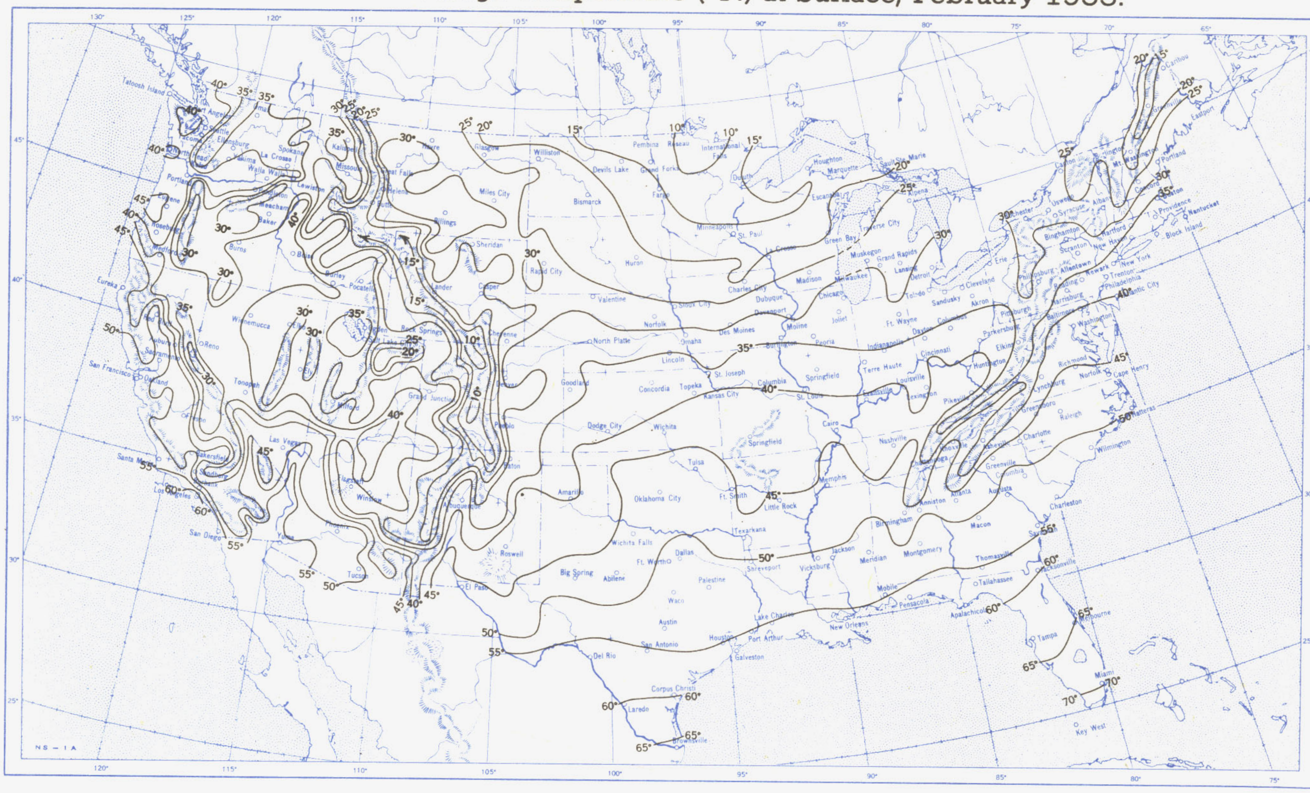
As the storm moved eastward, it picked up additional moisture from the Gulf of Mexico source region, and thunderstorms and heavy rain occurred in the Midwest and South. Tornadoes and severe wind squalls in sections of Alabama, Mississippi, and Louisiana caused death, injuries, and destruction. This storm was followed by severely cold weather over much of the western portion of the country, including the coldest weather of the winter in sections of southern Arizona. Below freezing temperatures caused some crop damage in southern California. The closing week of the month was uneventful with no important storminess occurring, however, frost was still causing some damage in the Southwest.

As a result of persistently above normal temperatures in the Great Lakes Region throughout the early winter and during this month, ice on the lakes was considerably thinner and areal coverage much less than usual as the month closed. It was reported that southern waters had remained mostly open throughout the winter, with very few ice fields in northern waters. Conditions were similar to early 1921 and 1942 seasons, when port openings were abnormally early.

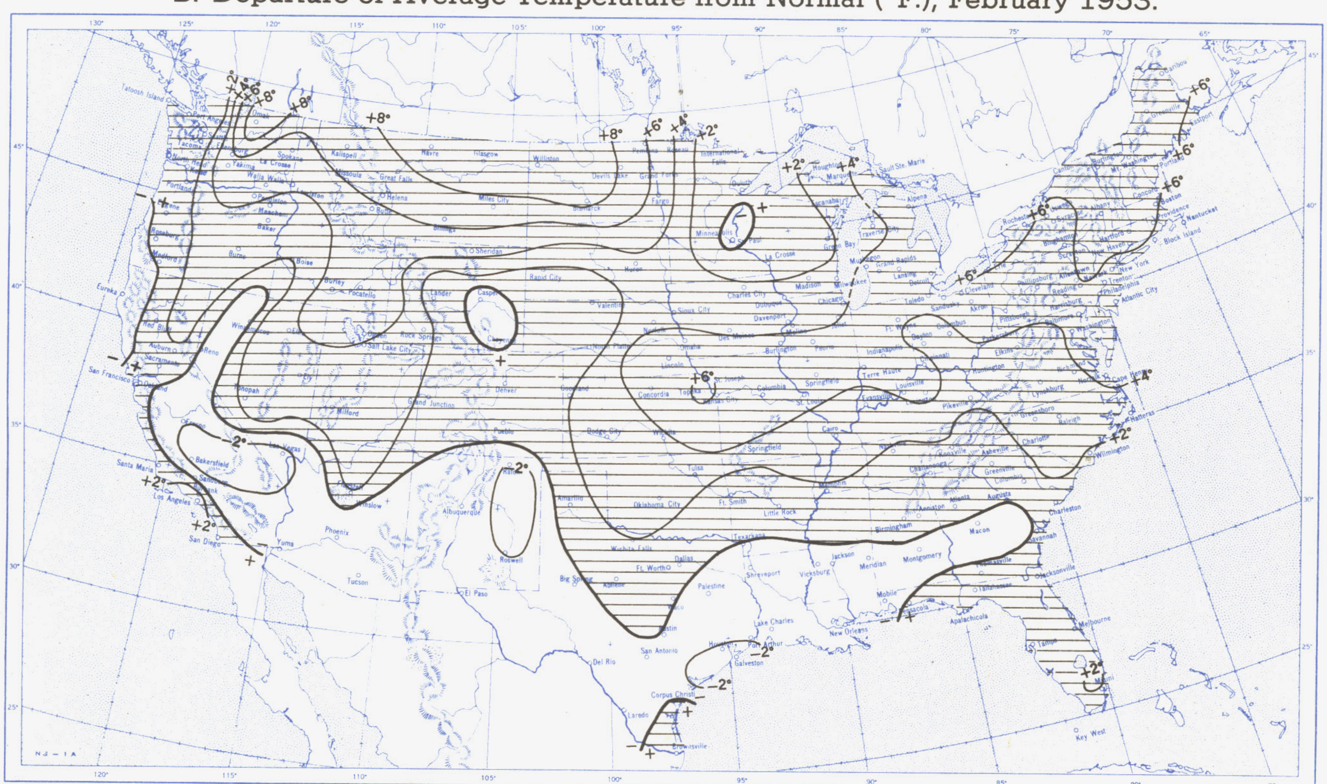
## REFERENCES


1. H. F. Hawkins, Jr., "The Weather and Circulation of November 1952, A Pronounced Reversal from October," *Monthly Weather Review*, vol. 80, No. 11, November 1952, pp. 220–226.
2. H. F. Hawkins, Jr., "The Weather and Circulation of December 1952," *Monthly Weather Review*, vol. 80, No. 12, December 1952, pp. 246–249.
3. Kenneth E. Smith, "The Weather and Circulation of January 1953," *Monthly Weather Review*, vol. 81, No. 1, January 1953, pp. 16–19.
4. J. Namias and P. F. Clapp, "Confluence Theory of the High Tropospheric Jet Stream," *Journal of Meteorology*, vol. 6, No. 5, October 1949, pp. 330–336.
5. U. S. Weather Bureau, *Normal Weather Maps, Northern Hemisphere Upper Level*, October 1944.

# Chart I. A. Average Temperature (°F.) at Surface, February 1953.

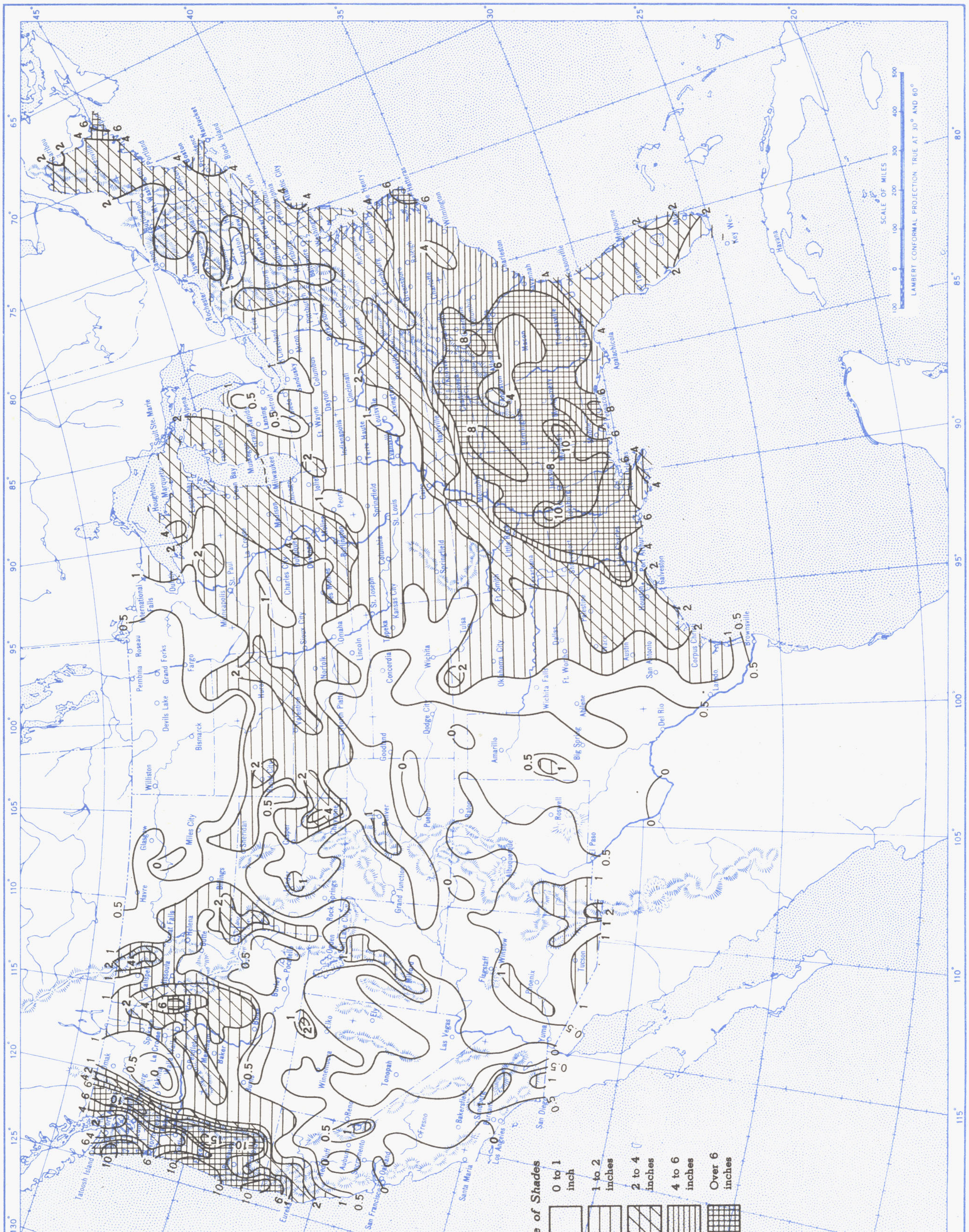


## B. Departure of Average Temperature from Normal (°F.), February 1953.



A. Based on reports from 800 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. Normal average monthly temperatures are computed for Weather Bureau stations having at least 10 years of record.

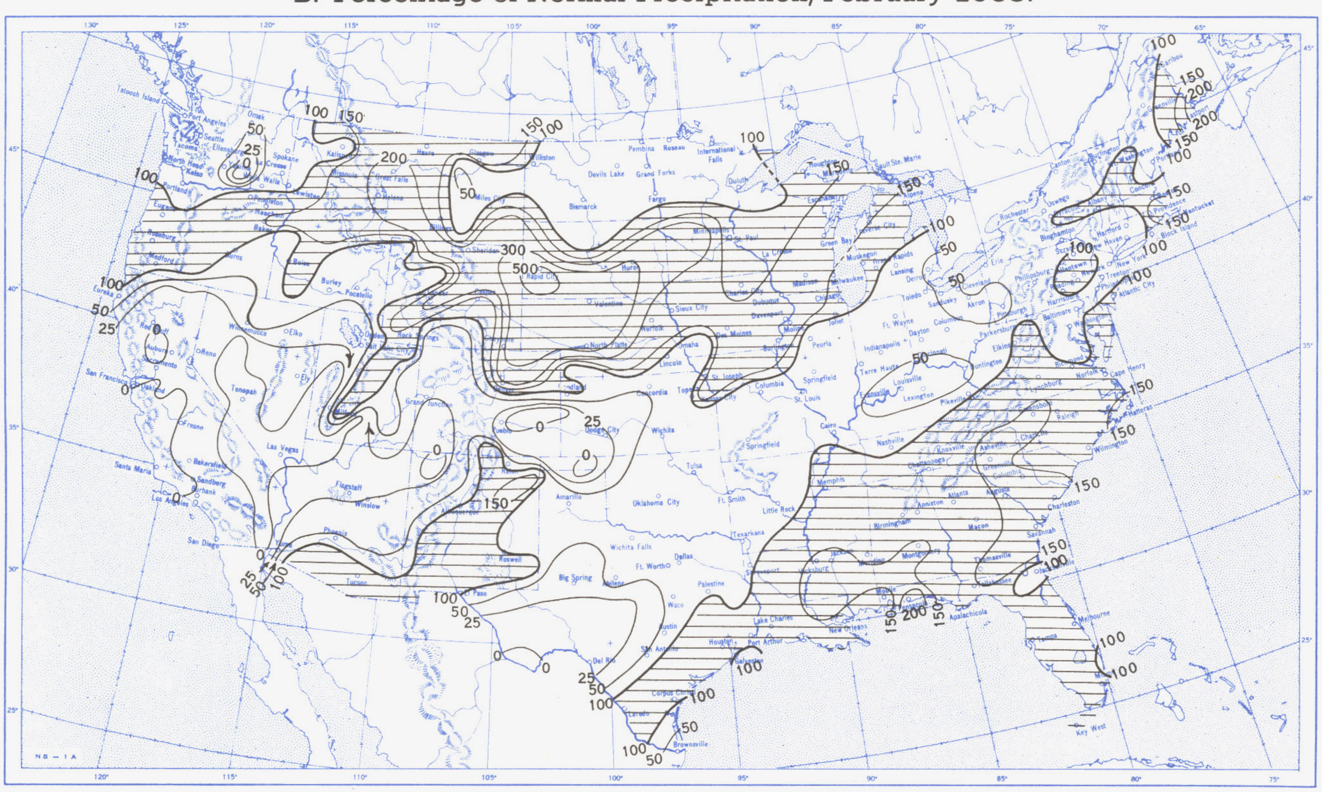
## Chart II. Total Precipitation (Inches), February 1953.




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

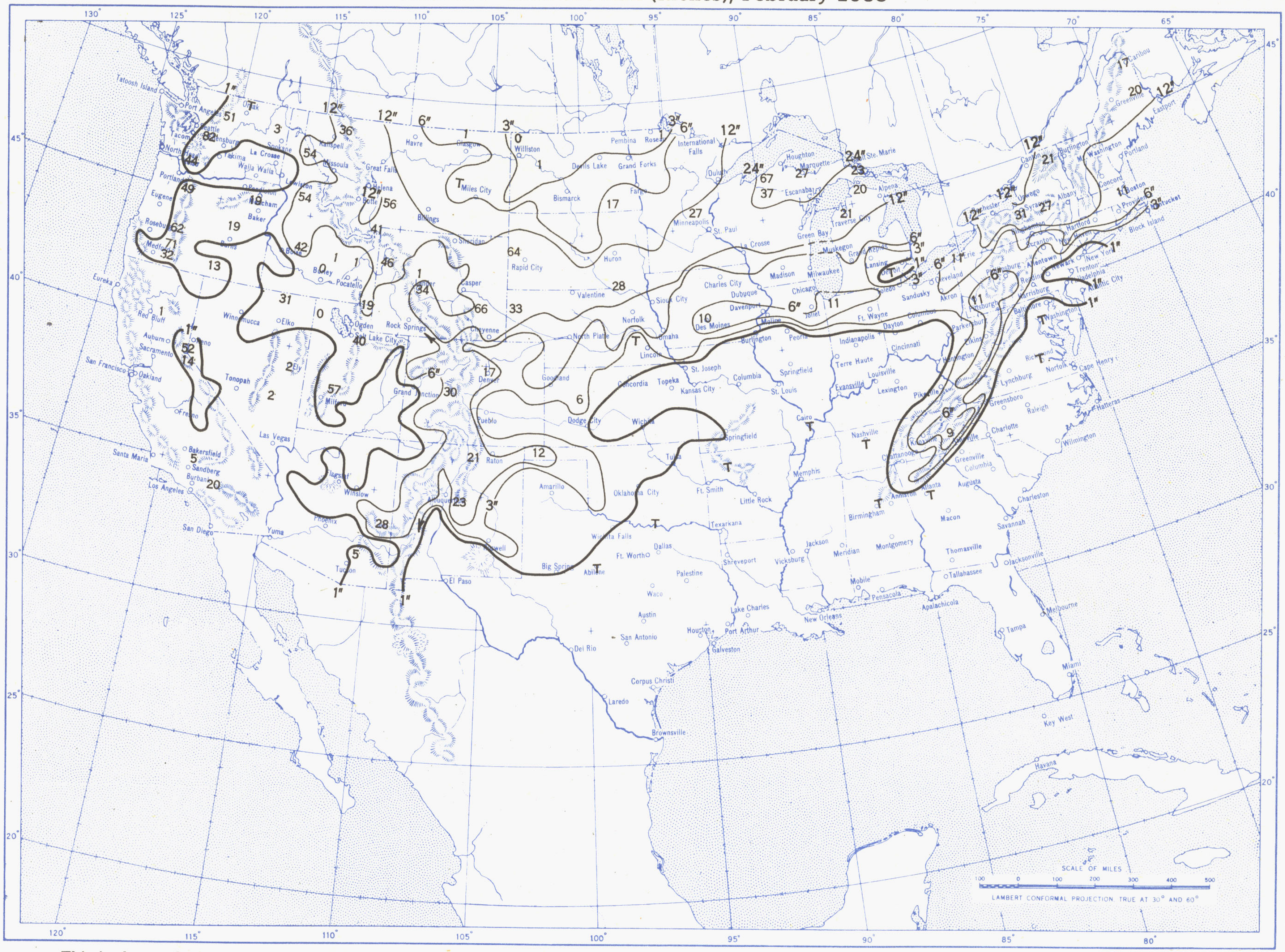
## Chart III. A. Departure of Precipitation from Normal (Inches), February 1953.

## B. Percentage of Normal Precipitation, February 1953.



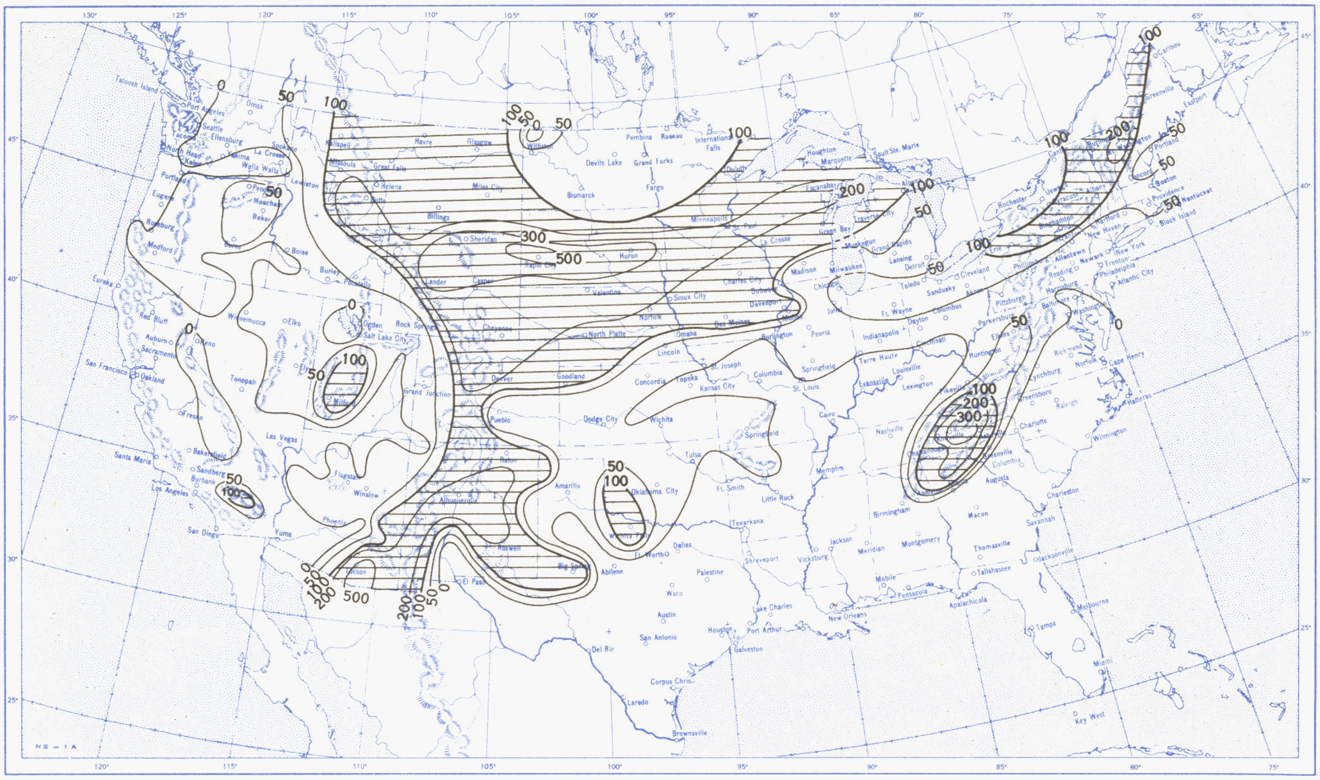
Normal monthly precipitation amounts are computed for stations having at least 10 years of record.

## Chart IV. Total Snowfall (Inches), February 1953

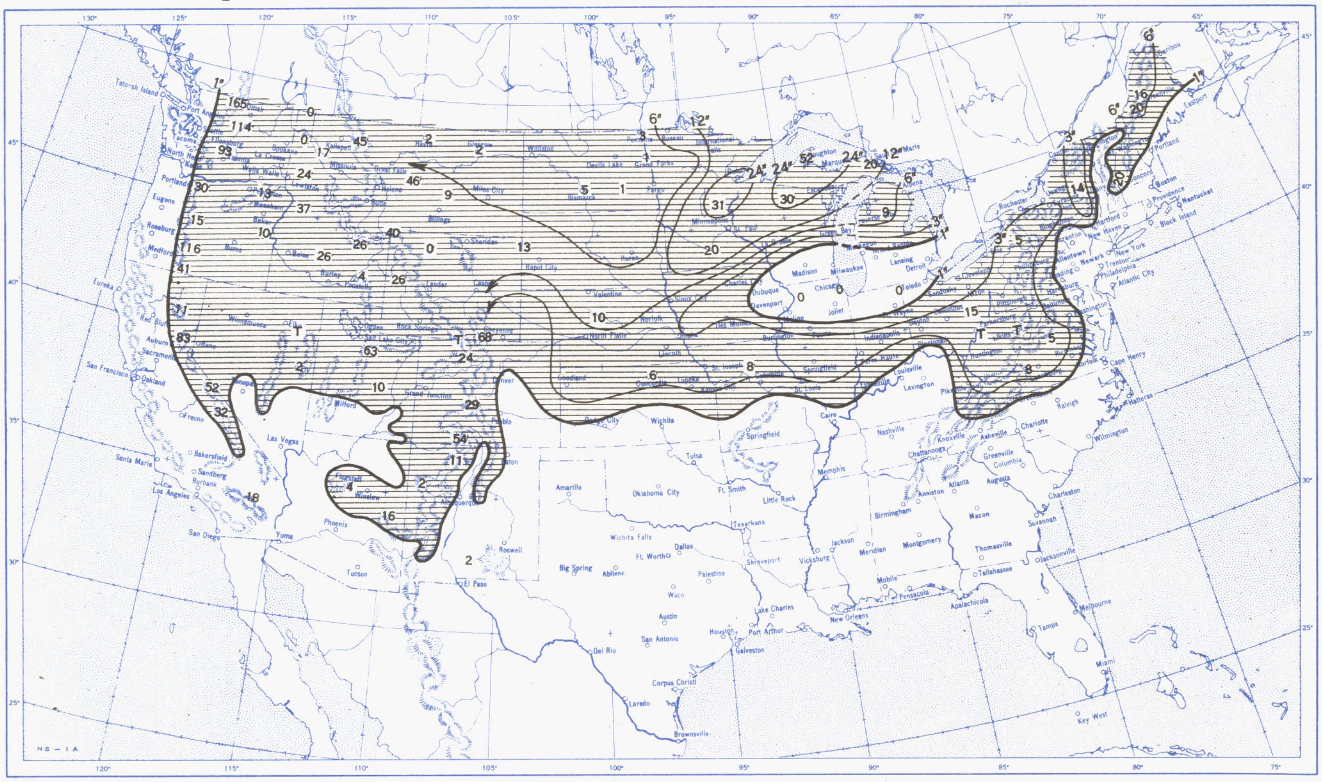



This is the total of unmelted snowfall recorded during the month at Weather Bureau and cooperative stations. This chart and Chart V are published only for the months of November through April although of course there is some snow at higher elevations, particularly in the far West, earlier and later in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

## Chart V. A. Percentage of Normal Snowfall, February 1953.

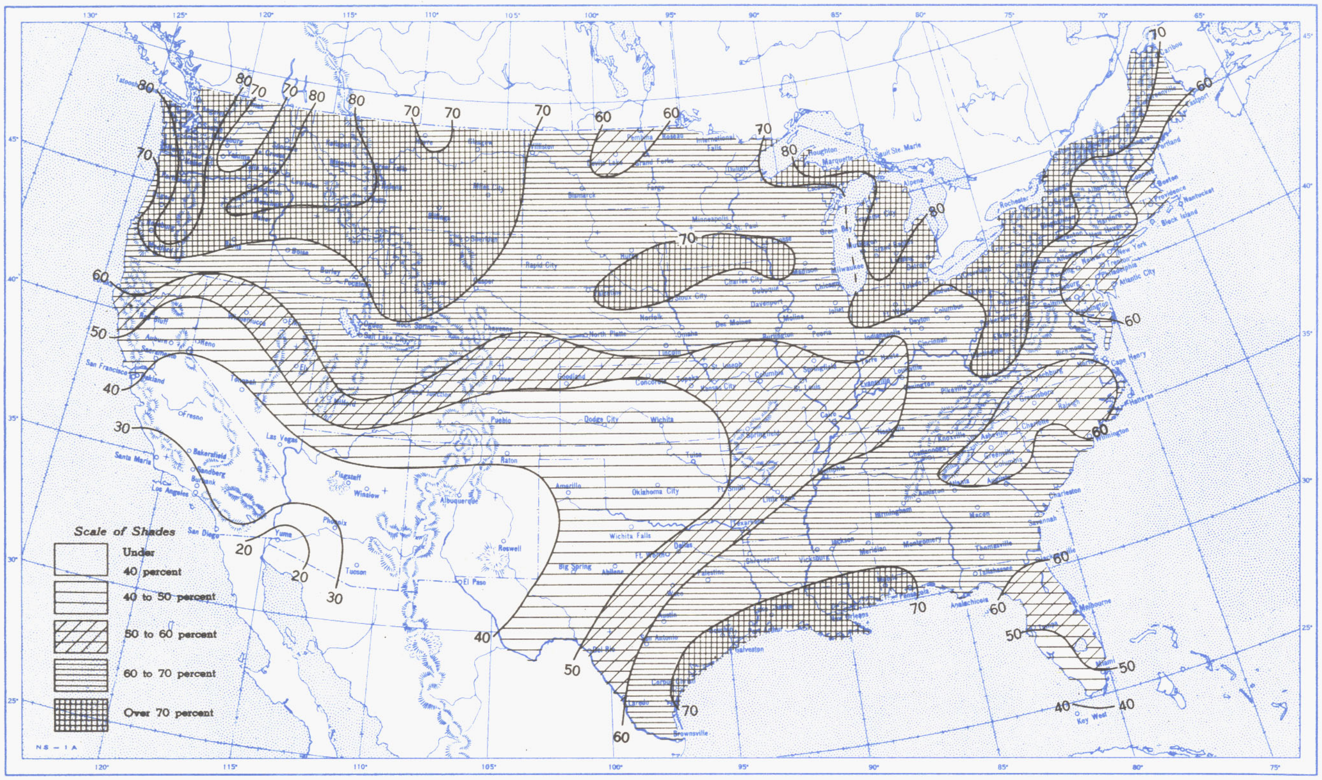


## B. Depth of Snow on Ground (Inches), 7:30 a. m. E. S. T., February 24, 1953.

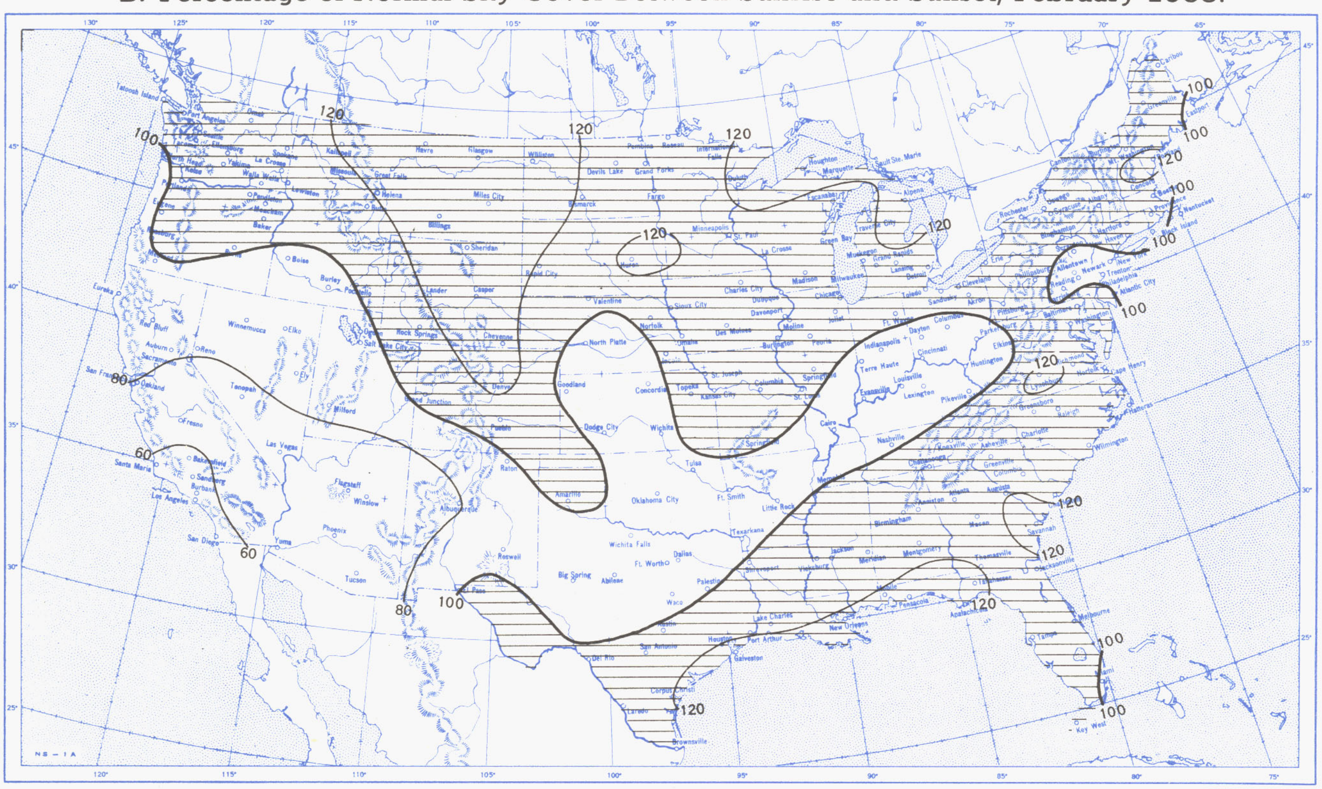


A. Amount of normal monthly snowfall is computed for Weather Bureau stations having at least 10 years of record.
B. Shows depth currently on ground at 7:30 a. m. E. S. T., of the Tuesday nearest the end of the month. It is based on reports from Weather Bureau and cooperative stations. Dashed line shows greatest southern extent of snowcover during month.

## Chart VI. A. Percentage of Sky Cover Between Sunrise and Sunset, February 1953.

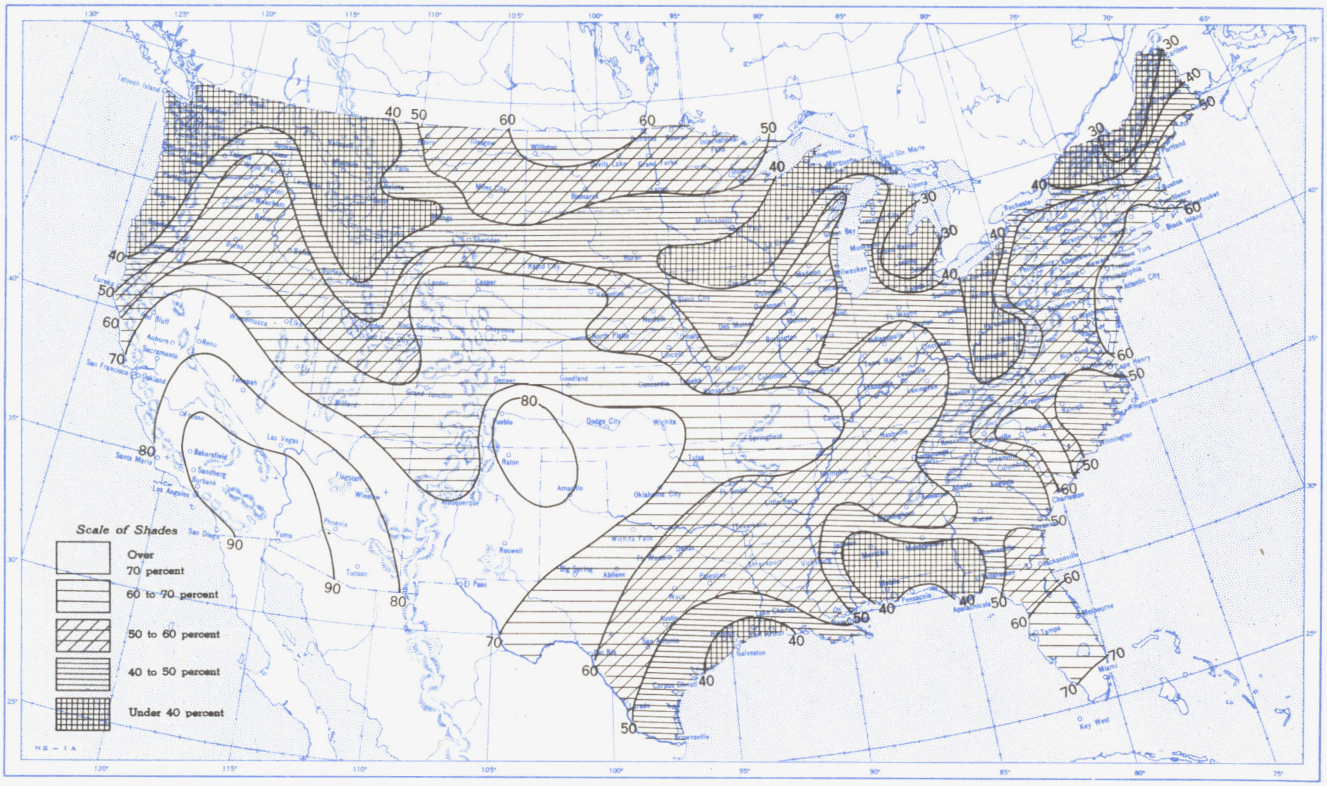



## B. Percentage of Normal Sky Cover Between Sunrise and Sunset, February 1953.

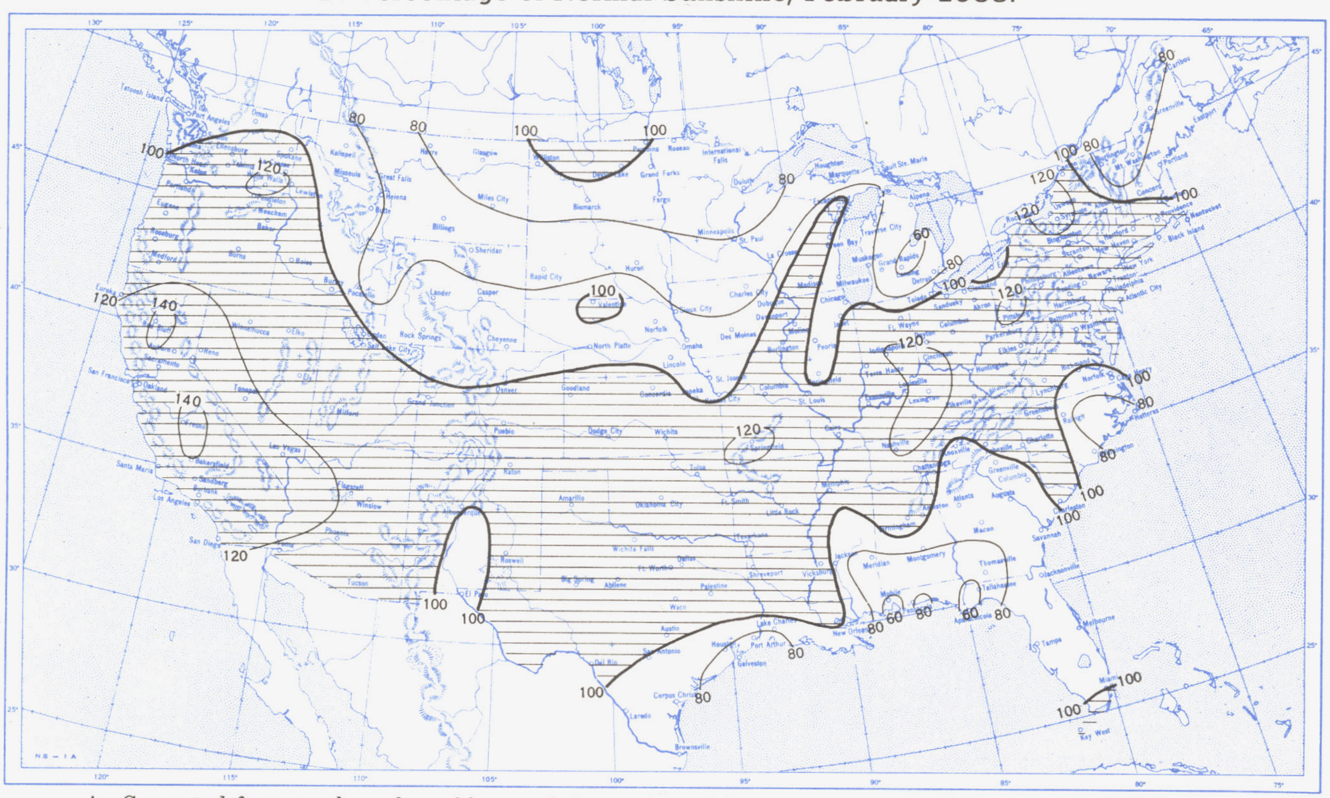



A. In addition to cloudiness, sky cover includes obscuration of the sky by fog, smoke, snow, etc. Chart based on visual observations made hourly at Weather Bureau stations and averaged over the month. B. Computations of normal amount of sky cover are made for stations having at least 10 years of record.

## Chart VII. A. Percentage of Possible Sunshine, February 1953.




## B. Percentage of Normal Sunshine, February 1953.



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, February 1953. Inset: Percentage of Normal Average Daily Solar Radiation, February 1953.

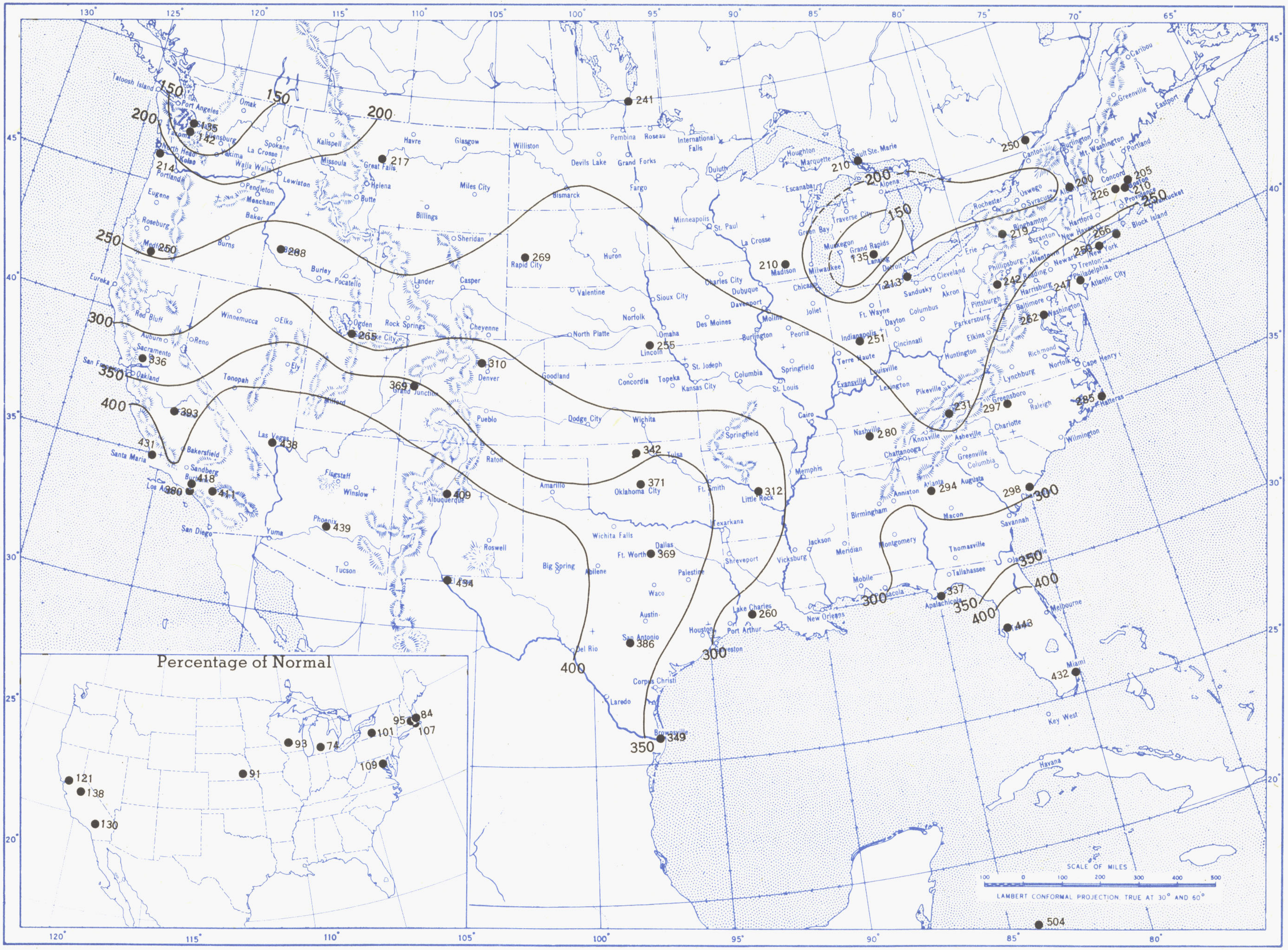
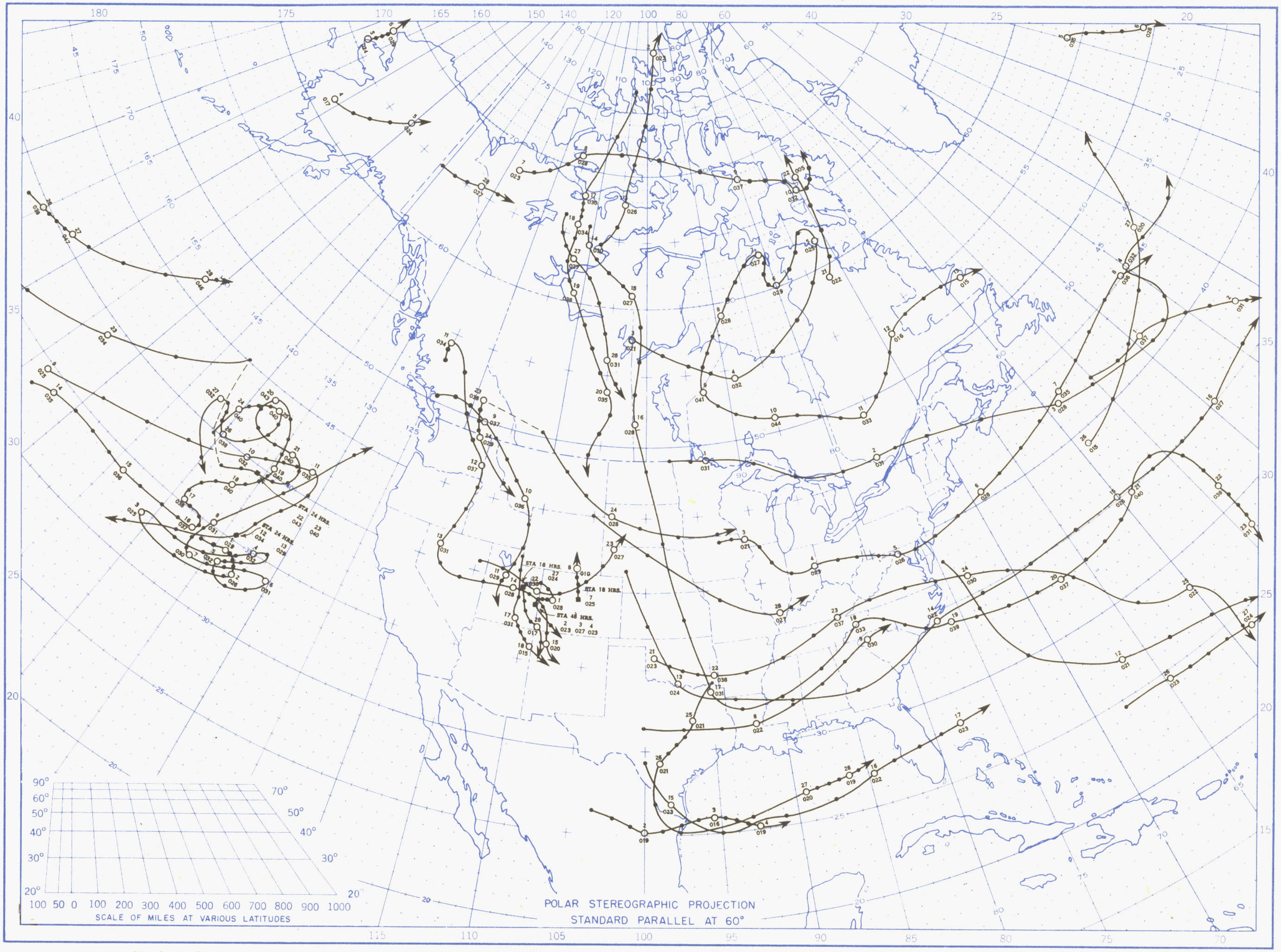


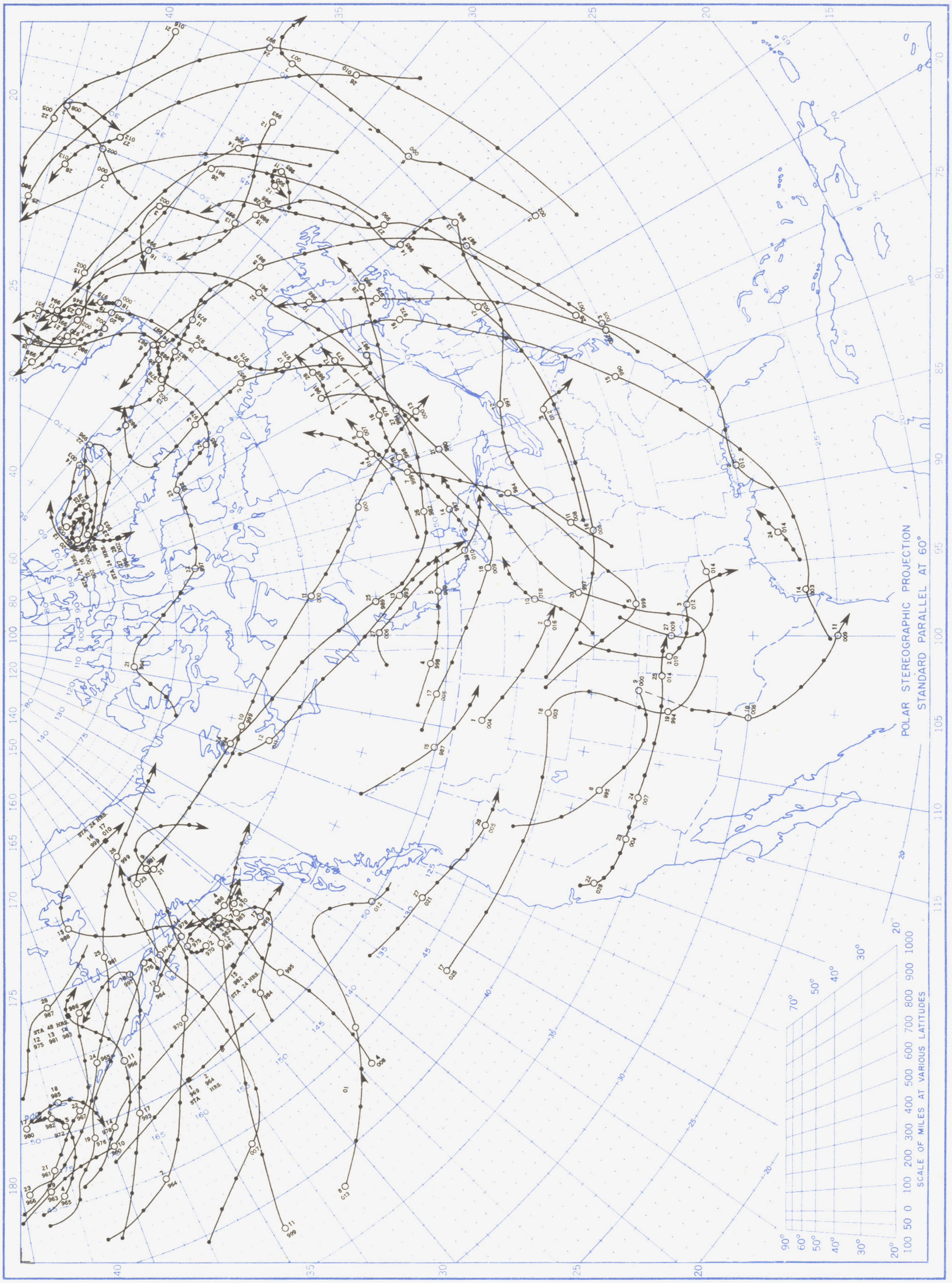

Chart shows mean daily solar radiation, direct + diffuse, received on a horizontal surface in langleys (1 langley = 1 gm. cal. cm. $^{-2}$). Basic data for isolines are shown on chart. Further estimates are obtained from supplementary data for which limits of accuracy are wider than for those data shown. Normals are computed for stations having at least 9 years of record.

# Chart IX. Tracks of Centers of Anticyclones at Sea Level, February 1953.



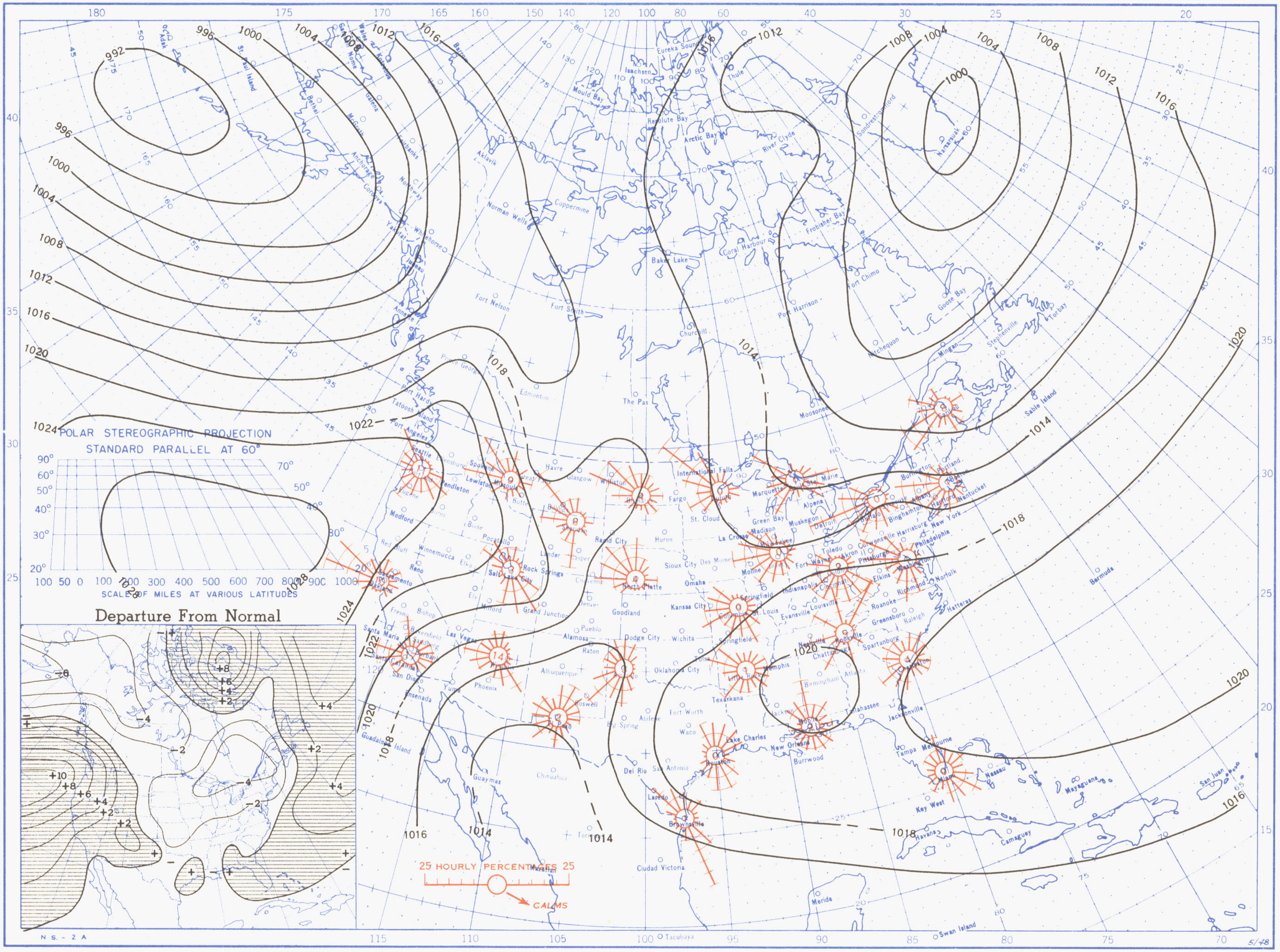

Circle indicates position of center at 7:30 a. m. E. S. T. Figure above circle indicates date, figure below, pressure to nearest millibar. Dots indicate intervening 6-hourly positions. Squares indicate position of stationary center for period shown. Dashed line in track indicates reformation at new position. Only those centers which could be identified for 24 hours or more are included.

Chart X. Tracks of Centers of Cyclones at Sea Level, February 1953.



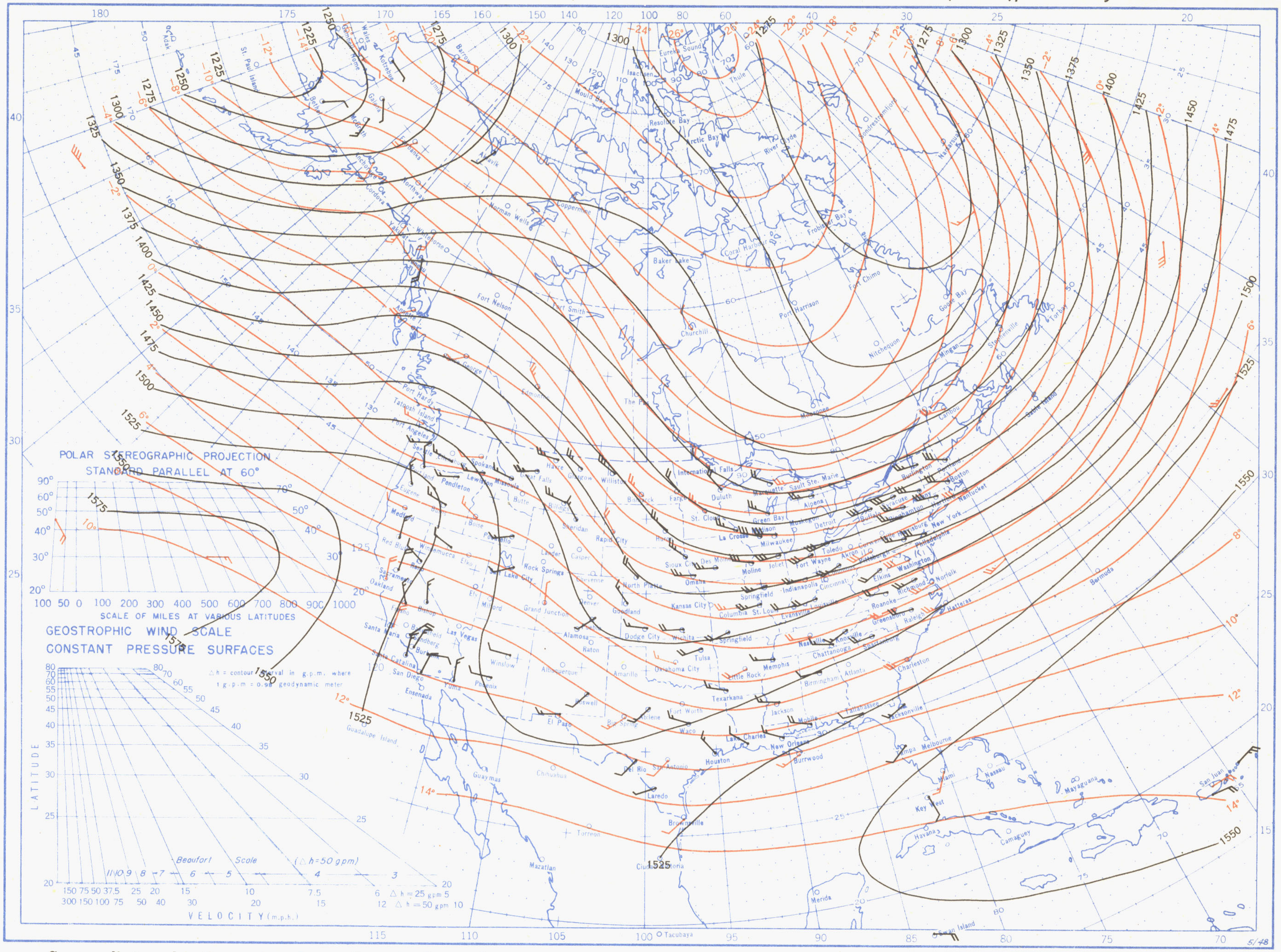

Circle indicates position of center at 7:30 a. m. E. S. T. See Chart IX for explanation of symbols.

# Chart XI. Average Sea Level Pressure (mb.) and Surface Windroses, February 1953. Inset: Departure of Average Pressure (mb.) from Normal, February 1953.



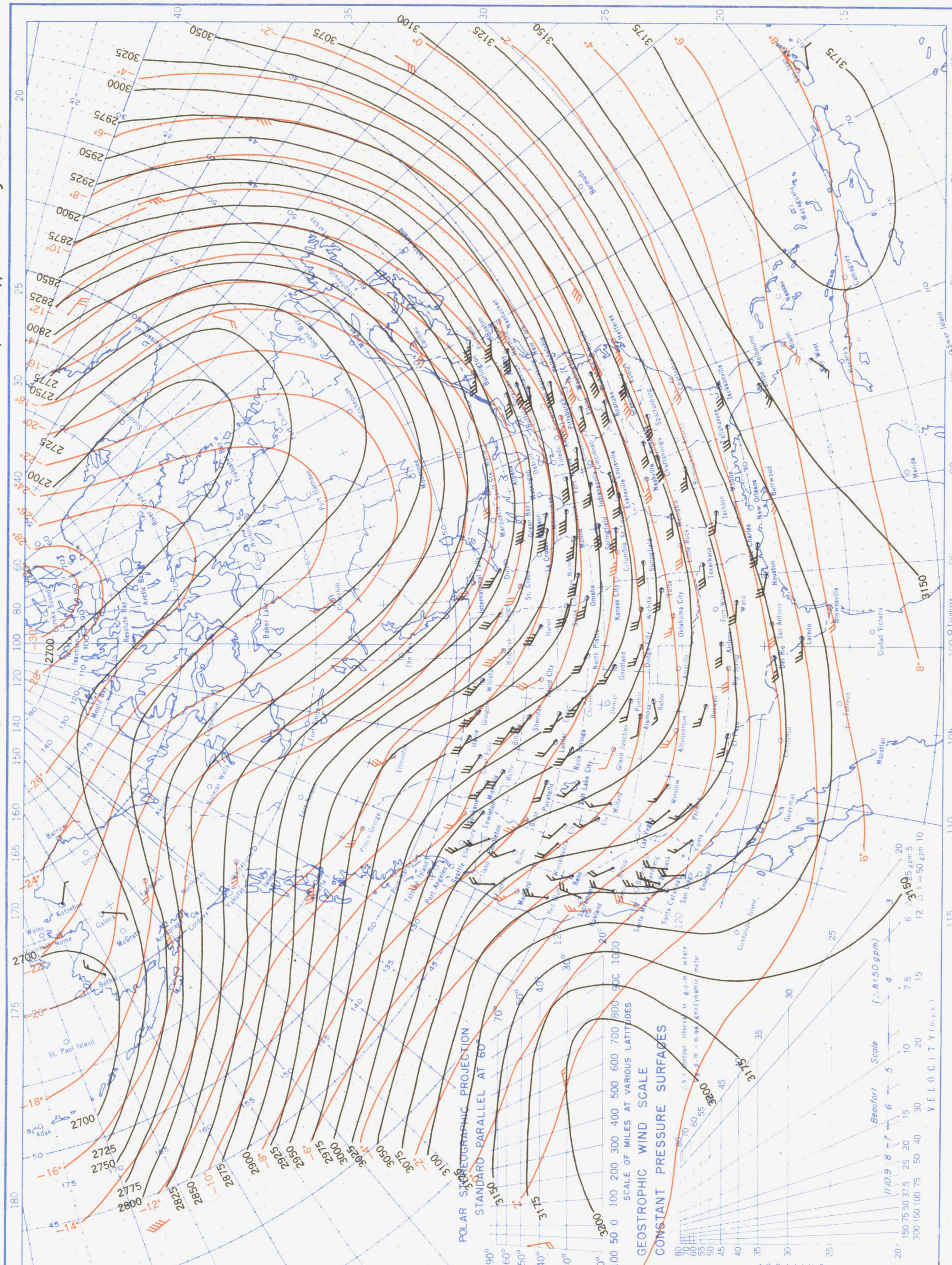

Average sea level pressures are obtained from the averages of the 7:30 a. m. and 7:30 p. m. E. S. T. readings. Windroses show percentage of time wind blew from 16 compass points or was calm during the month. Pressure normals are computed for stations having at least 10 years of record and for 10° intersections 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. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 850-mb. Pressure Surface, Average Temperature in °C. at 850 mb., and Resultant Winds at 1500 Meters (m.s.l.), February 1953.



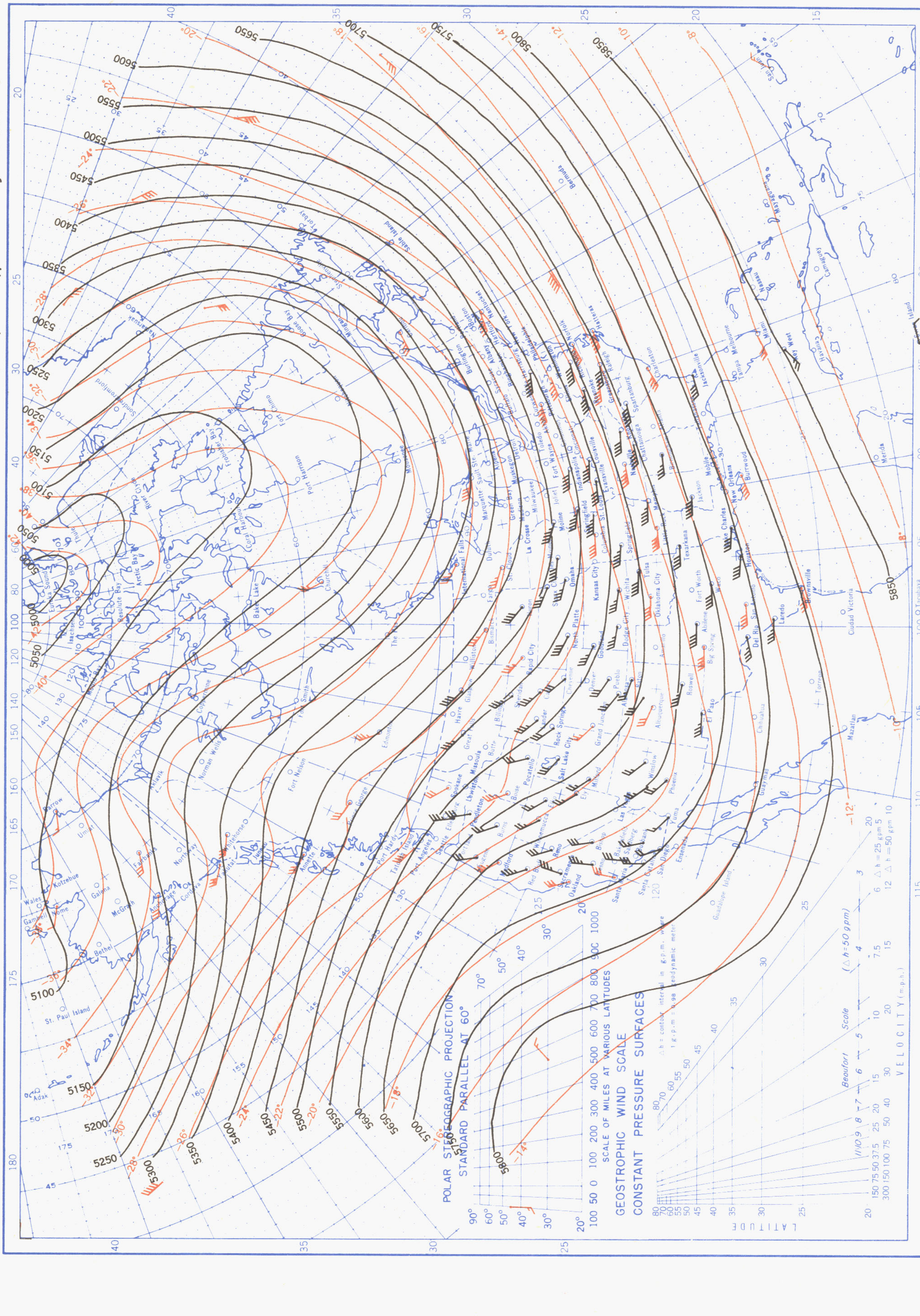

Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins taken at 0300 G. M. T.

Chart XIII. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 700-mb. Pressure Surface, Average Temperature in °C. at 700 mb., and Resultant Winds at 3000 Meters (m.s.l.), February 1953.



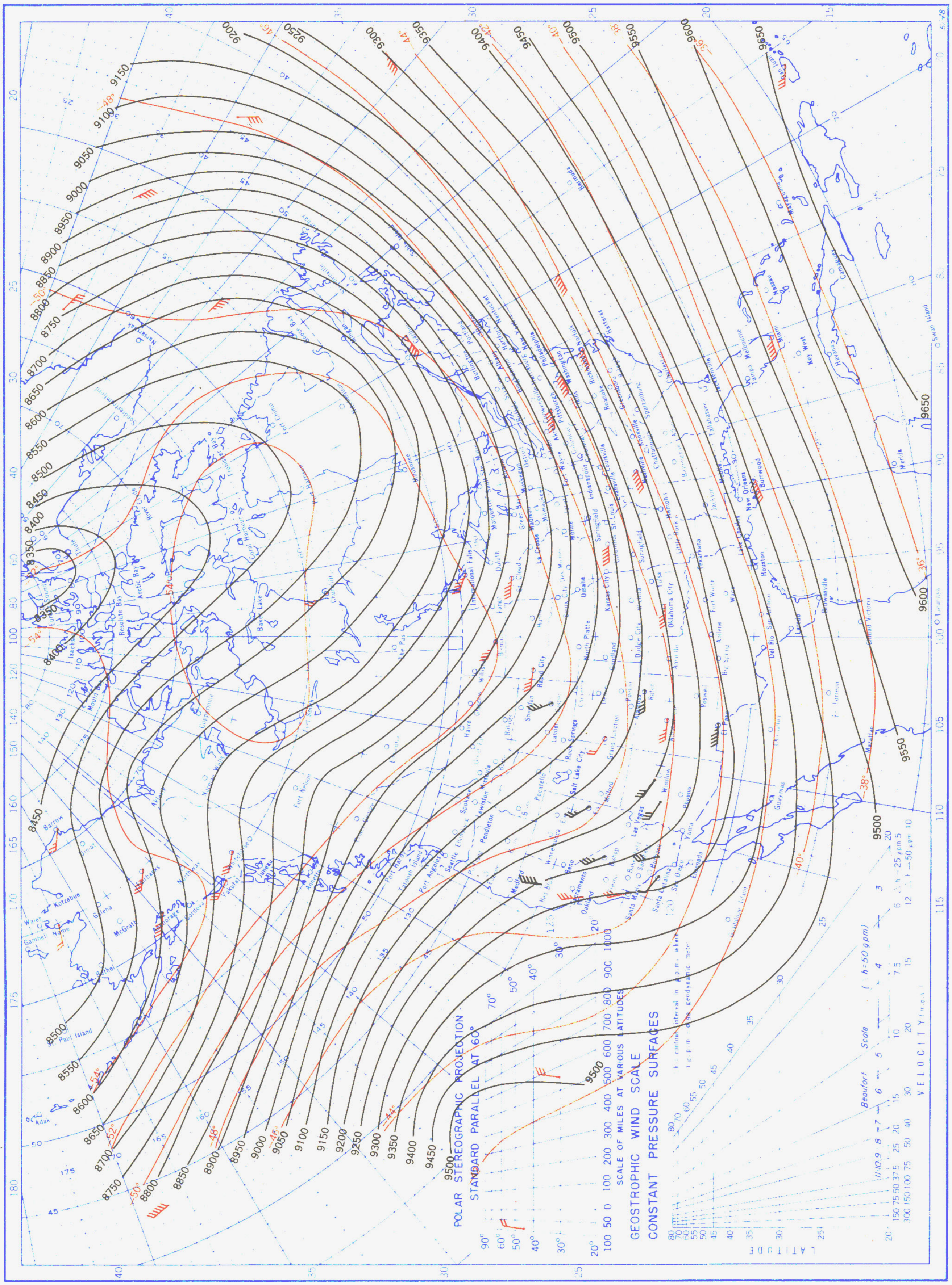

Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins taken at 0300 G. M. T.

Chart XIV. Average Dynamic Height in Geopotential Meters (1 g. p. m. = 0.98 dynamic meters) of the 500-mb. Pressure Surface, Average Temperature in °C. at 500 mb., and Resultant Winds at 5000 Meters (m. s. l.), February 1953.




Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins at 0300 G. M. T.

Chart XV. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 300-mb. Pressure Surface, Average Temperature in °C. at 300 mb., and Resultant Winds at 10,000 Meters (m.s.l.), February 1953.




Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins at 0300 G. M. T.