NOAA ATLAS No. 10

Atlas of Climatology and Variability of Monthly Mean Northern Hemisphere Sea Level Pressure, 700 mb Geopotential Height, and 1000-700 mb Thickness, 1950-1992

Camp Springs, Md.
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U.S. DEPARTMENT OF COMMERCE
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Ronald H. Brown, Secretary
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ABSTRACT

This atlas contains several statistics of monthly sea level pressure (SLP), mean 700 mb height, and 1000-700 mb thickness for each of the twelve months over the extratropical Northern Hemisphere for the 1950-1992 period. For each of the three fields, the statistics are presented in the following order: Following presentation of the mean and the departures from the zonal mean (i.e. eddy), the interannual standard deviation is shown. Next, the skew is displayed, followed by the month-to-month autocorrelation of the field. The autocorrelation identifies the locations and times of the year tending to have low-frequency persistence (or, on rare occasions, antipersistence)--a potentially important tool for long-range forecasters. Finally, the leading unrotated EOF is presented, including the spatial loading pattern and the accompanying amplitude time series for 1950-92. The compiling of the above statistics is intended to provide reference material for descriptive purposes and for forecast applications. A companion journal article (Barnston and Van den Dool 1993) highlights and extends some of the more interesting features of the maps for 700 mb height found in this atlas.

1. Motivation

The behavior of the monthly mean planetary scale circulation is of interest to meteorologists both from a purely physical, descriptive and predictive standpoint. Many studies have attempted to characterize this behavior in terms of preferred flow patterns (O'Connor 1969, Wallace and Gutzler 1981, Namias 1981, Horel 1981, Esbensen 1984, Barnston and Livezey 1987), persistence of the flow (Namias 1952, Van den Dool and Livezey 1984) and the correspondence to the climate at the surface (Klein 1983, Klein and Walsh 1983).

This atlas is based on three relatively unique Northern Hemisphere data sets: (1) sea level pressure (SLP), (2) 700 mb geopotential height, and (3) 1000-700 mb thickness. The existence of continuous, twice-daily SLP and 700 mb data sets for the period 1950-92 is credited to those in charge of what formerly was the Extended Forecast Division of the U.S. Weather Bureau and subsequently became the Prediction Branch of the Climate Analysis Center. Within the upper atmosphere, the 700 mb level has been considered desirable because it is an intermediate level, close to the middle troposphere which is best forecast by numerical models, and the surface whose prediction is ultimately of greatest interest to us. The 1000-700 mb thickness, calculated approximately from the SLP and 700 mb height, is meaningful because it represents the mean temperature of the atmospheric layer between the two levels.

The application of a monthly mean filter to daily SLP, 700 mb height and thickness data removes most of the high frequency variability (i.e. individual weather systems associated with baroclinic eddies), resulting in a description of the low frequency variability that applies to long-range forecasts such as those issued at the Climate Analysis Center (CAC) of the National Meteorological Center (NMC).

The first statistic presented for each of the three data sets is the spatial map of the 43 year mean (by month) and the departures from the zonal mean (termed "eddy") for each month. Next, the field of the interannual standard deviation is shown for each month. This quantity is relevant to a wide variety of studies and applications and should be available to the research community as well as climatologists and operational meteorologists for guidelines for prediction (e.g. where to place anomaly centers or "zero lines"); yet it is often difficult to acquire readily. Next, the skew is presented, reflecting the degree and direction of asymmetry in the frequency distributions of monthly mean pressure, height and thickness. Next, the month-to-month autocorrelation is shown. This field identifies the locations and times of the year tending to have low-frequency persistence (or, in rare times and places, antipersistence)--a potentially important tool for long-range forecasters. Finally, the first unrotated empirical orthogonal function (EOF) is displayed, describing the most prominent pattern of coherent interannual

variability. A plot of the amplitude time series associated with each such EOF is also included. We found the first EOF to be the easiest and most concise summary of a large collection of teleconnection maps created by letting each grid point be the "base point" in turn (as in Namias 1981).

The compiling of the above statistics in this atlas is intended to provide reference material for descriptive purposes and for forecast applications. A companion journal article (Barnston and Van den Dool 1993) highlights and extends some of the more interesting features of the 700 mb height maps found in this atlas and may be used for comparison to the output of long runs with numerical models. The analyses performed in that article include, among others:

- Map of the location of the standard deviation maxima for the three general peak regions (Pacific, Atlantic, and Arctic oceans) for each of the twelve months (i.e. seasonality in position)

- Plot of peak standard deviation in each of the three high variability areas as a function of month (i.e. seasonality in magnitude)

- Time series of January and July monthly mean 700 mb height over the 1950-91 period at 50N,170W at the Pacific high variability site

- Map of the axes of the little studied standard deviation minimum (in western North America) for each of the twelve months

- Time series of one month mean 700 mb height over the 1950-91 period at 50N,110W in a southwestern Canada low variability site for various times of the year, to reveal low frequency signals without the interference from "ordinary" strong interannual variability

- Maps of total teleconnectivity and principal component loading pattern centers to explore the relationship between each of these and the field of interannual standard deviation

2. Data and Analysis

The data consist of monthly mean SLP and 700 mb height at 358 grid points from 15 to 90^{o}N, derived from twice daily data from 1950 through 1992 from NMC. The 1000-700 mb thickness is calculated from the SLP and 700 mb height as follows:

$$\text{thickness (gpm)} = \text{700 mb height (gpm)} - \text{1000 mb height (gpm)} \quad (1)$$

$$= \text{700 mb height (gpm)} - [(\text{SLP}-1000) \times 8.50],$$

where gpm denotes geopotential meters, and SLP is in mb. Equation (1) does not use the actual surface temperature to calculate the 1000 mb height from the SLP (which has problems of its own, particularly in elevated regions), but assumes .120 mb/m for the correspondence between pressure and geopotential height. Each of the 15 5-degree-apart latitude circles contain 36 grid points with longitudes offset by 5^{o} on successive latitude circles such that a diamond configuration is created. Fewer points are included at higher latitudes to establish an approximate equal area representation. Further details on this grid and on the treatment of brief missing periods in the early part of the record are described in Barnston and Livezey (1987). Because the 15^{o}N latitude circle and an area in the low latitude Eastern Hemisphere contain the most noticeable missing data problem, points in these locations were omitted from the analysis.

The SLP and 700 mb datasets are concatenations of different analysis schemes used at NMC over the 43-year period of record, and hence may contain subtle discontinuities. It would be desirable to have a continuous version of the highest quality gridded data produced by a non-changing analysis method. Such data sets may become available for a sizable portion (1958 to present) of this atlas' historical period as a result of the multi-institutional project, currently in progress, to reanalyze the data using a consistent data assimilation scheme (Kalnay and Jenne 1991). The creation of more homogeneous data sets, expected near the turn of the century, could produce maps slightly different from those appearing in this atlas.

The uniqueness of the present 3-member data set lies in its length and spatial coverage. For the upper level (700 mb) data set a record length of over 40 years is very rare, matched only by one or two 500 mb data sets maintained in the United Kingdom and (Federal Republic of) Germany. Other global or hemispheric daily upper level data sets usually do not begin until the 1960s and 1970s. The 700 mb data set in its present form goes back even to January 1947, but data prior to 1950 are omitted from our study due to persistent areas of missing early data, primarily at subtropical latitudes. Because we present results here for a 3 member data set we also left out SLP data prior to 1950 which are available (largely through the efforts of the same people; see Acknowledgment) back to the late 1890s.

3. The Mean State and Eddy Component

The mean SLP in the extratropical Northern Hemisphere for the 1950-92 period is shown in twelve panels in Fig. 1 for the months of January through December. Departures from the zonal mean (termed "eddy") for each month are shown in similar format in Fig. 2. Because there is no general decrease in SLP with increasing latitude as there is for 700 mb height and 1000-700 mb thickness, the eddy and mean fields exhibit a very similar pat-

tern; therefore, the eddy field is shown only for January and July for SLP. The same statistics for 700 mb height are shown in Figs. 9 and 10 (with the eddy shown for all twelve months), and for 1000-700 mb thickness in Figs. 17 and 18. From the 700 mb eddy maps (Fig. 10), we note that in most regions of the Hemisphere there is a gradual amplitude increase from summer to winter. The general similarity of the phasing of these fields in North America over the annual cycle reflects, in our view, their association with geographically fixed features such as terrain, land versus ocean interfaces, etc. On the other hand, there is an annual oscillation in the sign of the eddy component in central and southern Asia versus the Pacific, in which the relatively warmer surface is associated with lower heights. The latter relation is found more pervasively for sea level pressure (Hsu and Wallace 1976) and surface pressure (Van den Dool and Saha 1993), as shown here for the winter versus summer SLP mean and eddy maps over land versus ocean regions (Figs. 1 and 2). The eddy maps for thickness (Fig. 18) in the cold half of the year show maxima and minima somewhat upstream of those found for 700 mb height (Fig. 10), due to advective processes. During the warm half of the year centers for the two fields are roughly congruent.

4. Interannual Variability

The interannual variability is described using the standard deviation of the monthly mean SLP, 700 mb height, or 1000-700 mb thickness over the 43-year period of record, by individual grid point. The standard deviation is computed both for individual months and for pooled data spanning a three month window centered on the month in question. As discussed in the Appendix, the data from five half-month-apart one month periods are used in the pooling procedure. Pooling is carried out to reduce sampling uncertainty by increasing the effective number of elements in the sample. Uncertainties in sampling are more severe in second moment quantities (e.g. standard deviations or correlations) than first moment quantities (e.g. means, eddies). A danger in pooling is that elements from adjacent time periods, that are possibly seasonally dissimilar to the elements from the central time period, are included. To illustrate the effect (believed mostly advantageous) of pooling, resulting standard deviation fields for the individual (unpooled) months of January, February and March are shown, followed by pooled results for all months of the year. The standard deviation fields for the unpooled winter months are shown for SLP (in tenths of mb) in Fig. 3, for 700 mb height (in gpm) in Fig. 11, and for 1000-700 mb thickness (in gpm) in Fig. 19. Pooled results representing each centered month are displayed in Fig. 4 for SLP, Fig. 12 for 700 mb height, and Fig. 20 for thickness.

Inspection of the 700 mb maps (Figs. 11 and 12) shows increases in variability with latitude up to about 45 to 50^{o} at all times of the year, northward of which the variability depends more on longitude than latitude because three focal points of

maximum variability are found in this general latitude region. In Barnston and Van den Dool (1993) the seasonality of the high and low 700 mb height variability regions are discussed in some detail. The SLP maps (Figs. 3 and 4) exhibit variability patterns somewhat similar to those of 700 mb height. For thickness, the locations of the variability maxima tend to be over land (Figs. 19 and 20), in contrast to SLP and 700 mb height which vary maximally over the ocean.

5. Skew

Skew is defined qualitatively as an asymmetry in a distribution. A positively skewed distribution has a longer upper than lower tail, and has a mean that is greater than the value(s) that occurs most frequently. The skew is calculated as the mean of the cubed deviations from the distribution mean (i.e. the third moment), divided by the cube of the standard deviation to yield a unit-free quantity. The skew of a symmetric distribution such as the normal distribution is zero.

The existence of skew in surface as well as upper air weather data has been noted in a number of studies (e.g. Van den Dool et al. 1978, Opsteegh and Van den Dool 1979, Lehman 1987, Toth and Szentimrey 1990). In particular, a tendency for positive skew in 500 mb geopotential height north of the jet streams and negative skew to their south has been documented elsewhere (White 1980, Chen and Van den Dool 1993). In these studies, the skews, or asymmetries in the distribution, are attributed to occasional occurrences of unusually strong blocking regimes (positive anomalies) north of the jet stream and cut-off lows (negative anomalies) south of the jet stream. Because the skew is the third moment, it is highly sensitive to sampling uncertainty, and unpooled results are quite noisy. Therefore, only pooled estimates (using a three month window with five overlapping one month periods; see Appendix) are presented here. The resulting maps of skew fields representing each centered month are displayed in Fig. 5 for SLP, Fig. 13 for 700 mb height, and Fig. 21 for thickness. The skew fields for thickness appeared noisy and nonmeaningful; hence, only the January map is shown as an example in Fig. 21. Inspection of the 700 mb maps shows maxima in positive skew around the 50^{o} latitude circle in winter, 60^{o} in summer; minima occur near the 30^{o} latitude circle in winter and slightly farther north in summer. Oceans tend to be favored over land for the highest positive skew. A roughly similar but somewhat noisier outcome is found in the SLP skewness maps, with the additional feature that regions of strongly negative skew appear at low (subtropical) latitudes, particularly in the warm months in the Pacific, eastern Atlantic and North Africa.

The fourth moment, or kurtosis, was also explored. However, results did not appear meaningful (small in scale, and noisy) and thus were not included.

6. Month-to-Month Autocorrelation

While the month-to-month autocorrelation field is presented for all twelve pairs of adjacent months of the year using pooled data, those between adjacent individual (unpooled) one month periods is presented only for April-to-May data (to highlight a feature to be described shortly) in Fig. 6 for SLP, Fig. 14 for 700 mb height, and Fig. 22 for 1000-700 mb thickness. Pooling of data from the five overlapping pairs of adjacent one month periods spanning the two temporally surrounding months (see Appendix) is carried out to reduce sampling uncertainty by increasing the effective sample size for the autocorrelation estimates. The pooled results are shown for each month-to-month pair in Fig. 7 for SLP, Fig. 15 for 700 mb height, and Fig. 23 for thickness. As noted elsewhere (Van den Dool and Livezey 1984), persistence for 700 mb height is greatest by far in the subtropics. However, some lesser peaks are noted in the extratropics at certain times of the year. Examples are in east-central Canada for Jan-Feb and Feb-Mar, in the mid-Pacific for Dec-Jan and Jan-Feb, and just north of Kamchatka for Jun-Jul and Jul-Aug. While relatively infrequent, negative autocorrelation is found, such as in the mid-latitude Atlantic in spring. For the 700 mb height field, this is evident in unpooled autocorrelation results for Mar-to-Apr (not shown) and even more so for Apr-to-May (Fig. 14). This particular example has been related to a tendency for a reversal in polarity of the North Atlantic Oscillation (NAO) 700 mb height pattern in middle to late spring (Barnston and Livezey 1987).

While the autocorrelation maps for SLP (Figs. 6 and 7) and thickness (Figs. 22 and 23) have gross similarity to those for 700 mb height, specific differences are plentiful. Some of these may be caused by the method(s) used for reduction to sea level for SLP in elevated regions.

7. First Unrotated EOF

As documented extensively elsewhere, empirical orthogonal functions (EOFs) can help describe a data set's preferred patterns of interannual variability in the form of characteristic spatial patterns and their accompanying amplitude time series. While rotation of a set of leading such patterns may provide more regional and physically meaningful modes of variability (Horel 1981, Barnston and Livezey 1987), unrotated patterns are designed to include larger amounts of variance in the first modes within any given set. The first unrotated EOF, in particular, "bites off" the maximum amount of variance possible in the data set, and, unlike subsequent EOFs, is unaffected by the nature of the variance already accounted for by previously defined, stronger EOFs. The first unrotated EOF is a compact expression of the most major segment of coherent variability in the data set, describing regions that tend to covary positively and negatively with respect to one another. It is usually a terse summary in

one map of what a large number of teleconnectivity (defined in Wallace and Gutzler 1981) maps tell us. In the computation of the EOF maps, a correlation matrix is used to ensure that all grid points have equal opportunity to participate in the coherent variability structures regardless of their latitude and longitude dependent interannual variances. Pooling with a three month window using five overlapping one month periods (as described in the Appendix) is carried out to reduce sampling uncertainty, hopefully without seriously compromising temporal (seasonal) resolution. The pooled results are shown in Fig. 8 for SLP, Fig. 16 for 700 mb height, and Fig. 24 for thickness. The amplitude time series associated with each EOF accompany these maps. The percentage of total variance explained by the first EOF for each month is shown in Table 1. Aside from the overall differences in explainable variance among the three fields (which itself varies with season), a primary (secondary) maximum in winter (summer) is noted in all three fields. Overall, the most variance is explained for 700 mb height, followed by SLP and then thickness. For 700 mb height the explained variance does not exceed 20 percent for any month. However, when a covariance rather than a correlation matrix is used for the EOF computation (not shown) the patterns and time series are very similar, and the explained variance is as much as 25 percent in winter months.

A tendency for zonally symmetric patterns (e.g. a dipole between the polar region and the mid-latitudes) is found in many of the results, especially for SLP and 700 mb in winter. In summer a zonally symmetric dipole pattern sometimes appears between the subtropics versus the middle and high latitudes (e.g. the "subtropical zonal" (SZ) pattern described for 700 mb height in Barnston and Livezey 1987). While the amplitude time series often show variability on a mixture of time scales for the leading EOFs, occasionally a marked trend or interdecadal signal is found. For example, note June, July, August and September for SLP (Fig. 8); July for 700 mb height (Fig. 16); and November for thickness (Fig. 24). The SLP and 700 mb height examples indicate a summer regime from the late 1970s through most of the remainder of the period of record featuring below normal ("normal" defined as the 1950-92 average) pressure (height) in the polar region and above normal pressure (height) in the middle and lower latitudes.

Acknowledgments

We are indebted to those people and groups who carefully archived and maintained the unique twice-daily sea level pressure and 700 mb data sets from 1947 to the present. Dr. Jerome Namias, Chief of the former Extended Forecast Division of the U.S. Weather Bureau, along with his primary colleagues Hurd Willett, Carl-Gustav Rossby and William Klein, are credited with this fine achievement. After Dr. Namias' retirement, the Extended Forecast Division continued for a few years as the Long Range Prediction Group, under the direction of Dr. Donald Gilman. In 1979 it became the Prediction Branch of the newly organized Climate Analysis Center, headed by Dr. Gilman and staffed with Deputy Chief Robert Dickson and data set managers David Durdall and then Randy Schechter. Since April 1990 the second author has assumed the Chief position, with Edward O'Lenic as Head of Operations.

Appendix

Pooling with a Three Month Window

Pooling is done to reduce sampling uncertainty by increasing the effective number of elements in the sample. Sampling uncertainty is substantial in second moment quantities (standard deviations, correlations, and correlation-derived products such as EOFs) and even more severe in third moment quantities such as skew. In this atlas pooling is carried out using a three month window, where the data from five half-month-apart one month periods are included in the pooling procedure. For example, for the month of January, results for December, mid-December to mid-January, January, mid-January to mid-February, and February would be pooled. (In the pooling process for standard deviation [or skew], squared [or cubed] deviations are computed with respect to the mean of the appropriate individual one month period.) In analogous fashion, the pooled autocorrelation centered on January to February would use the autocorrelations from (1) December to January, (2) mid-December-mid-January to mid-January-mid-February, (3) January to February, (4) mid-January-mid-February to mid-February-mid-March, and (5) February to March. Even though this procedure involves redundancy in the raw data, it is found that it produces more stable results (both between adjacent months for a given location, and between adjacent grid points for a given time) than the simple pooling of three separate individual months (Van den Dool and Livezey 1984).

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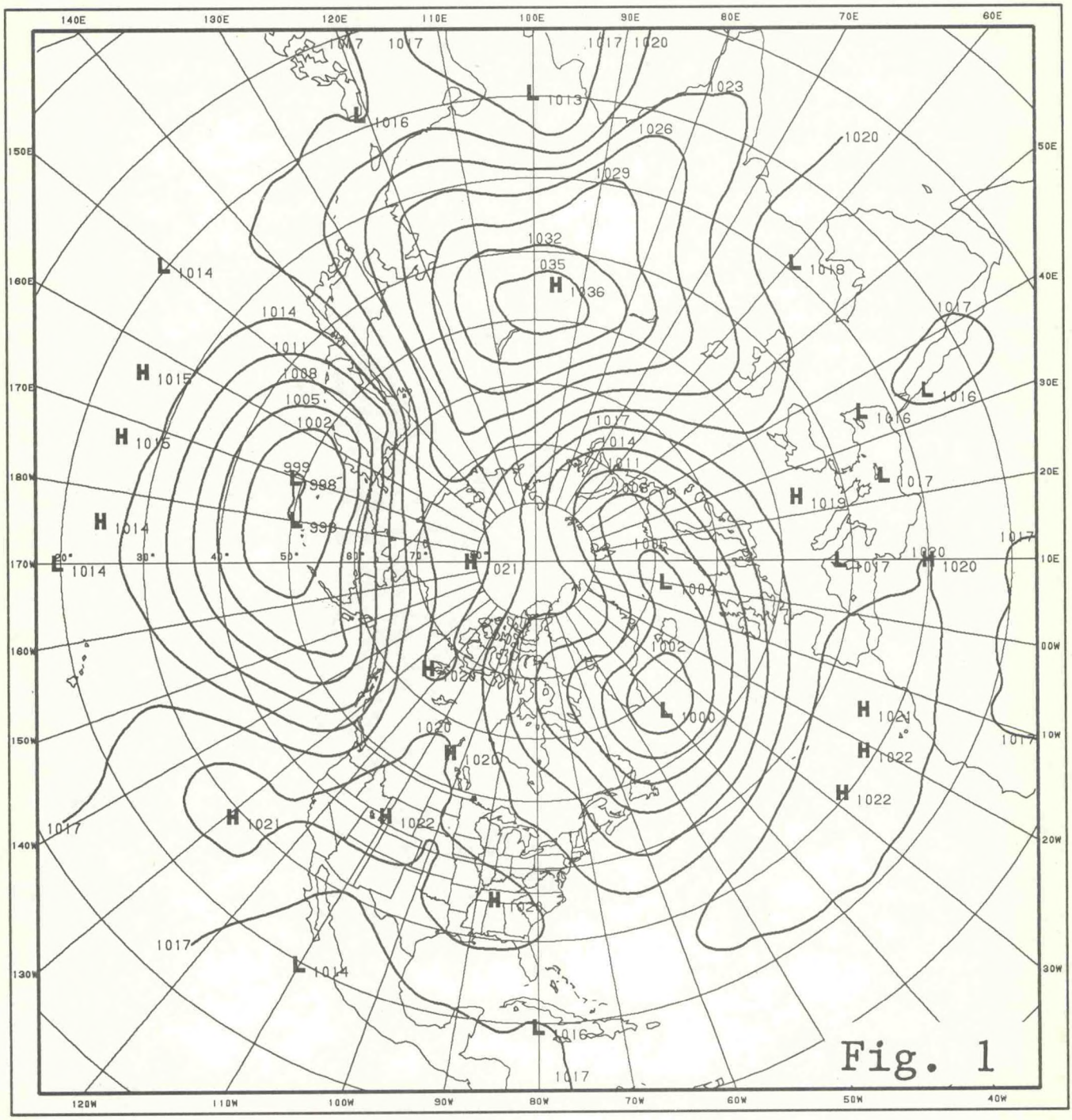
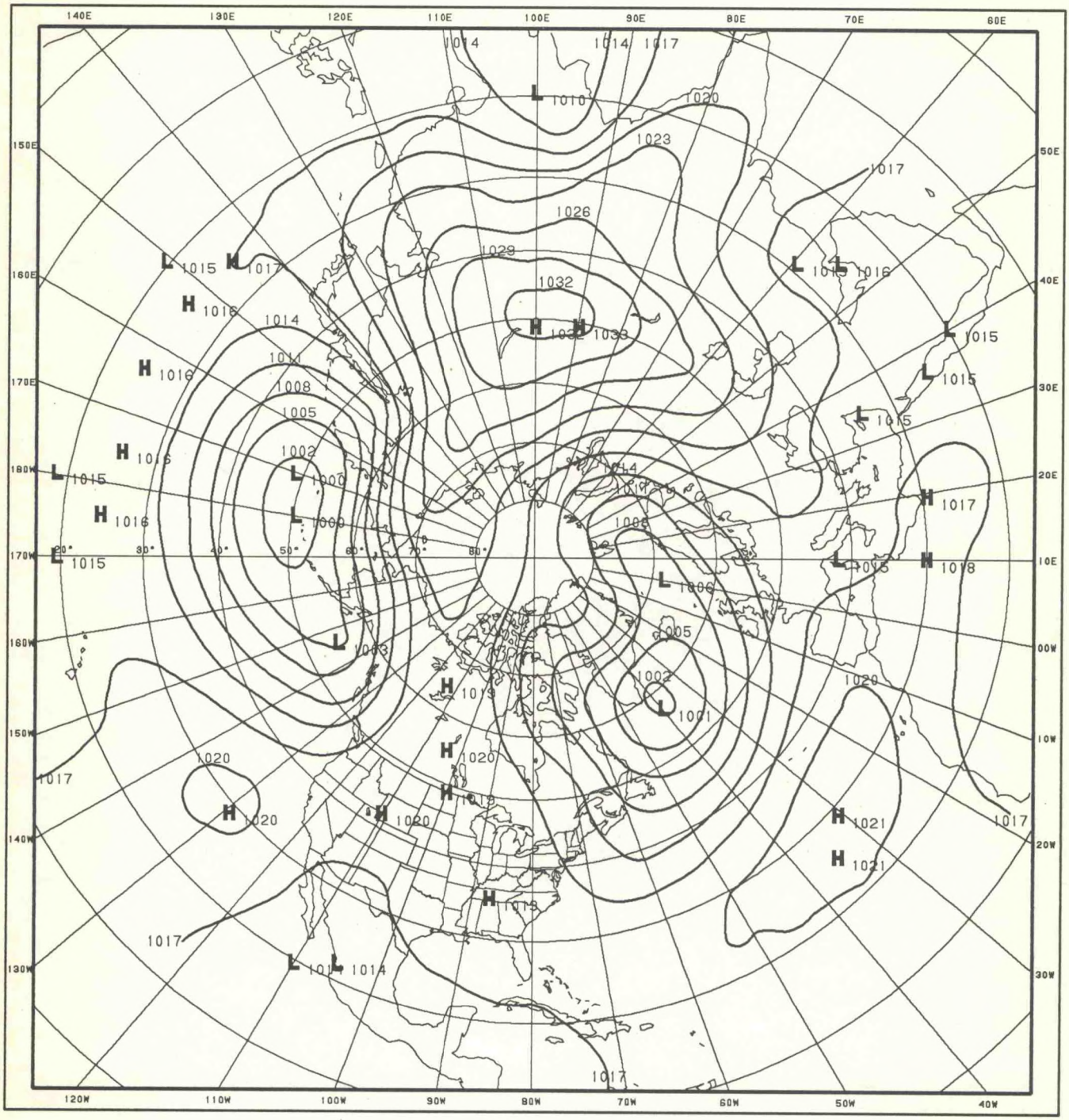
Table 1. Percentage of total variance explained by the leading EOF (see section 7) for each centered month using a three month pooling window (as explained in the Appendix).

	Sea Level Pressure	700 mb Height	1000-700 mb Thickness
January	18.4	16.4	12.5
February	19.2	17.5	13.2
March	17.7	15.9	12.6
April	14.5	13.4	10.0
May	10.1	10.0	7.2
June	11.0	8.4	8.8
July	11.9	9.5	10.1
August	11.1	9.7	10.1
September	10.9	9.2	8.9
October	11.0	10.0	8.8
November	12.5	10.6	9.8
December	16.9	14.8	10.8



SEA LEVEL PRESSURE MEAN JANUARY
1-MONTH MEAN UNPOOLED 1950-92

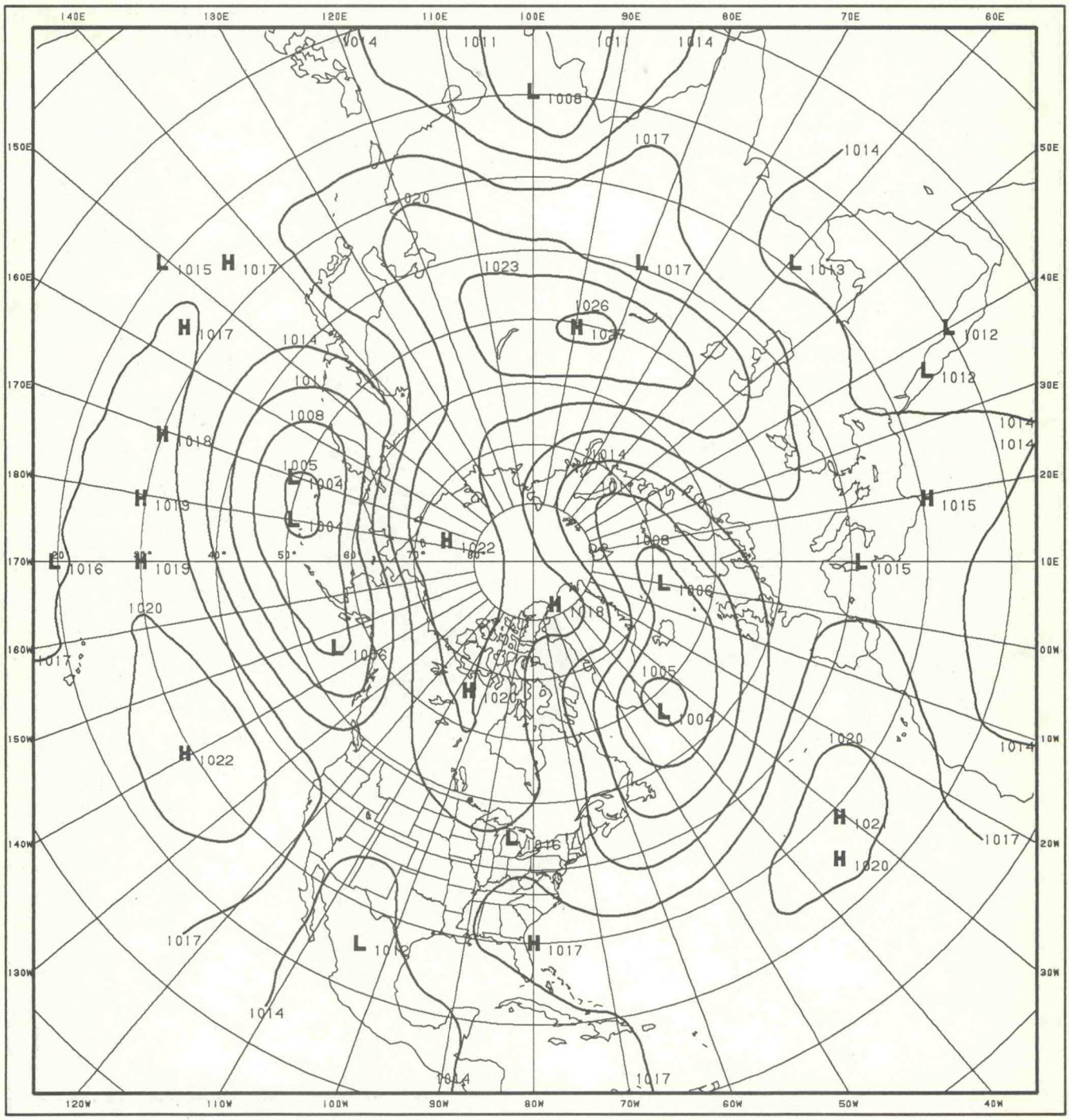
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE MEAN FEBRUARY

1-MONTH MEAN UNPOOLED 1950-92

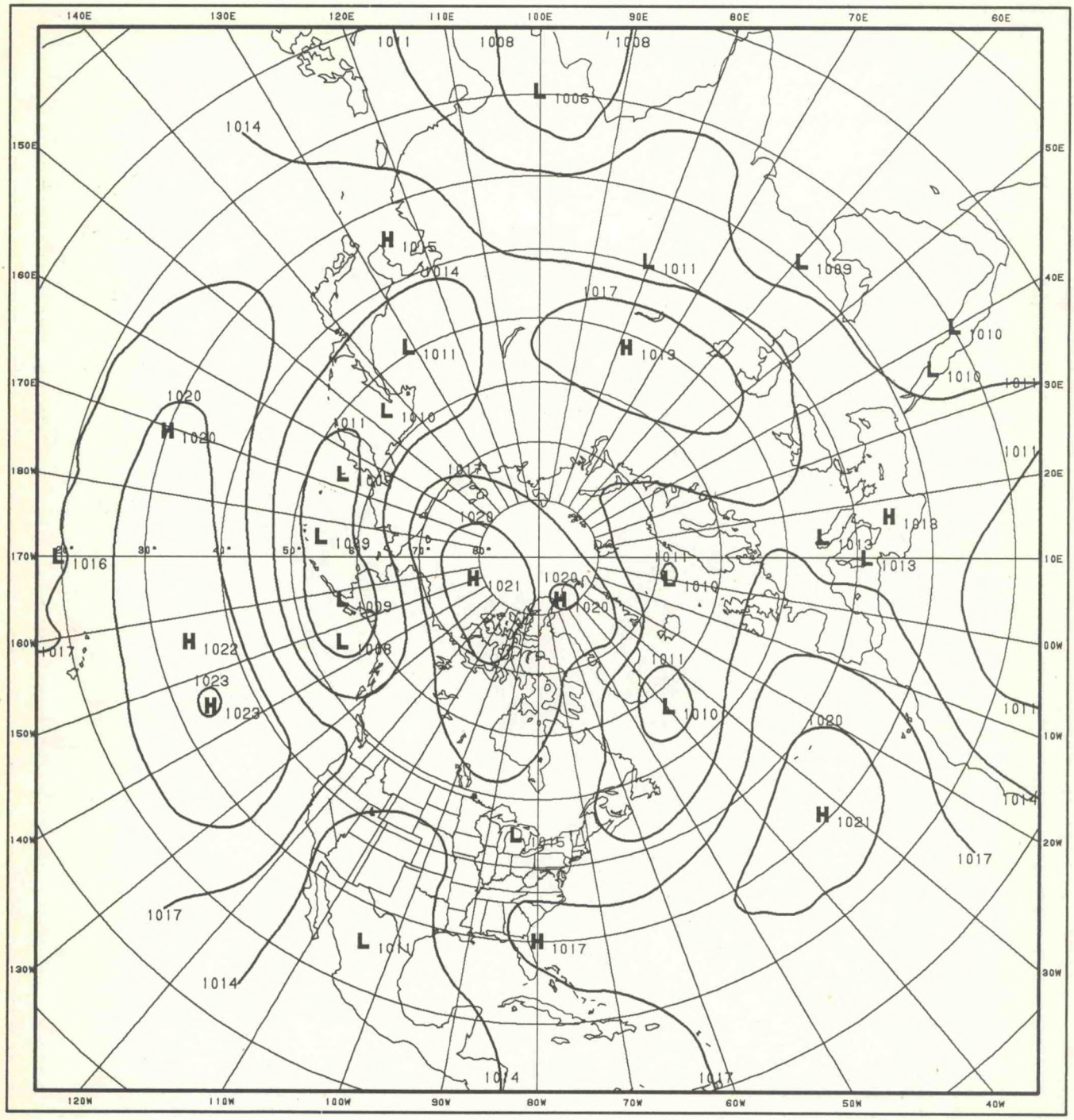
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE MEAN MARCH

1-MONTH MEAN UNPOOLED 1950-92

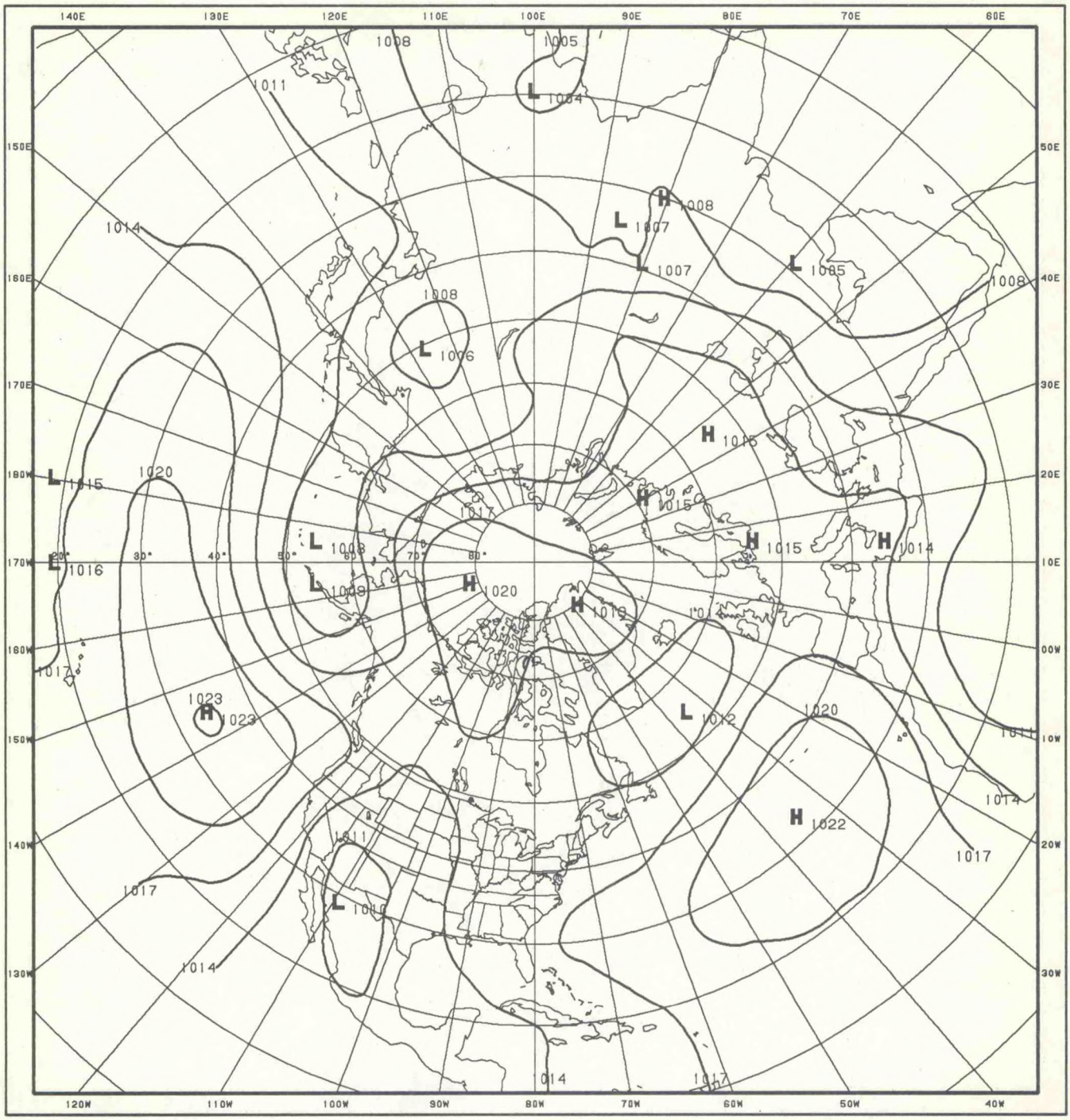
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE MEAN APRIL

1-MONTH MEAN UNPOOLED 1950-92

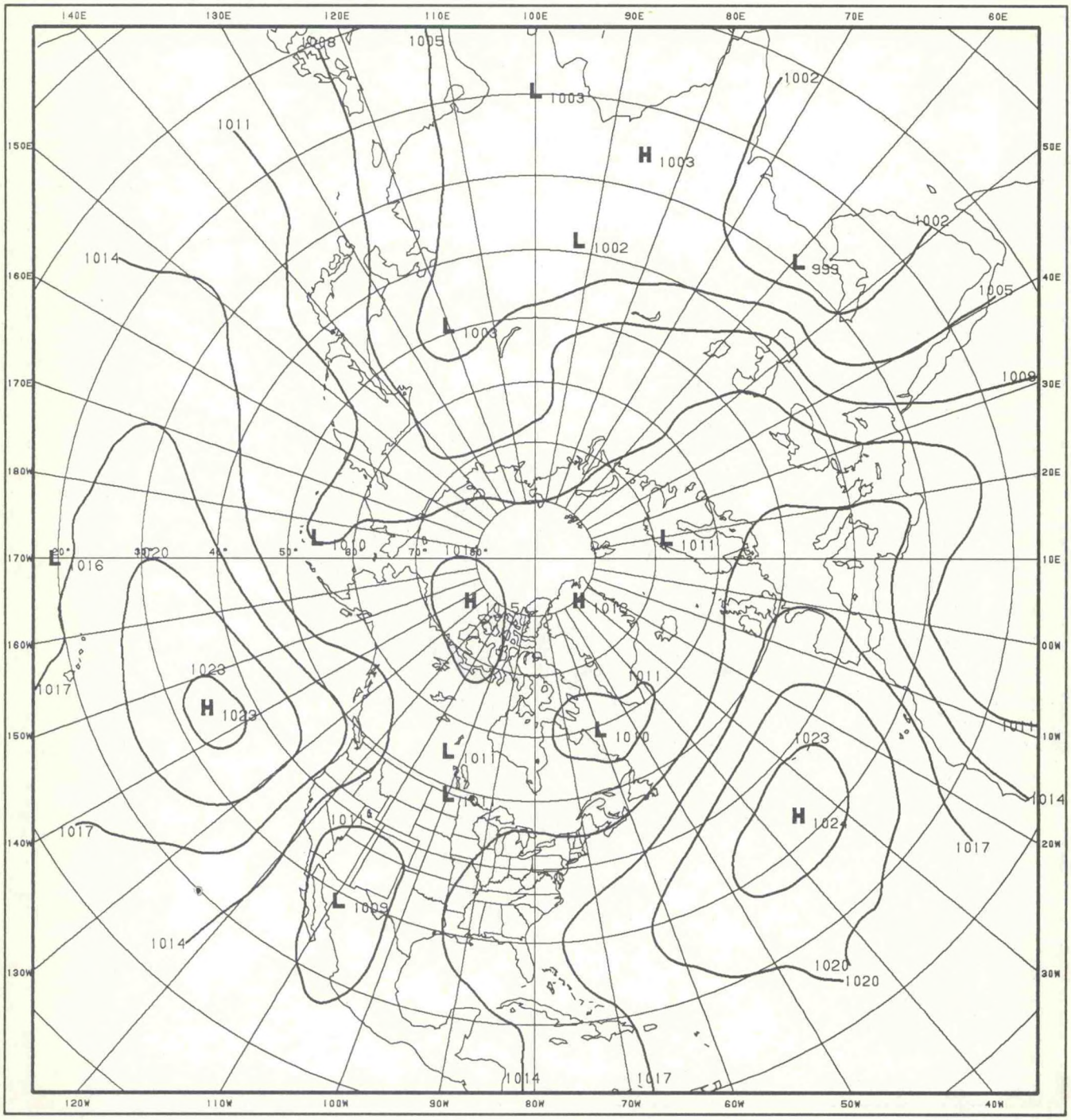
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE MEAN MAY

1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE MEAN JUNE

1-MONTH MEAN UNPOOLED 1950-92

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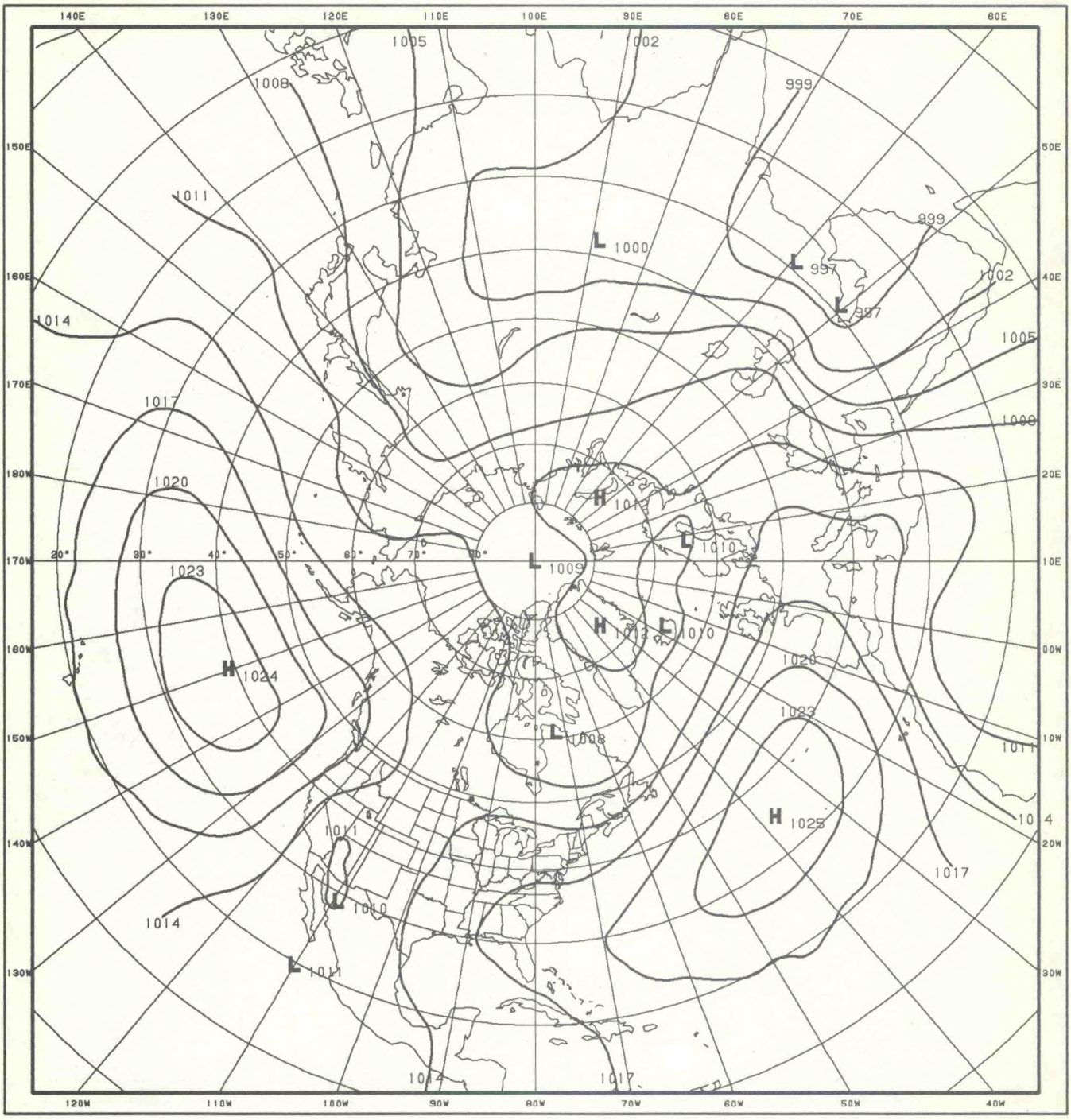

SEA LEVEL PRESSURE MEAN JULY

1-MONTH MEAN UNPOOLED 1950-92

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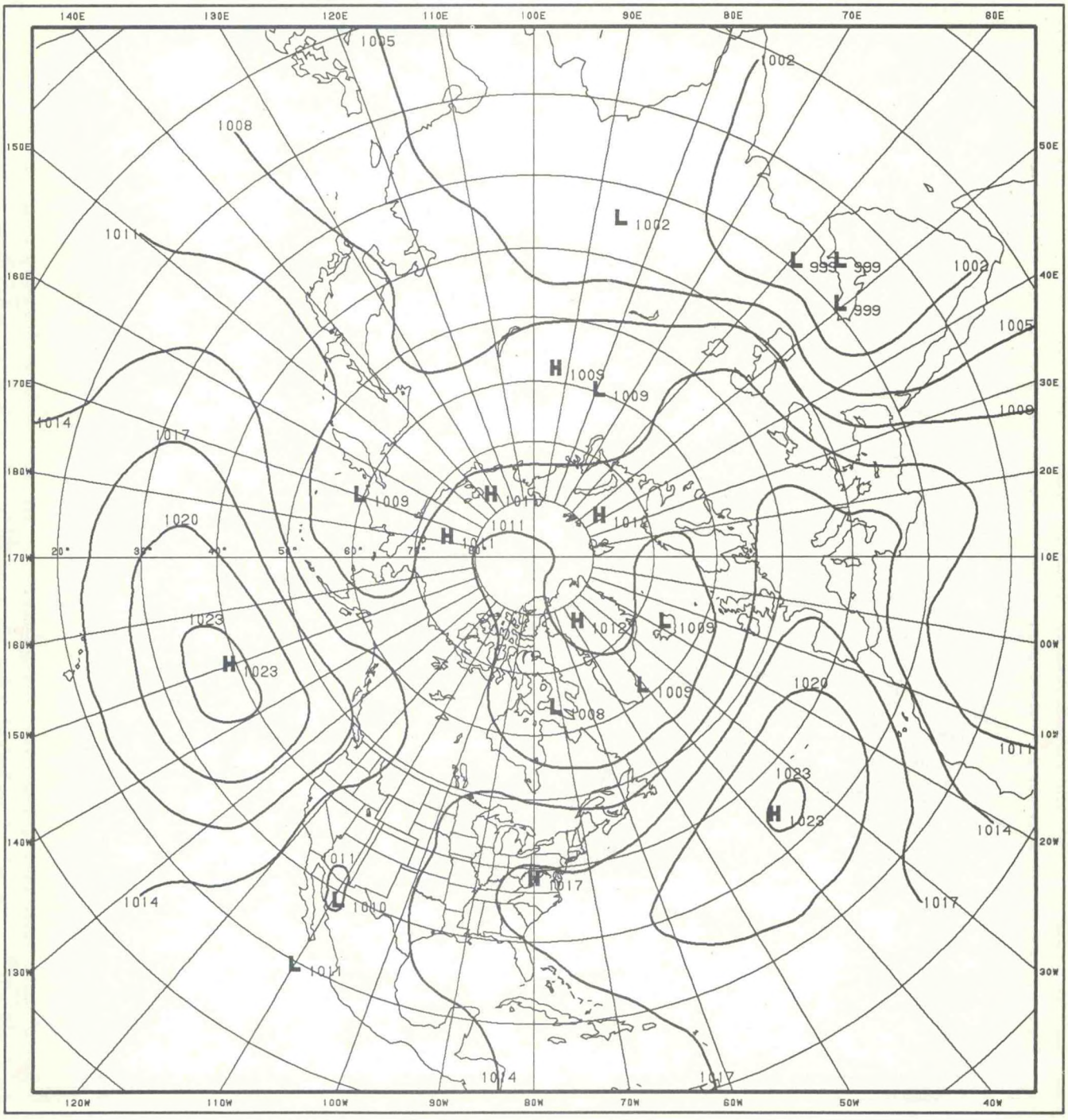
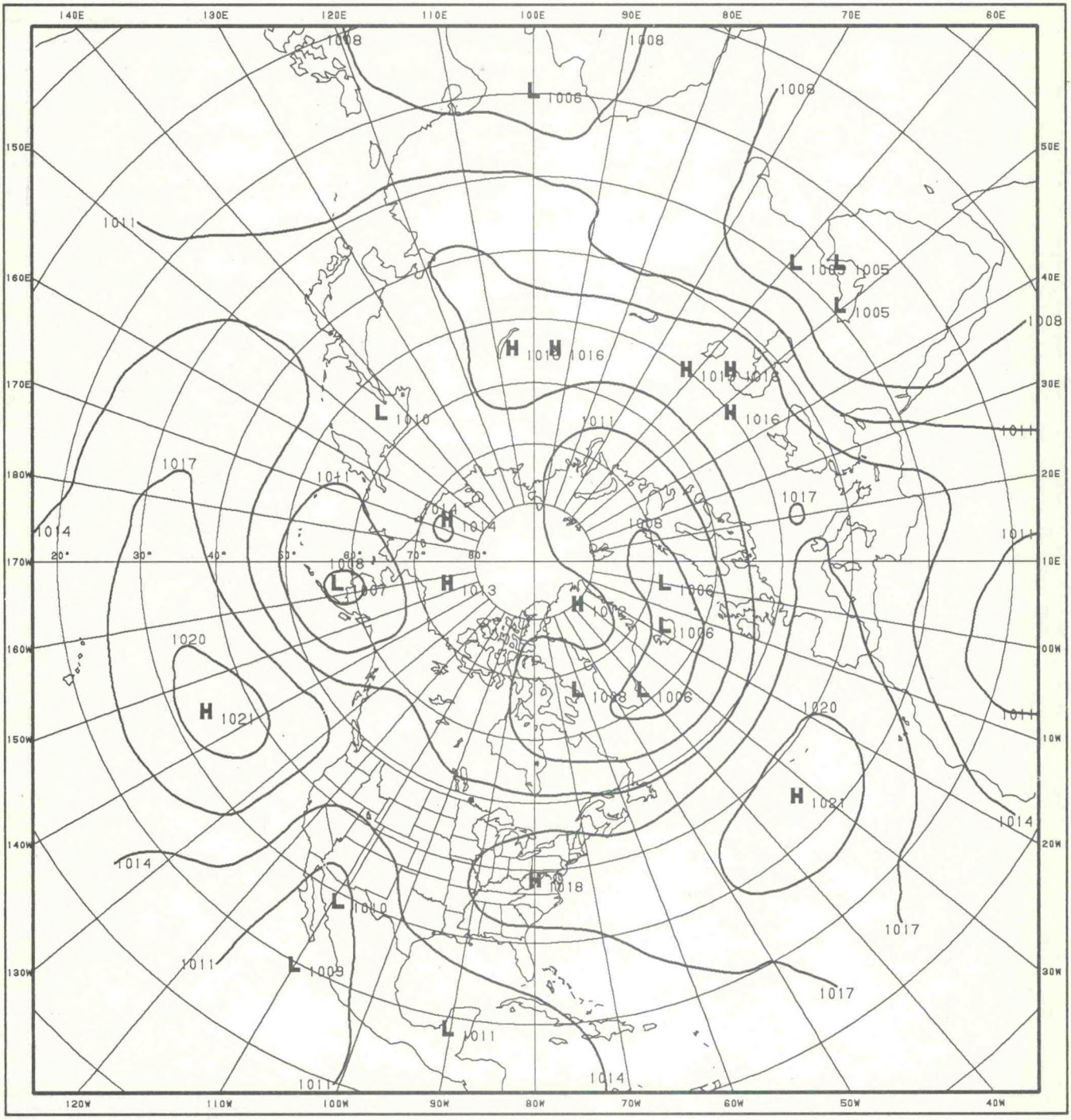


SEA LEVEL PRESSURE MEAN AUGUST

1-MONTH MEAN UNPOOLED 1950-92

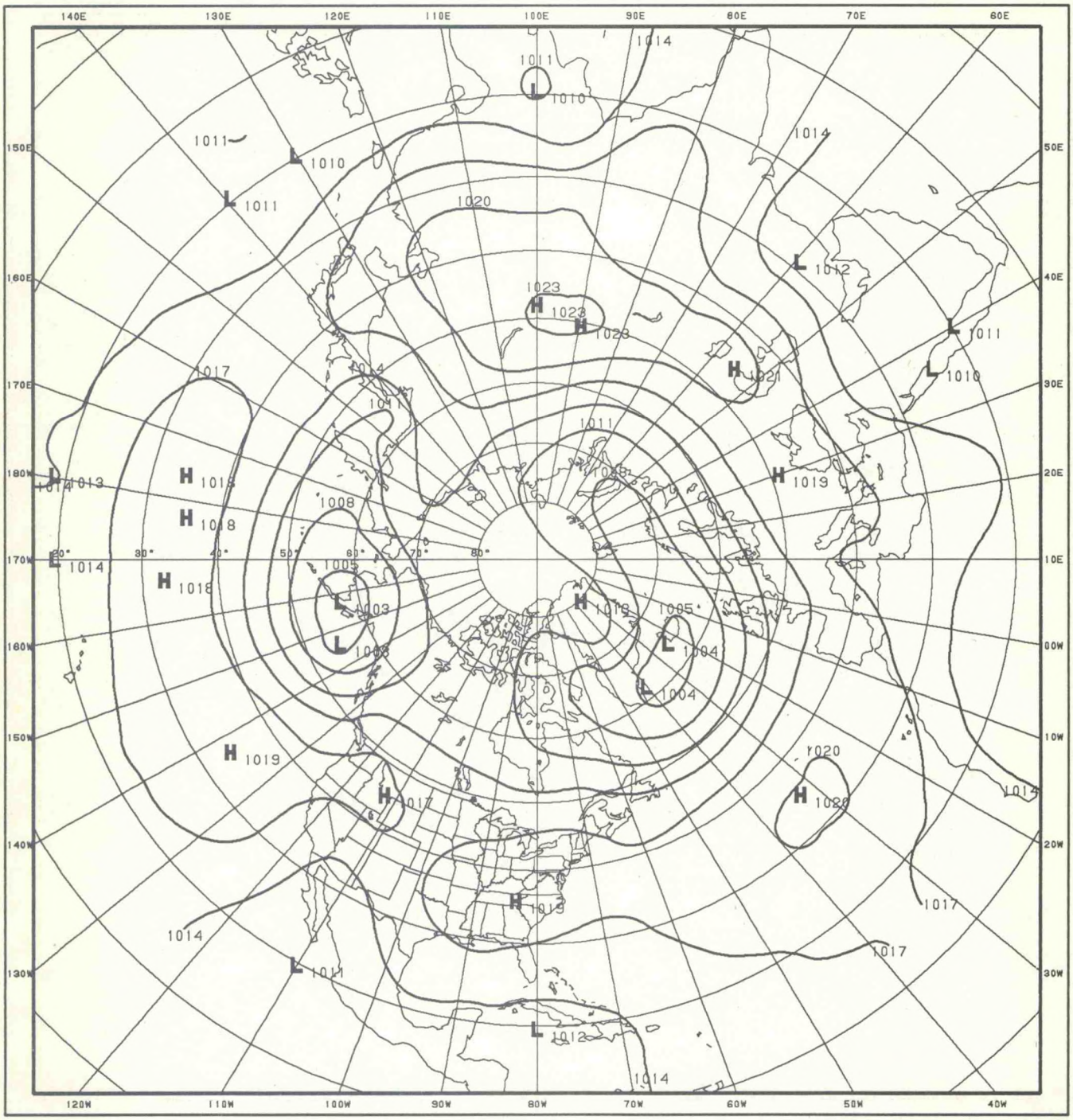
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE MEAN SEPTEMBR

1-MONTH MEAN UNPOOLED 1950-92

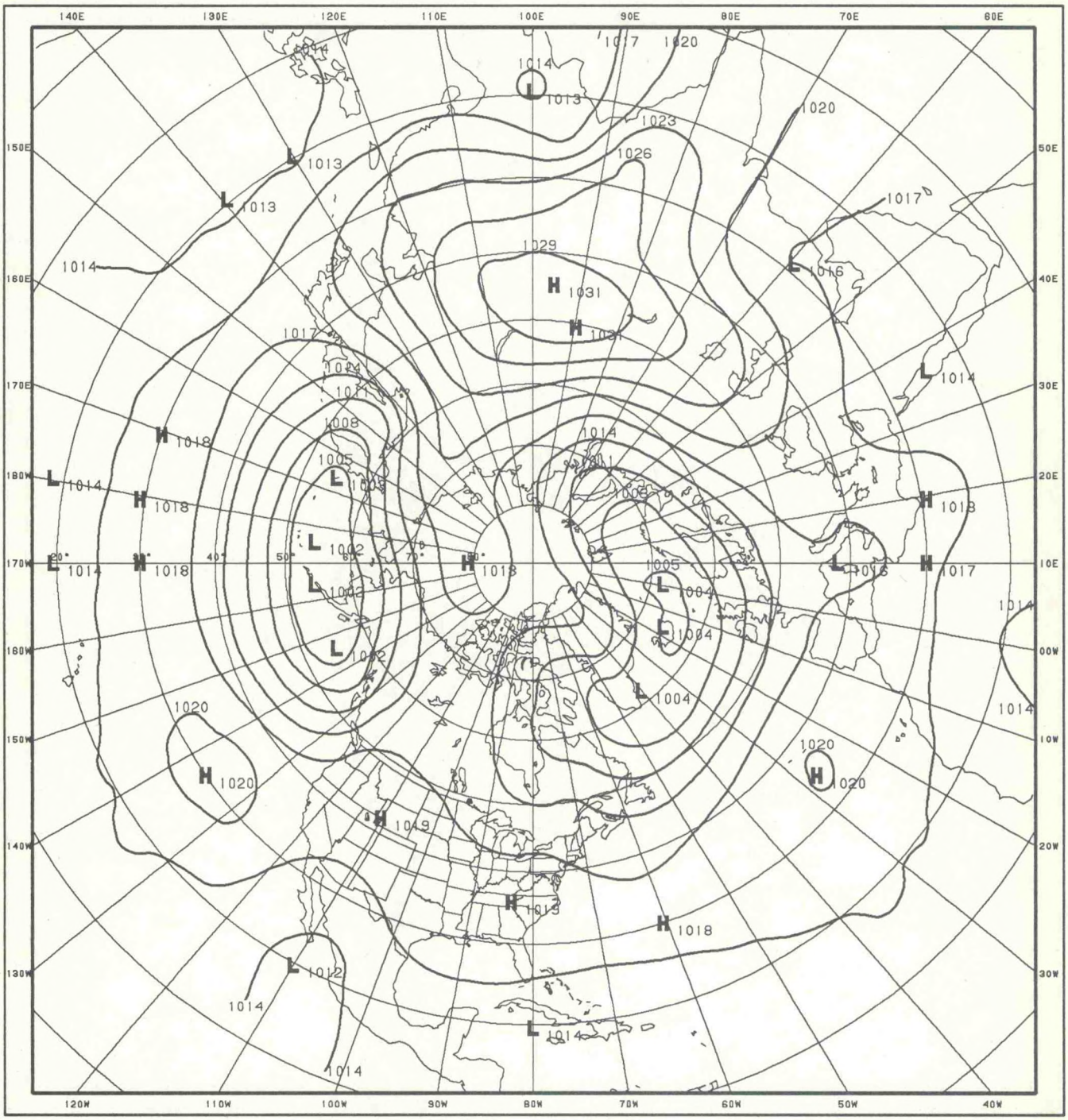
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE MEAN OCTOBER

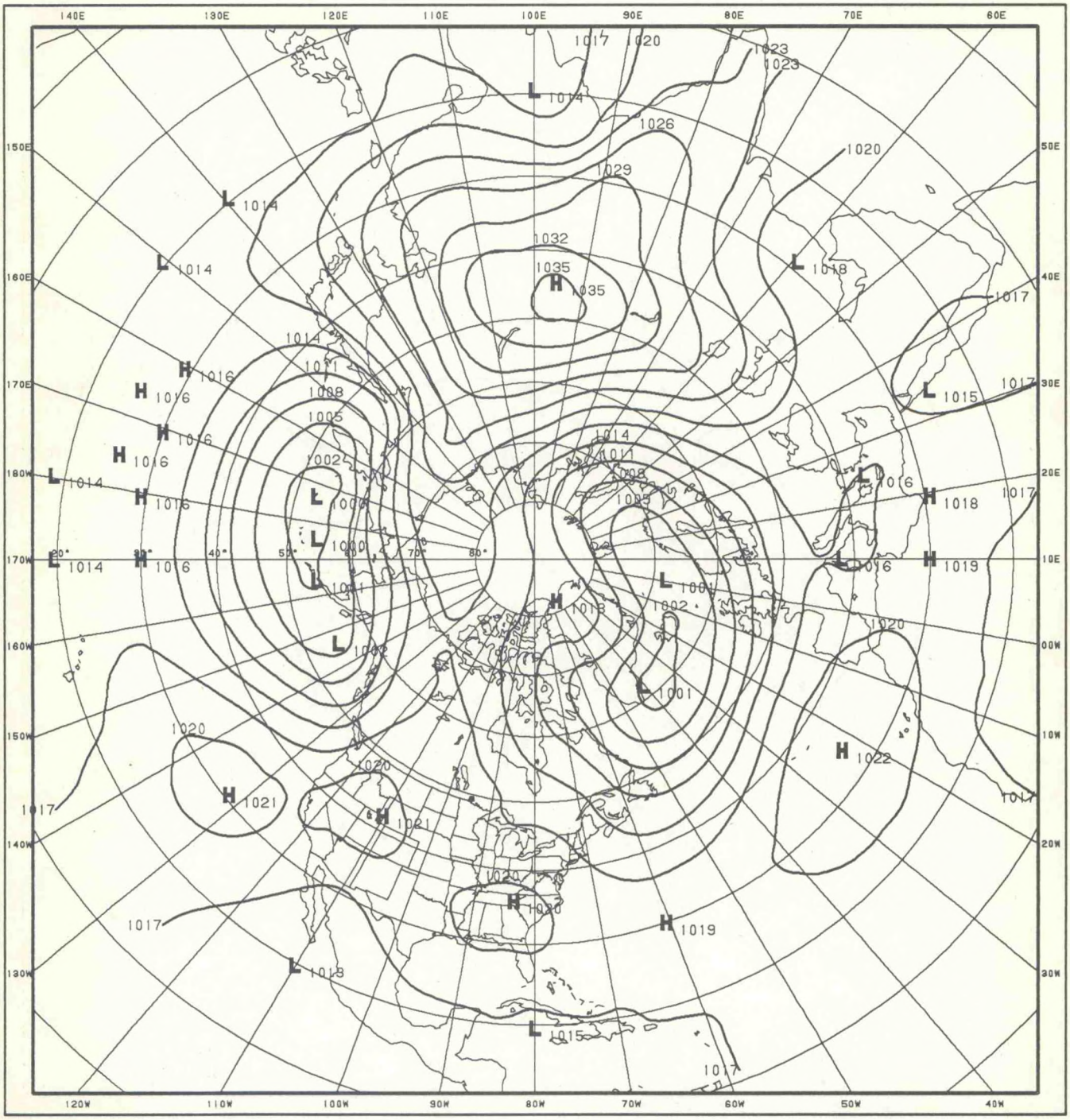
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



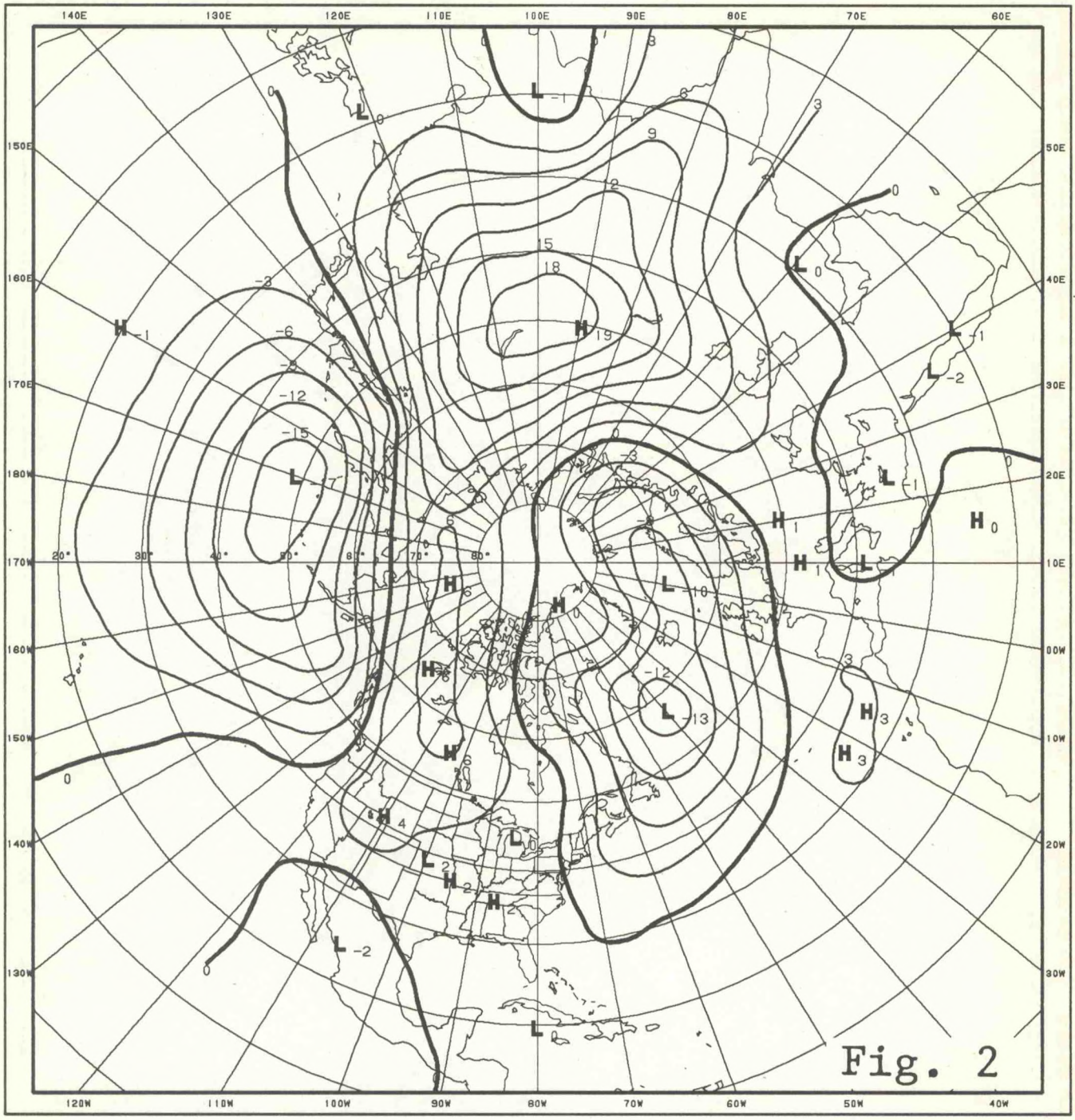
SEA LEVEL PRESSURE MEAN NOVEMBER
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



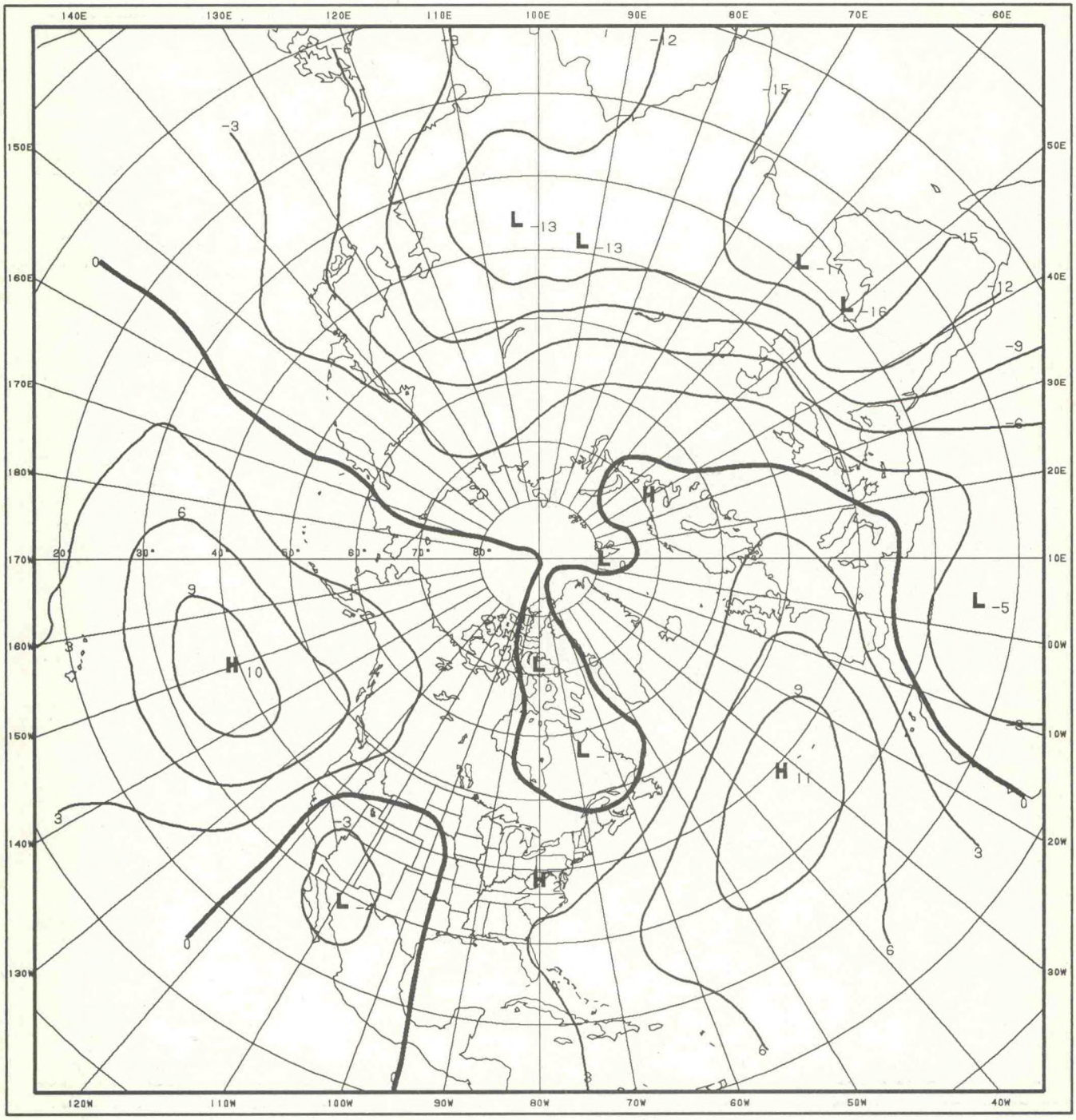
SEA LEVEL PRESSURE MEAN DECEMBER
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



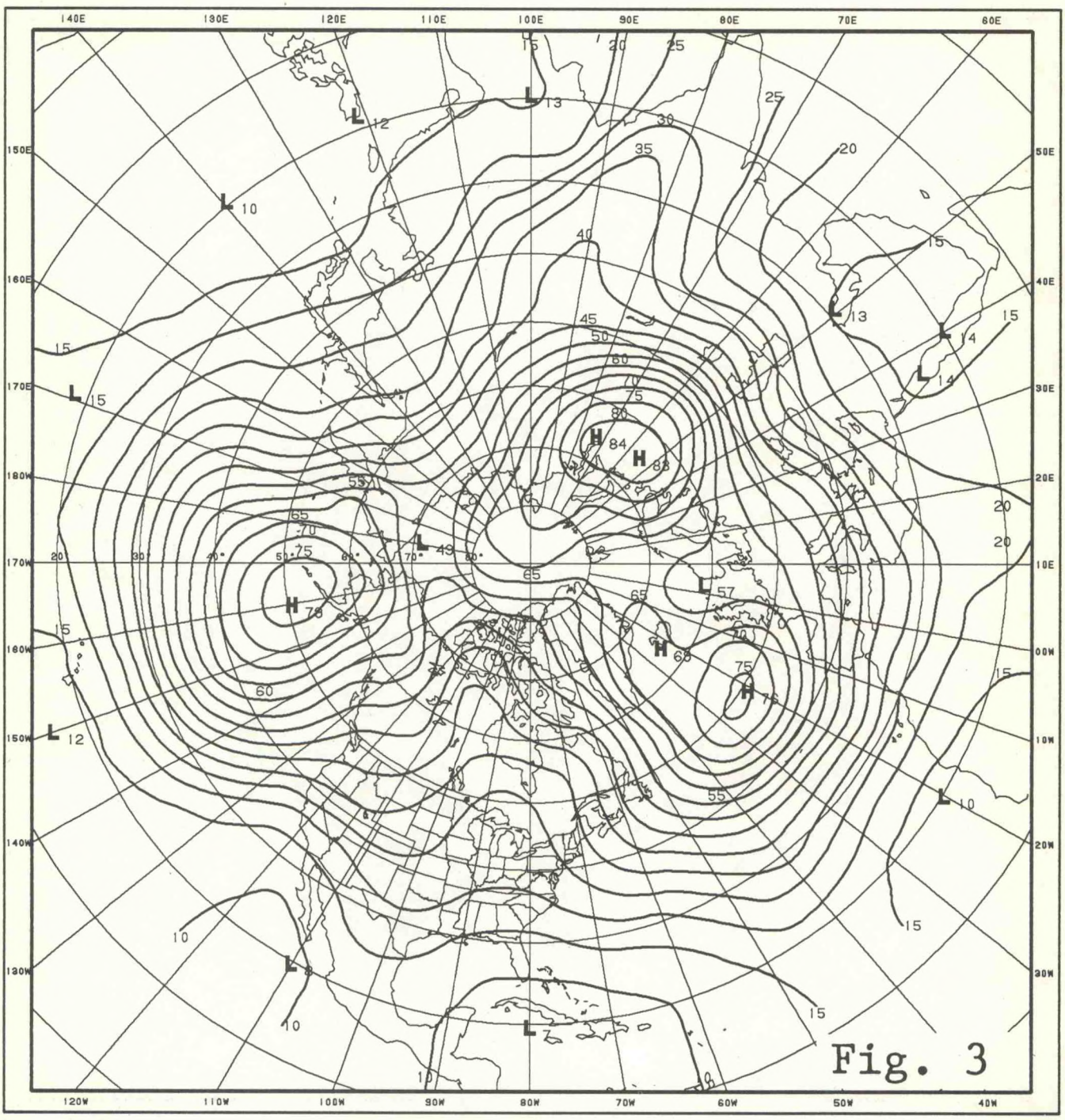
SEA LEVEL PRESSURE EDDY JANUARY
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



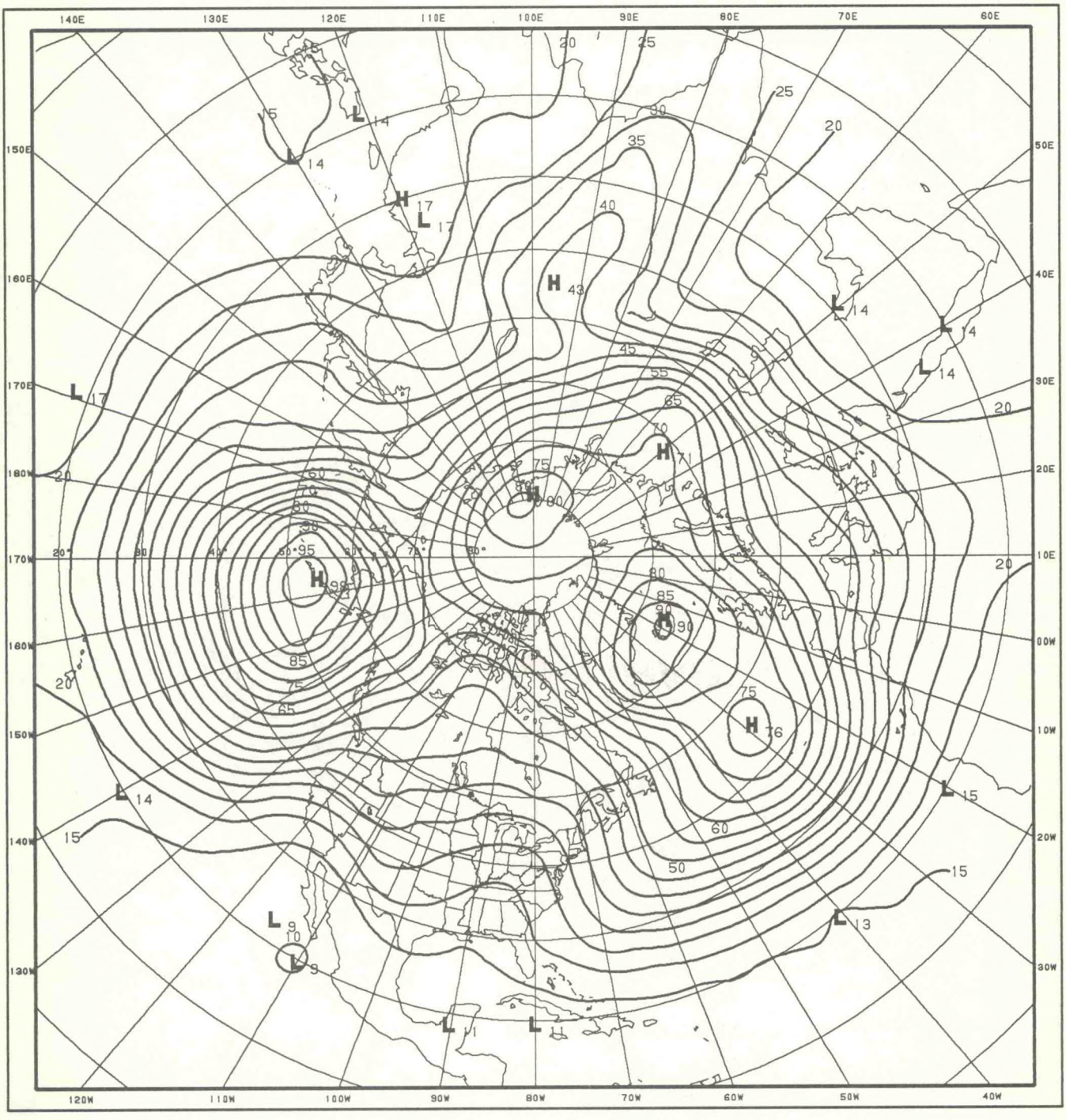
SEA LEVEL PRESSURE EDDY JULY
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



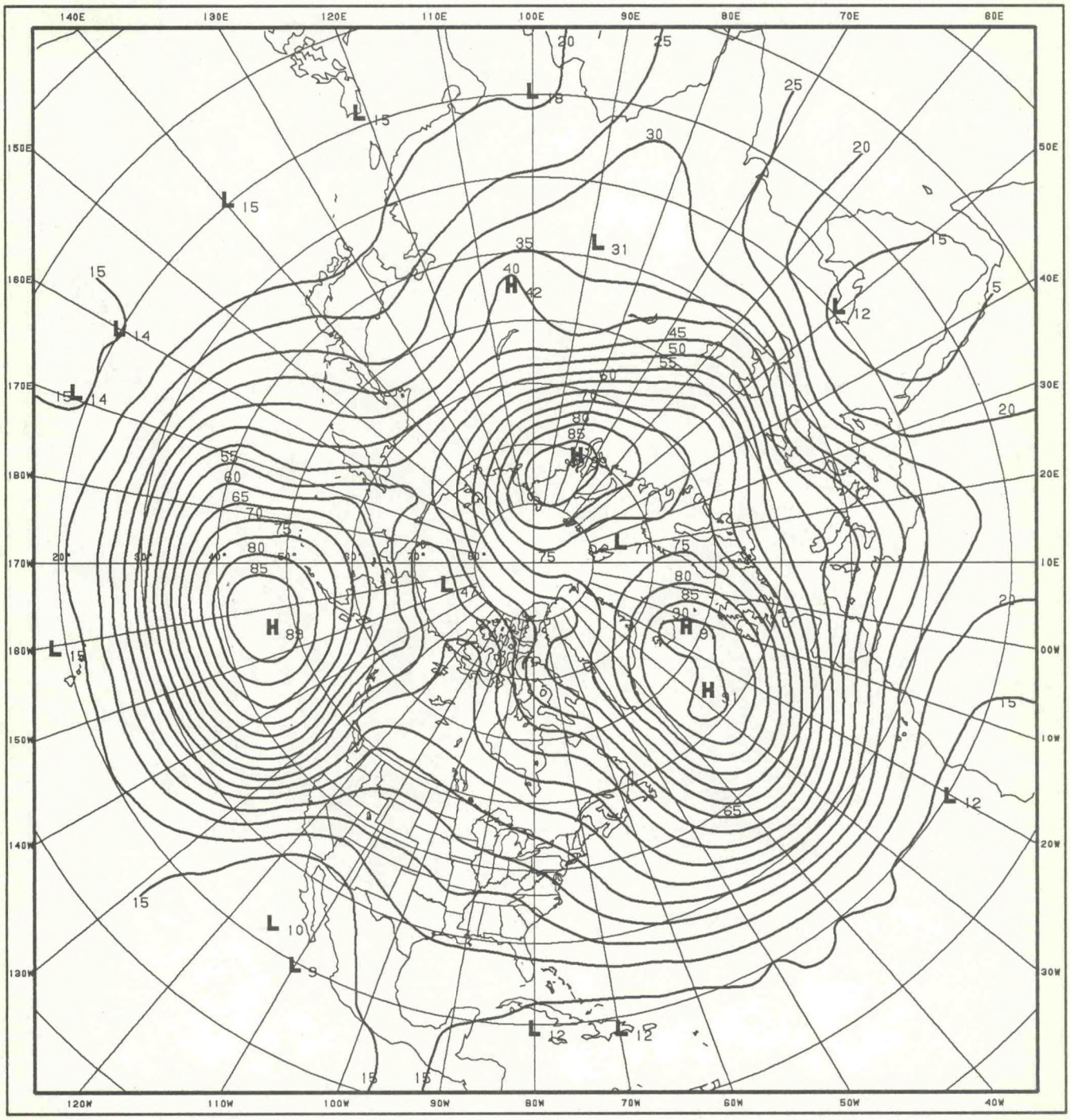
SEA LEVEL PRESSURE STAND DEV DECEMBER
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE STAND DEV JANUARY
1-MONTH MEAN UNPOOLED 1950-92

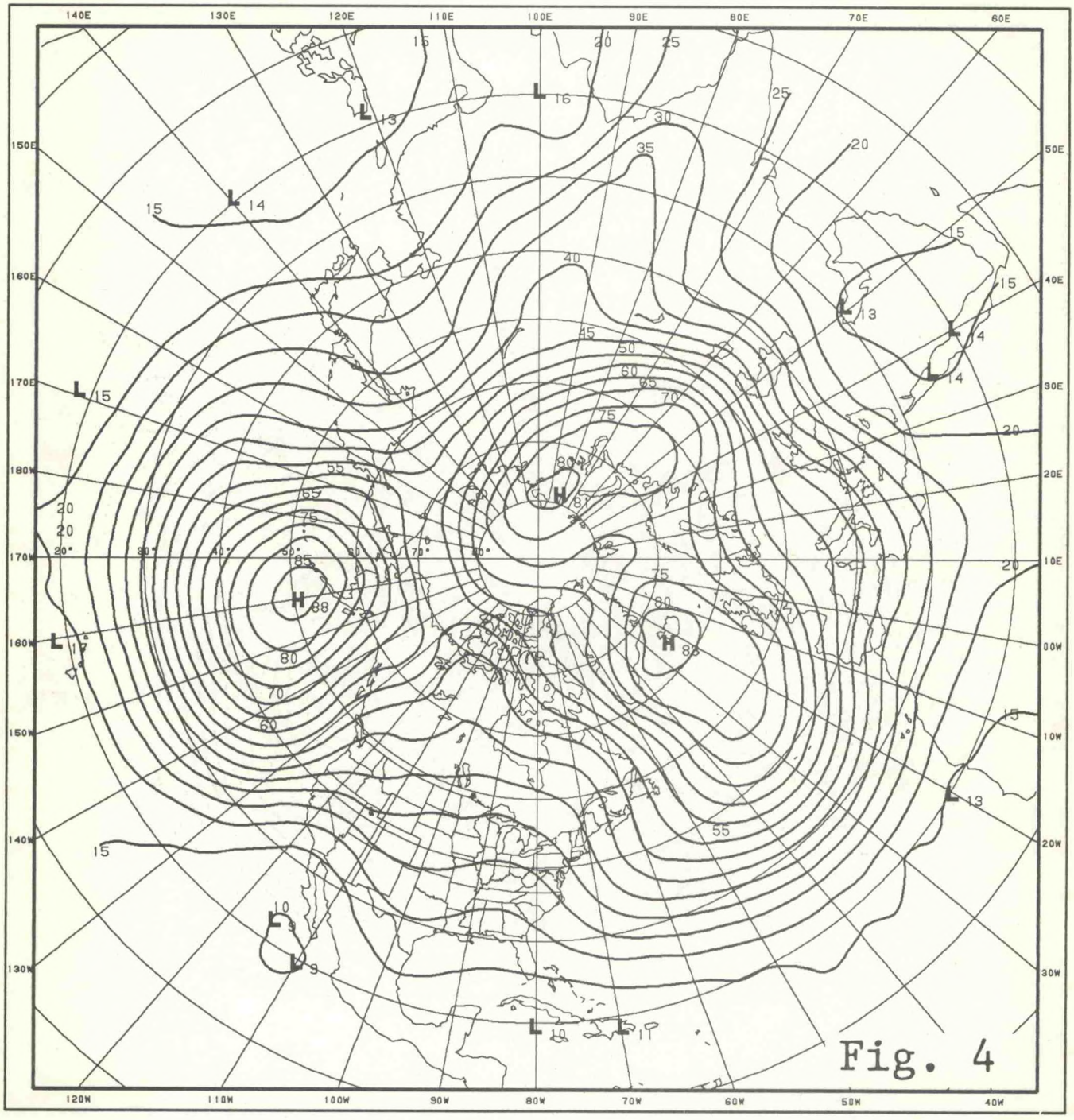
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE STAND DEV FEBRUARY

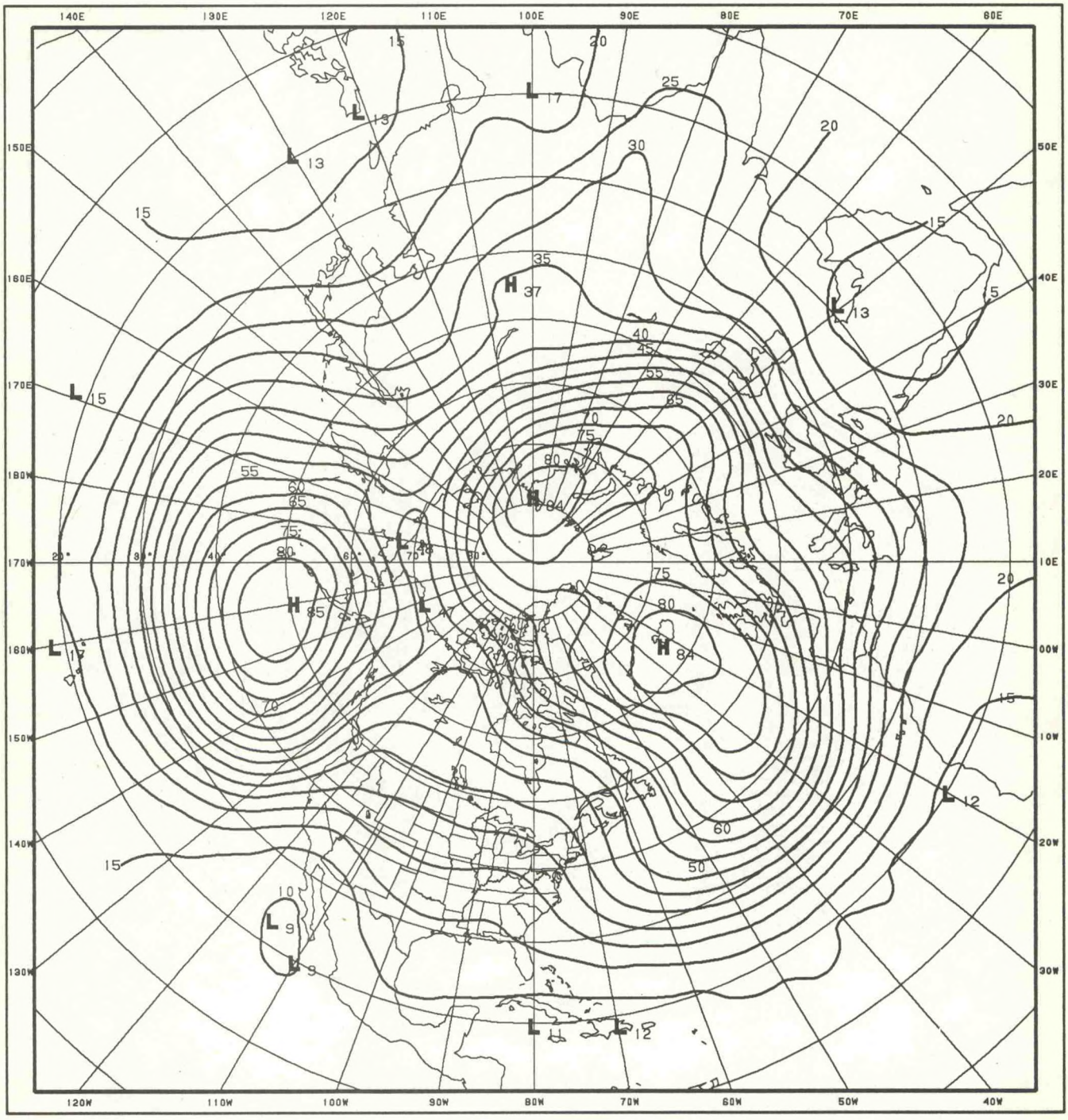
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



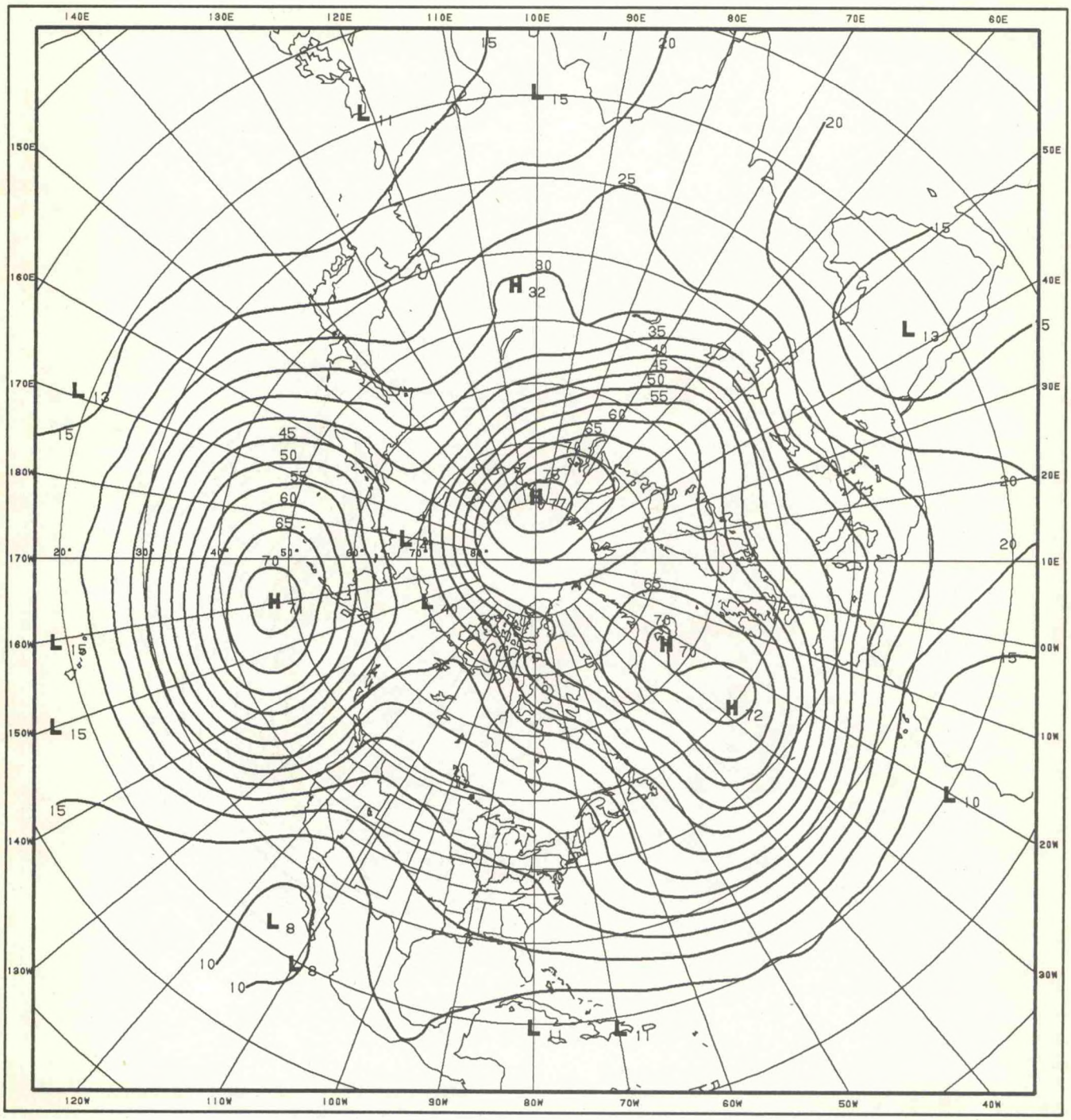
SEA LEVEL PRESSURE STAND DEV JANUARY
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



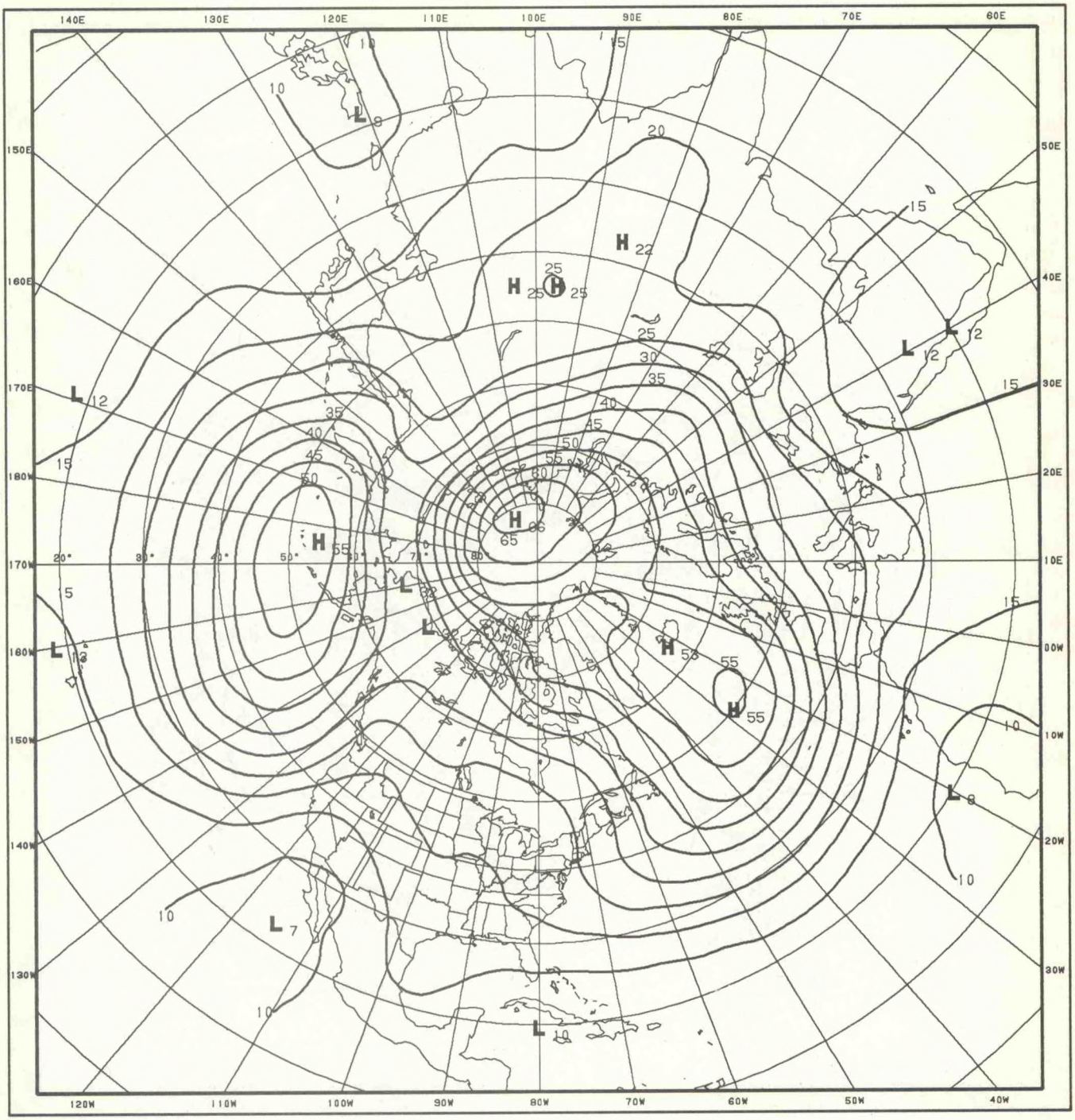
SEA LEVEL PRESSURE STAND DEV FEBRUARY
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



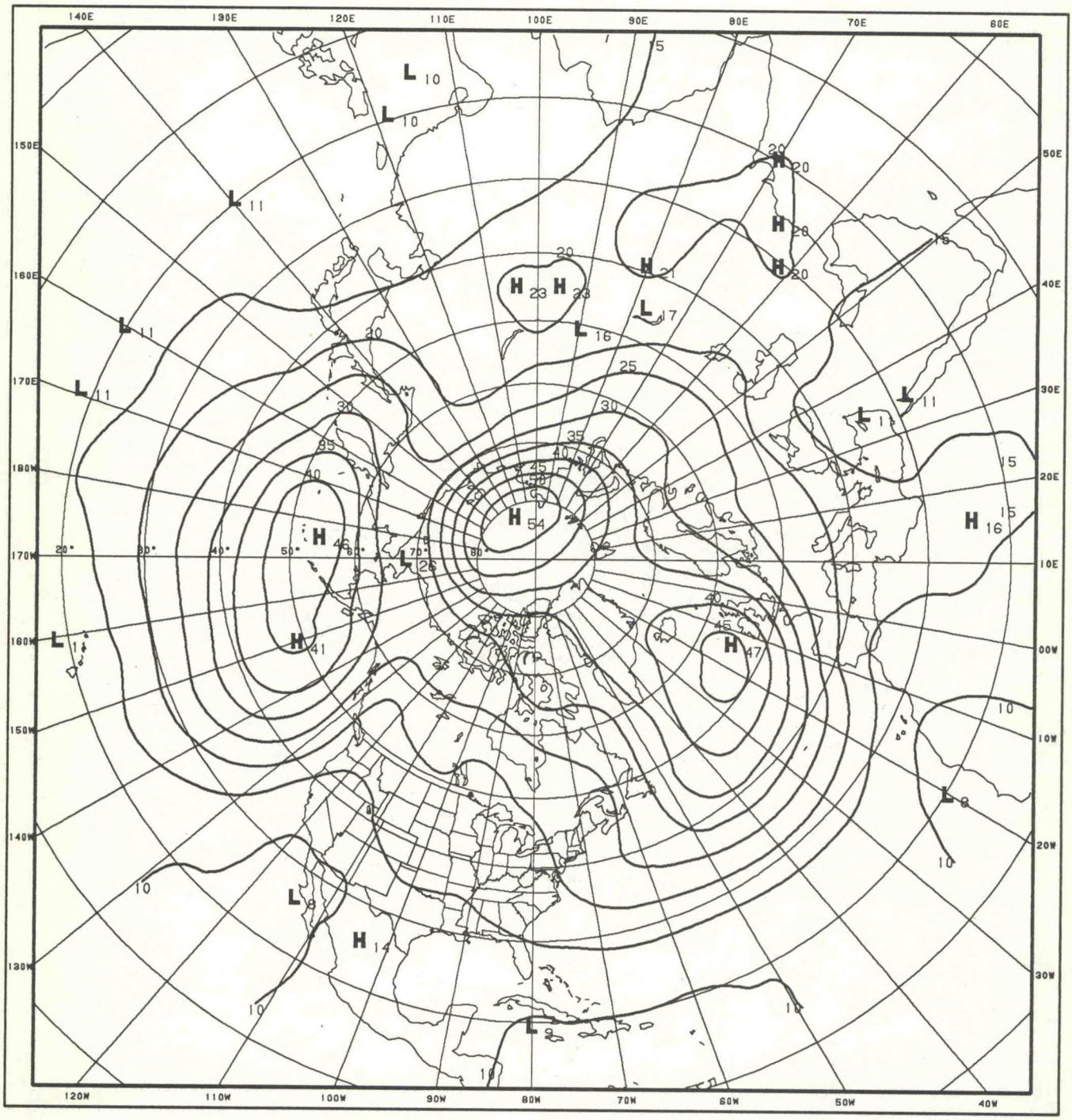
SEA LEVEL PRESSURE STAND DEV MARCH
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE STAND DEV APRIL
1-MONTH MEAN POOLED 1950-92

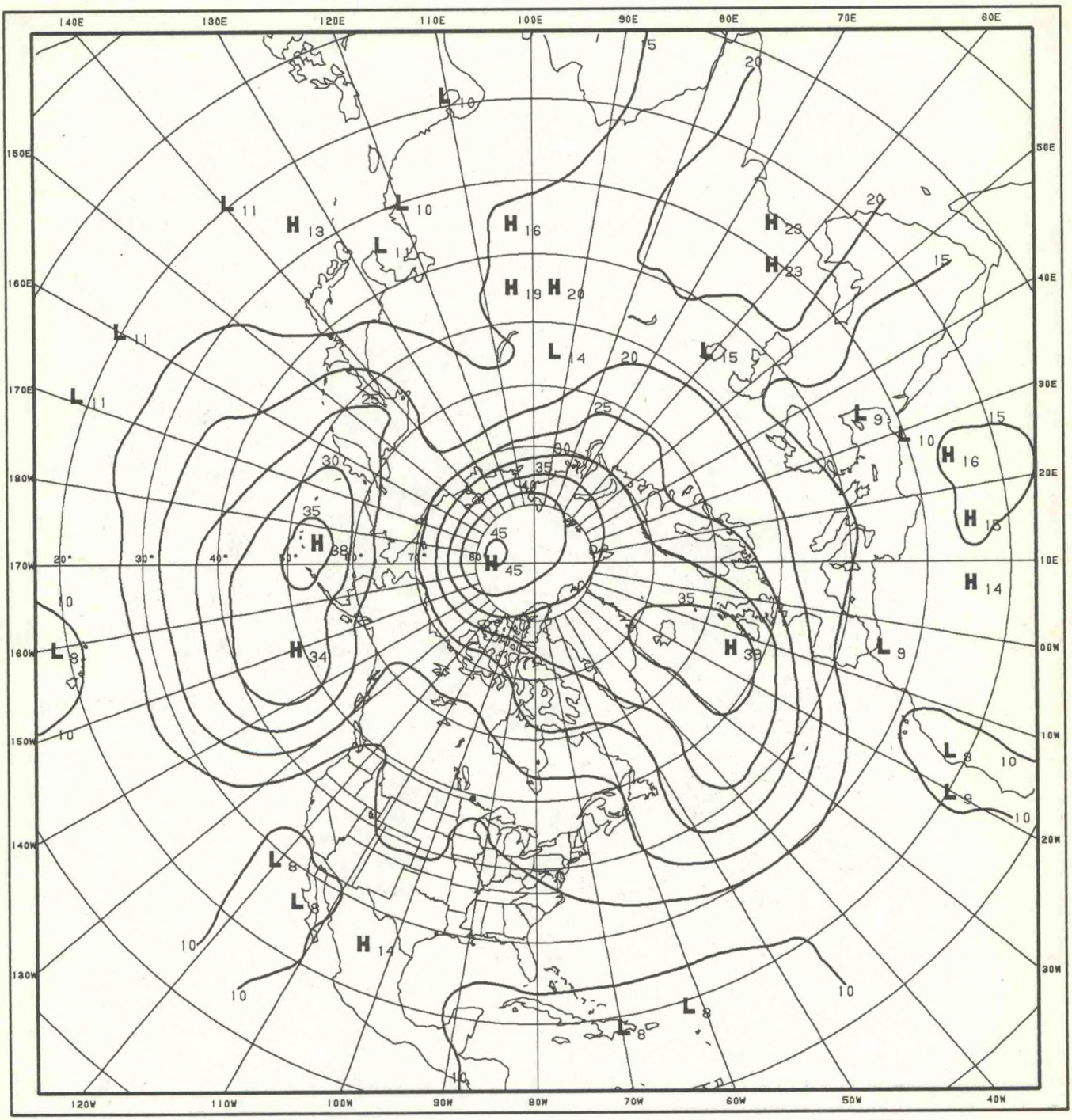
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE STAND DEV MAY

1-MONTH MEAN POOLED 1950-92

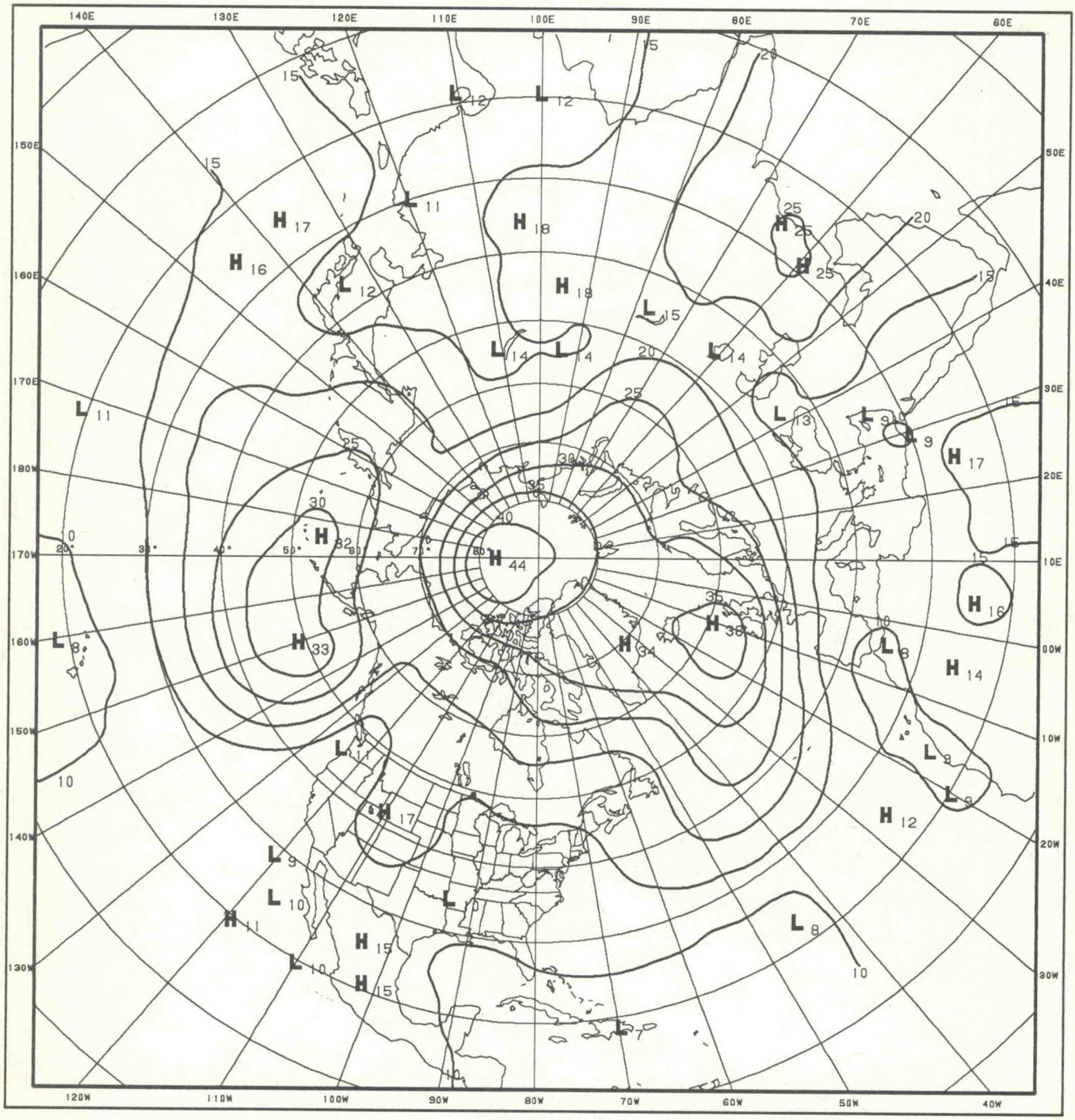
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE STAND DEV JUNE

1-MONTH MEAN POOLED 1950-92

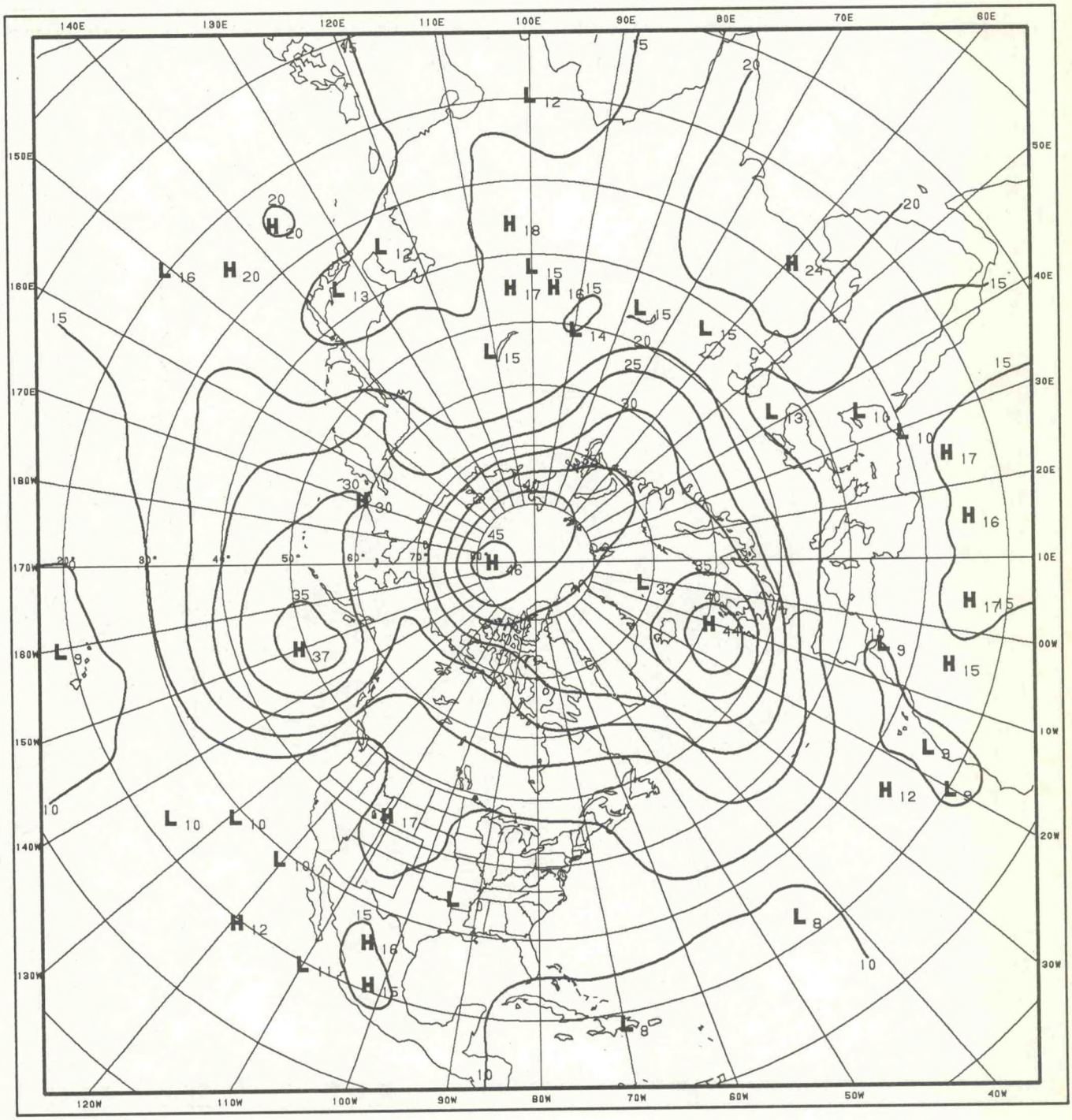
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE STAND DEV JULY

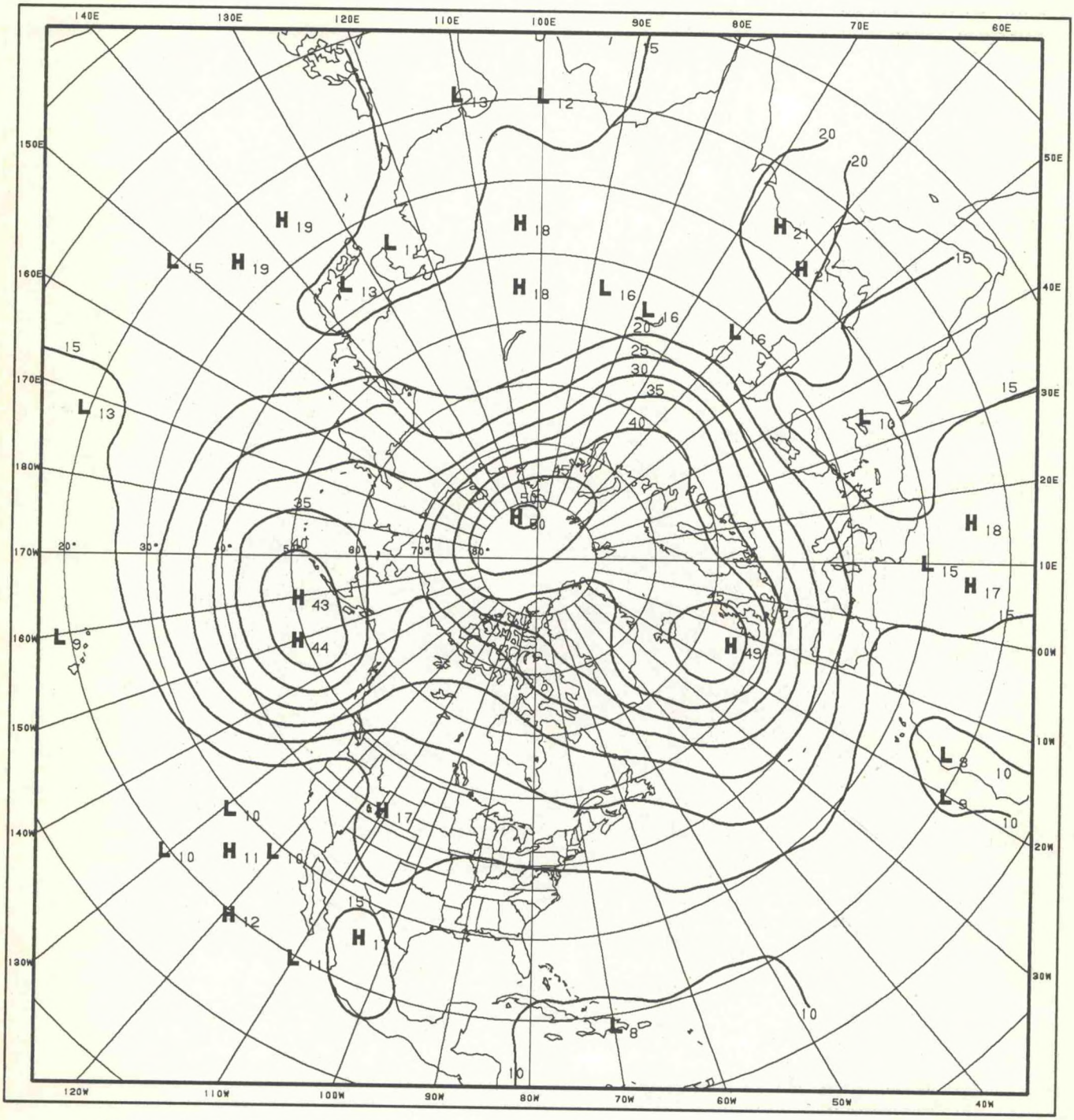
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



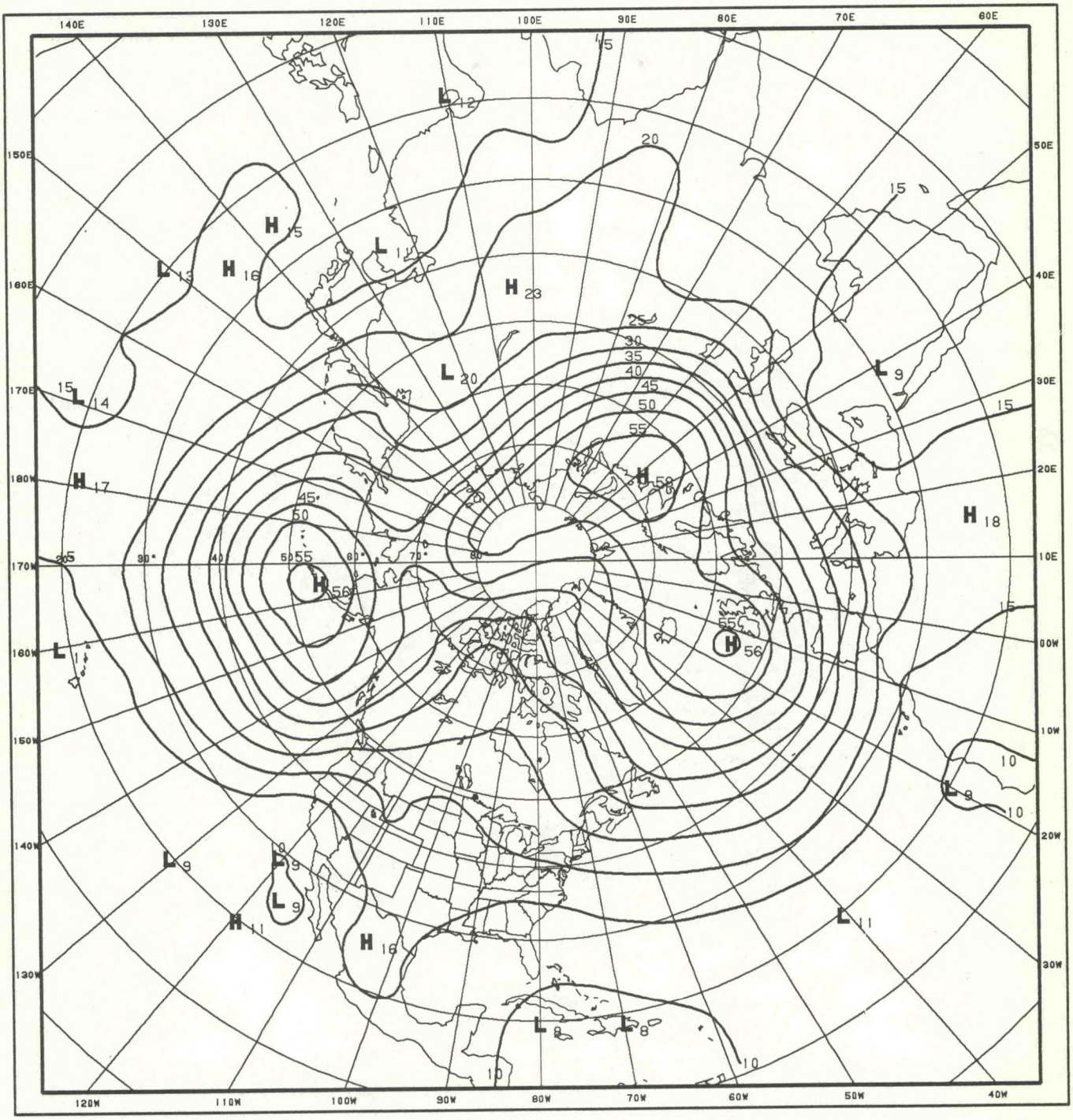
SEA LEVEL PRESSURE STAND DEV AUGUST
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE STAND DEV SEPTEMBR
1-MONTH MEAN POOLED 1950-92

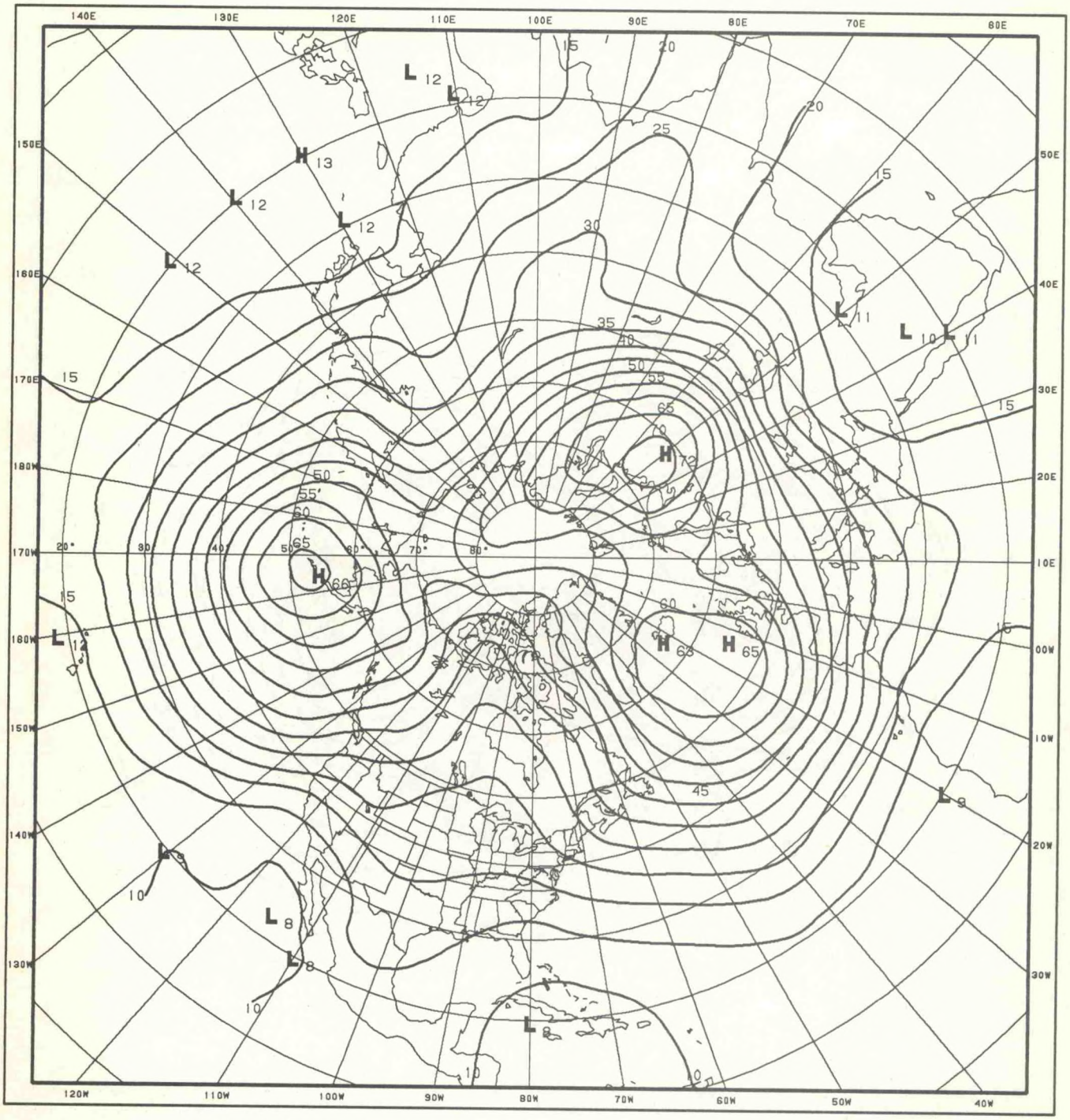
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE STAND DEV OCTOBER

1-MONTH MEAN POOLED 1950-92

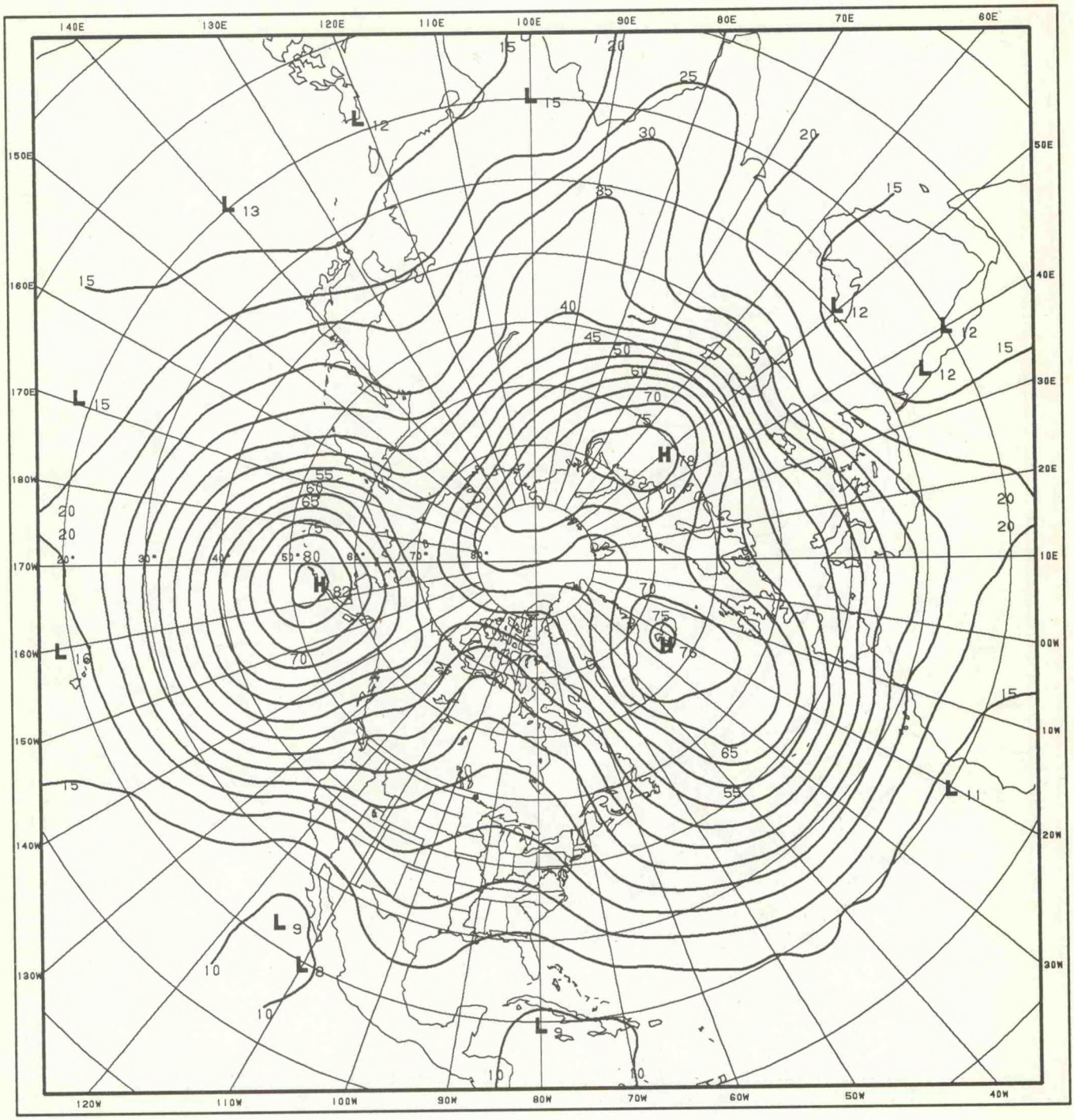
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE STAND DEV NOVEMBER

1-MONTH MEAN POOLED 1950-92

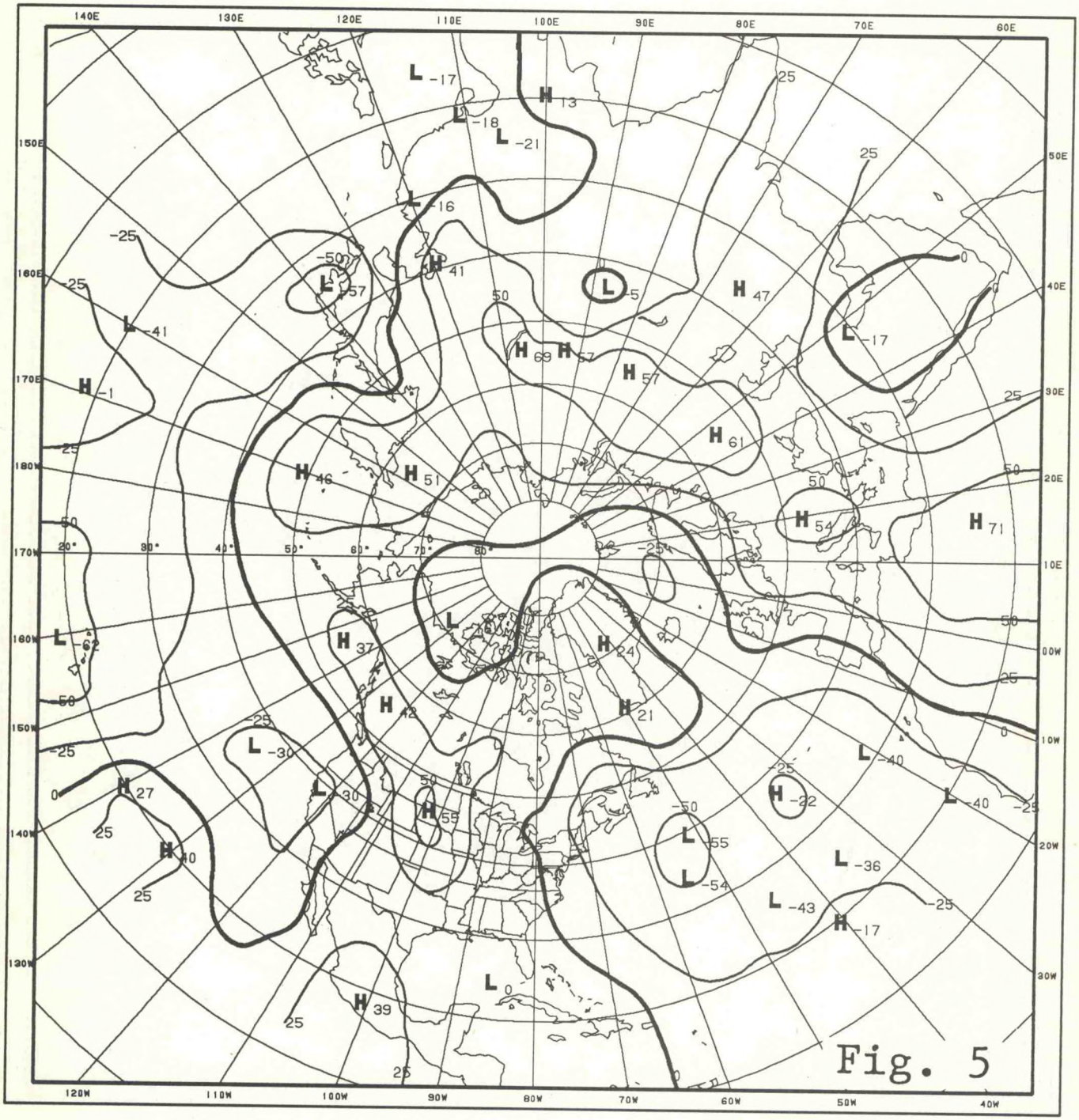
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE STAND DEV DECEMBER

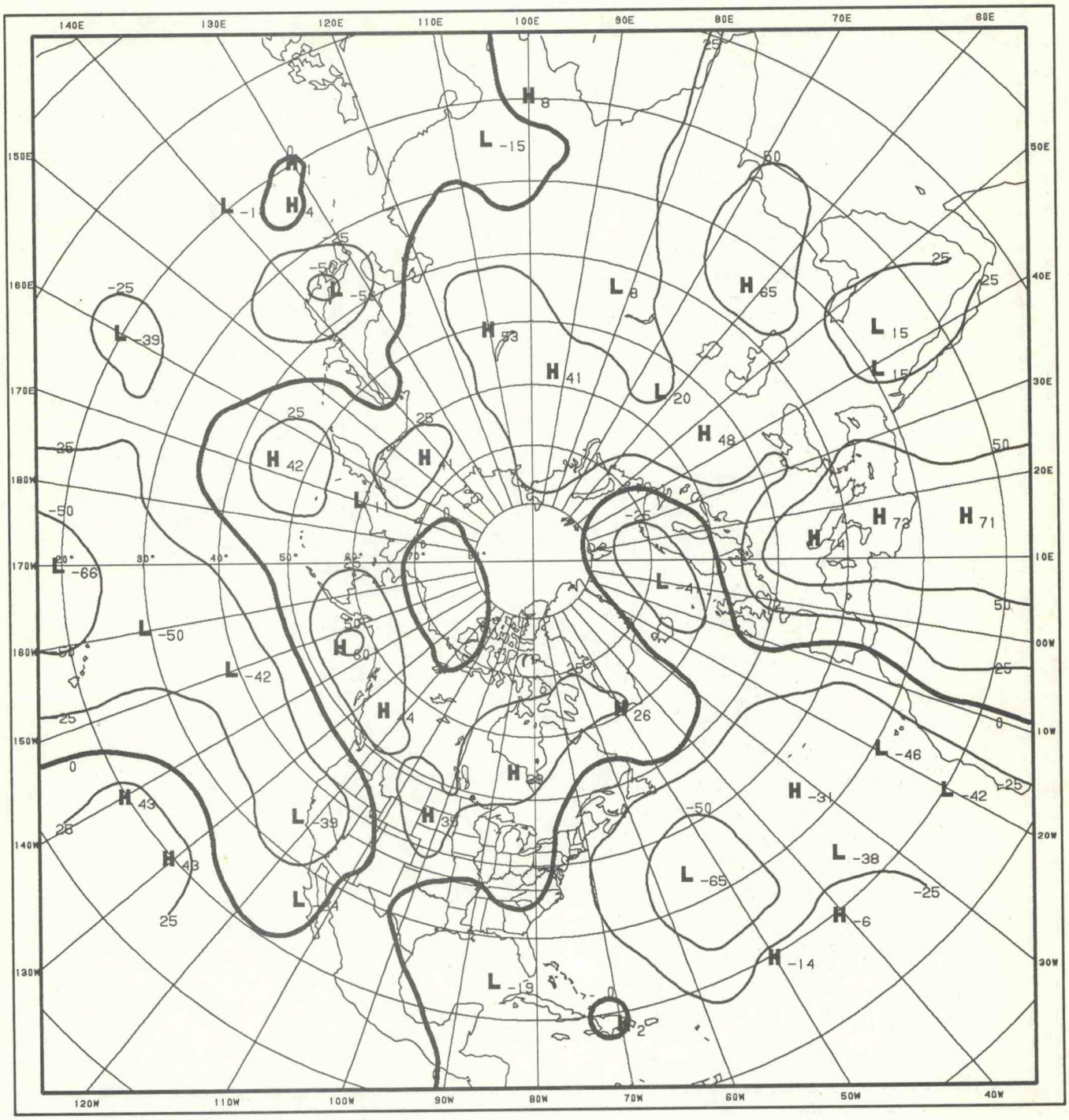
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



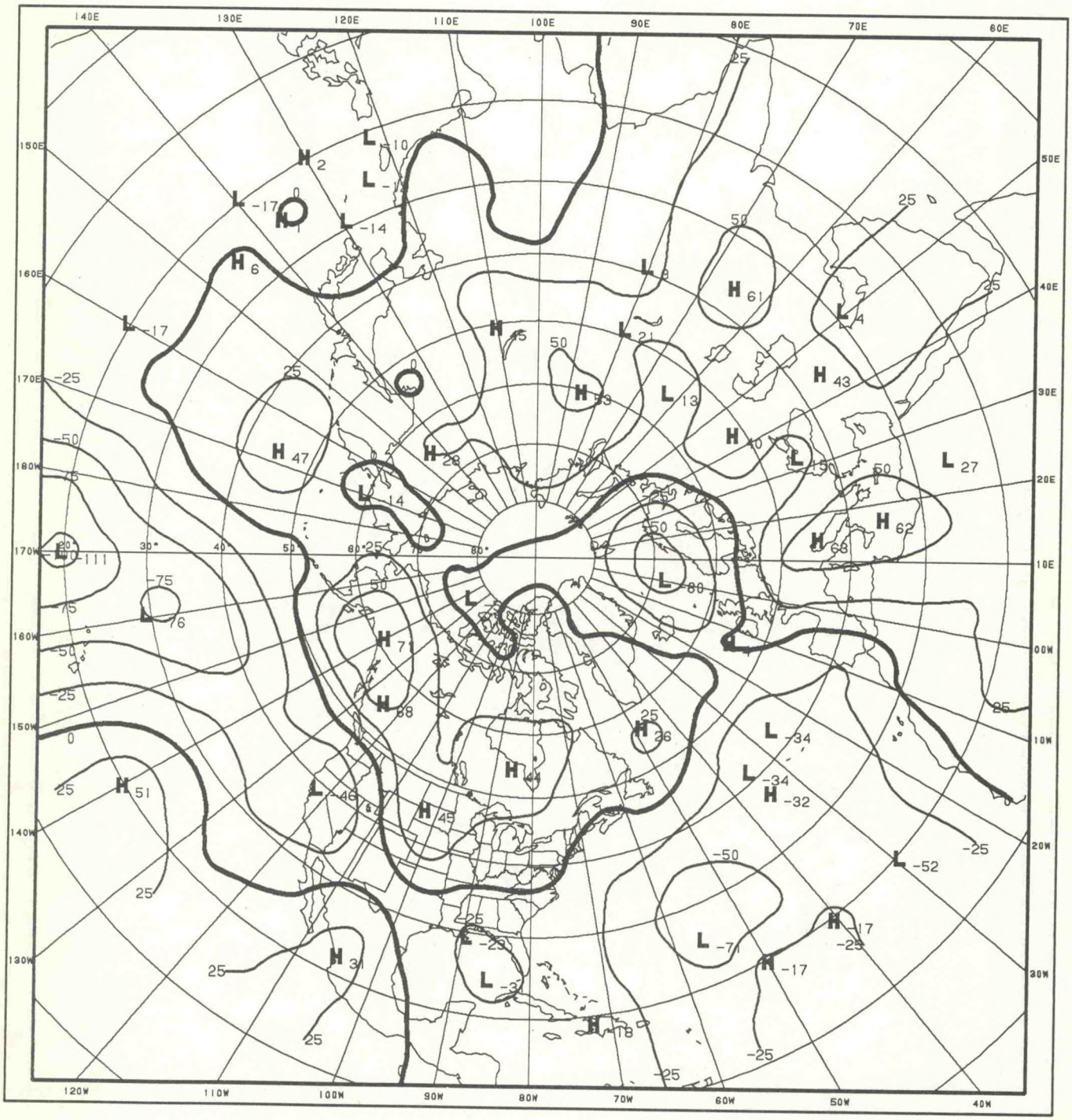
SEA LEVEL PRESSURE SKEW JANUARY
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE SKEW FEBRUARY
1-MONTH MEAN POOLED 1950-92

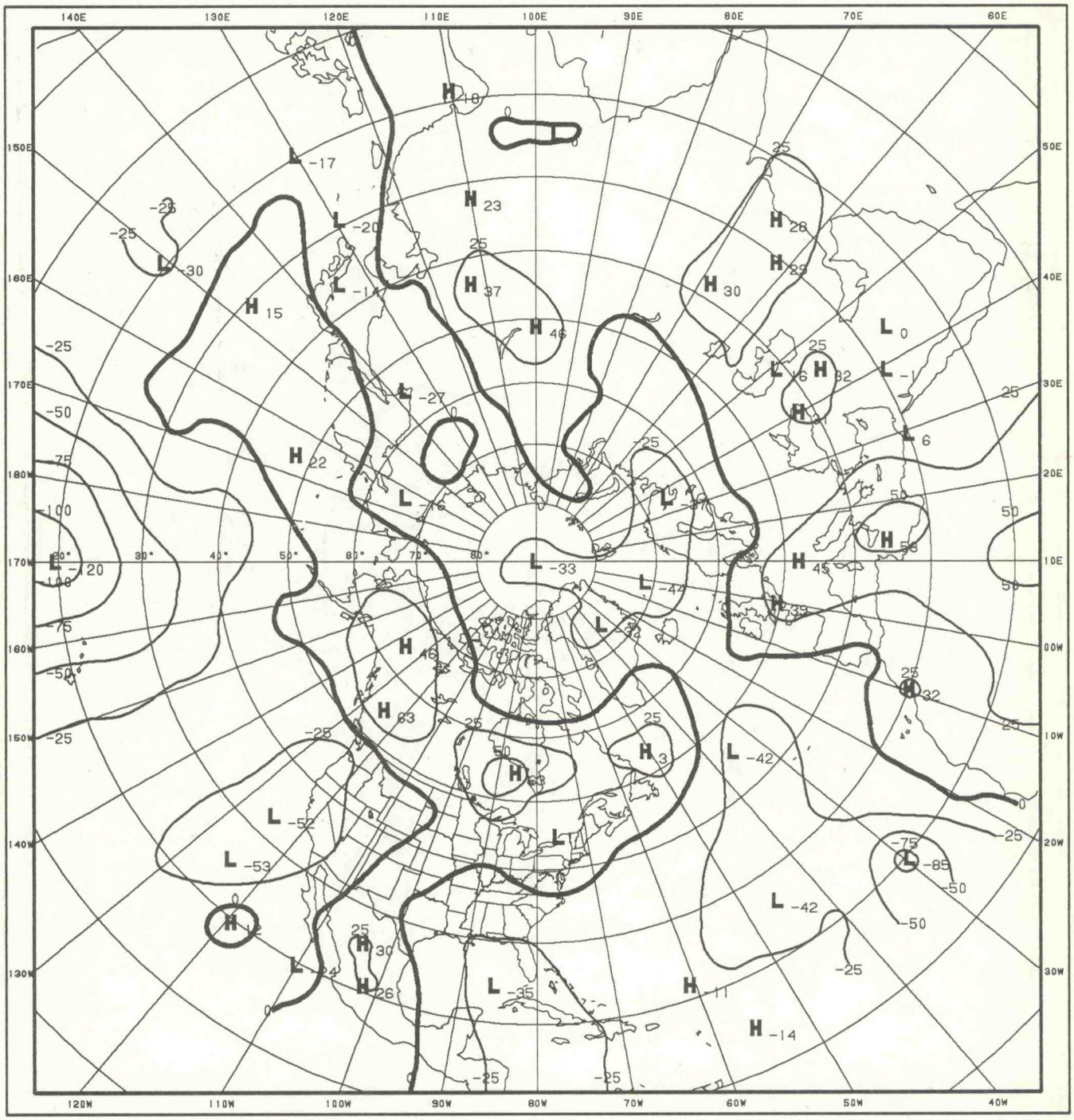
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE SKEW MARCH

1-MONTH MEAN POOLED 1950-92

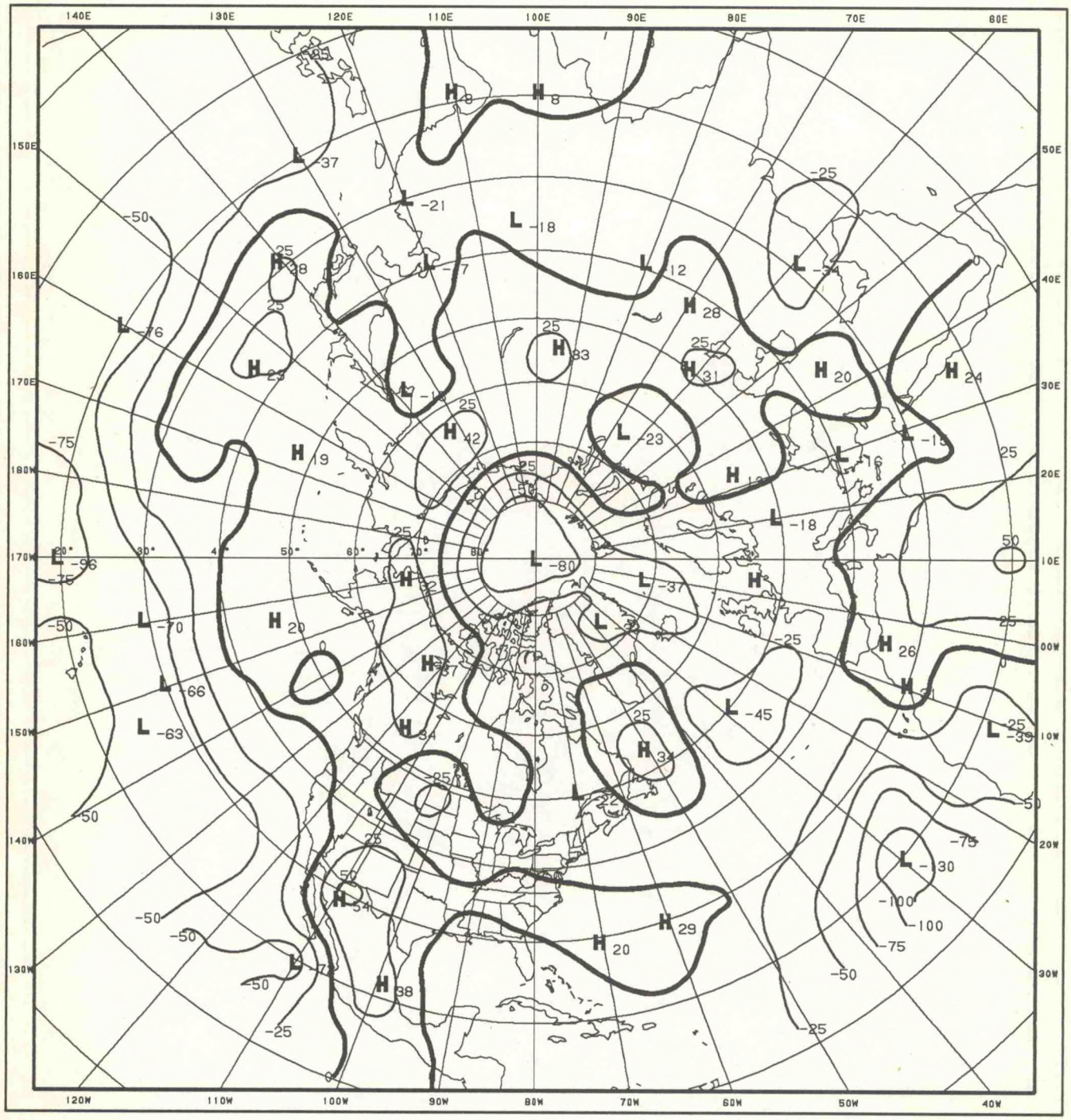
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE SKEW APRIL

1-MONTH MEAN POOLED 1950-92

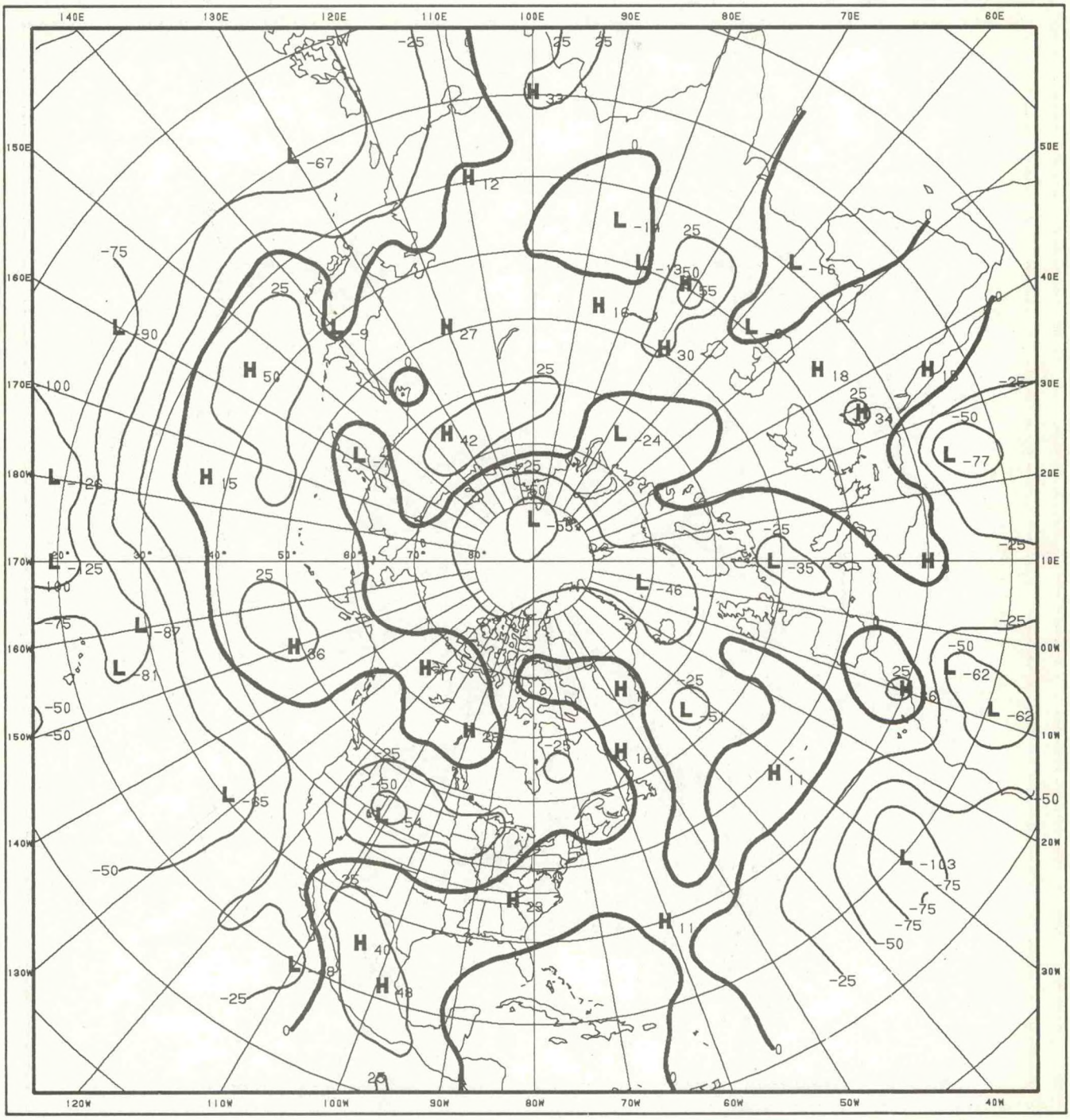
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE SKEW MAY

1-MONTH MEAN POOLED 1950-92

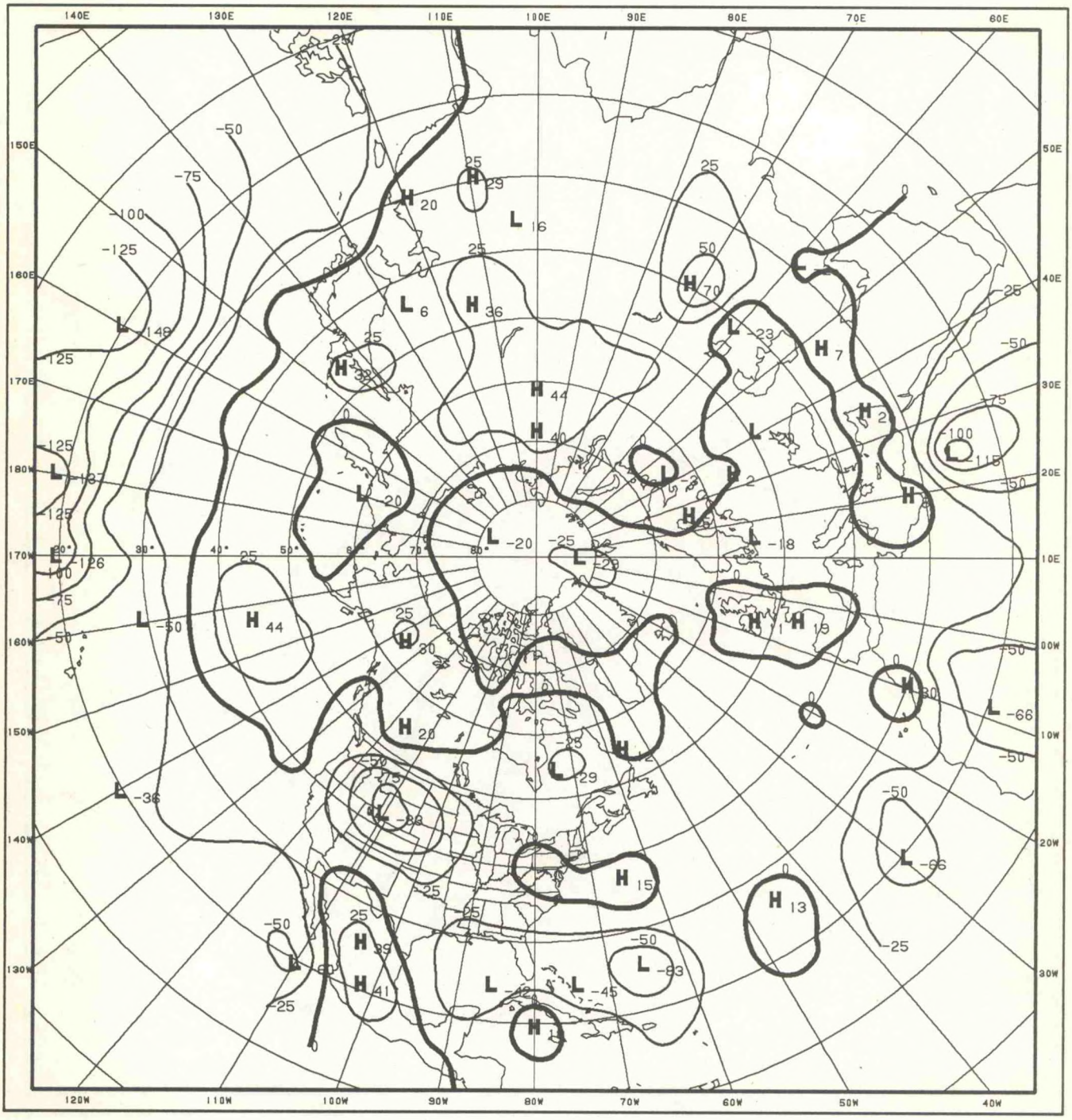
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE SKEW JUNE

1-MONTH MEAN POOLED 1950-92

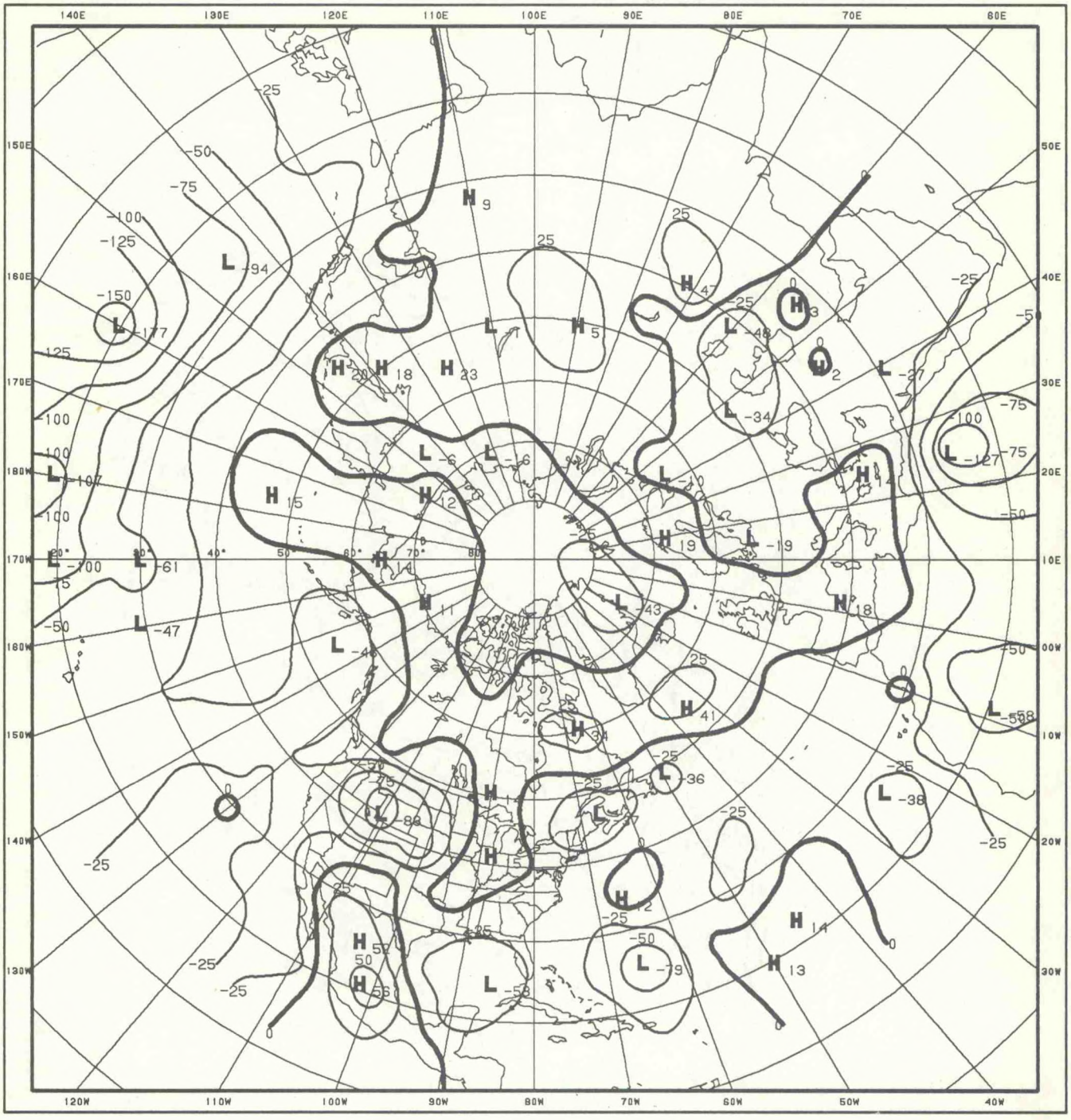
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE SKEW JULY

1-MONTH MEAN POOLED 1950-92

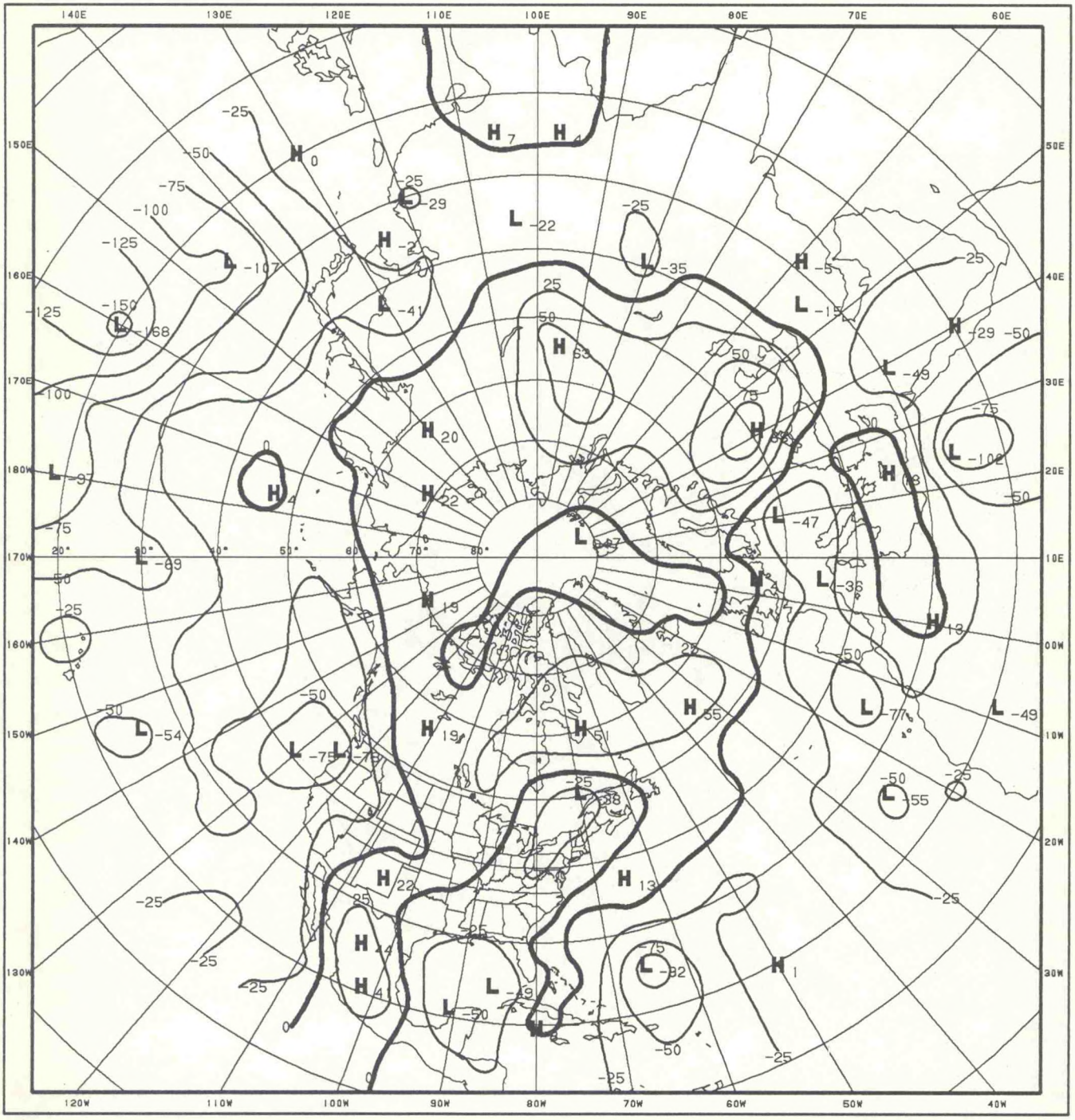
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE SKEW AUGUST

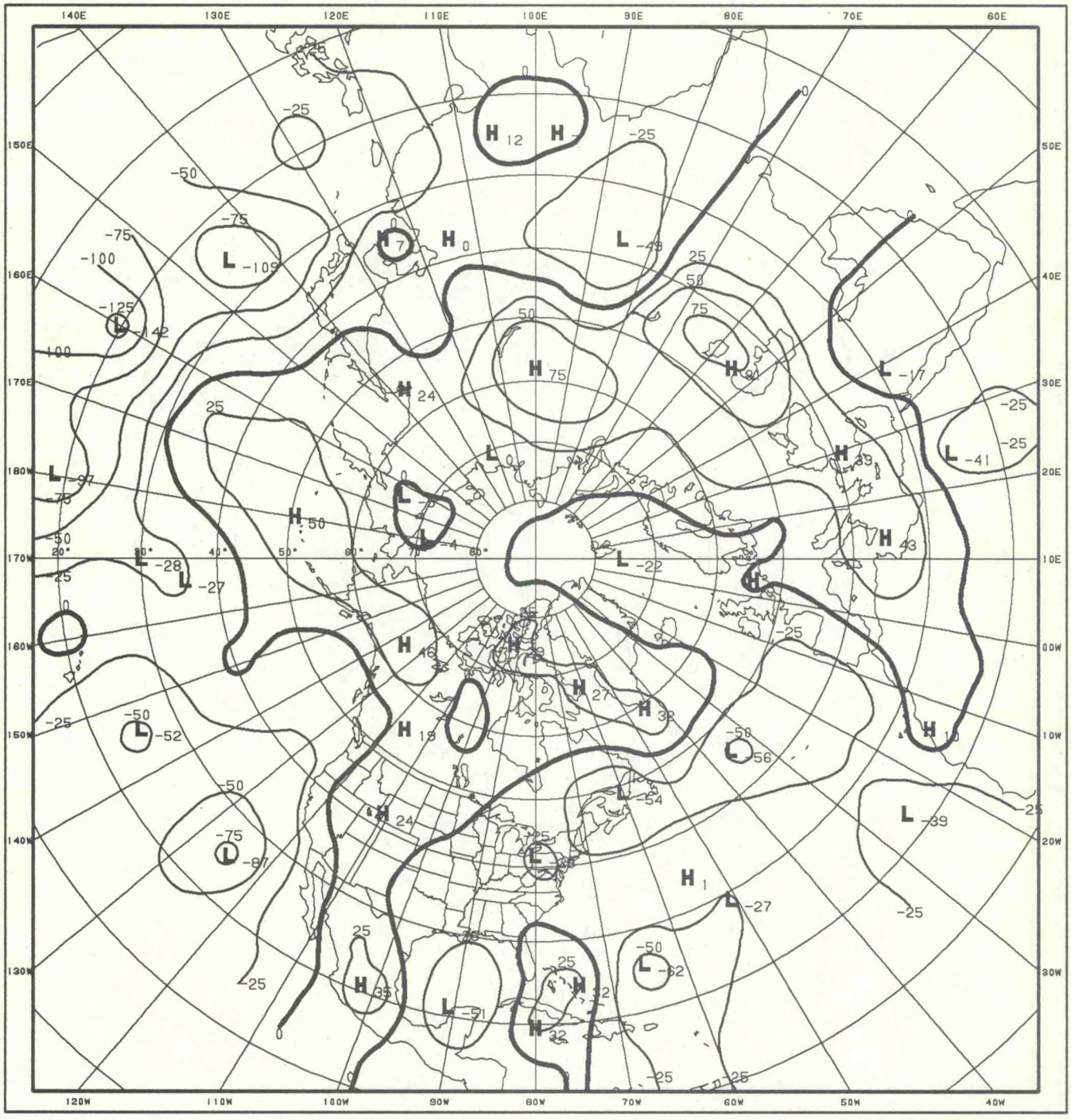
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



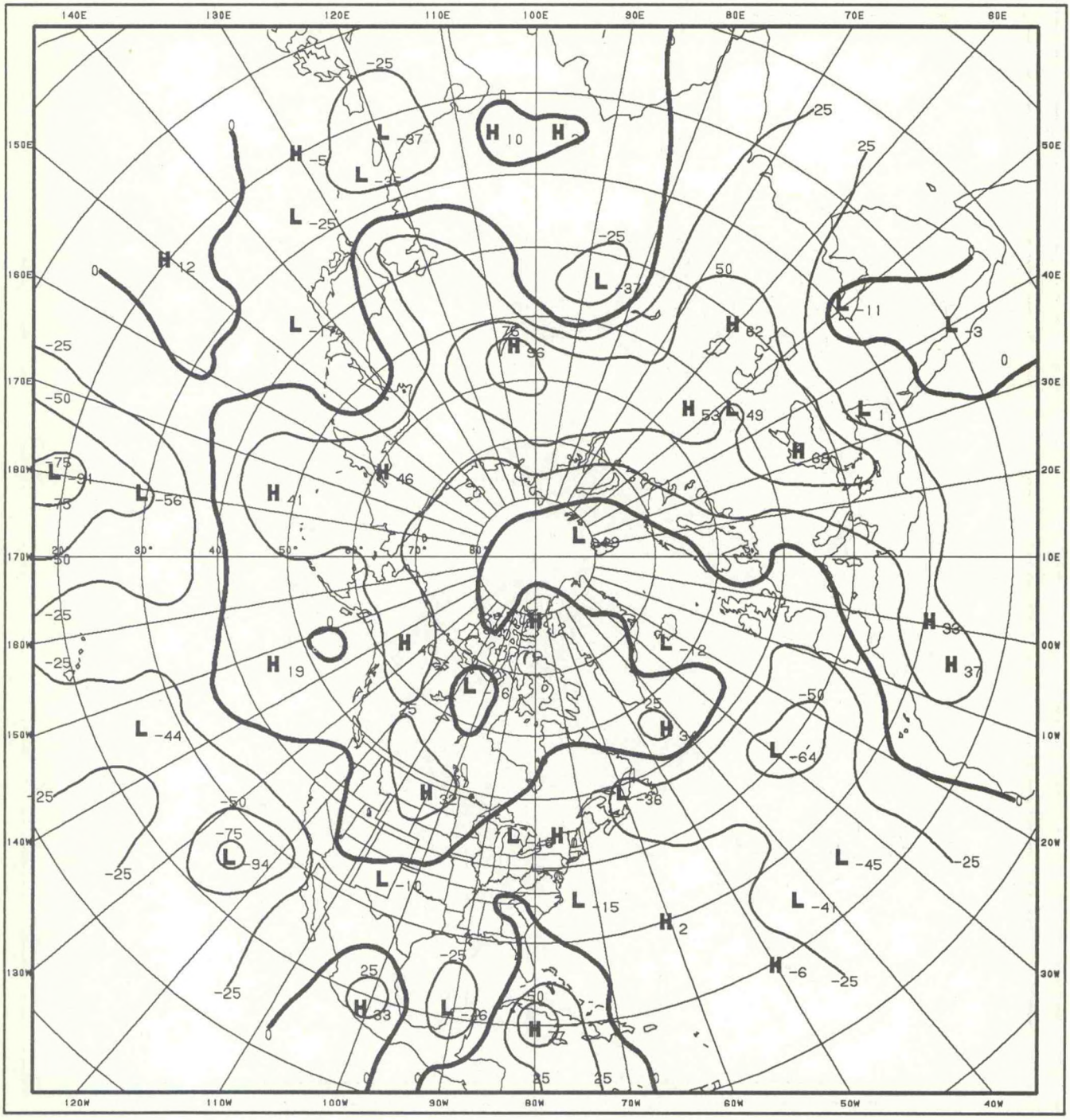
SEA LEVEL PRESSURE SKEW SEPTEMBR
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



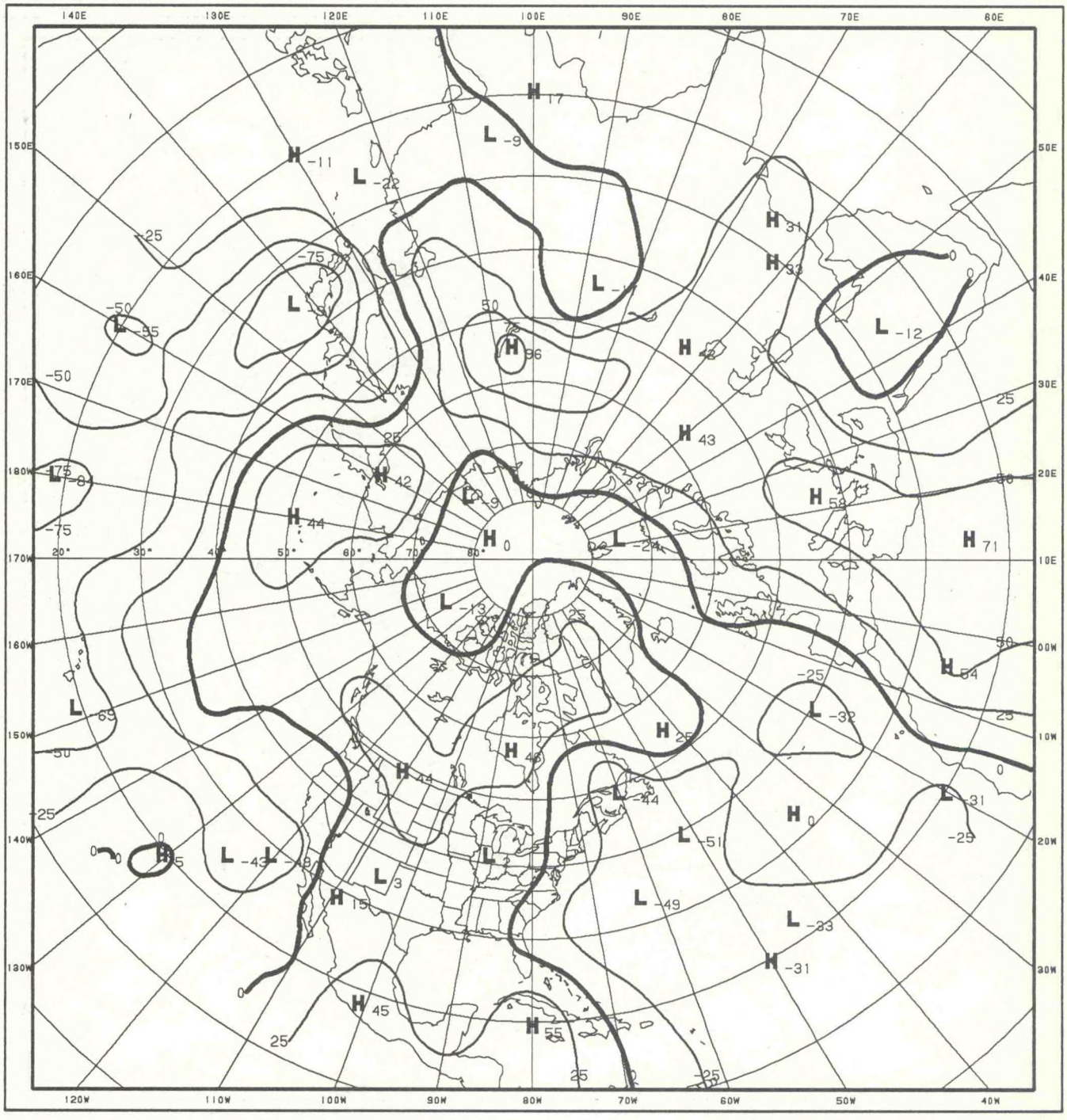
SEA LEVEL PRESSURE SKEW OCTOBER
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE SKEW NOVEMBER
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE SKEW DECEMBER
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS

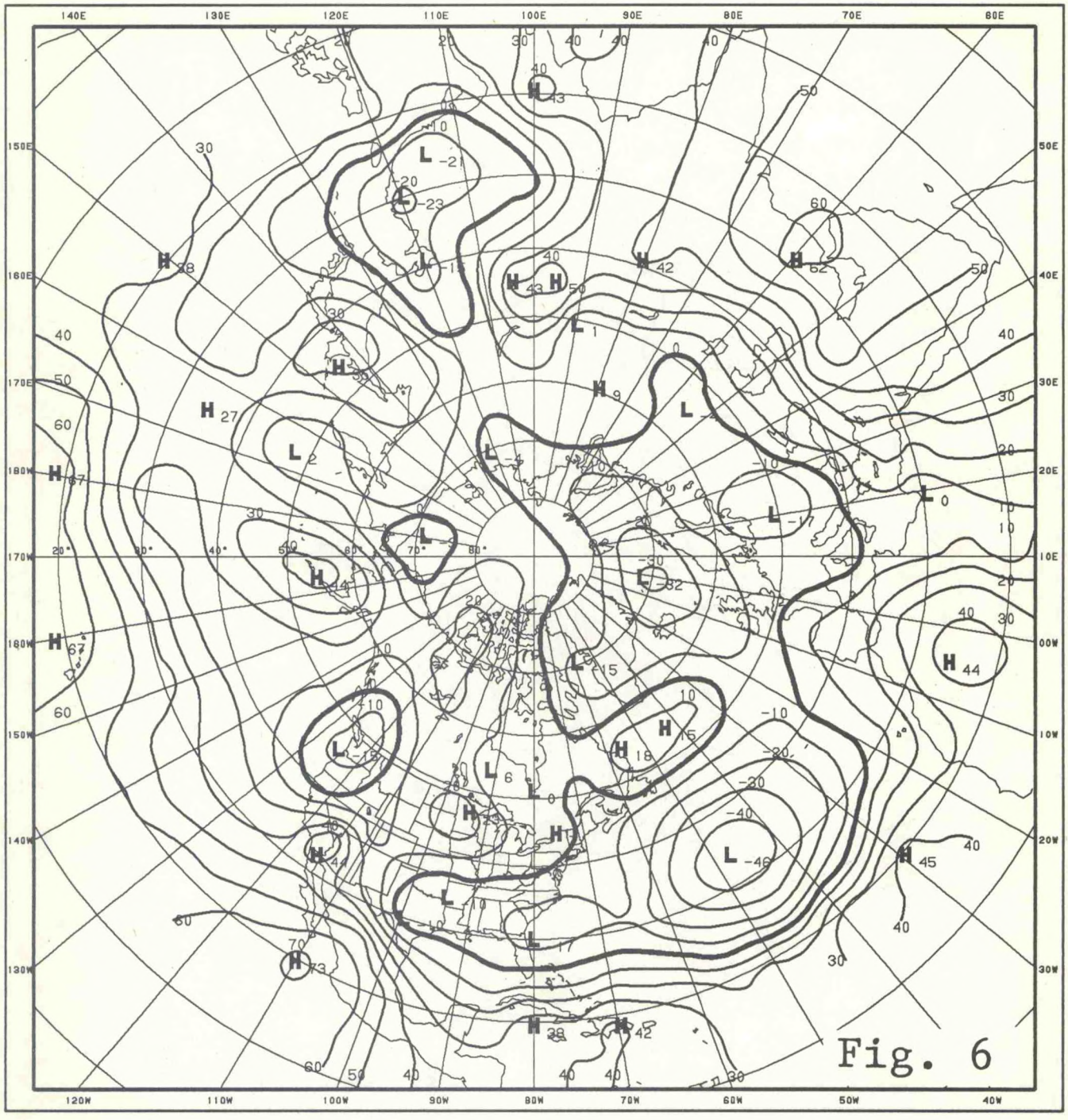
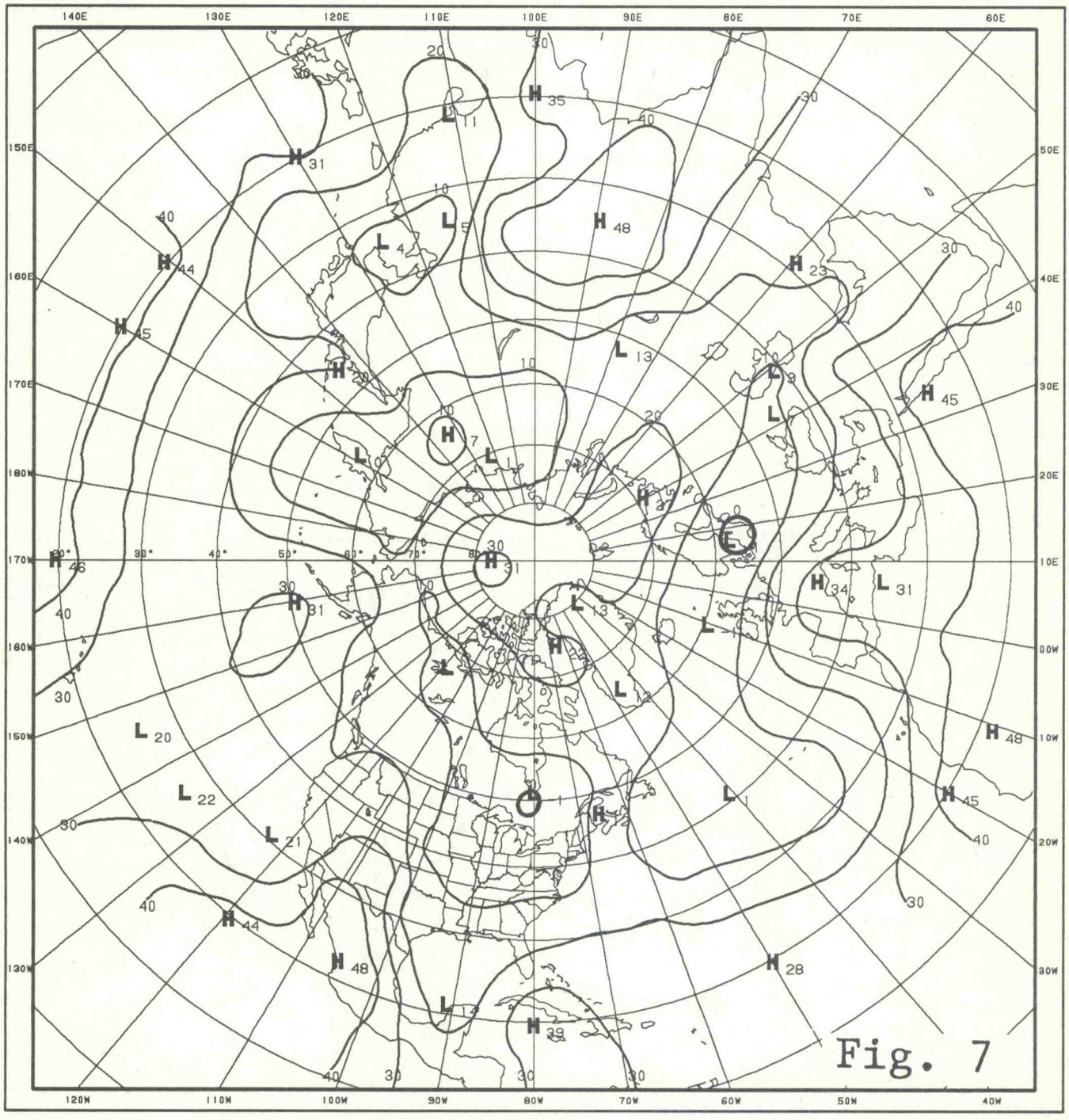


Fig. 6

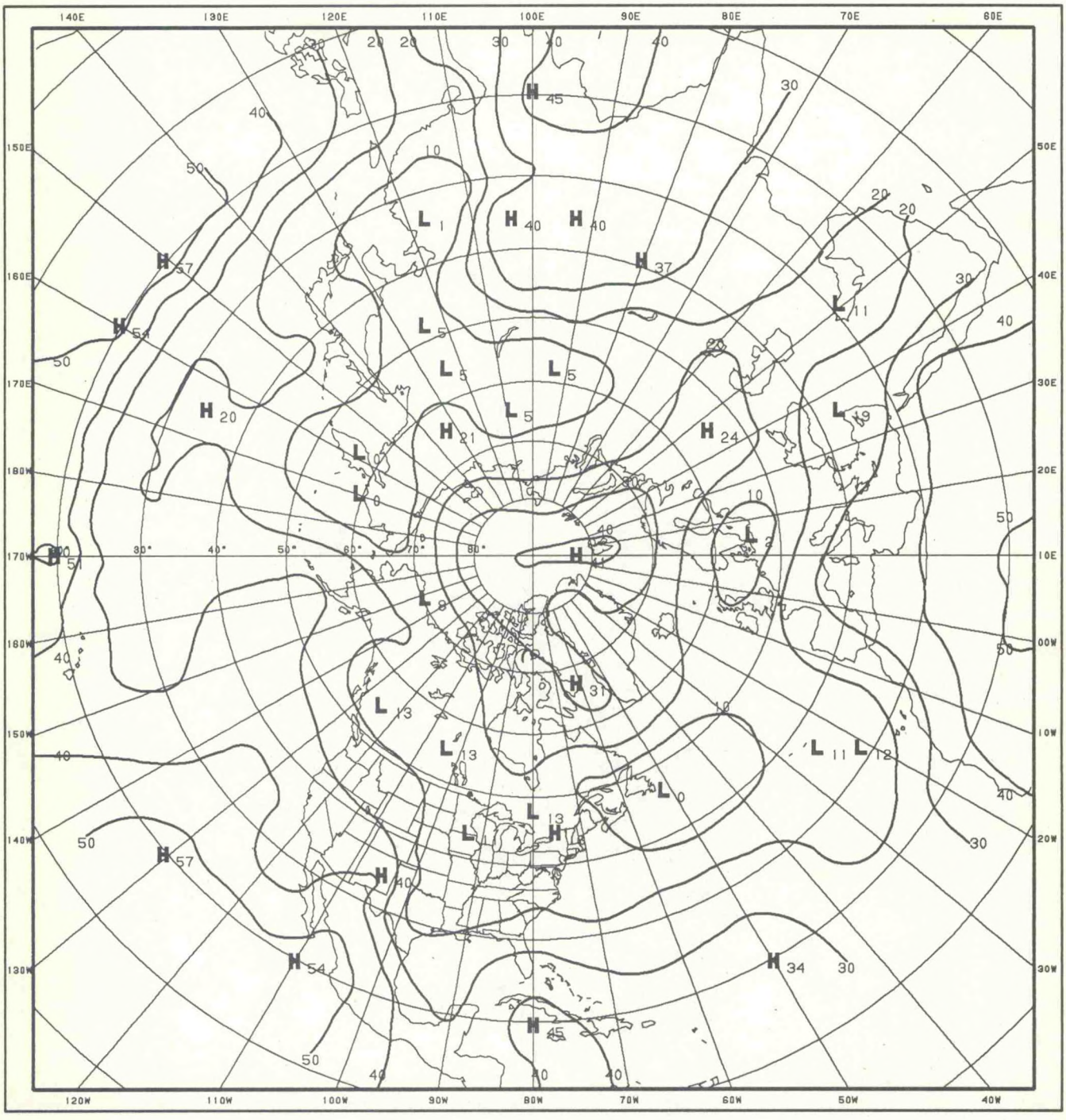
SEA LEVEL PRESSURE AUTOCORREL APR-MAY
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



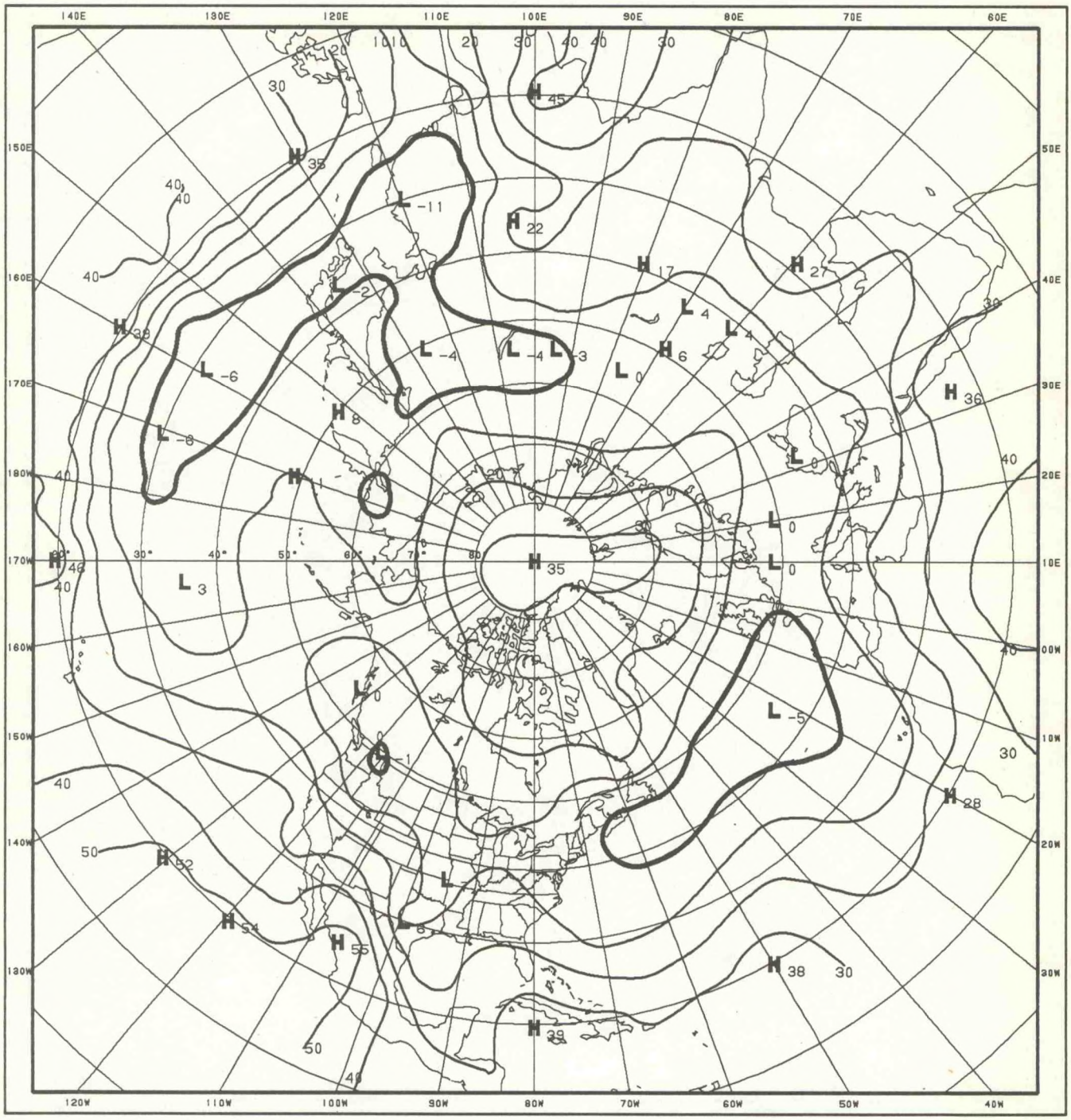
SEA LEVEL PRESSURE AUTOCORREL DEC-JAN
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE AUTOCORREL JAN-FEB
1-MONTH MEAN POOLED 1950-92

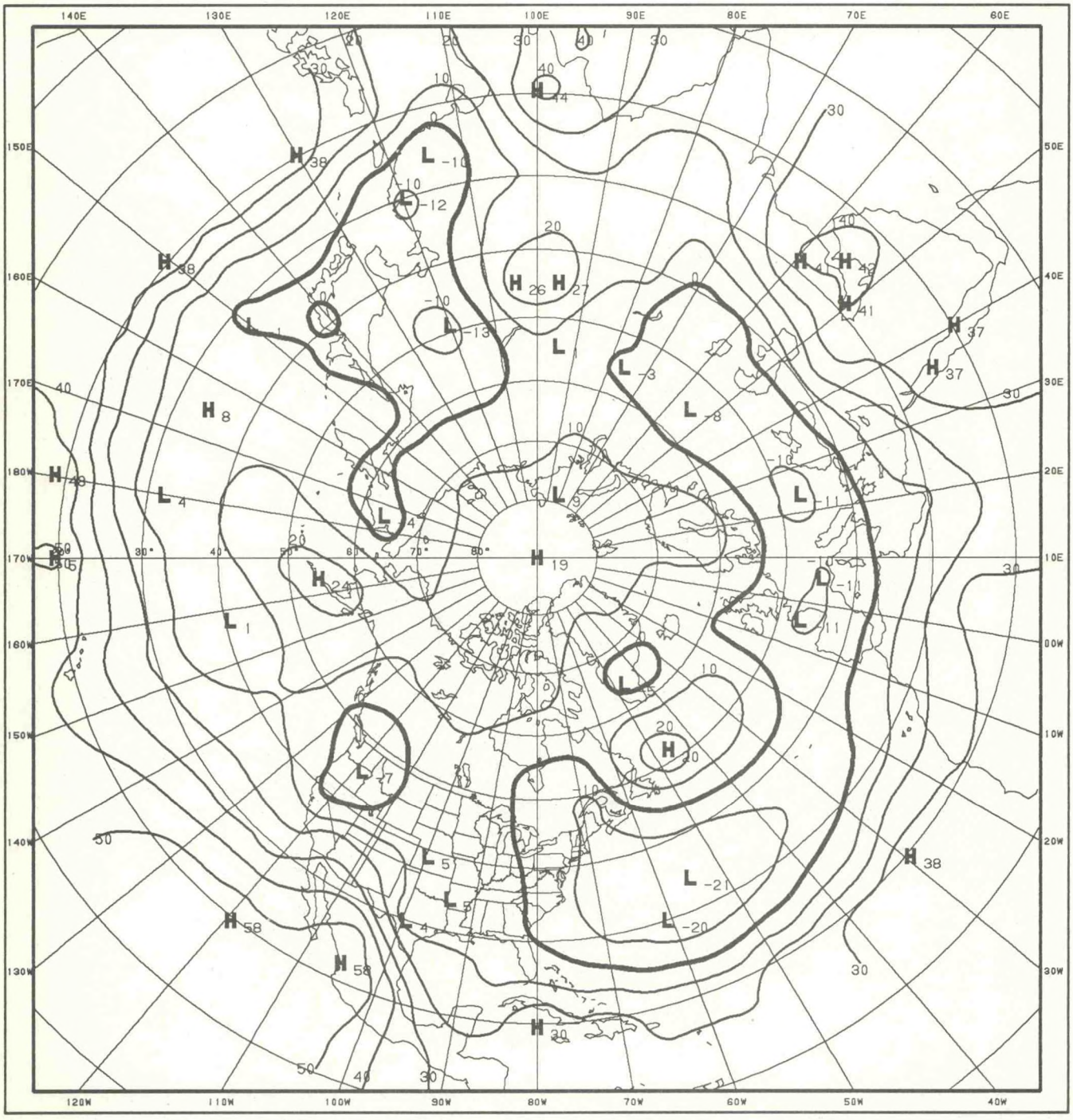
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE AUTOCORREL FEB-MAR

1-MONTH MEAN POOLED 1950-92

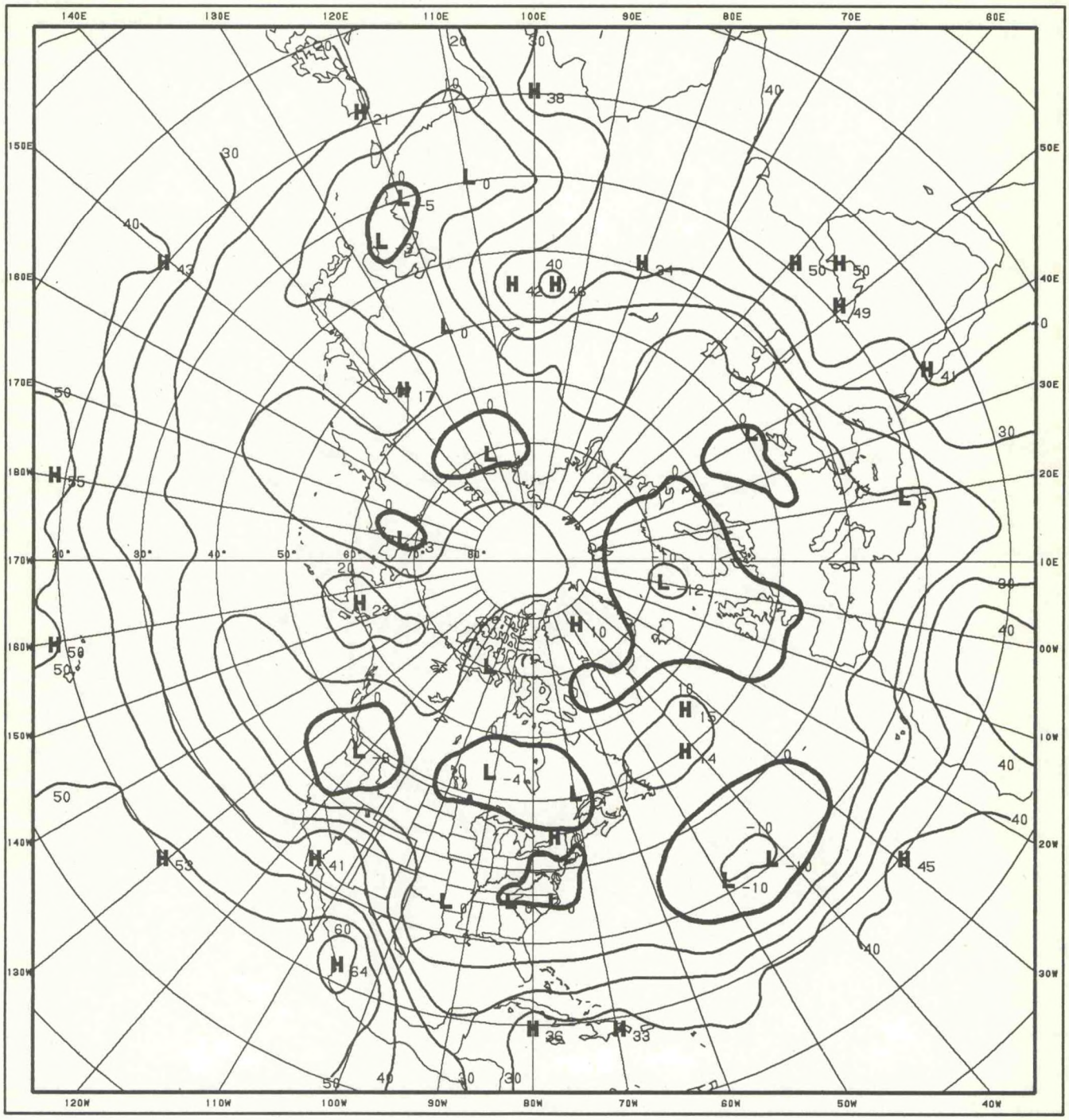
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE AUTOCORREL MAR-APR

1-MONTH MEAN POOLED 1950-92

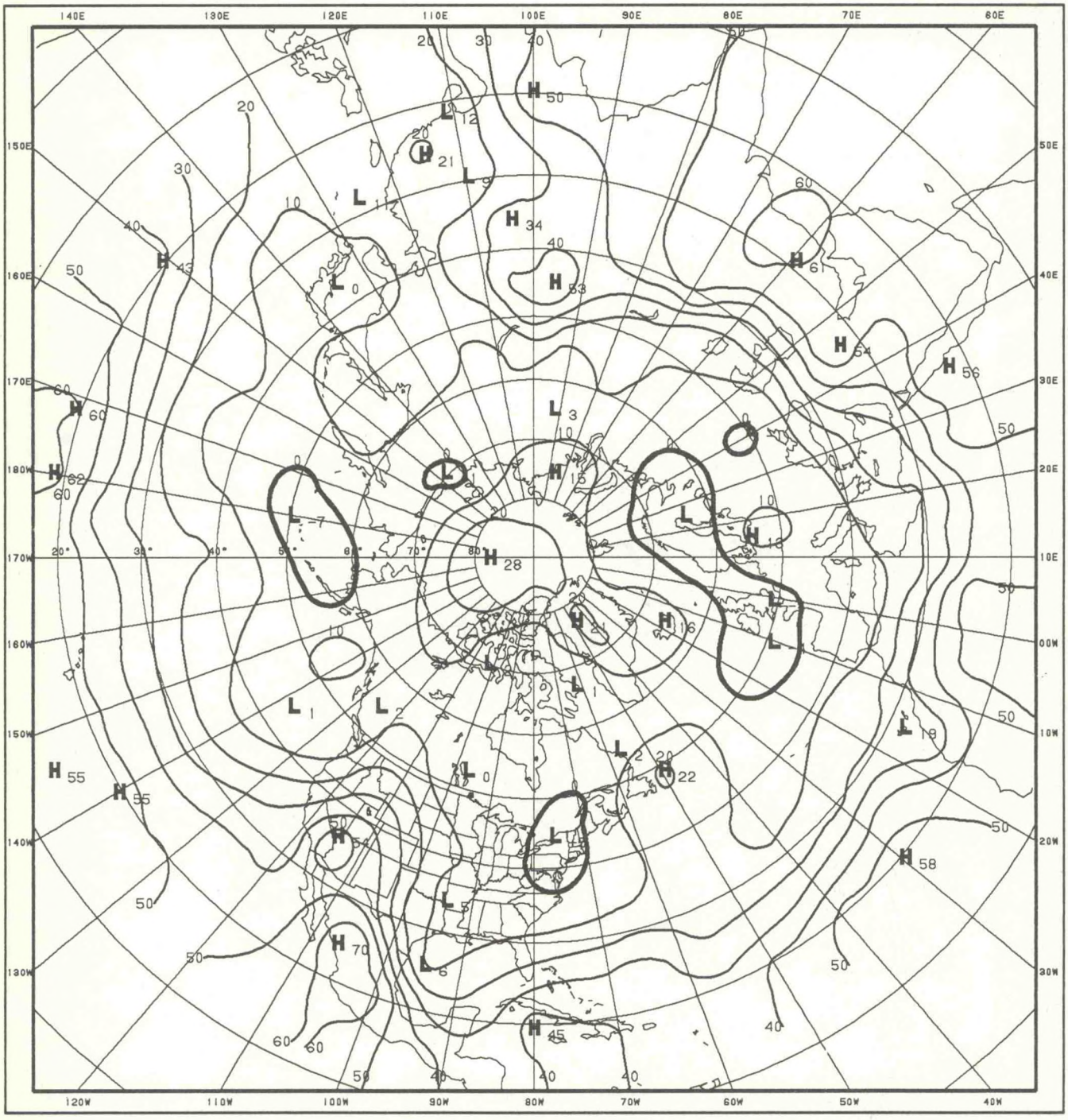
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE AUTOCORREL APR-MAY

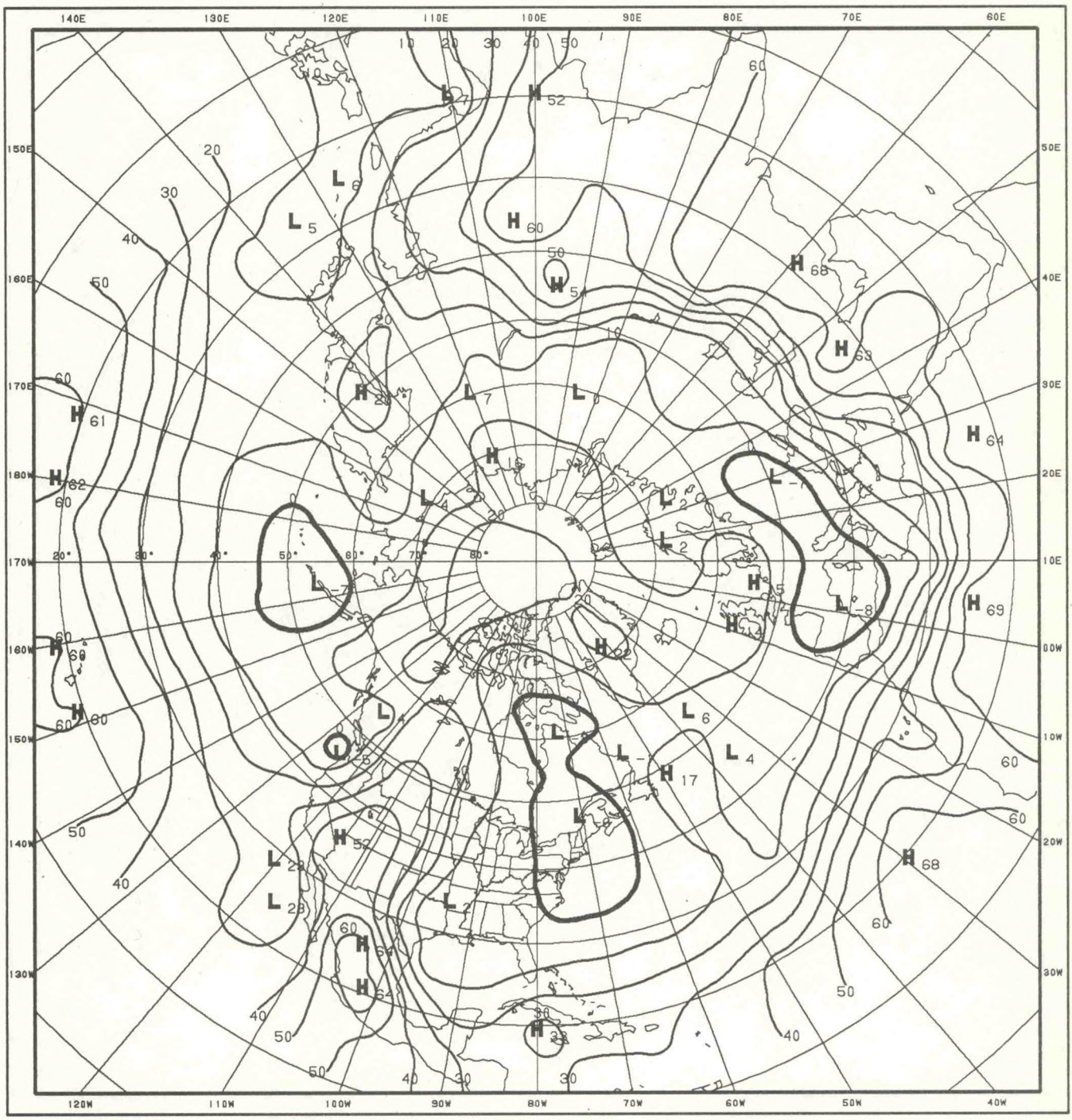
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



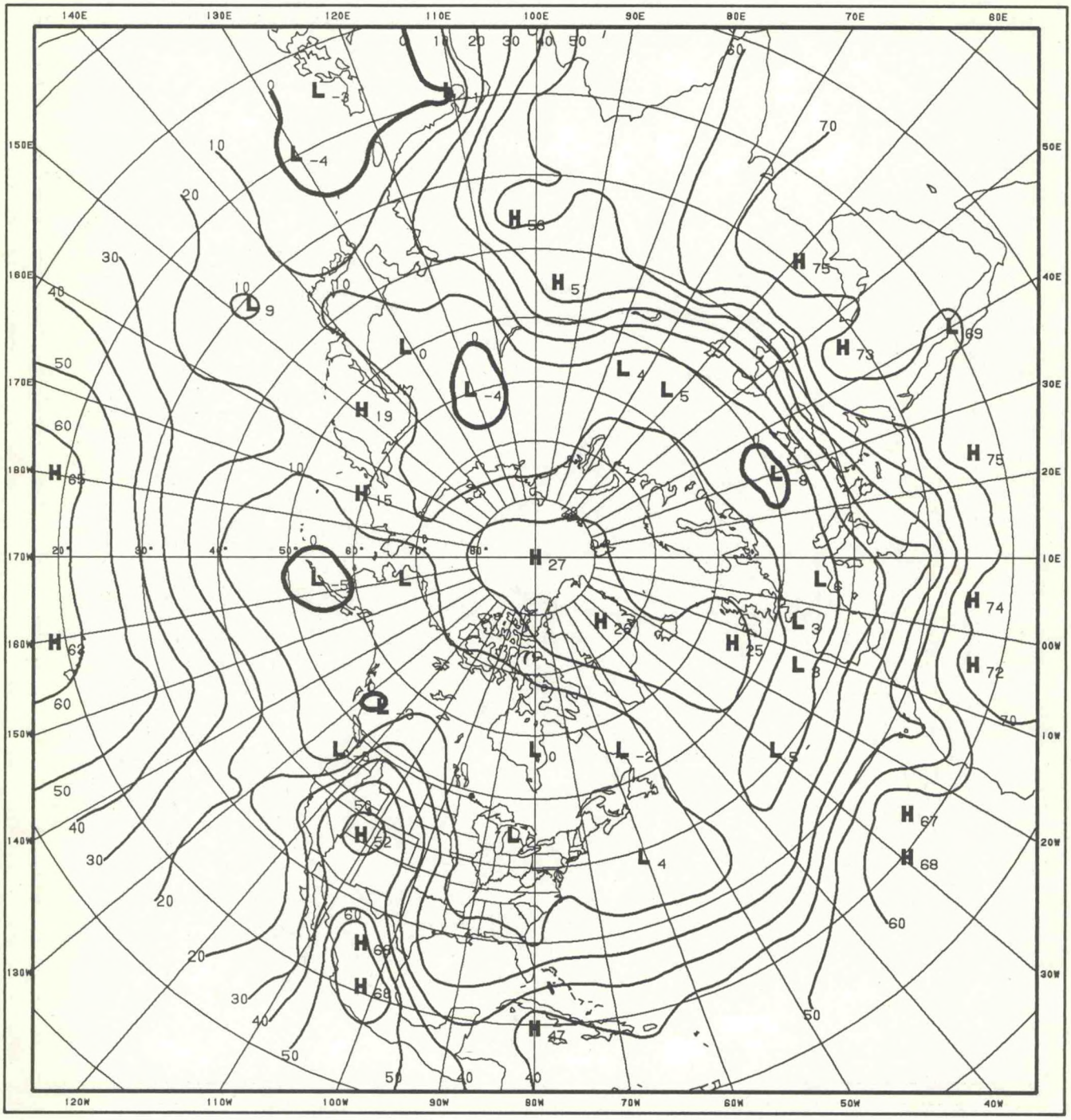
SEA LEVEL PRESSURE AUTOCORREL MAY-JUN
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



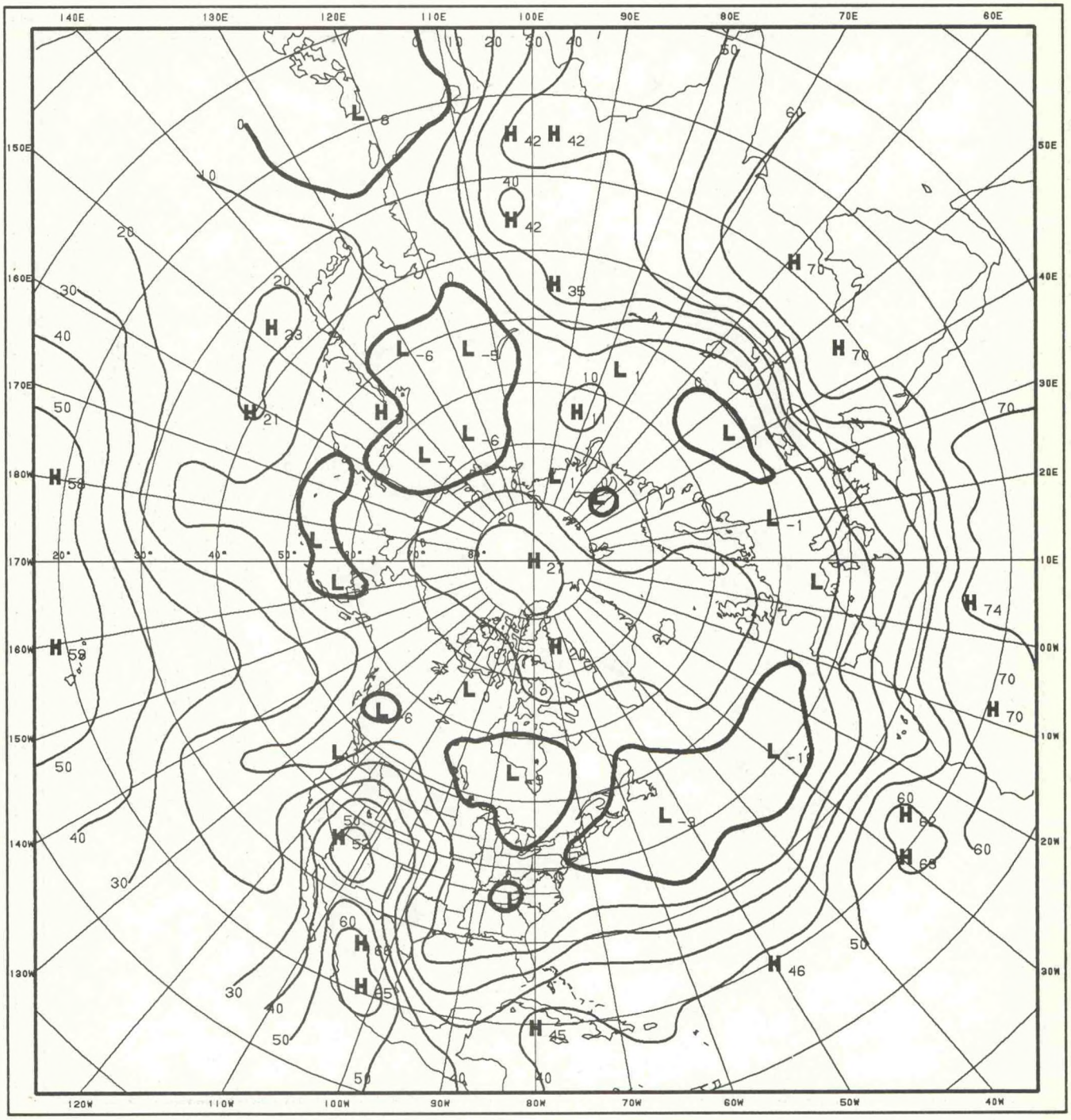
SEA LEVEL PRESSURE AUTOCORREL JUN-JUL
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE AUTOCORREL JUL-AUG
1-MONTH MEAN POOLED 1950-92

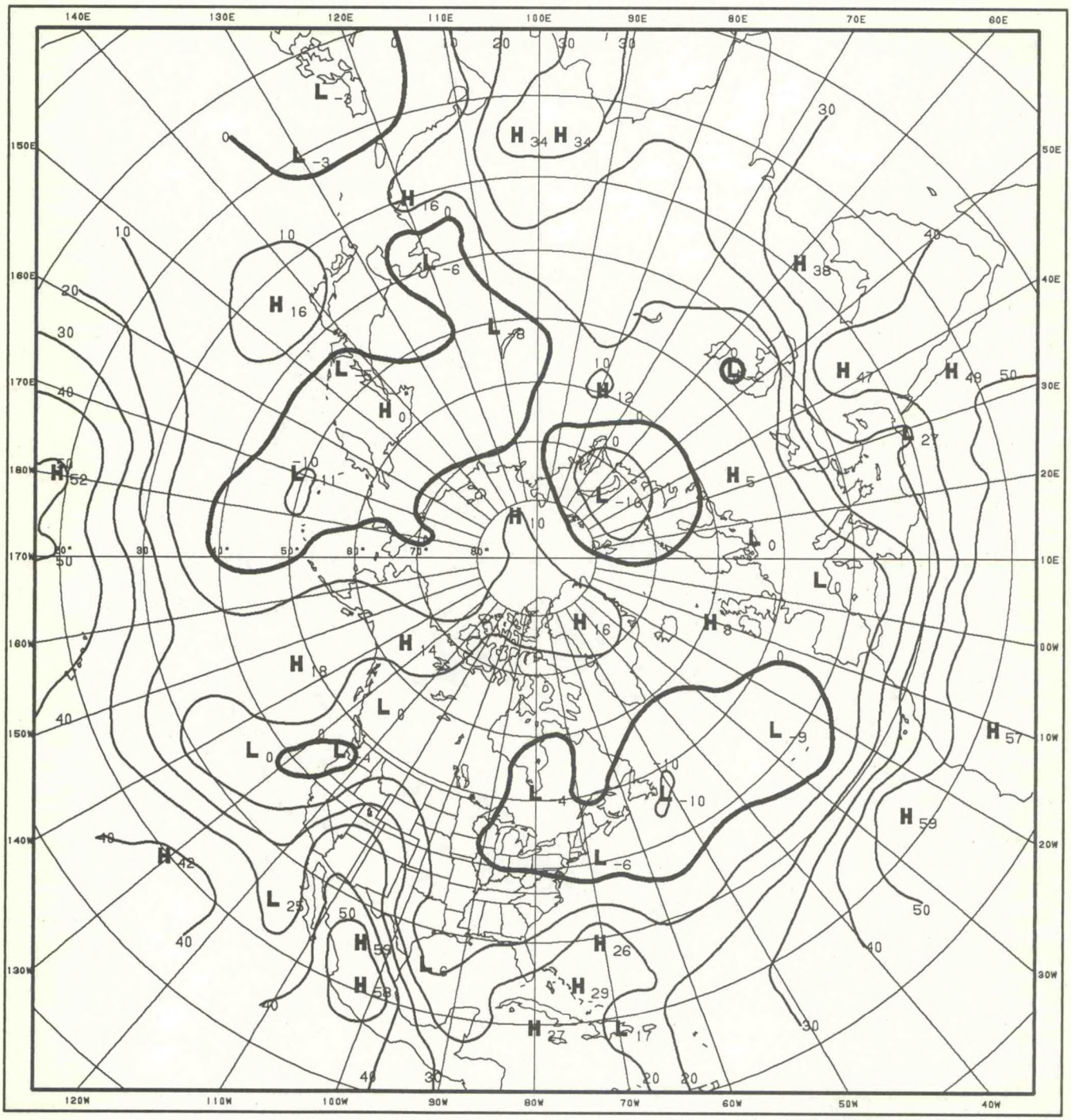
PREDICTION BRANCH CAC, NMC, NWS



SEA LEVEL PRESSURE AUTOCORREL AUG-SEP

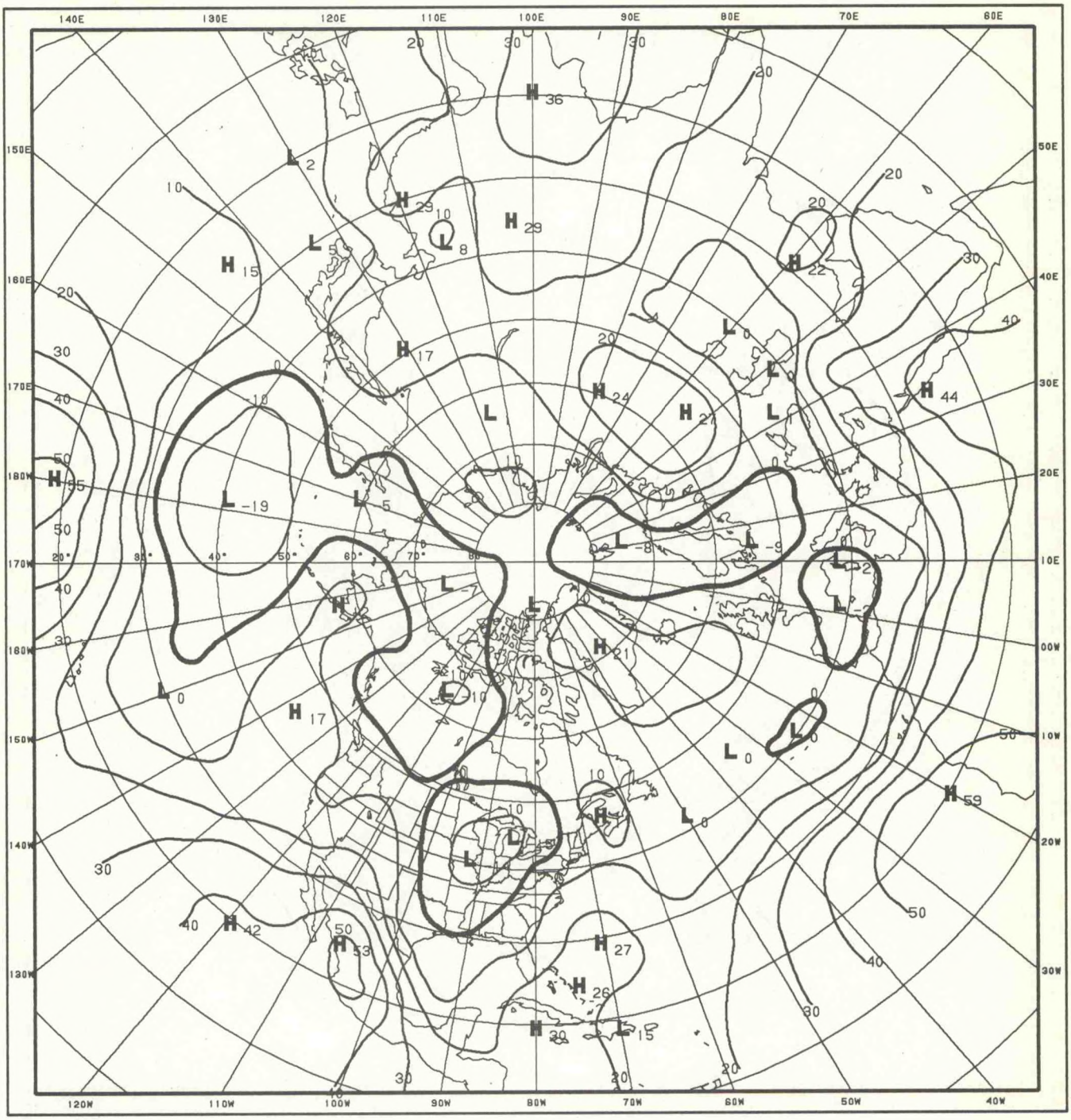
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



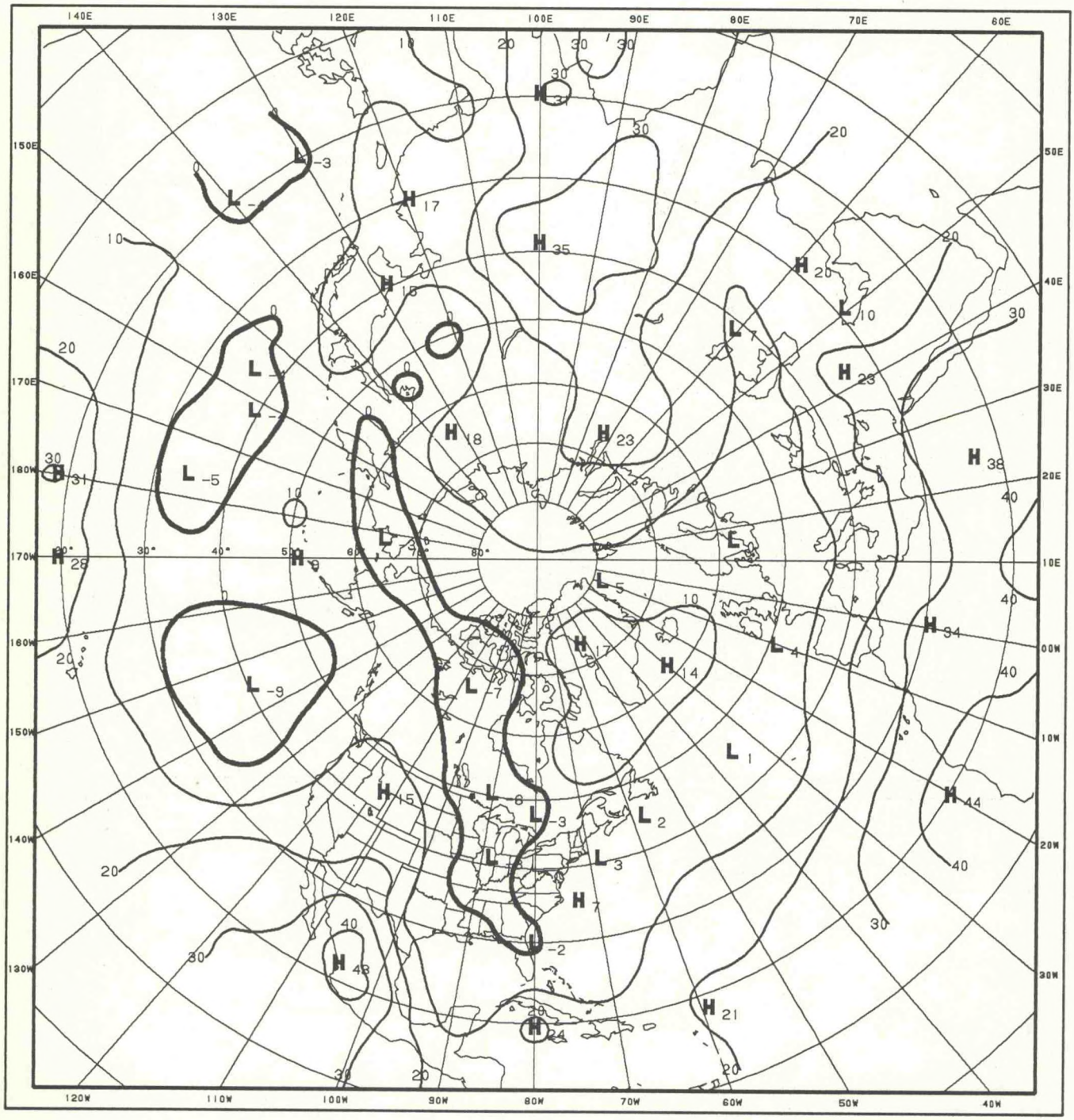
SEA LEVEL PRESSURE AUTOCORREL SEP-OCT
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



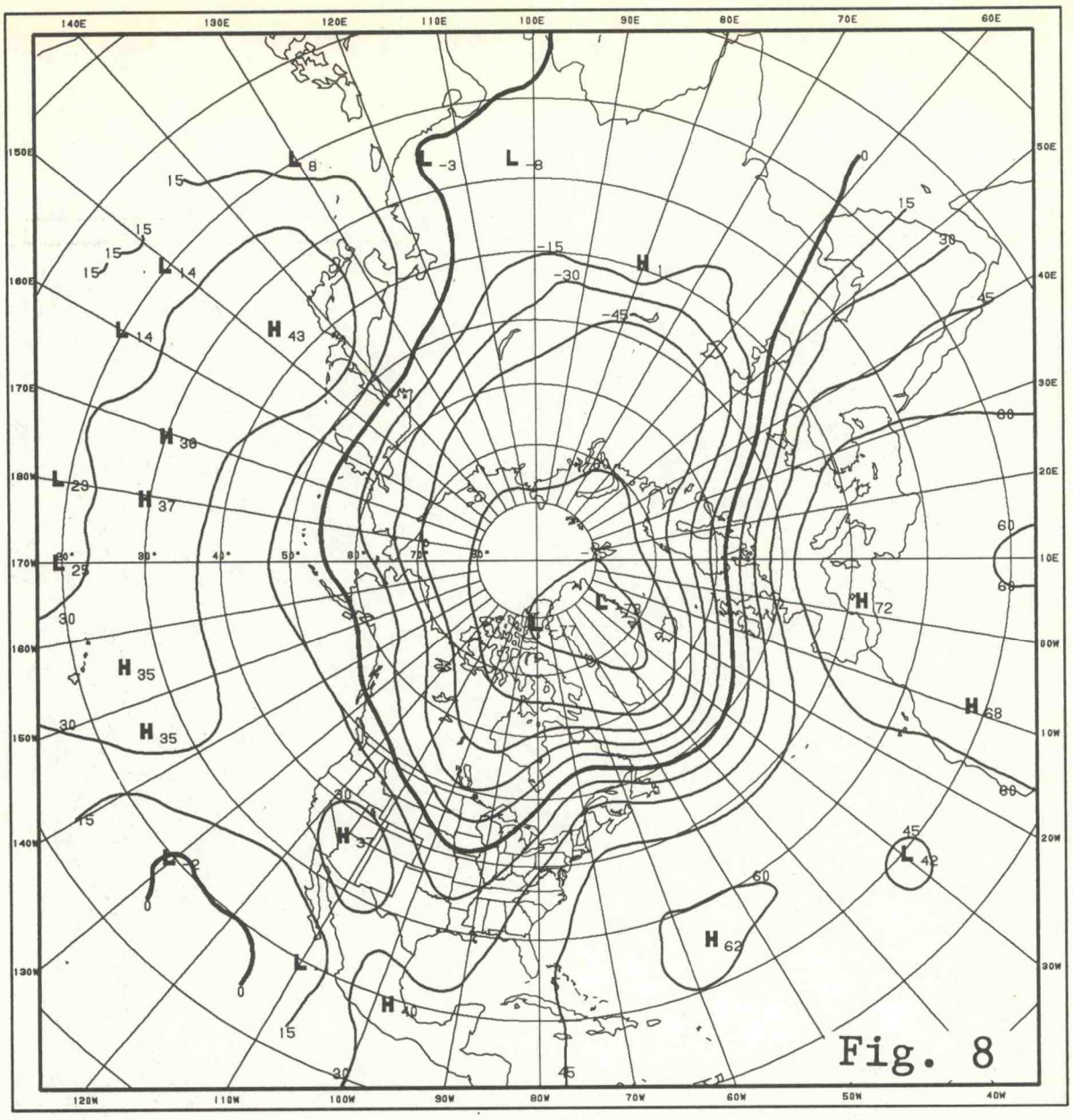
SEA LEVEL PRESSURE AUTOCORREL OCT-NOV
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS

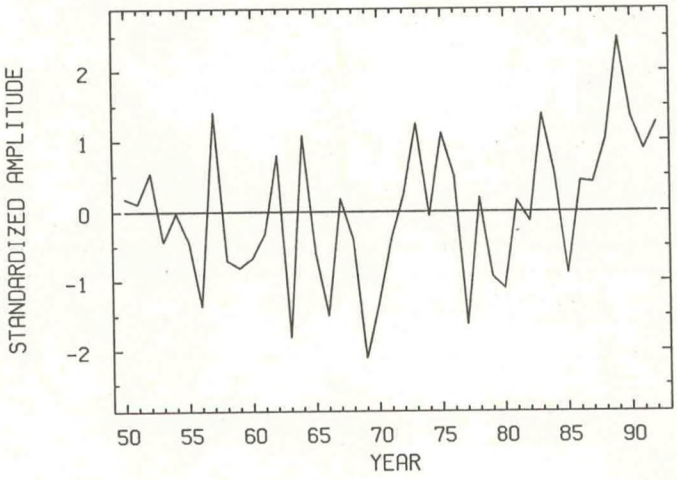


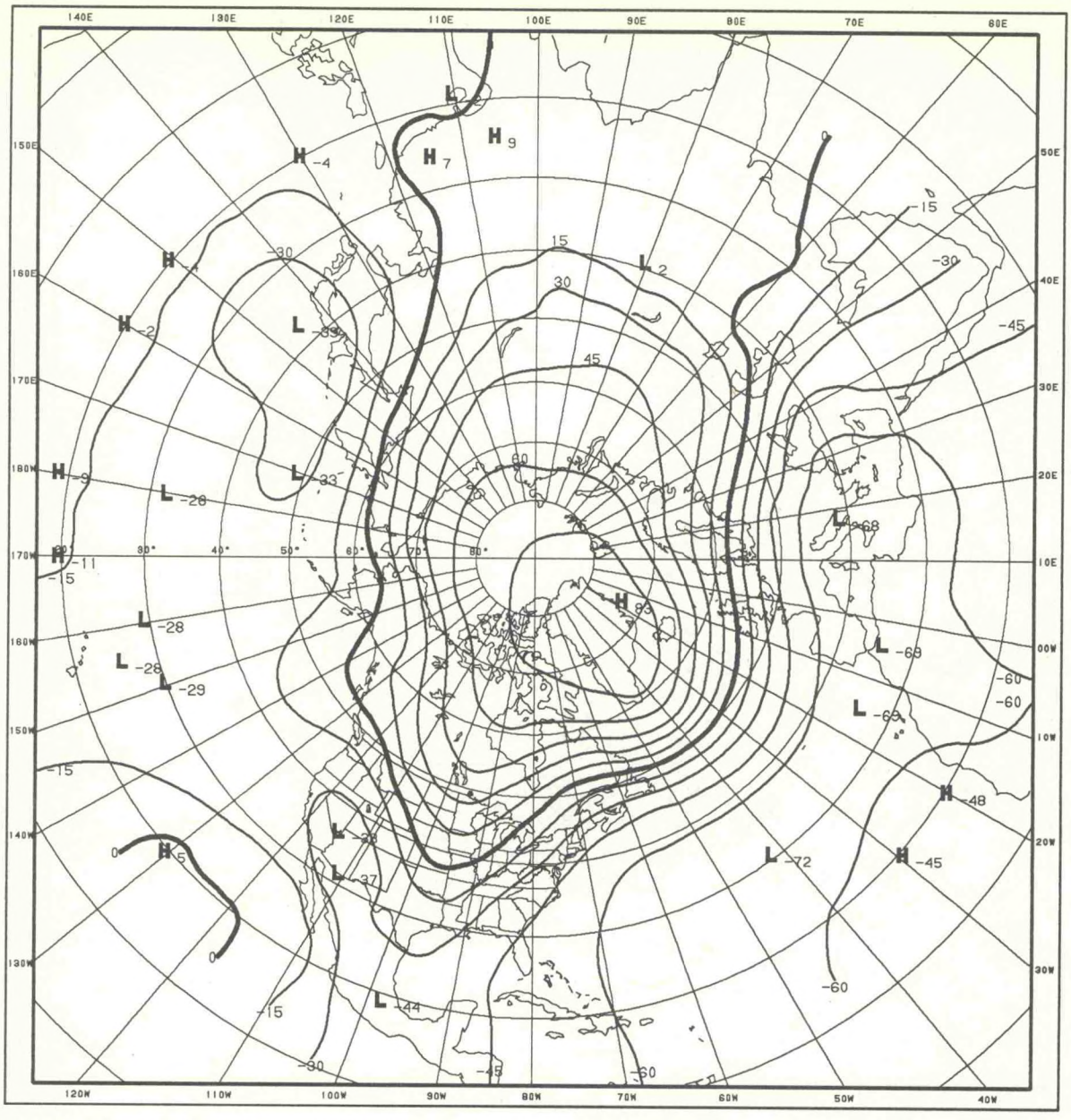
SEA LEVEL PRESSURE AUTOCORREL NOV-DEC
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS

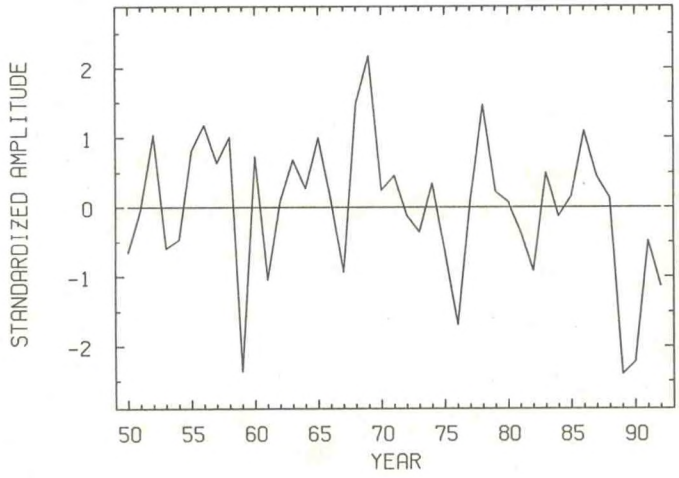


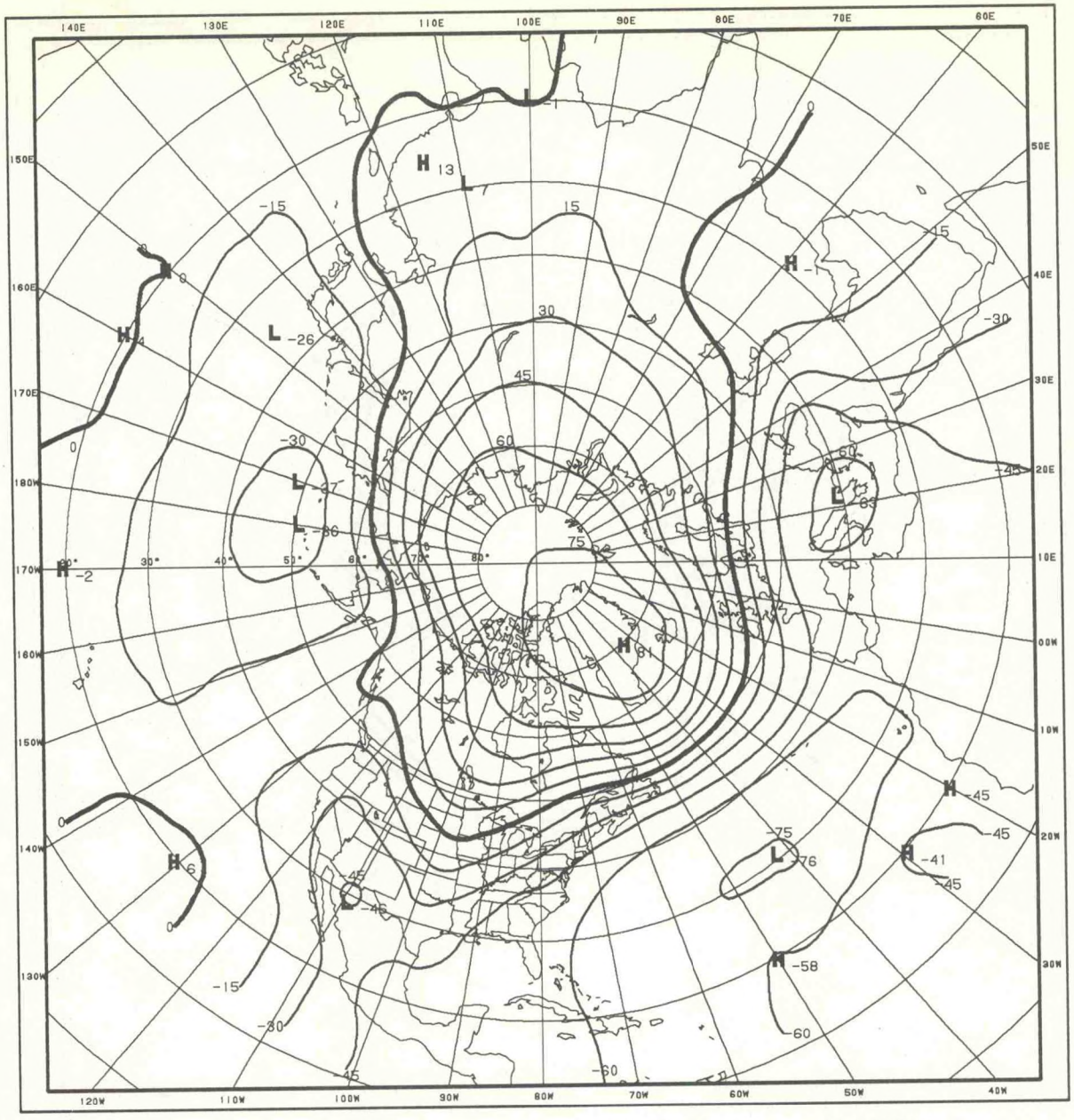
SEA LEVEL PRESS 1ST UNROT EOF JANUARY
1-MONTH MEAN POOLED 1950-92



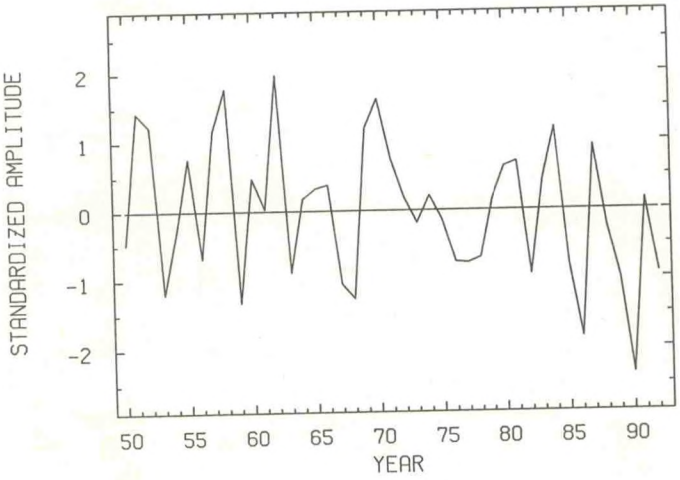


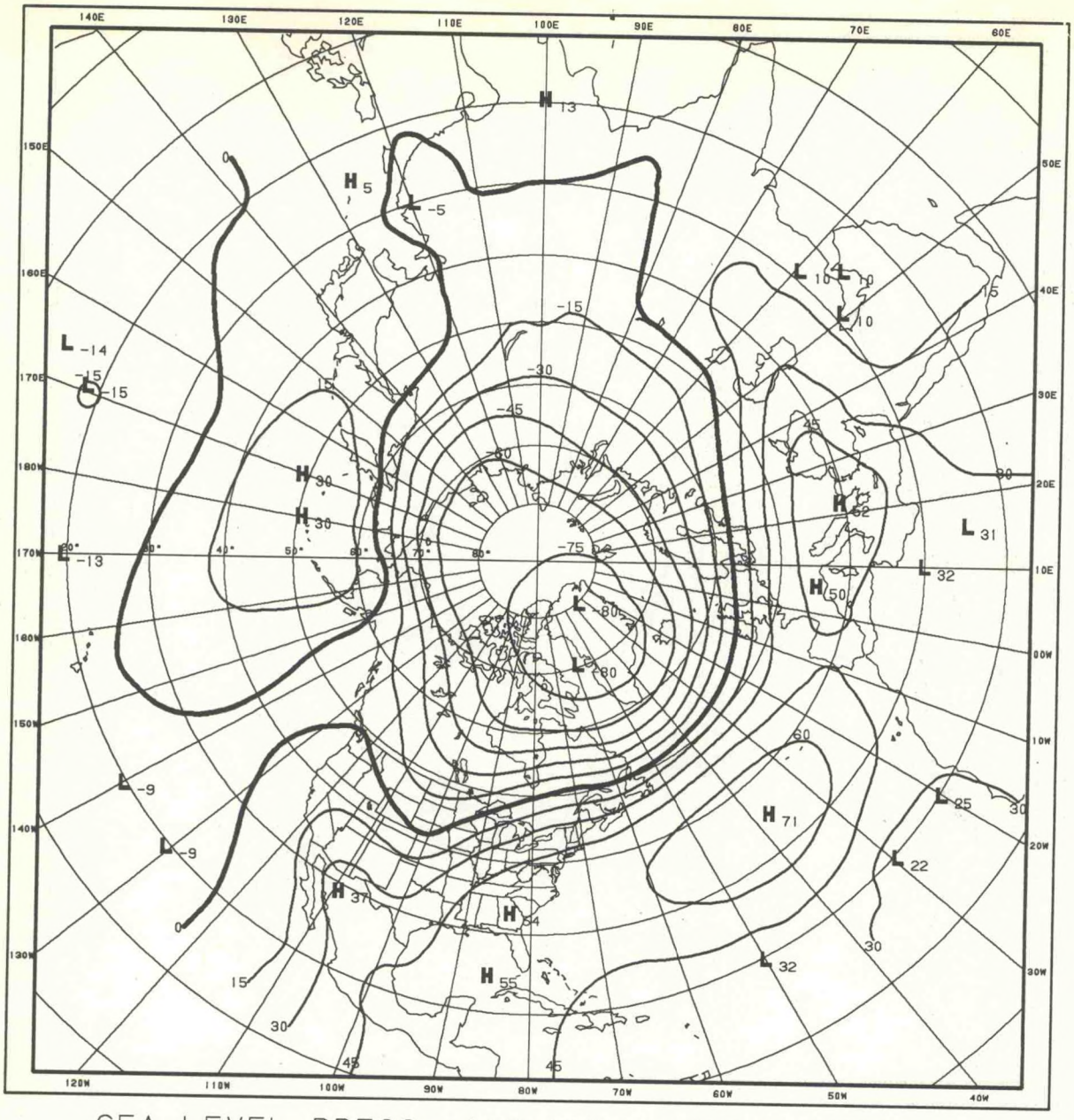
SEA LEVEL PRESS 1ST UNROT EOF FEBRUARY
1-MONTH MEAN POOLED 1950-92



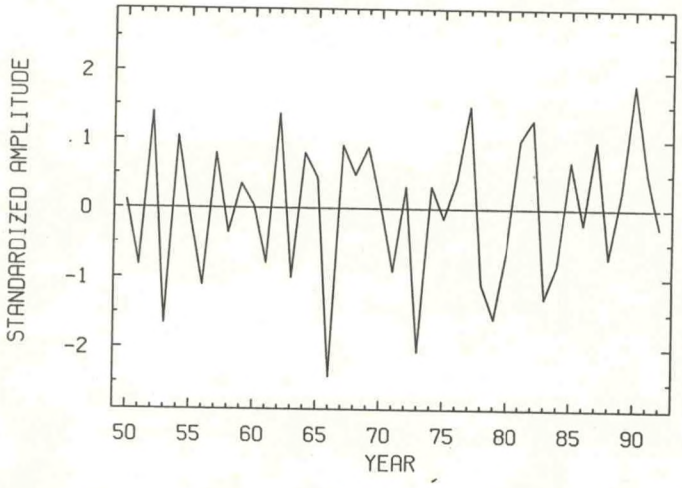


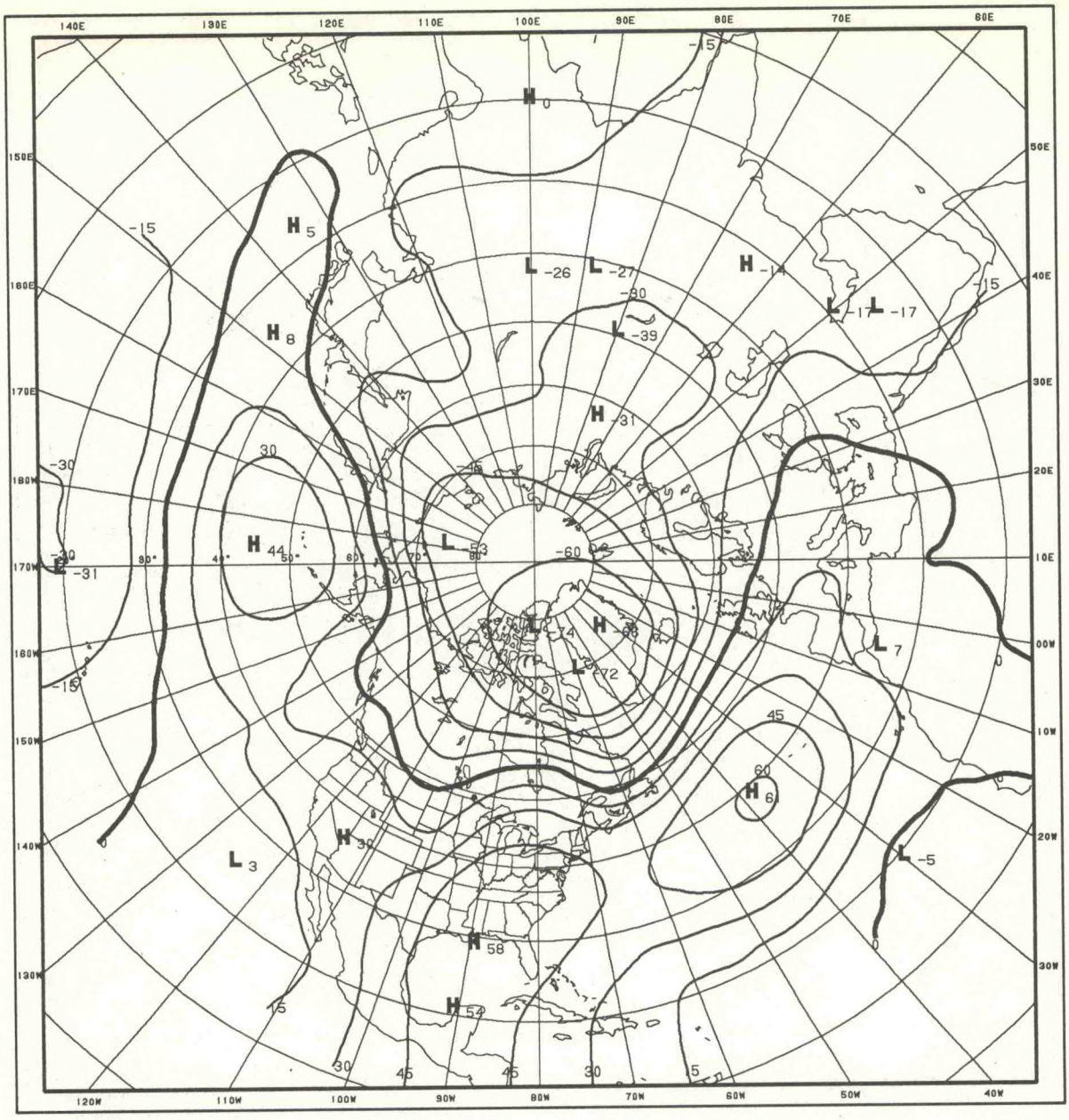
SEA LEVEL PRESS 1ST UNROT EOF MARCH
1-MONTH MEAN POOLED 1950-92



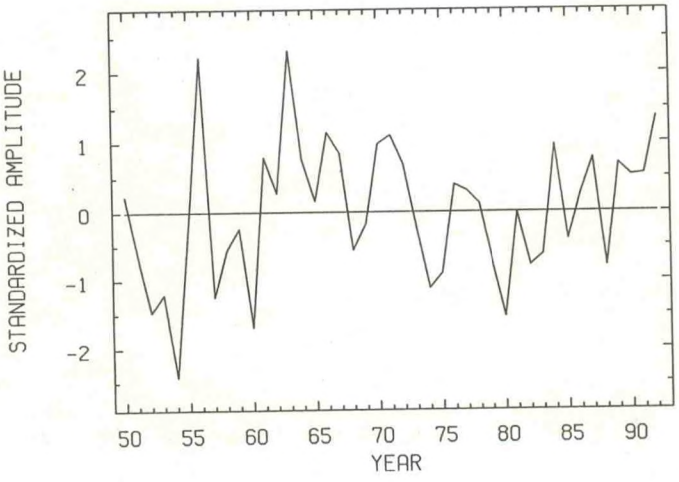


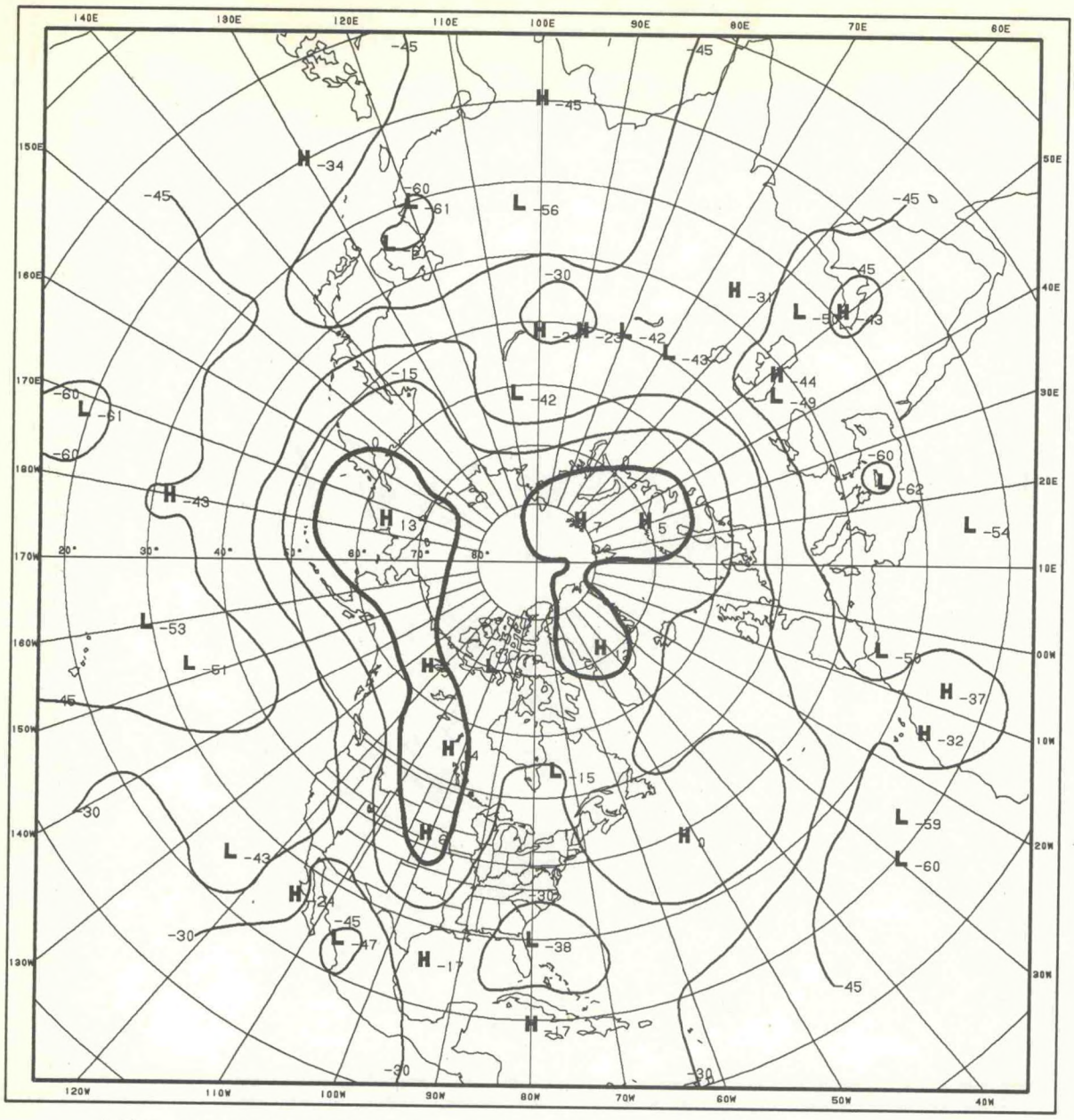
SEA LEVEL PRESS 1ST UNROT EOF APRIL
1-MONTH MEAN POOLED 1950-92



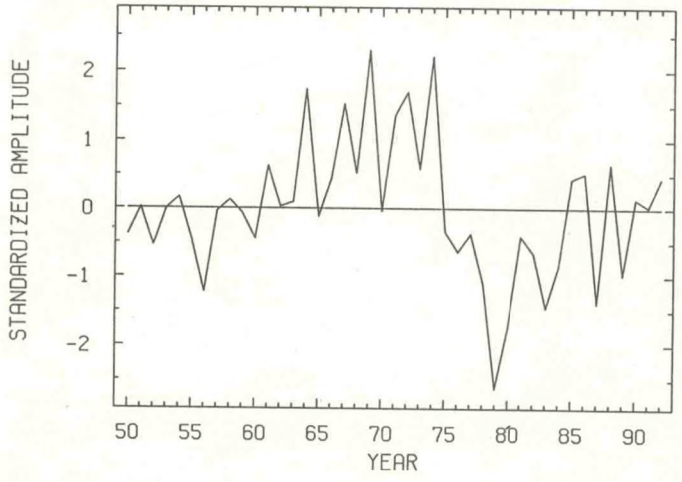


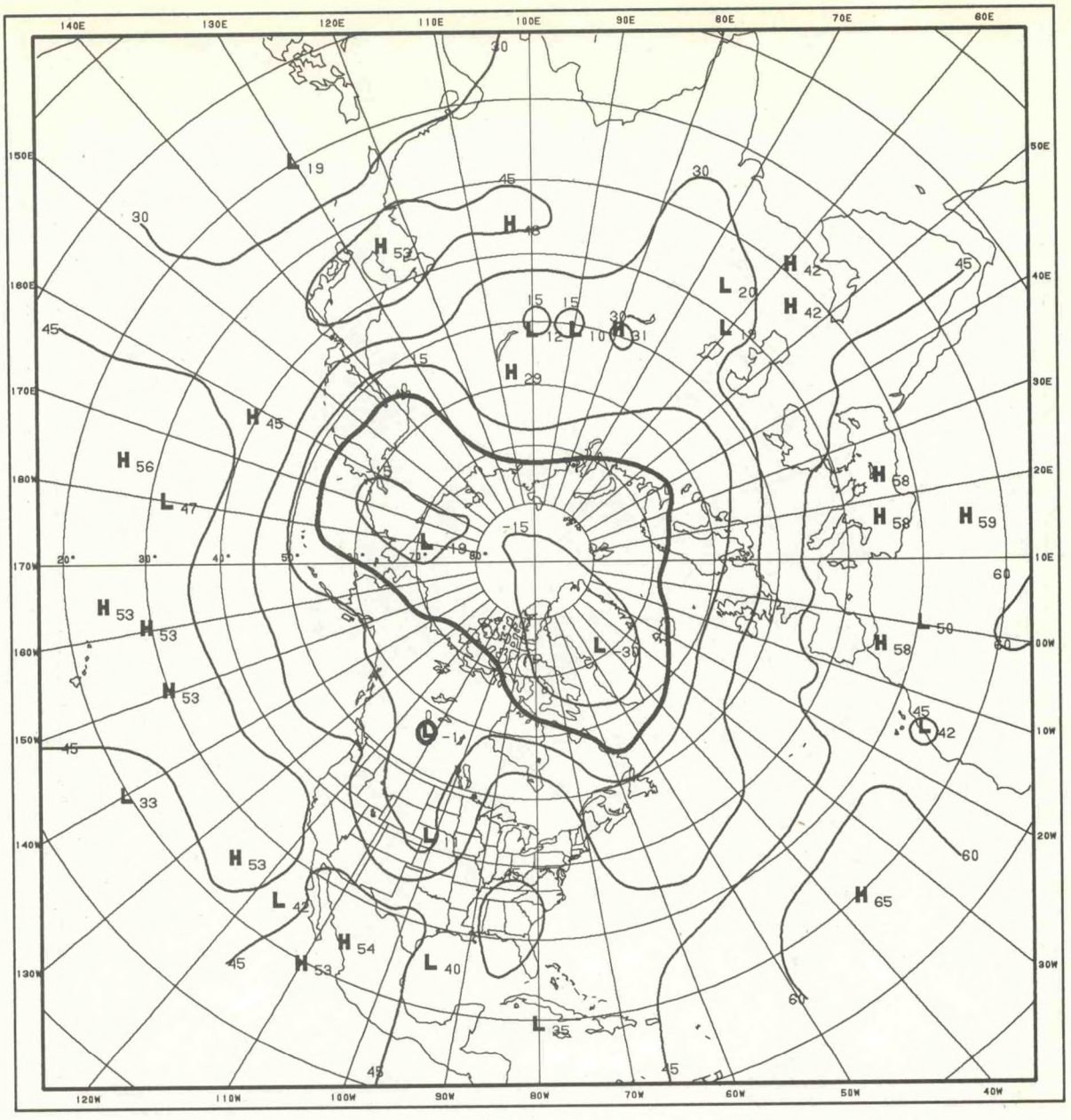
SEA LEVEL PRESS 1ST UNROT EOF MAY
1-MONTH MEAN POOLED 1950-92



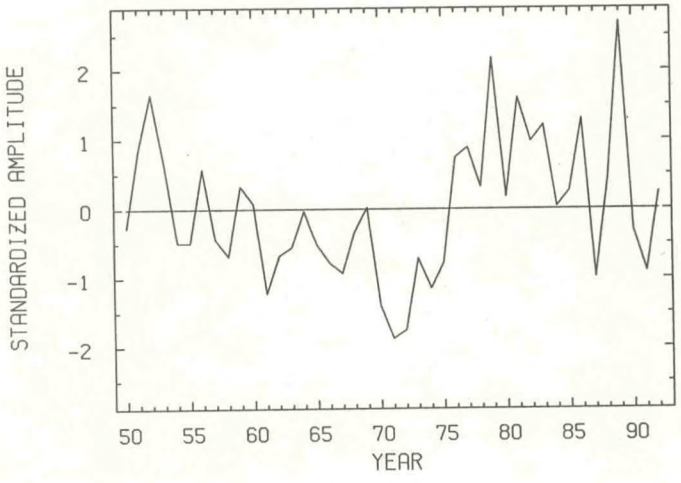


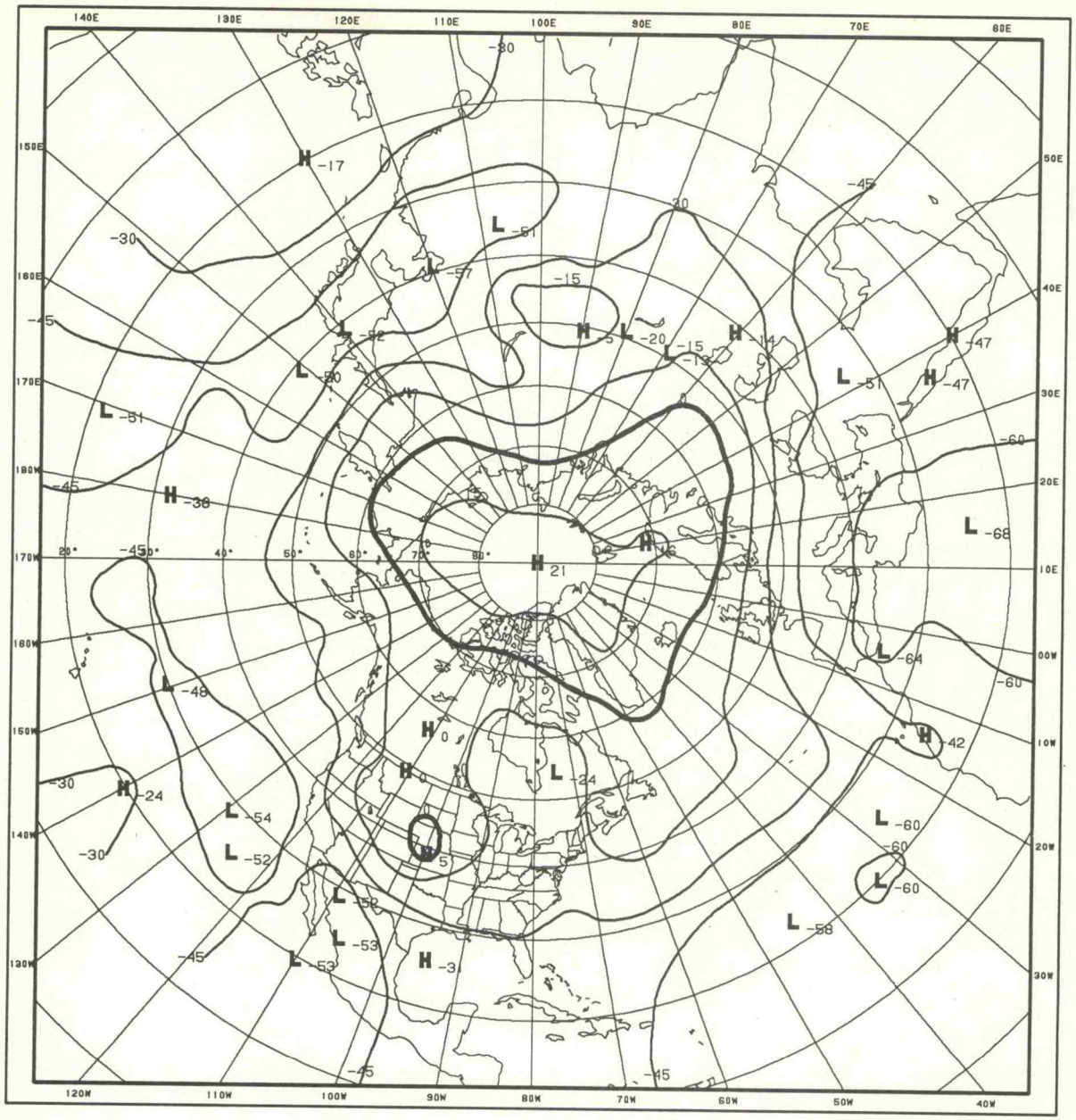
SEA LEVEL PRESS 1ST UNROT EOF JUNE
1-MONTH MEAN POOLED 1950-92



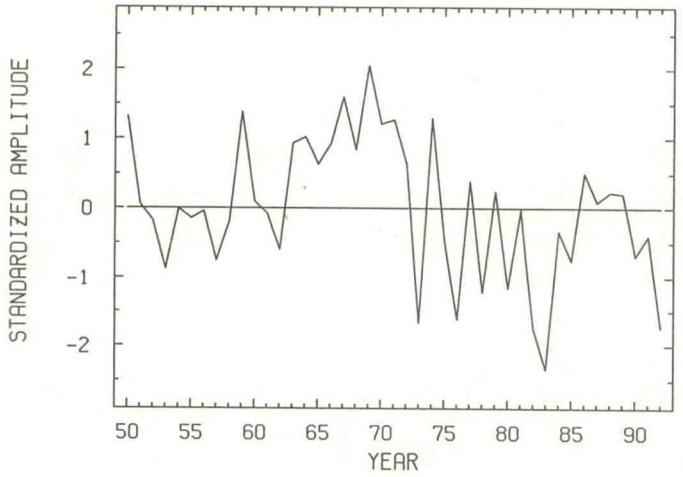


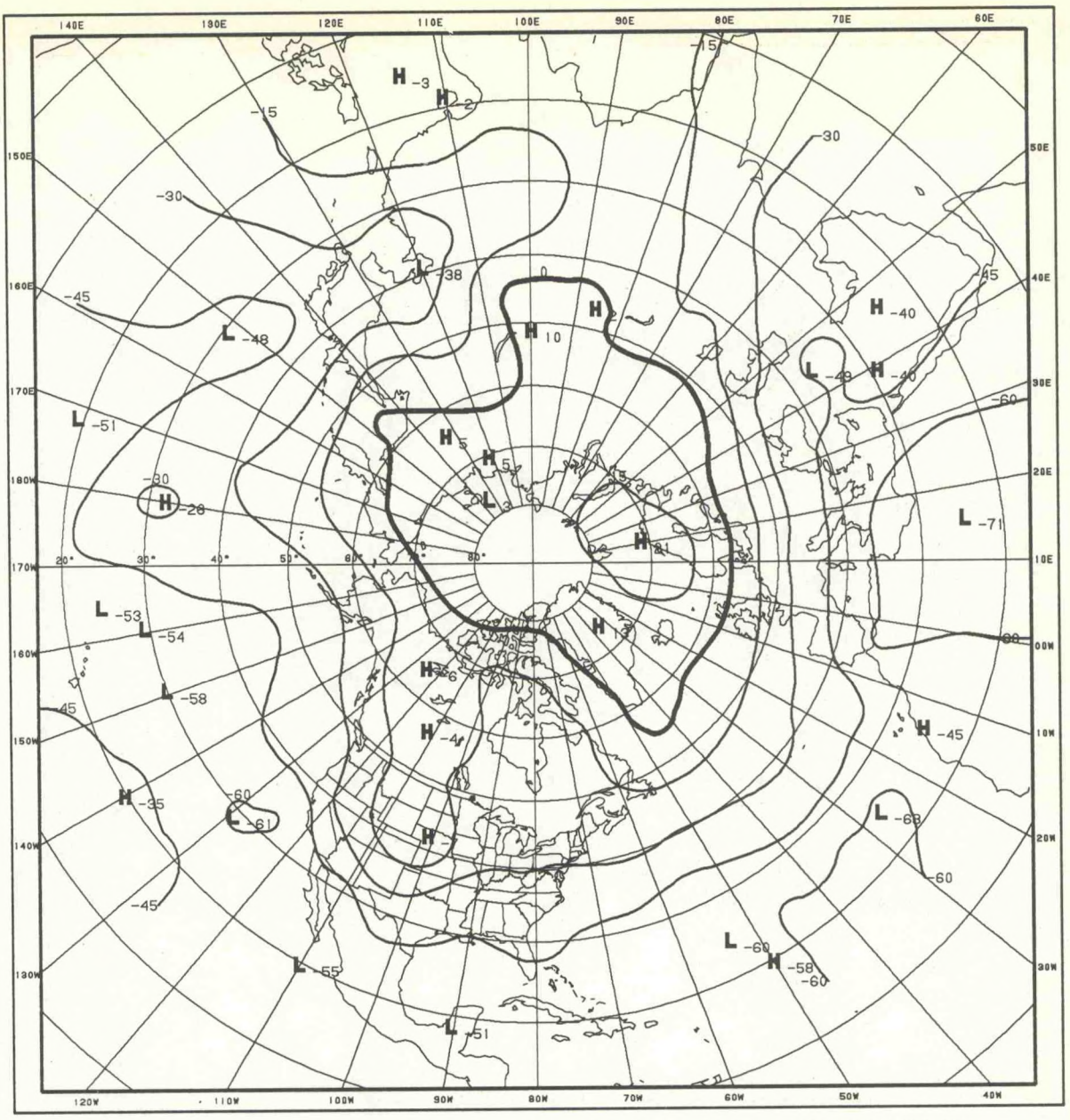
SEA LEVEL PRESS 1ST UNROT EOF JULY
1-MONTH MEAN POOLED 1950-92



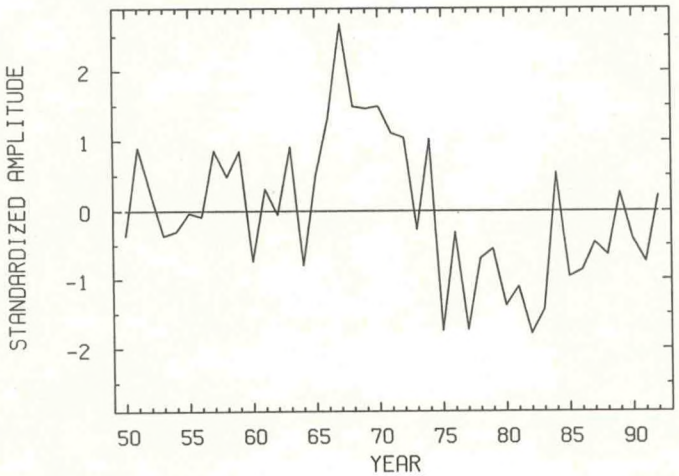


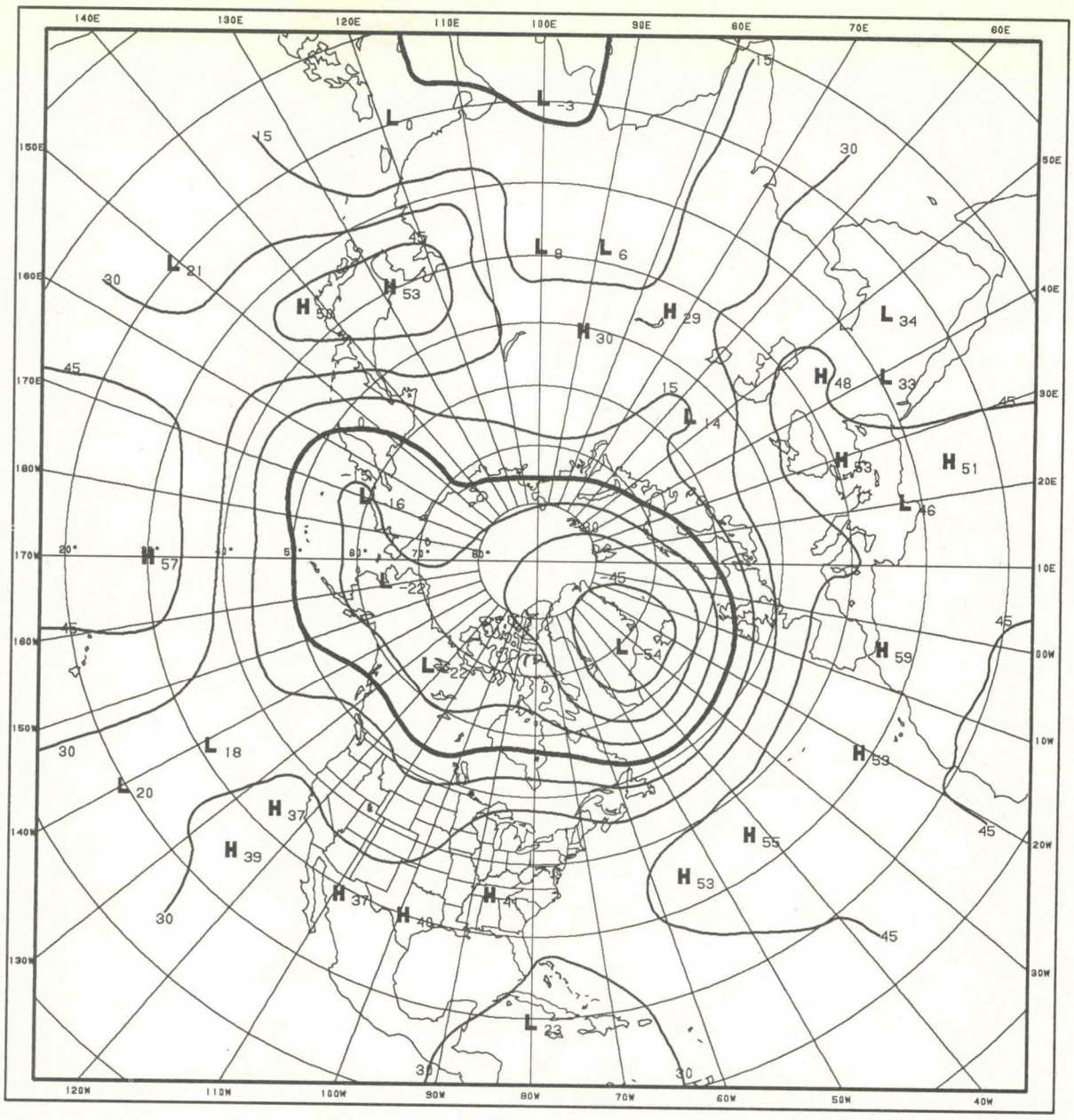
SEA LEVEL PRESS 1ST UNROT EOF AUGUST
1-MONTH MEAN POOLED 1950-92



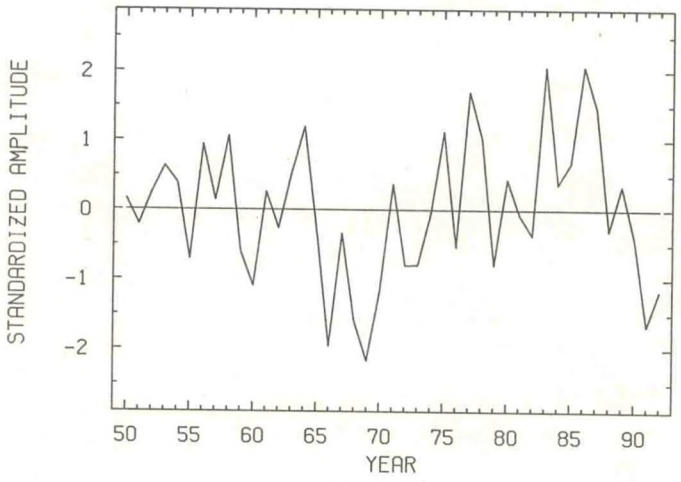


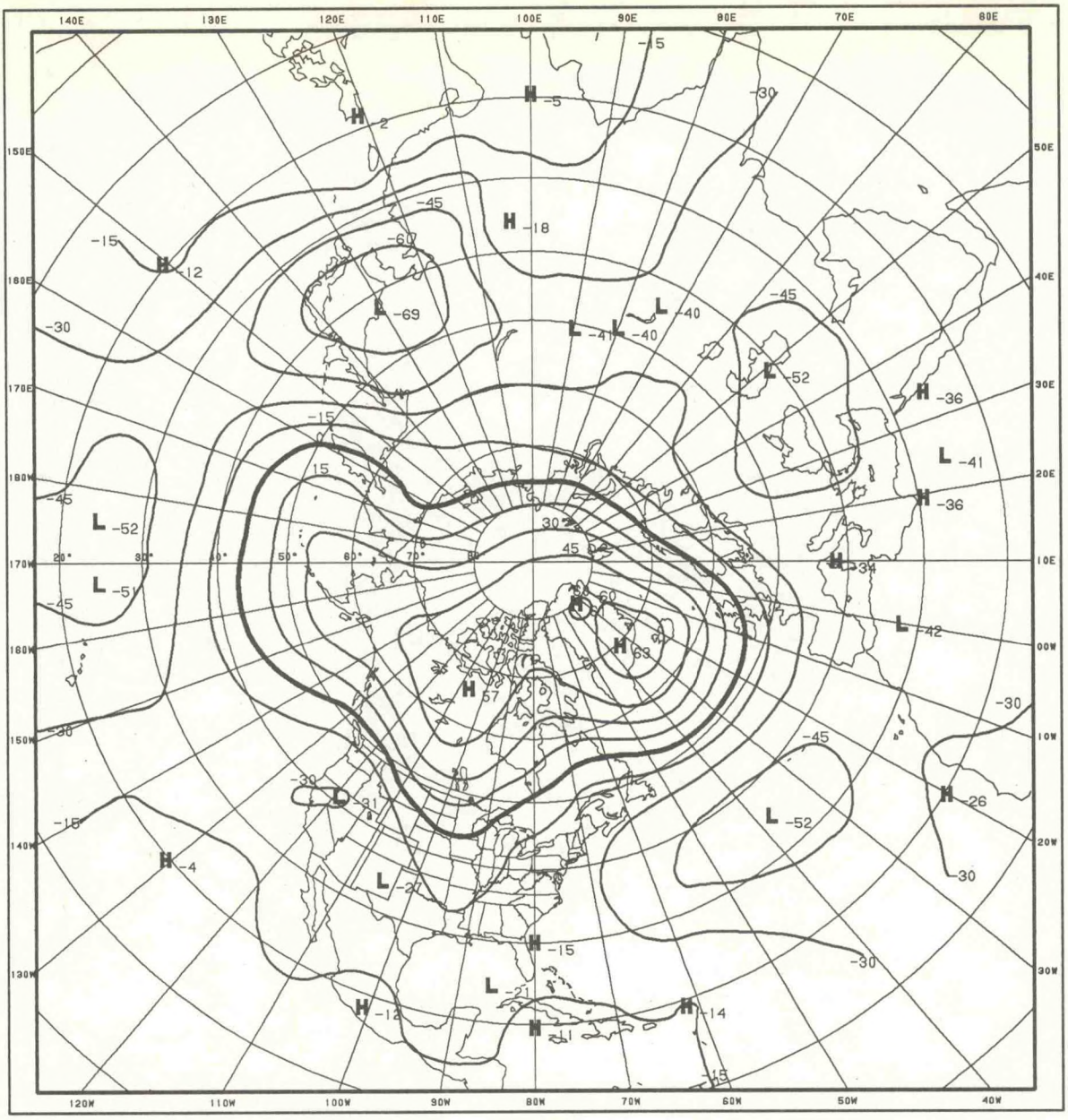
SEA LEVEL PRESS 1ST UNROT EOF SEPTEMBR
1-MONTH MEAN POOLED 1950-92



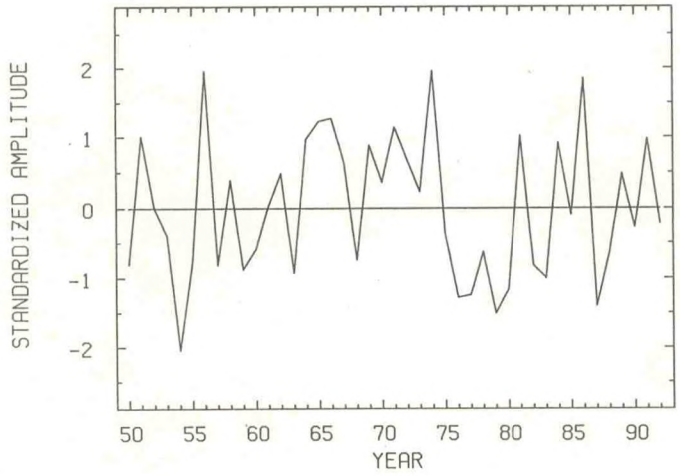


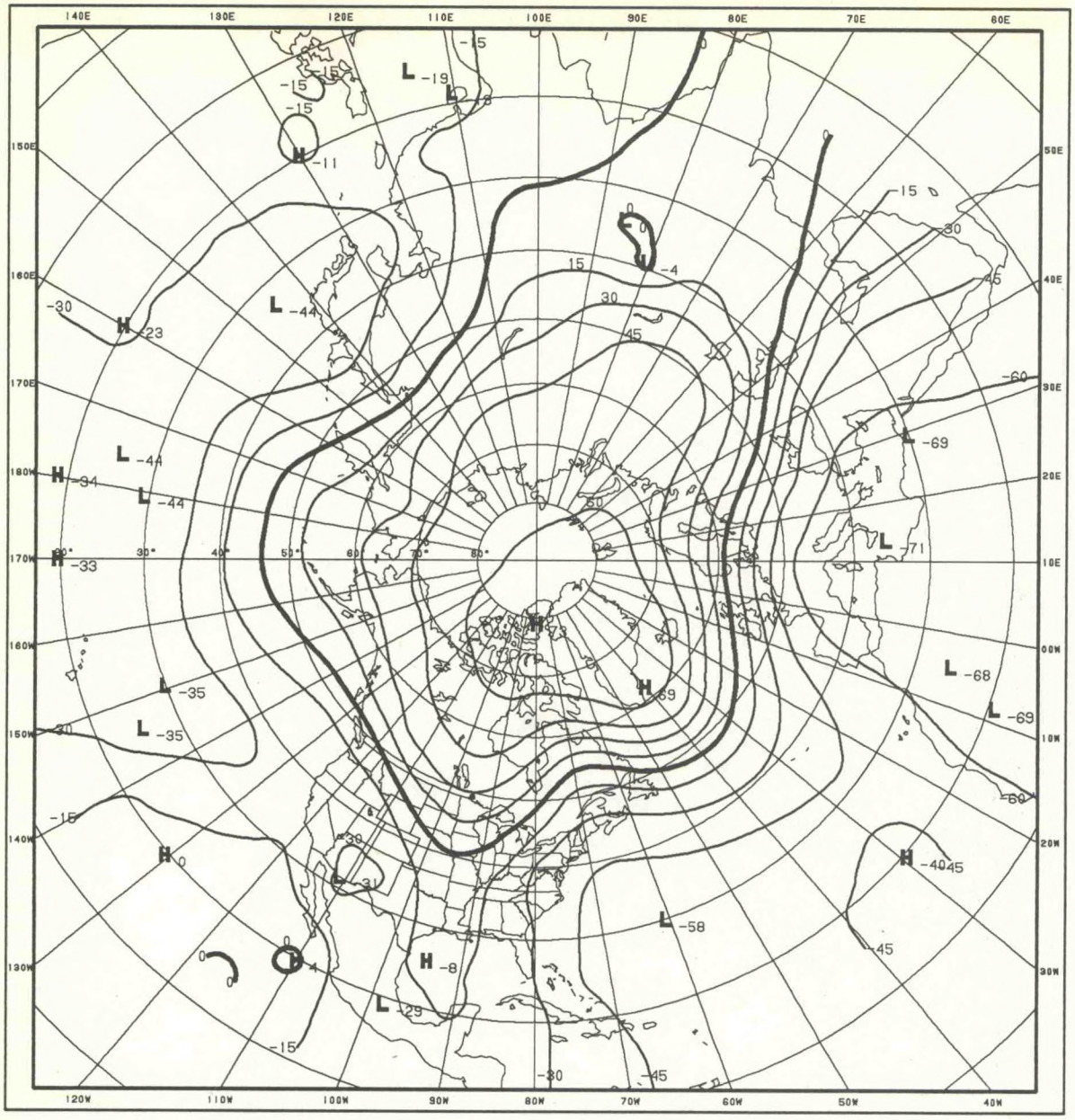
SEA LEVEL PRESS 1ST UNROT EOF OCTOBER
1-MONTH MEAN POOLED 1950-92



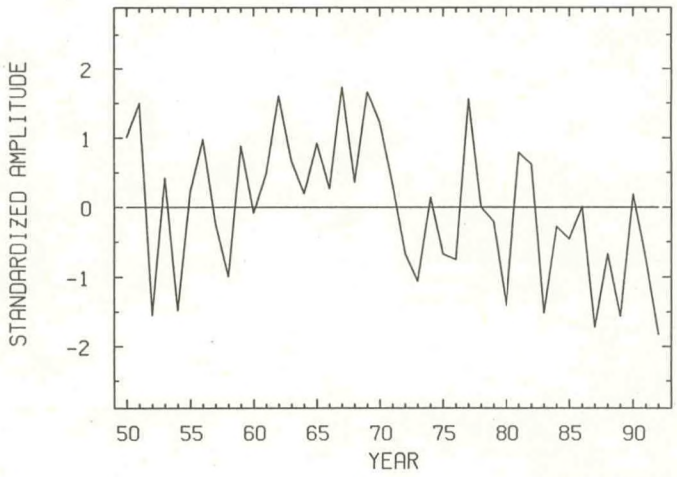


SEA LEVEL PRESS 1ST UNROT EOF NOVEMBER
1-MONTH MEAN POOLED 1950-92





SEA LEVEL PRESS 1ST UNROT EOF DECEMBER
1-MONTH MEAN POOLED 1950-92



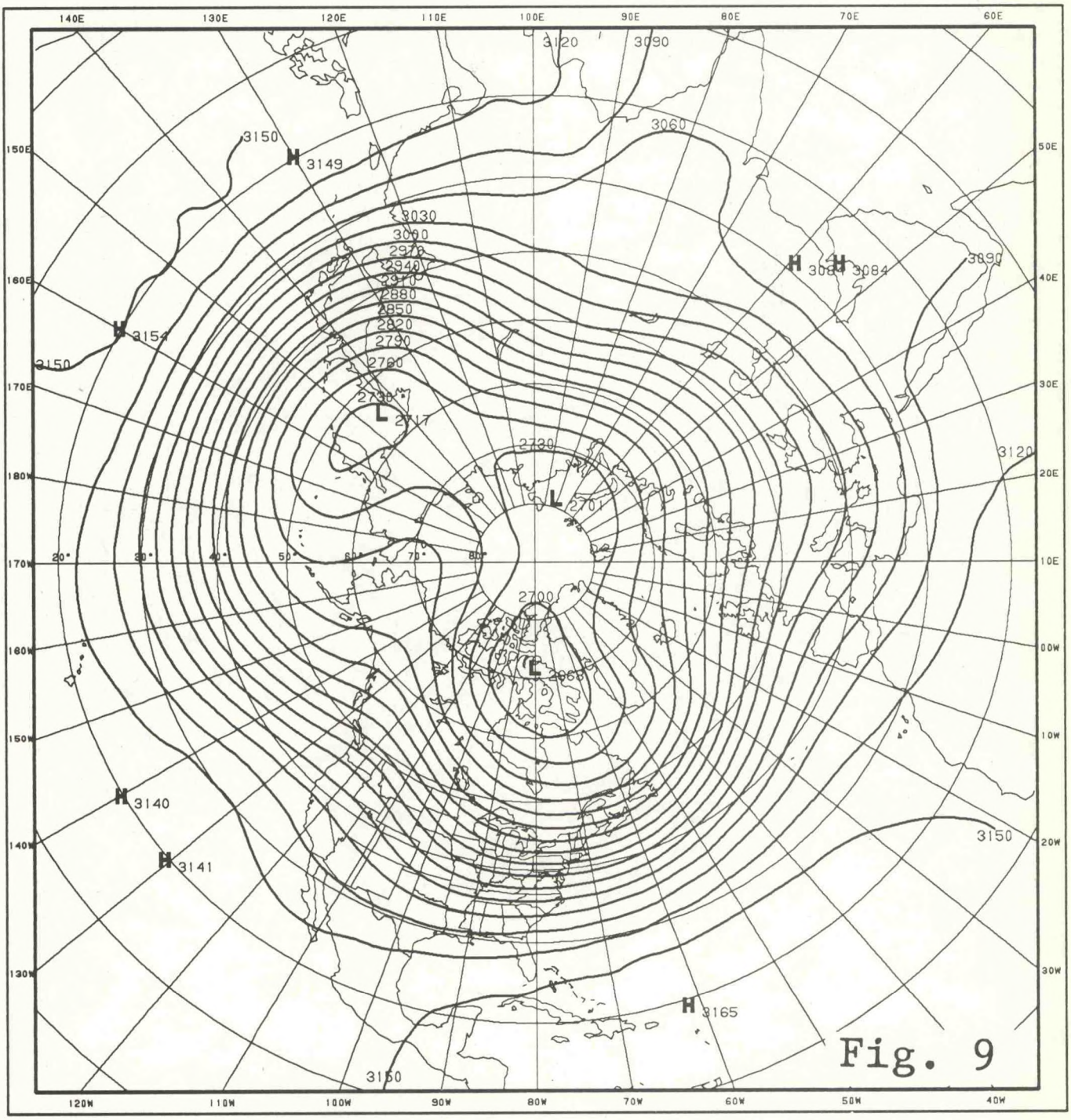
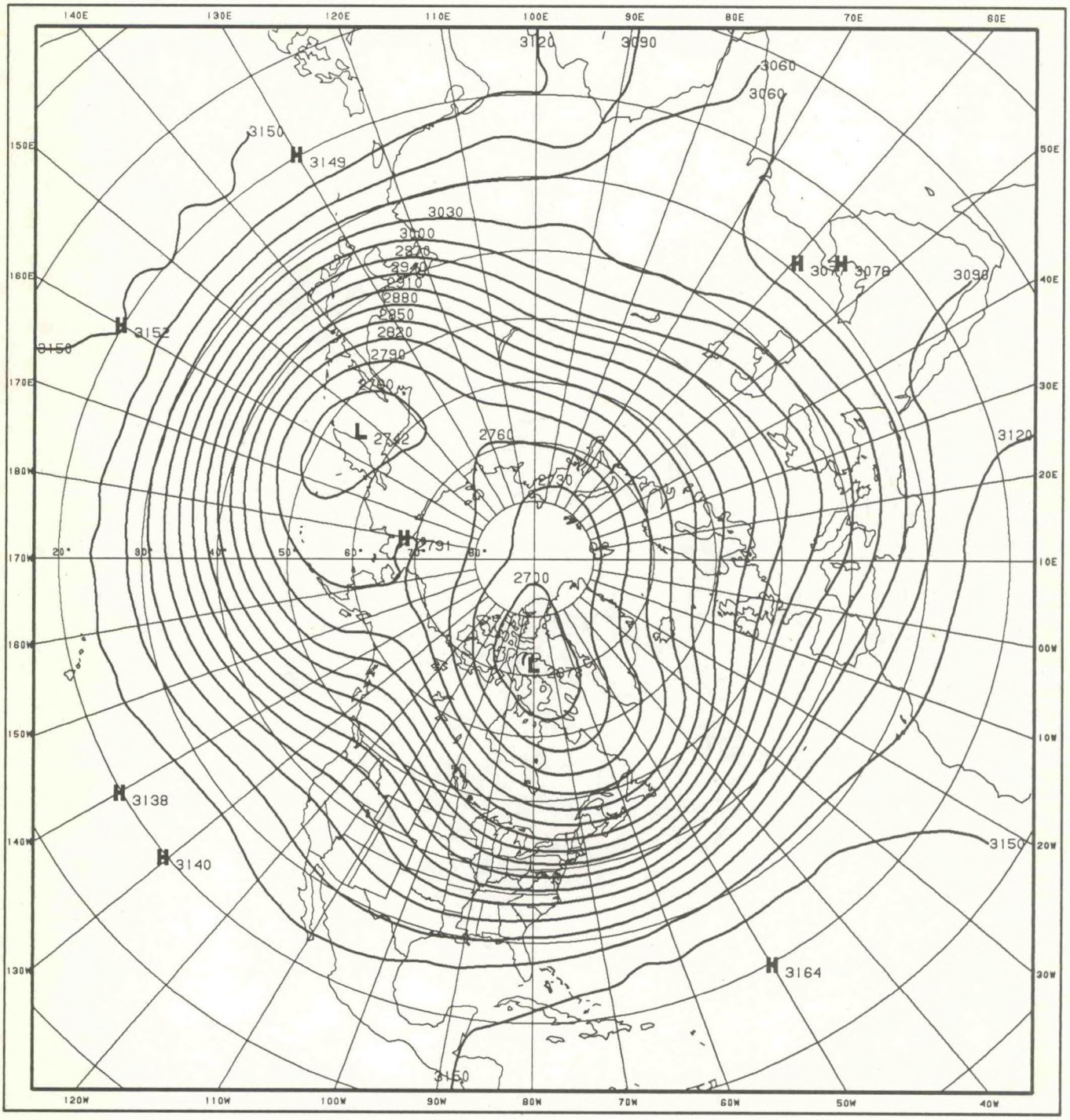


Fig. 9

700 MB HEIGHT MEAN JANUARY

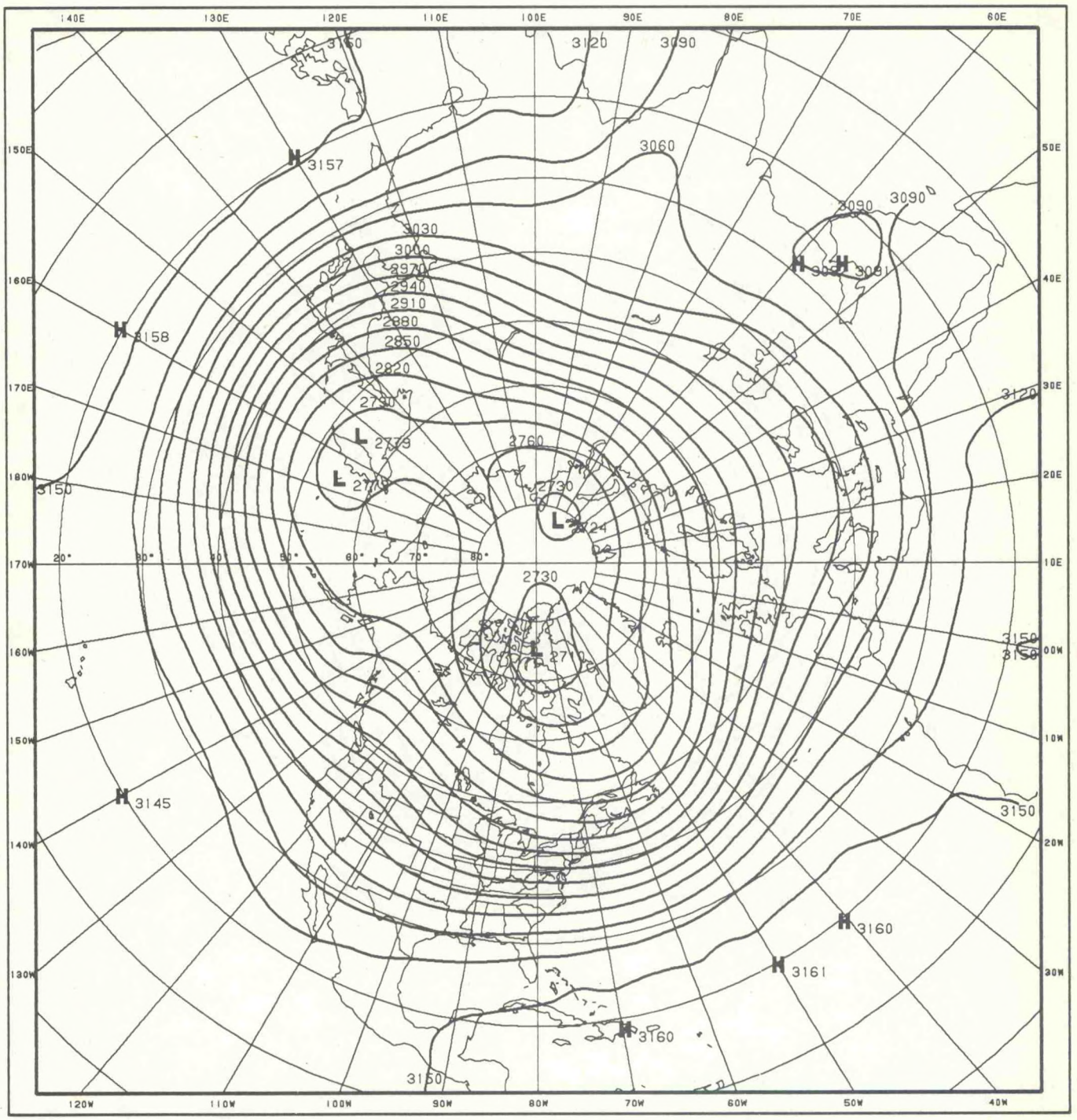
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT MEAN FEBRUARY
1-MONTH MEAN UNPOOLED 1950-92

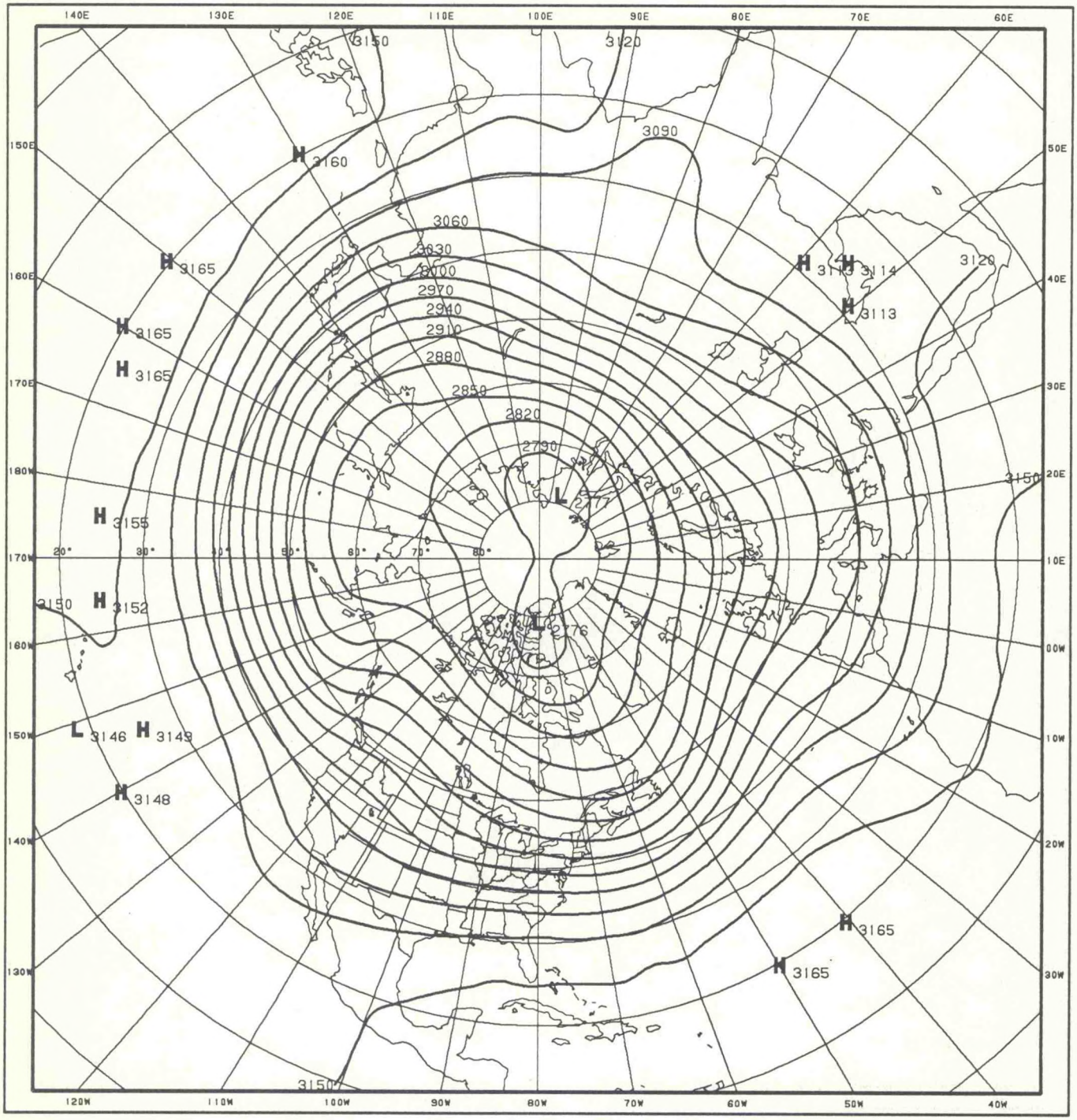
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT MEAN MARCH

1-MONTH MEAN UNPOOLED 1950-92

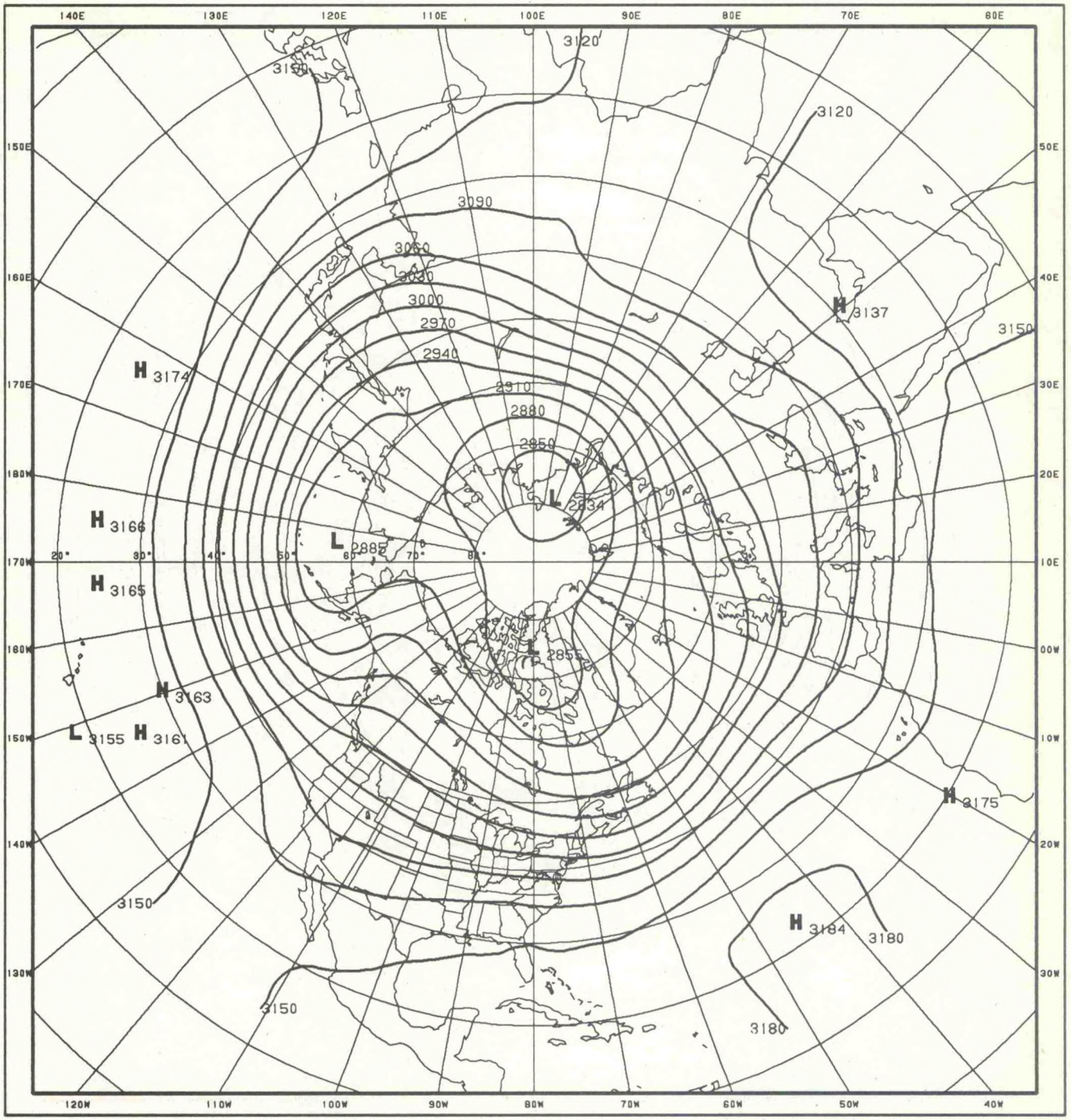
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT MEAN APRIL

1-MONTH MEAN UNPOOLED 1950-92

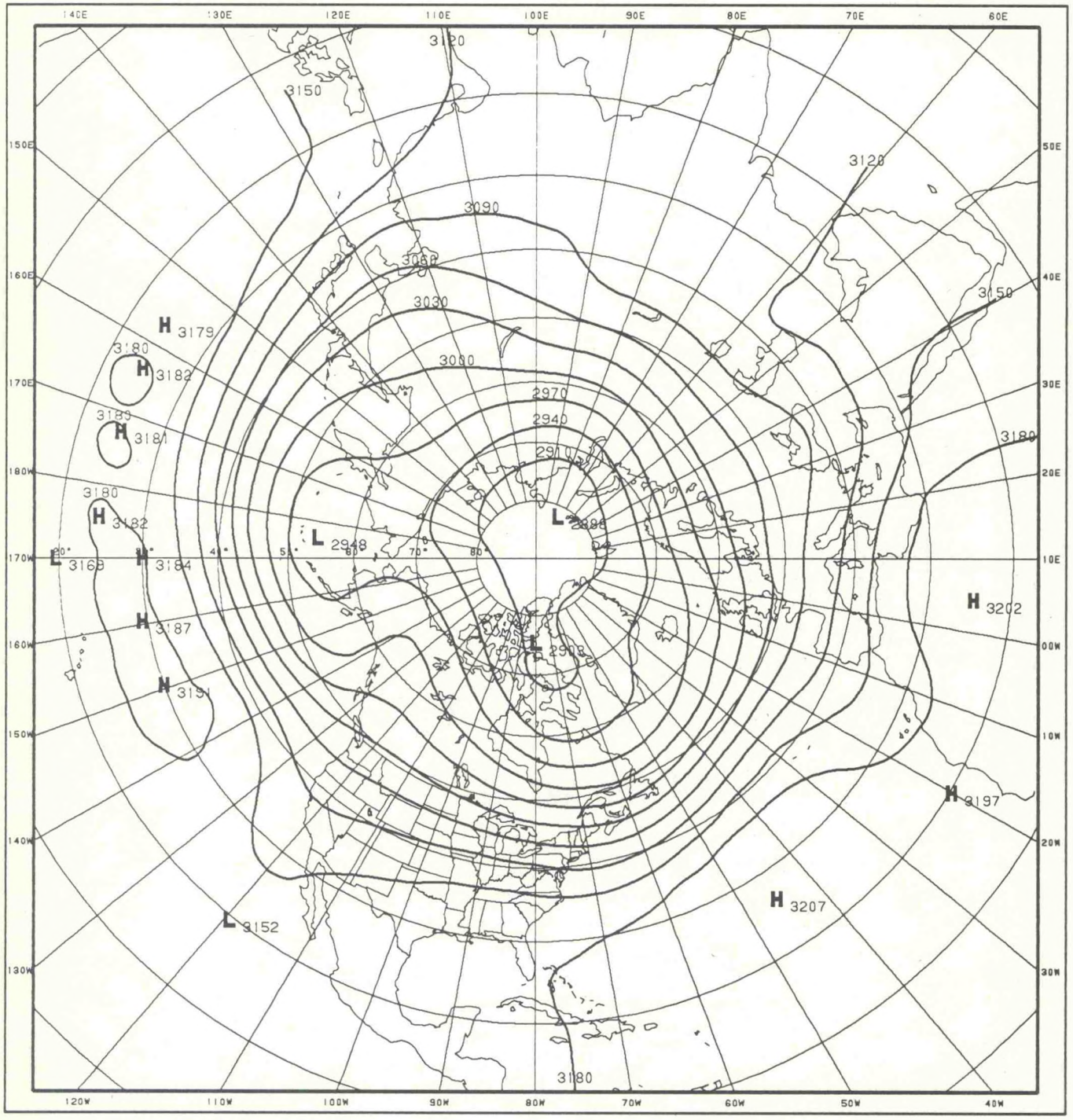
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT MEAN MAY

1-MONTH MEAN UNPOOLED 1950-92

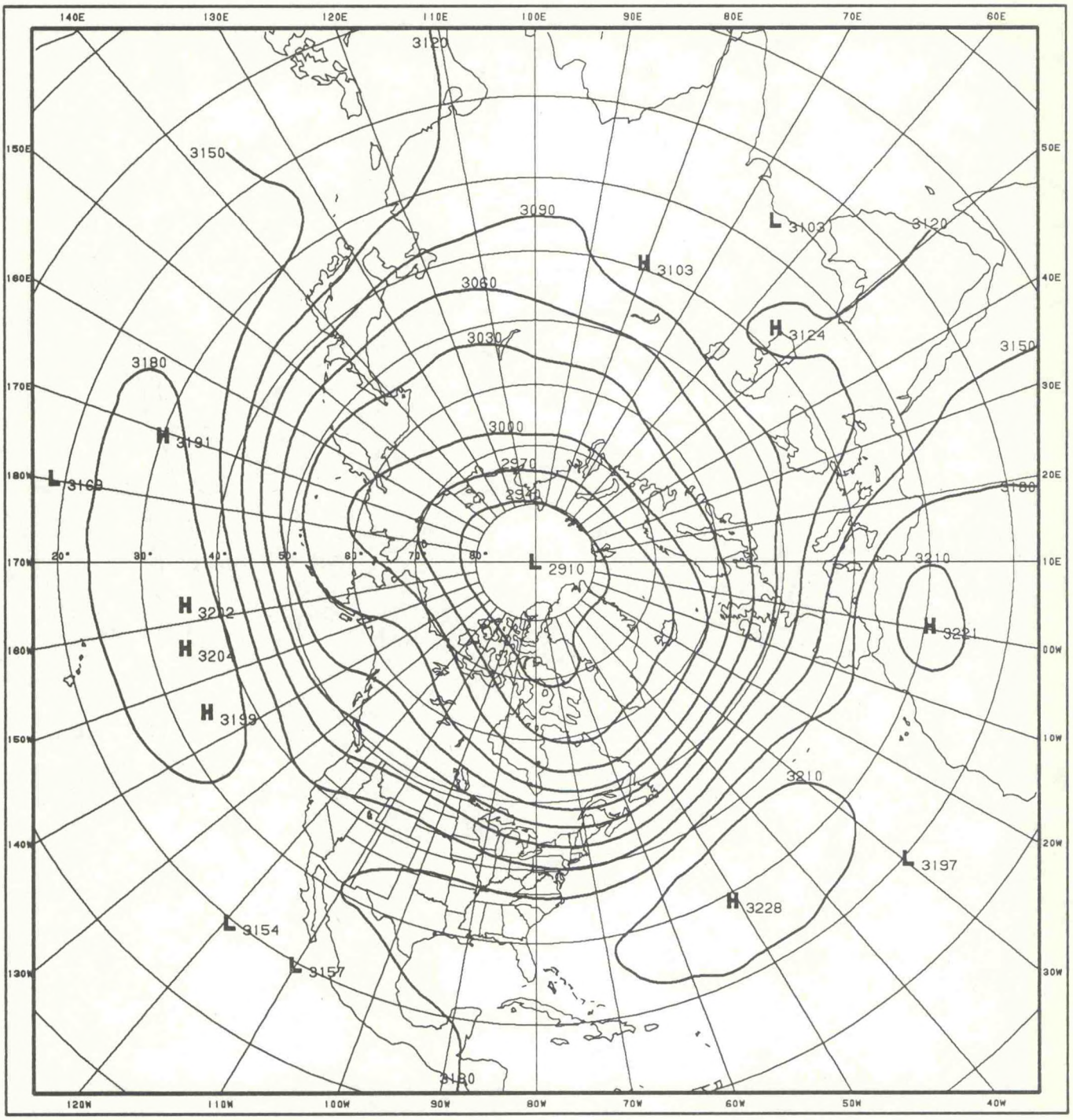
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT MEAN JUNE

1-MONTH MEAN UNPOOLED 1950-92

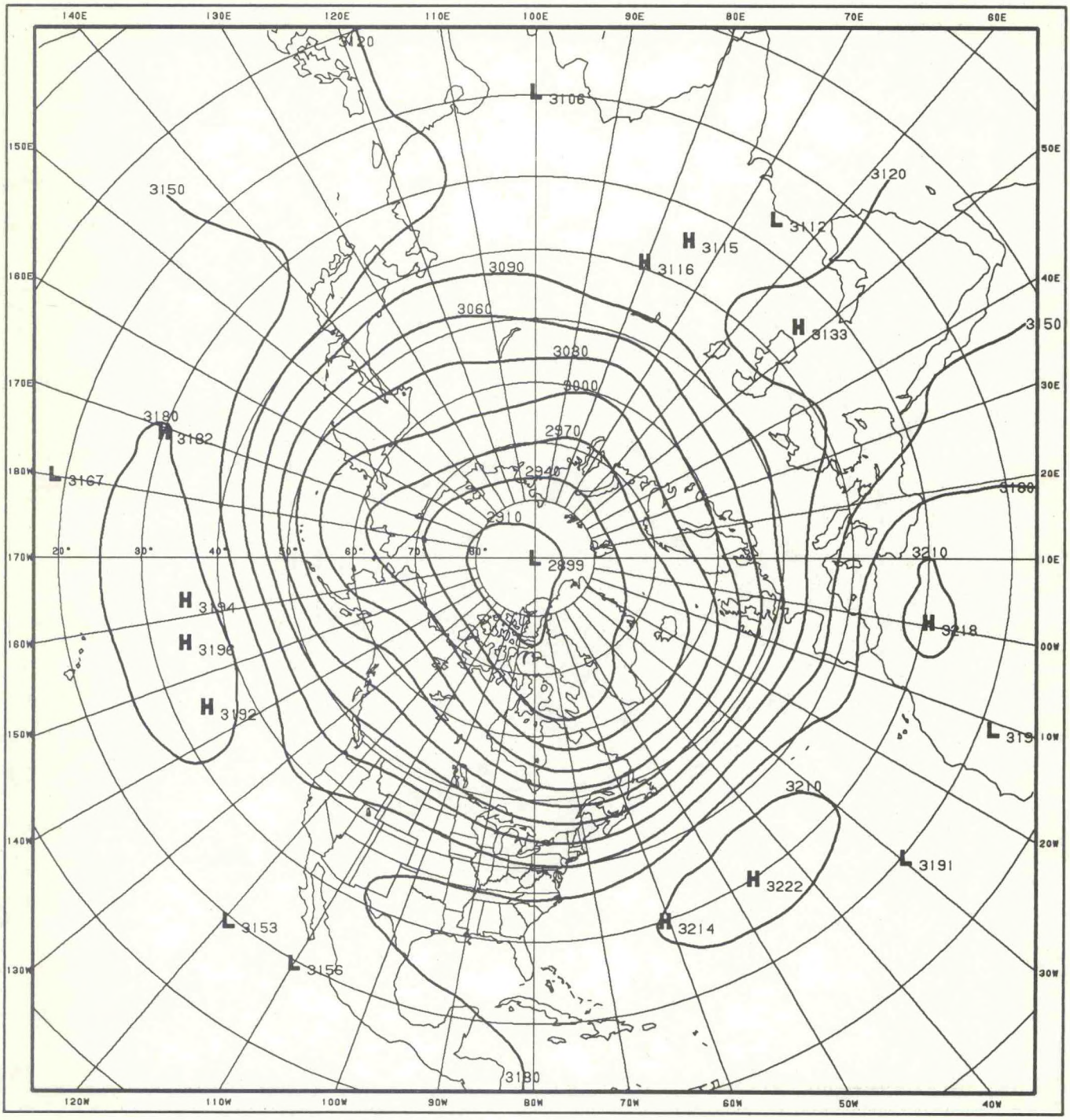
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT MEAN JULY

1-MONTH MEAN UNPOOLED 1950-92

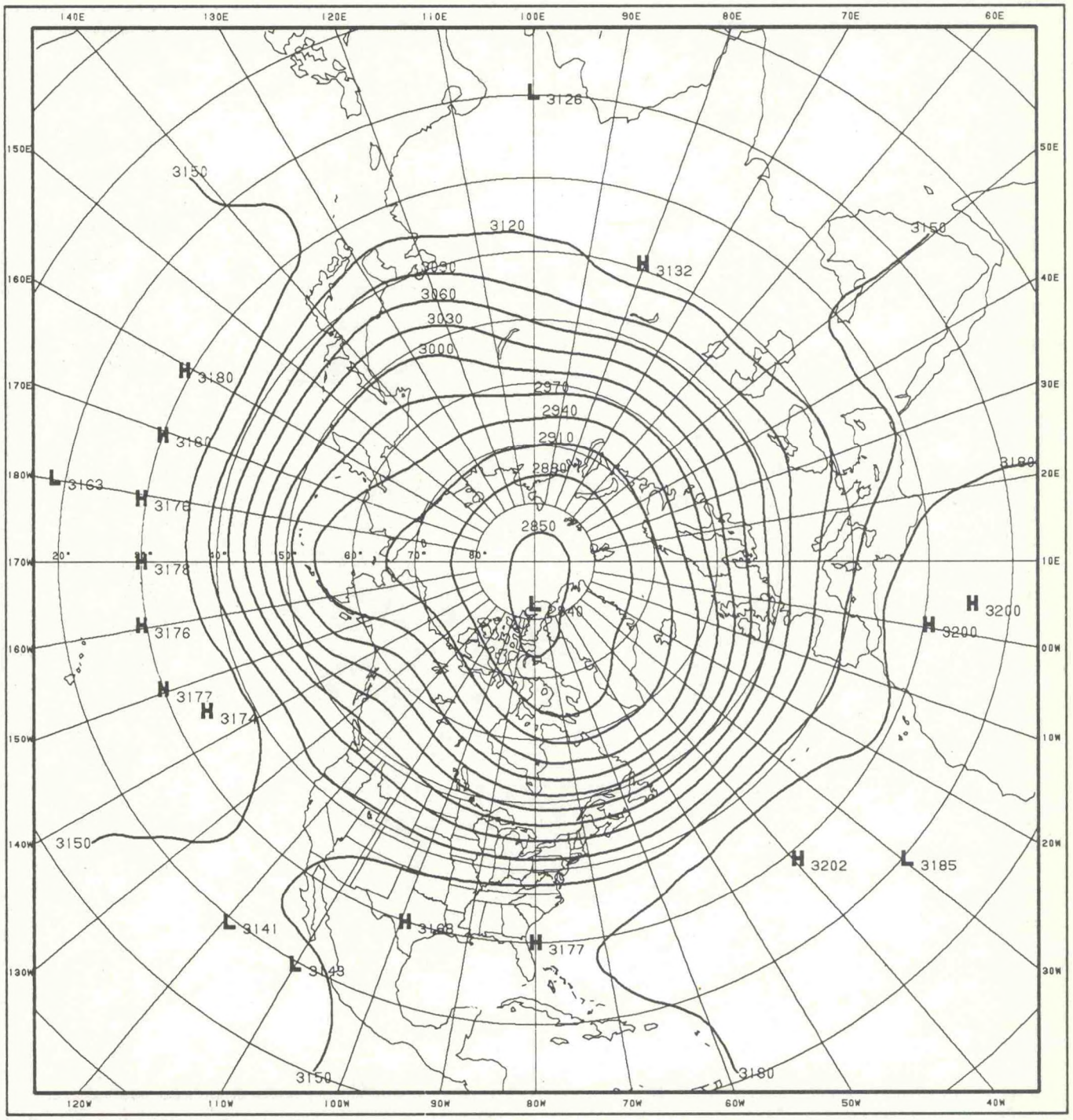
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT MEAN AUGUST

1-MONTH MEAN UNPOOLED 1950-92

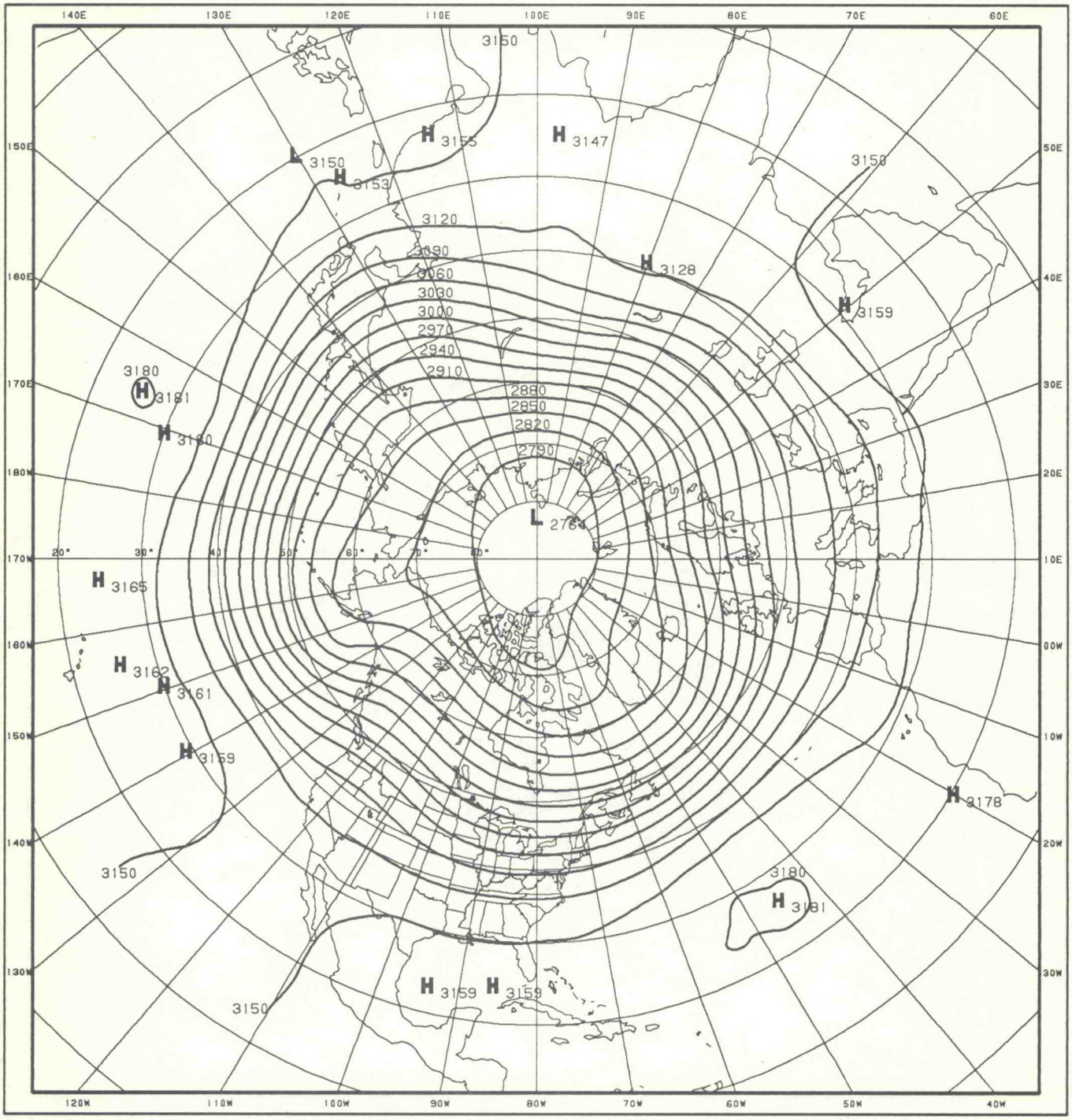
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT MEAN SEPTEMBR

1-MONTH MEAN UNPOOLED 1950-92

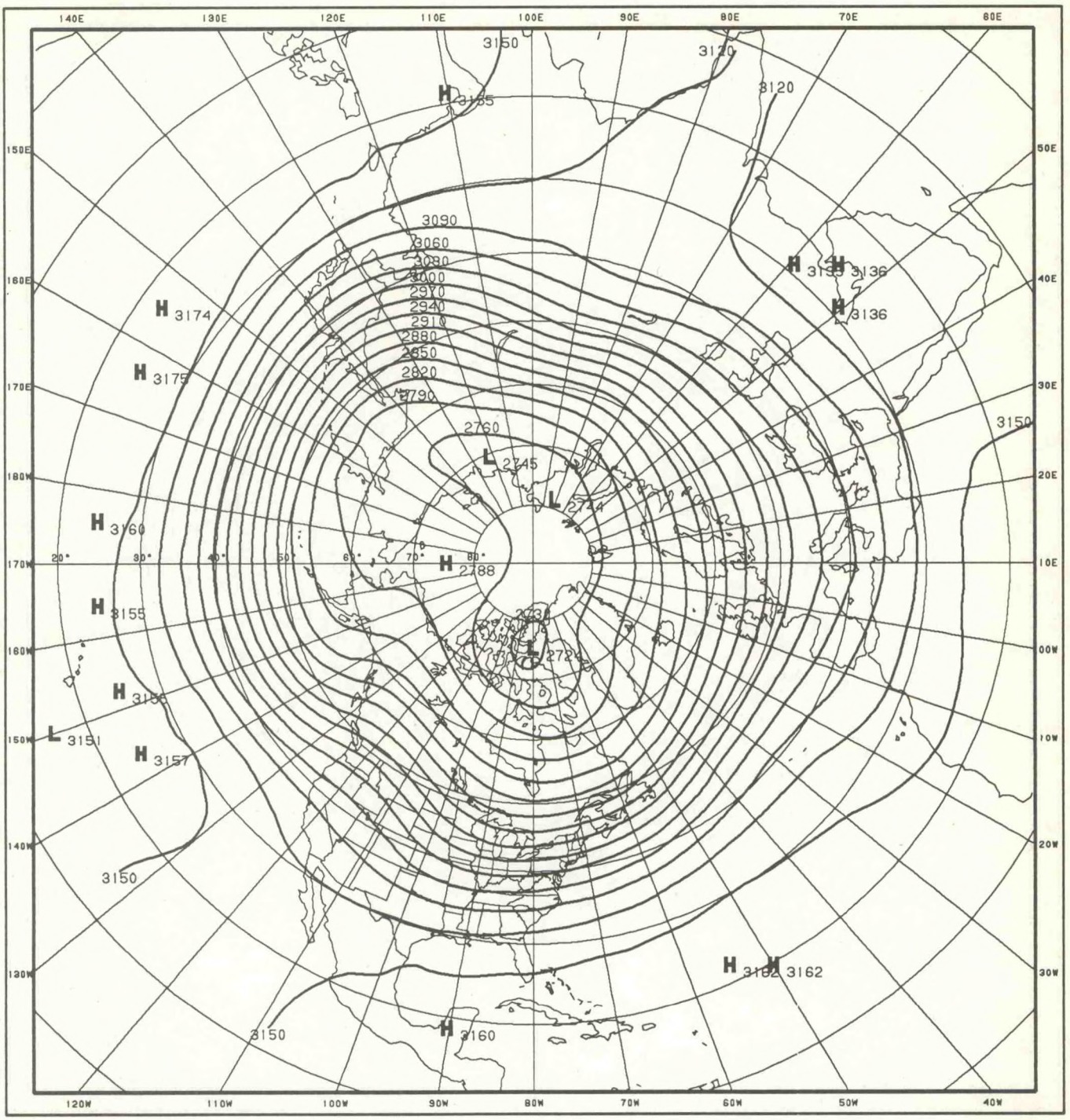
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT MEAN OCTOBER

1-MONTH MEAN UNPOOLED 1950-92

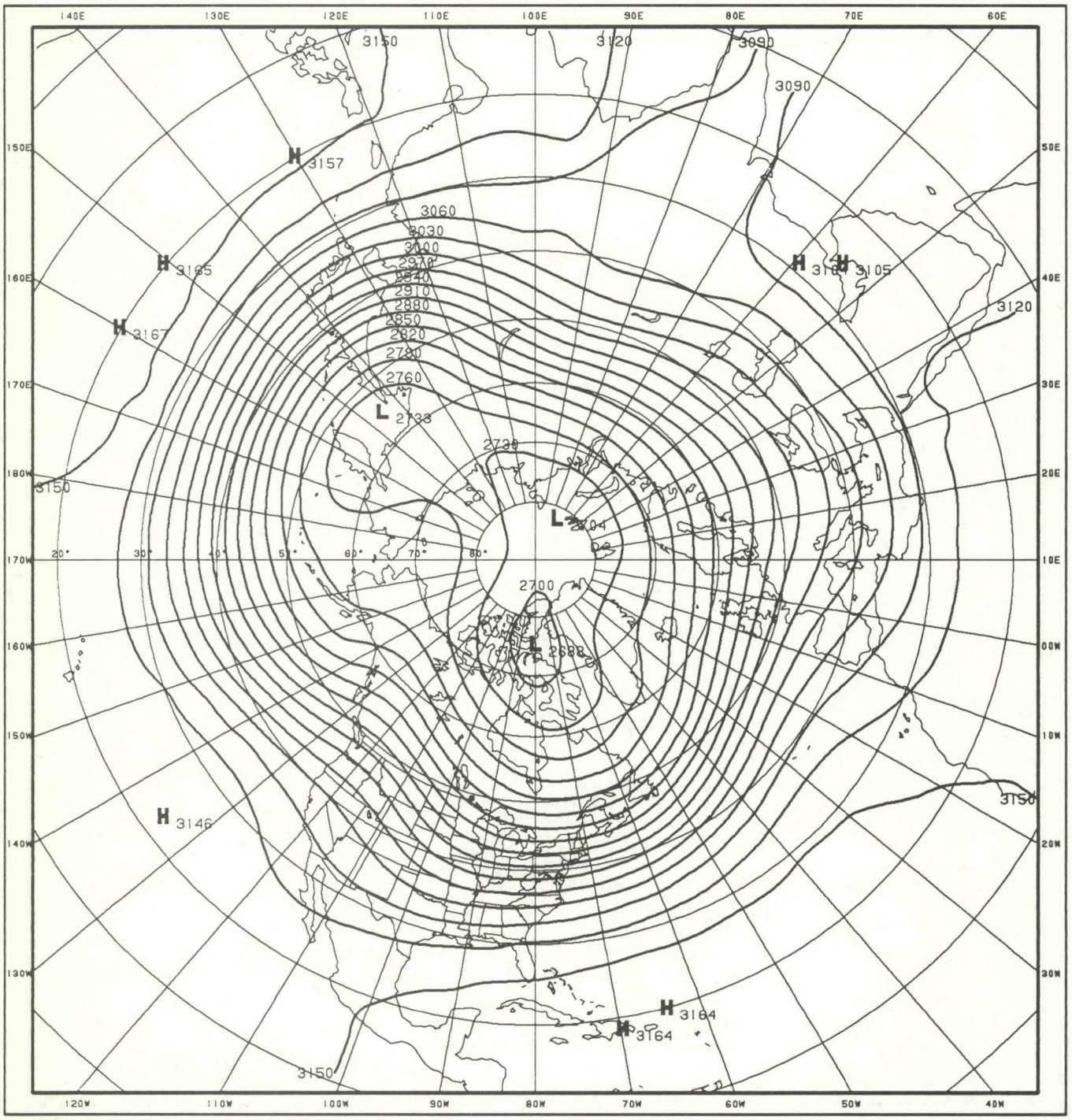
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT MEAN NOVEMBER

1-MONTH MEAN UNPOOLED 1950-92

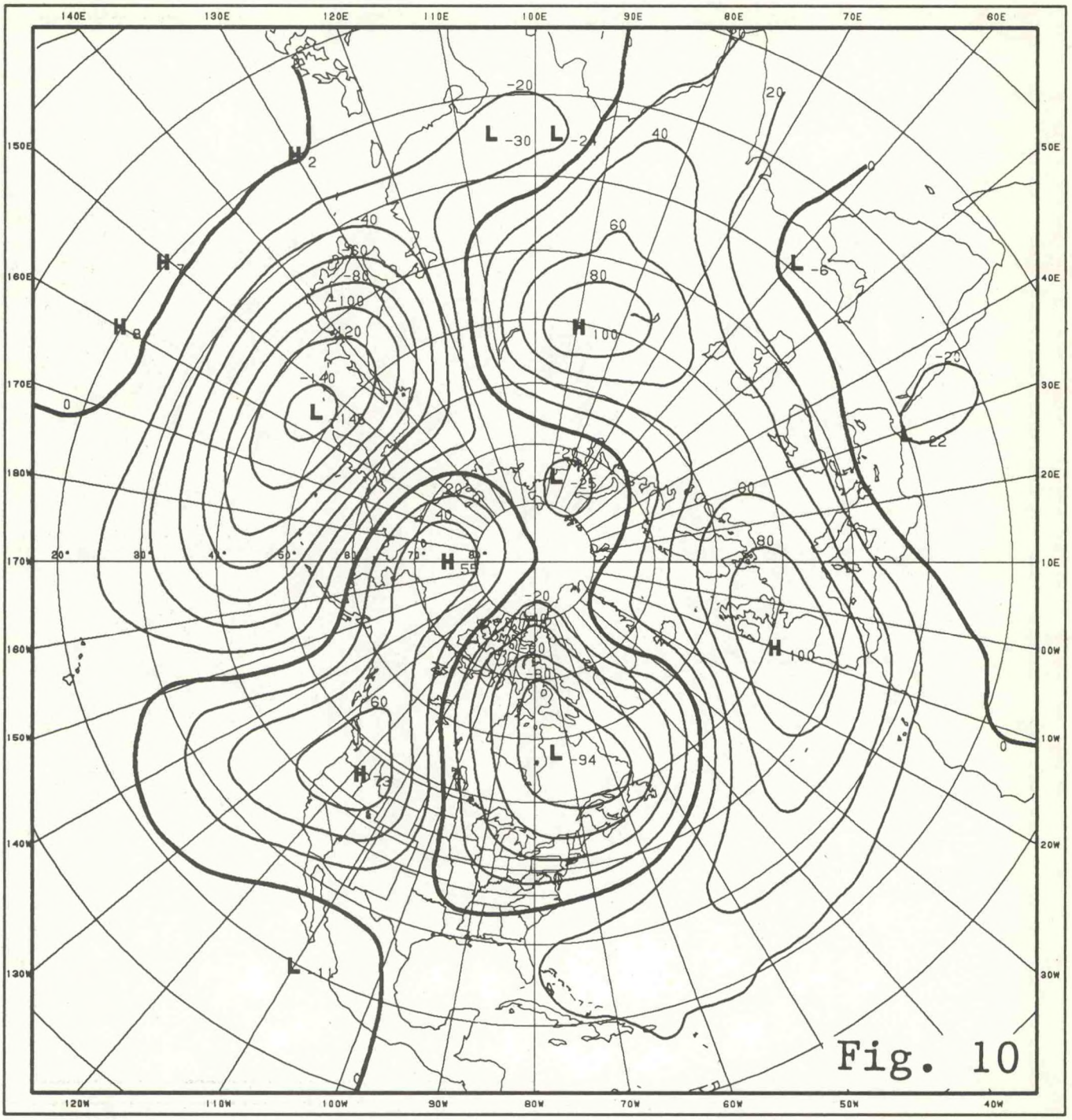
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT MEAN DECEMBER

1-MONTH MEAN UNPOOLED 1950-92

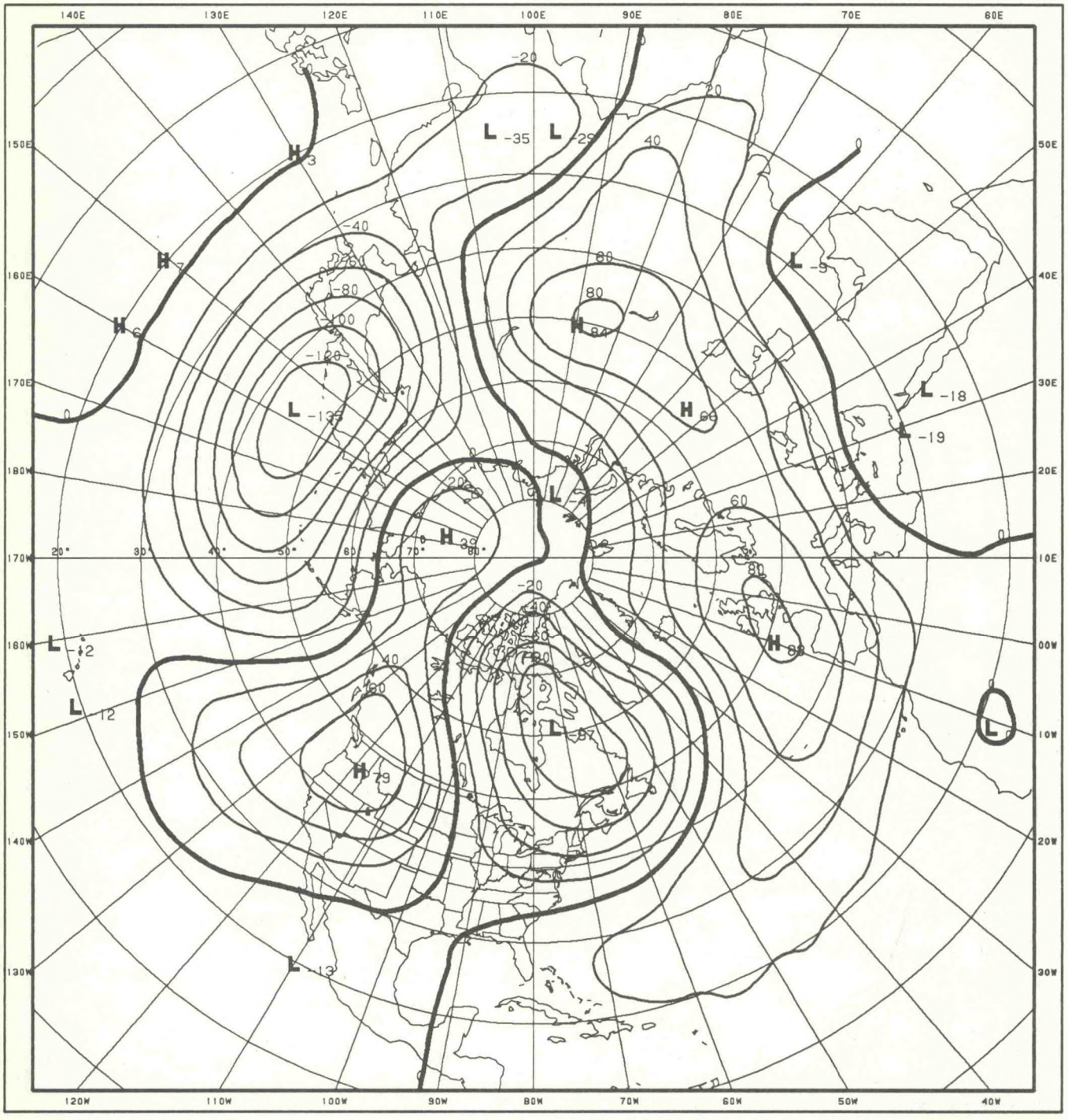
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT EDDY JANUARY

1-MONTH MEAN UNPOOLED 1950-92

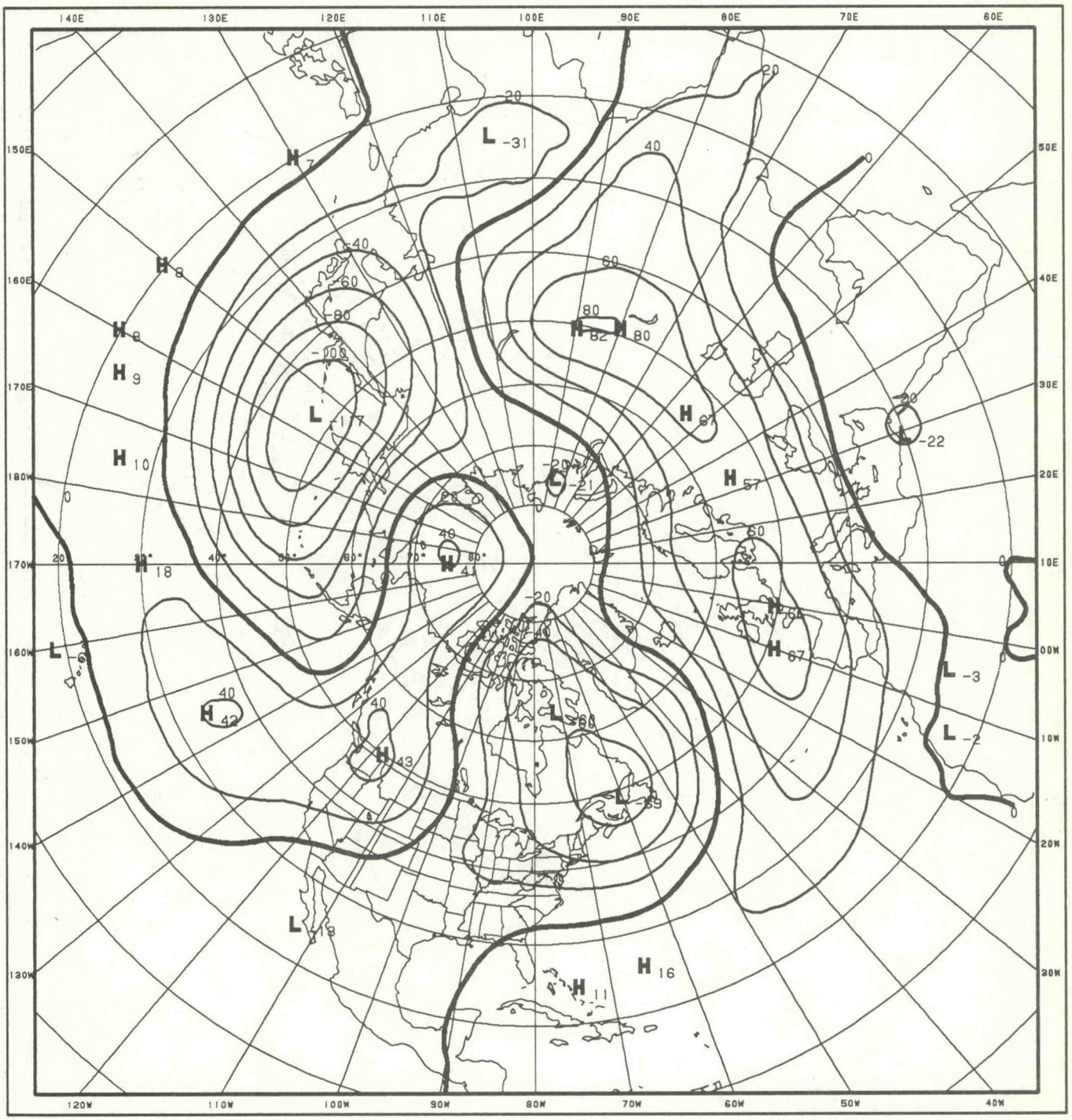
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT EDDY FEBRUARY

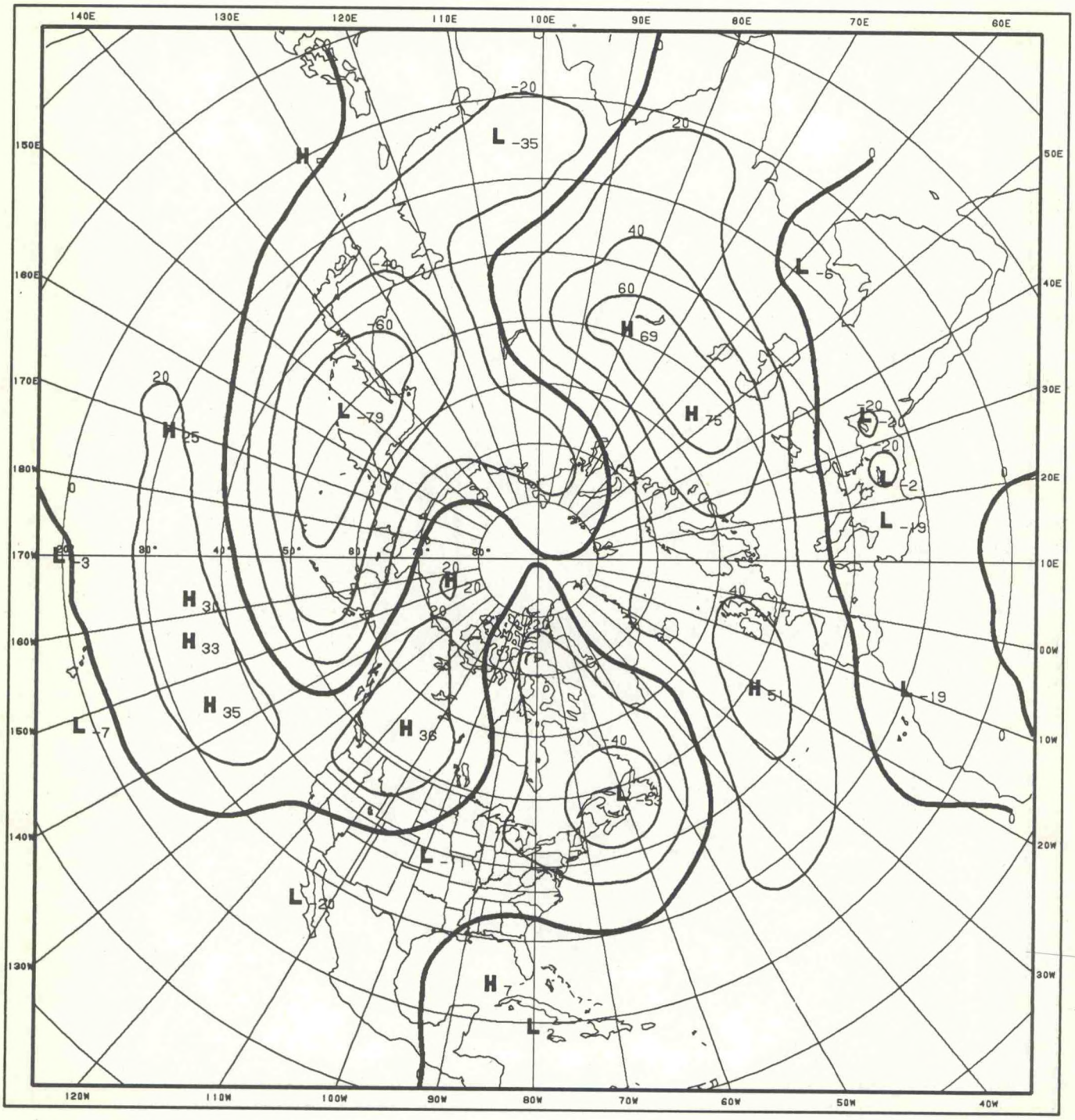
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



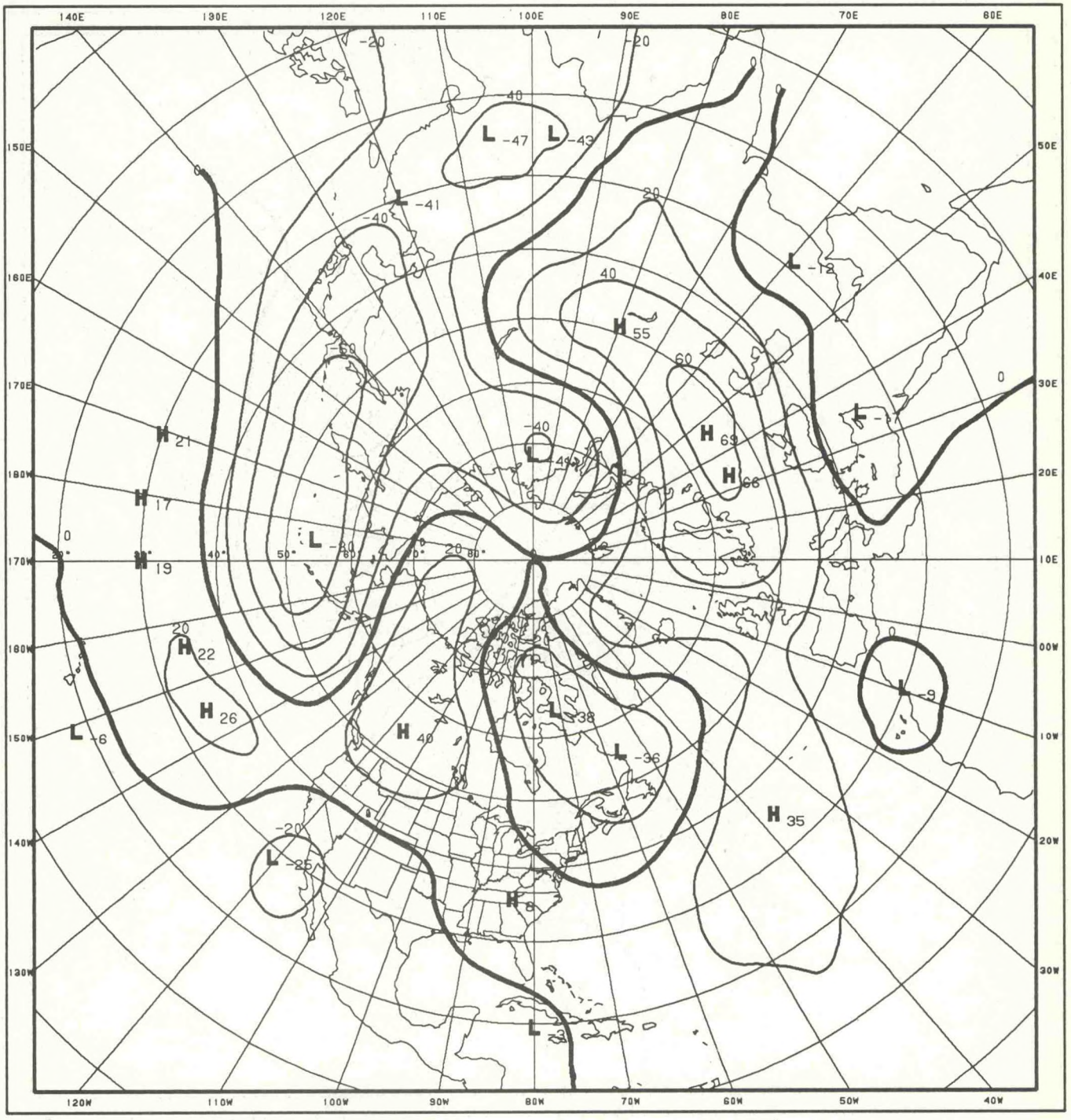
700 MB HEIGHT EDDY MARCH
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



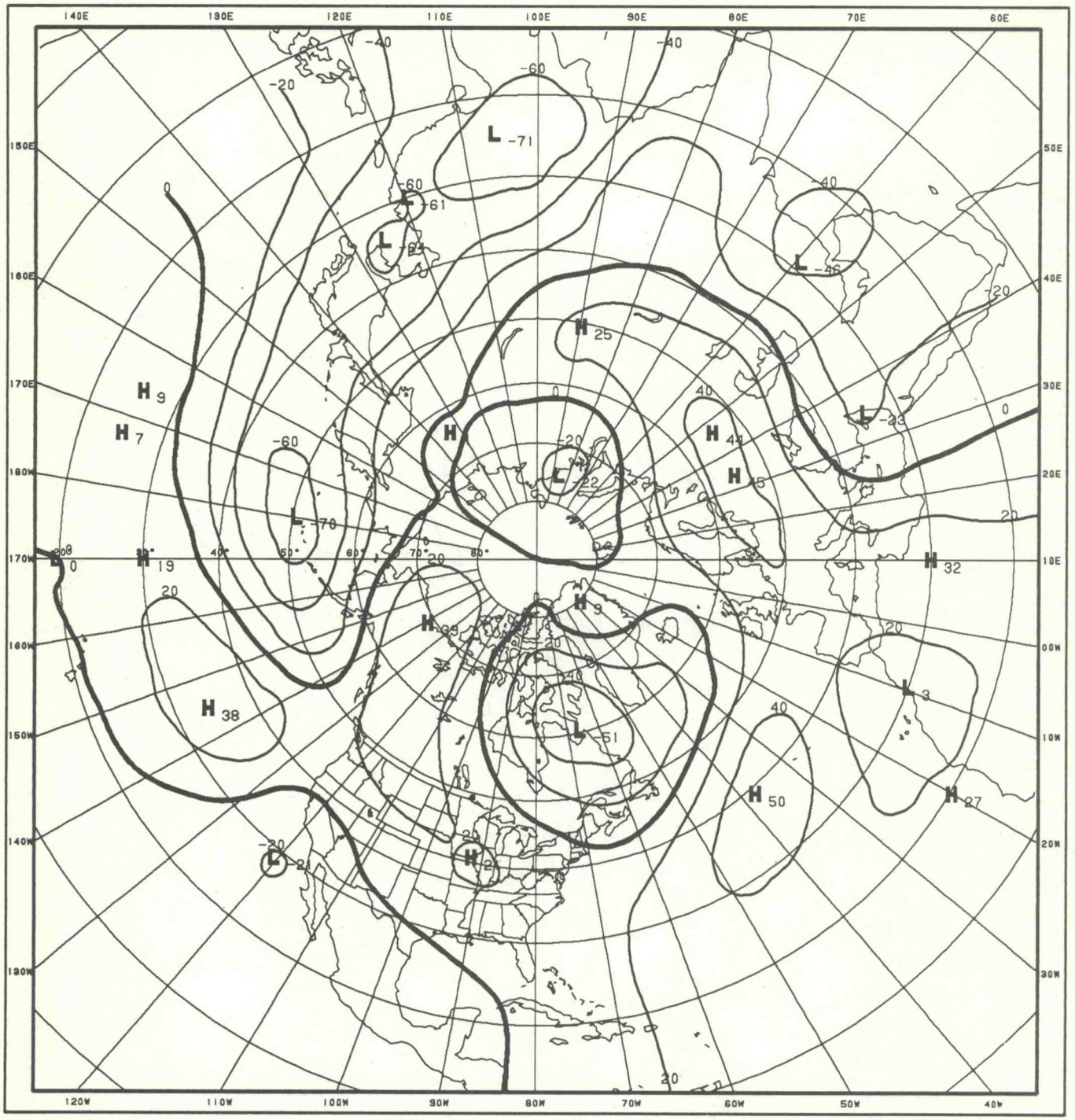
700 MB HEIGHT EDDY APRIL
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT EDDY MAY
1-MONTH MEAN UNPOOLED 1950-92

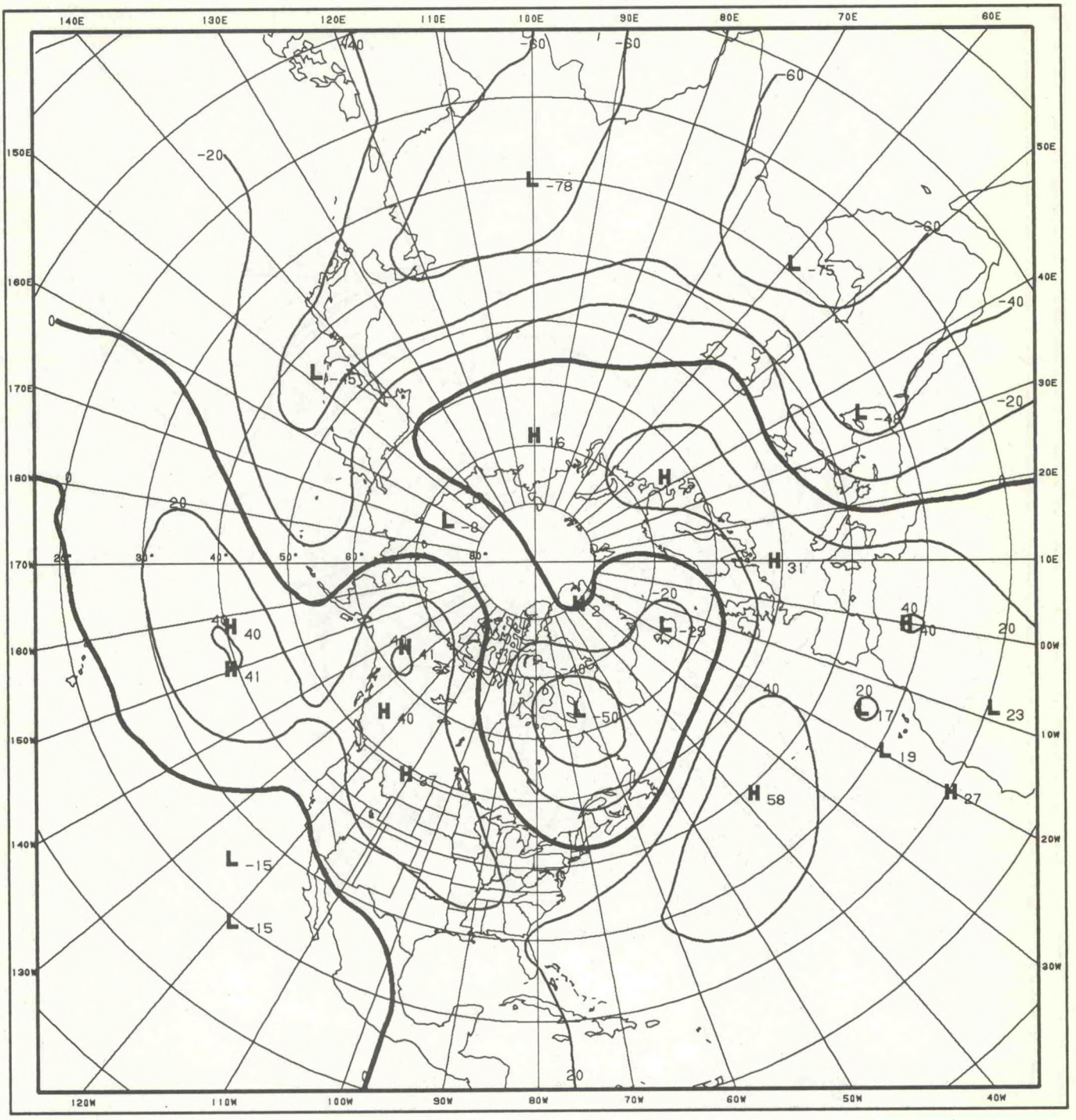
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT EDDY JUNE

1-MONTH MEAN UNPOOLED 1950-92

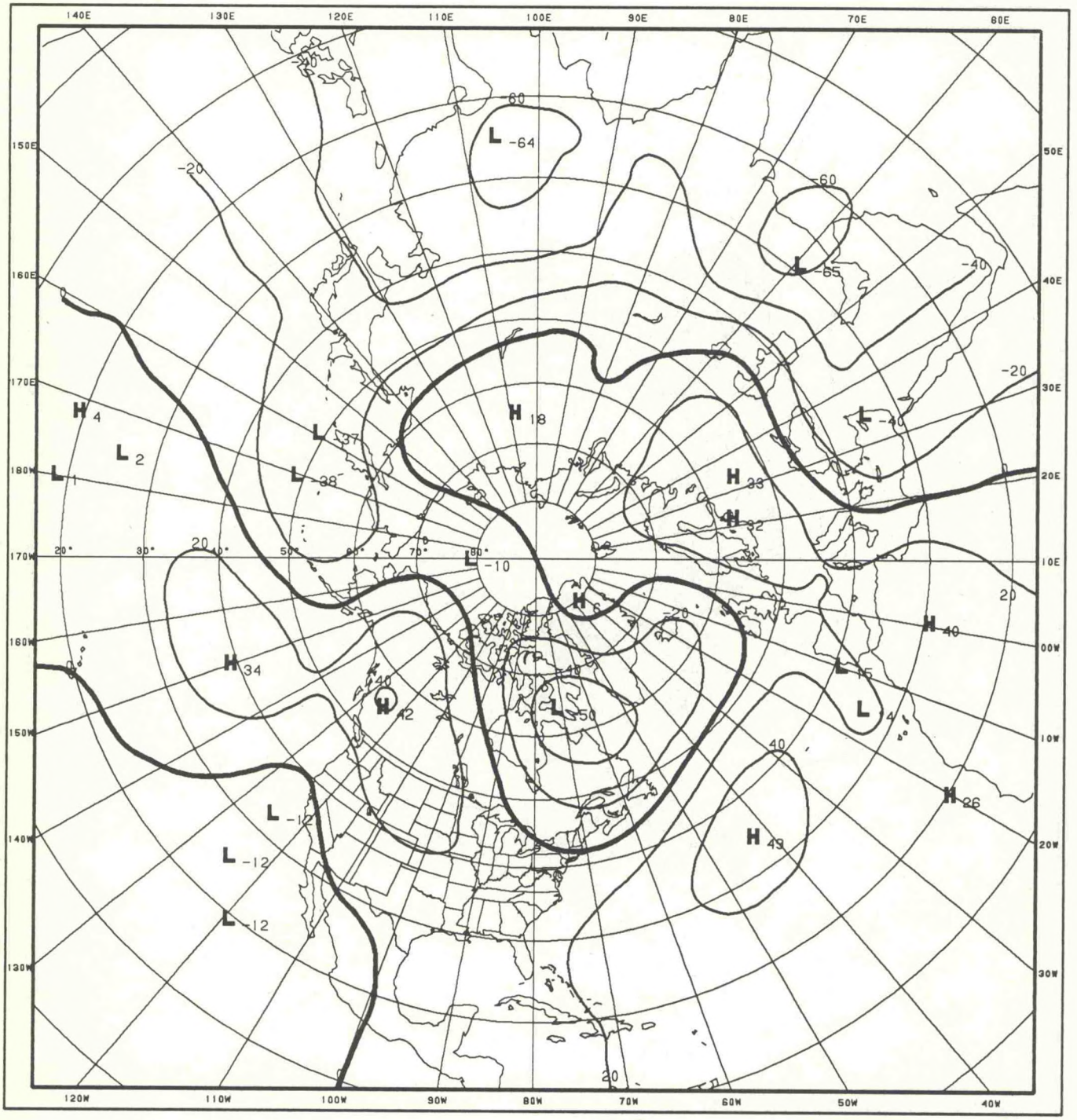
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT EDDY JULY

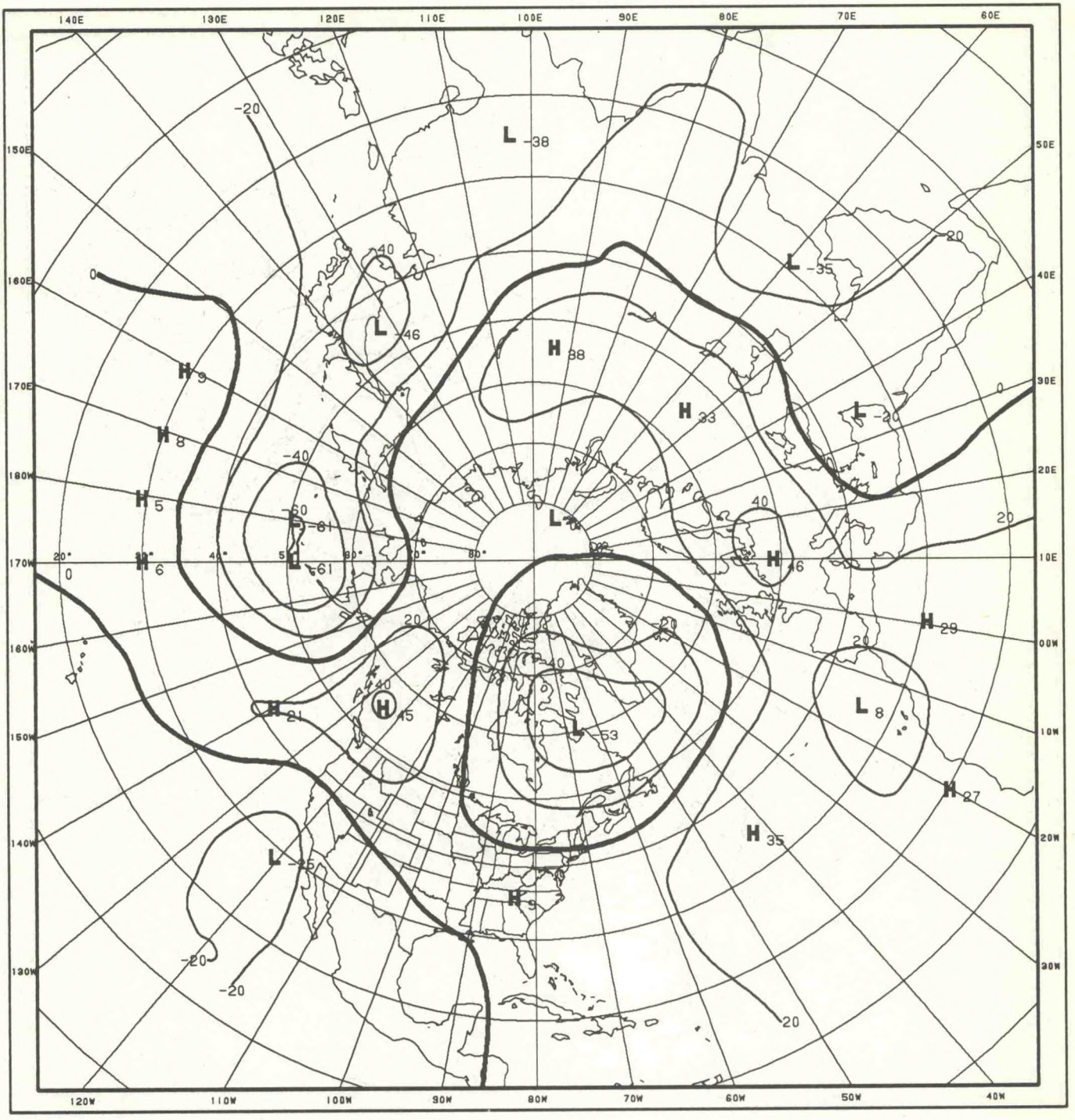
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT EDDY AUGUST
1-MONTH MEAN UNPOOLED 1950-92

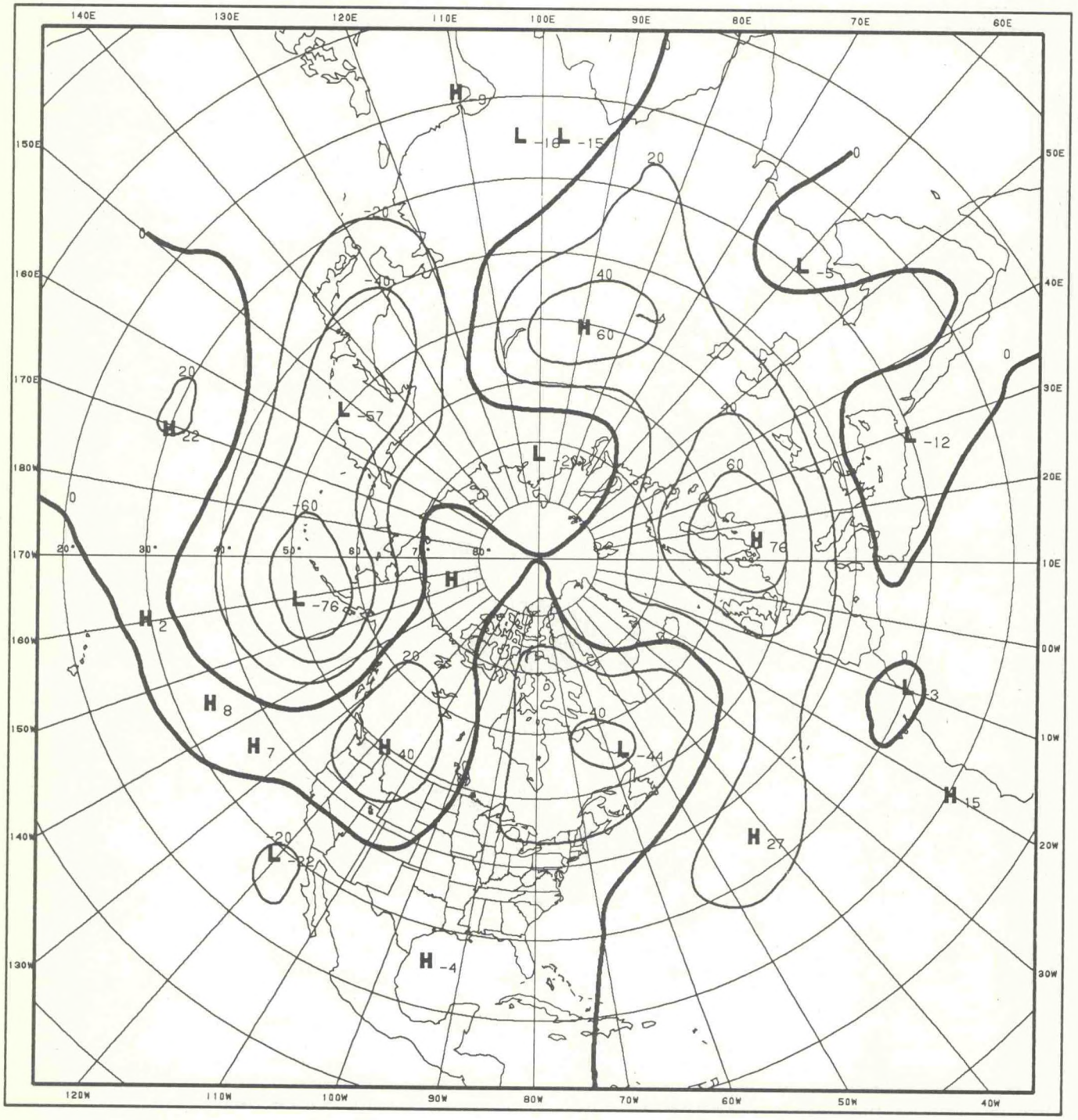
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT EDDY SEPTEMBR

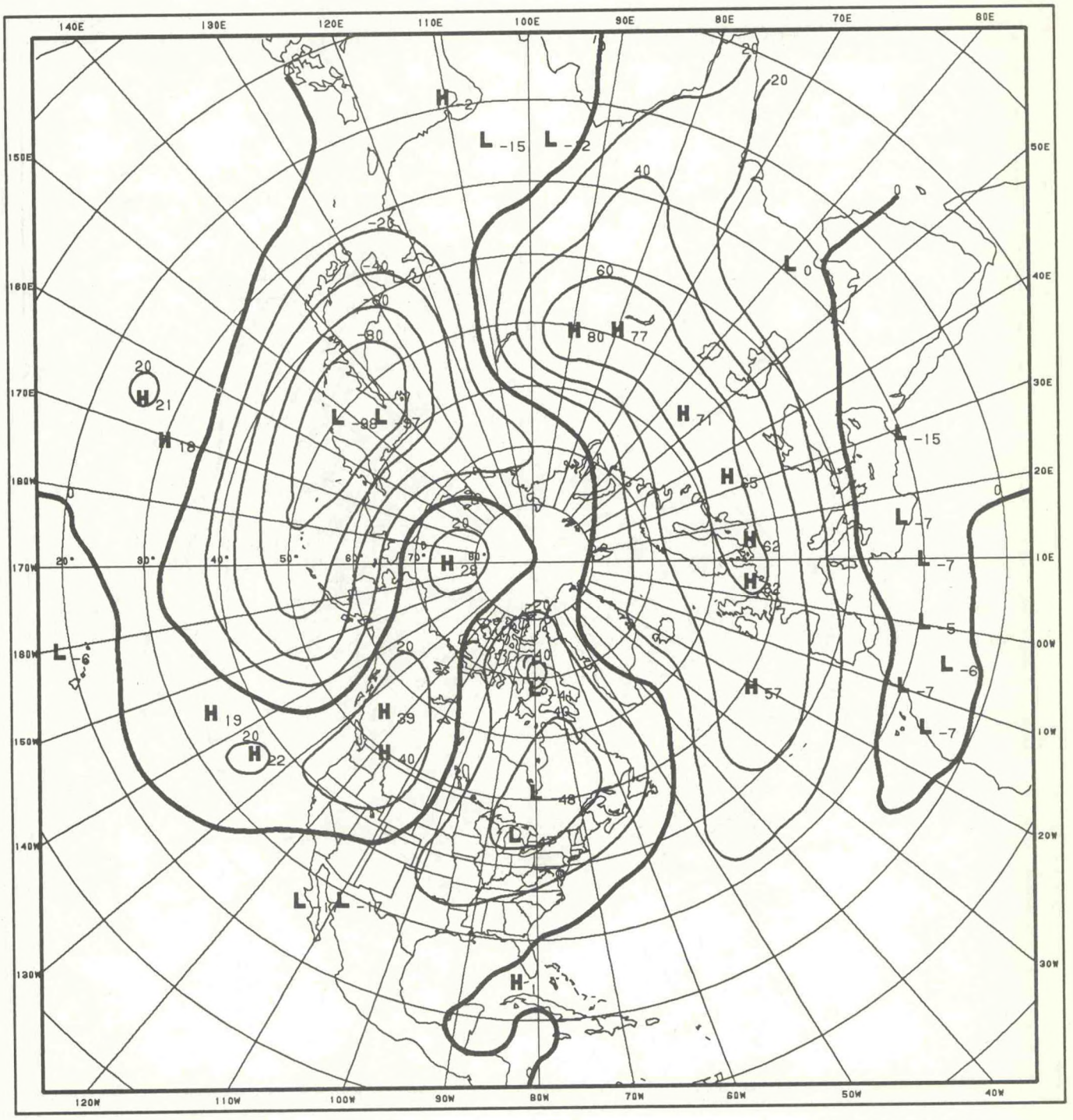
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT EDDY OCTOBER
1-MONTH MEAN UNPOOLED 1950-92

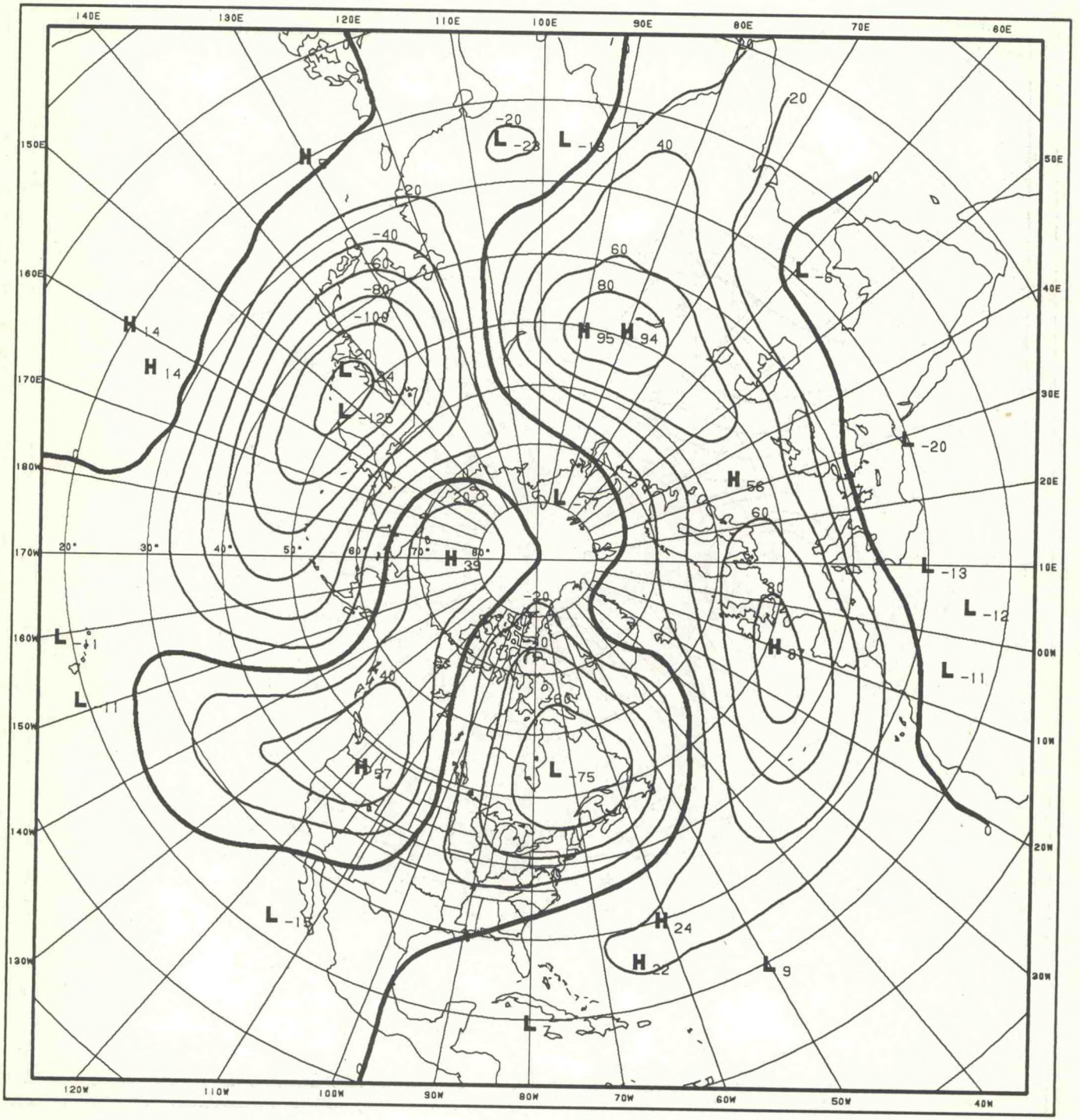
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT EDDY NOVEMBER

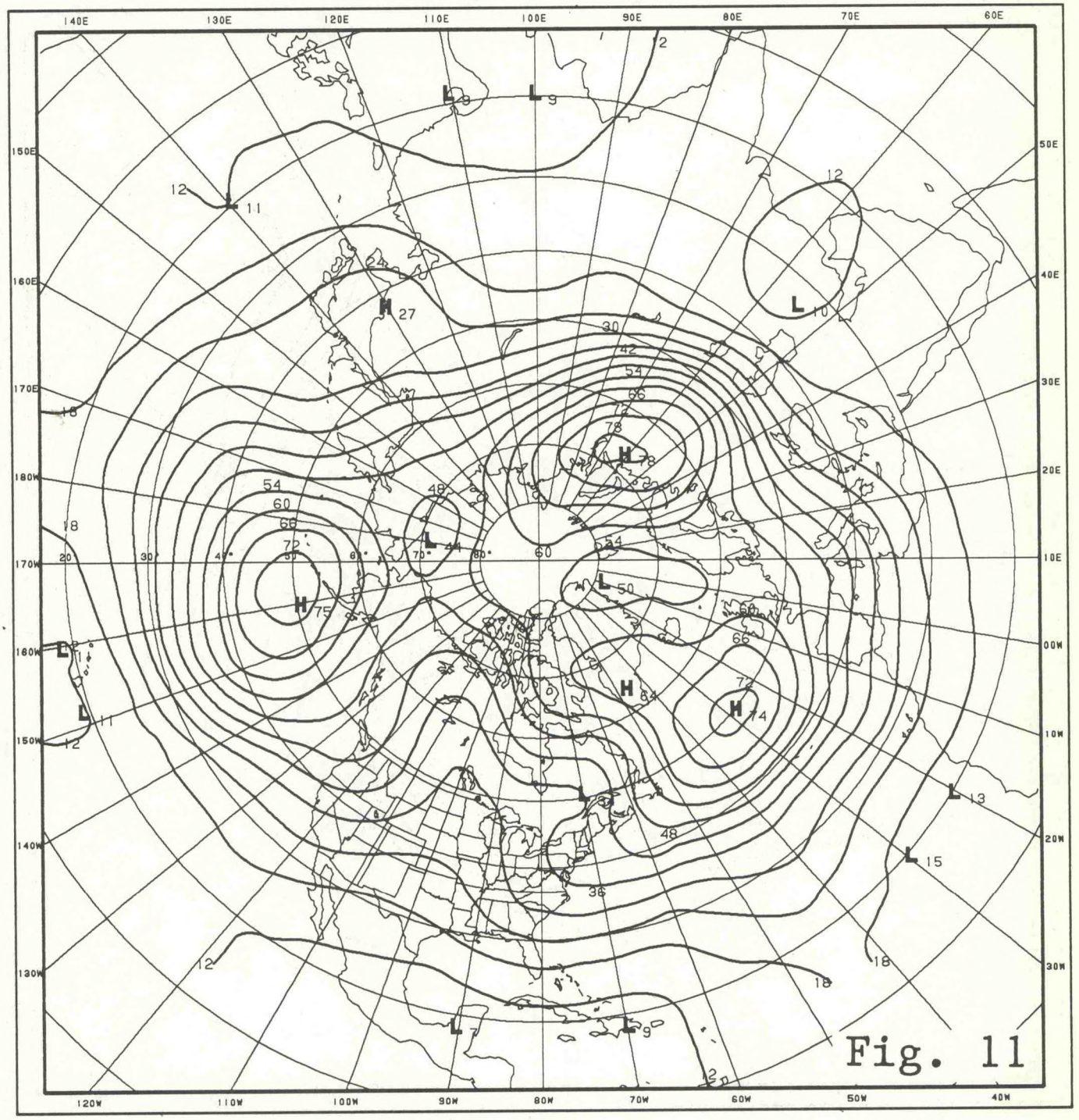
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



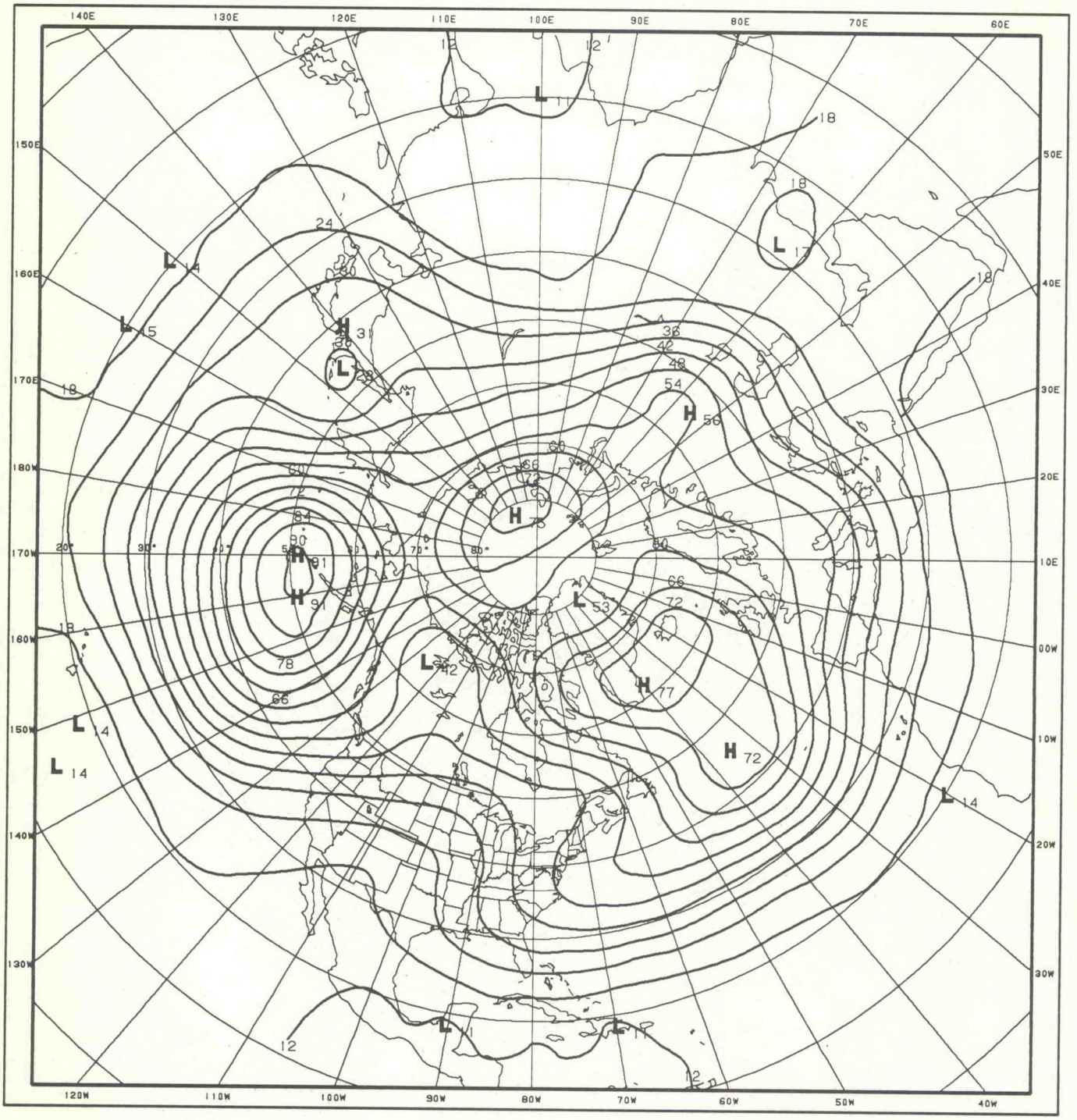
700 MB HEIGHT EDDY DECEMBER
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT STANDARD DEV DECEMBER
1-MONTH MEAN UNPOOLED 1950-92

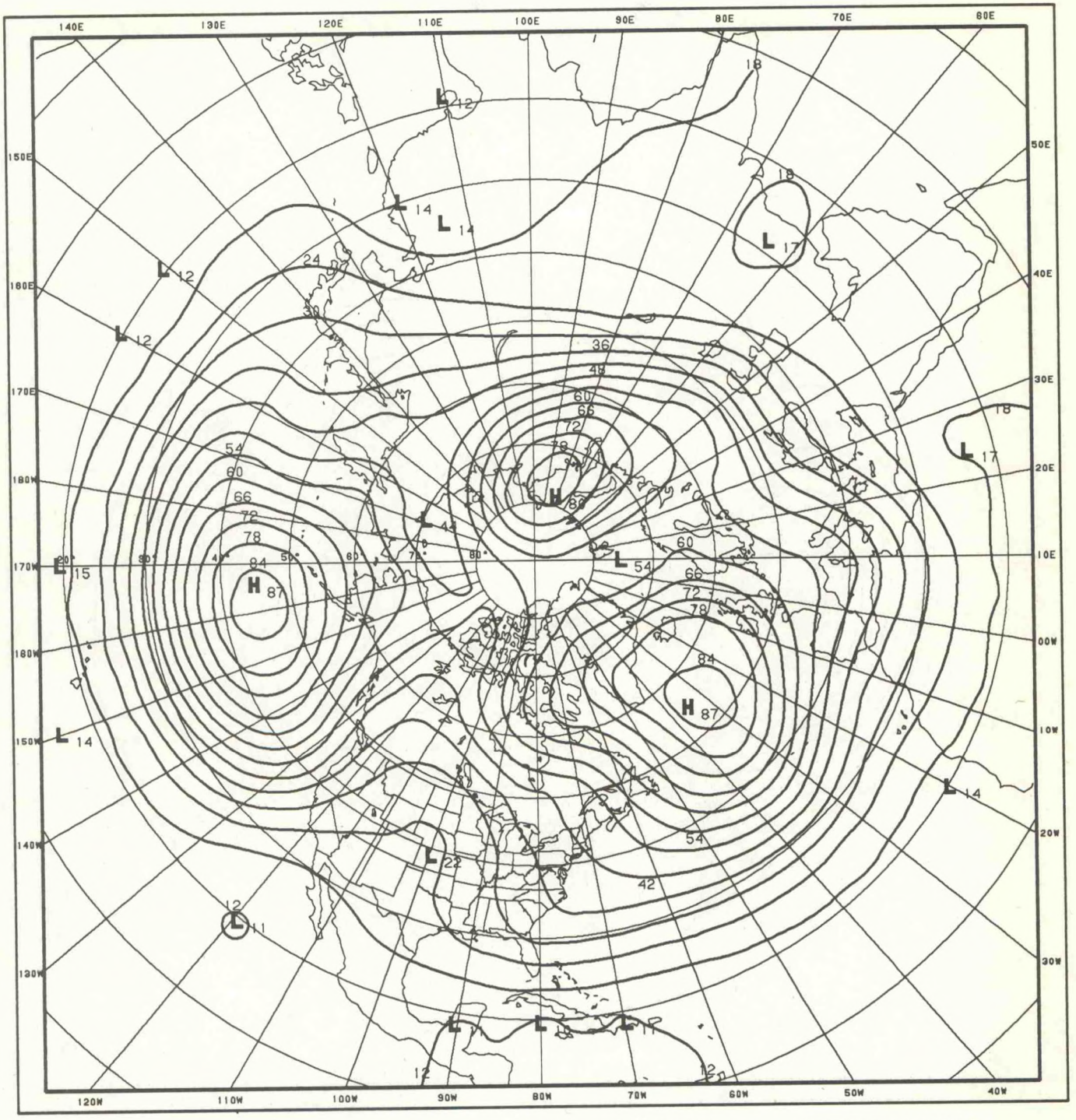
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT STANDARD DEV JANUARY

1-MONTH MEAN UNPOOLED 1950-92

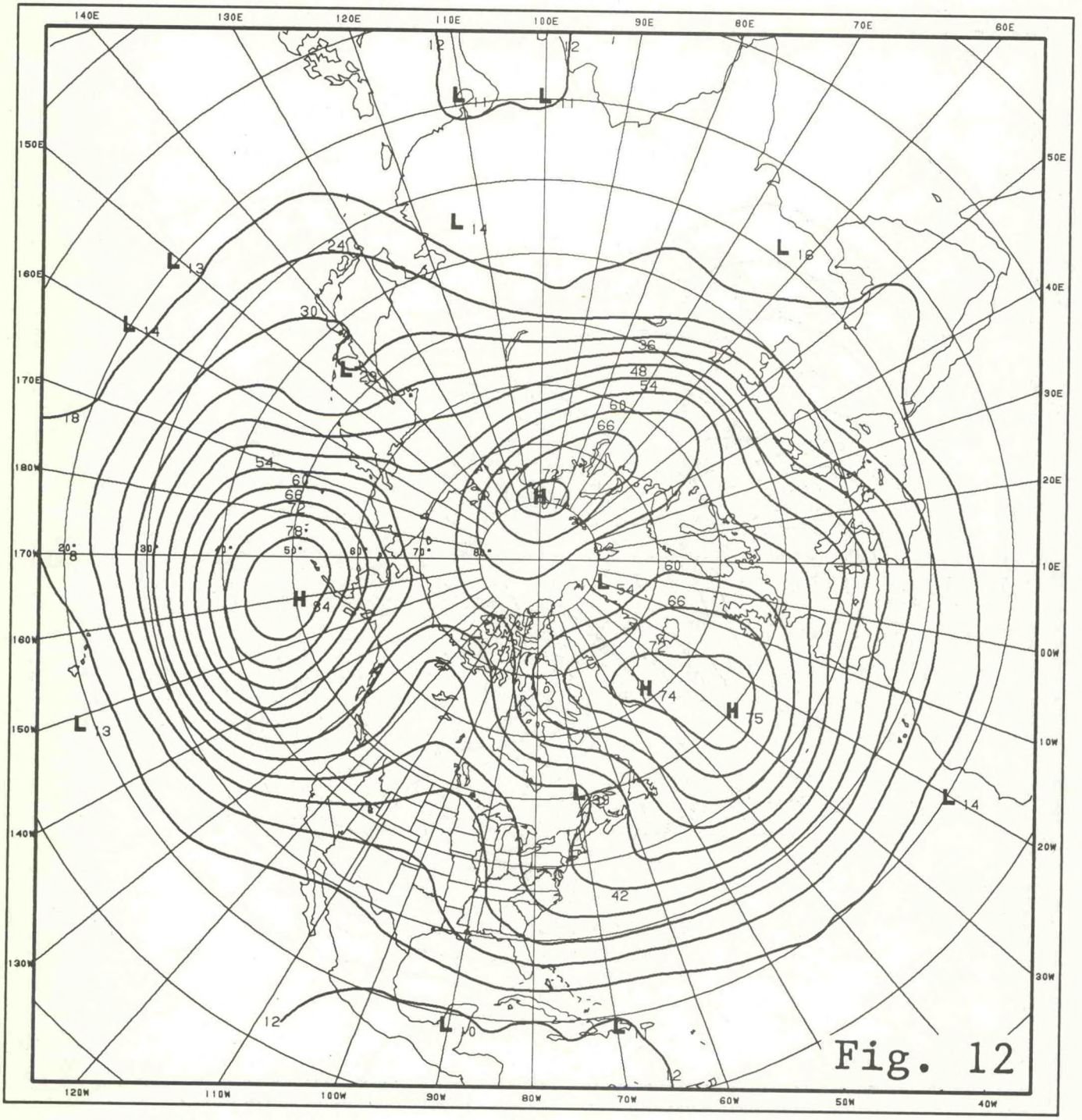
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT STANDARD DEV FEBRUARY

1-MONTH MEAN UNPOOLED 1950-92

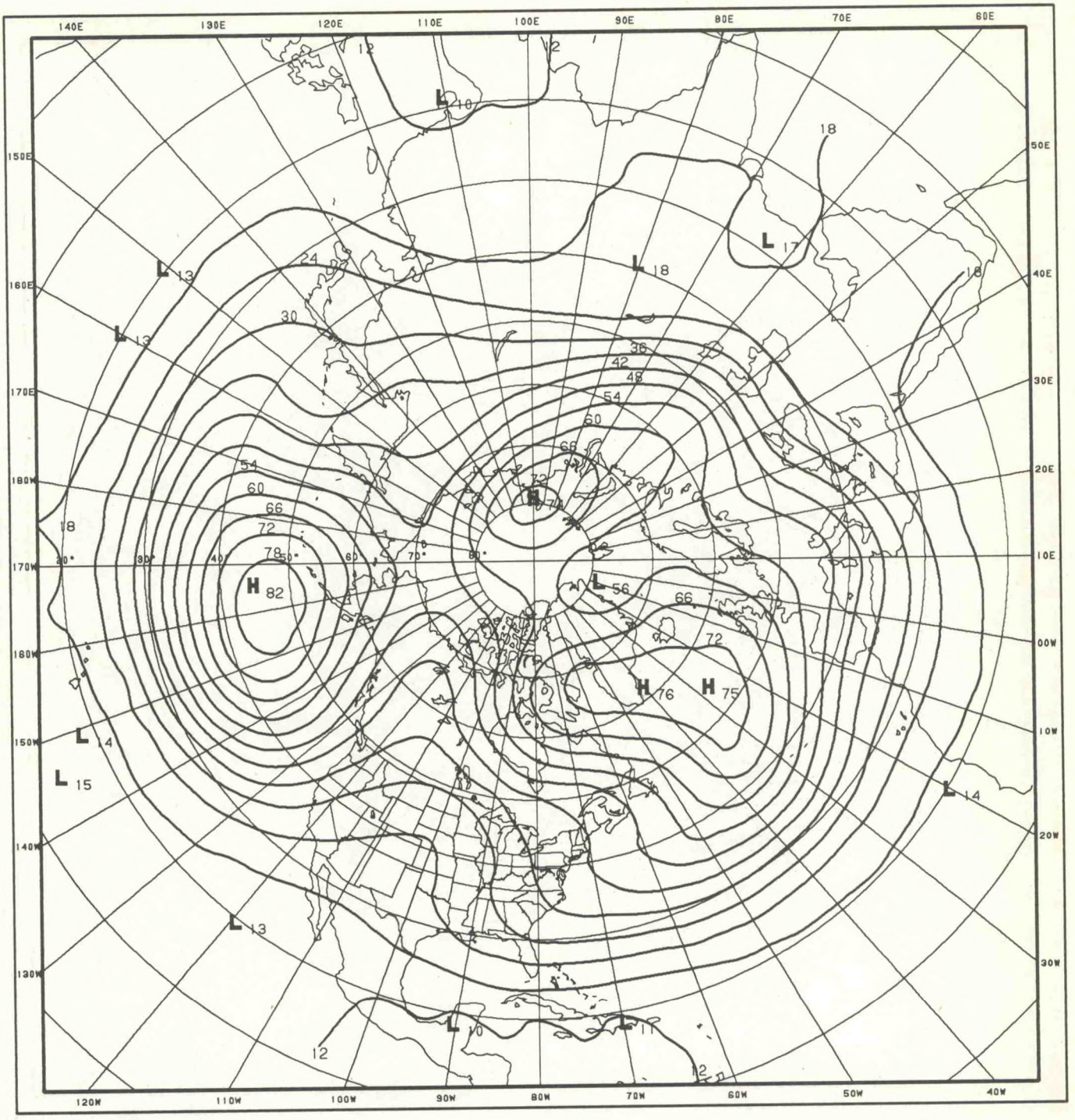
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT STANDARD DEV JANUARY

1-MONTH MEAN POOLED 1950-92

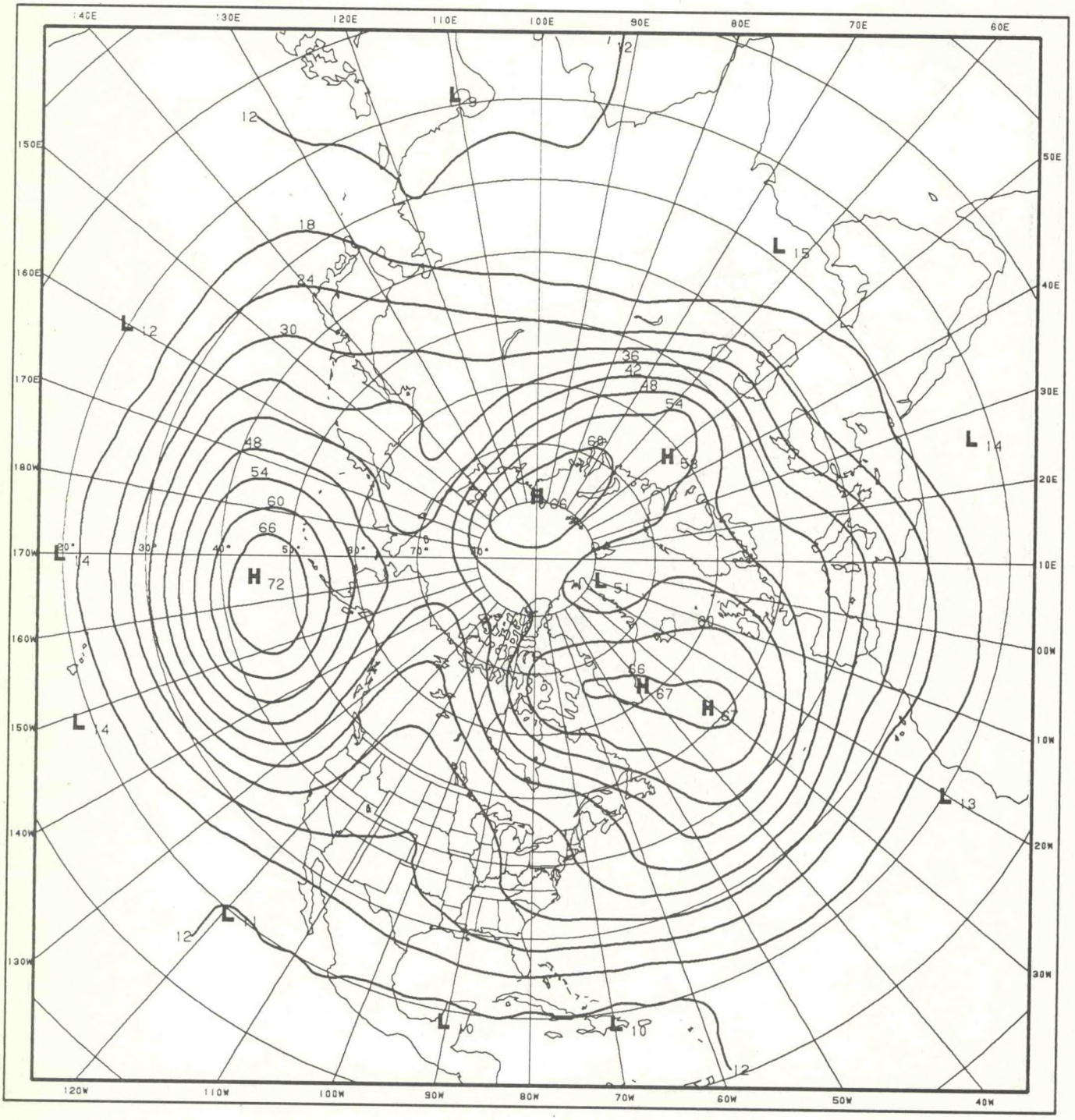
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT STANDARD DEV FEBRUARY

1-MONTH MEAN POOLED 1950-92

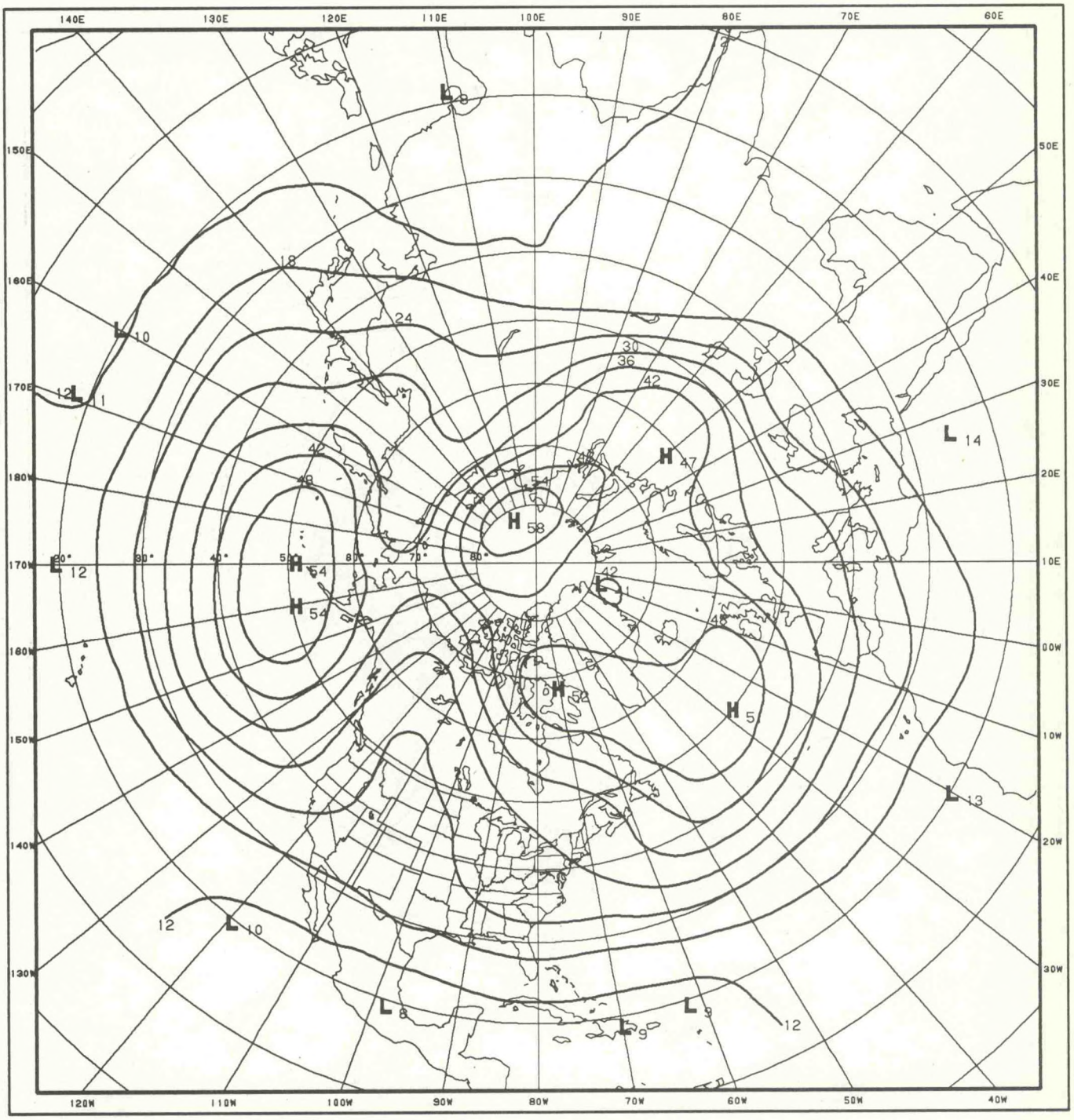
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT STANDARD DEV MARCH

1-MONTH MEAN POOLED 1950-92

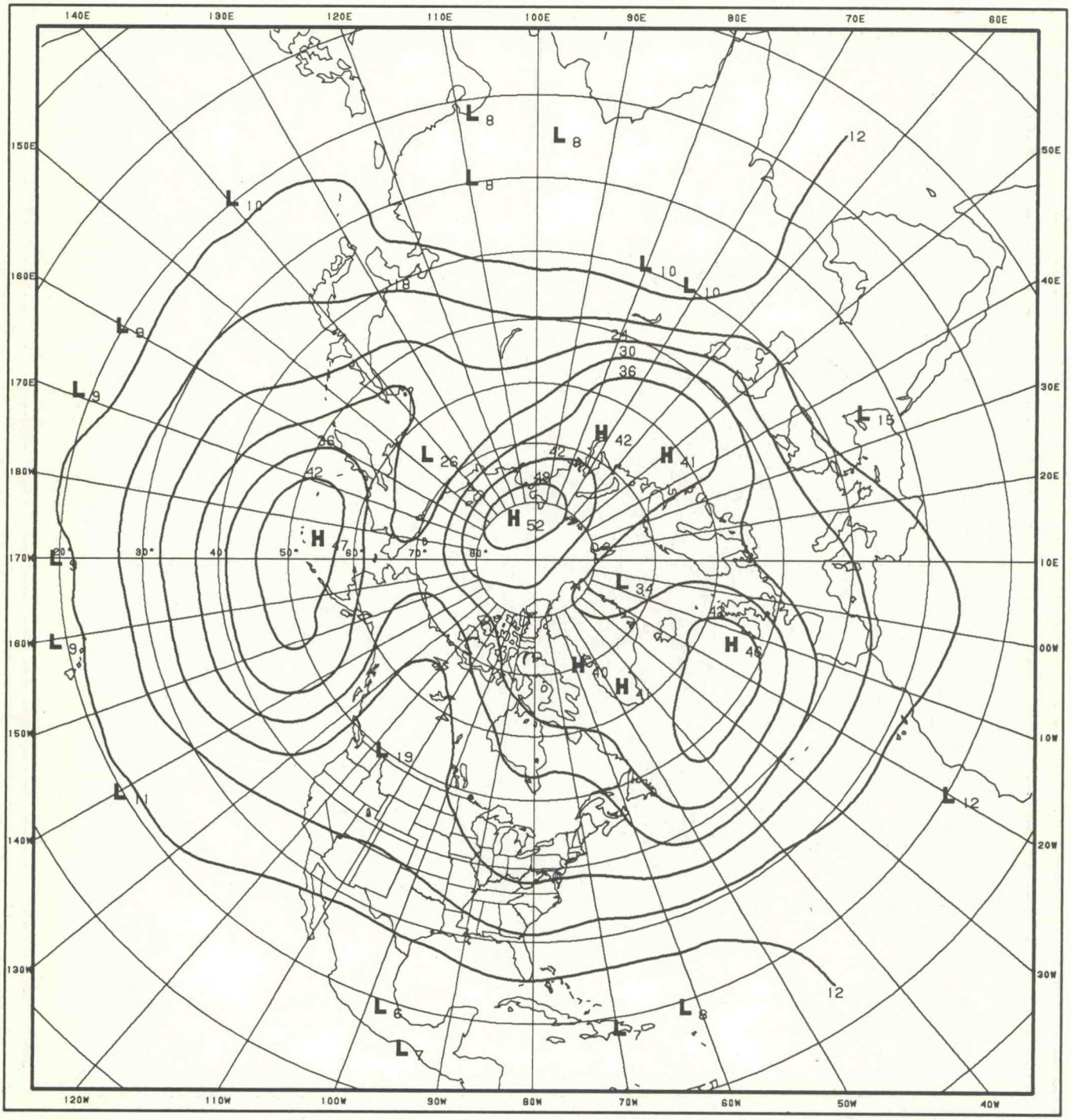
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT STANDARD DEV APRIL

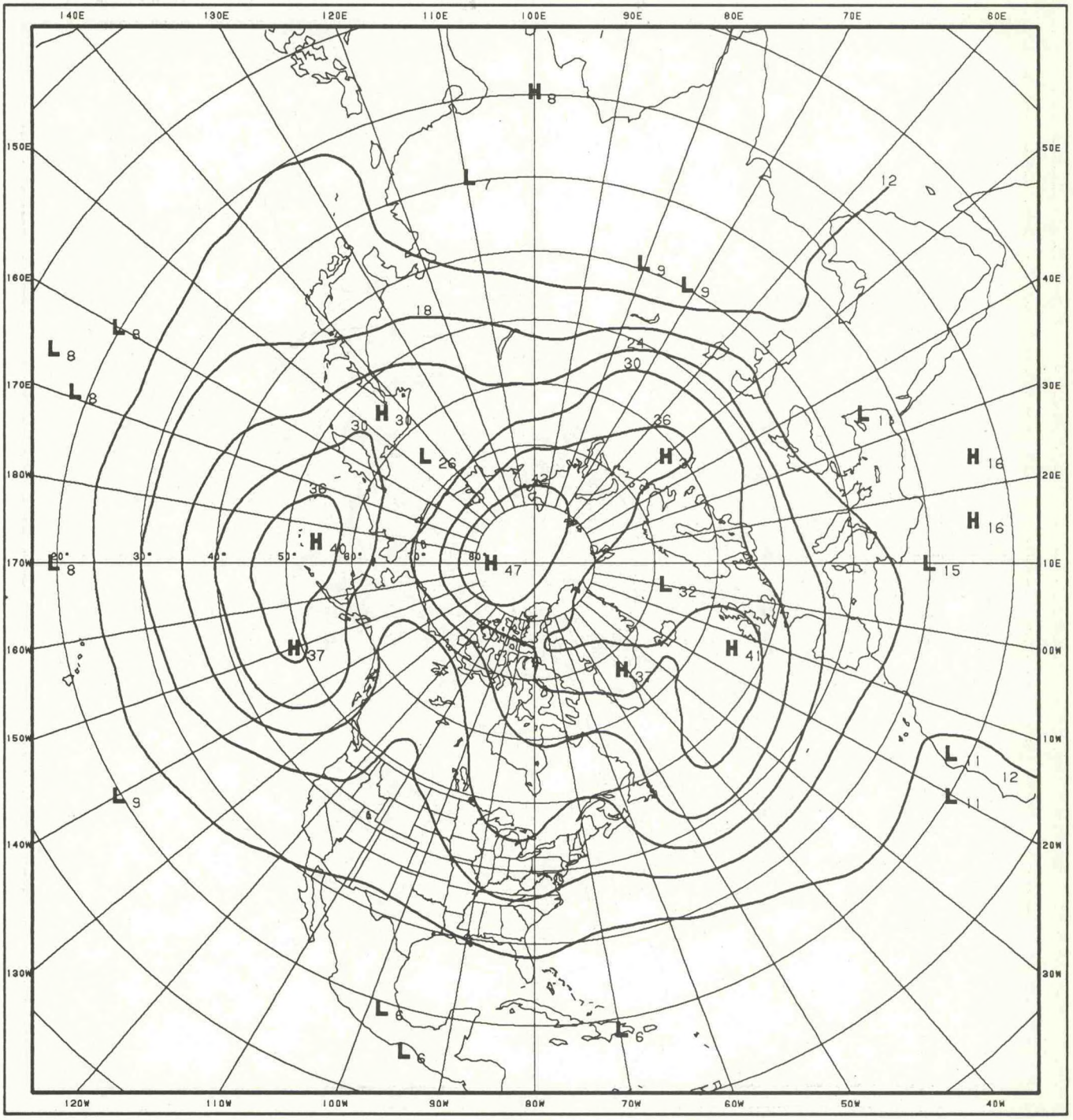
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT STANDARD DEV MAY
1-MONTH MEAN POOLED 1950-92

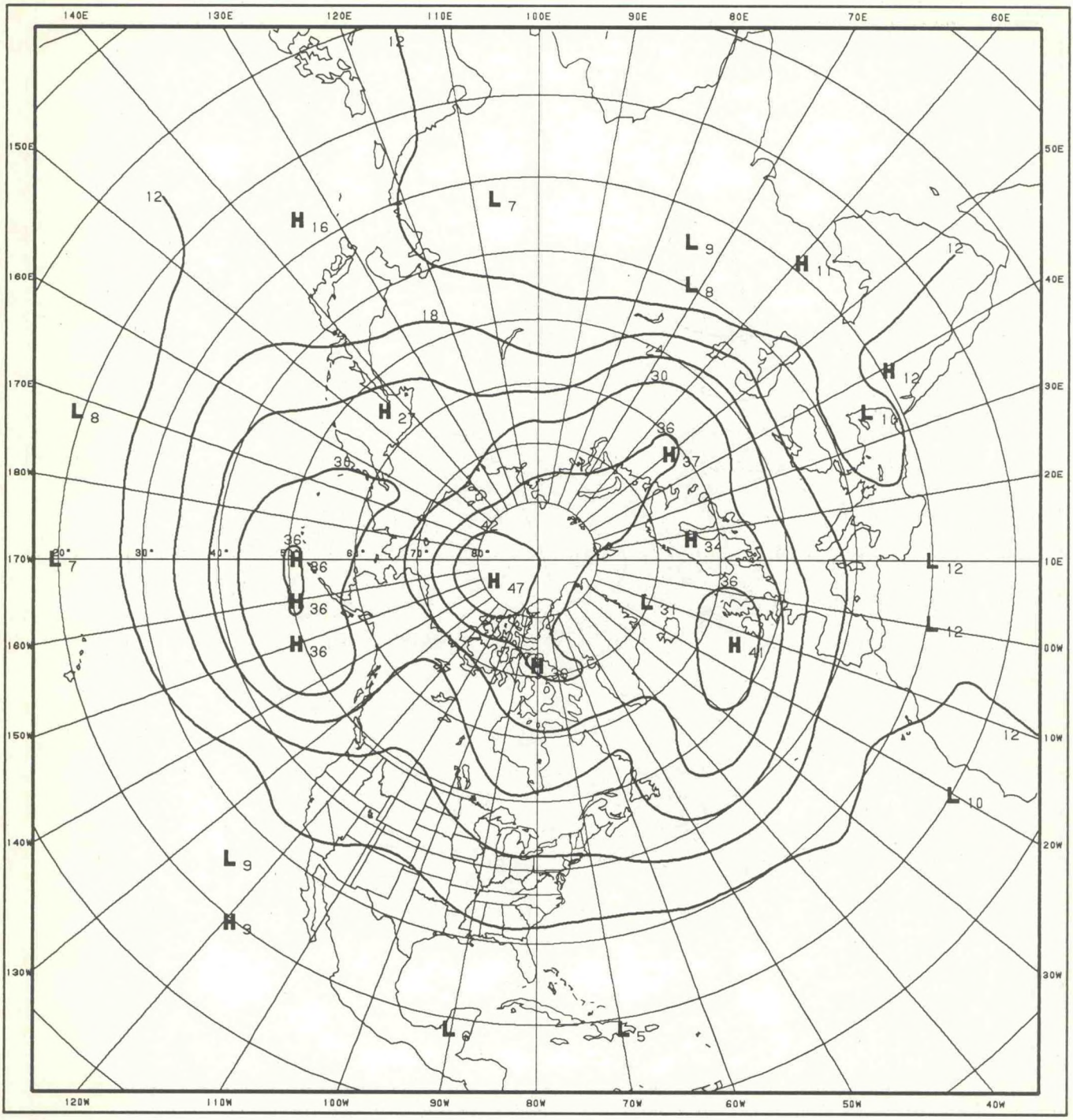
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT STANDARD DEV JUNE

1-MONTH MEAN POOLED 1950-92

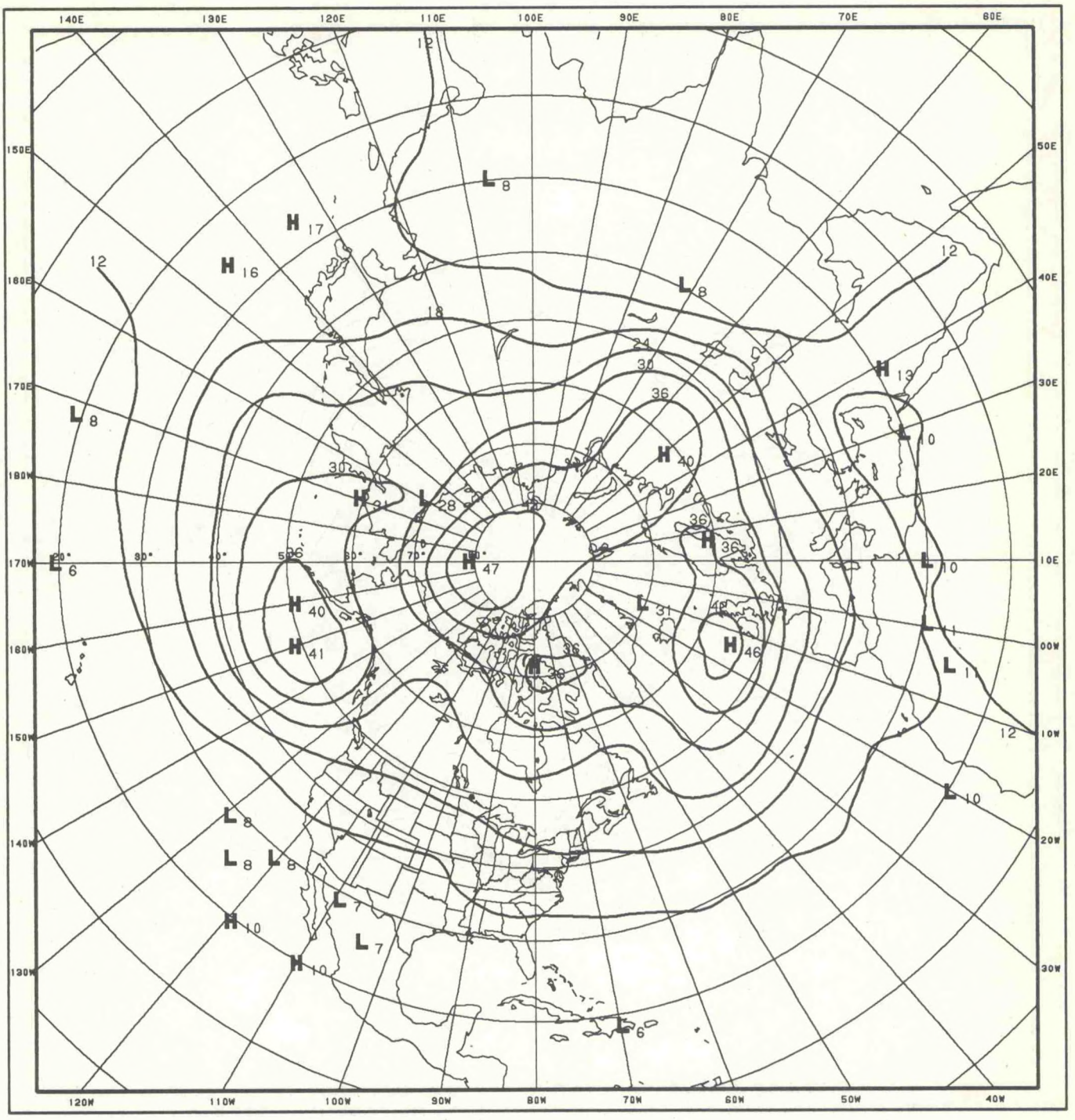
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT STANDARD DEV JULY

1-MONTH MEAN POOLED 1950-92

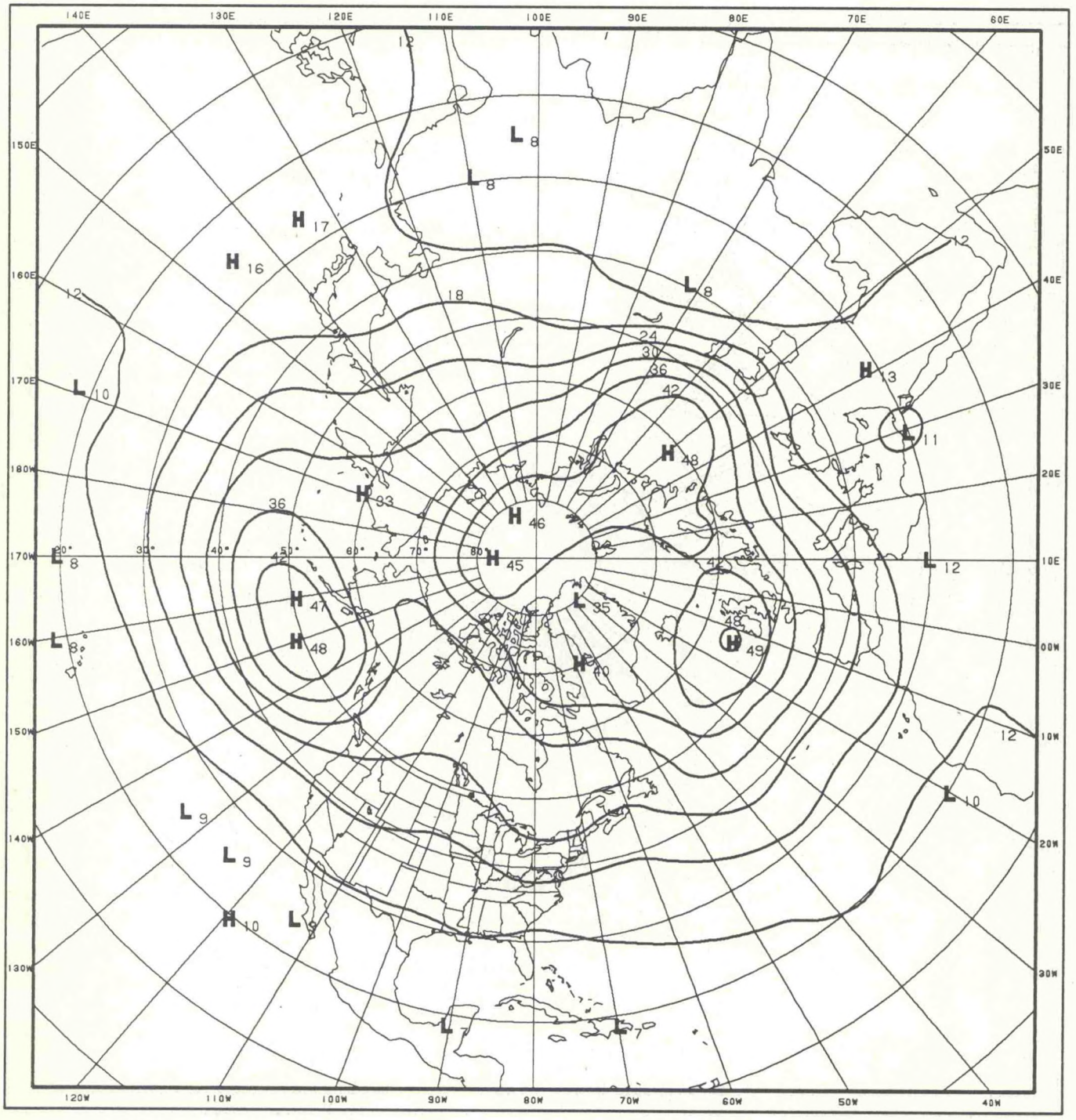
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT STANDARD DEV AUGUST

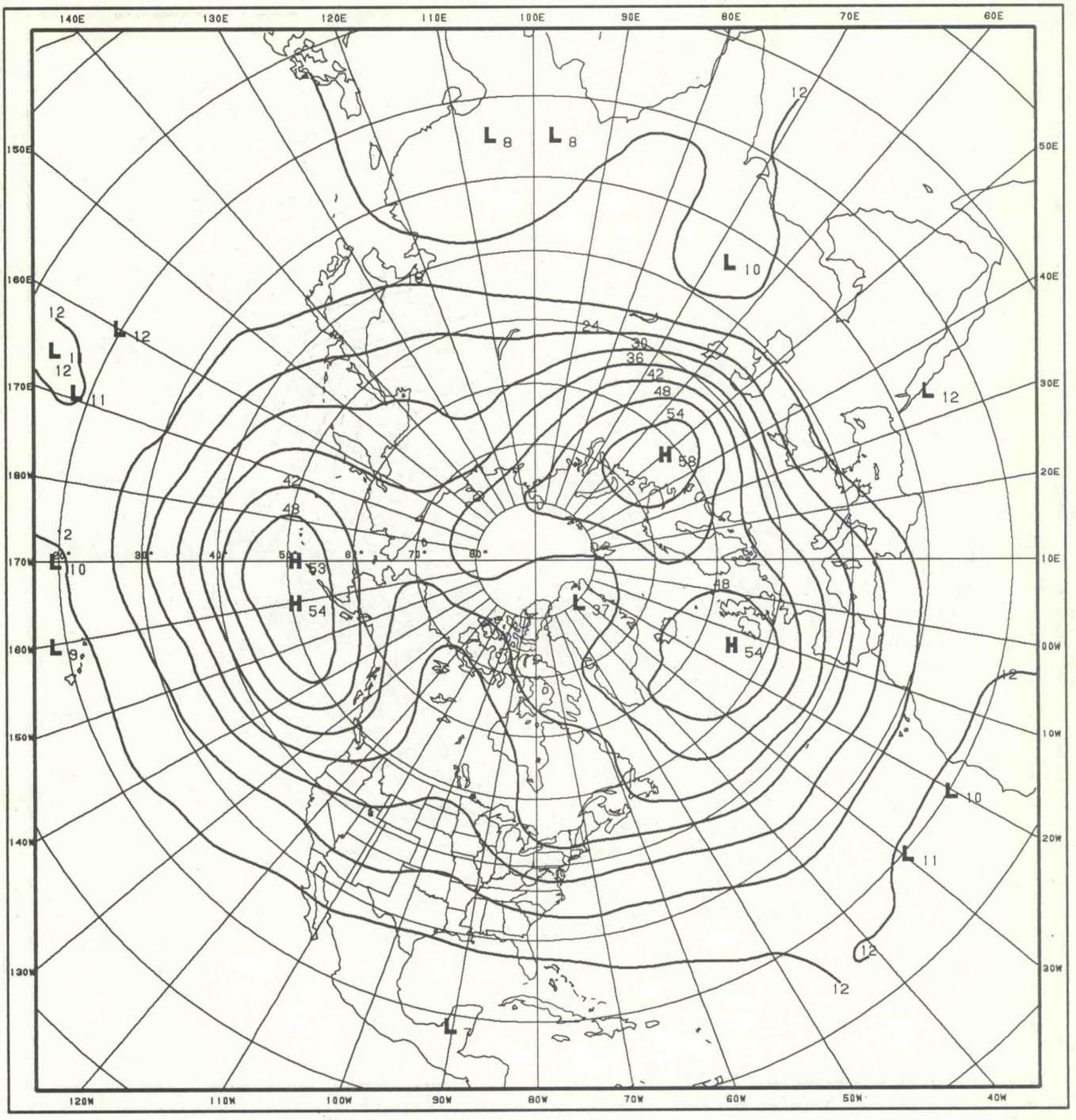
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT STANDARD DEV SEPTEMBR
1-MONTH MEAN POOLED 1950-92

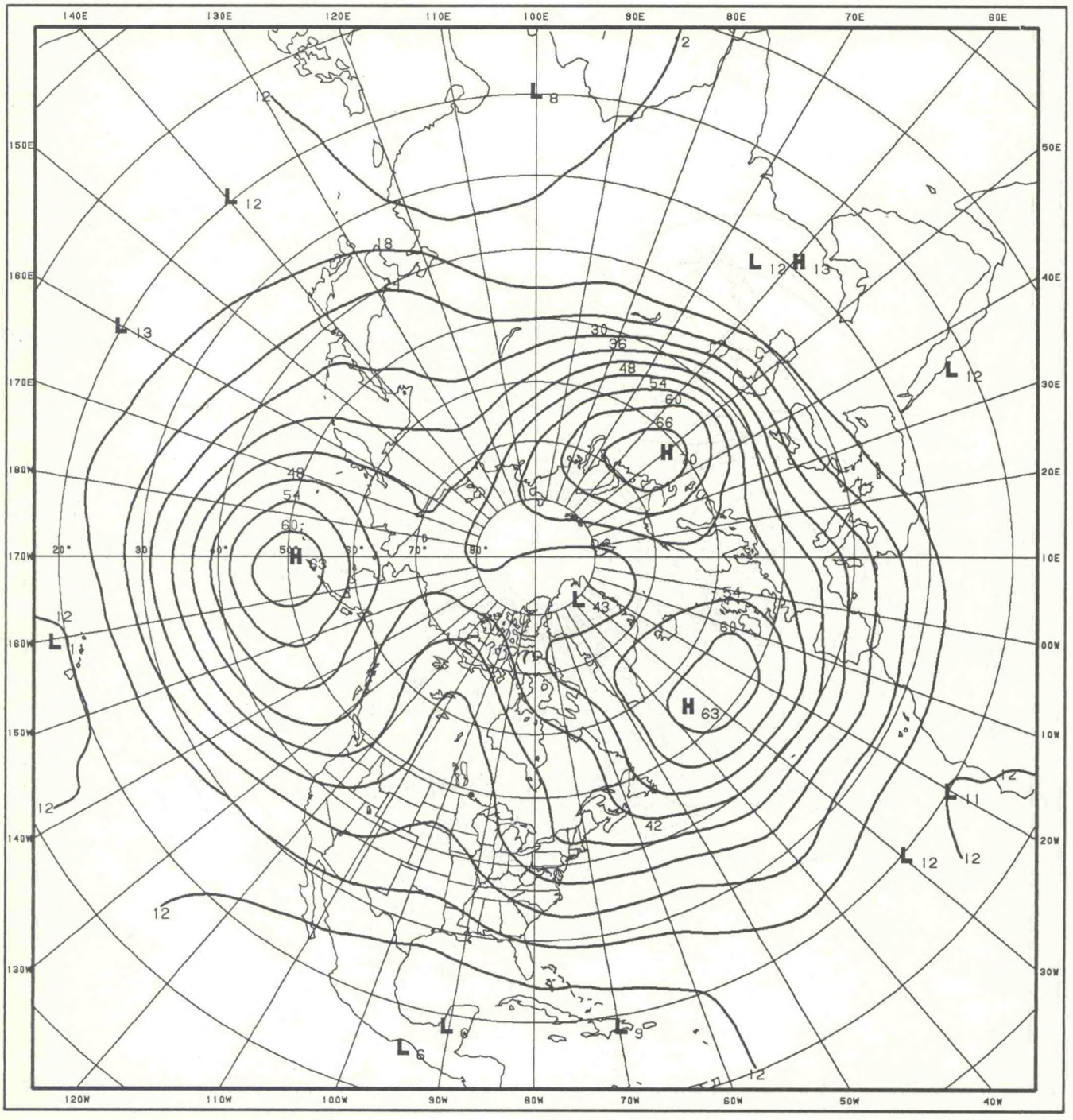
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT STANDARD DEV OCTOBER

1-MONTH MEAN POOLED 1950-92

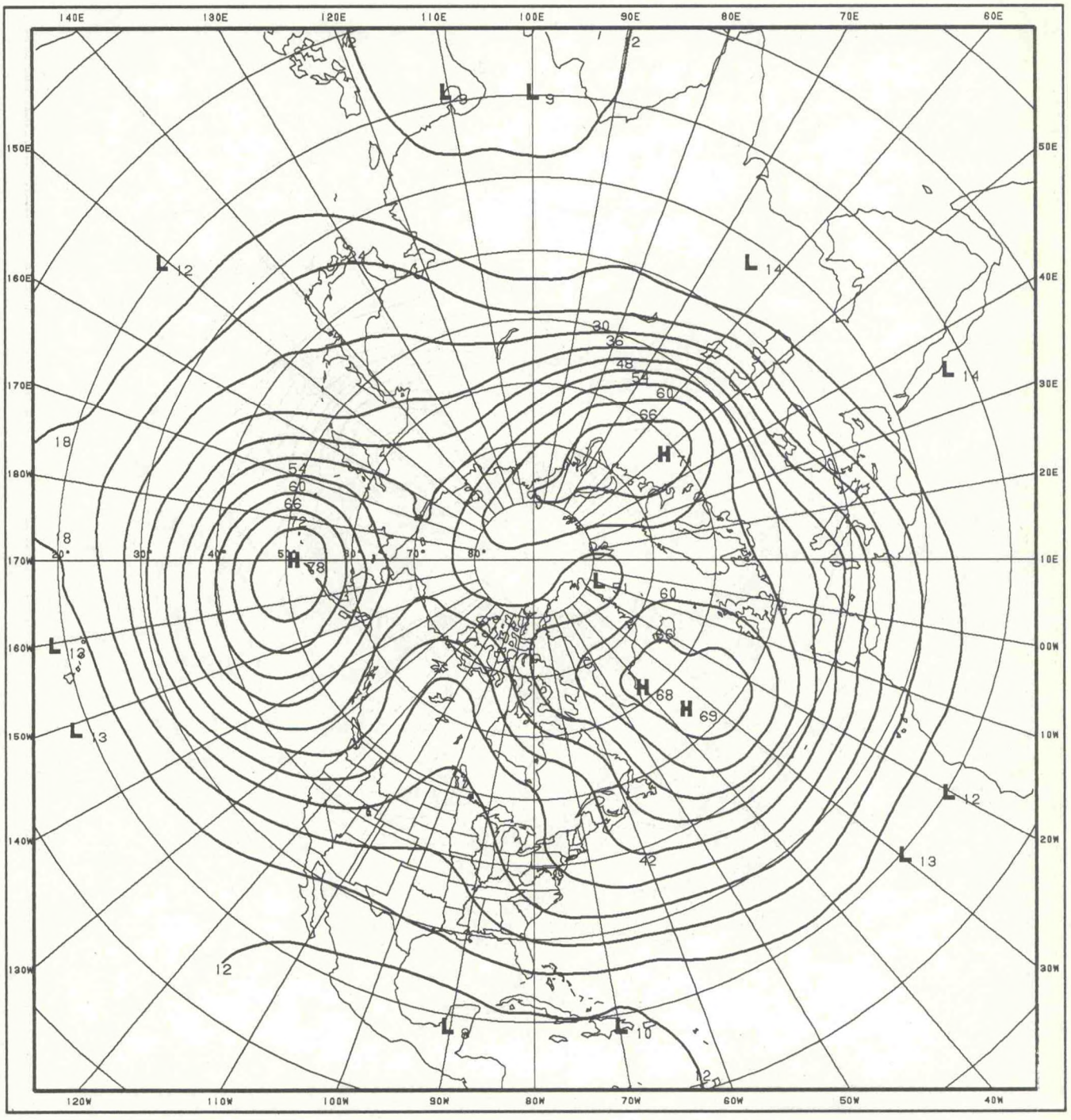
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT STANDARD DEV NOVEMBER

1-MONTH MEAN POOLED 1950-92

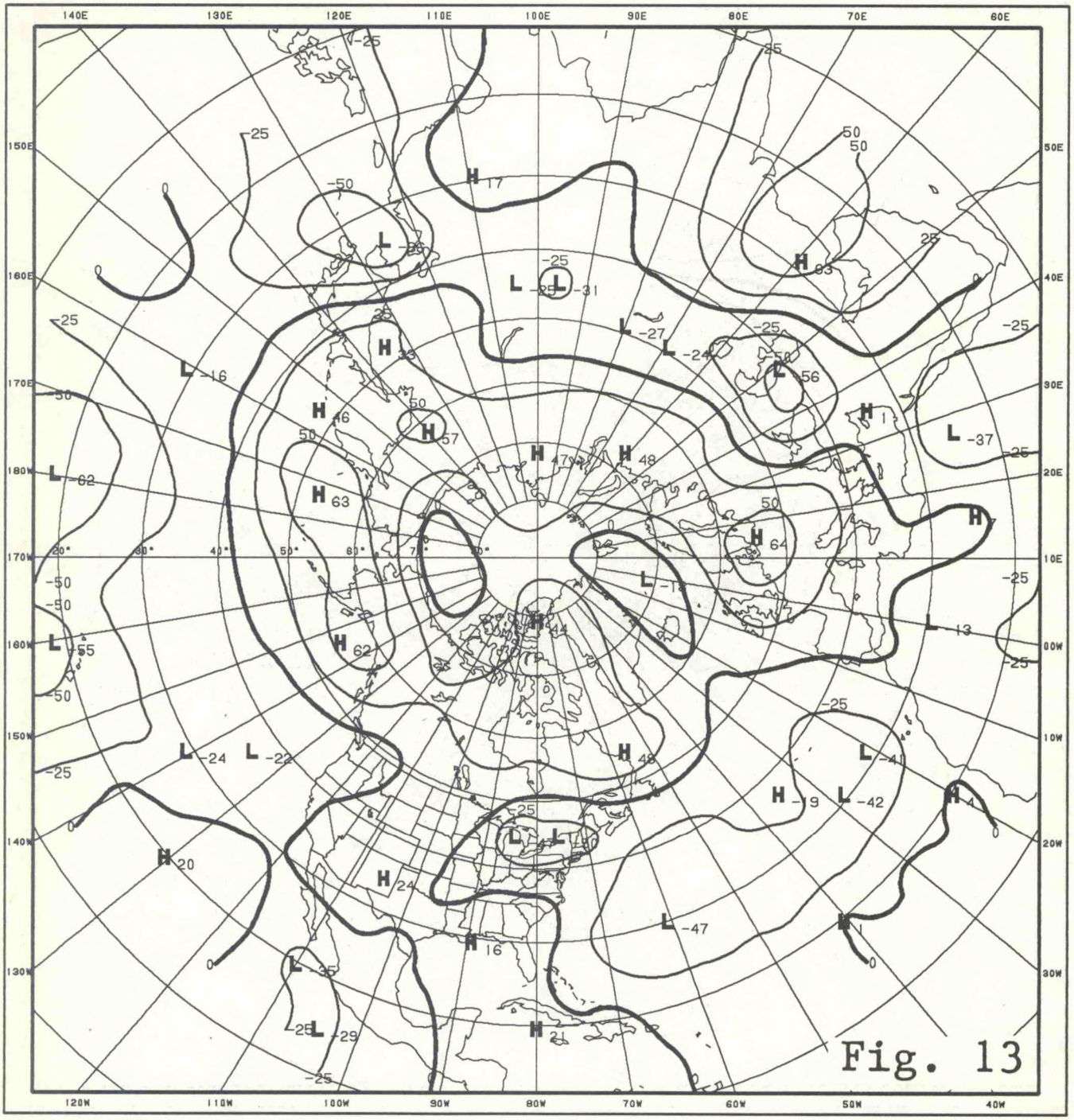
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT STANDARD DEV DECEMBER

1-MONTH MEAN POOLED 1950-92

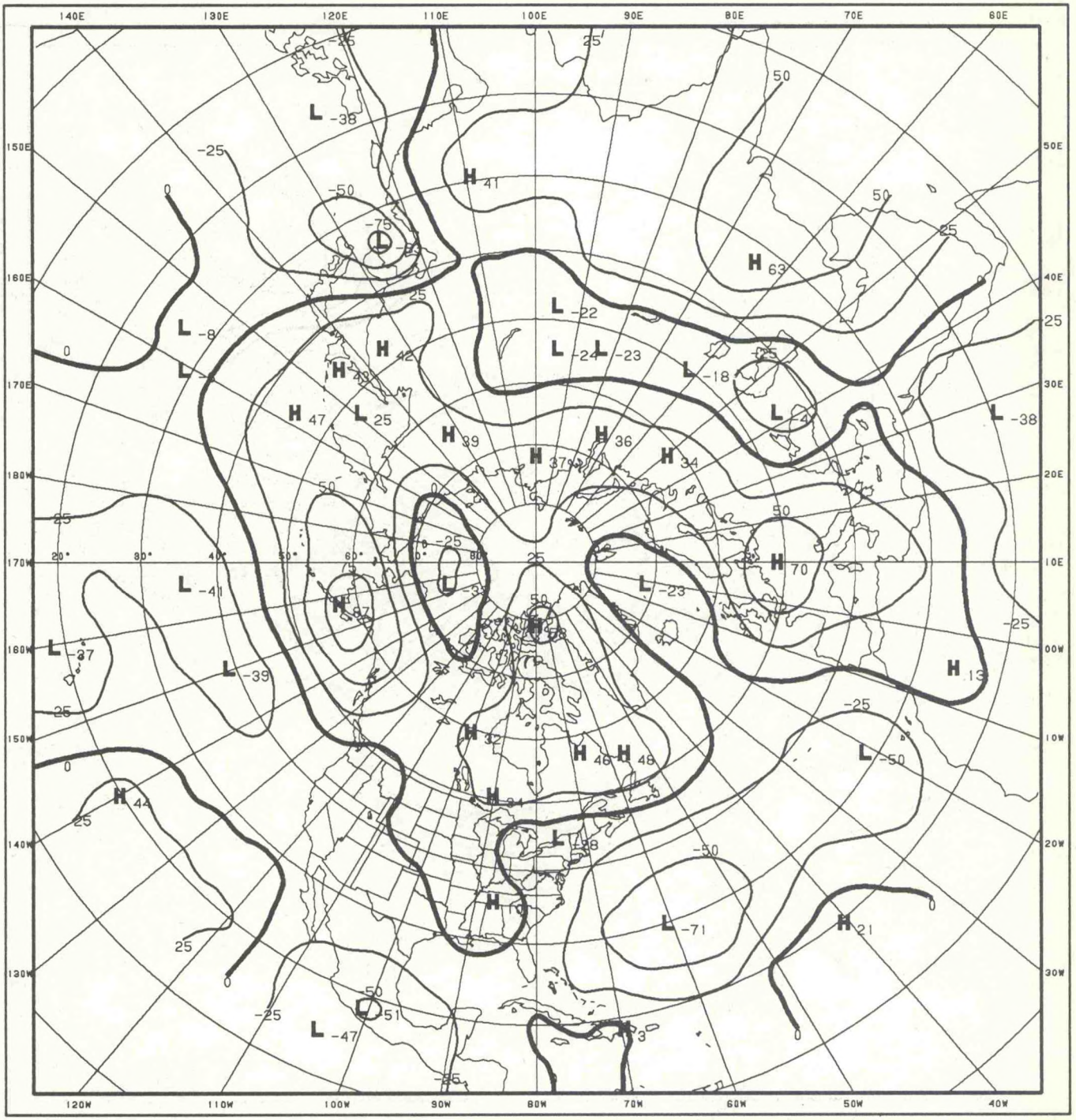
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT SKEW JANUARY

1-MONTH MEAN POOLED 1950-92

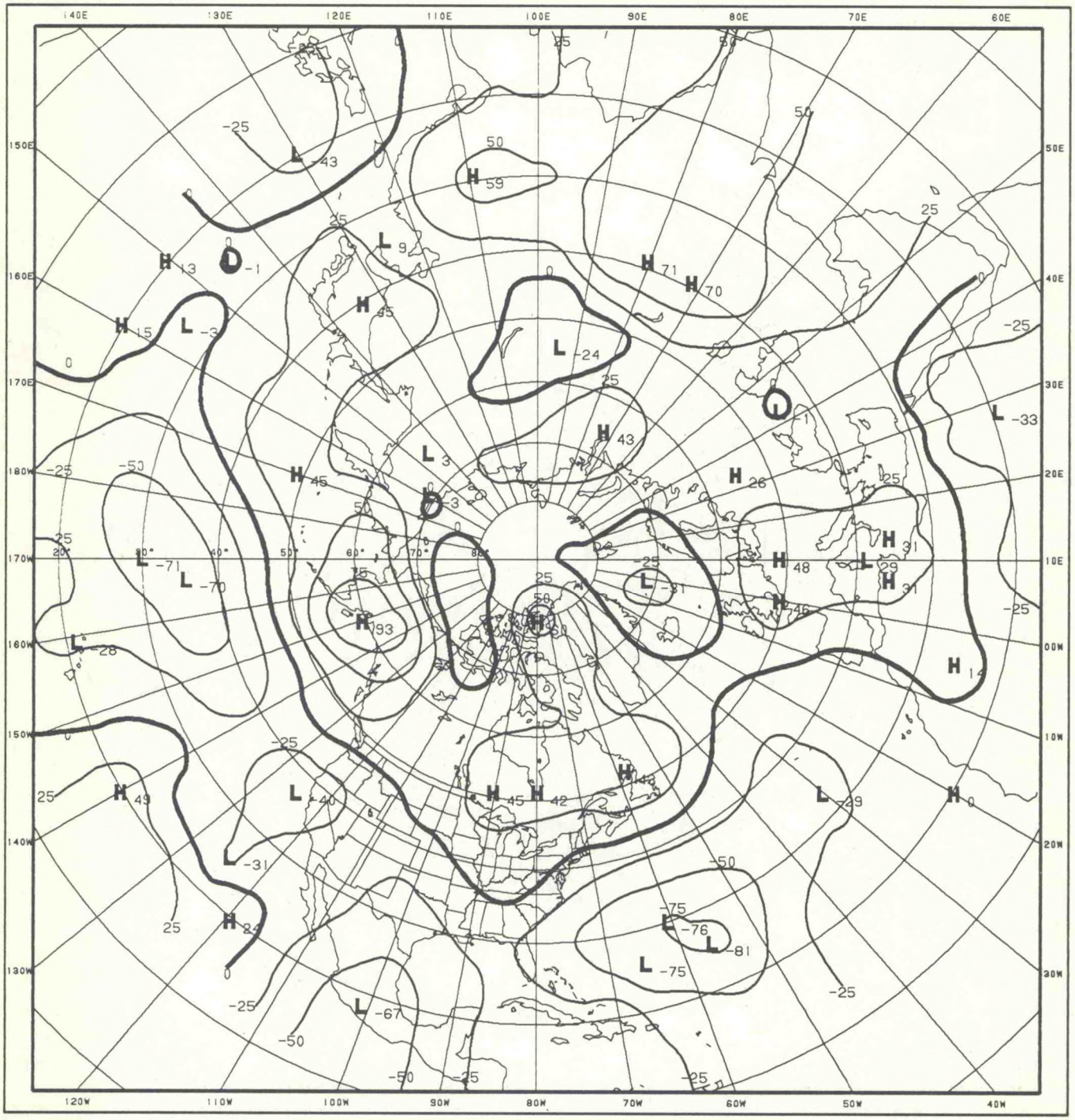
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT SKEW FEBRUARY

1-MONTH MEAN POOLED 1950-92

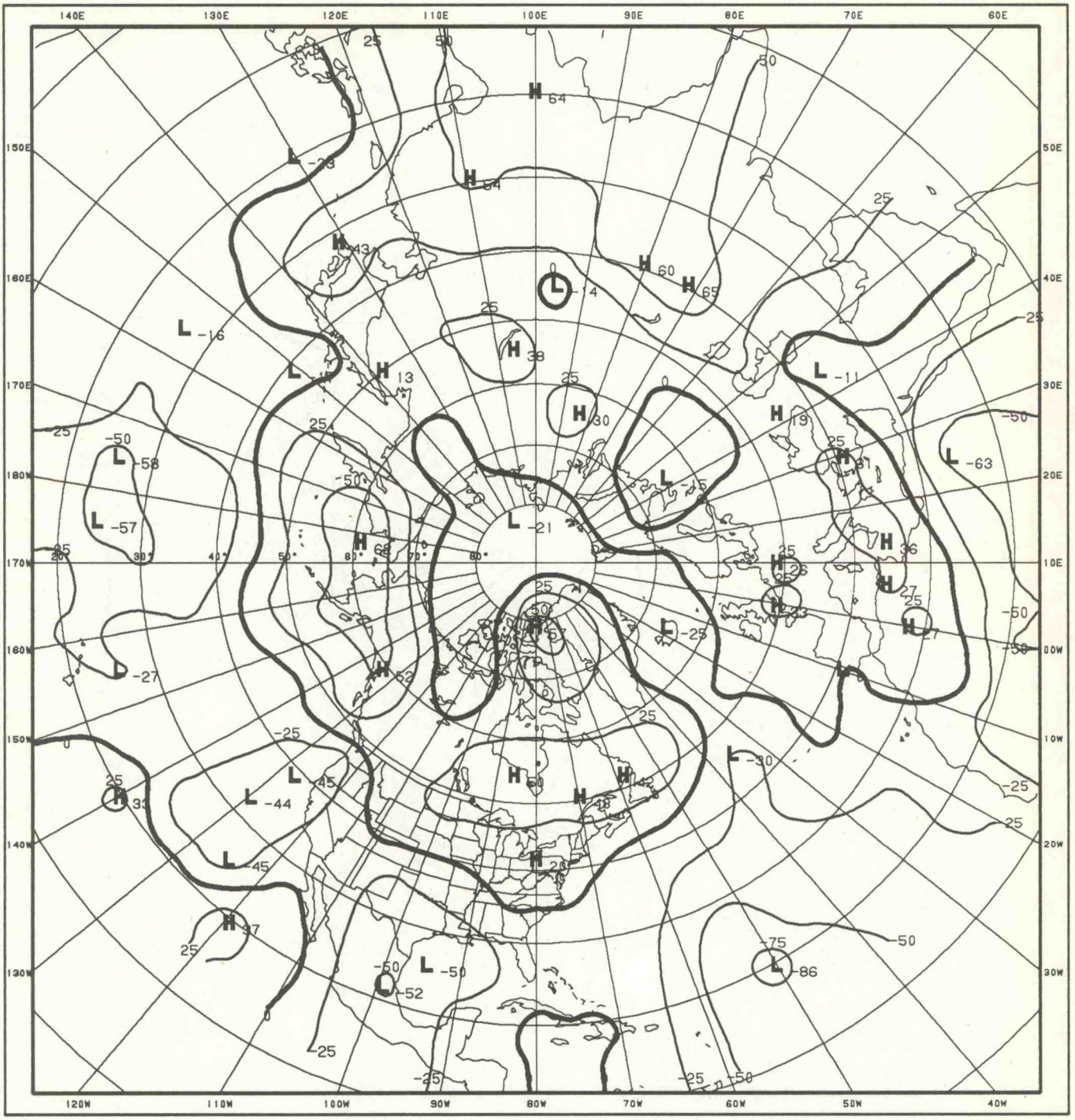
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT SKEW MARCH

1-MONTH MEAN POOLED 1950-92

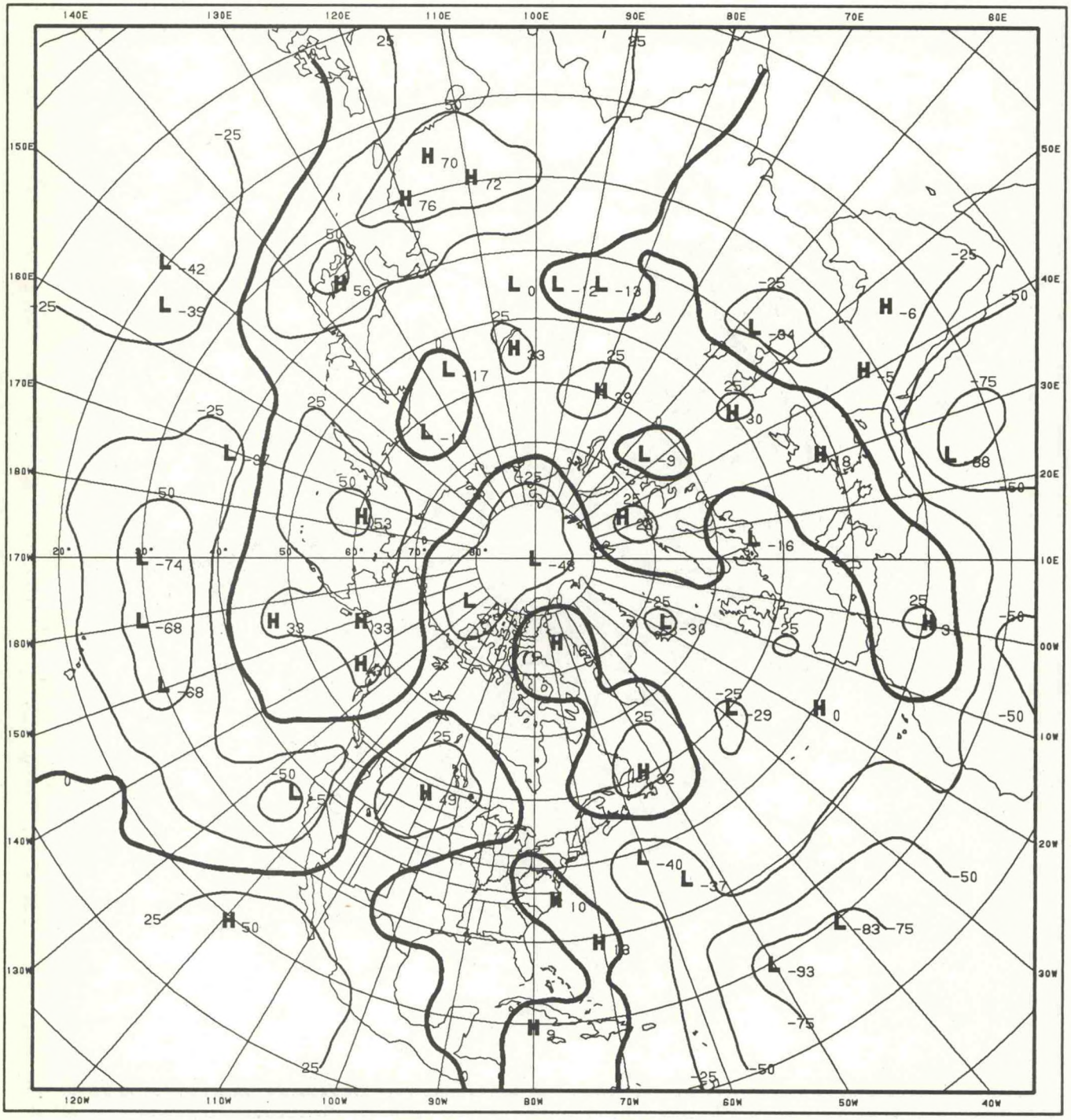
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT SKEW APRIL

1-MONTH MEAN POOLED 1950-92

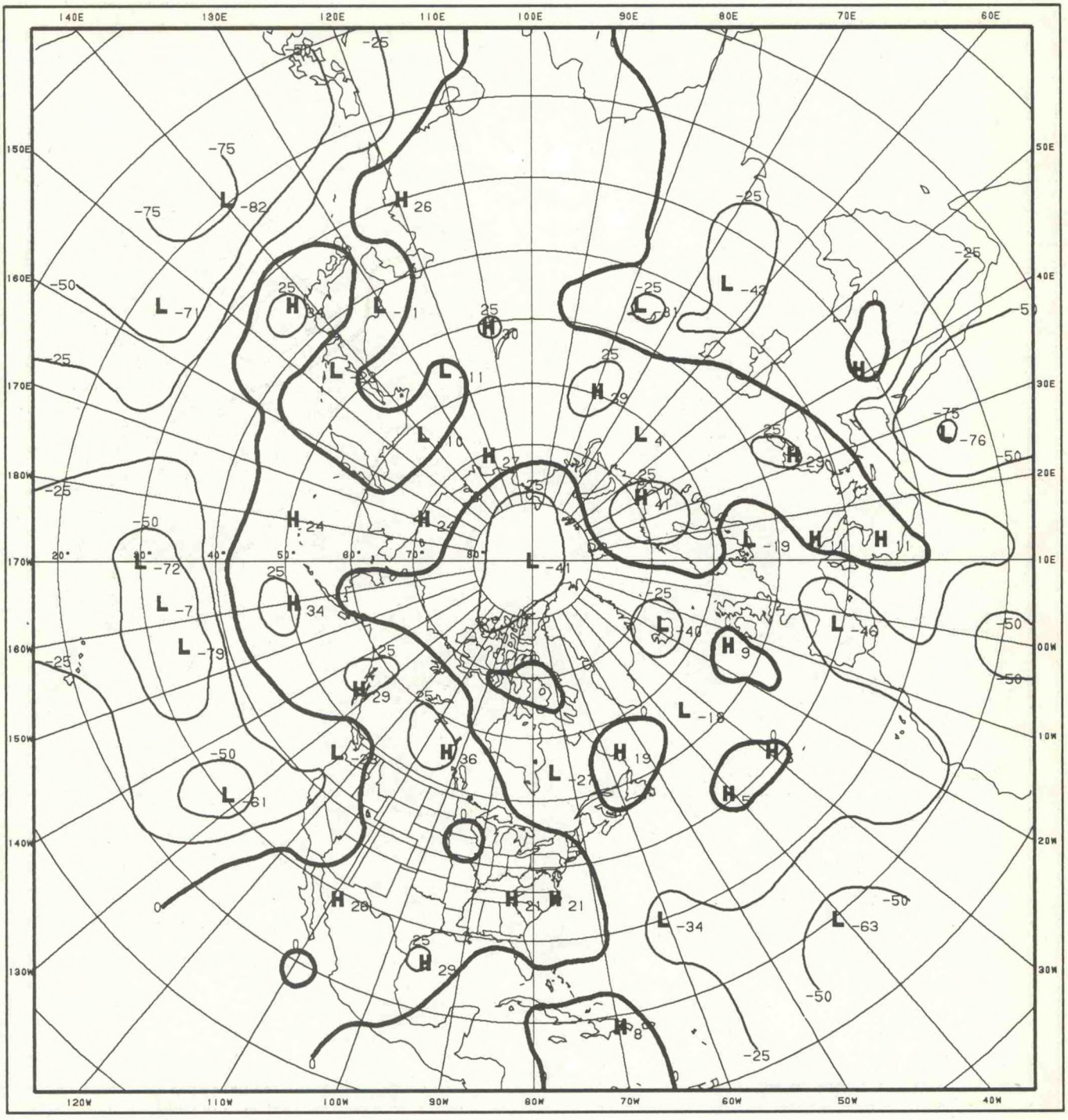
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT SKEW MAY

1-MONTH MEAN POOLED 1950-92

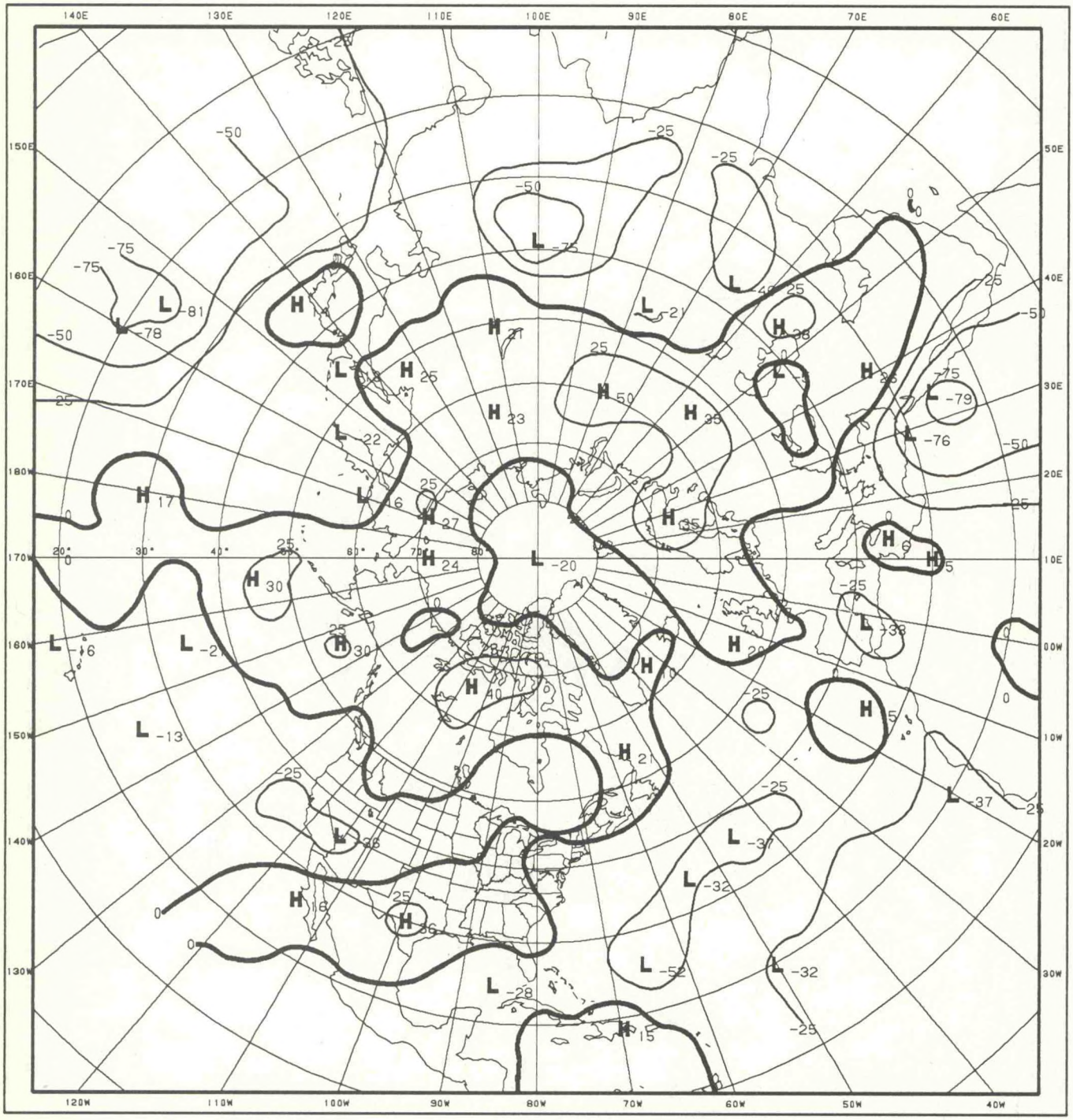
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT SKEW JUNE

1-MONTH MEAN POOLED 1950-92

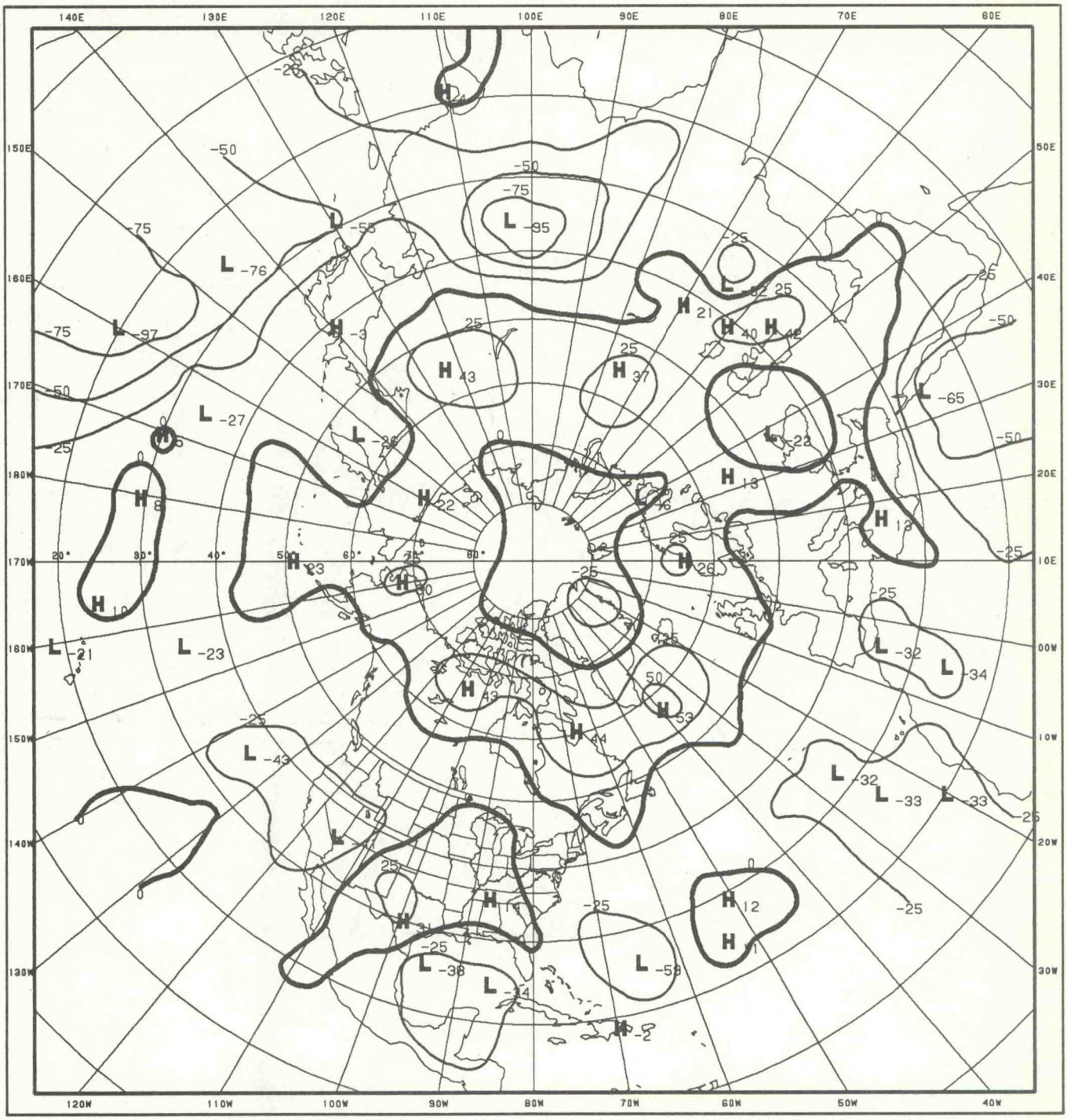
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT SKEW JULY

1-MONTH MEAN POOLED 1950-92

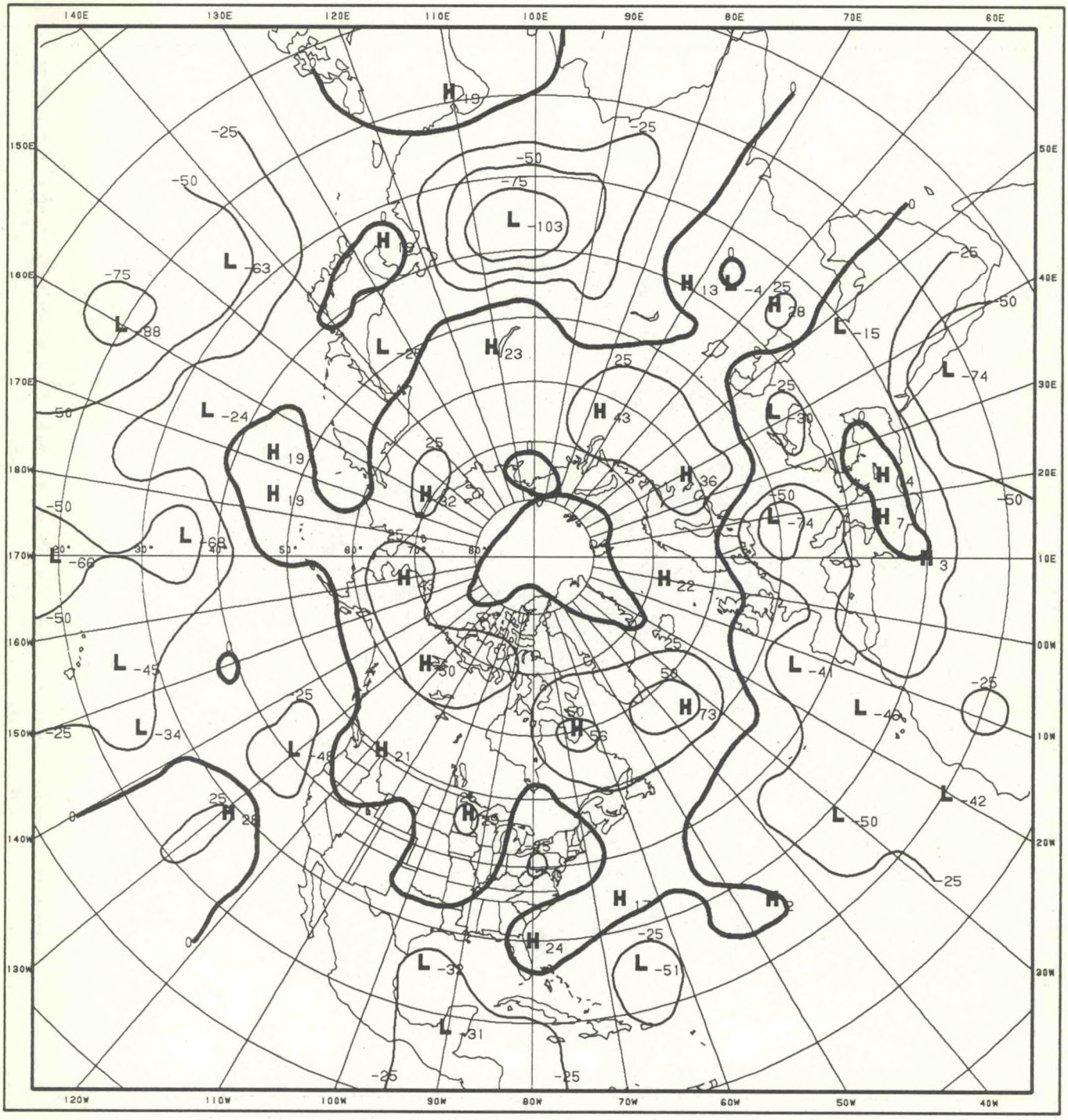
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT SKEW AUGUST

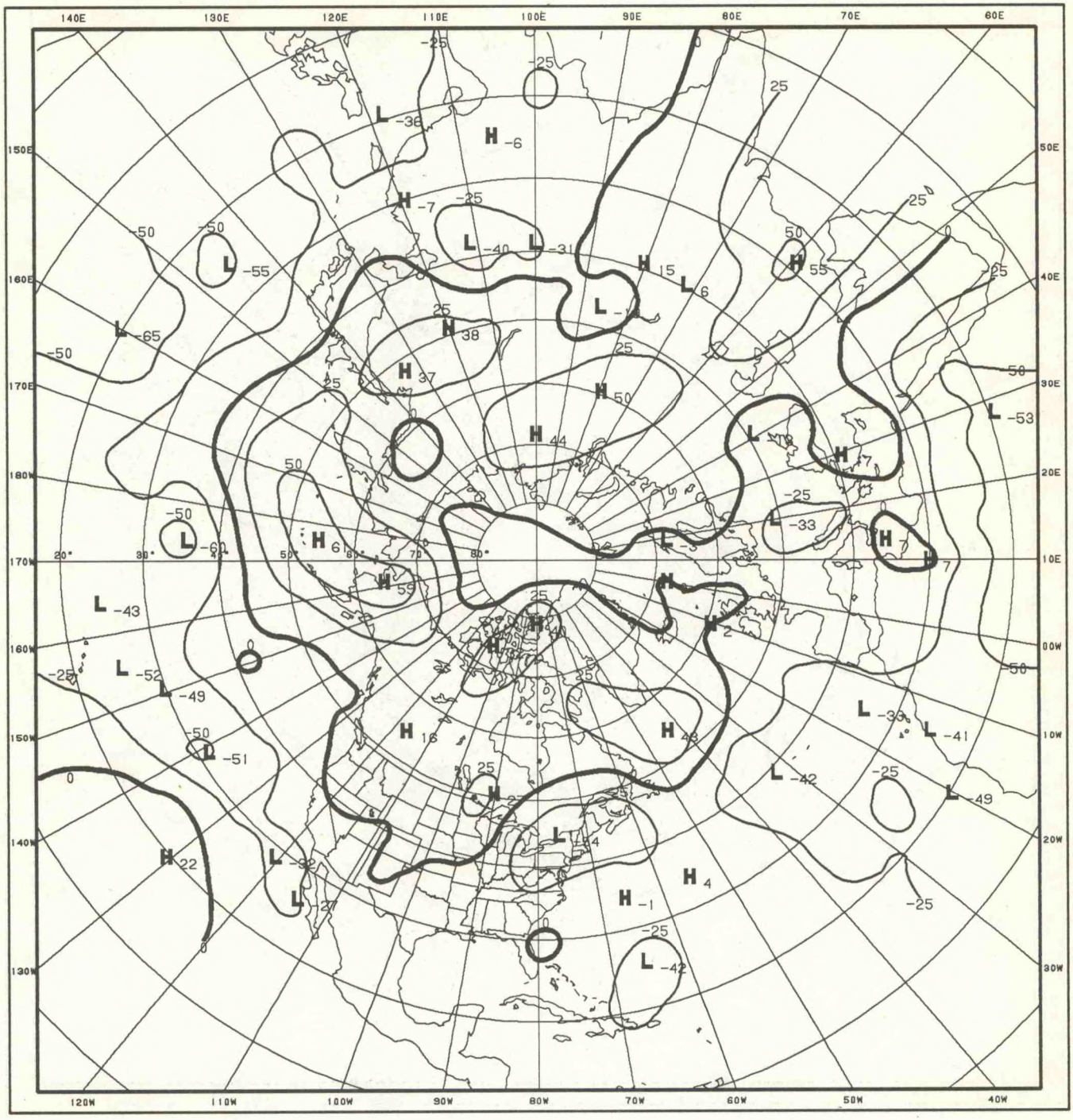
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT SKEW SEPTEMBR
1-MONTH MEAN POOLED 1950-92

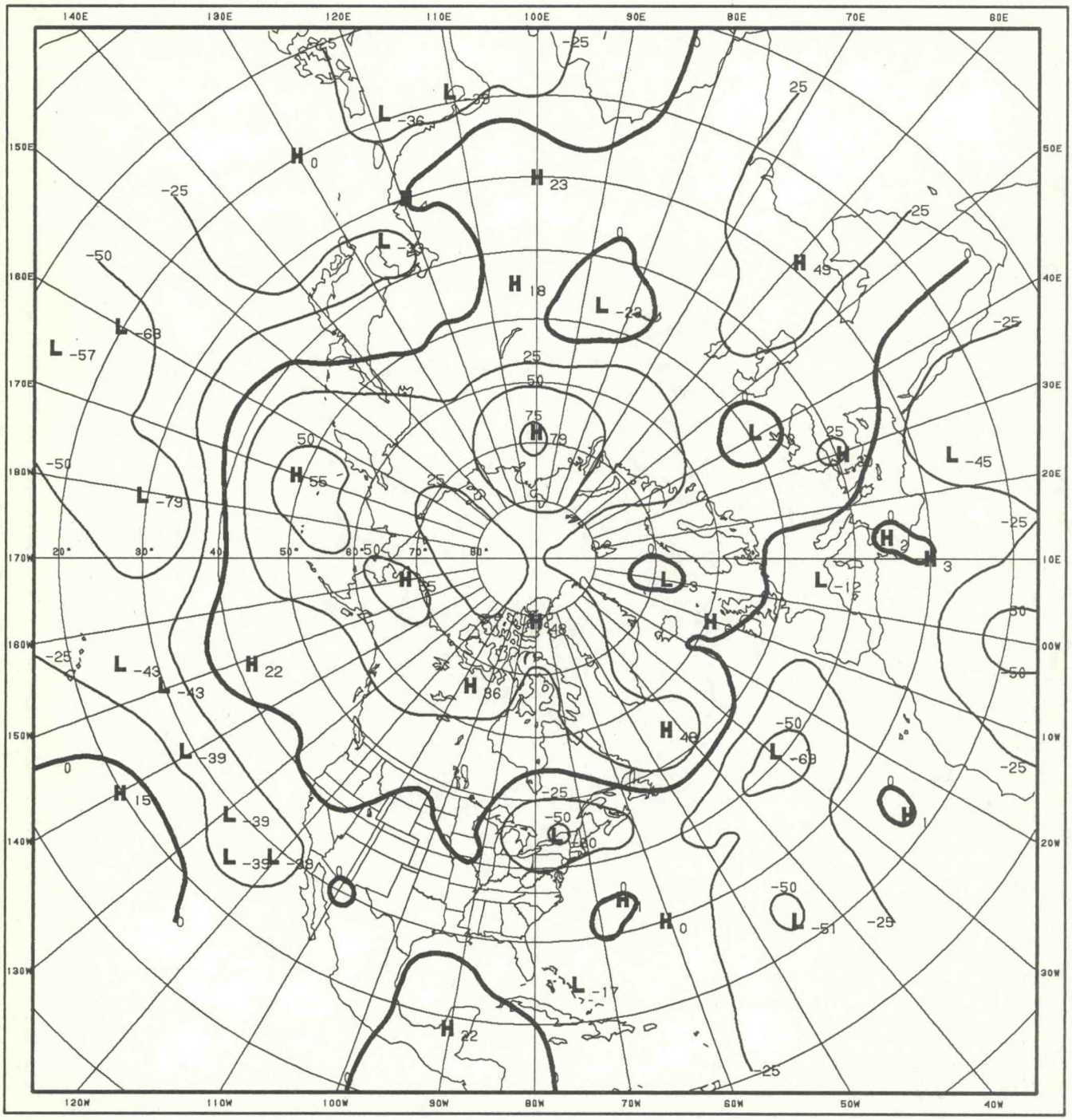
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT SKEW OCTOBER

1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT SKEW NOVEMBER

1-MONTH MEAN POOLED 1950-92

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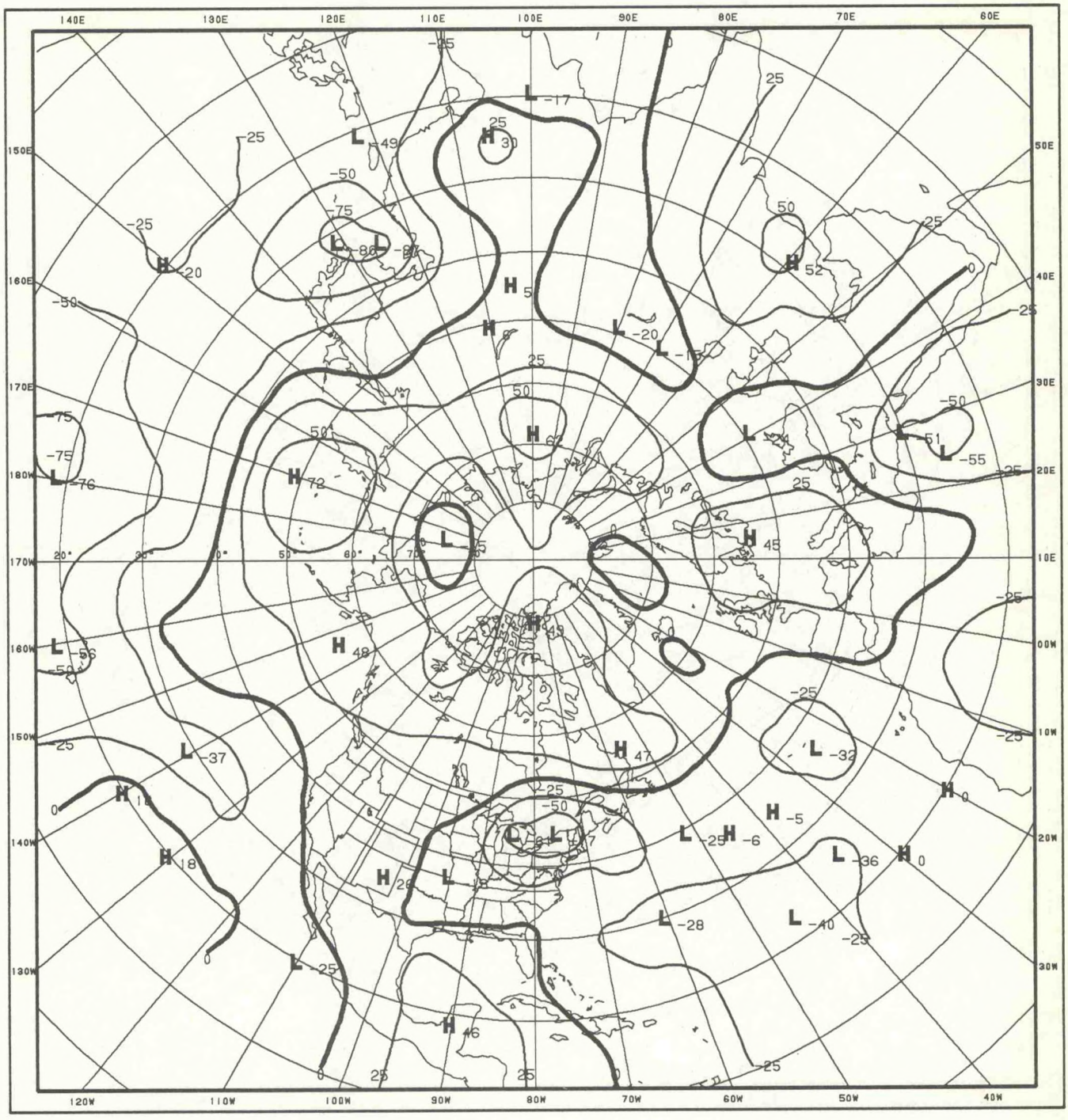
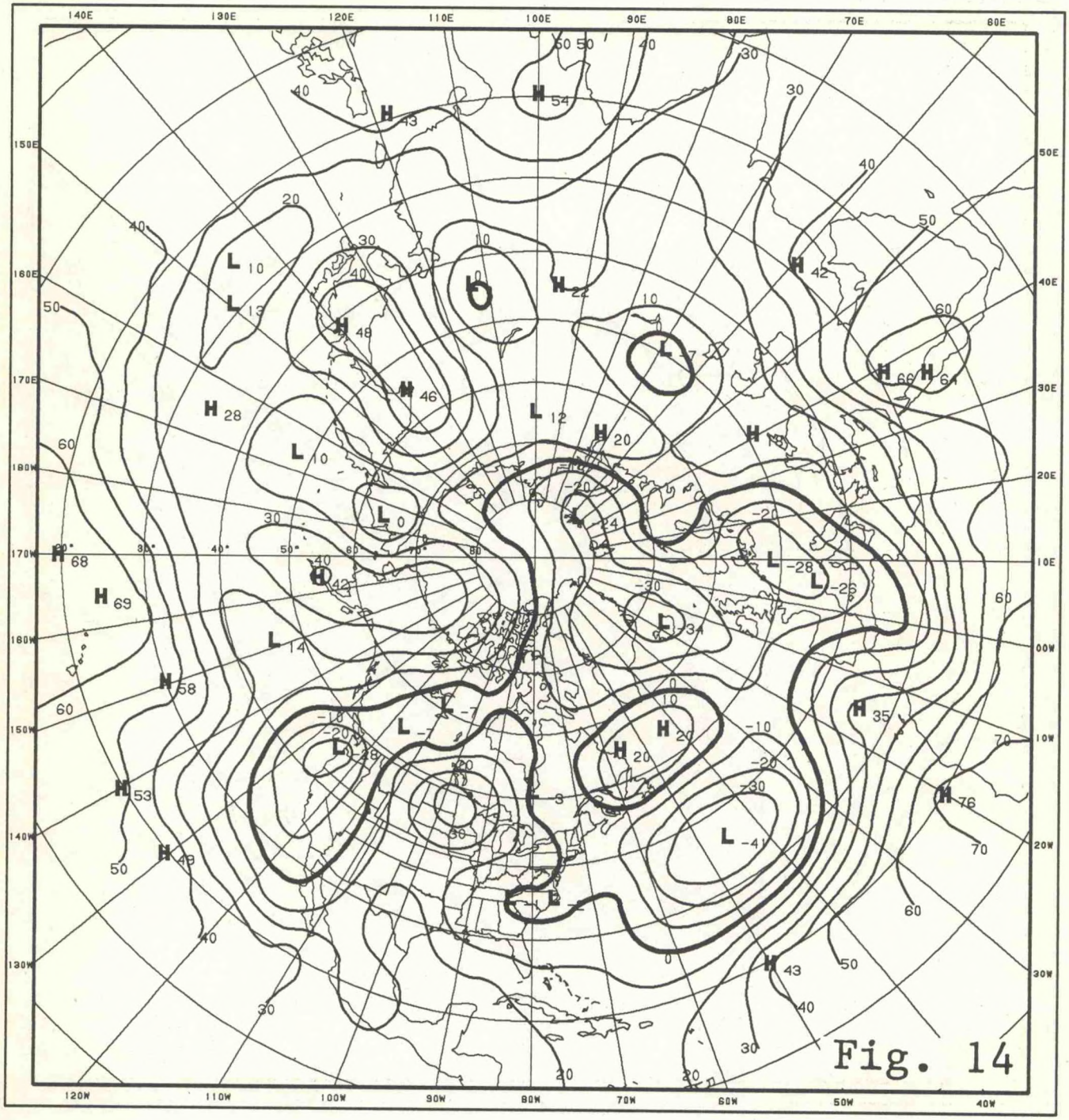


700 MB HEIGHT SKEW DECEMBER

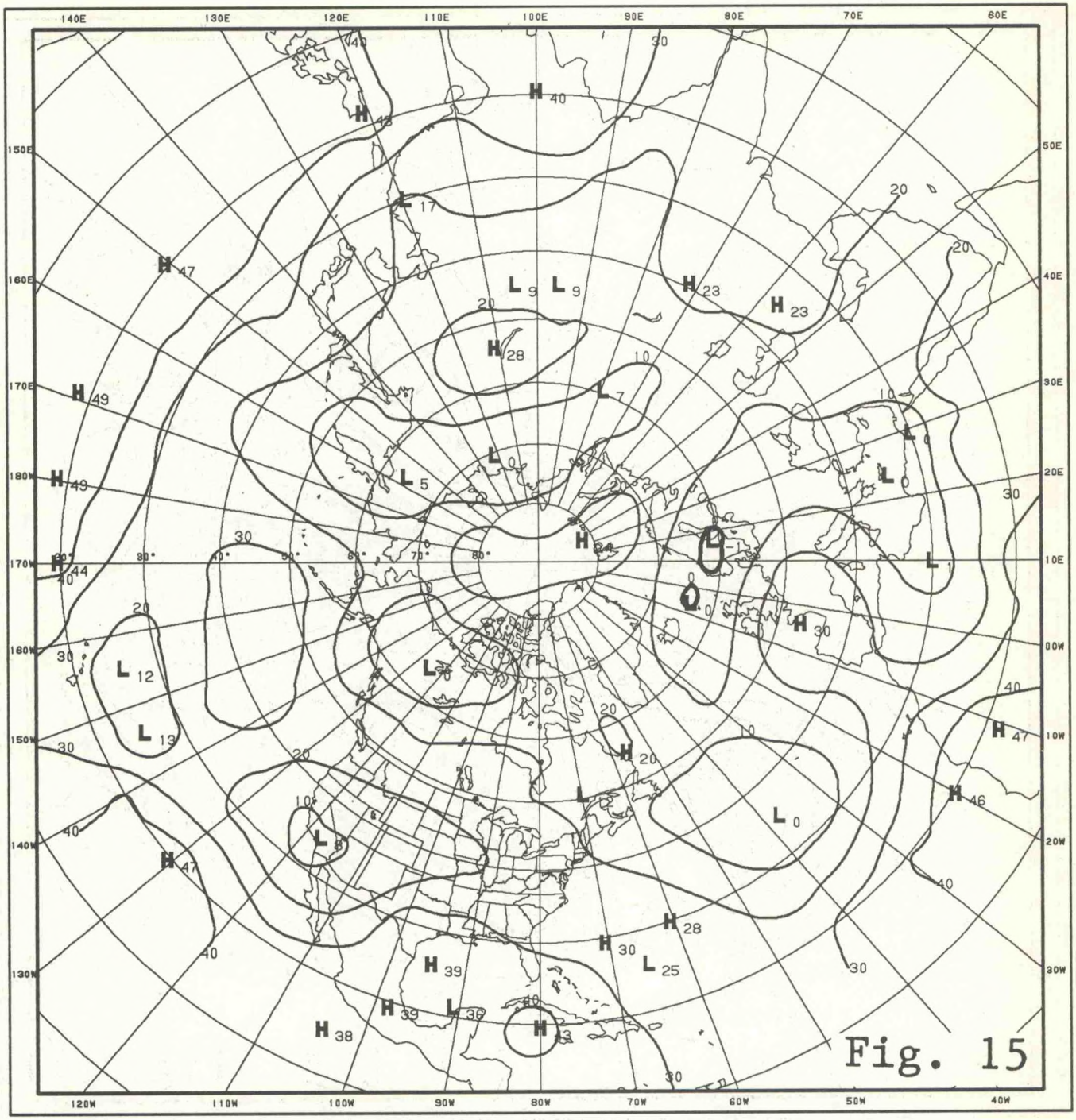
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT AUTOCORRELATION APR-MAY
1-MONTH MEAN UNPOOLED 1950-92

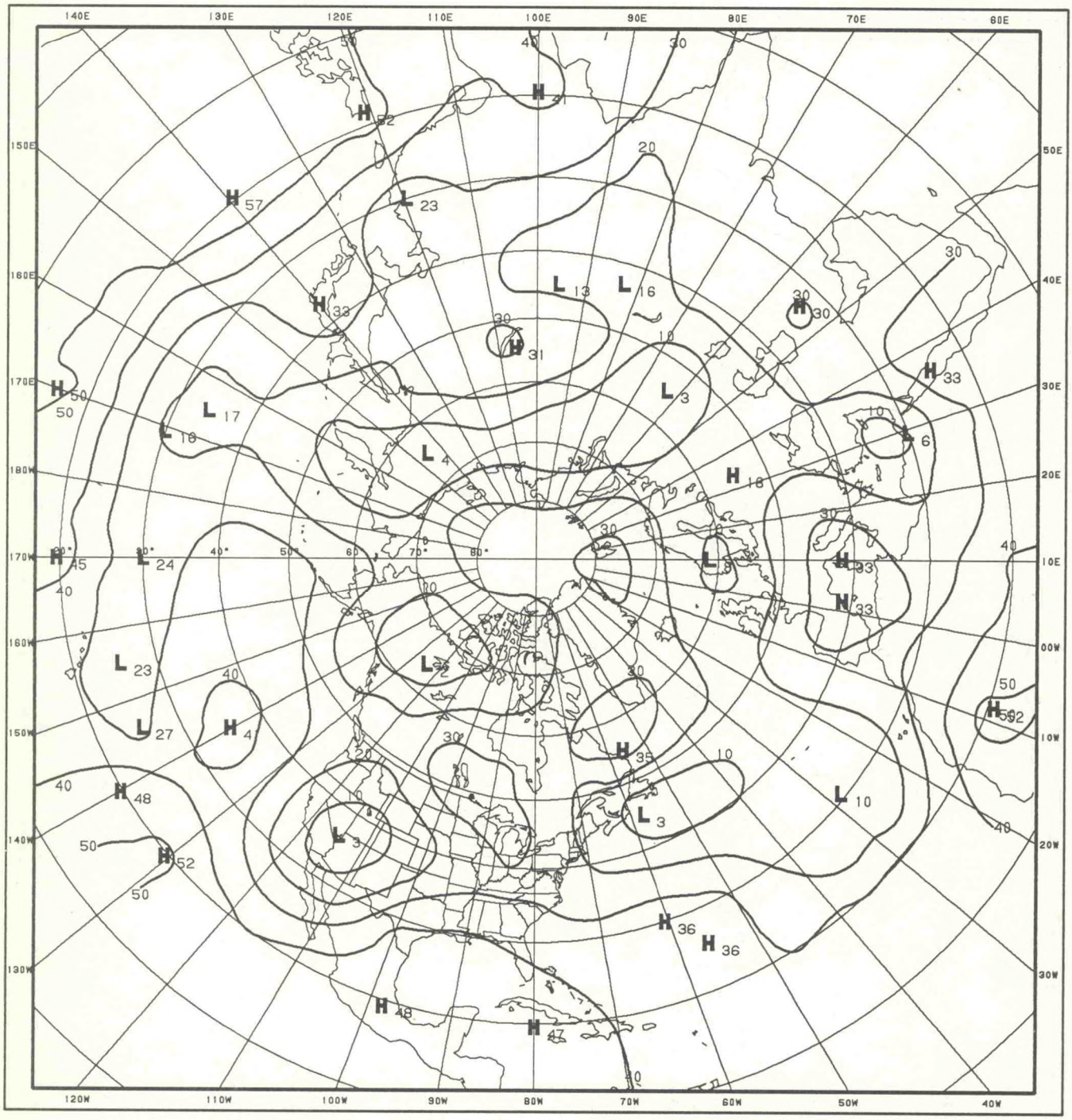
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT AUTOCORRELATION DEC-JAN

1-MONTH MEAN POOLED 1950-92

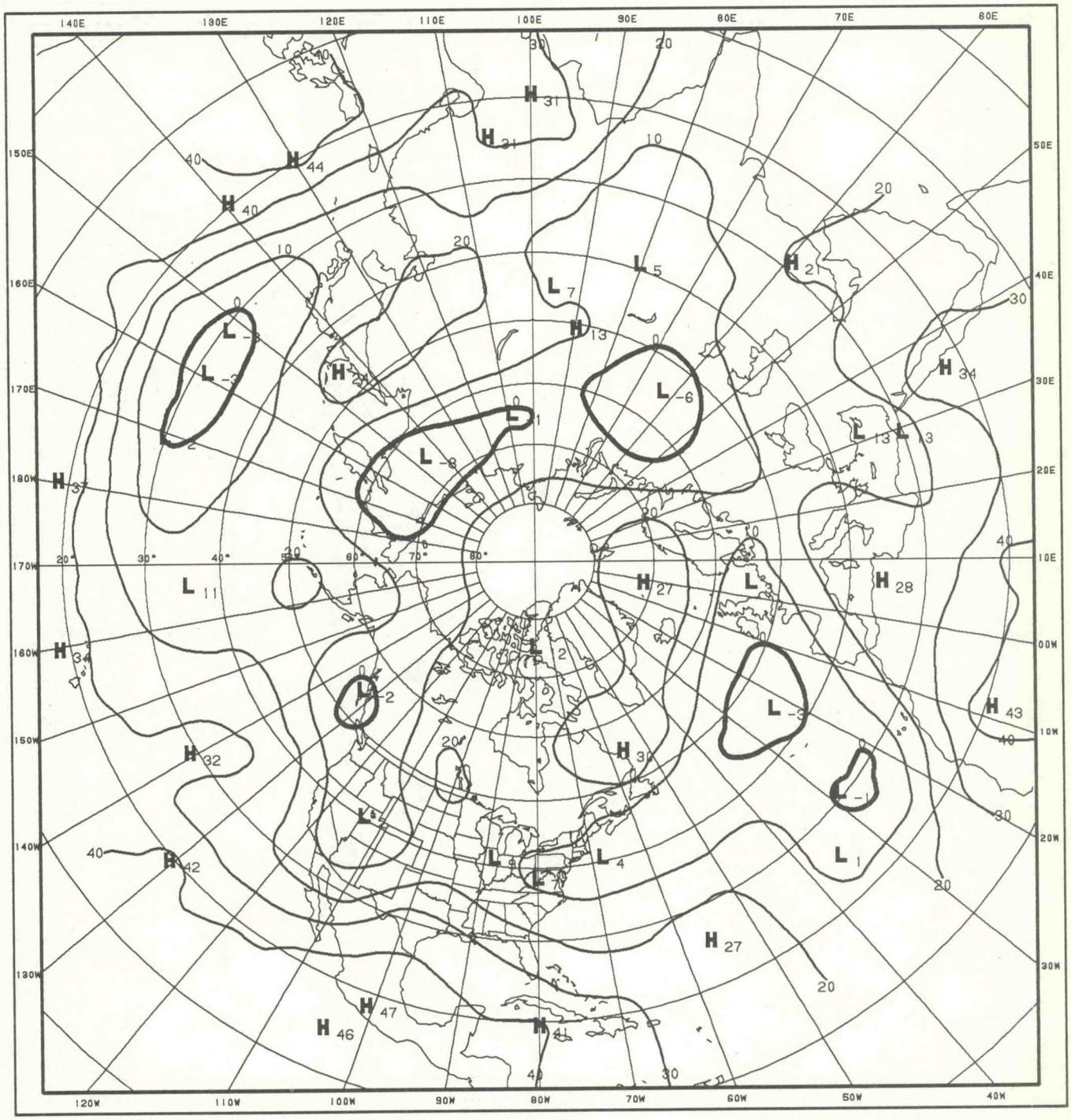
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT AUTOCORRELATION JAN-FEB

1-MONTH MEAN POOLED 1950-92

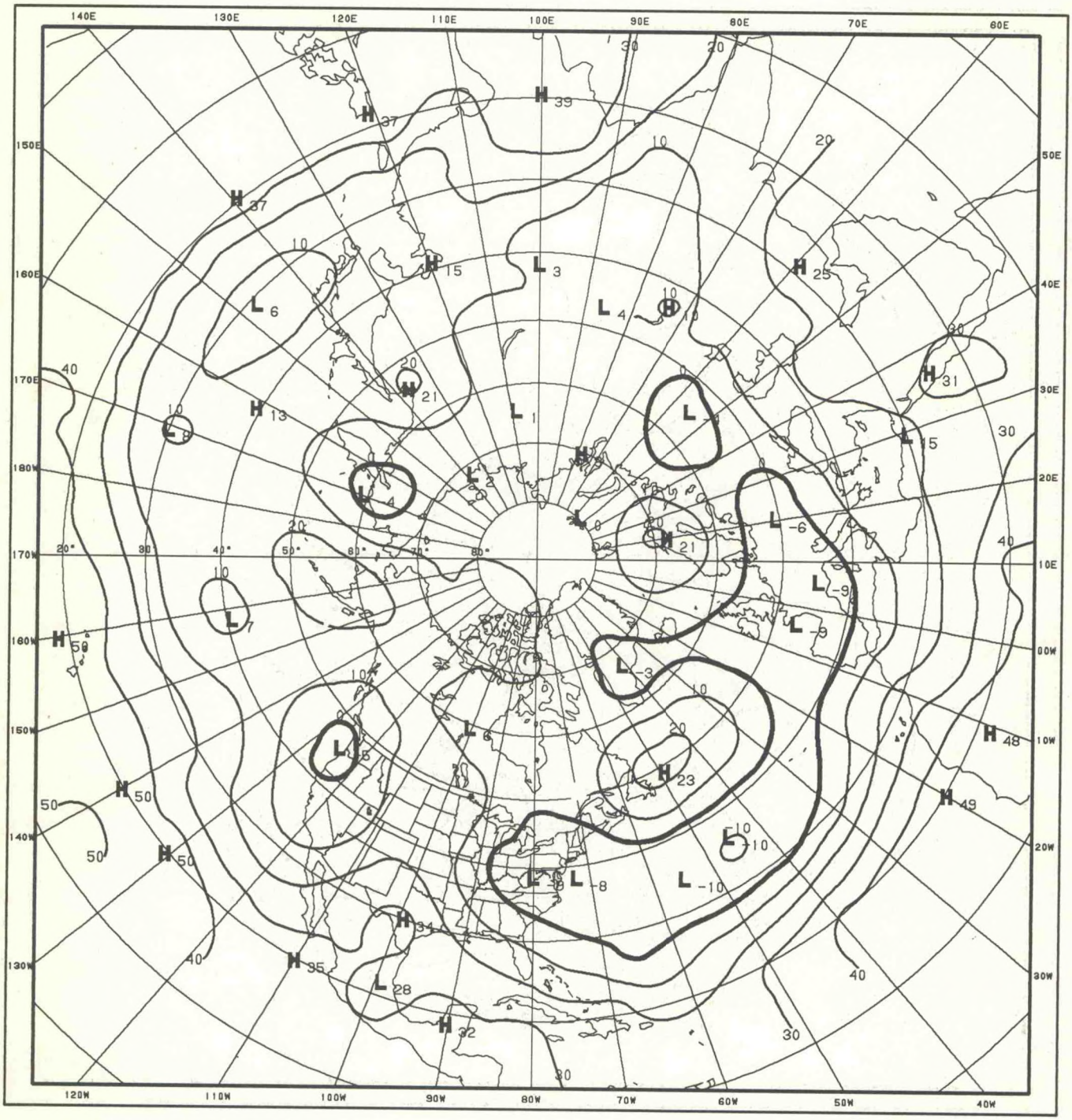
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT AUTOCORRELATION FEB-MAR

1-MONTH MEAN POOLED 1950-92

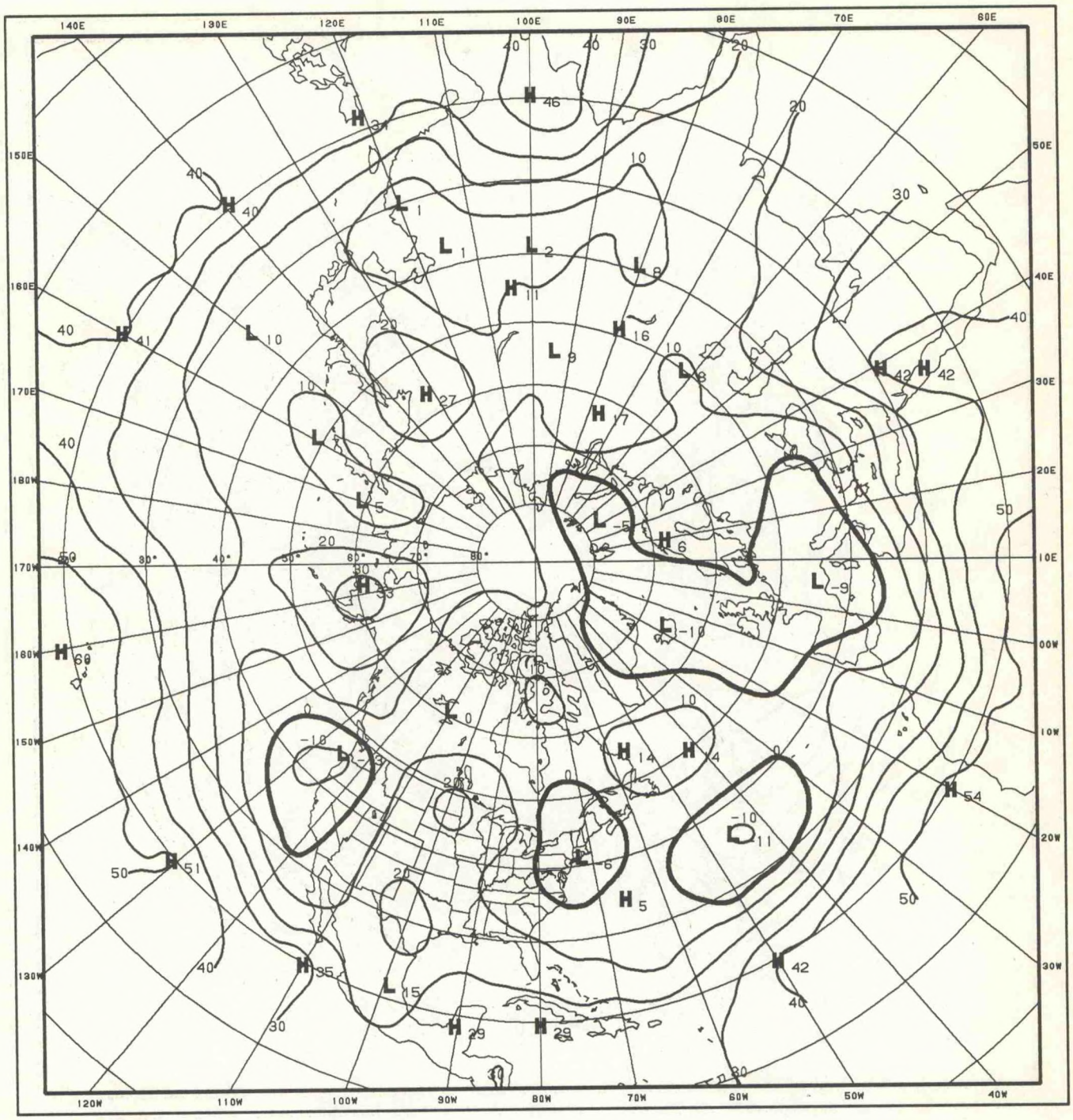
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT AUTOCORRELATION MAR-APR

1-MONTH MEAN POOLED 1950-92

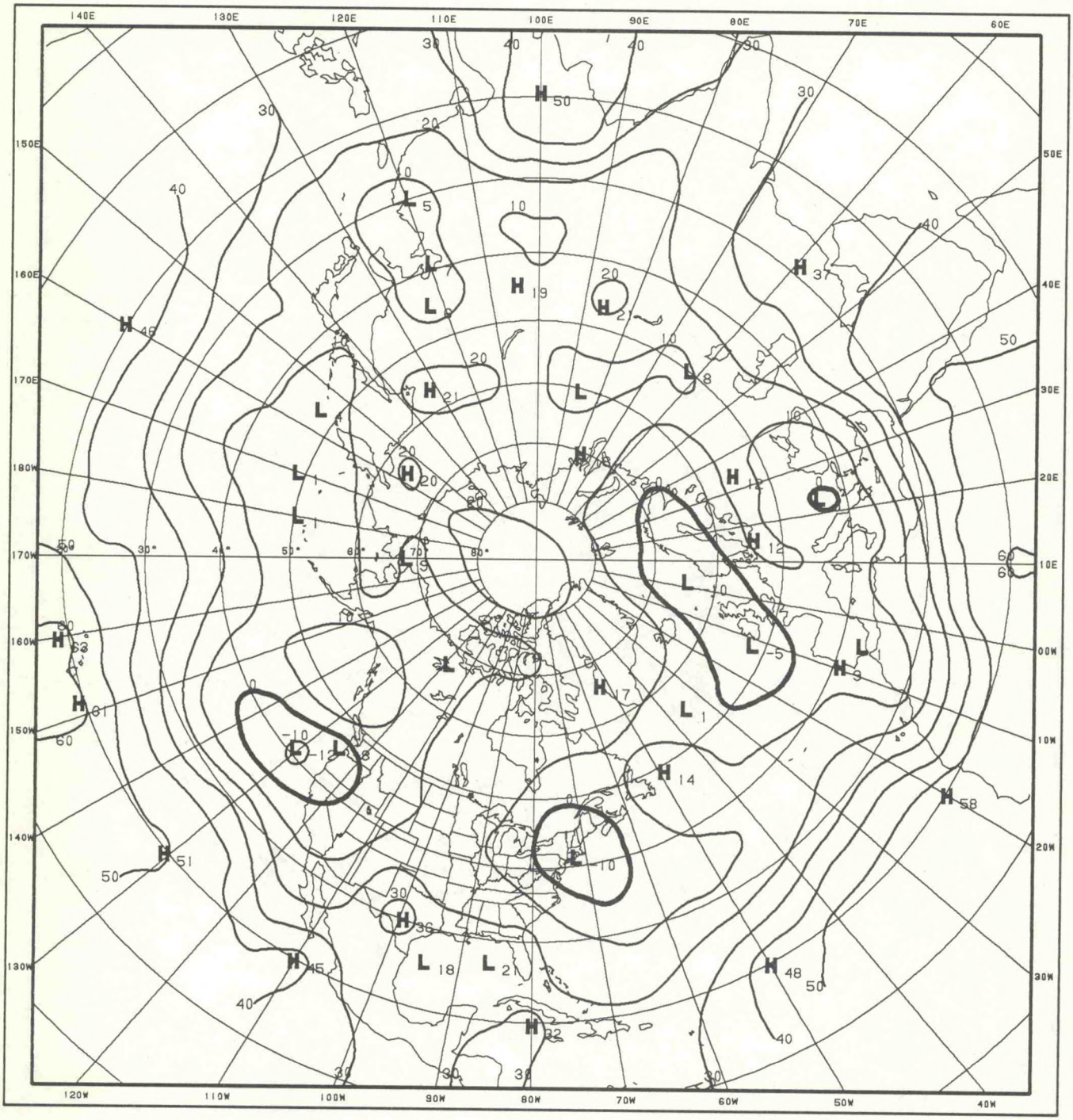
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT AUTOCORRELATION APR-MAY

1-MONTH MEAN POOLED 1950-92

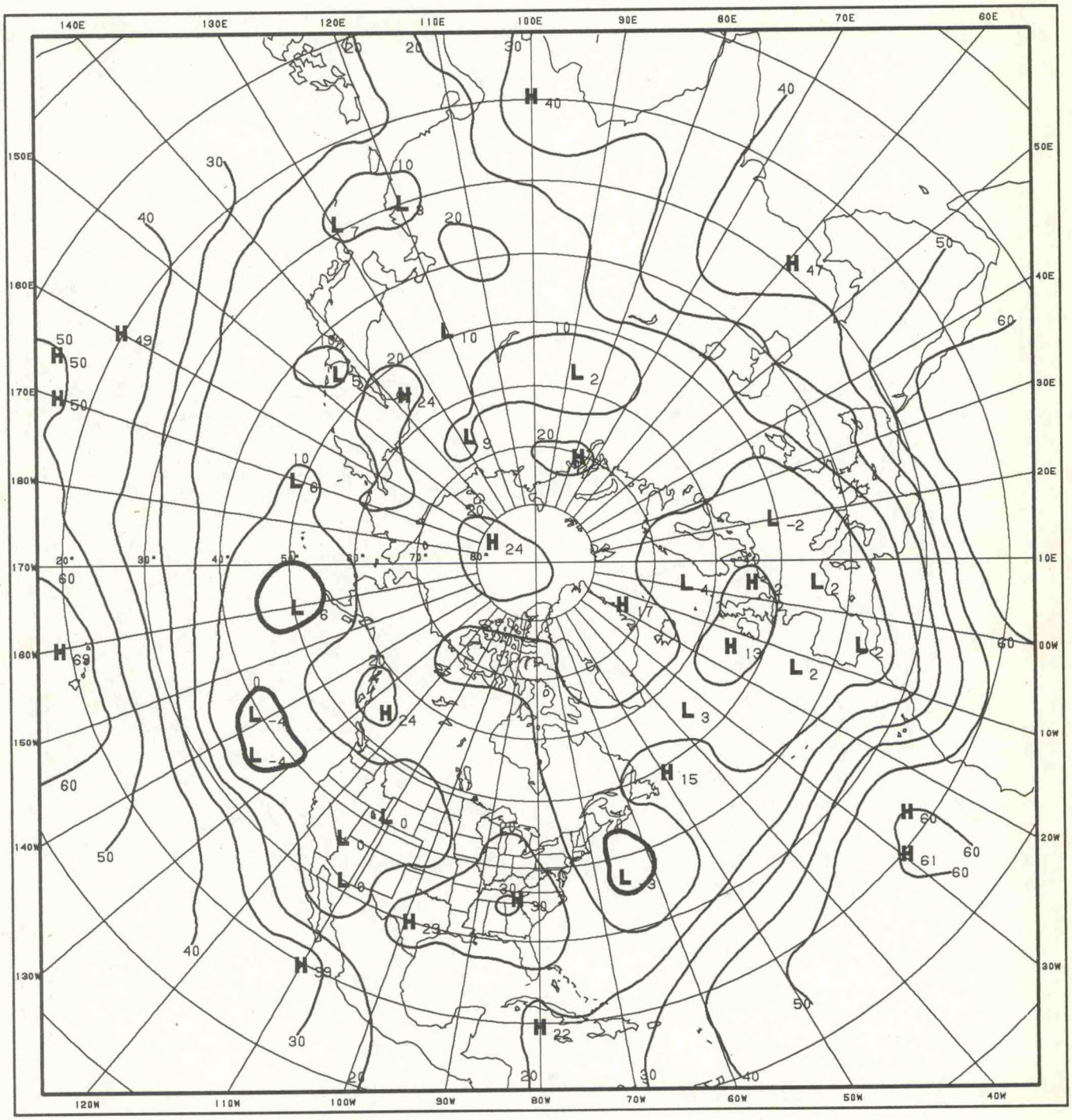
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT AUTOCORRELATION MAY-JUN

1-MONTH MEAN POOLED 1950-92

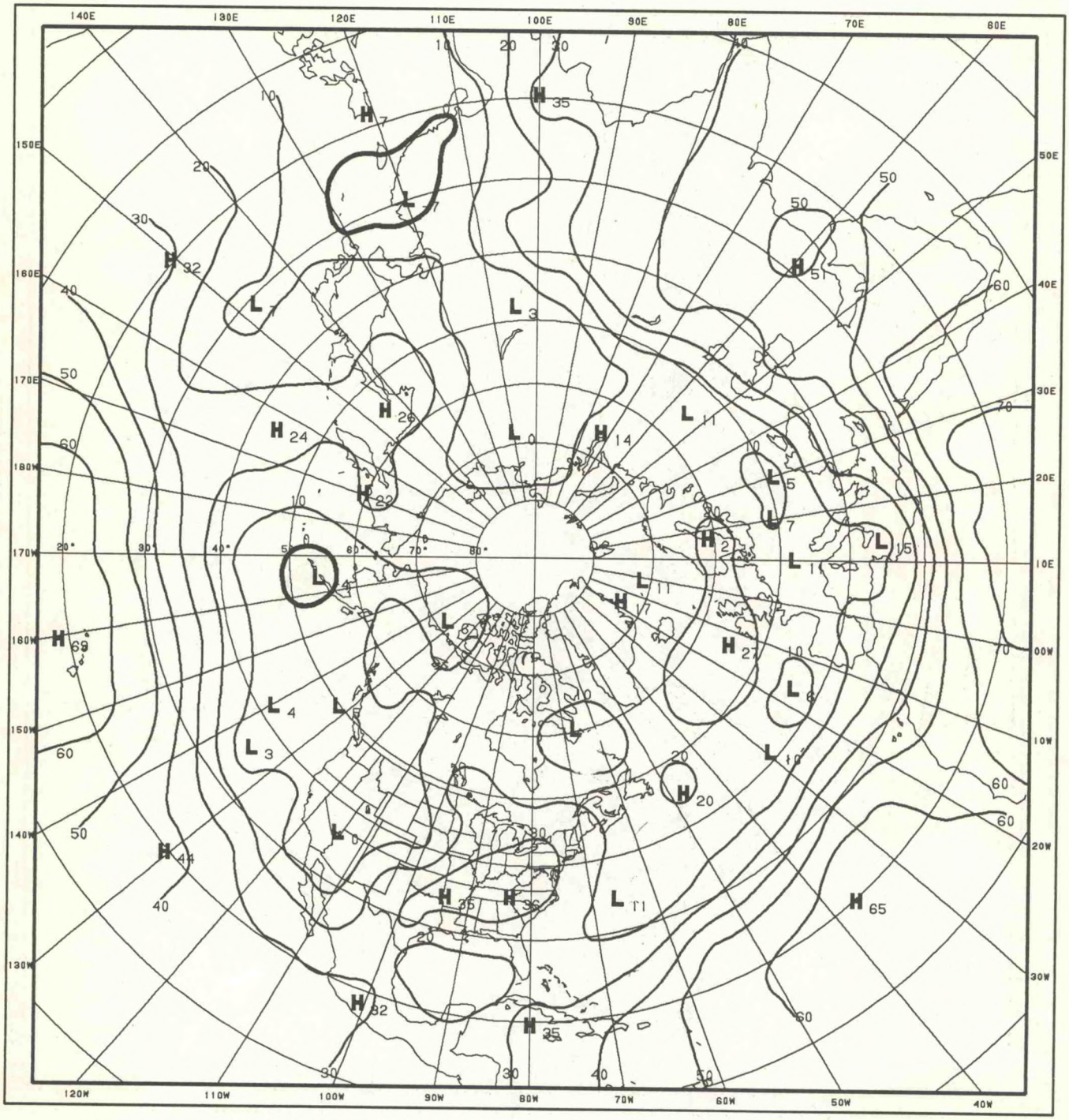
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT AUTOCORRELATION JUN-JUL

1-MONTH MEAN POOLED 1950-92

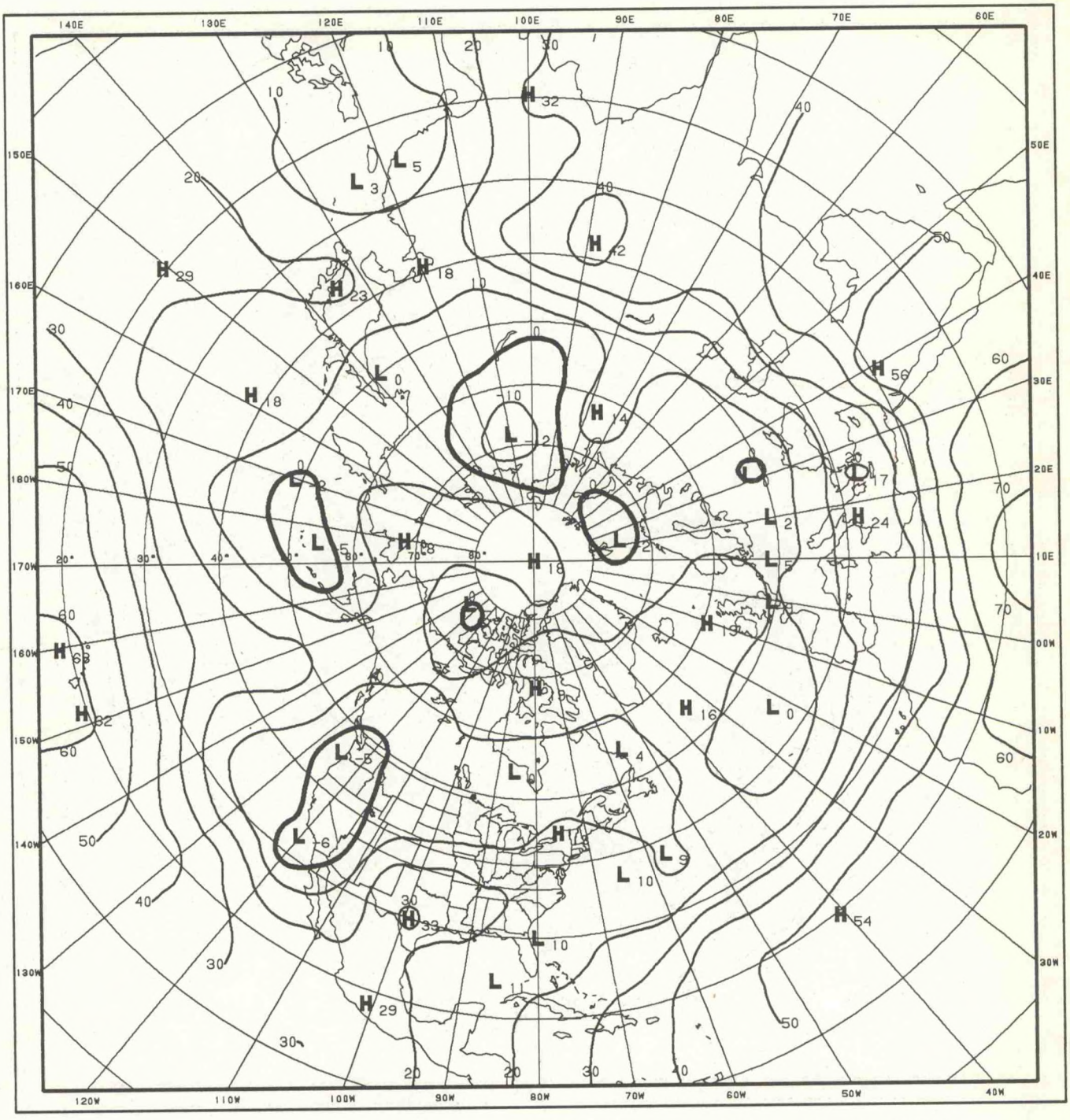
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT AUTOCORRELATION JUL-AUG

1-MONTH MEAN POOLED 1950-92

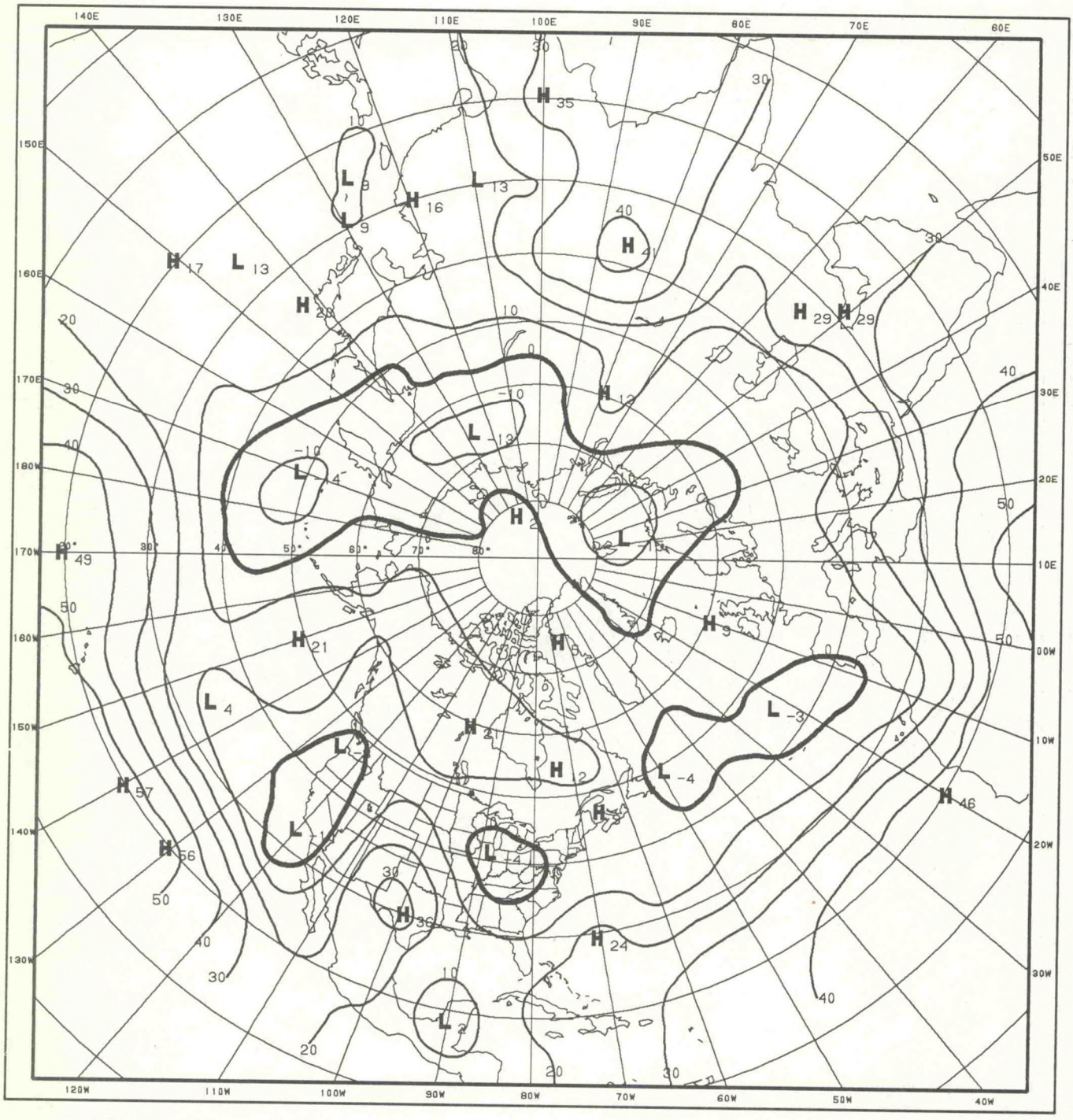
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT AUTOCORRELATION AUG-SEP

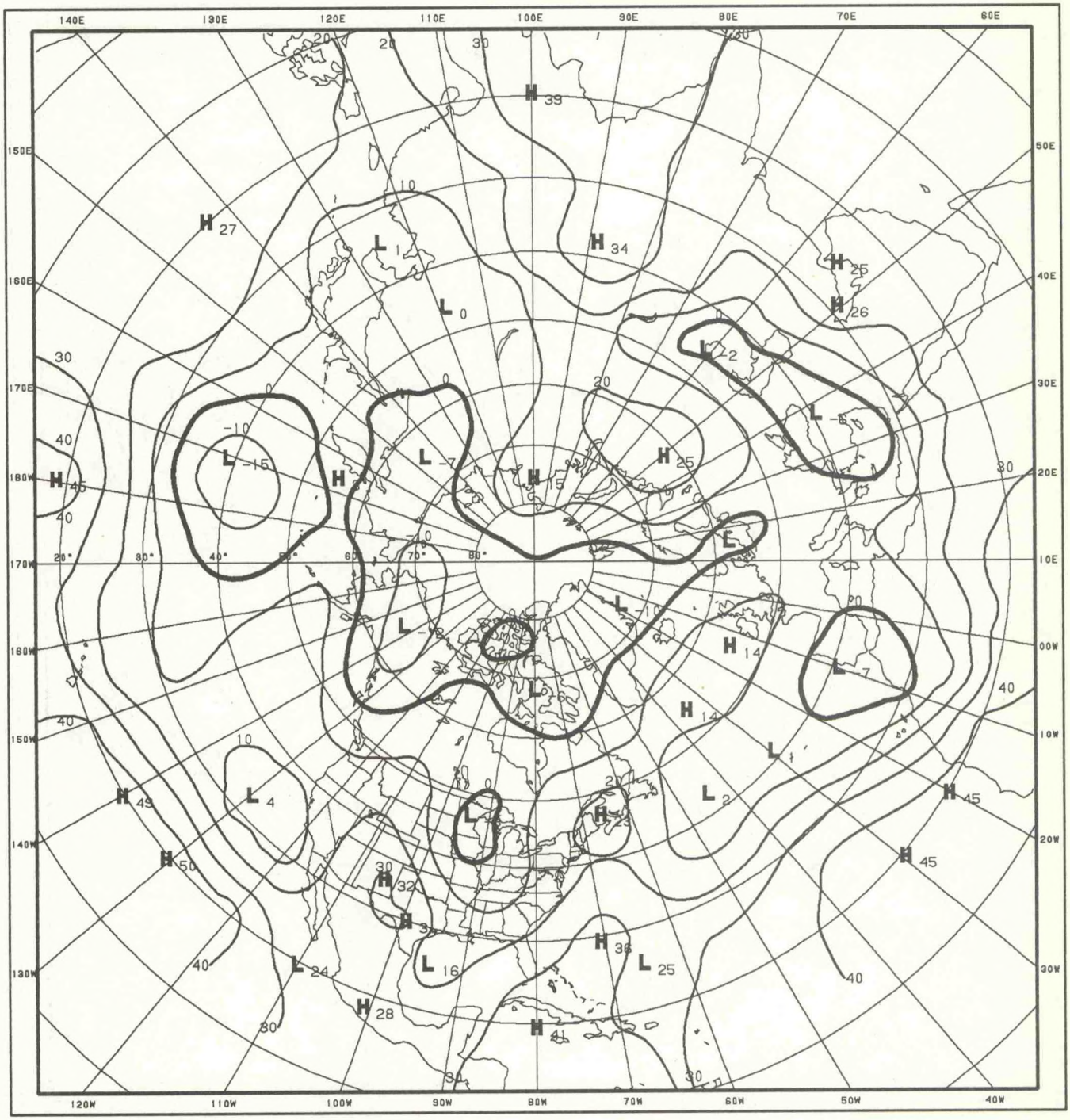
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT AUTOCORRELATION SEP-OCT
1-MONTH MEAN POOLED 1950-92

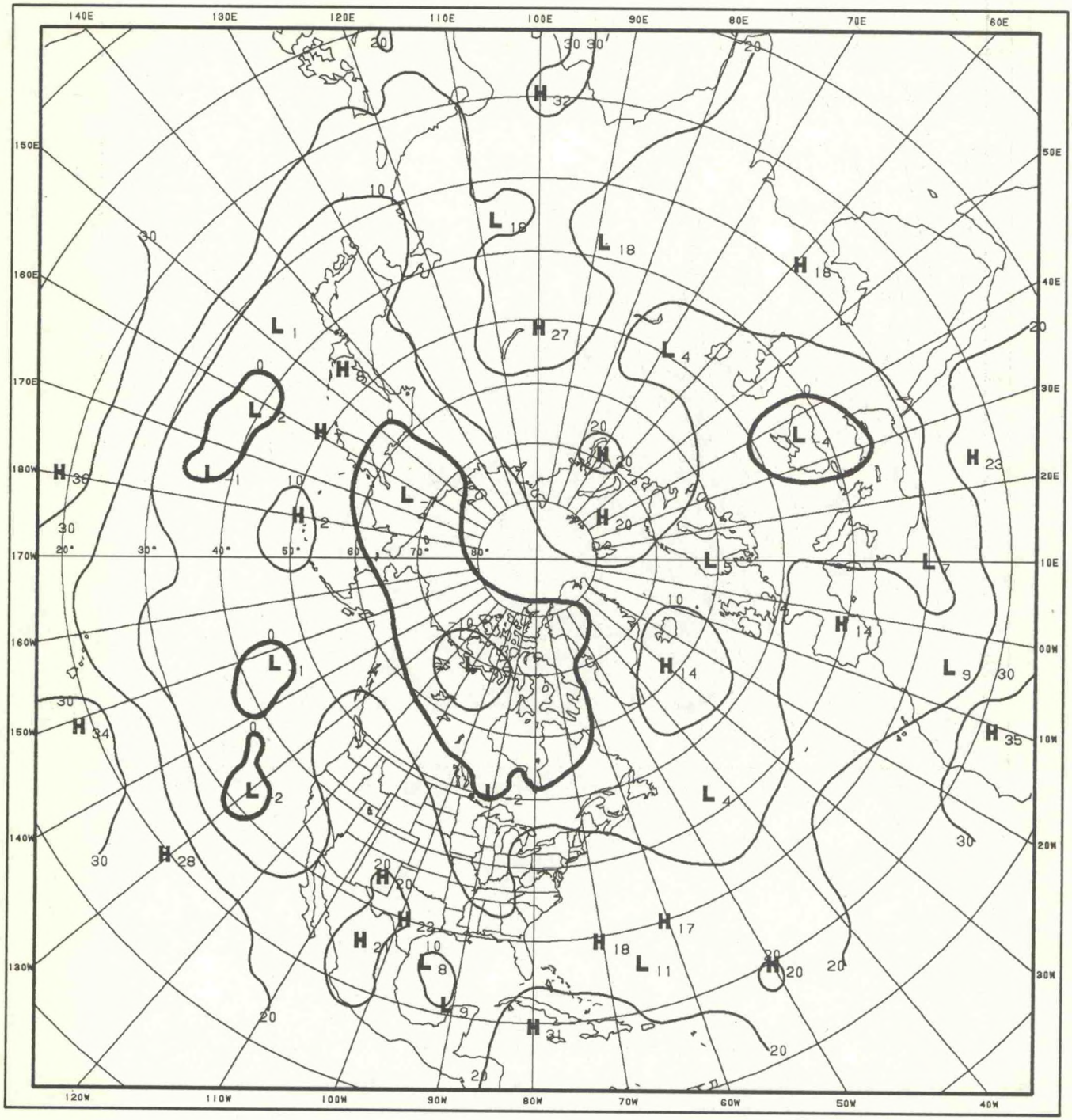
PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT AUTOCORRELATION OCT-NOV

1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



700 MB HEIGHT AUTOCORRELATION NOV-DEC

1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS

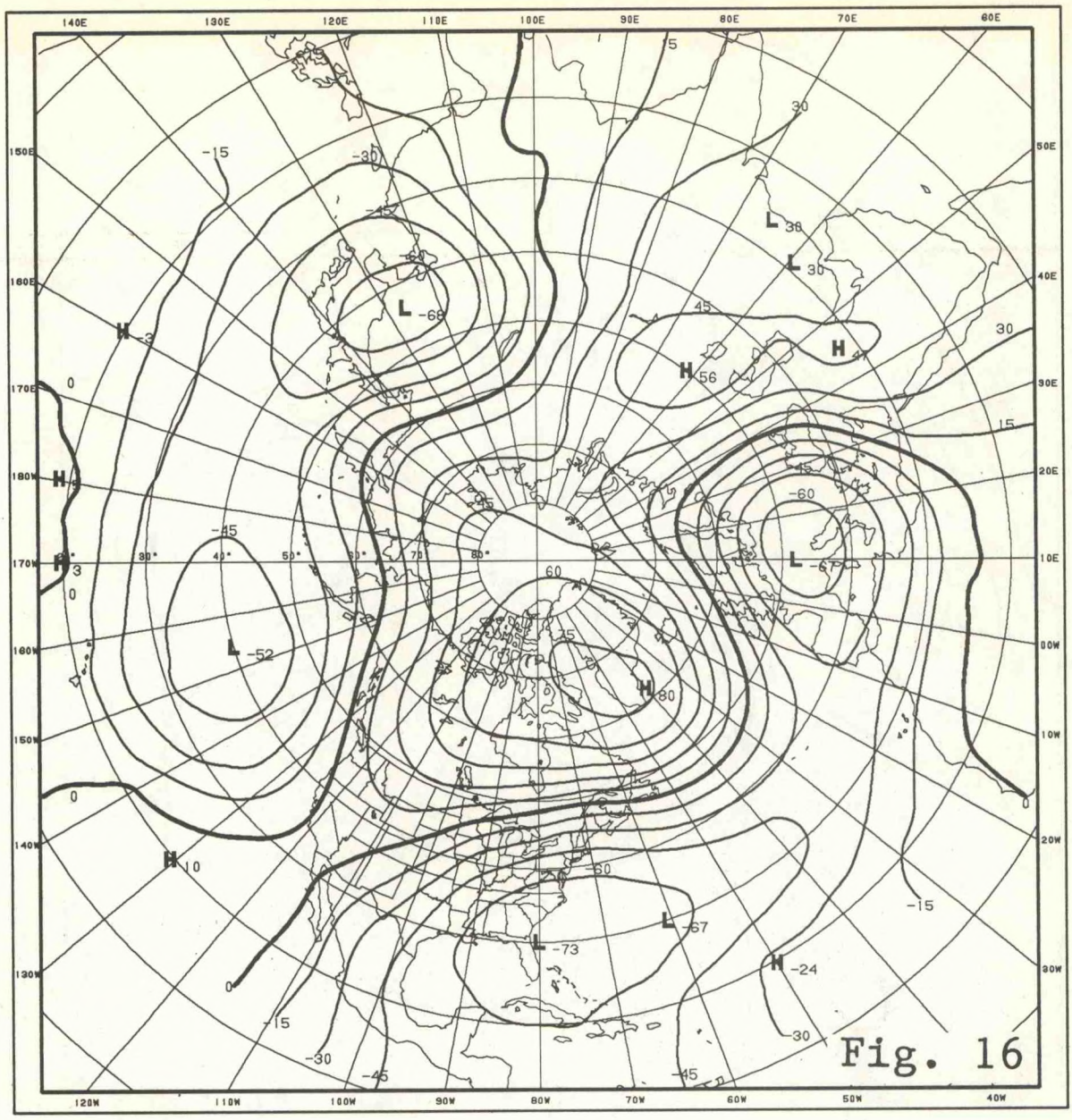
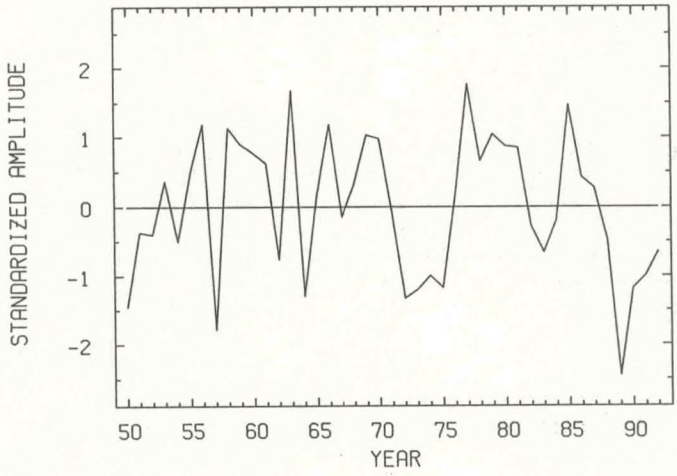
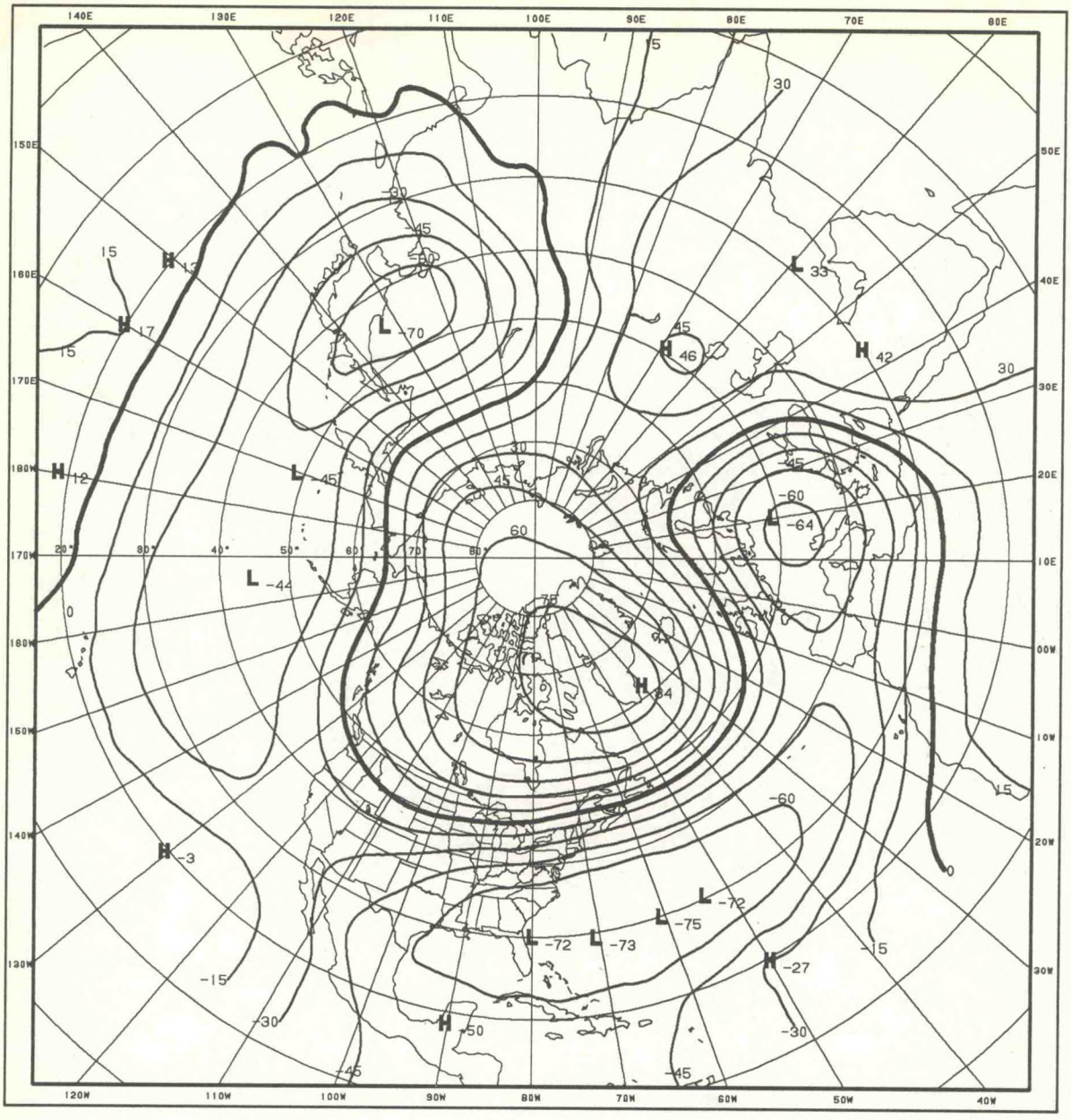


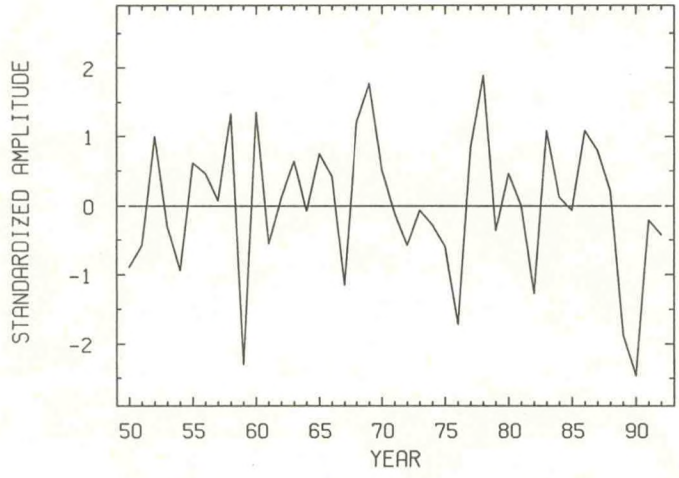
Fig. 16

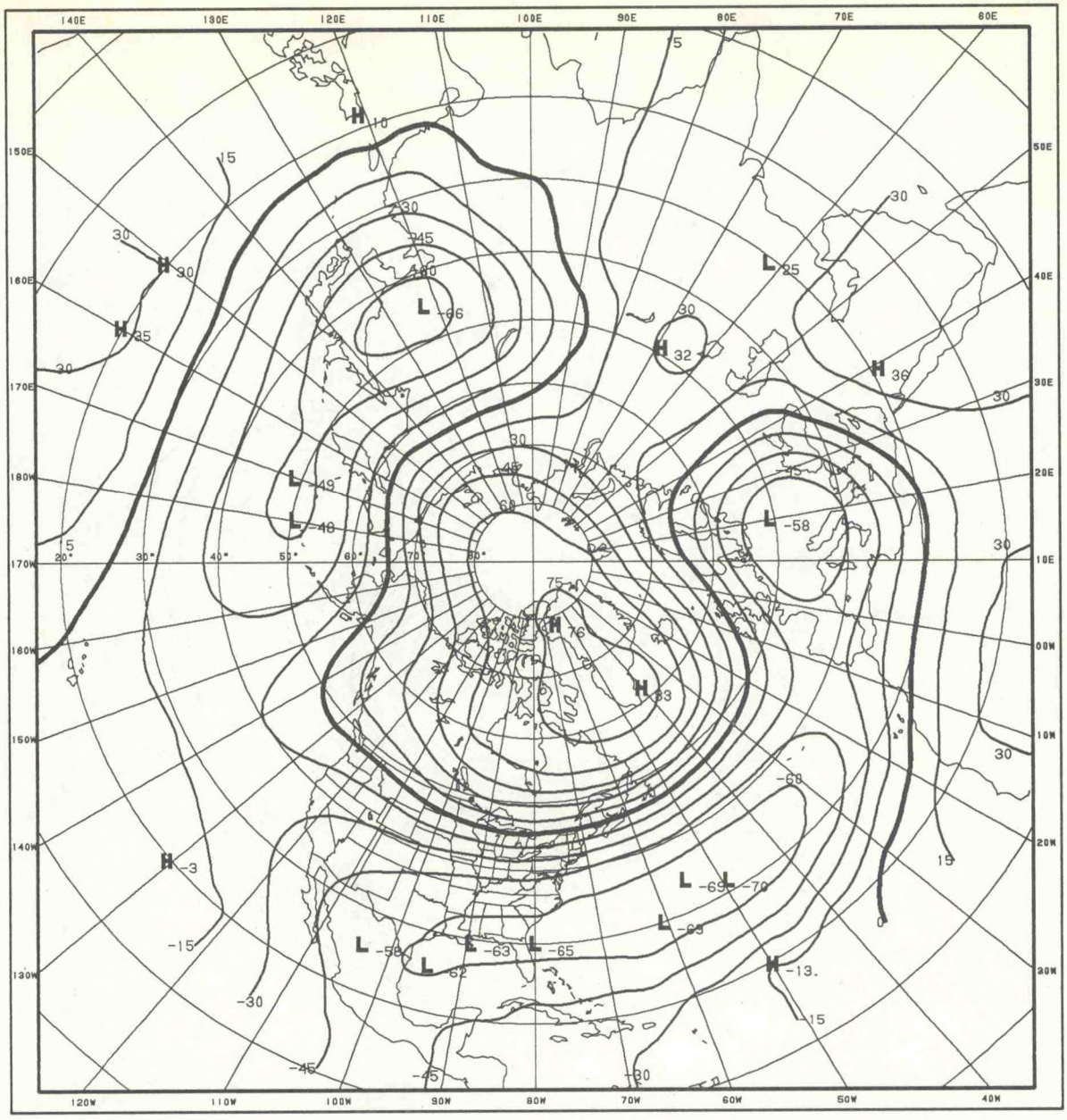
700 MB HEIGHT 1ST UNROT EOF JANUARY
1-MONTH MEAN POOLED 1950-92



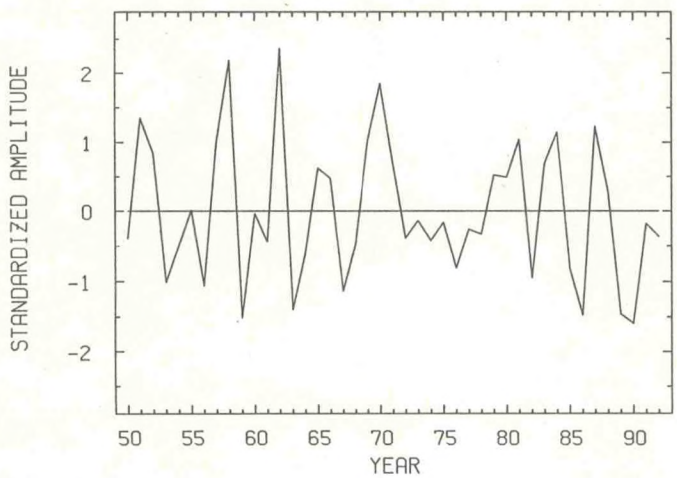


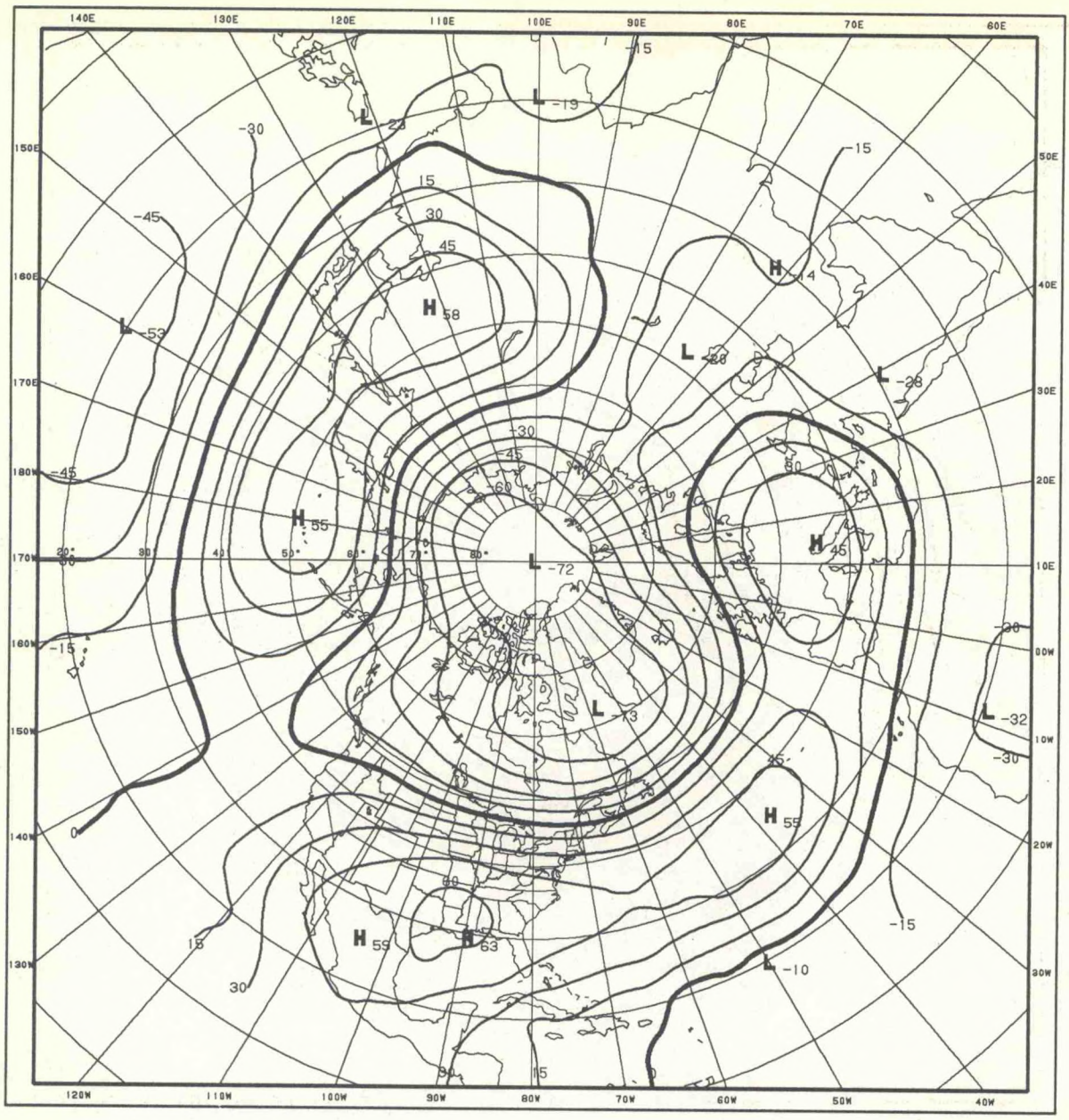
700 MB HEIGHT 1ST UNROT EOF FEBRUARY
1-MONTH MEAN POOLED 1950-92



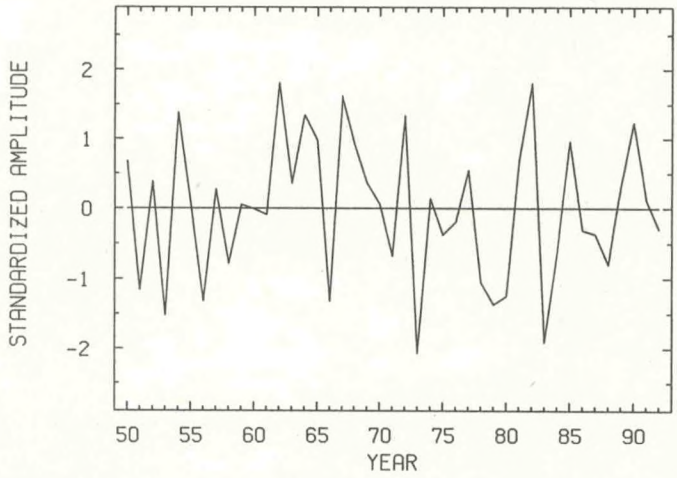


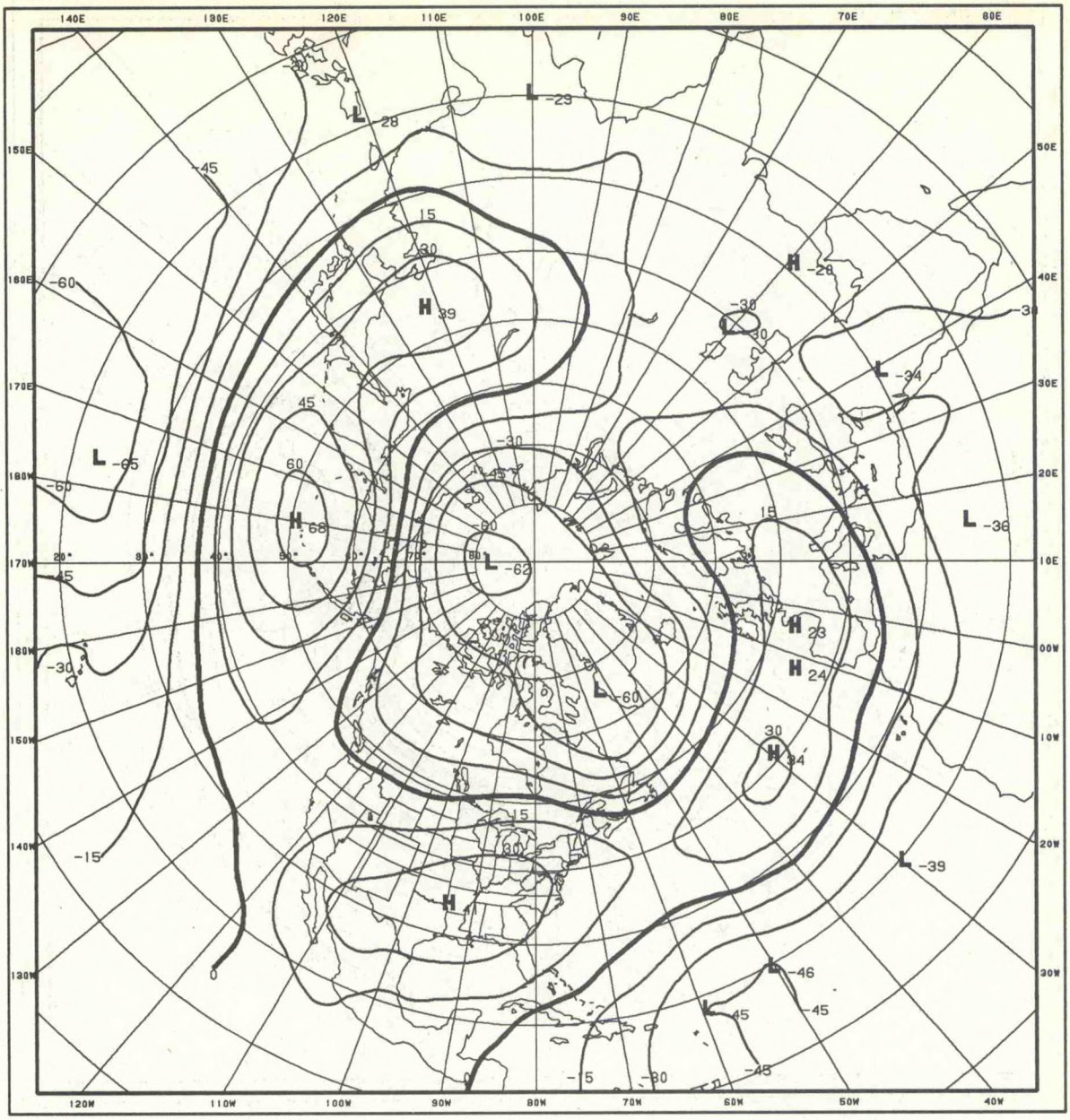
700 MB HEIGHT 1ST UNROT EOF MARCH
1-MONTH MEAN POOLED 1950-92



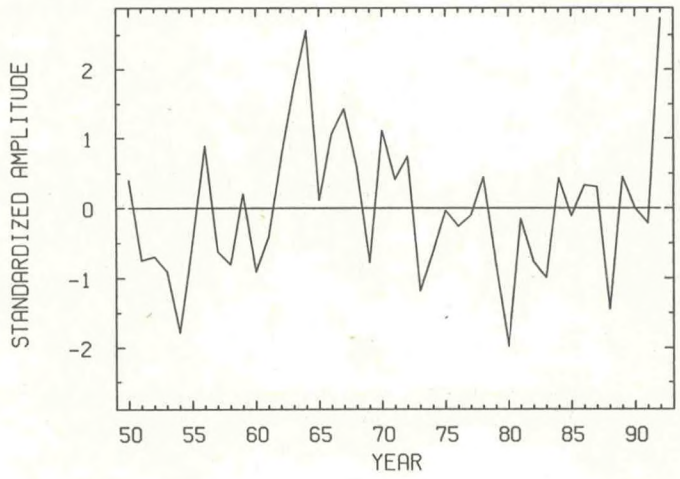


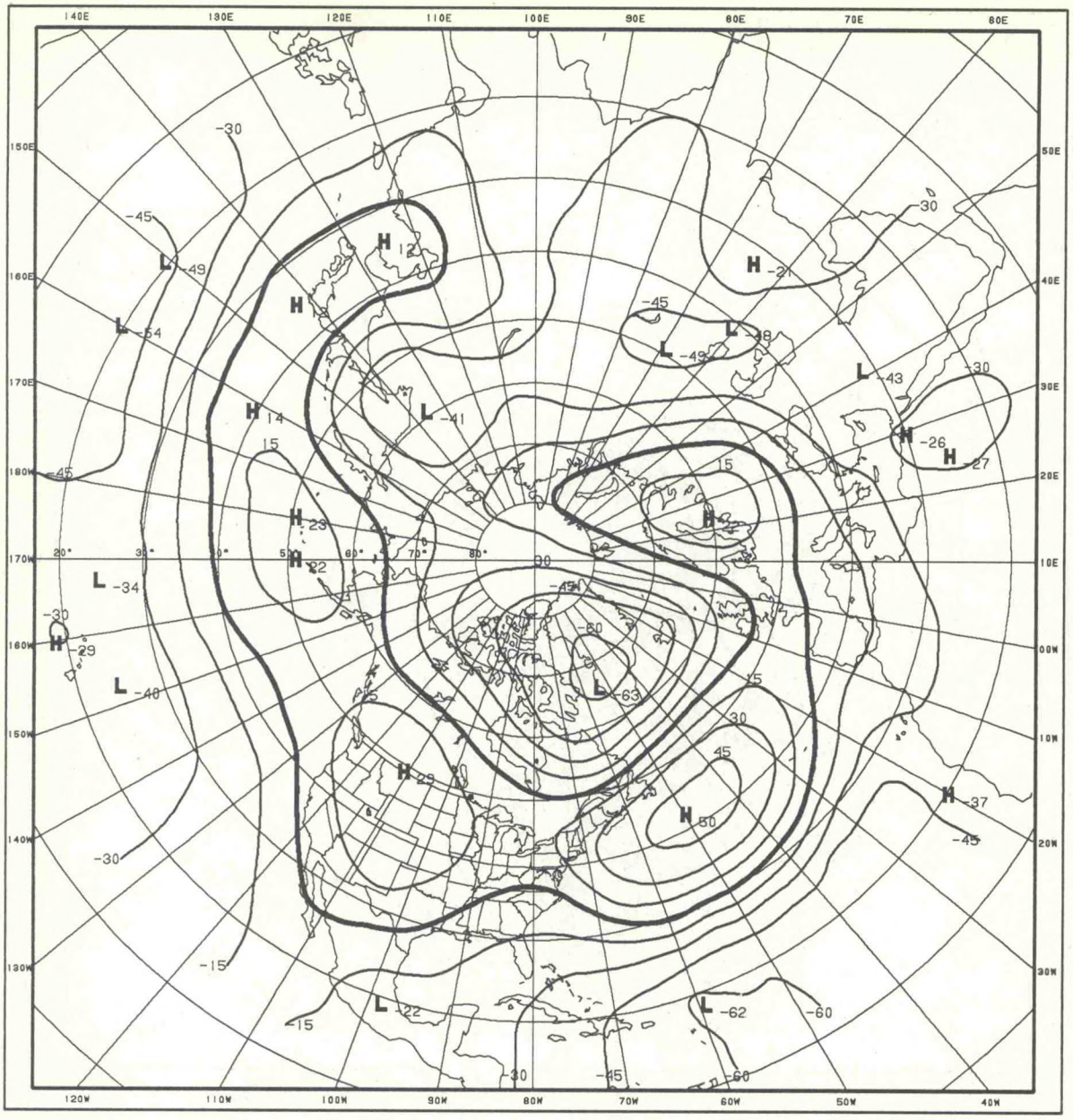
700 MB HEIGHT 1ST UNROT EOF APRIL
1-MONTH MEAN POOLED 1950-92



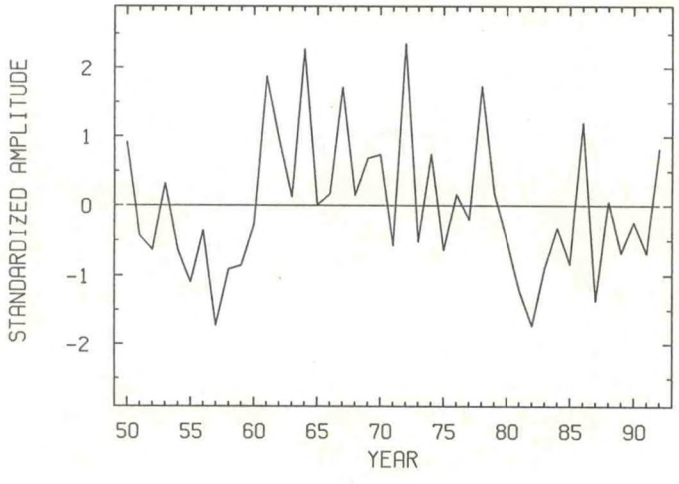


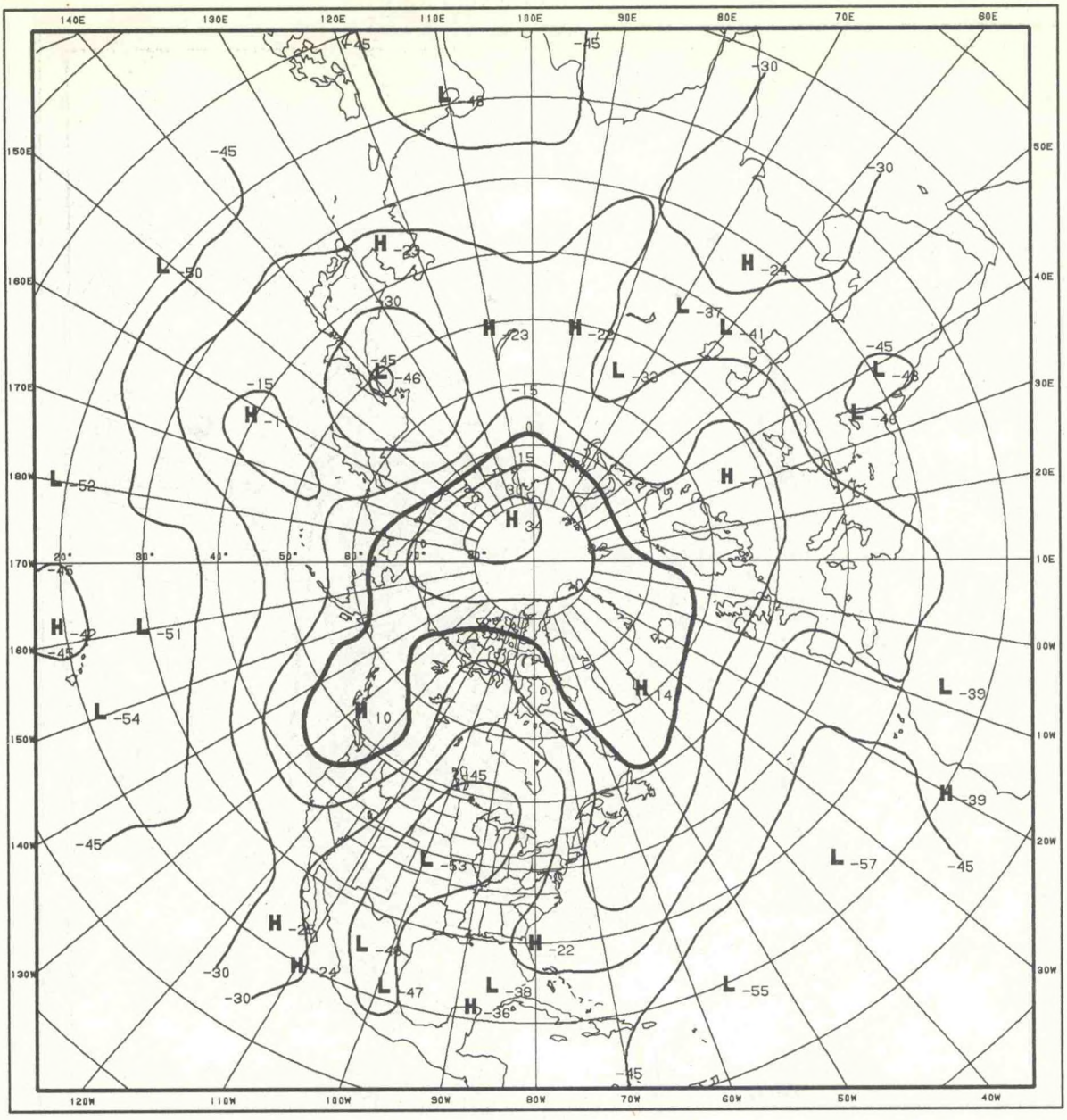
700 MB HEIGHT 1ST UNROT EOF MAY
1-MONTH MEAN POOLED 1950-92



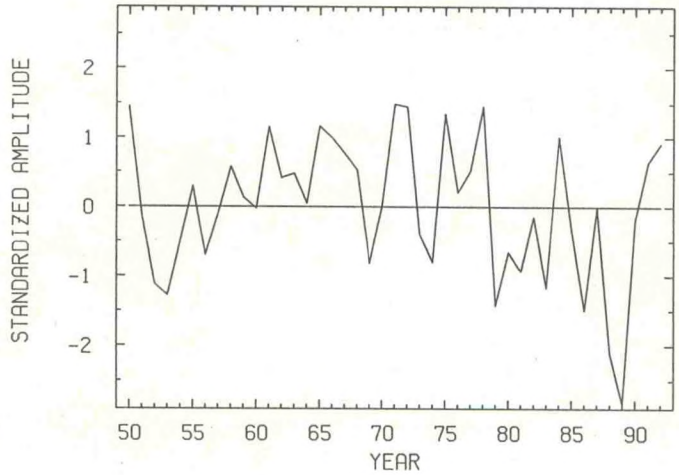


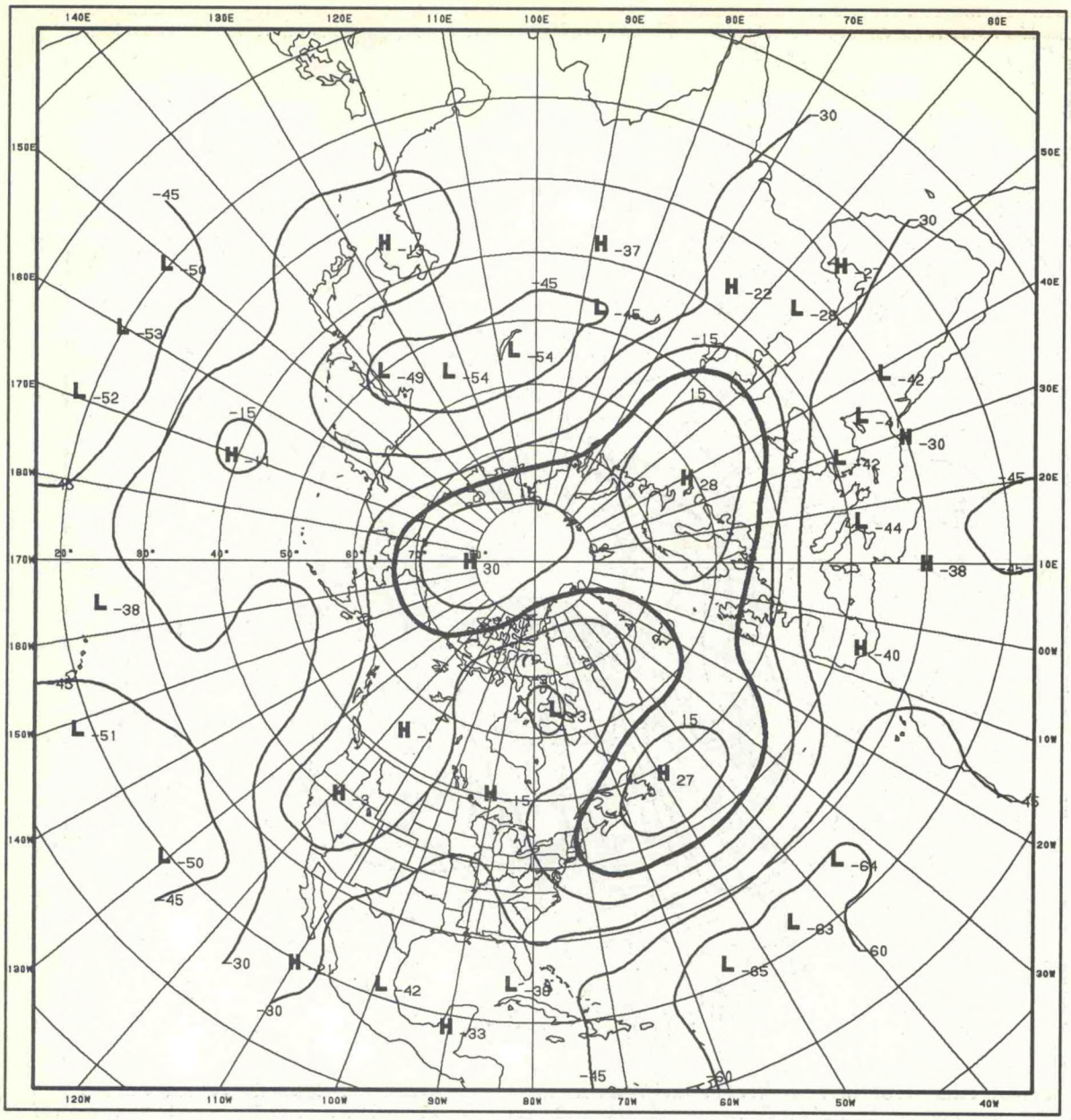
700 MB HEIGHT 1ST UNROT EOF JUNE
1-MONTH MEAN POOLED 1950-92



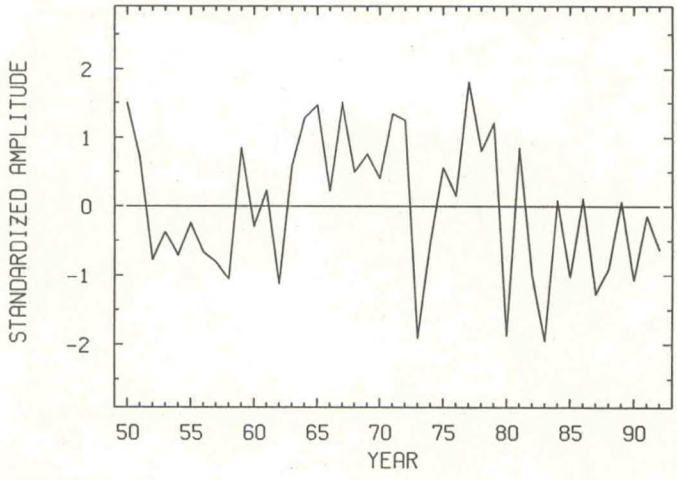


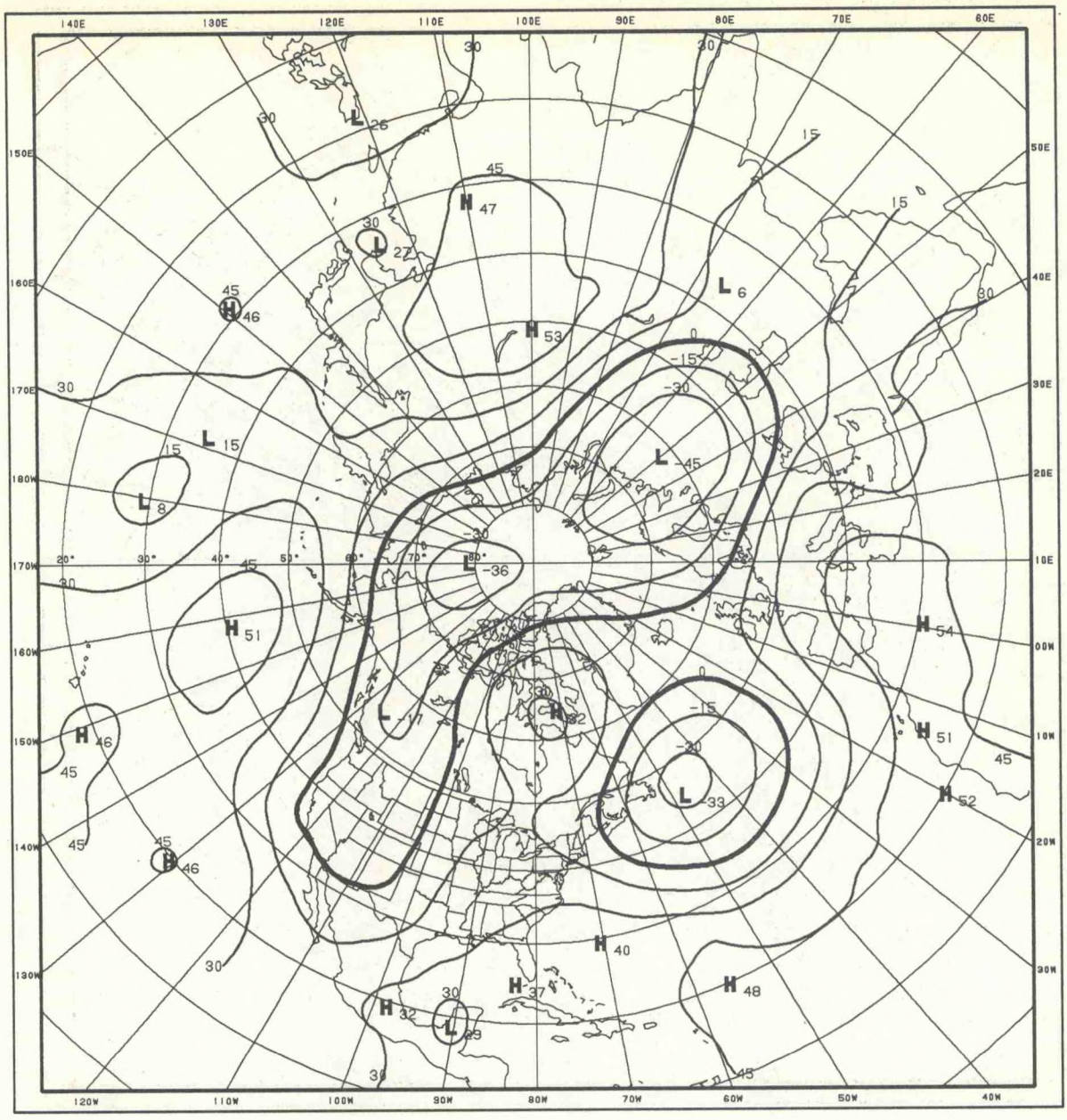
700 MB HEIGHT 1ST UNROT EOF JULY
1-MONTH MEAN POOLED 1950-92



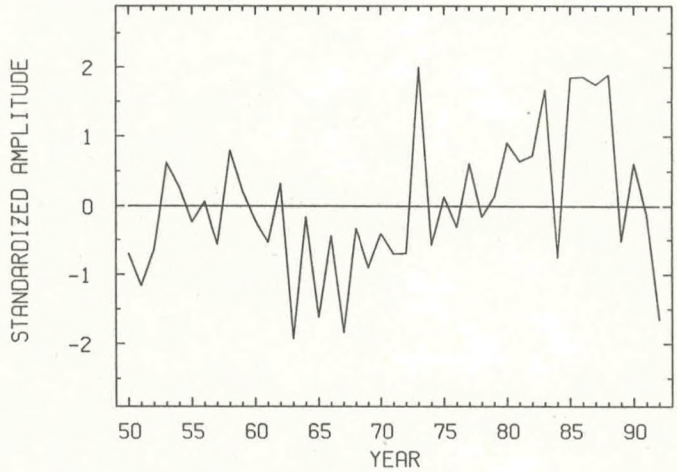


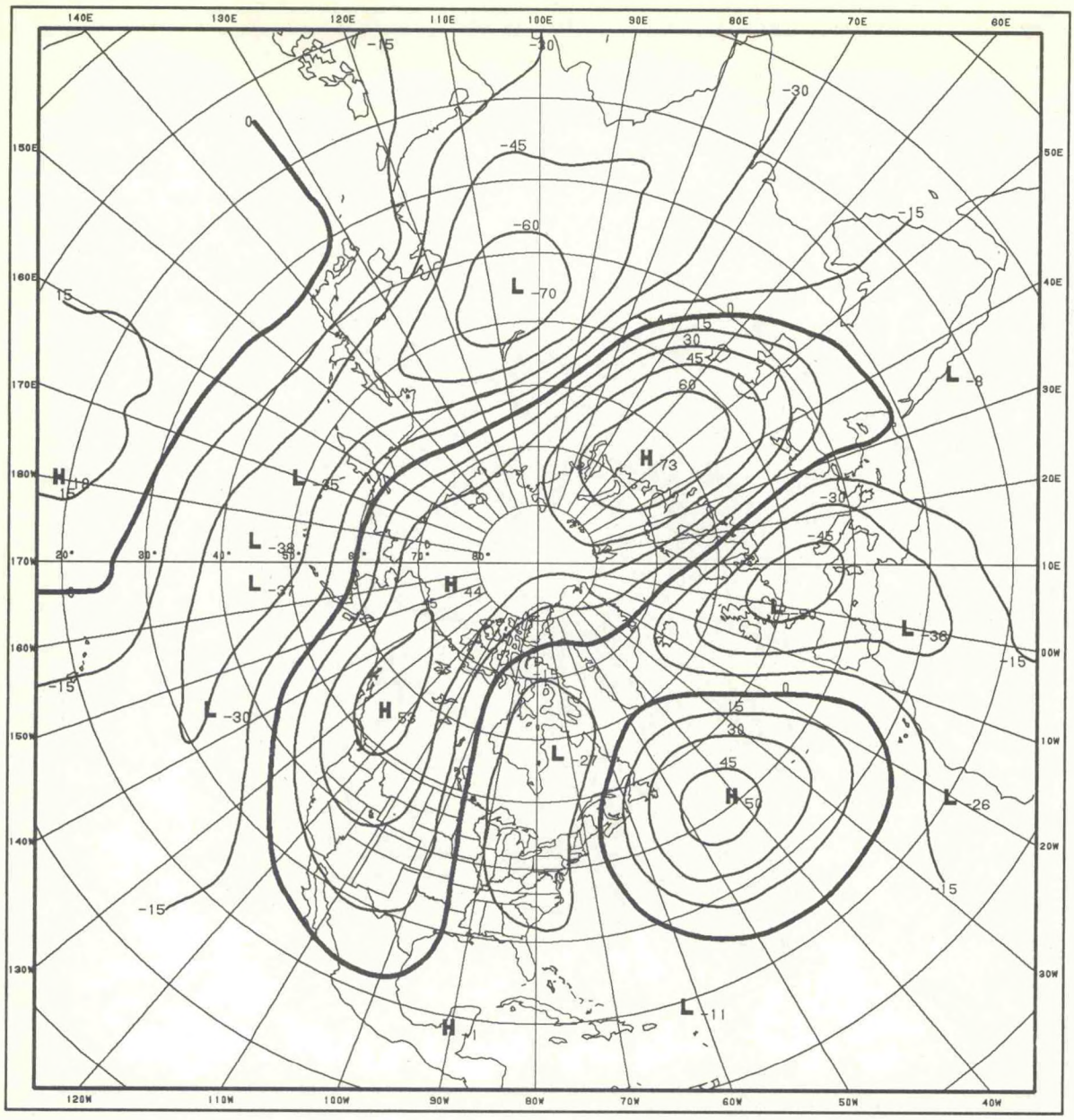
700 MB HEIGHT 1ST UNROT EOF AUGUST
1-MONTH MEAN POOLED 1950-92



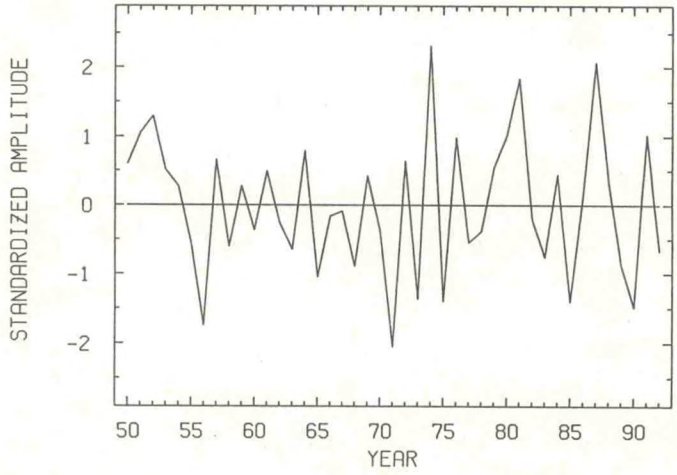


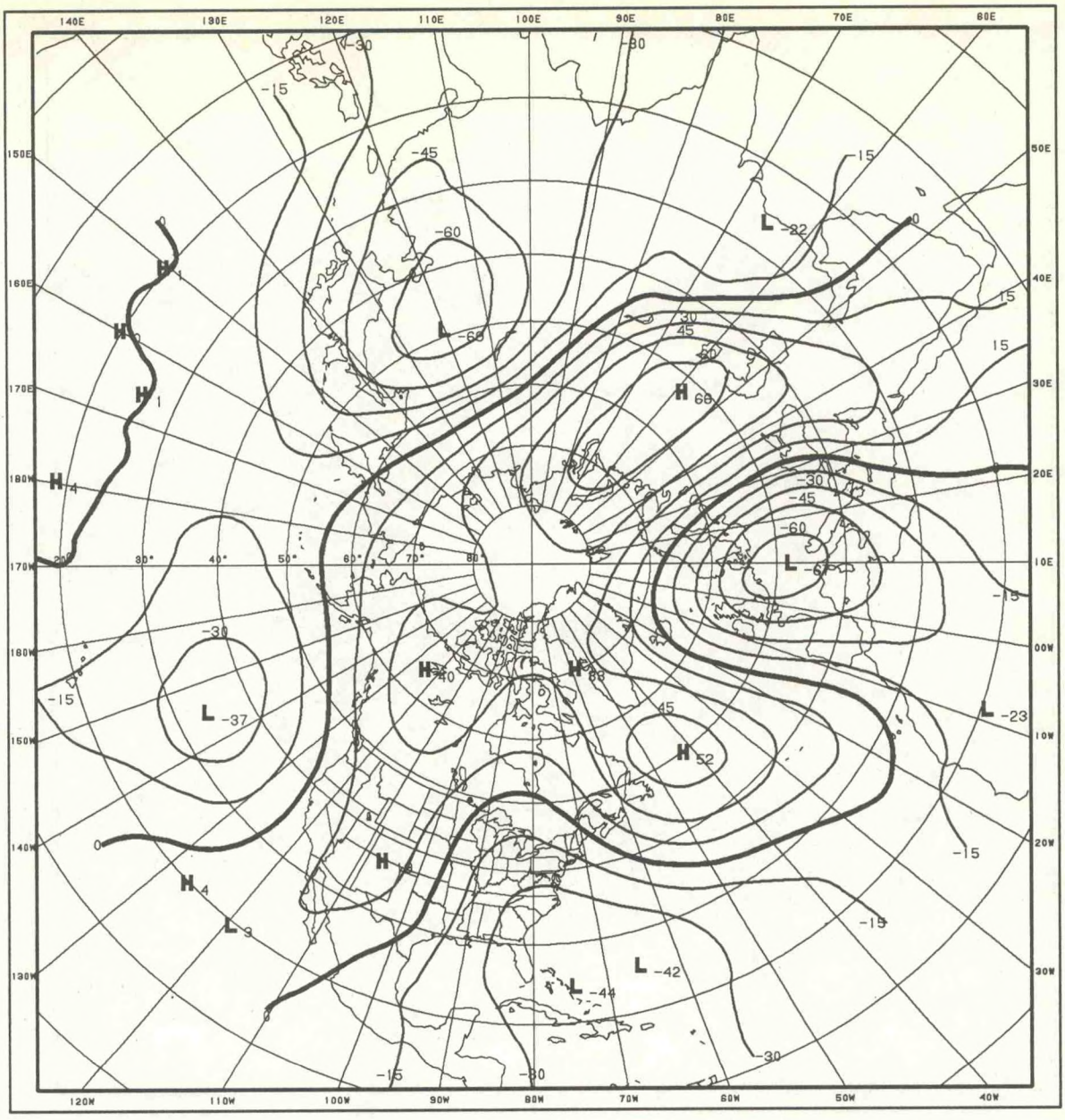
700 MB HEIGHT 1ST UNROT EOF SEPTEMBR
1-MONTH MEAN POOLED 1950-92



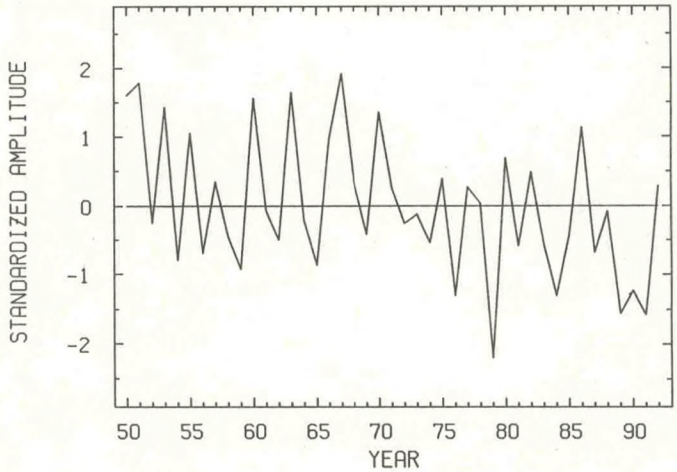


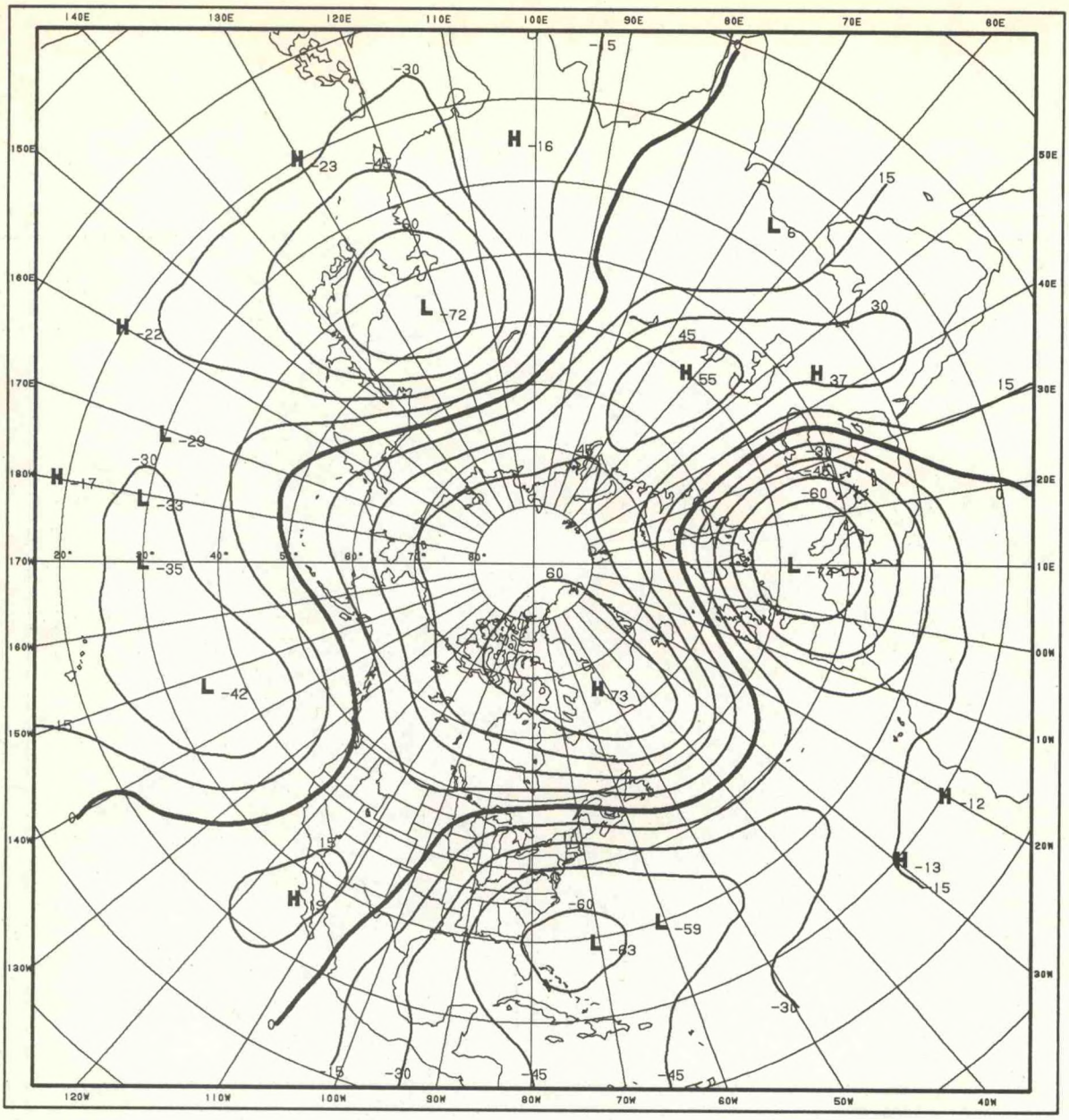
700 MB HEIGHT 1ST UNROT EOF OCTOBER
1-MONTH MEAN POOLED 1950-92



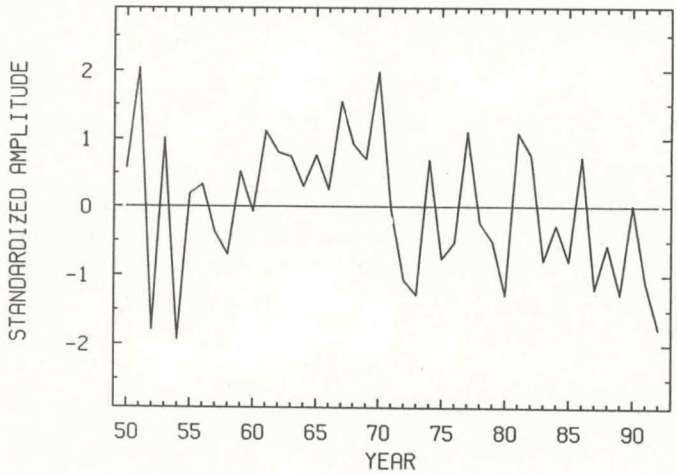


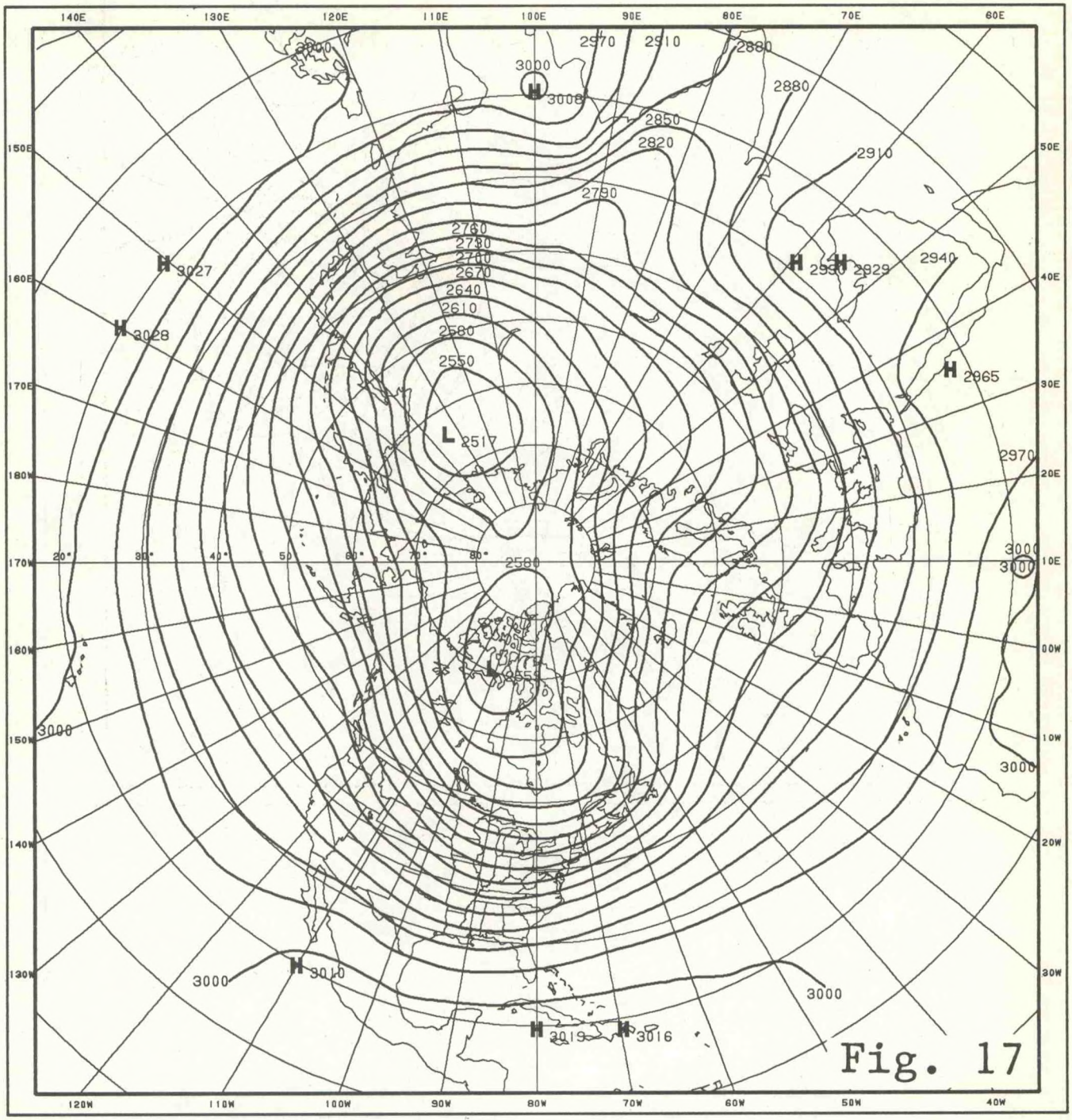
700 MB HEIGHT 1ST UNROT EOF NOVEMBER
1-MONTH MEAN POOLED 1950-92





700 MB HEIGHT 1ST UNROT EOF DECEMBER
1-MONTH MEAN POOLED 1950-92

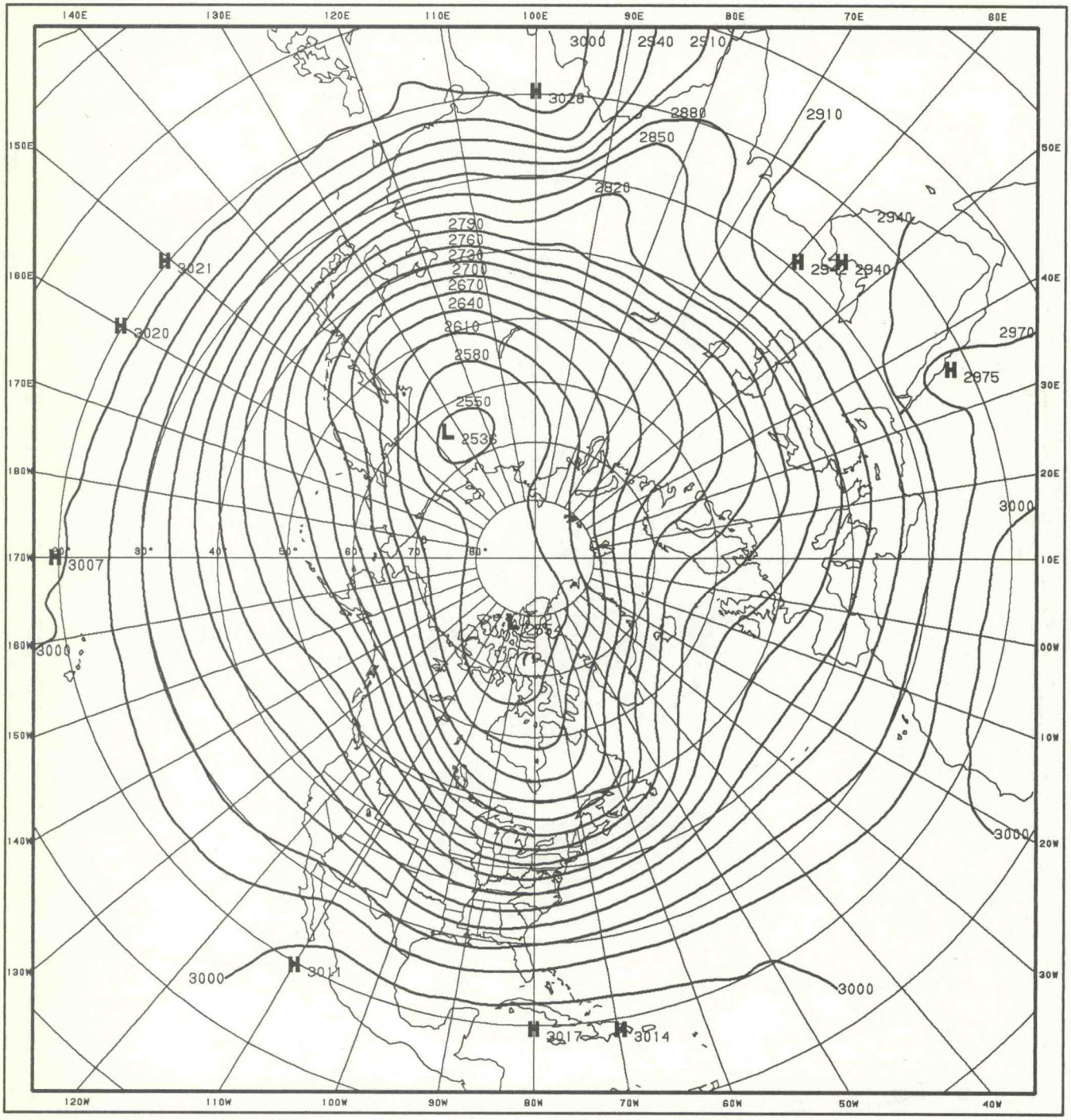




1000-700 MB THICKNESS MEAN JANUARY

1-MONTH MEAN UNPOOLED 1950-92

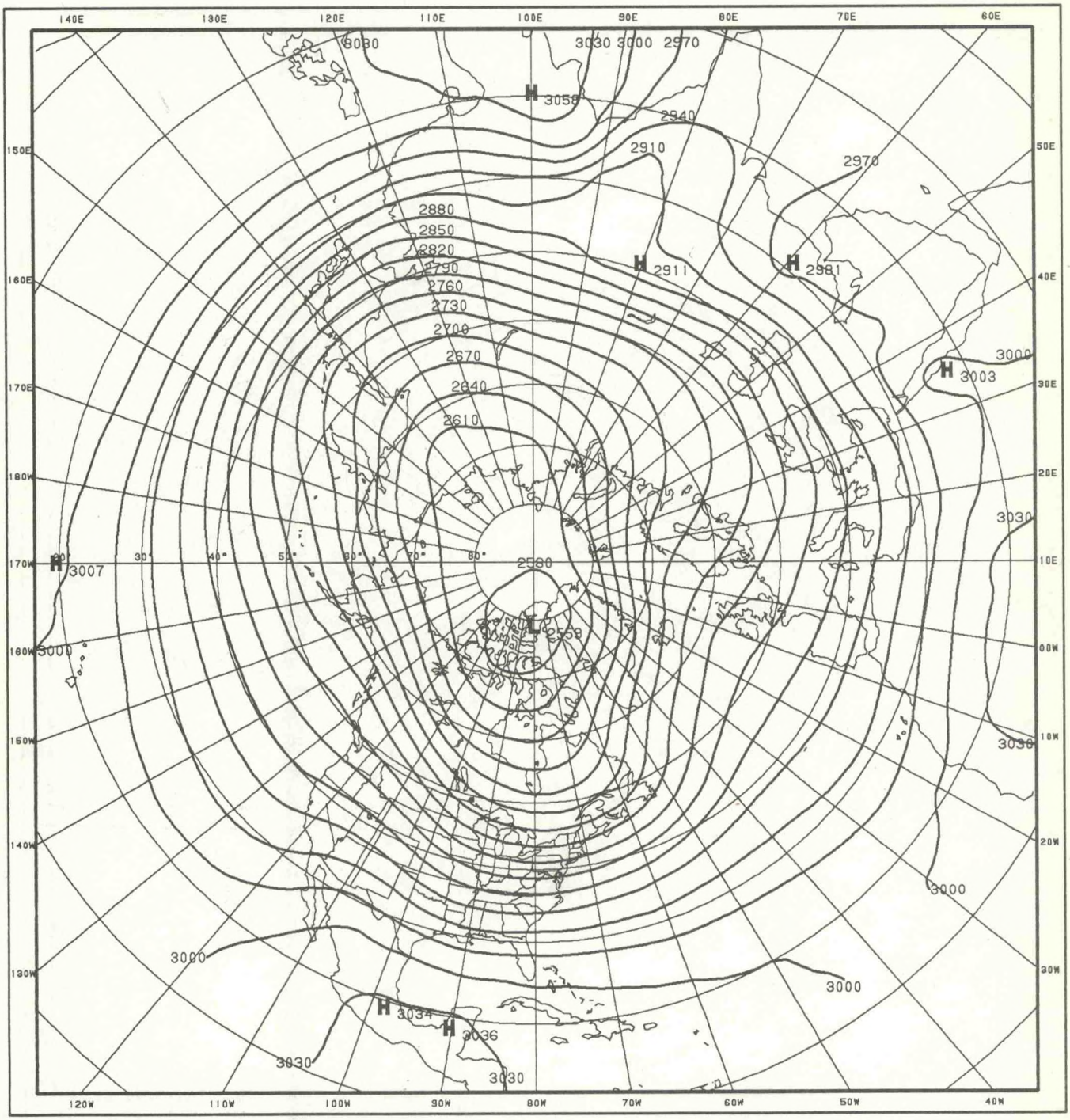
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS MEAN FEBRUARY

1-MONTH MEAN UNPOOLED 1950-92

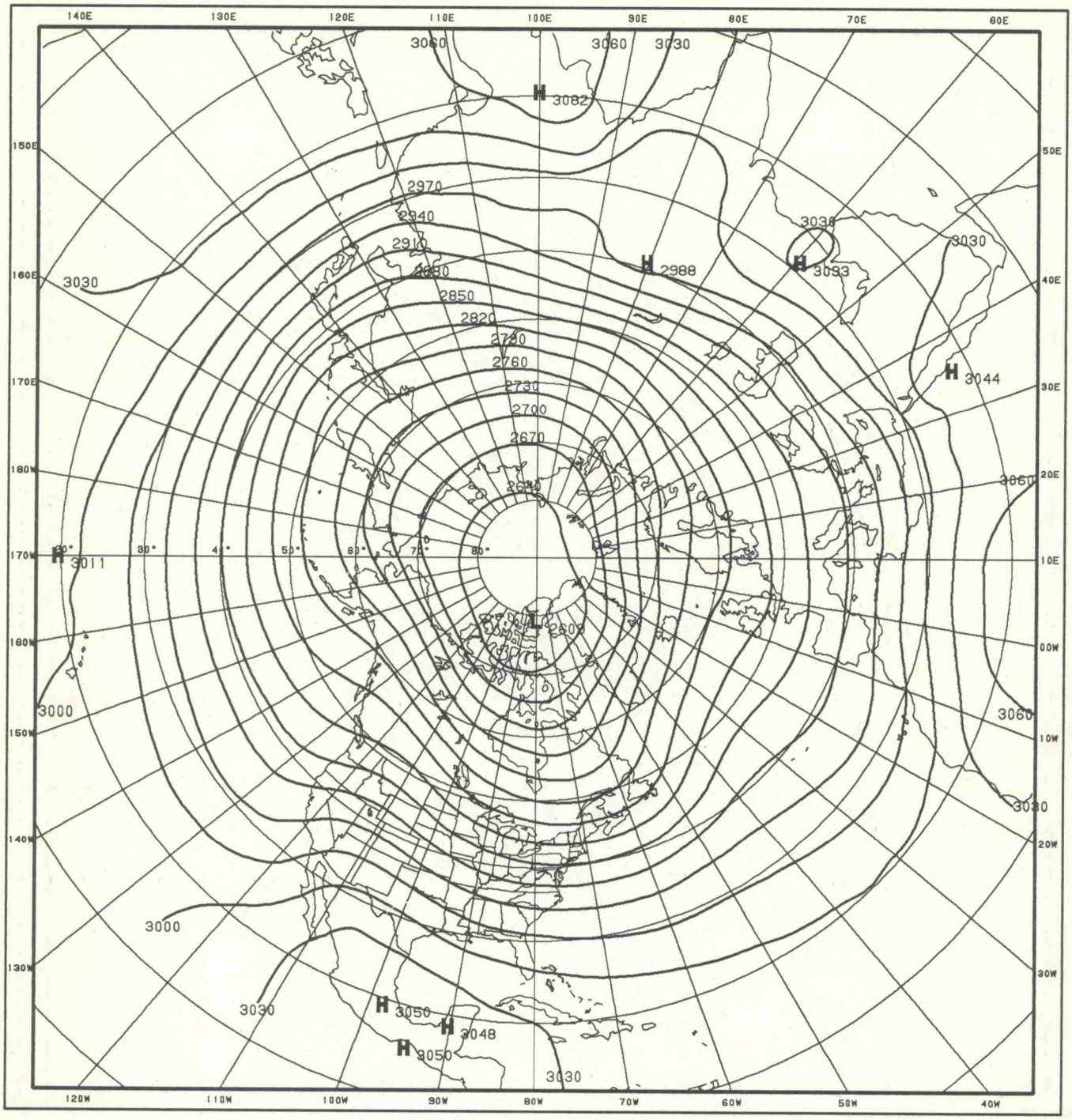
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS MEAN MARCH

1-MONTH MEAN UNPOOLED 1950-92

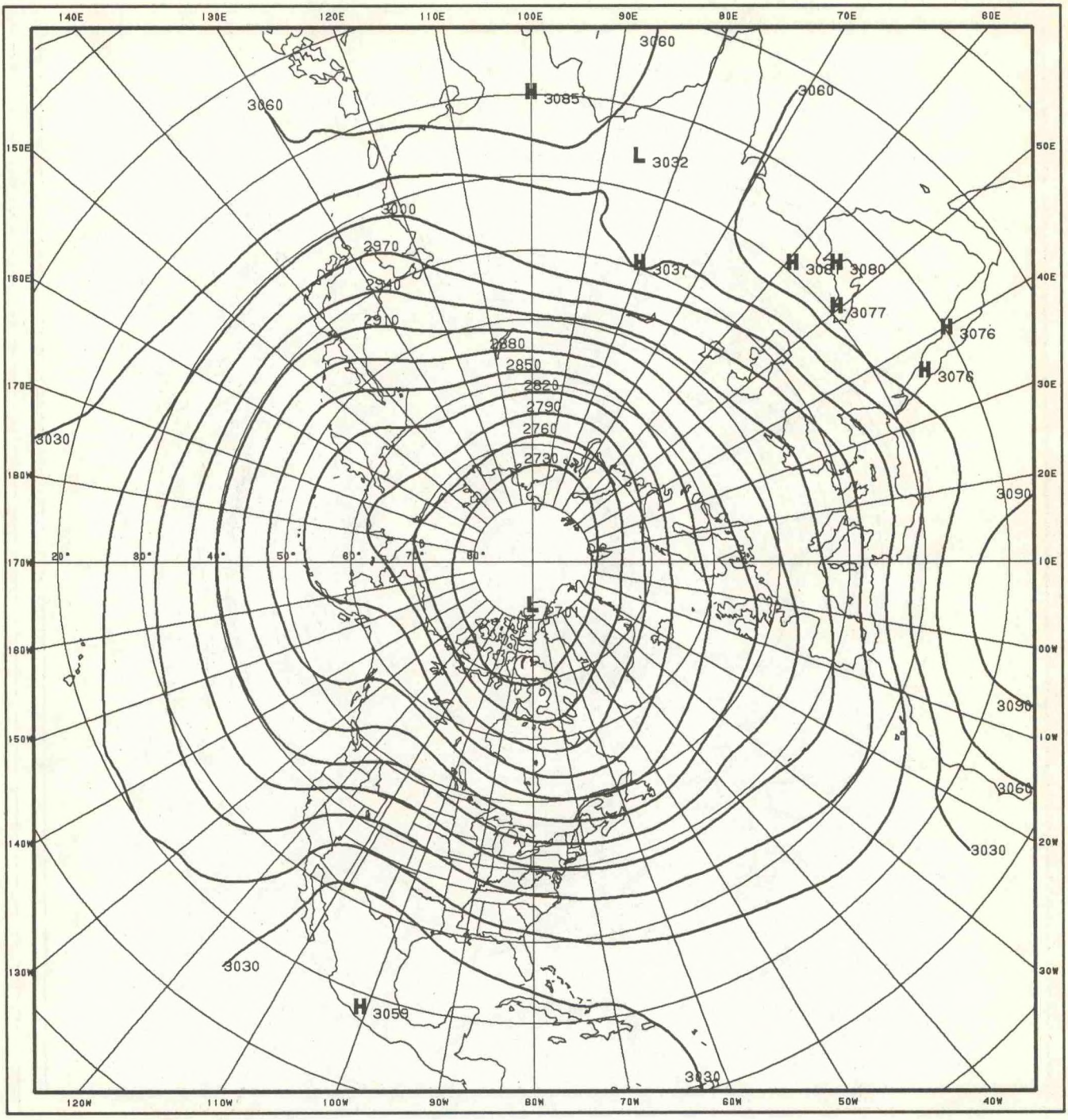
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS MEAN APRIL

1-MONTH MEAN UNPOOLED 1950-92

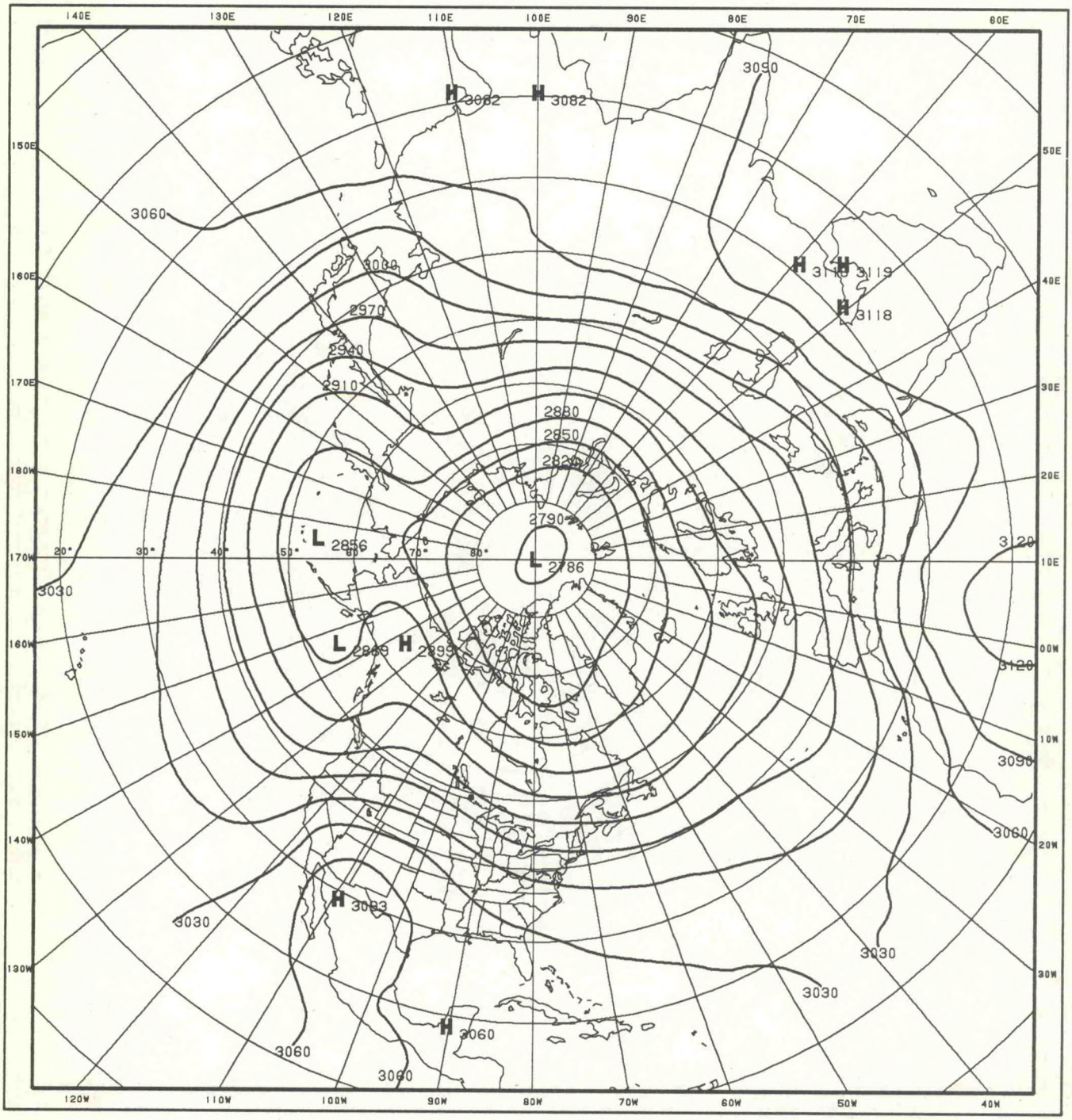
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS MEAN MAY

1-MONTH MEAN UNPOOLED 1950-92

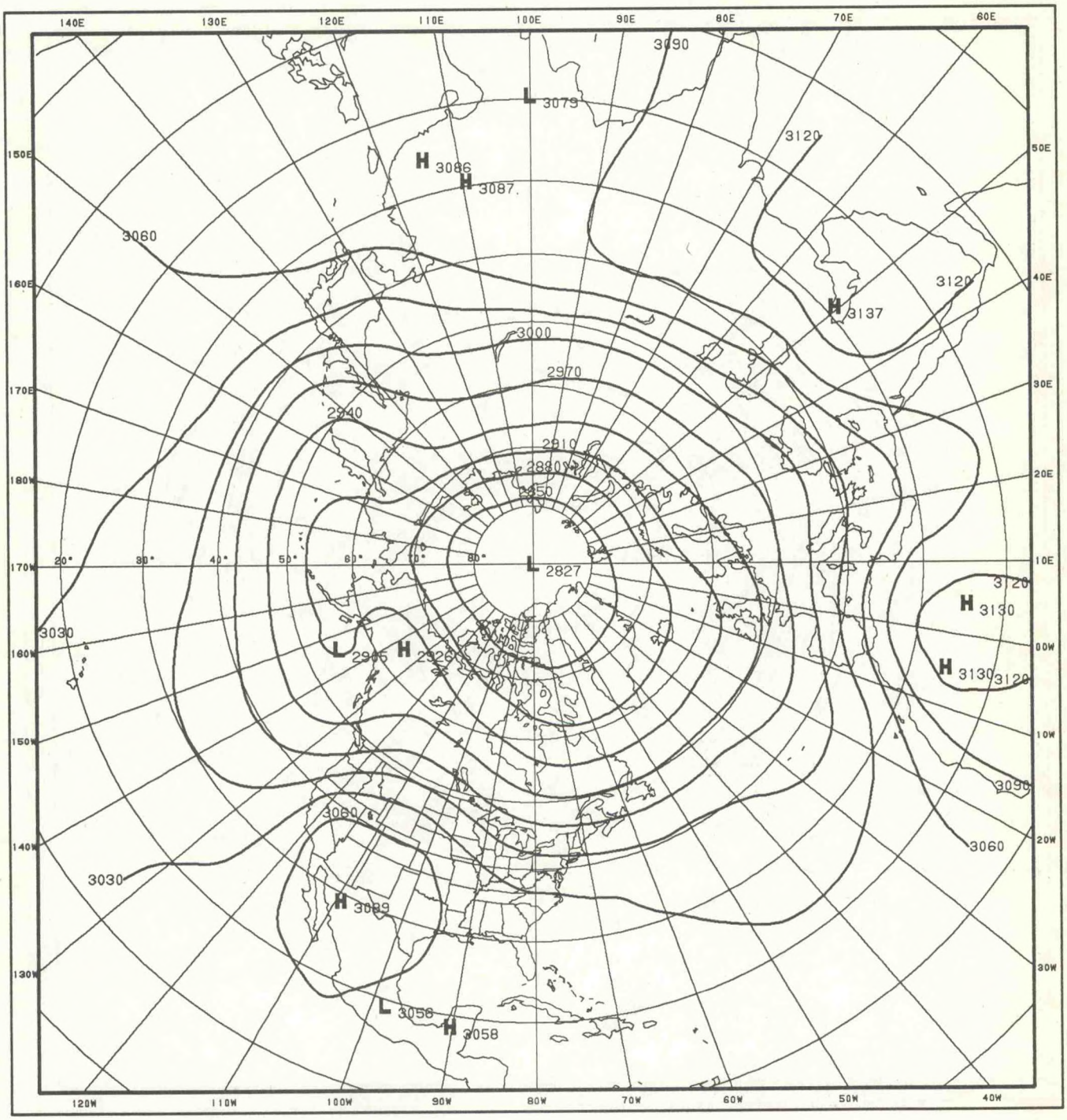
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS MEAN JUNE

1-MONTH MEAN UNPOOLED 1950-92

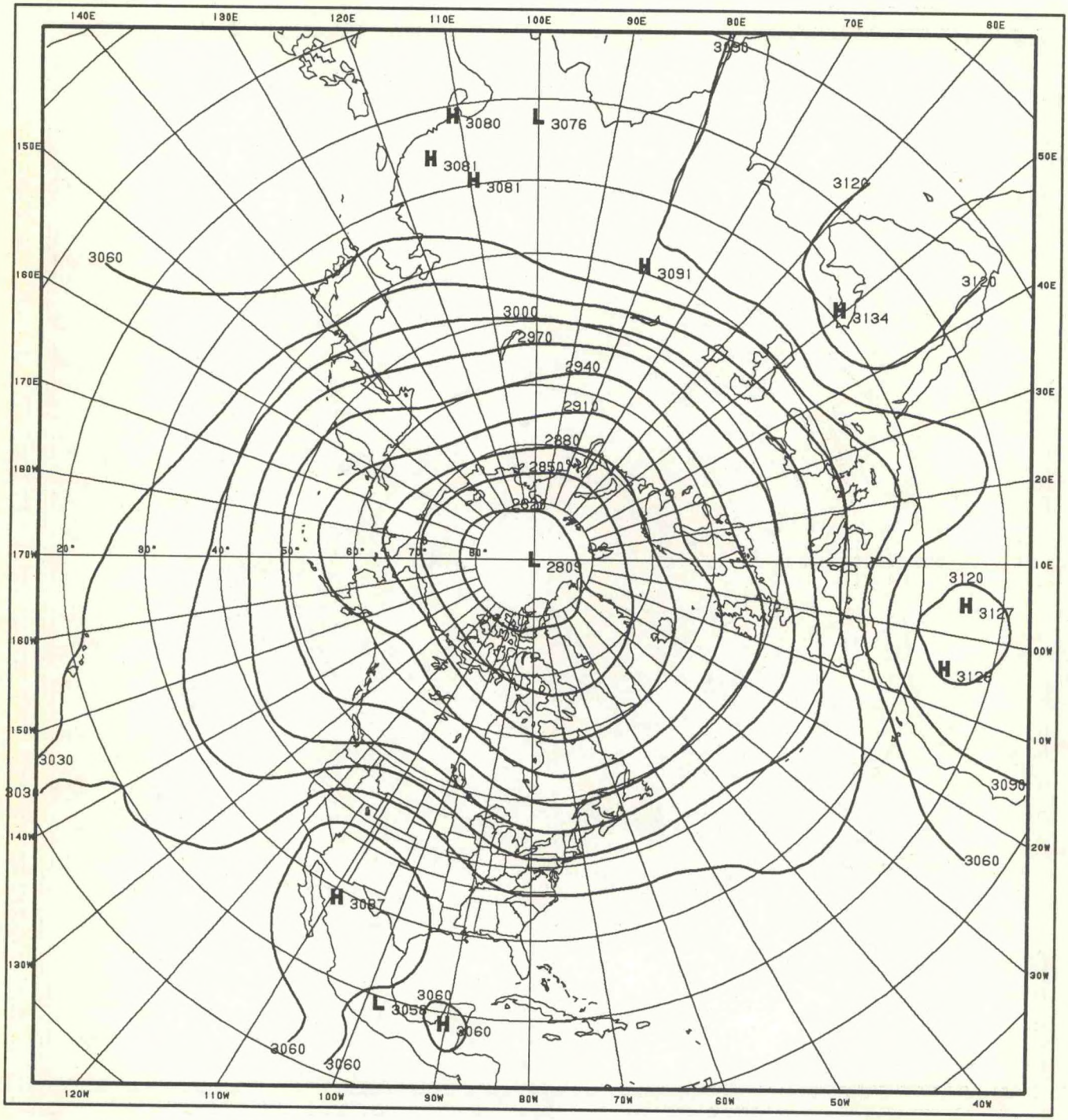
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS MEAN JULY

1-MONTH MEAN UNPOOLED 1950-92

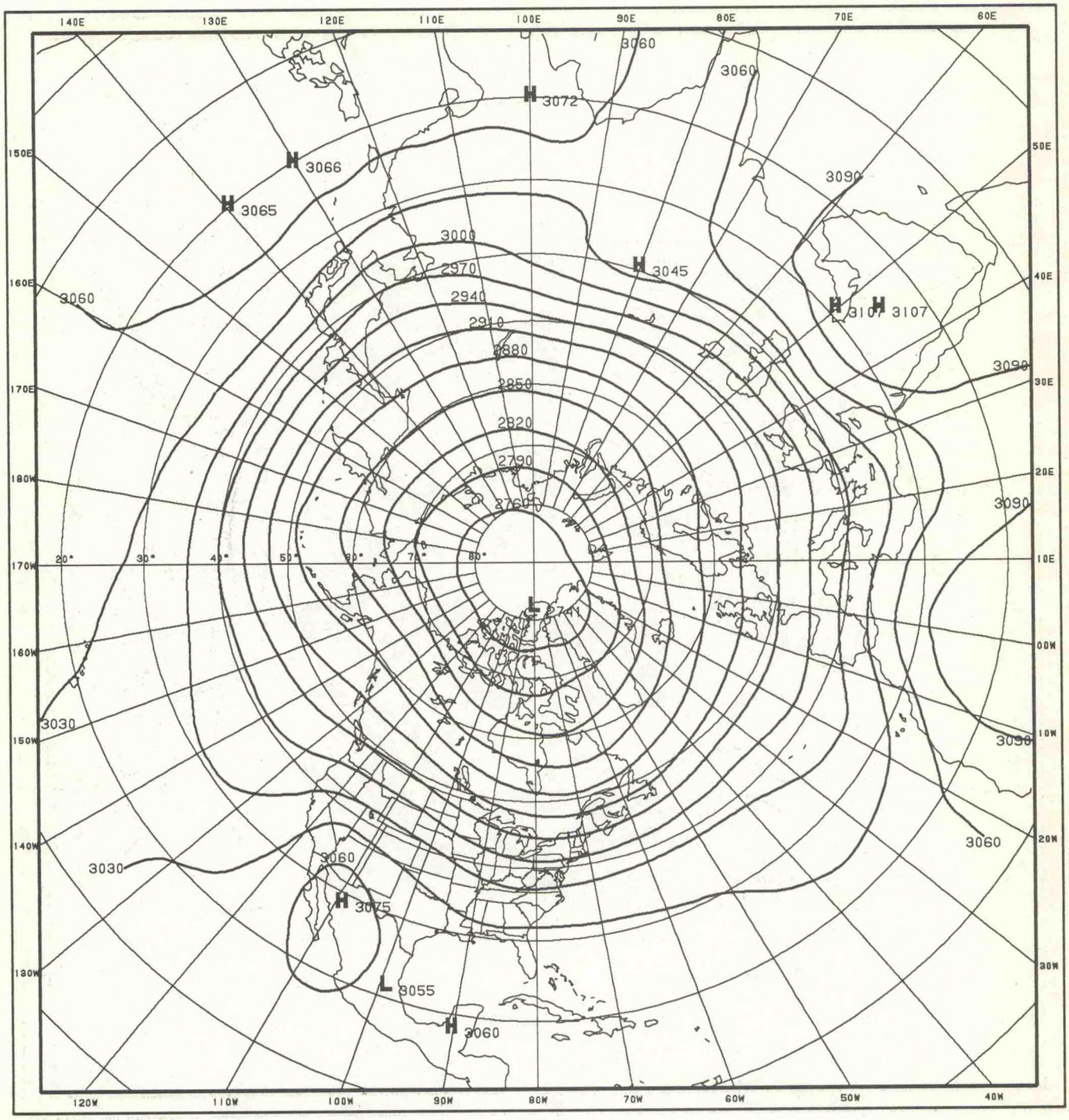
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS MEAN AUGUST

1-MONTH MEAN UNPOOLED 1950-92

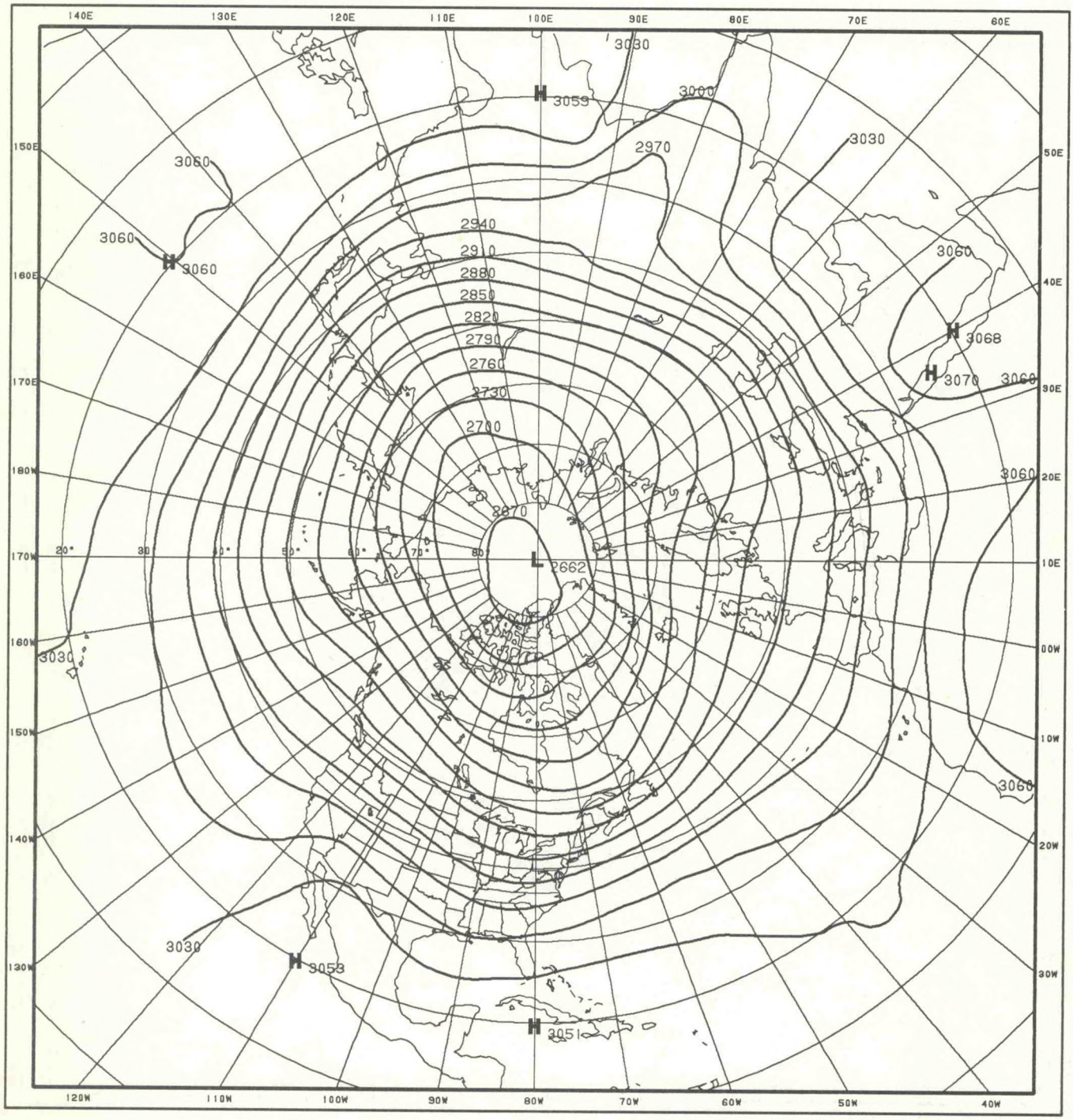
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS MEAN SEPTEMBR

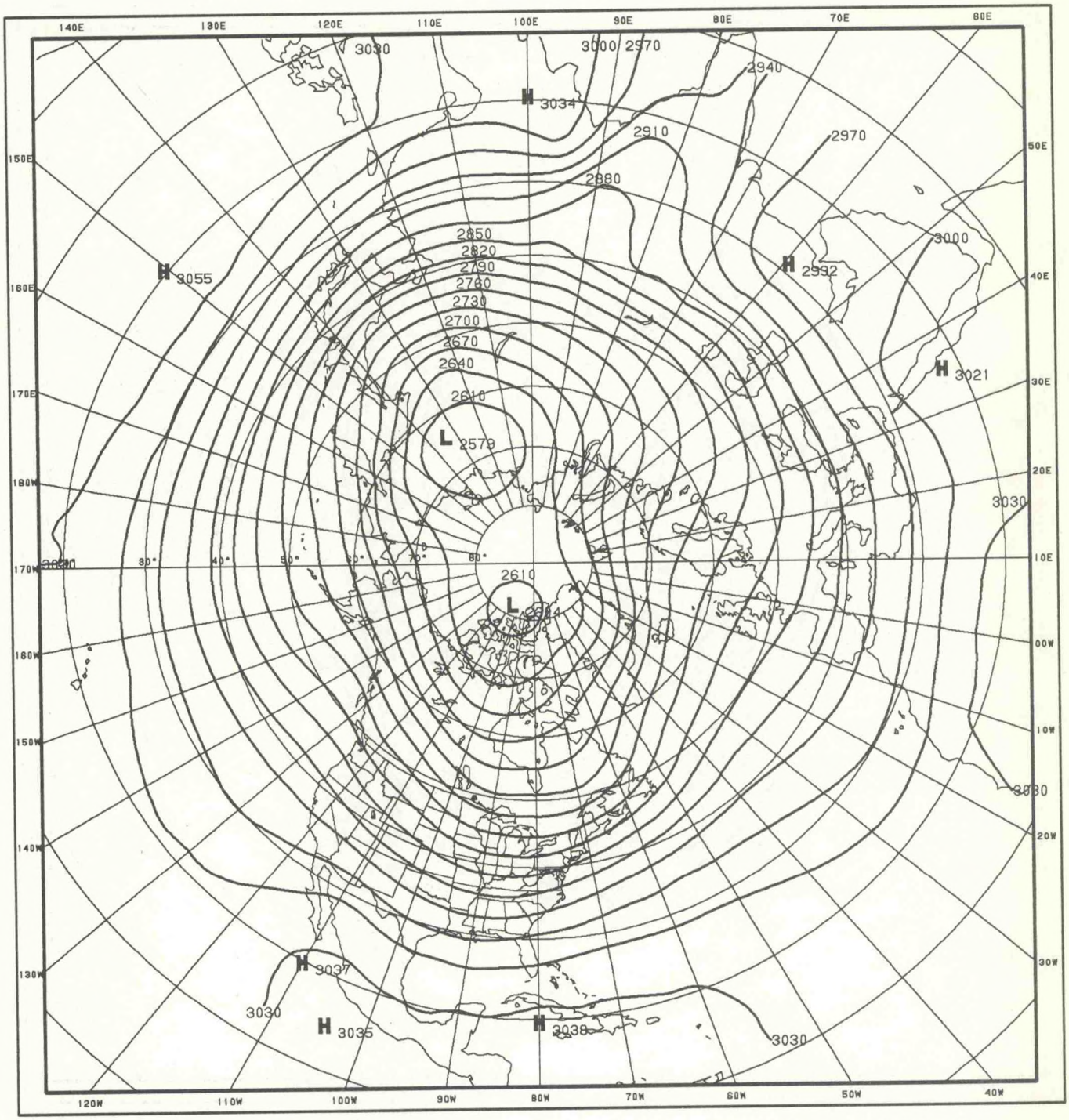
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS MEAN OCTOBER
1-MONTH MEAN UNPOOLED 1950-92

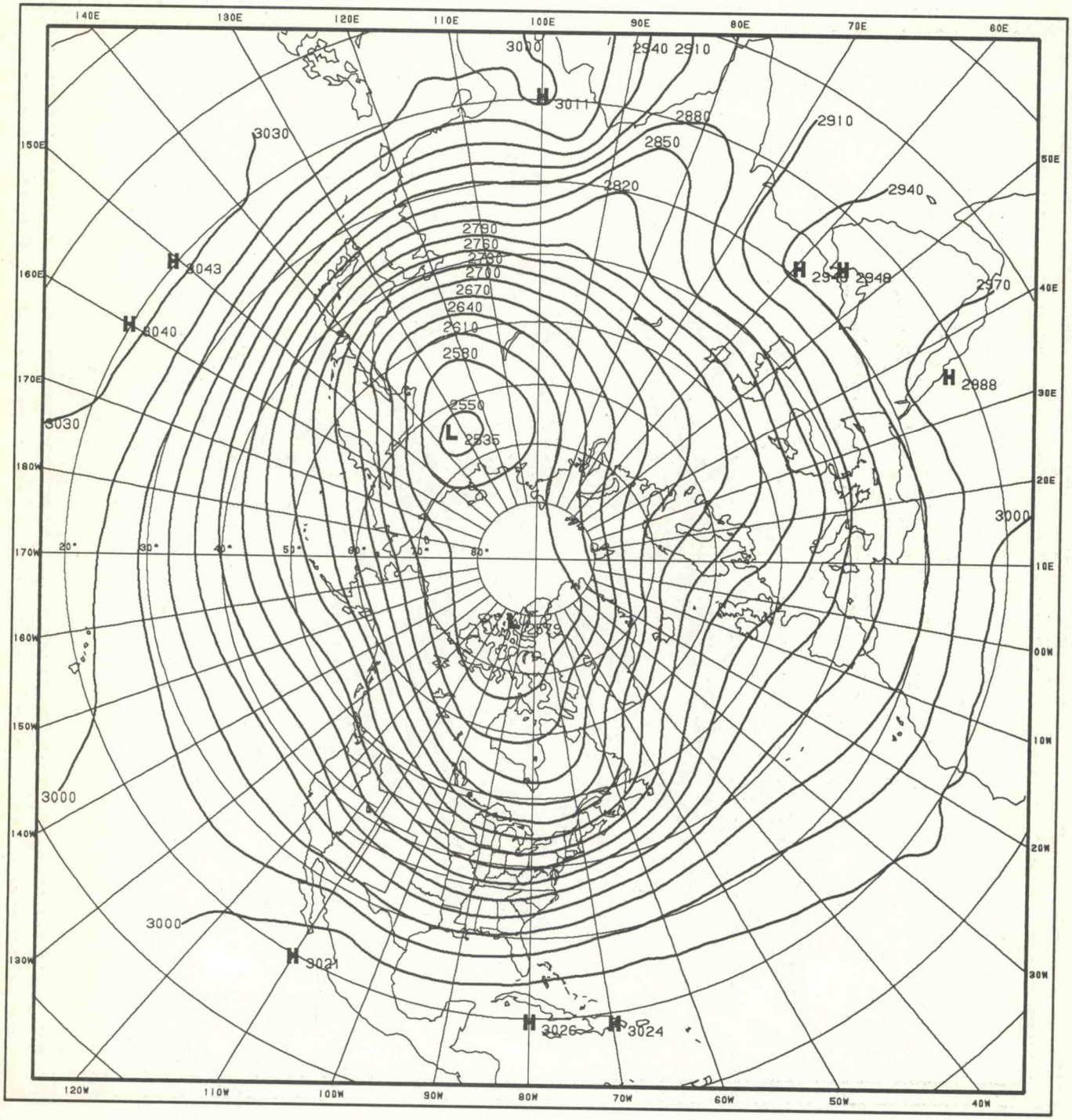
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS MEAN NOVEMBER

1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS MEAN DECEMBER

1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS

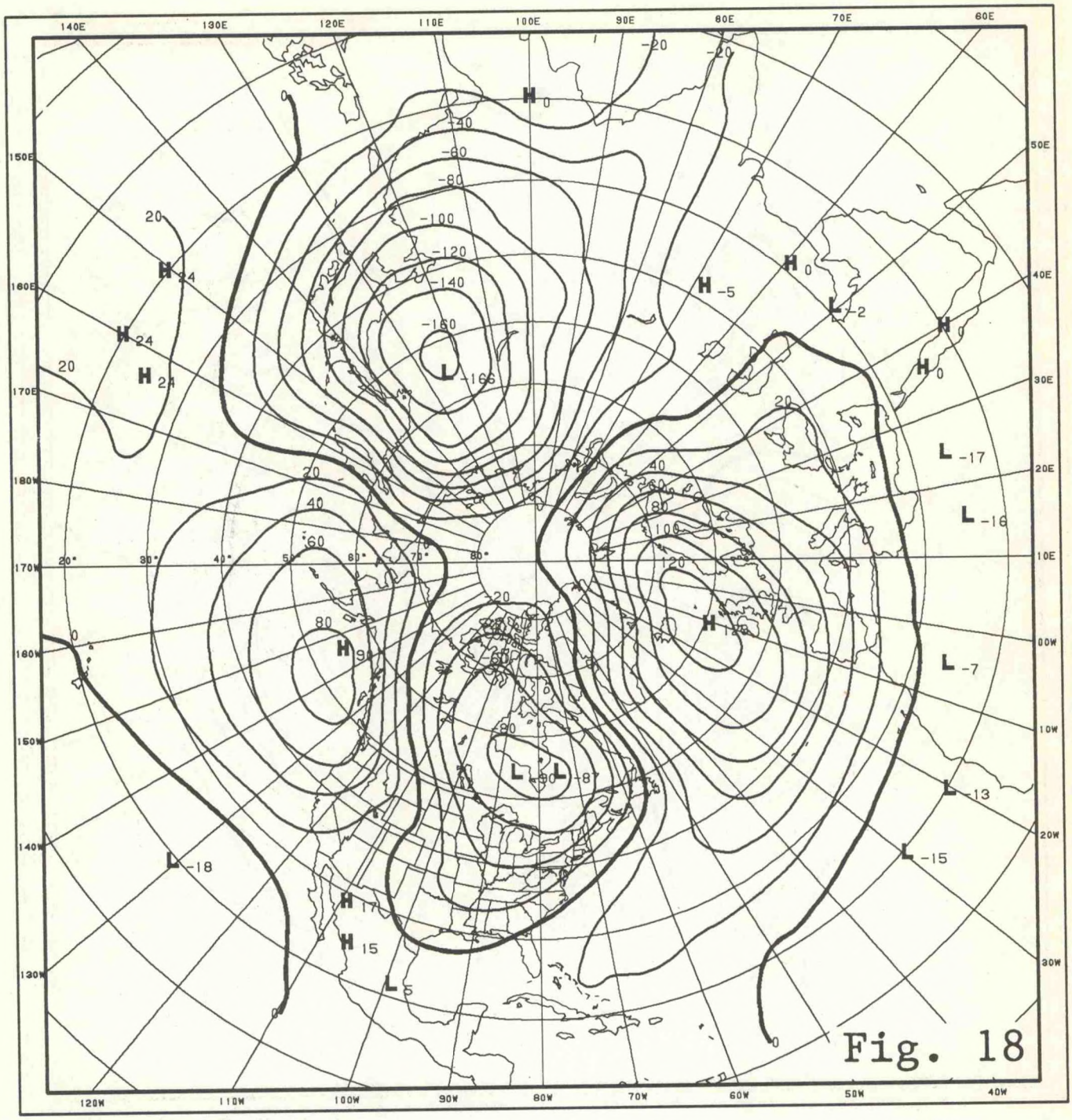
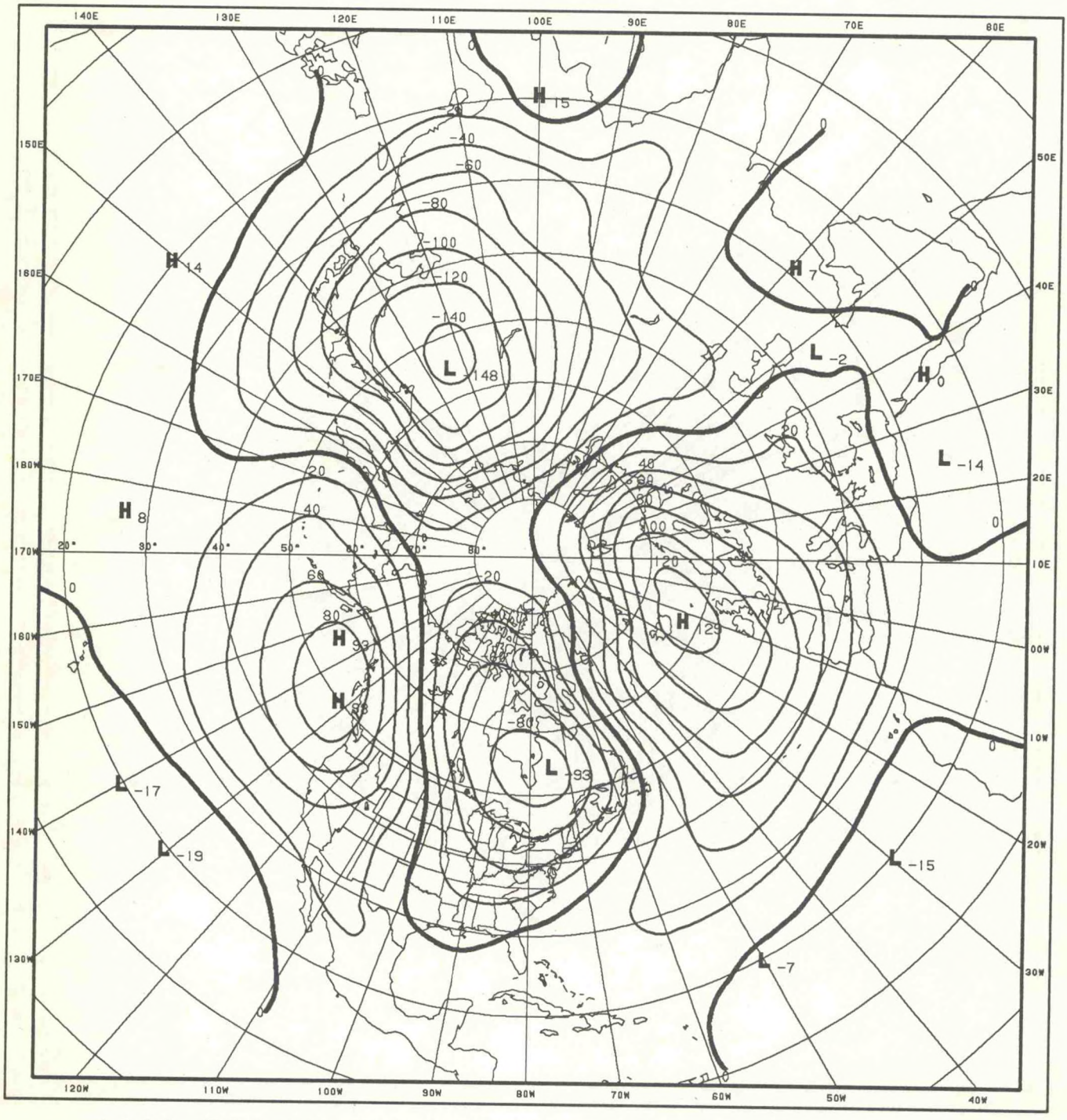


Fig. 18

1000-700 MB THICKNESS EDDY JANUARY
1-MONTH MEAN UNPOOLED 1950-92

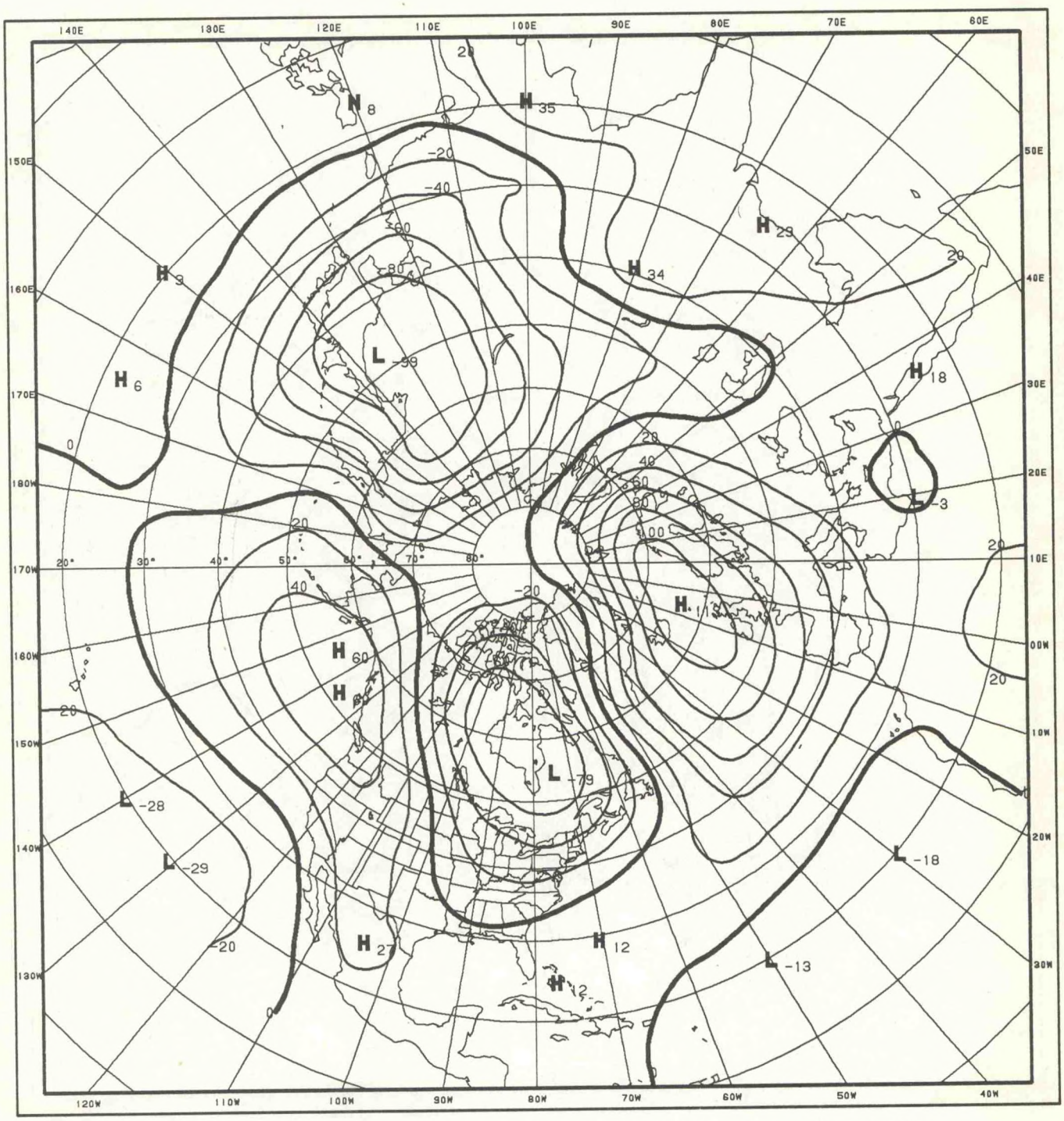
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS EDDY FEBRUARY

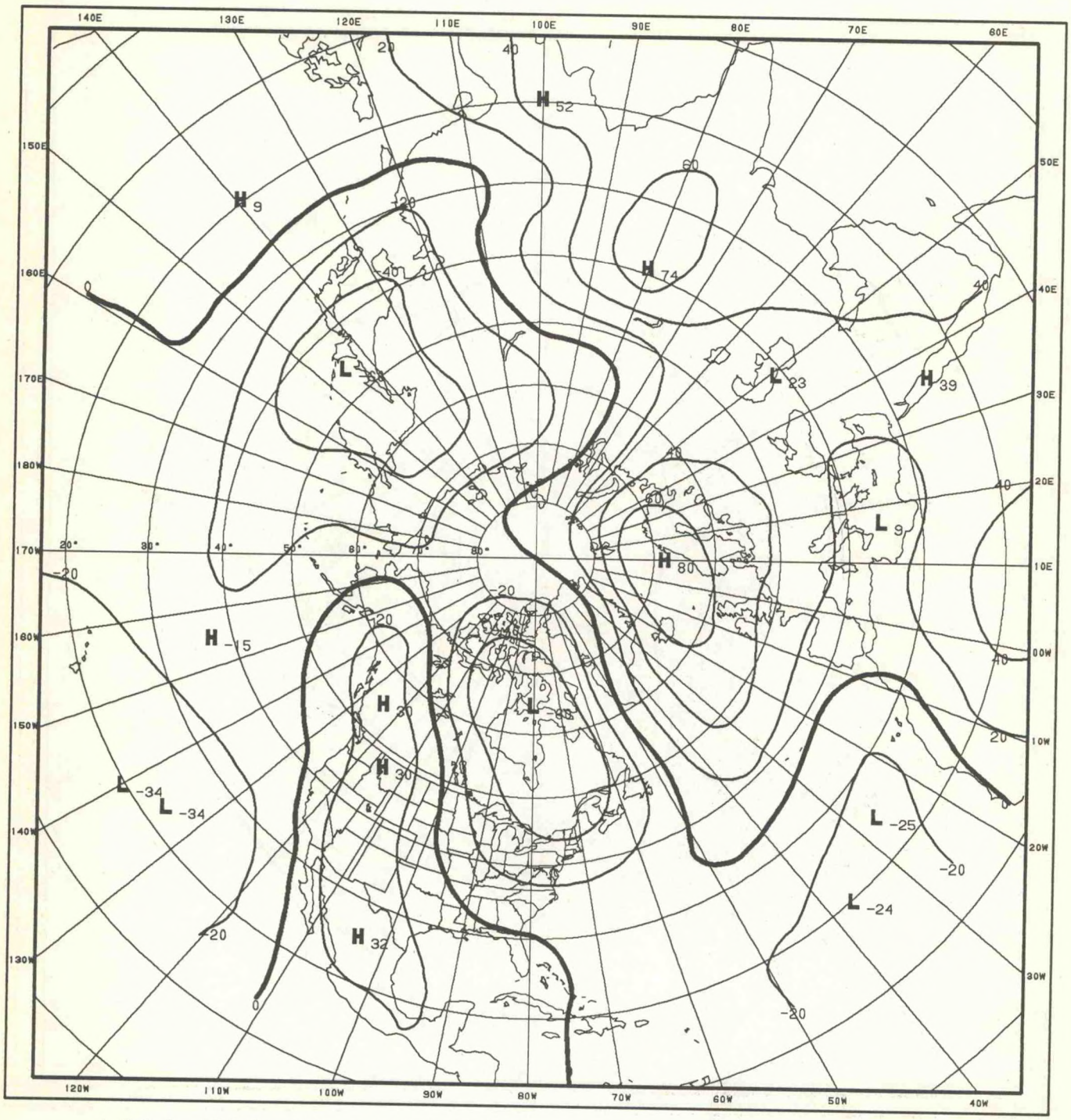
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



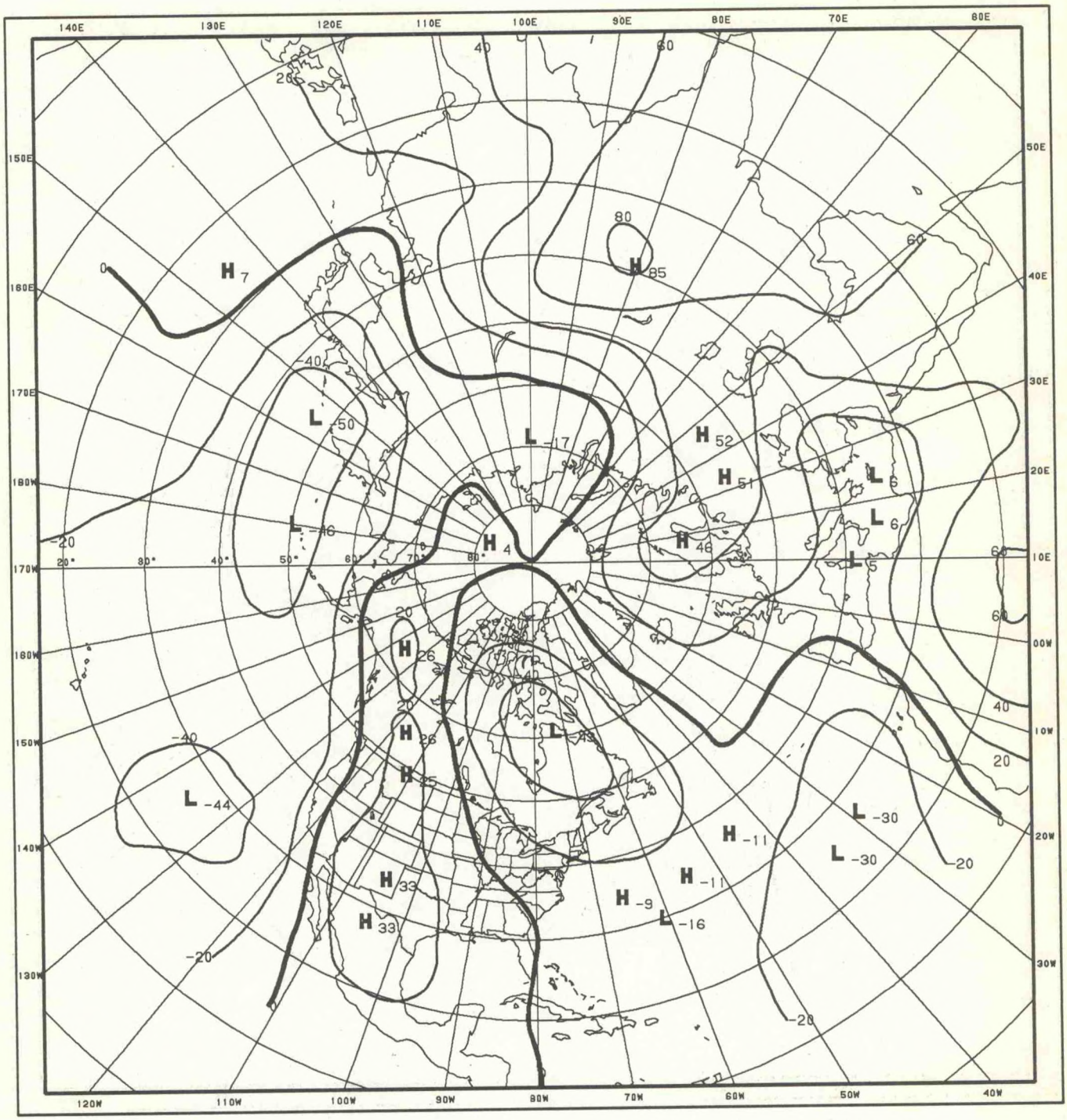
1000-700 MB THICKNESS EDDY MARCH
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



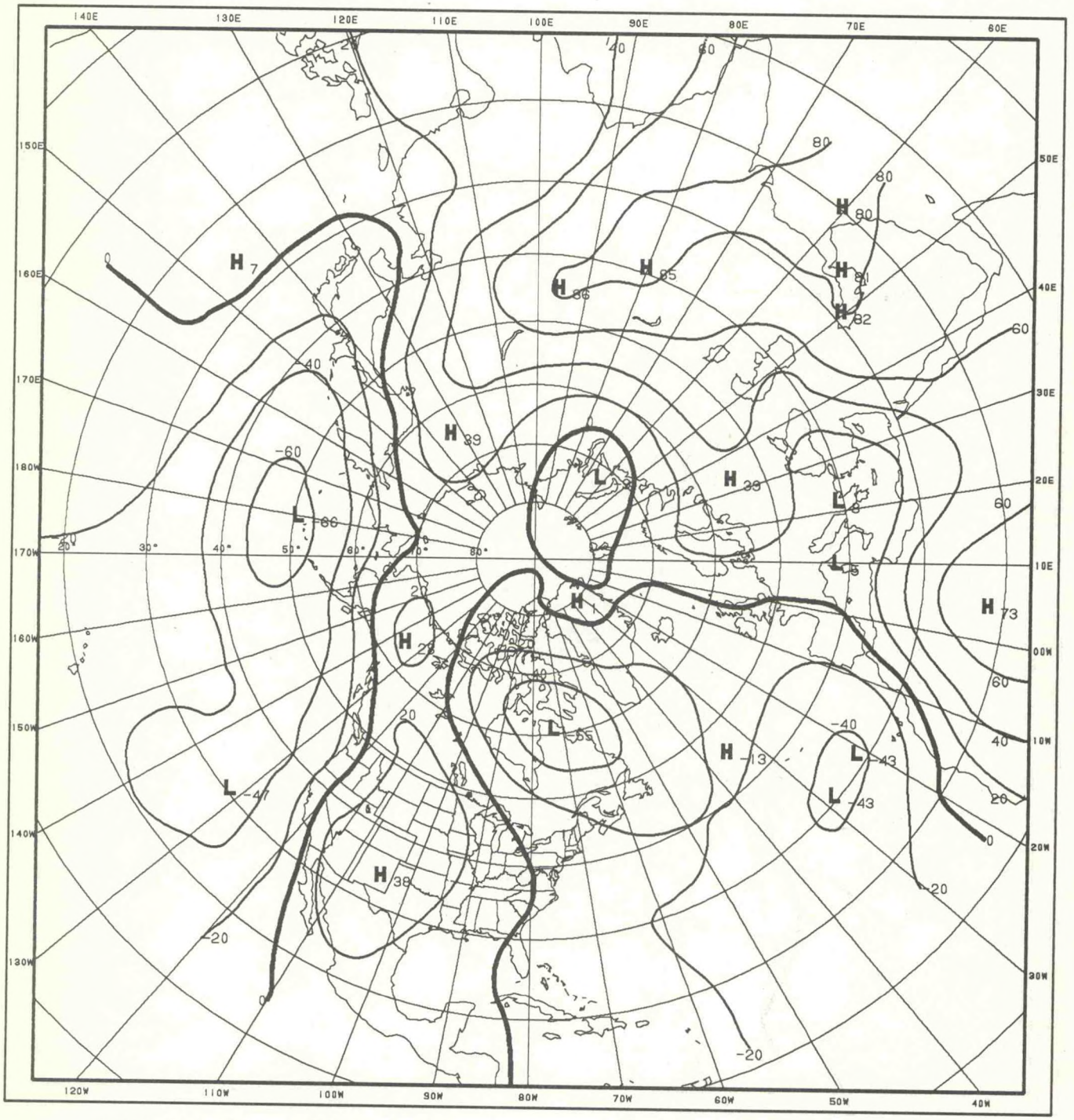
1000-700 MB THICKNESS EDDY APRIL
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



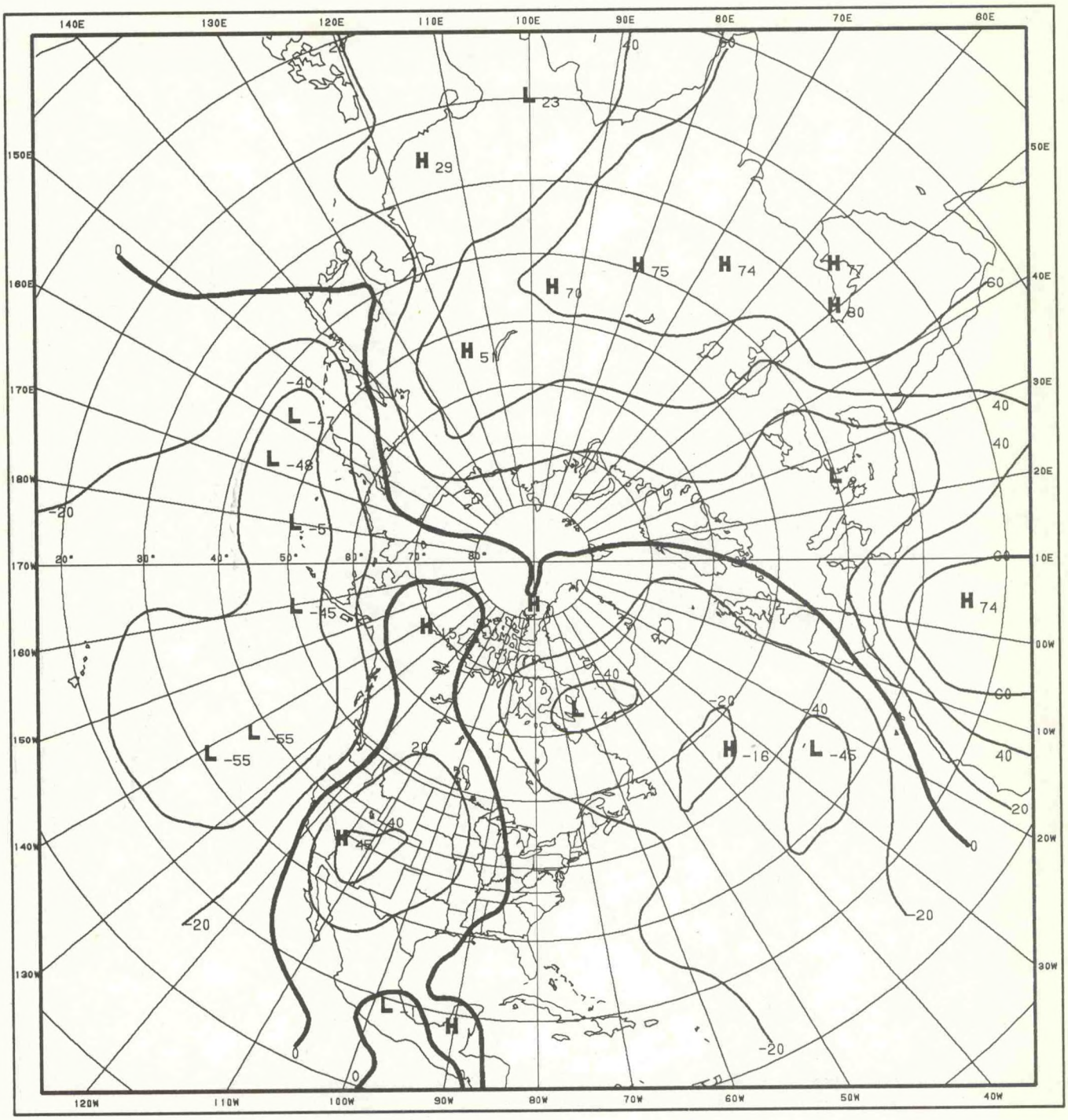
1000-700 MB THICKNESS EDDY MAY
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS EDDY JUNE
1-MONTH MEAN UNPOOLED 1950-92

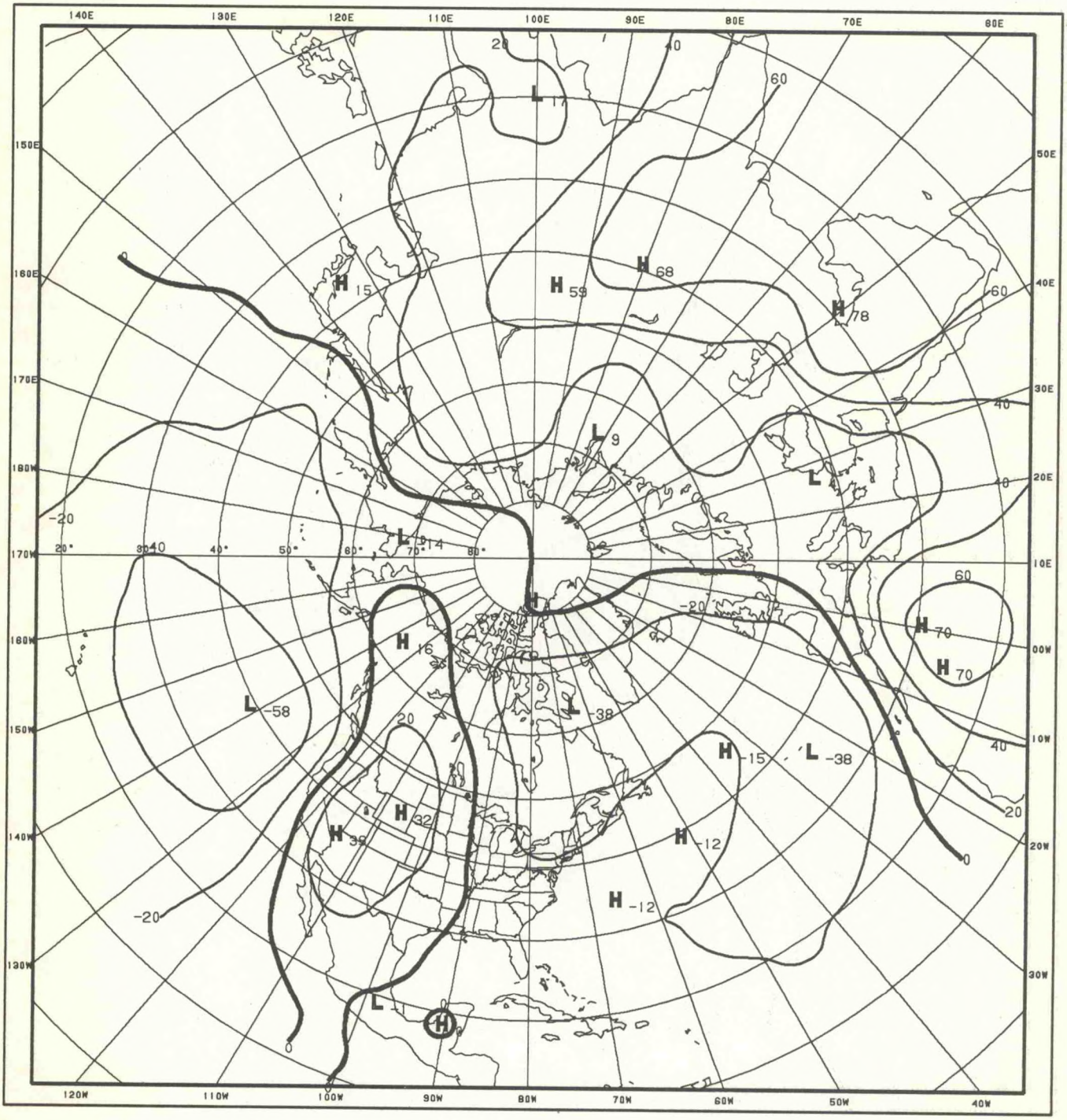
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS EDDY JULY

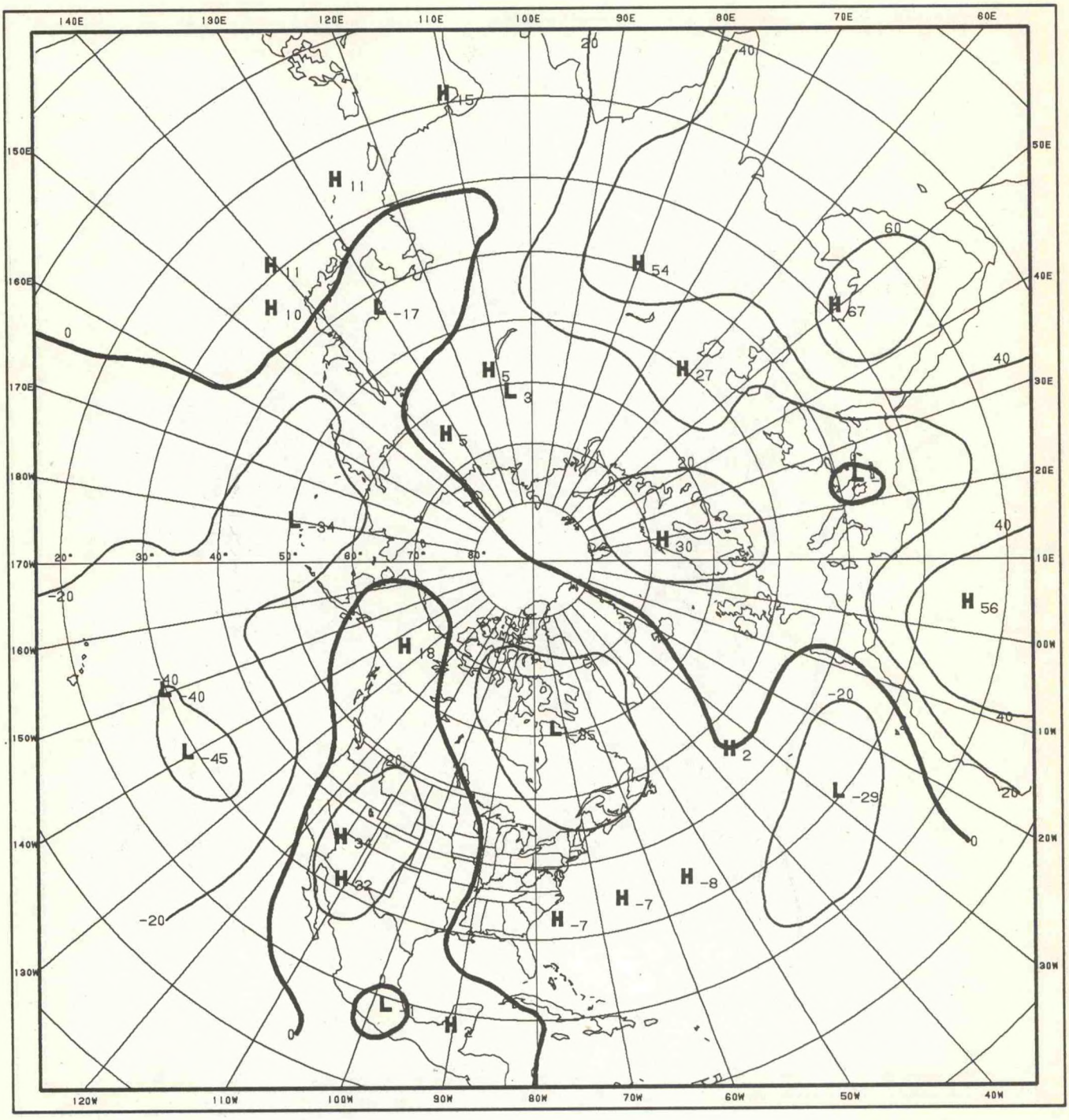
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



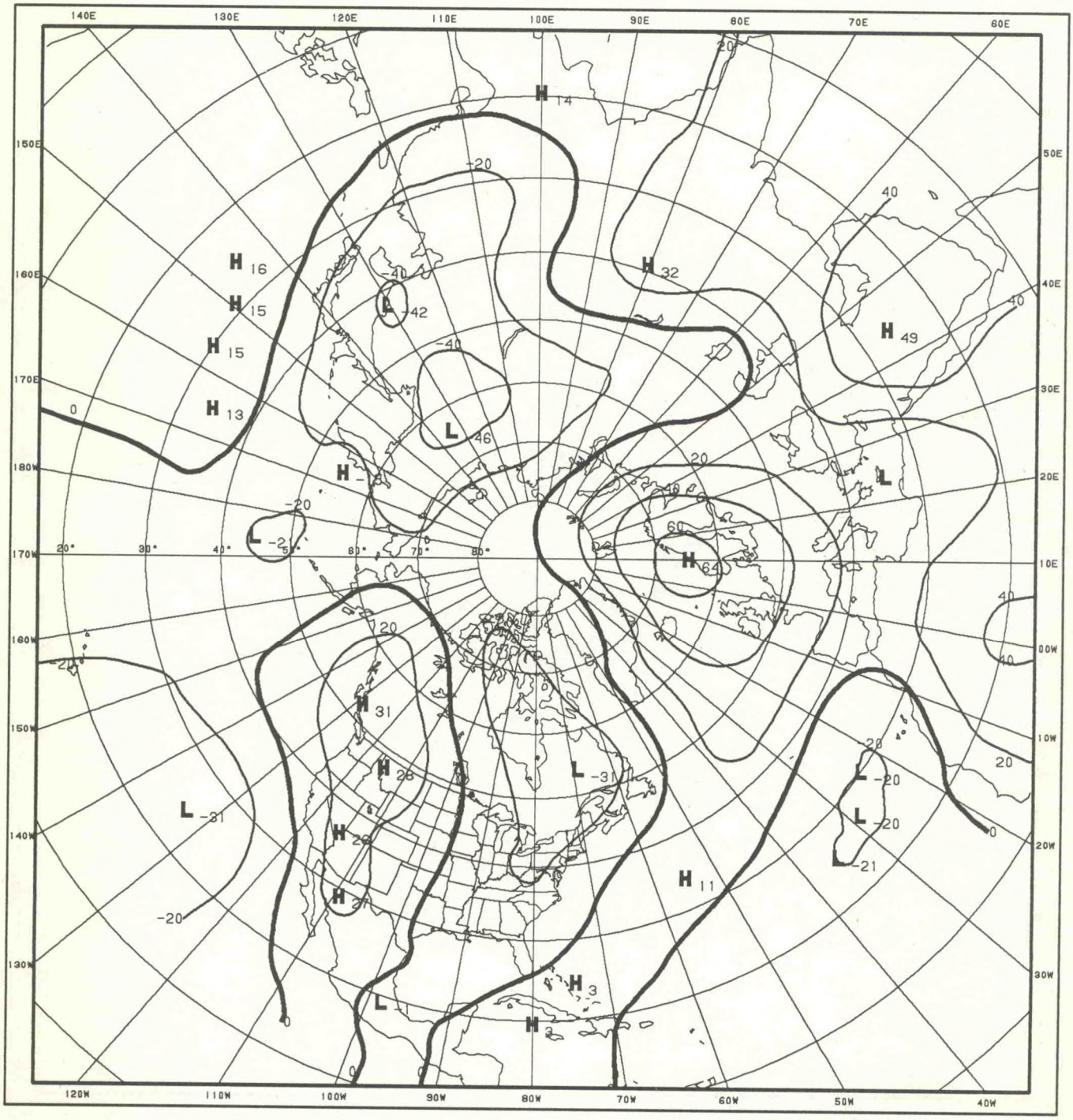
1000-700 MB THICKNESS EDDY AUGUST
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



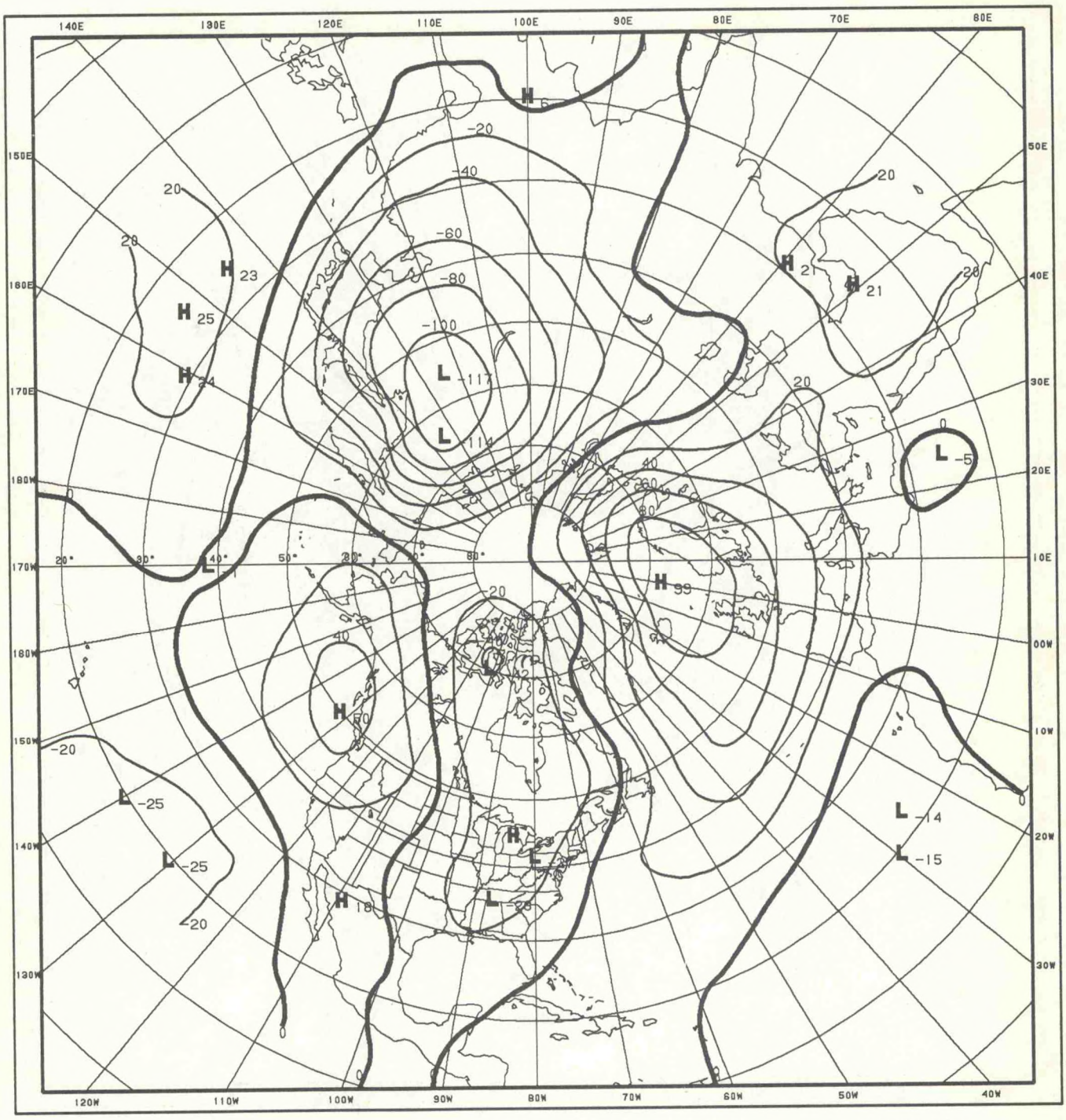
1000-700 MB THICKNESS EDDY SEPTEMBR
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS EDDY OCTOBER
1-MONTH MEAN UNPOOLED 1950-92

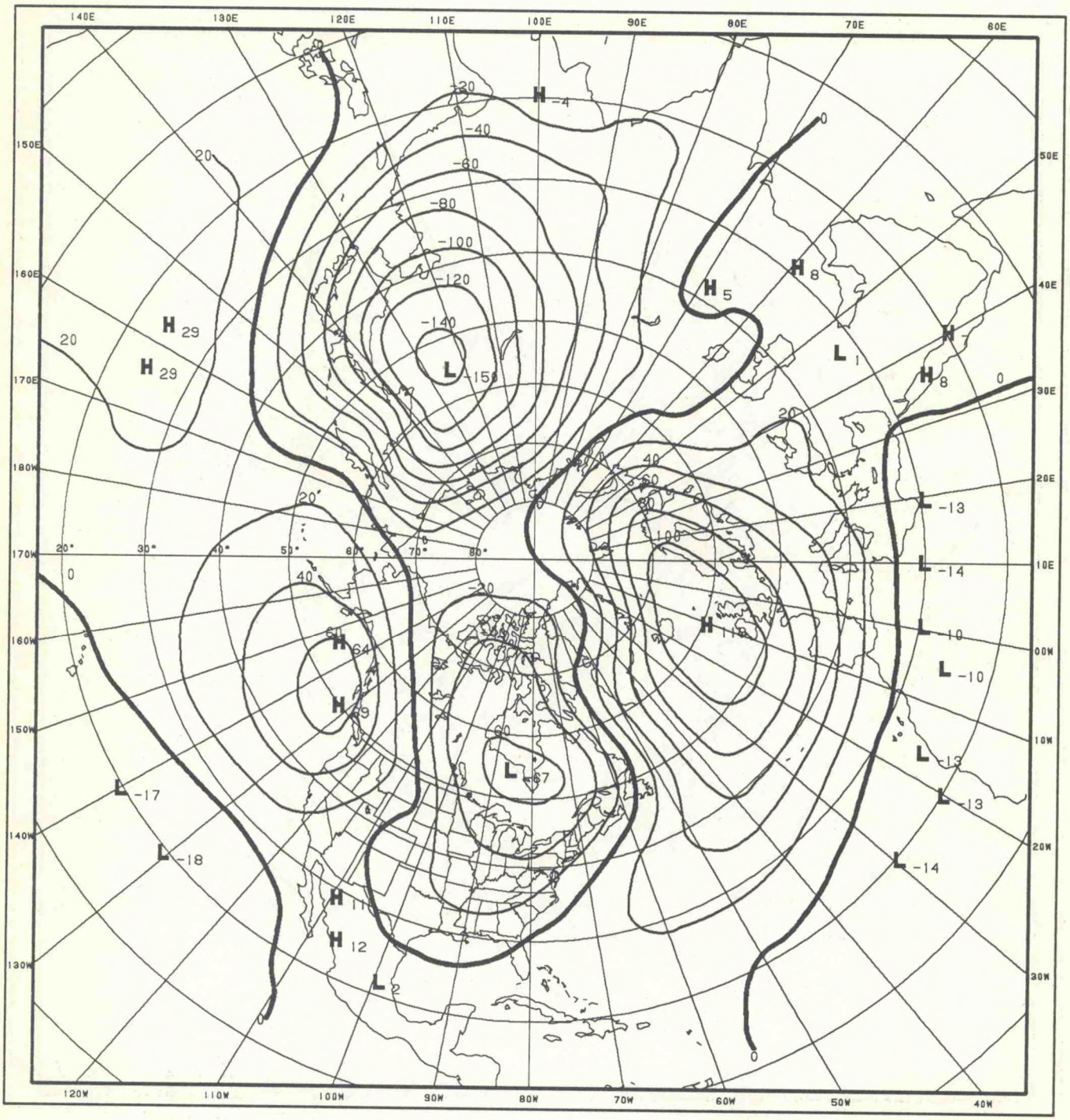
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS EDDY NOVEMBER

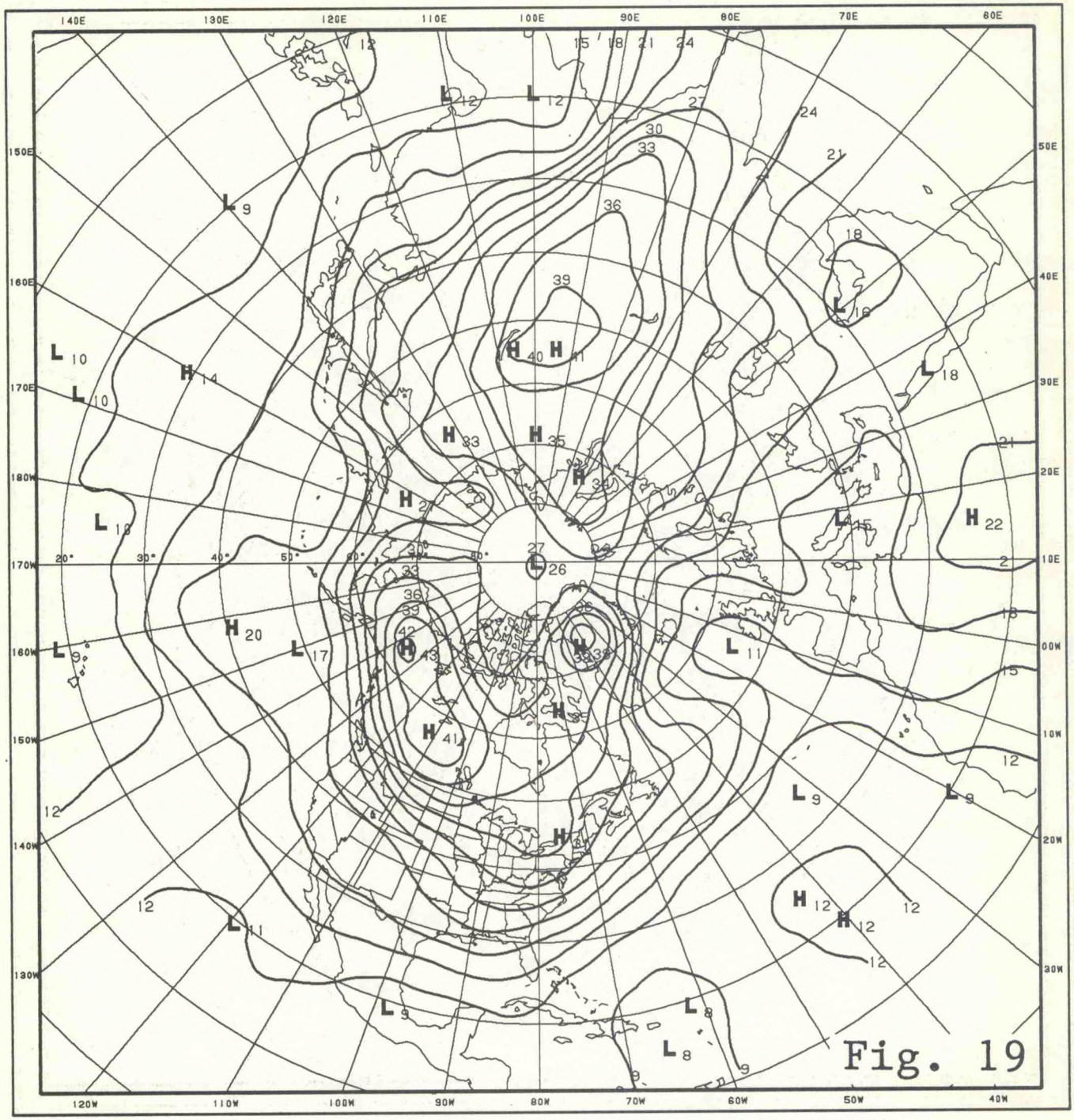
1-MONTH MEAN UNPOOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS EDDY DECEMBER
1-MONTH MEAN UNPOOLED 1950-92

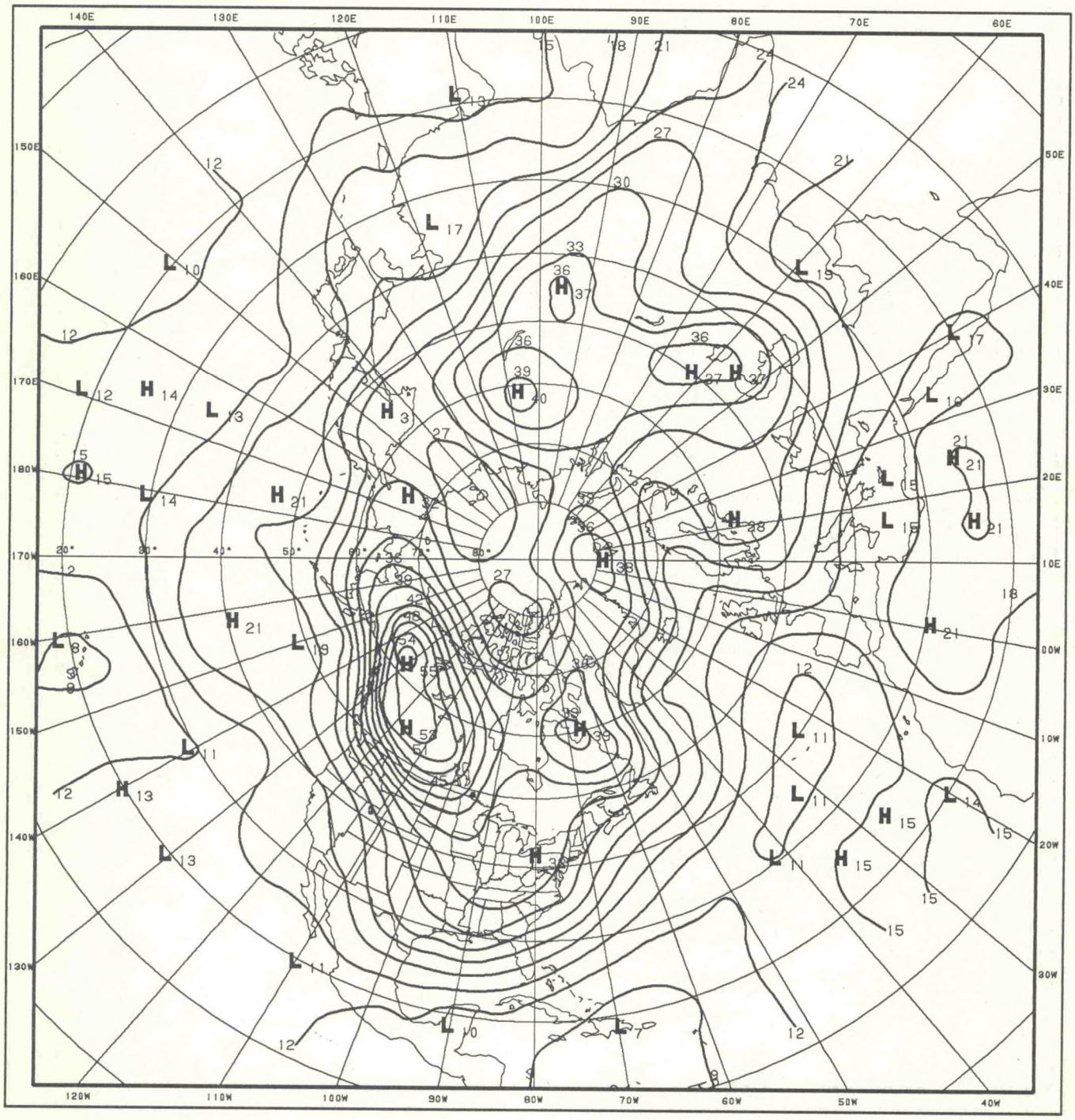
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS STAND DEV DECEMBER

1-MONTH MEAN UNPOOLED 1950-92

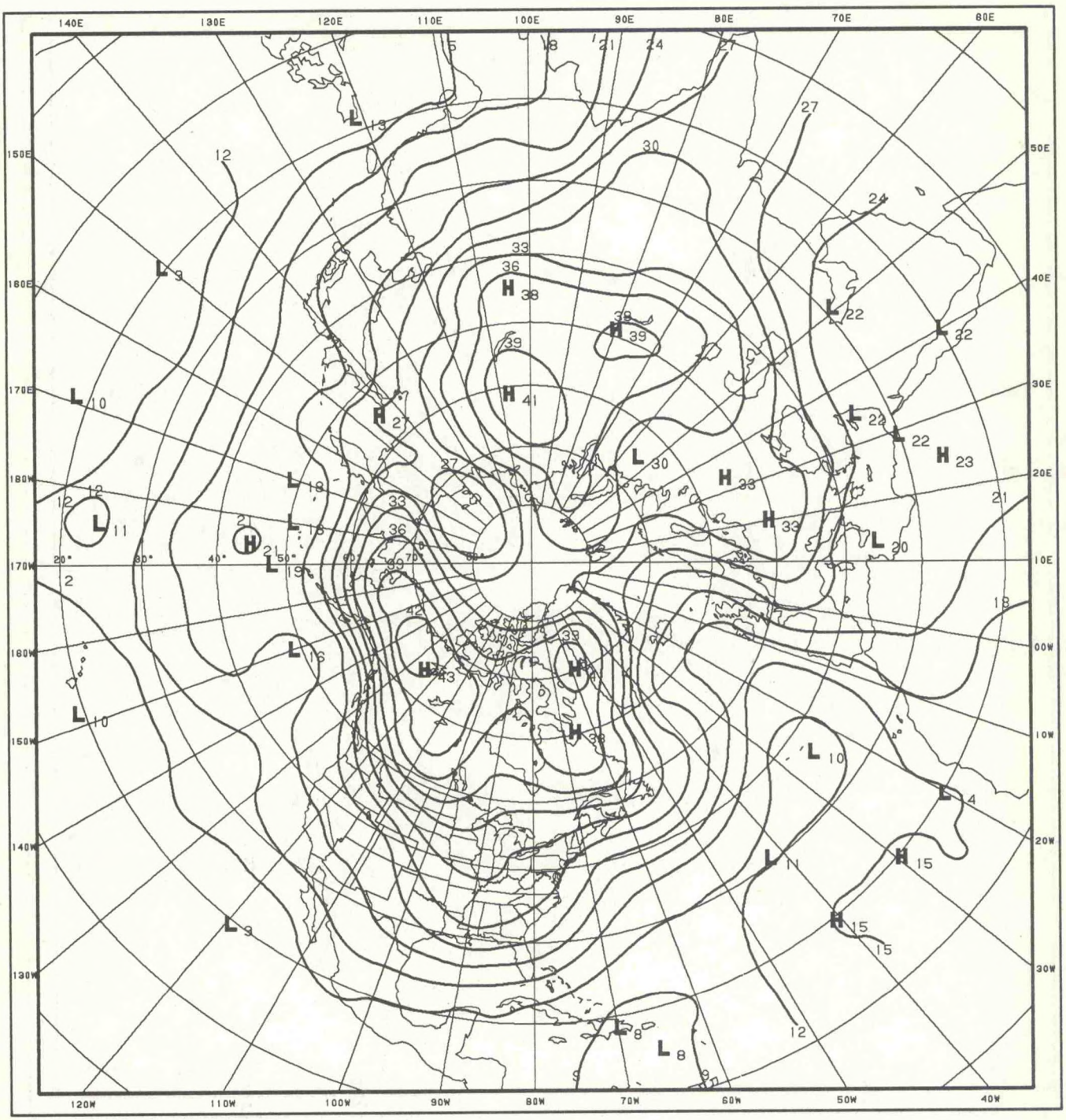
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS STAND DEV JANUARY

1-MONTH MEAN UNPOOLED 1950-92

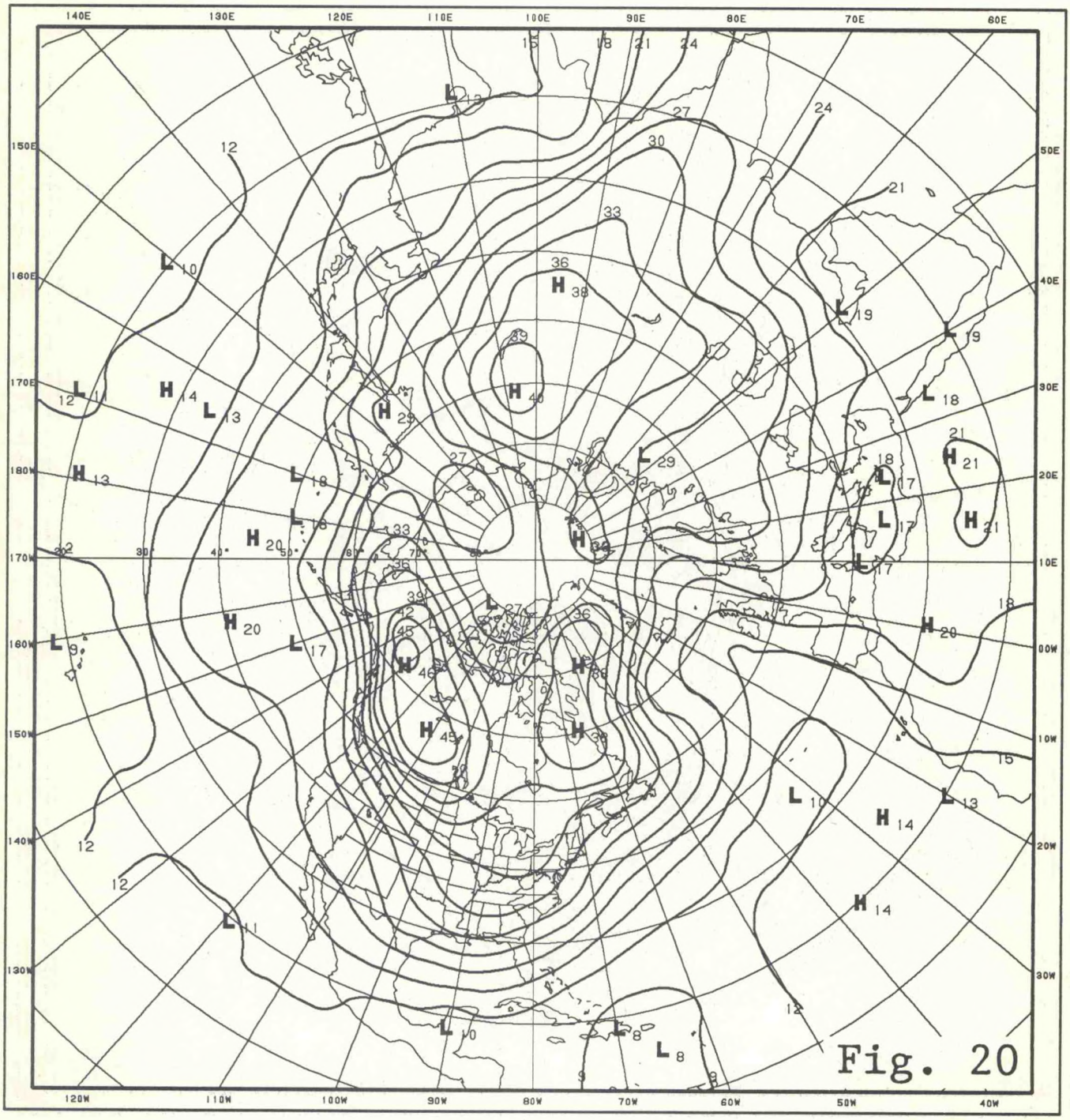
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS STAND DEV FEBRUARY

1-MONTH MEAN UNPOOLED 1950-92

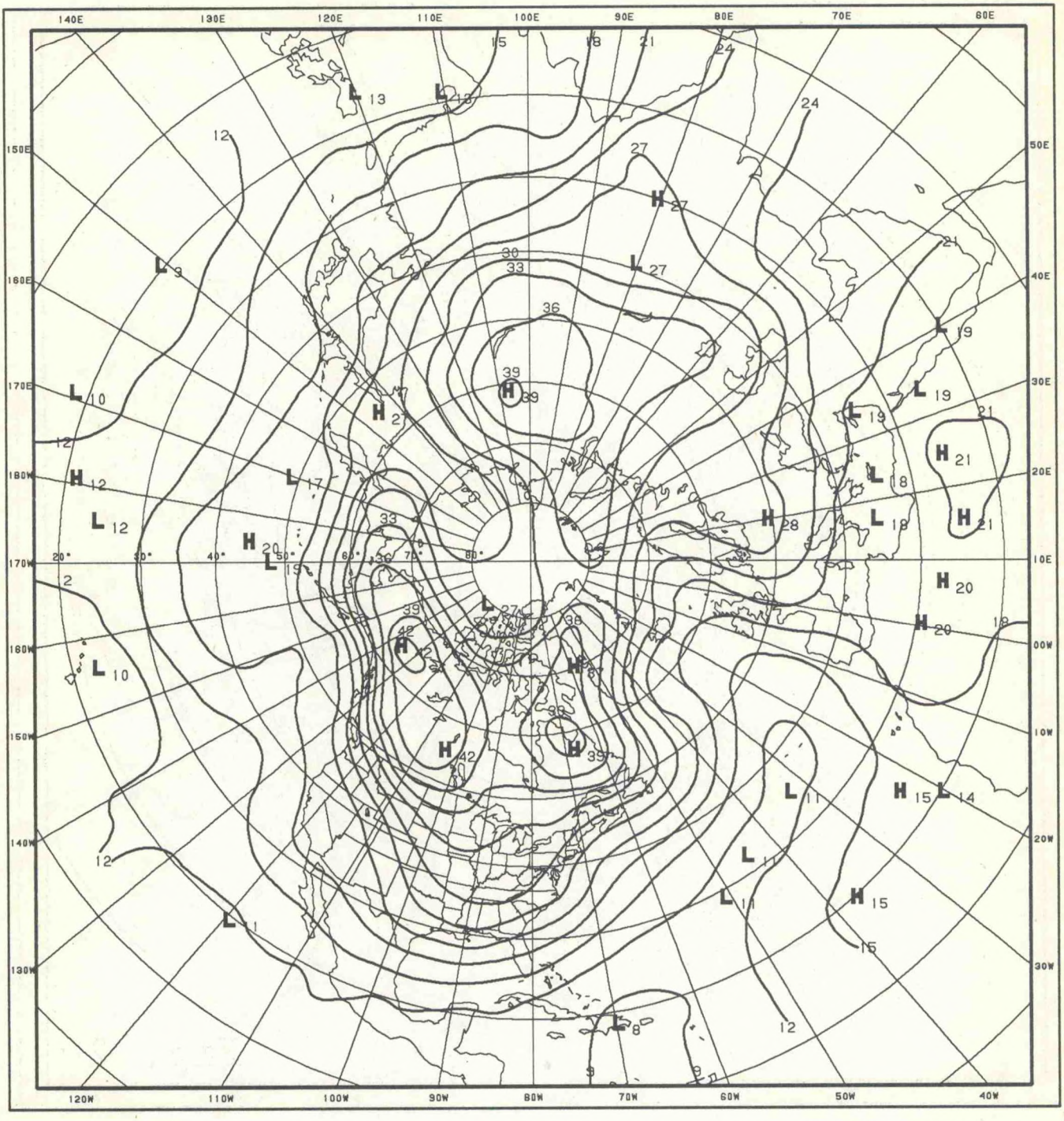
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS STAND DEV JANUARY

1-MONTH MEAN POOLED 1950-92

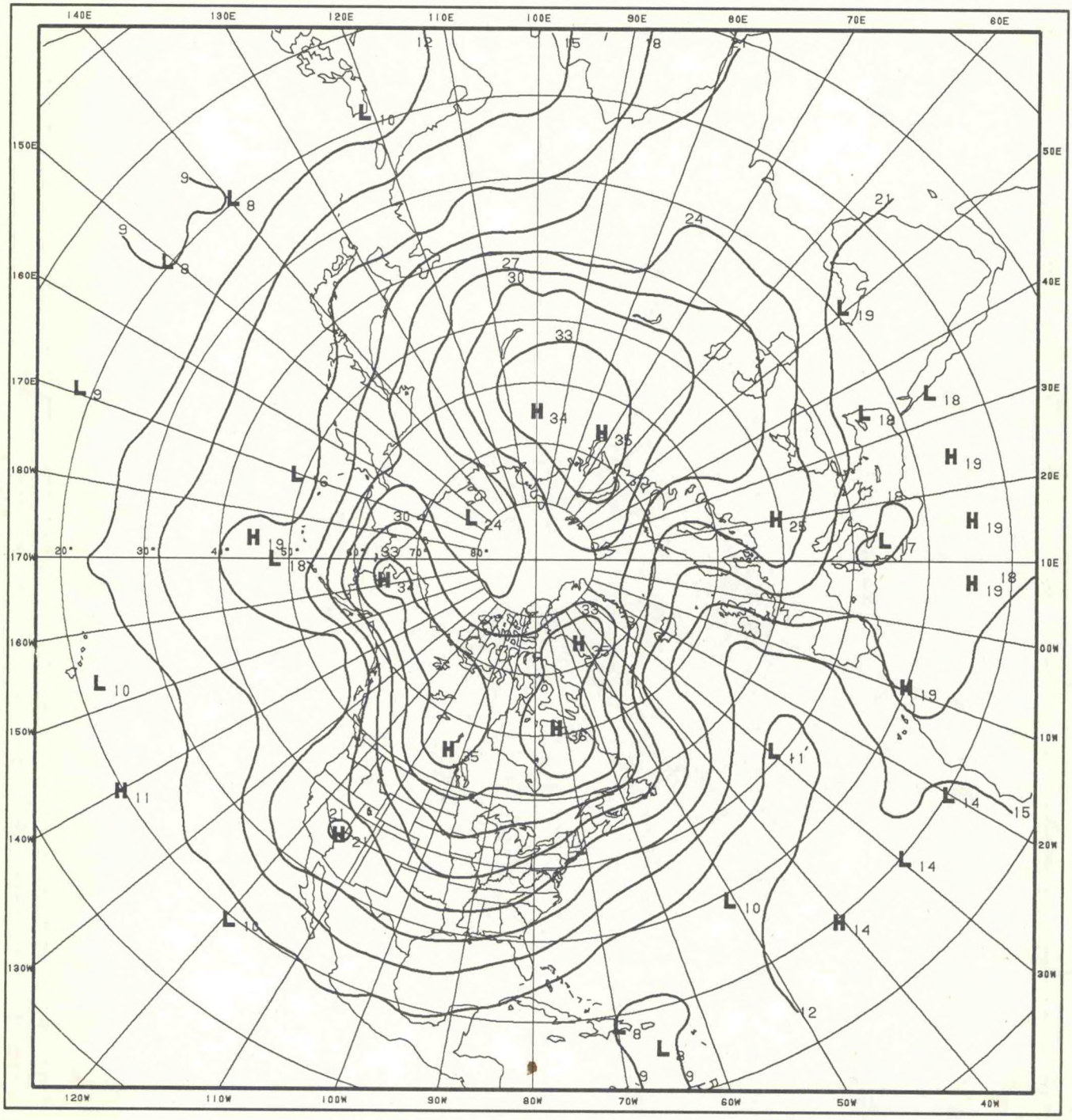
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS STAND DEV FEBRUARY

1-MONTH MEAN POOLED 1950-92

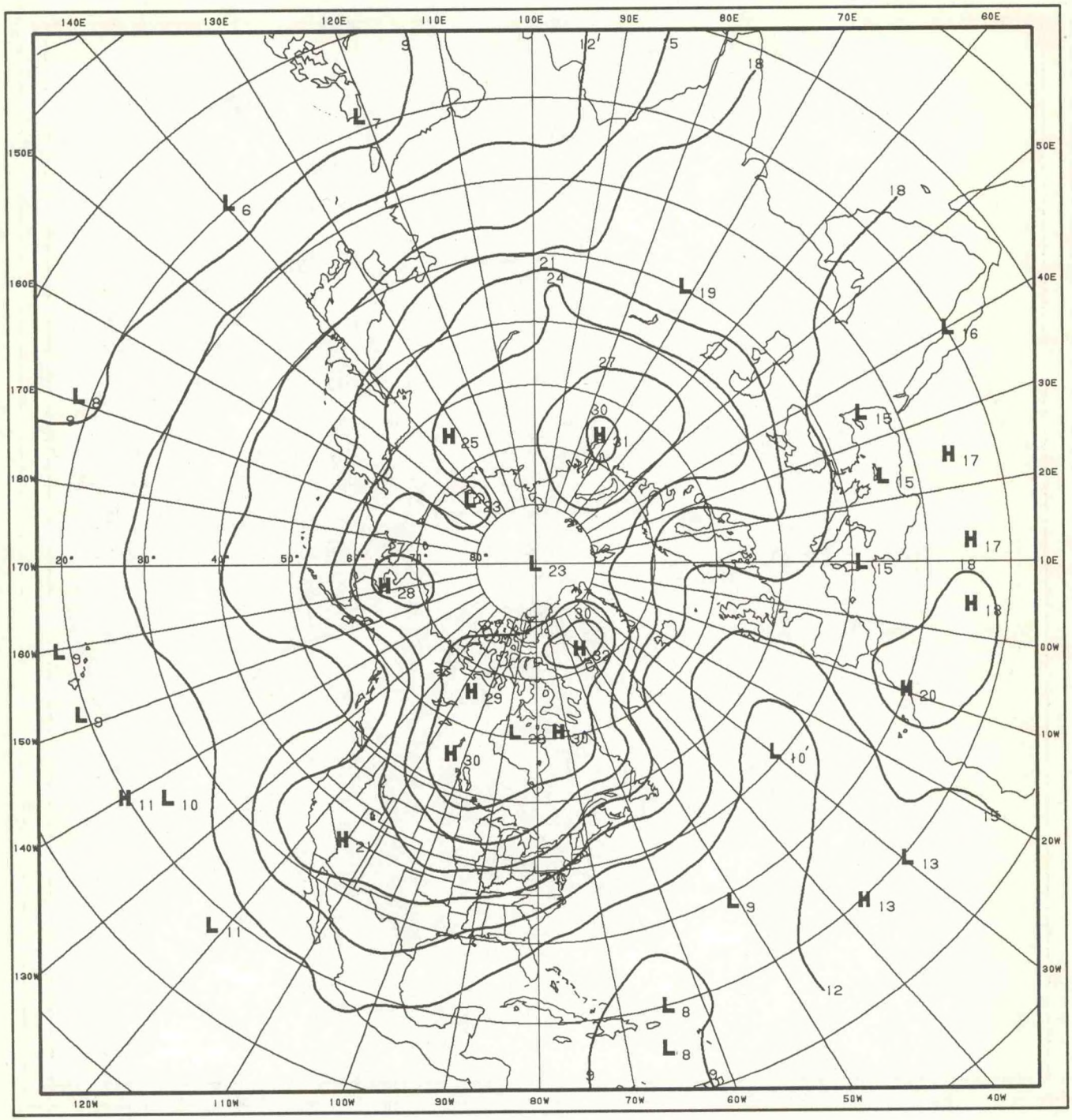
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS STAND DEV MARCH

1-MONTH MEAN POOLED 1950-92

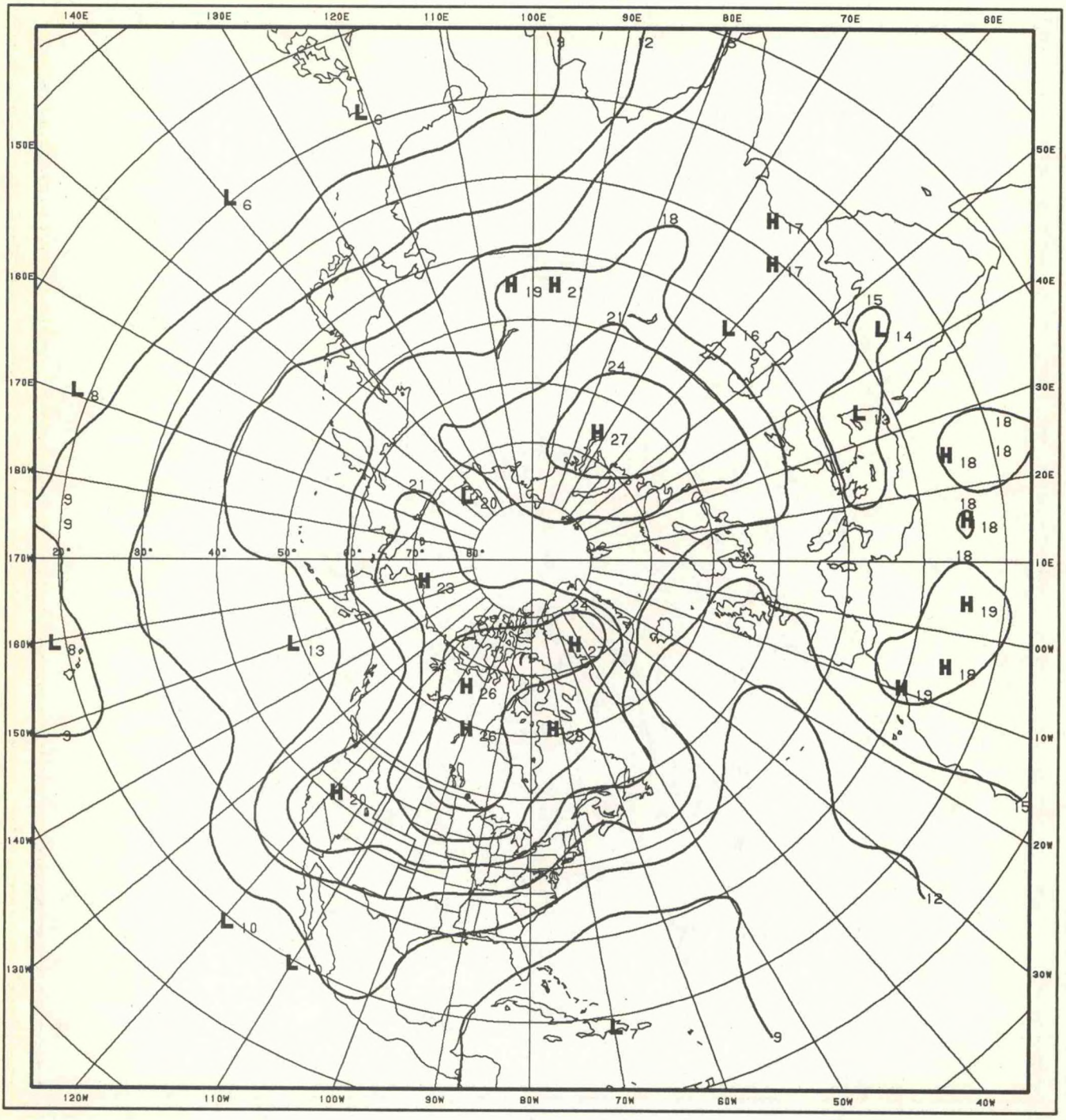
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS STAND DEV APRIL

1-MONTH MEAN POOLED 1950-92

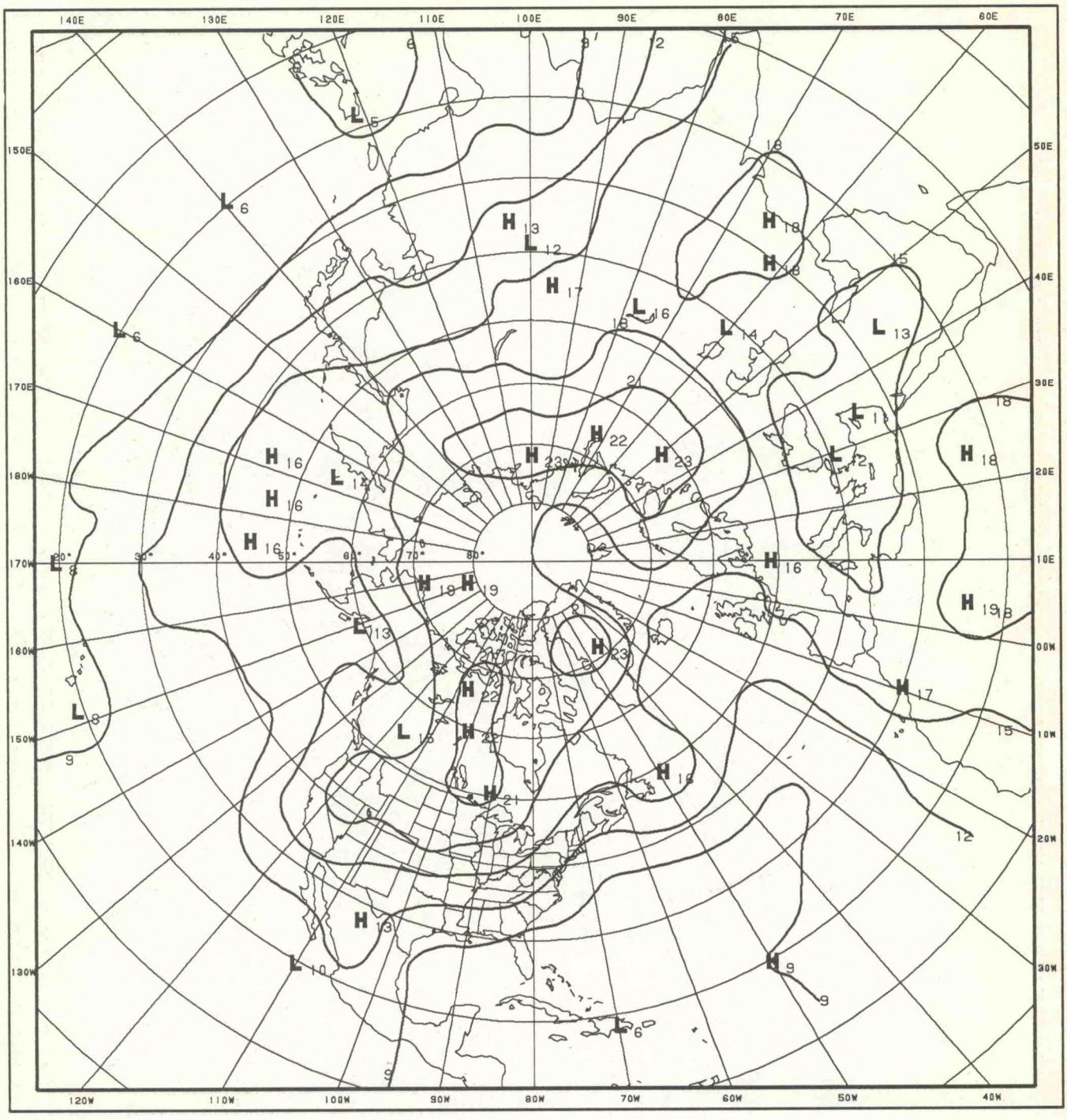
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS STAND DEV MAY

1-MONTH MEAN POOLED 1950-92

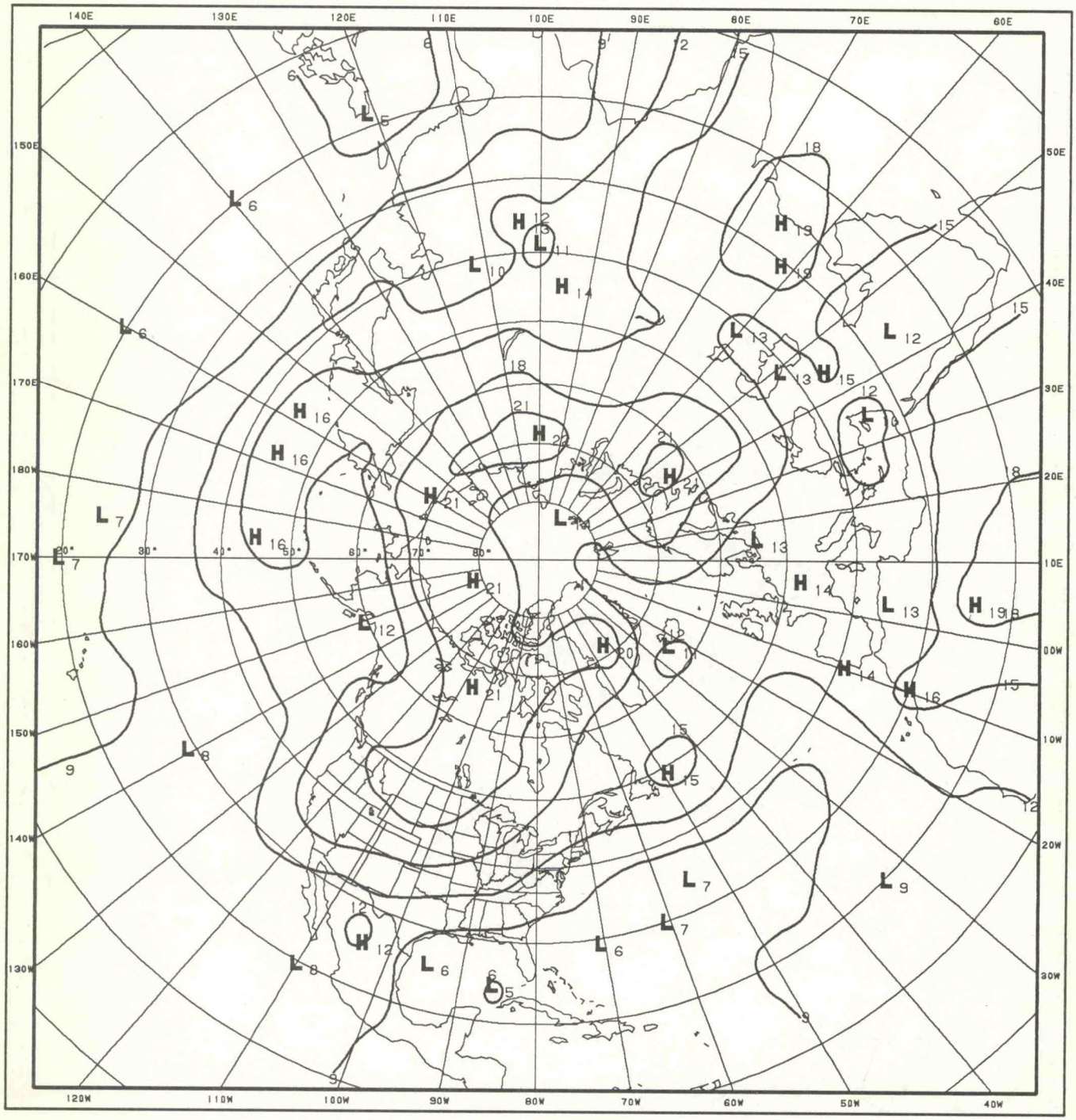
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS STAND DEV JUNE

1-MONTH MEAN POOLED 1950-92

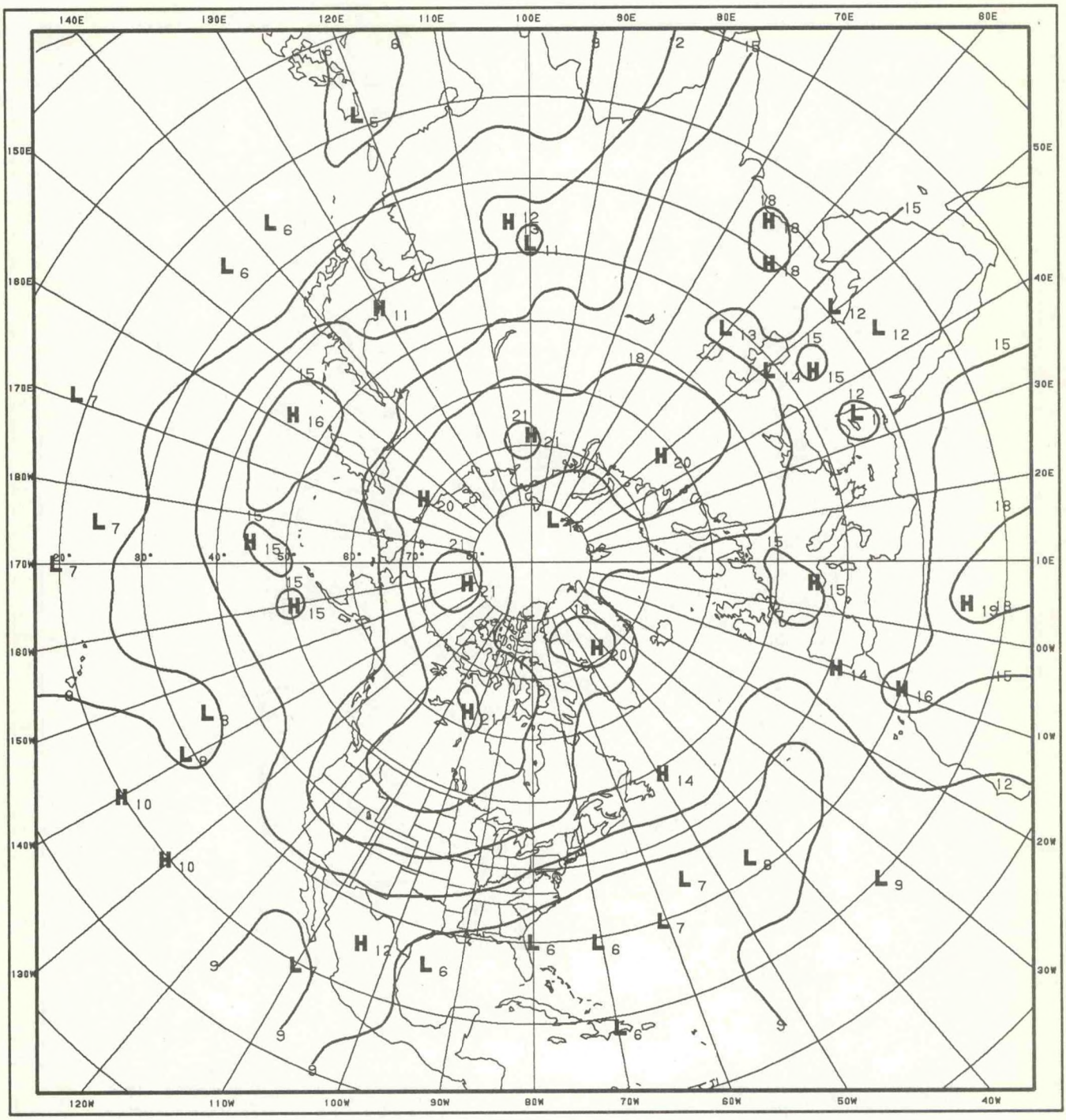
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS STAND DEV JULY

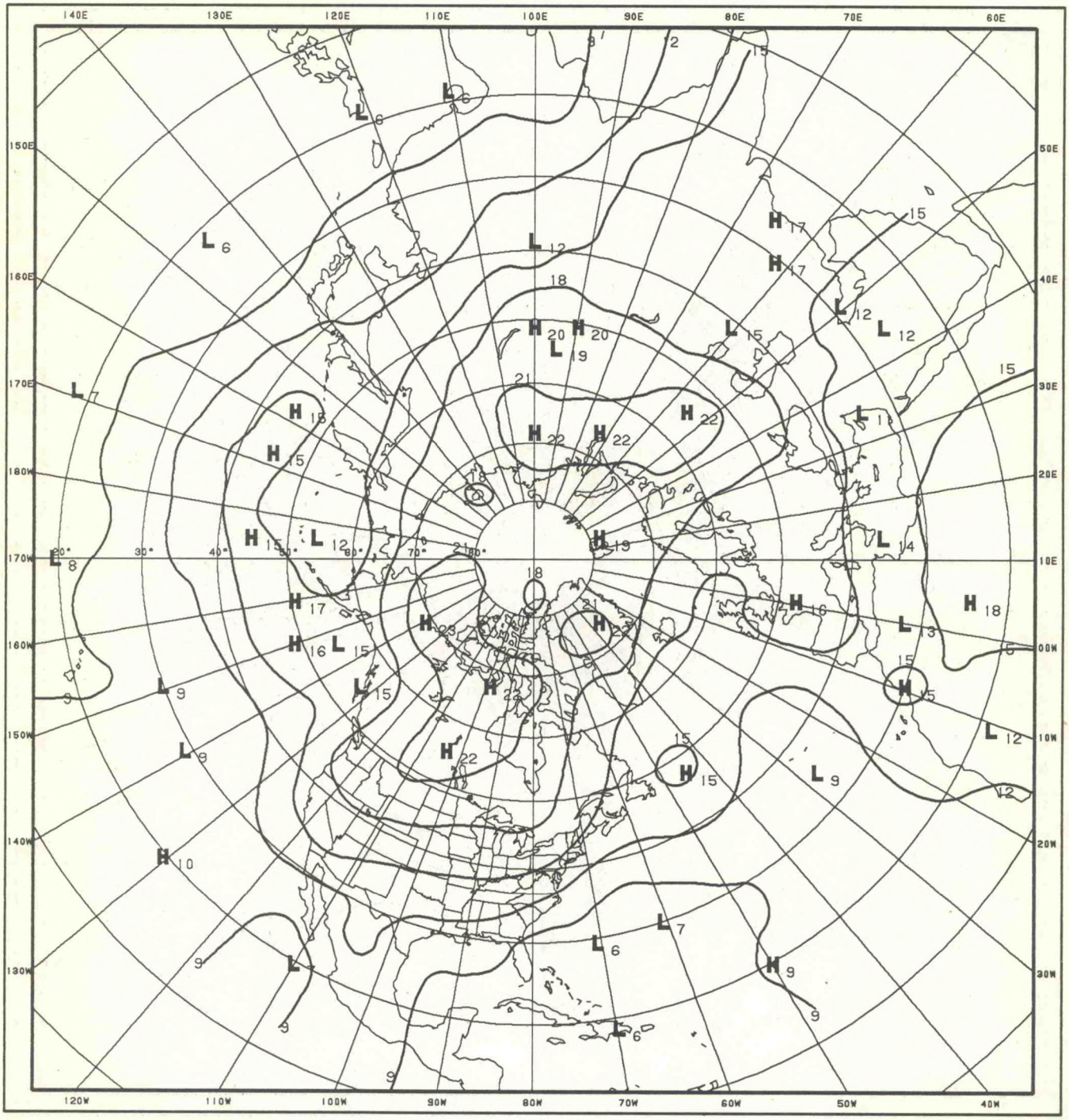
1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS STAND DEV AUGUST
1-MONTH MEAN POOLED 1950-92

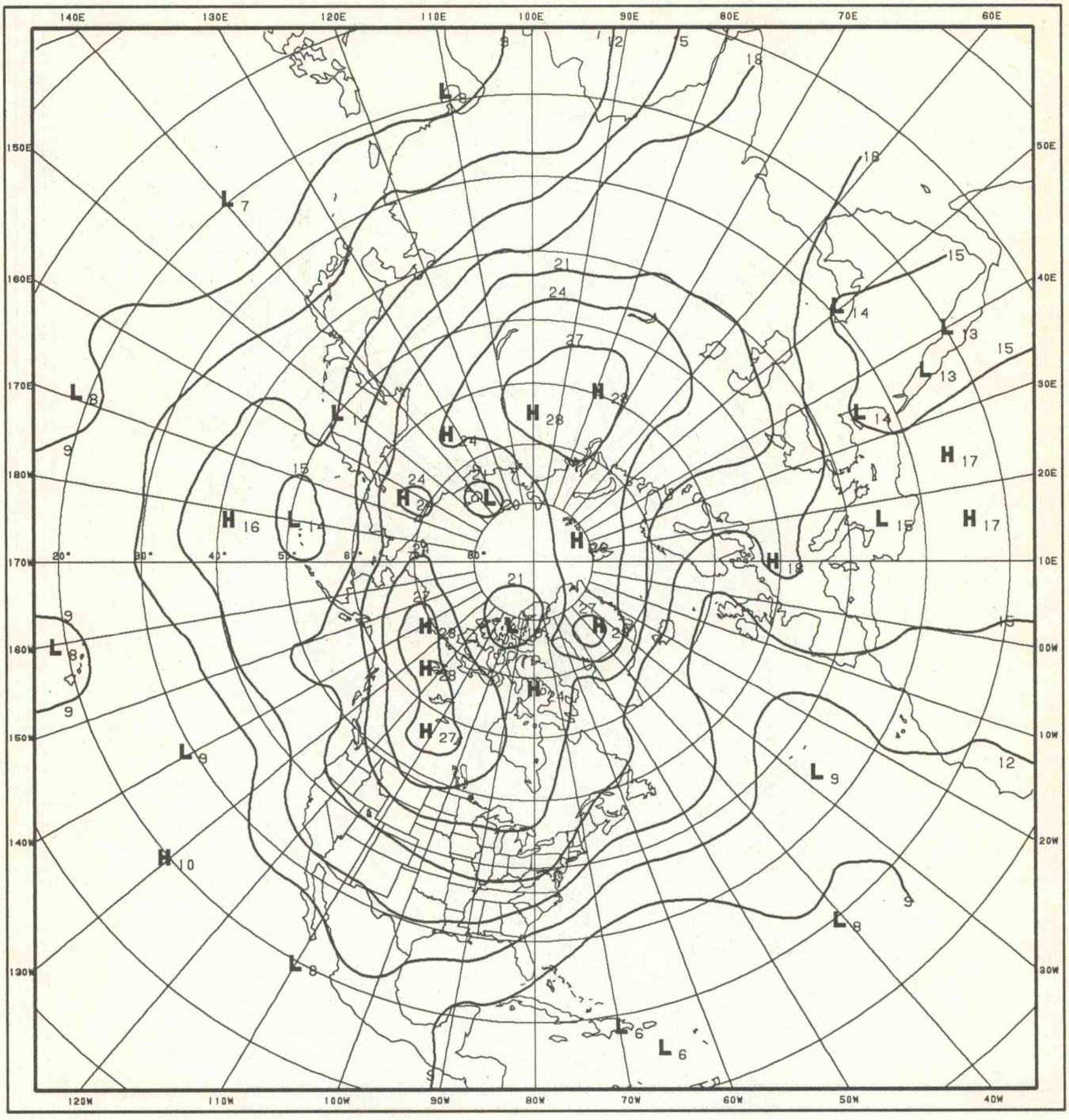
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS STAND DEV SEPTEMBR

1-MONTH MEAN POOLED 1950-92

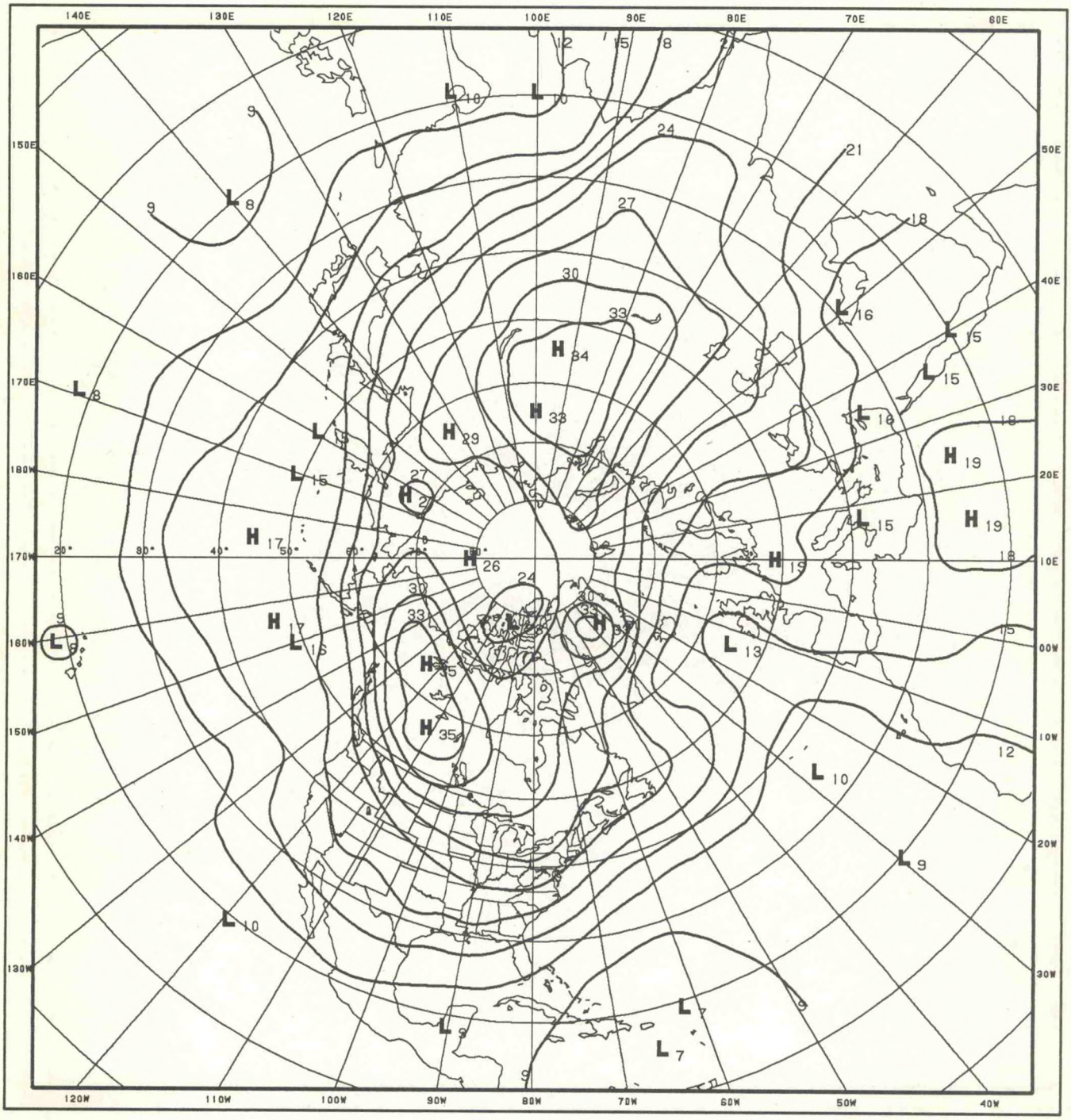
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS STAND DEV OCTOBER

1-MONTH MEAN POOLED 1950-92

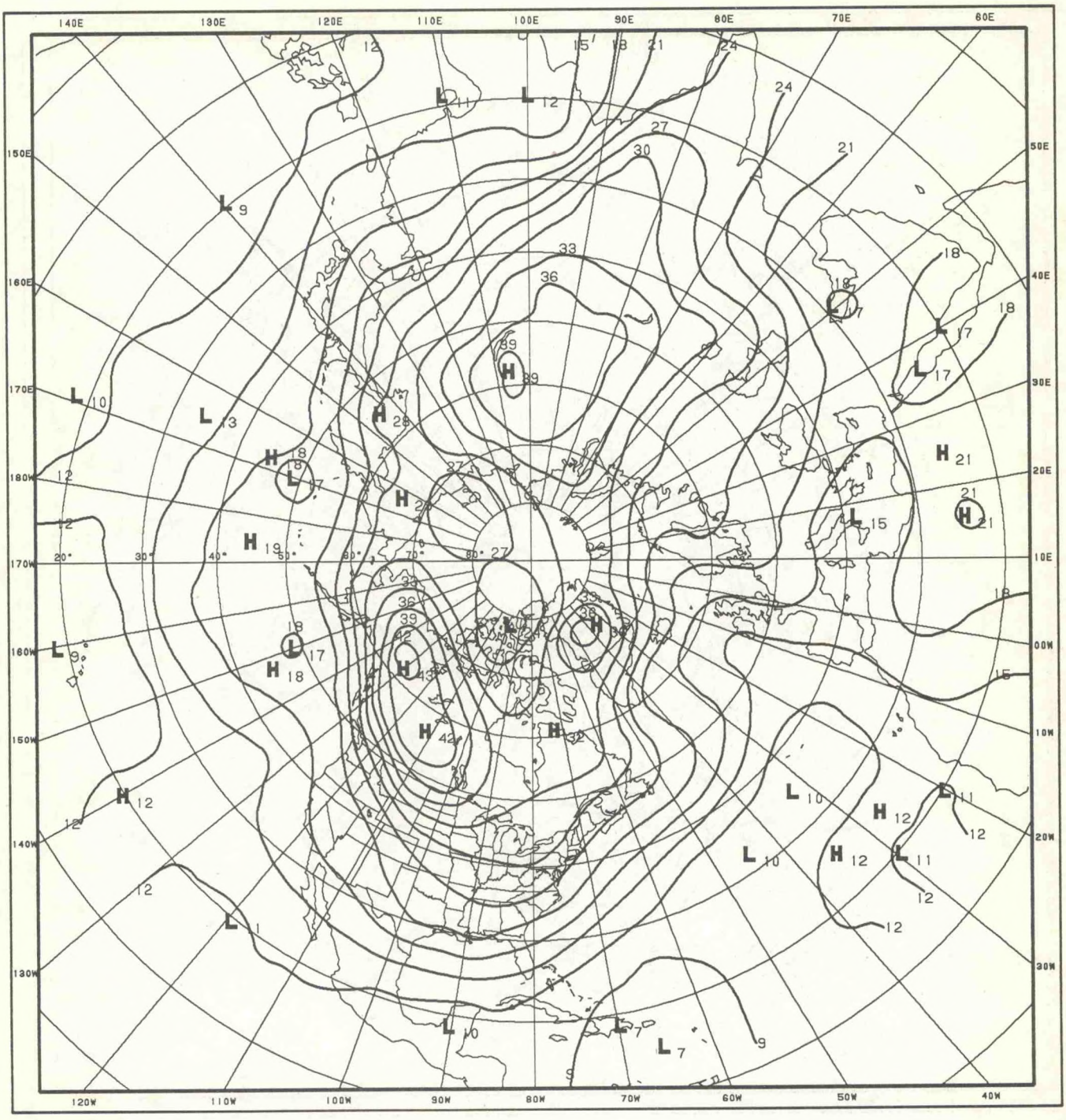
PREDICTION BRANCH CAC, NMC, NWS



1000-700 MB THICKNESS STAND DEV NOVEMBER

1-MONTH MEAN POOLED 1950-92

PREDICTION BRANCH CAC, NMC, NWS



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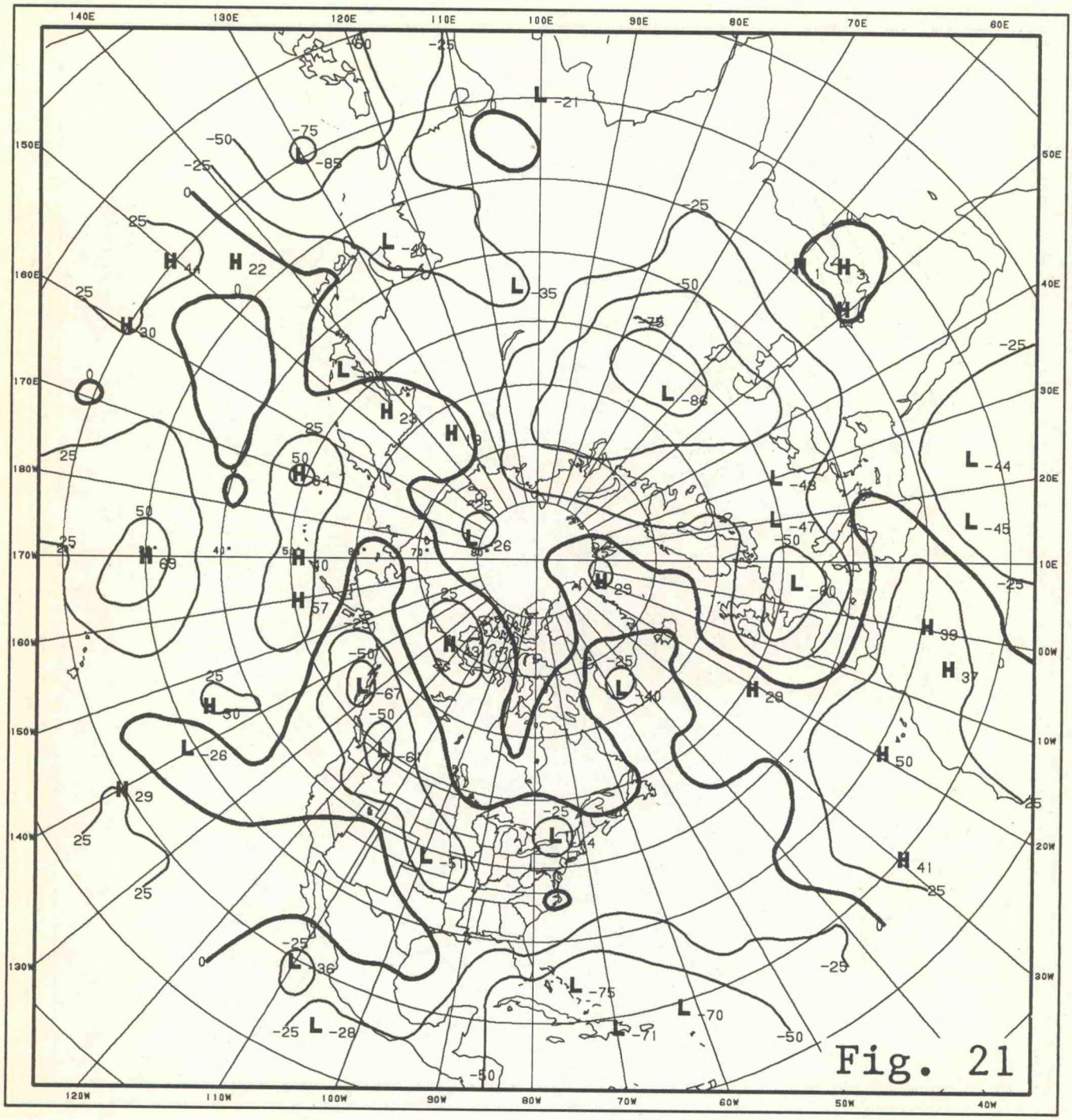

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1-MONTH MEAN POOLED 1950-92

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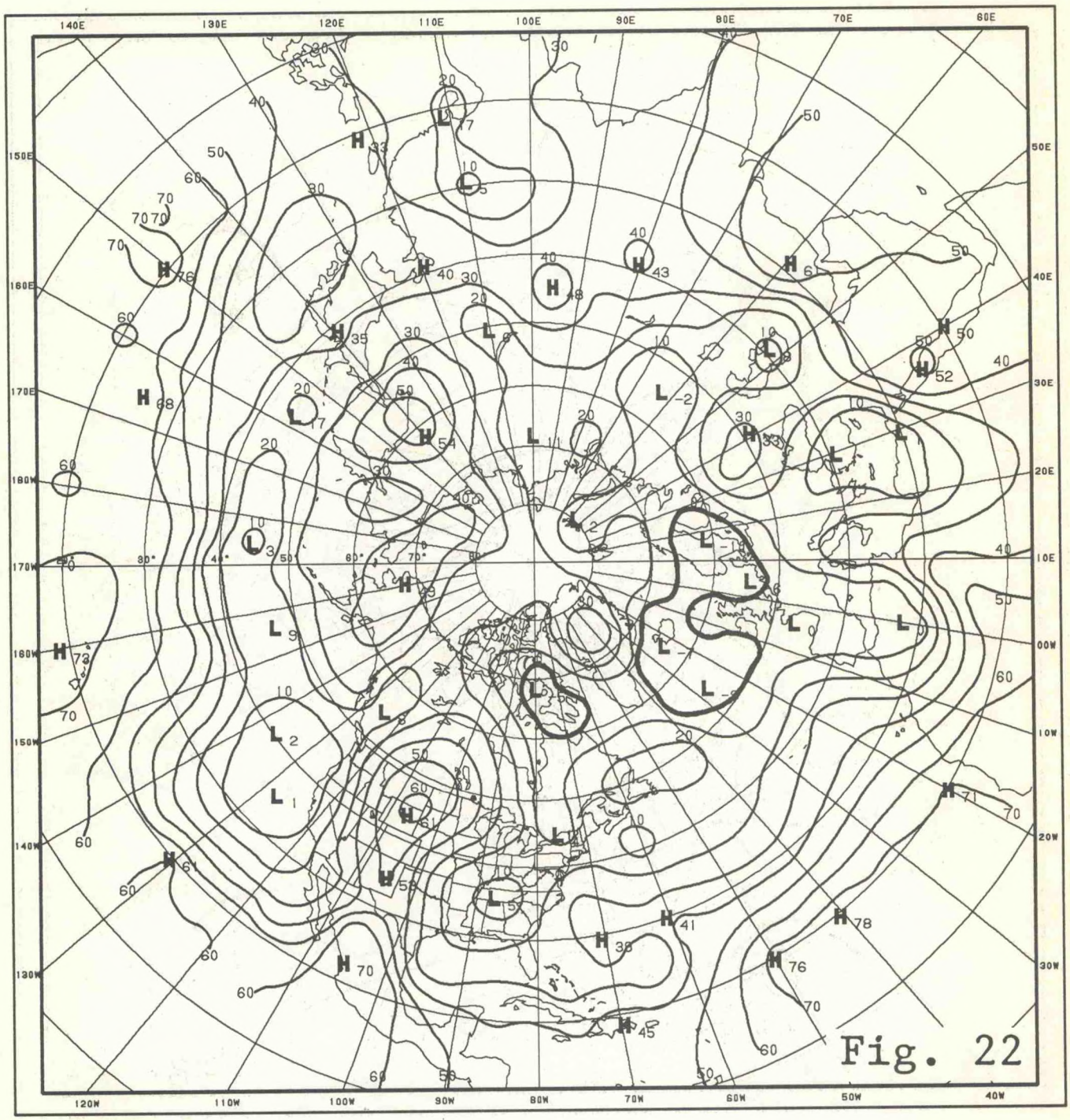

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1-MONTH MEAN UNPOOLED 1950-92

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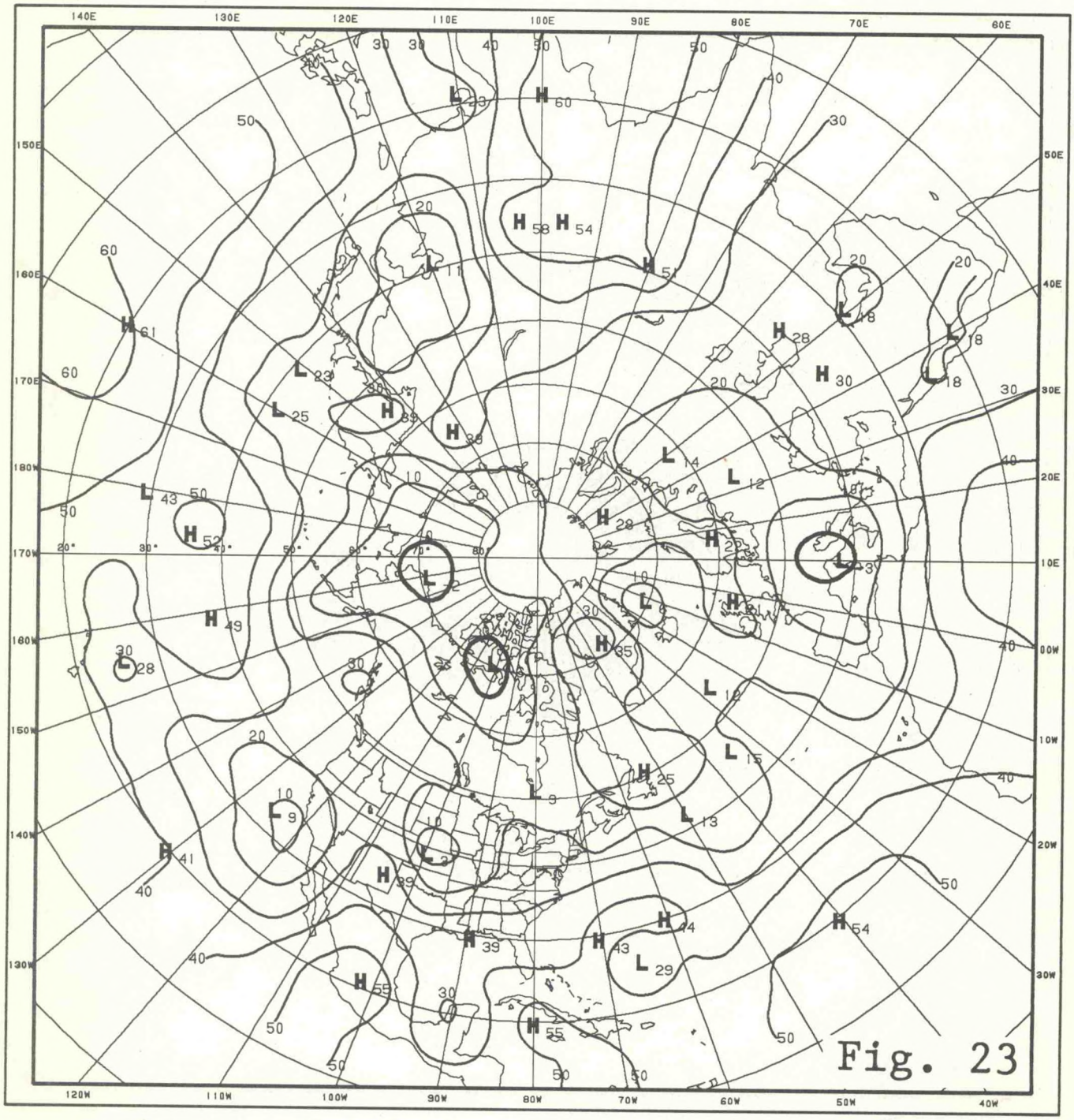

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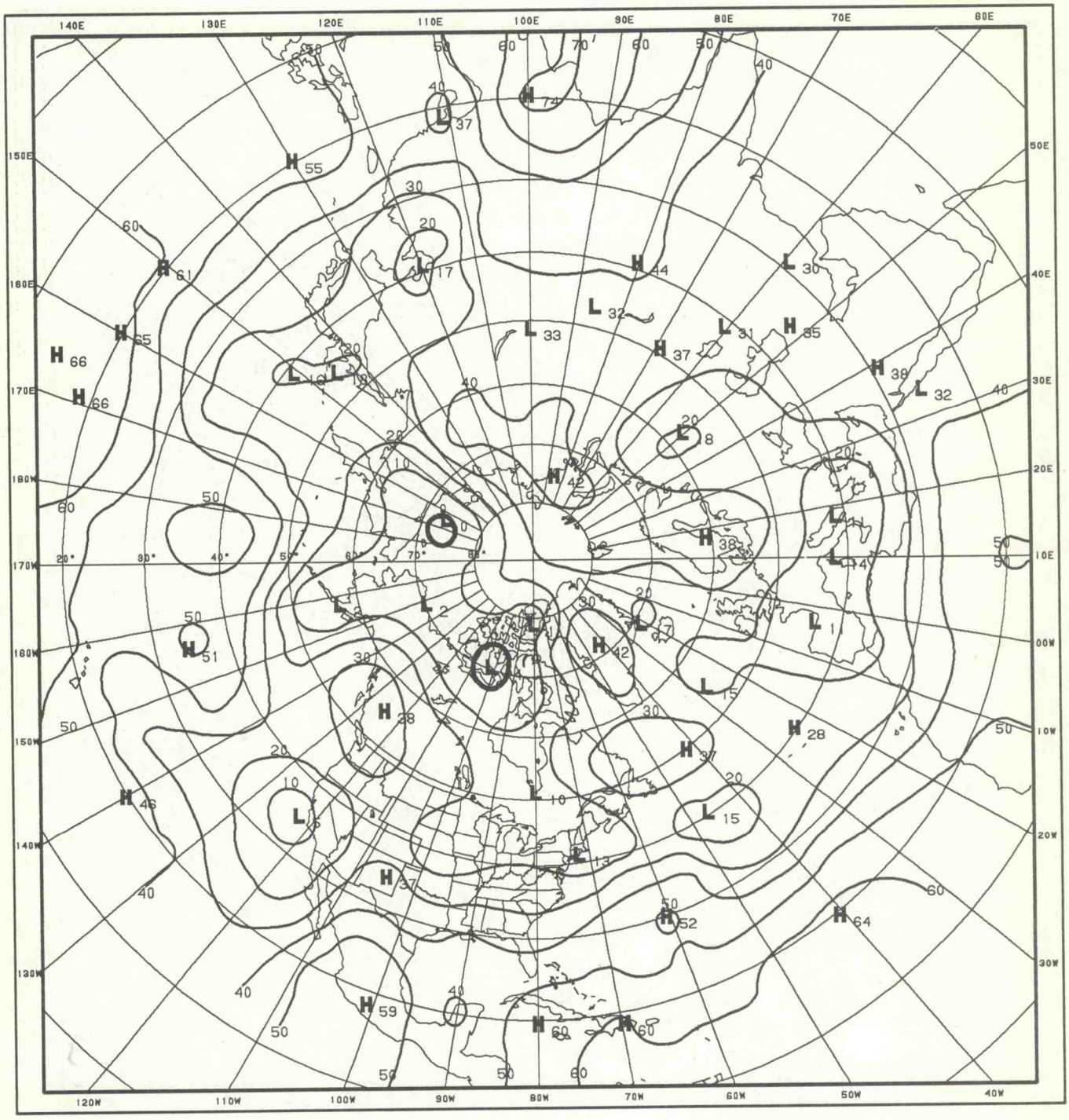

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1-MONTH MEAN POOLED 1950-92

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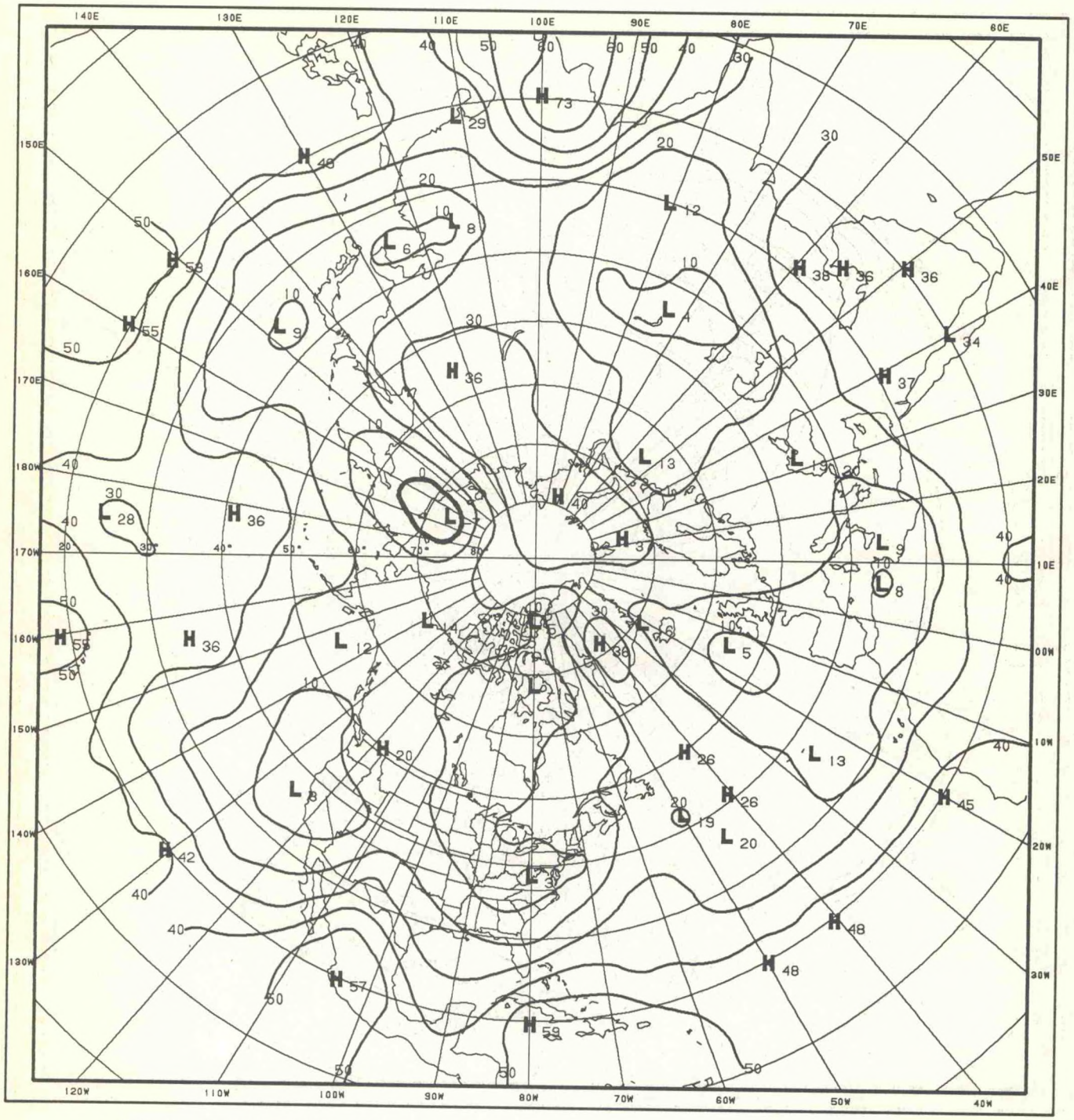

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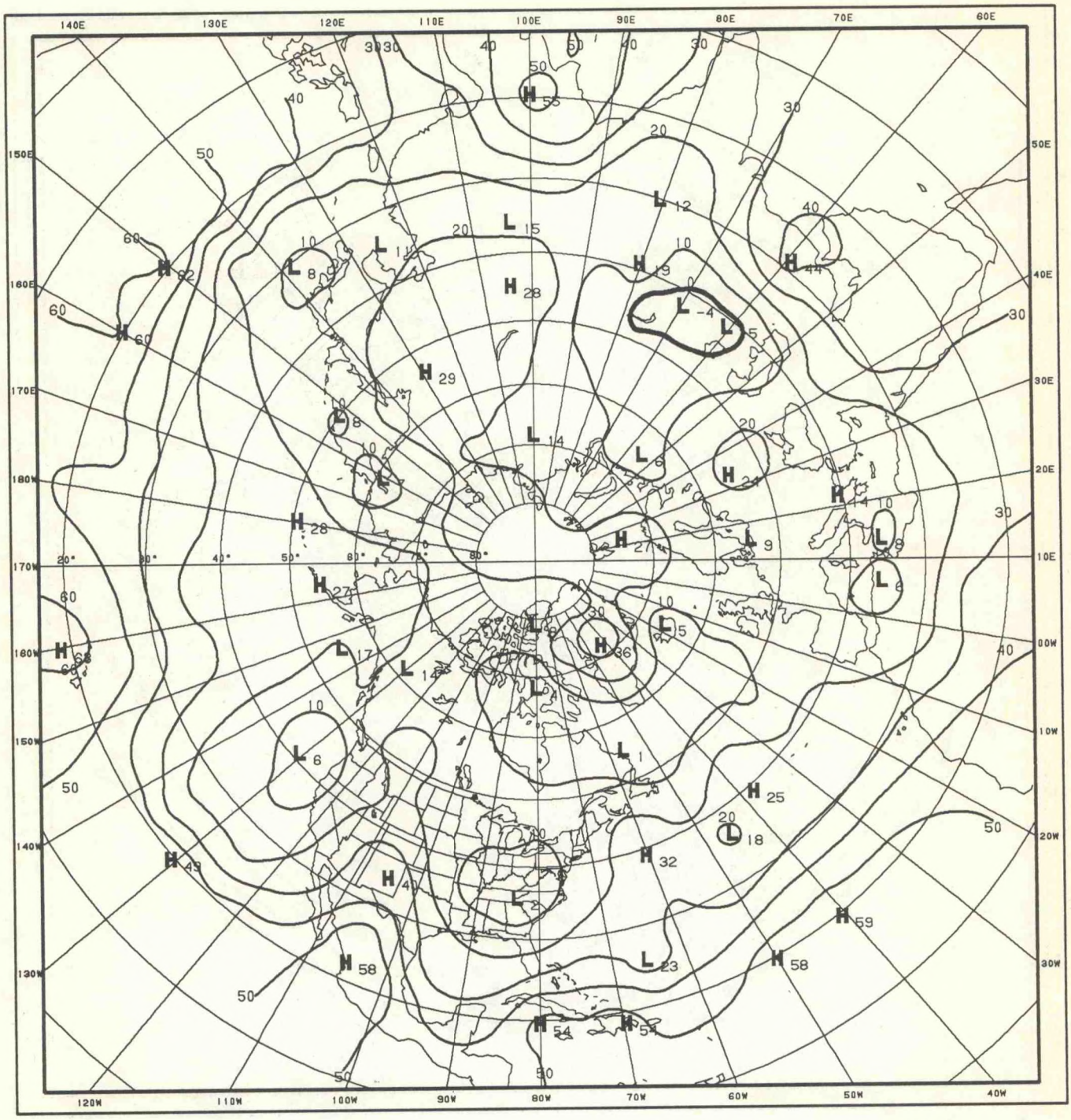

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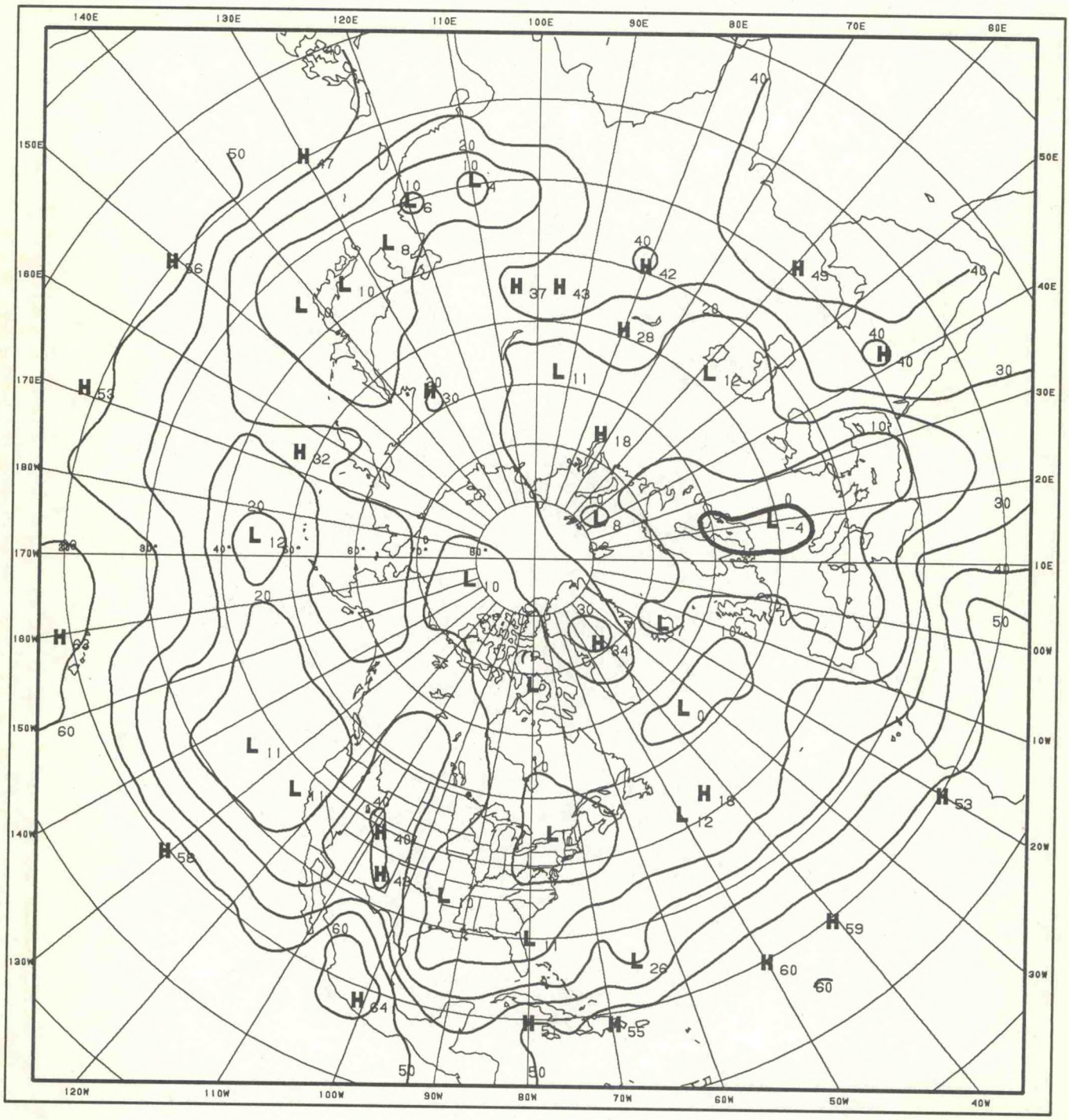

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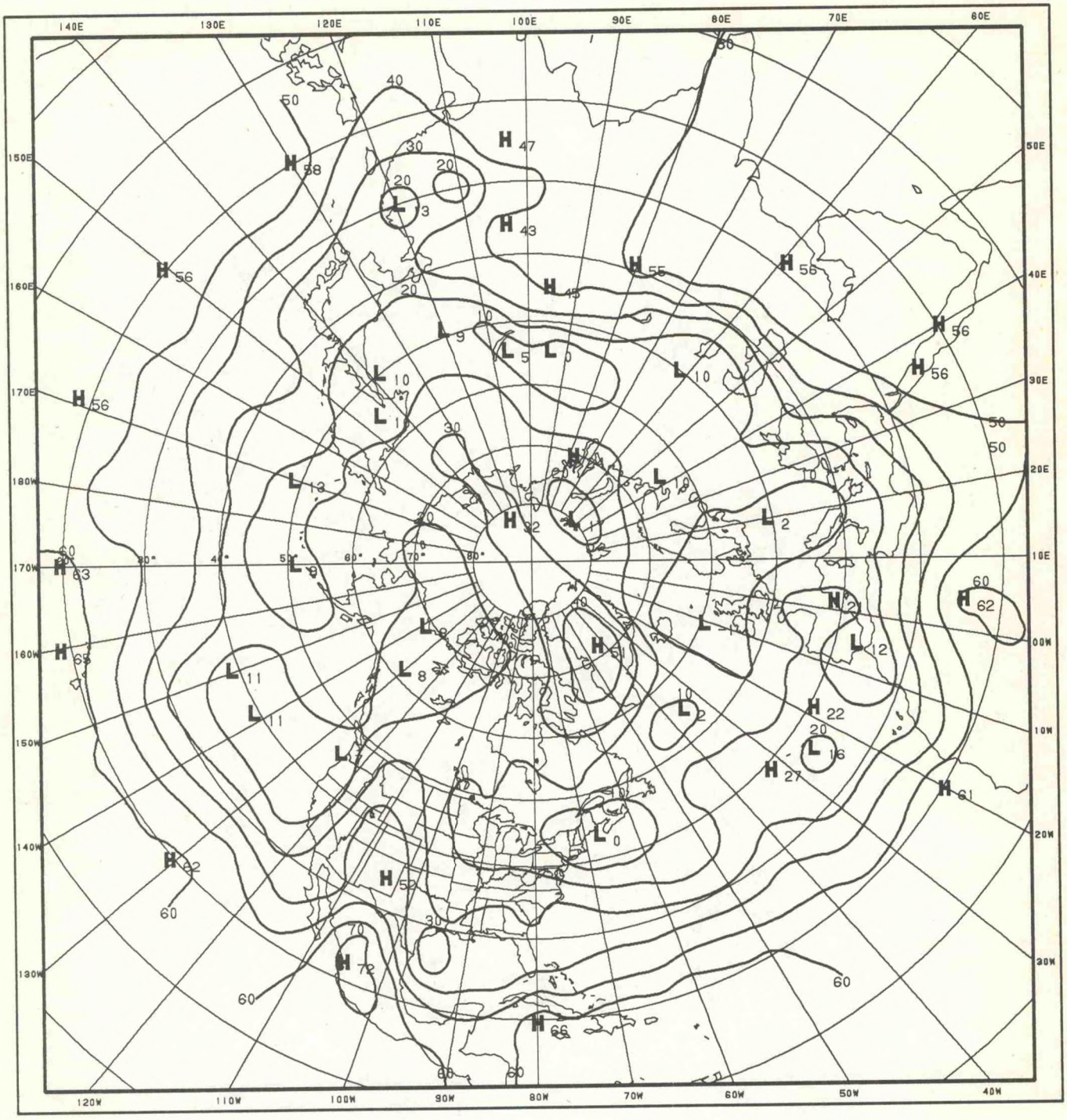

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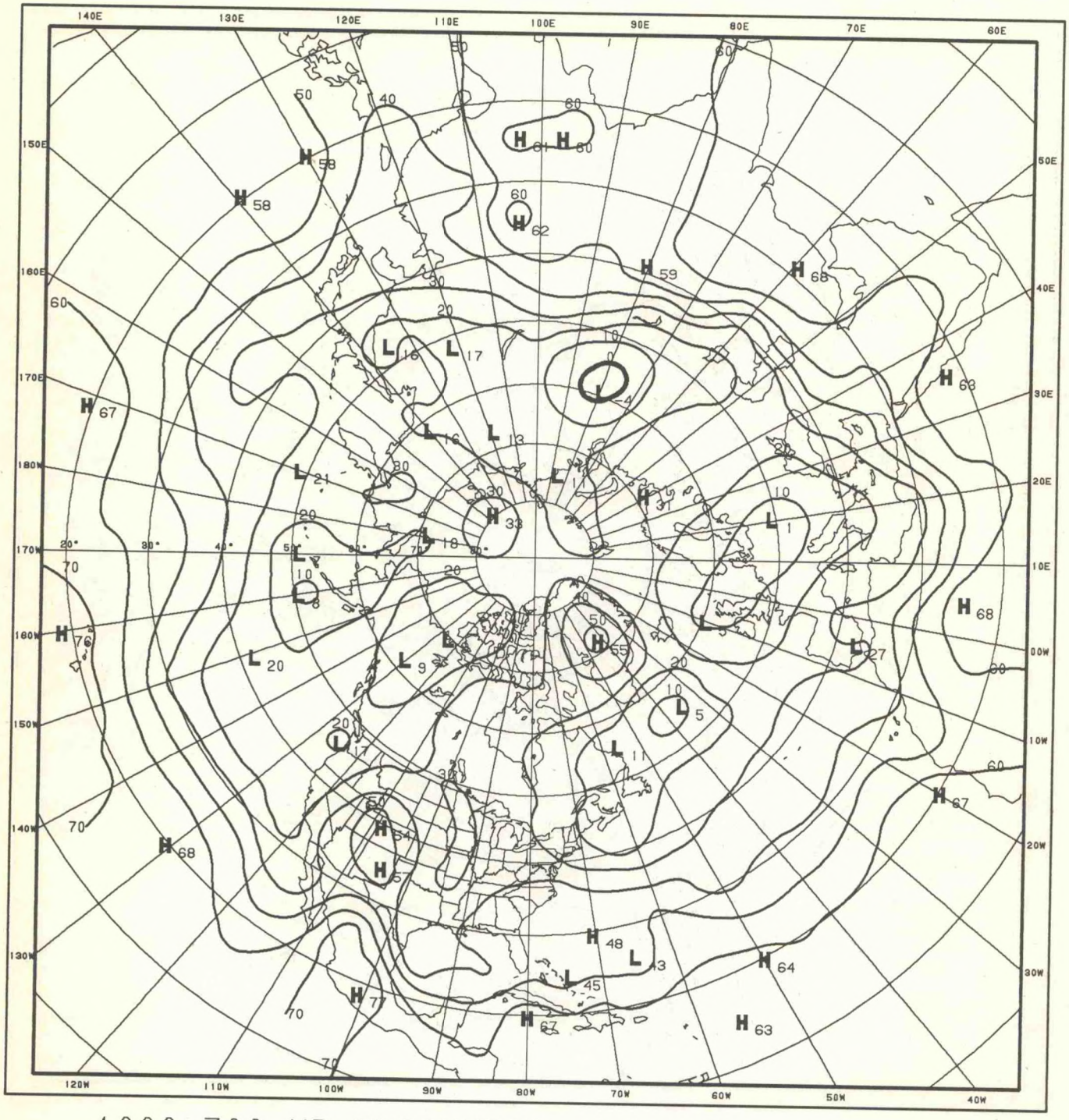

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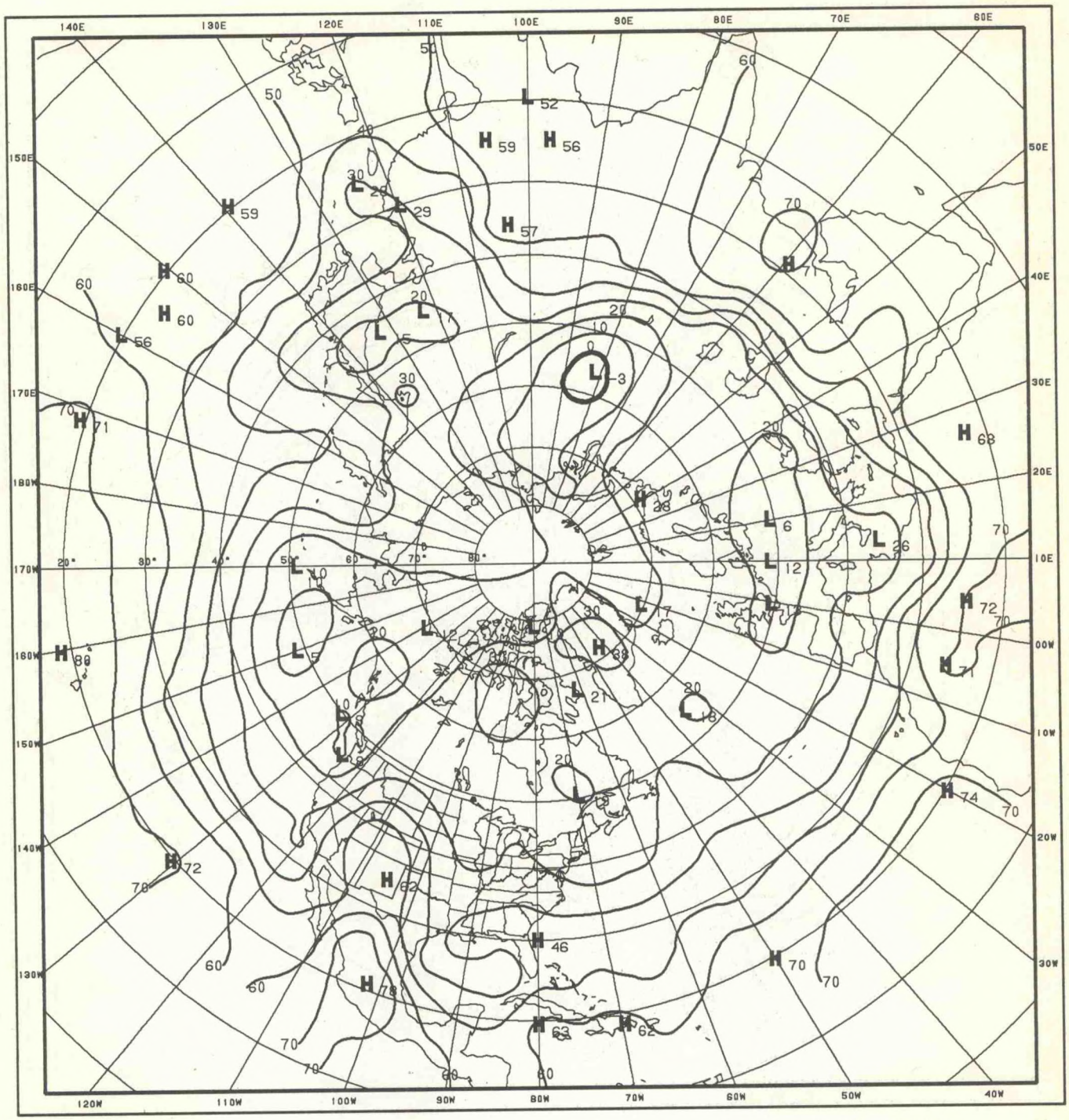

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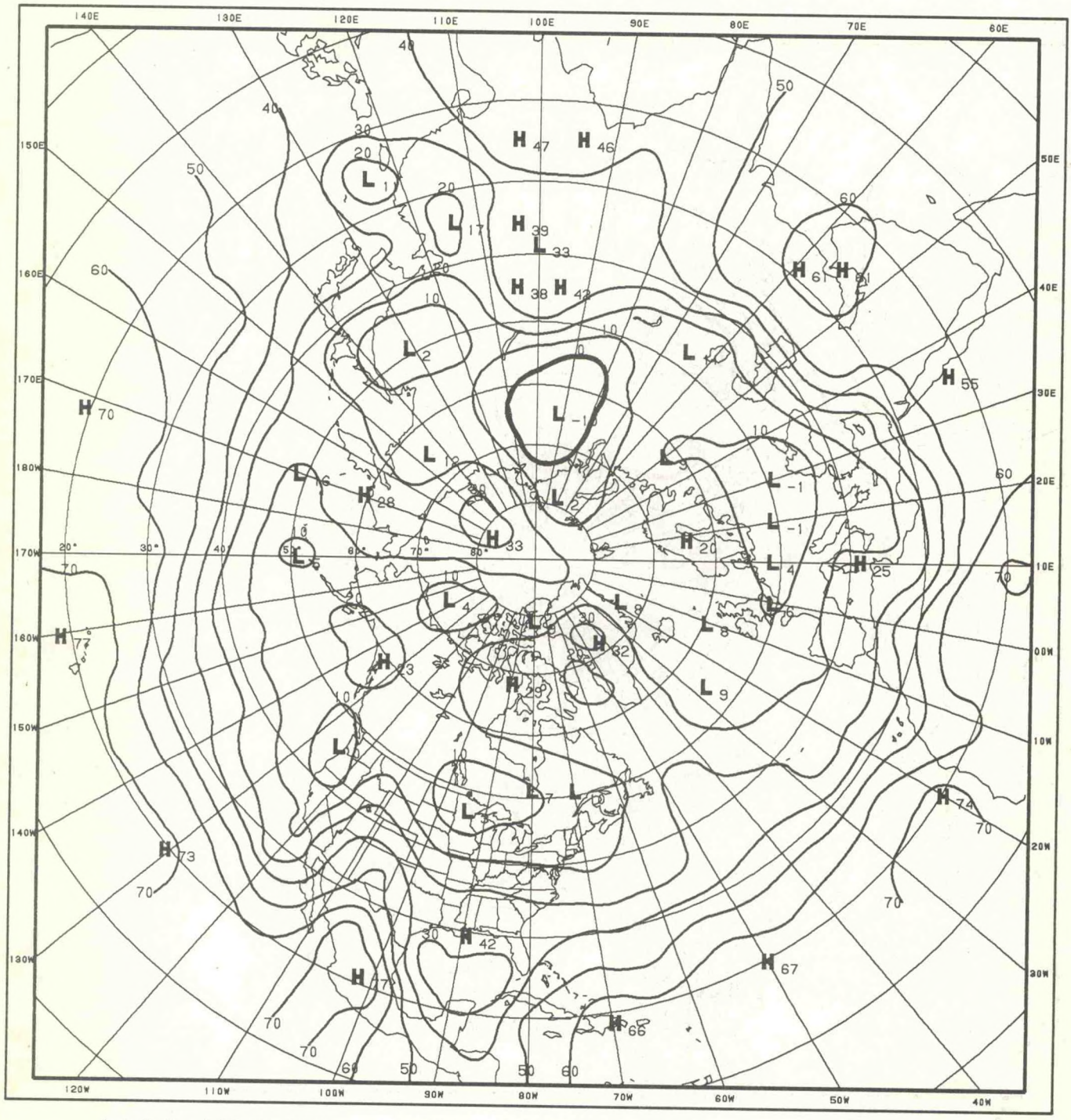

1000-700 MB THICKNESS AUTOCOR AUG-SEP

1-MONTH MEAN POOLED 1950-92

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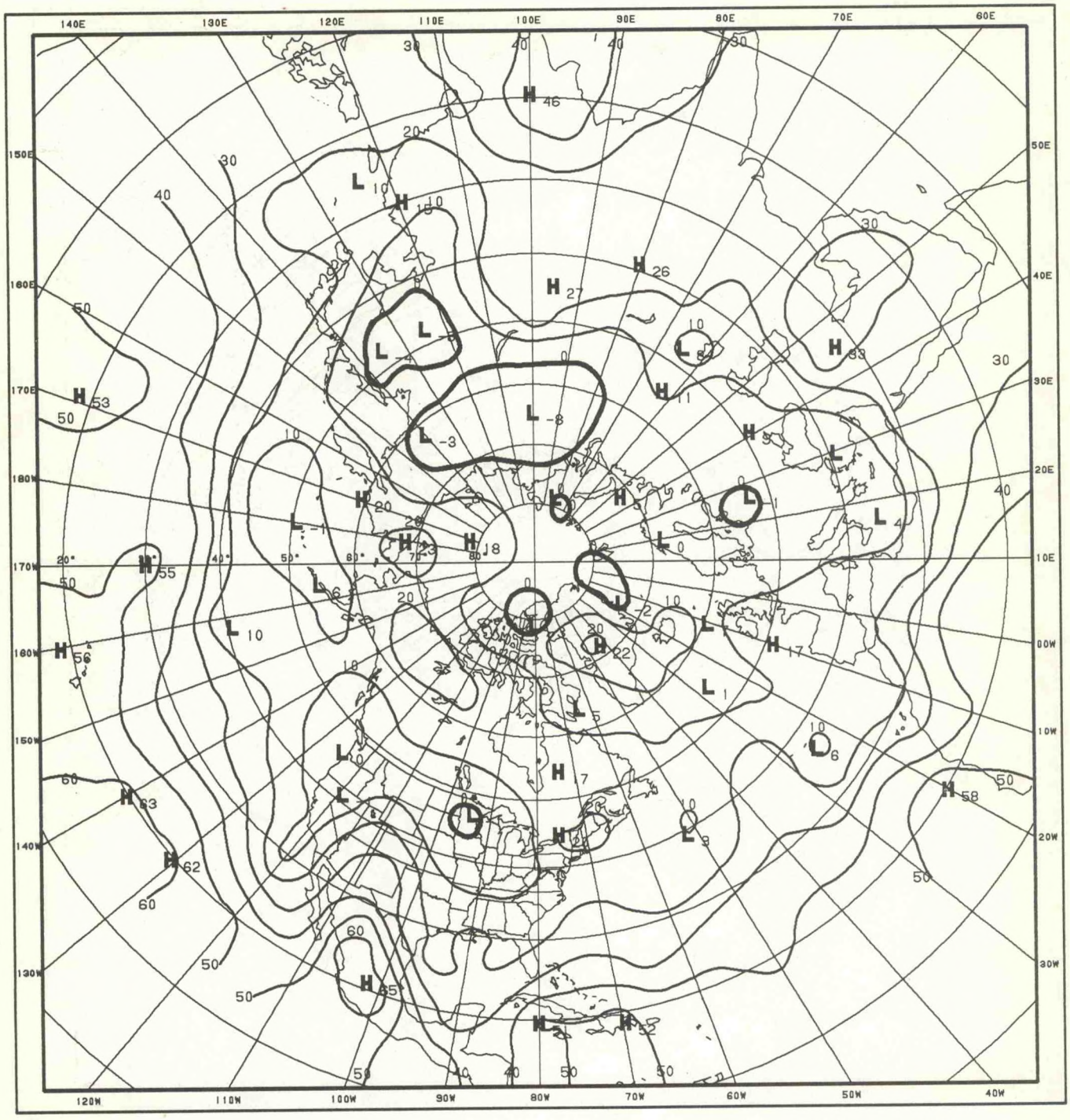

1000-700 MB THICKNESS AUTOCOR SEP-OCT

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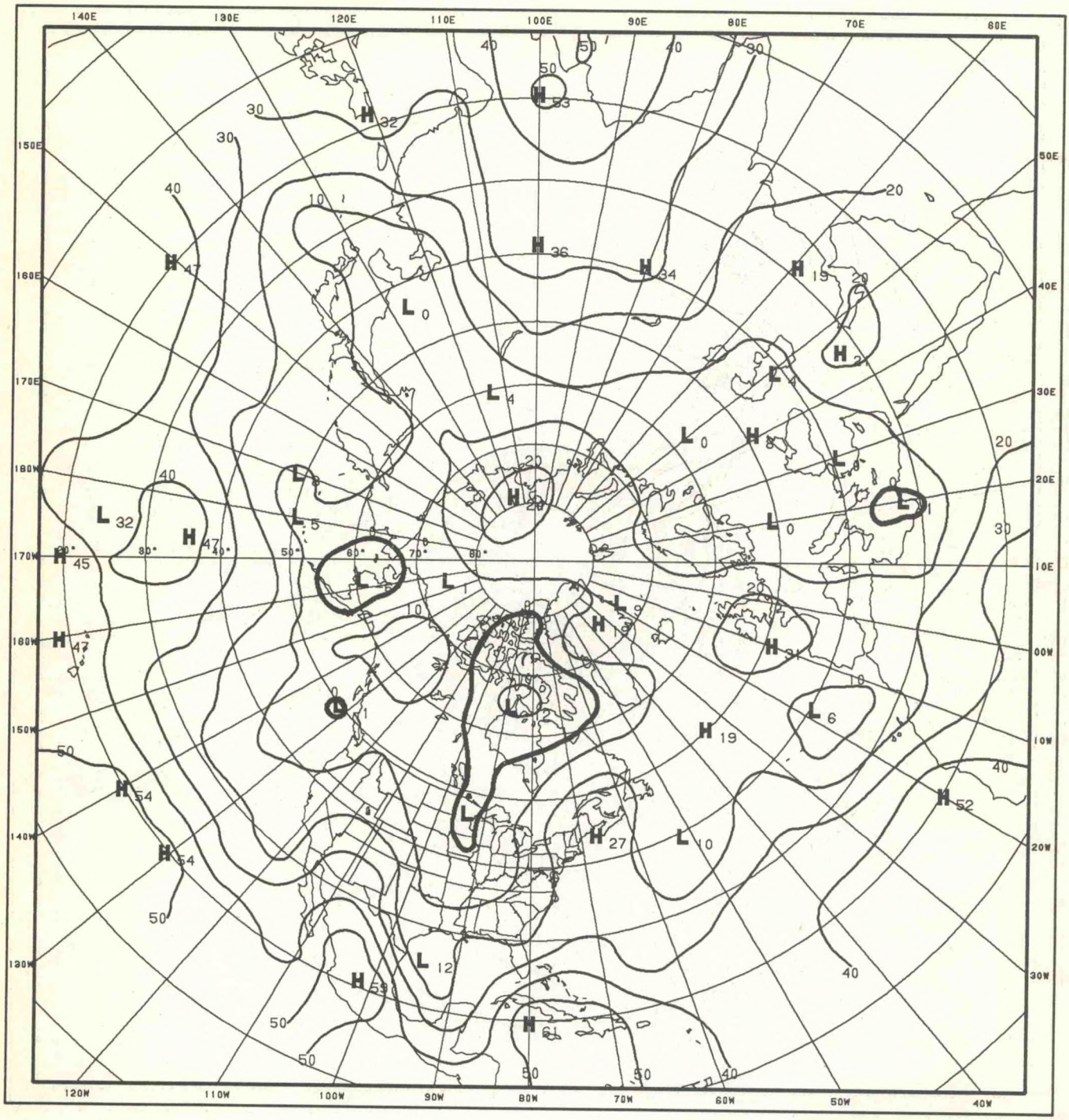

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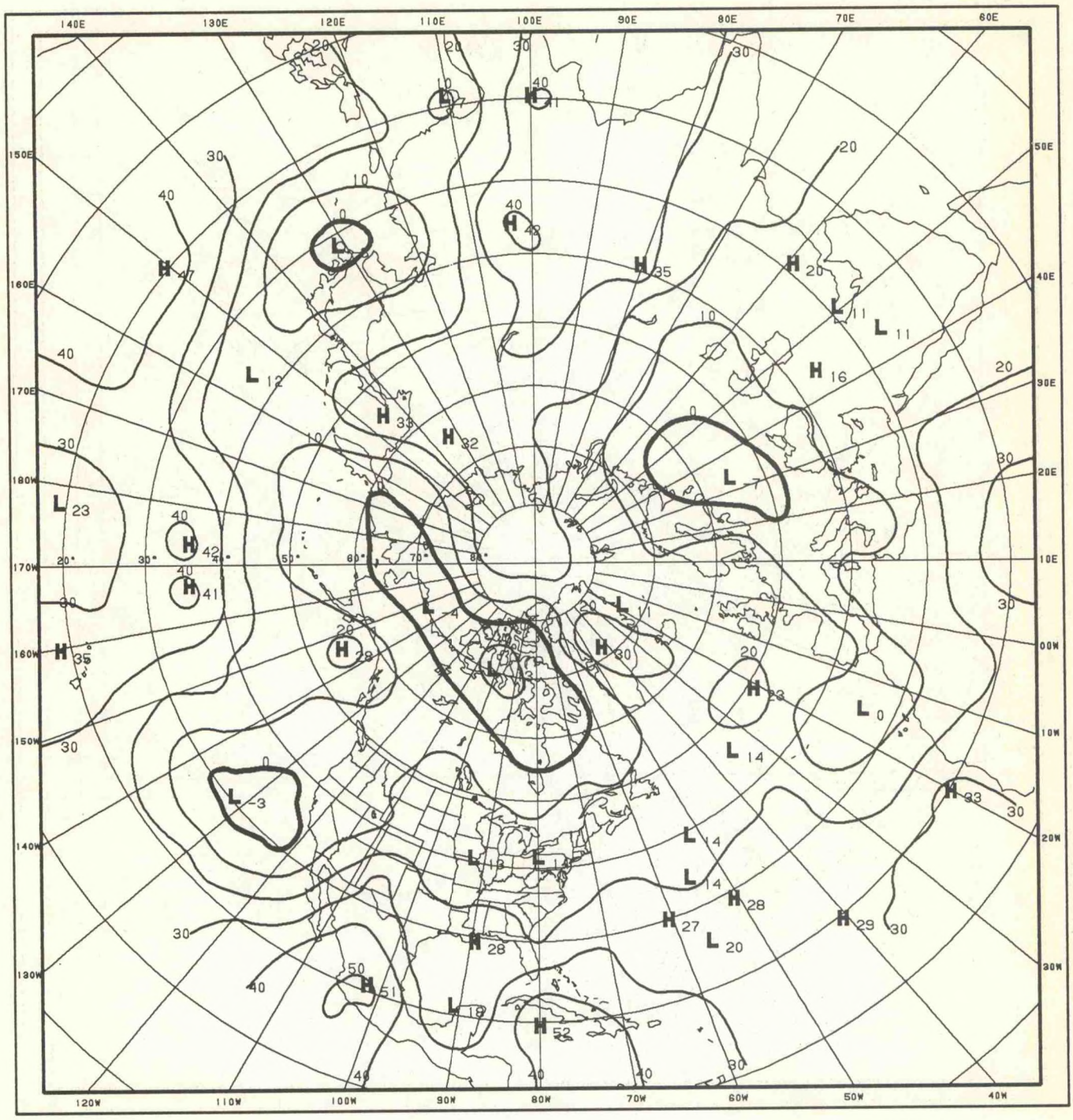

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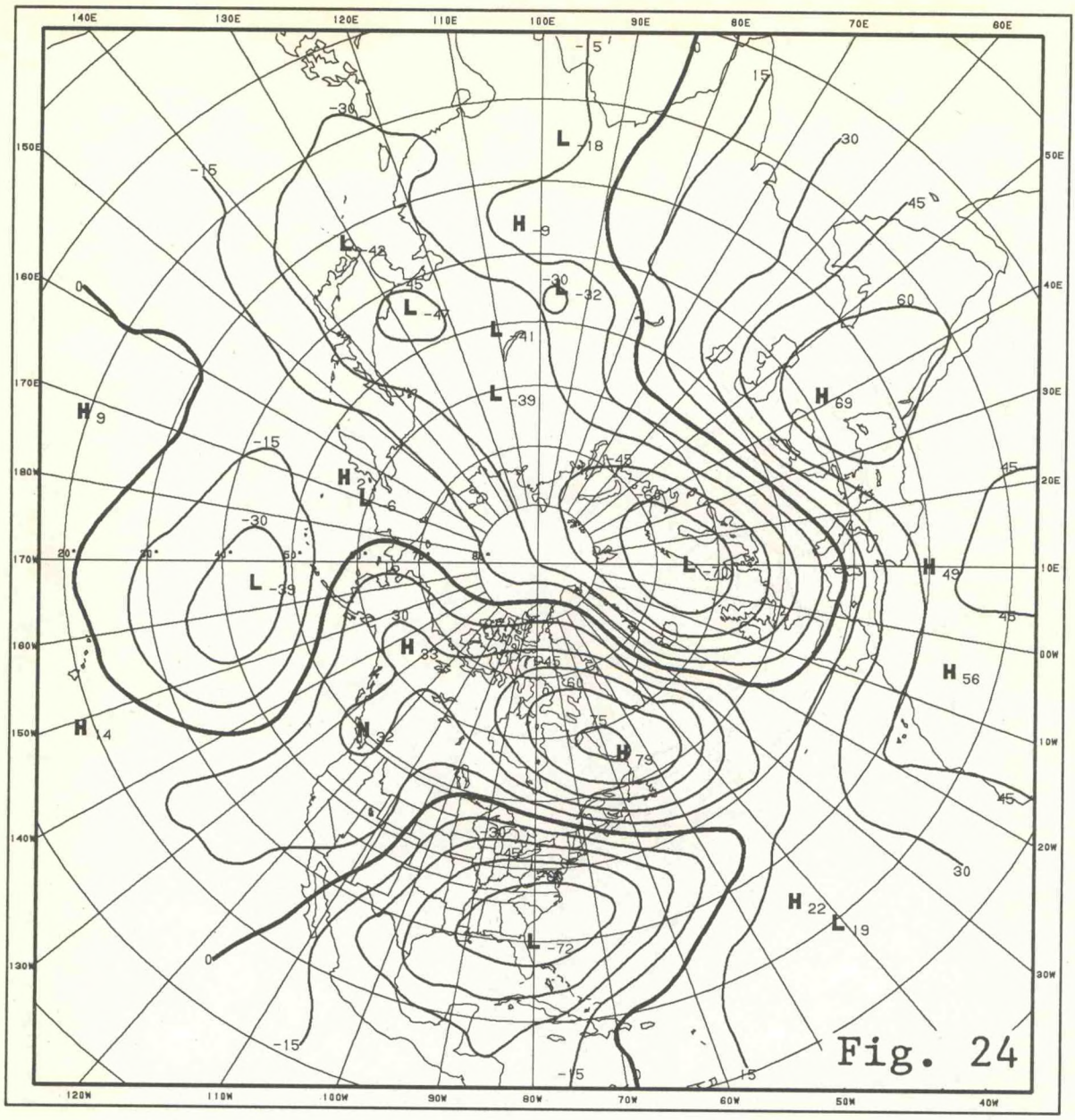

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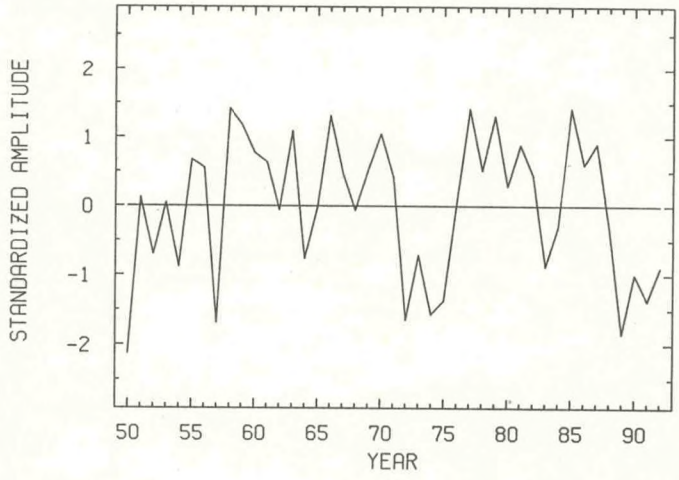

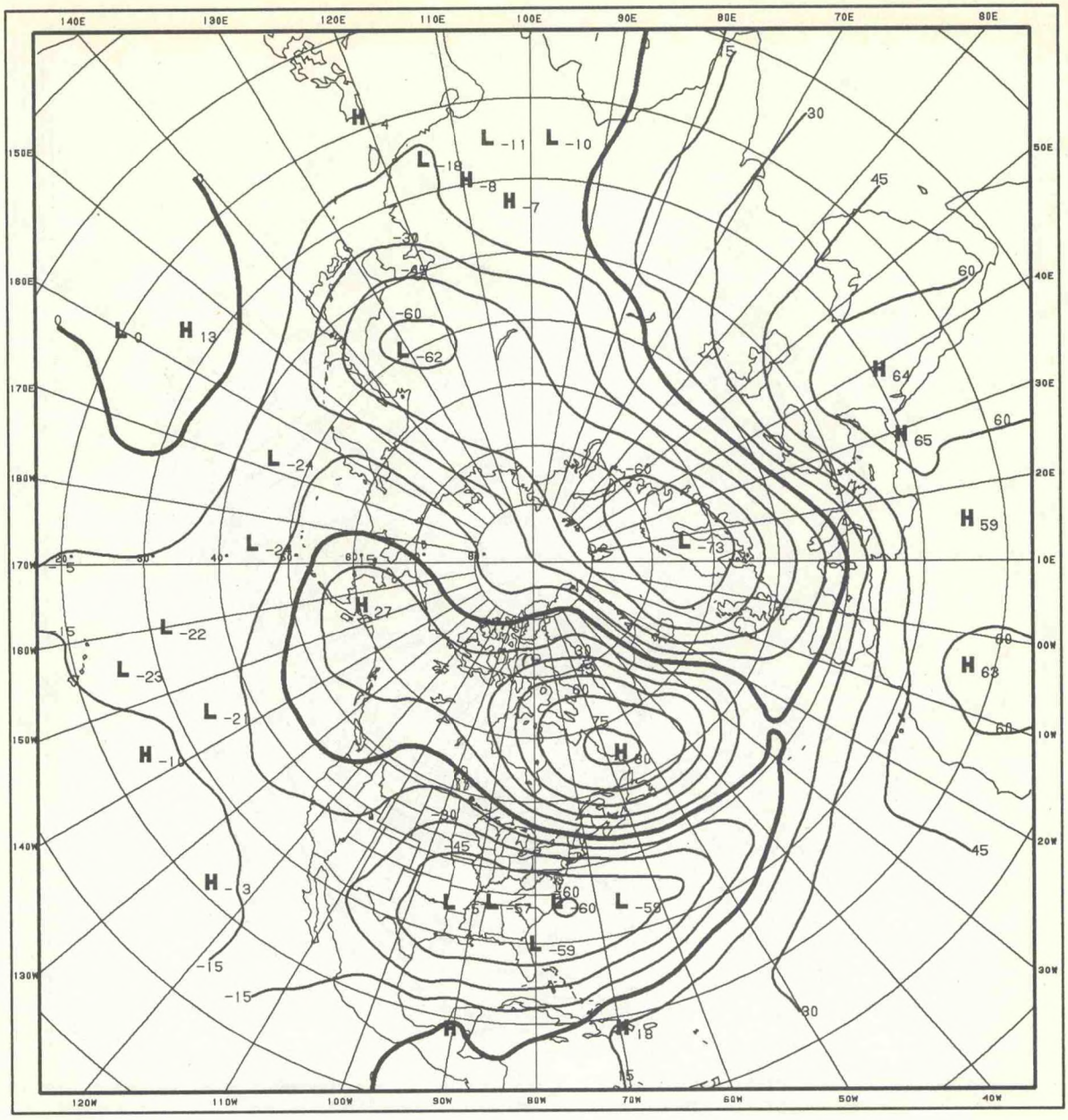

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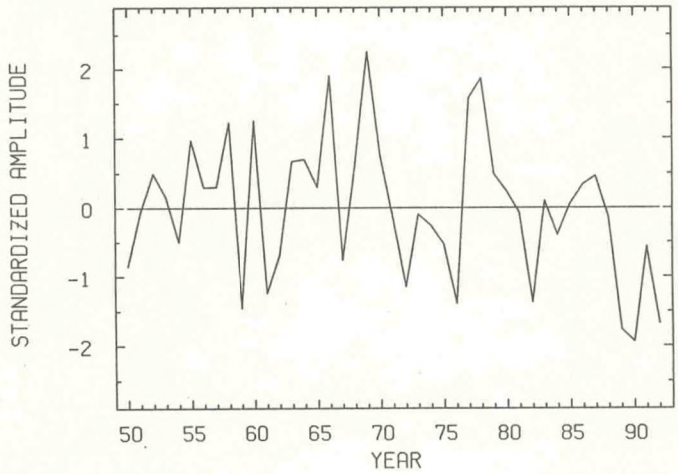

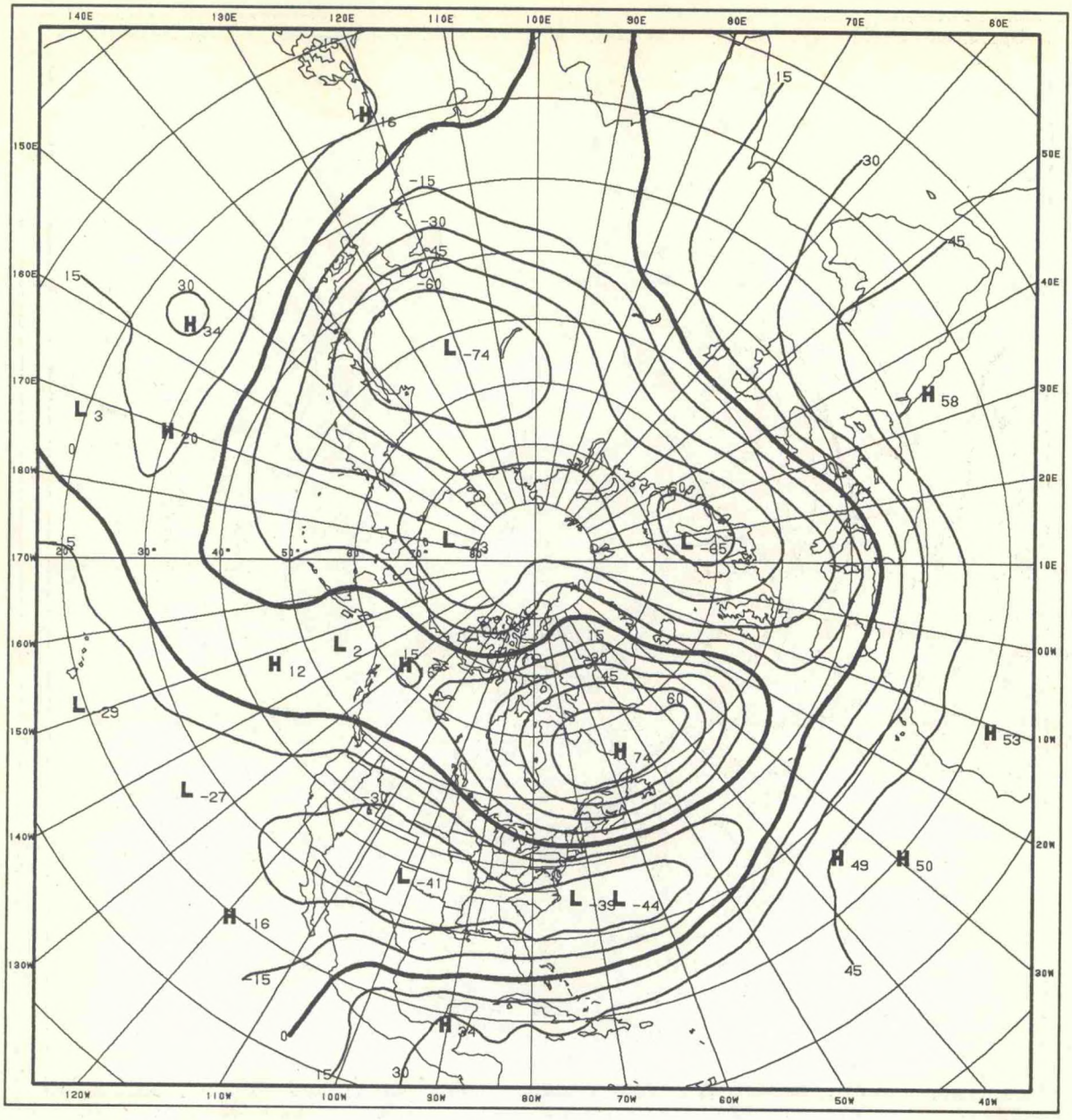

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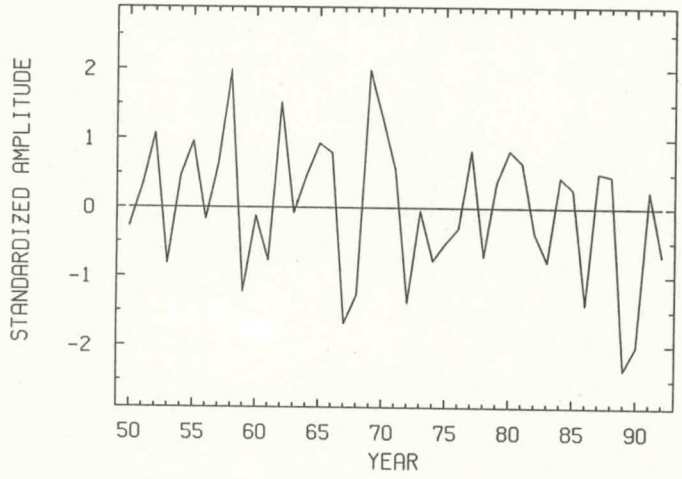

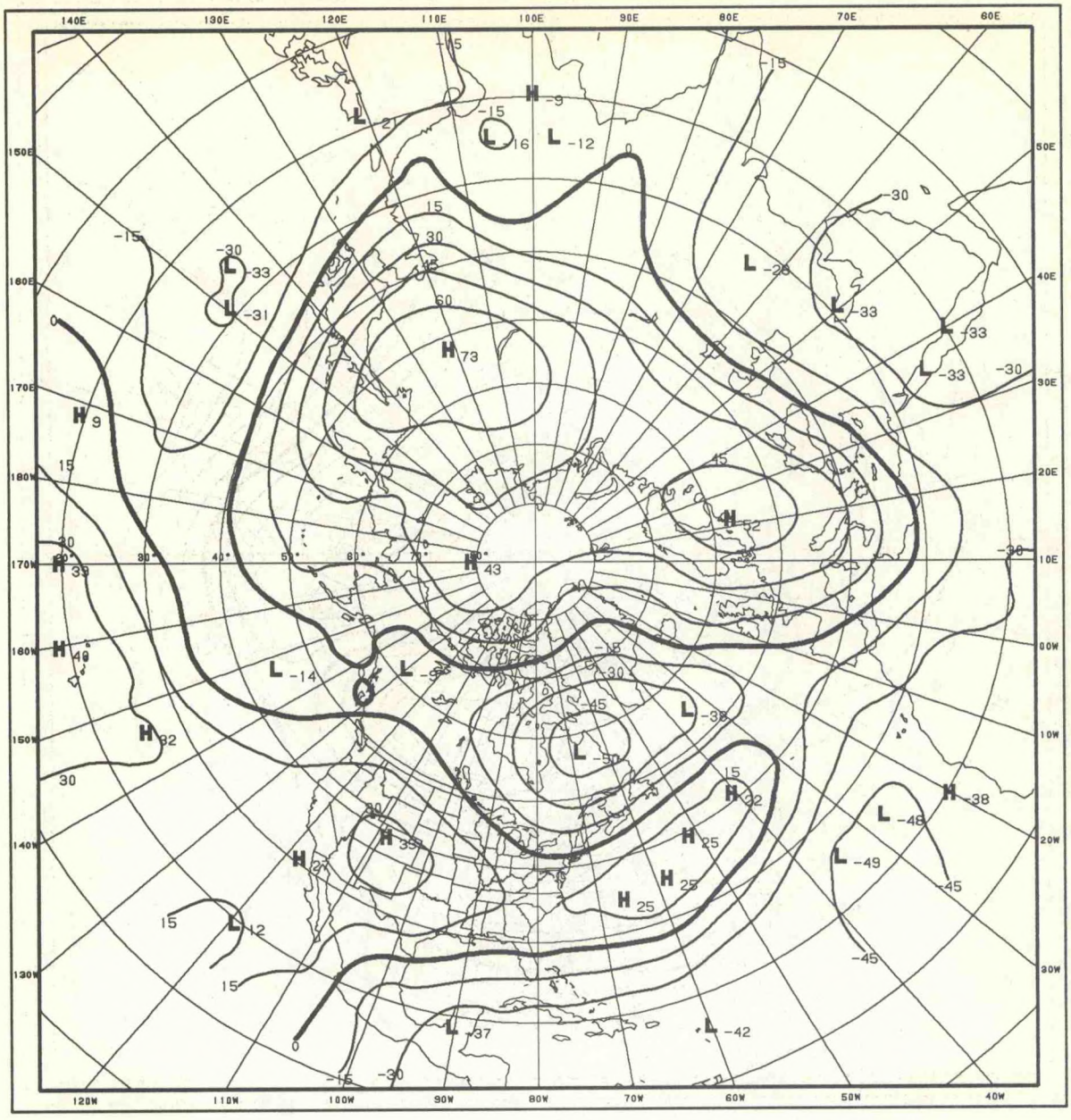

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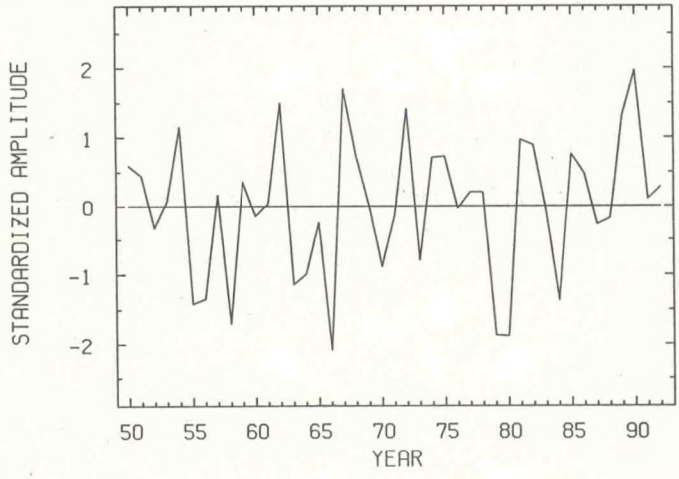

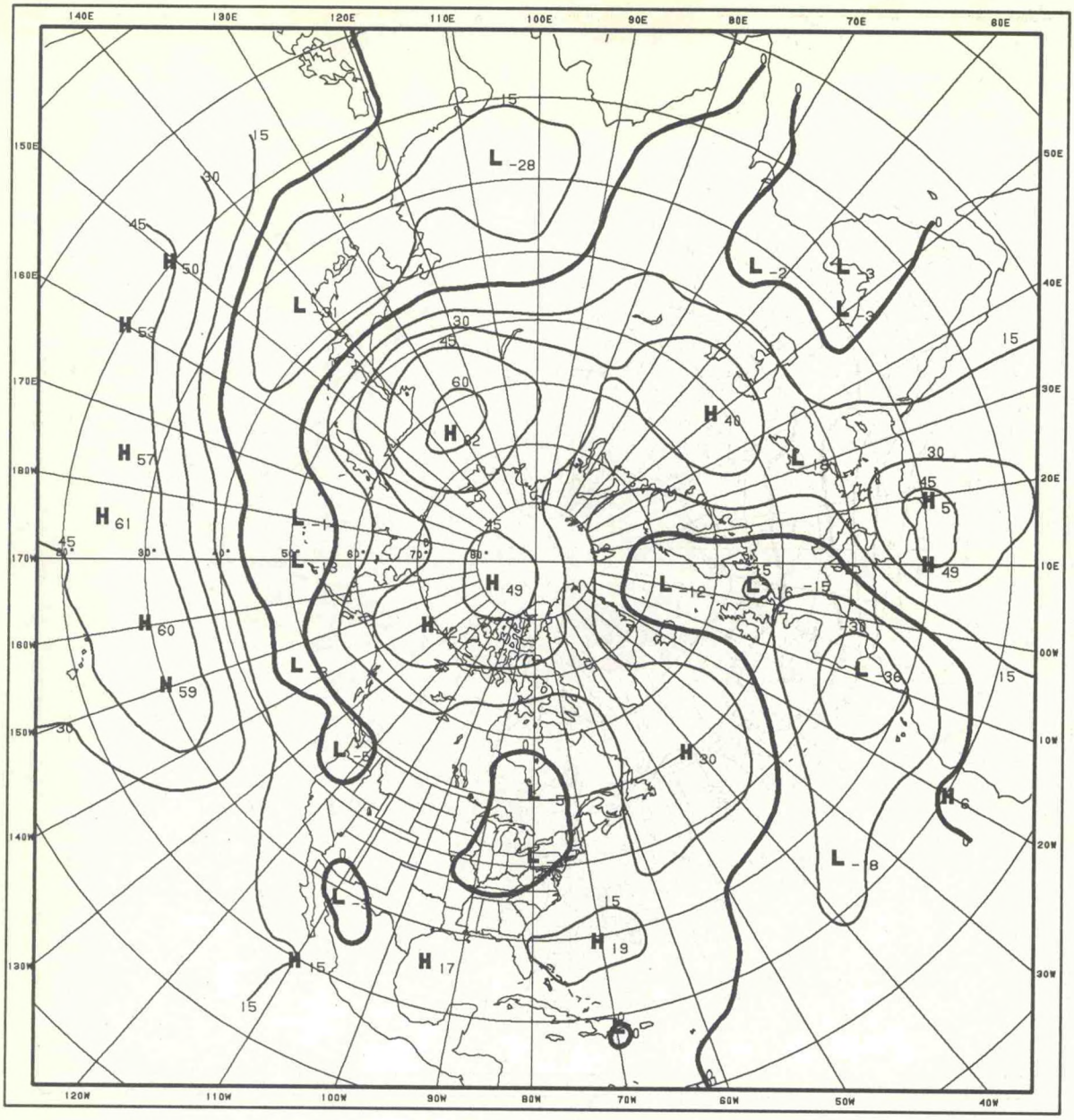

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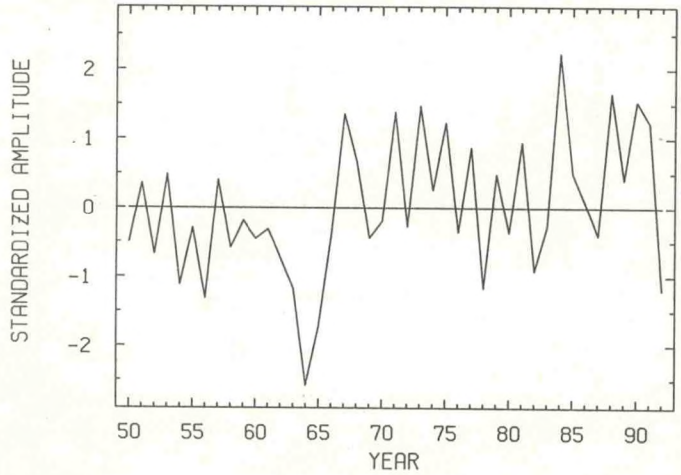

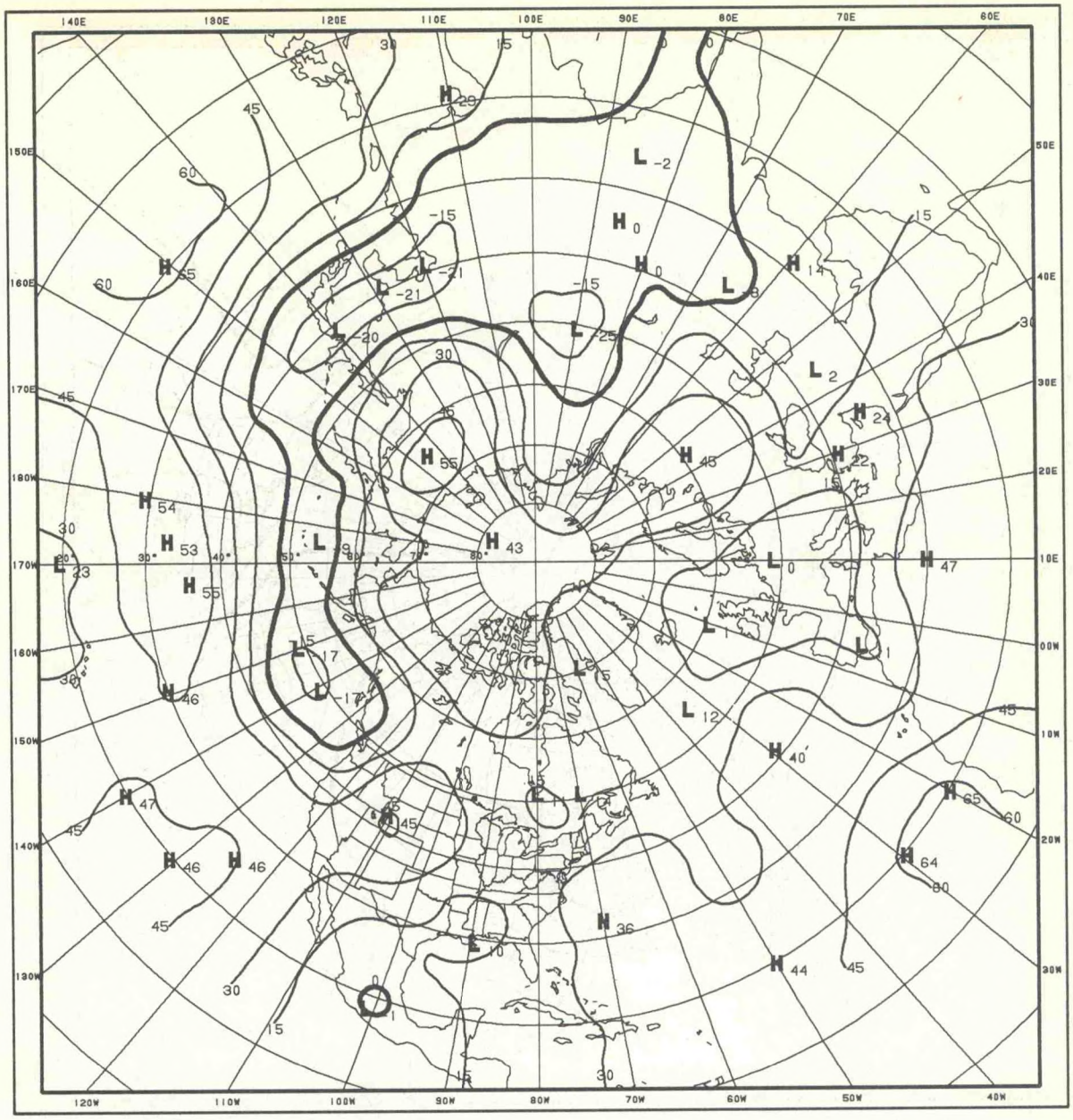

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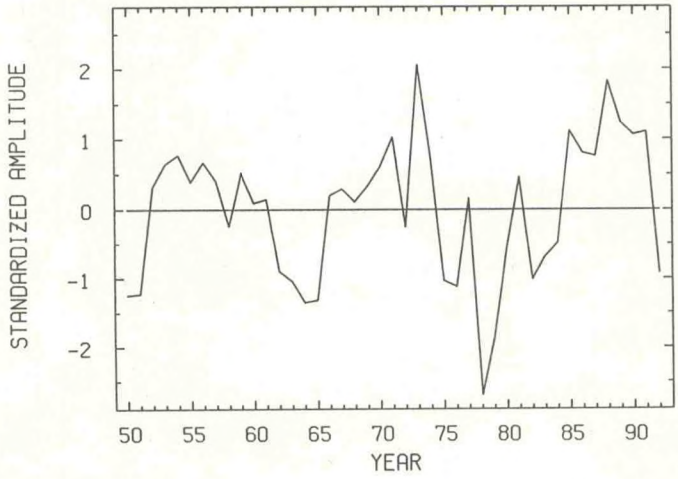

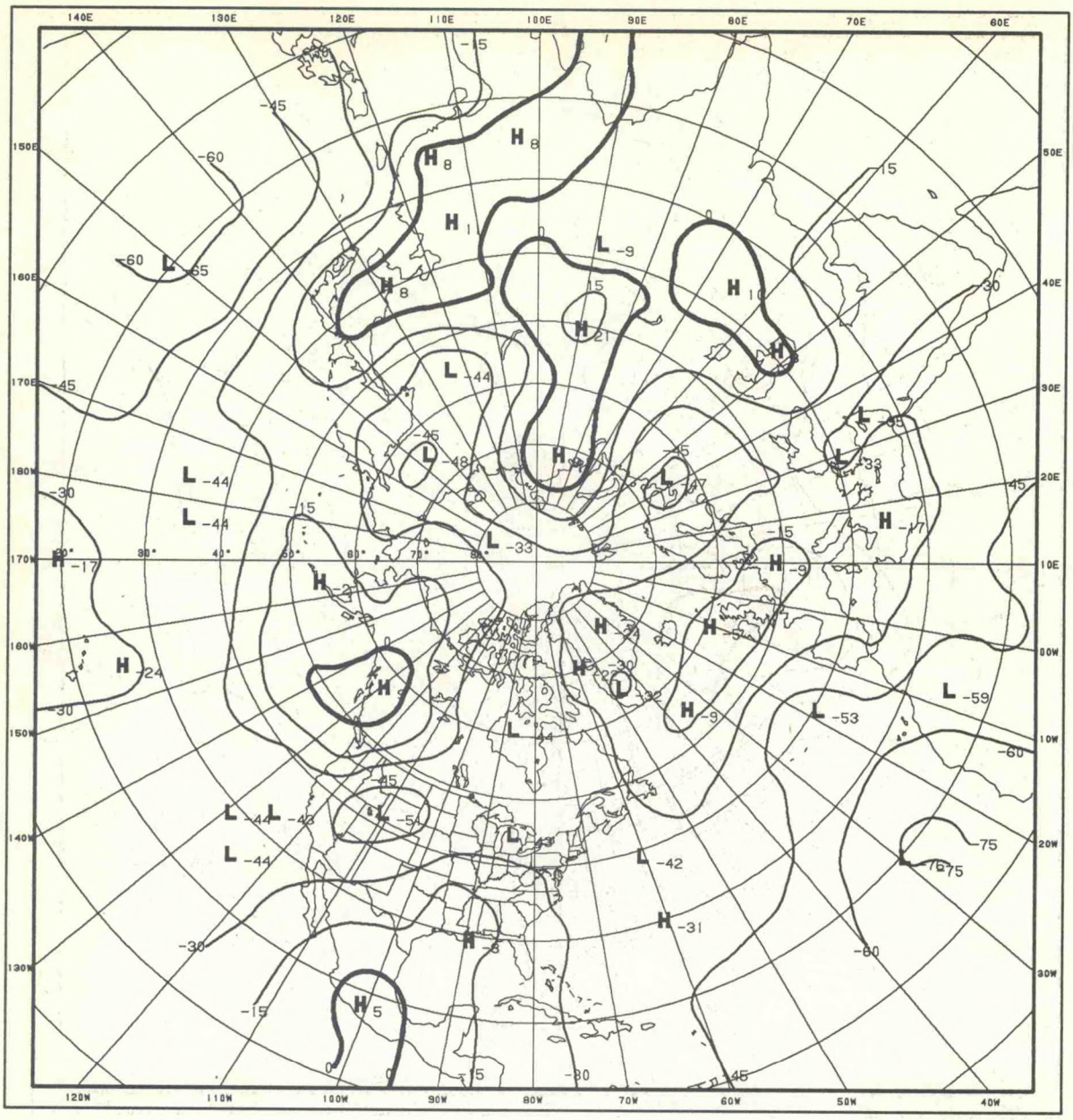

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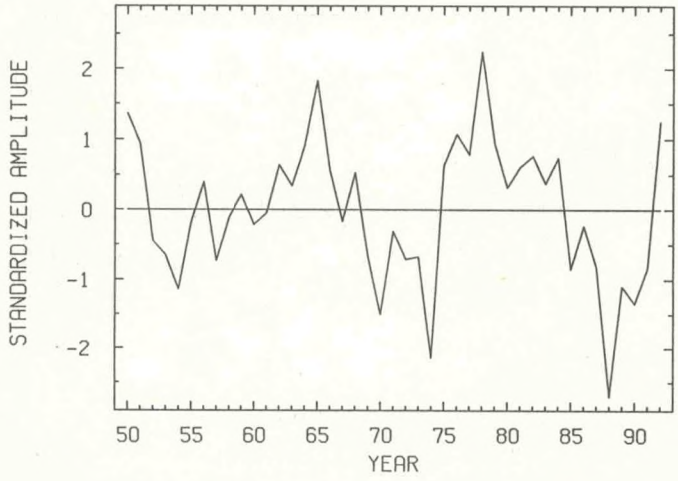

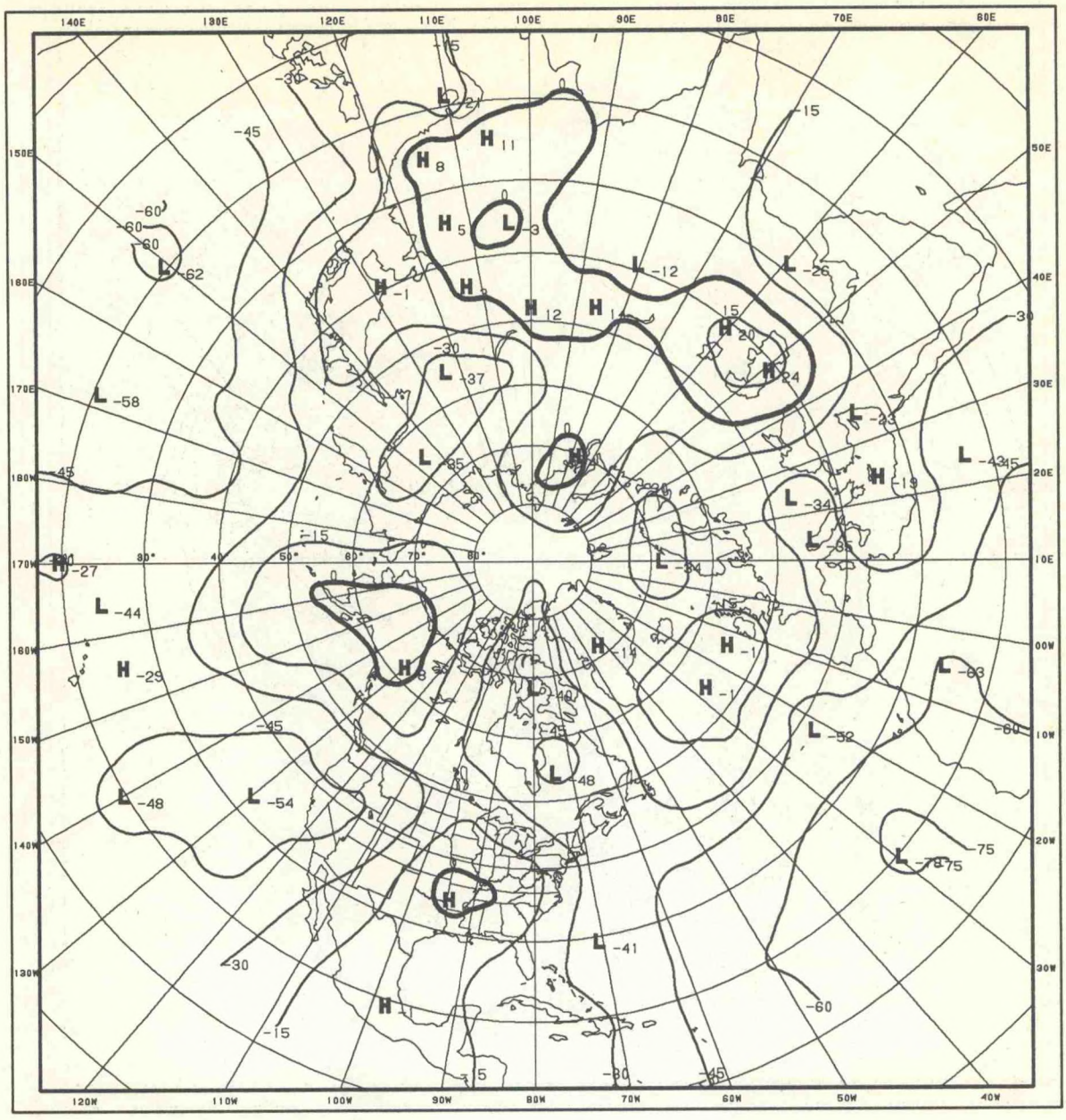

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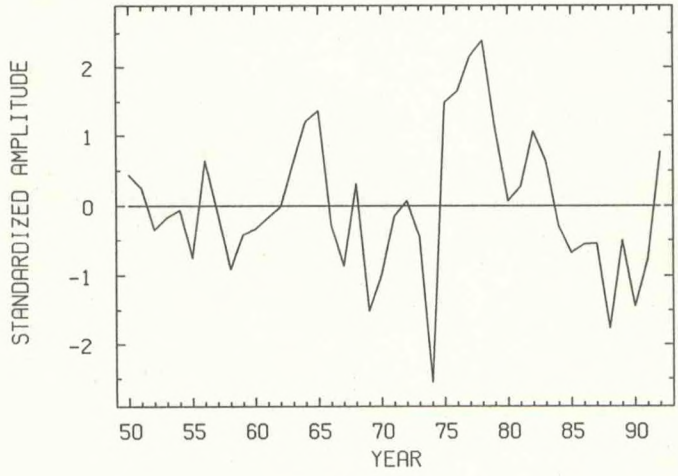

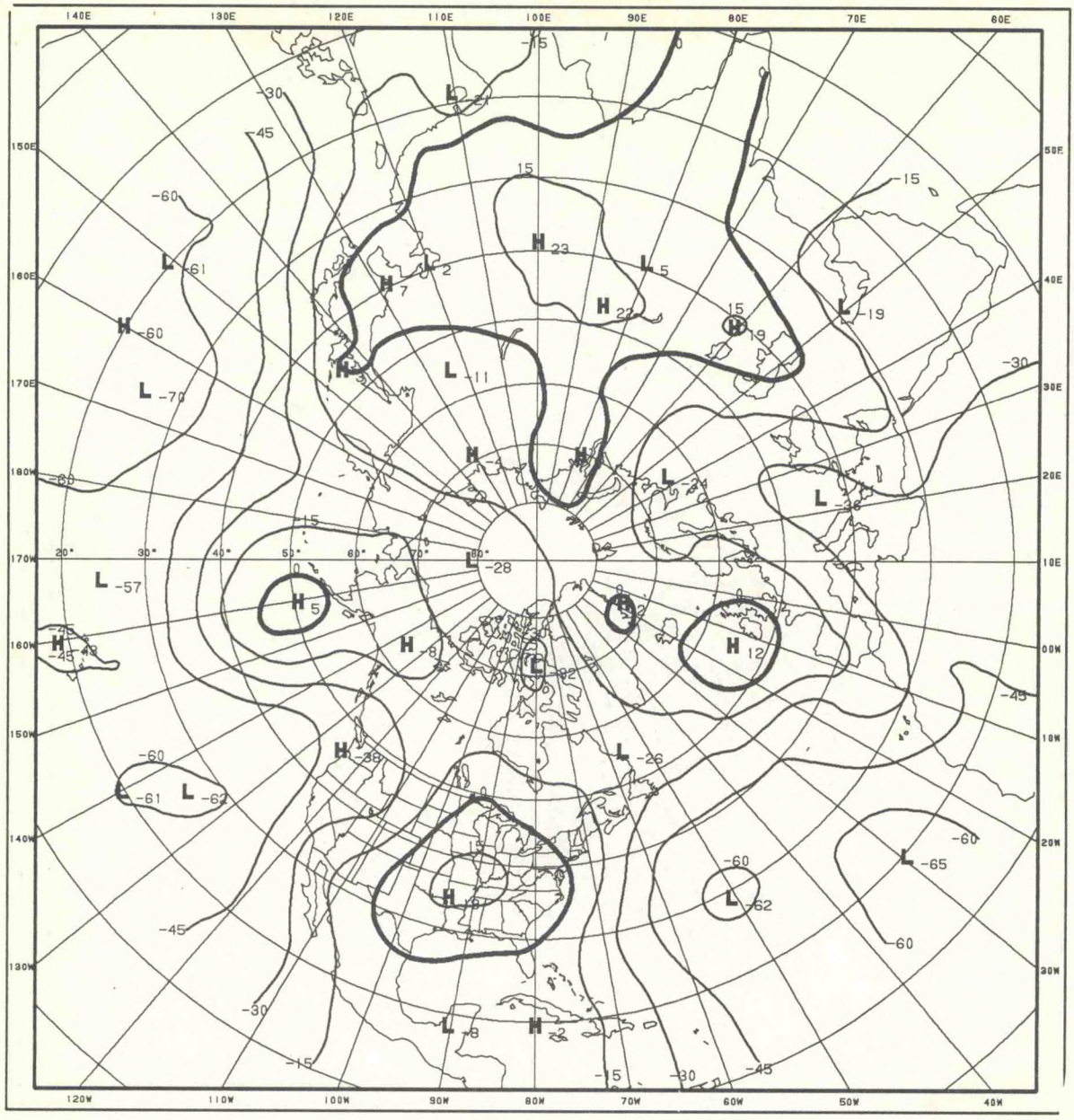

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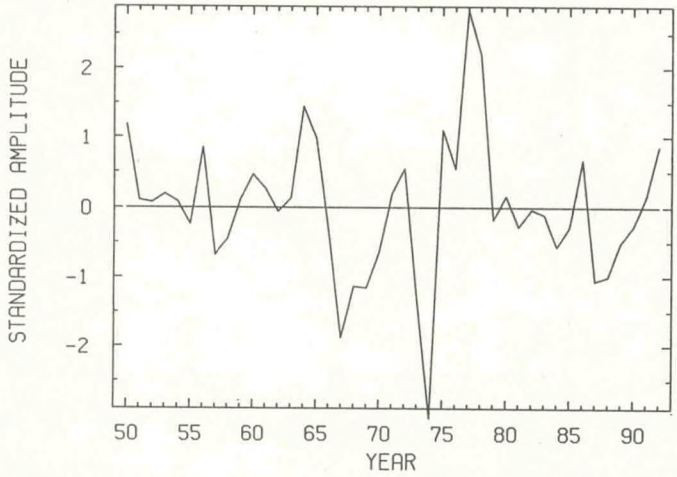

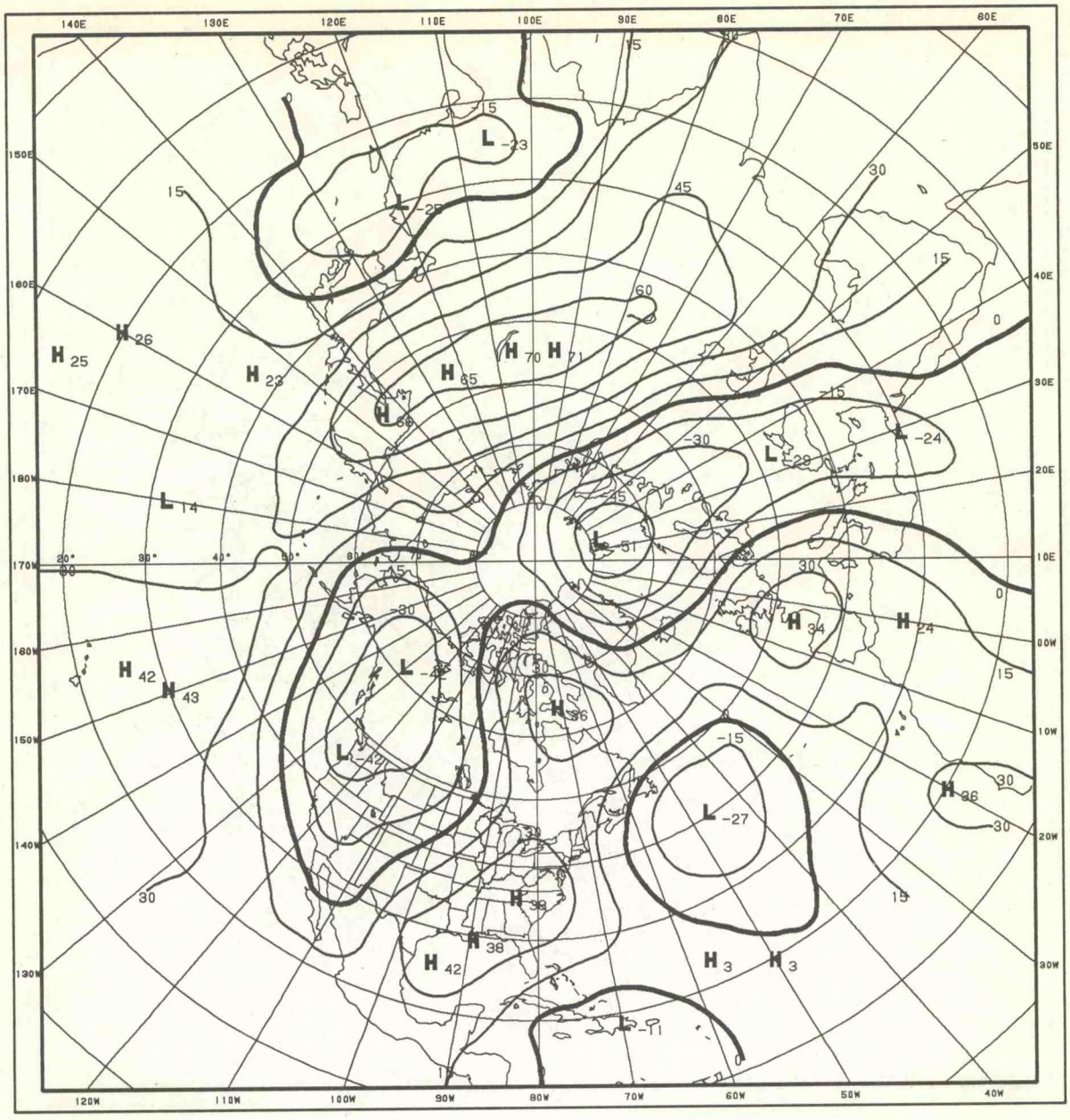

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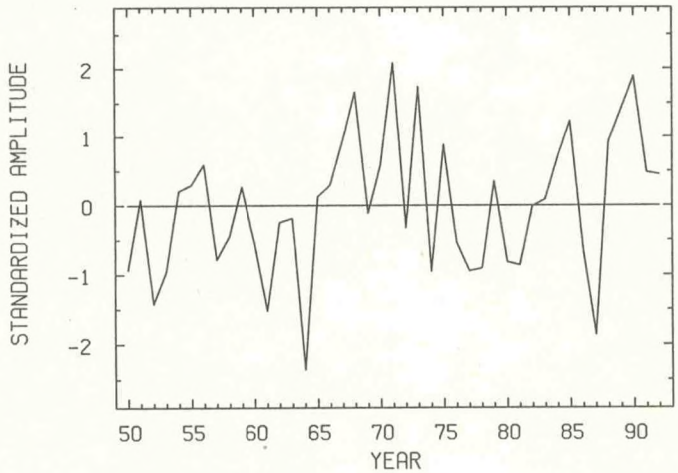

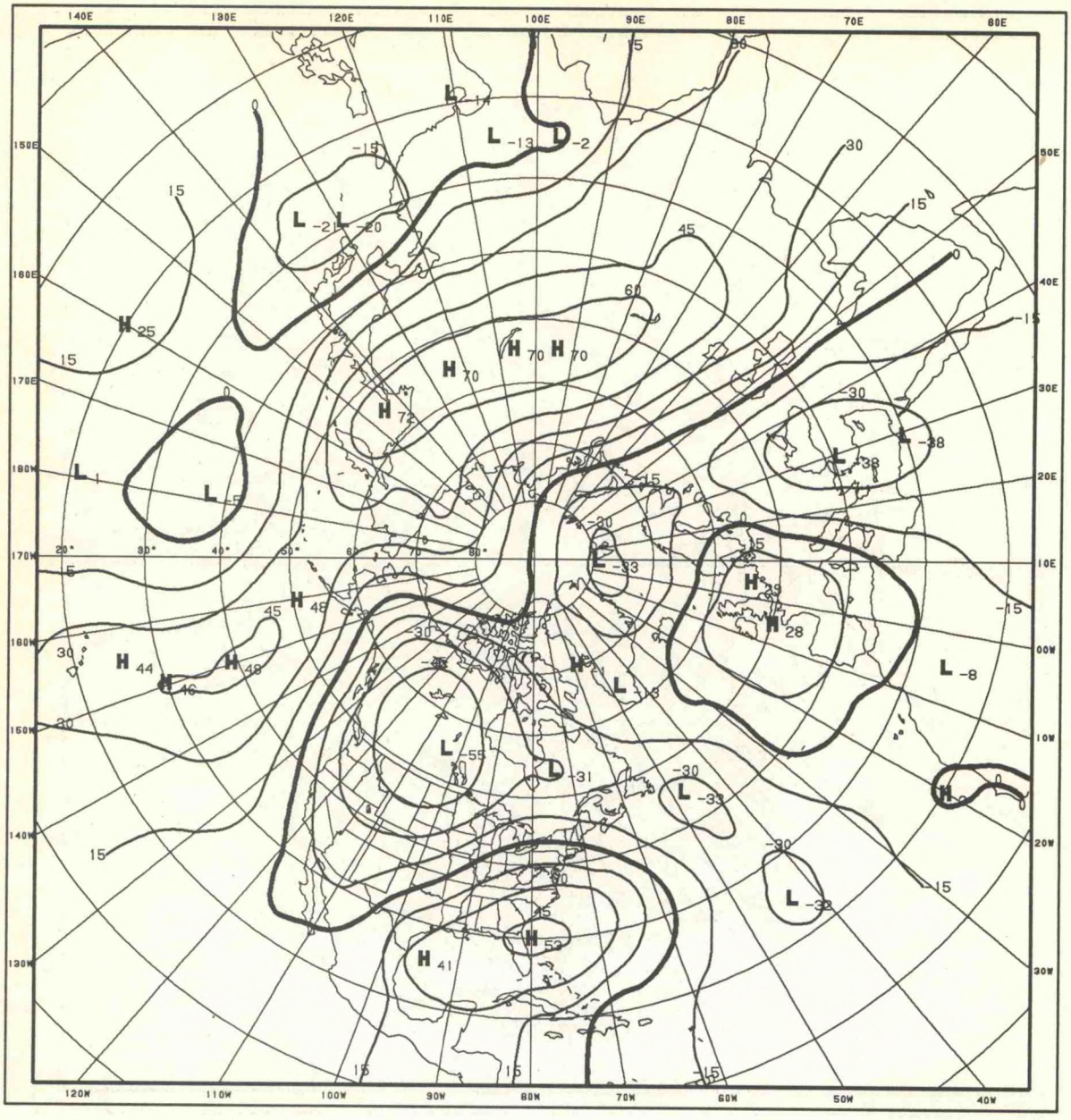

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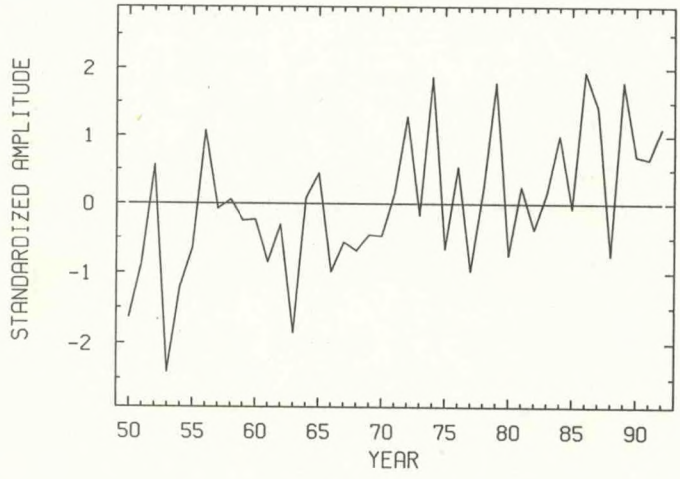

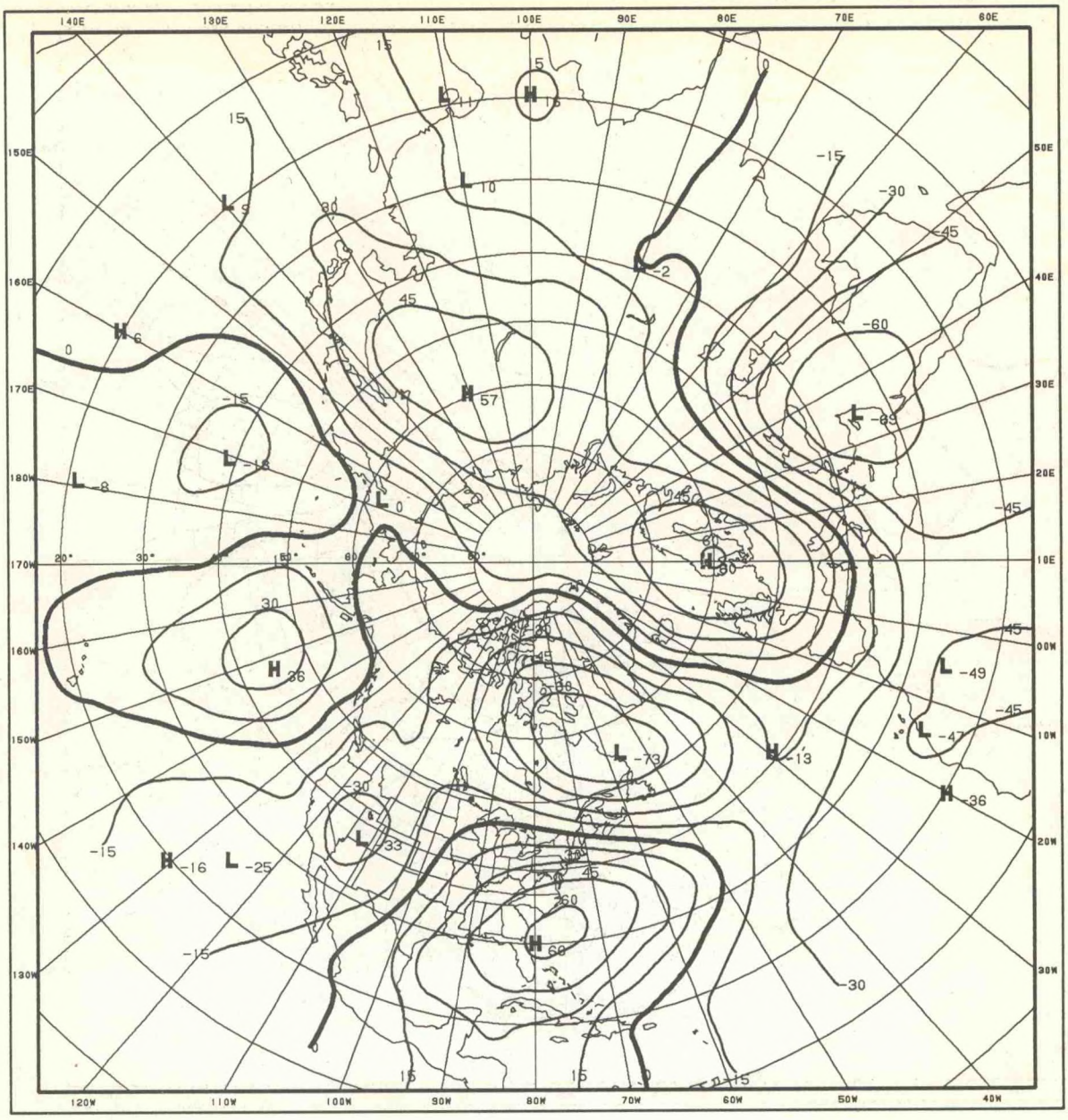

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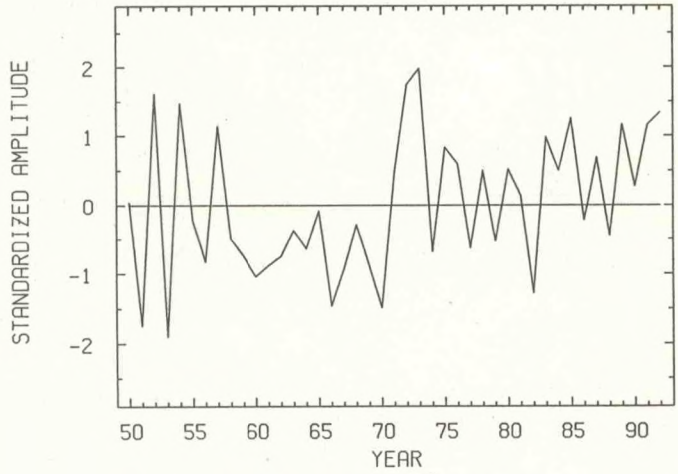

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