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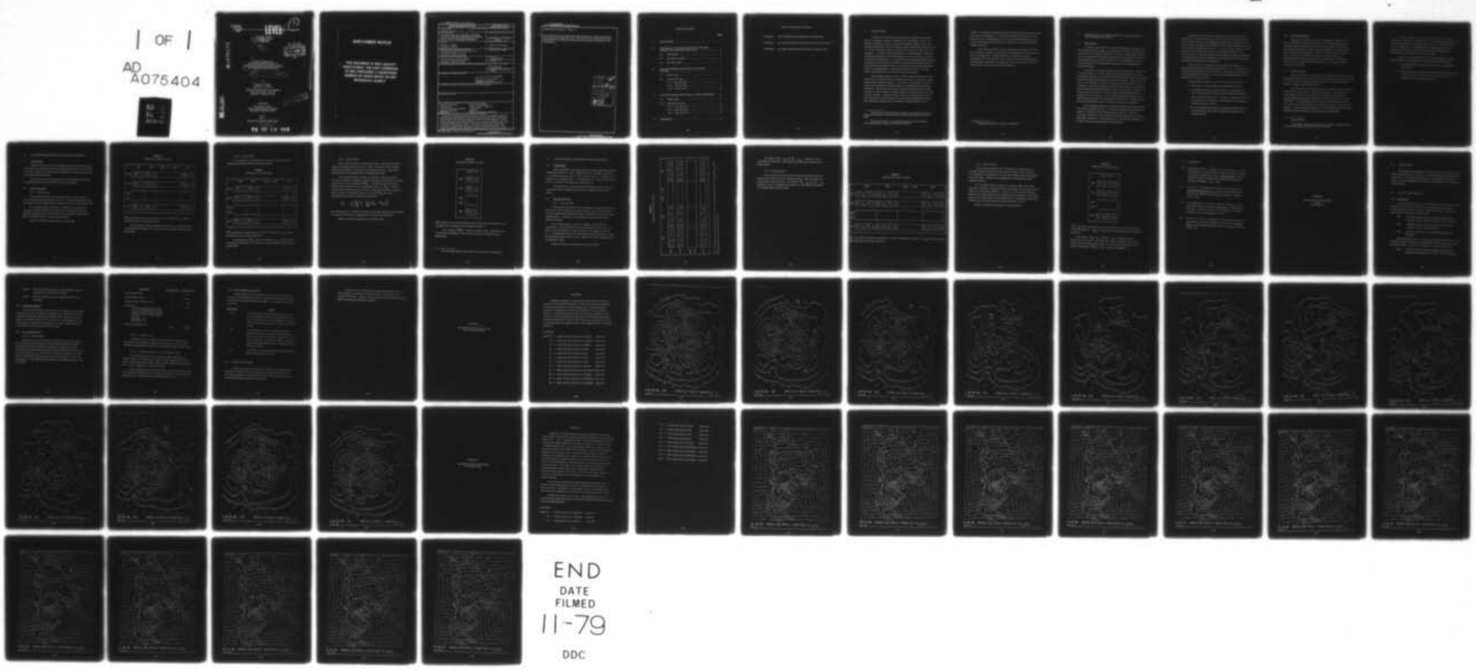

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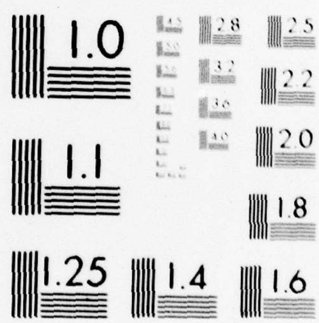
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(11) October 1978

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MONTHLY MEAN AND STANDARD DEVIATION FIELDS OF SEA-LEVEL PRESSURE AND SURFACE WIND FOR THE NORTHERN HEMISPHERE

(9) Technical rept.,

by

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

In March 1978 there became available a Northern Hemisphere history of analyzed sea-level pressure fields and diagnosed wind fields covering the period January 1946 through December 1977 at 6-hourly intervals. These fields have been used to generate Data Sets containing monthly-mean, and all-years monthly-mean, fields of sea-level pressure and surface wind components together with associated fields of standard deviation. This Report is designed to be suitable for dissemination with data charts and/or

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Continuation of Block 20. Abstract

Cont'd data tape fields and provides background information, format specifications and contents of the new Data Sets. All-years monthly-mean fields of sea-level pressure and surface wind (speed and direction) are presented in the Appendices.

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TABLE OF CONTENTS (Continued)

1. INTRODUCTION

In March 1978, Meteorology International Incorporated completed a series of projects on behalf of FNWC which culminated, in part, in a Northern Hemisphere history of analyzed sea-level pressure fields[1] and diagnosed wind fields covering the period January 1946 through December 1977 in 6-hourly intervals--a total of some 47,000 fields for each of the two parameters. In effect these fields provide a time-sequence of sea-level pressure and diagnosed wind every 6 hours for a 32-year period at any point in the Northern Hemisphere. The fields[2] of sea-level pressure were produced by applying a consistent state-of-the-art analysis technique (the Fields by Information Blending methodology) to a very extensive data base (Tape Data Family-11 and Supplements, augmented by FNWC data sets). The wind fields were diagnosed from the fields of sea-level pressure.

Time-averaged mean fields of sea-level pressure and surface wind, together with associated fields of standard deviation, are required for many meteorological purposes ranging, for example, from studies of climatic trends to the evaluation of certain aspects of extended-range forecasting techniques. The best fields of mean sea-level pressure and wind hitherto available for such purposes have been compiled from sequences of real-time synoptic analyses. However in marine areas the real-time observational data contributing to these analyses was much less comprehensive than the data collections available for the reanalysis of Marine History and, in

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[1]Known as the "Marine History" because of the emphasis placed on improving the quality of historical sea-level pressure analyses in marine areas.

[2]All fields referred to in this Report utilize the standard FNWC 63x63 analysis grid, polar stereographic projection.

addition, the analysis techniques employed changed with time as improvements were made and implemented. Thus one readily-apparent application of the Marine History is the determination of improved time-averaged mean fields of sea-level pressure and surface wind, together with associated fields of standard deviation.

These improved fields have been compiled from the Marine History and this Report, designed to be suitable for dissemination with data charts and/or data tape files, provides background information and format specifications[3] for the new data sets. Details of the Fields by Information Blending (FIB) methodology, the production of the Marine History, and the wind algorithm, are to be found in the References.

[3]Format specifications are given in Appendix A.

2. BACKGROUND OF THE MARINE HISTORY OF SEA-LEVEL PRESSURE AND DIAGNOSED WIND FIELDS

2.1 Data Sources

The FNWC copy of TDF-11, including Supplements, occupies over 550 large-reel magnetic tapes, the total number of reports being in excess of 50 million for the period 1854-1974. The reports in this FNWC "Marine Deck" are organized by Marsden square; within each Marsden square they are organized by year, and then by month. This organization is suitable for the compilation of climatological summaries but is inappropriate for synoptic analyses.

To establish a synoptic marine data base necessary for a reanalysis of Marine History, the FNWC Marine Deck was processed to extract, synoptically organize, and compact the observed values of sea-level pressure, and wind direction and speed, for the period 1946-1972. Data for the years 1973 to 1975 required to complete the 30-year period 1946-1975 was to be provided by marine data obtained by FNWC during the course of conducting routine operational synoptic analyses of sea-level pressure. However, for reasons given in Reference [1], the procedure eventually adopted was to reanalyze to 1971 and then to "add on" the high quality FIB analyses then being produced by FNWC to cover the period 1972-1975. An additional two years was subsequently added to cover the 32-year period 1946-1977.

Any hemispheric analysis of sea-level pressure cannot be performed using marine observations only. To carry out the reanalysis land data was essential, particularly from island and coastal stations. However no ready-made collection of land reports was available which could make any significant contribution to the reanalysis and, because of the magnitude of the task, such a collection could not be undertaken.

The problem of acquiring the information content provided by land observations, without actually assembling a data base of individual reports, was resolved by the use of historical surface-pressure analyses--these fields include all relevant land, island and ship reports which were available at the time the analysis was performed. It was not known, however, which stations actually contributed reports to each synoptic analysis of the available history. How the problems of extracting the essential information from each historical field and effecting its assimilation into the reanalysis were resolved is described in Reference [1].

Another source of information for any particular analysis of a meteorological parameter is the preceding analysis; i.e., information that has been carried forward along the time axis. The steering field necessary to carry information along the time axis by kinematical extrapolation was provided by the SR_{500} field [2].

The input data for analysis at each map time thus consisted of:

a. Ship reports from the synoptically organized Marine Deck.

b. The history field for the current map time. (Missing history fields were generated by forward-and-backward extrapolation.)

c. The field previously analyzed. (In order to maximize the yield and utilization of information, the reanalysis was designed to progress backward-in-time.)

d. The steering field based on the geostrophic wind derived from the SR-component of the 500-mb height field nearest to the current map time.

2.2 The Analysis System

The analysis system utilized for the reanalysis of Marine History was an application of the Fields by Information Blending methodology [3]. The data sources described above were provided as input to the system, which generated 6-hourly fields of sea-level pressure on a 63x63 analysis grid for the Northern Hemisphere. These fields were stored on magnetic tape, initially in a high-density format (9-track tape; 1600 b.p.i.). Subsequently this format was converted to NEDN format[1] (7-track tape; 800 b.p.i.) this storage density allowing one year of Marine History to be stored on each tape.

2.3 The Wind Fields

Wind fields (speed and direction) were diagnosed for the FNWC 63x63 analysis grid from the pressure fields using the algorithm originally developed for use in the FNWC Singular Sea/Swell Model [4]. The wind fields were stored on magnetic tape in NEDN format.

Prior to production the wind algorithm was examined in detail by both FNWC and MII with a view to effecting improvements. A comparison was made between over 2.3 million wind speeds reported by ships with the corresponding diagnosed wind speeds; no significant statistical bias was uncovered.[2] Other independent investigators had previously established that the wind algorithm produces no systematic bias with regard to wind direction. It was concluded therefore that no modification to the formulation could be devised which gave a significant overall improvement.

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[1] See Appendix A.

[2] On average, diagnosed wind speeds were found to be approximately 1.8% low when compared with observed wind speeds.

It should be noted that the wind algorithm computes a quasi-geostrophic wind from the pressure field. The algorithm has been tuned so that the computed values of wind are representative of observed surface winds in marine areas. For land areas the computed winds should be interpreted as quasi-geostrophic winds--they are not (necessarily) representative of observed surface winds over land.

In addition, the wind defined by the pressure gradient in tropical regions may not be representative of observed winds for two reasons:

a. The geostrophic wind relationship becomes less meaningful in low latitudes.

b. Tropical cyclones are generally below the resolution capabilities of the grid used for pressure analysis and hence will not be represented in the diagnosed wind field.

3. THE TIME-AVERAGED MEAN FIELDS OF SEA-LEVEL PRESSURE

3.1 Source Fields

These consisted of the 46,752 analyzed fields of sea-level pressure for the Northern Hemisphere covering the period 00Z 01JAN46 to 18Z 31DEC77 in 6-hourly intervals, each field being represented by 63x63 grid points on a polar stereographic projection.

Three data sets of time-averaged mean fields and associated fields of standard deviation were compiled from the source fields.

3.2 The SLP Data Sets

3.2.1 Data Set SLP1

This contains 384 fields of sea-level pressure, each an average over one calendar month from JAN 46 to DEC 77, and ordered chronologically. Each field of SLP is accompanied by an associated field of standard deviation.

For a calendar month of 30 days, for example, 120 source fields (30 days x 4 analyses per day) contributed to the monthly mean value of sea-level pressure; these 120 fields were used to compute the associated field of standard deviation for that particular month.

Table 3.1 shows the organization of Data Set SLP1.

Table 3.1

Organization of Data Set SLP1.

	JAN	FEB	MAR ---- NOV	DEC
1946	$\overline{SLP}_J$, σ_J	$\overline{SLP}_F$, σ_F		$\overline{SLP}_D$, σ_D
1947	$\overline{SLP}_J$, σ_J	$\overline{SLP}_F$, σ_F		$\overline{SLP}_D$, σ_D
1948 : 1976				
1977	$\overline{SLP}_J$, σ_J	$\overline{SLP}_F$, σ_F		$\overline{SLP}_D$, σ_D

($\overline{SLP}_M$ denotes the monthly mean field of SLP for month M , σ_M being the associated field of standard deviation.)

The 384 fields of $\overline{SLP}_M$ and the 384 fields of σ_M, arranged in pairs in accordance with Table 3.1, are stored on one large-reel magnetic tape in NEDN format.

3.2.2 Data Set SLP2

This contains the same 384 pairs of fields as Data Set SLP1 but ordered by like-month rather than chronologically.

Table 3.2

Organization of Data Set SLP2.

	1946	1947	1948 ---- 1976	1977
JAN	$\overline{SLP}_J$, σ_J	$\overline{SLP}_J$, σ_J		$\overline{SLP}_J$, σ_J
FEB	$\overline{SLP}_F$, σ_F	$\overline{SLP}_F$, σ_F		$\overline{SLP}_F$, σ_F
MAR ⋮ NOV				
DEC	$\overline{SLP}_D$, σ_D	$\overline{SLP}_D$, σ_D		SLP_D , σ_D

($\overline{SLP}_M$ denotes the monthly mean field of SLP for month M , σ_M being the associated field of standard deviation.)

The 384 fields of $\overline{SLP}_M$ and the 384 fields of σ_M , arranged in pairs in accordance with Table 3.2, are stored on one large-reel magnetic tape in NEDN format.

3.2.3 Data Set SLP3

This contains 12 fields of sea-level pressure, one for each calendar month and averaged over all 32 years. (These correspond to the "standard" monthly climatologies to be found in climatological atlases.) Each field is accompanied by an associated field of standard deviation.

For a calendar month of 30 days, for example, 3840 source fields (32 years x 30 days x 4 analyses per day) contributed to the all-years monthly mean field of sea-level pressure, $\overline{SLP}_{\overline{M}}$. However these monthly fields actually were computed from the 32 appropriate fields of $\overline{SLP}_M$. Similarly, the associated all-years monthly fields of standard deviation were computed from the 32 pairs of appropriate fields of σ_M and $\overline{SLP}_M$ rather than (unnecessarily) from the contributing source fields:

$$\sigma^2_{\overline{M}} = \frac{1}{32}\left[\sum_{32}\sigma^2_M + \sum_{32}\left(\overline{SLP}_M - \overline{SLP}_{\overline{M}}\right)^2\right]$$

at each grid point. It should be noted that the standard deviation corresponding to a mean field is that of all source fields making up the mean field.

Table 3.3 shows the organization of Data Set SLP3.

Table 3.3

Organization of Data Set SLP3.

	1946 to 1977
JAN	$\overline{SLP}_{\overline{J}}$, $\sigma_{\overline{J}}$
FEB	$\overline{SLP}_{\overline{F}}$, $\sigma_{\overline{F}}$
MAR ⋮ NOV	
DEC	$\overline{SLP}_{\overline{D}}$, $\sigma_{\overline{D}}$

($\overline{SLP}_{\overline{M}}$ denotes the all-years monthly mean field of SLP for calendar month M, $\sigma_{\overline{M}}$ being the associated field of standard deviation.)

The 12 fields of $\overline{SLP}_{\overline{M}}$ [1] and the 12 fields of $\sigma_{\overline{M}}$, arranged in pairs in accordance with Table 3.3, are stored on one reel of magnetic tape in NEDN format.

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[1] The all-years monthly mean fields of SLP are shown in Appendix B.

4. THE TIME-AVERAGED MEAN FIELDS OF WIND COMPONENTS

4.1 Source Fields

These consisted of the diagnosed fields of wind speed and direction interpreted in terms of u and v components where, by FNWC convention, u is directed along the I-axis of the analysis grid (u is positive in the direction of increasing I) and v is directed along the J-axis of the analysis grid (v is positive in the direction of increasing J).

Three data sets of time-averaged mean fields of surface wind and associated fields of standard deviation were compiled from the source fields.

4.2 The Wind Data Sets

4.2.1 Data Set WUV1

This contains 384 fields of the u-component of diagnosed wind, and 384 fields of the v-component of diagnosed wind, each of the 768 fields being an average over one calendar month from JAN46 to DEC77 and ordered chronologically. Each field is accompanied by an associated field of standard deviation.

For a 30-day calendar month, for example, 120 fields of the u-component of wind contributed to the monthly mean field of u and 120 fields of the v-component of wind contributed to the monthly mean field of v. The appropriate set of 120 component-fields were utilized to compute the standard deviations of the u and v components of wind respectively for that particular month.

Table 4.1 shows the organization of Data Set WUV1.

Table 4.1

Organization of Data Set WUV1.

	JAN	FEB	MAR ---- NOV	DEC
1946	$\overline{u_J}, \sigma_{uJ}; \overline{v_J}, \sigma_{vJ}$	$\overline{u_F}, \sigma_{uF}; \overline{v_F}, \sigma_{vF}$		$\overline{u_D}, \sigma_{uD}; \overline{v_D}, \sigma_{vD}$
1947	$\overline{u_J}, \sigma_{uJ}; \overline{v_J}, \sigma_{vJ}$	$\overline{u_F}, \sigma_{uF}; \overline{v_F}, \sigma_{vF}$		$\overline{u_D}, \sigma_{uD}; \overline{v_D}, \sigma_{vD}$
1948 ⋮ 1976				
1977	$\overline{u_J}, \sigma_{uJ}; \overline{v_J}, \sigma_{vJ}$	$\overline{u_F}, \sigma_{uF}; \overline{v_F}, \sigma_{vF}$		$\overline{u_D}, \sigma_{uD}; \overline{v_D}, \sigma_{vD}$

($\overline{u_M}$, $\overline{v_M}$ denote the monthly mean fields of u and v respectively for month M, σ_{uM} and σ_{vM} being the associated fields of standard deviation.)

The fields of $\overline{u_M}$, σ_{uM} and $\overline{v_M}$, σ_{vM}, arranged in pairs in accordance with Table 4.1, are stored on one large-reel magnetic tape in NEDN format.

4.2.2 Data Set WUV2

This contains the same 768 pairs of fields as Data Set WUV1 but ordered by like-month rather than chronologically. Table 4.2 shows the organization of Data Set WUV2. The fields of $\overline{u_M}$, σ_{uM} and $\overline{v_M}$, σ_{vM}, arranged in pairs in accordance with Table 4.2, are stored on one large-reel magnetic tape in NEDN format.

Table 4.2

Organization of Data Set WUV2.

	1946	1947	1948 ---- 1976	1977
JAN	$\overline{u_J}$, σ_{uJ} ; $\overline{v_J}$, σ_{vJ}	$\overline{u_J}$, σ_{uJ} ; $\overline{v_J}$, σ_{vJ}		$\overline{u_J}$, σ_{uJ} ; $\overline{v_J}$, σ_{vJ}
FEB	$\overline{u_F}$, σ_{uF} ; $\overline{v_F}$, σ_{vF}	$\overline{u_F}$, σ_{uF} ; $\overline{v_F}$, σ_{vF}		$\overline{u_F}$, σ_{uF} ; $\overline{v_F}$, σ_{vF}
MAR : NOV				
DEC	$\overline{u_D}$, σ_{uD} ; $\overline{v_D}$, σ_{vD}	$\overline{u_D}$, σ_{uD} ; $\overline{v_D}$, σ_{vD}		$\overline{u_D}$, σ_{uD} ; $\overline{v_D}$, σ_{uD}

($\overline{u_M}$, $\overline{v_M}$ denote the monthly mean fields of u and v respectively for month M, σ_{uM} and σ_{vM} being the associated fields of standard deviation.)

4.2.3 Data Set WUV3

This contains 12 fields of the u-component of surface wind, one for each calendar month and averaged over all 32 years, and 12 fields of the v-component of surface wind, one for each calendar month and averaged over all 32 years. Each field is accompanied by an associated field of standard deviation.

For a calendar month of 30 days, for example, 3840 source fields (32 years x 30 days x 4 analyses per day) contributed to the all-years monthly mean field of each wind component. However, as with sea-level pressure, these monthly fields actually were computed from the appropriate mean fields. Similarly, the associated all-years monthly fields of standard deviation were computed from the appropriate mean fields (see Section 3.2.3).

Table 4.3 shows the organization of Data Set WUV3.

Table 4.3

Organization of Data Set WUV3.

1946 - 1977	
JAN	$\overline{u}_{\overline{J}}, \sigma_{\overline{uJ}} ; \overline{v}_{\overline{J}}, \sigma_{\overline{vJ}}$
FEB	$\overline{u}_{\overline{F}}, \sigma_{\overline{uF}} ; \overline{v}_{\overline{F}}, \sigma_{\overline{vF}}$
MAR ⋮ NOV	
DEC	$\overline{u}_{\overline{D}}, \sigma_{\overline{uD}} ; \overline{v}_{\overline{D}}, \sigma_{\overline{vD}}$

($\overline{u}_{\overline{M}}$, $\overline{v}_{\overline{M}}$ denote the all-years monthly mean fields of u and v respectively for calendar month M, $\sigma_{\overline{uM}}$ and $\sigma_{\overline{vM}}$ being the associated fields of standard deviation.)

The fields of $\overline{u}_{\overline{M}}$, $\sigma_{\overline{uM}}$ and $\overline{v}_{\overline{M}}$, $\sigma_{\overline{vM}}$, arranged in pairs in accordance with Table 4.3, are stored on one reel of magnetic tape in NEDN format. All-years monthly mean fields of surface wind (speed and direction), computed from fields of $\overline{u}_{\overline{M}}$ and $\overline{v}_{\overline{M}}$, are given in Appendix C.

5. REFERENCES

[1] Mendenhall, Bruce R., Manfred M. Holl and Michael J. Cuming, Development of a Marine History of Analyzed Sea-Level Pressure Fields and Diagnosed Wind Fields, Technical Report, Contract N00228-76-C-3273, Meteorology International Incorporated, Monterey, California, 36 pp., 1978.

[2] Holl, M. M., Scale-and-Pattern Spectra and Decompositions, Technical Memorandum No. 3, Contract N228-(62271)60550, Meteorology International Incorporated, Monterey, California, 28 pp., 1963.

[3] Holl, Manfred M., The Upper-Air Analysis Capability, FIB/UA Introducing Weighted Spreading, Final Report, Contract N00228-75-C-2374, Meteorology International Incorporated, Monterey, California, 32 pp. plus Appendix A, 1976.

[4] Hubert, W. E. and B. R. Mendenhall* (*Meteorology International Incorporated), The FNWC Singular Sea/Swell Model, Technical Note 59, Fleet Numerical Weather Central, Monterey, California, 29 pp., 1970.

APPENDIX A

DATA FORMAT SPECIFICATIONS
AND
PLOT ROUTINE

A.1 INTRODUCTION

The purpose of this Appendix is to provide users of the FNWC Monthly Mean and Standard Deviation Fields of Sea-Level Pressure and Surface Wind components for the Northern Hemisphere with a description of the data set format. Users of the Appendix are assumed to be familiar with the associated Technical Report.

A.2 DATA SET CHARACTERISTICS

A.2.1 Organization

The sea-level pressure data set is organized in the following tape file structure where each field is a record of the indicated file and mean and standard deviation fields are paired as consecutive records. Each file is contained on a single reel of magnetic tape.

SLP1 Individual monthly mean and standard deviation fields organized chronologically from 1946 to 1977 (768 fields).

SLP2 Individual monthly mean and standard deviation fields organized by like months (768 fields).

SLP3 All-years monthly mean and standard deviation fields (24 fields).

The surface wind data set is organized similarly except that the U- and V-component mean fields and associated standard deviation fields are ordered as consecutive pairs. Each file is contained on a single mangetic tape.

WUV1 Individual monthly mean and standard deviation fields organized chronologically from 1946 to 1977 (1536 fields).

WUV2 Individual monthly mean and standard deviation fields organized by like months (1536 fields).

WUV3 All-years monthly mean and standard deviation fields (48 fields).

A.2.2 Data Tape Attributes

The data of each file has been recorded on 7-track tape at a density of 800 bits per inch. The tapes are unlabeled. The data have been written in Naval Environmental Data Network (NEDN) format. Specifics of NEDN format are provided in Sections A.2.3 and A.2.4. A full description of the NEDN format is presented in the FNWC User's Guide. Each data tape file is terminated by an end-of-information tape mark.

A.2.3 Data Characteristics

A.2.3.1 Packing Format

Each record of the files contains a packed version of a full field of 3969 (63x63) grid-point values and an associated identification (IDENT). The packed data field and IDENT are represented in 1007 60-bit words. These data are automatically unpacked if standard FNWC utility routines are used (see Section A.2.4). The first 14 60-bit words are used as the field IDENT; the remaining words contain the data points packed 4 to 1 (15 bits for each point). The following table identifies the pertinent elements of the field IDENT.

PARAMETER	WORD (60 bit)	BIT POSITIONS
Year (External BCD)	1	0-11
Month (External BCD)	2	48-59
Parameter Name (External BCD)	2	6-23
Scale Factor This value represents the number of fractional bits (integer scaling) relative to a 60-bit word, for fixed point data values contained within the field. SLP fields = 36 WND fields = 40	3	1-6
Field Title (External BCD)	9 10-13	0-36 0-60

A.2.3.2 Parameter Units

The values of the sea-level pressure parameters, when unpacked and scaled, are expressed in millibars (to the nearest 1/8 mb); the wind parameters are expressed in meters per second (to the nearest 1/128 m/sec).

A.2.3.3 Parameter Names and Date-Time-Group Coding

For sea-level pressure fields, parameter names PMM (pressure monthly mean) and PMS (pressure monthly standard deviation) have been used. For wind parameters, UMM, UMS and VMM, VMS have been used for the U- and V-components of wind respectively.

Date-time-groups have been represented as the first day of the month for all individual monthly fields. For long-term monthly fields, the year and day equal zero. In all cases the hour has been set to zero.

A.2.4 FNWC Supporting Subroutines

FNWC maintains program library subroutines which are specially designed to handle NEDN data fields. Procedures for using these routines are provided in the FNWC Subroutine Manual. The routines are identified as follows:

Subroutines	Purpose
TW	To write 6500 fields from central memory to tape or disk with standard NEDN ident (readable with routine TR). Will perform float to fix conversion if necessary and pack the data as requested. Any size field may be written.
TR	To read NEDN standard format fields (written with routine TW) from tape or disk into central memory. Will convert ident to 6500 format, unpack the data and float if requested. There are two modes: a standard search under subroutine control; or a sequential search under user control.
TI	To print a list of the identification of fields written in NEDN format by subroutine TW.

A.3 UTILITY PLOT ROUTINE

A utility plot routine is available at FNWC for plotting full northern hemisphere contour charts for any of the fields provided in the data sets. The routine operates in a conversational mode in that it prompts the user in describing the fields he desires to be plotted.

Procedures for utilizing the plot routine simply require access to a remote terminal, execution of a BEGIN procedure and provision of the requested information. Specific access procedures can be obtained from the FNWC Data Archives and Display Division.

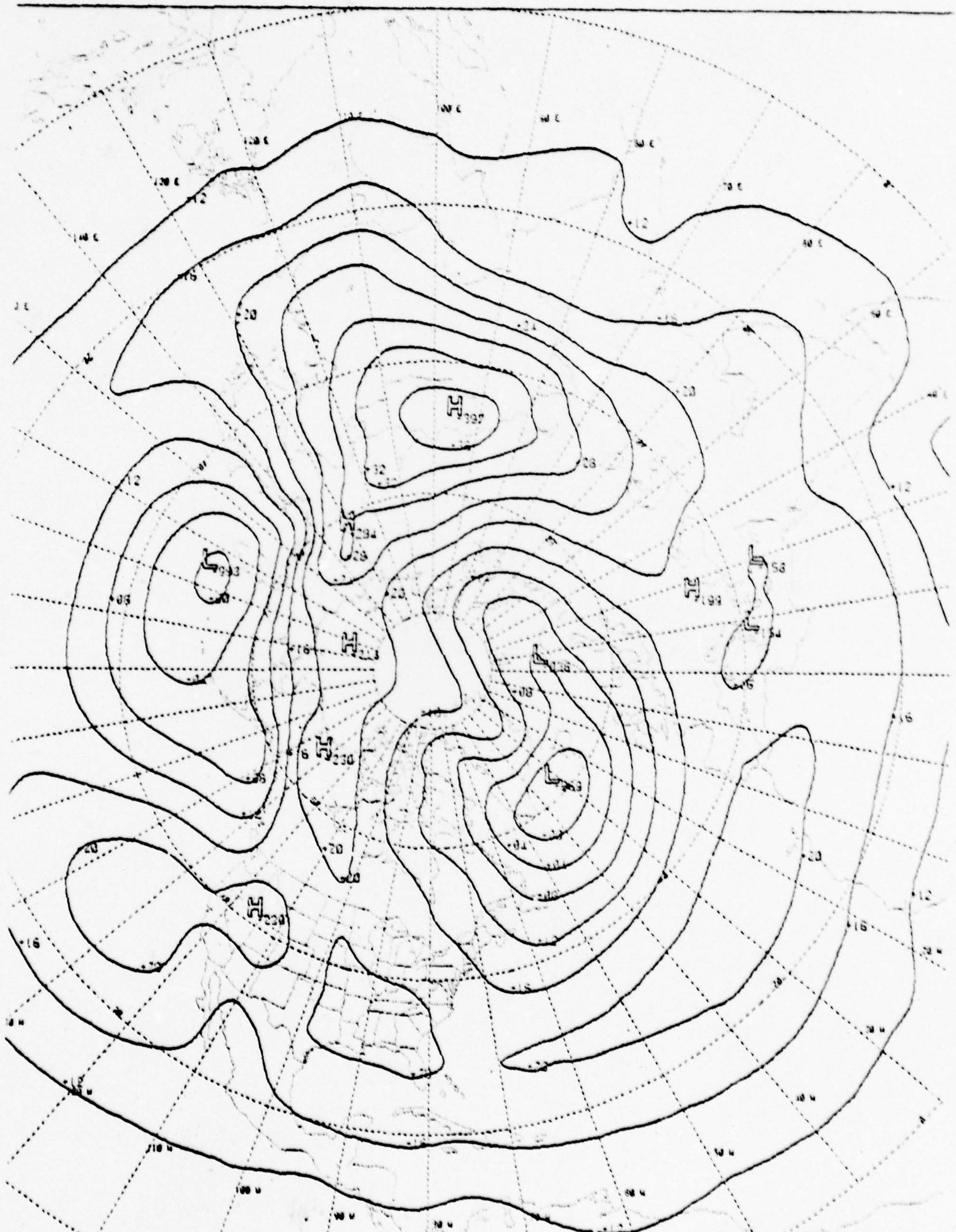
APPENDIX B

ALL-YEARS MONTHLY MEAN FIELDS OF SEA-LEVEL PRESSURE

APPENDIX B

Appendix B contains all-years monthly mean fields of sea-level pressure for the Northern Hemisphere. These fields have been compiled from 6-hourly analyses on a 63x63 analysis grid, polar stereographic projection, covering the 32-year period 1946-1977--a total of 46,752 analyses. All analyses have been produced utilizing a consistent state-of-the-art analysis technique (an application of the Fields by Information Blending methodology). Monthly mean fields of sea-level pressure for the same period also are available as well as all associated fields of standard deviation.

CONTENTS: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FLEET NUMERICAL WEATHER CENTRAL

Fig. B1

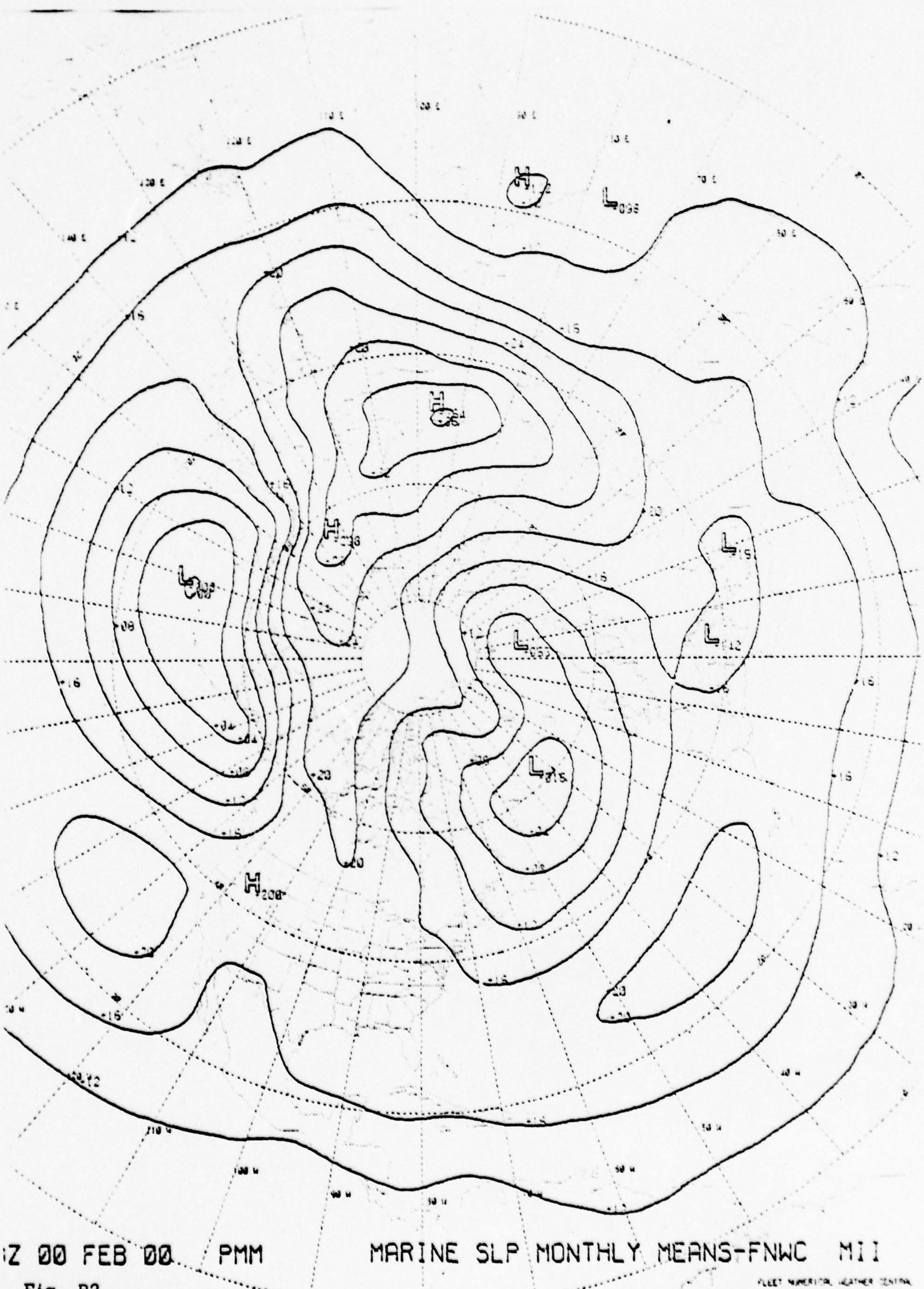
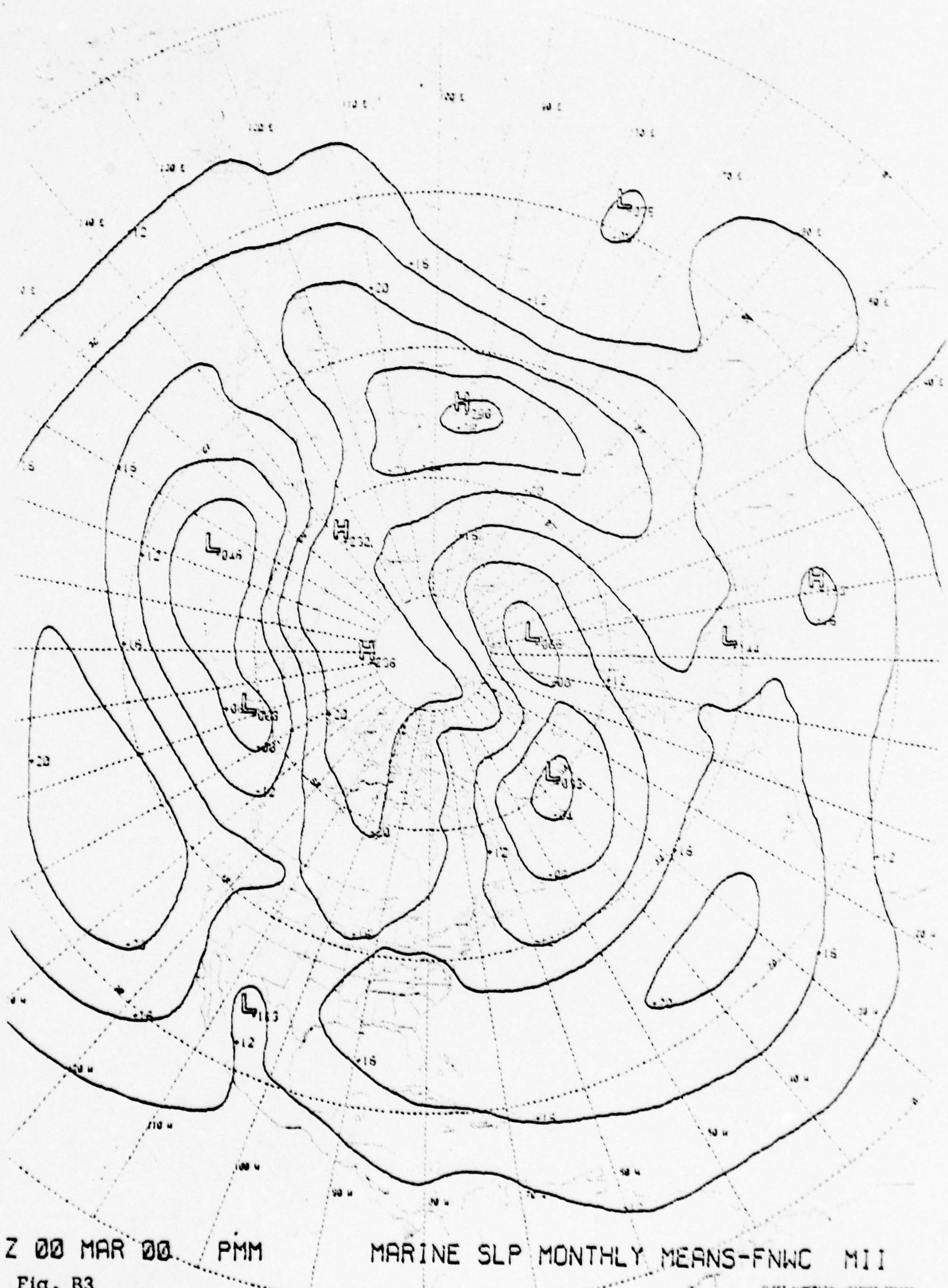


Fig. B2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FLEET NUMERICAL WEATHER CENTRAL

Fig. B3

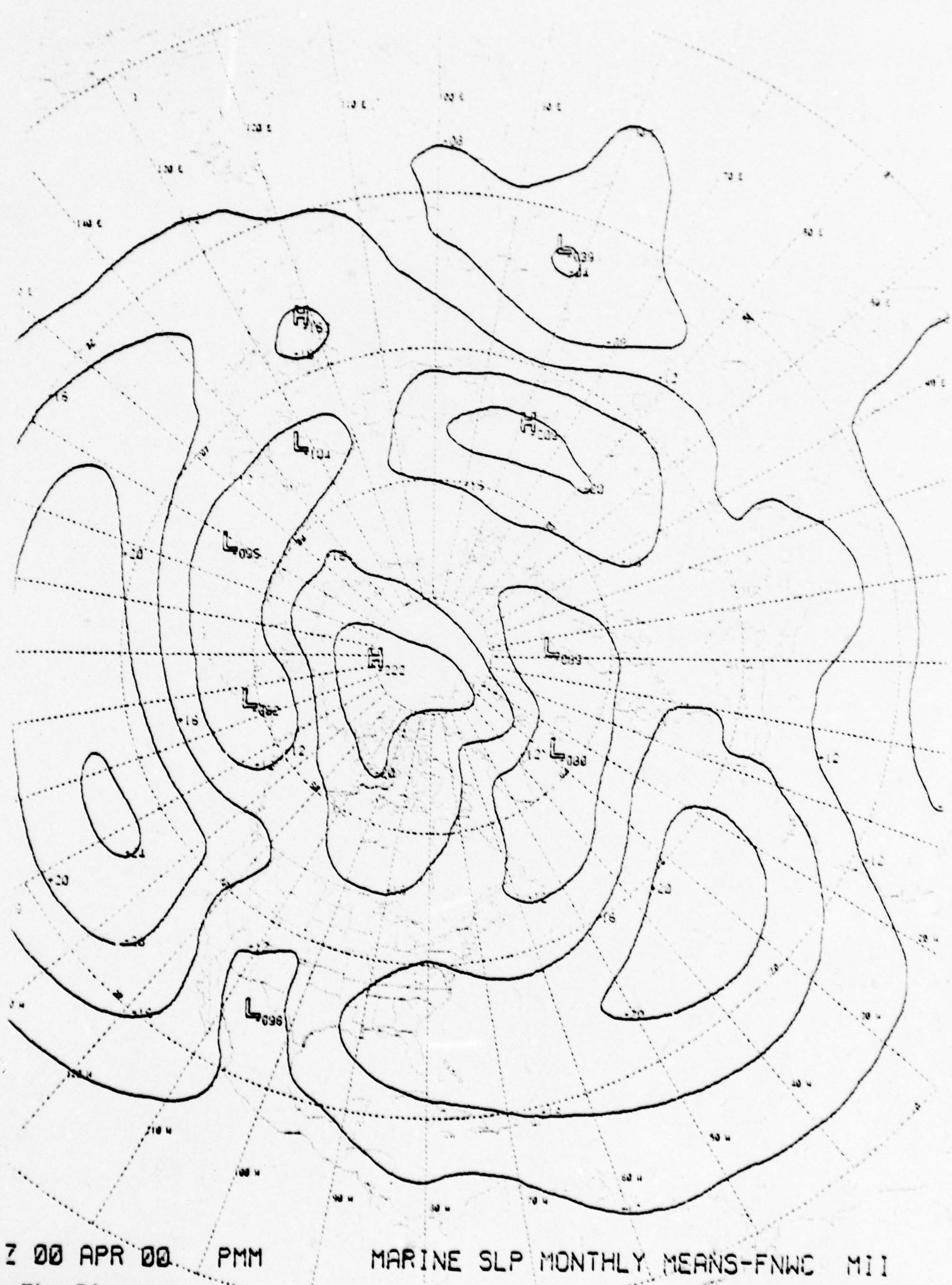


Fig. B4

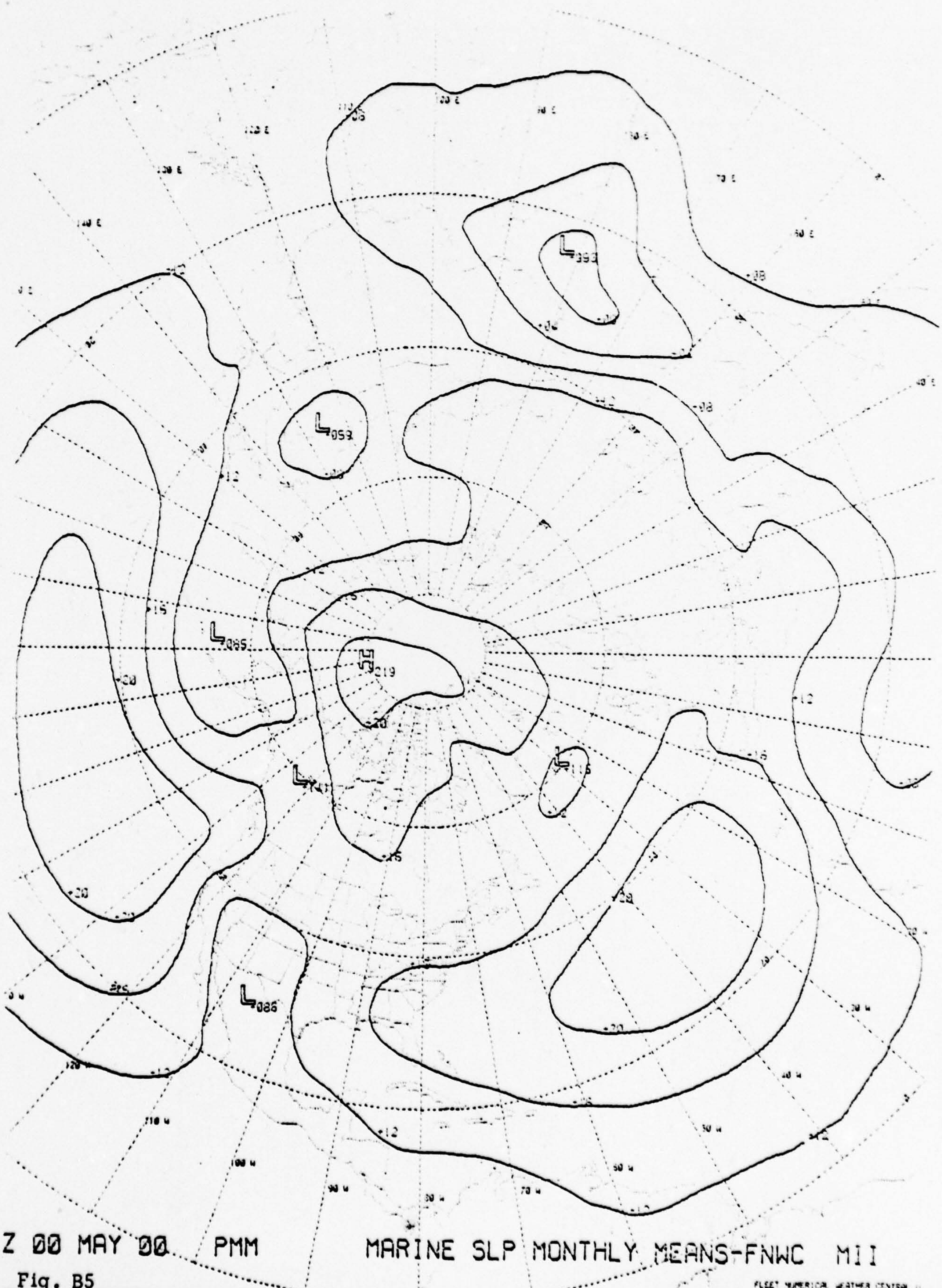
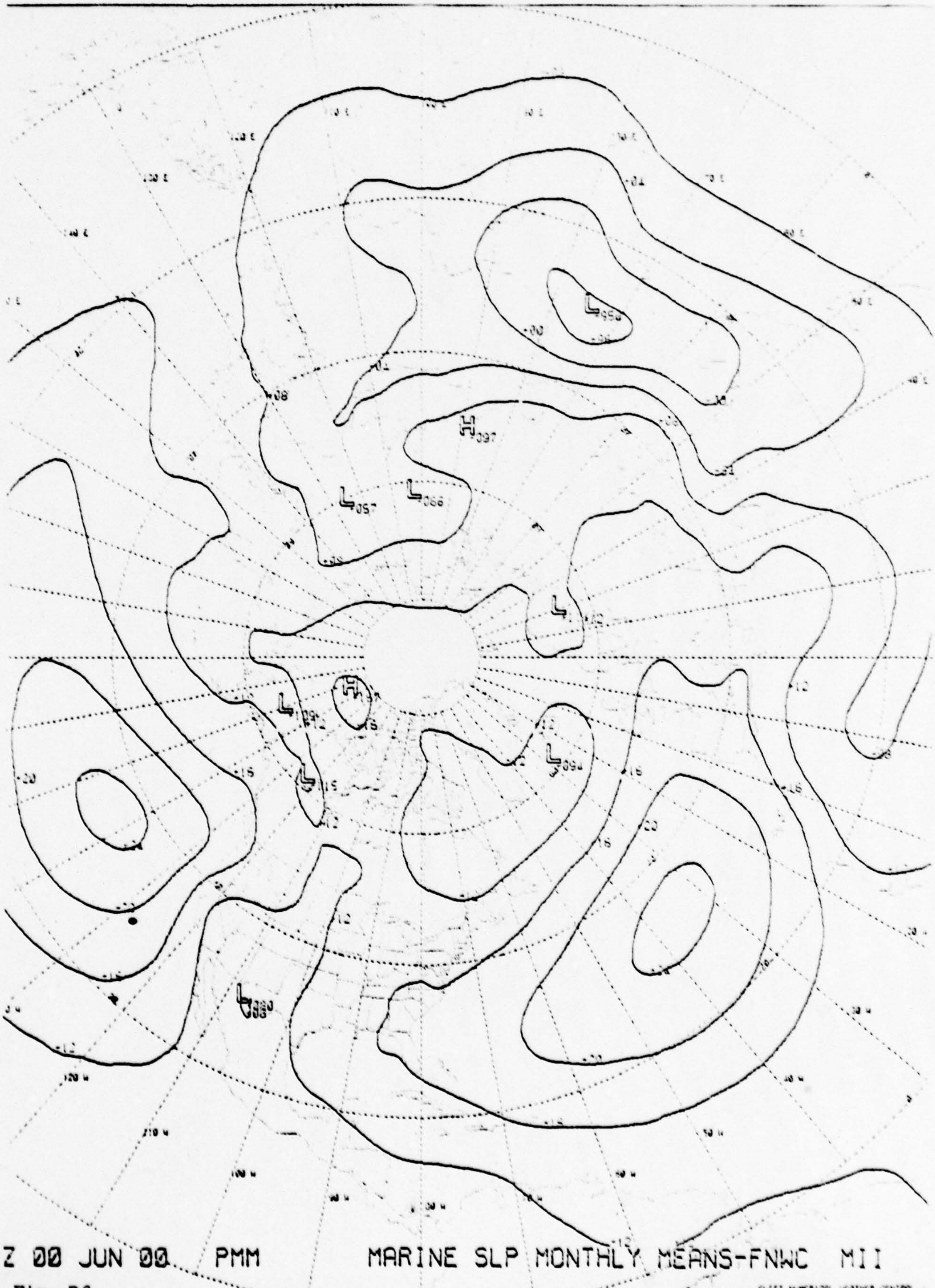

Z 00 MAY 00 PMM MARINE SLP MONTHLY MEANS-FNWC MII

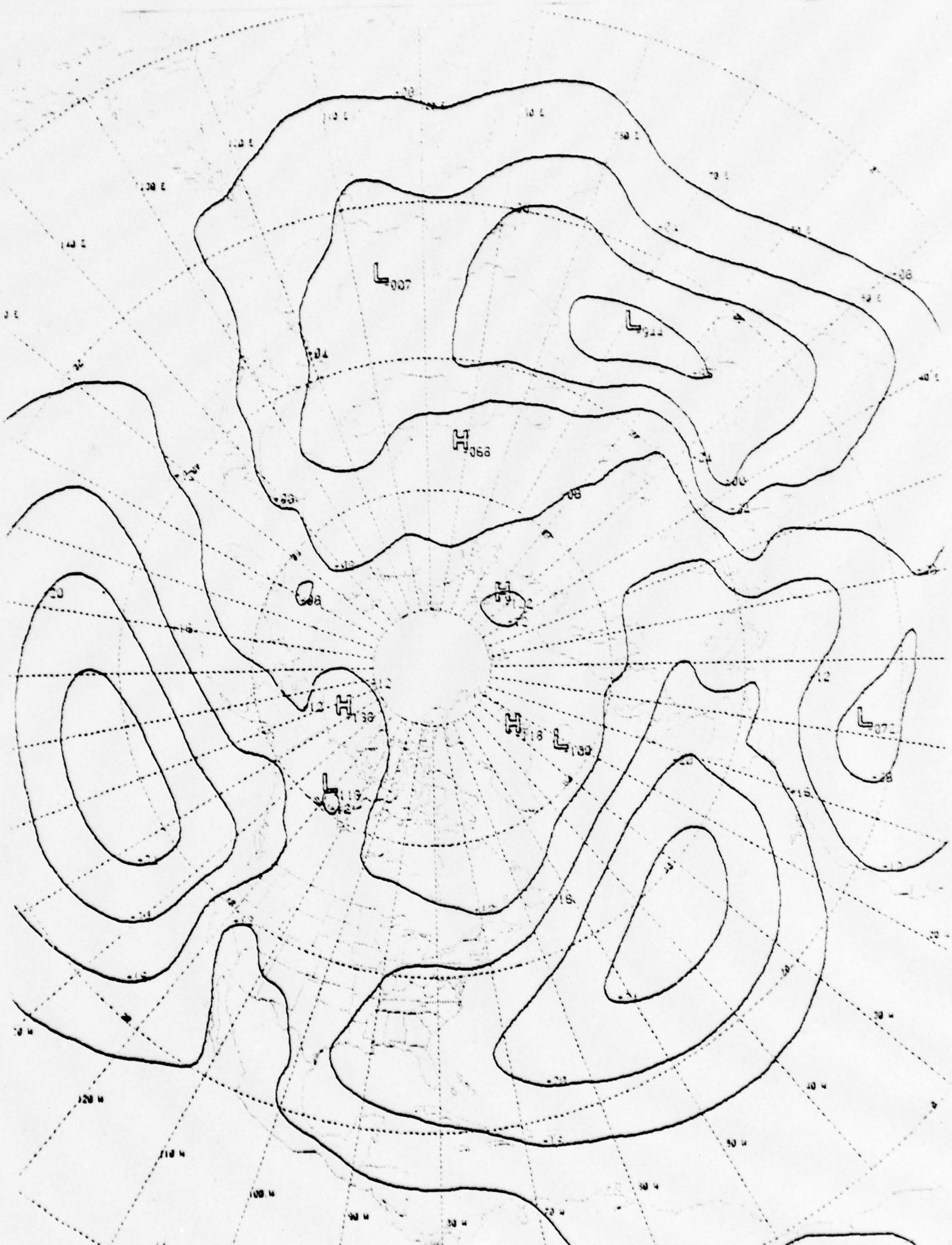
Fig. B5

FLEET NUMERICAL WEATHER CENTRAL



Z 00 JUN 00   PMM   MARINE SLP MONTHLY MEANS-FNWC MII

Fig. B6



Z 00 JUL 00 PMM MARINE SLP MONTHLY MEANS-FNWC MII

FLEET NUMERICAL WEATHER CENTRAL

Fig. B7


0Z 00 AUG 00 PMM MARINE SLP MONTHLY MEANS-FNWC MII
FLEET NUMERICAL WEATHER CENTRAL

Fig. B8

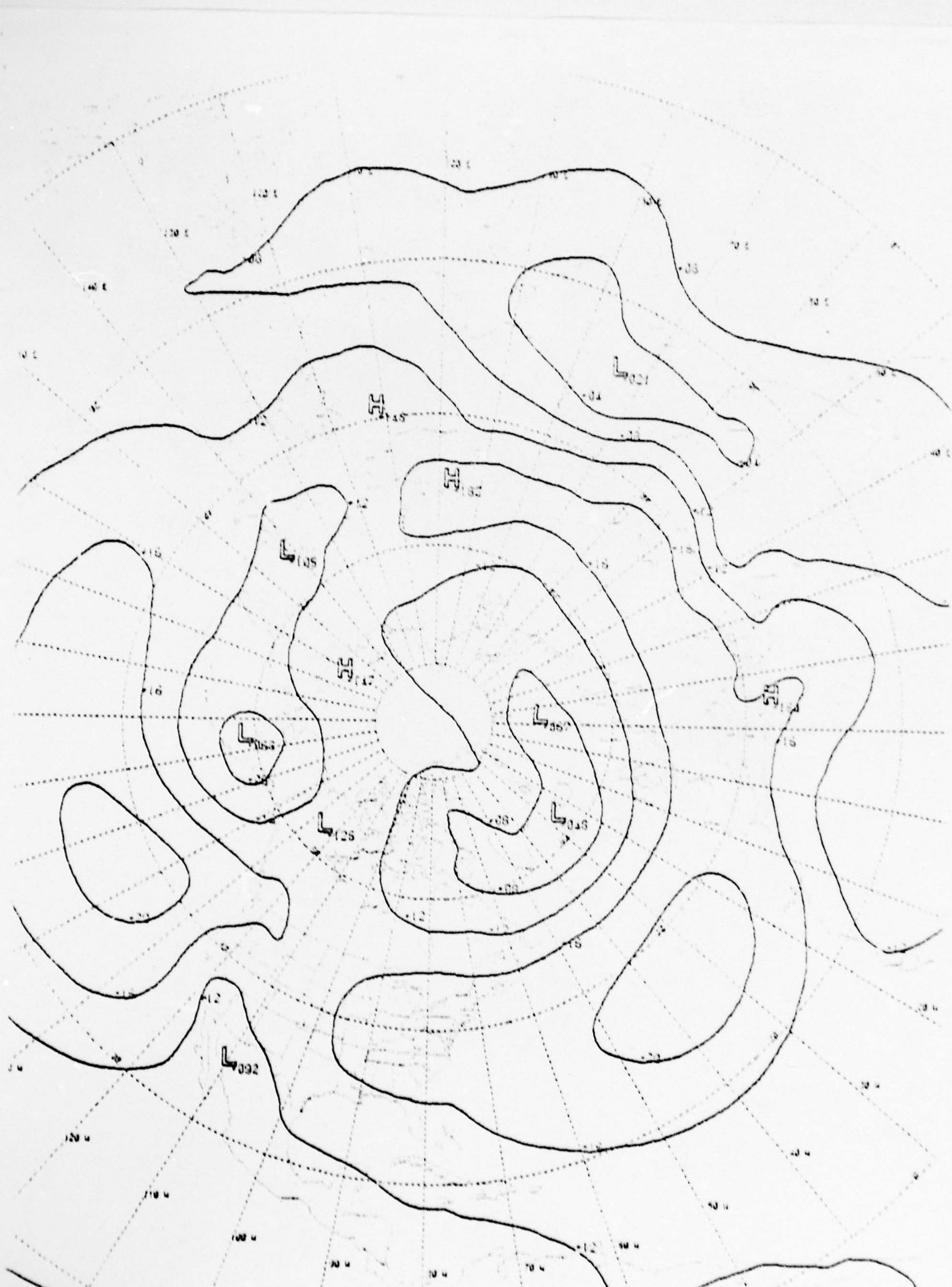
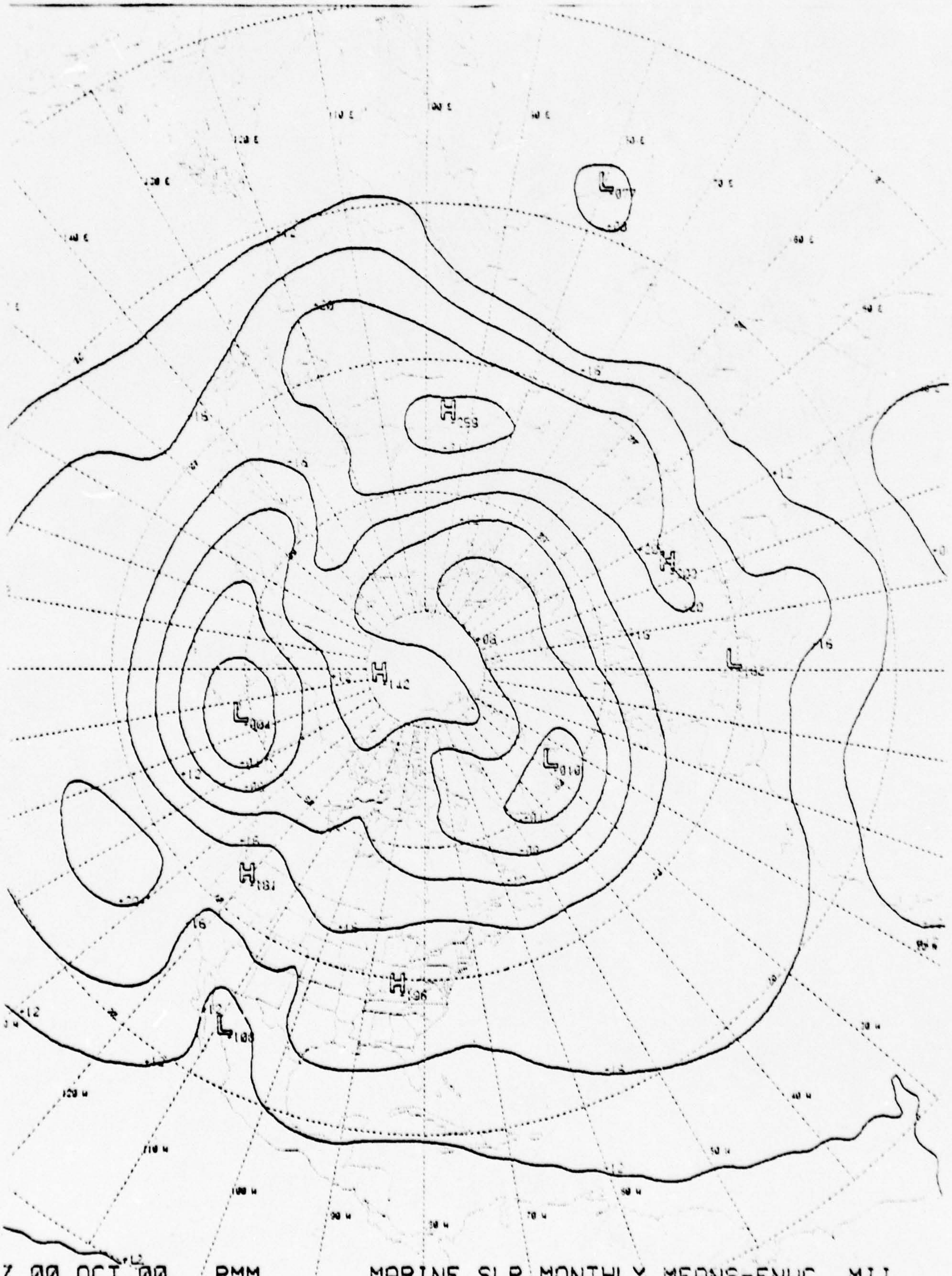

Z 00 SEP 00 PMM MARINE SLP MONTHLY MEANS-FNWC MII
FLEET NUMERICAL WEATHER CENTRAL

Fig. B9



Z 00 OCT 00   PMM   MARINE SLP MONTHLY MEANS-FNWC MII

Fig. B10

FLEET NUMERICAL WEATHER CENTRAL

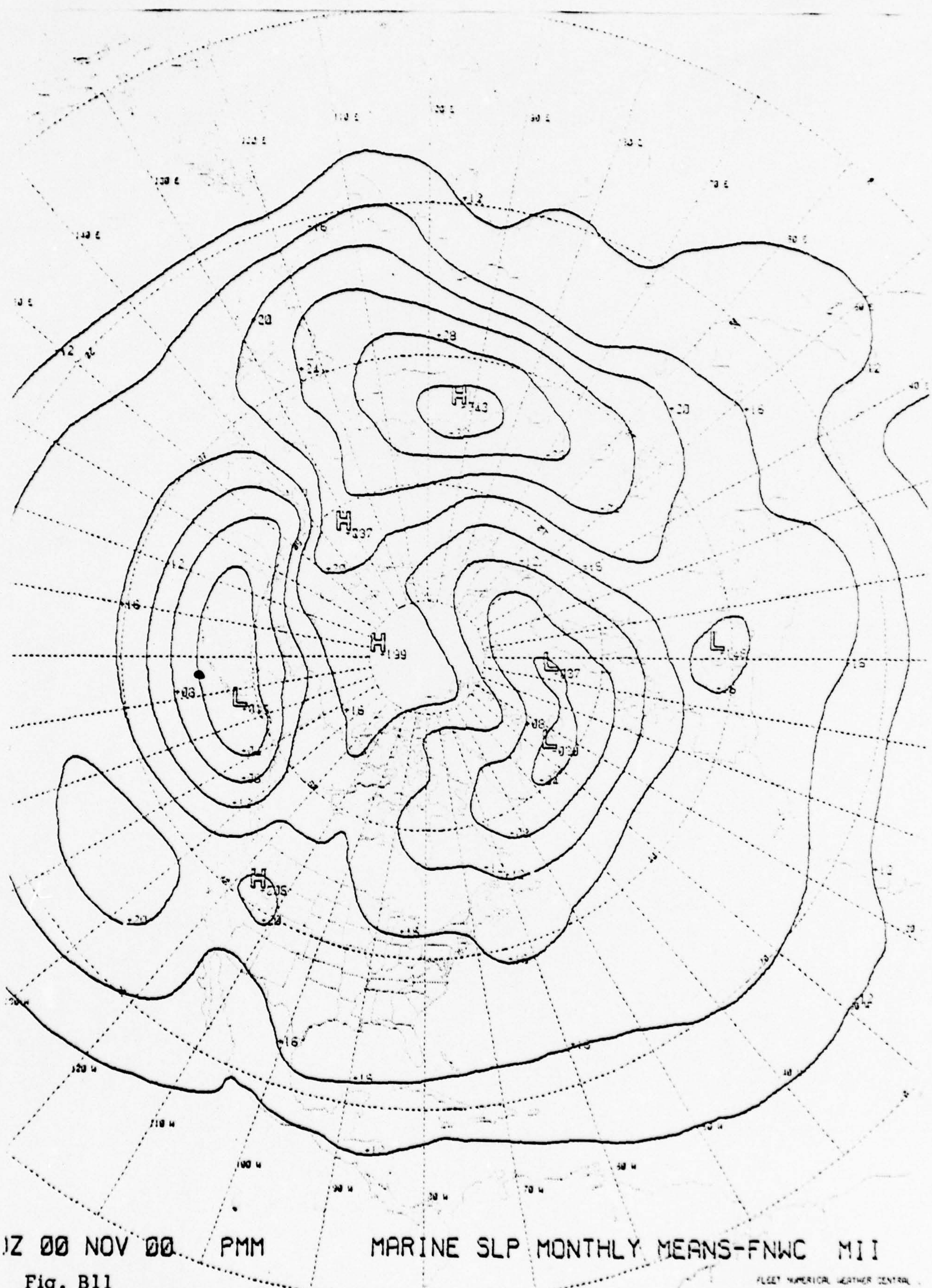
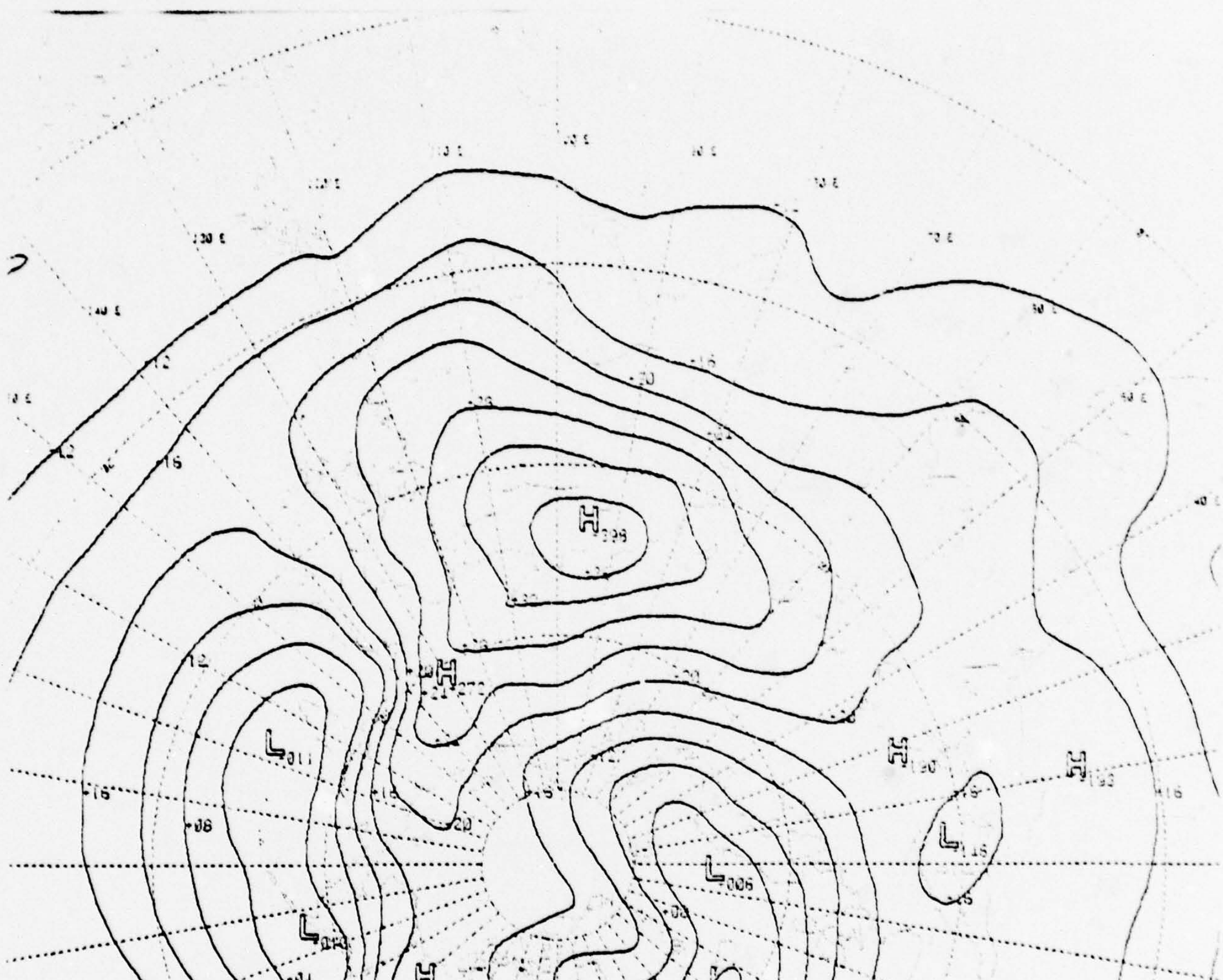


Fig. B11



0Z 00 DEC 00 PMM MARINE SLP MONTHLY MEANS-FNWC MII

Fig. B12

FLEET NUMERICAL WEATHER CENTRAL

APPENDIX C

ALL-YEARS MONTHLY MEAN FIELDS OF SURFACE WIND

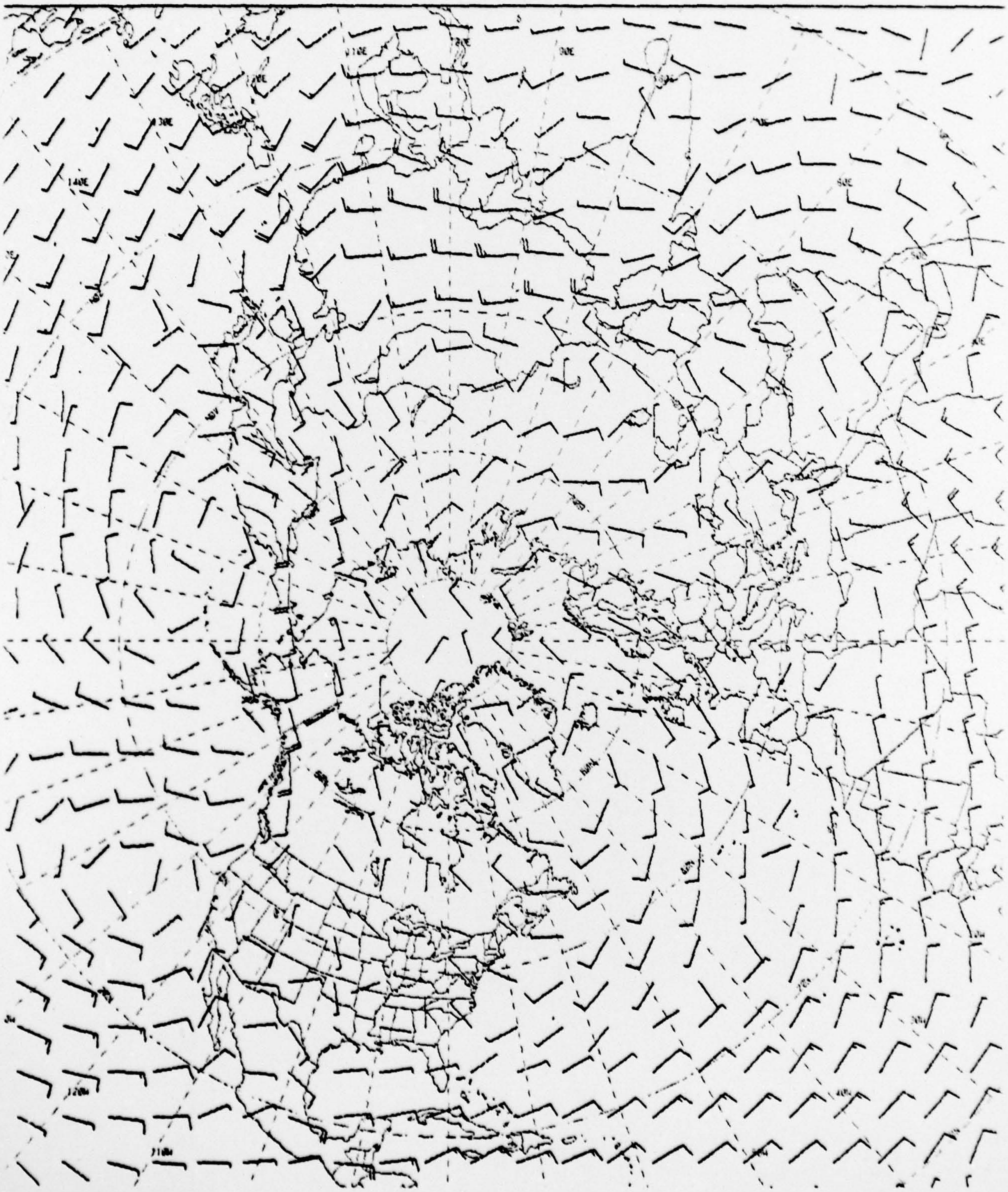
APPENDIX C

Appendix C contains all-years monthly mean fields of surface wind (speed and direction) for the Northern Hemisphere computed from corresponding fields of the u and v components of wind. The wind-component fields were compiled from winds diagnosed from 6-hourly analyses of sea-level pressure on a 63x63 analysis grid, polar stereographic projection, covering the 32-year period 1946-1977--a total of 46,752 analyses. The sea-level pressure analyses were produced using a consistent state-of-the-art analysis technique (an application of the Fields by Information Blending methodology). The algorithm used to diagnose wind from sea-level pressure was tuned to provide a (quasi-geostrophic) wind representative of observed surface winds over marine areas. Over land the wind fields should be interpreted as quasi-geostrophic winds--they are not (necessarily) representative of observed surface winds for land areas. In addition, for reasons explained in the text, these winds are not representative in low latitudes (i.e., tropical regions).

The all-years monthly-mean surface wind vectors shown in Figs. C1 through C12 are represented by "arrows", the direction of the arrow being that of the wind. Wind speeds, to the nearest 5 knots, are shown by barbs with a long barb representing 10 knots and a short barb representing 5 knots.

Monthly mean fields of the u and v wind components for the same period also are available as well as all fields of standard deviation associated with wind component fields.

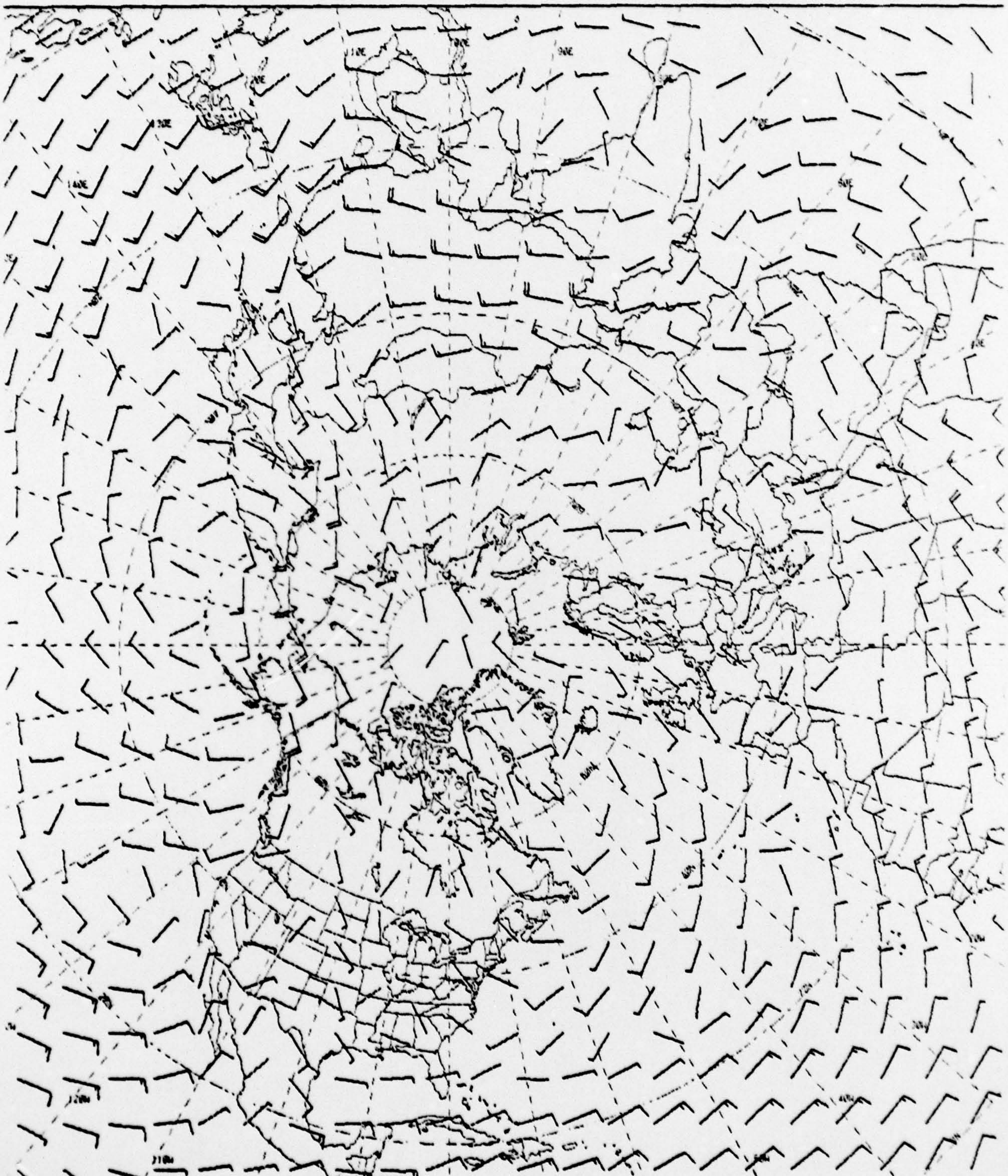
CONTENTS:



00 JAN 00 MARINE WIND MONTHLY MEANS-FNWC MII 10/78

Fig. C1

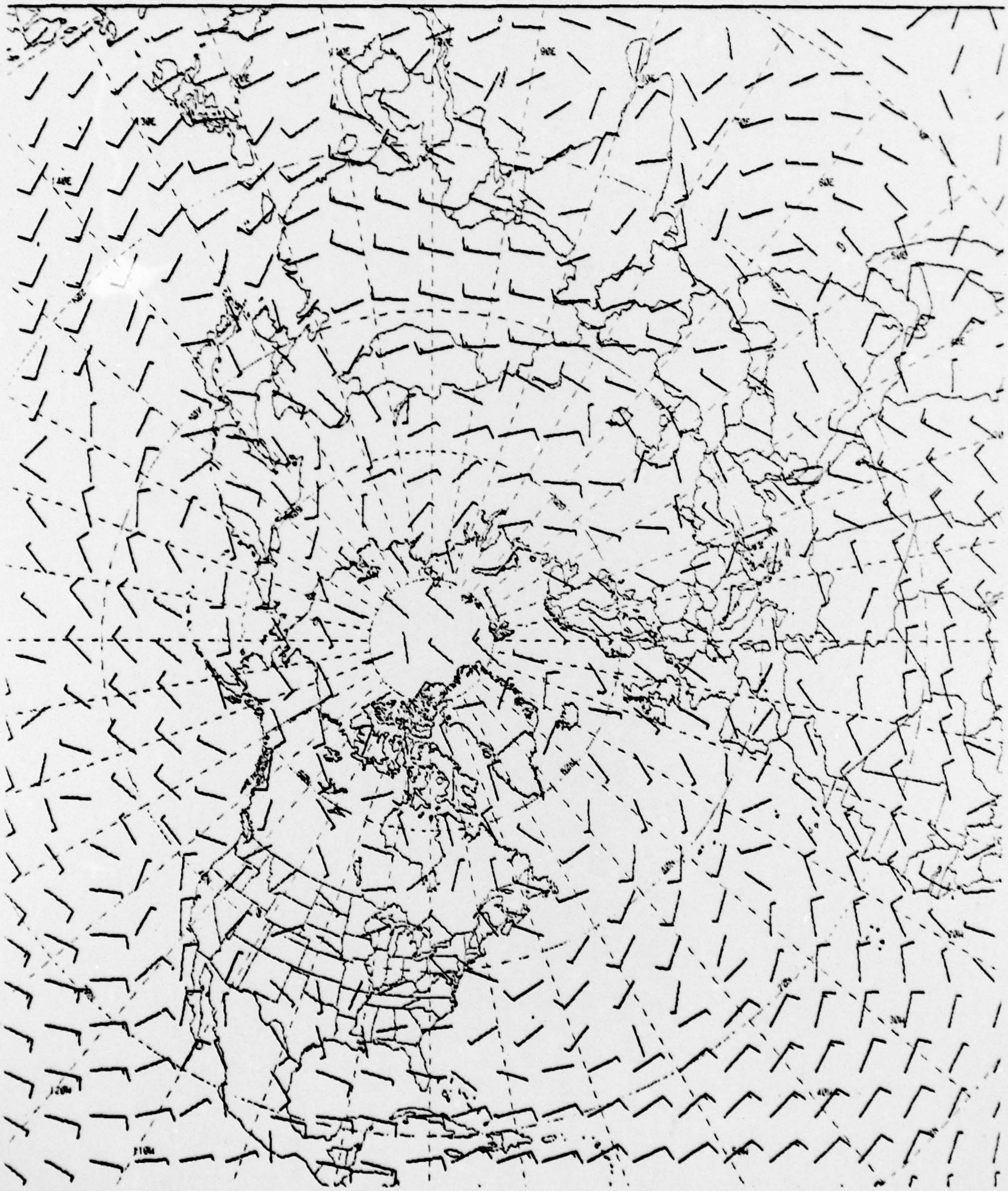
FLEET NUMERICAL WEATHER CENTRAL, U.S.NAVY



00 FEB 00 MARINE WIND MONTHLY MEANS-FNWC MII 10/78

FLEET NUMERICAL WEATHER CENTRAL, U.S. NAVY

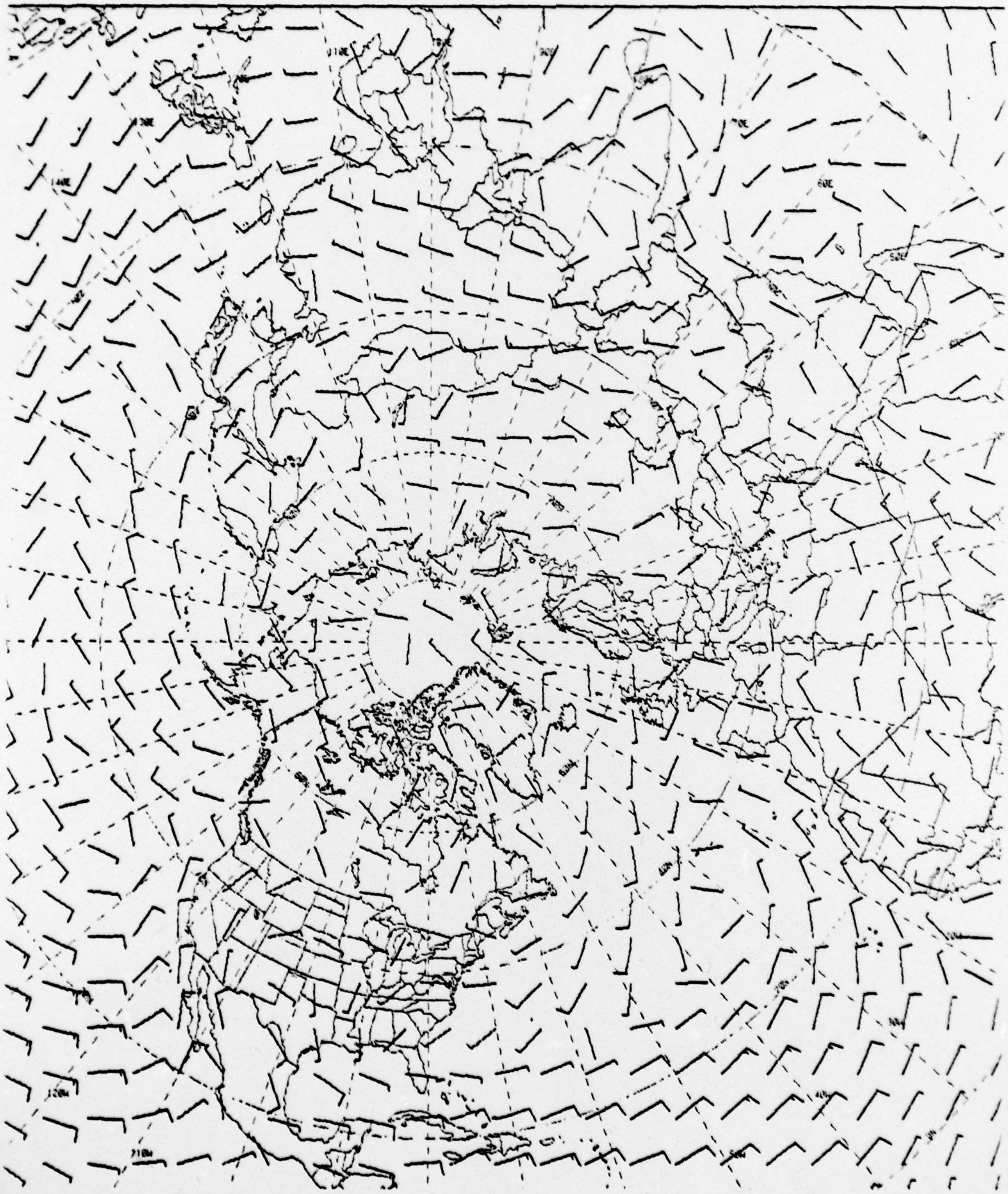
Fig. C2



]Ø MAR ØØ MARINE WIND MONTHLY MEANS-FNWC MII 10/78

FLEET NUMERICAL WEATHER CENTRAL, U.S.NAVY 19.2

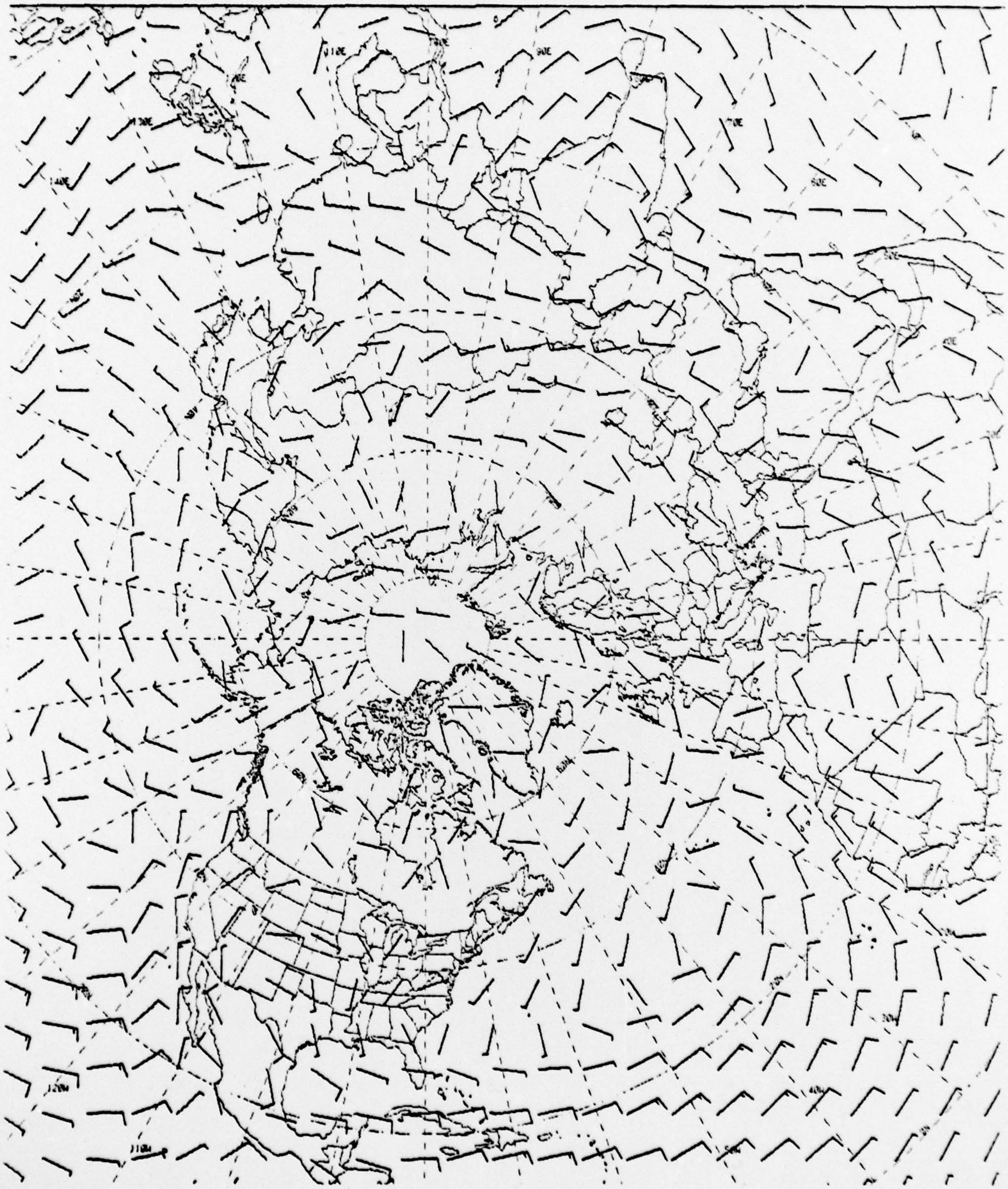
Fig. C3



10 APR 00 MARINE WIND MONTHLY MEANS-FNWC MII 10/78

FLEET NUMERICAL WEATHER CENTRAL, U.S.NAVY

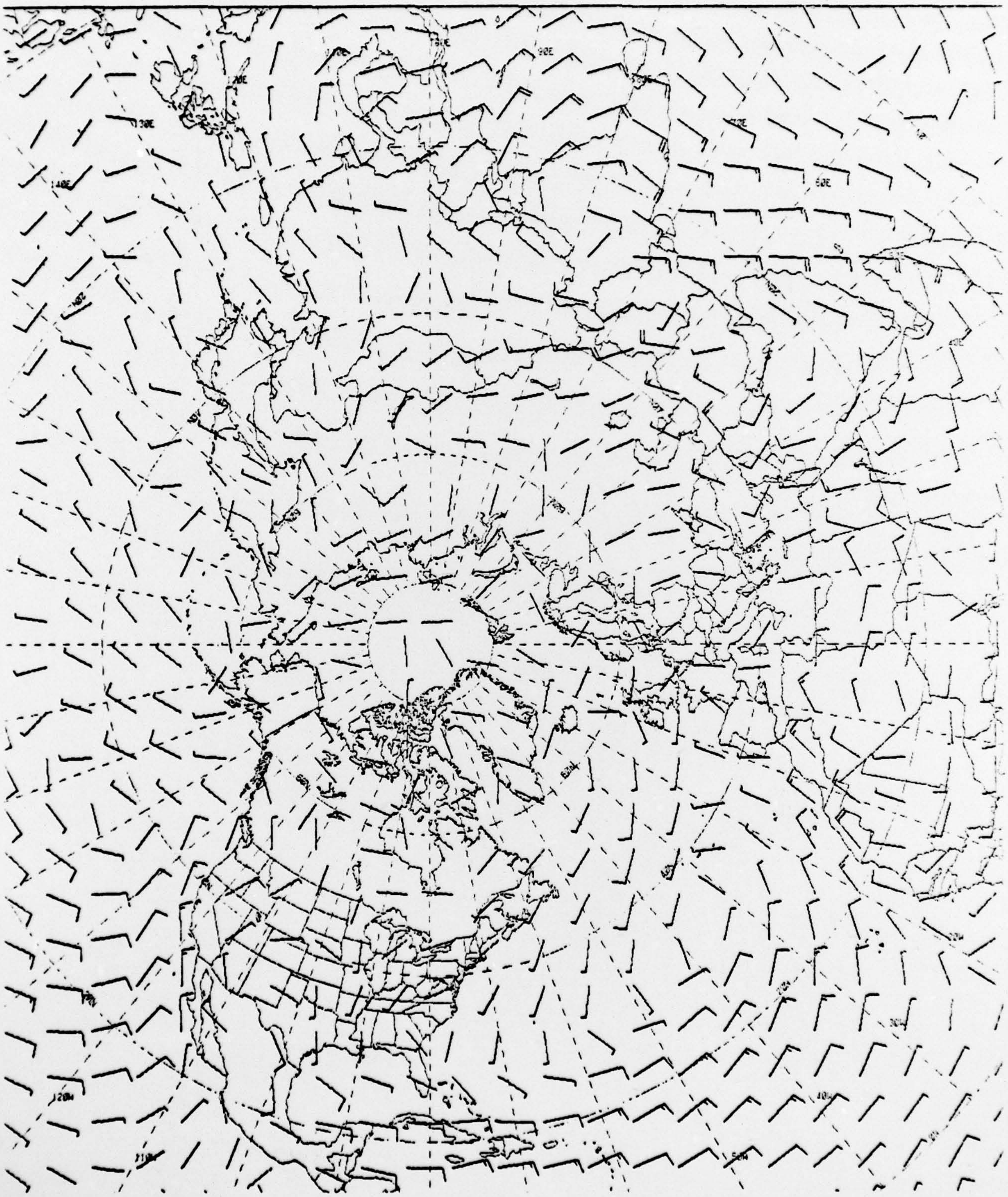
Fig. C4



10 MAY 00 MARINE WIND MONTHLY MEANS-FNWC MII 10/78

FLEET NUMERICAL WEATHER CENTRAL, U.S.NAVY

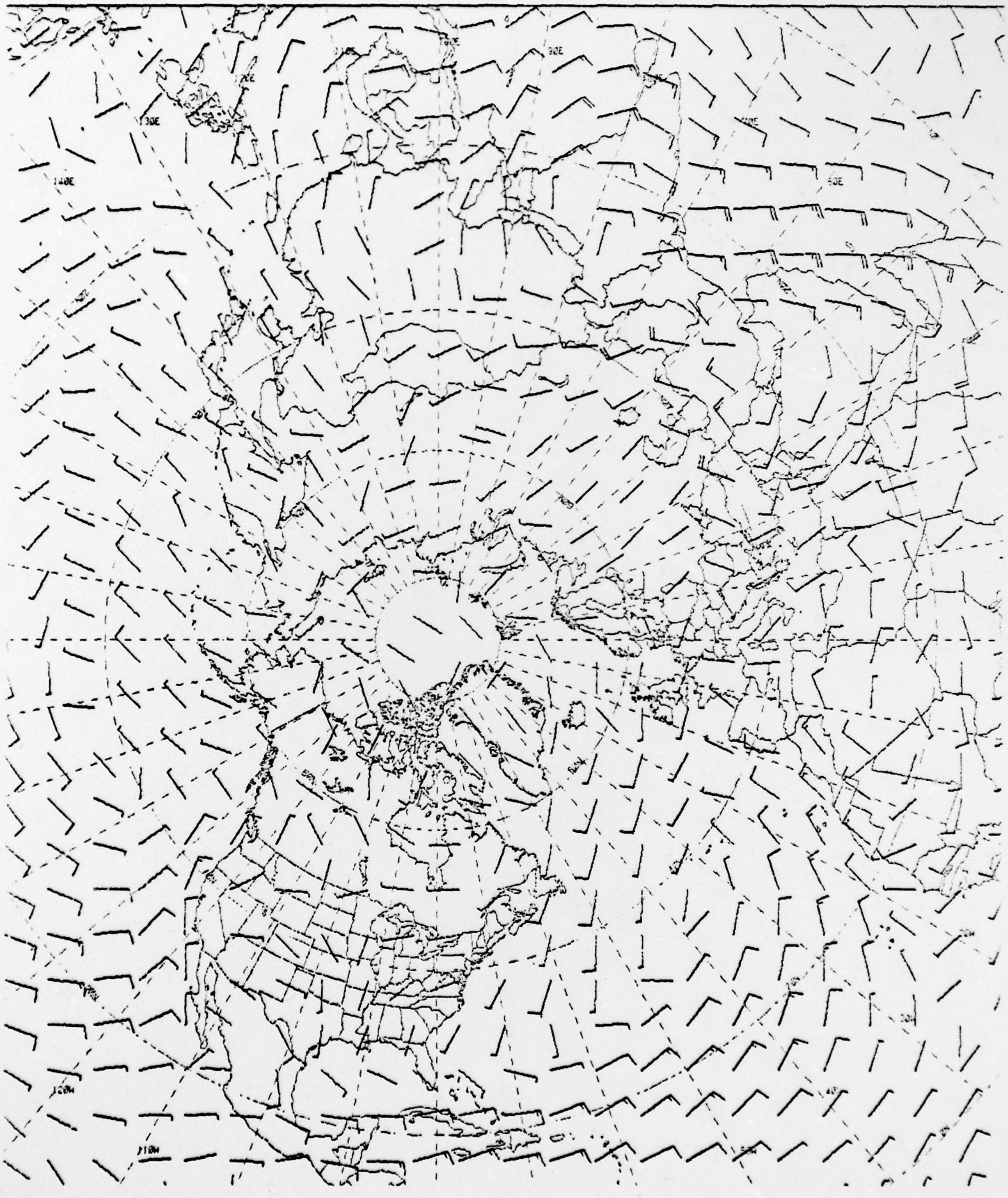
Fig. C5



30 JUN 00 MARINE WIND MONTHLY MEANS-FNWC MII 10/78

FLEET NUMERICAL WEATHER CENTRAL, U.S.NAVY

Fig. C6



00 JUL 00 MARINE WIND MONTHLY MEANS-FNWC MII 10/78

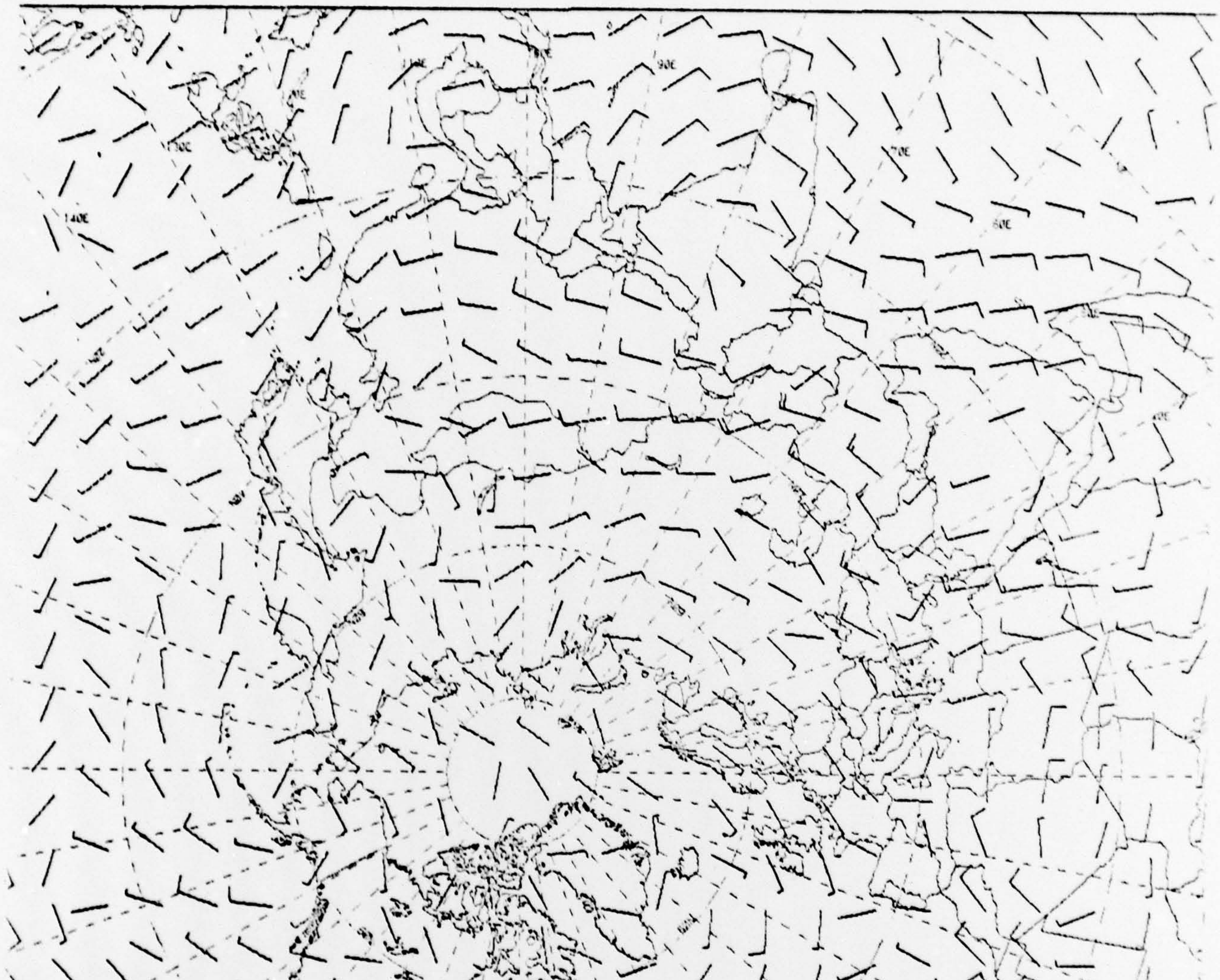
FLEET NUMERICAL WEATHER CENTRAL, U.S.NAVY

Fig. C7

30 AUG 00 MARINE WIND MONTHLY MEANS-FNWC MII 10/78

FLEET NUMERICAL WEATHER CENTRAL, U.S.NAVY

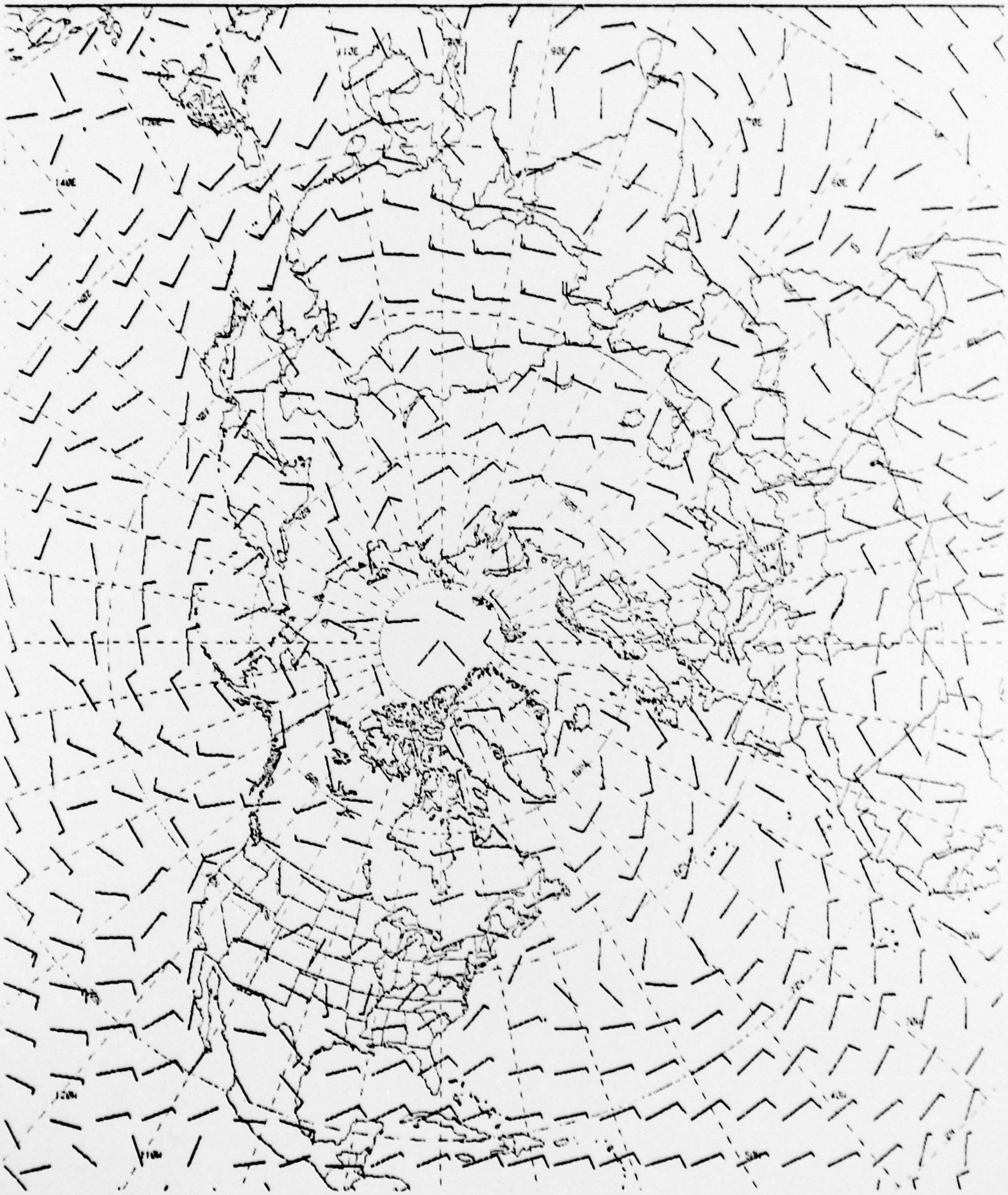
Fig. C8



00 SEP 00 MARINE WIND MONTHLY MEANS-FNWC MII 10/78

Fig. C9

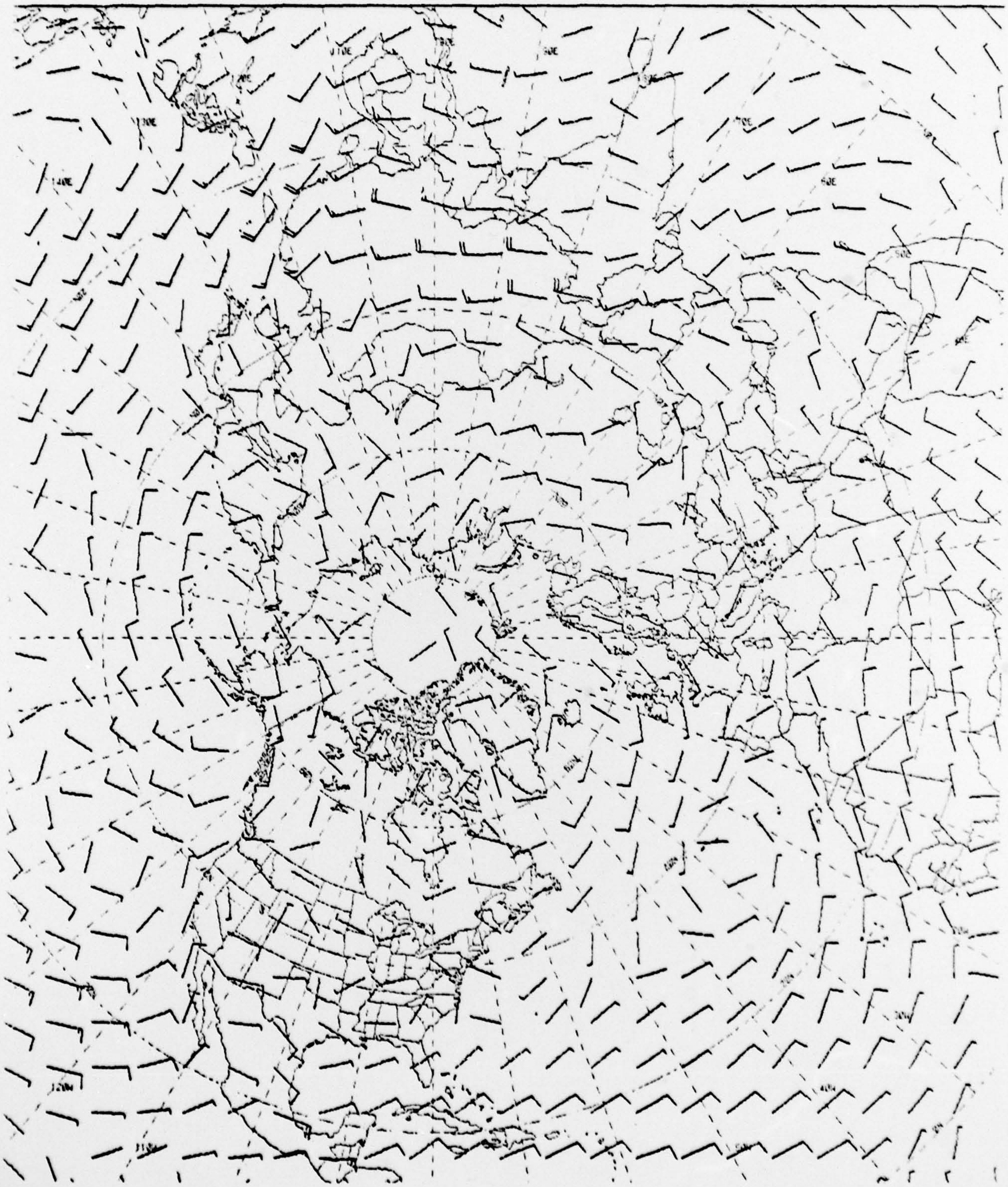
FLEET NUMERICAL WEATHER CENTRAL, U.S.NAVY



ØØ OCT ØØ MARINE WIND MONTHLY MEANS-FNWC MII 1Ø/78

FLEET NUMERICAL WEATHER CENTRAL, U.S.NAVY

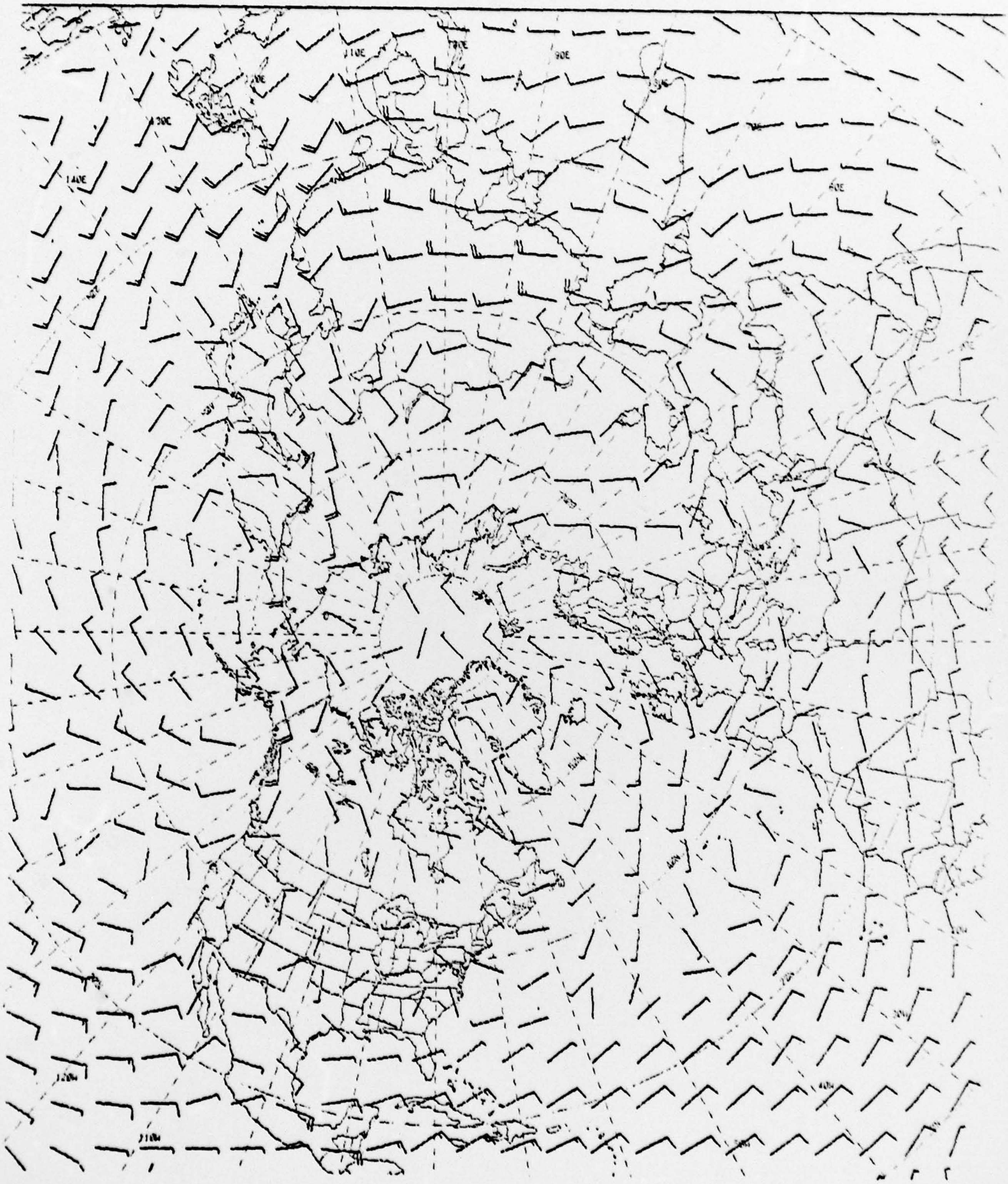
Fig. C10



ØØ NOV ØØ MARINE WIND MONTHLY MEANS-FNWC MII 10/78

FLEET NUMERICAL WEATHER CENTRAL, U.S.NAVY 19.

Fig. C11



00 DEC 00 MARINE WIND MONTHLY MEANS-FNWC MII 10/78

Fig. C12