NOAA Technical Memorandum NESDIS AISC 9

SELECTIVE RETRIEVAL OF SPECTRAL MRF MODEL WINDS FOR MARINE APPLICATIONS

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Washington, D.C.
March 1987

U.S. DEPARTMENT OF COMMERCE / National Oceanic and Atmospheric Administration / National Environmental Satellite, Data, and Information Service

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Abstract. A capability to access and use global NMC model data in marine applications has been developed. Spectral model coefficients for near-surface winds, pressures, and temperatures are saved at NMC. These data are now stored on a MEAD tape archive.

1. INTRODUCTION

Predictions of atmospheric variables at or near the ocean surface can serve as surrogates for observations which are often unavailable (Reeves and Pytlowany, 1985). The spectral model used in the Medium Range Forecast (MRF) run was developed at the National Meteorological Center (NMC) of the National Weather Service (NWS) and provides uniformly gridded predictions of near-surface parameters, globally, up to 10 days in advance; the analysis file used for model initialization at 00Z daily is also available. The spectral representation of the MRF data in the horizontal permits the archiving of coefficients, which can later be converted to fields on an appropriate grid chosen by the user. Since conventional oceanic and atmospheric observations of physical variables, and satellite data, are used in spectral model initialization, the MRF data provide an integrated and synoptic perspective that is lacking in measurements taken in situ. The availability of model data for the boundary layer of the atmosphere make the use of the data particularly appealing for marine studies and applications for which wind-driven currents and derivative environmental effects are paramount.

The purpose of this report is to document: (a) methods of archiving, then (b) instructions for selectively retrieving global model data for application in studies of marine circulation. The latter is an important factor in simulating the transport and fate of biological species and pollutants. The objective of this report is to provide users the capability of easily accessing model winds, temperatures, and pressures by criteria of time and geography for the atmospheric level nearest the ocean surface. The availability of the model data will provide an important analytical tool for marine scientists.

The project objective was to begin an archive of spectral coefficients from daily MRF model runs for 00Z and 24Z to derive model winds, temperatures, and pressures at or near the ocean surface. The chosen model parameters are:

1. Wind U-component (m/s) at 1000 mb (toward E +, W -)
2. Wind V-component (m/s) at 1000 mb (toward N +, S -)
3. Air temperature (^{o}C) at 1000 mb
4. Height (m) of the 1000 mb pressure level
5. Height (m) of the 500 mb pressure level

The last two spectral coefficient arrays are needed to derive the Mean Sea Level (MSL) pressure.

The information in this document should allow an investigator to select a grid and retrieve all or a specified subset of gridded model data for an area of interest globally for a specified time span. Eventually, the archive would be used in climatological as well as event-oriented studies so that anomalies could be identified and their morphology could be analyzed. The MRF predictions could be used as input to three-dimensional marine circulation models such as MECCA (Hess, 1985) or for deriving mass transports (Dowgiallo et al., 1986) and could be integrated with satellite and conventional data to provide an enhanced analysis tool for global studies.

The goals of storing and accessing model data were implemented with two programs developed by the Marine Environmental Assessment Division (MEAD) for use on the NAS 9050 computer located in Suitland, MD. The first program selects the parameters and creates a tape archive of spectral coefficients from the NMC 42-day diagnostic disk archive. This preserves the present data so that the rotating disk structure does not result in over-written data being lost. The tape archive is built by periodically adding data from new time periods to existing data. The second program accesses either the NMC disk archive or the MEAD tape archive, converts spectral coefficients to a field of variables on a grid system specified by the user, and allows the user to selectively retrieve gridded data by criteria of time and geography for various applications.

2. THE SPECTRAL MODELS

2.1 Similarities Between the NMC Spectral Models

The MRF model data are used in the MEAD archiving and grid retrieving procedures. The model used in the MRF run is an enhanced adaptation of the NMC spectral forecast model (Sela, 1980,1982) used in the Aviation run (AVN) of the NMC operational run suite and shares with it many basic characteristics.

The spectral model represents variables as functions of position on a sphere expressed as truncated spherical harmonic expansions. The spectral coefficients for each parameter and height are global arrays of length 961 complex-valued words for scalar variables such as temperature and pressure and 992 words for vector variables, the u and v wind components. The representation of variables in the horizontal is spectral, with 40-wave truncation providing an increase in resolution for the MRF model data from the original 24-wave and 30-wave spectral models. The grid mesh used for model integrations does not contain the poles. The North-South separation of the spectral grid is determined by the zeros of the Legendre polynomials used in the truncated spherical harmonic expansions of the spectral model formulation. For each latitude circle, the resolution derives from an equally-spaced grid. The spectral coefficients are also known as pressure coefficients since they are given at discrete pressure levels of the atmosphere.

The capability to efficiently convert spectral coefficients to a gridded field (and vice versa) for a given parameter and height is an important feature of the transform method used in the spectral model. This formulation, designed to efficiently compute the expansions of quadratic terms which appear in the forecast equations, also allows for physical parameterizations on the transform grid as well as flexibility in the user selection of grid projections (Sela, 1982). The conversion from spectral coefficients to a field of variables on a latitude-longitude grid consists of applying, for each chosen latitude, α, in succession, a single Fast Fourier Transform (FFT), to obtain the equation

$$H(\alpha, \lambda_j) = \sum_{k=0}^{M-1} H_k EXP(2\pi ikj/M) \qquad (2.1)$$

where values of the variable H at all longitudes, λ_j, are computed from the complex spectral coefficients, H_k, for the chosen latitude, α. For exact integrations, the grid is specified with M points so that $M \geq 3J+1$, where J=40 in the model of the present MRF run. The procedure continues along each successive latitude, α, until the hemispheric or global model array is filled.

2.2 Differences in Model Characteristics

The model used in the MRF run differs from the previous spectral model used in the AVN run in important characteristics, many of which can contribute substantially to enhance marine applications of the model data. The original boundary layer processes (Sela, 1980) of the spectral model have been upgraded with new algorithms, reflecting improved understanding of physics, with the participation of personnel of NOAA's Geophysical Fluid Dynamics Laboratory (GFDL). Radiative heating and cooling effects have been included with shortwave calculations based on the method of Lacis and Hansen (NMC, 1986a) and longwave calculations based on Fels and Schwarzkopf (NMC, 1986a). Unlike the spectral model used in the AVN run which has 12 unequal layers of pressure thickness, the model for the MRF run is formulated with 18 layers of equal pressure thickness. Predictions extend up to 10 days from each MRF run, unlike the AVN run which produces forecasts up to 72 hours in advance.

The MRF run is the latest global run which includes data for both model initialization at 00Z and the forecast for 24Z. Also, the MRF run has better initialization than the AVN run as more conventional and satellite data are available when the run is made. For these two reasons, MEAD chose to archive data from the MRF run instead of data from another model.

2.3 NMC Storage of MRF Output

The MRF is but one of several NMC runs for which an online archive of all basic state variables (height, temperature, wind, and relative humidity) is available (NMC, 1986b). The NMC archive consists of 12 pressure levels from all operational NMC analysis/forecast systems for the minimum period (plus one day) needed to verify the longest model forecast for 30 days. Since the MRF run provides forecasts up to ten days in advance, at least 41 days are kept to verify a 30-day mean forecast for day 10. Predictions from all global models are generally stored as pressure level coefficients in increments of 12 hours. The system of random access files has space for 42 days of MRF data and a rotating configuration so that data from the latest model runs replace the earliest data. Unless the earlier data are extracted and stored elsewhere, they are overwritten.

2.4 Direct Access of Individual Fields or Coefficients

The direct method of accessing the NMC archive allows the user to return a single field or set of pressure level coefficients from the archive into any FORTRAN program code so that selected fields over a time interval can be accessed for applications. The method requires using an NMC FORTRAN subroutine within a user-supplied source program. Fully qualifying information about date and time, parameter and height, and grid type are passed in an array named LABEL which contains the NMC Office Note 85 (O.N. 85) header information (NMC, 1973). Greater flexibility in applying the model data is realized at the cost of requiring more familiarity with NMC source code used in accessing the data. This method was selected for MEAD programs and its use will be discussed in the next chapter.

3. THE MEAD ARCHIVE OF MRF SPECTRAL COEFFICIENTS

3.1 Description of the Archiving Procedure

In order to store the spectral output from the daily MRF model run, an archiving program (AMOS) (Figure 3.1a) was developed which would enable the user to specify a time span from 1 to 42 days, access the NWS disk archive (described in Sec. 3.2 below) on the NOAA NAS 9050 system, and write the output to a magnetic tape on the NAS at NOAA building FOB4 in Suitland, MD. Thus a time series of global spectral coefficients can be built over time and used in conjunction with the newest 42 days of data found in the disk archive. Instructions on running AMOS are given in Appendix A.

In practice, AMOS is executed every 41 days. The new beginning date/time specified is one day later than the last day of the previous archiving execution and extends the archive by 41 days. The MEAD archive begins 1 January 1987 and will continue on the same tape and file until one year of spectral data have been collected. The second file on tape will contain data for 1988, etc. We anticipate storing five files of yearly spectral data per tape.

3.2 The NMC Archive Files

The MEAD program AMOS accesses the NMC archive directly. The two NMC files accessed are specified by the following Job Control Language (JCL) (Figure 3.1a):

(1) File 1:
```
//ARCHMRF1 DD DSN=NMC.WD20.MRFS.DIARCH1,DISP=SHR,LABEL=(,,,IN)
```

(2) File 2:
```
//ARCHMRF2 DD DSN=NMC.WD20.MRFS.DIARCH2,DISP=SHR,LABEL=(,,,IN)
```

The field LABEL=(,,,IN) must be included to prevent any inadvertent overwriting of the archive. The model data in these random access files are stored in contiguous locations in large arrays which are read using FORTXDAM, a specialized package of input/output software designed for disk operations and capable of

```
//DMRF JOB (GGGGGGTTTTTTTT,BINPAGE),PROGRAMMER,
// TIME=1,REGION=1000K
//STEP1 EXEC JSFXCLG
//FORT.SYSIN DD DSN=NMC.WD20.ARCH.SOURCE(W3GETMOF),DISP=SHR
//           DD *

 (MEAD PROGRAM AMOS INSERTED HERE)

/*
//GO.SYSIN DD *
 87 01 01 00 87 02 11 00
//ARCHMRF1 DD DSN=NMC.WD20.MRFS.DIARCH1,DISP=SHR,LABEL=(,,,IN)
//ARCHMRF2 DD DSN=NMC.WD20.MRFS.DIARCH2,DISP=SHR,LABEL=(,,,IN)
//GO.FT10F001 DD DSN=MRF,UNIT=T6250,DISP=(NEW,PASS),
// DCB=(RECFM=VBS,LRECL=7984,BLKSIZE=31956,DEN=4),
// LABEL=(1,SL,,OUT),VOL=SER=E11203
/*
//
```

(a)

```
//DXS JOB (GGGGGGTTTTTTTT,BINPAGE),PROGRAMMER,
// TIME=1,REGION=1000K
//STEP1 EXEC JSFXCLG
//FORT.SYSIN DD DSN=NMC.WD20.ARCH.SOURCE(W3GETMOF),DISP=SHR
//           DD *

 (MEAD PROGRAM XSMRF INSERTED HERE)

/*
//GO.SYSIN DD *
 87 01 01 00 87 02 11 00
  -70.00  -65.00  -90.00  -80.00
    0   1
//ARCHMRF1 DD DSN=NMC.WD20.MRFS.DIARCH1,DISP=SHR,LABEL=(,,,IN)
//ARCHMRF2 DD DSN=NMC.WD20.MRFS.DIARCH2,DISP=SHR,LABEL=(,,,IN)
//GO.FT10F001 DD DSN=MRF,UNIT=T6250,DISP=(OLD,PASS),
// DCB=(RECFM=VBS,LRECL=7984,BLKSIZE=31956,DEN=4),
// LABEL=(1,SL,,IN),VOL=SER=E11203
/*
//
```

(b)

Figure 3.1 Sample version of (a) file AMOS.RJE used in submitting the MEAD archiving program AMOS, and (b) file XSMRF.RJE used in submitting the MEAD selective retrieval program XSMRF to the NAS 9050 computer in batch mode. The field GGGGGG is the organization code and field TTTTTTTT is the task code number in line 1 of (a) and (b) above.

reading the entire track length of the 3380 disk pack which is 47440 bytes. Currently, three 3380 disk packs comprise the NMC archive on the NAS. Each disk pack has the capacity of four 6250 BPI magnetic tapes. The archive data are packed to optimize disk usage and require special routines for proper access.

3.3 Reading the NMC Archive Files

In order to read spectral MRF coefficients directly from the archive, a special call must be made to an NMC routine contained as the source member W3GETMOF (NMC, 1986b) in a library whose name is specified by the DSN field as follows:

```
//FORT.SYSIN DD DSN=NMC.WD20.ARCH.SOURCE(W3GETMOF),DISP=SHR
```

This source library has a block size of 6400 bytes and may be concatenated with other libraries containing user developed or NMC source code or inline source code with the provision that the libraries must be concatenated in decreasing order of block size with inline source code last. The subroutine is accessed with the following FORTRAN CALL statement:

```
CALL GETM(LABEL,IANL,IVER,COEFF,IERR)
```

which returns a complex spectral array in COEFF corresponding to one parameter of MRF model data for a given hour and forecast. The arguments for the subroutine call are:

1. LABEL - an integer array of size 12 words containing the O.N. 85 label in hexadecimal (Z) for the desired field. Only words 1, 2, 5, and 7 are presently used.

   Word 1 is the parameter type requested.
   (eg. Z03000800 represents wind u-component)

   Word 2 is the pressure level requested.
   (eg. Z00271081 represents 1000 mb)

   Word 5 is the grid marker for the field requested and is disregarded if a spectral array is sought.
   (eg. Z0000001B represents the polar grid for the Northern hemisphere)

   Word 7 is the NMC packed date word.
   (eg. Z57020C00 represents 12 February 1987 at 00Z)

   (An inventory can be done to identify the available fields and codes (NMC, 1986b)).

2. IANL - A non-negative integer variable. A positive value will return the analysis file in spectral form. A zero value will return the forecast specified in word 1 of LABEL.

3. IVER - A non-negative integer variable. A positive value will return the forecast valid on the date specified in word 7 of LABEL. A zero value will return the forecast from the date specified in word 7 of LABEL and valid for the date as determined by the forecast sought.

4. COEFF - complex one-dimensional array to hold spectral coefficients.

5. IERR - error return code

   0: field returned normally

   1: date requested not in archive

   2: grid requested not in archive

   3: pressure requested not in archive

   4: parameter requested not in archive

3.4 Archived Variables

The MEAD program extracts the 00Z analysis and 24Z forecast files from daily MRF runs by calling subroutine GETM twice for each day and parameter sought as follows:

1. IANL=1, IFHR=0, IVER=0 returns the analysis file from a given day.

2. IANL=0, IFHR=24, IVER=0 returns the forecast from a given day and valid 24 hours later, i.e., at 00Z on the following day.

For each day, a spectral coefficient array represents one of five parameters at 00Z or 24Z so that a total of ten arrays are archived to tape. At 00Z and 24Z the following five parameters are chosen:

1. U wind component (+ toward E) (m/s) at 1000 mb

2. V wind component (+ toward N) (m/s) at 1000 mb

3. Air temperature (^{o}C) at 1000 mb

4. Height (m) of the 1000 mb pressure level

5. Height (m) of the 500 mb pressure level

The heights are used to compute MSL pressures (mb), P, according to

$$P = 1000 \times EXP(Z_{1000}/[1.5422885 \times (Z_{500} - Z_{1000})]), \quad (3.1)$$

where Z_{500} and Z_{1000} are the heights (m) of the 500 mb and 1000 mb pressure levels, respectively.

3.5 Description of the Archiving Program

The MEAD archiving program converts the beginning date of the requested time period into packed form and stores it in word 7 of the array LABEL, which is also the first argument of subroutine GETM. The words identifying the parameters and levels are also filled with the appropriate values and subroutine GETM is called ten times (See Sec. 3.3). Each spectral array with header information consisting of the 12 words of the array LABEL is written to tape sequentially. The tape contains fully qualifying information about parameter and level with its position within the sequence of ten arrays also identifying it as either the analysis file at 00Z or the 24Z forecast made from the date. The Julian day is then incremented by one and used to check for change of year and leap year. A new year, month, and day is defined and used to assemble a new date word. Then ten new calls of GETM are made to retrieve the spectral arrays which are then written to tape. The data are retrieved and stored until the program completes the number of days specified by the requested span. A diagnostic summary file is printed with the error codes from calls to GETM indicating the status of the data retrieval.

The MEAD archiving and selective retrieval programs make extensive use of the NMC package of W3LIB subroutines and functions for input/output operations, to pack/unpack data fields, make date and time conversions, and transform data fields (NMC, 1982). Calls to these routines can be made directly on the NAS 9050.

3.6 Description of the Archive Tape Format

The MEAD archive of spectral coefficients consists of binary data written to magnetic tape on the NAS 9050 system. The tapes are 9-track, standard labelled (SL), 6250 bytes per inch

(BPI) tapes having a data set name (DSN) of MRF.

Each spectral array consists of 12 integer words of header information in NWS' O.N. 85 format followed by 992 complex words of which the last 31 apply only to wind variables. The complex values are equivalenced with an array of length 1984 integer words to facilitate the input/output operations. A spectral array consists of 1996 integer words with a logical record length (LRECL=7984) specified in bytes. This spectral data represent one parameter of global MRF data of either an analysis file (00Z) or a forecast file (24Z) from a given day.

Each physical record is preceded by a block descriptor word (BDW) four bytes long and each logical record containing a header and spectral array is preceded by a segment descriptor word (SDW) four bytes long. With a blocking factor of 4:1 and with block and segment descriptors comprising 20 bytes, the physical record size in bytes is 31956 (BLKSIZE=31956). The record format is binary (RECFM=VBS) and density at which data are written is 6250 BPI (DEN=4). The NAS DCB characteristics are given in the following DCB statement:

```
// DCB=(RECFM=VBS,LRECL=7984,BLKSIZE=31956,DEN=4)
```

Since ten arrays are needed for each date specified, a total of 420 arrays represent 42 days of spectral data selected from the NMC disk archive. This constitutes approximately 51.3 ft of magnetic tape for storage purposes. For each execution of the archiving program, an output tape number must be assigned (VOL=SER=TAPENO), a file number specified in field FILENO of (LABEL=(FILENO,SL,,OUT)), and a disposition of either NEW (DISP=(NEW,PASS)) for an initial use of the tape and file or MOD (DISP=(MOD,PASS)) if data are to be added sequentially behind already existing spectral arrays as follows:

```
// VOL=SER=TAPENO,LABEL=(FILENO,SL,,OUT),DISP=(NEW[MOD],PASS)
```

Current plans are to store MRF spectral coefficients by executing the MEAD archiving program approximately ten times per year. Each tape file would then contain one year of model data from which gridding and selective retrieval could be made. The procedures for running the MEAD archiving program are given in Appendix A.

4. THE MEAD SELECTIVE RETRIEVAL OF GRIDDED MRF DATA

4.1 Description of the Selective Retrieval Program

The second MEAD program (XSMRF) (Figure 3.1b) reads spectral arrays within a given time span, converts the coefficients to a field of variables on a specified grid mesh, and selectively retrieves a subset of gridded values by a user-specified latitude/longitude window. The user has the option of selecting from either the current NMC 42-day disk archive or the MEAD archive on magnetic tape, but not both, for each submission. Since the spectral arrays are global, data from both Northern and Southern hemispheres can be retrieved simultaneously. The user-specified window contains the minimum and maximum values of latitude and longitude between which the grids are taken. It can include grids from both hemispheres.

For a given user request, only one of the two available grid meshes can apply: either (a) a 2.5 degree X 2.5 degree latitude/longitude array of word size (37 X 145 X 2) or (b) a polar projection array of word size (65 X 65 X 2). Spectral arrays are converted to gridded data values for each parameter for both hemispheres. The program systematically determines whether or not each grid point of the chosen gridmesh is within the requested window. If it is, the proper hemisphere is identified and parameter values are printed to an output file directly. A print file is returned to the VAX 11/780 via a Remote Job Entry (RJE) telecommunications line designated as PAG26. At this point the file can be printed in its entirety or stored and used as input to an applications program as determined by the user.

Instructions for running the MEAD selective retrieval program are given in Appendix B. Formats for the output file are given in Appendix C.

4.2 Description of the User Input

The user provides information to the retrieval program (XSMRF) in an input file as part of the batch submission. The first input record of this file specifies the time span sought as a beginning date/time field consisting of year, month, day, and hour followed by a second (ending) date/time field. Each field value is two digits long with hour having a value of 00 since the MRF model runs once daily at 00Z.

The second input record specifies the latitude/longitude window as a minimum latitude, maximum latitude, minimum longitude, and maximum longitude. All available model data are retrieved that fall within this window. The window values are specified as real numbers given in degrees and hundredths. The latitudes are given between -90.00 and 90.00 degrees and longitudes between -180.00 and 180.00 degrees. Eastern hemisphere longitudes are positive and increase to the east of the Greenwich meridian. Western hemisphere longitudes are negative and decrease in magnitude to the west of the Greenwich meridian.

The first of two fields of the third input record specifies the input source of the MRF model data as either the current 42-day disk archive or the MEAD archive tape. The disk archive is specified with a value of 0 and tape input is specified with a value of 1. The second field specifies the gridmesh from which the selective retrieval occurs. There are two options: a value of 1 specifies the latitude/longitude grid of size 2.5 degrees and a value of 2 specifies the polar stereographic grid.

4.3 Description of the Output File

The output returned from the user request consists, for each grid, of four parameters in the following order: (1) wind U-component (m/s) at 1000 mb, (2) wind V-component (m/s) at 1000 mb, (3) atmospheric temperature (^{O}C) at 1000 mb, and (4) atmospheric pressure (mb) at Mean Sea Level (MSL). For each day of the request, these parameters are returned for both the analysis file at 00Z and the 24-hour prediction (24Z) from the MRF model run so that two lines of output having a header identifying the date and time, the analysis or forecast, the grid type, the hemisphere, the latitude and longitude of the grid point, and the values for the parameters are given (Appendix C). The model data follow sequentially until values for the last day of the selected time span are given.

If data for a given day are unavailable, a message informing the user is printed in a separate message file. For a given day, values for all grids in the requested window are given before the next day's data begin in sequence.

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Appendix A. Running the MEAD Archive Program (AMOS).

These steps are needed to run the archiving program AMOS on the NAS in batch mode with a run file created on the AISC VAX 11/780.

1. Log on to the VAX.

2. The run file AMOS.RJE is stored in SY1:[LFMDB] on the VAX where SY1 identifies the disk pack and LFMDB is the directory name. Copy AMOS.RJE into the user's directory. Make the desired changes in the runstream as follows (see Figure 3.1a) :

   (a) //DMRF JOB (GGGGGGTTTTTTTT,BINPAGE),PROGRAMMER

   Enter GGGGGG as the organization code, TTTTTTTT as the task code number, and PROGRAMMER as the programmer name.

   (b) 87 1 1 0 87 2 11 0 (data input)

   Specify the beginning and ending date/times of the retrieval period as year, month, day, and hour (Z) for each date/time. The FORTRAN FORMAT is 2(4I3). No more than 42 days should be requested for the time span with no initial date/time preceding the current date by more than 41 days since the disk archive holding 42 days of data is to be accessed.

   (c)
   ```
   //GO.FT10F001 DD DSN=MRF,DISP=(NEW,PASS),
   // DCB=(RECFM=VBS,LRECL=7984,BLKSIZE=31956,DEN=4),
   // UNIT=T6250,LABEL=(fileno,SL,,OUT),VOL=SER=EMMMMM
   ```

   Enter the file number (fileno) to which spectral coefficients are to be written on a magnetic tape with a number given as EMMMMM (available from the NAS tape librarian). The present archive is on tape E11202 for which the backup is tape E11204.

3. Check the status of the VAX Remote Job Entry (RJE) line by entering: Q RJE. If the line is stopped, a message will appear. Dial user services for the NAS and ask to have the PAG26 line restarted.

4. Submit the run to the NAS by entering:

   NASRJE AMOS

   The VAX file AMOS.RJE is sent to the NAS computer without having to specify the three letter qualifier RJE.

5. Check the file RJESUB.LOG to ensure file was properly sent. This involves editing the file RJESUB.LOG and doing a word search for the word TRANSMIT. If the messages "TRANSMIT BEGINNING..." and "TRANSMIT COMPLETED..." are found, the submission was successful. If the message "TIMEOUT BIDDING..." is found the submission was unsuccessful and must be repeated after the line is brought up.

6. To check for a completed run of AMOS on the NAS, log into account RJE on the VAX and enter:

   SCAN2

   A complete list of returned jobs will appear with the following specification: "RJE2.RJE;[version no.] [jobname]". For a submission of AMOS a jobname of DMRF should appear. This file can be perused using the VAX editor or printed in part or in its entirety.

Appendix B. Running the MEAD Selective Retrieval Program (XSMRF).

1. Log on to the VAX.

2. The run file XSMRF.RJE is stored in SY1:[LFMDB] on the VAX where SY1 identifies the disk pack and LFMDB is the directory name. Copy AMOS.RJE into the user's directory. Make the desired changes in the runstream as follows (see Figure 3.1b):

   (a) //DXS JOB (GGGGGGTTTTTTTT,BINPAGE),PROGRAMMER

   Enter GGGGGG as the organization code, TTTTTTTT as the task code number, and PROGRAMMER as the programmer name.

   (b) 87 1 1 0 87 2 11 0 (data input)

   Specify the beginning and ending date/times of the retrieval period as year, month, day, and hour (Z) for each date/time. The FORTRAN FORMAT is 2(4I3). No more than 42 days should be requested for the time span with no initial date/time preceding the current date by more than 41 days since the disk archive holding 42 days of data is to be accessed.

   (c) -70.00 -65.00 -90.00 -80.00 (data input)

   Specify the minimum latitude, maximum latitude, minimum longitude, and maximum longitude with a FORTRAN FORMAT of 2(2F8.2). The latitude must be specified between -90.00 and 90.00 degrees, and the longitude must be between -180.00 and 180.00 degrees.

   (d) 0 1 (data input)

   Enter the tape/disk option field and the grid specifier field in the next record with a FORTRAN FORMAT of 2I5. The tape/disk option field is given a value of 0 for accessing the 42-day disk archive or a value of 1 for accessing the MEAD tape archive. The grid specifier field is given a value of 1 for the 2.5 degree latitude/longitude field or 2 for the polar field.

   (e) //GO.FT10F001 DD DSN=MRF,DISP=(OLD,PASS),
       // DCB=(RECFM=VBS,LRECL=7984,BLKSIZE=31956,DEN=4),
       // UNIT=T6250,LABEL=(fileno,SL,,IN),VOL=SER=EMMMMM

   Enter the file number (fileno) from which spectral coefficients are to be read on a magnetic tape with a number given as EMMMMM (available from MEAD). The present archive is on tape E11202 for which the backup is tape E11204. The disposition field DISP must be specified as OLD and the LABEL field must be specified as IN for input only operations.

3. Perform Step 3 of Appendix A to check status of the RJE line. The submission of program XSMRF is made by entering:

   NASRJE XSMRF

   When the program completes on the NAS, the output is returned through the RJE line designated as PAG26. The SCAN2 procedure can be used as described in Appendix A to check the returned output, which has a jobname of DXS.

Appendix C. Output File of the Selective Retrieval Program

Each record of the output file defines one returned time for one grid of either the 00Z analysis file or the 24Z prediction file (forecast valid for 00Z on the next day) which is contained within the geographical window.

Record No. 1 : FORMAT(1X,2(I4),2(2F8.2),I5)

Record No. (2 - [N+1]): FORMAT(1X,5I3,2I2,2F8.2,4F7.1)

Record No.	Variables	Definition
1	Date/time 1	First Year, Month, Day, Hour
	Date/time 2	Last Year, Month, Day, Hour
	Lat/min,max	Minimum, maximum latitude (decimal degrees) to hundredths
	Lon/min,max	Minimum, maximum longitude (decimal degrees) to hundredths
	N	Number of data records to follow
2 - (N+1)	Year	Year of model run
	Month	Month of model run
	Day	Day of model run
	Hour	Hour of model run
	Forecast Hour	Analysis file (00) or prediction for the given hour (24)
	Grid Type	Value of 1 is 2.5 degree lat/lon grid; value of 2 is polar grid
	Hemisphere	Value of 1 is Northern hemisphere, and 2 is Southern hemisphere
	Latitude	Latitude of the grid point in degrees and hundredths
	Longitude	Longitude of the grid point in degrees and hundredths
	U	East (+) wind velocity component (m/s) at 1000 mb to tenths
	V	North (+) wind velocity component (m/s) at 1000 mb to tenths
	T	Temperature (^{o}C) at 1000 mb to tenths
	P	Mean Sea Level Pressure (mb) to tenths