Technical Document 2697
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Downloading Environmental Data in the New MOODS Format

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INTRODUCTION

The Master Oceanographic Observation Data Set (MOODS) maintained by the Naval Oceanographic Office (NAVOCEANO) is the standard Navy file for oceanographic data (references 1 and 2). Recent changes in the MOODS format were necessitated to conform with security requirements, thus making the new file incompatible with data included in earlier versions. The routines described in this report are designed to read small files in the new format, such as from an individual oceanographic survey or fleet exercise, and to convert them into the format used for storing processed MOODS data at the Naval Command, Control and Ocean Surveillance Center, RDT&E Division (NRaD). The software described herein is designed to operate on an IBM-compatible personal computer equipped with a hard disk output to a Hewlett-Packard Laser Jet Series II or later printer.

> **NOTE**: Some MOODS data are classified. The user is reminded that security regulations require that a TEMPEST-certified, IBM/PC–compatible computer be used to process classified data. If classified, the level of classification will be marked on both the transmittal sheet and data diskette received from NAVOCEANO.

MOODS files are received from NAVOCEANO Code N3211 with a unique six-digit identification number with the file extension .DOM, for example: 260393.DOM.

The file may contain data from several sources, including expendable bathythermographs (XBT), hydrocasts (Nansen casts), salinity-temperature depth (S-T-D) or conductivity–temperature–depth (C-T-D) probes, sonobuoys (AXBT), and naval message (BATHY) reports. The contents may include all available data from an area of interest, such as the southern California Bight, or may be restricted to a specific type data, or data set (SHAREM XBT data).

The output file should be given a name no longer than eight characters that reflects the geographic region of the data (i.e., SOCAL for the Southern California Bight) or a particular event (SHRM102A for SHAREM 102A). The name need not reflect the type data contained in the file, because data source will be indicated in an automatically assigned file extension; for example, file SOCAL.MBT contains XBT data (“BT”) in the MOODS format (“M”) collected in the southern California Bight (“SOCAL”). The name of a file containing CTD data in the SOCAL area would differ only by the extension .MST.

Each observation in the MOODS file includes three lines of information, including position, day–time group, cruise number, number of data points, maximum observed depth, and classification. With the exception of cruise number, these parameters are self-evident. The cruise number is a unique identifier for a specific data set assigned by the archival agency.

A sequential listing of file contents may be obtained either (1) as the data are processed or (2) prior to processing, if the traces are operated on one at a time. In table 1, the example given is for the latter case where only the first file header line was read; thus, maximum observed depth is unknown. Had the data been processed, the greatest depth observed would have been printed. The number of points indicates either (1) smoothed points for processed data or (2) the number of observed points for unprocessed (raw) data. The last column shows the NAVOCEANO instrument code (11), indicating that the observations were taken with an XBT.

Table 1. Sequential listing of file contents.

FILE C:\TEST0.MBT DOWNLOADED FROM FILE B:\260393.DOM AT 1452 16 AUG '94

I	LAT	LON	GMT	MON	YR	CRNO	NPTS	DPTH	INSTR
1	26-13N	53-58E	050819Z	JAN	1993	260393	194	UNKWN	11
2	25-10N	57-32E	060818Z	JAN	1993	260393	791	UNKWN	11
3	24-52N	60-56E	070255Z	JAN	1993	260393	793	UNKWN	11
4	24-39N	60-19E	080807Z	JAN	1993	260393	788	UNKWN	11
5	24-39N	60-13E	081035Z	JAN	1993	260393	788	UNKWN	11
6	24-49N	60-32E	081230Z	JAN	1993	260393	788	UNKWN	11
7	24-43N	60-37E	081815Z	JAN	1993	260393	783	UNKWN	11
8	24-45N	60-28E	082032Z	JAN	1993	260393	789	UNKWN	11
9	24-45N	60-21E	082234Z	JAN	1993	260393	790	UNKWN	11
10	24-44N	60-01E	090340Z	JAN	1993	260393	789	UNKWN	11
11	24-53N	60-00E	090604Z	JAN	1993	260393	791	UNKWN	11
12	24-53N	59-52E	090800Z	JAN	1993	260393	789	UNKWN	11
13	24-53N	59-46E	090907Z	JAN	1993	260393	796	UNKWN	11
14	24-53N	59-41E	091000Z	JAN	1993	260393	789	UNKWN	11
15	24-59N	59-47E	091200Z	JAN	1993	260393	797	UNKWN	11
16	25-01N	59-38E	091400Z	JAN	1993	260393	795	UNKWN	11
17	25-02N	59-31E	091558Z	JAN	1993	260393	671	UNKWN	11
18	24-59N	59-20E	091800Z	JAN	1993	260393	790	UNKWN	11
19	24-53N	59-02E	092002Z	JAN	1993	260393	794	UNKWN	11
20	24-49N	59-01E	092200Z	JAN	1993	260393	797	UNKWN	11
21	24-50N	59-01E	100000Z	JAN	1993	260393	796	UNKWN	11
22	24-45N	59-03E	100205Z	JAN	1993	260393	798	UNKWN	11
23	24-44N	58-56E	100401Z	JAN	1993	260393	797	UNKWN	11
24	24-53N	59-19E	100556Z	JAN	1993	260393	783	UNKWN	11
25	24-53N	59-20E	100635Z	JAN	1993	260393	792	UNKWN	11
26	24-55N	59-13E	100800Z	JAN	1993	260393	786	UNKWN	11
27	24-56N	59-02E	101000Z	JAN	1993	260393	799	UNKWN	11
28	24-56N	58-55E	101159Z	JAN	1993	260393	774	UNKWN	11
29	24-59N	58-59E	101400Z	JAN	1993	260393	793	UNKWN	11
30	24-52N	59-07E	101556Z	JAN	1993	260393	742	UNKWN	11
31	24-44N	59-00E	101803Z	JAN	1993	260393	783	UNKWN	11
32	24-54N	58-55E	102001Z	JAN	1993	260393	790	UNKWN	11
33	25-08N	58-45E	102221Z	JAN	1993	260393	546	UNKWN	11
34	25-07N	58-55E	110022Z	JAN	1993	260393	656	UNKWN	11
35	25-06N	58-54E	110201Z	JAN	1993	260393	651	UNKWN	11
36	25-05N	59-11E	110418Z	JAN	1993	260393	722	UNKWN	11
37	25-08N	58-59E	110608Z	JAN	1993	260393	668	UNKWN	11
38	25-01N	58-58E	110800Z	JAN	1993	260393	794	UNKWN	11
39	24-55N	58-59E	111000Z	JAN	1993	260393	785	UNKWN	11
40	24-55N	58-54E	111159Z	JAN	1993	260393	781	UNKWN	11
41	24-59N	58-48E	111400Z	JAN	1993	260393	778	UNKWN	11
42	24-57N	58-29E	111600Z	JAN	1993	260393	797	UNKWN	11
43	24-55N	58-11E	111800Z	JAN	1993	260393	789	UNKWN	11
44	24-52N	57-50E	112001Z	JAN	1993	260393	782	UNKWN	11
45	24-49N	57-33E	112200Z	JAN	1993	260393	793	UNKWN	11
46	24-49N	57-14E	120001Z	JAN	1993	260393	788	UNKWN	11
47	24-49N	57-01E	110205Z	JAN	1993	260393	790	UNKWN	11
48	24-47N	57-01E	120415Z	JAN	1993	260393	789	UNKWN	11
49	24-47N	57-01E	120600Z	JAN	1993	260393	789	UNKWN	11
50	25-12N	57-04E	120900Z	JAN	1993	260393	770	UNKWN	11
51	25-17N	56-56E	121116Z	JAN	1993	260393	183	UNKWN	11
52	25-23N	56-53E	121151Z	JAN	1993	260393	136	UNKWN	11
53	25-45N	56-45E	121404Z	JAN	1993	260393	73	UNKWN	11
54	25-47N	56-45E	121413Z	JAN	1993	260393	77	UNKWN	11

The user has the option of filtering the data as a function of month, season, or annual (all) data. This feature can be used to access data for a specific period from a data file containing all available data. It is particularly helpful in illustrating monthly or seasonal change.

DRIVE ASSIGNMENT

It is likely that different computers and situations (i.e., processing of classified and unclassified data) will require that different drives be used; for example, data received from NAVOCEANO may be stored on a 3.5-inch diskette, which the operator might insert into drive B, and processed (downloaded) either to a hard drive (usually drive C) or to a 5.25-inch diskette on drive A. Drive designation is assigned a given computer as desired by using the supporting program NUDRV. Program NUMDS automatically accesses drive assignments from file NUFLS.

SMOOTHING

Input of data to many acoustic performance prediction programs is limited to a set number of data points.[1] Because MOODS observations may include several hundred depth–temperature pairs, it may be necessary to smooth the data using a modification of a NOAA smoothing function (reference 3). A default number of 33 data points is selected, thus permitting the addition of additional points during the editing routine. If the default value is unacceptable for any reason, the operator may change the number as long as it does not exceed a maximum of 60 data points.

[1]For example, the ODAS module of the GFMPL can accept up to 50 sets of depth–temperature pairs; whereas, the SASEA Program at NRaD can accept only 33.

The smoothing algorithm begins by forming a rectangle around the first two data points of the temperature profile. Orientation of the box is determined by the temperature gradient, with width (filter) offset a predetermined amount to either side of a line connecting the first two temperature–depth pairs. If the next data point falls within the rectangle formed by the box, the box is extended downward. If a data point falls outside the box, then this point is selected as an inflection point and a new box is formed. Should the number of data points in the candidate smoothed profile be more than the maximum number allowed, the offset (filter) will be increased by 10 percent and the process repeated. Filter size appears on the screen whenever the program chooses a new filter. In the extreme case where a profile is too complex to permit smoothing within the allowed number of points, the user will be asked to either skip the profile or increase filter size. In most cases, it is recommended that the trace be skipped.

The smoothing process will be reiterated until either (1) trace decimation has occurred within the allowed number of data points or (2) an error message is shown. Successful completion of the smoothing process causes a graphic to appear with raw and processed traces superimposed as shown in figure 1. Trace editing can be accomplished as shown in figure 2. The XBT trace shown was taken in the Gulf of Oman during January 1993. Outflow of warm, highly saline water from the Persian Gulf is evident at a depth of approximately 200 meters. The accuracy of the smoothing algorithm is illustrated by the excellent agreement between profiles.

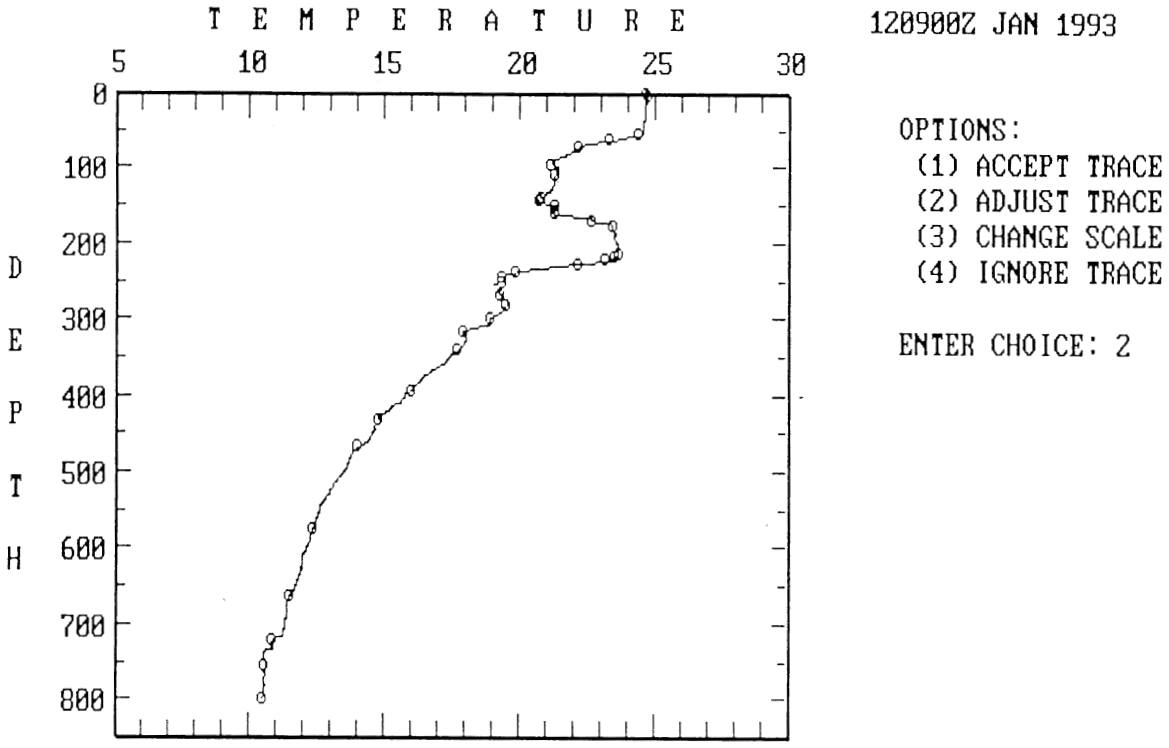

Figure 1. A smoothed trace ready for editing. The smoothed trace is shown by circles superimposed on the raw trace.

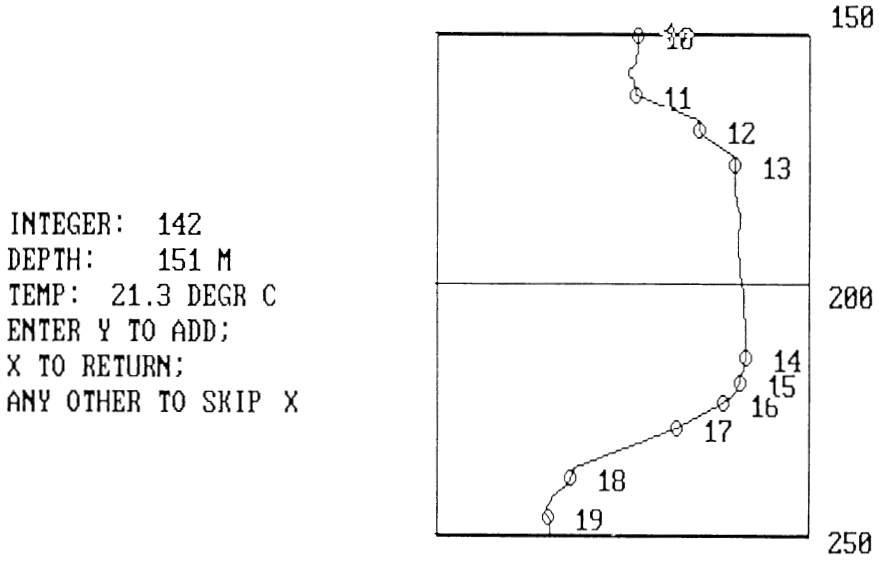

Figure 2. Expanded segment of above profile between 150 and 250 m.

TRACE EDITING

Unless otherwise specified, the program will automatically set the horizontal (temperature) and vertical (depth) scales. The editing process progresses faster if the limits are set automatically; however, the limits can be set manually should the user want to make copies of the data using a standard base.

The user is asked if the trace should be (1) accepted for downloading to the data file, (2) modified by addition or deletion of points, (3) ignored without being downloaded, or (4) examined more closely. Upon selecting an option, the user will be asked to enter the approximate depth of the feature of interest. The program then plots a 100–meter segment of the trace below that point (figure 2).

ACOUSTIC MODEL INTERFACE

At the present time, there is no way to load data processed with NUMDS into standard Navy programs, such as the Oceanographic Data Analysis System (ODAS) module of the Geophysical Fleet Mission Program Library (GFMPL). (See reference 4). The NAVOCEANO Code N544 is addressing this problem, and it is hoped that a link will be available in the near future.

REFERENCES

1. Bauer, R., “Functional Description; Master Oceanographic Observation Data Set (MOODS),” Compass Systems Inc., 1982.

2. Jugan, M.J., and H. Beresford, “Editing Approach for the Navy’s Master Oceanographic Observation Data Set,” published in *Proceedings of MTS ’91, An Ocean Cooperative: Industry, Government, and Academia, Vol II,* 1991.

3. National Atmospheric and Oceanic Administration, “SEAS III SOFTWARE; Version 2.1,” National Ocean Services, Ocean Observation Div., 1980.

4. Naval Oceanographic Office, “Geophysical Fleet Mission Program Library (GFMPL); PC/AT DTC User’s Manual,” 1992.

APPENDIX A
TYPICAL RUN STREAMS

DRIVE ASSIGNMENTS

A1. Enter **NUDRV**[1] to assign drive. You will then be directed to designate the drives desired for each file assignment.

```
ENTER DRIVE FOR NEW MOODS DISKETTE:  B

IS DRIVE B:\ CORRECT? ANS Y OR N:  Y[2]

ENTER DRIVE FOR STORAGE OF PROCESSED DATA:  A

ENTER DRIVE FOR CLASSIFIED DATA (IF REQ'D):  A
```

Drive assignments will be copied to file NUFLS and assignments confirmed. Thereafter, this routine need not be used unless drive reassignment is required.

MAIN PROGRAM

A2. Initiate Routine NUMDS by entering **NUMDS**. On startup, you will be asked if the program is being run on a secure computer (i.e., TEMPEST approved).[3] If the reply is in the affirmative, printer output will be suppressed and all listings will be downloaded to a diskette in drive A: for later examination. File name for downloaded header data is the same as the input file, but with the extension starting with the letter "M" and ending with two letters indicating the type data.

```
IS PROGRAM BEING RUN ON A SECURE COMPUTER? ANS Y OR N:  N
```

A3. You will be asked to enter the name of the MOODS file as received from NAVOCEANO. The file extension (.DOM) should not be input as it will be added automatically.

```
ENTER FILE NAME (W/O EXTENSION):  970A
```

A4. The file may be run in two modes: (1) automatic processing of all observations in sequential order or (2) processing of selected observations only.

```
SELECT OPERATION:
  (1) PROCESS COMPLETE DATA SET,
  (2) PROCESS SINGLE PROFILE,
  (3) END PROGRAM
ENTER DESIRED OPERATION:  1
```

---

[1] In this document, computer input is shown in **bold face**.

[2] The phrase "ANS Y OR N," although used throughout the computer dialogue, will not be used henceforth in this text.

[3] Under most circumstances, processed data downloaded from CONFIDENTIAL files will be unclassified as only cruise number, not ship name/designator or platform, is extracted. However, classification must be made on a case-by-case basis.

A5. You must then specify type instrument desired when designating a file to ensure that the output file is assigned the proper extension. File extension denoting type data stored in the file is shown on the right side of the menu.

```
INDICATE TYPE DATA:
  (1) XBT DATA                [.MBT]
  (2) CTD OR STD DATA         [.MST]
  (3) NANSEN CAST DATA        [.MOS]
  (4) AXBT DATA               [.MAX]
  (5) BATHY MSG DATA          [.MSG]
ENTER CORRECT INSTRUMENT:  1
```

NOTE: Smoothed (decimated) and unsmoothed (raw) data co-exist in the MOODS XBT, CTD/STD, and AXBT files. It should also be noted that data measured by any of the above systems may be contained in the same file.

A6. Data files may contain data collected anywhere from a relatively short period to all data ever collected. You may filter these data by month or season using the following menu:

```
SELECT PERIOD:
  (1) JAN          (7)  JUL        (13)  WINTER (JAN-MAR)
  (2) FEB          (8)  AUG        (14)  SPRING (APR-JUN)
  (3) MAR          (9)  SEP        (15)  SUMMER (JUL-SEP)
  (4) APR          (10) OCT        (16)  WINTER (OCT-DEC)
  (5) MAY          (11) NOV        (17)  ANNUAL (JAN-DEC)
  (6) JUN          (12) DEC
ENTER CORRECT PERIOD:  14
```

A7. You must indicate whether the data file is to be smoothed (decimated) or retained in the original format. The option to smooth is the normal choice to permit efficient use of the data for acoustic performance prediction or statistical computations.

```
DO YOU WANT TO SMOOTH THE DATA?:  Y
```

If the response is negative, the program will jump to paragraph A11.

A8. You should enter a different file name for the processed file. It is suggested that a descriptive name (e.g., SOCAL) be used in lieu of a numerical name assigned by NAVOCEANO to differentiate the raw file from the processed file.

```
ENTER NAME FOR THE PROCESSED DATA FILE: SOCAL

IS FILE NAME SOCAL CORRECT?  Y
```

A9. The maximum number of points in a smoothed profile is limited to 60. However, this number is greater than the maximum allowable number of points that can be entered into navy standard acoustic performance prediction programs. Thus, a default value of 33 points has been selected. If this number is unacceptable, enter the number desired. Otherwise, press the **<RETURN>** key.

```
MAX NUMBER OF POINTS IN SMOOTHED PROFILE WILL BE 33.
PRESS RETURN IF OK OR ENTER NEW NUMBER: 30

MAX NUMBER OF POINTS RESET TO 30.  IS THAT CORRECT? Y
```

The raw profile (continuous line) and smoothed profiles (dots) appears on an x-y plot as shown in figure 1 (of main text). Horizontal and vertical plot axes may be set automatically based on the profile under examination or standardized to remain constant on all profiles. It is recommended that the automatic option be used unless a screen copy is to be made of each graphic. This option is discussed further in paragraph A10.

```
DO YOU WANT GRAPHIC LIMITS SET AUTOMATICALLY?:  N
```

If the response to the above query is negative, the program scans the profile for minimum and maximum values (rounded up or down as appropriate) and queries if the computed values are OK.

A10. If you opted to plot selected profiles only (see paragraph A4), the sequence number must be entered before the trace can be downloaded. If desired, you may print a sequential listing of profiles as shown in table 1 (of main text).

```
YOU NEED TO KNOW THE SEQUENTIAL TRACE ORDER IN THIS MODE.

DO YOU WANT A LISTING OF THE SEQUENTIAL ORDER?  Y

ENTER FILE POSITION (I) OF DESIRED TRACE: 5
```

A11. If automatic scale selection was selected, the computer will ignore this section. However, if this is not the case, and you want the same limits for all plots, then you must enter the desired limits for each graphic.

```
HORIZ PLOT LIMITS ARE 13 AND 22.  IS THIS OK?  N

ENTER DESIRED PLOT MINIMUM:  10

ENTER DESIRED PLOT MAXIMUM:  25

MAXIMUM DEPTH SET AT 200.  IS THIS OK?  N

ENTER PLOT DEPTH IN METERS:  500
```

A12. After the profiles have been plotted on the screen, you must decide if the plot is acceptable or if additional work is required. (See figure 1 of the main text.) The user must make a selection from the option menu shown on the right side of the graphic before continuing.

```
OPTIONS:
  (1) ACCEPT TRACE
  (2) ADJUST TRACE
  (3) CHANGE SCALE
  (4) IGNORE TRACE
ENTER CHOICE:
```

Accept Trace: This option results in the trace being downloaded into a smoothed data file with the designated file name, including extension.

If multiple profiles are being processed, the program will extract the next observation until the file is exhausted. If individual profiles are being extracted, you will be asked if another profile is

desired upon completion of the current profile. Upon reaching the end of the file, you must indicate if the program should be ended or another file examined.

Adjust Trace: The smoothing algorithm may (1) miss a desirable inflection point such as sonic layer depth or (2) accept an obviously erroneous point. This option permits you to edit the profile by addition or subtraction of points, or truncation at a user-designated depth. If the addition of points increases the number beyond the maximum number selected in paragraph A9, you will be told that a point must be deleted before another point can be added.

```
OPTIONS:
  (1) ADD POINT
  (2) DROP POINT
  (3) TRUNCATE OB
  (4) RETURN
ENTER CHOICE
```

Add Point: Upon selection of this option, you must enter the depth of the point of interest and an expanded portion of the trace will be drawn around that point as discussed below. An arrow will appear to the right of the first (shallowest) point of the expanded profile, with depth and temperature of that point shown to the lower left of the box. The arrow may be made to move down to the next point on the raw trace by pressing **RETURN**. Enter **Y** to select the point for the digitized profile or **X** to exit from the expanded profile. If a desired point is missed on the first try, continue downward by pressing **RETURN** and the arrow will recycle to the top of the trace. However, the arrow will not be seen on this descent of the profile. Position of the cursor will be at that depth point immediately above the uppermost arrow.

Delete Point: When this option is selected, you must enter a depth less than that of the point to be deleted. This depth should be not more that 50 m above the deleted point. An expanded plot will appear with the desired depth segment. The depth increment will appear to the right of each point of the smoothed profile. Eliminate a point by entering the appropriate increment (example: **21**).

Truncate Ob: Once again, you will be asked to enter the approximate depth for an expanded profile. Enter a depth about 25 m above the estimated depth of truncation on the raw profile and examine the ensuing expanded plot. Truncate the trace by entering the depth of truncation (example: **275**) and all smoothed values below that depth will be eliminated.

> **Note**: Points cannot be added to the trace after the truncation option has been exercised. Therefore, if a smoothed point does not occur immediately above the depth of truncation, be sure to add one using the add point option before truncating.

Return: This option permits you to return to the previous menu should you decide that no action is required.

Change Scale: The original plot limits selected may not illustrate the plot to best advantage. This may occur when the plot is to be saved using a screen capture utility for comparison with

other profiles with different depth or temperature scales. By activating this option, you can change the horizontal (temperature) and vertical (depth) scales before replotting.

Ignore Trace: This option will drop this trace from consideration and extract another profile. Exercising this option excludes this trace from the processed data file.

```
DO YOU WANT TO LIST THE HEADER INFO?:  N

COMPLETED READING FILE 970A FOR XBT DATA.

DO YOU WANT TO RUN ANOTHER DATA SET?  N
```

If the response is negative, the program stops. Otherwise, you will be asked to supply a new file name and the process is repeated.

Look at Trace: A 50-m segment of the raw and smoothed profiles can be examined using this option. This feature is very useful when trying to determine if data points should be added to or deleted from the smoothed trace. A depth value representing the top of the expanded portion of the profile is entered by the user. The program rounds off this entry to the nearest 25 m below the depth entered. For example, an entry of 320 m would be rounded off to 300 m. The temperature trace may extend outside the rectangle in the presence of a steep thermal gradient; however, this will not affect the ability to process the data.

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13. ABSTRACT *(Maximum 200 words)*

Oceanic data in the revised MOODS format require transformation into a modified format before they can be used by various processing and analysis routines resident at the NCCOSC RDT&E Division. This document describes a technique developed to modify small data sets into the desired format using an IBM-compatible personal computer. Depth increments may be reduced using a smoothing routine to a number of points compatible with the requirements of standard Navy acoustic performance prediction systems. Data editing routines are available.

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Oceanographic graphic data editing
Master Oceanographic Observation Data Set (MOODS)

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