NOAA Technical Memorandum ERL WPL-198

PROFILE - A PROGRAM TO GENERATE PROFILES FROM HARPO/HARPA ENVIRONMENTAL MODELS

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J.A. Harlan, T.M. Georges, and R.M. Jones

Abstract. We describe a FORTRAN computer program, PROFILE, that will generate plotting-command files for profile plots of the environmental models (e.g. sound speed, current or wind velocity, temperature) used with the acoustic ray tracing programs HARPO (underwater acoustics) and HARPA (atmospheric acoustics). Profiles (plots of depth/height versus environmental model parameter) can be made for any longitude-latitude for models that depend on all three spatial dimensions. A companion report describes an associated plotting program that produces PostScript files as well as screen graphics for PC-compatible computers. An additional companion report describes a computer program that calculates contours of these environmental model parameters. Includes a floppy disk with computer programs and a sample case. Also included are instructions for obtaining the programs (with updates) via Internet.

1. WHAT PROFILE DOES

1.1 Introduction

The ray tracing programs HARPA (Jones et al., 1986a) and HARPO (Jones et al., 1986b; Georges et al., 1990) use a variety of subroutines to specify sound speed, current/wind velocity, temperature, etc., as functions of the three spatial coordinates (longitude, latitude, and depth/height). When adjusting the parameters of such models to approximate measurements, it is helpful to plot profiles that compare the models to be used for ray tracing with measurements. We describe here a program, PROFILE, that produces such profile plots specifically for the model subroutines used by the HARPA/HARPO ray tracing programs.

The user may specify the longitude and latitude of the profile and also the desired height/depth interval. In addition, it is possible to specify one or more profiles (represented by a set of points, possibly measurements) to superimpose on any of the profile plots for comparison. It is also possible to plot multiple profiles on the same graph as long as the same set of models is used (though parameters may differ). It is not possible to plot profiles from different models on the same graph.

Profile creates a text output file TXTOUT that is read by

the program PSGRAPH (Harlan, et al., 1991a) that creates plots of publication quality which can be used in journal papers, presentations and reports to display the models used in ray tracing. Besides producing PostScript files PSGRAPH also produces PC-compatible screen graphics.

An additional companion report (Harlan, et al., 1991b) describes a computer program CONPLT, for calculating contours of the environmental models.

The body of this report has been written for the user with an IBM-PC-compatible computer. Because the PROFILE program was written in machine-independent FORTRAN, it can be used on any machine, however, PC-specific peripheral programs and operating system commands are necessary also (see Section 5).

1.2 Note for Non-PC Computer Users and PC-Users without Microsoft Compiler/Linker

Be sure to read Appendix A, which explains the system-dependent functions of the software provided on the distribution disk. This appendix is divided into sections for each operating system for which the PROFILE program has been successfully compiled.

2. INSTALLATION

2.1 Installing PROFILE via the Distribution Disk

The distribution floppy disk (1.2 MB, 5-1/4" IBM-PC/AT format) contains ASCII files, object files for the models, object files for the PROFILE program, three executable files and a copy of the report you are now reading. See Appendix B for a complete description of the files on the disk.

There are over 100 files provided on the diskette. Most of these files (about 80) are the environmental models source code and object files. Because the models are used by programs besides PROFILE, e.g., CONPLT and PC-HARPO, the user may want to locate the models in a directory which would be available to all programs. The INSTALL procedure described below allows the user to put the models in either 1) a subdirectory (called "MODELS") to the PROFILE working directory or 2) any existing directory (including the PROFILE working directory). If option 1 is chosen, the MODELS subdirectory will be created by the INSTALL program.

First, move to the directory in which you want to store and run the PROFILE program (and its peripheral files), but not necessarily the models files. The main directory of the

distribution diskette will always be copied into the directory from which INSTALL is invoked.

Second, invoke the INSTALL procedure. Type: **A:INSTALL**.

The user is prompted for answers and may restart the INSTALL program if a change is desired.

The location of the models files is written to the MODELDIR.DAT file. This file is used by the FINDMODL program to determine where the object files for the models are located when linking.

If, at a later time, the user decides to put the models files in a different directory, the MODELDIR.DAT file could be edited to reflect the new location of the models object files. This would avoid having to re-install the PROFILE diskette.

2.2 Installing PROFILE via Internet

The PROFILE program and its peripheral programs (i.e., the contents of the distribution disk) can be obtained via Internet and anonymous FTP. The "anonymous" account contians a directory "raytracing" which is divided into several subdirectories. The subdirectory "profile" contains the files which you will need. To access these files via anonymous FTP through the Internet, proceed as follows:

1. Log on to a host at your site that has an Internet connection and also supports the FTP command.

2. Invoke FTP by entering the Internet address of the server at our site:

   ftp pooh.wpl.erl.gov

   or

   ftp 140.172.32.11

3. **Log in as "anonymous"**

4. **For the password, enter your complete Internet address, e.g., jah@node.her.thr.gov**

5. **General instructions and information about the anonymous FTP account at our site is available in a file named "readme." To transfer this file to your local host, enter:**

   get readme

6. Change your current directory to the "raytracing/profile" subdirectory by entering:

   cd raytracing/profile

7. To transfer information about the profile subdirectory to your local host, enter:

   get readme.prf

8. To transfer those files in the profile subdirectory that you are interested in, enter:

   get file name

9. To return to your local host, enter:

   quit

3. THE SAMPLE CASE

The sample case illustrates many of the features of PROFILE and allows the user to verify that the program is working correctly.

Some of the features illustrated by the sample case are sound speed profiles, current/wind speed (magnitude and component) profiles, a temperature profile, a bottom topography profile, and comparison of measured profiles (points) with a sound speed profile produced from a HARP0 model.

3.1 Description of the Sample Case Input and Output

Figures 1 through 6 show completed input data forms indicating the profiles desired and the models to be used. (Appendices C1-C3 contain blank forms for general use. Appendix C4 describes the format for tabular input data). There are two examples of tabular data sets for sound speed profiles in the sample case as well as one example for temperature profiles.

Because of the large number of models available, many possible combinations of models can determine a profile. Figure 7 shows the input data file corresponding to the completed input data forms for the sample case (DINP.SAM). Appendix G contains a list of the plotting commands written to the output file, TXTOUT. Figures 8 through 13 show the plots produced by the program, PSGRAPH, for the sample case.

Model ID: ØT6

Profile type: sound speed 1.0 (W90=1.0)

current/wind speed _____ (W90=2.0)

vertical component of current/wind velocity _____ (W90=3.0)

southward component of current/wind velocity _____ (W90=4.0)

eastward component of current/wind velocity _____ (W90=5.0)

Superimpose this profile on the graph of the previous runset:

Yes __ (W90 negative; suppresses frame advance before plotting.)

No X (W90 positive.)

Latitude of the profile = 0.0 (rad, deg, (km)) north (W83)

Longitude of the profile = 0.0 (rad, deg, (km)) east (W84)

Height above sea level of bottom of graph = -5.0 km (W88)

Height above sea level of top of graph = 0.0 km (W89)

Minimum speed = 1.49 (km/s,) m/s (W92) (auto-scaling if zero)

Maximum speed = 1.54 (km/s) m/s (W93) (auto-scaling if zero)

Horizontal tick mark interval = 0.01 (km/s,) m/s (W94)
(auto-scaling if zero)

Vertical tick mark interval = 1.0 km (W96)
(auto-scaling if zero and defaults to meters)

Figure 1.--Input Data Form for Sample Case, Plot 1, Sound speed Profile

Model ID: ØT6

Profile type: sound speed _____ (W90=1.0)

current/wind speed 2 (W90=2.0)

vertical component of current/wind velocity _____ (W90=3.0)

southward component of current/wind velocity _____ (W90=4.0)

eastward component of current/wind velocity _____ (W90=5.0)

Superimpose this profile on the graph of the previous runset:

Yes __ (W90 negative; suppresses frame advance before plotting.)

No X (W90 positive.)

Latitude of the profile = 5.0 (rad, deg, (km)) north (W83)

Longitude of the profile = 145.0 (rad, deg, (km)) east (W84)

Height above sea level of bottom of graph = -5.0 km (W88)

Height above sea level of top of graph = 0.0 km (W89)

Minimum speed = 0.0 km/s, m/s (W92) (auto-scaling if zero)

Maximum speed = 0,0 km/s, m/s (W93) (auto-scaling if zero)

Horizontal tick mark interval = 0.0 km/s, m/s (W94)
(auto-scaling if zero)

Vertical tick mark interval = 1,0 km (W96)
(auto-scaling if zero and defaults to meters)

Figure 2.--Input Data Form for Sample Case, Plot 2, Current Speed Profile

Model ID: QT6

Profile type: sound speed _____ (W90=1.0)

current/wind speed _____ (W90=2.0)

vertical component of current/wind velocity _____ (W90=3.0)

southward component of current/wind velocity 4.0 (W90=4.0)

eastward component of current/wind velocity _____ (W90=5.0)

Superimpose this profile on the graph of the previous runset:

Yes __ (W90 negative; suppresses frame advance before plotting.)

No X (W90 positive.)

Latitude of the profile = 5.0 (rad, deg, (km)) north (W83)

Longitude of the profile = 145.0 (rad, deg, (km)) east (W84)

Height above sea level of bottom of graph = -5.0 km (W88)

Height above sea level of top of graph = 0.0 km (W89)

Minimum speed = 0.0 km/s, m/s (W92) (auto-scaling if zero)

Maximum speed = 0.0 km/s, m/s (W93) (auto-scaling if zero)

Horizontal tick mark interval = 0.0 km/s, m/s (W94)
(auto-scaling if zero)

Vertical tick mark interval = 0.0 km (W96)
(auto-scaling if zero and defaults to meters)

Figure 3.--Input Data Form for Sample Case, Plot 3, Southward Current Component Profile

Model ID: ØT6

Profile type: sound speed _____ (W90=1.0)

current/wind speed _____ (W90=2.0)

vertical component of current/wind velocity _____ (W90=3.0)

southward component of current/wind velocity _____ (W90=4.0)

eastward component of current/wind velocity 5.0 (W90=5.0)

Superimpose this profile on the graph of the previous runset:

Yes __ (W90 negative; suppresses frame advance before plotting.)

No X (W90 positive.)

Latitude of the profile = 5.0 (rad, deg, (km) north (W83)

Longitude of the profile = 145.0 (rad, deg, (km) east (W84)

Height above sea level of bottom of graph = -5.0 km (W88)

Height above sea level of top of graph = 0.0 km (W89)

Minimum speed = 0.0 km/s, m/s (W92) (auto-scaling if zero)

Maximum speed = 0.0 km/s, m/s (W93) (auto-scaling if zero)

Horizontal tick mark interval = 0.0 km/s, m/s (W94)
(auto-scaling if zero)

Vertical tick mark interval = 1.0 km (W96)
(auto-scaling if zero and defaults to meters)

Figure 4.--Input Data Form for Sample Case, Plot 4, Eastward Current Component Profile

Model ID: ØT6

Profile type: temperature
7.0 (W90=7.0)

Superimpose this profile on the graph of the previous runset?

Yes __ (W90 negative; suppresses frame advance before plotting.)

No X (W90 positive.)

Latitude of the profile = 5.0 (rad, deg, (km)) north (W83)

Longitude of the profile = 145.0 (rad, deg, (km)) east (W84)

Height above sea level of bottom of graph = 0.0 km (W88)

Height above sea level of top of graph = 3.0 km (W89)

Minimum Temperature (auto-scaling if zero) = 290.0 deg K (W92)

Maximum Temperature (auto-scaling if zero) = 300.0 deg K (W93)

Horizontal Tick Mark Interval (auto-scaling if zero) = 0.0 deg K (W94)

Vertical tick mark interval = 0.0 km (W96)
(auto-scaling if zero and defaults to meters)

Figure 5.--Input Data Form for Sample Case, Plot 5, Temperature Profile

Model ID: ØT6
Profile type: topography 6.0 (W90=6.0)

Superimpose this profile on the graph of the previous runset?

Yes __ (W90 negative; suppresses frame advance before plotting.)

No X (W90 positive.)

Left Latitude of the profile = 0.0 (rad, deg, (km)) north (W83)

Longitude of the profile = 0.0 (rad, deg, (km)) east (W84)

Right Latitude of the profile = 20.0 (rad, deg, (km)) north (W85)

Figure 6.--Input Data Form for Sample Case, Plot 6, Topography Profile

```
MIKE=JONES=RL3=X6464
0T6  MUNK'S 1974 UNIFORM SOUND CHANNEL WITH VVORTEX CURRENT MODEL 3
 83 0.              AN KM  LEFT LATITUDE OF PLOT, KM
 84 0.              AN KM  LEFT LONGITUDE OF PLOT, KM
 88-5.00000000000          HEIGHT ABOVE SEA LEVEL OF BOTTOM OF GRAPH, KM
 89 0.                     HEIGHT ABOVE SEA LEVEL OF THE TOP OF THE GRAPH
 90 1.00000000000          SELECT SOUND SPEED
 92 1.49000000000          HORIZONTAL AXIS MINIMUM
 93 1.54000000000          HORIZONTAL AXIS MAXIMUM
 94 .010000000000LN KM     HORIZONTAL AXIS TICK MARK INTERVAL
 96 1.00000000000          DISTANCE BETWEEN VERTICAL TICK MARKS, KM
100        9.              VVORTX3 MODEL CHECK NUMBER
 -1                        DATA SUBSET FOR BACKGROUND CURRENT MODEL
  A  VORTEX AT LONGITUDE 150 KM E, UMAX= 1.02 M/S, R= 50 KM
  0        RETURN TO W-ARRAY DATA SET
102        3.              VVORTX3 BACKGROUND CURRENT DATA SET ID
103      1.02     LN  M    MAXIMUM TANGENTIAL CURRENT, M/S
104       50.              RADIUS OF VORTEX CORE, KM
105        0.     AN KM    LATITUDE OF VORTEX CENTER, KM
106      150.     AN KM    LONGITUDE OF VORTEX CENTER, KM
107        1.              VERTICAL HALF-WIDTH OF VORTEX, KM
108       -1.              HEIGHT OF VORTEX CENTER ABOVE MSL, KM
125        0.              NPCURR MODEL CHECK NUMBER
 -2                        DATA SUBSET FOR PERTURBATION CURRENT MODEL
  A  NO CURRENT PERTURBATION
  0        RETURN TO W-ARRAY DATA SET
150 5.00000000000          CSMUNK1 SOUND SPEED MODEL
152 2.00000000000          INPUT DATA SET ID NUMBER
153 1.00000000000          REFERENCE SOUND SPEED
154 0.             AN KM   PH1 LONGITUDE 1
155 1.49200000000          CA1 SOUND SPEED ON AXIS
156-1.30000000000          ZA1 DEPTH OF AXIS
157 1.30000000000          H1 SCALE DEPTH
158 .007400000000          EP1 FRACTIONAL INCREASE OF C WITH DEPTH
159 1000.00000000AN KM     PH2 LONGITUDE 2
160 1.49200000000          CA2 SOUND SPEED ON AXIS
161-1.30000000000          ZA2 DEPTH OF AXIS
162 1.30000000000          H2 SCALE DEPTH
163 .007400000000          EP2 FRACTIONAL INCREASEE OF C WITH DEPTH
200 1.0                    TLINEAR MODEL CHECK NUMBER
201 1.                     DATA FORMAT CODE
202 1.                     DATA SET ID NUMBER
203 293.                   BOTTOM.TEMPERATURE, DEGREES KELVIN
204 2.3                    TEMPERATURE GRADIENT, DEGREES KELVIN/KM
225 0.                     NPTEMP, DO-NOTHING TEMPERATURE PERTURBATION
275 1.00000000000          RHORIZ RECEIVER MODEL CHECK NUMBER
300        4.              GLORENZ BOTTOM MODEL CHECK NUMBER
302        3.              GLORENZ BOTTOM MODEL DATA SET ID
303        .5              HEIGHT OF RIDGE, KM ABOVE BASE
304       10.     AN KM    N. LATITUDE OF RIDGE CENTER, KM
305        2.     AN KM    HALF-WIDTH OF THE RIDGE, KM
306       -3.              HEIGHT ABOVE MSL OF BASE OF RIDGE, KM
```

Figure 7.--Input Data File for the Sample Case

```
325         0.              DO-NOTHING BOTTOM PERTURBATION
  0
0T6    SAMPLE SOUND SPEED DATA POINTS
 90-42.0000000000        NEGATIVE VALUE INDICATES SUPERIMPOSE DATA POINTS
-42                      ENTERING DATA SUBSET
  2      999.0
   LN KM          LN KM
 -.568240E-01   1.53400
 -.710503E-01   1.53282
 -.853171E-01   1.53165
 -.995969E-01   1.53048
 -.113850       1.52931
 -.128006       1.52814
 -.141939       1.52697
 -.155372       1.52581
 -.167350       1.52464
 -.177608       1.52348
 -.195094       1.52232
 -.212698       1.52117
 -.230376       1.52001
 -.248050       1.51886
 -.265561       1.51770
 -.282521       1.51655
 -.297255       1.51540
 -.313064       1.51426
 -.335598       1.51311
 -.358481       1.51197
 -.381655       1.51082
 -.404971       1.50968
 -.428009       1.50854
 -.448662       1.50741
 -.471800       1.50627
 -.503609       1.50514
 -.536853       1.50401
 -.571848       1.50288
 -.609165       1.50175
 -.650365       1.50062
 -.698865       1.49950
 -.733760       1.49837
 -.770014       1.49725
 -.806911       1.49613
 -.841016       1.49501
 -.843638       1.49390
 -.941190       1.49278
 -4.32248       1.53400
 -4.26850       1.53282
 -4.21328       1.53165
 -4.15665       1.53048
 -4.09840       1.52931
 -4.03821       1.52814
 -3.97557       1.52697
 -3.90943       1.52581
 -3.83637       1.52464
 -3.75539       1.52348
 -3.69719       1.52232
```

Figure 7. (cont.)

```
 -3.63710        1.52117
 -3.57480        1.52001
 -3.50979        1.51886
 -3.44119        1.51770
 -3.36717        1.51655
 -3.28030        1.51540
 -3.19451        1.51426
 -3.13375        1.51311
 -3.07037        1.51197
 -3.00377        1.51082
 -2.93298        1.50968
 -2.85600        1.50854
 -2.76490        1.50742
 -2.67538        1.50627
 -2.45335        1.50288
 -2.36103        1.50175
 -2.24327        1.50062
 -2.06858        1.49950
 -2.03932        1.49837
 -2.01206        1.49725
 -1.99054        1.49613
 -1.98684        1.49501
 -2.08138        1.49390
 -1.97047        1.49278
  999.000
  0                      RETURNING TO W ARRAY DATA SET
  0
0T6    SAMPLE SOUND SPEED DATA POINTS
 90-41.0000000000        NEGATIVE VALUE = SUPERIMPOSE ON PREVIOUS PLOT
-41                      NEGATIVE VALUE = TABULAR DATA SET FOLLOWS
  2      999.0
   LN KM          LN KM
 -2.66103        1.51175
 -2.54327        1.51062
 -2.40858        1.50950
 -2.40932        1.50837
 -2.40206        1.50725
 -2.38054        1.50613
 -2.28684        1.50501
 -2.30138        1.50390
 -2.27047        1.50278
  999.000
  0                      RETURNING TO W ARRAY DATA SET
  0
0T6  MUNK'S 1974 UNIFORM SOUND CHANNEL WITH VVORTEX CURRENT MODEL 3
 29 1.0000               1 = PROFILE, 0 = SKIP THIS RUNSET
 83 5.          AN KM    Latitude of the profile   (rad, deg, km) north
 84 145.        AN KM    Longitude of the profile   (rad, deg, km) east
 88-5.00000000000        Height above sea level of bottom of graph   km
 89 0.                   HEIGHT ABOVE SEA LEVEL OF TOP OF GRAPH
 90 2.00000000000        CURRENT SPEED
 92 0.00000000000        Minimum speed km/s, m/s
 93 0.00000000000        Maximum speed km/s, m/s
 94 0.00000000000        Horizontal tick mark interval km/s, m/s
 96 1.00000000000        Vertical tick mark interval km
```

Figure 7. (Cont.)

```
 0
0T6  MUNK'S 1974 UNIFORM SOUND CHANNEL WITH VVORTEX CURRENT MODEL 3
 29 1.0000                 1 = PROFILE, 0 = SKIP THIS RUNSET
 83 5.           AN KM     Latitude of the profile   (rad, deg, km) north
 84 145.         AN KM     Longitude of the profile   (rad, deg, km) east
 88-5.00000000000          Height above sea level of bottom of graph   km
 89    0.                  Height above sea level of top of graph  km
 90 4.00000000000          SOUTHWARD component of current velocity
 92 0.00000000000          Minimum speed km/s, m/s
 93 0.00000000000          Maximum speed km/s, m/s
 94 0.00000000000          Horizontal tick mark interval km/s, m/s
 96 0.00000000000          Vertical tick mark interval km
 0
0T6  MUNK'S 1974 UNIFORM SOUND CHANNEL WITH VVORTEX CURRENT MODEL 3
 29 1.0000                 1 = PROFILE, 0 = SKIP THIS RUNSET
 83 5.           AN KM     Latitude of the profile  (rad, deg, km) north
 84 145.         AN KM     Longitude of the profile  (rad, deg, km) east
 88-5.00000000000          Height above sea level of bottom of graph  km
 89 0.                     Height above sea level of top of graph  km
 90 5.00000000000          EASTWARD component of current velocity
 92 0.00000000000          Minimum speed  km/s, m/s
 93 0.00000000000          Maximum speed  km/s, m/s
 94 0.00000000000          Horizontal tick mark interval km/s, m/s
 96 1.00000000000          Vertical tick mark interval km
 0
0T6    TLINEAR TEMPERATURE PROFILE
 29 1.0000                 1 = PROFILE, 0 = SKIP THIS RUNSET
 83 5.           AN KM     Latitude of the profile   (rad, deg, km) north
 84 145.         AN KM     Longitude of the profile   (rad, deg, km) east
 88 0.00000000000          Height above sea level of bottom of graph   km
 89    3.                  Height above sea level of top of graph  km
 90 7.00000000000          TEMPERATURE PROFILE
 92 290.000000000          Minimum temperature deg K
 93 300.000000000          Maximum temperature deg K
 94 0.00000000000          Horizontal tick mark interval deg K
 96 0.00000000000          Vertical tick mark interval km
   0
0T6    SAMPLE TEMPERATURE DATA POINTS
 90-45.0000000000          NEGATIVE VALUE = SUPERIMPOSE ON PREVIOUS PLOT
-45                        NEGATIVE VALUE = TABULAR DATA SET FOLLOWS
  2      999.0
 1.06103       295.1175
 1.04327       295.1062
 1.00858       295.0950
 1.10932       295.0837
 1.20206       295.0725
 1.38054       296.0613
 1.28684       296.0501
 1.40138       296.0390
 1.47047       296.0278
  999.000
  0                        RETURNING TO W ARRAY DATA SET
  0
0T6    GLORENZ TOPOGRAPHY PROFILE
 29 1.0000                 1 = PROFILE, 0 = SKIP THIS RUNSET
```

Figure 7. (Cont.)

```
83 0.              AN KM  Left Latitude of plot   (rad, deg, km) north
84 0.              AN KM  Longitude of plot  (rad, deg, km) east
85 20.             AN KM  Right Latitude of plot  (rad, deg, km) north
90 6.00000000000          TOPOGRAPHY PROFILE
 0
```

Figure 7. (Cont.)

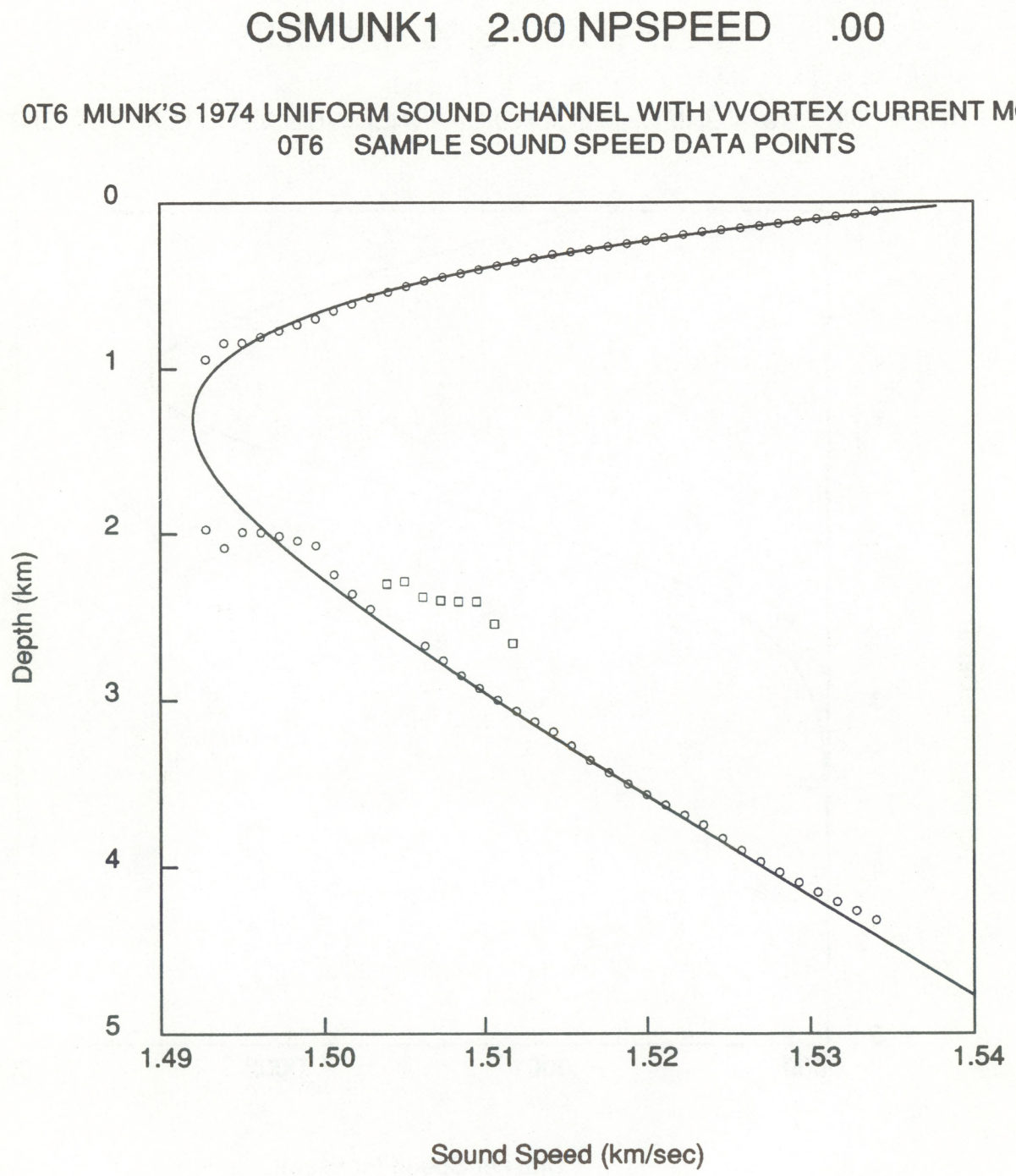

Figure 8.--Sound Speed Profiles, for Sample Case, Plot 1

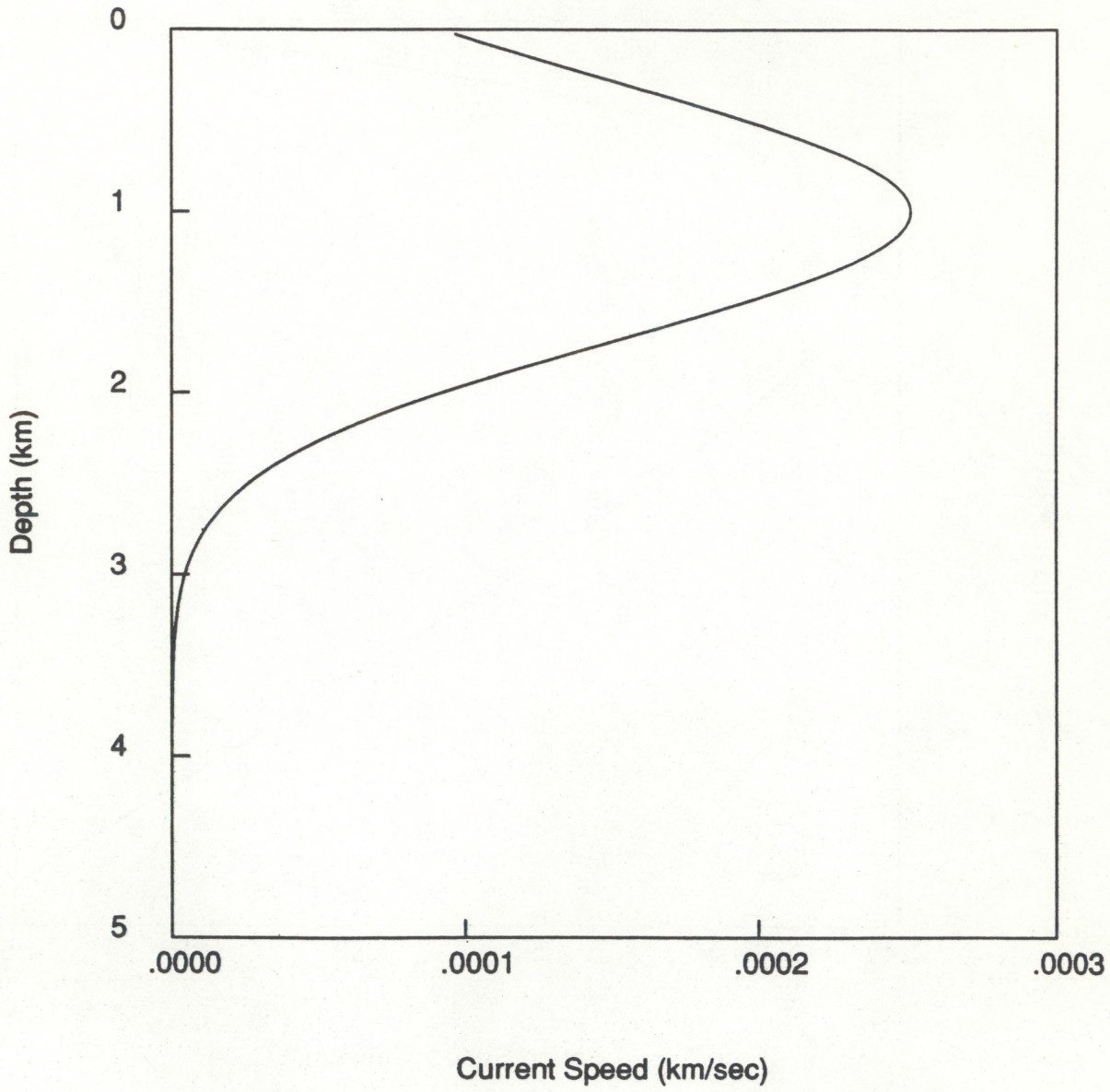

Figure 9.--Current Speed Profile, for Sample Case, Plot 2

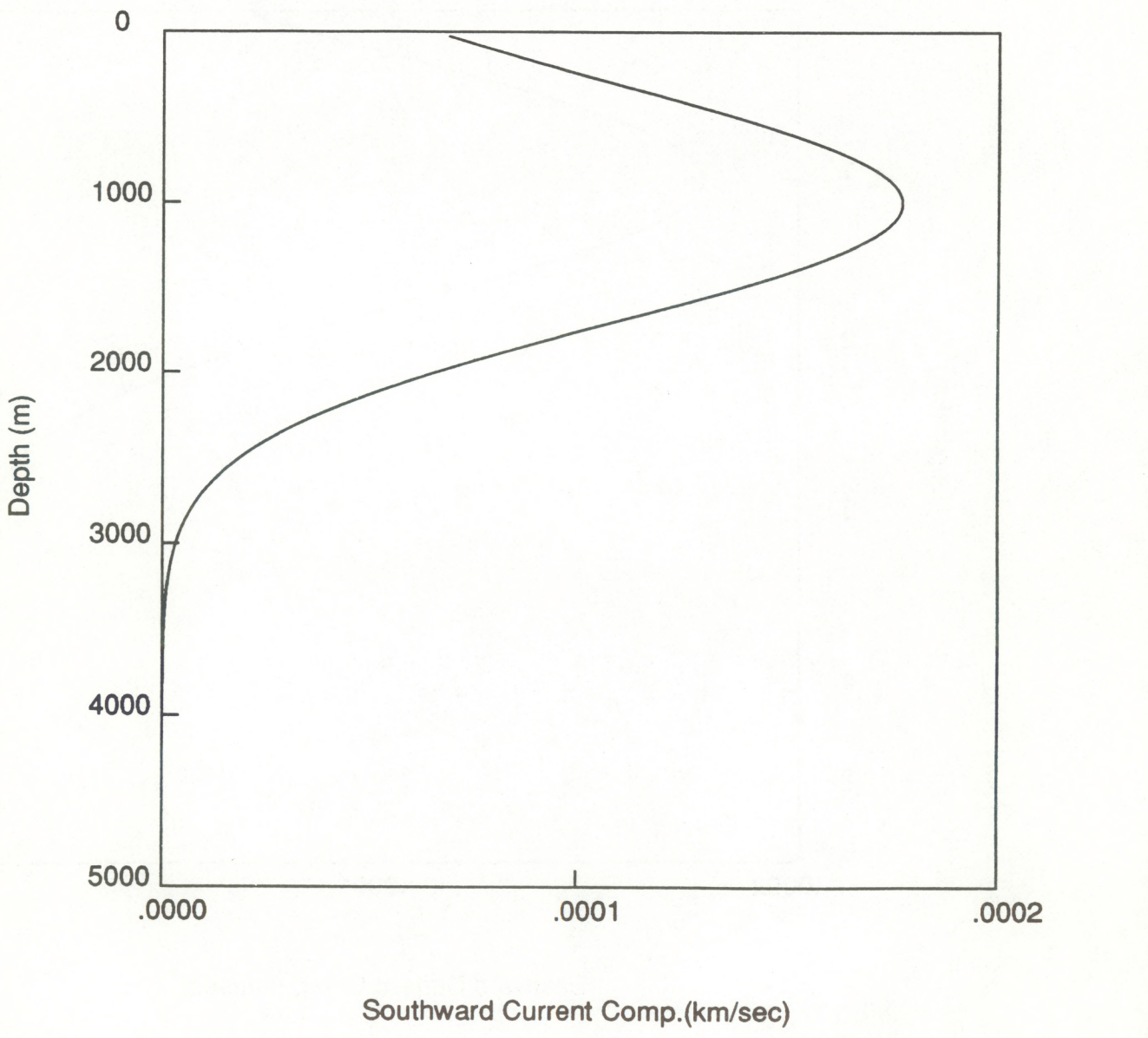

Figure 10.--Southward Current Component Profile, for Sample Case, Plot 3

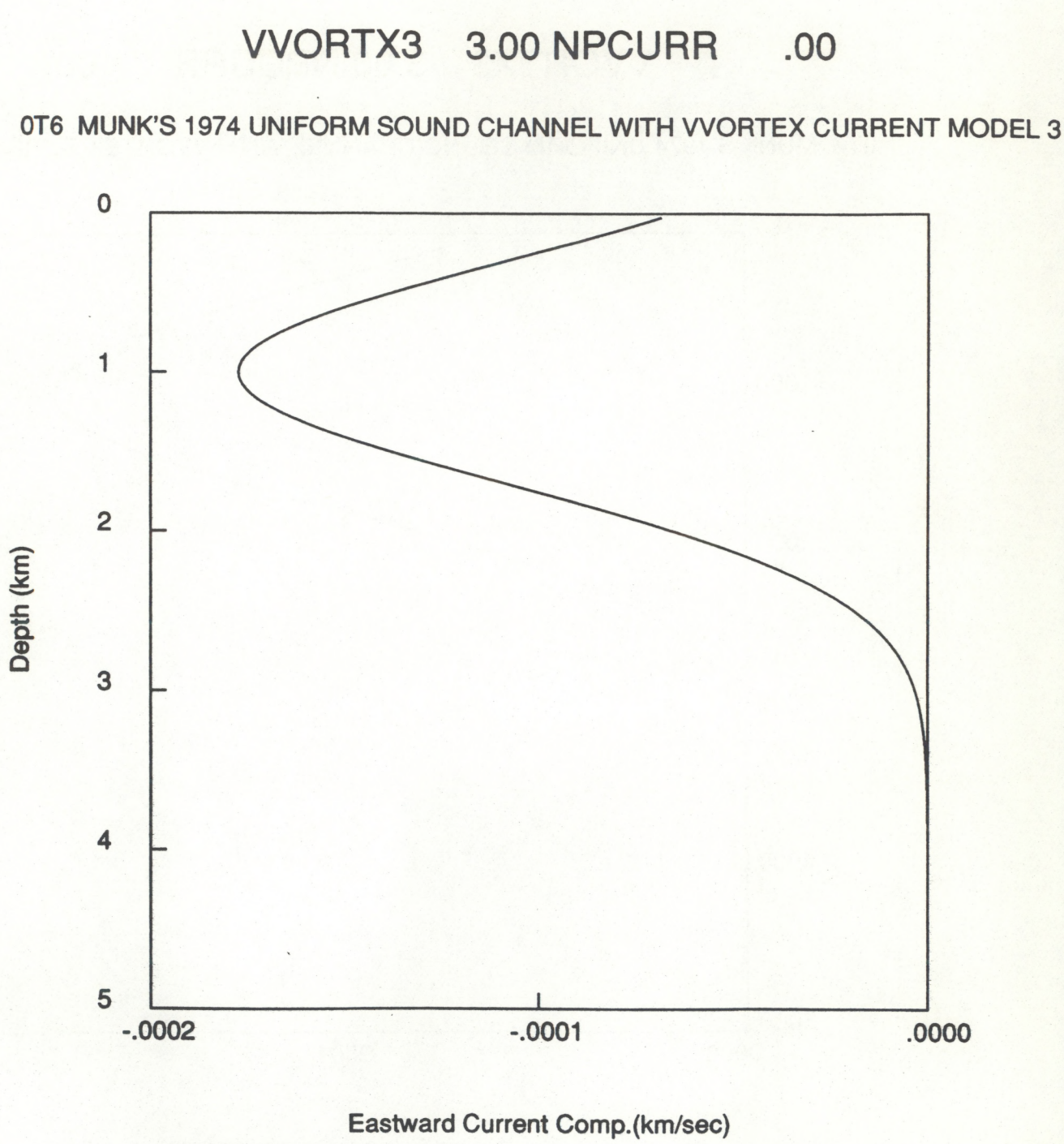

Figure 11.--Eastward Current Component Profile, for Sample Case, Plot 4

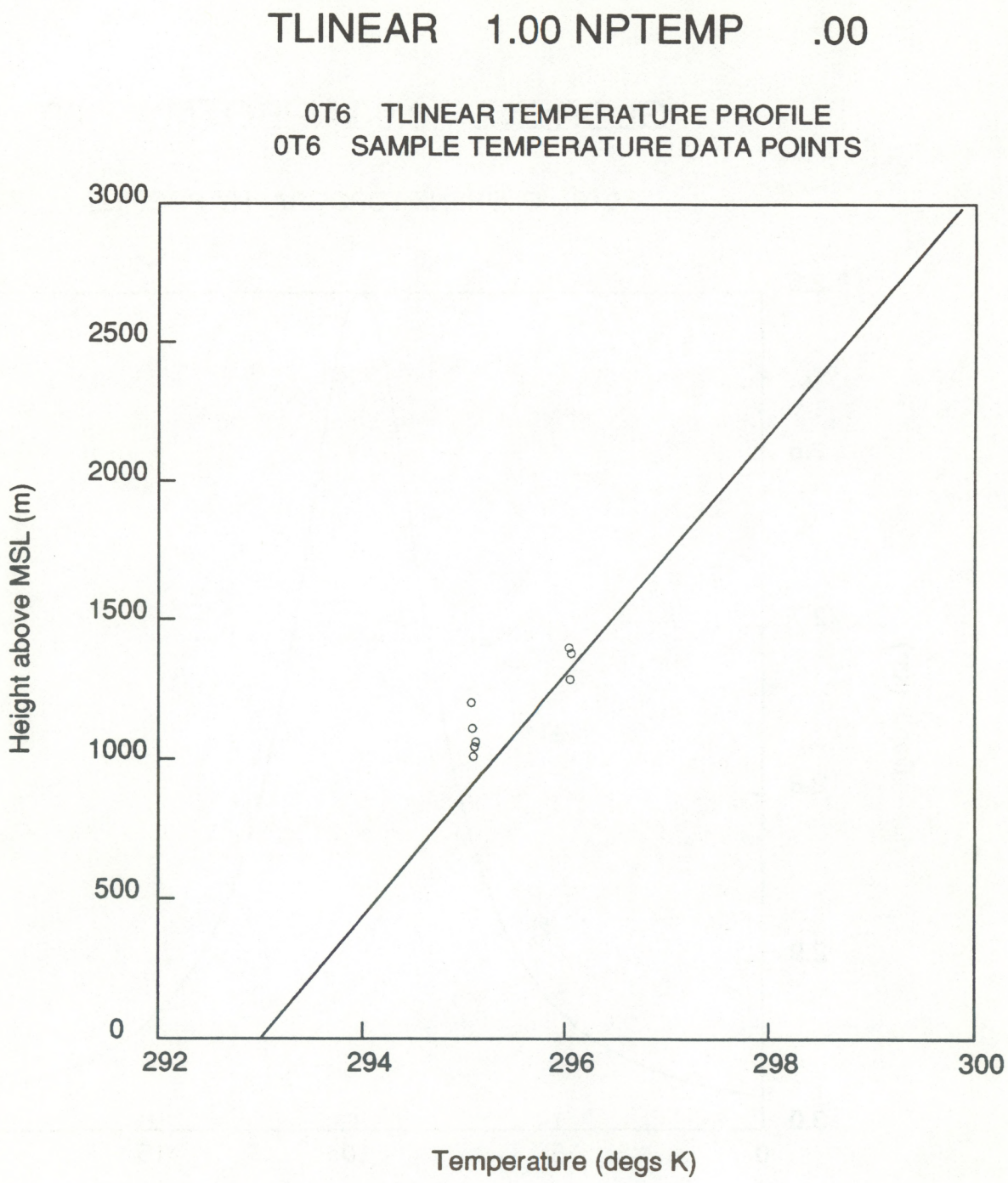

Figure 12.--Temperature Profile with One Tabular Data Set for Sample Case, Plot 5

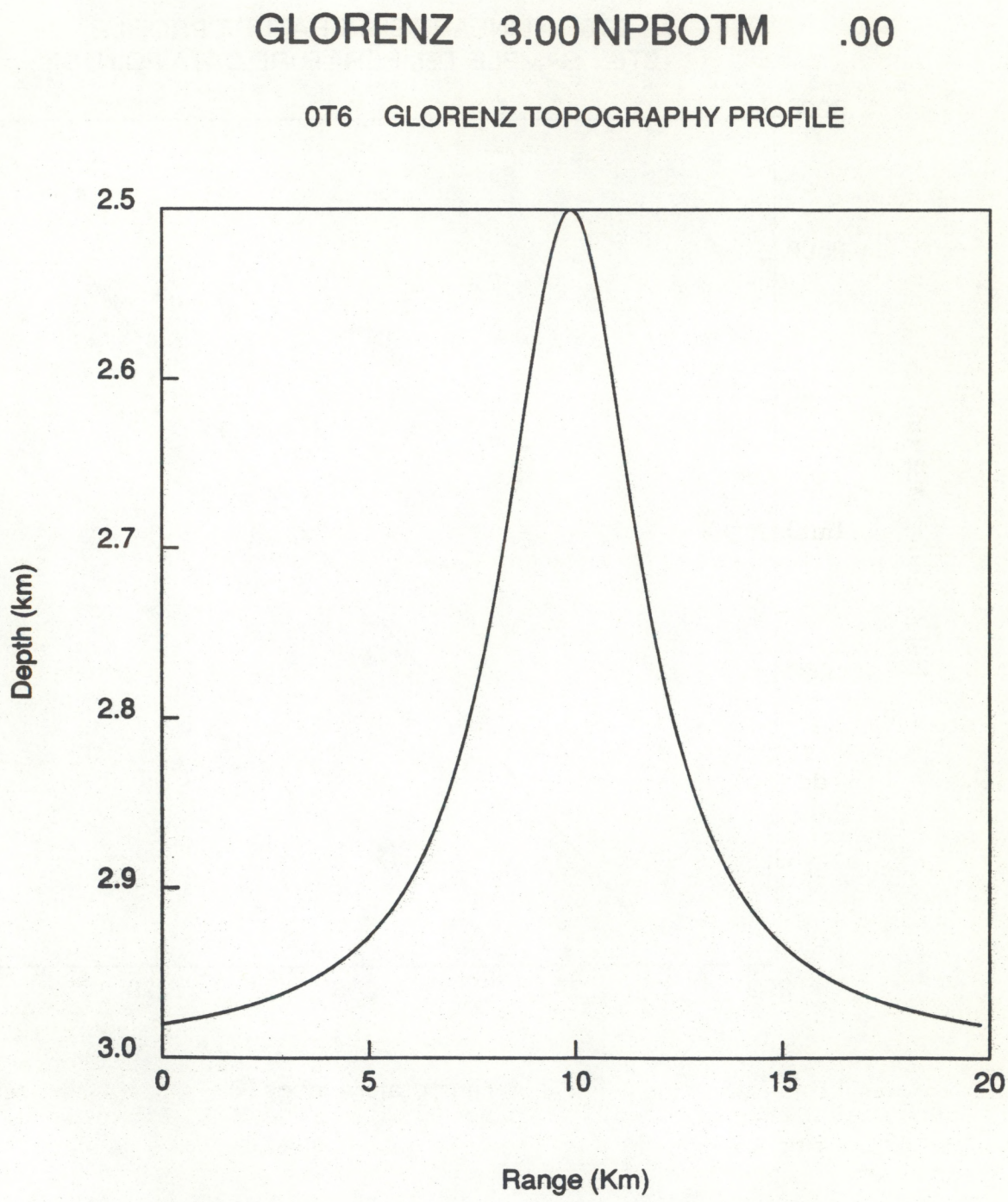

Figure 13.--Topography Profile for Sample Case, Plot 6

3.2 How to Run the Sample Case

In this section, boldface upper case letters indicate user input.

Type: **RUNPROF**

You will then see the following:

```
*********************************************************
******************** PROFILE PROGRAM ********************
*********************************************************

    No DINP file exists for PROFILE program.
    Enter filename on the next line >>>>>
    Using file: DINP.SAM
```

The program is now executing, using the sample input datafile, DINP.SAM, and when finished, the last lines should be:

```
 PROFILE completed normally
 Number of profiles generated:  9
 Output File:  TXTOUT
```

The output file, TXTOUT, which contains the data to be plotted as well as the plotting commands, can then be compared with the sample case output, TXTOUT.SAM, in the SAMPLE subdirectory of the diskette.

If the user has the companion PSGRAPH report (Harlan et al., 1991a), and the PSGRAPH program is in the current directory, the plots can be printed and viewed on the screen.

Type: **RUNPS** and type a carriage return for all the choices (i.e., use defaults).

4. HOW TO USE PROFILE

4.1 Create an Input Data File

The input data file, usually called DINP, has the same form as input files for the HARPO program. A DINP can contain an unlimited number of "runsets," each of which plots a profile. The file can have any name, up to 80 characters (including the path), but both the FINDMODL program and PROFILE are expecting a file called DINP. If the file DINP is not found in the local directory, the user will be prompted for a file name.

Use the blank order forms for the input data in Appendices C1, C2, and C3 when creating an input DINP file to be sure that the necessary input data are complete and accurate.

Note that the input data forms contain only those W-array elements necessary for the particular profile type (as indicated in the input data forms) except for W(29), which should always be 1.0.

See Appendix C5 for a table of current and future profile types.

A format that is unique to the PROFILE program is available for plotting tabular data (or point plots). The sample case input data file, DINP.SAM, contains three examples of such a plot. This format allows the user to include arrays of data that can be plotted as individual points. See Appendix C4 for more description and an example.

When deciding on maximum/minimum values in a profile [specified by W(92),W(93)], the user may choose to have the PROFILE program compute appropriate maximum and minimum values. This is called "auto-scaling" and is selected by setting the maximum and minimum to the same value (0.0 is a good choice) or by setting the associated tick mark interval [e.g., W(94)] to 0.0. Also, the program will perform auto-scaling if the user inadvertently submits an input data file with a tick mark interval whose absolute value is larger than both the maximum and minimum values.

As in HARPO, W-array values that do not change need not be repeated after the first run set. For example, you do not have to enter the latitude of every profile if all profiles in the file have the same latitude. You can enter only the first profile's latitude.

See the HARPO/HARPA report (Sec. 2.4) for more format specifications for the input files.

4.2 The Two Modes for Running PROFILE with RUNPROF.BAT

A DOS batch file, RUNPROF.BAT, controls the linking and running of the PROFILE program.

MODE 1. Linking before running.
Used whenever a model is changed in the DINP file since last invoking RUNPROF. Not necessary when only data used by a model is changed.

Type: **RUNPROF L**

Several lines of linker commands will appear on the screen.

MODE 2. Running without linking.

Used when no changes (or non-model changes) have been made to the DINP file since last invoking RUNPROF.

Type: **RUNPROF**

IMPORTANT:
The PROFILE program will look for and use a file called "DINP" or, if not found, the last input data file that was linked. The program will place a message on the screen when it is using a file other than "DINP". See Section 4.2.1.

FOR BOTH MODES:

When the PROFILE program begins, the following lines will appear:

```
**********************************************************
******************** PROFILE PROGRAM ******************
**********************************************************
```

The program is now executing and when finished, the last lines should be:

```
PROFILE Completed Normally.
Number of profiles generated:
Output File:  TXTOUT.
```

Assuming the user has the companion report (Harlan et al., 1991a), and that the program, PSGRAPH, from that report has been loaded, the plots can now be viewed.

Type: **RUNPS** and type a carriage return for all the choices (i.e., use defaults).

4.2.1 Using Input Data File other than DINP with RUNPROF.BAT

For mode 1 (linking before running) if there is no file named DINP in the local directory, the user is prompted by FINDMODL for a file name as follows: (Note that bold lowercase indicates user-selected input, bold uppercase indicates non-selectable input.)

```
No DINP file exists for FINDMODL program.
Enter file name on the next line >>>>>
Type:  filename
```

When using a file with a name other than DINP, the user may

avoid being prompted by FINDMODL by typing: **RUNPROF L filename**

Then, when the PROFILE program begins, the following will appear. (The user does not have to re-enter the file name, since the file name entered in response to the previous prompt is used.)

```
No DINP file exists for PROFILE program.
Enter file name on the next line >>>>>
Using file:  filename
```

The RUNPROF.BAT file re-directs standard input from a file called FNAME.OUT. This file contains the name of the input data file when it is something other than "DINP". It was created by FINDMODL and serves as a communications channel between the two programs for the input file name. It was created by FINDMODL and serves as a communications channel between the two programs for the input file name. Therefore, be sure not to delete this file when using RUNPROF.BAT.

4.3 Compiling

It is not necessary to compile any of the source code provided in the distribution disk unless you modify it.

The object modules and the source code for the model subroutines are provided in the distribution disk subdirectory, MODELS.

If modifications to PROFILE are desired, the COMPROF.BAT batch file contains the compiler instructions to compile all the PROFILE source code.

5. HOW PROFILE WORKS

5.1 Basic Overview

The operation of PROFILE is complicated by the fact that the input data file, DINP, indicates which model subroutines must be linked with the main body of the PROFILE program. The FINDMODL program reads DINP to determine which models will be linked to produce the executable file, PROFILE.EXE.

Creating profiles from an input file (DINP) is actually a three-step process:

1. Run FINDMODL
2. Invoke the MicroSoft Linker
3. Run PROFILE.

The DOS batch file, RUNPROF.BAT, performs all three steps when you type "RUNPROF L" or "RUNPROF L filename". When you type "RUNPROF" with no parameter, it will bypass the FINDMODL program and the linking process. This is desirable if no changes have been made to the model selections in the DINP file.

The first program, FINDMODL, reads the DINP file to determine which models are to be used to construct the profile. If there is no file named DINP in the local directory, the user is prompted for a file name. That file name is then written to a file named FNAME.OUT (which is later used by the PROFILE program, see below).

The primary function of FINDMODL is to create an output file, called LINKMODL.DAT, which is used as input to the MicroSoft Linker. This file, called a "response file" by MicroSoft, contains a list of the names (and locations) of all object modules for the models to be linked.

Appendices D and E show the linker response file for the sample case and the linker commands that result from the response file.

Then, the linker is invoked, producing the executable file, PROFILE.EXE, which is the PROFILE program linked with the models selected by the user's DINP file.

The RUNPROF batch file redirects standard input to the PROFILE program from FNAME.OUT. Thus, when a file named DINP is not available, the user is prompted for a file name but the FNAME.OUT file provides the response to the prompt.

Then, PROFILE executes, producing the output text file, TXTOUT. TXTOUT contains plotting commands that can be used as input to the DISSPLA plotting package or as input to the IBM PC-compatible program PSGRAPH.

5.2 The DINP file and Linking the PROFILE Program

The PROFILE program and the models that are linked with it are all written in machine-independent FORTRAN.

Because all the models for a particular parameter (e.g., background ocean current) have the same entry point names, it is not possible to link all models when creating the executable program. Most linkers generate "re-definition" errors when faced with this situation. Therefore, it is necessary to link only those models that have been selected via the input (DINP) data file.

5.3 How FINDMODL Works

FINDMODL simply reads the input DINP file to determine all models that are to be linked with the main PROFILE program.

Before reading the DINP file, however, FINDMODL reads the "locations" file, MODELDIR.DAT (described in Section 4.1.2). The one line of text in MODELDIR.DAT is written to LINKMODL.DAT in the appropriate places.

A character string table containing all the model names and their associated check numbers is in the INCLUDE file, MODLTABL.DAT.

The FINDMODL program simply compares the numbers found in DINP with those in MODLTABL.DAT and extracts the appropriate character string from the table; e.g., if W(150) in DINP is 6, it indicates the CSMUNK2 sound speed model.

In order to satisfy all external references for the PROFILE program, several "stub" subroutines have been created (e.g., NOSURF, NOCURR). These are included in the LINKMODL.DAT file when the DINP file does not have a selection for a particular type of model (e.g., surface model, current model).

The user can modify MODLTABL.DAT to include any new models created. Of course, it would then be necessary to recompile and relink FINDMODL.

6. References

Georges, T.M., R. Michael Jones, and R.S. Lawrence, 1990, A PC version of the HARPO ocean acoustic ray-tracing program, NOAA Tech. Memo. ERL WPL-780, NOAA Environmental Research Laboratories, Boulder, Colorado, 18 pp. + disk.

Jones, R.M., J.P. Riley, and T.M. Georges, 1986a, HARPA--A versatile three-dimensional Hamiltonian ray-tracing program for acoustic waves in an atmosphere above irregular terrain, NOAA Report, Environmental Research Laboratories, Boulder, CO, 410 pp.

Jones, R.M., J.P. Riley, and T.M. Georges, 1986b, HARPO--A versatile three-dimensional Hamiltonian ray-tracing program for acoustic waves in an ocean with irregular bottom, NOAA Report, Environmental Research Laboratories, Boulder, CO, 455 pp.

Harlan, J.A., R.M. Jones, and T.M. Georges, 1991a, PSGRAPH--A program to generate PostScript files from PC-HARPO, PROFILE and CONPLT, NOAA Tech. Memo. in preparation.

Harlan, J.A., T.M. Georges, and R.M. Jones, 1991b, CONPLT--A program to generate contour plots from HARPO/HARPA input files, NOAA Tech. Memo. in preparation.

Appendix A. Instructions for Non-PC Users and PC-Users Without MicroSoft Compiler/Linker Utilities

A.1. General Guidelines

The PROFILE program is made up of scores of subroutines extracted intact from HARPA/HARPO and contains approximately 2750 lines of code, not including the models. Even though it is often desirable to allocate a single module of a program to a unique file, the large number of subroutines makes this impractical.

In addition, the use of multiple entry points within subroutines inherently precludes the "one module-one file" philosophy.

It is left to the user to decide whether or not to combine PROFILE.FOR, PCPROFx.FOR and CONBLK.FOR into one larger file.

Obviously, object modules must be created for each of the model subroutines using your own compiler.

Also, the batch files (*.BAT) provided in the distribution disk have no direct use for non-MicroSoft systems. However, they may provide some guidance in designing equivalent functions, whether via files or operating system commands.

The correct object modules for the models selected in the DINP file must be linked with the main portion of PROFILE before running. Therefore, the FINDMODL program MUST BE MODIFIED in order to create output equivalent to LINKMODL.DAT for your own operating system. See Section 5.3, the FINDMODL source code and the appropriate section below corresponding to your operating system for more information.

A.2. Running the Sample Case

After FINDMODL has been modified and the correct model object modules have been linked with the main program, PROFILE can be run. The output file, TXTOUT, can then be compared with the sample case, TXTOUT.SAM, on the diskette.

A.3. Instructions for CYBER NOS Users

A.3.1 Compilation Considerations for PROFILE

The following changes need to be made to the source code furnished by the distribution disk. See the Historical Note, Appendix F.

1. Throughout all files, replace "DOUBLE PRECISION" with "REAL".

2. Throughout all files, replace double precision intrinsic functions with their single precision equivalents:

   DMAX1 with AMAX1
   DINT with AINT
   DLOG10 with ALOG10
   DABS with ABS

A.3.2 Source Code Changes Necessary to FINDMODL

Section 5.3 contains a description of FINDMODL's functions. The FINDMODL output file, LINKMODL.DAT, will have to have a different form. The likely candidate is a NOS procedure file. The file will need to specify the object modules of those models which need to be linked with the main PROFILE program.

This may be done by explicitly specifying each object module or by putting all the object modules in a library which is then linked with the main program.

The reference to GETARG must also be removed. Compile FINDMODL after appropriate changes have been made. The INCLUDE file, MODLTABL.DAT, must be present during compilation.

A.4. Instructions for VAX VMS Users

A.4.1 Compilation Considerations for PROFILE

In subroutine CONBLK, replace "1H" with "1H ". That is, make sure that there is a space after the H. This is an oddity of VAX and VAX editors.

A.4.2 Source Code Changes Necessary to FINDMODL

Section 5.3 contains a description of FINDMODL's functions. The FINDMODL output file, LINKMODL.DAT will have to have a different form. The likely candidate is a DCL command file. The file will need to specify the object modules of those models which need to be linked with the main PROFILE program.

This may be done by explicitly specifying each object module or by putting all the object modules in a library which is then linked with the main program, probably using a VMS Linker options file.

The reference to GETARG must also be removed. Compile

FINDMODL after the appropriate changes have been made. The INCLUDE file, MODLTABL.DAT, must be present during compilation.

A.5. Instructions for UNIX Users

A.5.1 Compilation Considerations for PROFILE

Use the option, "-Nx250", to "f77" which increases the maximum number of external names (e.g. COMMON blocks, function names, entry points etc.) from 200 (default) to 250.

A.5.2 Source Code Changes Necessary to FINDMODL

Section 5.3 contains a description of FINDMODL's functions. The FINDMODL output file, PROFLNKR.BAT, will have to have a different form. The likely candidate is a "makefile." The file will need to specify the object modules of those models which need to be linked with the main PROFILE program. This may be done by explicitly specifying each object module or by putting all the object modules in a library which is then linked with the main program.

With UNIX, much of this could be done when invoking the "f77" command.

The reference to GETARG must also be removed. Compile FINDMODL after the appropriate changes have been made. The INCLUDE file, MODLTABL.DAT, must be present during compilation.

A.6. Instructions for PC Users without MS-Utilities

A.6.1 Compilation Considerations for PROFILE

The source code should be easily compiled although PROFILE has not, as of this writing, been ported to a PC without MS-Utilities.

A.6.2 Source Code Changes Necessary to FINDMODL

Section 5.3 contains a description of FINDMODL's functions. The FINDMODL output file, LINKMODL.DAT, will have to have a different form. The likely candidate is a batch file. The file will need to specify the object modules of those models which need to be linked with the main PROFILE program.

This may be done by explicitly specifying each object module or by putting all the object modules in a library which is then linked with the main program.

Compile FINDMODL after the appropriate changes have been made. The INCLUDE file, MODLTABL.DAT, must be present during compilation.

Appendix B. Description of the Distribution Disk Contents

B.1 Main Directory of the Distribution Disk

PROFILE.FOR
PCPROFx.FOR (x = 1,2,3,4,5,6)
CONBLK.FOR

All source code for PROFILE and its subroutines. PROFILE was separated into 8 files due to its large size. This separation was somewhat arbitrary although the intent was to have files that could be compiled without exceeding the 64 Kbyte limit of the MicroSoft compiler.

FINDMODL.FOR

Source code for FINDMODL, which reads the input data file (usually DINP) to determine which models will be linked with the main PROFILE program.

MODLTABL.DAT - An INCLUDE file for FINDMODL.

COMPROF.BAT - use for compiling all source code in the main directory of the distribution diskette.

RUNPROF.BAT - use for linking and running PROFILE.

FINDMODL.EXE - Executable version of FINDMODL.

PROFILE.EXE - Executable version of PROFILE for the sample case.

FNAME.OUT

Data File for communicating the input data file name from FINDMODL to PROFILE program. On distribution diskette, contains "DINP.SAM".

DINP.SAM - Input data file for the sample case.

LINKMODL.SAM - output from FINDMODL for the sample case.

TXTOUT.SAM - output from PROFILE for the sample case.

INSTALL.BAT - Batch file which creates models subdirectory and copies diskette contents to user's machine.

INSTALIT.EXE - Executable file which is called by INSTALL.BAT.

PROFILE.DOC - The report you are reading.

B.2 Subdirectories of the Distribution Disk.

1. MODELS Subdirectory.
   Contains source code and object modules for all the models.

   The object modules are provided for MS-Utilities users.

   There is no need to compile the model source code if you are using MS-Utilities.

   Note that older versions of PC-HARPO models are not compatible with PROFILE due to the following two changes:

   a. New error handling has eliminated the use of the RERROR routine.

   b. Changes to the WW common block.

Appendix C. Blank Input Data Forms

There are currently three different types of profiles that can be generated by the PROFILE program:

1. Sound Speed/Current Speed/Wind Speed
2. Temperature
3. Topography

In addition, PROFILE will generate plots of data points entered by the user in the input data file. See APPENDIX C4.

Appendix C1. Form to Specify Input Data for Profiles of Sound Speed/Current Speed/Wind Speed

Model ID:_____

Profile type: sound speed _____(W90=1.0)

current/wind speed _____(W90=2.0)

vertical component of current/wind velocity _____(W90=3.0)

southward component of current/wind velocity _____(W90=4.0)

eastward component of current/wind velocity _____(W90=5.0)

Superimpose this profile on the graph of the previous runset:

Yes __ (W90 negative; suppresses frame advance before plotting.)

No __ (W90 positive.)

Latitude of the profile = _____ (rad, deg, km) north (W83)

Longitude of the profile = _____ (rad, deg, km) east (W84)

Height above sea level of bottom of graph = _____ km (W88)

Height above sea level of top of graph = _____ km (W89)

Minimum speed = _____ km/s, m/s (W92) (auto-scaling if zero)

Maximum speed = _____ km/s, m/s (W93) (auto-scaling if zero)

Horizontal tick mark interval = _____ km/s, m/s (W94)
(auto-scaling if zero)

Vertical tick mark interval = _____ km (W96)
(auto-scaling if zero and defaults to meters)

Appendix C2. Form to Specify Input Data for Profiles of Topography

Model ID:_____
Profile type: topography _____(W90=6.0)

Superimpose this profile on the graph of the previous runset?

Yes __ (W90 negative; suppresses frame advance before plotting.)

No __ (W90 positive.)

Left Latitude of the profile = _____ (rad, deg, km) north (W83)

Longitude of the profile = _____ (rad, deg, km) east (W84)

Right Latitude of the profile = _____ (rad, deg, km) north (W85)

Appendix C3. Form to Specify Input Data for Profiles of Temperature

Model ID:_____

Profile type: temperature
_____(W90=7.0)

Superimpose this profile on the graph of the previous runset?

Yes __ (W90 negative; suppresses frame advance before plotting.)

No ___ (W90 positive.)

Latitude of the profile = _____ (rad, deg, km) north (W83)

Longitude of the profile = _____ (rad, deg, km) east (W84)

Height above sea level of bottom of graph = _____ km (W88)

Height above sea level of top of graph = _____ km (W89)

Minimum Temperature (auto-scaling if zero) = _____ deg K (W92)

Maximum Temperature (auto-scaling if zero) = _____ deg K (W93)

Horizontal Tick Mark Interval (auto-scaling if zero) = _____
deg K (W94)

Vertical tick mark interval = _____ km (W96)
(auto-scaling if zero and defaults to meters)

Appendix C4. Format for Tabular Data Input

The tabular data must always have the same general format as the example given below:

```
0T6    XYZ DATA POINTS
 90-45.0000000000   NEGATIVE VALUE = SUPERIMPOSE ON PREVIOUS PLOT
-45                 NEGATIVE VALUE = TABULAR DATA SET FOLLOWS
  A                 Descriptive Comments about Data Set
  2      999.0
 LN KM          LN KM
 1.06103        295.1175
 1.04327        295.1062
 1.00858        295.0950
 1.10932        295.0837
 1.20206        295.0725
 1.38054        296.0613
 1.28684        296.0501
 1.40138        296.0390
 1.47047        296.0278
  999.000
  0                      RETURNING TO W ARRAY DATA SET
  0
```

The following lines must be present:

1. Model ID and Title Line
2. 90 followed by a (usually negative) value from 41 to 62.
3. A negative value which is the same as that given in line 2.
4. Any descriptive comments (optional)
5. 2 followed by a flag value which indicates the end of the data when it is placed in the first column of numbers.
6. Indications of the units for the data set (optional) for each column following the format requirements given in HARPO report.
7. 2 columns of input data of 13 columns each of any floating point format.
8. Flag value in first column.
9. 0 optionally followed by some commentary starting in column 25.
10. 0 indicating the end of the runset.

Appendix C5. Table of W(90) Values to Specify Profile Type

W(90) Value	Common Block	Profile Type
1	CC	Sound Speed
2	UU	Current/Wind Speed
3	UU	Vertical Component
4	UU	Southward Component
5	UU	Eastward Component
6	GG	Topography
7	TT	Temperature
8*	MM	Molecular Weight
9*	AA	Viscosity
10*	AA	Thermal Conductivity
11*	LL	Absorption
12*	PP	Pressure
>40 and <63		Point Plots

* - indicates not yet implemented but values have been reserved.

Appendix D. The Linker Response File for the Sample Case

LINKMODL.DAT

```
models\VVORTX3+
models\NPCURR +
models\CSMUNK1+
models\NPSPEED +
models\TLINEAR +
models\NPTEMP +
models\RHORIZ +
models\GLORENZ +
models\NPBOTM +
models\NOLOSS +
models\NOSURF
```

This file provides input to the LINK command. See the MicroSoft Linker manual for explanations of the syntax.

Appendix E. Linker Instructions Generated for the Sample Case

```
MicroSoft (R) Segmented-Executable Linker  Version 5.03
Copyright (C) Microsoft Corp 1984-1989.  All rights reserved.

Object Modules [.OBJ]: /STACK:4096 /SEGMENT:130 /NOE  MODELS\VVORTX3+
Object Modules [.OBJ]:  MODELS\NPCURR +
Object Modules [.OBJ]:  MODELS\CSMUNK1+
Object Modules [.OBJ]:  MODELS\NPSPEED +
Object Modules [.OBJ]:  MODELS\TLINEAR+
Object Modules [.OBJ]:  MODELS\NPTEMP +
Object Modules [.OBJ]:  MODELS\RHORIZ +
Object Modules [.OBJ]:  MODELS\GLORENZ+
Object Modules [.OBJ]:  MODELS\NPBOTM +
Object Modules [.OBJ]:  MODELS\NOSURF +
Object Modules [.OBJ]:  MODELS\NOLOSS
Run File [PROFILE.EXE]:
```

Appendix F. Historical Note on the Use of Double Precision

The PROFILE program was originally written on a CYBER machine using numerous common blocks and Hollerith data instead of character data. HARPO and PROFILE use the same common blocks and many of the same routines. While updating the PROFILE program for ASCII text output, a principal design goal was to maintain as much compatibility with HARPO as possible. Because of the unusual (60-bit) word length of the CYBER and the CYBER's 6-bit characters, 10 characters could be put in a single word. This fact, coupled with our design goal, caused us to use double precision variables to accommodate more characters per word.

Appendix G. PROFILE Plotting Commands

G.1 Plotting Commands in TXTOUT Used by PSGRAPH

22	Lower left origin (in inches from corner)
25	Title Text and Axis Labels
29	Points to be plotted
30	Frame advance
31	End of plotting
39	Coordinates for plot (in plotting units)

G.2 Plotting Commands in TXTOUT Ignored by PSGRAPH

10	Font indicator
11	Case indicator
12	Case indicator
13	Text Height
20	Initializes DISSPLA to create an intermediate compressed output file
21	Clipping Indicator
23	Page Limits
24	Scale Factor for plot symbols
26	Draw a frame
32	Number of X axis ticks
33	Number of Y axis ticks
35	For converting label values
36	Suppress border

G.3 FORTRAN Format Specification for Plotting Commands

Command

10 Font indicator

Number of Lines: 1

Contents of Line 1: "10"

Format of Line 1: I2

11 Case indicator

Number of Lines: 1

Contents of Line 1: "11 STAND !"

Format of Line 1: I2,trl,a,lx,al

12 Case indicator

Number of Lines: 1

Contents of Line 1: "12 L/CSTD #"

Format of Line 1: I2,trl,a,lx,al

13 Text Height

Number of Lines: 1

Contents of Line 1: "13" number

Format of Line 1: I2,F4.2

20 Initializes DISSPLA to create an intermediate compressed output file

Number of Lines: 1

Contents of Line 1: "20"

Format of Line 1: I2

21 Clipping Indicator

Number of Lines: 1

Contents of Line 1: "21" number

Format of Line 1: I2,F4.2

22 Lower Left Origin (in inches from lower left corner)

Number of lines: 1

Contents of Line 1: "22" X Y

Format of Line 1: I2 2(F5.2)

23 Page Limits

Number of Lines: 1

Contents of Line 1: "23" number, number

Format of Line 1: I2,F6.2

24 Scale Factor for plot symbols

Number of Lines: 1

Contents of Line 1: "24" number

Format of Line 1: I2,F5.2

25 - Text for Title and Axis Labels

Number of Lines: 4

Contents of Line 1: "25" X-axis length, Y-axis length (inches)

Contents of Line 2: Title length, title

Contents of Line 3: X-axis label length, X-axis label

Contents of Line 4: Y-axis label length, Y-axis label

Format of Line 1: I2 2(F6.2)
Format of Line 2: I5 1X A40
Format of Line 3: I5 1X A40
Format of Line 4: I5 1X A40

29 - Points to be Plotted for a Curve

Number of Lines: Variable

Contents of Line 1: "29", Number of points, Symbol Marker

Contents of Line 2 to N: x(i), y(i), x(i+1), y(i+1)
where i = 1 to Number of points

Format of Line 1: I2, 2(I5)

Format of Line 2 to N: 4(E14.6)

NOTE: If the number of points is odd, then the last line has only one x,y pair. Thus, the Nth line would have format 2(E14.6).

30 - Frame Advance for Profiles

Number of Lines: 1

Contents of Line 1: "30 1"

Format of Line 1: I2, I3

31 - End of Plotting

Number of Lines: 1

Contents of Line 1: "31"

Format of Line 1: I2

32 Number of X axis ticks

Number of Lines: 1

Contents of Line 1: "32" number

Format of Line 1: I2,I3

33 Number of Y axis ticks

Number of Lines: 1

Contents of Line 1: "33" number

Format of Line 1: I2,I3

35 For converting negatively valued labels to positive numbers. Begin converting at the "mth" number and continuing for "n" numbers.

Number of Lines: 1

Contents of Lines 1: "35" m, n

Format of Line 1: I2, 2I3

36 Suppress border

Number of Lines: 1

Contents of Line 1: "36"

Format of Line 1: I2

39 Maximum, minimum and interval values for both axes in real units.

Number of Lines: 1

Contents of Line 1: "39",
X-axis minimum, X-axis interval, X-axis
Y-axis minimum, Y-axis interval, Y-axis

Format of Line 1: I2, 6(E13.7)

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