NGU Rapport 93.065

# IMPPROF
# Magnetic and Gravity Profile Database

NORGES GEOLOGISKE UNDERSØKELSE

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf. (07) 90 40 11
Telefax (07) 92 16 20

# REPORT

Report no. 93.065 | ISSN 0800-3416 | Grading: Åpen

Title:
IMPPROF - Magnetic and Gravity Profile Database

Author:
T.H. Torsvik & O. Olesen

Client:
NGU

County:

Commune:

Map-sheet name (M=1:250.000)

Map-sheet no. and name (M=1:50.000)

Deposit name and grid-reference:

Number of pages: 39 Price: kr 60,-

Map enclosures:

| Fieldwork carried out: | Date of report: | Project no.: | Person responsible: |
|---|---|---|---|
| | 12.05.93 | 24.0123.01 | Jan S. Rønning |

Summary:

IMPPROF is an interactive database system for storage and manipulation of magnetic and gravity profiles. Profiles can be displayed together with gridded image files and/or geographic vector data. The system principally aims to extract and manipulate profiles interactively on the screen. A selected profile can subsequently be exported for pseudo-3D forward modelling and/or interactively subjected to magnetic or gravity inversion.

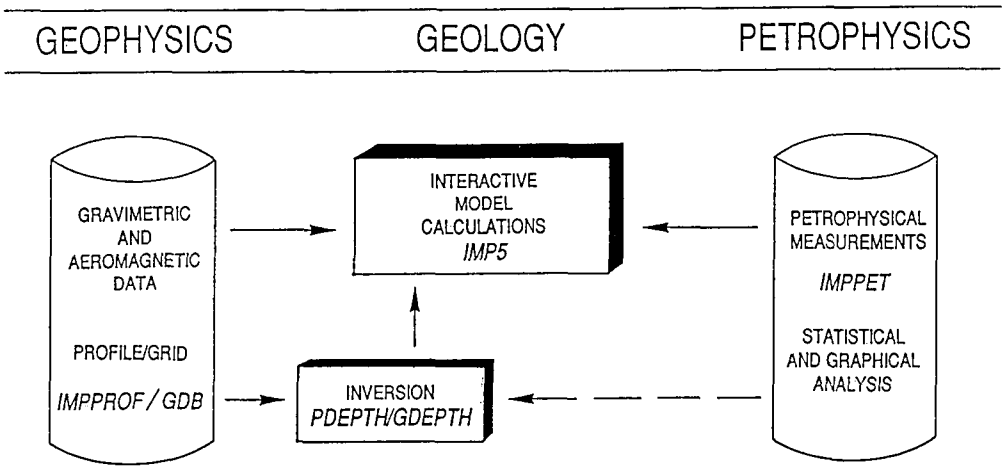
| Keywords: | Magnetometri | |
|---|---|---|
| Database | Gravimetri | |
| Tolkning | Geofysikk | Brukerdokumentasjon |

| CONTENT | PAGE |
|---|---|

## 1. INTRODUCTION

IMPPROF is an interactive database system for storage and manipulation of magnetic and gravity profiles. Profiles can be displayed together with gridded image files created with GDB2 (Smethurst 1992) and/or geographic vector data generated with IMPATLAS (Torsvik 1992a).

The system principally aims to extract and manipulate profiles interactively on the screen. A selected profile can subsequently be exported to IMP5 (Torsvik 1992c) for pseudo-3D forward modelling and/or interactively subjected to magnetic or gravity inversion utilizing the programs PDEPTH (Torsvik & Olesen 1992) or GDEPTH (Torsvik & Fichler, 1993).



## 1.1 HARDWARE REQUIREMENTS

**System requirement:**

- IBM AT or compatible (80286/386/486) computer
- Mathematical co-processor (80287/387/487)
- VGA (colour) graphics card
- Microsoft compatible mouse (3 button)

**Graphical Output Devices:**

- HP Laser/Deskjet compatible printer,
  HP Deskjet 500C (colour) the optimal choice, or
- almost any output devices via the use of HALO Graphics Kernel System. This, however, needs a separate software licence (Copyright Media Cybernetics, Inc., USA) and the use of the program IMPRINT (Torsvik 1992b).

## 1.2 IMPPROF FILE TYPES (MAIN)

Programs:

| | |
|---|---|
| IMPPROF.EXE | - Main database program |
| IMPORTP.EXE | - Import Program for ASCII files |
| PDEPTH.BAT | - Magnetic inversion control |
| GDEPTH.BAT | - Gravity inversion control |

Files:

| | |
|---|---|
| *.PID | - Profile Index File |
| *.PDB | - Profile Database File |
| *.DAT | - Profile Info File |
| *.REP | - Profile Report File |
| *.INT/.RED/.BLU/.GRN | - Profile Image Files |
| *.XSP | - Profile help file |
| *.YSP | - Profile help file |
| *.GDI | - Grid Info File |
| *.UTM | - Geographic contour (coastline) file |
| IMPPROF.SYS | - IMPPROF System file |
| IMPORTP.SYS | - IMPORT system file |
| *.PTZ | - Depth analysis file |

Program and files used with PDEPTH, GDEPTH, IMP5 or GDB2 are described seperately (Torsvik & Olesen 1992a;Torsvik & Fichler 1993; Torsvik 1992c; Smethurst 1992).

## 2. INSTALLATION OF IMPPROF

- Type **A:INSTALL** at the DOS system prompt.
  This will create a sub-directory named \MAGMOD\IMPPROF (if not already done) and copy all files to sub-directory MAGMOD\IMPPROF.

- Trim AUTOEXEC.BAT AND CONFIG.SYS as suggested in Appendix 1 in order to have the maximum memory available for the system.

- Add MAGMOD directory in the AUTOEXEC.BAT (unless previously done) file by typing PATH C:\MAGMOD (see Appendix 1)

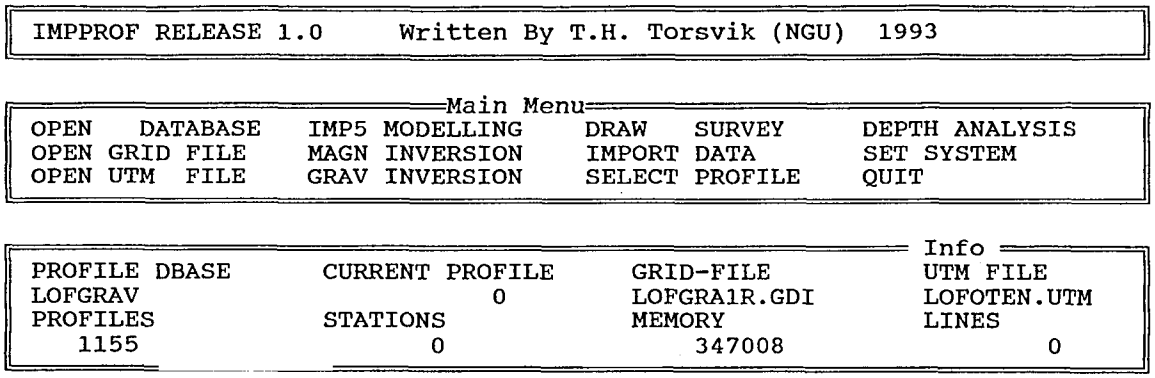
- Install MOUSE driver (see CONFIG.SYS;Appendix 1)

## 3. DESCRIPTION OF IMPPROF

Type IMPPROF at the DOS system prompt or select sub-option IMPPROF in the IMP menu program. The program immediately searches for a configuration file named IMPPROF.SYS. If this file is not found on the \MAGMOD\IMPPROF directory, IMPPROF.SYS is automatically created, containing the default values listed in section 3.11.

After start-up the main menu is displayed (Fig. 1). An **option** in the menu may be selected through the use of the arrow keys, and executed by pressing <ENTER>.

**FIGURE 1** Main menu IMPPROF



The main menu has the following options:

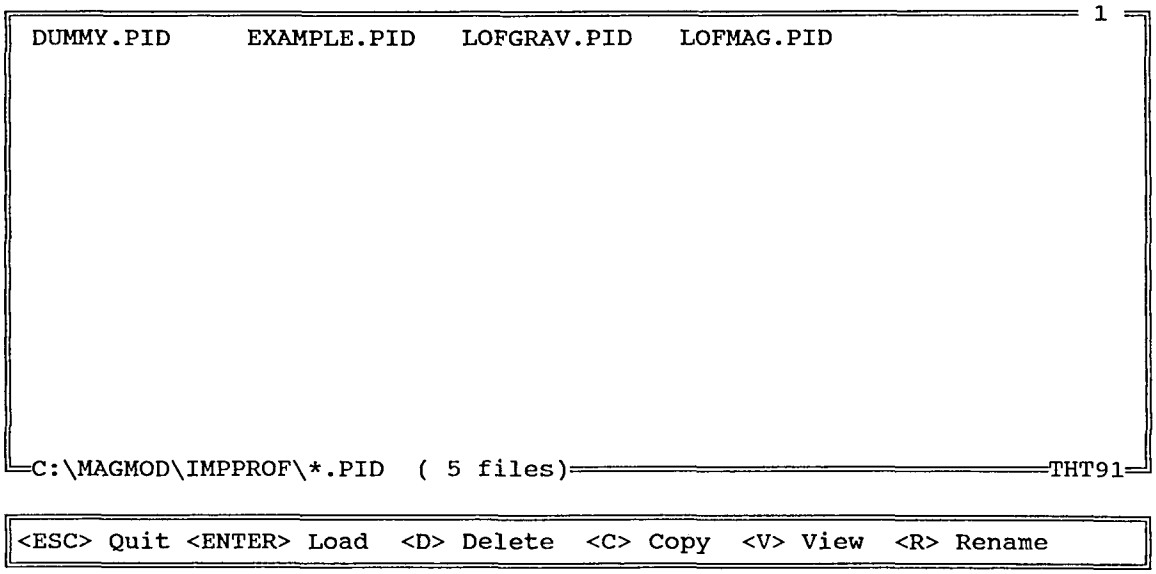
| OPTION | EFFECT |
|---|---|
| OPEN DATABASE | SELECT PROFILE DATABASE |
| OPEN GRID FILE | SELECT GRID FILE |
| OPEN UTM FILE | SELECT UTM FILE (COASTLINE FILE) |
| IMP5 MODELLING | EXPORT A PROFILE TO IMP5 FORMAT |
| MAGN INVERSION | MAGNETIC INVERSION (RUN PDEPTH) |
| GRAV INVERSION | GRAVITY INVERSION (RUN GDEPTH) |
| DRAW SURVEY | DISPLAY PROFILE DATABASE ON SCREEN |
| IMPORT DATA | IMPORT PROFILES FROM AN ASCII FILE |
| SELECT PROFILE | SELECT A PROFILE FROM DATABASE |
| DEPTH ANALYSIS | CREATE A DEPTH TO BASEMENT FILE |
| SET SYSTEM | SET SYSTEM CONFIGURATION |
| QUIT | END PROGRAM |

The information box below the main menu contains information regarding PROFILE DBASE FILE, NUMBER OF PROFILES, CURRENT (SELECTED) PROFILE, NUMBER OF PROFILE STATIONS, NAME OF GRID-FILE AND NAME OF UTM FILE.

## 3.1 OPEN DATABASE

The current directory is automatically sorted and the available profile databases (index files with extension .PID; actual data-base file has extension .PDB) are displayed (Fig. 2). Use cursor arrows (use <PGUP> & PGDN> keys to change directory 'page') to select the appropriate file followed by <ENTER>. Use <ESC> to leave this option without selecting a file.

**FIGURE 2** Sorted list of profile data-base files using option 'OPEN DATABASE'



## 3.2 OPEN GRID FILE

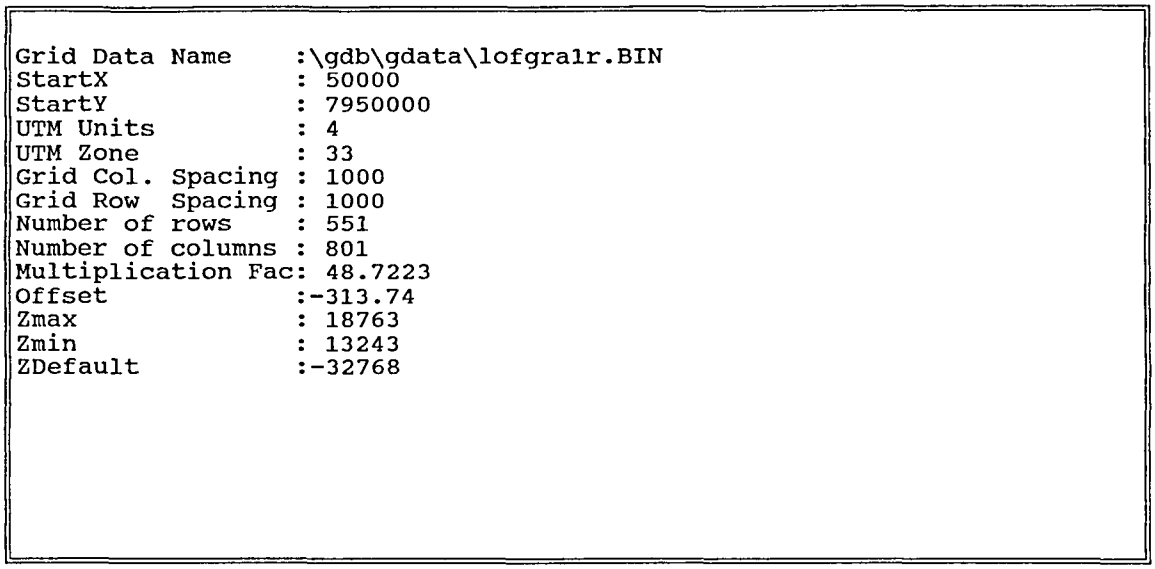
The directory is sorted and available GRID-FILES (index/info files with extension .GDI) are displayed. Use cursor arrows (use <PGUP> & PGDN> keys to change directory 'page') to select the appropriate file followed by <ENTER>. Use <ESC> to leave this option without selecting a file.

**NOTE:** Assure that grid-files (extension *.GDI) are in the local directory, i.e. \MAGMOD\IMPPROF.

The grid can be displayed as an underlay for the profiles in option 'DRAW SURVEY'.

After selecting a grid-file (created from GDB2; Smethurst 1992), grid-file information is displayed on the screen (Fig. 3).

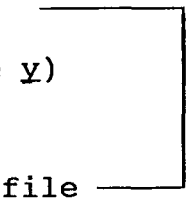
**FIGURE 3** Display of grid-file information



### 3.2.1 CREATE A GRID FILE USING GDB2

PROCEDURE (Cf. Smethurst 1992 for details):

1. Start GDB2 from the IMP menu
2. SELECT : Grid
   Select the grid to subset
3. VIEW : Read the image file and mark a sub-region from the grid
4. EXPORT : Grid
   Confirm export to a new GDB database entry (type y)
   Enter new database GRID name
   Confirm to make a subset (type y)
5. SELECT : Grid
   Select the newly created GRID file
6. EXPORT : Grid
   Negate export to a new GDB database entry (Type n)
   Confirm creation of an information file (Type y)



This procedure creates a binary GRID file located in sub-directory \GDB\EXPORT. The information file will be stored in the local directory from where GDB2 was started. For example, if you run GDB2 from the IMP menu program, the information file will be stored in the \MAGMOD\ directory with file extension .GDI. You must copy this file to \MAGMOD\IMPPROF directory (COPY c:\magmod*.gdi c:\magmod\impprof).

## 3.3 OPEN UTM FILE

This option loads a contour data-file, i.e. a UTM file with paired X (EAST) and Y (NORTH) co-ordinates (Standard ASCII file with X and Y co-ordinates; -9999.0 -9999.0 indicate 'pen-up'). A UTM file can be generated with the program IMPATLAS (cf. Torsvik 1992a) for Norwegian data or during IMPORT (see later).

Upon entering this option the current directory is sorted. Use cursor arrows to select the appropriate profile file followed by <ENTER>. Use <ESC> to leave this option without selecting a file.

*Make sure that the UTM file is generated with 10 meters precision, i.e. using factor 100 in IMPATLAS (Torsvik 1992a). Also assure that the UTM-file is generated with the same UTM-ZONE (30-37) as the profile-data-base and/or grid-files.*

## 3.4 IMP5 MODELLING

This option is used to export selected profiles to IMP5 data-format. Number of profile stations, average data-spacing, total distance and profile direction is displayed when entering this mode. IMP5 format profiles are created with file-extension *.OUT and stored in directory \MAGMOD\. The operator is prompted to execute IMP5 or not (y or n).

**NOTE**

IMP5 only handles profiles with a maximum of 300 data stations. For longer profiles this problem can be overcome by increasing the 'Profile sampling rate (profile mode)' in option 'SET SYSTEM' before you select a profile in order to decrease the number of stations.

## 3.5 MAGN INVERSION

This sub-option allows IMPPROF to interface with PDEPTH (Torsvik & Olesen 1992a), a program to calculate depth to magnetic basement.

This option can only be used for equally spaced data-points, hence spline fitting is automatically performed in order to create equally spaced stations. The maximum number of points is 1024; the operator is prompted for number of points, but can always use the displayed default value. If the default-value is above 1024, the value is automatically set to 1024.

The operator is further prompted for autocorrelation window length/length of the adaptive window (in number of data-points). 15-20 is a good starting value for profiles with approximately 100 data-points. An upper value (maximum) is indicated dependent on the depth of maximum interest (listed for 2, 5 and 10 km). See Torsvik & Olesen (1992a) for detailed operation of PDEPTH. Finally, the operator can enter flight height (for magnetic data) in order to correct the calculated inversion depths (Fig. 4). An example of depth estimates is shown in fig. 5.

**FIGURE 4** 'MAGN INVERSION' option

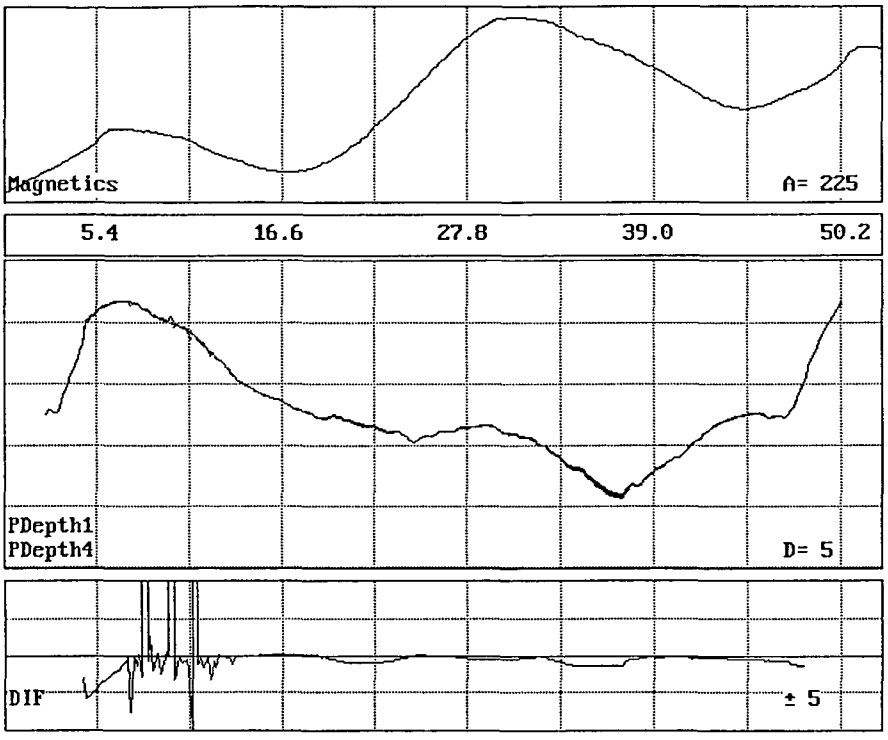
```
Profile Stations        :      330
Calculated Dataspacing  :       0.1600 km (Min    0.0793  Max    0.1753)
Calculated Distance     :      52.6242 km
Calculated Direction    :      138.1982
```

```
Number of points (MAX 1024  ):330

Maximum Window Lengths       :   25 (2km)    62 (5km)   125 (10km)
Autocorrelation Window Length:30

Fligth Altitude (in km)      :0.5
```

**FIGURE 5** Example of magnetic inversion



## 3.6 GRAV INVERSION

This option (Fig. 6) initiate gravity inversion and calculates basement surface depths (Cf. GDEPTH; Torsvik & Fichler 1993). Maximum number of data-points is 105 and data must be equally spaced, hence spline fitting is a necessity (automatic). Parameters which affect the gravity inversion solutions are as follows:

1. Number of iterations (100=default):

The gravity inversion routine uses an iteration scheme which employs Markquardt's (1963) optimization. Iteration will always terminate when the Markquardt's damping factor become large, i.e. >15 (cf. Murthy & Rao, 1989). The operator, however, can terminate iteration interactively at any stage by setting a maximum value of iterations.

2. Damping Factor Lambda (0.5=default):

The Markquardt's damping factor (see above) controls termination of the iterative inversion process.

3. Lowpass Filter Value (odd number;5=default):

In order to 'smooth' oscillating depth estimates a lowpass filter (moving average) has been implemented. Only odd numbers should be entered (1,3,5,7 etc.).

4. Profile Extension (y or n; n=default):

The program automatically subtracts a regional trend (if not already removed). This implicate that inversion of asymmetric gravity profiles, e.g. associated with intra-basement faulting, results in erroneous depth estimates. In such cases it is necessary to 'extend' the original profile. The profile is extended 50% and the extended anomaly values are linearly interpolated between the end profile value and a value corresponding to the start value. Depth values will now be correct, but it is obvious that depth estimates along the extended part of the profile should not be used.

5. Depth to interface (in km):

The gravity inversion procedure initially assumes a flat basement topography, i.e. the density surface between sediments and basement, at a specific depth which must be defined by the

operator. This depth will represent the depth to basement at the starting point of the profile. The choice of minimum and maximum depth's (see below) dictate inversion convergence.

6. Minimum depth to interface (in km):

Set minimum depth to interface (see point 5).

7. Maximum depth to interface (in km):

Set maximum depth to interface (see point 5).

8. Density contrast across interface (in 1000kg/$m^3$):

Set density contrast across interface in 1000kg/$m^3$ (= g/$cm^3$; e.g. 0.3)

9. Station interval (in Km):

All data-points must be equally spaced (maximum 104) and station interval is given in kilometre. The listed station interval is an average based on reel data. Ignore this entry since spline fitting should be performed (see below).

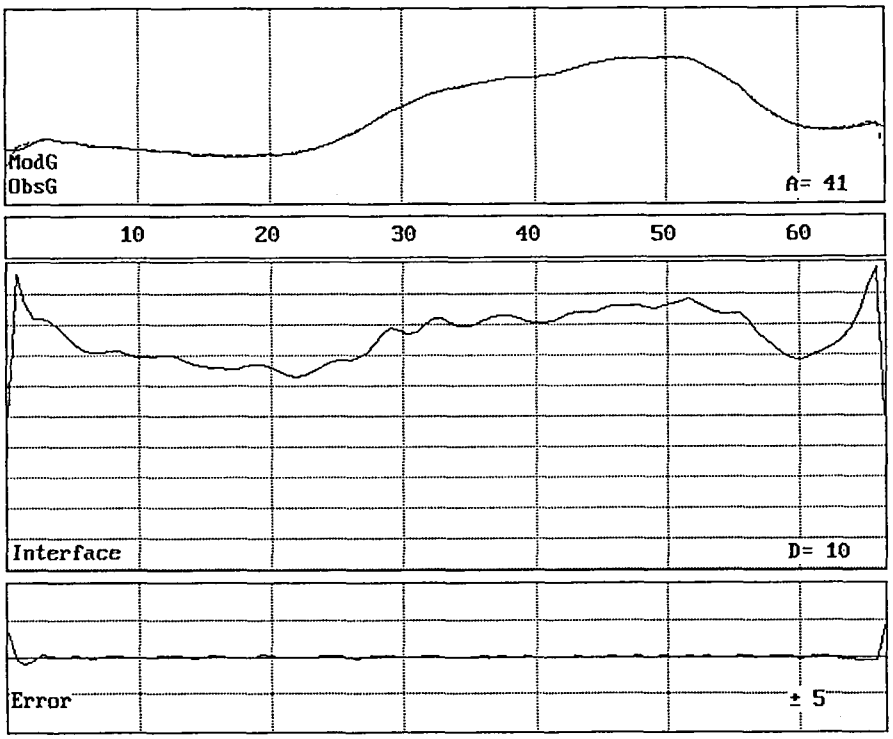
The operator select number of points (equally spaced distances is then automatically calculated based on maximum number of points). The default value can always be used; number of points above 104 will be set to 104.

**FIGURE 6** Option 'GRAV INVERSION'

```
Number of iterations (100=default)                    :5
Damping Factor Lamda (0.5=default)                    :0.5
Lowpass Filter (moving average;1,3,5,7 or 9)          :5
Profile extension    (Y or N)                         :n
Depth to Interface   (in Km)                          :5
Minimum depth to interface          (in Km)           :0
Maximum depth to interface          (in Km)           :10
Density contrast across interface (in 1000kg/CM)      :0.3
```

```
Number of points (MAXIMUM 104):110
```

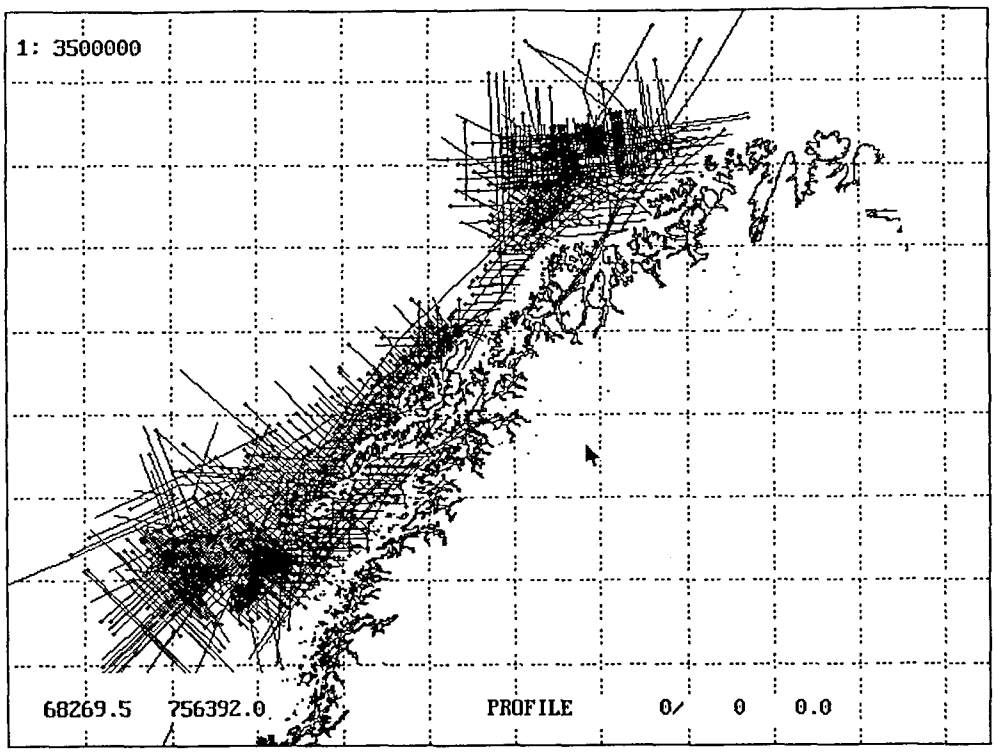
**FIGURE 7** Example of gravity inversion.



## 3.7 DRAW SURVEY

After the operator has selected a profile database (option 'OPEN DATABASE' all profile lines (a Survey) are displayed (Fig. 8) on the screen upon accessing this option. The start-point for each profile is indicated as a red dot. The details in the profile lines are drawn according to the 'Profile sampling rate (survey mode)' in option 'SET SYSTEM'. The map scale is displayed in the upper left corner, whereas X(east) and Y(north) co-ordinate for the position of the mouse arrow is indicated in the bottom left corner.

**FIGURE 8** Option 'DRAW SURVEY'



Sub-options (type h = HELP for screen display) are as follows:

| OPTION | EFFECT |
|---|---|
| **LEFT BUTTON** mouse | **SELECT A PROFILE**<br>-MOVE ARROW TO A PROFILE AND CLICK THE LEFT BUTTON<br>-THE SELECTED PROFILE NUMBER IS DISPLAYED IN THE BOTTOM RIGHT CORNER OF THE SCREEN ALONG WITH THE NUMBER OF STATIONS/VALUE OF POINT1<br>-THE ACTUAL PROFILE IS HIGHLIGHTED ON THE SCREEN AND DISPLAYED IN THE TOP RIGHT CORNER OF THE SCREEN (Fig. 9)<br>-FOR GRAVITY DATA FREE AIR/BOUGUER ANOMALIES WILL BE DISPLAYED IN YELLOW/WHITE RESPECTIVELY (SEE SET SYSTEM) |
| **MIDDLE BUTTON** mouse | **SELECT A POINT WITHIN A PROFILE**<br>-SELECT A PROFILE (SEE ABOVE)<br>-MOVE ARROW TO A SELECTED POINT WITHIN THE PROFILE AND CLICK THE MIDDLE BOTTOM<br>-ACTUAL DATA VALUE FOR THE POINT WILL BE DISPLAYED IN THE BOTTOM RIGHT CORNER |
| **RIGHT BUTTON** mouse | **SELECT MAP ZOOM-CENTRE**<br>-MOVE ARROW TO DESIRED ZOOM-CENTRE AND CLICK RIGHT BUTTON<br>-PROFILES WILL BE REDRAWN CENTRED AROUND THE NEW ZOOM-CENTRE<br>-STOP PROFILE DRAWING AT ANY STAGE BY PRESSING THE 'A' (ABORT) KEY |
| **ARROW KEYS** | ***SCROLL MAP UP/DOWN OR SIDEWAYS*** |
| **PG UP / PG DN** | **EXPAND / DECREASE SCALE BY FACTOR 2** |
| **1-SOL/ 2-EOL** | **DEFINE A NEW START AND/OR END OF A PROFILE**<br>-SELECT PROFILE AND A POINT WITHIN THE PROFILE (SEE ABOVE)<br>-TYPE 1 TO INDICATE START OF LINE (SOL)<br>-SELECT A SECOND POINT WITHIN THE PROFILE<br>-TYPE 2 TO INDICATE END OF LINE (EOL) |
| **CrIMG** | **CREATE A DEFAULT IMAGE FOR THE SURVEY**<br>-TYPE C (SEE LATER DESCRIPTION) |

| OPTION | EFFECT |
|---|---|
| **PROF** | **DRAW PROFILES**<br>-TYPE P (ABORT DRAWING BY PRESSING THE 'A' KEY) |
| **GRID** | **DRAW A GRID DEFINED IN OPTION 'OPEN GRID'**<br>-TYPE G (ABORT DRAWING BY PRESSING THE 'A' KEY) |
| **MAP** | **DRAW A UTM-FILE SET IN OPTION 'OPEN UTM'**<br>-TYPE M (ABORT DRAWING BY PRESSING THE 'A' KEY) |
| **INVERT** | **INVERT PROFILE CO-ORDINATES**<br>-TYPE I<br>-START WILL BECOME END AND VISA VERSA |
| **LASER** | **COPY IMAGE TO A HP-LASER/DESKJET PRINTER**<br>-TYPE L |
| **SCALE** | **SET MAPSCALE**<br>-TYPE S FOLLOWS BY SCALE |
| **UTMG** | **DEFINE UTM GRID SPACING**<br>-TYPE U FOLLOWED BY SPACING IN KM |
| **QUIT** | **RETURN TO MAIN MENU**<br>-TYPE Q |

**NOTE:**

When a profile has been selected in option 'DRAW SURVEY' then this profile can subsequently be exported to IMP5 format or processed using the magnetic or gravity inversion routines available from the main menu.

**FIGURE 9** Example of selecting a profile

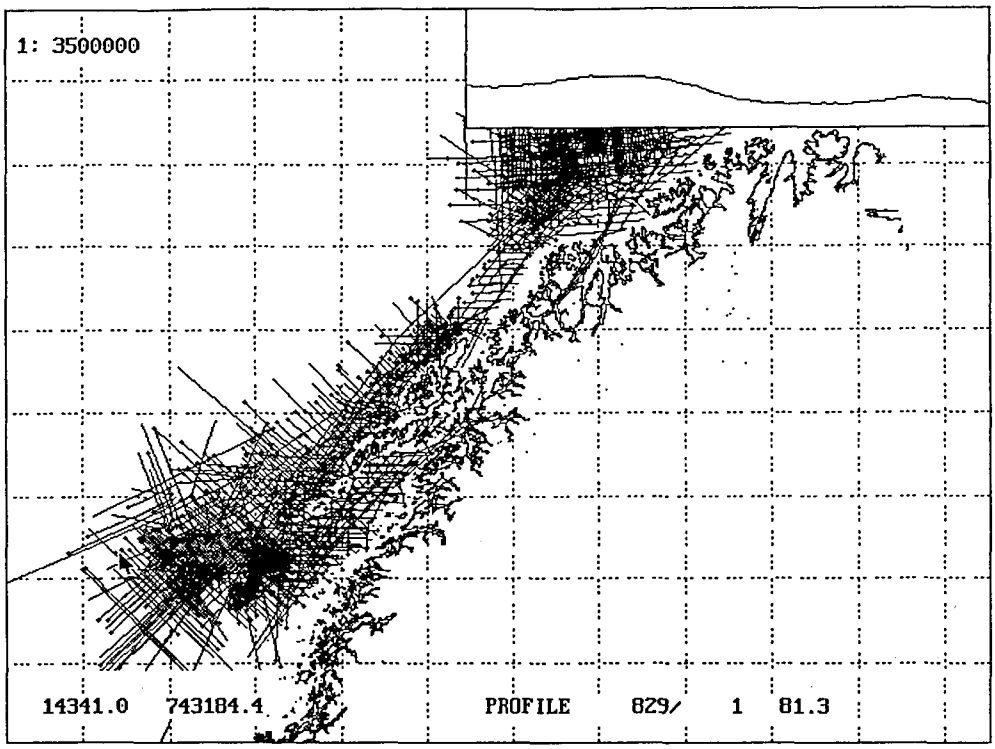
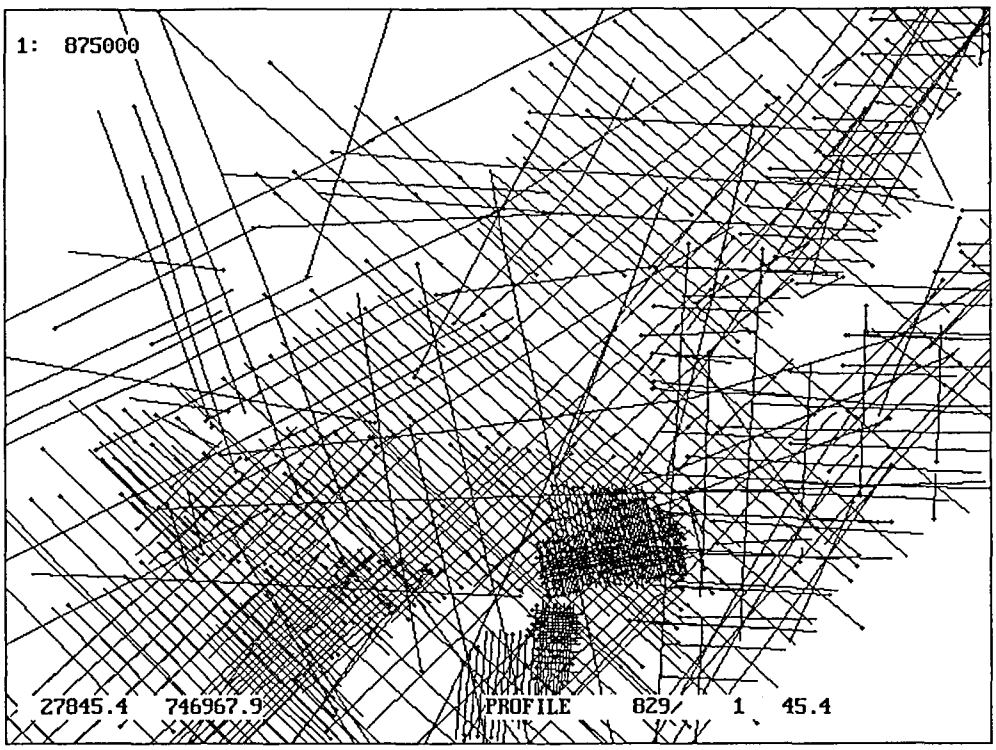



**FIGURE 10** Example of change of zoom-center and map expansion



### 3.7.1 CrIMG

Whenever a profile data-base has been created (using option 'IMPORT DATA') it is convenient to create an image file which is displayed whenever option 'DRAW SURVEY' is engaged. This will speed up the system considerable.

The procedure to construct an image file is as follows:

(1)

- Select a profile database with option 'OPEN DATABASE'
- Select a grid (if available) with option 'OPEN GRID FILE'
- Select a UTM file (if available) with option 'OPEN UTM FILE'
  Assure that all files are produced for the same UTM zone

(2)

- Select option 'DRAW SURVEY'
- Zoom, Scale and display Profiles, Grid and/or Utm-file on the screen
- The screen can be saved to an image file at any stage by pressing the c key. This produces four image files with the names *.INT,*.RED,*.GRN & *.BLU (*='Profile Database Name') plus an image information file named <Profile Database Name>.DAT.

**NOTE 1:**

The default image file associated with a particular Profile Database can be changed at any time by pressing the c key.

**NOTE 2:**

Image files can subsequently be copied to a printer with the aid of the program IMPPRINT (Torsvik 1992b) or directly to an HP LASER/DESKJET printer by pressing the l (=laser) key.

**NOTE 3:**

When option 'DRAW SURVEY' is used for the first time, the default image is loaded (if created). Subsequent use of option 'DRAW SURVEY' loads an image which resemblance any changes to the default image.

### 3.7.2 LASER

This option provides a hardcopy of the screen to a HP LASER/DESKJET compatible printer (will not work if a POST-SCRIPT cartridge is installed). For any other output-device make sure that you first save the screen using the option 'CrIMG' (see previous section). Images can subsequently be copied to a printer with the program IMPPRINT (Torsvik 1992b).

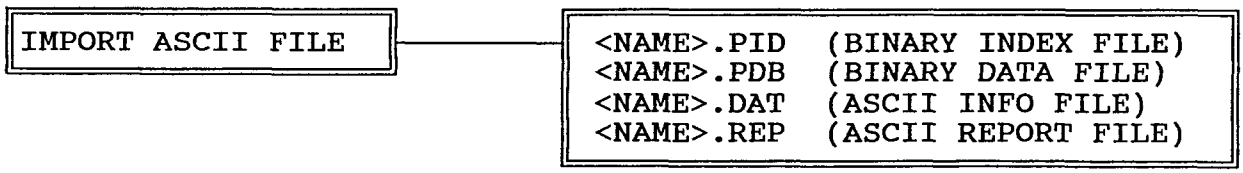
## 3.8 IMPORT DATA

This option converts profile data from ASCII format to IMPPROF profile database format (creates a new set of binary random access files). The input ASCII file must have the following format (cf. EXAMPLE.XYZ located in sub-directory \MAGMOD\IMPPROF):

| PROFILE-NAME | SHOT-POINT | X(EAST) | Y(NORTH) | Z(W-DEPTH) | VALUE |
|---|---|---|---|---|---|
| A16 | I6 | F9.1 | F9.1 | F7.1 | F7.1 |

Note that Z(depth or height) should always be in meter units.

The import option produces two binary random access files and two ASCII information/report files (see below). The report file contain the actual profile-name which relates to the actual profile-number used in IMPPROF. This file can be copied to a printer, e.g. using the DOS command COPY <NAME>.REP LPT1:




**NOTE:**

During operation of IMPPROF two more files are created (named <NAME>.XSP & <NAME>.YSP) when the profile database is accessed for the first time. If any of these two files or the <NAME>.DAT file is deleted the system will crash.

Whenever importing and converting an ASCII file to IMPPROF format, the operator is prompted for the following information (Fig. 11):

(1) Input File Name
(2) Output File Name (use no file extension)
(3) UTM factor for input file (1=km,10=100m,100=10m & 1000=meter units)
(4) UTM zone for input file
(5) IMPATLAS directory (e.g. \atlas\)

Create a UTM file:

When importing data the program determines the geographic area covered by all the profiles and this information is stored in file <NAME>.DAT (never delete this file). This information can subsequently be used to construct a UTM map for the region. UTM maps are always created with 10 meter units.

After converting all profiles the operator can produce a UTM map (Fig. 12), but it is of ultimate importance that the UTM map is produced in the same UTM zone as the original profile data.

The import option is ended by displaying a status report on newly created files.

**FIGURE 11** Option 'IMPORT DATA'; Import Menu Options

```
            PROGRAM IMPORTP - IMPORT ASCII PROFILES TO IMPPROF FORMAT
                              THT/NGU 1992
```

```
INPUT  FILE NAME                    :lofgra2f.xyz
OUTPUT FILE NAME (NO EXTENSION)     :DUMMY
UTM FACTOR (1=km,10,100,1000=m)     :100
UTM ZONE   (31,32,33,34......)      :33
IMPATLAS DIRECTORY (e.g. \atlas\):\MAGMOD\KYST\
START IMPORTING (y/n)               :n
```

**FIGURE 12** Option 'IMPORT DATA'; Create a UTM map

```
Create a UTM map file from Norwegian coastline file: KYST.BIN
MinLat    70.040  MinLong   17.126
MaxLat    71.818  MaxLong   25.918
```

```
UTM Zone                            :33
Start Exporting (y/n)               :y    At Rec    13000
```

```
STATUS REPORT:

FILES CREATED: DUMMY.PID     (BINARY INDEX   FILE)
               DUMMY.PDB     (BINARY DATA    FILE)
               DUMMY.REP     (ASCII  REPORT  FILE)
               DUMMY.DAT     (ASCII  MIN/MAX FILE)
               DUMMY.UTM     (ASCII  UTM     FILE)
```

```
Record Size is    81254 for FILE KYST.BIN        Press A to Abort
```

## 3.9 SELECT PROFILE

The program is principally designed to select profiles graphically, but this option allows the operator to select a profile by entering the appropriate profile number (within the profile database, profiles are organized and identified by numbers <1 to N> and not their original profile names). The selected profile is displayed on the screen and the operator may invert (turn) the profile if necessary by typing y. It is also possible to export the selected profile to an ASCII file (output format is Distance along profile and Z-value; free format; file name = <Profile Number>.EXP) which can later be used for other purposes (e.g. own-built inversion routines etc.)

Note for gravity data that free air anomalies are drawn in yellow and Bouguer corrected anomalies in white (if bathometry data are available and 'Bouguer correction' is set to y (yes) in option 'SET SYSTEM'. In the latter case, the Bouguer corrected data is used for gravity inversion.

## 3.10 DEPTH ANALYSIS

Depth Save Files in PDEPTH/GDEPTH:

Whenever accessing the magnetic and gravity inversion programs (PDEPTH and GDEPTH) from IMPPROF, the operator can now interactively select depths in option 'VIEW' and store these depth-estimates in a file. The file-name is set in option 'CONFIGURE' ('Name of Depth Save File') and they are automatically given file-extension .PTZ. This file (free format ASCII file) contain the following information:

-Profile Database name/Profile number
-Inverted (-1) or regular profile (1)
-Distance along profile
-Actual Depth

For a particular project the operator can use the same file-name since depths from consecutive profile depth estimates are 'appended' to the existing data.

How to select depths interactively:

-Select a profile in IMPPROF

-Select option 'MAGN INVERSION' or 'GRAV INVERSION' (IMPPROF)

-Select option 'VIEW' in PDEPTH or GDEPTH

-Move mouse cursor to a selected depth (distance=X and depth=D is displayed in the lower left corner) and click any mouse buttom. This will save ('append') the actual depth value and distance in the file defined in option 'CONFIGURE' (in PDEPTH/GDEPTH).

How to create the final depth file:

-Select the appropriate profile database with option 'OPEN DATABASE' in IMPPROF

-Select option 'DEPTH ANALYSIS'

-Select input depth file (with extensions .PTZ)

-Enter the file-name of the final output depth file

**A new depth-file with X,Y and DEPTH (all in km units) will now be created. This file can later be used to produce a depth grid- or contour-map with any commercial software or by hand-drawing.**

## 3.11 SET SYSTEM

This option (Fig. 13) permits the adjustment of parameters which control program output and performance.

*A configuration file named IMPPROF.SYS (free format ASCHI file) contains names of the variables which are adjusted using 'SET SYSTEM'. Whenever a parameter is changed, the file IMPPROF.SYS is automatically updated, thus recording the adjustment even after IMPPROF is terminated.*

The following parameters can be changed/updated:

| PARAMETER | VALUE |
|---|---|
| PROFILE SAMPLING RATE (PROFILE EXTRACT)<br>(Initial value=1;read all data points)<br>-This sampling rate is used whenever a selected profile is read from the disk | 1 to N |
| PROFILE SAMPLING RATE (SURVEY DISPLAY)<br>(Initial value=100)<br>-This sampling rate is used to generate an overview off all profiles in a the database | 1 to N |
| AUTOCORRELATION WINDOW LENGTH<br>(Initial value=40)<br>-Value is used for magnetic inversion<br>Cf. Torsvik & Olesen 1992a | 1 to N/2 |
| BOUGUER CORRECTION<br>(Initial value=y) | y or n |
| BOUGUER PLATE DENSITY (1000kg/m$^3$)<br>(Initial value=2.67) | any value |

| PARAMETER | VALUE |
|---|---|
| -This value is used for calculating bouguer gravity anomalies from free air gravity anomalies | |
| NUMBER OF ITERATIONS<br>(Initial value = 100)<br>-Value controls termination of gravity inversion if no convergence; should be set at a high value | 1 to 100 |
| DAMPING FACTOR LAMBDA | 0 to 15 |
| LOWPASS FILTER<br>(Initial value=5) | 1,3,5 or 7 |
| PROFILE EXTENSION<br>(Initial value=n) | y or n |
| DEPTH TO INTERFACE (in km)<br>(Initial value=5) | any number |
| STATION INTERVAL (in Km) | |
| FREE..... | |
| PRINTER PORT<br>(Initial value=lpt1:) | com1:,com2,lpt1:<br>or lpt2: |
| BAUDRATE (for com1: or com2:)<br>(Initial value=9600) | 110,300,600,1200<br>,2400,4800 or 9600 |
| PARITY (for com1: or com2:)<br>(Initial value=n) | no, even or odd |
| DATABITS (for com1: or com2:)<br>(Initial value=8) | 7 or 8 |
| STOPBIT (for com1: or com2:)<br>(Initial value=1) | 1 or 2 |
| FREE..... | |
| PLOT SIZE LASER DUMP<br>(Initial value=3) | 1(small) 2, 3<br>or 4 (large) |

Cf. Torsvik & Olesen 1992a and Torsvik & Fichler (1993) concerning parameters controlling magnetic and gravity inversions.

**FIGURE 13** Option 'SET SYSTEM'

```
                              S E T  S Y S T E M
          Profile sampling rate (profile mode)          :1
          Profile sampling rate (survey mode)           :100
MAGN INV  Autocorrelation window length                 :30
GRAVITY   Bouguer Correction (y/n)                      :y
GRAVITY   Bouguer Plate Density (GM/CC)                 :2.67
GRAV INV  Number of iterations                          :5
GRAV INV  Damping Factor Lamda                          :0.5
GRAV INV  Lowpass Filter (moving average;1,3,5,.)       :5
GRAV INV  Profile Extension (y or n)                    :n
GRAV INV  Depth to Interface (in km)                    :5
GRAV INV  Minimum depth to Interface (in Km)            :0
GRAV INV  Maximum depth to Interface (in Km)            :10
GRAV INV  Density Contrast (in 1000kg/CM)               :0.3
          Station Interval (in Km)                      :.5750551
                                                        :
LASER     Printer Port LIST/F1      (lpt1: com1:    ) :lpt1:
LASER     Baudrate                  (110 to 9600    ) :9600
LASER     Parity                    (n,o or e       ) :n
LASER     Databits                  (8 or 7         ) :8
LASER     Stopbits                  (1 or 2         ) :1
                                                      ) :
LASER     Plot Size LASER-DUMP      (1 to 4)        ) :3
```

## 4 REFERENCES


Marquardt, D.W., 1963. An algorithm for least-squares-estimation of non-linear parameters.. J. Soc. Industr. Appl. Mathematics, 11, 2, 431-441.

Murthy, I.V.R. & Rao, S.J., 1989. Short Note: A Fortran 77 program for inverting gravity anomalies of two-dimentional basement structures. Computing & Geosciences, 15, 7, 1149-1156.

Smethurst, M.A., 1992. GDB: Et PC database program for data som er systematisk ordnet i et rutemønster, og profiler gjennom slike rutenett. NGU Report 92.328.

Torsvik, T.H., 1992a. IMPATLAS - Geographic database and map-generating system. NGU Report 92.223.

Torsvik, T.H., 1992b. IMPPRINT - A Print-Driver Program. NGU Report 92.304.

Torsvik, T.H., 1992c. IMP5 - Interactive Modelling of Potential Field Data (Release 5). NGU Report 92.305.

Torsvik, T.H. & Olesen, O., 1992a. PDEPTH - Calculation of depth to magnetic basement from profile data. NGU Report 92.212.

Torsvik, T.H. & Olesen, O., 1992b. IMPPET - Petrophysical Database System. NGU Report 92.275.

Torsvik, T.H. & Fichler, C., 1993. GDEPTH - Gravity Inversion and calculation of basement depths. NGU Report 93.066

## APPENDIX 1 SETTING AUTOEXEC.BAT & CONFIG.SYS IN MS-DOS 5

Example of AUTOEXEC.BAT set-up with QEMM memory manager

```
@ECHO OFF
PROMPT $p$g
PATH C:\dos
SET COMSPEC=C:\DOS\COMMAND.COM
SET DOS16M=11
SET TEMP=C:\DOS
MODE CON CODEPAGE PREPARE=((865) C:\DOS\EGA.CPI)
MODE CON CODEPAGE SELECT=865
c:\qemm\loadhi /r:1 c:\dos\doskey.com
PATH C:\MAGMOD
c:\qemm\loadhi /r:2 c:\mouse\mouse.com
```

Example of CONFIG.SYS set-up with QEMM memory manager

```
break=on
device=c:\dos\setver.exe
dos=high
DEVICE=C:\QEMM\QEMM386.SYS x=1000-B0FF ROM RAM MA=0
COUNTRY=47,865,C:\DOS\COUNTRY.SYS
BUFFERS=20
FILES=30
STACKS=0,0
SHELL=C:\DOS\COMMAND.COM /P /E:640
device=c:\qemm\loadhi.sys /r:1 c:\dos\display.sys con=(ega,865,1)
INSTALL=c:\qemm\loadhi.com /r:2 /tsr c:\dos\keyb.com
        _no,865,c:\dos\keyboard.sys
lastdrive=z
```

## APPENDIX 2 GENERAL EDITOR/INPUT FUNCTIONS IN IMPPROF

When entering a single data-entry or editing etc., the following general features are implemented:

| | |
|---|---|
| Up/Dn arrows | : Move up/down in input tables |
| Left/Right arrows | : Move Left/Right within a single data-entry |
| <RETURN> | : Move to next entry field or end a single data entry routine |
| <ESC> | : Escape/Quit input/edit mode |
| <INS> | : Change from INSERT to REPLACE (overwrite) mode or from REPLACE to INSERT mode. (Defaults to REPLACE mode) |