Creating a user interface to GRAVSOFT

by

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1. Introduction.

As a support for the Klang Valley Height Modernisation Project, a height reference surface (geoid) has to be computed. This will be done using the GRAVSOFT suite of FORTRAN programs. These programs have been developed continuously since 1970 by the staff of the DTU-Space (earlier Danish National Survey and Cadastre (KMS)) in cooperation with the University of Copenhagen.

The software uses a text-oriented interface (see e.g. Tscherning et al. 1992), which is difficult to use for modern users who are used to more user-friendly systems. The University of Copenhagen (UCPH) was therefore sub-contracted by DTU-Space with the task of creating a modern user-friendly system. UCPH had earlier cooperated with professor Janni Nielsen, Copenhagen Business School, in the area of information technology and she agreed to act as a consultant in relation to the design of the new user interface, see Section 2.

As a tool to create the new interface the programming language Python (http://www.python.org/) was selected This language permits the creation of cross-platform interfaces (Windows, Linux, Mac) and is an open-source product.

A prototype interface has been tested initially by 4 Danish students and by the authors of the GRAVSOFT programs (R.Forsberg and C.C.Tscherning). This has resulted in many improvements with respect to the interface, so that a well functioning system now is in place. However the design of the interface may possibly be further improved, and Prof. Janni Nielsen has designed a questionnaire (see Section 3) which will be used to clarify if further improvements are needed.

2. Design life cycle

The interface design has been developed following Apple Design Guidelines (Apple Human Interface Guidelines: The Apple Desktop Interface, Inc. Apple Computer) and has evolved during an iterative process of conceptual design, product design and test, building on Preece et al.(2004)'s lifecycle model The life cycle is a dynamic model that combines the progression of an interaction design process over time with the returning activities of each iteration during the process from the initial project start, to the final product deliverance (cf. figure below). The model consists of four primary activities:

1) Pre-analysis, including identification and specification of needs
2) Conceptual Design: the development and refinement of design ideas
3) Product Design: Build/rebuild interactive version – the construction of physical representations of conceptual models
4) Test and evaluation – this activity confronts the physical representation with users

As the model represents a dynamic and progressive process, it is important to note that the primary activities are not to be understood as sequential phases. Also, there is no linear determinant sequence between the activities (which the model may seduce us to assume).

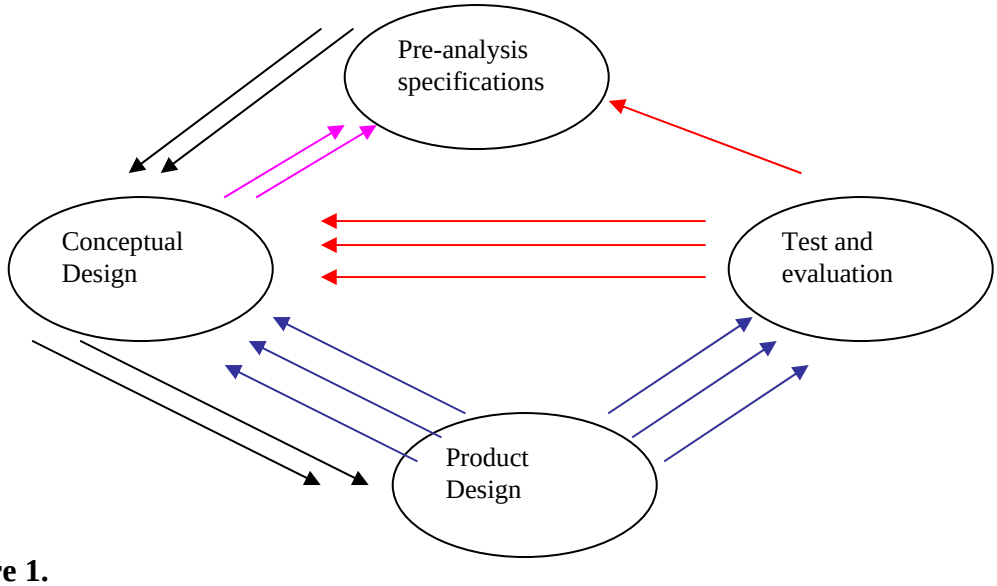

Figure 1.

3. Questionnaire

The questionnaire is part of the test and evaluation circle of the Gravsoft software interface. It is designed as an electronic user feed back survey and the survey is anonymous. It is accessible from http://www.cctscherning.dk/survey .

There are 25 questions divided into four themes. The first theme is general aspects of Usability Satisfaction, the second theme has focus on the Interface and is subdivided into: screen, terminology and system information, system capabilities and finally learning – which is related to learning to use. The third theme is concerned with Usefulness and Ease of Use and finally the fourth theme which is the Background Information.

In Background Information, the traditional demographic data such as age of user, gender, nationality, educational background etc. is requested. There are also questions of user´s knowledge of mathematics, user´s computer competence, experience with using different gravity data as well as user´s knowledge of physical geodesy.

The questionnaire is designed with a feedback in percentage so the users know how far they are in the survey. The themes are constructed using the Lickert scale and most themes needs to be answered before the user can move on to the next theme.

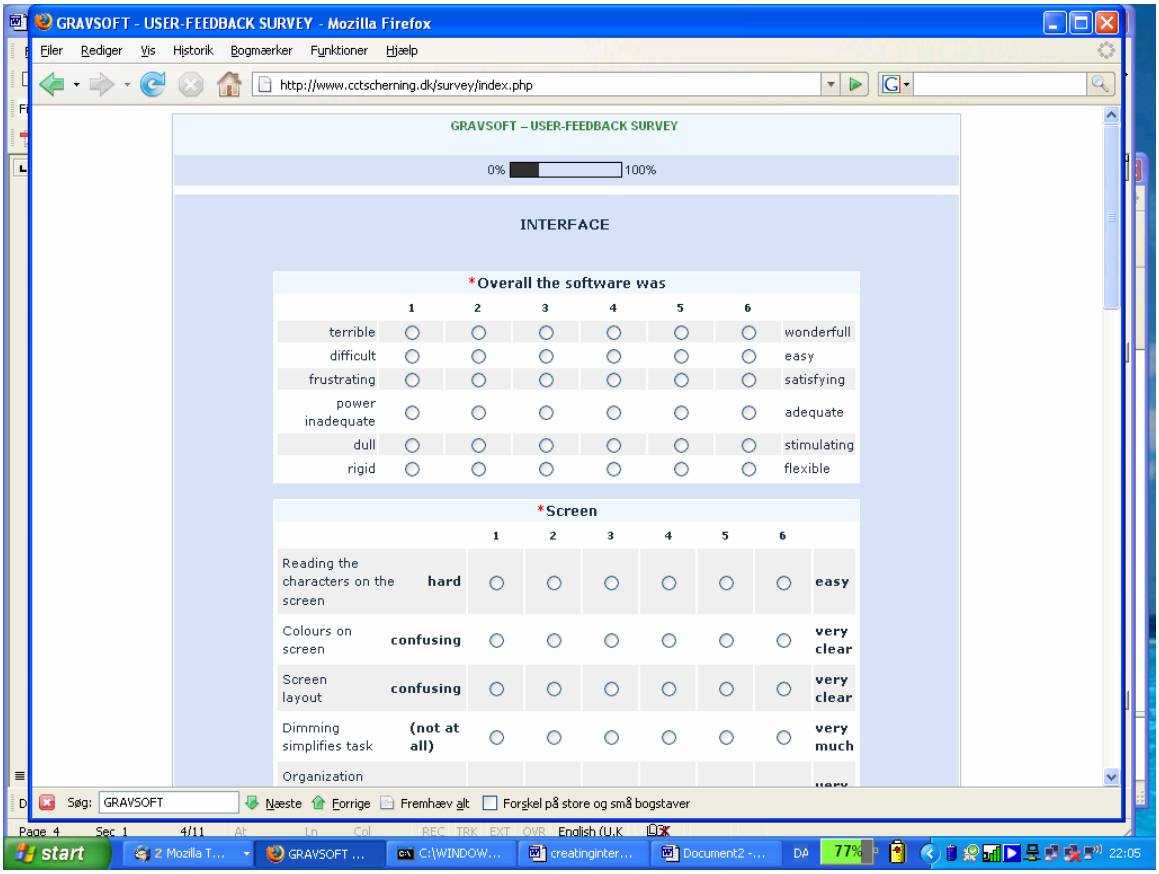

Figure 2. Example page from survey.

4. Python software and interface to GRAVSOFT.

As explained in the README.TXT file (Appendix 1) Windows users must download and install Python. The python programs, the FORTRAN executables and the test-data must be extracted from a ZIP-file using Winzip to a directory pyGravsoft.

In the directory will be found:
(a) python programs recognizable by the suffix .py
(b) the README.TXT file
(c) subdirectories

src	source codes to all FORTRAN programs (suffix .for)
bin	program executables (suffix .exe)
doc	availabe documentation (most programs include extensive documentation in the text)
data	test data from the New Mexico standard test area and EGM96.

The interface can be started up either by clicking on the program launcher.py or by writing launcher.py in a window shell (see appendix 2). This will create the initial screen which also gives an overview over the programs, see Figure 1.

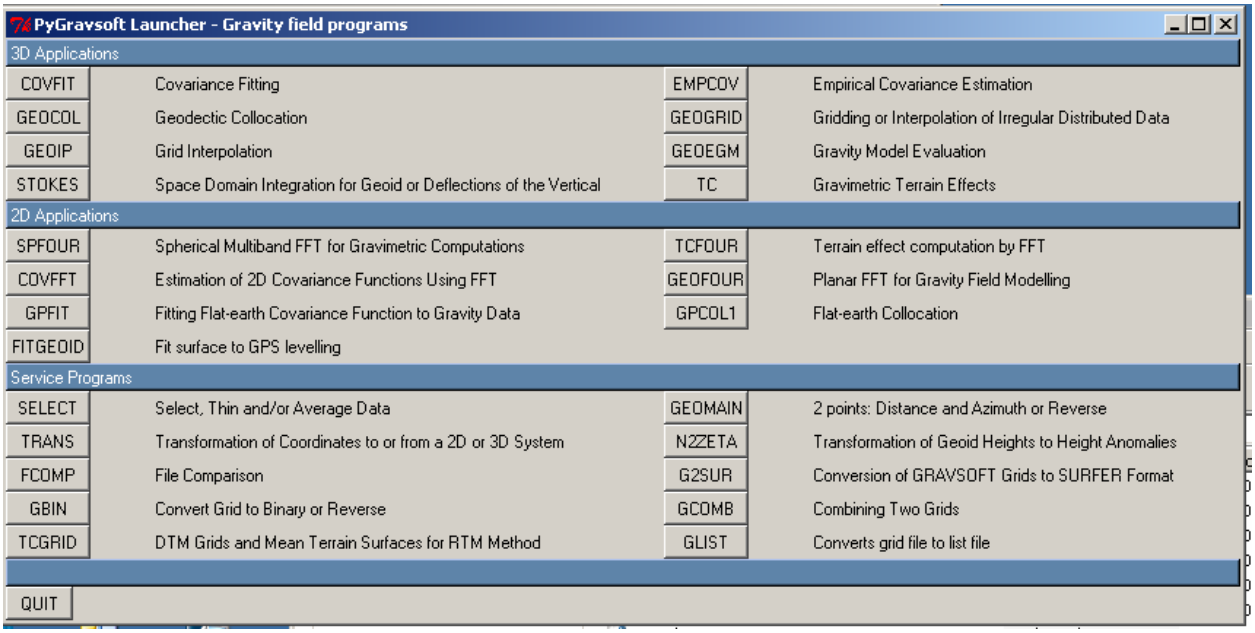

Figure 3. GRAVSOFT Launcher.

Notice that the Launcher window divides the programs in 3 groups: 3D applications, 2D applications and Service programs. The last group of programs is primarily used for data-manipulation or coordinate transformation. Nearly all the 2D programs use a planar approximation to the surface of the Earth and makes naturally necessary corrections related to this into account. The 3D programs operate either without any approximations (global calculations) or uses spherical approximations for local or regional calculations.

In order to use a program, the user must click on the appropriate button. This will launch a window with slots where information must be typed in, such as the names of files. Some default values are provided in order to aid the user in understanding what is asked for, but in most cases clicking on a help-button will give detailed information, see Figure 2. A link to a general Help (documents on the internet or in the sub-directory doc) is also provided.

The program may be run clicking on the “run” button. This will create an ASCII input file named <program name>.inp which is used by the executable. The result of the run will be seen on the screen, and it is also stored in a file <program name>.log. If only the input file is needed, clicking on the “write” button is sufficient. Note that the files are over-written if the program is run a second time. They should therefore be renamed is the user wants to save the files.

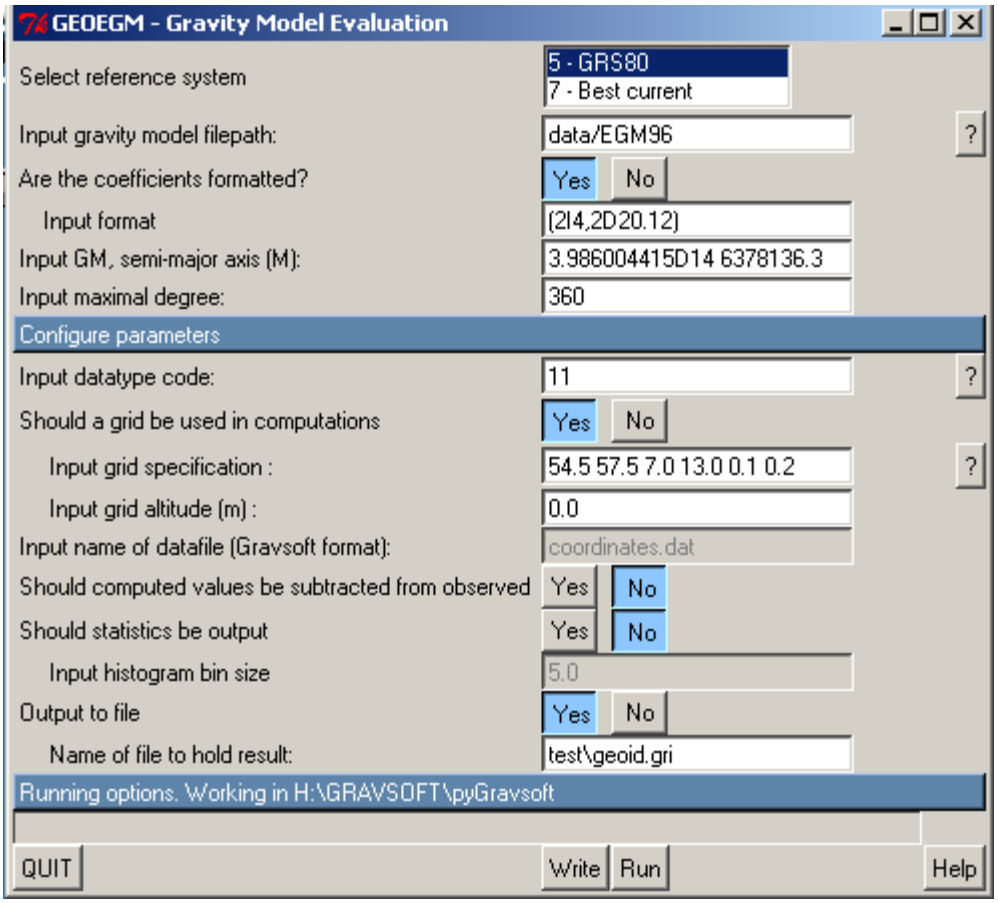

Figure 4. Python interface to GEOEGM. The example shows the computation of geoid heights in a grid over Denmark based on the EGM96 Earth Gravity Model. The run as shown requires that the user has created a sub-directory called “test”, where the grid file is stored.

The use of other GRAVSOFT modules is illustrated in the lecture notes delivered.

References:

Preece, J., Rogers, Y. and H. Sharp, Interaction design, Apogeo Editore, 2004

Tscherning, C.C., R.Forsberg and P.Knudsen: The GRAVSOFT package for geoid determination. Proc. 1. Continental Workshop on the Geoid in Europe, Prague, May 1992, pp. 327-334, Research Institute of Geodesy, Topography and Cartography, Prague, 1992.

Appendix 1.

```
# $Id: README.TXT 179 2008-08-14 22:34:50Z tjansson $
############################
## 1.1 ABOUT pyGravsoft
############################
PyGravsoft provides the graphical user interface to the program in Gravsoft.
It is developed by:
Thomas R. N. Jansson (info@tjansson.dk) - www.tjansson.dk
C. C. Tscherning (cct@gfy.ku.dk) - www.gfy.ku.dk/~cct/

The src/ folder contains the source code for the fortran programs.
The bin/ folder contains the binary fortran programs.
The data/ folder contains example data files for use in the programs.
The doc/ folder contains the documentation of the programs.

############################
## 1.2 INSTALLATION
############################
PyGravsoft depends on the Python binaries which can be downloaded here:
http://www.python.org/download/
Pygravsoft should work out-of-the-box on all modern Linux systems with python
installed. The program is also tested on Windows XP and Solaris 8 but PyGravsoft
should work on all the machines where python is available. The program should
work on other *NIX's as Mac OS X and Solaris.

## 1.2.1 Linux/Unix
Most modern Linux distributions already have python install and there is no
installation. Running the program is don by writing the following:
username@machine:~/pyGravsoft$./launcher.py
or
username@machine:~/pyGravsoft$python launcher.py

The program uses a absolute path to the binary fortran programs. This path is given in
the first line of geomodule.py and should be changed upon a new installation.

## 1.2.2 Windows
Windows does not have python installed by default and this should be downloaded
from the webpage:
http://www.python.org/download/
After the installation .py files will be associated with python programs and a
double-click on a the launcher.py file will start the program.

############################
## 1.3 LICENSE
############################

Copyright 2007 Thomas Jansson IT and University of Copenhagen.
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This file is part of pyGravsoft.
pyGravsoft is free software: you can redistribute it and/or modify
it under the terms of the GNU General Public License as published by
the Free Software Foundation, either version 3 of the License, or
(at your option) any later version.

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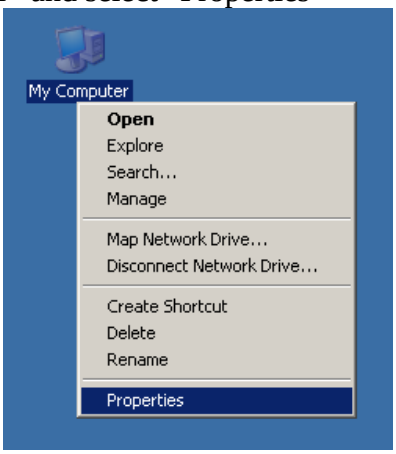
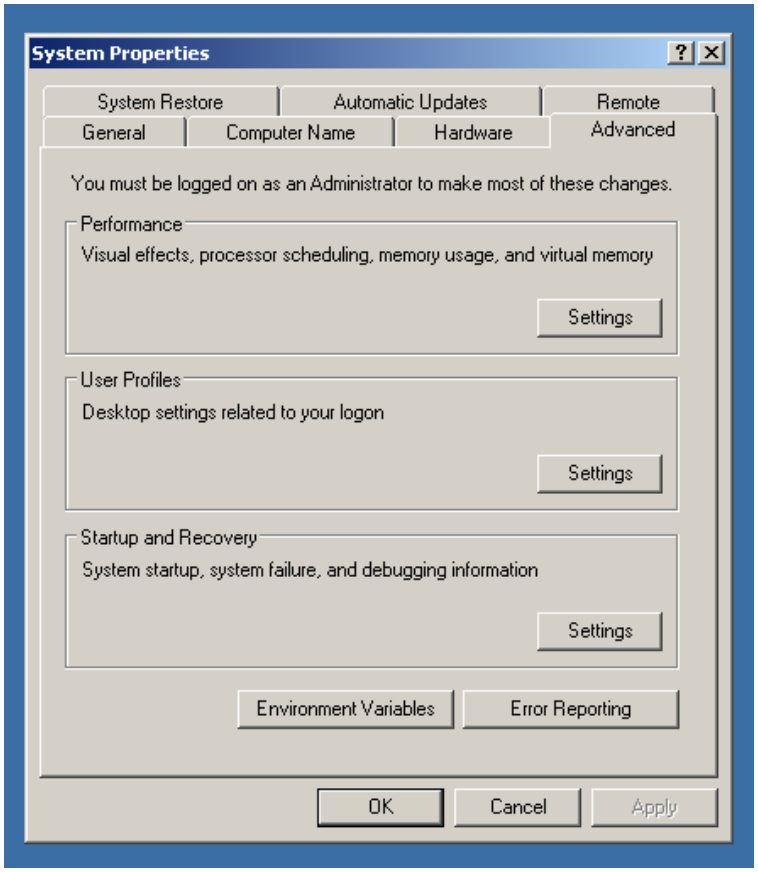
Appendix 2: Setting Path to pyGravsoft in Windows

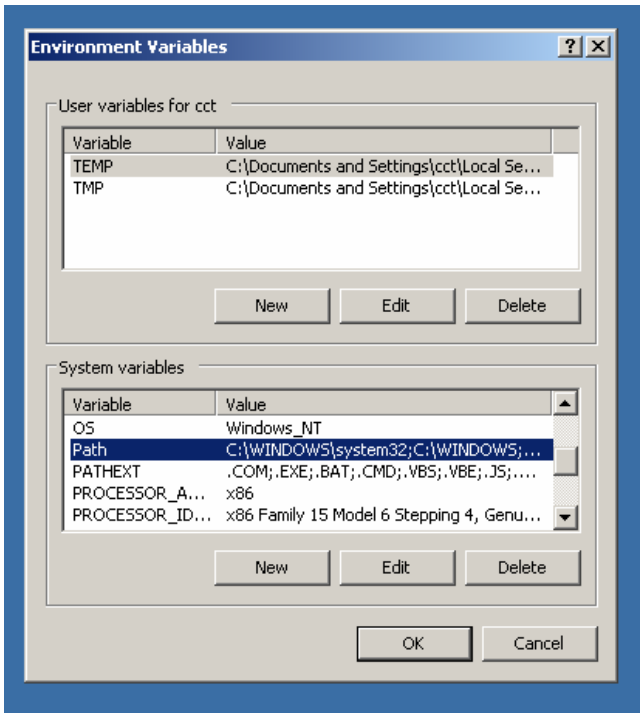
This is appendix is need if one whishes to run pyGravsoft from an arbitrary directory. Right-click on “My Computer” and select “Properties”



Select the fan name “Advanced” and click on the button called “Enviromental Variables”.

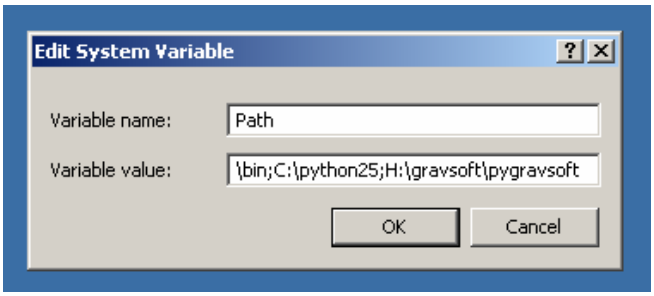


Scroll down in the “System variables” until the “Path” variable is found. Click to edit.

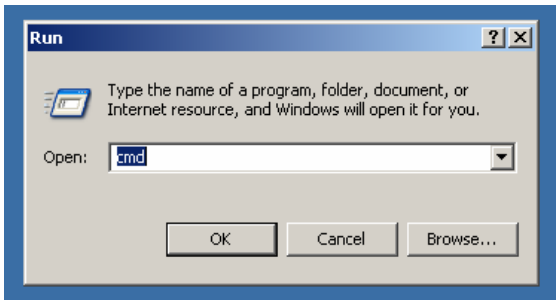


Finally add the path to both the python installation (typically C:\python25) and to the folder containing the pyGravsoft folder. Case is not important when writing the path but it is important not to have trailing backslash. As a example one can add the following:

C:\python25; H:\gravsoft\pygravsoft



The windows command shell which can be invoke by clicking “Start”, “run” and typing “cmd”.



After having altered the Path variable it is now possible to launch pyGravsoft from any directory. In the screenshot we launch the program in H:\