Geosoft Technical Note

Microlevelling Gravity Data

Introduction

There are a number of techniques for microlevelling randomly sampled datasets. The method outlined in this technical note uses the **Oasis montaj™ MAGMAP Tool** to apply a Butterworth (high pass) filter to a Bouguer gravity grid. The filter grid is sampled at the acquisition points and these filter data values are then subtracted from the original Bouguer gravity data values, to create a new "Bouguer_Microlev" data channel.

Grids created from randomly sampled gravity data can have a 'lumpy' appearance in the final grid (see Figure 1). This artefact can then be exaggerated after data enhancements, such as FFT vertical derivative filtering. The cause of the 'lumps' around individual sample points is due to a combination of sparse sampling and acquisition errors.

A number of methods have been proposed to minimize this effect ranging from repetitive gridding (A. Murray, High Precision Gridding of Gravity Data, ASEG, 1998.) to increasing the cell size. The repetitive gridding technique works only where there are no acquisition errors present in the data, and increasing the cell size has the disadvantage of loss of resolution where the data was finely sampled.

The microlevelling method described in this technical note demonstrates how to smooth out acquisition errors as well as minimize gridding artefacts.

The Geological Survey of Victoria provided the gravity data used in this technical note. Note that, although this data is of good quality some artefacts are still visible in the Bouguer grid (Figure 1) but have been minimized in the microlevelled grid (Figure 2).

Steps to Perform Microlevelling on Gravity Data

1. Open a workspace that contains the original gravity database and Bouguer gravity grid.
2. Using the *MAGMAP*|*One-step filtering* menu, apply a high pass Butterworth filter to the Bouguer gravity grid using a cut off wavelength of approximately 2-3 times the average sample spacing of the grid.
3. The resultant filtered grid contains the data values that are to be removed from the original "Bouguer" gravity data.
4. Before you can sample the filtered grid you must create a new "Bouguer_filter" channel in the database. Click on an empty channel header and type in the new channel name "Bouguer_filter". The *Create channel* dialog will be displayed, enabling you to define the channel characteristics.
5. On the *Grid* menu, click *Utilities*|*Sample a grid*. The *Sample a grid* dialog is displayed. Specify the new *Grid sampled channel* name "Bouguer_filter" and save the filter grid point values to the database.

6 Before you can remove the "Bouguer_filter" data values from the original "Bouguer" gravity data you must create a new "Bouguer_Microlev" channel in the database.

7 On the *X-Utility* menu, click *Expressions*|*Expression* menu. Subtract the "Bouguer_filter" channel from the original "Bouguer" gravity channel and display the results in the new "Bouguer_Microlev" channel. (Bouguer-Bouguer_filter= Bouguer_Microlev)

8 Grid the "Bouguer_Microlev" channel to view your results (See Figure 2).

Figures 1 and 3 show the standard Bouguer gravity and it's vertical derivative showing how individual points often have high frequency anomalies associated with them.

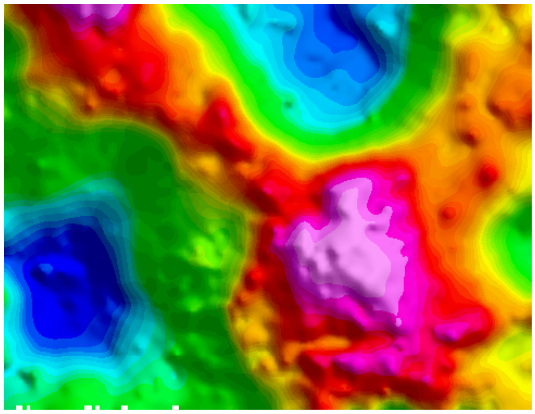

Figure 1. Standard Bouguer gravity grid (500m cell size) of GSV data

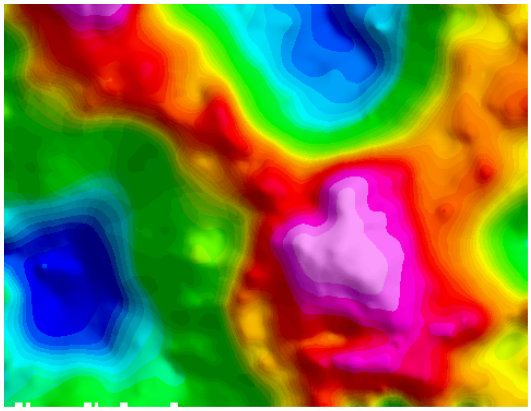

Figure 2. Bouguer gravity grid (500m cell size) of "microlevelled" gravity.

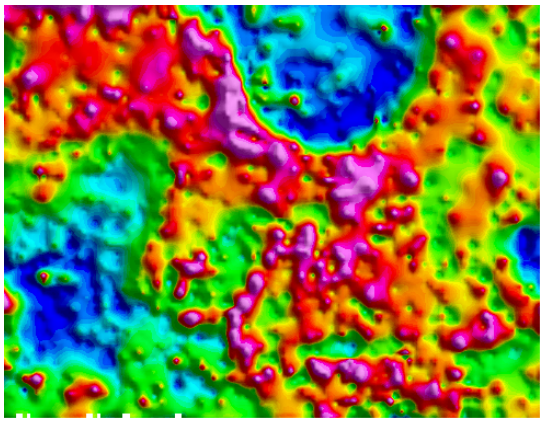

Figure 3. First vertical derivative of grid in Figure 1.

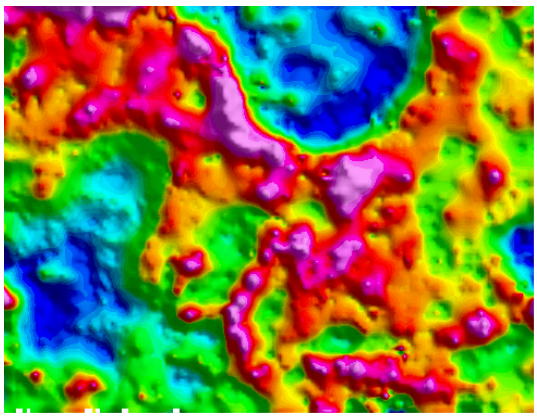

Figure 4. First vertical derivative of grid in Figure 2.

The "microlevelling" process as shown in Figures 2 and 4 seems to have retained the geological integrity of the grid while removing much of the high frequency noise as well as enhancing the definition of structural edges on the vertical derivative image.

The success of this technique is dependant on the high pass cut-off wavelength used, however it is a trivial task to set up batch processing scripts to run this process for a number of wavelengths and then select the most appropriate result.

For more information, contact the Geosoft office nearest you:

North America

Geosoft Inc.,
85 Richmond St. W., 8th Floor
Toronto, Ont.,
Canada
M5H 2C9

Tel. (416) 369-0111
Fax (416) 369-9599

E-mail: tech@geosoft.com

South America

Geosoft Latinoamerica Ltda.
Av. Rio Branco, 156 - Gr. 2615
CEP 20043-900, Centro
Rio de Janeiro, RJ, Brasil

Tel: (55-21) 2532-0140
Fax: (55-21) 2532-7197

Email: tech.sa@geosoft.com

South and Central Africa

Geosoft Africa Ltd.
Buren Building, Second Floor
Kasteelpark Office Park
c/o Nossob & Jochemus Streets
Erasmuskloof X3, Pretoria

Tel: 27 12 347 4519
Fax: 27 12 347 6936

E-mail: tech.za@geosoft.com

Europe and North Africa

Geosoft Europe Ltd.
20/21 Market Place, First Floor
Wallingford, Oxfordshire
United Kingdom
OX10 OAD

Tel: 44 1491 835 231
Fax: 44 1491 835 281

E-mail: tech.eu@geosoft.com

Australia and Southeast Asia

Geosoft Australia Pty. Ltd
350 Hay St.
Subiaco, WA 6008
Australia

Tel. 61 (8) 9382 1900
Fax 61 (8) 9382 1911

E-mail: tech.au@geosoft.com