

Gravity inversion using block model 2

GRABLOX2

Version 2.1a (c) 2014 by Markku Pirttijärvi

GRABLOX2 computes the gravity field and the gravity gradients of a 3-D block model which consists of a large super block divided into smaller brick-like elements the size of which can vary. Each minor block is assigned individual density value and the gravity effect is obtained as a superposition of all volume elements. For more information about 3-D block models, please, see the documentation of the BLOXER program, which is used to visualize and to maintain 3-D block models.

GRABLOX2 can be used for both forward and inverse modeling (inversion). Gravity field (gz) and either the vertical gravity gradient (gzz) or seven gravity gradients (tensor elements) (gxx, gxy, gxz, gyy, gyz, gzz & $g_{uv}=(g_{xx}-g_{yy})/2$ curvature component) can be modelled. The inversion optimizes the density of the blocks so that the difference between the measured and the computed gravity (and gradient) data gets minimized. The optimization is based on linearized inversion. The unconstrained inversion uses singular value decomposition (SVD) with adaptive damping. The constrained inversion utilizes Occam's method where the roughness of the model is minimized together with data misfit. The coefficients of the base anomaly, which is represented by a second degree polynomial can be optimized separately for the gravity and gradient data. Density of the blocks can be fixed (and weighted) based on a priori information (e.g., petrophysical or drill-hole data). Gradient data can be used together with gravity data in the inversion, but gradient data cannot be inverted alone. After density inversion the distribution of the density variations inside the resulting block model can be used in geological interpretation.

Screen dump of GRABLOX2

GRABLOX2 can be run on a PC with Microsoft Windows operating system and a graphics display with a screen size of at least 1280x1024 pixels. In forward modelling the computer memory and CPU requirements are usually not critical factors, because the program uses dynamic memory allocation and the computations are quite simple. However, models with hundreds of thousands of elements may take several hours to compute even on a modern computer. Likewise, inversion of block models with tens of thousands of elements may not be practical because of the increased computation time. The size of continuous memory (1 GB) that is allocated for the sensitivity matrix restricts the usage of the 32 bit version. The 64 bit version of GRABLOX2 that can only be run under 64 bit Windows does not have this memory restriction. Furthermore, the 64 bit version uses OpenMP parallelisations and therefore runs faster on modern PC's with multiple processor cores. GRABLOX2 has simple graphical user interface (GUI) that can be used to modify the parameter values, to handle file input and output, and to visualize the gravity data and the model. The user interface and graphics are based on the DISLIN graphics library (<http://www.dislin.de>).

[Download the GRABLOX2.ZIP package \(3.4 MB\).](#)

The program requires either the 32 bit stand-alone version GRABLOX2.EXE or the 64 bit version GRABLOX64.EXE and the LIBIOMP5MD.DLL dynamic link library for OpenMP parallel computations. The distribution file (GRABLOX2.ZIP) also contains a short description file (_README.TXT), user's manual (GRABLOX2_MANU.PDF) in PDF format, and some example data (*.DAT & *.GAT) and model files (*.INP & *.BLX). To install the program simply decompress the distribution ZIP file somewhere on a hard disk and a new folder GRABLOX2 appears. When running the program over local network, one should provide the network drive with a logical drive letter (e.g., Explorer/Tools/ Map network drive...).

[User's guide \(Grablox2_manu.pdf\) \(1.9 MB\).](#)

Since I've not been able to make a paper on this subject, please, refer to this web-page and program manual if possible. Before I manage to prepare better examples, please, use the following workshop [handout](#) (2.25 MB) as a starting point to your own experiments. Here is also a small page of [Grablox examples](#) including 2.5D and overburden models.

Note that GRABLOX2 does not include block height inversion. Use GRABLOX 1.6 for two-layer inversions.

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