

GMG: An open-source two-dimensional geophysical modelling GUI

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Summary

For decades, forward modelling of potential field data, such as gravity and magnetic anomalies, has been common practice within the geophysics community as a means for constraining subsurface structure. Many software packages (both freely available and commercially licensed) exist for performing such modelling. However, most, if not all of these packages suffer from at least one major drawback. Such draw-backs include: (1) Being closed-source, with limited information regarding how anomalies are calculated; (2) Being difficult to obtain and install (3) lacking the ability to calculate both gravity and magnetic anomalies simultaneously; (4) providing no means for integrating complementary data within the modelling environment (e.g., earthquake hypocenters) and (5) being programmed in such a way that the software is cumbersome for integrating within a modern research project due to, for example, being a single platform release (usually Windows only), having poor I/O functionality and/or limited documentation.

GMG is a graphical user interface (GUI) primarily intended as an interactive two-dimensional (2D) forward modelling program designed to alleviate the draw-backs listed above. Both gravity and magnetic anomalies can be computed along a 2D profile consisting of subsurface bodies defined as any number of 2D polygons. Moreover, functions for displaying complementary data within the modelling environment, such as exploration well logs, seismic data and XY point data are provided. **GMG** has been designed with a minimalist user-interface and simple I/O functionality in order to enhance usability. Most importantly, **GMG** is open source, providing an environment where users can customise the software and add new functionality. In this way, it is hoped the software will naturally become more useful and streamlined over time. We anticipate ‘GMG’ will be useful for both research purposes and for undergraduate education.

GMG makes extensive use of functions from the Scientific Computing in Python (SciPy) package [oliphant2007]. In particular, NumPy [vanderwalt2011] data structures are used for data handling and computational efficiency. Matplotlib

[@hunter2007] plotting tools are employed for displaying and interacting with graphics. The GUI is implemented using the wxWidgets GUI toolkit, wxPython [@rappin2006]. The function `fatiando.polygon` from Fatiando a Terra [@Uieda2013] is used for handling model layers and the seismic plotting function `obspy.read` from ObsPy [@beyreuther2010] is used for loading seismic data. The algorithms for calculating the gravity and magnetic anomalies are adapted from [@bott1969] and [@talwani1964] respectively. The source code for **GMG** is stored on github at: <https://github.com/btozer/gmg>

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References