Colorado School of Mines
Center for Gravity, Electrical & Magnetic Studies
CGEM
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CGEM's Mission

CGEM is an academic research center that focuses on the processing and quantitative interpretation of gravity, magnetic, electrical and electromagnetic data in applied geophysics. The center brings together the diverse expertise of faculty and students in these different geophysical methods and works towards advancing the state of art in geophysical data interpretation for real-world problems.

Contact Information

We are an academic group in the Department of Geophysics at the Colorado School of Mines. If you are a potential sponsor or student interested in joining CGEM, feel free to contact us or make arrangements to visit:

Email: **cgem@mines.edu**

Web: **geophysics.mines.edu/cgem**

Senior Members

Yaoguo Li, Associate Professor & Principal Investigator: Geophysical inverse theory, gravity, magnetic and electrical methods

Misac Nabighian, Distinguished Senior Scientist: Gravity, magnetic and electromagnetic methods in applied geophysics

Richard Krahenbuhl, Research Assistant Professor: Time-lapse gravity for dynamic systems and interpretation in highly magnetic environments

Associates and Students

Jiajia Sun, Post-doctoral fellow: Joint inversion of multiple geophysical data sets

Cericia Martinez, CGEM Associate: Applied inversion and interpretation methodologies for potential-field data

Hyoungrea Bernard Rim, CGEM Associate: Modeling and inversion of borehole gravity and gravity gradiometry data

Wenwu Wang, CGEM Associate: forward modeling, processing, inversion of electromagnetic and magnetotelluric data.

Gyesoon Park, Post-doctoral fellow and CGEM Associate: Potential method and geostatistical integration using multi-geophysical data

Leon Foks, PhD candidate: Inversion and interpretation of large-scale potential field data sets.

Joseph Capriotti, PhD student: 4D time-lapse gravity; modeling and inversion of electromagnetic data

Patricia MacQueen, PhD student: 4-D gravity inversion and gravity survey design optimization

Andy McAliley, PhD student: Basin modeling using thermal data and joint inversion

Aline Tavares Melo, PhD student: Inversion, interpretation of gravity gradiometry data and integration with other geophysical datasets

Ryan North, PhD student: Near-surface geophysics and characterization of soil physical properties

Haoran Wang, Visiting PhD student: 3-D joint inversion of gravity gradient and magnetic data in spherical coordinates

Thomas Rapstine, MS candidate: Utilizing airborne gravity gradiometry and seismic data to refine salt body images

Andrea Balza, MS student: Time-lapse gravity, marine gravity and magnetic noise estimation, and environmental geophysics

Elizabeth Maag, MS student: Binary inversion and clustering techniques for borehole gravity data

Qian Yin, MS student: 4D gavity monitoring for waterflood surveillance

# Center for Gravity, Electrical & Magnetic Studies
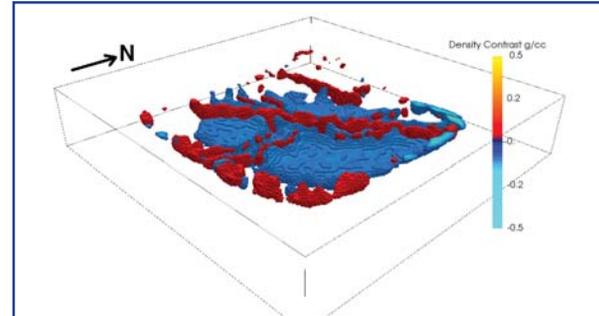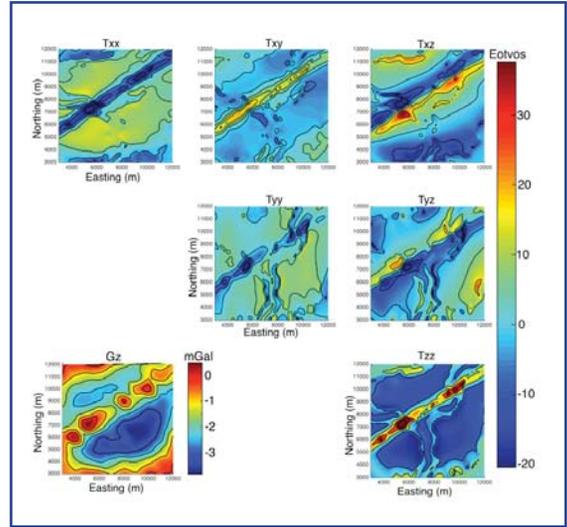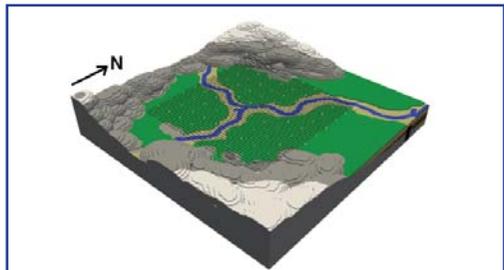
CGEM

*"Interpreting the world since 1999, one dataset at a time."*

Research

CGEM aims to bring together a number of diverse but related research areas and foster a stimulating environment for both research and education. We have diverse funding sources and research areas, however, the common underlying theme is the processing and inversion of applied geophysical data acquired primarily in potential-field, electrical, and electromagnetic methods. The largest research program within CGEM is the Gravity and Magnetics Research Consortium (GMRC), sponsored by the oil and gas industry, mining industry, instrument developers, and service providers. The mandate of GMRC focuses on the processing and inversion of gravity, gravity gradiometer, magnetic, electrical, and electromagnetic data. Research projects undertaken by CGEM members are formulated in cooperation with our sponsors and driven by scientific questions and personal intellectual interests. The following is a sample of research areas pursued by our members:

- Processing of potential-field and EM data
- Inversion methodology
- Petroleum and mineral exploration
- 4D monitoring
- Geothermal reservoir characterization
- Groundwater geophysics
- Archaeological investigations
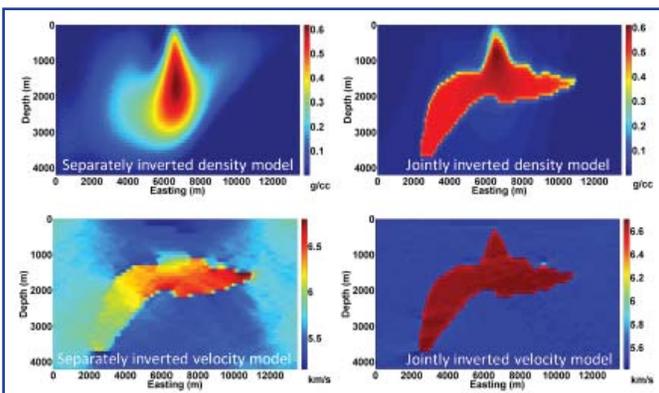
Technology Transfer

One emphasis of CGEM is technology transfer. In addition to the usual approach of holding annual meetings and providing our sponsors with annual and detailed technical reports on different projects, we are committed to delivering one program package each year. The objective is to transfer the technologies resulting from research back to our sponsors for practical applications. The software packages are developed in high-level languages such as FORTRAN or C++, with stand-alone executables that can be run directly on command line or called from a graphic user interface (GUI). These deliverables allow sponsors to rapidly access the research accomplishments and provide feedback, and enable the consortium to formulate new research directions.
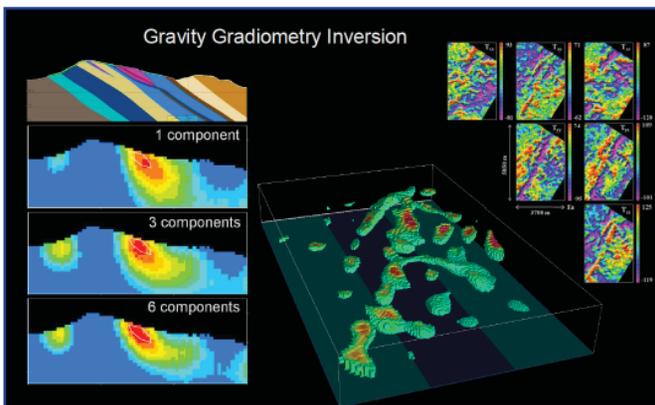
GGD3D: A program library for 3D inversion of gravity gradiometry data

These packages are not the typical research programs. Instead, we take the codes generated from the research phase and further develop them into near commercial quality software that are fully tested and documented. The included GUI enables these delivered programs to be used directly in active exploration projects without the need to integrate them into sponsors' existing software.

CGEMaestro
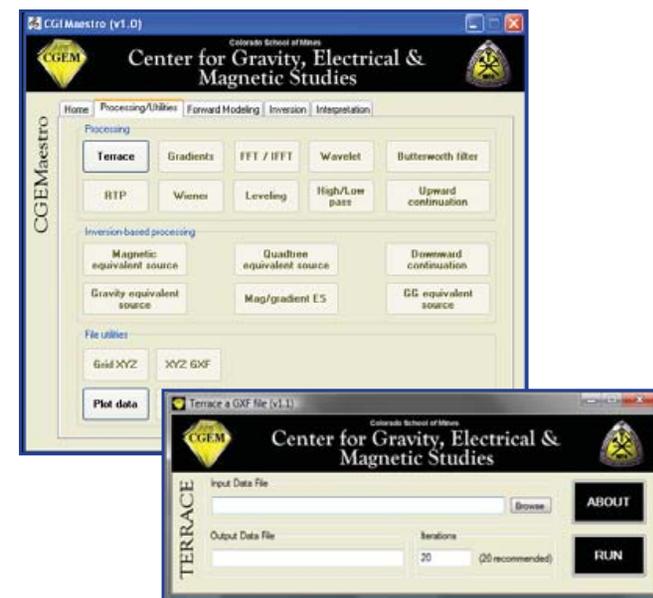
CGEMaestro: A master application that brings together the various processing and inversion algorithms developed by the researchers of CGEM.

CGEMaestro is our master application that brings all software deliverables from our research together into a single & simple to operate framework. *CGEMaestro* has been developed with a graphical user interface to enable researchers and sponsors to run all inversion algorithms, process their potential field datasets with old and new technologies, and plot and implement grid utilities. The major benefit of the application is that it brings these separate research developments together, not only through a single environment, but also by standardizing all model and data formats to allow easy movement from one process to another. *CGEMaestro* is continuously being linked to previous software deliverables created specifically for our sponsors. The package continues to grow and evolve over time as we incorporate past and future utility, processing and inversion tools.