

Aeromagnetic and Gravity Data Over the Central Transantarctic Mountains (CTAM), Antarctica: A Website for the Distribution of Data and Maps

Open-File Report 2006–1255



In cooperation with National Science Foundation, Bundesanstalt für Geowissenschaften und Rohstoffe, and University of Minnesota, Duluth.

Aeromagnetic and Gravity Data Over the Central Transantarctic Mountains (CTAM), Antarctica: A Website for the Distribution of Data and Maps

By E. D. Anderson¹, C. A. Finn¹, D. Damaske², J. D. Abraham¹, F. Goldmann², J. W. Goodge³, P. Braddock⁴

1. US Geological Survey, Crustal Imaging and Characterization Team, Denver, CO, USA
2. Federal Institute for Geosciences and Natural Resources, Hannover, Germany
3. Department of Geological Sciences, University of Minnesota, Duluth, MN, USA
4. Peter Braddock Inc, Columbus, OH, USA

Open-File Report 2006–1255

U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
DIRK KEMPTHORNE, Secretary

U.S. Geological Survey
P. Patrick Leahy, Acting Director

U.S. Geological Survey, Reston, Virginia 2006
Revised and reprinted: 2006

For product and ordering information:
World Wide Web: <http://www.usgs.gov/pubprod>
Telephone: 1-888-ASK-USGS

For more information on the USGS—the Federal source for science about the Earth,
its natural and living resources, natural hazards, and the environment:
World Wide Web: <http://www.usgs.gov>
Telephone: 1-888-ASK-USGS

Any use of trade, product, or firm names is for descriptive purposes only and does not imply
endorsement by the U.S. Government.

Although this report is in the public domain, permission must be secured from the individual
copyright owners to reproduce any copyrighted material contained within this report.

Contents

| | |
|-----------------------|---|
| Introduction | 1 |
| Data Processing | 5 |
| CTAM Projection | 7 |
| Metadata..... | 8 |

Figures

| | |
|---|---|
| Figure 1 - Index map showing the location of the CTAM survey. | 2 |
| Figure 2 - Shaded-relief topography map of survey area. | 3 |
| Figure 3 - Location map of 42 gravity stations and the profile of the Bouguer anomaly. | 4 |
| Figure 4 - Shaded-relief images of final processed magnetic data. | 6 |

Aeromagnetic and Gravity Data Over the Central Transantarctic Mountains (CTAM), Antarctica: A Website for the Distribution of Data and Maps

By E. D. Anderson, C. A. Finn, D. Damaske, J. D. Abraham, F. Goldmann, J.W. Goodge, P. Braddock

Introduction

Near-complete coverage of the East Antarctic Shield by ice restricts geological study of crustal architecture important for understanding global tectonic and climate history. Limited exposures in the central Transantarctic Mountains (CTAM), however, show that Archean and Proterozoic rocks of the shield as well as Neoproterozoic/lower Paleozoic sedimentary successions were involved in oblique convergence associated with Gondwana amalgamation. Subsequently, the area was overprinted by Jurassic magmatism and Cenozoic uplift. To extend the known geology of the region to ice-covered areas, an aeromagnetic survey was flown in draped mode by helicopters over the Central Transantarctic Mountains and by fixed-wing aircraft over the adjacent polar plateau.

During the 2003-2004 field season the CTAM project flew more than 32,000 line-km covering an area of nearly 60,000 km² at an average altitude of 600 m. Average line spacing was 2.5 km over most areas and 1.25 km over exposed basement rocks in the Miller and Geologists Ranges (figs. 1 and 2). Additional lines flown to the north, south, and west extended preliminary coverage and tied into existing surveys.

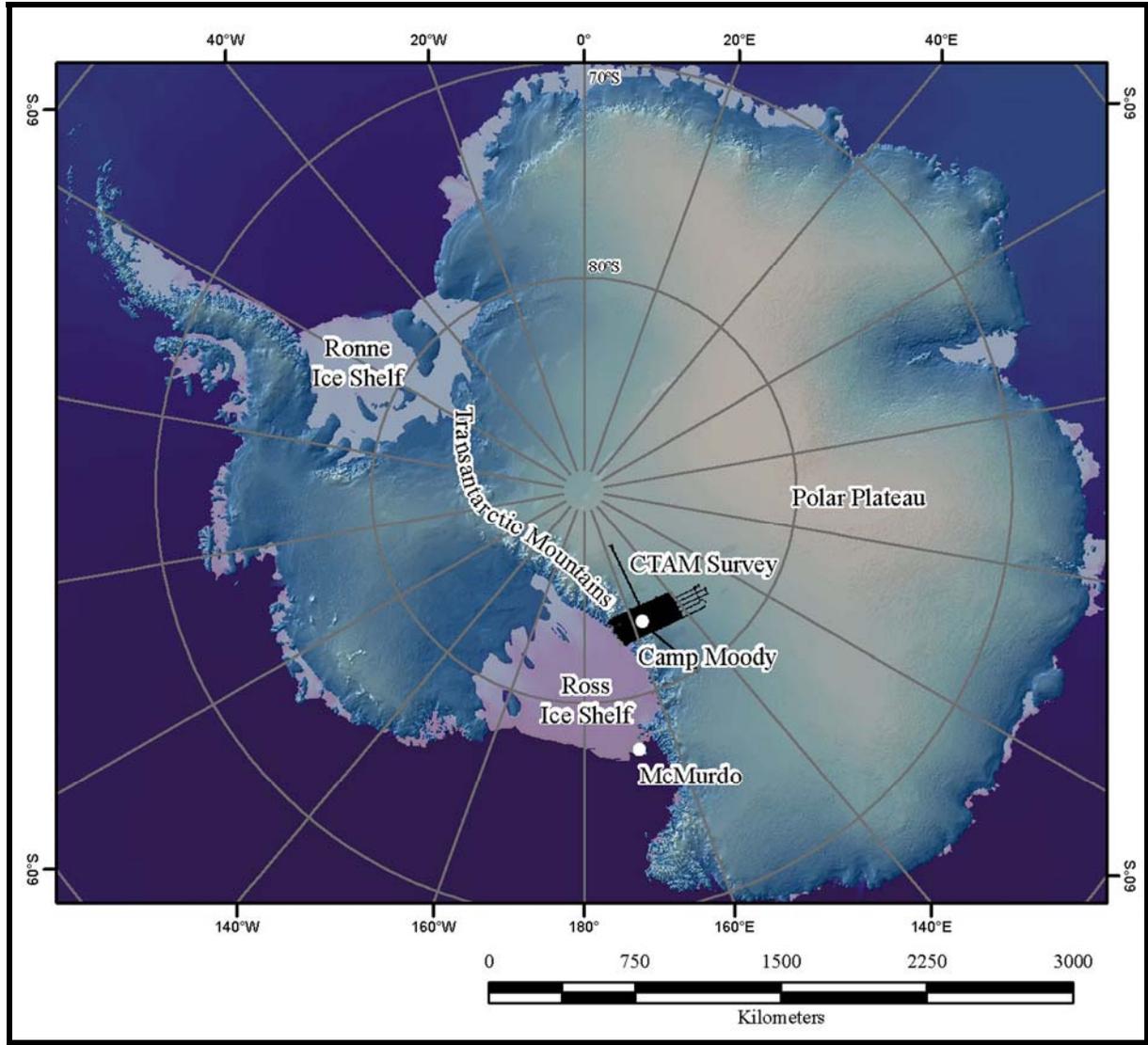


Figure 1. Index map showing the location of the CTAM survey. Black lines represent lines flown.

The survey was flown in two operations: helicopter operations and fixed-wing operations (fig. 2). During helicopter operations, two A-stars were deployed daily for a total of six flights. The crew consisted of 6 helicopter support personnel (4 pilots and 2 mechanics) and 6 scientific staff (geophysicists, engineers, and quality control specialists). Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) oversaw 3 flights daily using one A-star and the U.S. Geological Survey (USGS) oversaw 3 flights on the other. All helicopter operations were flown in draped mode at a nominal height of 600 m above the surface. Two separate acquisition systems were used. The BGR used PDAS; the

USGS used MagLogNT. Both systems used a cesium magnetometer (USGS - Geometrics 823A, BGR - Scintrex CS-2) with a sensitivity of 0.002 nanoteslas (nT) at 1 Hz and 0.02 nT at 10 Hz. The BGR used an Ashtech Surveyor-12 GPS receiver, while the USGS used a Trimble 4000 GPS receiver to record the position of the bird slung below the helicopters. The GPS antennas were mounted to the windshield of the A-Stars.

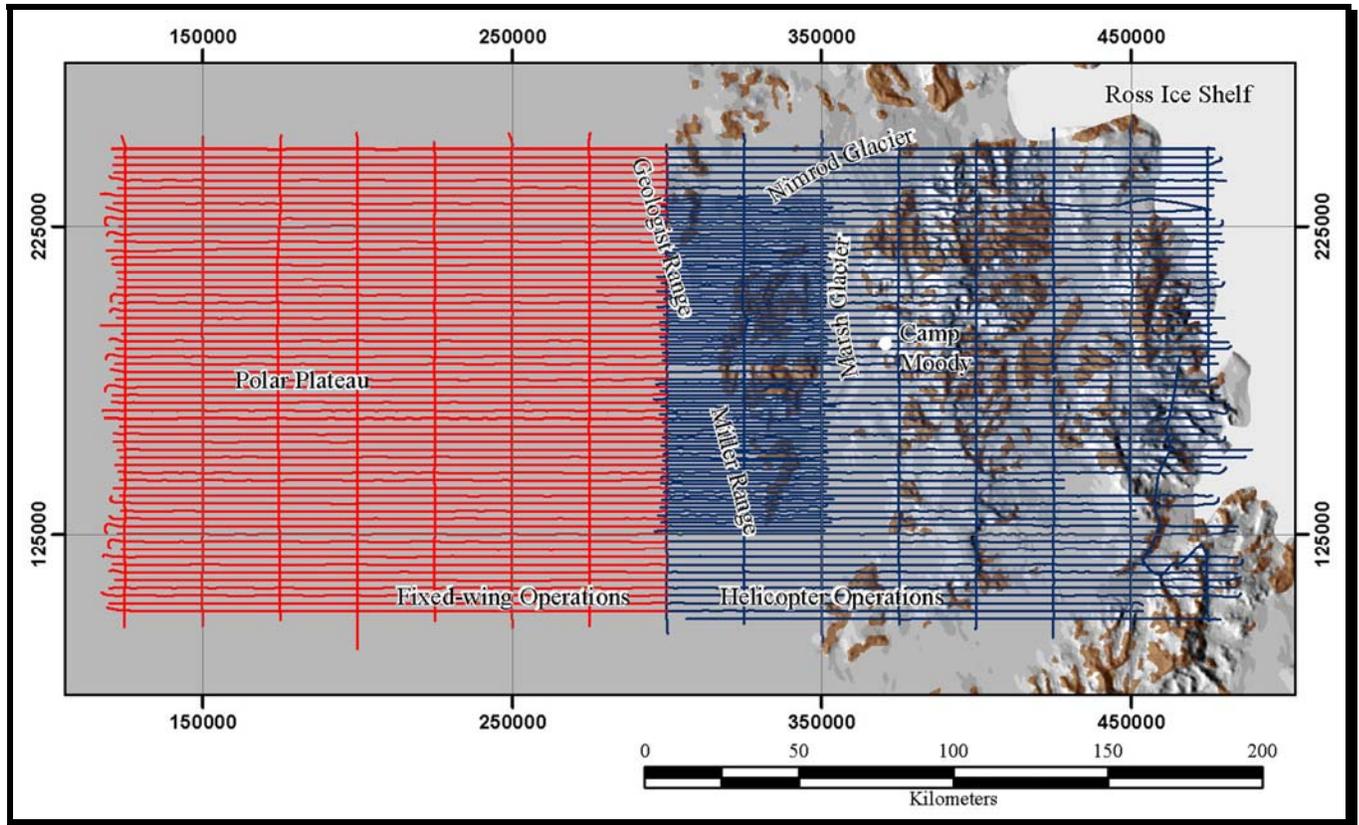


Figure 2 - Shaded-relief map of survey area. Blue lines represent helicopter operations; red lines represent fixed-wing operations. Brown patches represent areas where rock is exposed.

During the fixed-wing operations, a Twin-Otter aircraft flew three flights daily. The crew consisted of 3 Twin-Otter support personnel (2 pilots and a mechanic) and 4 scientific staff (geophysicists, engineers, and quality control specialists). This operation continued where the helicopter operations ceased near the Central Transantarctic Mountains over the Polar Plateau and was flown at a constant elevation above the ice (~600 m). The USGS MagLogNT acquisition system was used along with a Geometrics 823A cesium magnetometer. The position of the bird slung below was

recorded using a Trimble 4000 GPS receiver with the antenna mounted to the top of the main fuselage of the Twin-Otter directly behind the cockpit.

A magnetic base station (using a Geometrics G-856 magnetometer), centrally located relative to the survey, was established at Camp Moody (near Moody Nunatak). The base station recorded, at one-minute intervals, the daily variations of Earth's magnetic field necessary for removal from the observed total-field to create the residual or anomaly field.

In addition to the aeromagnetic data, 42 gravity stations were collected along a profile in the Central Transantarctic Mountains from the Ross Ice Shelf to the Miller and Geologist Ranges (fig. 3). Further information and data can be found in the /gravity directory.

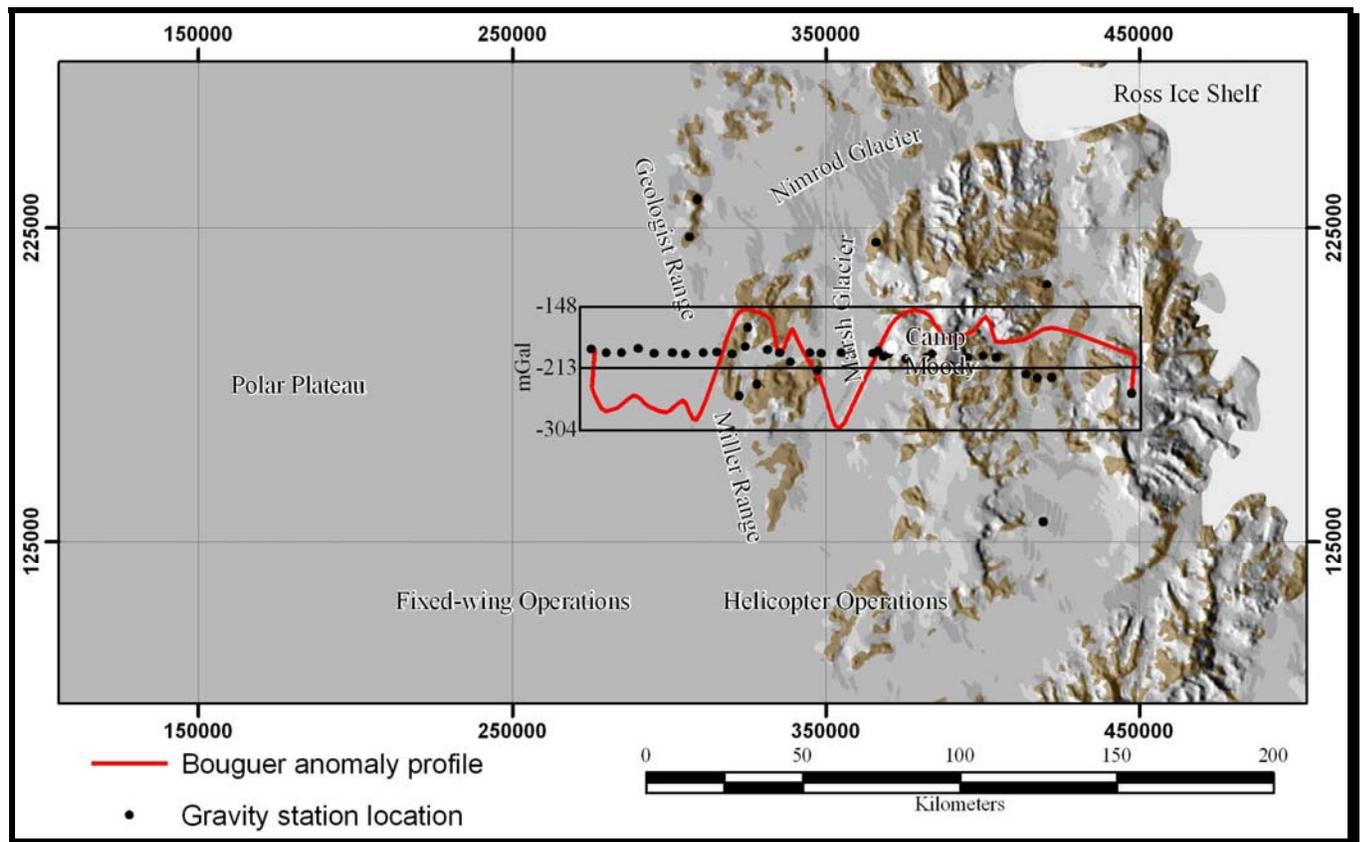


Figure 3. Location map of 42 gravity stations and the profile of the simple Bouguer anomaly.

The material referenced in this publication is based upon work supported by the National Science Foundation (NSF) under Grant No. 0232042.

Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Data Processing

The binary data collected from the acquisition systems for each survey flight were converted to ASCII data. USGS and BGR personnel then imported the ASCII data into the Geosoft software package Oasis Montaj 5.1.6 for processing. Standard quality control (QC) procedures were administered. Latitude, longitude, and magnetic values were checked for obvious errors or spikes and null values were assigned to such. The null values were then re-assigned values through linear interpolation. Horizontal positions were converted to a Lambert Conformal Conic projection as described below. Vertical positions were converted from orthometric elevation to ellipsoid height by subtracting the geoid model from the orthometric elevation.

Diurnal corrections of the magnetic field values were calculated by subtracting the base magnetometer values recorded at Camp Moody. These data were collected at one-minute intervals and subsequently smoothed with a low-pass filter. These values were then subtracted from the survey's magnetic field values to produce the corrected magnetic field.

The internal (main-field) component of the magnetic field, calculated for each survey point using the IGRF (International Geomagnetic Reference Field) model 2000, was subtracted from the corrected magnetic field values to produce the residual field.

After base station corrections and IGRF removal, discrepancies between the magnetic field values at the intersections of profile- and tie-lines remained. The calculated deviations were minimized using an iterative levelling approach. In this way, not only were the higher-frequency parts of the diurnal variation accounted for, but discrepancies due to differences in elevation were also reduced. Standard microleveling adjustments were then applied.

Grids were constructed from the final dataset (not including tie-lines) using a cell size of 625 m for the USGS grid and 500 m for the BGR grid. The final grids are shown in figure 4.

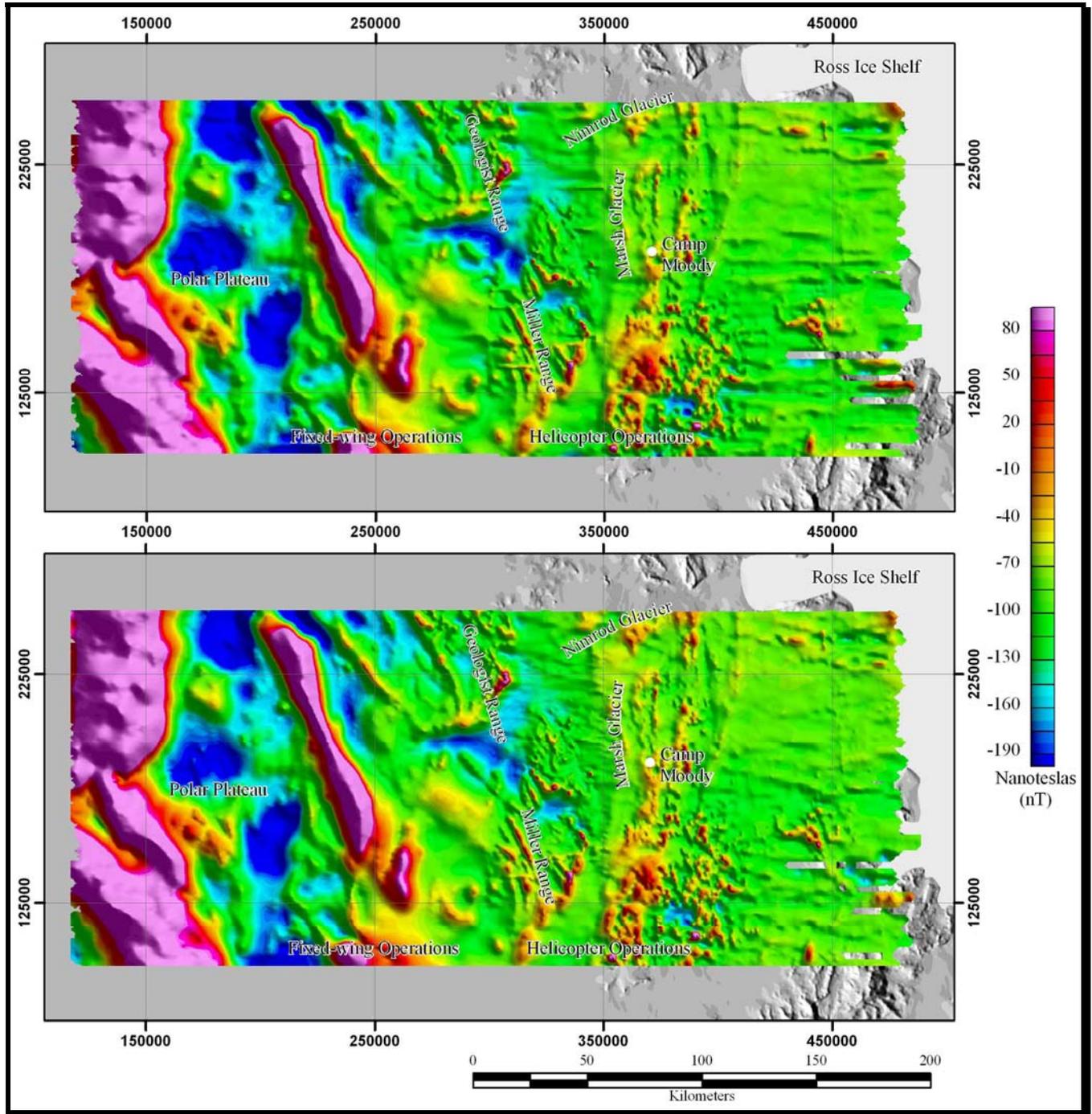


Figure 4. Shaded-relief magnetic images of final processed magnetic data. Top image leveled by USGS and bottom image leveled by BGR.

CTAM Projection

The CTAM dataset has been converted from a geographic coordinate system to a projected Lambert Conformal Conic system. The following are the specifics for the Lambert Conformal Conic system:

- Projection: Lambert Conformal Conic
- Standard Parallels: -82.850000, -83.650000
- Longitude of Central Meridian: 154.500000
- Latitude of Projection Origin: -83.250000
- False Easting: 300000 meters
- False Northing: 175000 meters
- Datum: WGS84
- Local Datum Transform: [WGS84] World

Appendix A

Metadata

Identification_Information:

Citation:

Citation_Information:

Originator: U.S. Geological Survey

Publication_Date: Unknown

Title: Aeromagnetic and gravity data of the Central Transantarctic Mountains

Series_Information:

Series_Name: U.S. Geological Survey Open-File Report

Issue_Identification: OFR 06-1255

Publication_Information:

Publication_Place: Denver, CO

Publisher: U. S. Geological Survey

Description:

Abstract: Near complete coverage of the East Antarctic Shield by ice hampers geological study of crustal architecture important for understanding global tectonic and climate history. Limited exposures in the central Transantarctic Mountains (CTAM), however, show that Archean and Proterozoic rocks of the shield as well as Neoproterozoic-lower Paleozoic sedimentary successions were involved in oblique convergence associated with Gondwana amalgamation. Subsequently, the area was overprinted by Jurassic magmatism and Cenozoic uplift. To extend the known geology of the region to ice-covered areas, we conducted an aeromagnetic survey flown in draped mode by helicopters over the Central Transantarctic Mountains and by fixed-wing aircraft over the adjacent polar plateau. We flew more than 32,000 line km covering an area of nearly 60,000 km² at an average altitude of 600 m, with average line spacing 2.5 km over most areas and 1.25 km over basement rocks exposed in the Miller and Geologists ranges. Additional lines flown to the north, south, and west extended preliminary coverage and tied with existing surveys. Gravity data was collected on the ground along a central transect of the helicopter survey area.

Purpose: From December 2003 to January 2004, the CTAM group flew a helicopter and twin-otter aeromagnetic survey and collected ground gravity station data along a profile. These data will be integrated with other geologic and geophysical data in order to extend the known geology of the region to ice-covered areas.

Time_Period_of_Content:

Time_Period_Information:

Single_Date/Time:

Calendar_Date: unknown

Time_of_Day: unknown

Currentness_Reference: publication date

Status:

Progress: Complete

Maintenance_and_Update_Frequency: As needed

Spatial_Domain:

Bounding_Coordinates:

West_Bounding_Coordinate: 139.275383

East_Bounding_Coordinate: 170.218440

North_Bounding_Coordinate: -82.357327

South_Bounding_Coordinate: -83.952338

Keywords:

Theme:

Theme_Keyword_Thesaurus: none
Theme_Keyword: Gravity
Theme_Keyword: Magnetic Anomalies
Theme_Keyword: Magnetic Field
Theme_Keyword: Magnetic Intensity
Theme_Keyword: Tectonic Landforms
Theme_Keyword: Tectonic Processes

Theme:

Theme_Keyword_Thesaurus: none
Theme_Keyword: Transantarctic Mountains
Theme_Keyword: TAM
Theme_Keyword: geophysical data
Theme_Keyword: aeromagnetic data
Theme_Keyword: aeromagnetic grid
Theme_Keyword: gravity data

Theme:

Theme_Keyword_Thesaurus: none
Theme_Keyword: English

Place:

Place_Keyword_Thesaurus: none
Place_Keyword: Antarctica
Place_Keyword: Transantarctic Mountains

Access_Constraints: None

Use_Constraints: None. Acknowledgement of the U.S. Geological Survey (USGS), German Federal Institute for Geosciences and Natural Resources (BGR), and the National Science Foundation would be appreciated in products derived from these data.

Point_of_Contact:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Eric D. Anderson
Contact_Organization: U. S. Geological Survey

Contact_Position: Geologist

Contact_Address:

Address_Type: mailing address
Address: U.S. Geological Survey
Address: Box 25046 Mail Stop 964
Address: Denver Federal Center
City: Denver
State_or_Province: Colorado
Postal_Code: 80225-0046
Country: USA

Contact_Voice_Telephone: (303) 236-5652

Contact_Facsimile_Telephone: (303) 236-1425

Contact_Electronic_Mail_Address: ericanderson@usgs.gov

Data_Set_Credit: This project was funded by the National Science Foundation, Grant No. 0232042 and was in collaboration with scientists from the U. S. Geological Survey (USGS), German Federal Institute for Geosciences and Natural Resources (BGR) and University of Minnesota, Duluth.

Native_Data_Set_Environment: Microsoft Windows XP Version 5.1 (Build 2600) Service Pack 1; ESRI ArcCatalog 9.0.0.535

Data_Quality_Information:

Attribute_Accuracy:

Attribute_Accuracy_Report: The data in this file have been processed using various formulas and methods that are not usually documented but that represent industry standard practices for airborne data reduction.

Logical_Consistency_Report:

The data in this file were collected by a single contractor or group (CTAM) who were responsible for collecting and processing the data.

The data from this survey were collected using the same instruments (magnetometers and navigational systems) throughout the survey and were collected in a normal length of time with no long delays between survey beginning and end. Standard industry practices of the time were followed in data collection and processing.

A magnetic base station centrally located relative to the survey was established on ice close to Moody Nunatak which recorded the daily variations of Earth's magnetic field for removal from the total-field observed from the airborne instrument. The position of a cesium magnetometer carried in a bird slung ~30 m below the helicopter was accomplished with Trimble 4000 GPS and Ashtech Surveyor 12 receivers. The data from each flight were quality controlled.

The crew for the aeromagnetic survey consisted of 4 helicopter pilots, 2 helicopter mechanics, 2 twin-otter pilots, 1 twin-otter mechanic, 6 scientists (geophysicist, geologists and engineers), a mountaineer and various camp operations staff.

Completeness_Report: Loss of data due to poor transmission, channel dropout, obvious spiking, missing channels, and other obvious errors were replaced with a null value and subsequently interpolated.

Positional_Accuracy:

Horizontal_Positional_Accuracy:

Horizontal_Positional_Accuracy_Report: Flight Path Recovery - High-resolution horizontal position of the survey aircraft used to collect data were determined from Global Positioning System (GPS) satellites. Positioning data were recorded in-flight independently using a Trimble GPS receiver. For some flights a differential position was calculated. For the rest of the flights an autonomous position was used.

Quantitative_Horizontal_Positional_Accuracy_Assessment:

Horizontal_Positional_Accuracy_Value: 20 m

Horizontal_Positional_Accuracy_Explanation: Good to one meter when differentially corrected. Good to 20 meters when autonomous position was used.

Vertical_Positional_Accuracy:

Vertical_Positional_Accuracy_Report:

Flight Path Recovery -High-resolution horizontal positions of the survey aircraft used to collect data were determined from Global Positioning System (GPS) satellites. Positioning data were recorded in-flight independently using a Trimble GPS and Ashtech Surveyor 12 receiver. For some flights a differential position was calculated. For the rest of the flights an autonomous position was used.

The magnetometer was hung below the aircraft using a cable. This data set was collected as a draped survey having average terrain clearance of 600 m. Because aircraft, especially airplanes, cannot safely maintain a constant terrain clearance, error in vertical position is introduced.

Quantitative_Vertical_Positional_Accuracy_Assessment:

Vertical_Positional_Accuracy_Value: 20 m

Vertical_Positional_Accuracy_Explanation: Good to one meter when differentially corrected. Good to 20 meters when autonomous position was used.

Lineage:

Process_Step:

Process_Description:

USGS and BGR personnel used the Geosoft software package Oasis Montaj version 5.1.6 to process the data. Standard quality control (QC) procedures were administered. Latitude, longitude and magnetic values were checked for obvious errors or spikes and null values were assigned to such. These points were then assigned values through linear interpolation. Horizontal positions were converted to a Lambert Conformal Conic projection described under spatial reference. Vertical positions recorded by the GPS unit were converted from orthometric elevation to ellipsoid height by adding the geoid model to the orthometric elevation recorded in the receiver.

During helicopter operations two separate systems were flown simultaneously. One was controlled by the USGS and the other by the BGR. QC checks were performed by both groups. The individual datasets were then merged into a composite dataset where diurnal corrections and IGRF removal were performed, as well as tie-line and microleveling adjustments computed using standard Geosoft procedures with slight modifications to the microleveling amplitude cutoff.

Process_Date: Unknown

Spatial_Reference_Information:

Horizontal_Coordinate_System_Definition:

Planar:

Map_Projection:

Map_Projection_Name: Lambert Conformal Conic

Lambert_Conformal_Conic:

Standard_Parallel: -83.650000

Standard_Parallel: -82.850000

Longitude_of_Central_Meridian: 154.500000

Latitude_of_Projection_Origin: -83.250000

False_Easting: 300000.000000

False_Northing: 175000.000000

Planar_Coordinate_Information:

Planar_Coordinate_Encoding_Method: coordinate pair

Coordinate_Representation:

Abscissa_Resolution: 625.000000

Ordinate_Resolution: 625.000000

Planar_Distance_Units: meters

Geodetic_Model:

Horizontal_Datum_Name: WGS_84

Ellipsoid_Name: WGS_84

Semi-major_Axis: 6378137.000000

Denominator_of_Flattening_Ratio: 298.257224

Entity_and_Attribute_Information:

Detailed_Description:

Entity_Type:

Entity_Type_Label: Longitude

Entity_Type_Definition: Longitude WGS84

Entity_Type_Definition_Source: self evident

Attribute:

Attribute_Definition: Longitude WGS84

Attribute_Definition_Source: self evident

Attribute_Domain_Values:

Range_Domain:

Range_Domain_Minimum: 128.745892093

Range_Domain_Maximum: 169.69225

Attribute_Units_of_Measure: decimal degrees

Detailed_Description:

Entity_Type:

Entity_Type_Label: Latitude
 Entity_Type_Definition: Latitude WGS84
 Entity_Type_Definition_Source: self evident
 Attribute:
 Attribute_Definition: Latitude WGS84
 Attribute_Definition_Source: self evident
 Attribute_Domain_Values:
 Range_Domain:
 Range_Domain_Minimum: -87.117223185
 Range_Domain_Maximum: -79.920871861
 Attribute_Units_of_Measure: decimal degrees
 Detailed_Description:
 Entity_Type:
 Entity_Type_Label: x
 Entity_Type_Definition: Lambert Conformal Conic (2SP) Lat1 -82.85, Lat2 -83.65, Lat0 -83.25, Long0 154.5, FE 300000, FN 175000, Datum and Ellipsoid WGS84, Local Datum Transform WGS84
 Entity_Type_Definition_Source: self evident
 Attribute:
 Attribute_Definition: Lambert Conformal Conic (2SP) Lat1 -82.85, Lat2 -83.65, Lat0 -83.25, Long0 154.5, FE 300000, FN 175000, Datum and Ellipsoid WGS84, Local Datum Transform WGS84
 Attribute_Definition_Source: self evident
 Attribute_Domain_Values:
 Range_Domain:
 Range_Domain_Minimum: -59328.1568922
 Range_Domain_Maximum: 489059
 Attribute_Units_of_Measure: meters
 Detailed_Description:
 Entity_Type:
 Entity_Type_Label: y
 Entity_Type_Definition: Lambert Conformal Conic (2SP) Lat1 -82.85, Lat2 -83.65, Lat0 -83.25, Long0 154.5, FE 300000, FN 175000, Datum and Ellipsoid WGS84, Local Datum Transform WGS84
 Entity_Type_Definition_Source: self evident
 Attribute:
 Attribute_Definition: Lambert Conformal Conic (2SP) Lat1 -82.85, Lat2 -83.65, Lat0 -83.25, Long0 154.5, FE 300000, FN 175000, Datum and Ellipsoid WGS84, Local Datum Transform WGS84
 Attribute_Definition_Source: self evident
 Attribute_Domain_Values:
 Range_Domain:
 Range_Domain_Minimum: -257437.864195
 Range_Domain_Maximum: 539567.4249843
 Attribute_Units_of_Measure: meters
 Detailed_Description:
 Entity_Type:
 Entity_Type_Label: ellipsoid_elv
 Entity_Type_Definition: height of WGS84 ellipsoid
 Entity_Type_Definition_Source: self evident
 Attribute:
 Attribute_Definition: height of WGS84 ellipsoid
 Attribute_Definition_Source: self evident
 Attribute_Domain_Values:
 Range_Domain:
 Range_Domain_Minimum: 185.86
 Range_Domain_Maximum: 4680.8

Attribute_Units_of_Measure: meters

Detailed_Description:

Entity_Type:

Entity_Type_Label: DATE

Entity_Type_Definition: date

Entity_Type_Definition_Source: self evident

Attribute:

Attribute_Definition: date

Attribute_Definition_Source: self evident

Attribute_Domain_Values:

Unrepresentable_Domain: compound

Detailed_Description:

Entity_Type:

Entity_Type_Label: UTC

Entity_Type_Definition: Universal Time Coordinated

Entity_Type_Definition_Source: self evident

Attribute:

Attribute_Definition: Universal Time

Attribute_Definition_Source: self evident

Attribute_Domain_Values:

Unrepresentable_Domain: compound

Detailed_Description:

Entity_Type:

Entity_Type_Label: mag_field

Entity_Type_Definition: total magnetic field

Entity_Type_Definition_Source: self evident

Attribute:

Attribute_Definition: Despiked total magnetic field

Attribute_Definition_Source: self evident

Attribute_Domain_Values:

Range_Domain:

Range_Domain_Minimum: 57567.78

Range_Domain_Maximum: 61912.346

Attribute_Units_of_Measure: nanotesla (nT)

Detailed_Description:

Entity_Type:

Entity_Type_Label: mag_field_lp

Entity_Type_Definition: despiked total magnetic field with low pass filter applied

Entity_Type_Definition_Source: self evident

Attribute:

Attribute_Definition: despiked total magnetic field with low pass filter applied

Attribute_Definition_Source: self evident

Attribute_Domain_Values:

Range_Domain:

Range_Domain_Minimum: 57567.78

Range_Domain_Maximum: 61912.346

Attribute_Units_of_Measure: nanotesla (nT)

Detailed_Description:

Entity_Type:

Entity_Type_Label: base_station_raw

Entity_Type_Definition: raw base station values

Entity_Type_Definition_Source: self evident

Attribute:

Attribute_Definition: raw base station values

Attribute_Definition_Source: self evident

Attribute_Domain_Values:
 Range_Domain:
 Range_Domain_Minimum: 60159.3
 Range_Domain_Maximum: 60895.99796667
 Attribute_Units_of_Measure: nanotesla (nT)

Detailed_Description:
 Entity_Type:
 Entity_Type_Label: base_station_sm
 Entity_Type_Definition: base station values smoothed by removing dropouts and linearly interpolating with a spline filter
 Entity_Type_Definition_Source: self evident

Attribute:
 Attribute_Definition: base station values smoothed by removing dropouts and linearly interpolating with a spline filter
 Attribute_Definition_Source: self evident
 Attribute_Domain_Values:
 Range_Domain:
 Range_Domain_Minimum: 60174.86
 Range_Domain_Maximum: 60839.99998667
 Attribute_Units_of_Measure: nanotesla (nT)

Detailed_Description:
 Entity_Type:
 Entity_Type_Label: diurnal_raw
 Entity_Type_Definition: mag_field_lp diurnally corrected with raw base station data (60340-base_station+mag_field_lp, where 60340 represents an average base station value)
 Entity_Type_Definition_Source: self evident

Attribute:
 Attribute_Definition: mag_field_lp diurnally corrected with raw base station data (60340-base_station)+mag_field_lp)
 Attribute_Definition_Source: self evident
 Attribute_Domain_Values:
 Range_Domain:
 Range_Domain_Minimum: 57616.40903
 Range_Domain_Maximum: 61859.546
 Attribute_Units_of_Measure: nanotesla (nT)

Detailed_Description:
 Entity_Type:
 Entity_Type_Label: diurnal_sm
 Entity_Type_Definition: Mag_field_lp diurnally corrected with smoothed base station data (60340-base_station+mag_field_lp, where 60340 represents an average base station value)
 Entity_Type_Definition_Source: self evident

Attribute:
 Attribute_Definition: Mag_field_lp diurnally corrected with smoothed base station data (60340-base_station+mag_field_lp)
 Attribute_Definition_Source: self evident
 Attribute_Domain_Values:
 Range_Domain:
 Range_Domain_Minimum: 57617.16588333
 Range_Domain_Maximum: 61858.00126783
 Attribute_Units_of_Measure: nanotesla (nT)

Detailed_Description:
 Entity_Type:
 Entity_Type_Label: IGRF
 Entity_Type_Definition: International Geomagnetic Reference Field for 10th January 2004 - Model year 2000

Entity_Type_Definition_Source: self evident
 Attribute:
 Attribute_Definition: International Geomagnetic Reference Field for 10th
 January 2004 - Model year 2000
 Attribute_Definition_Source: self evident
 Attribute_Domain_Values:
 Range_Domain:
 Range_Domain_Minimum: 57681.96597918
 Range_Domain_Maximum: 62044.81844907
 Attribute_Units_of_Measure: nanotesla (nT)

Detailed_Description:
 Entity_Type:
 Entity_Type_Label: mag_final_sm
 Entity_Type_Definition: final residual mag with smoothed base station and
 IGRF removed (diurnal_sm-IGRF+60340, where 60340 represents an average base station
 value)
 Entity_Type_Definition_Source: self evident
 Attribute:
 Attribute_Definition: final residual mag with smoothed base station and IGRF
 removed (diurnal_sm-IGRF+60340)
 Attribute_Definition_Source: self evident
 Attribute_Domain_Values:
 Range_Domain:
 Range_Domain_Minimum: 60002.19268013
 Range_Domain_Maximum: 61041.48901929
 Attribute_Units_of_Measure: nanotesla (nT)

Detailed_Description:
 Entity_Type:
 Entity_Type_Label: residual
 Entity_Type_Definition: Anomalous magnetic field (mag_final_sm-60340, where
 60340 represents an average base station value)
 Entity_Type_Definition_Source: self evident
 Attribute:
 Attribute_Definition: Anomalous magnetic field (mag_final_sm-60340)
 Attribute_Definition_Source: self evident
 Attribute_Domain_Values:
 Range_Domain:
 Range_Domain_Minimum: -337.807319871
 Range_Domain_Maximum: 701.4890192911
 Attribute_Units_of_Measure: nanotesla (nT)

Detailed_Description:
 Entity_Type:
 Entity_Type_Label: leveled
 Entity_Type_Definition: Anomalous magnetic field tie-line leveled using
 standard defaults with Geosoft software and microleveled using an amplitude of 10
 nT as cutoff
 Entity_Type_Definition_Source: self evident
 Attribute:
 Attribute_Definition: Anomalous magnetic field tie-line leveled using
 standard defaults with Geosoft software and microleveled using an amplitude of 10
 nT as cutoff
 Attribute_Definition_Source: self evident
 Attribute_Domain_Values:
 Range_Domain:
 Range_Domain_Minimum: -315.693289269
 Range_Domain_Maximum: 576.1396095226
 Attribute_Units_of_Measure: nanotesla (nT)

Overview_Description:

Entity_and_Attribute_Overview:

Each record contains the following 17 attributes:

Longitude - Longitude WGS84 - Decimal degrees
Latitude - Latitude WGS84 - Decimal degrees
x - Local x coordinate - meters
y - Local y coordinate - meters
ellipsoid_elv - WGS84 ellipsoid elevation - Meters
Date - Date data was collected - YYYY/MM/DD
Time - Time data was collected - hh:mm:ss.ss
mag_field - Despiked magnetic field value - Nanotesla
mag_field_lp - Despiked magnetic field value with a low pass filter applied to get rid of micropulsations caused by instrumentation - Nanotesla
base_station_raw - raw base station value - Nanotesla
base_station_sm - smoothed base station value - Nanotesla
diurnal_raw - diurnal correction applied to mag_field_lp using raw base station values - Nanotesla
diurnal_smooth - diurnal correction applied to mag_field_lp using smoothed base station values - Nanotesla
IGRF - IGRF correction model 2000 - Nanotesla
mag_final_sm - final mag with smoothed base station - Nanotesla
residual - anomalous magnetic field - Nanotesla
leveled - final leveled data - both tie-line and microleveling techniques applied - Nanotesla

Because the magnetic field of the earth varies diurnally, a stationary base magnetometer is maintained on the ground during airborne surveying. The base magnetometer records changes in the magnetic field (in nanoTeslas) as a function of time. The magnetic changes may have an amplitude of 20 to 50 nanoTeslas. If changes are more severe, as would occur from a magnetic storm, surveying is discontinued or the data recorded are not used. Diurnal variations are then removed from the airborne magnetic data based on the common time.

The airborne magnetometer is accurate to about 0.002 nanotesla (nT) at 1 Hz and 0.02 nT at 10 Hz, and the base magnetometer has an accuracy of 1 nT. The accuracy of the base-corrected airborne value therefore is near 1 nanoTeslas or better.

The total magnetic value is the despiked, diurnally-corrected magnetic field minus a geomagnetic reference field (GRF), which is a long-wavelength regional magnetic field. The most commonly used reference field is determined from a model developed by the International Association of Geomagnetism and Aeronomy (IAGA). The International Geomagnetic Reference Field (IGRF) is a predictive model adopted at the beginning of a model period (e.g. in 1989 for 1990-1995). After the model period, a revised definitive model is adopted, the Definitive Geomagnetic Reference Field (DGRF). This is the preferred model to use for removing regional magnetic fields.

The temporal variations cannot be completely predicted, thus error arises in the application of the IGRF reductions. These errors cannot be evaluated until the release of the DGRF, a minimum of five years after the IGRF release. This field is issued to best describe the configuration of the earth's past magnetic field.

For this survey, the field removed was the IGRF model 2000.

Entity_and_Attribute_Detail_Citation:

Nettleton, L.L., 1971, Elementary Gravity and Magnetism for Geologists and Seismologists: Society of Exploration Geophysicists Monograph Series No. 1, p. 83-87.

Dobrin, M.B., 1976, Introduction to Geophysical Prospecting: New York, McGraw-Hill Book Company, p. 505-517.

Distribution_Information:

Distributor:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Eric D. Anderson

Contact_Organization: U. S. Geological Survey

Contact_Position: Geologist

Contact_Address:

Address_Type: mailing address

Address: U.S. Geological Survey

Address: Box 25046 Mail Stop 964

Address: Denver Federal Center

City: Denver

State_or_Province: CO

Postal_Code: 80225-0046

Country: USA

Contact_Voice_Telephone: (303) 236-5652

Contact_Facsimile_Telephone: (303) 236-1425

Contact_Electronic_Mail_Address: ericanderson@usgs.gov

Resource_Description: Downloadable Data

Distribution_Liability: Although all data published on this website have been used by the USGS, no warranty, expressed or implied, is made by the USGS as to the accuracy of the data and related materials. The act of distribution shall not constitute any such warranty, and no responsibility is assumed by the USGS in the use of these data or related materials.

Metadata_Reference_Information:

Metadata_Date: 20050204

Metadata_Contact:

Contact_Information:

Contact_Person_Primary:

Contact_Person: Eric D. Anderson

Contact_Organization: U. S. Geological Survey

Contact_Position: Geologist

Contact_Address:

Address_Type: mailing address

Address: U.S. Geological Survey

Address: Box 25046 Mail Stop 964

Address: Denver Federal Center

City: Denver

State_or_Province: CO

Postal_Code: 80225-0046

Country: USA

Contact_Voice_Telephone: (303) 236-5652

Contact_Facsimile_Telephone: (303) 236-1425

Contact_Electronic_Mail_Address: ericanderson@usgs.gov

Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata

Metadata_Standard_Version: FGDC-STD-001-1998

Metadata_Time_Convention: local time

Metadata_Extensions:

Online_Linkage: <http://www.esri.com/metadata/esriprof80.html>

Profile_Name: ESRI Metadata Profile