BEAVER CREEK ELECTROMAGNETIC AND MAGNETIC AIRBORNE GEOPHYSICAL SURVEY DATA COMPILATION

L.E. Burns, G.R.C. Graham, J.D. Barefoot, T.J. Naibert, CGG, and Fugro Airborne Surveys Corp.

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BEAVER CREEK ELECTROMAGNETIC AND MAGNETIC AIRBORNE GEOPHYSICAL SURVEY DATA COMPILATION

L.E. Burns¹, G.R.C. Graham¹, J.D. Barefoot¹, T.J. Naibert¹, CGG, and Fugro Airborne Surveys Corp.

ABSTRACT

The Beaver Creek survey is one of several geophysical surveys, collectively known as the Five Spot project (Southern Dishna River, Beaver Creek, and Fox Hills surveys), located in the Iditarod-Innoko and Aniak mining districts, which is about 575 km southwest from Fairbanks, Alaska. Frequency domain electromagnetic and magnetic data were collected with the DIGHEM^V system from September to November 2012. A total of 1771.2 line kilometers were collected covering 620.0 square kilometers for the Beaver Creek survey. Line spacing was 400 meters (m). Data were collected 30 m above the ground surface from a helicopter towed sensor platform (“bird”) on a 30 m long line.

PURPOSE

This airborne geophysical survey is part of a program to acquire data on Alaska’s most promising mineral belts and districts. The information acquired is aimed at catalyzing new private-sector exploration, discovery, and ultimate development and production. The purpose of the survey was to map the magnetic and conductive properties of the survey area. The Iditarod-Innoko and Aniak mining districts have a history of placer mining, and the discovery of the Donlin Gold lode deposit, 40 kilometers (25 miles) to the southwest, has kept mining activity in the region high. Other gold and base-metal anomalies, altered zones, favorable lithologies, and structural zones are known to exist throughout the survey area.

SURVEY OVERVIEW DESCRIPTION

This document provides an overview of the survey and includes text and figures of select primary and derivative products of this survey. A table of digital data packages available for download is provided to assist users in data selection. For reference, a catalog of the available maps is presented in reduced resolution. Please consult the metadata, project report, and digital data packages for more information and data.

ACKNOWLEDGMENTS

Funding was provided by the Alaska State Legislature as part of the DGGS Airborne Geophysical/Geological Mineral Inventory (AGGMI) program.

¹ Alaska Division of Geological & Geophysical Surveys, 3354 College Road, Fairbanks, Alaska 99709-3707

AVAILABLE DATA

Data Type	Provider	Description
ascii_data	contractor	ASCII format line data, other ASCII data
databases_geosoft	contractor	Geosoft format database of final line data, other Geosoft format databases
documents	contractor and DGGS	Project and field reports, survey background information, gridded data explanations, other documentation
grids_ermapper	contractor	Geographically registered gridded data, ER Mapper ERS format
grids_geosoft	contractor and DGGS	Geosoft-format grids, these grids can be viewed in ESRI ArcMap using a free plugin from Geosoft or the free viewer available from Geosoft
images_registered	DGGS	GeoTiff format images of all gridded data
kmz	DGGS	Keyhole markup language (kml) kmz archive files of project data. Viewable in Google Earth and other compatible programs
maps_pdf_format	contractor	Printable maps in pdf format
maps_prn_format	contractor	Printable maps in HPGL/2 printer file format with extension .prn
profiles_stacked	contractor	Distance-based profiles of the digitally recorded geophysical data are generated and plotted at an appropriate scale. The profiles display electromagnetic anomalies with their respective interpretive symbols. Printable in pdf format
vector_data	contractor and DGGS	Line path, data contours, and survey boundary in ESRI shapefile (SHP) format, ESRI Geodatabase format, and/or AutoCAD dxf format
video_flightpath	contractor	Survey flight path downward facing video

REFERENCES

- Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures: *Journal of the Association of Computing Machinery*, v. 17, n. 4, p. 589–602.
- Burns, L.E., CGG, and Fugro GeoServices, Inc., 2015, Project report, interpretation maps, EM anomalies, stacked multi-channel profiles, and other products of the airborne geophysical survey for the southern Dishna River, Fox Hills, and Beaver Creek survey areas, Iditarod, Ophir, and Holy Cross quadrangles, western Alaska: Alaska Division of Geological & Geophysical Surveys Geophysical Report 2014-3, 126 sheets, 1 DVD. <http://doi.org/10.14509/27326>
- Burns, L.E., Fugro Airborne Surveys Corp., and Fugro GeoServices, Inc., 2013, Southern Dishna River, Fox Hills, and Beaver Creek survey areas: Airborne Magnetic and electromagnetic data in line (point), grid, vector, and map formats, Iditarod, Ophir, and Holy Cross quadrangles, western Alaska: Alaska Division of Geological & Geophysical Surveys Geophysical Report 2013-1, scale 1:63,360, 1 DVD. <http://doi.org/10.14509/26701>

Figure 1. Beaver Creek electromagnetic and magnetic airborne geophysical survey location shown in western Alaska (inset). Beaver Creek survey area shown with adjacent DGGs geophysical surveys, landmarks, relevant 1:250,000-scale quadrangle boundaries, mountain ranges, rivers, glaciers, and elevation hillshade.

Figure 2. Flight path with orthometric image.

Figure 3. The magnetic total field data were processed using digitally recorded data from a Fugro D1344 magnetometer with a Scintrex CS3 cesium sensor. Data were collected at a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtracting the digitally recorded base station magnetic data, (2) IGRF corrected (IGRF model 2010, updated for date of flight and altimeter variations), (3) leveled to the tie line data, and (4) interpolated onto a regular 80 m grid using a modified Akima (1970) technique.

Figure 4. The magnetic total field data were processed using digitally recorded data from a Fugro D1344 magnetometer with a Scintrex CS3 cesium sensor. Data were collected at a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtracting the digitally recorded base station magnetic data, (2) IGRF corrected (IGRF model 2010, updated for date of flight and altimeter variations), (3) leveled to the tie line data, (4) a constant value of approximately 55,000 nT was added to all data, and (5) interpolated onto a regular 80 m grid using a modified Akima (1970) technique.

Figure 5. The first vertical derivative grid was calculated from the diurnally-corrected, IGRF-corrected total magnetic field grid using a FFT base frequency domain filtering algorithm. The resulting first vertical derivative grid provides better definition and resolution of near- surface magnetic units and helps to identify weak magnetic features that may not be evident on the total field data.

Figure 6. Analytic signal is the total amplitude of all directions of magnetic gradient calculated from the sum of the squares of the three orthogonal gradients. Mapped highs in the calculated analytic signal of magnetic parameter locate the anomalous source body edges and corners (such as contacts, fault/shear zones, etc.). Analytic signal maxima are located directly over faults and contacts, regardless of structural dip, and independent of the direction of the induced and/or remanent magnetizations.

Figure 8. The DIGHEM[®] EM system measured inphase and quadrature components at five frequencies. Two vertical coaxial coil-pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil-pairs operated at 900, 7,200, and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 56,000 Hz using the pseudo-layer half space model. The data were interpolated onto a regular 80 m grid using a modified Akima (1970) technique.

Figure 9. The DIGHEM[®] EM system measured inphase and quadrature components at five frequencies. Two vertical coaxial coil-pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil-pairs operated at 900, 7,200, and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 7,200 Hz using the pseudo-layer half space model. The data were interpolated onto a regular 80 m grid using a modified Akima (1970) technique.

Figure 10. The DIGHEM[®] EM system measured inphase and quadrature components at five frequencies. Two vertical coaxial coil-pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil-pairs operated at 900, 7,200, and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 900 Hz using the pseudo-layer half space model. The data were interpolated onto a regular 80 m grid using a modified Akima (1970) technique.

Table 1. Copies of the following maps are included at the end of this booklet. The low-resolution, page-size maps included in this booklet are intended to be used as a search tool and are not the final product. Large-scale, full-resolution versions of each map are available to download on this publication's citation page: <http://doi.org/10.14509/29821>.

Map Title	Description
beavercreek_residualmag_topo_map.pdf	residual magnetic intensity grid with topographic base map
beavercreek_residualmag_contours_plss_map.pdf	residual magnetic intensity grid with data contours and public land survey system base layer
beavercreek_calculated1vd_topo_map.pdf	calculated first vertical derivative of the residual magnetic intensity grid with topographic base map
beavercreek_analytic signal_topo_map.pdf	analytic signal grid with topographic base map
beavercreek_analytic signal_contours_plss_map.pdf	analytic signal grid with data contours and public land survey system base layer
beavercreek_tiltderivative_contours_topo_map.pdf	magnetic tilt derivative grid with data contours and topographic base map
beavercreek_residualmag_shaded_tiltderivative_contours_topo_map.pdf	shaded residual magnetic intensity grid with tilt derivative data contours and topographic base map
beavercreek_res56khz_topo_map.pdf	56,000 Hz apparent resistivity grid with topographic base map
beavercreek_res56khz_contours_plss_map.pdf	56,000 Hz apparent resistivity grid with data contours and public land survey system base layer
beavercreek_res7200hz_topo_map.pdf	7,200 Hz apparent resistivity grid with topographic base map
beavercreek_res7200hz_contours_plss_map.pdf	7,200 Hz apparent resistivity grid with data contours and public land survey system base layer
beavercreek_res900hz_topo_map.pdf	900 Hz apparent resistivity grid with topographic base map
beavercreek_res900hz_contours_plss_map.pdf	900 Hz apparent resistivity grid with data contours and public land survey system base layer
beavercreek_interpretation_plss_map.pdf	interpretation based on the geophysical data with public land survey system base layer
beavercreek_interpretation_residualmag_plss_map.pdf	interpretation based on the geophysical data with residual magnetic intensity grid and public land survey system base layer
beavercreek_emanomalies_residualmag_detailed_topo_map_1of2.pdf	detailed electromagnetic anomalies with residual magnetic intensity grid and topographic base map
beavercreek_emanomalies_residualmag_detailed_topo_map_2of2.pdf	detailed electromagnetic anomalies with residual magnetic intensity grid and topographic base map

PART OF THE IDITAROD QUADRANGLE

RESIDUAL MAGNETIC FIELD

The magnetic total field data were processed using digitally recorded data from a Fugro D1344 magnetometer with a Schriber C33 cesium sensor. Data were collected at a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtraction of the digitally recorded base station magnetic data, (2) IGRF corrected (IGRF model 2010, updated for date of flight and altimeter variations), (3) leveled to sea tie line data, and (4) reduced to the 1980-83 magnetic epoch (Maus and Korte, 2003; Korte and Alkema 1970) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this report.

Alding, H., 1970, A new method of Interpolation and smooth curve fitting based on local procedures: *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 569-602.

The geophysical data were acquired with a DIGHEM Electromagnetic (EM) system and a Fugro D135X helicopter. The EM system consists of a transmitter sensor, The EM and magnetic anemometers are flown at a height of 100 feet. In addition the system includes a GPS navigation system, 50/60 Hz monitors and video camera. Flights were made in a 100 ft by 50 ft grid pattern with a mean terrain clearance of 200 feet. The flight lines were spaced at 100 ft intervals, resulting in a spacing of a quarter of a mile. The lines were flown perpendicular to the flight lines.

A Novatel OEM4-G2 Global Positioning System was used for navigation. The helicopter position was determined by a GPS receiver and a differential positioning to a relative accuracy of better than 5 m. Flight path positions were determined by a GPS receiver and a differential positioning to a relative accuracy of better than 10 m. The system was used to determine the position of the helicopter and the position of the EM system. The system was used to determine the position of the helicopter and the position of the EM system. The system was used to determine the position of the helicopter and the position of the EM system.

SURVEY HISTORY

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGG), and Fugro GeoServices, Inc. Airborne geophysical data were collected by Fugro GeoServices, Inc. and processed by Fugro Airborne Surveys Corp. in 2012 and 2013. Previously flown DGGG surveys adjacent to the current survey are shown in the location map by dashed survey lines, name, and date of publication. The project was funded by the Alaska Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program.

All data and maps produced to date from this survey are available in digital format on DVD for a nominal fee of \$100.00. The DVD contains the following files: 99709-3707, and are downloadable for free from the DGGG website (www.dggs.alaska.gov/pubs). Maps are also available on paper through the DGGG office, and can be viewed online at the website in Adobe Acrobat .PDF file format.

Base from US Geological Survey Mineral D-3, 1987; D-4, 1994; C-1, 1992; C-4, 1992; Chertkof, Alaska.

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEMV Electromagnetic (EM) system and a Fugro D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from radar and laser altimeters, GPS navigation system, 50/60 Hz monitors and video camera. Flights were performed with an AS-350-B2 Sabre helicopter at a mean terrain clearance of 200 feet along NW-SE (340°) survey flight lines with a spacing of a quarter of a mile. Tie lines were flown perpendicular to the flight lines at intervals of approximately 3 miles.

A Novatel OEM4-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5m. Flight path positions were projected onto the Clarke 1866 (UTM zone 4) spheroid, 1927 North American datum using a central meridian (CM) of 159° 0' north constant of 0 and an east constant of 500,000. Positional accuracy of the presented data is better than 10m with respect to the UTM grid.

COLOR BAR HISTOGRAM

Approximately 98% of the first vertical derivative of the magnetic field for the Beaver Creek Survey Area dataset lie within the range displayed on the color bar. Data values actually range from -0.6178 nT/m (dark blue) to about 0.7752 nT/m (magenta).

by
Laurel E. Burns, Fugro Airborne Surveys Corp., and Fugro GeoServices, Inc.
2013

FIRST VERTICAL DERIVATIVE OF THE MAGNETIC FIELD
OF THE BEAVER CREEK SURVEY AREA,
WESTERN ALASKA
PART OF THE IDITAROD QUADRANGLE

FIRST VERTICAL DERIVATIVE OF
THE MAGNETIC FIELD

The magnetic total field data were processed using digitally recorded data from a Fugro D1344 magnetometer with a Scintrex CS3 cesium sensor. Data were collected at a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtraction of the digitally recorded base station magnetic data, (2) IGRF corrected (IGRF model 2010, updated for date of flight and altimeter variations), (3) leveled to the tie line data, and (4) interpolated onto a regular 80 m grid using a modified Akima (1970) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and find grids contained in this publication. The first vertical derivative grid was calculated from the processed total magnetic field grid using a FFT base frequency domain filtering algorithm. The resulting first vertical derivative grid provides better definition and resolution of near-surface magnetic units and helps to identify weak magnetic features that may not be evident on the total field data.

Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures, *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-592.

LOCATION INDEX

SURVEY HISTORY

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGGS), and Fugro GeoServices, Inc. Airborne geophysical data for the area were collected and processed by Fugro Airborne Surveys Corp. in 2012 and 2013. Previously flown surveys adjacent to the current survey are shown in the location map by dashed lines, survey name, and date of publication. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program.

All data and maps produced to date from this survey are available in digital format on DVD for a nominal fee through DGGGS, 3354 College Street, Fairbanks, Alaska, 99709-3707, and are downloadable for free from the DGGGS website (www.dgggs.alaska.gov/pubs). Maps are also available on paper through the DGGGS office, and are available online at the website in Adobe Acrobat .PDF file format.

Base Data: U.S. Geological Survey Mineral D-1, 1967; D-4, 1964; D-5, 1962; C-4, 1962; Gerington, Alaska.

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHMV Electromagnetic (EM) system and a Fugro D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from radar and laser altimeters, GPS navigation system, 50/60 Hz monitors and video camera. Flights were performed with an AS-350-B2 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (340°) survey flight lines with a spacing of a quarter of a mile. Tie lines were flown perpendicular to the flight lines at intervals of approximately 3 miles.

A Novatel OEM4-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5m. Flight path positions were projected onto the Clarke 1866 (UTM zone 4) spheroid, 1927 North American datum using a central meridian (CM) of 159° 0' north constant of 0 and an east constant of 500,000. Positional accuracy of the presented data is better than 10m with respect to the UTM grid.

**ANALYTIC SIGNAL
WITH TOPOGRAPHY
OF THE BEAVER CREEK SURVEY AREA,
WESTERN ALASKA**

PART OF THE IDITAROD QUADRANGLE

by
Laurel E. Burns, Fugro Airborne Surveys Corp., and Fugro GeoServices, Inc.
2013

ANALYTIC SIGNAL

Analytic signal is the total amplitude of all directions of magnetic gradient calculated from the sum of the squares of the three orthogonal gradients. Mapped highs in the calculated analytic signal of magnetic parameter locate the anomalous source body edges and corners (e.g., contacts, fault/shear zones, etc.). Analytic signal maxima are located directly over faults and contacts, regardless of structural dip, and independently of the direction of the induced and/or remanent magnetizations.

LOCATION INDEX

SURVEY HISTORY

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGG), and Fugro GeoServices, Inc. Airborne geophysical data for the area were collected and processed by Fugro Airborne Surveys Corp. in 2012 and 2013. Previously flown DGGG surveys adjacent to the current survey are shown in the location map by dashed lines, survey name, and date of publication. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program.

All data and maps produced to date from this survey are available in digital format on DVD for a nominal fee through DGGG, 3354 College Road, Fairbanks, Alaska, 99709-3707, and are downloadable for free from the DGGG website (www.dggg.alaska.gov/pubs/). Maps are also available on paper through the DGGG office, and are viewable online at the website in Adobe Acrobat .PDF file format.

A Novatel OEM4-G2L Global Positioning System was used for navigation. The helicopter position was used as the ground truth and the flight differential positioning to a relative accuracy better than 5m. Flight path positions were projected onto the Clarke 1866 (UTM zone 4) spheroid, 1927 North American datum using a central meridian (CM) of 159°, a north constant of 6400 and a scale factor of 0.999999. Positional accuracy of the presented data is better than 10cm with respect to the UTM grid.

Analytic signal is the total amplitude of all directions of magnetic gradient calculated from the sum of the squares of the three orthogonal gradients. Mapped highs in the calculated analytic signal of magnetic parameter locate the anomalous source body edges and corners (e.g., contacts, fault/shear zones, etc.). Analytic signal maxima are located directly over faults and contacts, regardless of structural dip, and independently of the direction of the induced and/or remanent magnetizations.

— 22 —

SCALE 1:63,360

0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

_____		0.050 nT/metre
_____		0.010 nT/metre
_____		0.002 nT/metre
_____		0.001 nT/metre

This map has been compiled and drawn under contract from the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Survey (DGGS), and Fugro GeoServices, Inc. All Alaska geophysical data for the area were acquired as part of the Fugro GeoServices contract for 2009 and 2013. Previously flown DGGS surveys adjacent to the current survey are shown in the local map by dashed lines, survey name, and date. The map is the property of the State of Alaska. The Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program.

All data and maps produced to date from this survey are available in digital format on DVD for a nominal charge. The data are available in the following formats: 99708-3707, and are downloadable for free from DGGS website (www.dggs.alaska.gov/pubs). Maps are also available on paper through the DGGS office, or online at the website in Adobe Acrobat file format.

PART OF THE IDITAROD QUADRANGLE

by
Laurel E. Burns, Fugro Airborne Surveys Corp., and Fugro GeoServices, Inc.
2013

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEMY Electromagnetic (EM) system and a Fugro D1344 digital magnetometer mounted on a helicopter-based sensor. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from radar and laser altimeters, GPS navigation system, 50/60 Hz monitors and an altimeter. The flight was performed with an AS-350-B2 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (340°) survey flight lines with a spacing of a quarter of a mile. The flight lines were spaced parallel to the trend of the flight lines at intervals of approximately 3 miles.

A Novatel OEM4-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5m. Flight path positions were projected onto the Clarke 1866 (UTM zone 4) spheroid, 1927 North American datum using a central meridian (CM) of 159°, a north constant of 0 and an east constant of 500,000m. Positional accuracy of the presented data is better than 10m with respect to the UTM grid.

MAGNETIC TILT DERIVATIVE

The tilt derivative is the angle between the horizontal gradient & the total gradient, which is useful for identifying the depth & type of source. The tilt angle is positive over the source, crosses through zero at, or near, the edge of a vertical sided source, and is negative outside the source region. It has the added advantage of responding equally well to shallow and deep sources and is able to resolve deeper sources that may be masked by larger responses from shallower sources.

MAGNETIC TILT DERIVATIVE CONTOURS

LOCATION INDEX

SURVEY HISTORY

This map has been compiled and drawn under contract between the State of Alaska Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGG), and Fugro GeoServices, Inc. Airborne geophysical data for the area were acquired and processed by Fugro GeoServices in 2008, 2009, and 2013. Previously flown DGGG surveys adjacent to the current survey are shown in the location map by dashed lines, survey name, and date of publication. The published map is in the public domain. The Alaska Department of Natural Resources is the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program.

All data and maps produced to date from this survey are available in digital format on DVD for a nominal fee of \$100.00. Single copies of the hard copy, Alaska 997005 1:50,000, are \$100.00. Alaska 997005 1:50,000, and are downloadable for free from the DGGG website (www.dggg.alaska.gov/fpubs). Maps are also available on paper through the DGGG office, and are viewable online at the website in Adobe Acrobat .PDF files.

PART OF THE IDITAROD QUADRANGLE

by
Laurel E. Burns, Fugro Airborne Surveys Corp., and Fugro GeoServices, Inc.
2013

Sun Azimuth: 0 degrees
Sun Inclination: 45 degrees

MAGNETIC TILT DERIVATIVE

The tilt derivative is the angle between the horizontal gradient & the total gradient, which is useful for identifying the depth & type of source. The tilt angle is positive over the source, crosses through zero at, or near, the edge of a vertical sided source, and is negative outside the source region. It has the added advantage of responding equally well to shallow and deep sources and is able to resolve deeper sources that may be masked by larger responses from shallower sources.

RESIDUAL MAGNETIC FIELD

The magnetic total field data were processed using digitally recorded data from a Fugro D1344 magnetometer with a Schlumberger 533 cesium sensor. Data were collected at a sampling interval of 0.1 seconds. The magnetic data were (1) corrected for diurnal variations by subtraction of the digitally recorded base station magnetic data, (2) IGRF contained (IGRF model 2010, updated for date of flight and altimeter variations), (3) leveled to the tie line data, and (4) interpolated onto a regular 80 grid using a modified inverse distance weighting. All grid cells were resampled from the 80 m cell size down to 25 m cell size to produce the maps and final grids contained in this publication.

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEX electromagnetic (EM) system and a Fugro D1344 cesium magnetometer from a Sincere CS3 cesium magnetometer towed by a tugboat at a constant flow rate at a height of 100 feet. In addition the system included a Fugro D1344 GPS receiver, altimeters, GPS navigation system, 50/60 Hz monitors and video camera. Flights were made over the study area at a constant altitude at a mean terrain clearance of 200 feet. The flight track was spaced at 1 mile intervals, with a cross-track spacing of a quarter of a mile. The tie lines were flown perpendicular to the flight lines.

A Novatel G21-G2L Global Positioning System was used for navigation. The helicopter position was determined by differential positioning to a relative accuracy of better than 5 m. Flight path positions were determined by differential positioning to a relative accuracy of better than 1 m. The survey was conducted in the northern hemisphere, 1977 North American datum using a WGS84 datum. The horizontal accuracy of the survey was 0 m and an east constant of 500,000. Positional accuracy of the presented data is better than 5 m.

SURVEY HISTORY

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and Fugro GeoServices, Inc. Airborne geophysical data for this area were acquired by Fugro GeoServices, Inc. in 2012 and 2013. Previously flown DGGS surveys adjacent to the current survey are shown in the location map by dashed lines, survey name, and date of publication. The data for this map were approved by the Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program.

All data and maps produced to date from this survey are available in digital format on DVD for a nominal fee of \$100.00. The data are available in digital format for 97979–3707, and are downloadable for free from the DGGS website (www.dggs.alaska.gov/pubs). Maps are also available on paper through the DGGS office, and are also online at the website in Adobe Acrobat .PDF file format.

Base from U.S. Geological Survey Mineral D-3, 1987; D-4, 1994.
C-1, 1982; C-4, 1984; G-1, 1984.

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a Fugro D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from radar and laser altimeters, GPS navigation system, 50/60 Hz monitors and video camera. Flights were performed with an AS-350-B2 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (340°) survey flight lines with a spacing of a quarter of a mile. Tie lines were flown perpendicular to the flight lines at intervals of approximately 3 miles.

A Novatel OEM4-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5 m. Flight path positions were projected onto the Clarke 1866 (UTM zone 4) spheroid, 1927 North American datum using a central meridian (CM) of 159° 0' north constant of 0 and an east constant of 500,000. Positional accuracy of the presented data is better than 10 m with respect to the UTM grid.

56,000 Hz COPLANAR APPARENT RESISTIVITY WITH TOPOGRAPHY OF THE BEAVER CREEK SURVEY AREA, WESTERN ALASKA

PART OF THE IDITAROD QUADRANGLE

by
Laurel E. Burns, Fugro Airborne Surveys Corp., and Fugro GeoServices, Inc.
2013

RESISTIVITY

The DIGHEM[®] EM system measured inphase and quadrature components at five frequencies. Two vertical coplanar coil-pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil-pairs operated at 900, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 56,000 Hz using the pseudo-layer half space model. The data were interpolated onto a regular 80 m grid using a modified Akima (1970) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

Akima, H., 1970. A new method of interpolation and smooth curve fitting based on local procedures. *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-602.

LOCATION INDEX

SURVEY HISTORY

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGG), and Fugro GeoServices, Inc. Airborne geophysical data for the area were acquired and processed by Fugro Airborne Surveys Corp. in 2012 and 2013. Previously flown DGGG surveys adjacent to the current survey are shown in the location map by dashed lines, survey name, and date of publication. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program.

All data and maps produced to date from this survey are available in digital format on DVD for a nominal fee through DGGG, 3354 College Road, Fairbanks, Alaska, 99709-3707, and are downloadable for free from the DGGG website (www.dggg.alaska.gov/pubs). Maps are also available on paper through the DGGG office, and are viewable online at the website in Adobe Acrobat .PDF file format.

Survey outline from U.S. Geological Survey Mineral B-6 1987, B-4, 1984.
C-1, 1984; C-1, 1984; C-1, 1984.

APPROXIMATE BEAR
RESISTIVITY, 2012

56,000 Hz COPLANAR APPARENT RESISTIVITY AND DATA CONTOURS OF THE BEAVER CREEK SURVEY AREA, WESTERN ALASKA

PART OF THE IDITAROD QUADRANGLE

by
Laurel E. Burns, Fugro Airborne Surveys Corp., and Fugro GeoServices, Inc.
2013

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a Fugro D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from radar and laser altimeters. GPS navigation system, 50/60 Hz monitors and video camera. Flights were performed with an AS-350-B2 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (340°) survey flight lines with a spacing of a quarter of a mile. Tie lines were flown perpendicular to the flight lines at intervals of approximately 3 miles.

A Novatel OEM4-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5m. Flight path positions were projected onto the Clarke 1866 (UTM zone 4) spheroid, 1927 North American datum using a central meridian (CM) of 159°, a north constant of 0 and an east constant of 500,000. Positional accuracy of the presented data is better than 10m with respect to the UTM grid.

RESISTIVITY

The DIGHEM[®] EM system measured inphase and quadrature components at five frequencies. Two vertical coil-pairs operated at 1000 and 5000 Hz while three horizontal coplanar coil-pairs operated at 800, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 56,000 Hz using the pseudo-layer half space model. The data were interpolated onto a regular 80 m grid using a modified Akima (1970) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

Akima, H., 1970. A new method of interpolation and smooth curve fitting based on local procedures. *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-902.

RESISTIVITY CONTOURS

LOCATION INDEX

SURVEY HISTORY

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGG), and Fugro GeoServices, Inc. Airborne geophysical data for the area were acquired and processed by Fugro Airborne Surveys Corp. in 2012 and 2013. Previously flown DGG surveys adjacent to the current survey are shown in the location map by dashed lines, survey name, and date of publication. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program.

All data and maps produced to date from this survey are available in digital format on DVD for a nominal fee through DGG, 3304 College Road, Fairbanks, Alaska, 99709-3707, and are downloadable for free from the DGG website (www.dgg.alaska.gov/pubs). Maps are also available on paper through the DGG office, and are viewable online at the website in Adobe Acrobat PDF file format.

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM Electromagnetic (EM) system and a Fugro D1544 cesium magnetometer with a Sinter CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from radar and laser altimetry. The data were collected using two video monitors and video camera. Flights were performed with an AS-350-82 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (30°) survey flight lines with a 1000 ft spacing. A total of 160 flight lines were flown perpendicular to the flight lines at intervals of approximately 3 miles.

A Novatel OEM4-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential correction. The horizontal accuracy was better than 5m. Flight path positions were projected onto the Clarke 1866 (UTM zone 4), spheroid, 1927 North American datum using a central meridian (CM) of 159°, a north constant of 100,000 and an east constant of 500,000. Positional accuracy of the corrected data was better than 10m with respect to the UTM grid.

7200 Hz COPLANAR APPARENT RESISTIVITY WITH TOPOGRAPHY OF THE BEAVER CREEK SURVEY AREA, WESTERN ALASKA

PART OF THE IDITAROD QUADRANGLE

by
Laurel E. Burns, Fugro Airborne Surveys Corp., and Fugro GeoServices, Inc.
2013

RESISTIVITY

The DIGEM[®] EM system measured inphase and quadrature components at 1000 and 5000 Hz. The two vertical coils of the coplanar coprocessor were driven by three horizontal coplanar coil-pairs operated at 900, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductance overburden and subsurface structure. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 7200 Hz using the pseudo-layer half space model. The data were interpreted to reveal 80 m and 25 m cell size. Aikma (1970) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this

Akima, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures: *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-602.

SURVEY HISTORY

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and Fugro GeoServices, Inc. Airborne geophysical data for the area were acquired and processed by Fugro Airborne Surveys Corp. in 2012 and 2013. Previously flown DGGS surveys adjacent to the current survey are shown in the location map by dashed lines, survey name, and date of publication. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical

All data and maps produced to date from this survey are available in digital format on DVD for a nominal fee through DGGs, 3354 College Road, Fairbanks, Alaska, 99709-3707, and are downloadable for free from the DGGs website (www.dggs.alaska.gov/pubs/). Maps are also available on paper through the DGGs office, and are viewable online at the website in Adobe Acrobat .PDF file format.

The geophysical data were acquired with a DIGHY Electromagnetic (EM) system and a Fugro D134X magnetometer. The EM system consists of a 100 m cable sensor, The EM and magnetic sensors were flown at a height of 100 feet. In addition the system includes a real time data processing unit, altimeters, GPS navigation system, 50/60 Hz line noise filter, and a 1000 Hz data logger. Data were performed with an AS-350-B2 Squirrel helicopter at a mean terrain clearance of 200 feet. The flight track was flown in a series of parallel lines spacing of a quarter of a mile. The lines were spaced at 1000 ft and the flight lines were spaced at intervals of approximately 3 miles.

A Novatel OEM4-G2L Global Positioning System was used for navigation. The helicopter position was determined by a GPS receiver and a real time differential positioning to a relative accuracy of better than 3m. Flight path positions were determined by a GPS receiver and a real time differential positioning to a relative accuracy of better than 3m. The flight path positions were determined by a GPS receiver and a real time differential positioning to a relative accuracy of better than 3m. The flight path positions were determined by a GPS receiver and a real time differential positioning to a relative accuracy of better than 3m.

The DIGHEM[®] EM system measured inphase and quadrature components at five frequencies. Two vertical coaxial coil-pairs operated at 1000 and 5500 Hz; three horizontal coplanar coil-pairs operated at 900, 7200 and 56,000 Hz. EM data were sampled at 0.1 m intervals. EM data were collected from bare conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 7200 Hz using the complex plane method. The data were then interpolated onto a regular 80 m grid using a modified Akima (1970) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

Alfaro, H., 1970, A new method of interpolation and smooth curve fitting based on local procedures *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-602.

PART OF THE IDITAROD QUADRANGLE

by
Laurel E. Burns, Fugro Airborne Surveys Corp., and Fugro GeoServices, Inc.
2013

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGS), and Fugro GeoServices, Inc. Airborne magnetic data were collected by Fugro GeoServices and processed by Fugro Airborne Surveys Corp. in 2012 and 2013. Previously flown DGGS surveys adjacent to the current survey are shown in the location map. Magnetic data were not available for this publication. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program.

All data and maps produced to date from this survey are available to the public at no charge. A nominal fee through DGGS, 3354 College Road, Fairbanks, Alaska, 99709-3707, and are downloadable for free from the DGGS website (www.dggs.alaska.gov/pubs). Maps are also available on paper through the DGGS office, and are also online at the website in Adobe Acrobat PDF file format.

Base Data: U.S. Geological Survey Miscellaneous D-5, 1967; D-4, 1964;
C-3, 1962; C-4, 1964; Washington, Idaho

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a Fugro D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from radar and laser altimeters. GPS navigation system, 50/60 Hz monitors and video camera. Flights were performed with an AS-350-B2 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (340°) survey flight lines with a spacing of a quarter of a mile. Tie lines were flown perpendicular to the flight lines at intervals of approximately 3 miles.

A Novatel OEM4-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5m. Flight path positions were projected onto the GRS80 (UTM zone 4) spheroid, 1927 North American datum using a central meridian (CM) of 159°, a north constant of 0 and an east constant of 500,000. Positional accuracy of the presented data is better than 10m with respect to the UTM grid.

SCALE 1:63,360
0 1 2 3 4 MILES
0 1 2 3 4 KILOMETERS
ORIGINAL INTENT TO PRINT
ON 11x17 INCH PAPER

900 Hz COPLANAR APPARENT RESISTIVITY WITH TOPOGRAPHY OF THE BEAVER CREEK SURVEY AREA, WESTERN ALASKA

PART OF THE IDITAROD QUADRANGLE

by
Laurel E. Burns, Fugro Airborne Surveys Corp., and Fugro GeoServices, Inc.
2013

RESISTIVITY

The DIGHEM[®] EM system measured inphase and quadrature components at five frequencies. Two vertical coaxial coil-pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil-pairs operated at 900, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 900 Hz using the Aluma (1970) technique. All grids were then resampled from the 80 m cell size down to a 20 m cell size to produce the maps and final grids contained in this publication.

Aluma, H., 1970. A new method of interpretation and smooth curve fitting based on total procedure. *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-602.

LOCATION INDEX

SURVEY HISTORY

This map has been compiled and drawn under contract between the State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys (DGGG), and Fugro GeoServices, Inc. Airborne geophysical data for the area were acquired and processed by Fugro Airborne Surveys Corp. in 2012 and 2013. Previously flown DGGG surveys adjacent to the current survey are shown in the location map by dashed lines, survey name, and date of publication. The project was funded by the Alaska State Legislature as part of the Alaska Airborne Geophysical and Geological Mineral Inventory Program.

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900 Hz COPLANAR APPARENT RESISTIVITY AND DATA CONTOURS OF THE BEAVER CREEK SURVEY AREA, WESTERN ALASKA

PART OF THE IDITAROD QUADRANGLE

by
Laurel E. Burns, Fugro Airborne Surveys Corp., and Fugro GeoServices, Inc.
2013

DESCRIPTIVE NOTES

The geophysical data were acquired with a DIGHEM[®] Electromagnetic (EM) system and a Fugro D1344 cesium magnetometer with a Scintrex CS3 cesium sensor. The EM and magnetic sensors were flown at a height of 100 feet. In addition the survey recorded data from radar and laser altimeters. GPS navigation system, 50/60 Hz monitors and video cameras. Flights were performed with an AS-350-B2 Squirrel helicopter at a mean terrain clearance of 200 feet along NW-SE (340°) survey flight lines with a spacing of a quarter of a mile. Tie lines were flown perpendicular to the flight lines at intervals of approximately 3 miles.

A Novatel OEM4-G2L Global Positioning System was used for navigation. The helicopter position was derived every 0.5 seconds using post-flight differential positioning to a relative accuracy of better than 5m. Flight path positions were projected onto the Clarke 1866 (Luzon zone 4) spheroid, 1927 North American datum using a central meridian (CM) of 159° and a north constant of 0 and an east constant of 500,000. Positional accuracy of the presented data is better than 10m with respect to the UTM grid.

RESISTIVITY

The DIGHEM[®] EM system measured inphase and quadrature components at five frequencies. Two vertical coplanar coil-pairs operated at 1000 and 5500 Hz while three horizontal coplanar coil-pairs operated at 800, 7200 and 56,000 Hz. EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and cultural sources. Apparent resistivity is generated from the inphase and quadrature component of the coplanar 900 Hz using the pseudo-layer half space model. The data were interpolated onto a regular 80 m grid using a modified Akima (1970) technique. All grids were then resampled from the 80 m cell size down to a 25 m cell size to produce the maps and final grids contained in this publication.

Akima, H., 1970. A new method of interpolation and smooth curve fitting based on test procedures. *Journal of the Association of Computing Machinery*, v. 17, no. 4, p. 589-602.

RESISTIVITY CONTOURS

Contours in ohm-m at 10 intervals per decade

..... reliability low

LOCATION INDEX

SURVEY HISTORY

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