AIRBORNE ELECTROMAGNETIC AND MAGNETIC SURVEY, WESTERN YUKON FLATS, INTERIOR ALASKA

Emond, A.M., Minsley, B.J., Daanen, R.P., Graham, G.R.C., and CGG

Geophysical Report 2016-2

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DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

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http://doi.org/10.14509/29683

AIRBORNE ELECTROMAGNETIC AND MAGNETIC SURVEY, WESTERN YUKON FLATS, INTERIOR ALASKA

Emond, A.M.,[1] Minsley, B.J.,[2] Daanen, R.P.,[1] Graham, G.R.C.,[1] and CGG

ABSTRACT

Alaska Division of Geological & Geophysical Surveys, in conjunction with the University of Alaska Fairbanks, Institute of Northern Engineering, Water and Environmental Research Center, managed the collection of frequency domain electromagnetic and magnetic data lines over a 200-square-kilometer portion of Western Yukon Flats, interior Alaska. Survey lines cover selected areas pertinent to the scope of research. The 301-line-kilometer survey was flown from February 25th to March 1st, 2016. Data were collected by CGG using the RESOLVE airborne geophysical survey system and measured 30 m above the ground surface from a helicopter-towed sensor platform ("bird") on a 30-m-long line.

PURPOSE

These geophysical data are part of the University of Alaska Fairbanks, Institute of Northern Engineering, Water and Environmental Research Center *Goldstream Valley Watershed* project, which aims to define processes within the hydrology–permafrost–methane system at the lake to watershed scale across the seasonal to millennial time scales. The data were collected to facilitate understanding of processes within a hydrology–permafrost–methane system in an area of discontinuous permafrost and thaw lakes in the sub-arctic region. Goldstream Valley and surrounding areas of Interior Alaska offer a convenient and data-rich study area for landscapes with discontinuous permafrost and thaw lakes in the sub-arctic region.

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.

[1] Alaska Division of Geological & Geophysical Surveys, 3354 College Road, Fairbanks, Alaska 99709-3707
[2] Geology, geophysics, and Geochemistry Science Center, U.S. Geological Survey, W 6th Ave., Kipling St., Lakewood, CO 80225

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 binary grids, these grids can be viewed in ESRI ArcMap using a free plugin from Geosoft
images_registered	DGGS	GeoTiff format images of all gridded data
kmz	contractor	kml language kmz archive files of project data
maps_pdf_format	contractor	Printable maps in pdf format
maps_prn_format	contractor	Printable maps in HPGL/G printer file format with extension .prn
resistivity_models	DGGS	ACSII CSV format resistivity models in project coordinates with data field guides, figures and supporting documentation in ASCII text, PDF, KML, and/or other formats
vector_data	contractor and DGGS	Line path, data contours, and survey boundary in ESRI shape file (SHP) format
video_flightpath	contractor	Survey flight path downward facing video

ACKNOWLEDGMENTS

The *Goldstream Valley Watershed* project is funded by the National Science Foundation, Office of Polar Programs, Arctic System Science Program, award #1500931.

REFERENCES

Ball, L.B., Smith, B.D., Minsley, B.J., Abraham, J.D., Voss, C.I., Astley, B.N., Deszcz-Pan, Maria, and Cannia, J.C., 2011, Airborne electromagnetic and magnetic geophysical survey data of the Yukon Flats and Fort Wainwright areas, central Alaska, June 2010: U.S. Geological Survey Open-File Report 2011–1304, 21 p. https://pubs.usgs.gov/of/2011/1304

Emond, A.M., Daanen, R.P., Graham, G.R.C., Walter Anthony, Katey, Liljedahl, A.K., Minsley, B.J., Barnes, D.L., Romanovsky, V.E., and CGG Canada Services Ltd., 2018, Airborne electromagnetic and magnetic survey, Goldstream Creek watershed, interior Alaska: Alaska Division of Geological & Geophysical Surveys Geophysical Report 2016-5, 14 p. http://doi.org/10.14509/29681

Emond, A.M., Little, L.M., Graham, G.R.C., Minsley, B.J., and CGG, 2018, Airborne electromagnetic and magnetic survey, Yukon Crossing, interior Alaska: Alaska Division of Geological & Geophysical Surveys Geophysical Report 2016-4. http://doi.org/10.14509/29682

Graham, G.R.C., Emond, A.M., Daanen, R.P., Minsley, B.J., and CGG, 2018, Airborne electromagnetic and magnetic survey, Yukon Crossing to Fox profile, interior Alaska: Alaska Division of Geological & Geophysical Surveys Geophysical Report 2016-3. http://doi.org/10.14509/29684

Minsley, B.J., Emond, A.M., and Rey, D.M., 2017, Airborne electromagnetic and magnetic survey data and inverted resistivity models, western Yukon Flats, Alaska, February 2016, U.S. Geological Survey data release. https://doi.org/10.5066/F7QC01P9

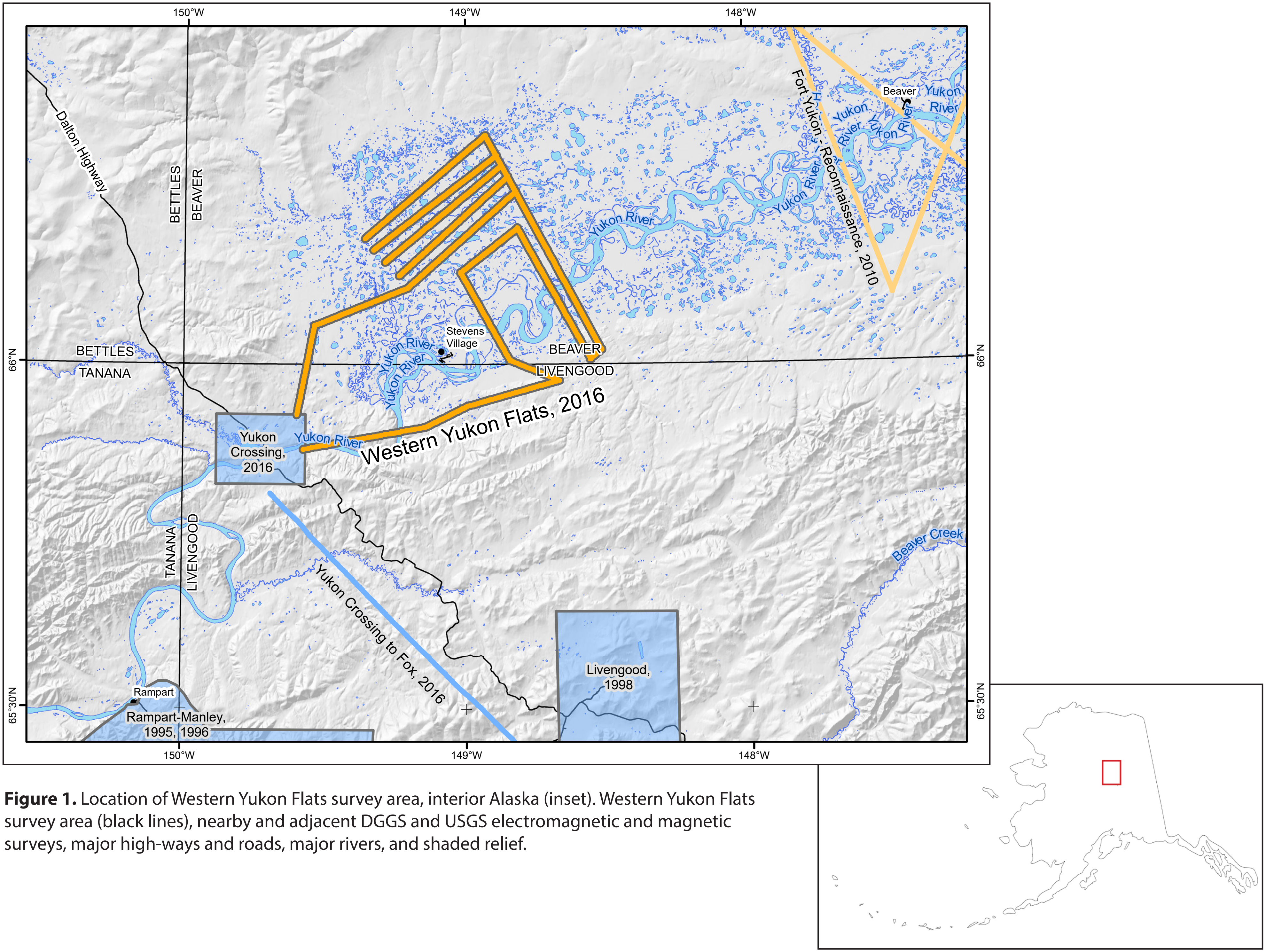


Figure 1. Location of Western Yukon Flats survey area, interior Alaska (inset). Western Yukon Flats survey area (black lines), nearby and adjacent DGGS and USGS electromagnetic and magnetic surveys, major high-ways and roads, major rivers, and shaded relief.

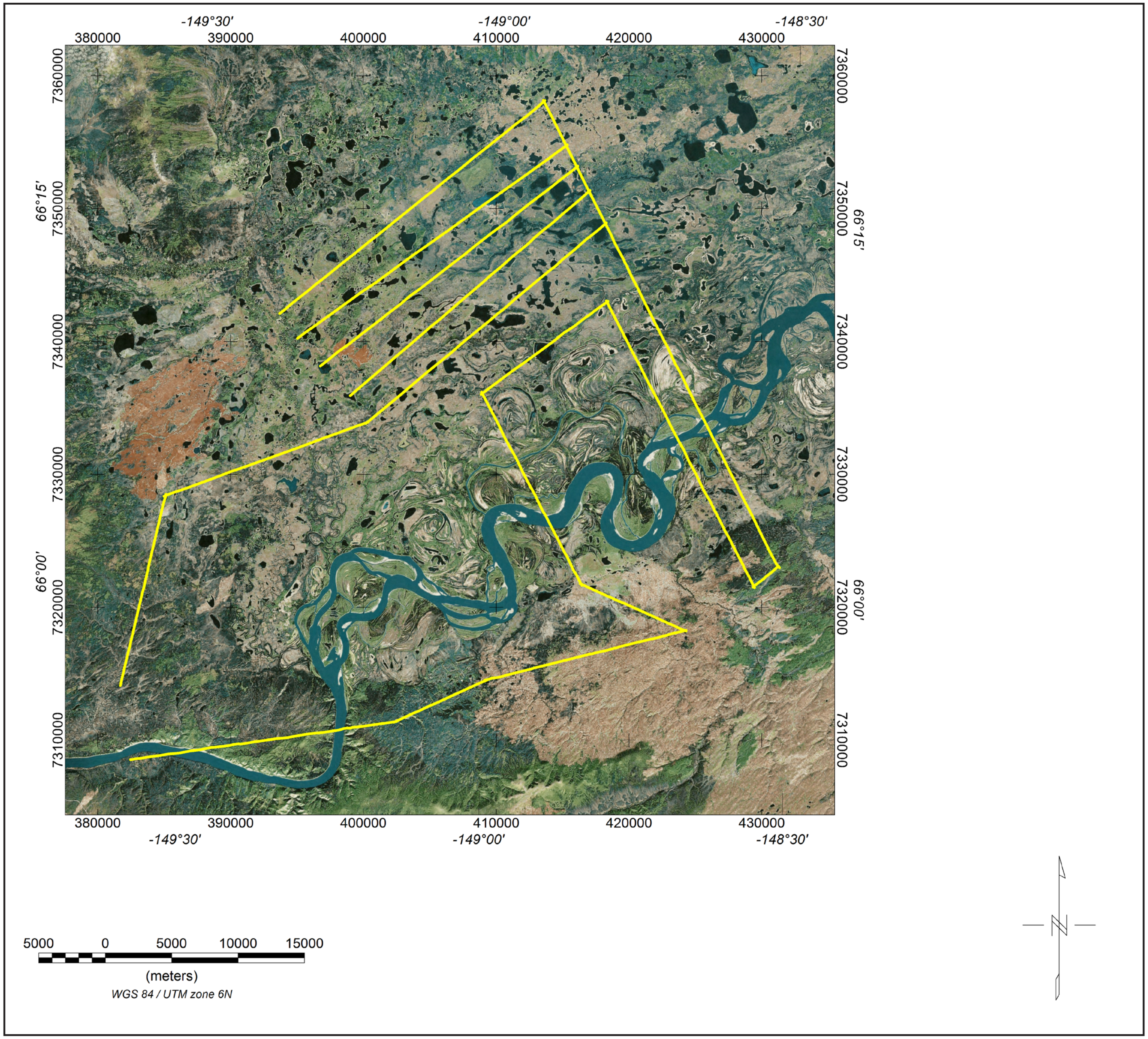


Figure 2. Paths of survey flight lines and wider-spaced perpendicular tie lines with orthophoto.

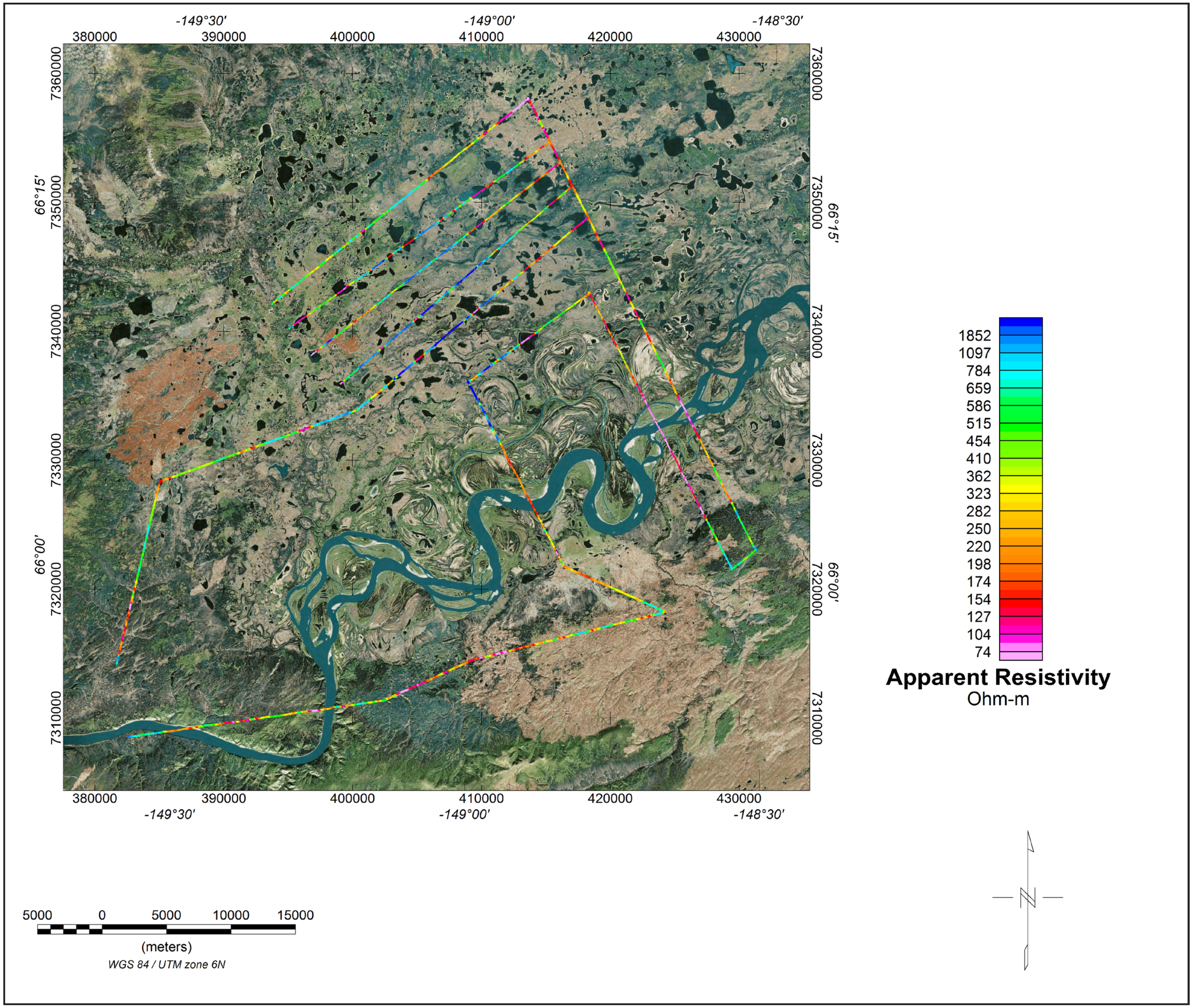


Figure 3. 8,200 Hz apparent resistivity grid and orthophoto. The RESOLVE EM system operates at six distinct frequencies, and measures the inphase and quadrature components at each frequency. Five coplanar coil pairs operate at 400, 1,800, 8,200 (shown), 40,000, and 140,000 Hz, and one coaxial coil pair operates at 3,300 Hz. The EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and man-made cultural sources. Apparent resistivity is generated from the inphase and quadrature components for each frequency using the pseudo-layer half-space model.

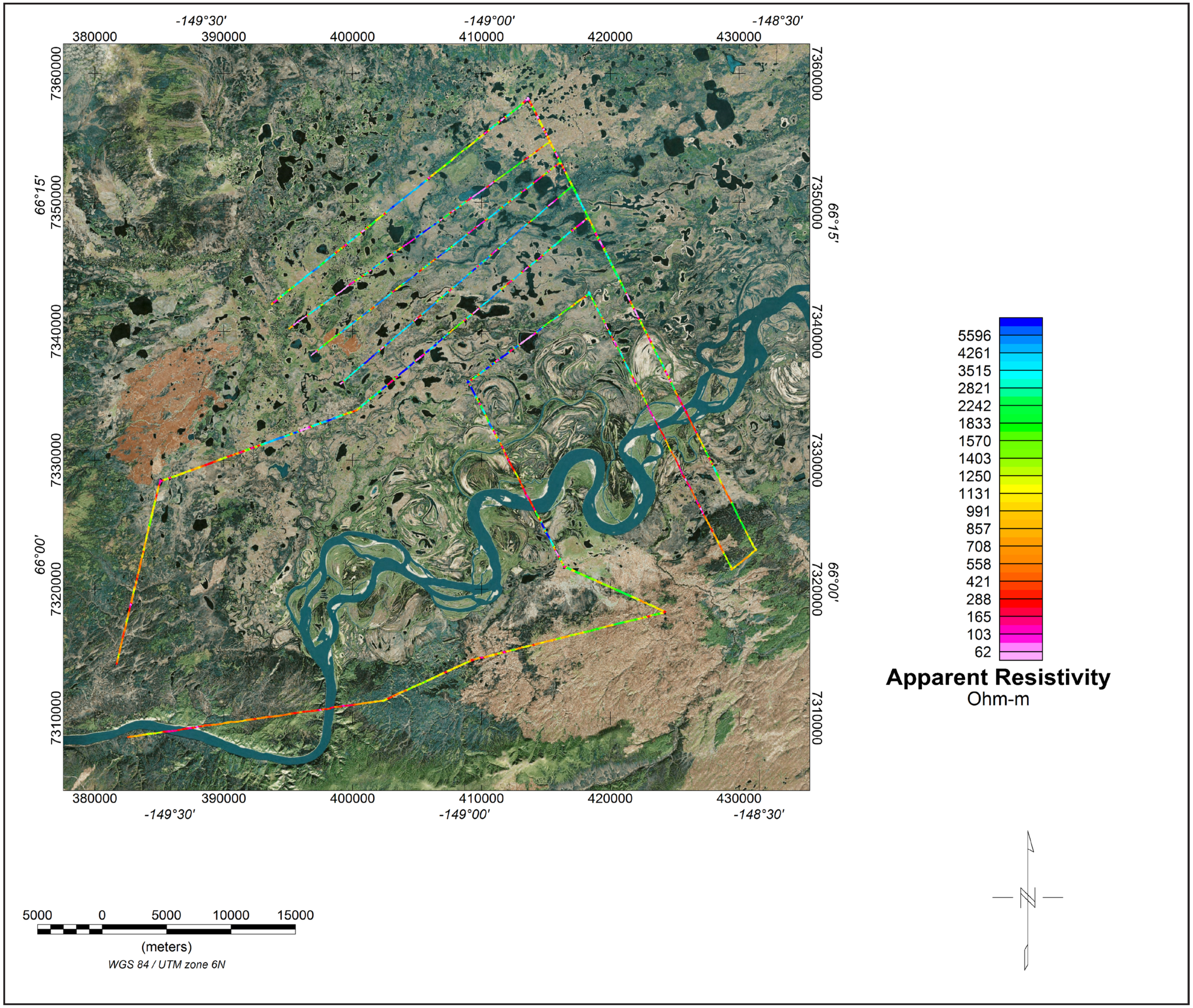


Figure 4. 140,000 hertz (Hz) apparent resistivity grid and orthophoto. The RESOLVE electromagnetic (EM) system operates at six distinct frequencies, and measures the inphase and quadrature components at each frequency. Five coplanar coil pairs operate at 400, 1,800, 8,200, 40,000, and 140,000 Hz (shown), and one coaxial coil pair operates at 3,300 Hz. The EM data were sampled at 0.1 second intervals. The EM system responds to bedrock conductors, conductive overburden, and man-made cultural sources. Apparent resistivity is generated from the inphase and quadrature components for each frequency using the pseudo-layer half-space model.

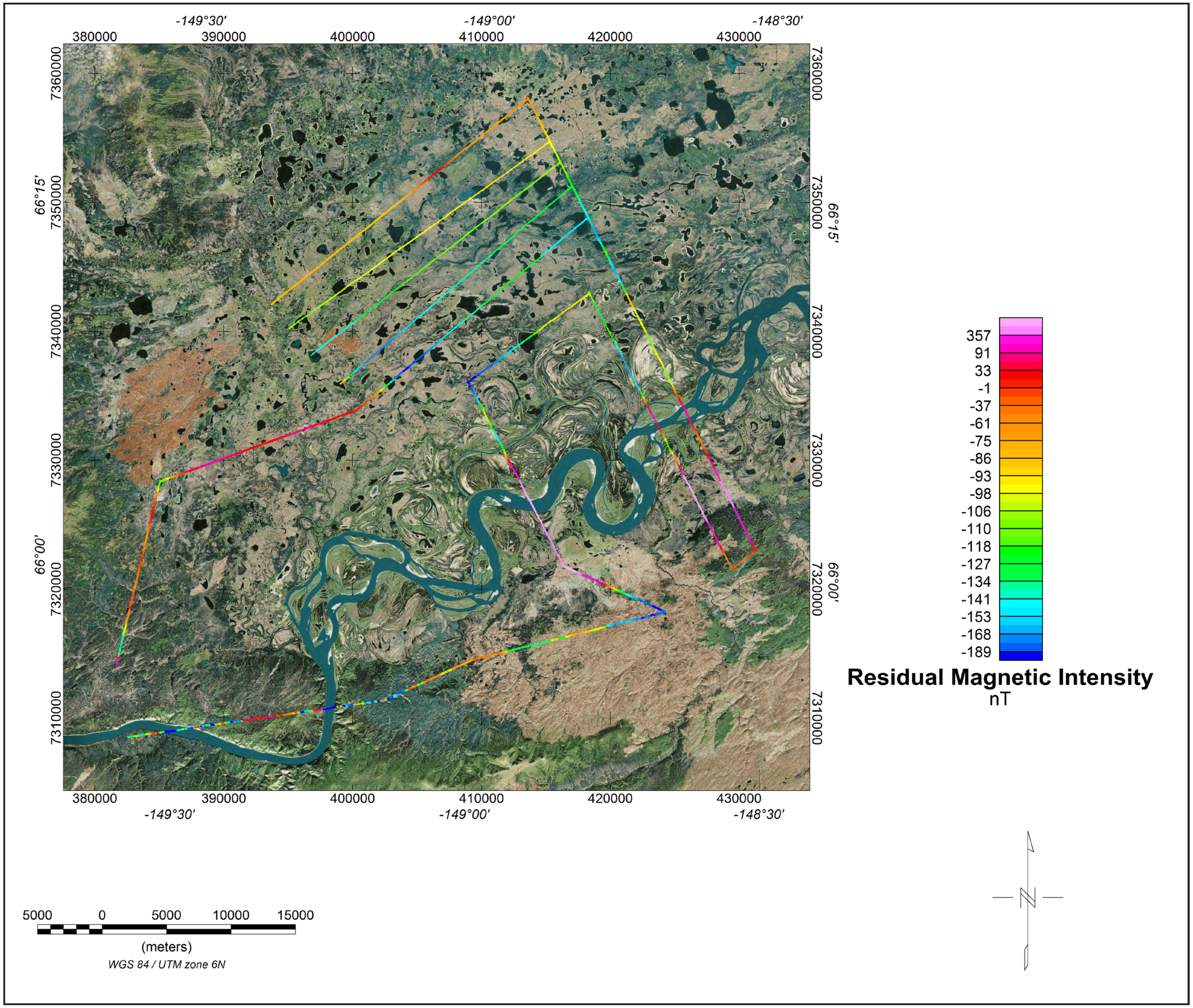


Figure 5. Residual magnetic intensity grid and orthophoto. The magnetic total field data were collected using a Scintrex CS3 cesium sensor at a sampling interval of 0.1 seconds and processed using digitally recorded data from a CGG D1344 base station magnetometer. The magnetic data were: (1) corrected for diurnal variations by subtraction of the base station magnetic data; (2) IGRF corrected (IGRF model 2010, updated for data of flight and altimeter variations).

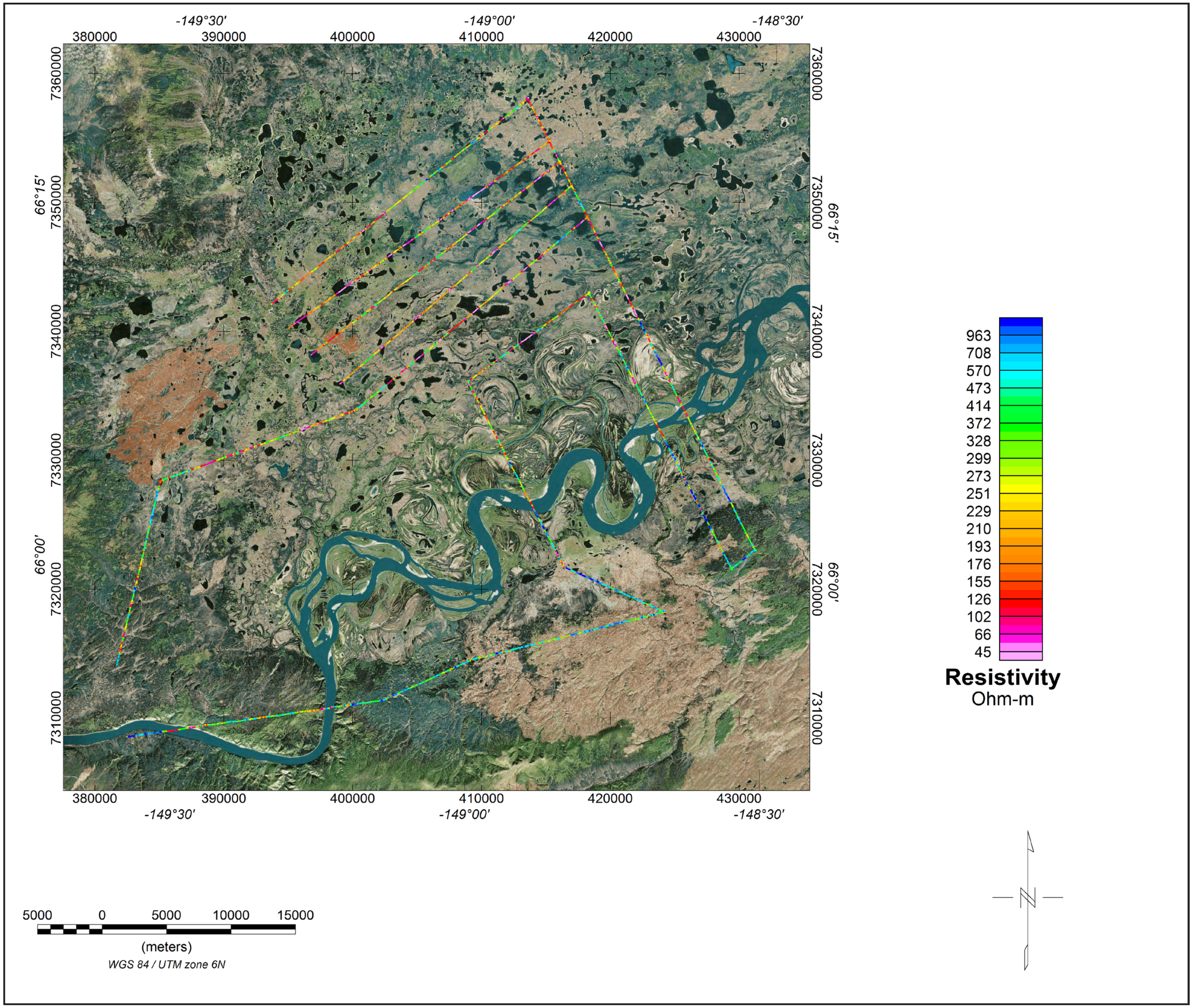


Figure 6. Resistivity model depth-slice grid; at ground surface (first model layer). Resistivity models are created from the recorded electromagnetic data through a process called inversion. Inversion programs create a resistivity model that has a data signature nearly the same as the recorded data. When this occurs the model is said to "fit" the data. This process is non-unique, meaning that many resistivity models could create similar data. The models presented are likely to (but might not) represent the real world distribution of resistivity in the subsurface. The recorded data are influenced by the subsurface on either side of the flight line; therefore, features in the model could be from either side of the flight line. Power lines and other infrastructure can negatively impact the data quality, which could result in missing data and/or cause erroneous models. Resistivity Model "workbench_lci" shown.

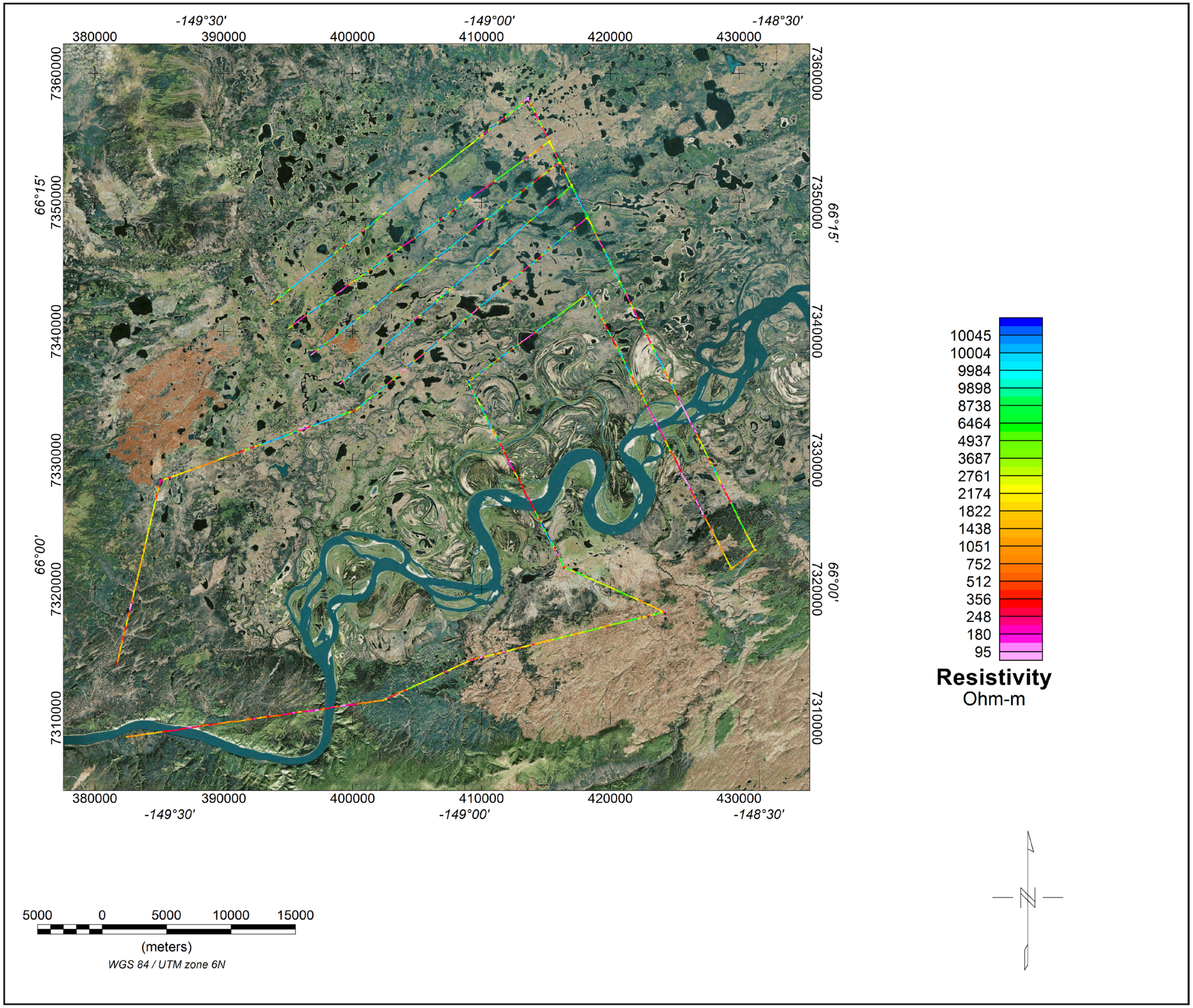
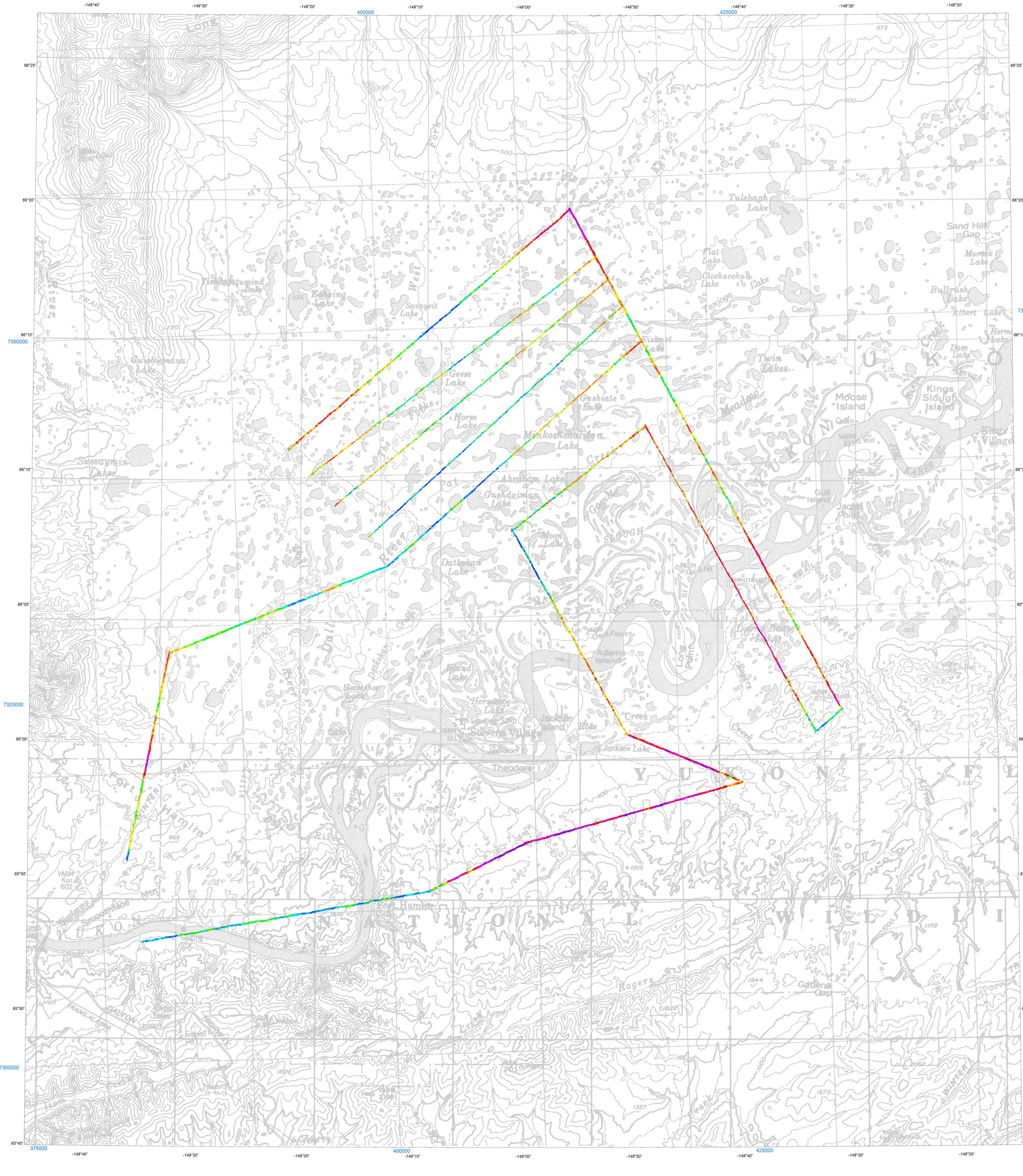


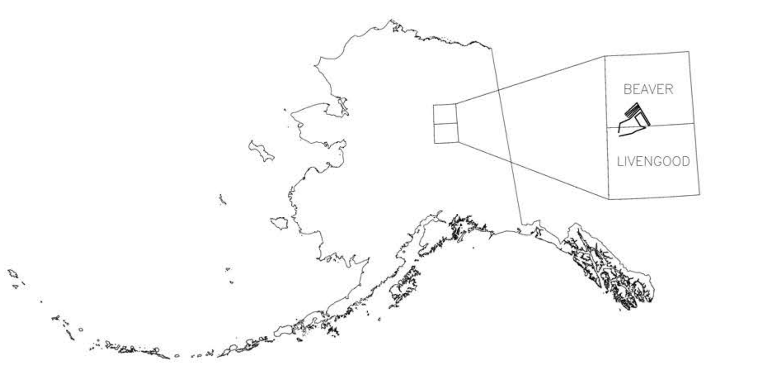
Figure 7. Resistivity model depth-slice grid; 30 meters below ground surface. Resistivity models are created from the recorded electromagnetic data through a process called inversion. Inversion programs create a resistivity model that has a data signature nearly the same as the recorded data. When this occurs the model is said to "fit" the data. This process is non-unique, meaning that many resistivity models could create similar data. The models presented are likely to (but might not) represent the real world distribution of resistivity in the subsurface. The recorded data are influenced by the subsurface on either side of the flight line; therefore, features in the model could be from either side of the flight line. Power lines and other infrastructure can negatively impact the data quality, which could result in missing data and/or cause erroneous models. Resistivity Model "workbench_lci" shown.

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/10.14509/29683.

Map Title	Description
res400hz_topo_map	400 Hz coplanar apparent resistivity grid (electromagnetic data), with topography background
res1800hz_topo_map	1800 Hz coplanar apparent resistivity grid (electromagnetic data, with topography background
res3300hz_topo_map	3300 Hz coaxial apparent resistivity grid (electromagnetic data), with topography background
res8200hz_topo_map	8200 Hz coplanar apparent resistivity grid (electromagnetic data), with topography background
res40khz_topo_map	40000 Hz coplanar apparent resistivity grid (electromagnetic data), with topography background
res140khz_topo_map	140000 Hz coplanar apparent resistivity grid (electromagnetic data), with topography background
residualmag_topo_map	residual magnetic intensity grid (magnetic data), with topography background



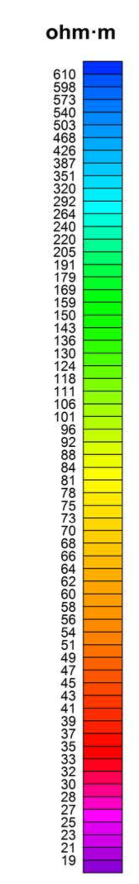
SURVEY LOCATION



AIRBORNE ELECTROMAGNETIC AND MAGNETIC SURVEY WESTERN YUKON FLATS, INTERIOR ALASKA

http://doi.org/10.14509/29683

APPARENT RESISTIVITY 400 Hz COPLANAR WITH TOPOGRAPHY



TRUE NORTH
MAGNETIC NORTH

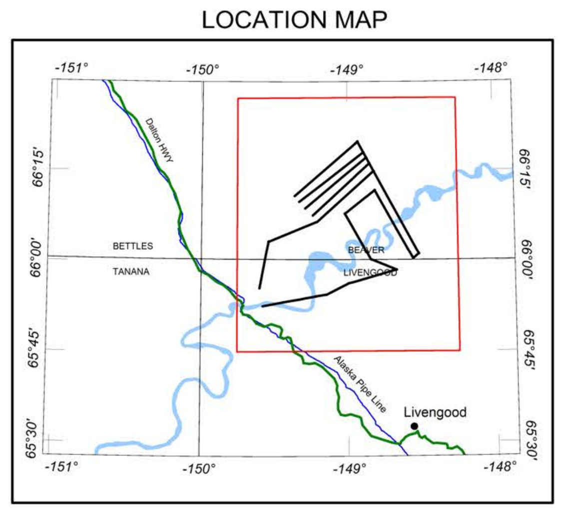
Inclination: 78.0° N
Declination: 18.0° W
IGRF Model Year: 2015

Scale 1:100,000

(miles)

(kilometers)

LOCATION MAP



DESCRIPTIVE NOTES

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RESISTIVITY ALTITUDE LIMITS

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Emond, A.M., Minsley, B.J., Daanen, R.P., Graham, G.C., and
CGG Canada Services Ltd.

SURVEY HISTORY

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National Science Foundation, Office of Polar Programs, Arctic System Science Program, Award #1500931

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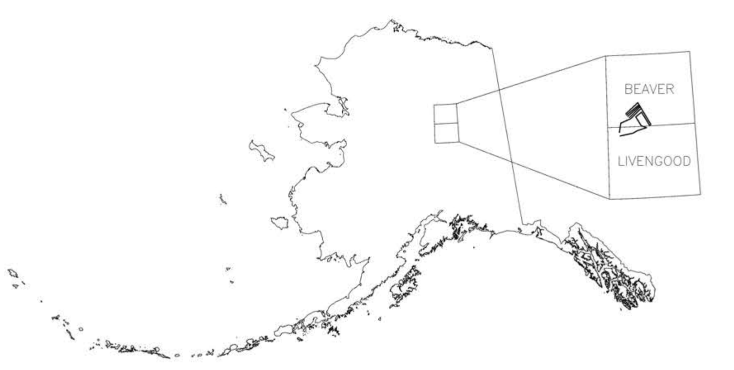
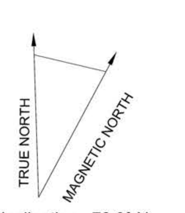
GEOPHYSICAL REPORT 2016-2
1,800 Hz COPLANAR APPARENT RESISTIVITY GRID WITH TOPOGRAPHY; SCALE 1:100,000; SHEET 1 OF 1
QUADRANGLES: LIVENGOOD D-3, D-4, D-5, D-6 BEAVER A-3, A-4, A-5, A-6, B-3, B-4, B-5, B-6



AIRBORNE ELECTROMAGNETIC AND MAGNETIC SURVEY WESTERN YUKON FLATS, INTERIOR ALASKA

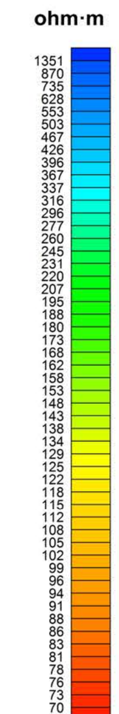
http://doi.org/10.14509/29683

APPARENT RESISTIVITY 1,800 Hz COPLANAR WITH TOPOGRAPHY

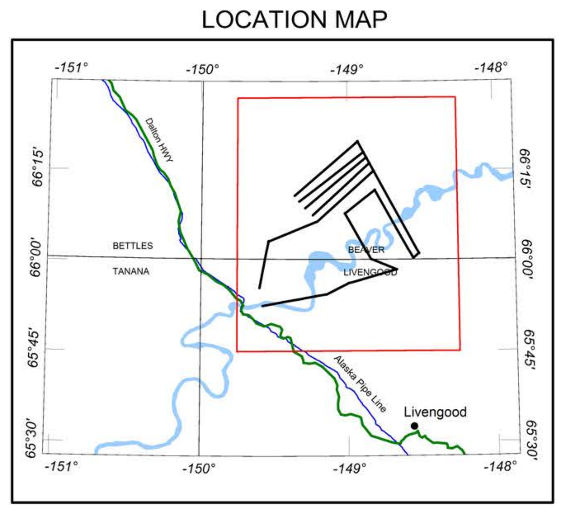


Inclination: 78.0° N
Declination: 18.0° W
IGRF Model Year: 2015

Scale 1:100,000



LOCATION MAP



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ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

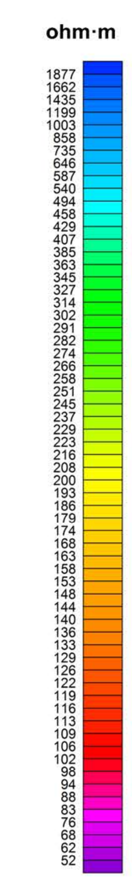
GEOPHYSICAL REPORT 2016-2
3,300 Hz COAXIAL APPARENT RESISTIVITY GRID WITH TOPOGRAPHY; SCALE 1:100,000; SHEET 1 OF 1
QUADRANGLES: LIVENGOOD D-3, D-4, D-5, D-6 BEAVER A-3, A-4, A-5, A-6, B-3, B-4, B-5, B-6

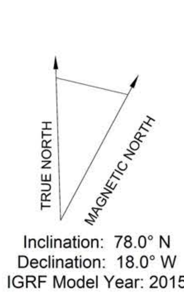
SURVEY LOCATION

AIRBORNE ELECTROMAGNETIC AND MAGNETIC SURVEY WESTERN YUKON FLATS, INTERIOR ALASKA

http://doi.org/10.14509/29683

APPARENT RESISTIVITY 3,300 Hz COAXIAL WITH TOPOGRAPHY





Inclination: 78.0° N
Declination: 18.0° W
IGRF Model Year: 2015

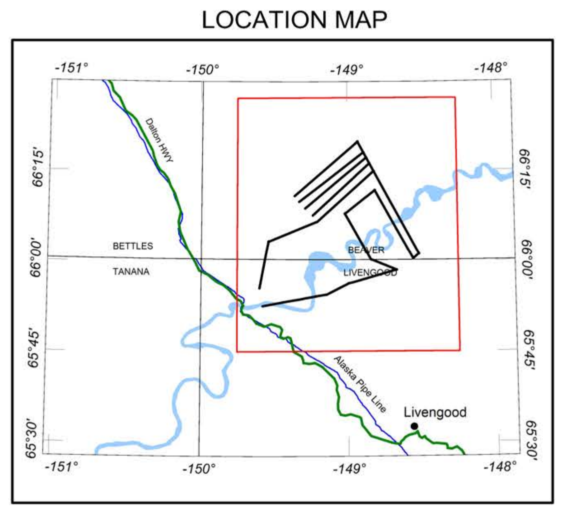
Scale 1:100,000

2 0 2 4 6 (miles)

2 0 2 4 6 (kilometers)

WGS 84 / UTM zone 6N

LOCATION MAP



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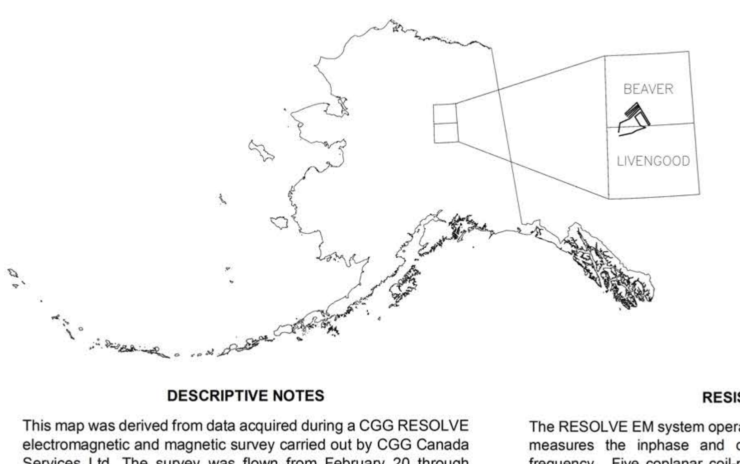
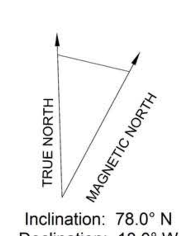
APPARENT RESISTIVITY 8,200 Hz COPLANAR WITH TOPOGRAPHY

Emond, A.M., Minsley, B.J., Daanen, R.P., Graham, G.C., and
CGG Canada Services Ltd.

SURVEY LOCATION

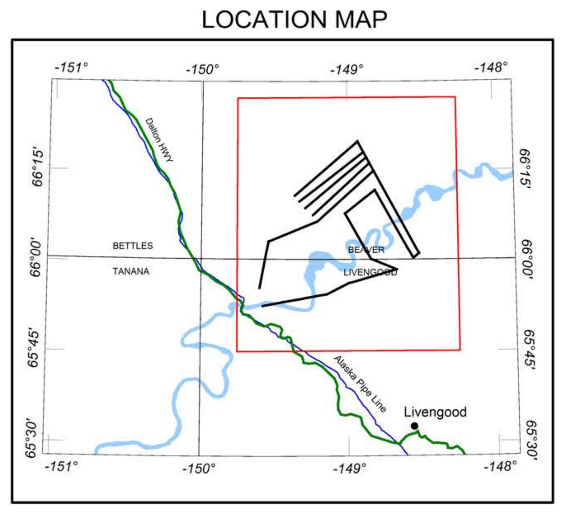




Inclination: 78.0° N
Declination: 18.0° W
IGRF Model Year: 2015

Scale 1:100,000

LOCATION MAP



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RESISTIVITY ALTITUDE LIMITS

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SURVEY HISTORY

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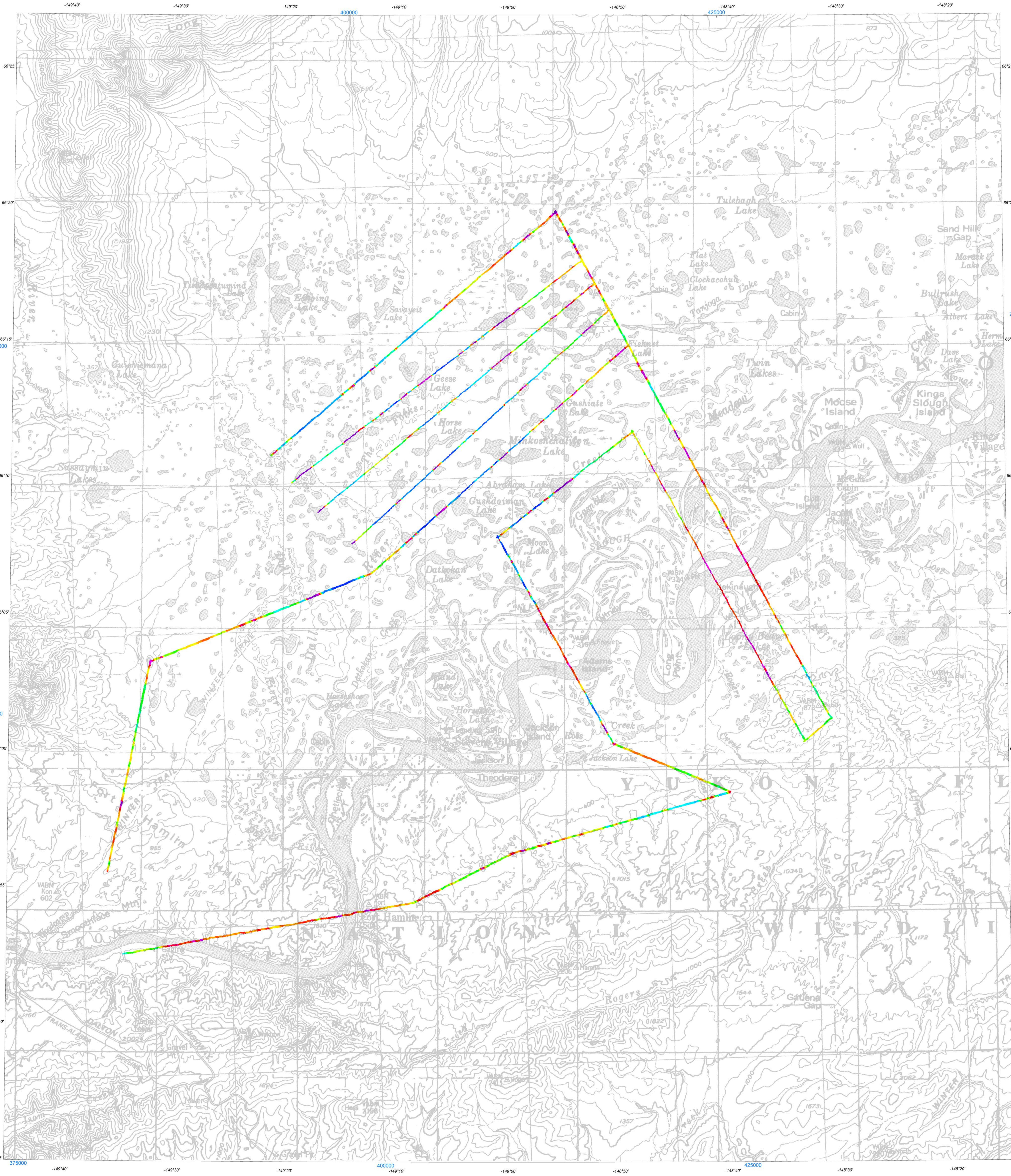
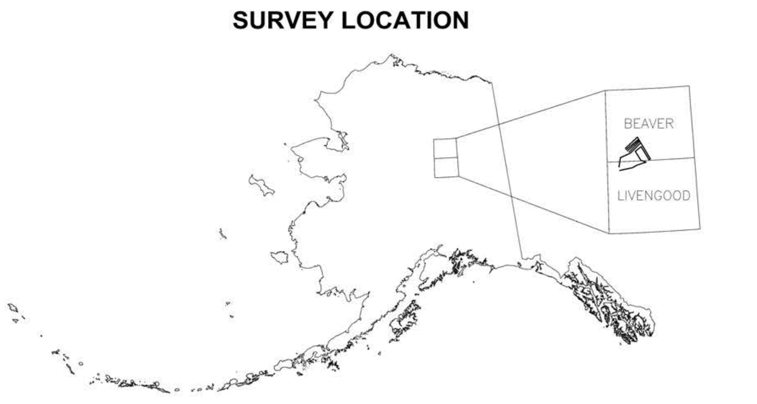


SURVEY LOCATION



AIRBORNE ELECTROMAGNETIC AND MAGNETIC SURVEY WESTERN YUKON FLATS, INTERIOR ALASKA

http://doi.org/10.14509/29683

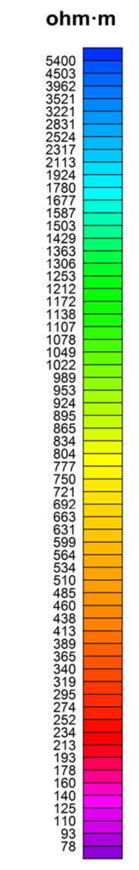
APPARENT RESISTIVITY 40,000 Hz COPLANAR WITH TOPOGRAPHY

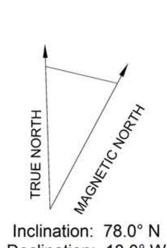
UAF UNIVERSITY OF ALASKA FAIRBANKS · STATE OF ALASKA · NATIONAL SCIENCE FOUNDATION

Scale 1:100,000

(miles)

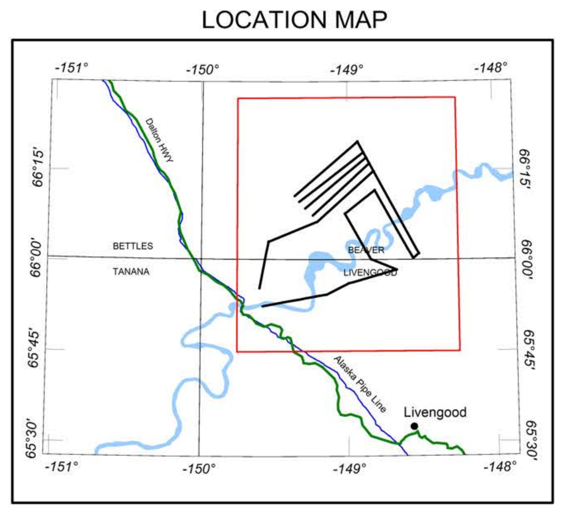
(kilometers)





Inclination: 78.0° N
Declination: 18.0° W
IGRF Model Year: 2015

LOCATION MAP



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Emond, A.M., Minsley, B.J., Daanen, R.P., Graham, G.C., and CGG Canada Services Ltd.

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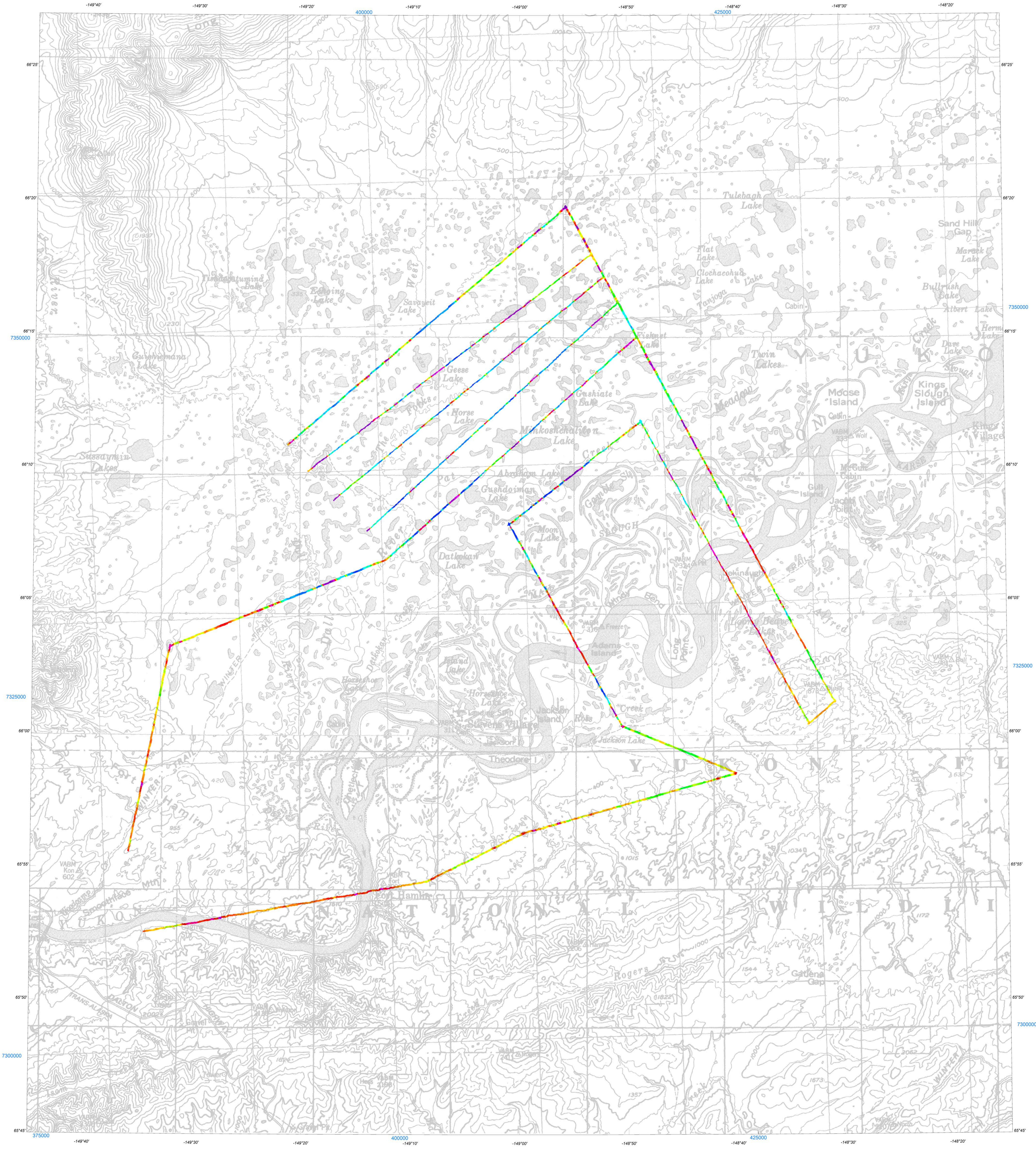
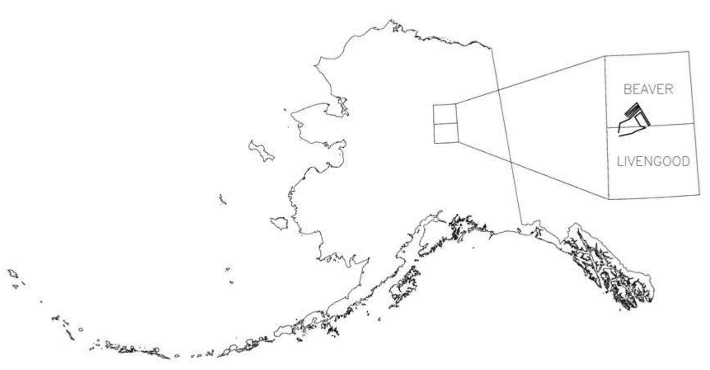
ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

GEOPHYSICAL REPORT 2016-2
140,000 Hz COPLANAR APPARENT RESISTIVITY GRID WITH TOPOGRAPHY; SCALE 1:100,000; SHEET 1 OF 1
QUADRANGLES: LIVENGOOD D-3, D-4, D-5, D-6 BEAVER A-3, A-4, A-5, A-6, B-3, B-4, B-5, B-6



SURVEY LOCATION



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http://doi.org/10.14509/29683

APPARENT RESISTIVITY 140,000 Hz COPLANAR WITH TOPOGRAPHY

Inclination: 78.0° N
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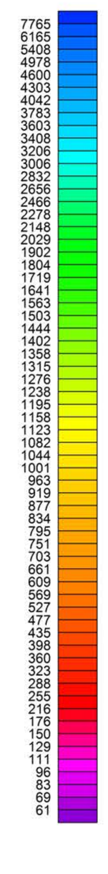
IGRF Model Year: 2015

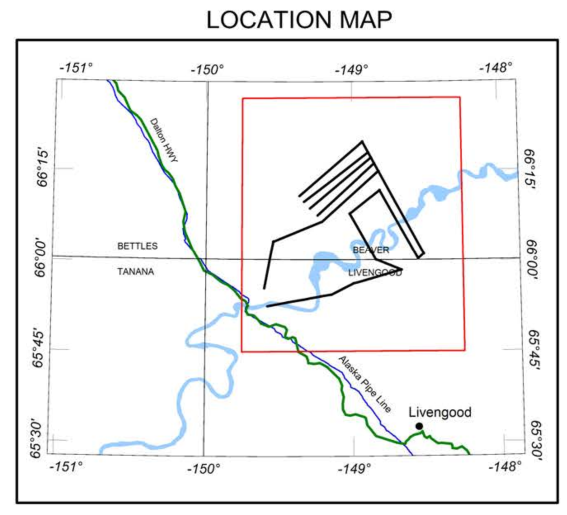
Scale 1:100,000

Emond, A.M., Minsley, B.J., Daanen, R.P., Graham, G.C., and
CGG Canada Services Ltd.

ohm·m



LOCATION MAP



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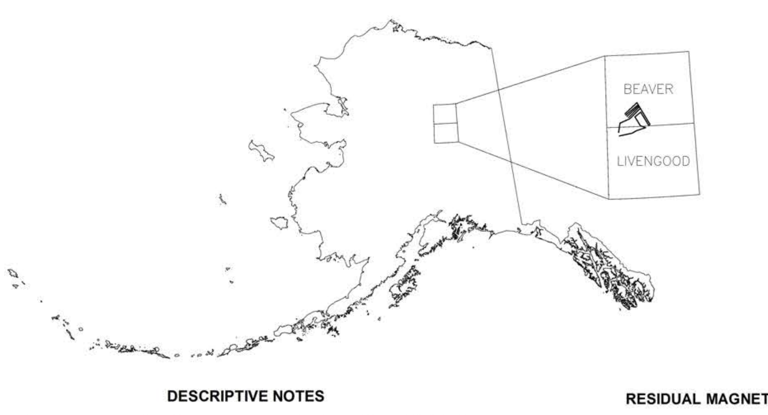

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RESIDUAL MAGNETIC INTENSITY

The magnetic total field data were processed using digitally recorded data from a CGG D1344 base station 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 base station magnetic data, (2) IGRF corrected (IGRF model 2015, updated for data of flight and altimeter variations), and (3) leveled using the tie line data.

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http://doi.org/10.14509/29683

RESIDUAL MAGNETIC INTENSITY WITH TOPOGRAPHY

Scale 1:100,000

(miles)

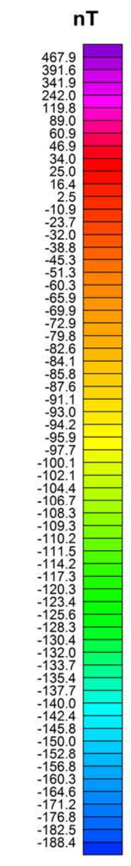
(kilometers)

WGS 84 / UTM zone 6N

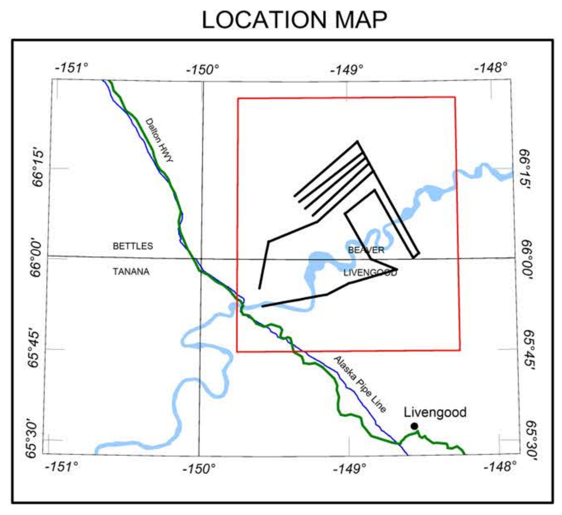
Emond, A.M., Minsley, B.J., Daanen, R.P., Graham, G.C., and CGG Canada Services Ltd.

TRUE NORTH
MAGNETIC NORTH

Inclination: 78.0° N
Declination: 18.0° W
IGRF Model Year: 2015



LOCATION MAP



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