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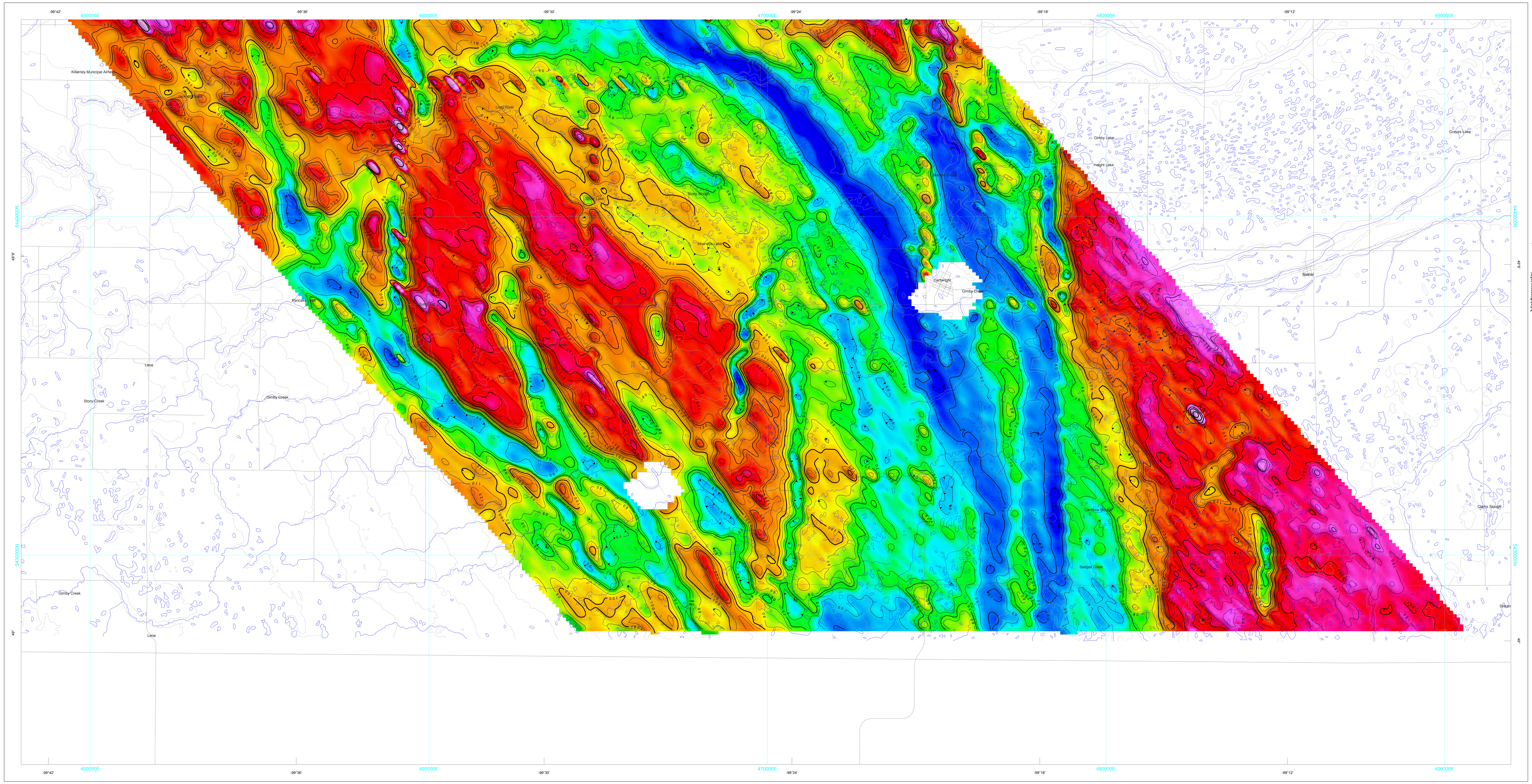
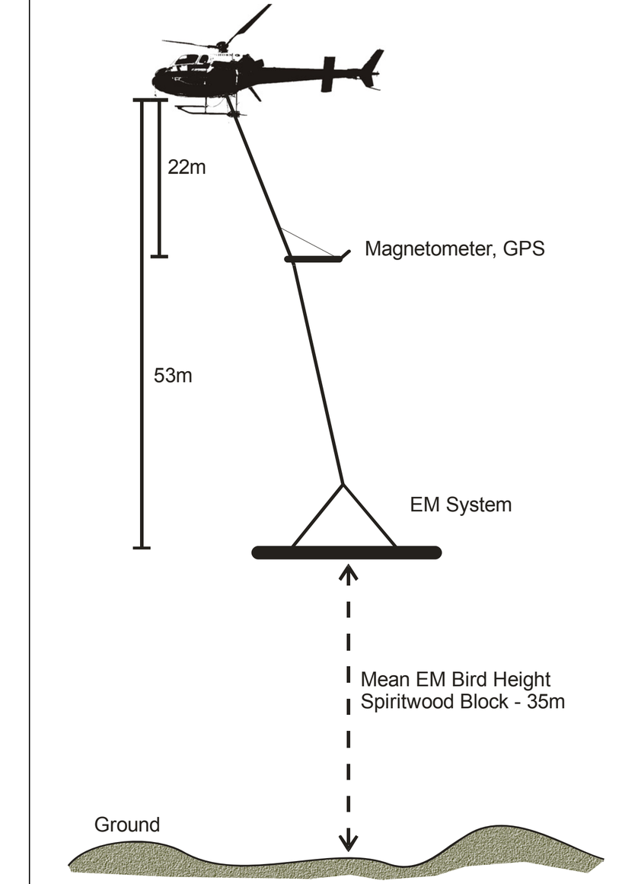
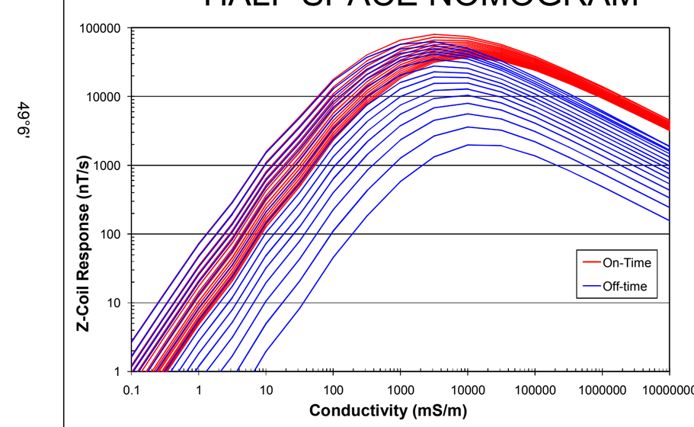
GEOLOGICAL SURVEY OF CANADA   COMMISSION GÉOLOGIQUE DU CANADA

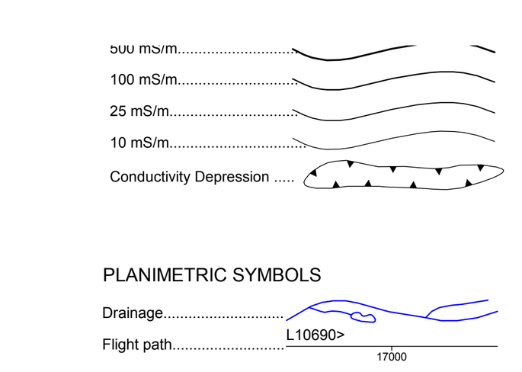


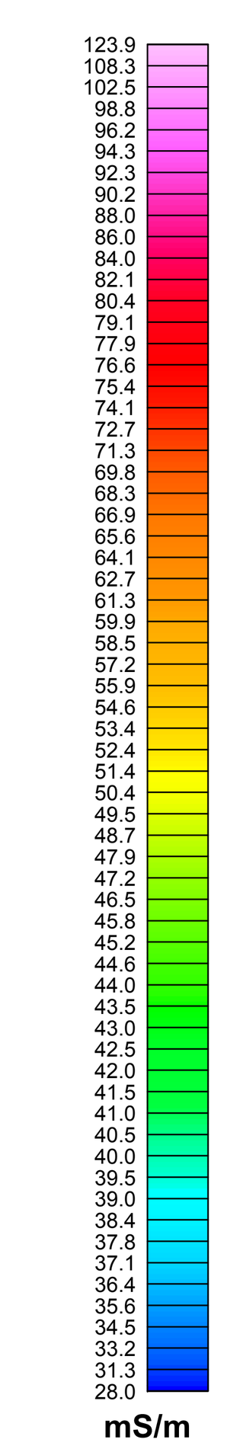
SYSTEM CONFIGURATION



HALF SPACE NOMOGRAM







DESCRIPTIVE NOTES

INTRODUCTION

This map was compiled from data acquired during an airborne electromagnetic/magnetic survey carried out by Aeroquest Surveys using a helicopter-borne AeroTEM III time-domain electromagnetic (EM) system and a Geometrics G823A Caesium magnetometer. The survey and associated calibrations were carried out during the period from February 26 to March 28, 2010.

Traverse lines were flown at approximately 50° at 400 m spacing. Control lines were flown at approximately 320° at 5000 m spacing. The survey was flown as two blocks and the data were merged by Aeroquest Surveys into a single dataset for map presentation.

EM system elevation was maintained at a nominal mean terrain clearance of 30 m. Navigation was performed using on-board real-time differential GPS and aircraft height was monitored with a radar altimeter. A vertically-mounted video camera was used to record images of the ground. The EM and magnetic data were acquired at a rate of 10 Hz.

The time-domain EM system transmits a time-varying electromagnetic signal from a horizontal loop and measures the associated time rate of change of the secondary magnetic field that results from electrical current induced in the earth. The EM system records x and z components of dB/dt over 16 gates during the transmitter on time and 17 gates during the transmitter off time. System operating frequency was 90 Hz.

RESIDUAL TOTAL MAGNETIC FIELD

The magnetic field data were corrected for lag and diurnal variations, levelled to the control lines and microlevelled to remove long wavelength (>2 km) variations parallel to survey lines with amplitudes less than +/-2 nT. The levelled data were interpolated using bidirectional gridding onto a regular 100 m grid. The International Geomagnetic Reference Field was removed from the total magnetic field using the model for 2010 (IGRF) computed at a constant altitude of 66 m.

EM DECAY CONSTANT

The EM decay constant is computed using an exponential fit to the off-time z component of dB/dt. Multiple decay constants were calculated from a series of time gates extracted from the levelled EM data at each measurement location. Individual decay constants were interpolated using bidirectional gridding onto a series of regular 100 m grids. The mapped decay constant is for channels 5–8 from 209.0–431.2 μs after transmitter turn off. The decay constant is a reflection of the decay rate and a function of the electrical conductivity: a high decay constant corresponds to a slow rate of decay and high conductivity.

APPARENT CONDUCTIVITY

Apparent conductivity is computed using the on- and off-time z component of dB/dt. Multiple apparent conductivities were calculated from a series of time gates extracted from the levelled EM data at each measurement location. Conductivity values were determined using a table look-up procedure based on the analytical solution over a homogenous halfspace (Huang and Rudd, 2008). Individual apparent conductivities were interpolated using bidirectional gridding onto a series of regular 100 m grids. The mapped on-time apparent conductivity is for channels 4–6 from 195.9–251.4 μs after current switching. The mapped off-time apparent conductivity is for channels 6–8 from 264.5–431.2 μs after transmitter turn off.

The EM system responds to conductive geologic and cultural sources. Identification of natural conductors is based on the decay curves, response patterns, and topography. Identification of cultural responses is possible by examining the power line monitor and the flight track video.

REFERENCES

Huang, H., and Rudd, J., 2008. Conductivity-depth imaging of helicopter-borne TEM data based on a pseudolayer half-space model; Geophysics; 73; F115-F120.

SURVEY PARAMETERS

AIRCRAFT
- Type: SA 315B
- Registration: C-GWAO

MAGNETOMETER
- Type: Geometrics G823A caesium-vapour
- Sensitivity: 0.001 nT
- Noise level: +/- 0.004 nT
- Sample interval: 10 readings per second
- Sensor location: 22 m below aircraft

ELECTROMAGNETIC SYSTEM
- Type: Aerotem III
- Base frequency: 90 Hz
- Current waveform: bipolar triangular
- Peak dipole moment: 237,000 NIA
- Pulse width: 1750 μsec
- Off-time: 3805 μsec
- Pulse repetition: 90 current cycles per second, 2 pulses per cycle
- Parameters: X and Z-components of dB/dt
- Noise levels: +/- 10 nT/s
- Sample interval: 10 readings per second
- Bird location: 53 m below aircraft

NAVIGATION SYSTEM
- GPS receiver: MID-TECH RX400p
- GPS sample interval: 10 readings per second (10 Hz)
- Radar altimeter: Terra TRA3000/TRI-30
- Radar sample interval: 10 readings per second
- Video flight path recorder: Archos 605 WiFi

BASE STATION
- Magnetometer: Geometrics G859 and AQL Base Station
- Magnetometer sample interval: 1 reading per second (1 Hz)

SURVEY SPECIFICATIONS
- Survey date: February 26 to March 28, 2010
- Nominal aircraft terrain clearance: 88 m
- Traverse line spacing: 400 m
- Control line spacing: 5000 m
- Traverse line direction: 50° azimuth
- Control line direction: 320° azimuth

Contribution to the Groundwater Geoscience Program of the Earth Sciences Sector, Natural Resources Canada.

GSC OPEN FILE 6663

OFF-TIME APPARENT CONDUCTIVITY

AeroTEM III SURVEY, Spiritwood Valley, MANITOBA

Parts of NTS 62G/3, 62G/4
MANITOBA

Scale 1:50,000
(kilometres)
NAD83 / UTM zone 14N

Universal Transverse Mercator Projection
North American Datum 1983

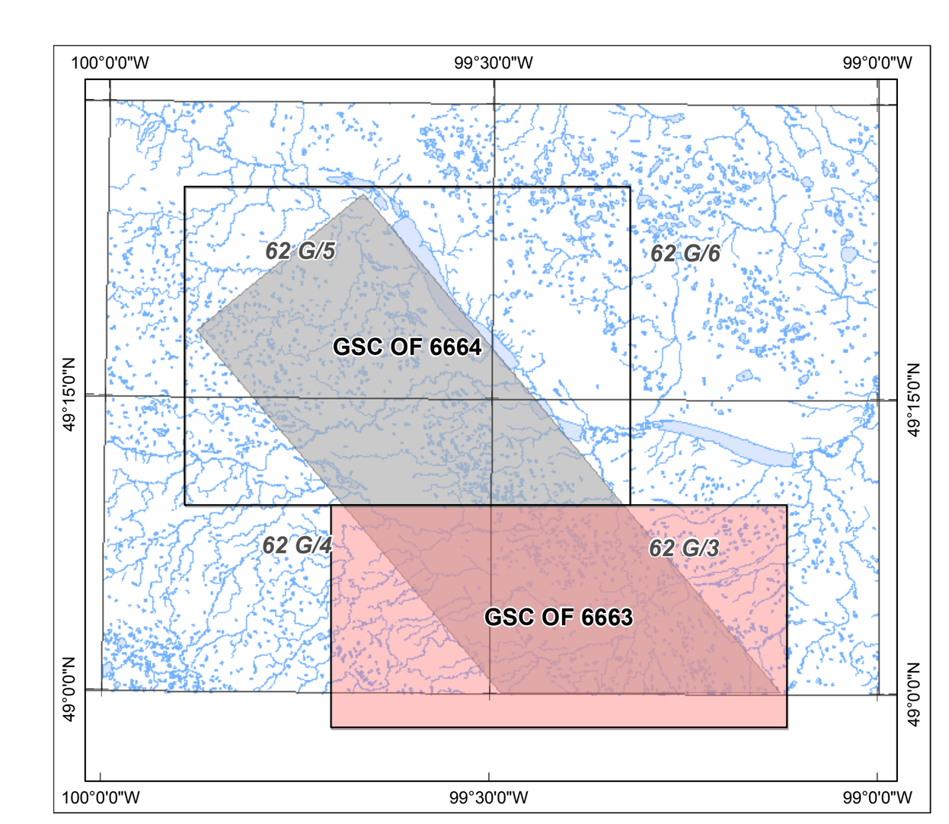
Digital topographic data provided by
Geomatics Canada, Natural Resources Canada

Topographic contour interval: 20 metres

Author: Greg A. Oldenborger
Data acquisition, compilation and map production by
Aeroquest Surveys, Mississauga, Ontario. Contract and project management by the
Geological Survey of Canada, Ottawa, Ontario.

MAP SHEET SUMMARY	
GSC Sheet	Map
1	Residual Total Magnetic Field
2	Electromagnetic Decay Constant
3	On-time Apparent Conductivity
4	Off-time Apparent Conductivity

SURVEY BLOCK AND OPEN FILE INDEX



MAP LOCATION

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DOSSIER PUBLIC
6663
GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA
2010
SHEET 4 OF 4
FEUILLET 4 DE 4

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Les dossiers publics sont des produits qui n'ont pas été soumis au processus officiel de publication de la CGC.

Recommended citation:

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AeroTEM III Survey, Spiritwood Valley, Manitoba, parts of NTS 62G/3, 62G/4;
Geological Survey of Canada, Open File 6663; Scale 1:50 000.

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