Natural Resources Canada / Ressources naturelles Canada

Yukon Geological Survey

TIME DECAY CONSTANT (TAU-Z) - EARLY CHANNELS 4 - 14 (0.018 ms - 0.103 ms)

Technical Information

This map was compiled from data acquired during an airborne electromagnetic/magnetic survey carried out by Geotech Ltd. utilizing a VTEM Plus™ Time-Domain Electromagnetic (TDEM) system. The system was mounted on a Eurocopter AS350 B3 helicopter (registration C-FVTM) and was carried out between March 31 and June 21, 2016. The helicopter flight altitude was maintained at an average ground clearance of 132 m with an average speed of 95 km/h. Aircraft navigation used a 12-channel NovaTel dual frequency GPS. Post-flight differential corrections were applied to finalize flight path position. A vertically mounted video camera was used to record images of the ground. The radar height was recorded ten times per second using a Terra altimeter and the barometric altitude was recorded five times per second using a Honeywell precision pressure transducter. The magnetic gradient data were recorded 10 times per second using two Geometrics G822-A cesium magnetometers separated by 12.5 m.

Electromagnetics

The TDEM system operating at a base frequency of 30 Hz transmits a 5.41 ms square signal from a four-turn, 531 m^2 horizontal loop mounted approximately 31.0 m below and 28 m behind the helicopter. This configuration generates a dipole moment of 470 000 Am^2. The response of conductors in the subsurface is recorded at 192 kHz over the entire waveform using a three axis (X, Y and Z) electromagnetic receiver coincident with the transmitter loop (In-Loop Transmitter-Receiver). The EM system records data in a continuous stream for each of the three components. The EM receiver directly measures the change in the magnetic field with respect to time (dB/dt) from which the secondary total magnetic field (B) is numerically integrated. High-altitude background sections flown at the start and end of each flight allow a 1st-order removal of system drift.

Apparent Conductivity

The apparent conductivity values (mS/m) were derived from the electromagnetic decays using selected early channels 4 to 14 (0.018 ms to 0.103 ms), middle channels 15 to 30 (0.103 ms to 0.945 ms) and late channels 31 to 46 (0.945 ms – 8.685 ms) of the off-time signal. The algorithm is based on the scheme of the apparent resistivity transform of Meju (1998) and the time domain electromagnetic response from the conductive half-space. The software was developed by Geotech Ltd. and depth calibrated based on forward plate modelling for the VTEM system configuration. The nomogram indicates the correspondence between the amplitude of the signal Z dB/dt (nT/s) and the half-space conductivities.

Electromagnetic Decay Constant

Decay constant (Tau) values are obtained by fitting the data from selected early channels 4 to 14 (0.018 ms to 0.103 ms), middle channels 15 to 30 (0.103 ms to 0.945 ms) and late channels 31 to 46 (0.945 ms – 8.685 ms) of the off-time signal to a single exponential. In semi-log space, the slope of this function will reflect the exponential decay rate of the transient field and, therefore, the strength of the conductivity. A slow rate of decay, reflecting a high conductivity, will be represented by a high decay constant value.

Magnetics

The magnetic field was sampled 10 times per second using a cesium vapour magnetometer (sensitivity = 0.005 nT) mounted 7 m above the EM transmitter loop. Differences in magnetic values at the intersections of control and traverse lines were analysed to obtain a mutually levelled set of flight-line magnetic data. The levelled values were then interpolated to a 50 m grid. The International Geomagnetic Reference Field (IGRF) defined at a mean GPS altitude (1375 m) for a constant mid-survey date (May 11, 2016) was then removed. Removal of the IGRF, representing the magnetic field of Earth's core, produces a residual component related essentially to magnetizations within Earth's crust.

The first vertical derivative of the magnetic field is the rate of change of the magnetic field in the vertical direction. Computation of the first vertical derivative removes long-wavelength features of the magnetic field and significantly improves the resolution of closely spaced and superposed anomalies. A property of first vertical derivative maps is the coincidence of the zero-value contour with vertical contacts at high magnetic latitudes (Hood, 1965). The first vertical derivative of the magnetic field was calculated using the fast Fourier transform on the gridded total magnetic field with a grid cell size of 50 m.

Digital versions of this map are available for free download through GEOSCAN (http://geoscan.nrcan.gc.ca/). Corresponding digital profile and gridded data as well as similar data for adjacent airborne geophysical surveys can be downloaded, at no charge, from Natural Resources Canada's Geoscience Data Repository for Geophysical Data at http://gdr.agg.nrcan.gc.ca/index_e.html. The same products are also available, for a fee, from the Geophysical Data Centre, Geological Survey of Canada, 601 Booth Street, Ottawa, Ontario K1A 0E8. Telephone: (613) 995-5326, email: infogdc@nrcan.gc.ca.

Copies of this map may also be obtained from the Yukon Geological Survey, Energy, Mines and Resources, Government of Yukon, P.O. Box 2703 (K-102), Whitehorse, Yukon, Y1A 2C6. Telephone: (867) 667-3201, email: geology@gov.yk.ca, website: http://www.geology.gov.yk.ca.

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References

Hood, P.J., 1965. Gradient measurements in aeromagnetic surveying; Geophysics, v. 30, p. 891-902.

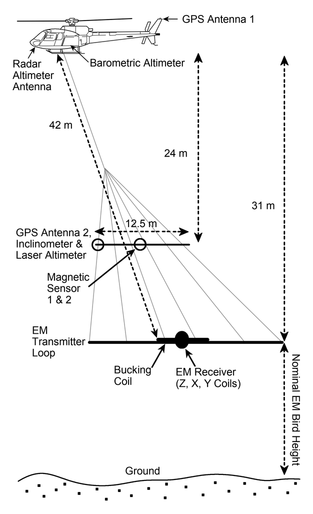
Meju, M.A., 1998. A simple method of transient electromagnetic data analysis; Geophysics, v. 63, p. 405-410.

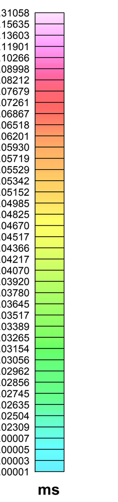
Survey Area Parameters:

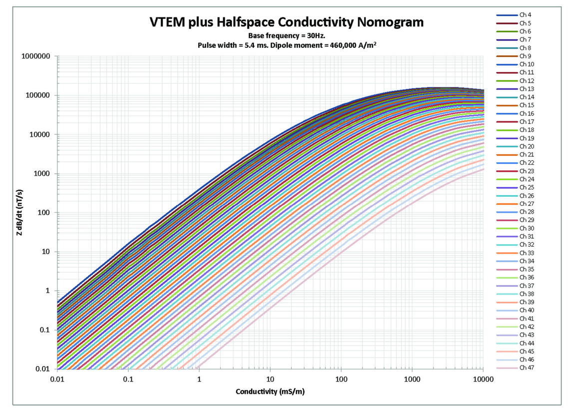
Parameter	
Traverse line azimuth	90°
Traverse line spacing	200 m
Tie line azimuth	0°
Tie line spacing	1200 m
Aircraft average clearance	132 m
EM transmitter nominal clearance	101 m
Magnetic sensor nominal clearance	108 m
EM Receiver nominal clearance	101 m

Electromagnetic System Specifications:

Base Frequency	30 Hz
Waveform	Bi-polar trapezoid
Transmitter Pulse width	5.41 ms
Transmitter Area/Effective Area	530.9 m^2 / 2123.7 m^2
Transmitter Off-time	11.17 ms
Transmitter Loop diameter	26 m
Transmitter Current	221 A
Dipole moment (approximately)	470 00 Am^2 (4 turns)
Windowed data sampling rate	10 Hz
Receiver	3-component induction coil (Z, X, Y)
Z and X-Y coils diameter(# turns)	1.2 m (100 turns) & 0.32 m (245 turns)
Measured Response	Voltage (dB/dt)
Digital recording	Z: 4-46 channels; X,Y: 20-46 channels
1st off-time Z channel	Channel 4 at ~0.021 ms after pulse turn off
Tx-Rx Configuration	In-loop Tx-Rx







PLANIMETRIC SYMBOLS

- Drainage
- Topographic Contours (Contour Interval = 20 m)
- Building
- Trail
- Flight Path (62500, L12370>)
- Project Limit

- Sheet 1: Time Decay Constant (Tau-Z) – Early Channels 4 - 14 (0.018 ms - 0.103 ms)
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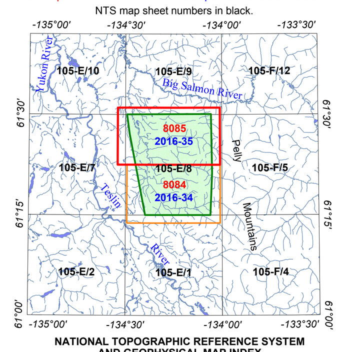
MAP LOCATION

GSC open file numbers in red. YGS open file numbers in blue.
NTS map sheet numbers in black.



NATIONAL TOPOGRAPHIC REFERENCE SYSTEM AND GEOPHYSICAL MAP INDEX

GSC OPEN FILE 8085 / YGS OPEN FILE 2016-35

ELECTROMAGNETIC SURVEY OF THE LIVINGSTONE CREEK AREA

YUKON
Parts of NTS 105-E/7, 8, 9 and 10

TIME DECAY CONSTANT (TAU-Z) EARLY CHANNELS 4 - 14 (0.018 ms - 0.103 ms)

Scale 1:20 000
250 0 250 500 750 1000 1250 1500
(metres)

Map projection Universal Transverse Mercator, zone 8. World Geodetic System 1984

Topographic data from Natural Resources Canada
Contour interval 20 metres

OPEN FILE / DOSSIER PUBLIC
8085
GEOLOGICAL SURVEY OF CANADA
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2016
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Canada

Yukon Energy Mines and Resources

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