Inversion of SkyTEM data over an ultramafic hosted Ni-Cu deposit in Greenland

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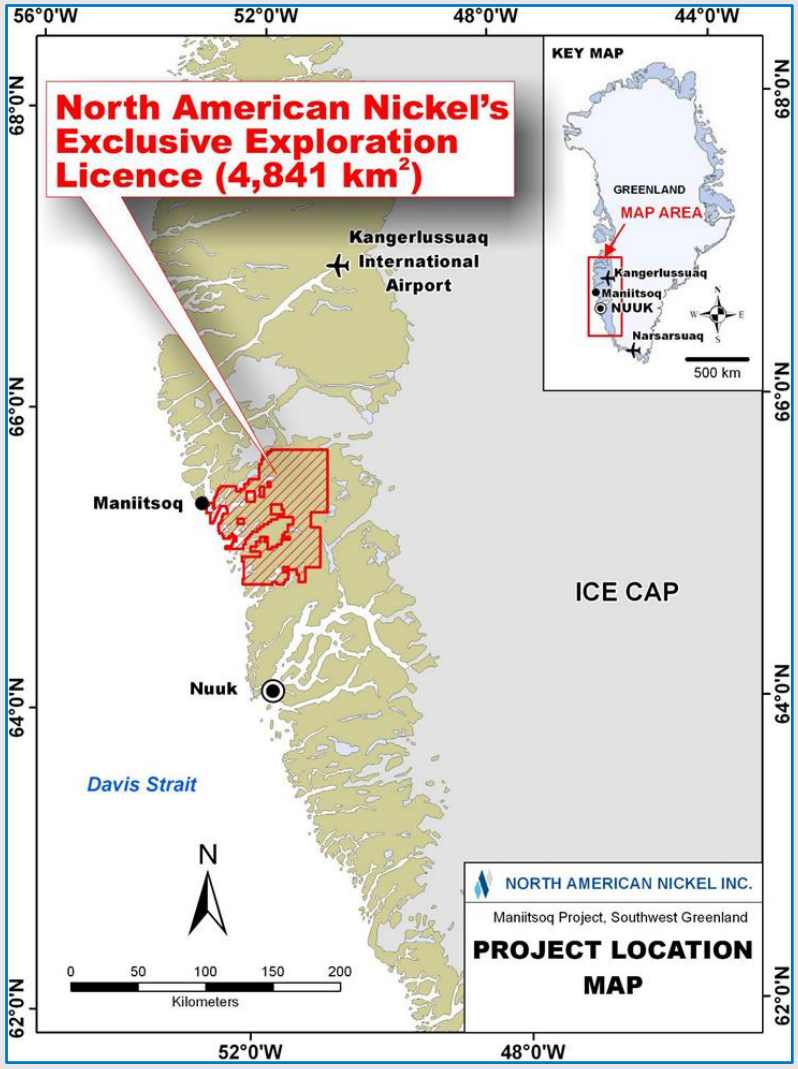
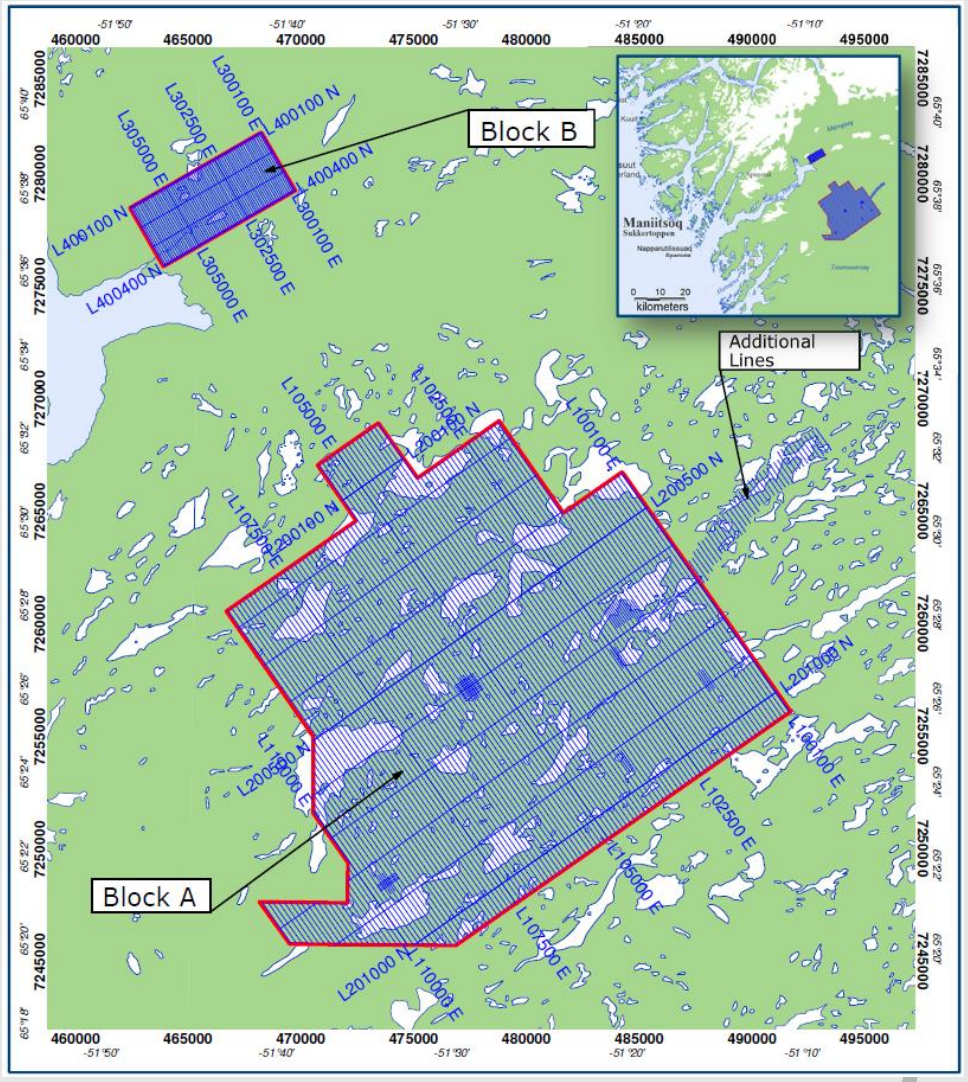
Why Greenland Example ?

Survey area & Survey lines





SKYTEM

SkyTEM^{304} time-domain (TDEM) System

Engineered specially to map subtle resistivity contrasts at near surface and at depth

Advantages include:

Dual Moment

- **Low Moment (LM)** mode, 3,000NIA, to record early time gates and near-surface information
- **High Moment (HM)** mode, 150,000 NIA, high signal-to-noise ratio at late time gates.

Fast transmitter turn off

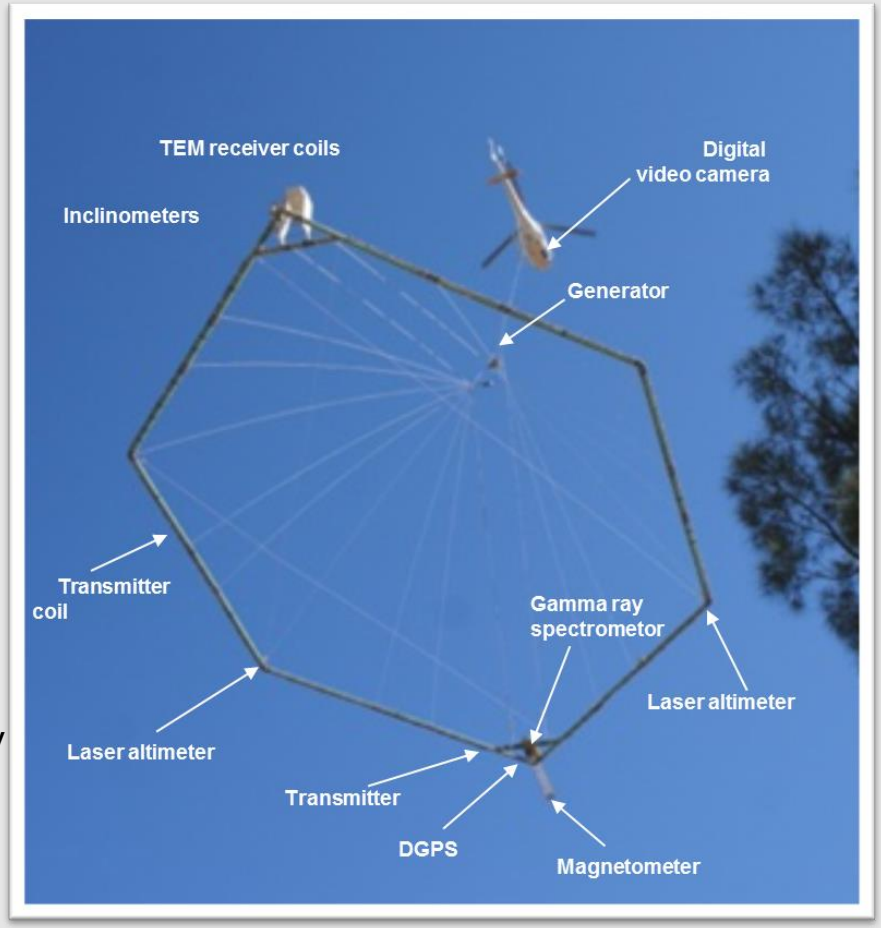
- Early times – 1st usable gate at 7 μsec for mapping near surface data.
- Late times-bias-free data as late as 10 ms for mapping at depth

Low noise

- Receiver coil in a null position minimizes intensity of the primary field.

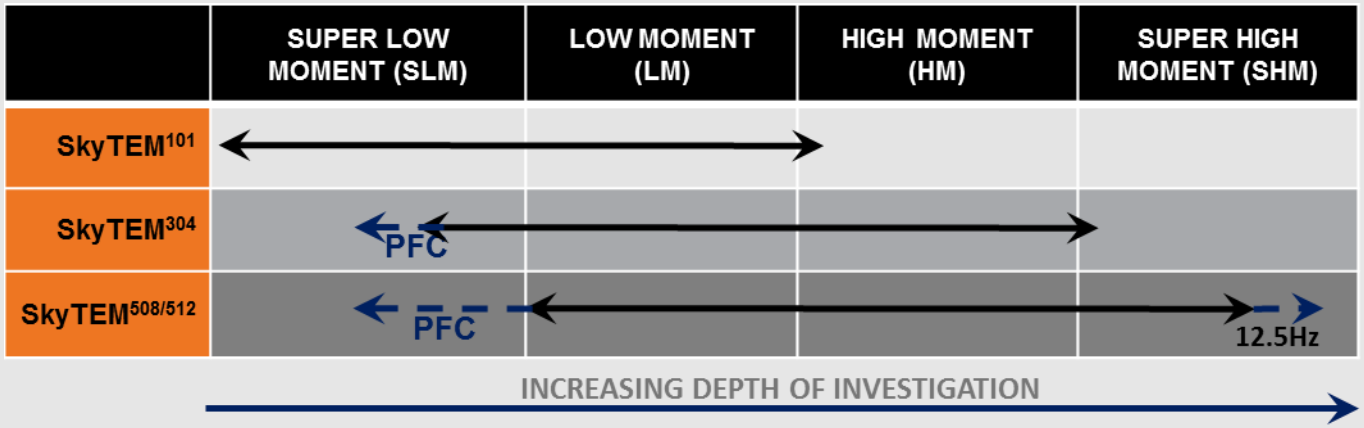
Accurate measurements

- All sensors mounted on the rigid carrier frame



SkyTEM Systems

- Systems for shallow, intermediate or deep mapping
  - ✓ **SkyTEM^{101}** – Very near surface
  - ✓ **SkyTEM$^{302/304}$** – Intermediate depths
  - ✓ **SkyTEM$^{508/512}$** – Deep targets
- Recent Developments – Pimary Field Compensation (PFC)



Working under all conditions

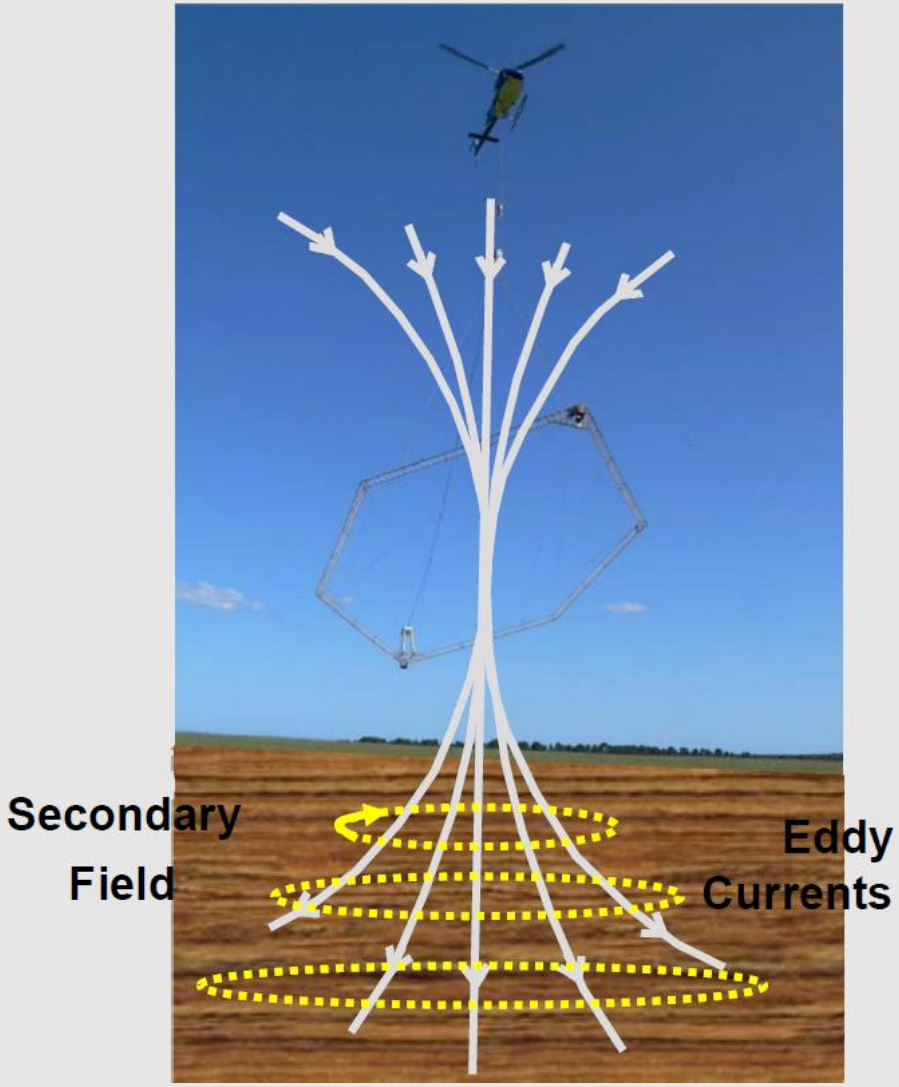
Hot and dusty

Hot and humid

Cold and remote

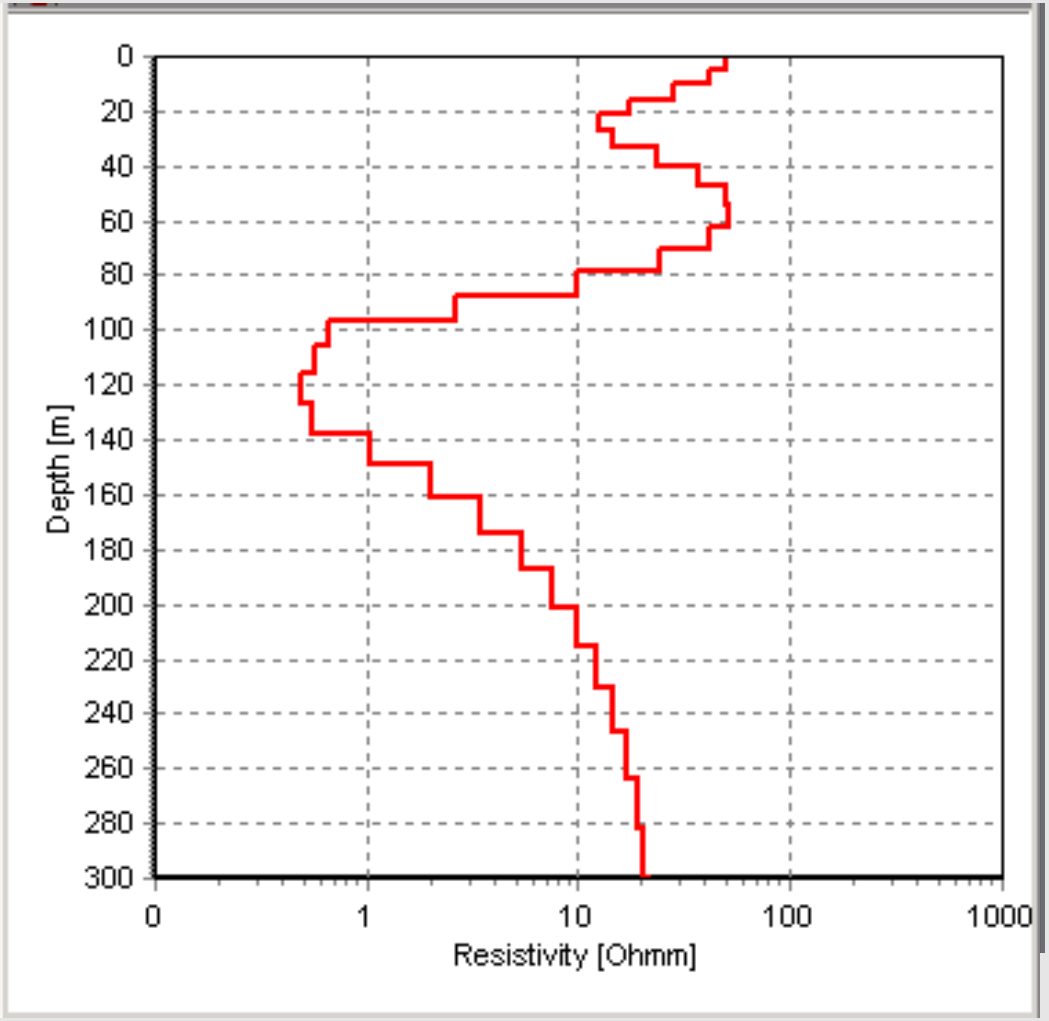
SkyTEM is the first airborne geophysical system to be selected to map in Antarctica

Basics of Airborne EM

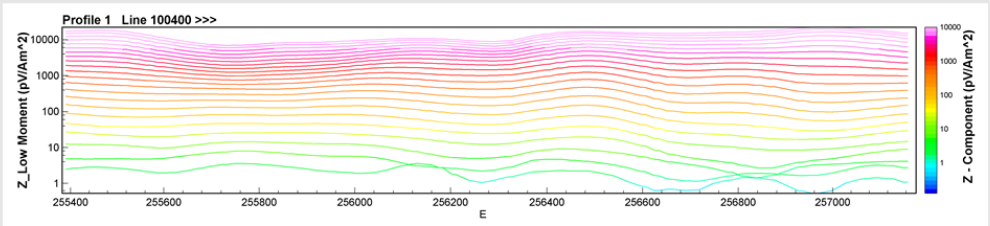


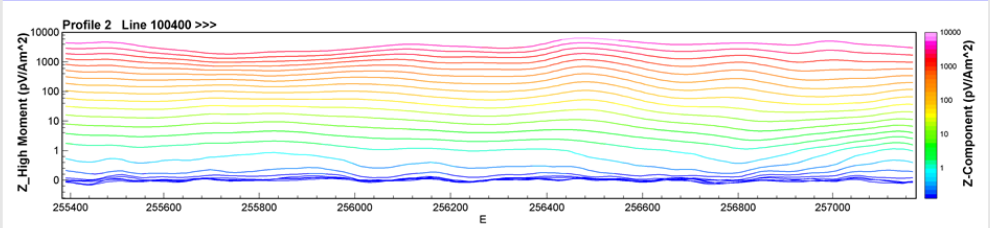
EM Responses

1-D Depth-Resistivity Model



Data Presentation (Example)





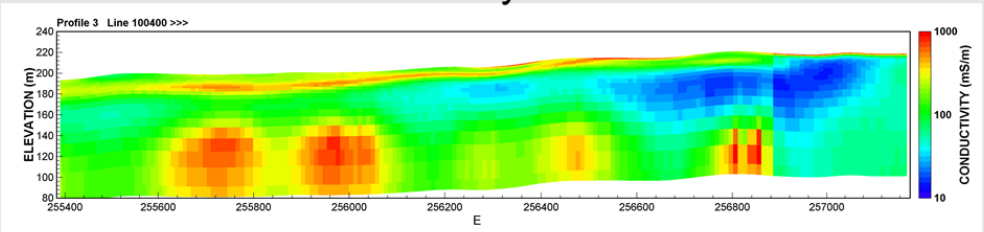
EM Profile Response

↓

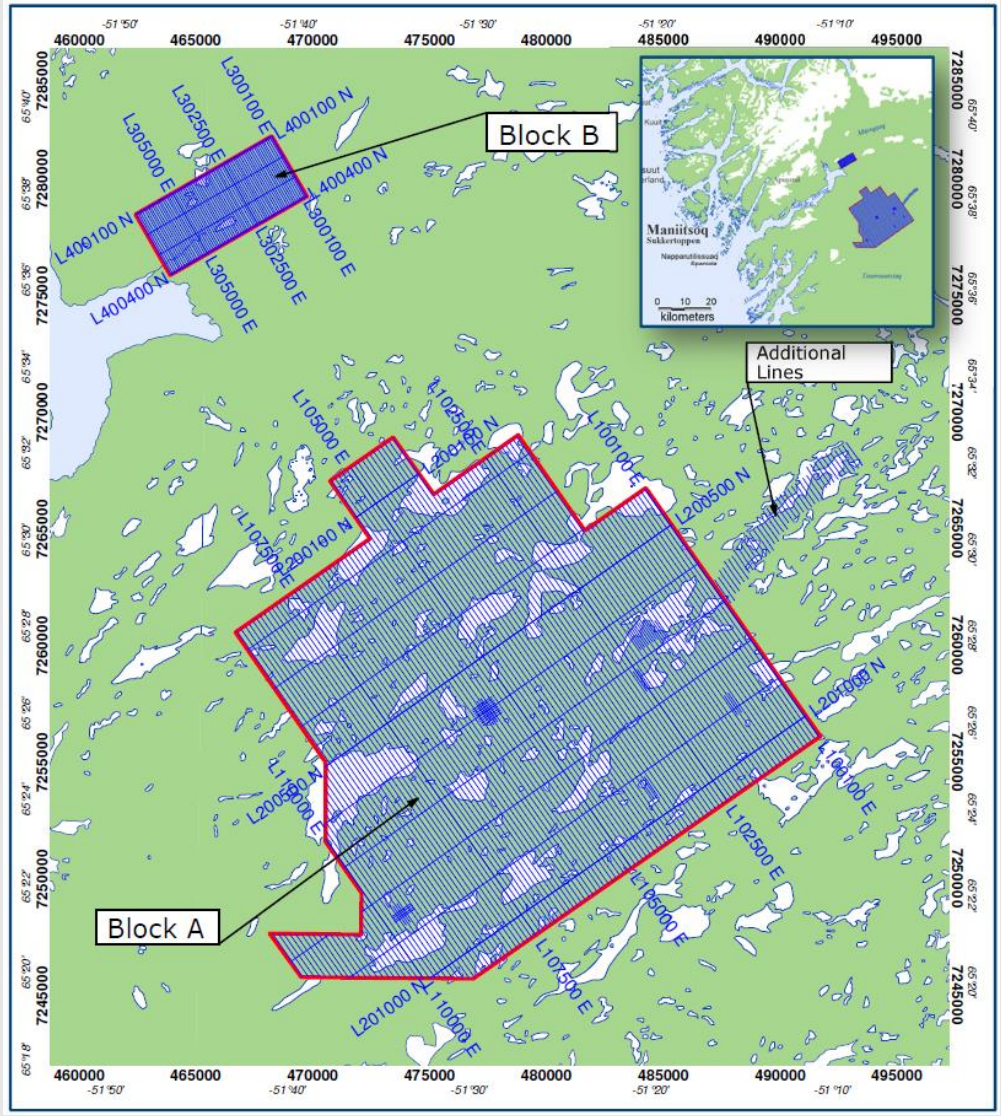
INVERSION

↓

Conductivity Section



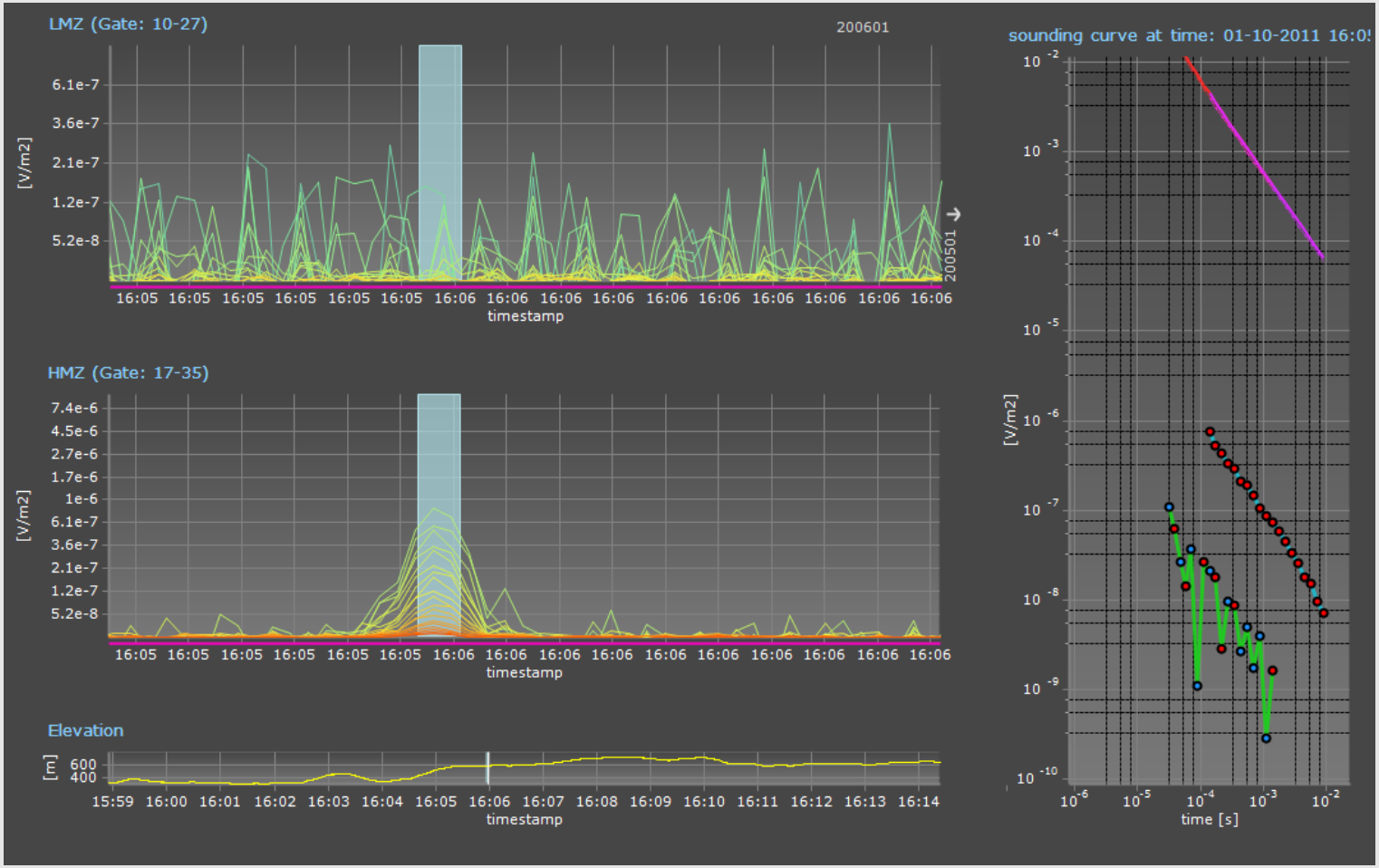
Survey Lines



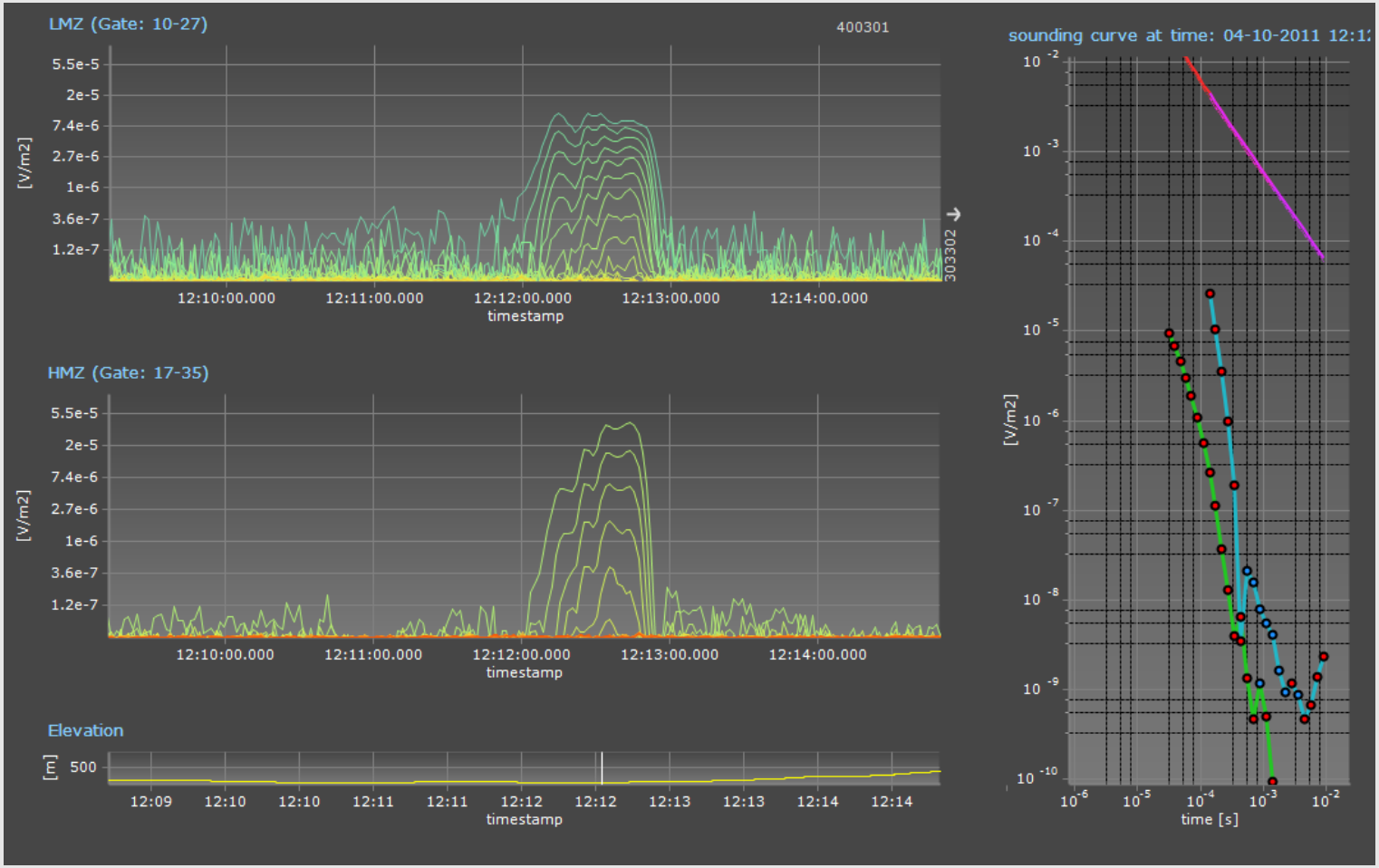
L101201 – Block A

SKYTEM

L200601 – Block A



L400301 Block-B



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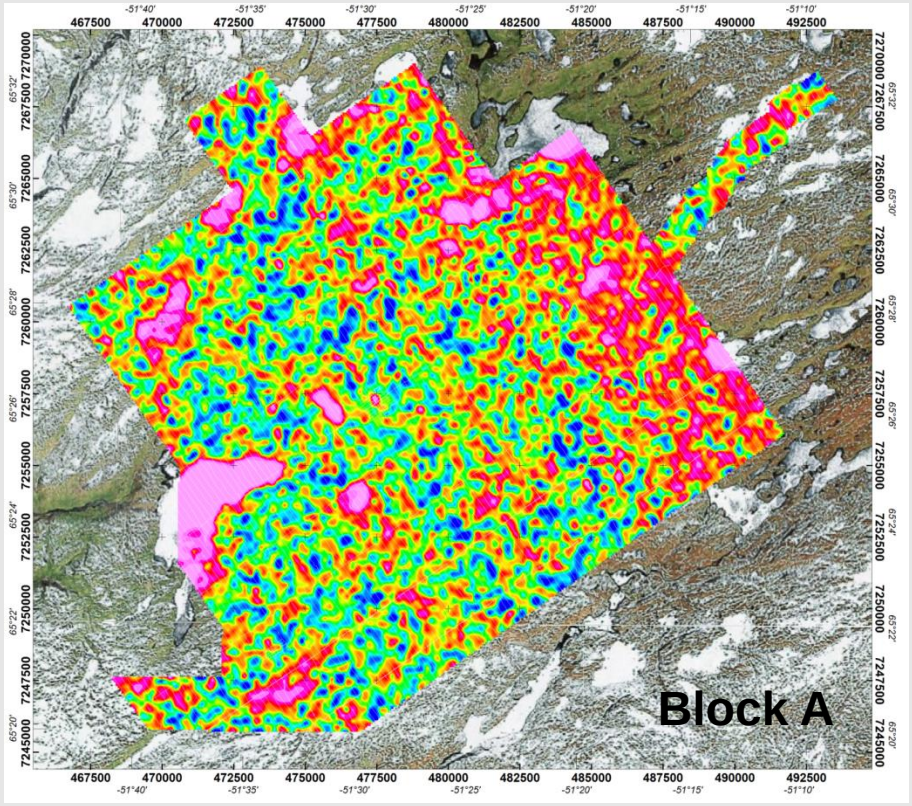
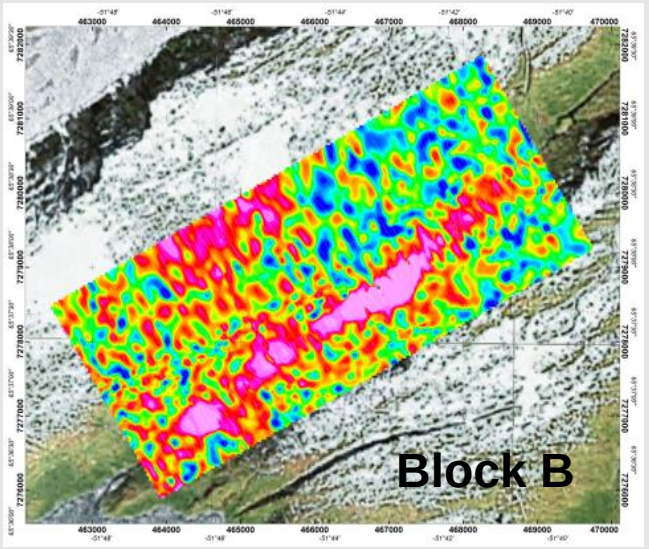
Z-Component EM Responses – LM Gates

LM-Z Gate 10

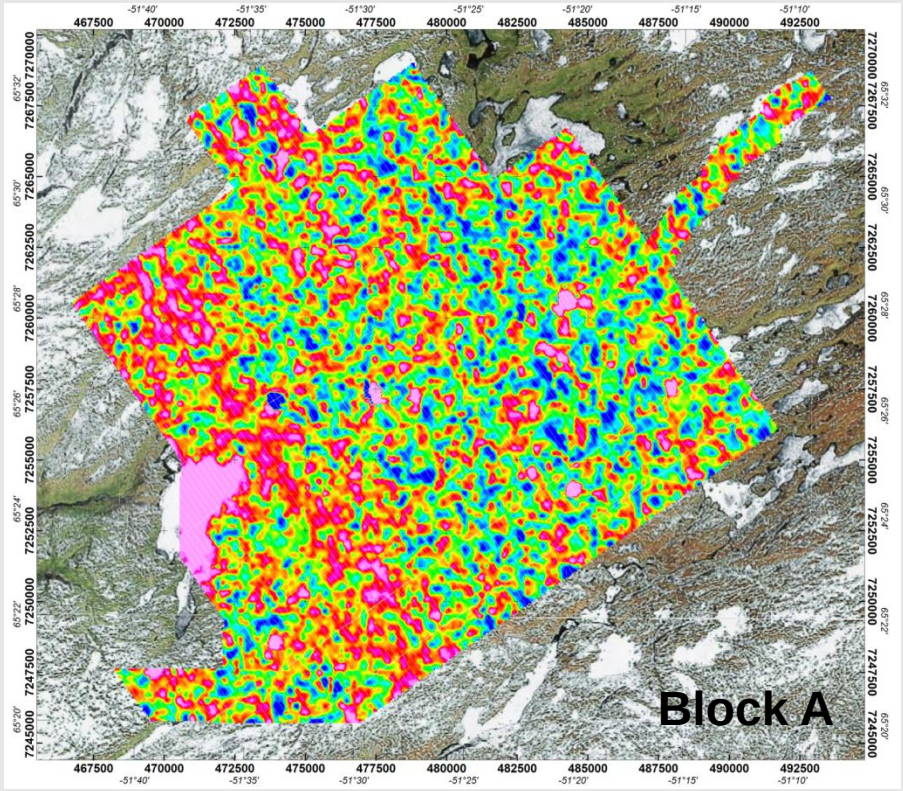


LMZ Gate 10

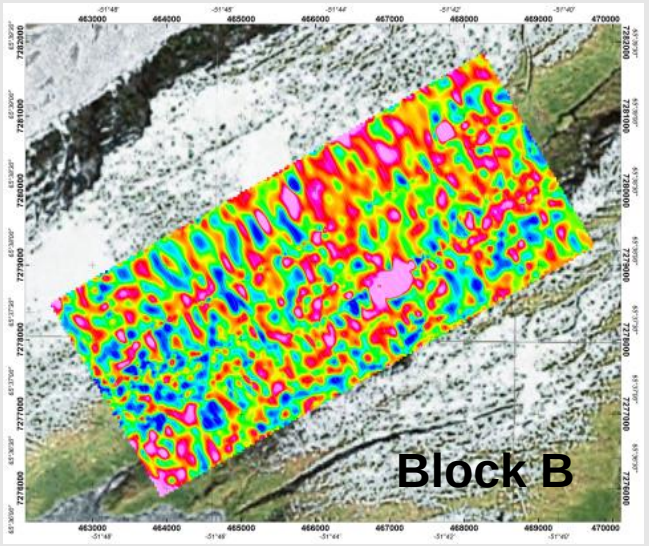


Z-Component EM Responses – HM Gates

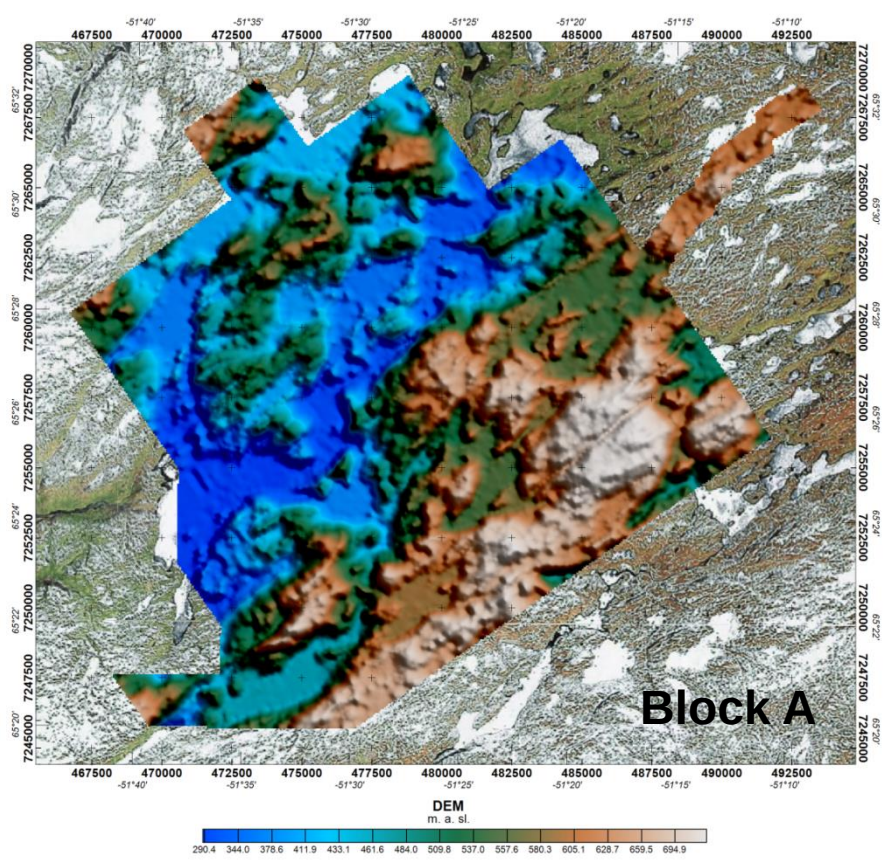
HMZ-Gate 20



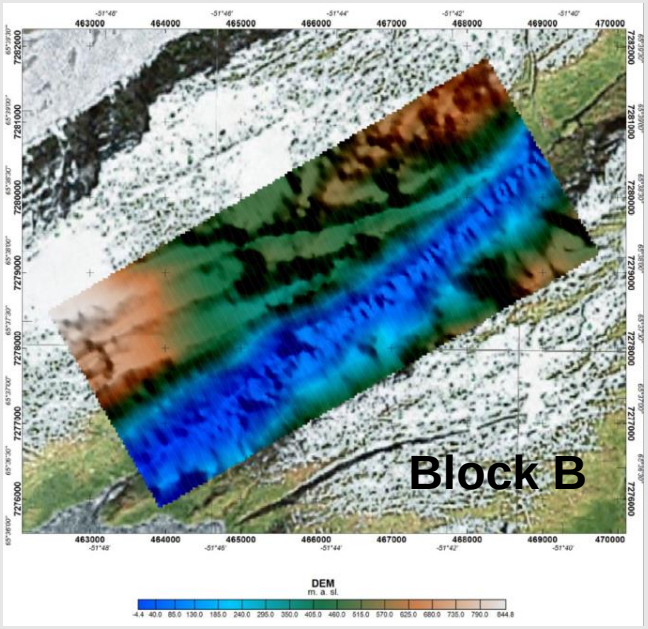
HMZ Gate 20



Rugged Topography



250-850m



0-850m

EM – Inversion Methods

HyTEM LPC (Lateral Parameter Correlation) Inversion

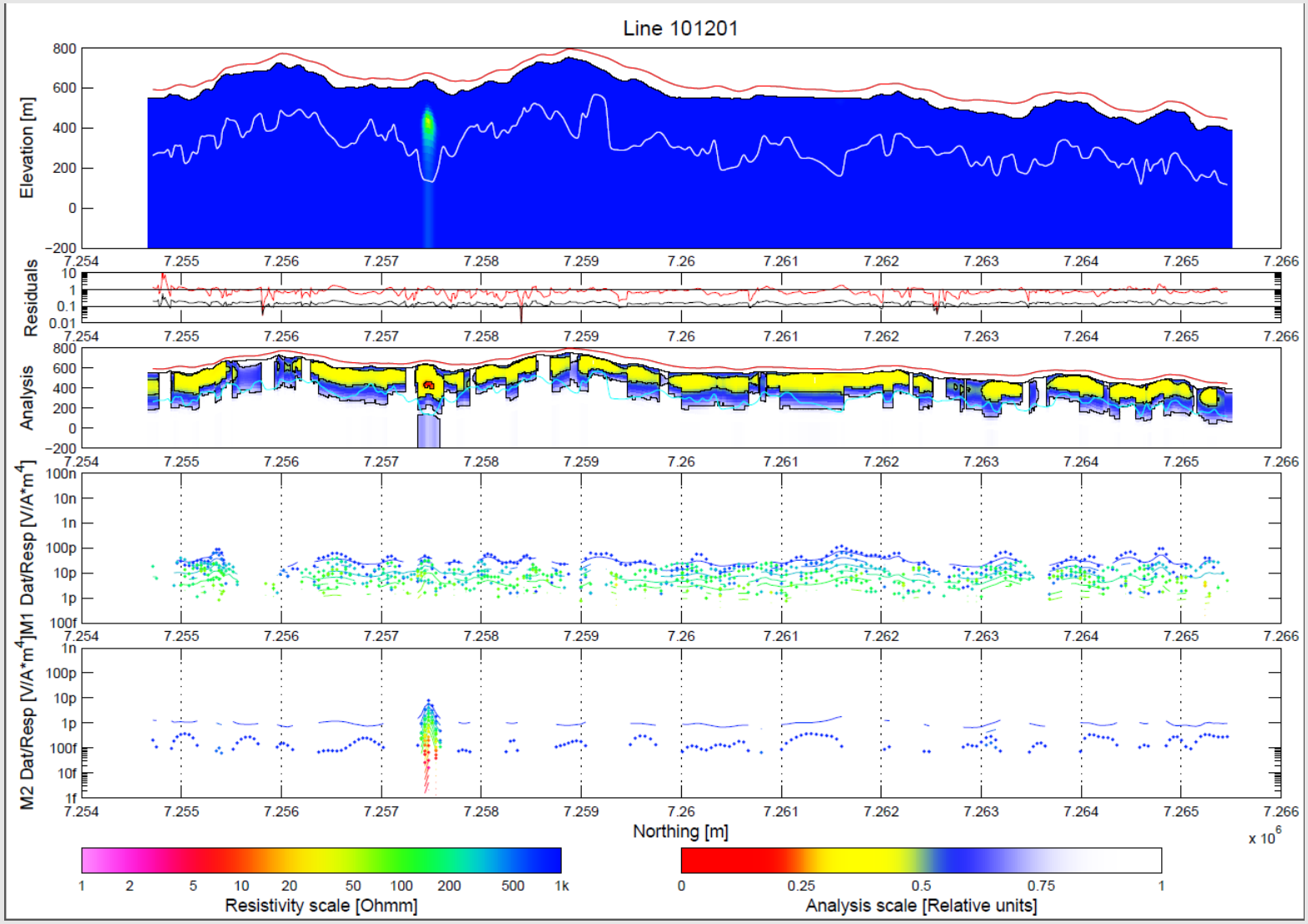
- **Fast Layered-Earth EM Inversion Routine (Christensen, 2002; Christensen and Tølbøll, 2009).**
- **Automated data pre-processing is performed to remove non-monotonic decays prior to inversion.**
- **The lateral parameter correlation (LPC) force the layer resistivities to vary gradually along a given profile.**
- **Permits abrupt lateral changes in resistivity where demanded by the data.**

Aarhus Workbench - Laterally Constrained Inversion (LCI)

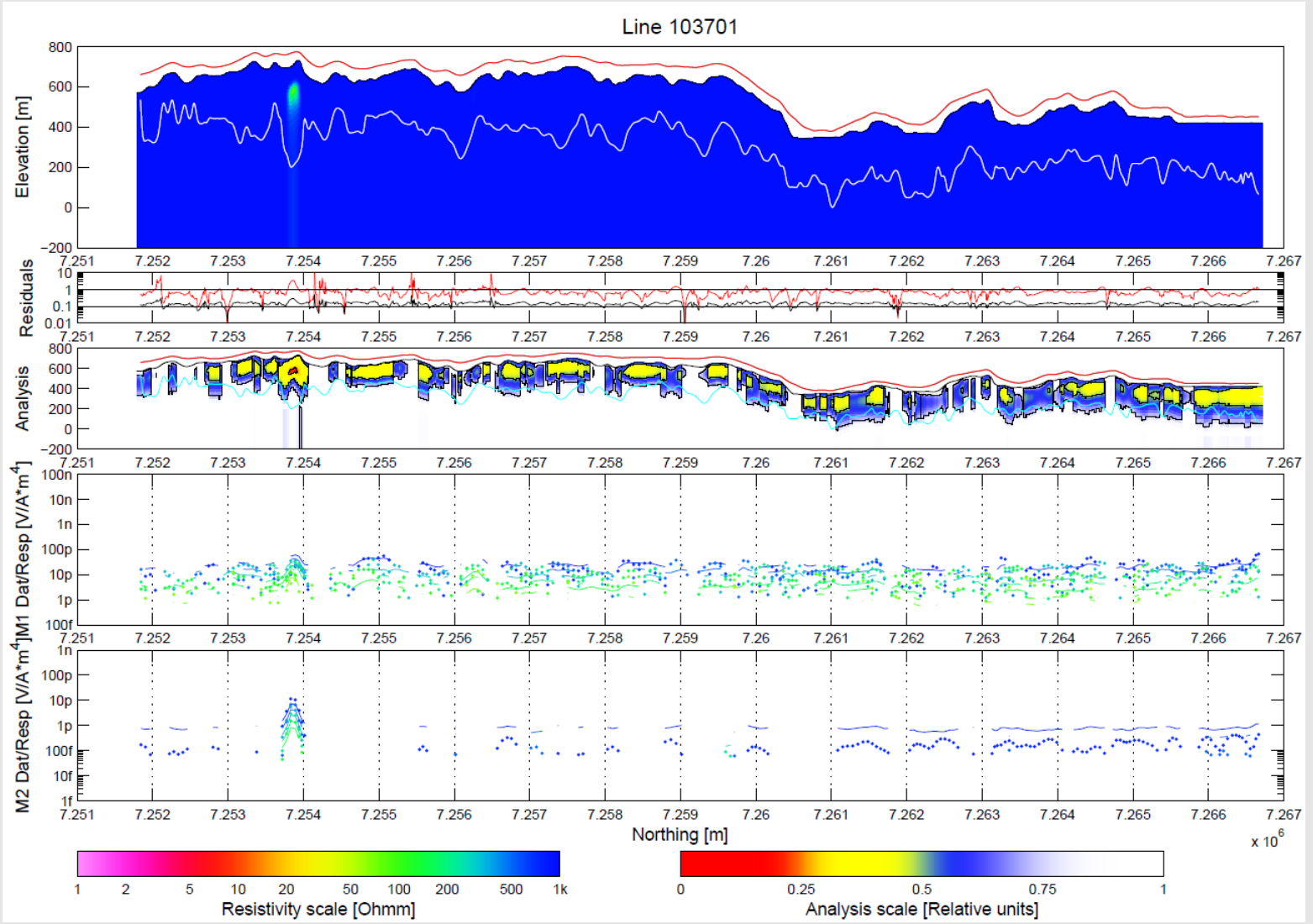
- **A full nonlinear inversion which provides a smooth multi-layer model. (Auken et al. 2008)**
- **Estimated model parameters (layer resistivities, thicknesses and interface depths) are constrained to vary smoothly along a profile.**

SKYTEM

Line 101201 – Block A



Line 103701 – Block A



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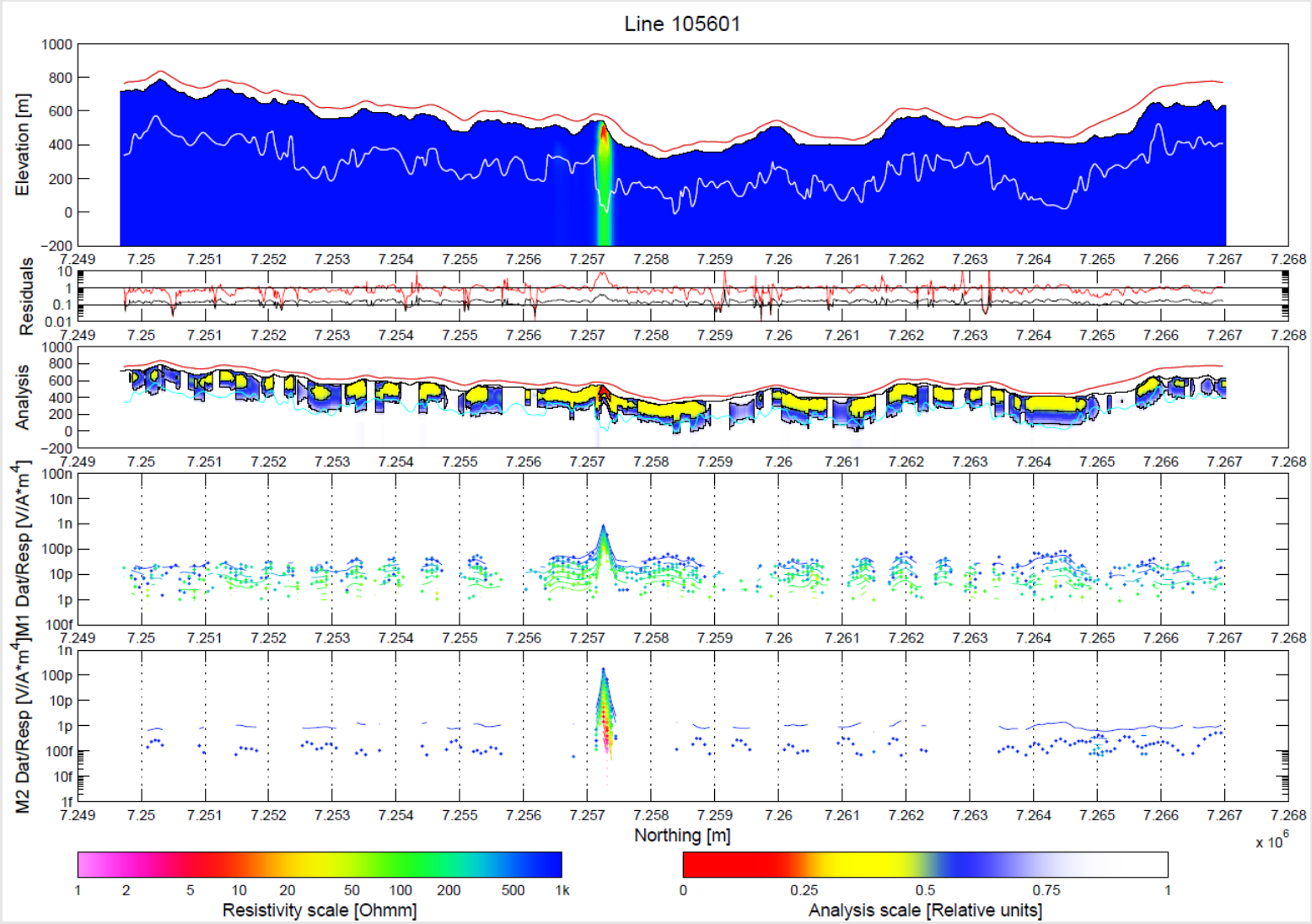
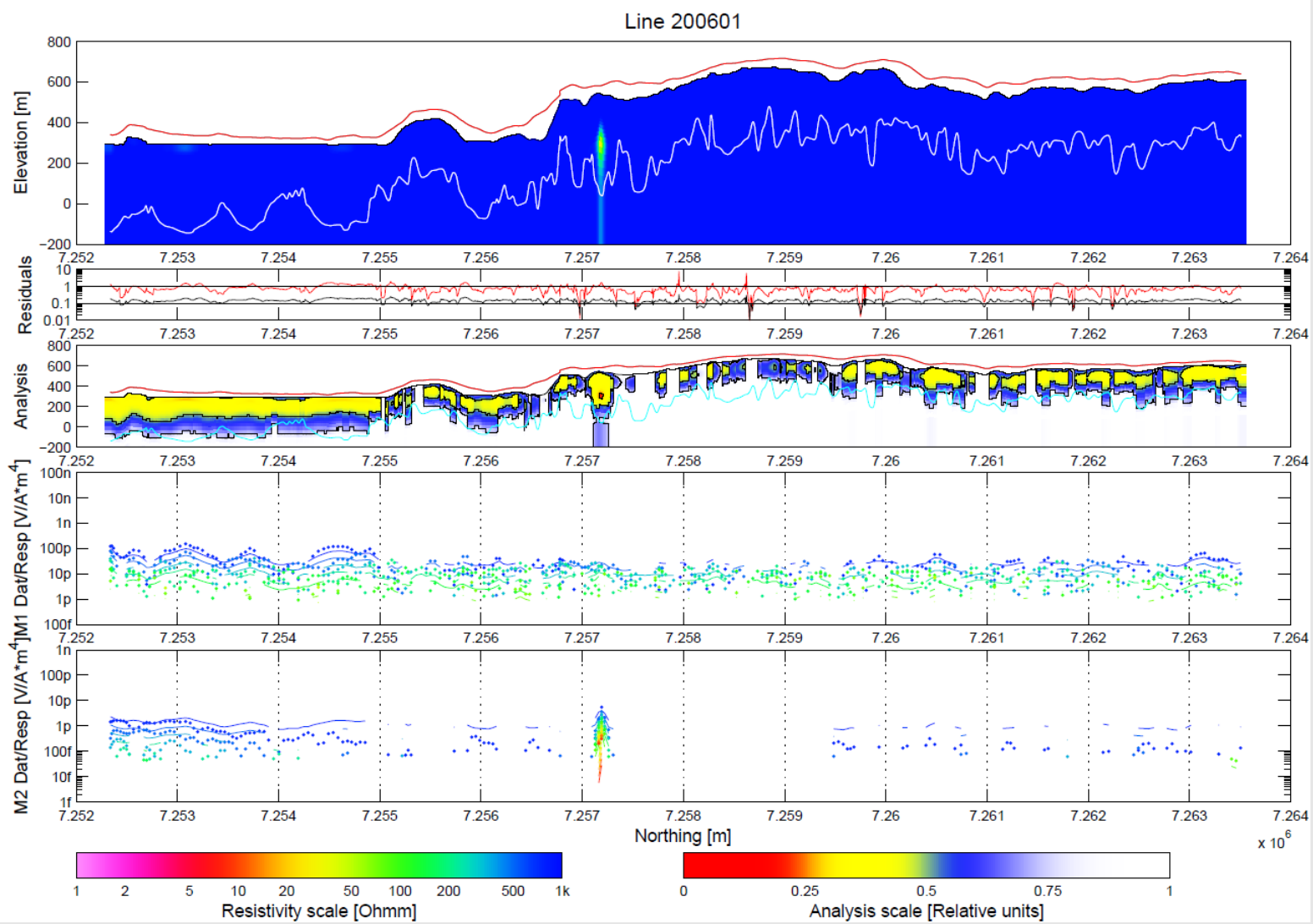
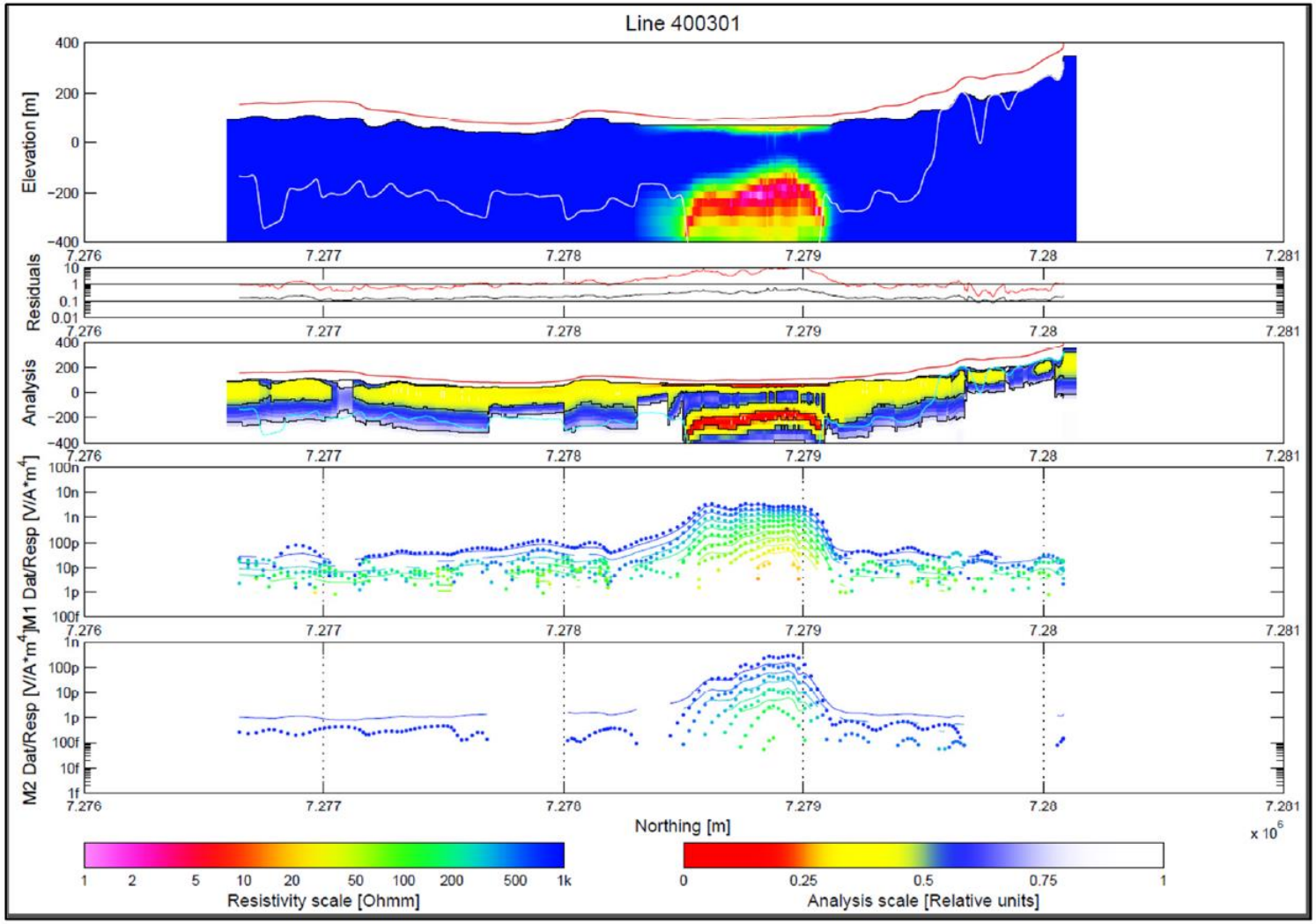


Line 200601 – Block A

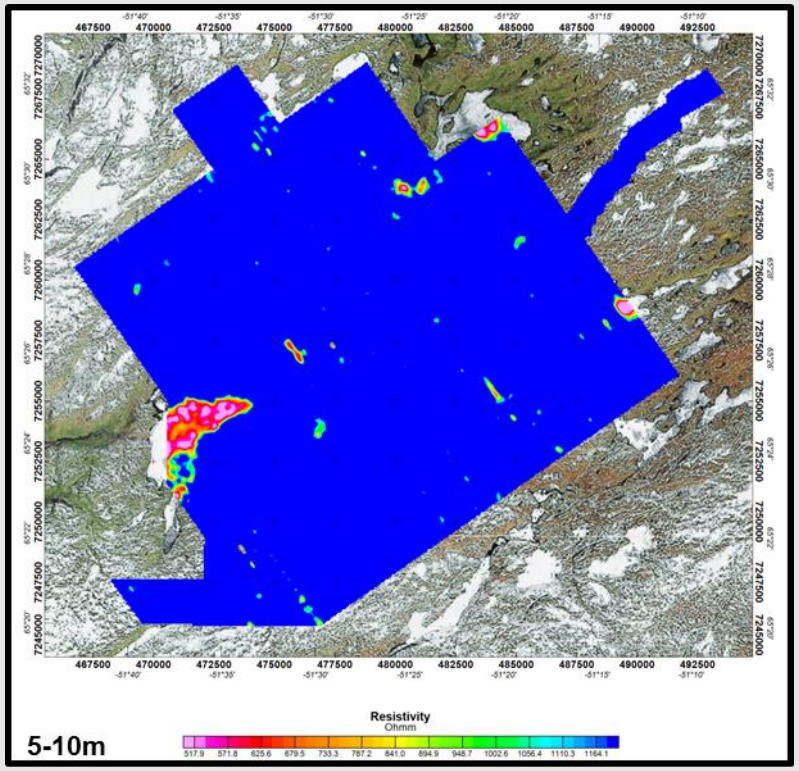


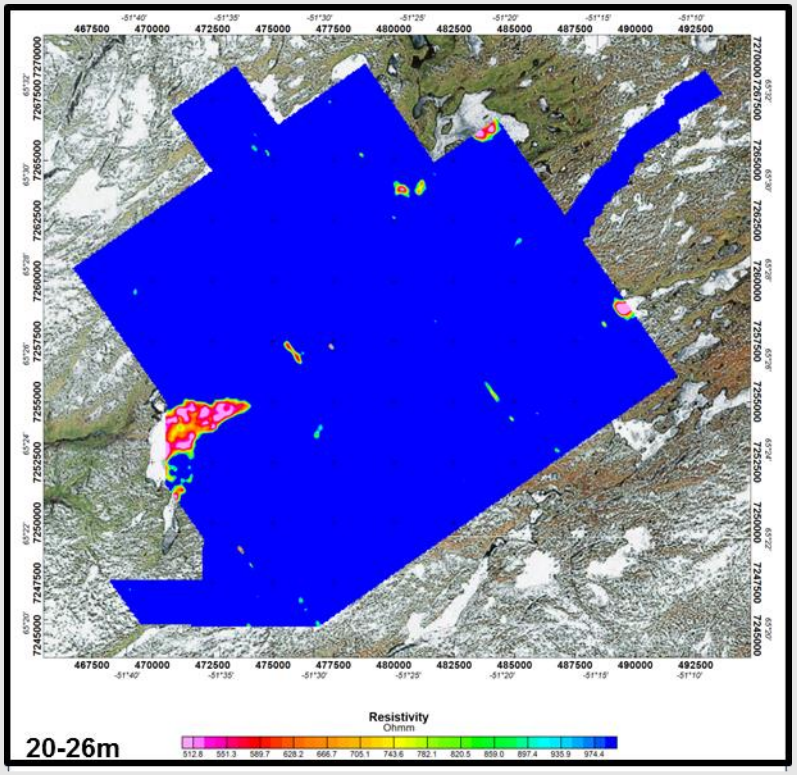
Line 400301 – Block B



Depth Slices of Resistivity distribution

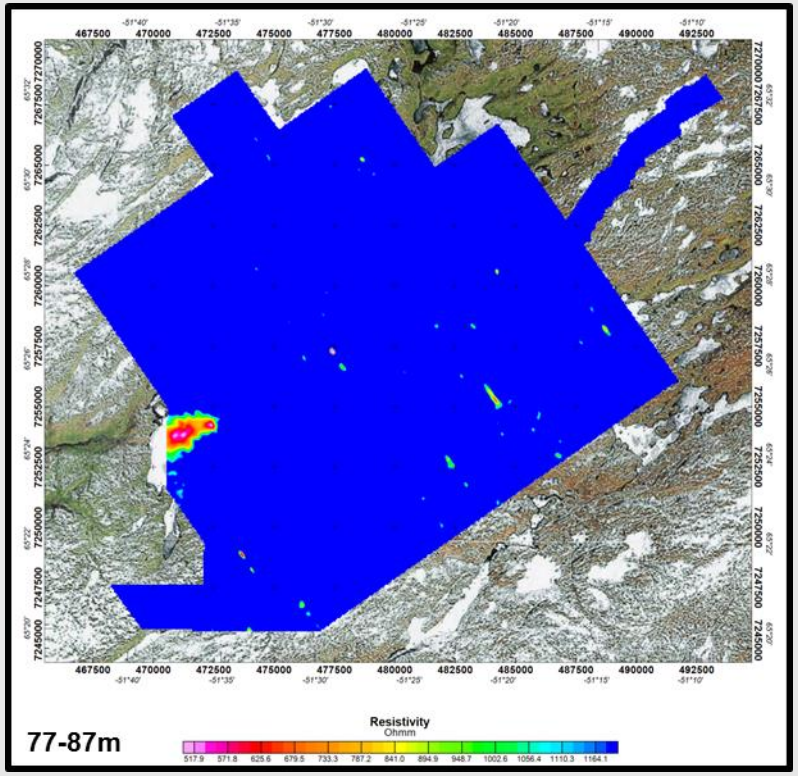
(Shallow – Near surface)

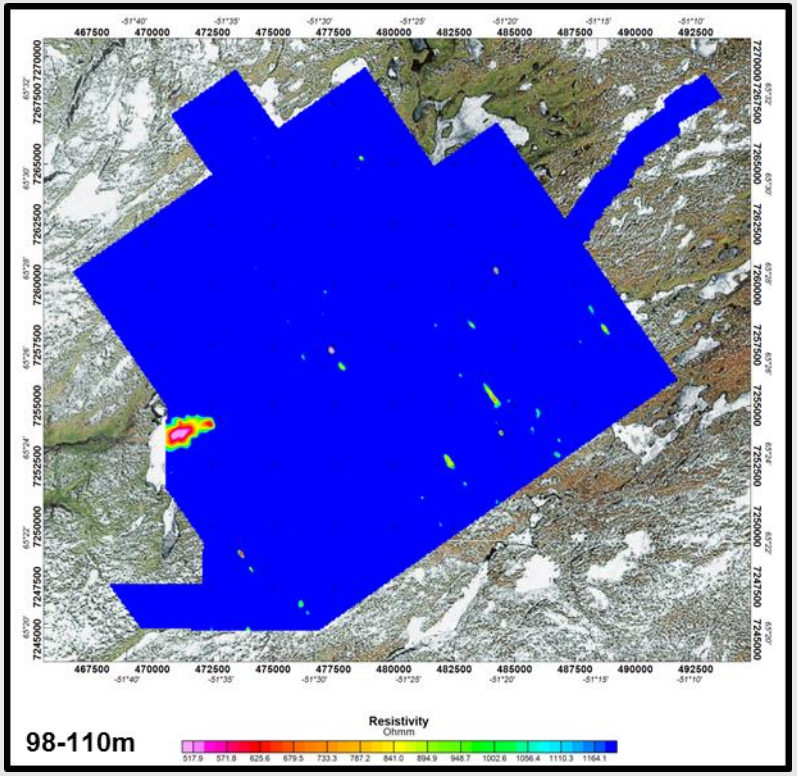




Depth Slices of Resistivity distribution

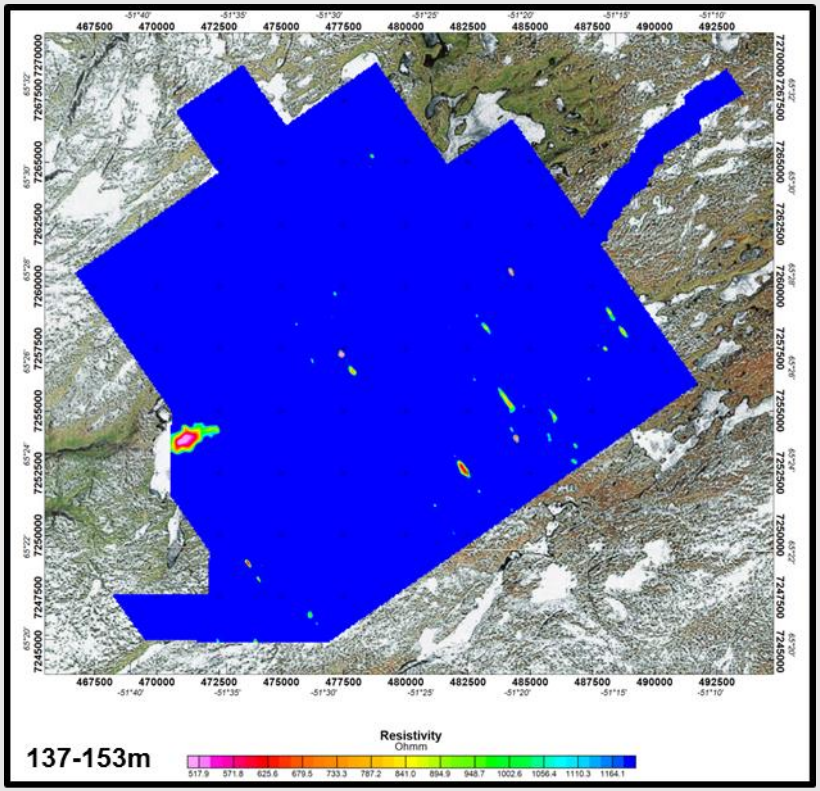
(Intermediate Depth)

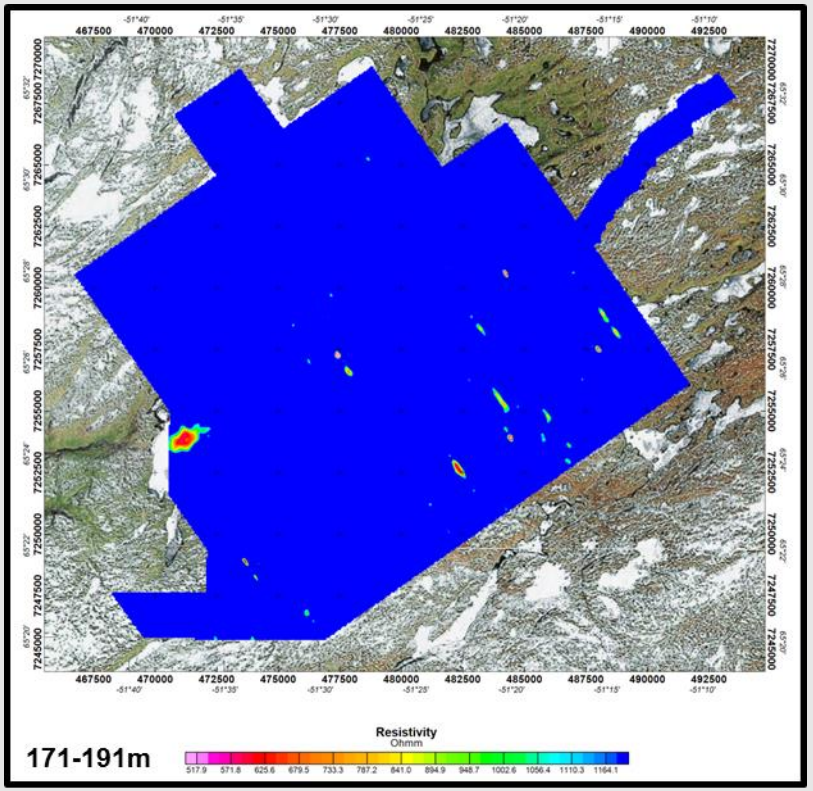




Depth Slices of Resistivity distribution

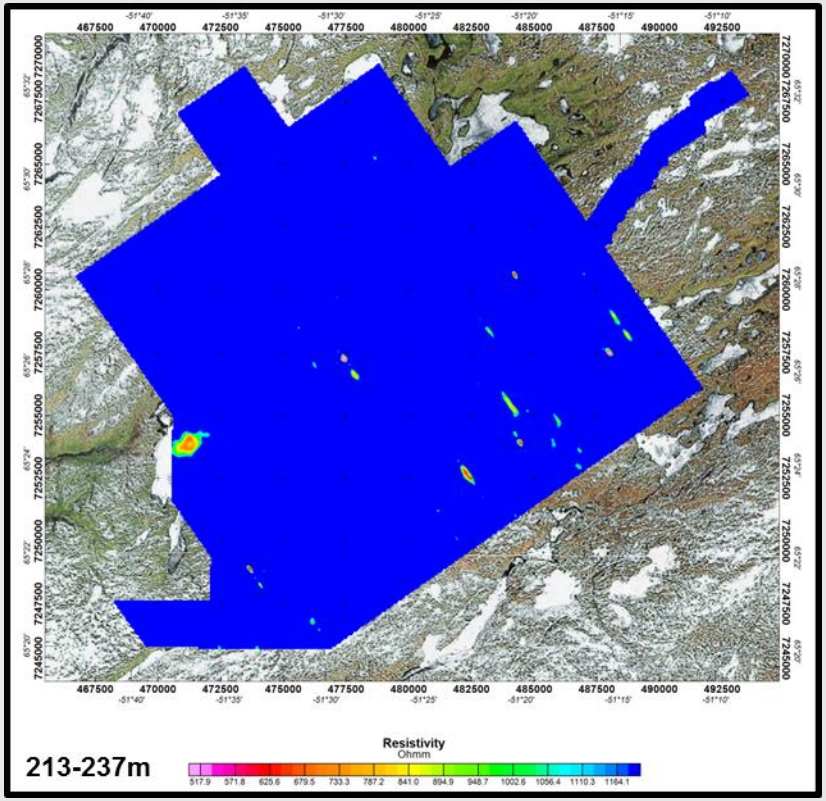
(Intermediate to Deeper)

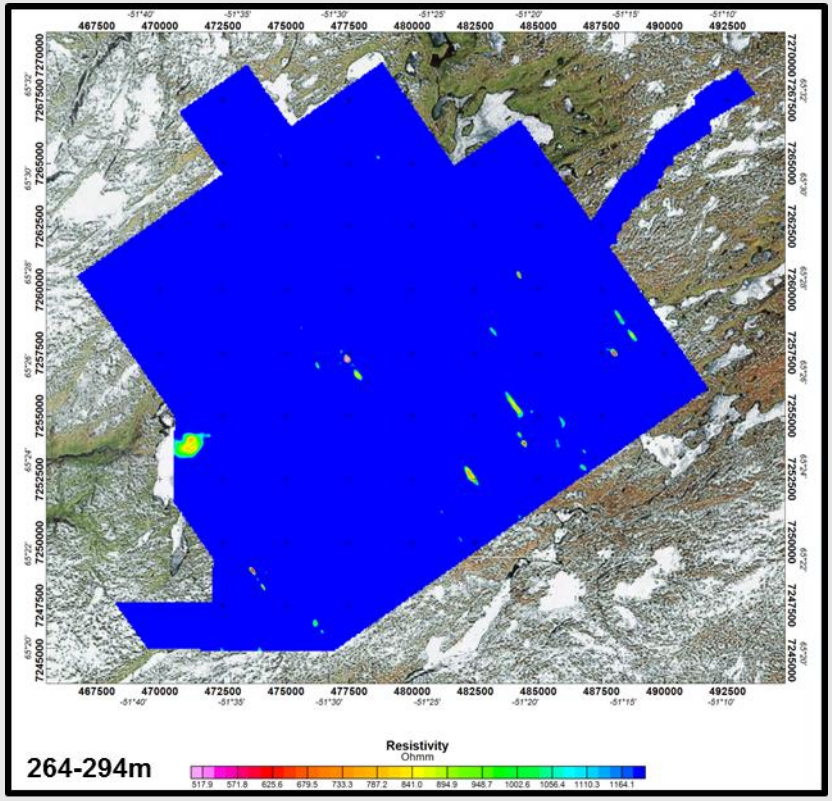




Depth Slices of Resistivity distribution

(Deeper)





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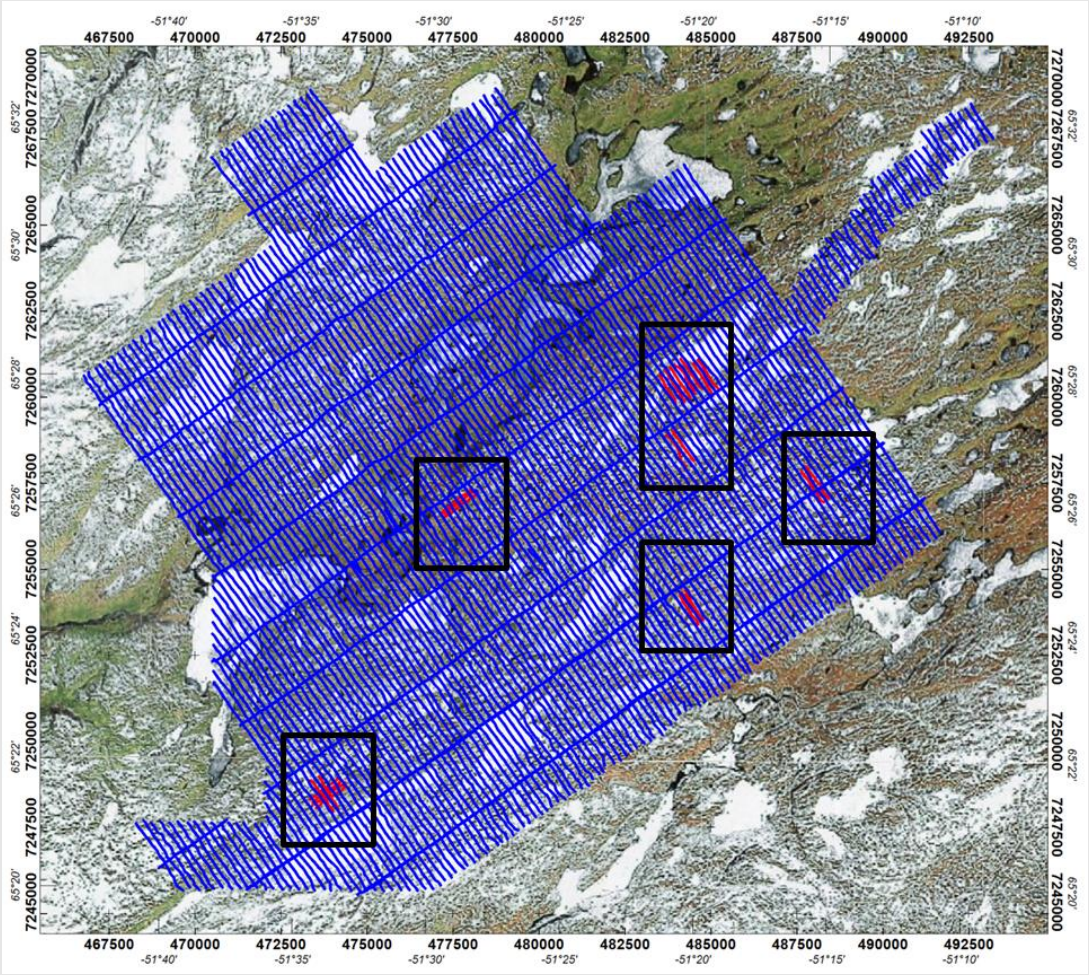
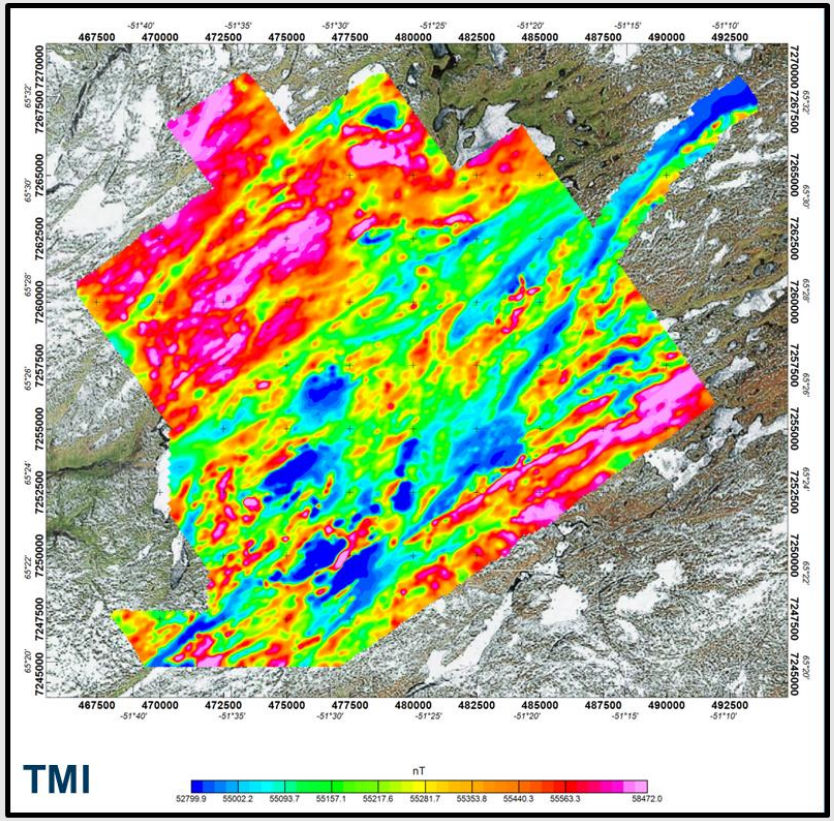
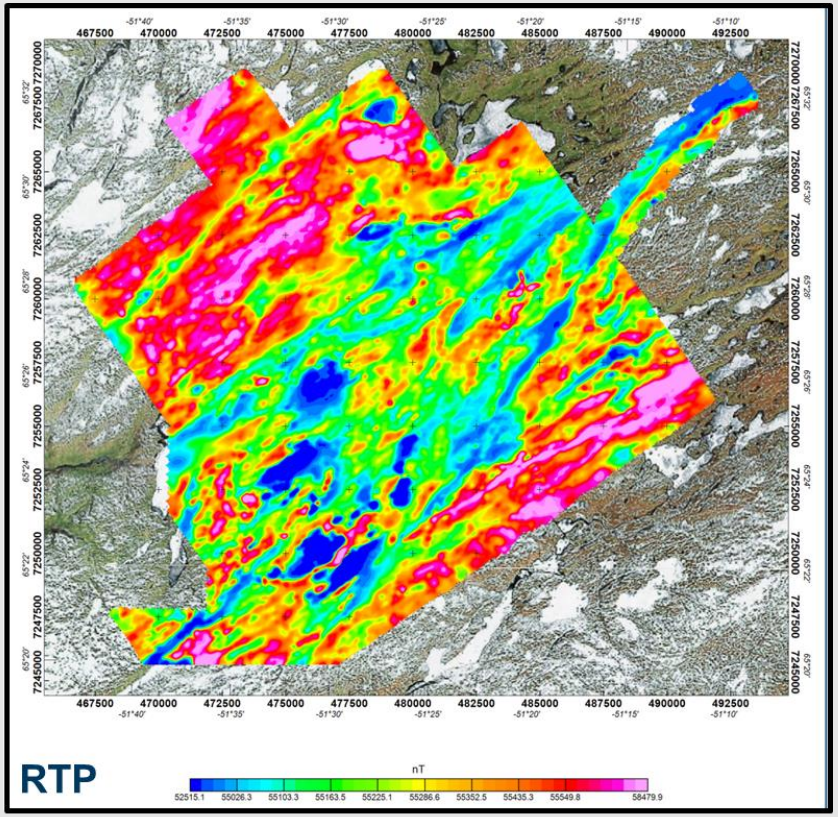
Infill Lines



Magnetics


TMI
nT
52799.9 55002.2 55093.7 55157.1 55217.6 55281.7 55353.8 55440.3 55563.3 58472.0


RTP
nT
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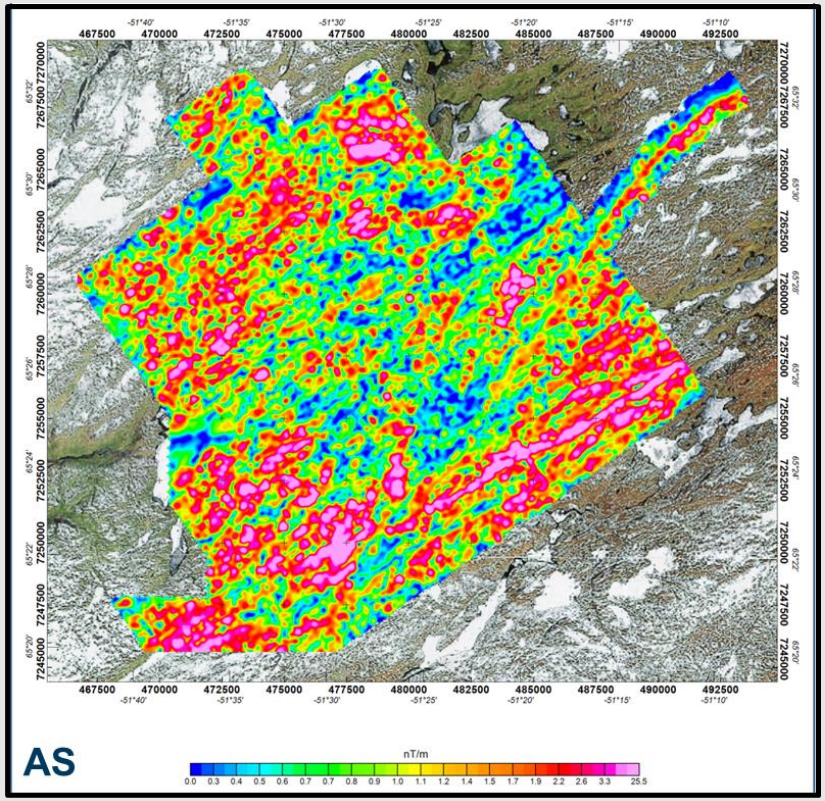
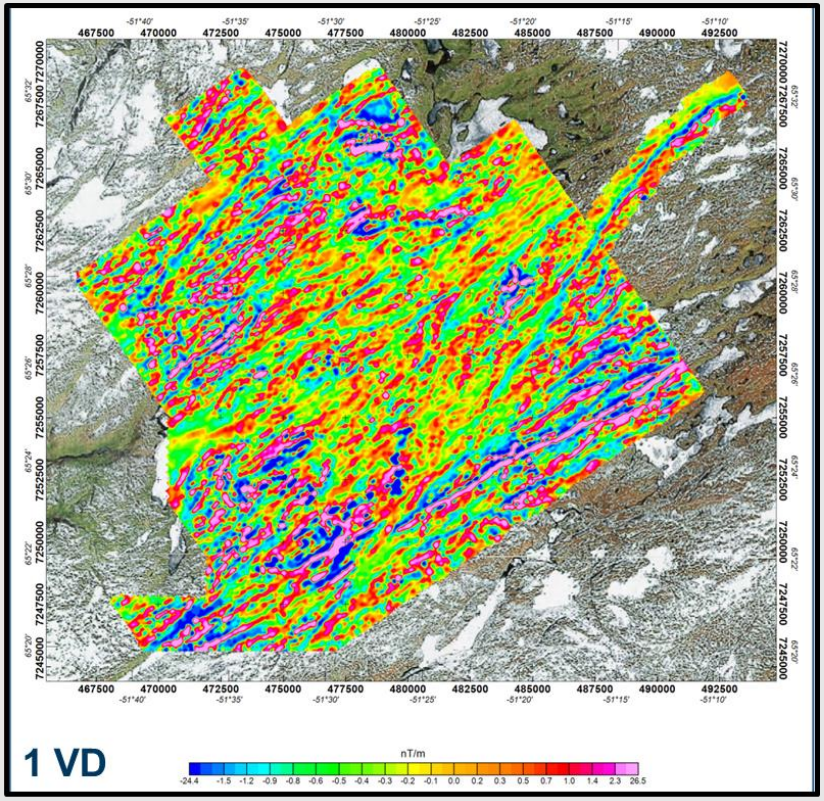
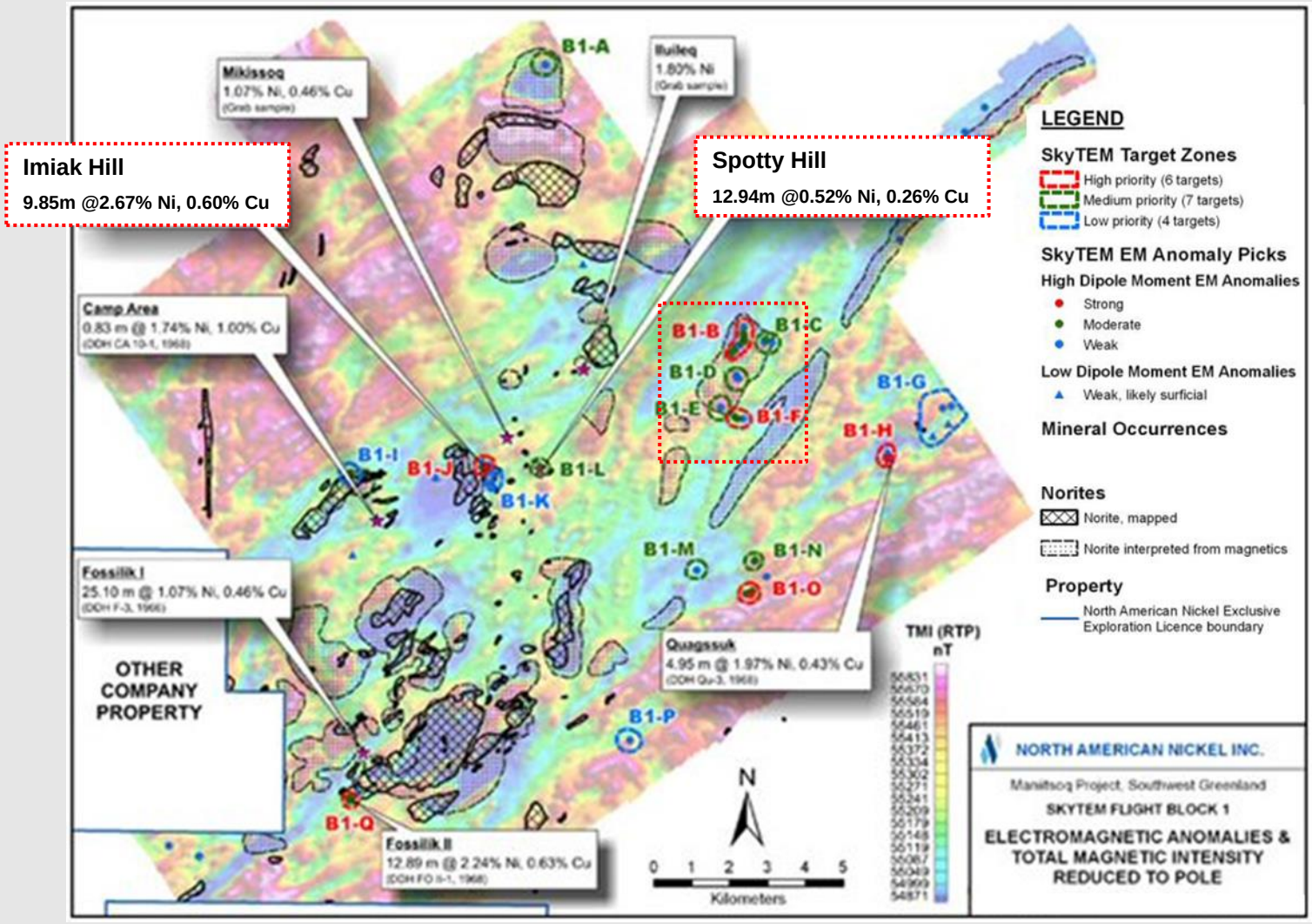
Magnetics



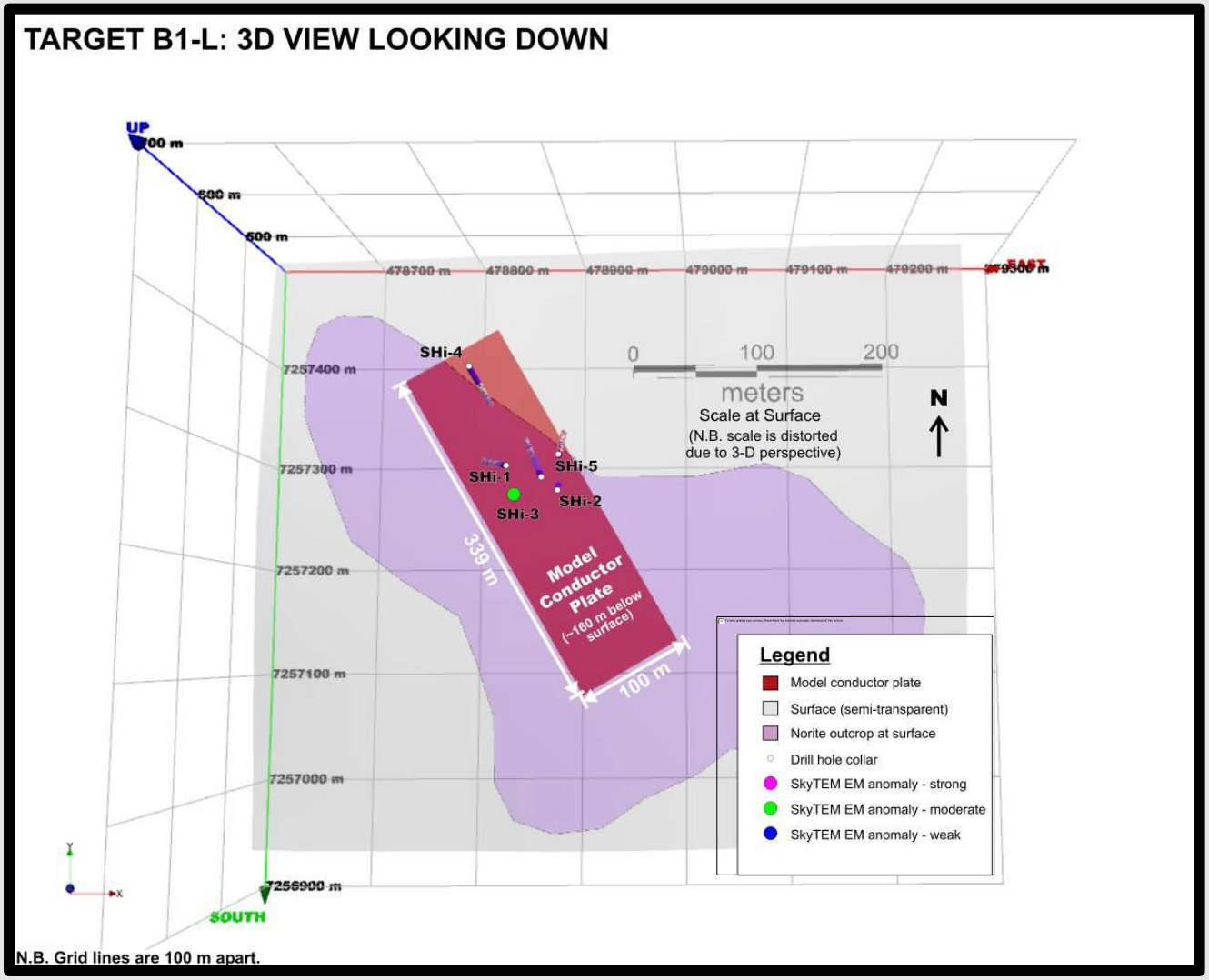


SKYTEM

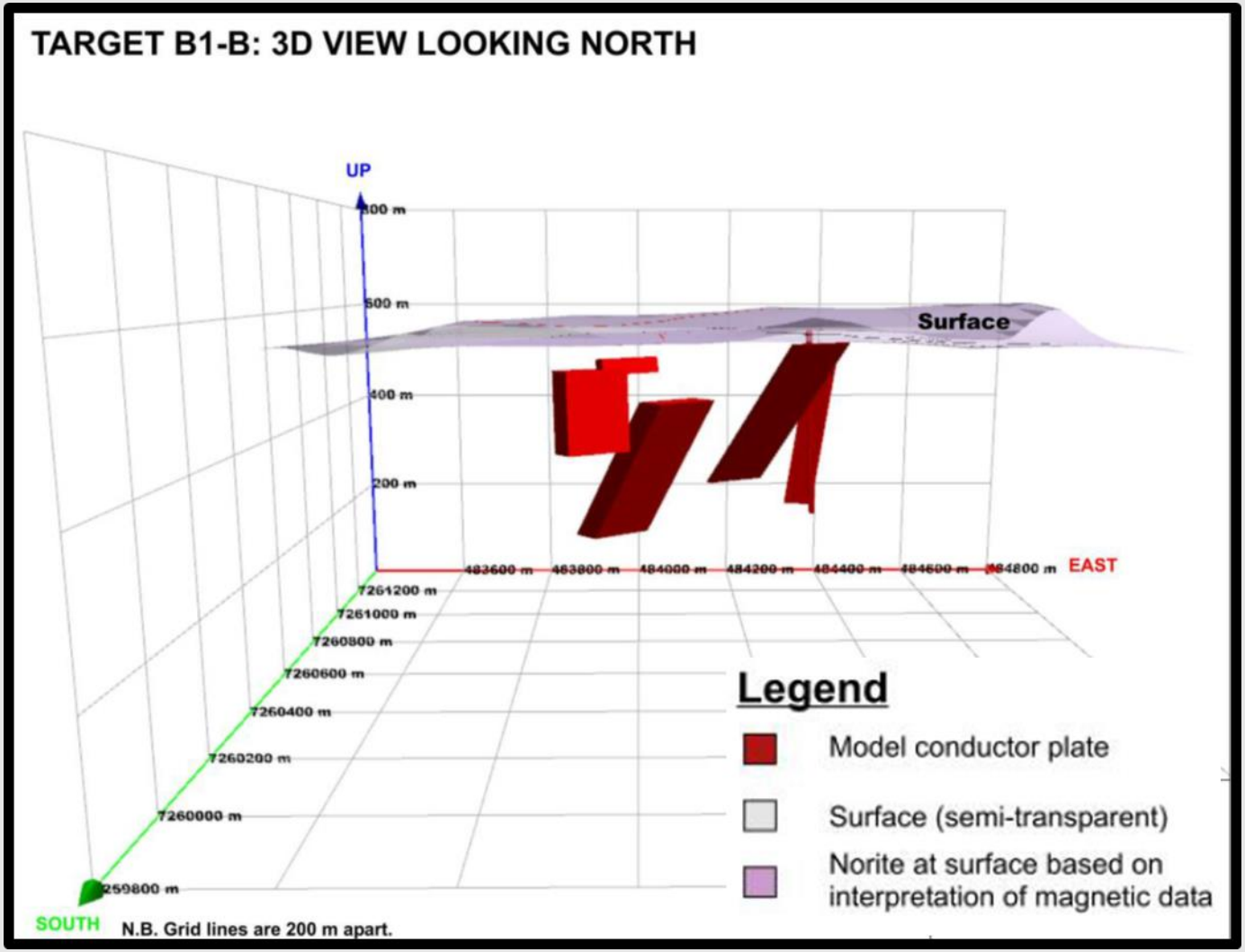
EM Anomalies with TMI-RTP



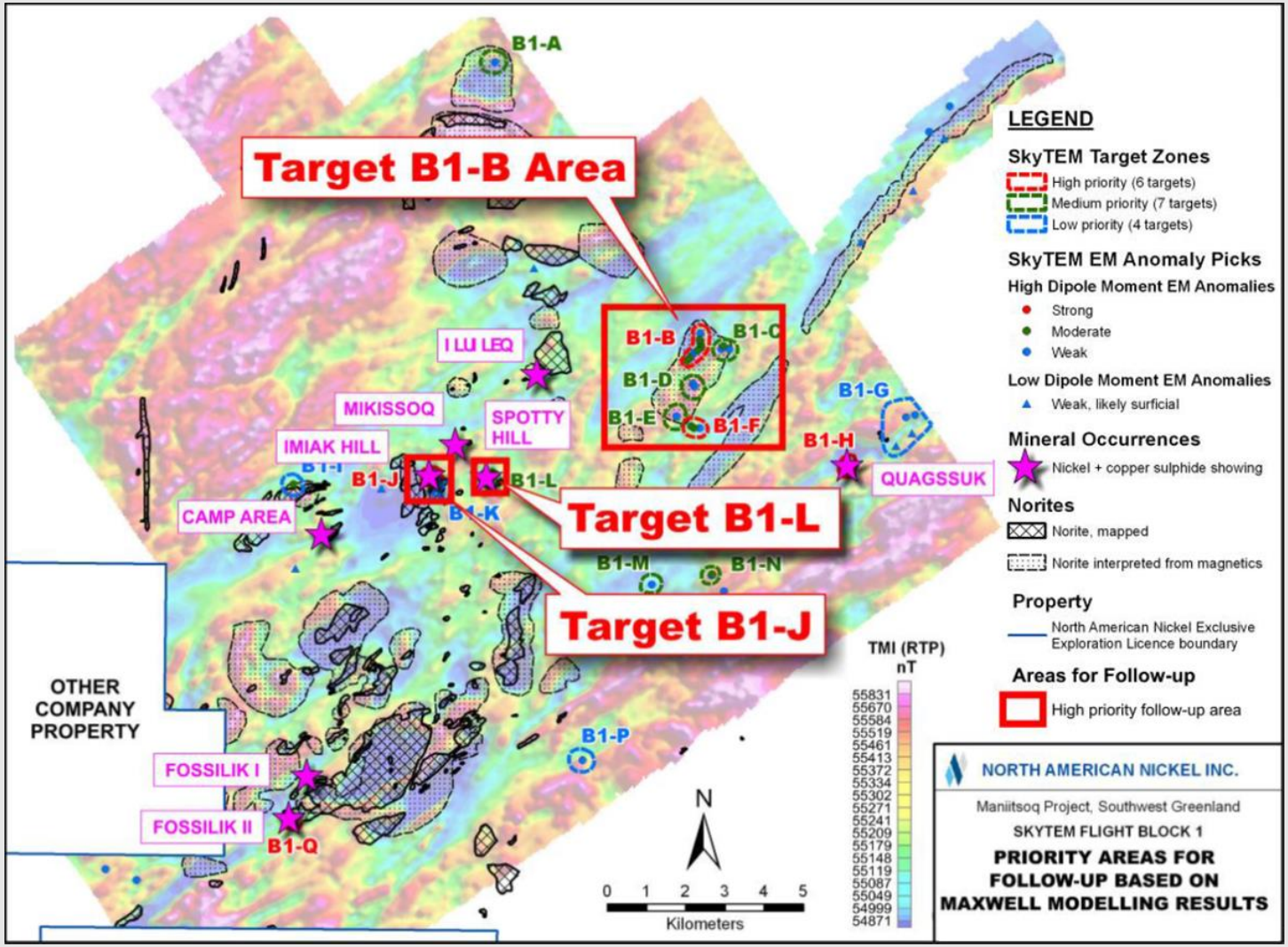
EMIT – MAXWELL Modelling (Spotty Hill)



EMIT – MAXWELL Modelling



EM Anomalies & Priority Areas



Drill Results – Imiak Hill

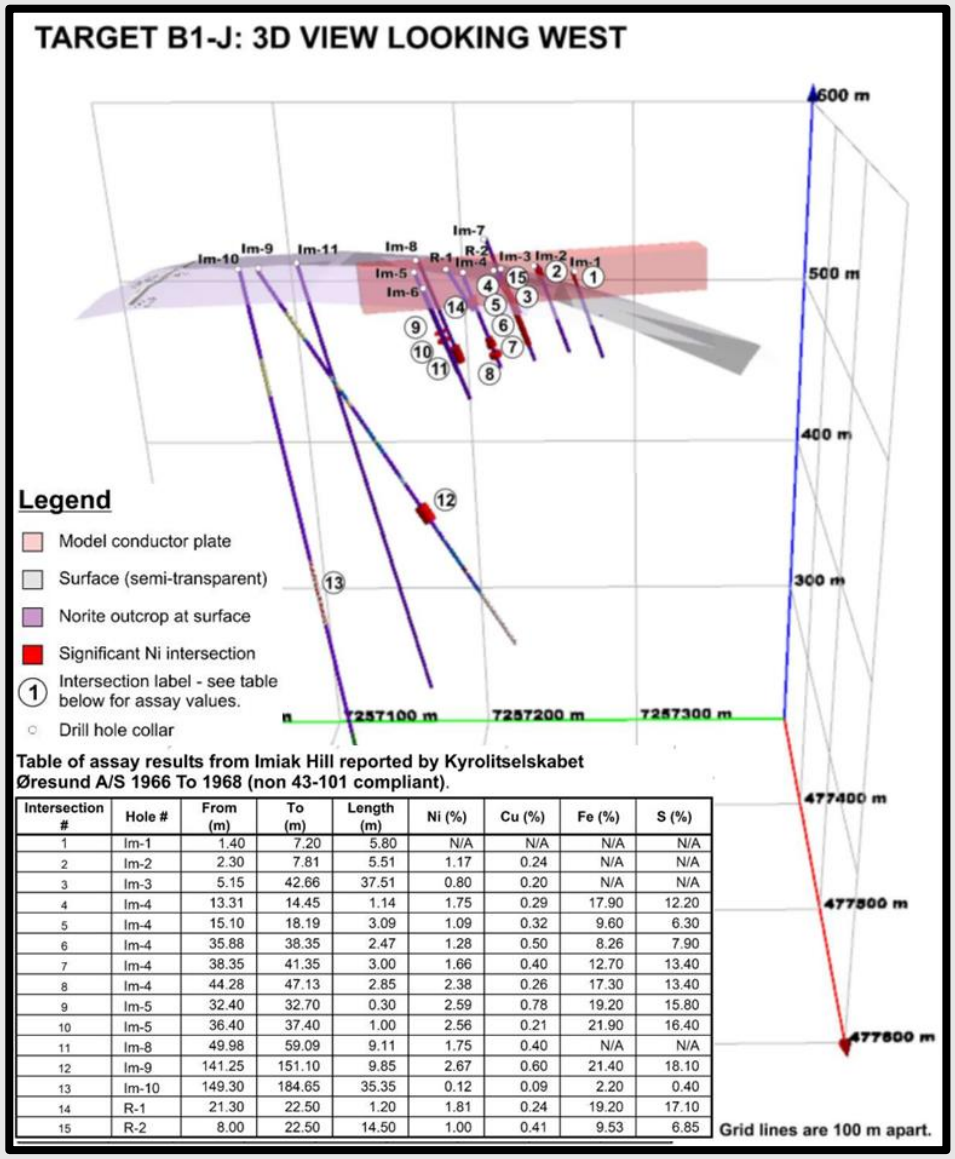


Table of assay results from Imiak Hill reported by Kyrolitselskabet Øresund A/S 1966 To 1968 (non 43-101 compliant).

Intersection #	Hole #	From (m)	To (m)	Length (m)	Ni (%)	Cu (%)	Fe (%)	S (%)
1	Im-1	1.40	7.20	5.80	N/A	N/A	N/A	N/A
2	Im-2	2.30	7.81	5.51	1.17	0.24	N/A	N/A
3	Im-3	5.15	42.66	37.51	0.80	0.20	N/A	N/A
4	Im-4	13.31	14.45	1.14	1.75	0.29	17.90	12.20
5	Im-4	15.10	18.19	3.09	1.09	0.32	9.60	6.30
6	Im-4	35.88	38.35	2.47	1.28	0.50	8.26	7.90
7	Im-4	38.35	41.35	3.00	1.66	0.40	12.70	13.40
8	Im-4	44.28	47.13	2.85	2.38	0.26	17.30	13.40
9	Im-5	32.40	32.70	0.30	2.59	0.78	19.20	15.80
10	Im-5	36.40	37.40	1.00	2.56	0.21	21.90	16.40
11	Im-8	49.98	59.09	9.11	1.75	0.40	N/A	N/A
12	Im-9	141.25	151.10	9.85	2.67	0.60	21.40	18.10
13	Im-10	149.30	184.65	35.35	0.12	0.09	2.20	0.40
14	R-1	21.30	22.50	1.20	1.81	0.24	19.20	17.10
15	R-2	8.00	22.50	14.50	1.00	0.41	9.53	6.85

CONCLUSIONS

- SkyTEM survey was carried out in Maniitsoq, Greenland in search of Ni-Cu minerals
- Rugged topography
- EM Data and Geophysical Inversion
- Resistive subsurface,
- Smaller conductive targets (both shallow & deep)
- Additional geophysical property - Magnetics
- Forward modelling – EMIT Maxwell
- Encouraging Drill Results

SKYTEM

Press Release from NAN

NORTH AMERICAN NICKEL

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Highlights:

- **Target B1-L –** modeled as a 330 x 100 m flat-lying conductor located 160 m below surface within a norite intrusion. The conductor is untested but past shallow drilling 100 to 150 m above the conductor intersected weakly disseminated, nickeliferous sulphides grading up to 0.52% Ni and 0.26% Cu over 12.94 m, demonstrating that mineralizing processes were at work in the intrusion.
- **Target B1-B –** 700 m long, untested, near surface conductive zone. The characteristics and orientation of the conductor vary considerably along strike suggesting it is not formational. Magnetic data suggests that it is hosted in a large (2.5 x 1.0 km) norite body.
- **Target B1-J -** 170 m long by 16 m wide conductor that comes to surface and is directly coincident with the Imiak Hill showing, the most significant nickel occurrence discovered to date in our Maniitsoq licence area. The model shows that the Imiak Hill mineralization strikes parallel to most of the historical drilling and therefore has not been properly tested. The model has very limited dip extent (21 m), but the best intersection on the showing (9.85 m averaging 2.67% Ni and 0.60% Cu) occurs 130 m below surface indicating that strong mineralization at surface is masking mineralization at depth.

SKYTEM

Acknowledgements

North American Nickel

THANK YOU