

Permafrost Remote Sensing Trough Airborne Electromagnetic Geophysics and Thermal Anomalies

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Vladimir Romanovsky, Dave Barnes



Goldstream Valley Watershed

AEM Geophysics equipment



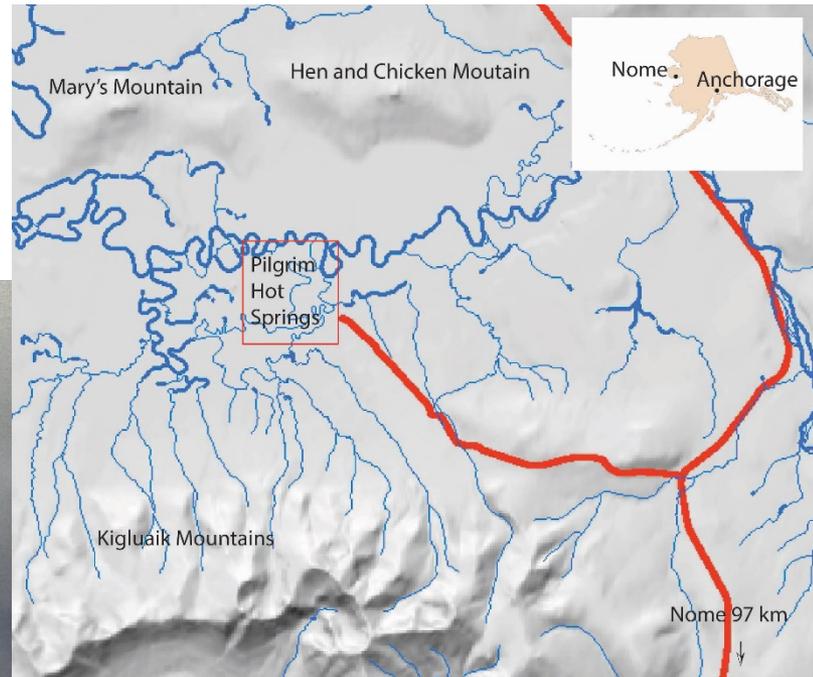
Time Domain



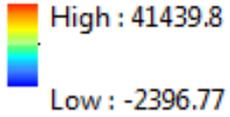
Frequency Domain



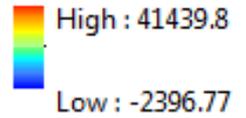
Pilgrim Hot Springs



Pilgrim Hot Springs Resistivity model



Johnathan Glen

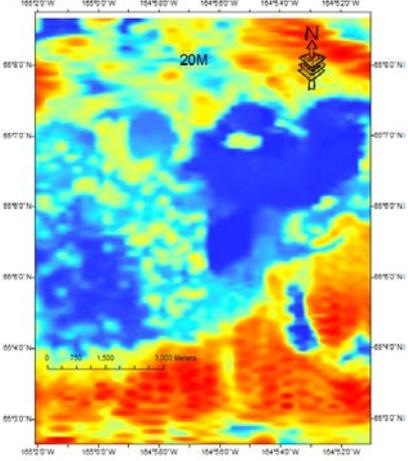
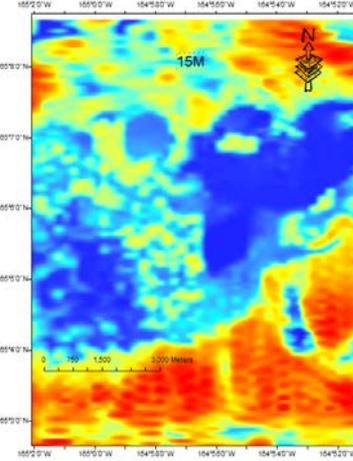
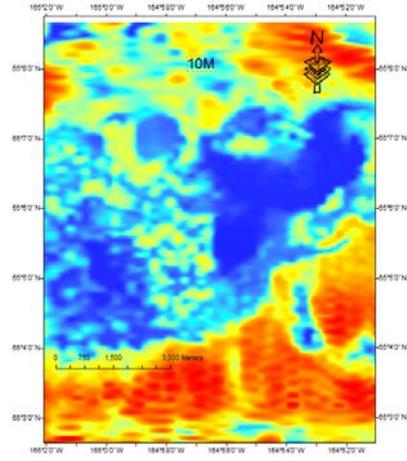
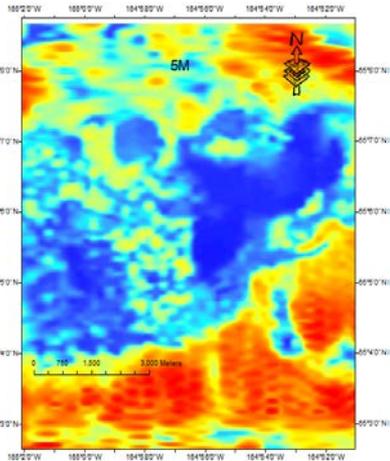


5m

10m

15m

20m

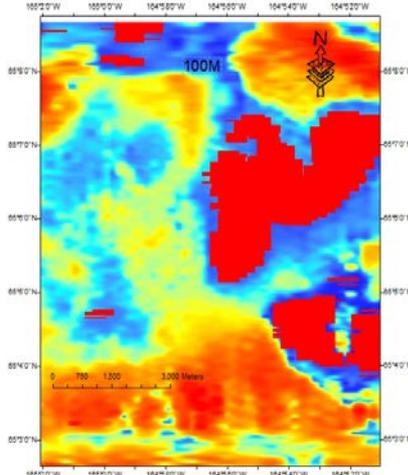
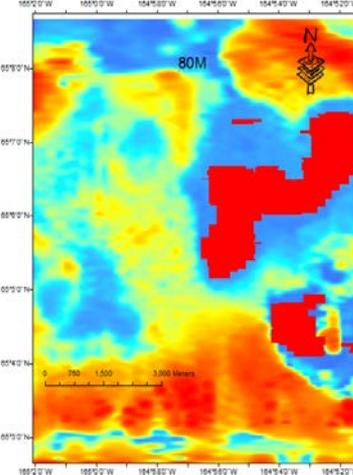
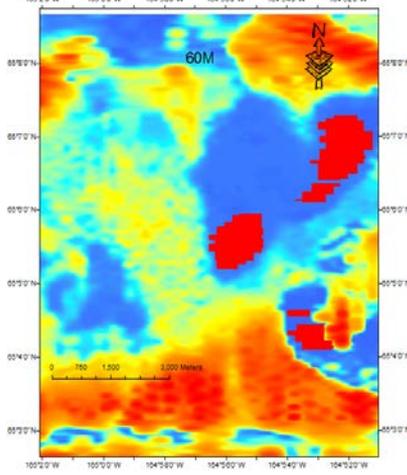
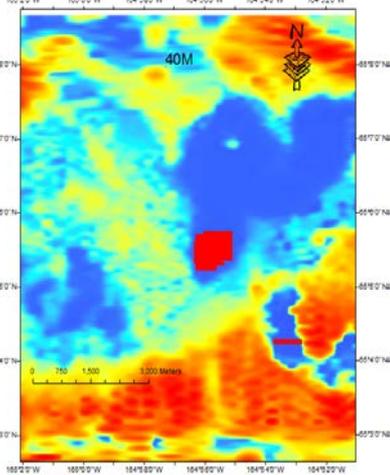


40m

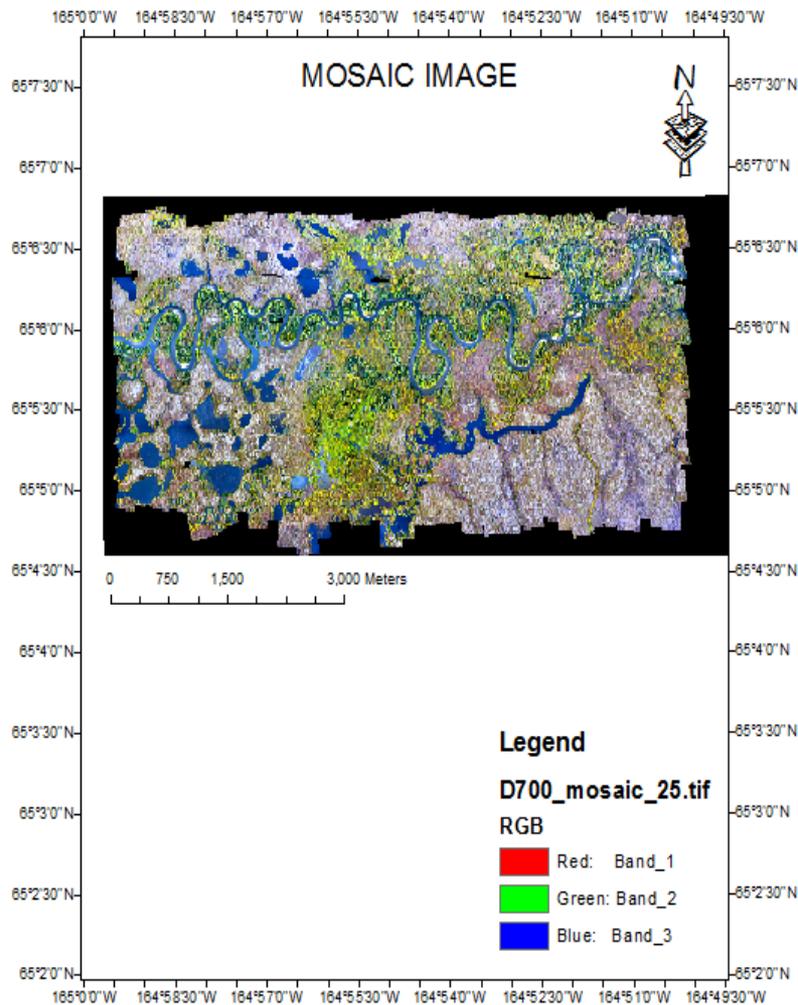
60m

80m

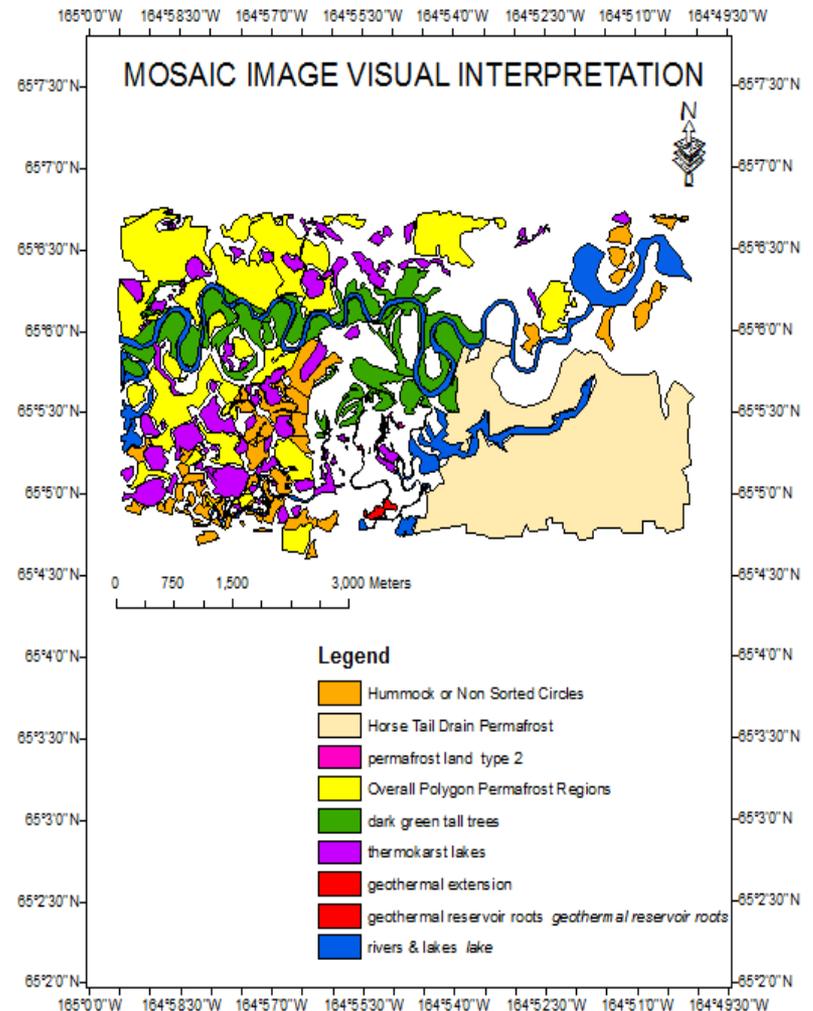
100m



Mosaic Image Visual Interpretation



Christian Haselwimmer

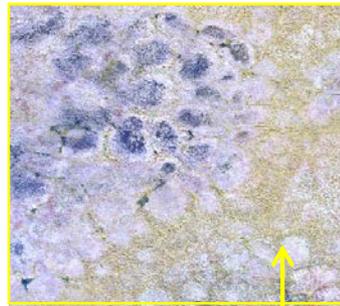


Arvind Chittambakkam

Mosaic Image Visual Interpretation



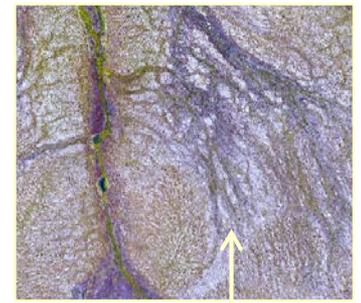
THERMOKARST LAKES



POLYGON SHAPED PERMAFROST LAND



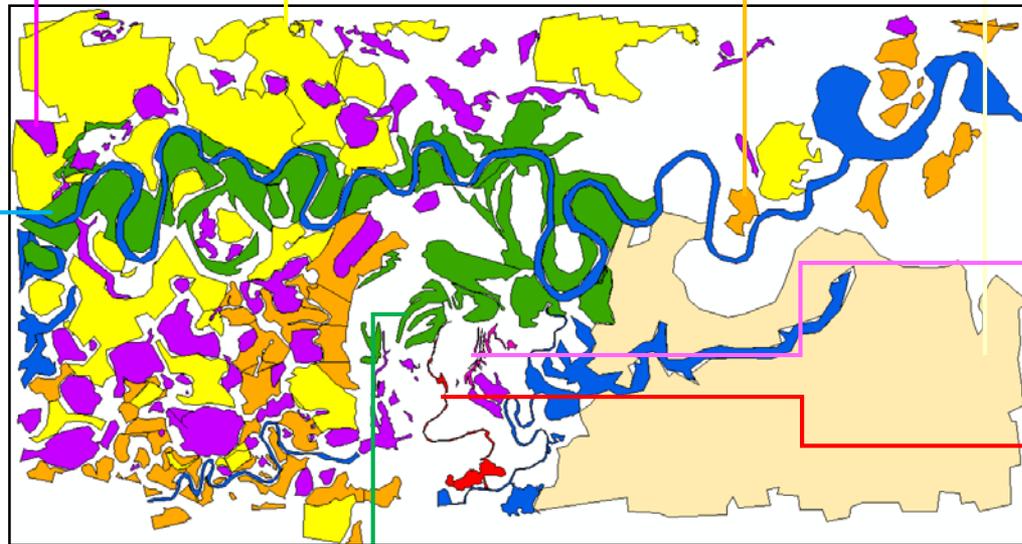
HUMMOCKS



HORSE TAIL DRAIN PERMAFROST



RIVERS



CIRCULAR FEATURES

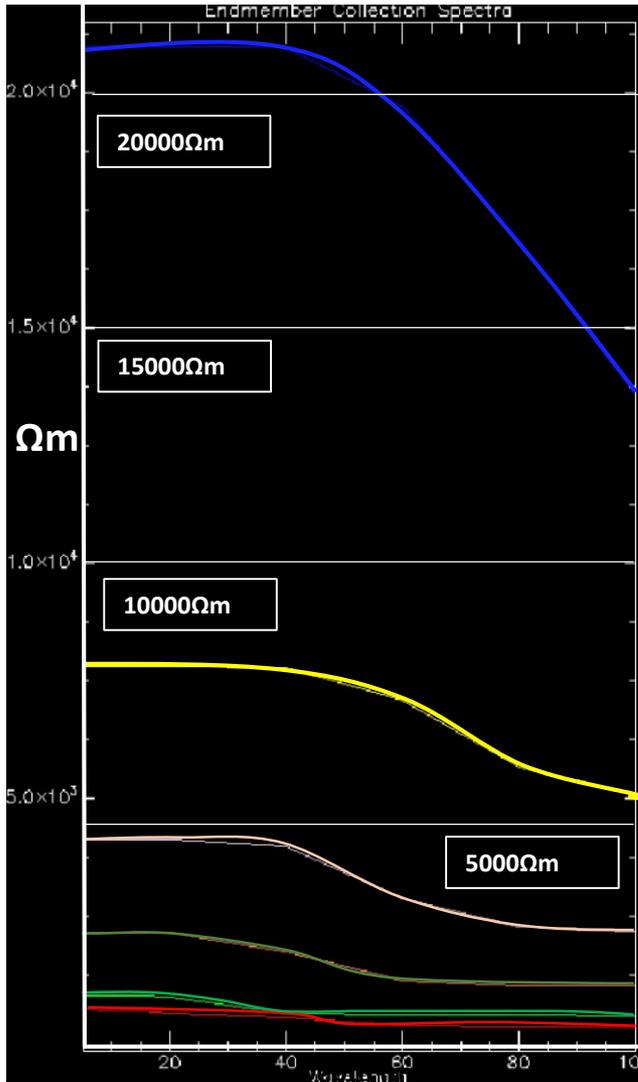


VEGETATION

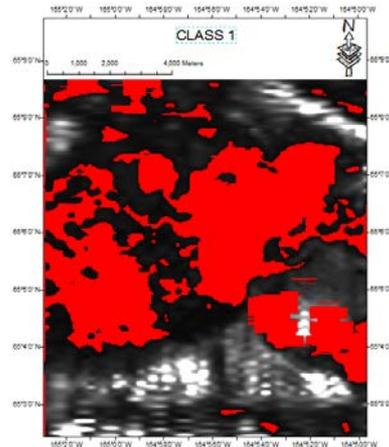


GEOHERMAL AREA

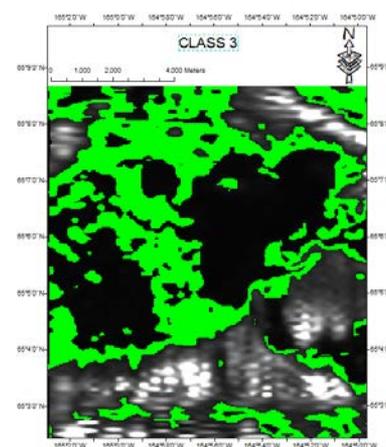
Frozen Ground



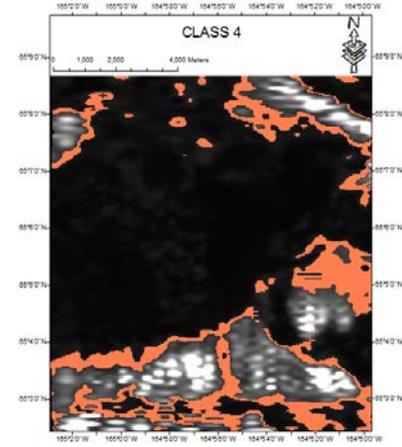
<5 % frozen



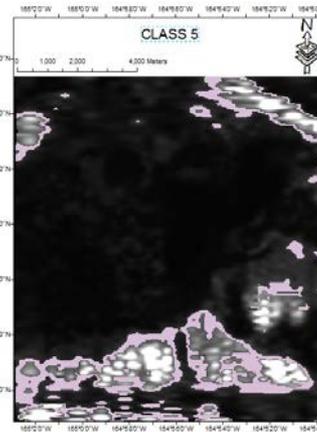
05-50 % frozen



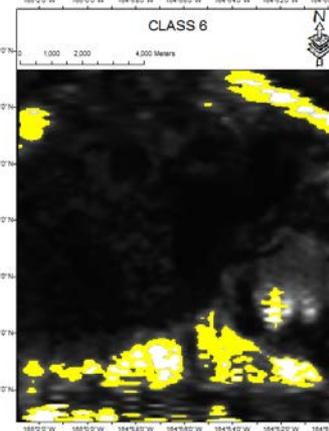
50-70 % frozen



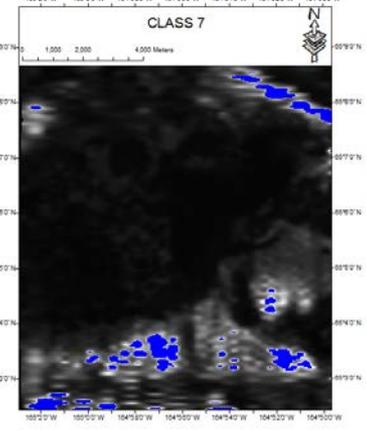
70-90 % frozen



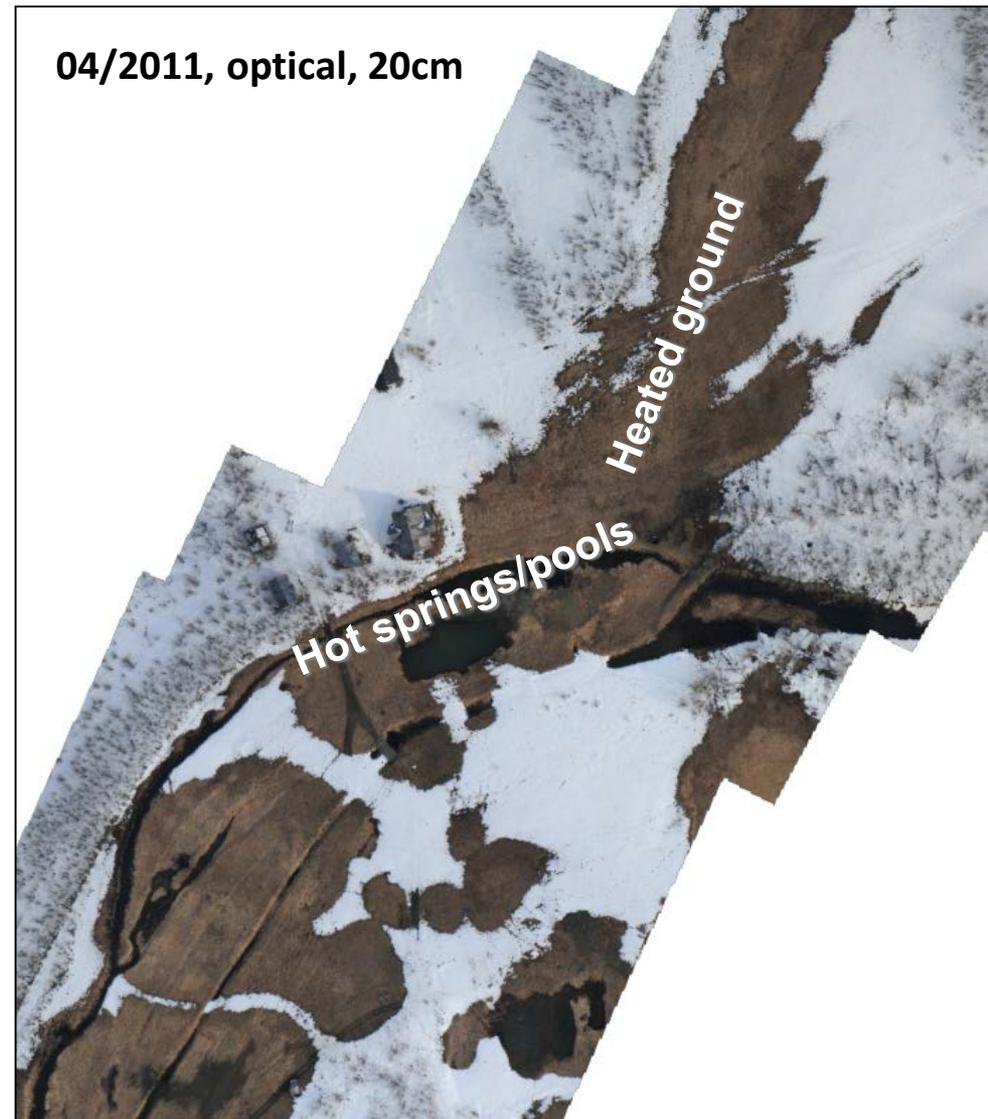
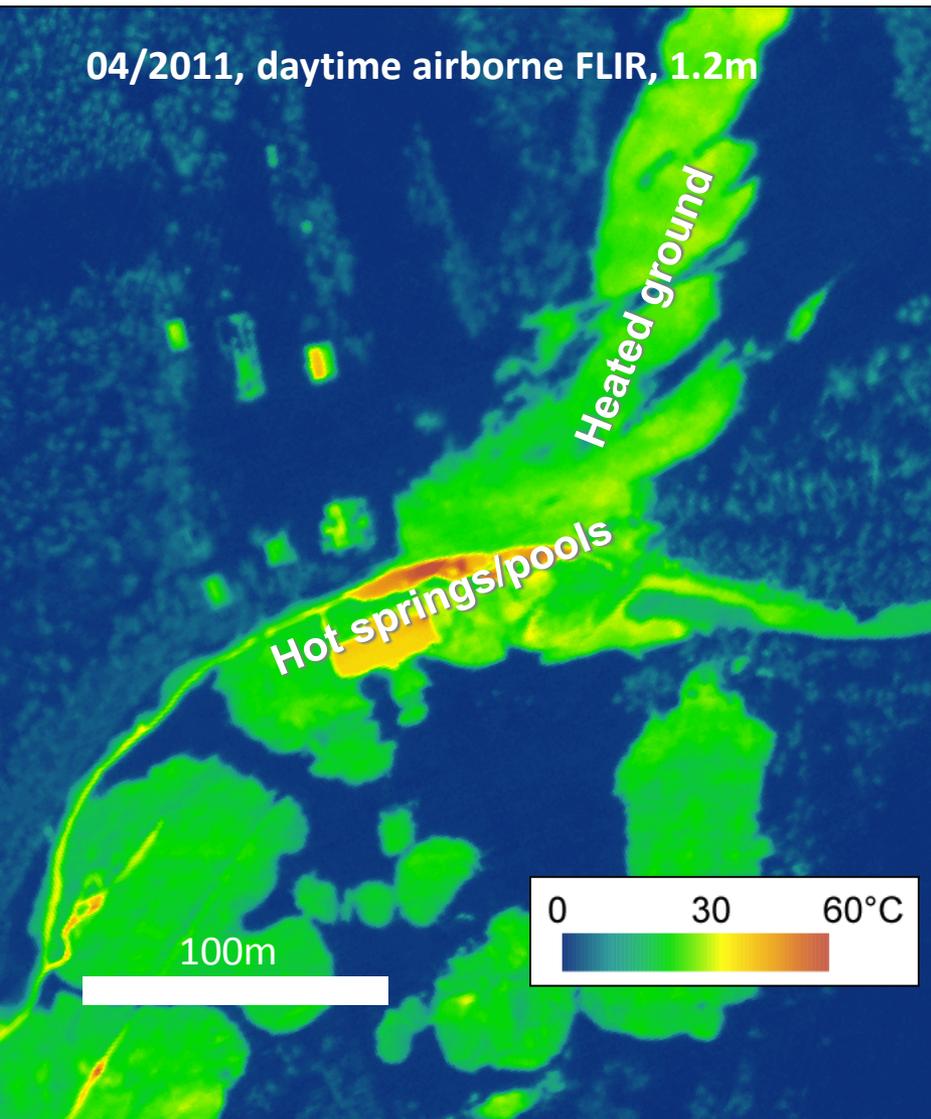
90-95 % frozen



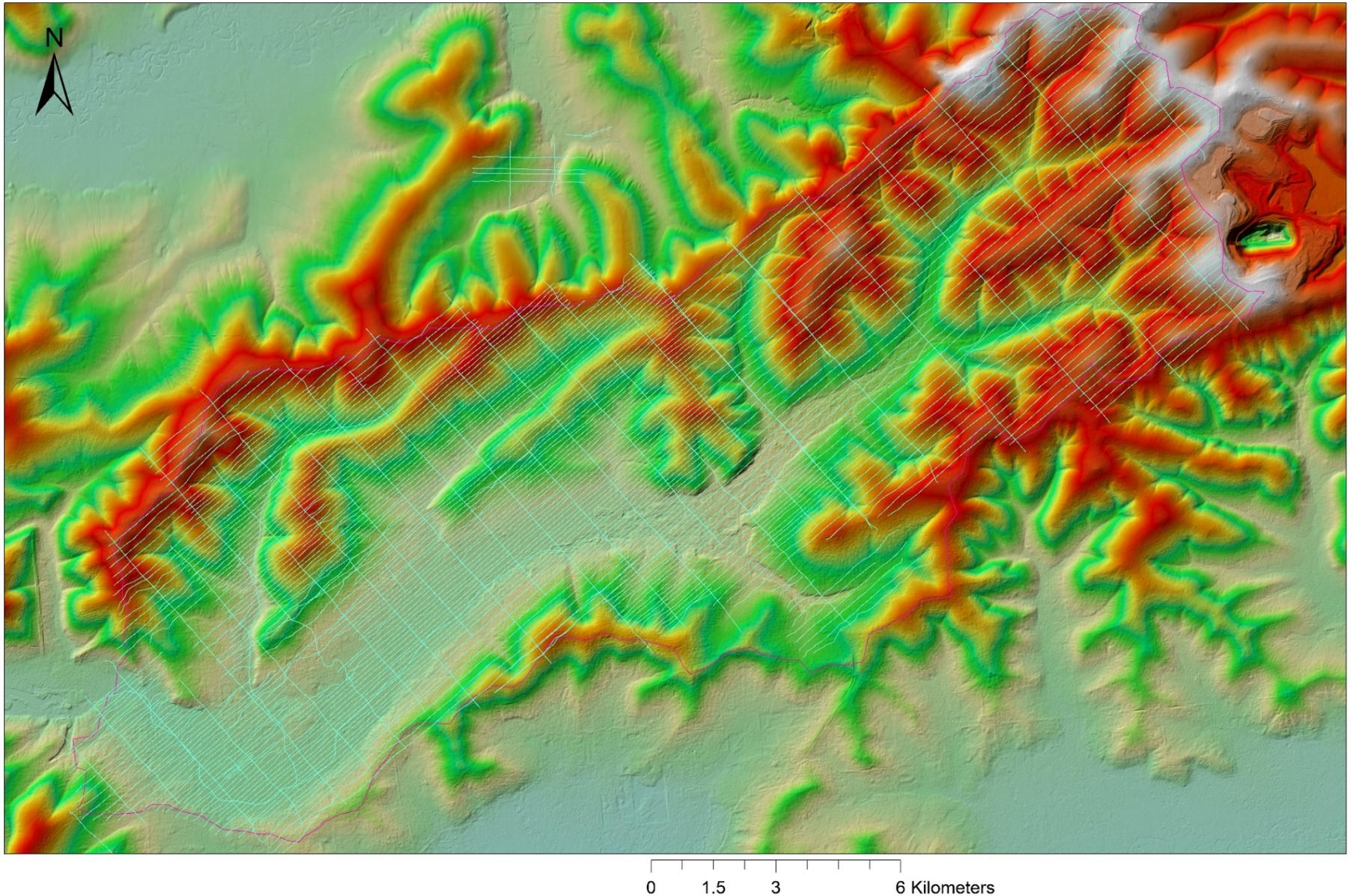
95-97 % frozen



Spring Thermal and Optical imagery

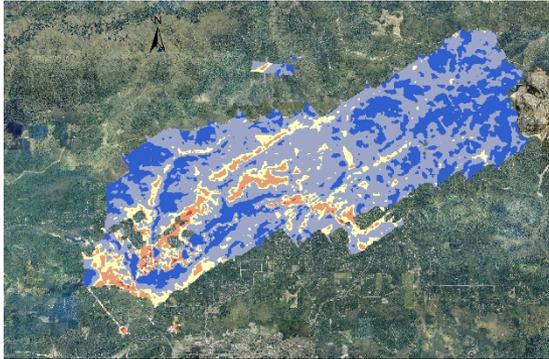


Goldstream Valley DEM and AEM lines

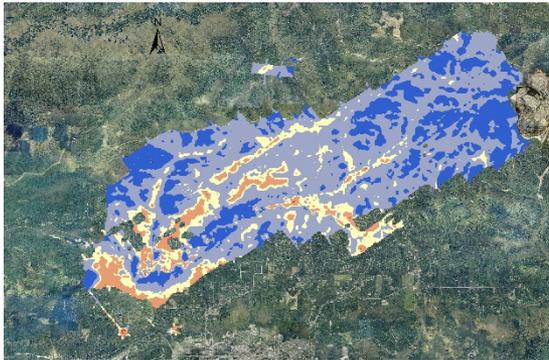


Apparent Resistivity maps

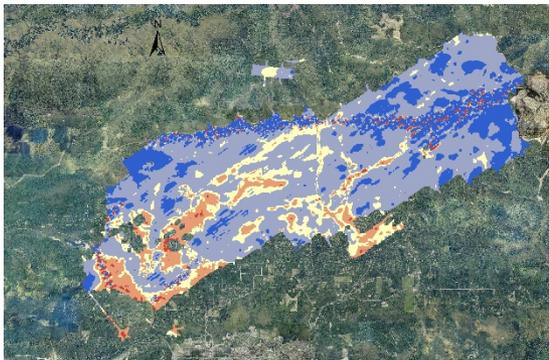
140KHz



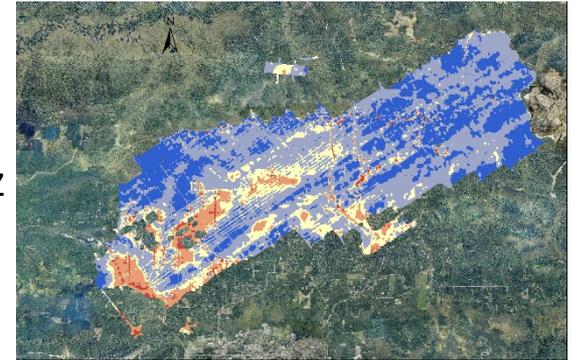
40KHz



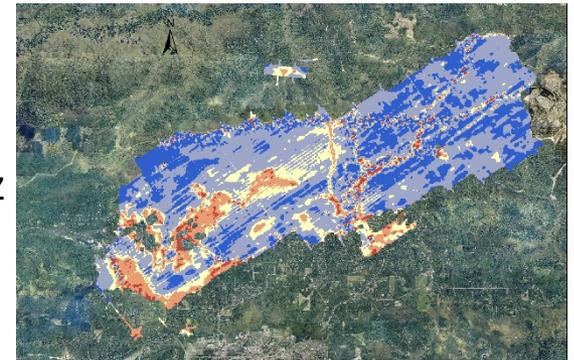
8200KHz



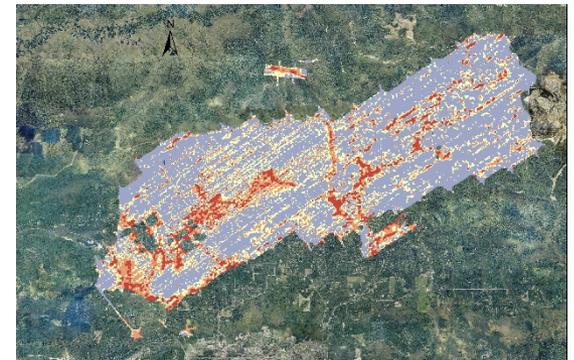
3300KHz



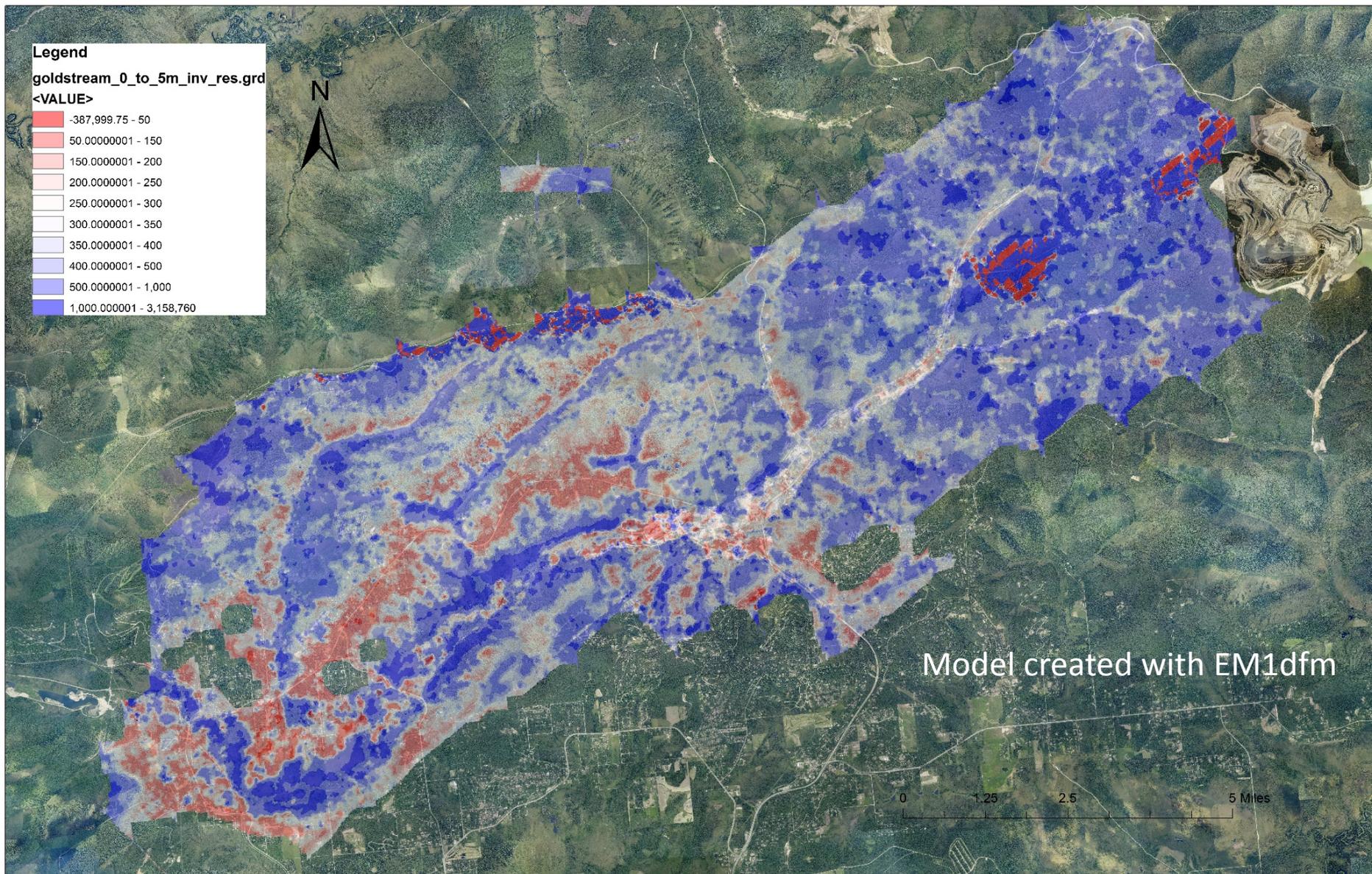
1800KHz



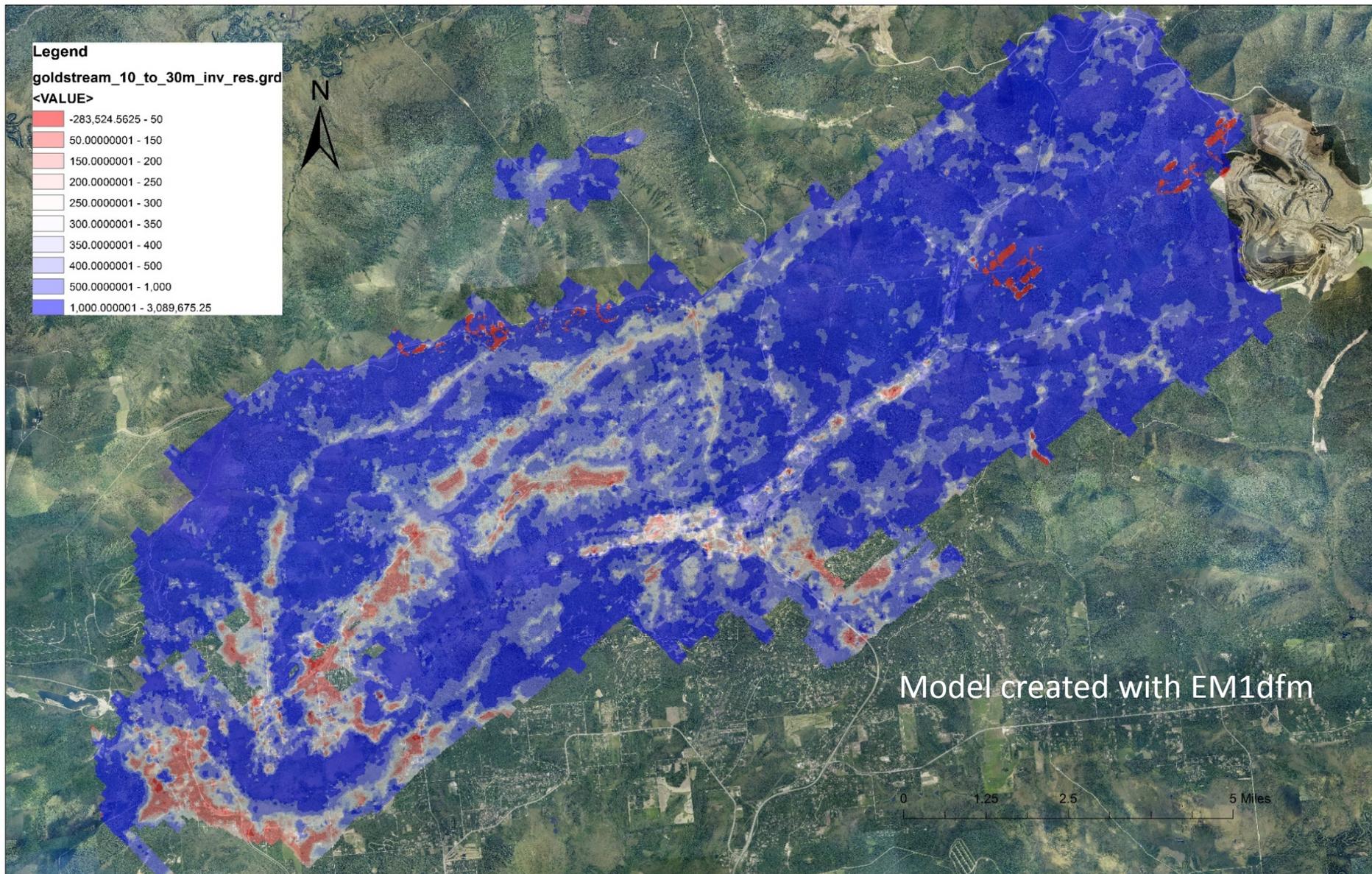
400KHz



Goldstream Valley Resistivity Model 0-5m



Goldstream Valley Resistivity Model 10-30m

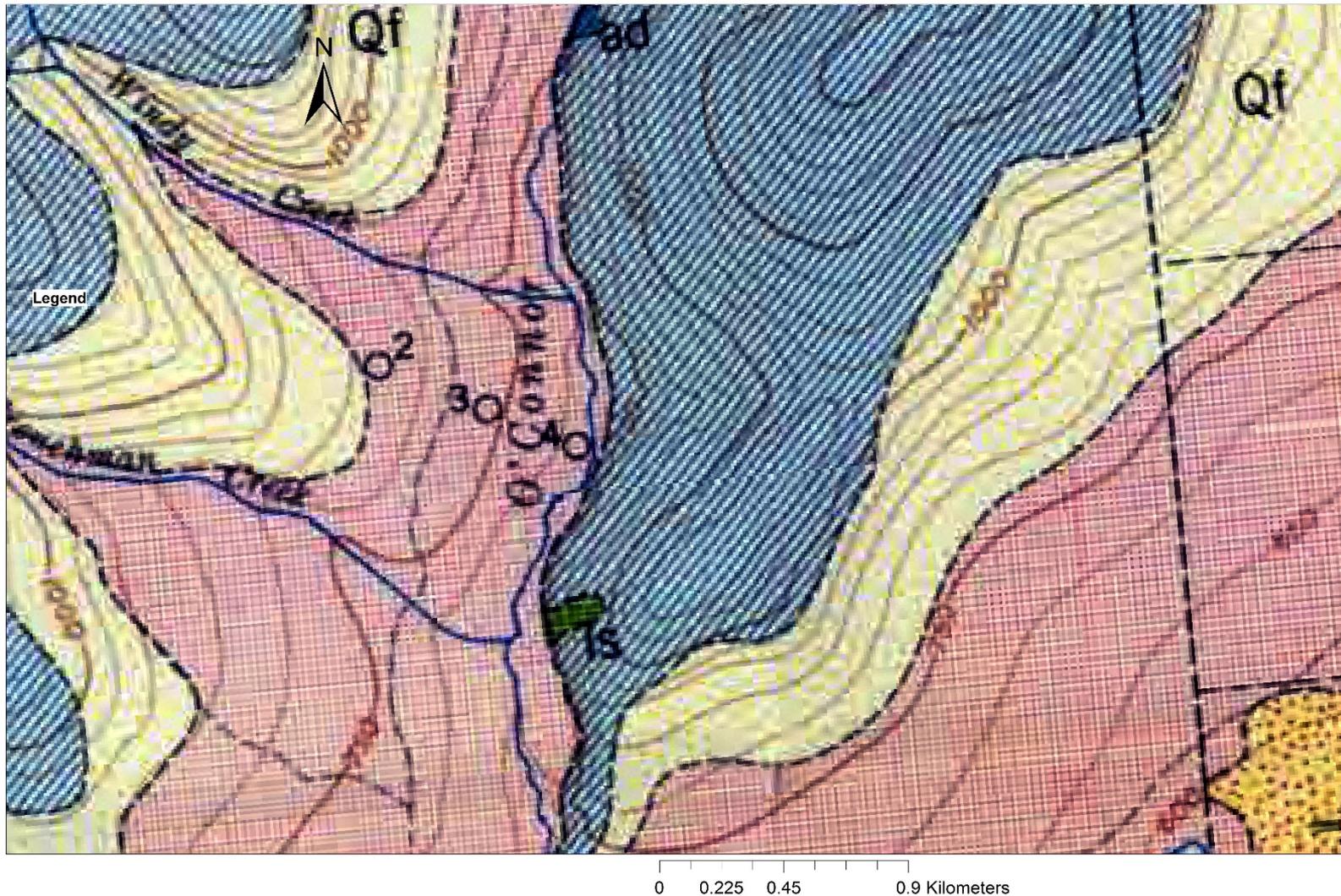


Aerial Imagery

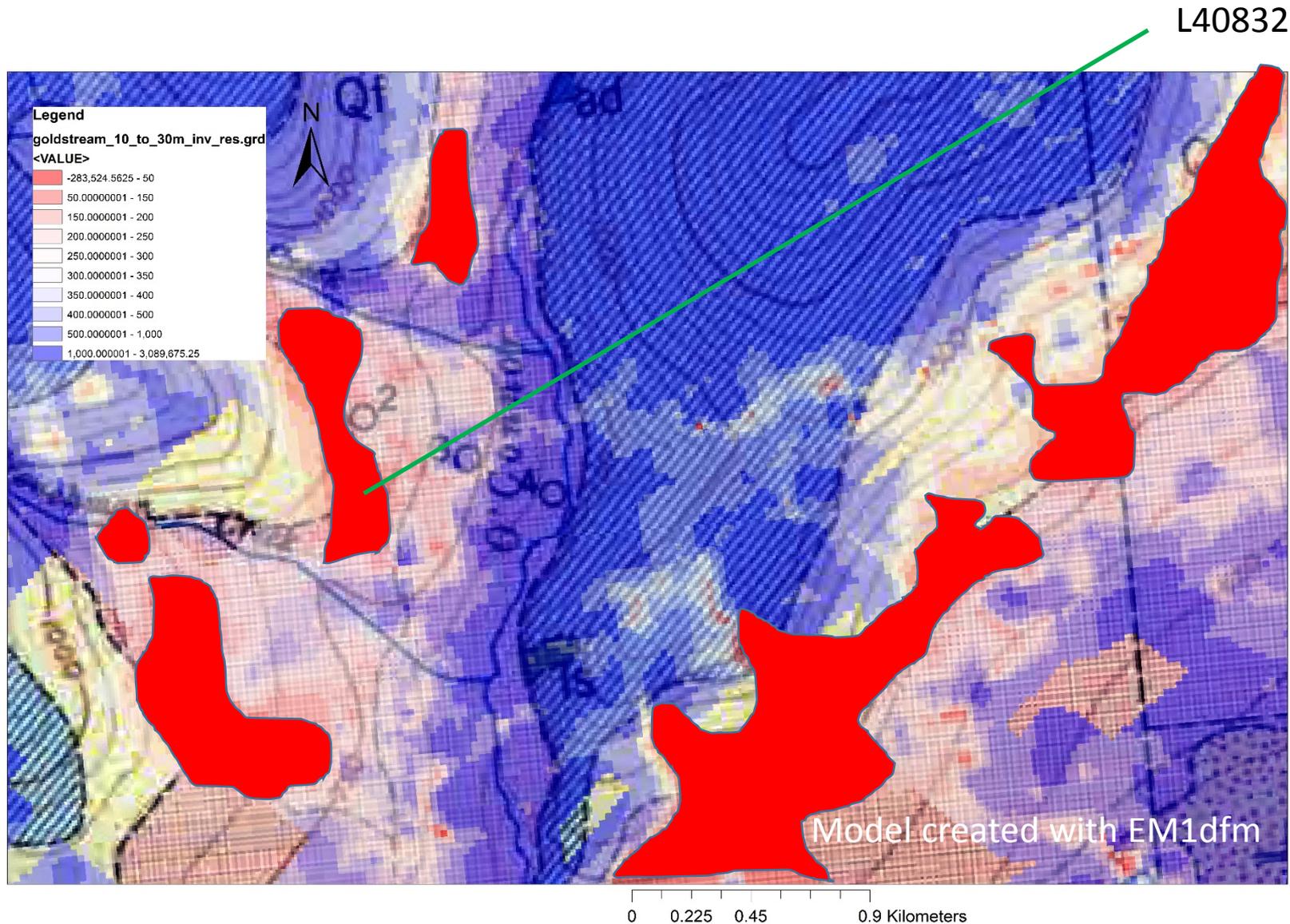


0 0.225 0.45 0.9 Kilometers

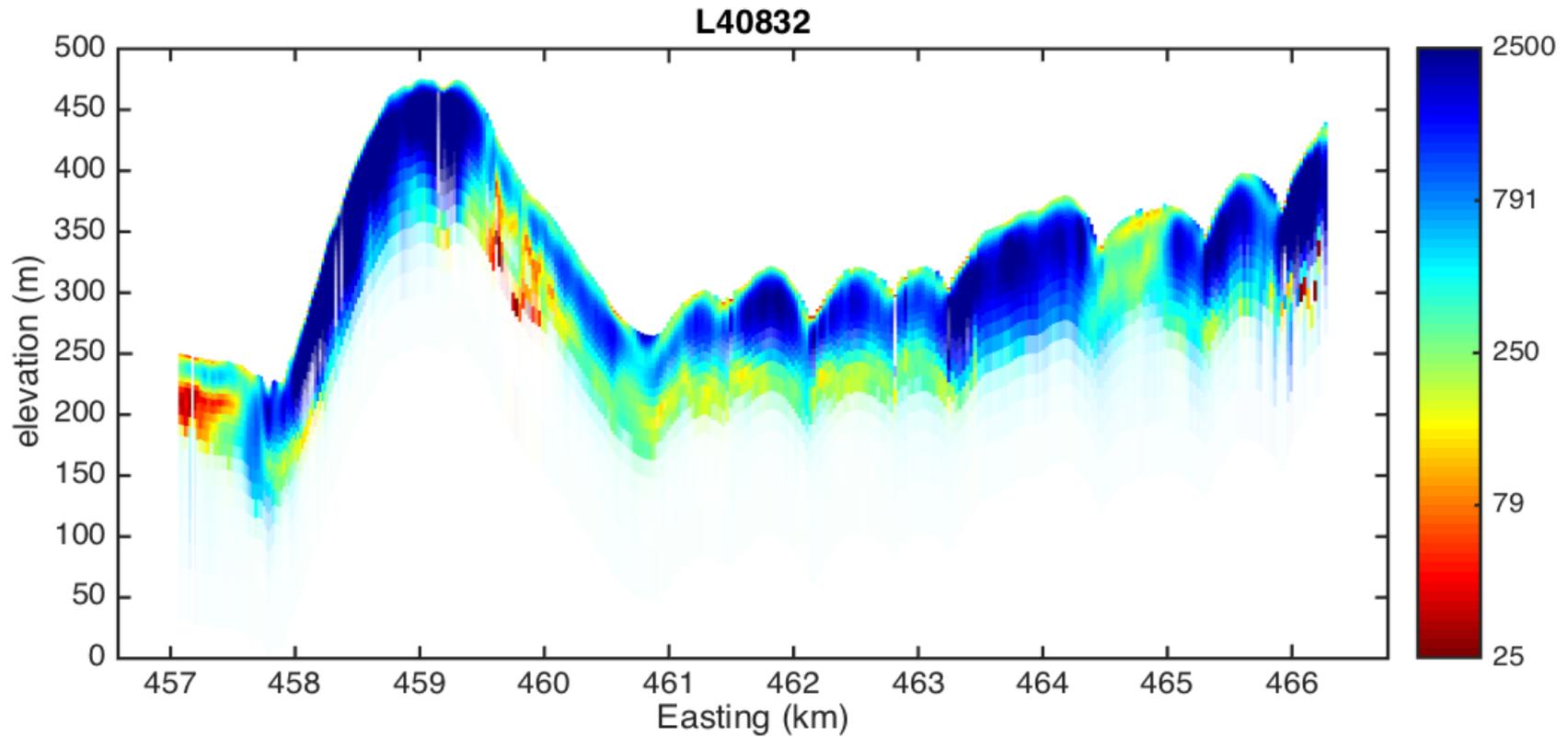
Péwé 1958 Geology map



Péwé 1958 Geology map and Resistivity

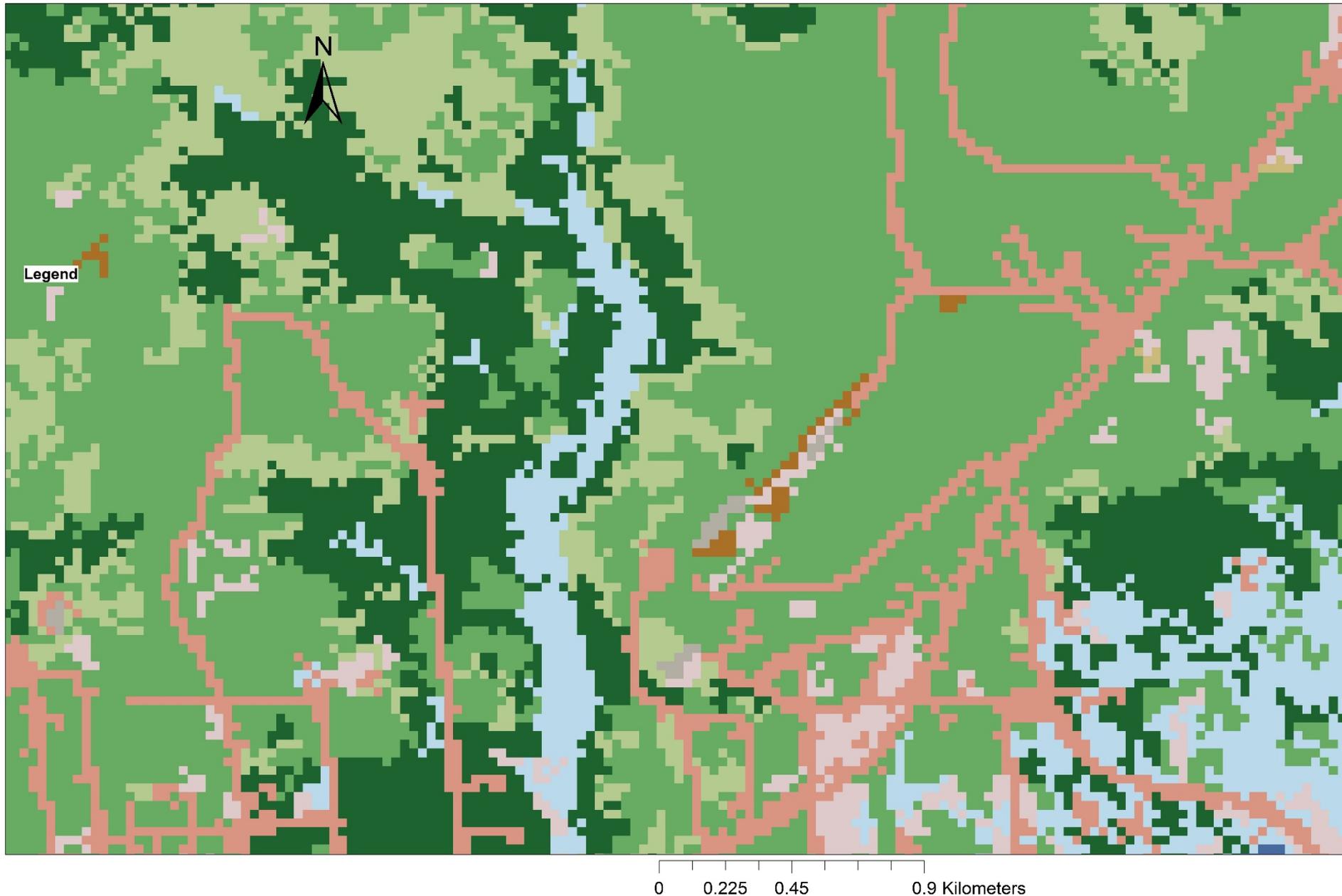


Line inversion results



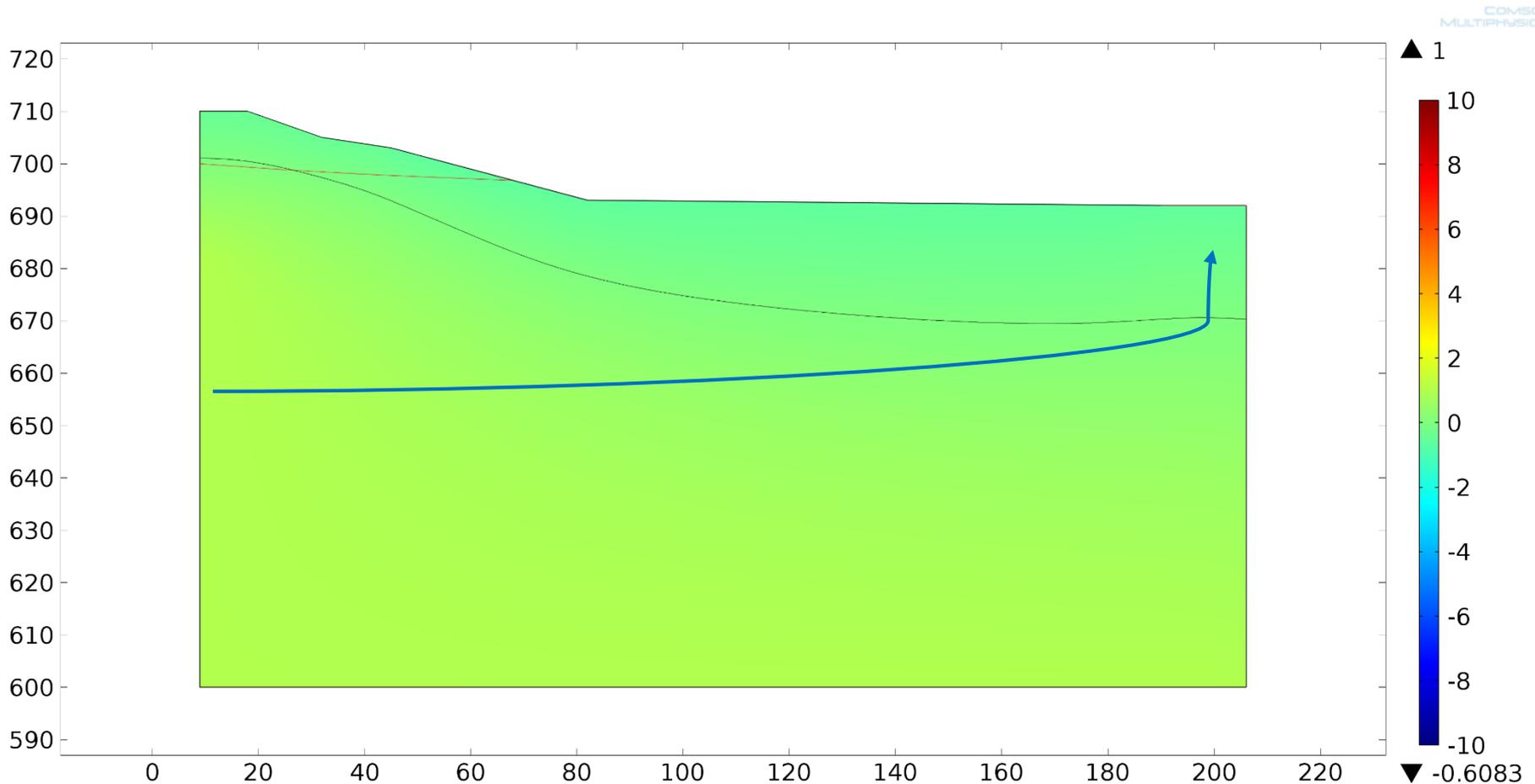
Model created with EM1dfm

Vegetation cover



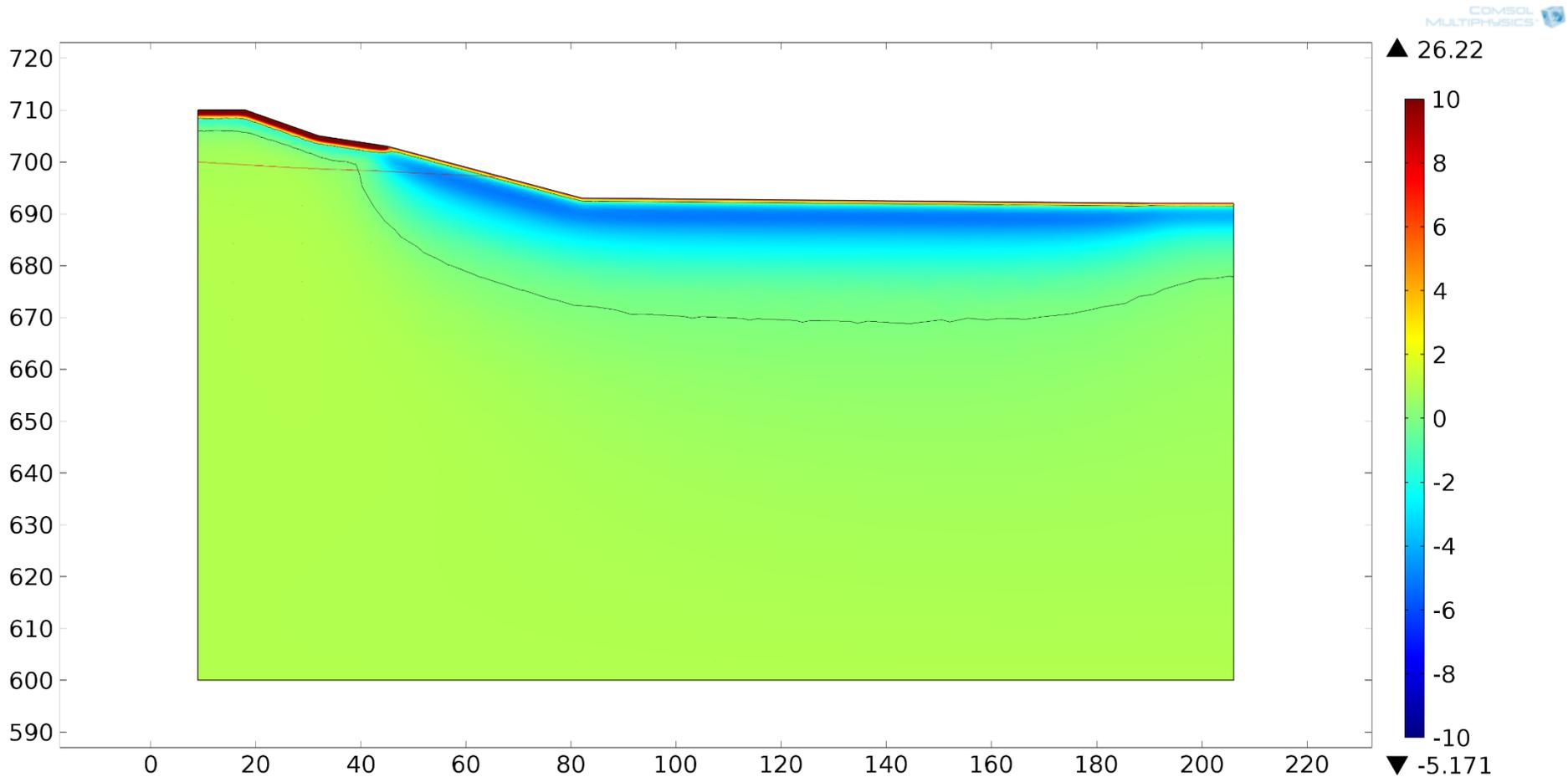
Modeled Ground Temperature

-1°C mean annual air temperature and groundwater flow into the valley and groundwater flow into the valley.



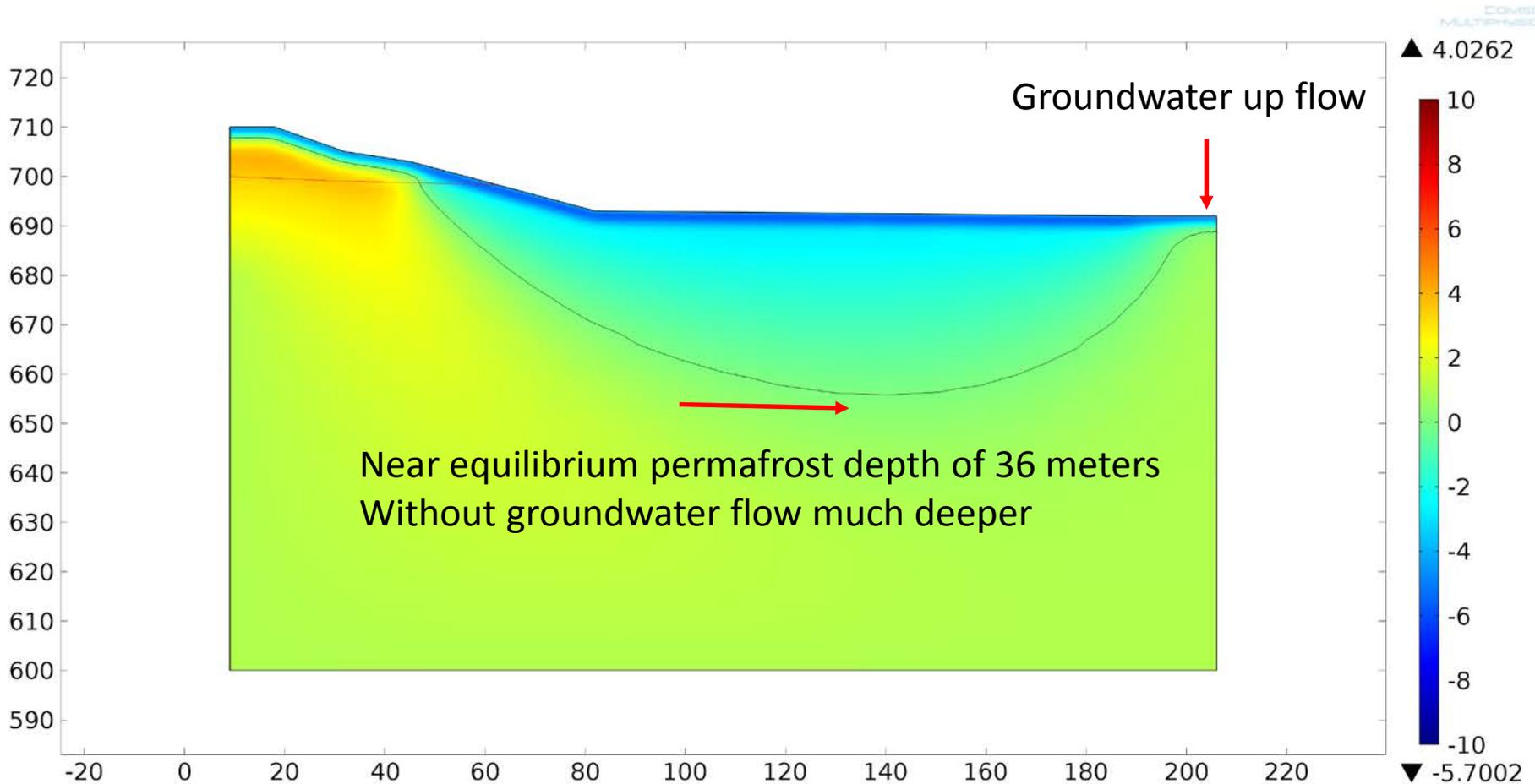
Modeled Ground Temperature

-1°C mean annual air temperature around sinusoidal annual distribution.
Summer and winter n-factor correction for vegetation.



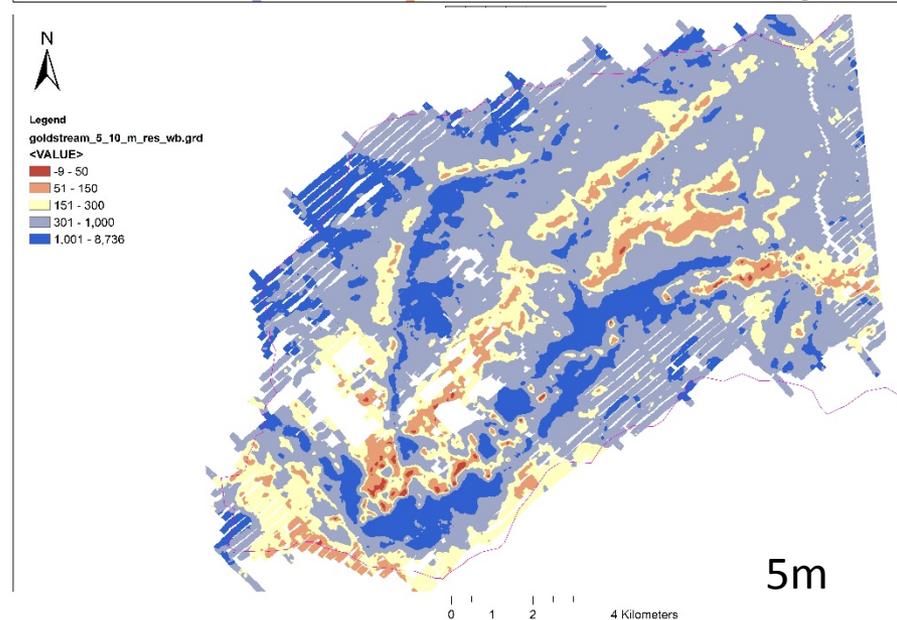
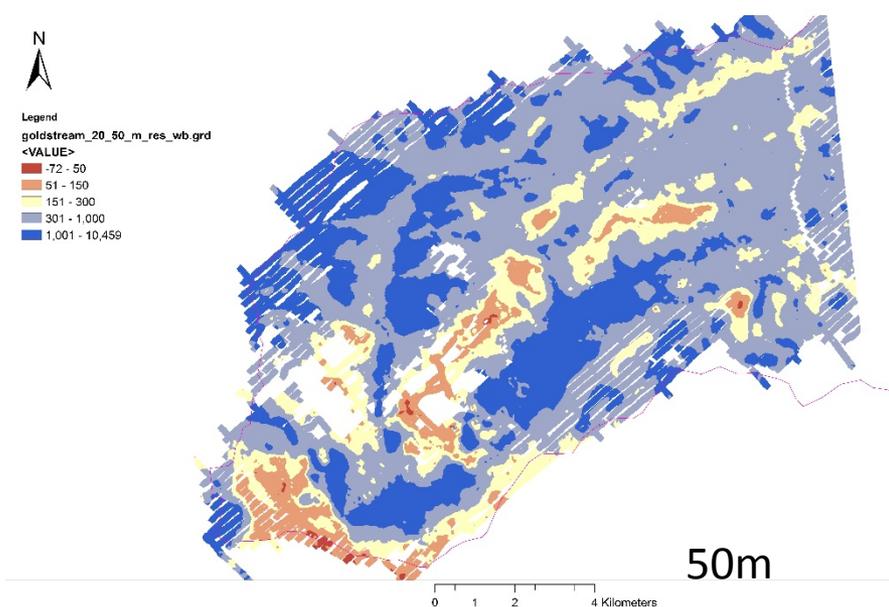
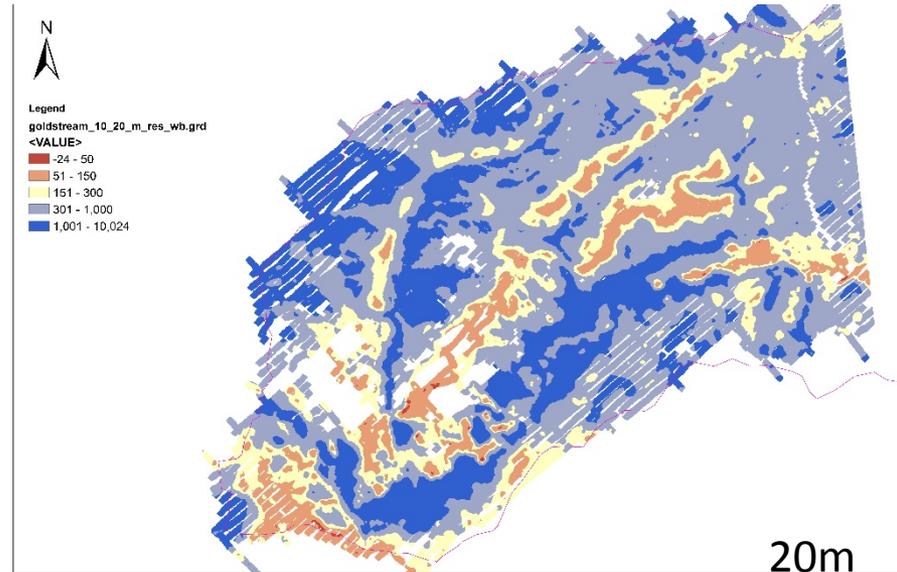
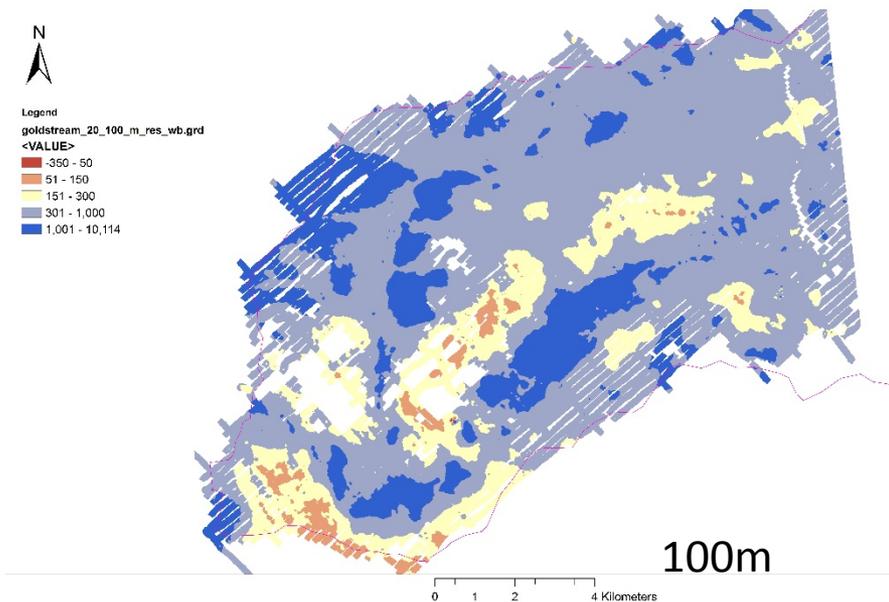
Modeled Ground Temperature

Same as before after 300 years.

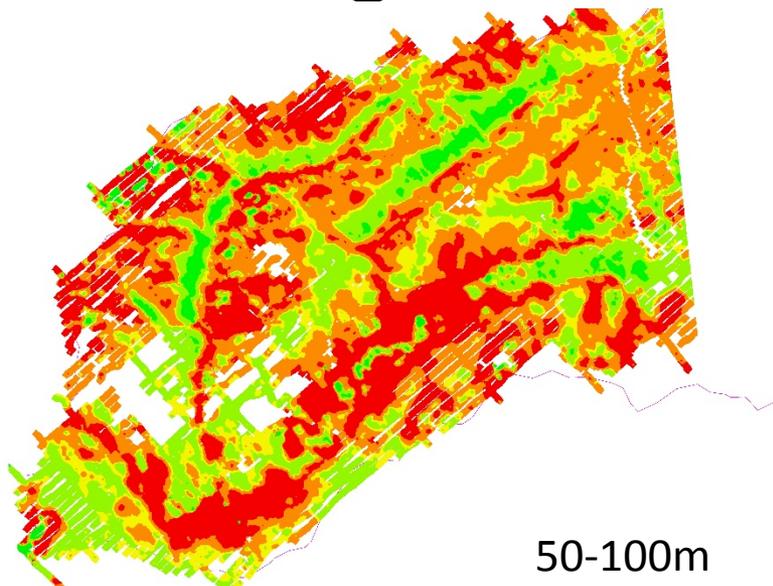


Bottom of permafrost?

2 ½ D inversion with Workbench

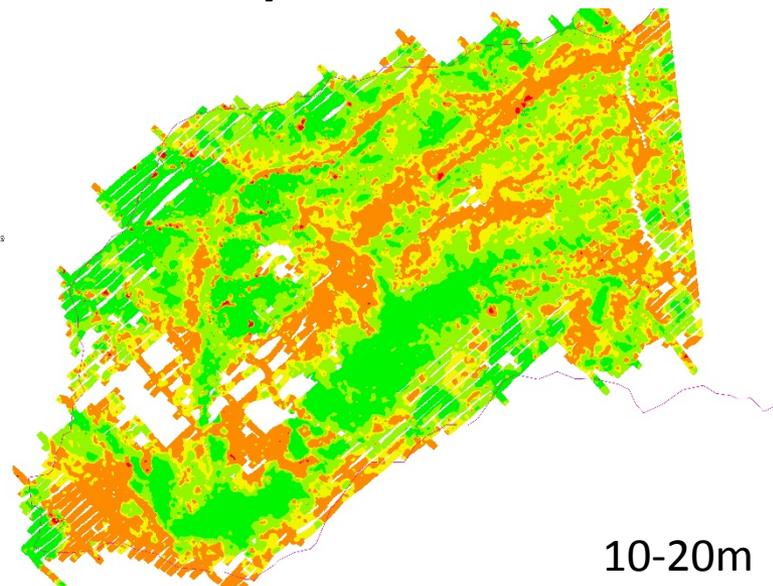


Vertical gradient of Resistivity



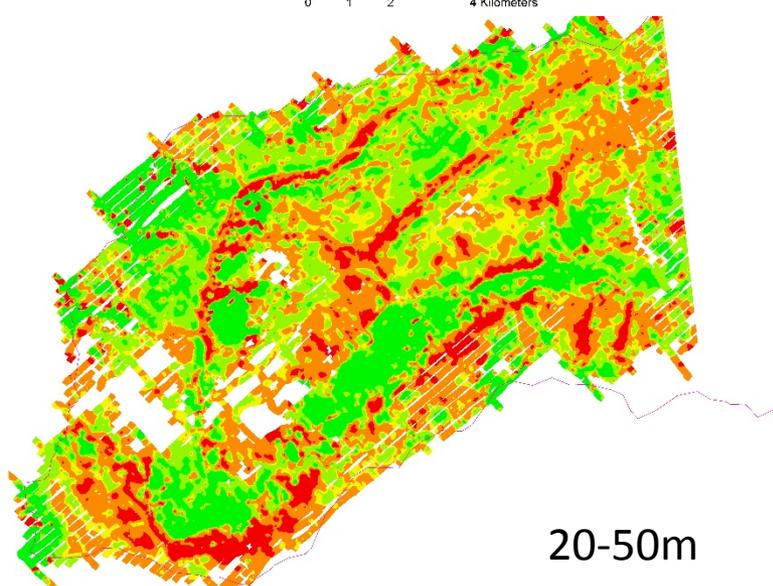
50-100m

0 1 2 4 Kilometers



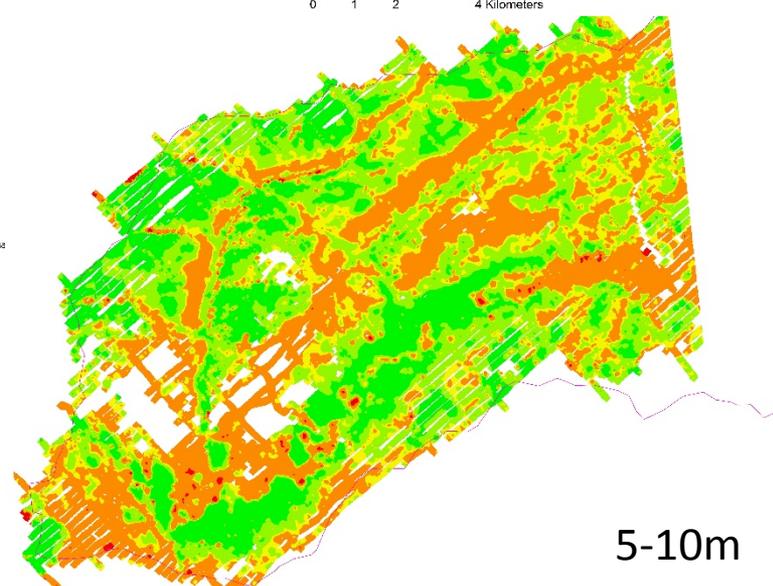
10-20m

0 1 2 4 Kilometers



20-50m

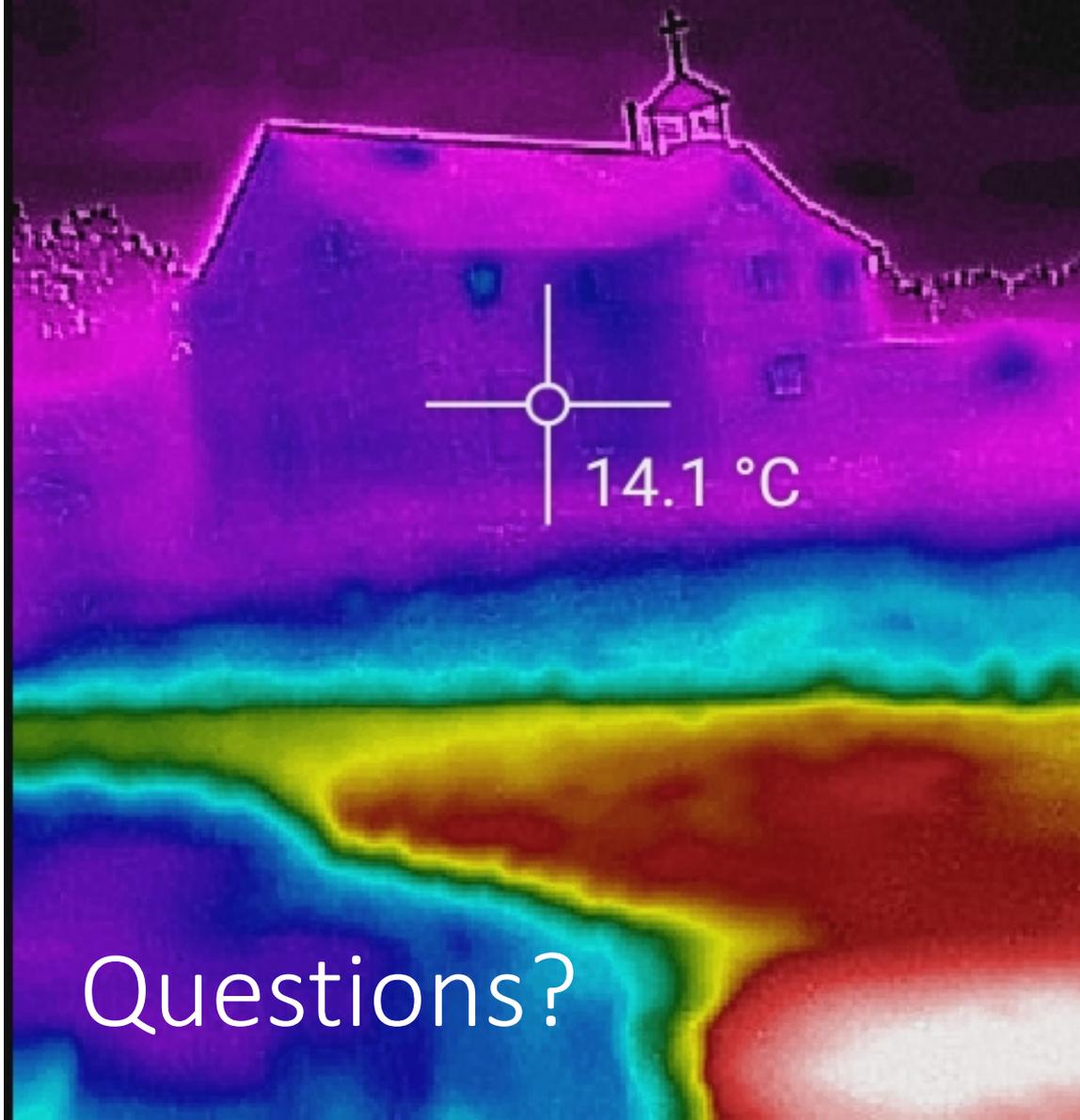
0 1 2 4 Kilometers



5-10m

0 1 2 4 Kilometers

Thank you



Questions?