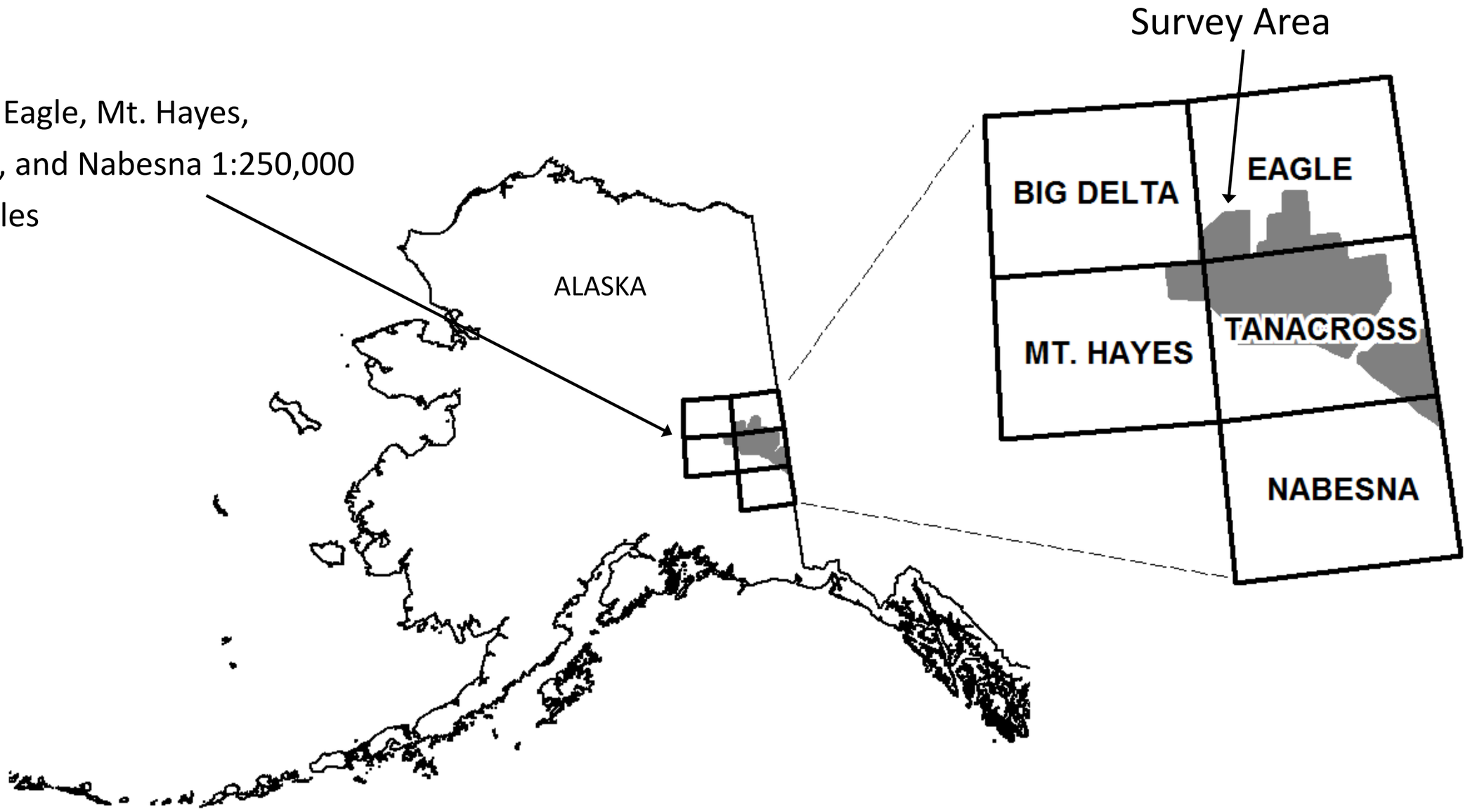
Airborne magnetic geophysical survey of the Tanacross region, Alaska

State of Alaska, Department of Natural Resources, Division of Geological & Geophysical Surveys

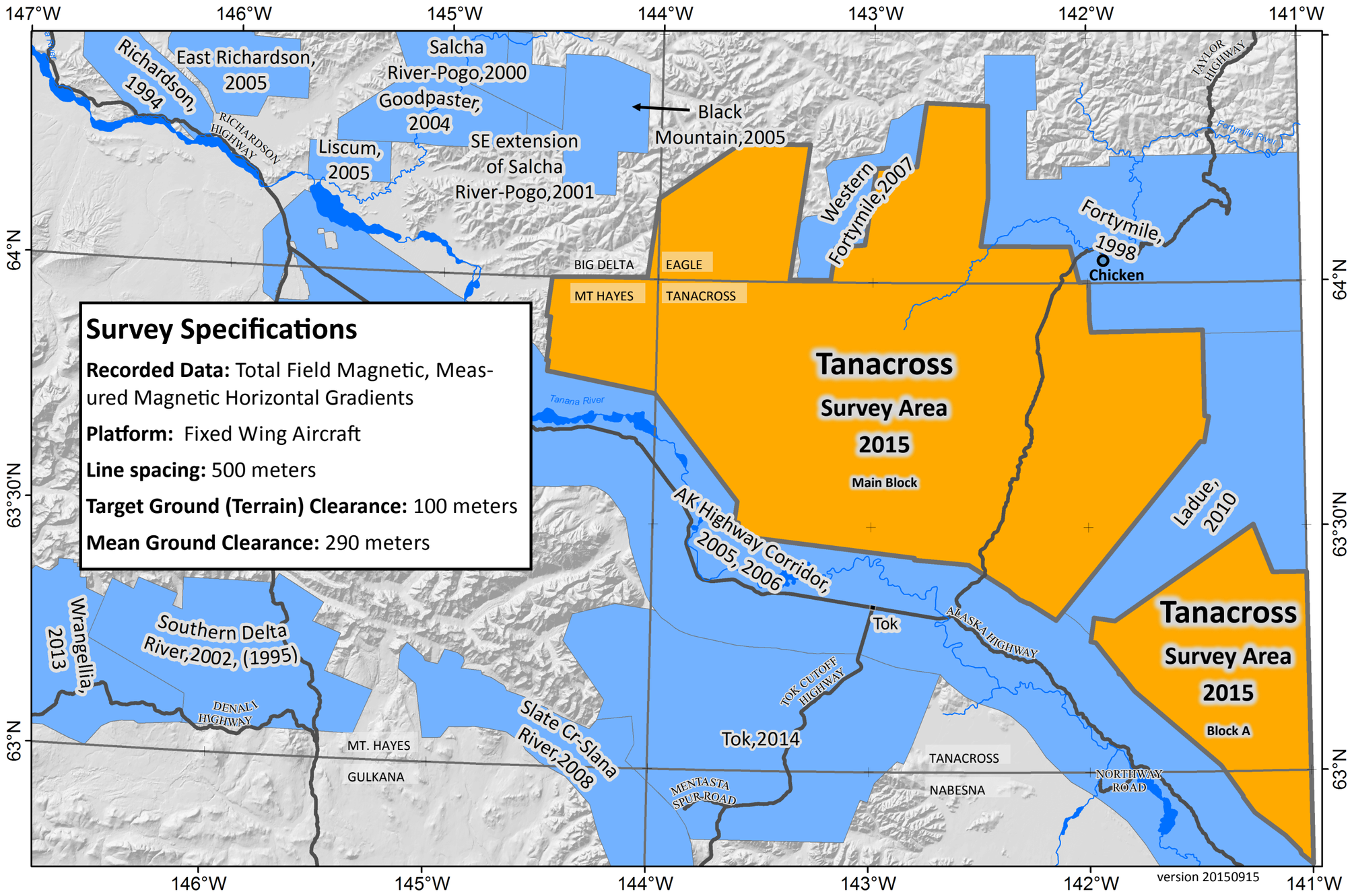
http://dx.doi.org/10.14509/29514

Survey Overview

Big Delta, Eagle, Mt. Hayes, Tanacross, and Nabesna 1:250,000 Quadrangles



Tanacross survey area, nearby and adjacent DGGS 400m line spacing electromagnetic and magnetic surveys, relevant 1:250,000-scale USGS quadrangle boundaries, major highways, major rivers, and shaded relief



Survey Specifications

Recorded Data: Total Field Magnetic, Measured Magnetic Horizontal Gradients

Platform: Fixed Wing Aircraft

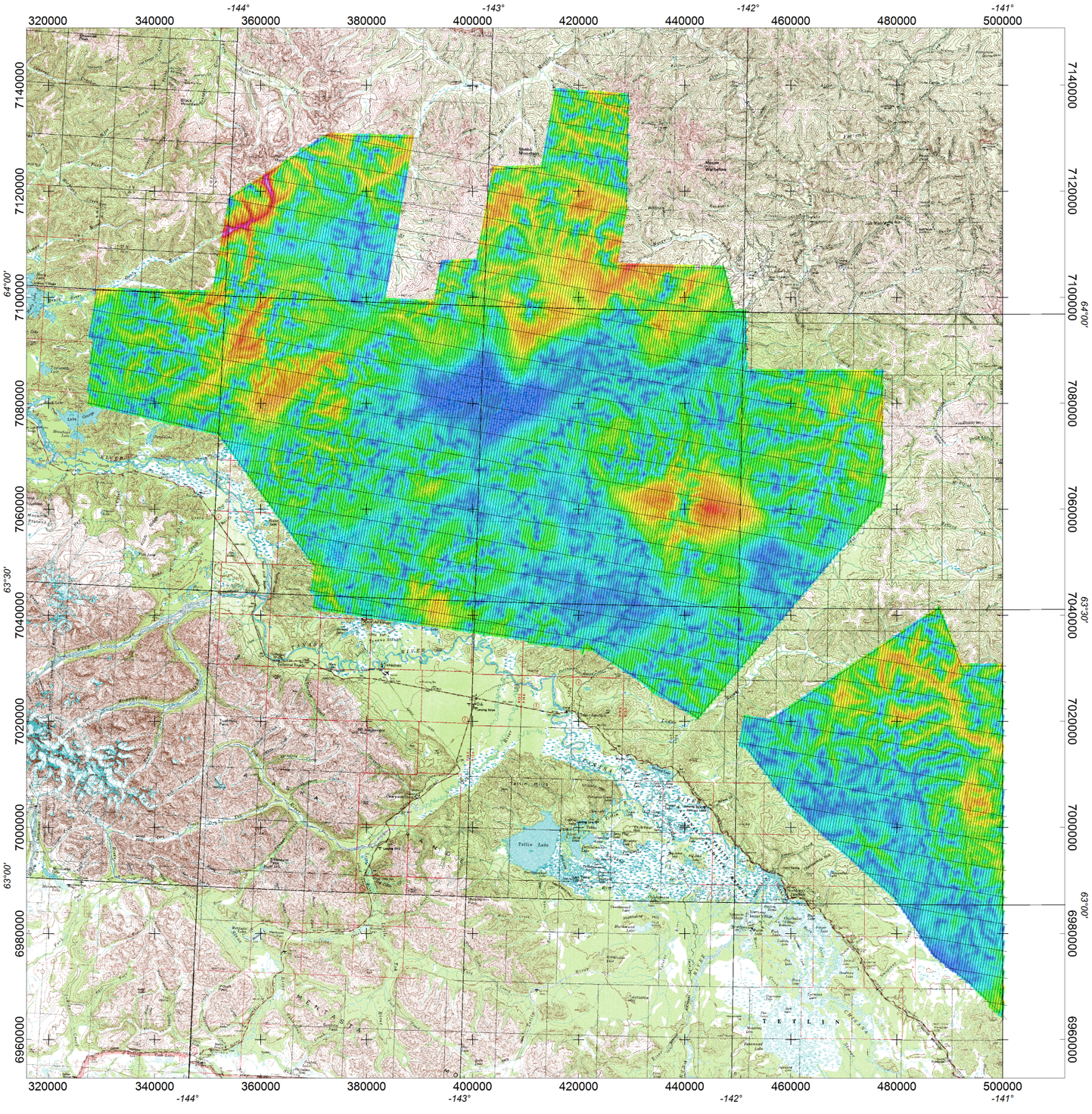
Line spacing: 500 meters

Target Ground (Terrain) Clearance: 100 meters

Mean Ground Clearance: 290 meters

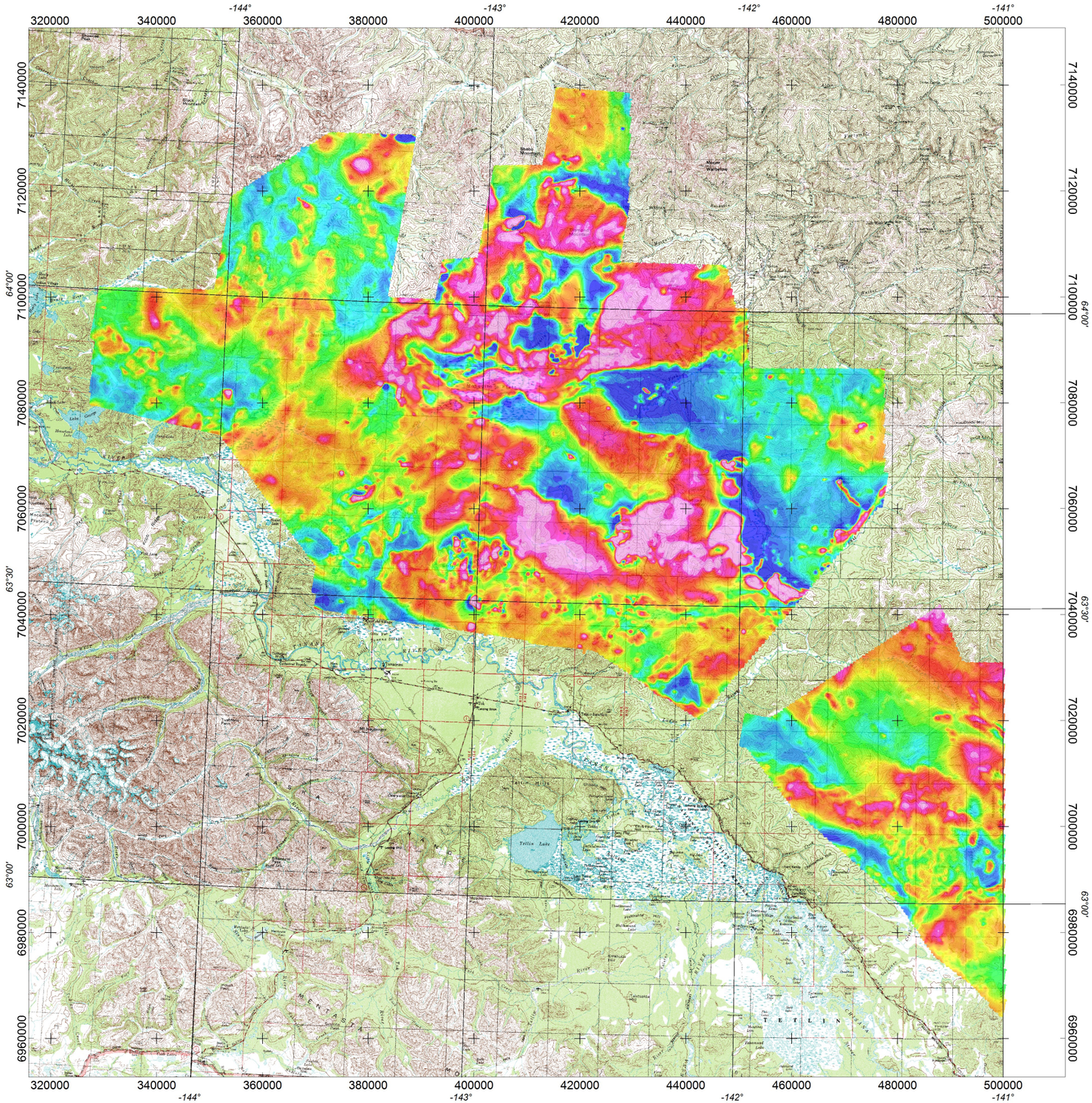
FLIGHT LINES AND GROUND CLEARANCE

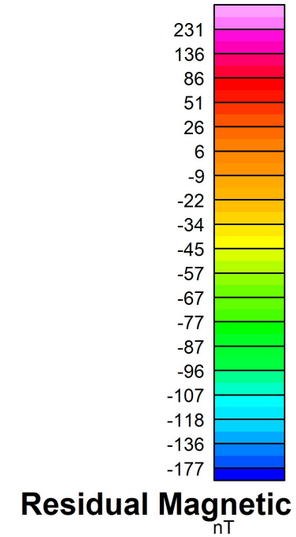
The ground clearance is the elevation of the aircraft and sensor from the onboard GPS minus the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global Digital Elevation Model Version 1 (GDEM V1). These values were then interpolated on to a 100 m grid using minimum curvature techniques.



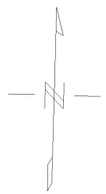
RESIDUAL MAGNETIC INTENSITY

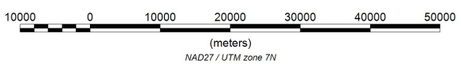
The residual magnetic field represents the component of the total magnetic field related almost entirely to the magnetic properties the Earth's crust. The data presented here were derived from the recorded data by: (1) application of a lag to accommodate system latency, (2) application of a diurnal correction derived from the magnetic base station data, (3) application of a height correction to account for line-to-line deviations from the pre-planned flight surface, (4) analysis of the remaining differences between the traverse and control line values at intersection points to obtain a correction profile that results in mutually leveled line data, (5) application of a micro-leveling correction to further reduce any remaining flight line noise, and (6) removal of The International Geomagnetic Reference Field (IGRF) values defined at the average mean sea-level height of 1048.5 m for the year 2015.52 to obtain the residual magnetic intensity. These final values were then interpolated onto a 100 m grid using the measured local horizontal gradients to guide between-line splines.





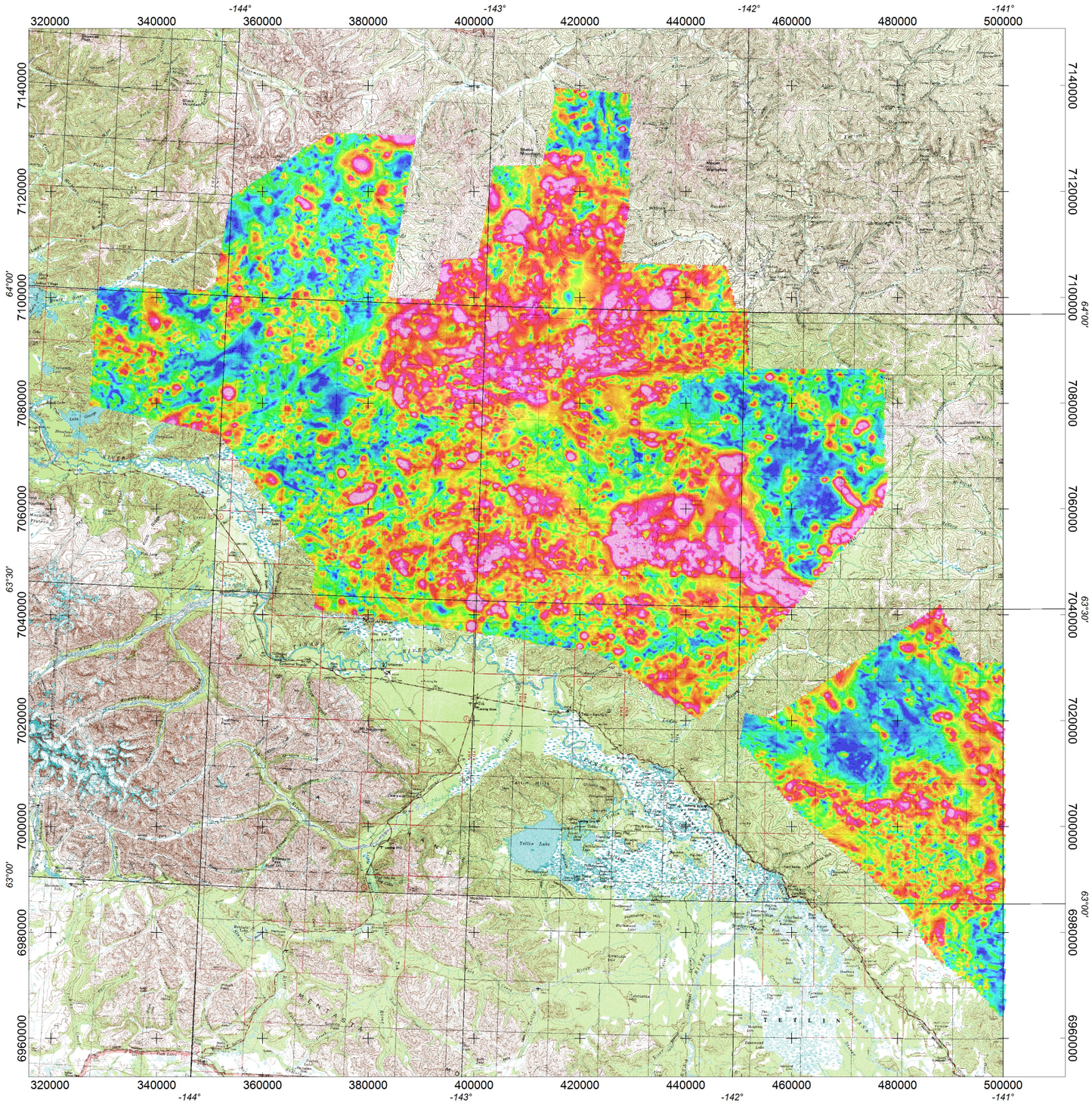
Residual Magnetic Intensity
nT





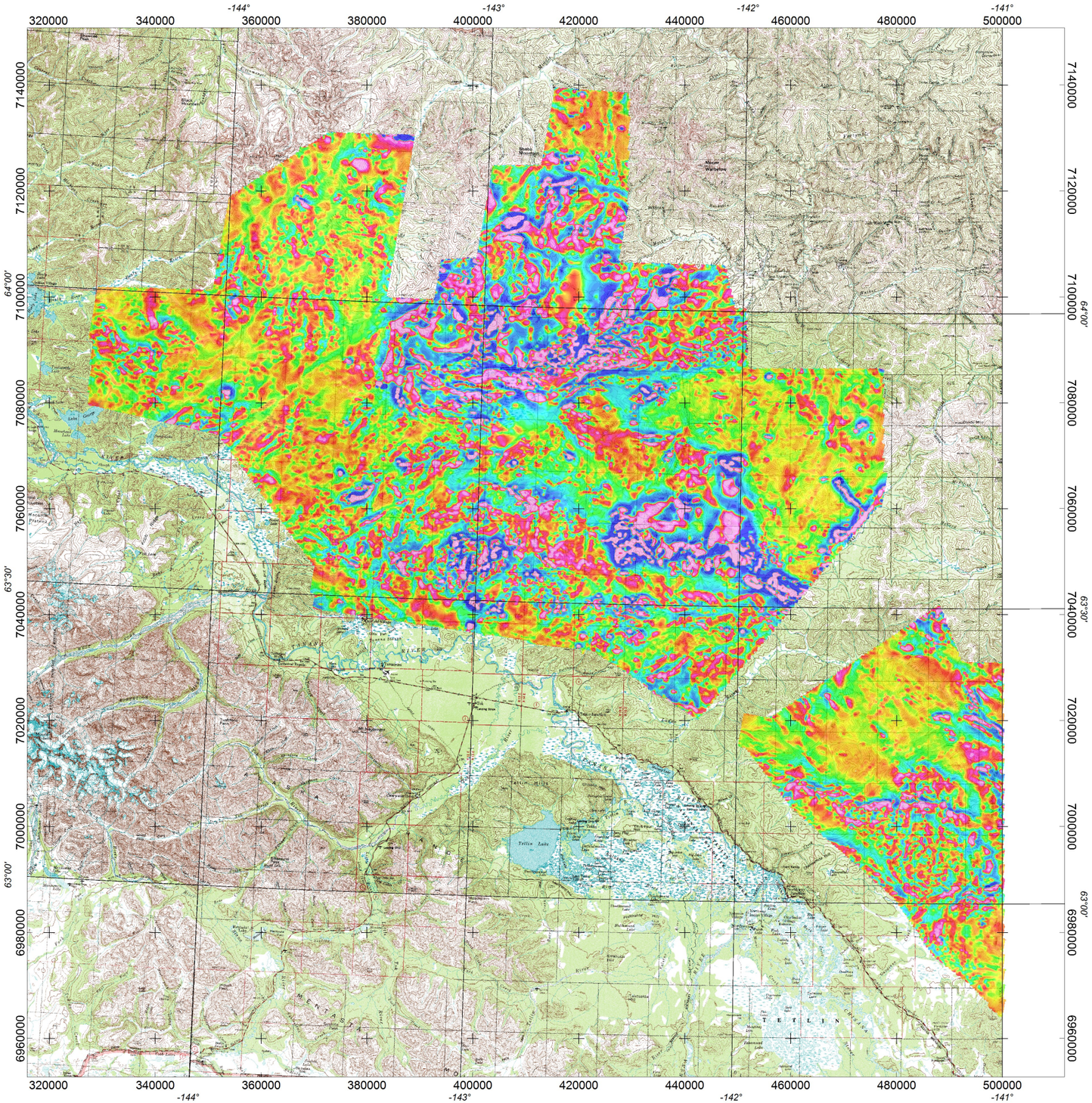
ANALYTIC SIGNAL

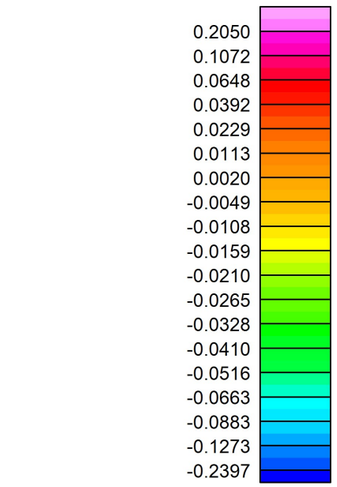
The analytic signal of the magnetic field is the total amplitude of the horizontal magnetic gradients with the vertical magnetic gradient. Computation of the analytic signal enhances the boundaries of magnetic anomalies and is independent of direction of magnetization. The data presented here were derived from the recorded data by the application of FFT-based vertical and horizontal derivative operators and computation of the total magnitude of the resulting components.



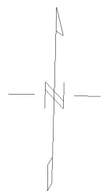
CALCULATED FIRST VERTICAL DERIVATIVE OF THE MAGNETIC FIELD

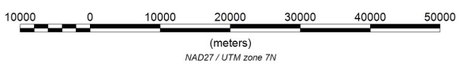
The first vertical derivative of the magnetic field is the rate of change of the magnetic field in the vertical direction. Computation of the first vertical derivative removes long wavelength features and improves resolution of closely spaced and superimposed anomalies. The data presented here were derived from the recorded data by application of a FFT-based transfer function to the residual magnetic intensity grid.





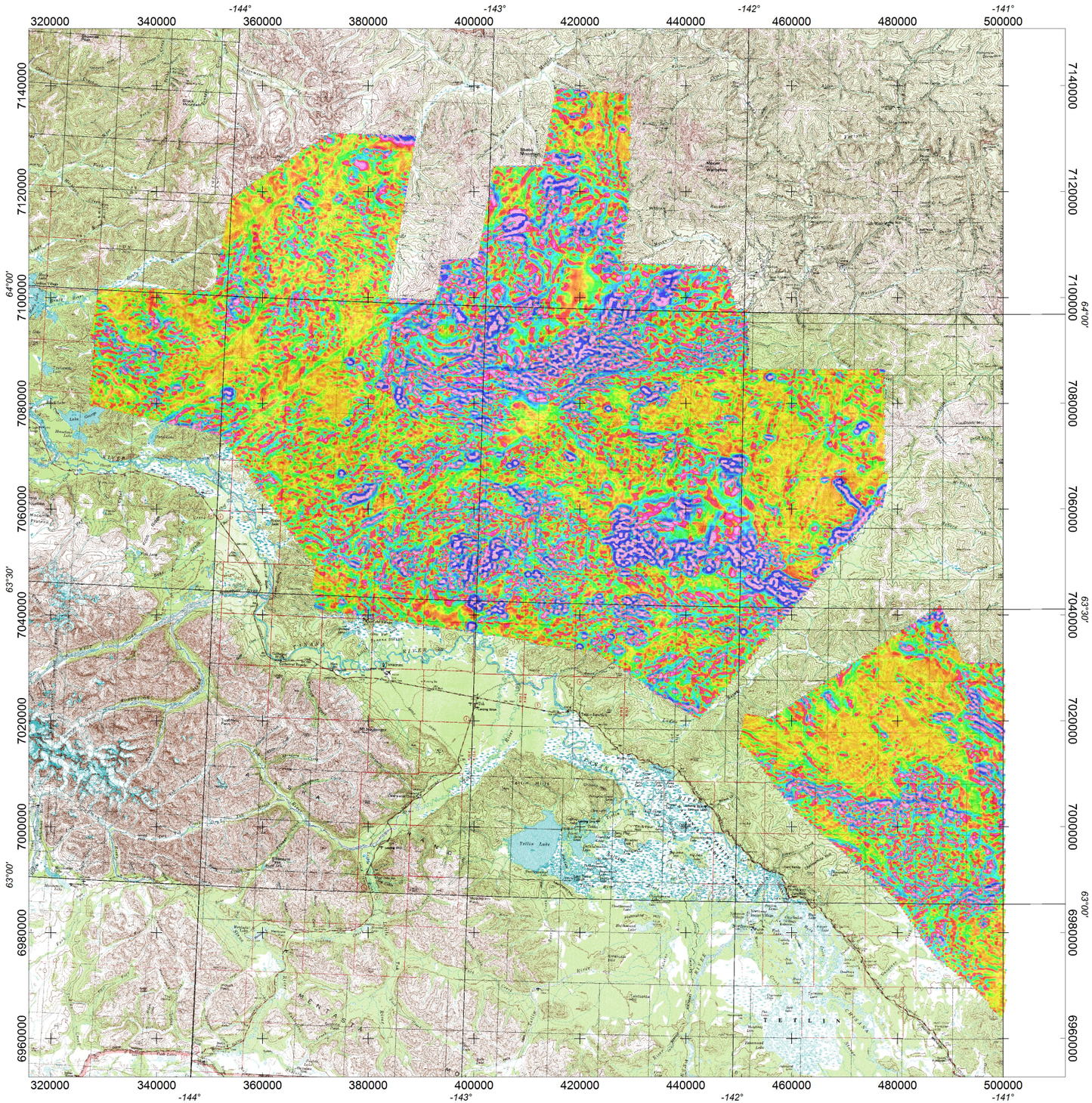
Calculated 1st Vertical Derivative
nT/m

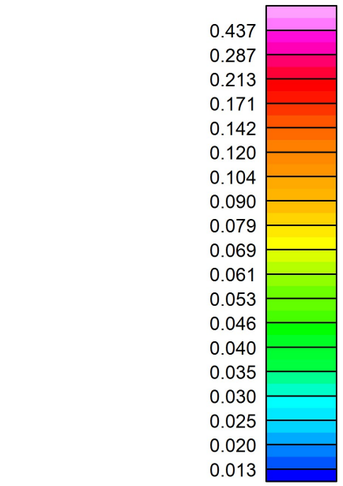




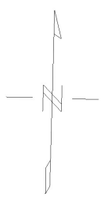
CALCULATED SECOND VERTICAL DERIVATIVE OF THE MAGNETIC FIELD

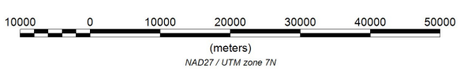
The second vertical derivative of the magnetic field is the rate of change of the magnetic field in the vertical direction. Computation of the second vertical derivative removes long wavelength features and improves resolution of closely spaced and superimposed anomalies. The data presented here were derived from the recorded data by application of an FFT-based transfer functions of the second vertical derivative and a fifth order Butterworth lowpass filter. The latter (lowpass filter) aimed at attenuating unwanted high frequencies enhanced by the derivative operator.





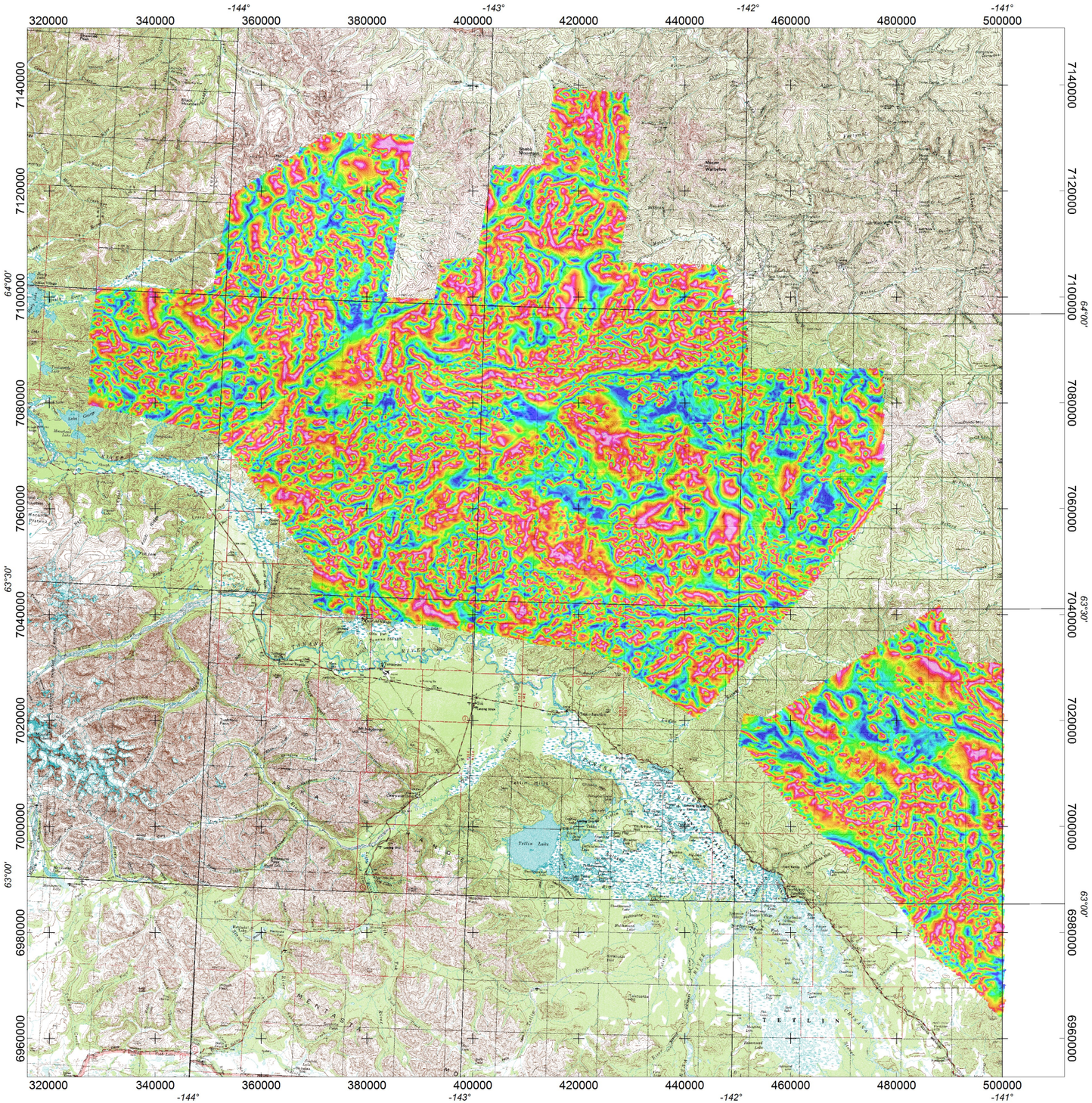
Calculated 2nd Vertical Derivative
nT/m





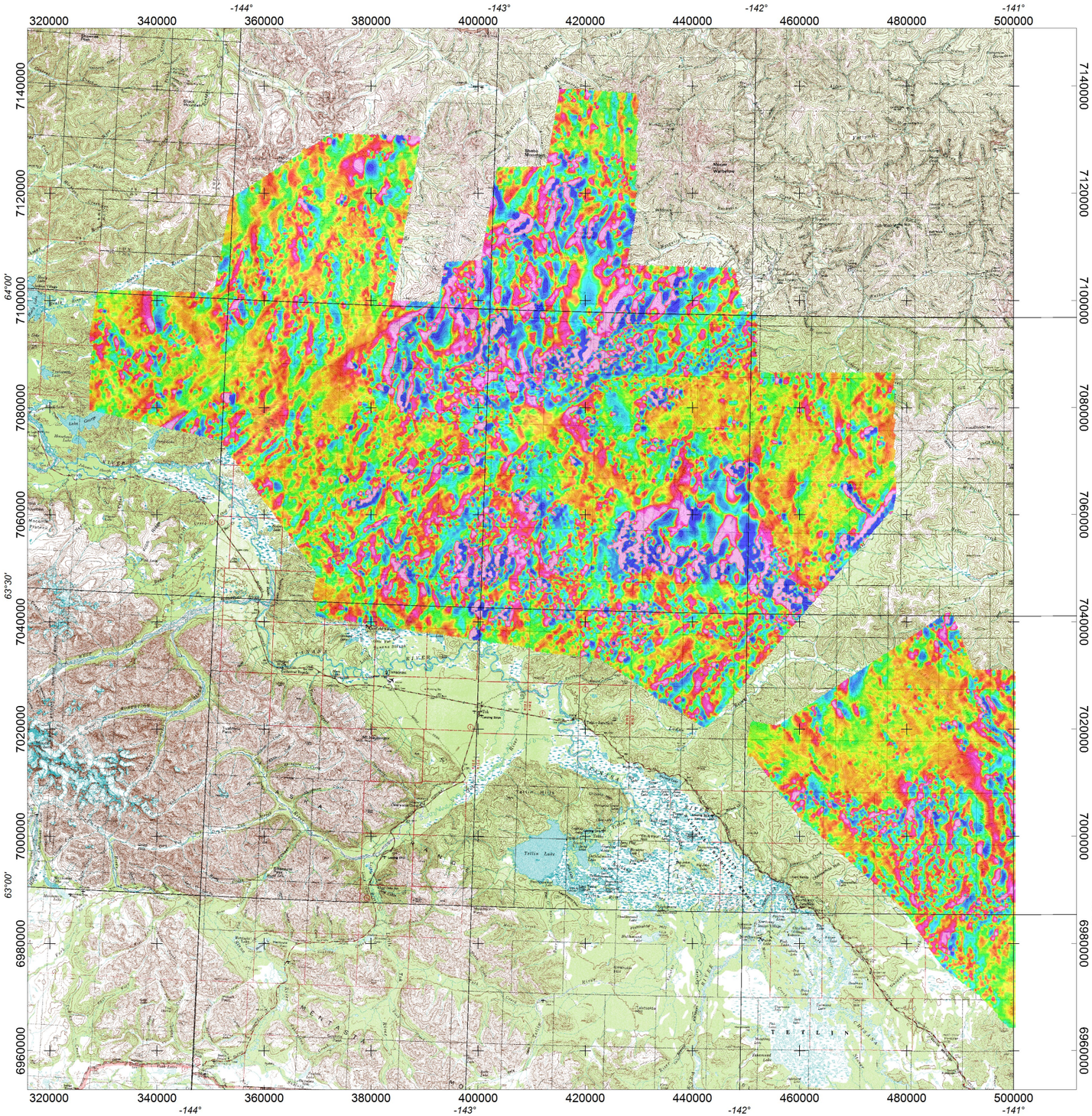
TILT DERIVATIVE

The tilt derivative of the magnetic field is its angle in the vertical direction with respect to the horizontal gradient. Computation of the tilt derivative minimizes variation in anomaly amplitude with respect to the depth to source. The data presented here were derived from the recorded data by resolving the residual magnetic field grid to horizontal and vertical components by use of frequency domain operators and computing angle between the resulting components.



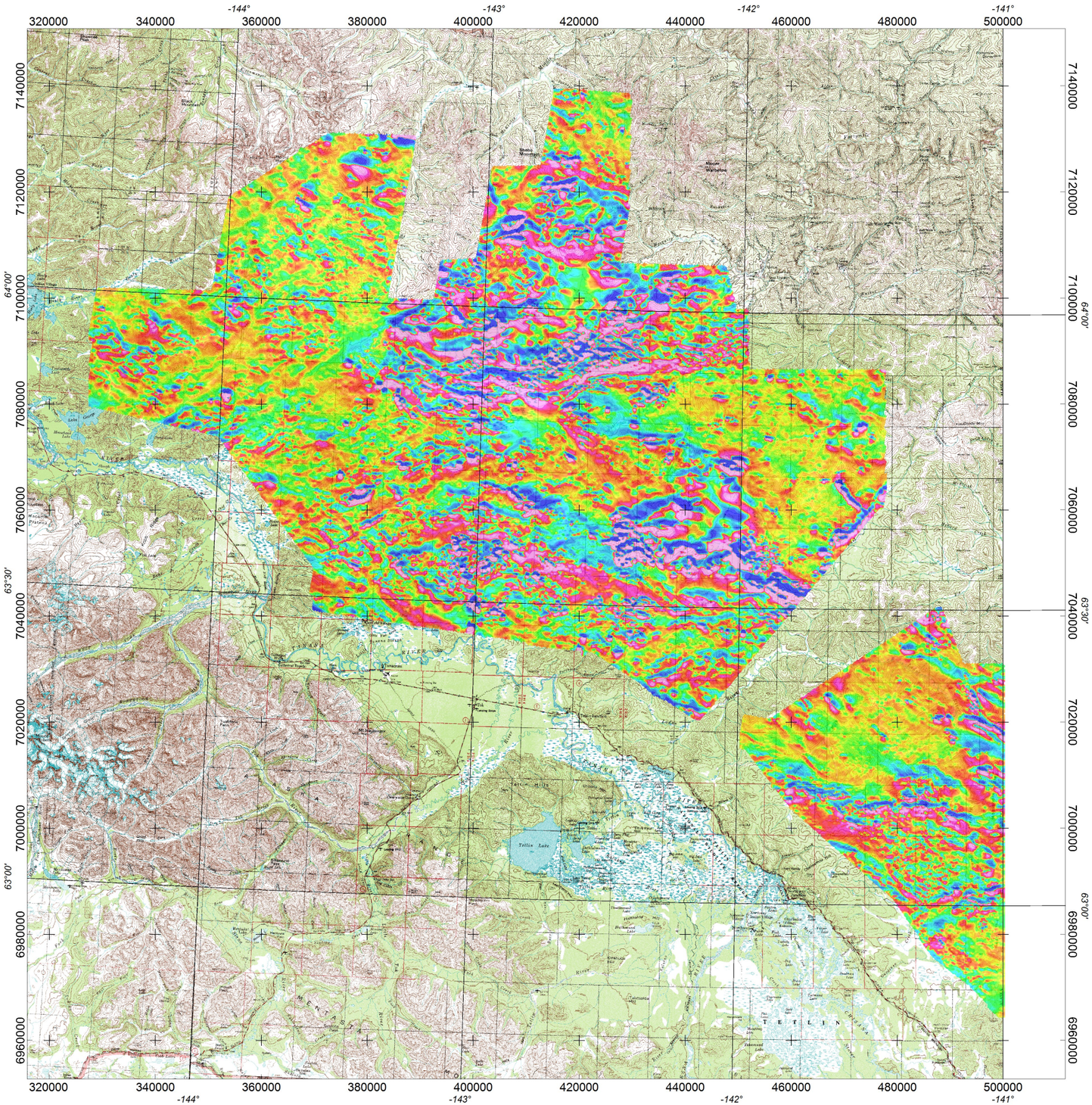
HORIZONTAL MAGNETIC GRADIENT AZIMUTH 100 DEGREES

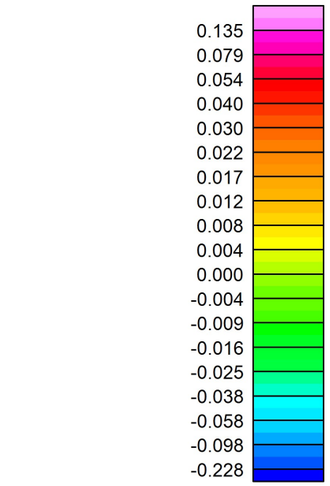
The horizontal magnetic gradient is change in the magnetic field in the horizontal plane along the axis of measurement. The data presented here were derived from the recorded data by: (1) application of a lag to accommodate system latency (2) application of unit and directional normalization factors (3) application of a scaling factor to account for the degree of deviation of the aircraft orientation relative to the ideal line direction (4) application of a leveling correction derived from the calculated horizontal gradients (5) application of a micro-leveling correction to further reduce any remaining flight line noise. The final values were then interpolated on to a 100 m grid using minimum curvature techniques.



HORIZONTAL MAGNETIC GRADIENT AZIMUTH 10 DEGREES

The horizontal magnetic gradient is change in the magnetic field in the horizontal plane along the axis of measurement. The data presented here were derived from the recorded data by: (1) application of a lag to accommodate system latency (2) application of unit and directional normalization factors (3) application of a scaling factor to account for the degree of deviation of the aircraft orientation relative to the ideal line direction (4) application of a leveling correction derived from the calculated horizontal gradients (5) application of a micro-leveling correction to further reduce any remaining flight line noise. The final values were then interpolated on to a 100 m grid using minimum curvature technique





Horizontal Gradient - Azimuth 10 Degrees
nT/m