TELLUS AIRBORNE GEOPHYSICAL SURVEY

DATA RELEASE

BLOCK A9

MARCH 2022

1. BLOCK A9 SURVEY DETAILS

Airborne survey operations over the Tellus A9 Block were flown in the southern part of the Republic of Ireland in 2022. The area of A9 Block covers the majority of county Cork. The survey over this block commenced 25th July 2022 and was completed on 21st September 2022. A total of 46 flights were flown during the survey to complete the planned 18,050.4 line-kilometres (as determined using the ITM projection). The survey operations were conducted from Waterford (EIWF) airport for all flights.

With the completion of Block A9, a total area of 63,275.5 km^2 has been covered across the Republic of Ireland (although this area does include regions of overlap between neighbouring blocks, and off-shore areas).

The survey technical specifications are listed in Table 1.

Survey specification highlights are:

1) Three geophysical data types collected:

    - Magnetics (single sensor: total magnetic intensity).
    - Gamma-ray spectrometer (total-count and potassium, equivalent uranium and equivalent thorium concentrations).
    - Frequency domain electromagnetics (four-frequencies: 912, 3005, 11962 and 24510 Hz, in-phase and quadrature EM responses and resistivity transforms).

2) Flight-line spacing: 200 m.

3) Flight altitude (ground clearance): nominal 60 m, increasing to 214 m over sensitive areas (e.g., livestock farms) and 305 m over larger population centres.

4) Along-line measurement spacing: nominal 6 m (for magnetics and electromagnetics) and nominal 60 m (for gamma-ray spectrometer).

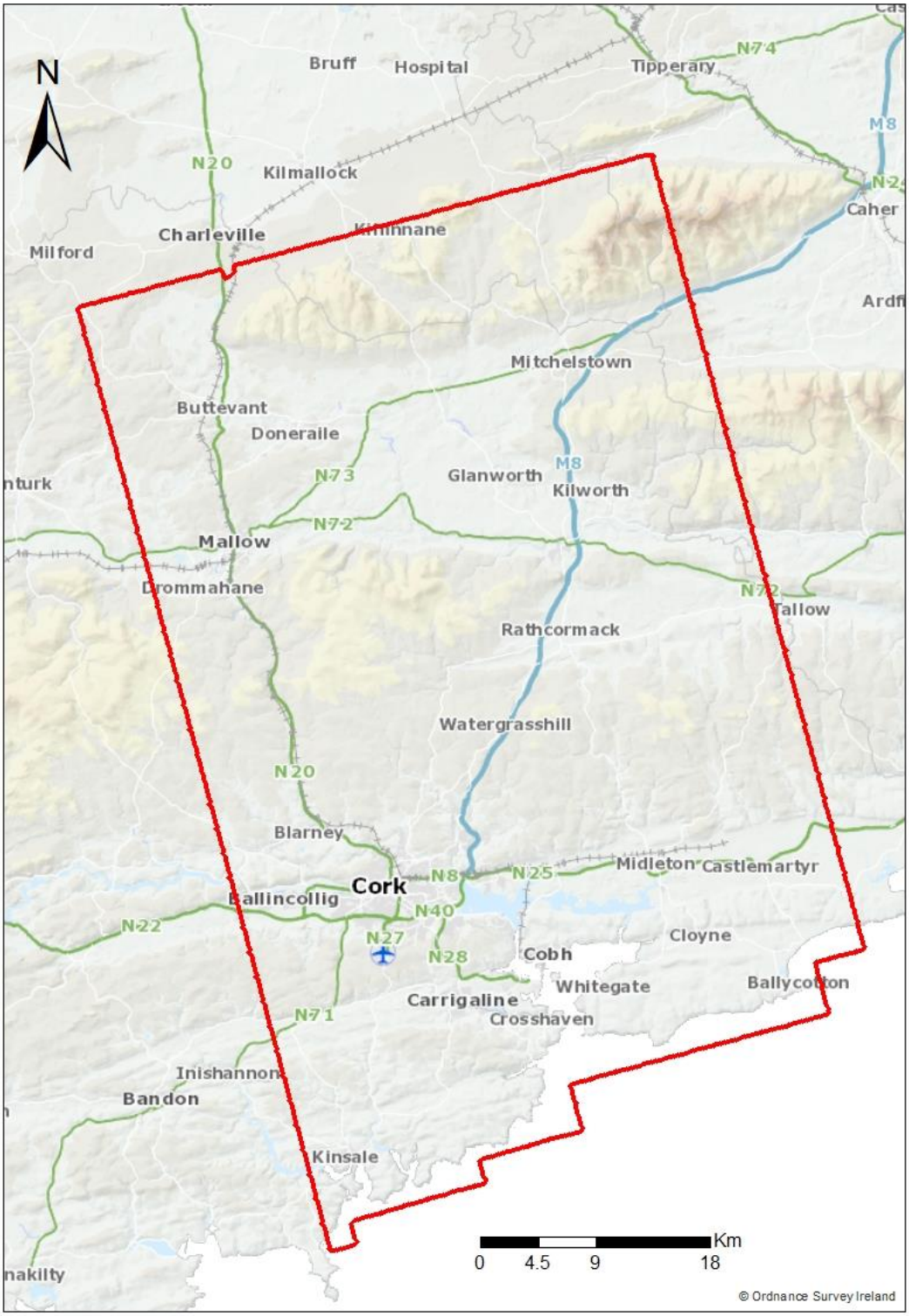

Figure 1. Locality of the Tellus A9 (Cork) Block. Area of coverage of Block A9 is 3,288 km^2.

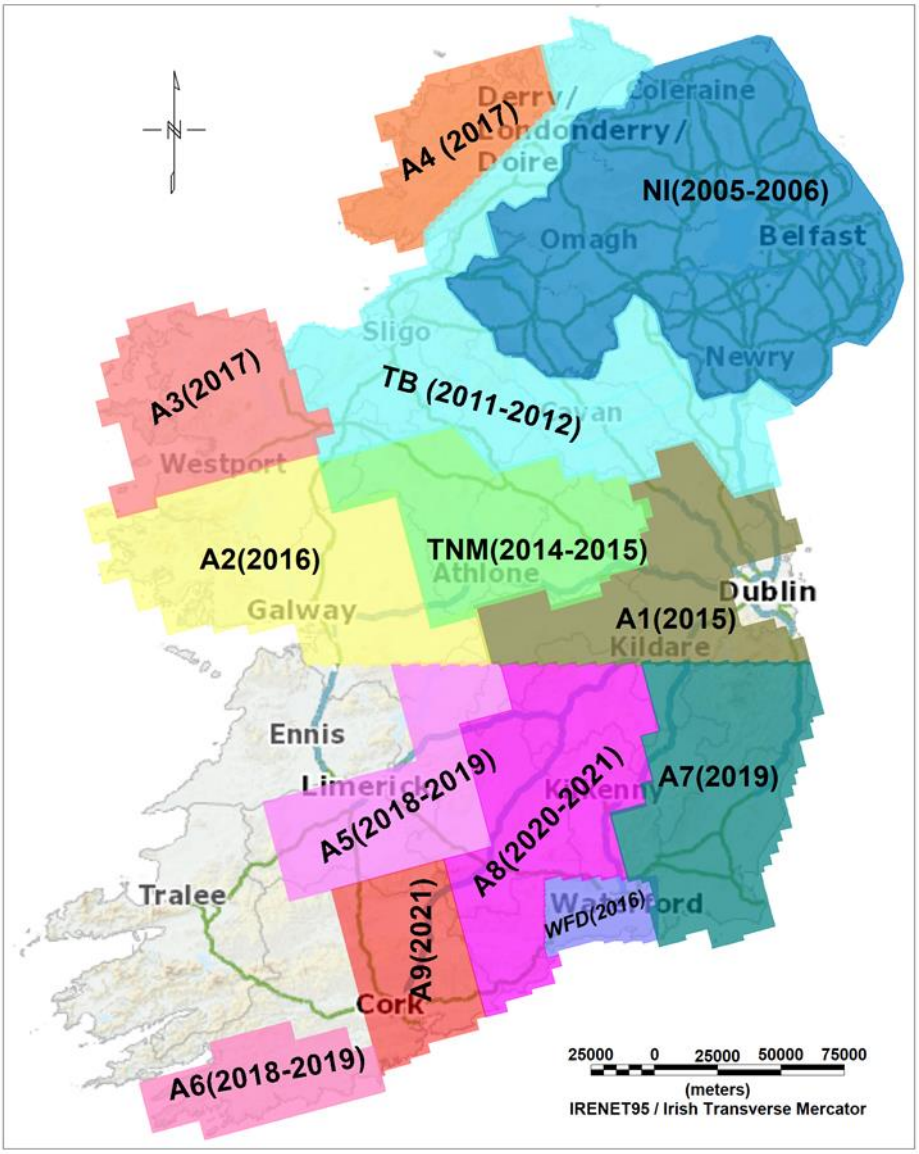

Figure 2. Locality of the Tellus A9 Block (Cork, deep light red), shown with all previously completed data blocks, both in the Republic of Ireland and Northern Ireland. The total area of coverage within Ireland (Republic) is 63,275 km^2, including regions of overlap between neighbouring blocks and off-shore areas.

Table 1. Summary of survey technical specifications: Tellus A9 (Cork) Block.

Geophysical Contractor	Sander Geophysics Limited (SGL)
Survey Start Date	25/07/2022
Survey End Date	21/09/2022
Aircraft Type	De Havilland DHC-6 Twin Otter
Total line kilometres	18,050 km
Traverse Lines	
Number of Lines	232
Line Numbers	L9001 to L9232
Line Direction:	N15°W

Line Spacing	200 m
Control Lines	
Number of Lines	39
Line Numbers	T901 to T939
Line Direction	E15°N
Line Spacing	2000 m
Survey Altitude	
Nominal	60 m
Sensitive Areas	214 m
Large Population Centres	305 m
Number of Flights	46
Flight Numbers	1001 to 1046
Aircraft Ground Speed Nominal	60 m/s
Instruments Carried	
Magnetics	Single sensor (tail-mounted)
Gamma-Ray Spectrometer	Total-count, potassium, uranium, thorium windows
Frequency Domain Electromagnetics	Four frequency: 912, 3005, 11962 and 24510 Hz
Sample Rates	
Magnetics and Electromagnetics	1 Hz (nominal 6 m)
Gamma-ray Spectrometer	10 Hz (nominal 60 m)
Coordinate System	
Datum	IRENET95
Projection	Irish Transverse Mercator (ITM)

2. URLs FOR DATA DOWNLOAD

Line-based (see Section 3 for details) and grid-based (Section 4) versions of the Block A9 data are now available. Data and supporting documentation may be downloaded from the GSI website at the following URLs:

Magnetic line data and grids:
[GSI_Tellus_A9_MAG_DATA_2022.zip] and [GSI_Tellus_A9_MAG_GRIDS_2022.zip]
https://gsi.geodata.gov.ie/downloads/Geophysics/Data/GSI_Tellus_A9_MAG_DATA_2022.zip
https://gsi.geodata.gov.ie/downloads/Geophysics/Data/GSI_Tellus_A9_MAG_GRIDS_2022.zip

Gamma-ray spectrometer line data and grids:
[GSI_Tellus_A9_RAD_DATA_2022.zip] and [GSI_Tellus_A9_RAD_GRIDS_2022.zip]
https://gsi.geodata.gov.ie/downloads/Geophysics/Data/GSI_Tellus_A9_RAD_DATA_2022.zip

https://gsi.geodata.gov.ie/downloads/Geophysics/Data/GSI_Tellus_A9_RAD_GRIDS_2022.zip

Frequency domain electromagnetic line data and grids:
[GSI_Tellus_A9_EM_DATA_2022.zip] and [GSI_Tellus_A9_EM_GRIDS_2022.zip]
https://gsi.geodata.gov.ie/downloads/Geophysics/Data/GSI_Tellus_A9_EM_DATA_2022.zip
https://gsi.geodata.gov.ie/downloads/Geophysics/Data/GSI_Tellus_A9_EM_GRIDS_2022.zip

Survey technical report:
[GSI_Tellus_TR_904_000.pdf]
https://gsi.geodata.gov.ie/downloads/Geophysics/Reports/GSI_Tellus_TR_904_000.pdf

For support and further information at GSI: Dr James Hodgson, Tellus Project Manager, jim.hodgson@gsi.ie, +353 (0)1 6782742.

3. RELEASE INFORMATION FOR LINE DATA

Line based data for all flight lines are provided in ascii-format files, separately for each data type:

- **Magnetic data:**
  [MAG_A9_2022_WEB.XYZ]

- **Gamma-ray spectrometer data:**
  [RAD_A9_2022_WEB.XYZ]

- **Frequency domain electromagnetic data:**
  [EM_A9_2022_WEB.XYZ]

The file format is suitable for direct import into Geosoft Oasis Montaj software or into any other software programme with an ascii, column-based import capacity. The data channel (column) descriptions for each data file are fully specified in the readme.txt files that accompany the data for each data type. For reference, the readme.txt files are included below in Section 5 (magnetic data), Section 6 (gamma-ray spectrometer data) and Section 7 (frequency domain electromagnetic data).

While the line-based data files contain a number of supplementary data channels (providing, e.g., flight altitude, temperature, air pressure, power-line monitor, digital elevation model and geographic coordinate data, as appropriate to each data type), the primary data channels of interest to the data user are likely to be:

- **Magnetics:**
  - "MIC-MAG" data channel – final microlevelled magnetic field anomaly (in nT).

- **Gamma-ray spectrometer:**
  - "C_TOT_DLU" channel – final corrected Total Count data (in cps), not clipped for high fly altitude.
  - "C_POT_DLU" channel – final corrected Potassium Concentration (in %), not clipped for high fly altitude.
  - "C_URA_DLU" channel–final corrected Equivalent Uranium Concentration (in ppm), not clipped for high fly altitude.
  - "C_THO_DLU" channel – final corrected Equivalent Thorium Concentration (in ppm), not clipped for high fly altitude.

- **Frequency domain electromagnetics:**
  Resistivity models (derived using approximate, half-space resistivity transformations)
  - "ExtendedRes09_GRID", "ExtendedRes3_GRID", "ExtendedRes12_GRID" and "ExtendedRes25_GRID" channels – final microlevelled resistivity model data for 912, 3005, 11962 and 24510 Hz respectively, nulled for flight altitudes greater than 120 m above ground level (in ohm.m).
  - "ExtendedResSlice10_GRID", "ExtendedResSlice30_GRID", "ExtendedResSlice60_GRID" and "ExtendedResSlice100_GRID" channels – resistivity depth slice at 10, 30, 60 and 100 m respectively, nulled for flight altitudes greater than 120 m above ground level (in ohm.m).

  Electromagnetic response data (for users wishing to model the EM data independently)
  - "P09lev", "Q09lev", "P3lev", "Q3lev", "P12lev", "Q12lev", "P25lev", "Q25lev" channels – final levelled in-phase and quadrature responses at 912, 3005, 11962 and 24510 Hz respectively (in ppm).

4. RELEASE INFORMATION FOR GRID DATA

Grids of the data are provided for all final data channels and may be located and downloaded at the URLs indicated above. Several file formats are provided: Geosoft Binary (. GRD), TIFF image (.TIF) and Grid Exchange (. GXF). Data are gridded at a 50 m interval, using an Irish Transverse Mercator projection with IRENET95 datum.

For reference, readme.txt files associated with the grid data are included below in Section 8 (magnetic data), Section 9 (gamma-ray spectrometer data) and Section 10 (frequency domain electromagnetic data).

- **Magnetics:**
  - "MAG_A9_MIC_2022" grid – Microlevelled Airborne Magnetic Field Anomaly (with IGRF removed) (in nT).
  - "MAG_A9_2022_UP150_pole30_1VD" grid – First vertical derivative of Microlevelled upward continued to 150 m and pole reduced with 30 degree Airborne Magnetic Field Anomaly (in nT/m).
  - "MAG_A9_2022_UP150_pole30_TDR" grid – Tilt derivative of Microlevelled upward continued to 150 m and pole reduced with 30 degree Airborne Magnetic Field Anomaly (in radians).

- **Gamma-ray spectrometer:**
  - "RAD_A9_TOTAL_COUNT_2022" grid – Total Counts (in cps).
  - "RAD_A9_PERCENT_POTASIUM_2022" grid – Potassium Concentration (in %)
  - "RAD_A9_EQUIVALENT_THORIUM_2022" grid – Equivalent Thorium Concentration (in ppm).
  - "RAD_A9_EQUIVALENT_URANIUM_2022" grid – Equivalent Uranium Concetration (in ppm).

- **Frequency domain electromagnetics:**
  - "EM_A9_RES09_EXTENDED_2022", "EM_A9_RES3_EXTENDED_2022", "EM_A9_RES12_EXTENDED_2029B" and "EM_A9_RES25_EXTENDED_2022" grids – resistivity models for 912, 3005, 11962 and 24510 Hz respectively (in ohm.m).
  - "EM_A9_RES09_EXTENDED_GRID_2022", "EM_A9_RES3_EXTENDED_GRID_2022", "EM_A9_RES12_EXTENDED_GRID_2022" and "EM_A9_RES25_EXTENDED_GRID_2022" grids – micro-levelled resistivity models for 912, 3005, 11962 and 24510 Hz respectively, nulled for flight altitudes greater than 120 m above ground level (in ohm.m).

5. MAGNETIC LINE DATA README FILE [MAG_A9_2022_ReadME.txt]

==========

This readme file relates to data from file: MAG_A9_2022_WEB.XYZ
Airborne magnetic geophysical data collected during 2022 by Geological Survey Ireland, Tellus Project.

Wordpad text editor is recommended to read the data correctly. Open Wordpad and click on view, then go to word wrap and tick no wrap.
Data type: The data are raw contractor delivered data from the A9 survey block
Date of collection: Data collected between 25/07/2022 and 21/09/2022.
Geographical extent: The A9 Survey block covers the S of Ireland/Cork.
Contractor: Sander Geophysics Ltd
Client: Geological Survey Ireland (GSI)
Date of data release: 10 March 2022
For data queries please contact: tellus@gsi.ie
The data contains the channels described below:

==========

File Name: MAG_A9_DATA_2022_WEB.XYZ

Name	Units	Description
ITM_X	m	X coordinate, IRENET95 ITM
ITM_Y	m	Y coordinate, IRENET95 ITM
DATE	-	Date YYYYMMDD
LONG	degree	Longitude, WGS-84
LAT	degree	Latitude, WGS-84
LINE	-	Line number
MSLHGT	m	GPS Elevation above Mean Sea Level
GCLEAR	m	Clearance above Terrain from Laser Altimeter
DEM	m	Digital Elevation Model with respect to Mean Sea Level from Laser and GPS Clearance
MIC -MAG	nT	Microlevelled Airborne Magnetic Field Anomaly (with IGRF removed)

==========

6. GAMMA-RAY SPECTROMETER LINE DATA README FILE [RAD_A9_2022_ReadMe.txt]

==========

This readme file relates to data from file: RAD_A9_2022_WEB.XYZ
Airborne radiometric geophysical data collected during 2022 by Geological Survey Ireland, Tellus Project.

Wordpad text editor is recommended to read the data correctly. Open Wordpad and click on view, then go to word wrap and tick no wrap.
Data type: The data are raw contractor delivered data from the A9 survey block
Date of collection: Data collected between 25/07/2022 and 21/09/2022.
Geographical extent: The A9 Survey block covers the S of Ireland/Cork.
Contractor: Sander Geophysics Ltd
Client: Geological Survey Ireland (GSI)
Date of data release: 10 March 2022
For data queries please contact: tellus@gsi.ie
The data contains the channels described below:

==========

File Name: RAD_A9_2018_2019_WEB.XYZ

Name	Units	Description
ITM_X	m	X coordinate, IRENET95 ITM
ITM_Y	m	Y coordinate, IRENET95 ITM
DATE	-	Date YYYYMMDD
LINE	-	Line number
LONG	degree	Longitude, WGS-84
LAT	degree	Latitude, WGS-84
MSLHGT	m	GPS Elevation above Mean Sea Level
GCLEAR	m	Clearance above Terrain from Laser and GPS
LASER	m	Clearance above Terrain from Laser Altimeter
DEM	m	Digital Elevation Model with respect to Mean Sea Level from Laser & GPS Clearance
TEMP	degree C	Temperature
BARO	m	Barometric Pressure Altitude
E_HGT	m	Effective Height at Standard Temperature and Pressure
R_TOT	counts/s	Recorded Total Count, de-lagged

R_POT	counts/s	Recorded Potassium Count, de-lagged
R_URA	counts/s	Recorded Uranium Count, de-lagged
R_THO	counts/s	Recorded Thorium Count, de-lagged
C_TOT_DLU	counts/s	Corrected Total Count, de-lagged, micro-levelled and minimum limited to 0, not clipped to high fly altitudes
C_POT_DLU	%	Corrected Potassium Concentration, de-lagged and minimum limited to 0, not clipped to high fly altitudes
C_URA_DLU	ppm	Corrected Uranium Concentration, de-lagged, micro-levelled and minimum limited to 0, not clipped to high fly altitudes
C_THO_DLU	ppm	Corrected Thorium Concentration, de-lagged and minimum limited to 0, not clipped to high fly altitudes

==========

7. FREQUENCY DOMAIN ELECTROMAGNETIC LINE DATA README FILE [EM_A9_2022_ReadME.txt]

==========

This readme file relates to data from file: EM_A9_2022_WEB.XYZ
Airborne electromagnetic geophysical data collected during 2022 by Geological Survey Ireland, Tellus Project.

Wordpad text editor is recommended to read the data correctly. Open Wordpad and click on view, then go to word wrap and tick no wrap.
Data type: The data are raw contractor delivered data from the A9 survey block
Date of collection: Data collected between 25/07/2022 and 21/09/2022.
Geographical extent: The A9 Survey block covers the S of Ireland/Cork.
Contractor: Sander Geophysics Ltd
Client: Geological Survey Ireland (GSI)
Date of data release: 10 March 2022
For data queries please contact: tellus@gsi.ie
The data contains the channels described below:

==========

File Name: EM_A9_2022_WEB.XYZ

Name	Units	Description
ITM_X	m	X coordinate, IRENET95 ITM

ITM_Y	m	Y coordinate, IRENET95 ITM
DATE	-	Date YYYYMMDD
LINE	-	Line number
LONG	degree	Longitude, WGS-84
LAT	degree	Latitude, WGS-84
MSLHGT	m	GPS Elevation above Mean Sea Level
CLEARANCE	m	Clearance above Terrain from Laser
DEM	m	Digital Elevation Model with respect to Mean Sea Level from Laser Clearance
TEMP	degree C	Temperature
P09lev	ppm	Levelled and filtered in-phase 912 Hz
Q09lev	ppm	Levelled and filtered quadrature 912 Hz
P3lev	ppm	Levelled and filtered in-phase 3005 Hz
Q3lev	ppm	Levelled and filtered quadrature 3005 Hz
P12lev	ppm	Levelled and filtered in-phase 11962 Hz
Q12lev	ppm	Levelled and filtered quadrature 11962 Hz
P25lev	ppm	Levelled and filtered in-phase 24510 Hz
Q25lev	ppm	Levelled and filtered quadrature 24510 Hz
PLM_nT	nT	Power line monitor
ExtendedRes09	ohm-m	Extended range resistivity, half-space model, 912 Hz
ExtendedRes3	ohm-m	Extended range resistivity, half-space model, 3005 Hz
ExtendedRes12	ohm-m	Extended range resistivity, half-space model, 11962 Hz
ExtendedRes25	ohm-m	Extended range resistivity, half-space model, 24510 Hz
ExtendedRes09_GRID	ohm-m	Microlevelled extended range resistivity, half-space model, 912 Hz, nulled >120 m
ExtendedRes3_GRID	ohm-m	Microlevelled extended range resistivity, half-space model, 3005 Hz, nulled >120 m
ExtendedRes12_GRID	ohm-m	Microlevelled extended range resistivity, half-space model, 11962 Hz, nulled >120 m
ExtendedRes25_GRID	ohm-m	Microlevelled extended range resistivity, half-space model, 24510 Hz, nulled >120 m
ExtendedResSlice10_GRID	ohm-m	Microlevelled extended range resistivity depth slice at 10 m, nulled >120 m
ExtendedResSlice30_GRID	ohm-m	Microlevelled extended range resistivity depth slice at 30 m, nulled >120 m
ExtendedResSlice60_GRID	ohm-m	Microlevelled extended range resistivity depth slice at 60 m, nulled >120 m
ExtendedResSlice100_GRID	ohm-m	Microlevelled extended range resistivity depth slice at 100 m, nulled >120 m

==========

8. MAGNETIC GRID DATA README FILE [MAG_A9_2022_ReadMe_GRIDS.txt]

==========

This readme file relates to grids provided in the file: [MAG_A9_GRIDS_2022.zip]

Date of data release: 10 March 2022

There are three different georeferenced grid formats for the Tellus geophysical data grids:

.grd files are Geosoft grid files and can be opened in: GIS software including Geosoft, ArcGIS (only with Geosoft ArcGIS plugin) and MAPINFO.
.tiff files are georeferenced coloured raster files.
.gxf are ASCII grid files and are an interrogatable raster file. This format can be opened in many GIS software programmes. Instructions on how to display the grids with the correct colour ramp in ArcGIS and QGIS are in the [ArcGIS_Colour_Ramp_gxf_InstructionsReadMe.pdf] and [QGIS_Colour_Ramp_gxf_InstructionsReadMe.pdf] files included in this .zip.

Images are intended to be viewed with in the Geosoft Clra 32 colour ramp. Included in this .zip file are an ArcGIS style file [Geosoft.Style] and an QGIS XML Colour ramp [Geosoft_Clra_32_qgis.XML] that contain Geosoft Clra 32 colour ramps.

==========

Name	Unit	Description
MAG_A9_MIC_2022	nT	Microlevelled Airborne Magnetic Field Anomaly (with IGRF removed)
MAG_A9_2022_UP150_POLE30_1VD	nT/m	First vertical derivative of Microlevelled, upward continued (by 150 m) and Pole reduced (30 degrees) Airborne Magnetic Field Anomaly
MAG_A9_2022_UP150_POLE30_TDR	radians	Tilt derivative of Microlevelled, upward continued (by 150 m) and Pole reduced (30 degrees) Airborne Magnetic Field Anomaly

==========

9. GAMMA-RAY SPECTROMETER GRID DATA README FILE [RAD_A9_2022_ReadMe_GRIDS.txt]

==========

This readme file relates to grids provided in the file: [RAD_A9_GRIDS_2022.zip]

Date of data release: 10 March 2022

There are three different georeferenced grid formats for the Tellus geophysical data grids:

.grd files are Geosoft grid files and can be opened in: GIS software including Geosoft, ArcGIS (only with Geosoft ArcGIS plugin) and MAPINFO.
.tiff files are georeferenced coloured raster files.
.gxf are ASCII grid files and are an interrogatable raster file. This format can be opened in many GIS software programmes. Instructions on how to display the grids with the correct colour ramp in ArcGIS and QGIS are in the [ArcGIS_Colour_Ramp_gxf_InstructionsReadMe.pdf] and [QGIS_Colour_Ramp_gxf_InstructionsReadMe.pdf] files included in this .zip.

Images are intended to be viewed with in the Geosoft Clra 32 colour ramp. Included in this .zip file are an ArcGIS style file [Geosoft.Style] and an QGIS XML Colour ramp [Geosoft_Clra_32_qgis.XML] that contain Geosoft Clra 32 colour ramps.

==========

Name	Units	Description
RAD_A9_TOTAL_COUNT_2022	counts/s	Corrected Total Count, de-lagged, micro-levelled and minimum limited to 0
RAD_A9_PERCENT_POTASSIUM_2022	%	Corrected Potassium Concentration, de-lagged and minimum limited to 0
RAD_A9_EQUIVALENT_URANIUM_2022	ppm	Corrected Uranium Concentration, de-lagged, micro-levelled and minimum limited to 0
RAD_A9__EQUIVALENT_THORIUM_2022	ppm	Corrected Thorium Concentration, de-lagged and minimum limited to 0
RAD_A9_TERNARY_IMAGE_2022	-	(.tif format only) Ternary colour display of potassium (red, in %), thorium (green, in ppm) and uranium (in blue, in ppm)

==========

10. FREQUENCY DOMAIN ELECTROMAGNETIC GRID DATA README FILE [EM_A9_2022_ReadMe_GRIDS.txt]

==========

This readme file relates to grids provided in the file: [EM_A9_GRIDS_2022.zip]

Date of data release: 10 March 2022

There are three different georeferenced grid formats for the Tellus geophysical data grids:

.grd files are Geosoft grid files and can be opened in: GIS software including Geosoft, ArcGIS (only with Geosoft ArcGIS plugin) and MAPINFO.
.tiff files are georeferenced coloured raster files.
.gxf are ASCII grid files and are an interrogatable raster file. This format can be opened in many GIS software programmes. Instructions on how to display the grids with the correct colour ramp in ArcGIS and QGIS are in the [ArcGIS_Colour_Ramp_gxf_InstructionsReadMe.pdf] and [QGIS_Colour_Ramp_gxf_InstructionsReadMe.pdf] files included in this .zip.

Images are intended to be viewed with in the Geosoft Clra 32 colour ramp. Included in this .zip file are an ArcGIS style file [Geosoft.Style] and an QGIS XML Colour ramp [Geosoft_Clra_32_qgis.XML] that contain Geosoft Clra 32 colour ramps.

==========

Name	Unit	DESCRIPTION	
EM_A9_RES09_EXTENDED_2022		ohm-m	Extended range resistivity, half-space model, 912 Hz
EM_A9_RES3_EXTENDED_2022		ohm-m	Extended range resistivity, half-space model, 3005 Hz
EM_A9_RES12_EXTENDED_2022		ohm-m	Extended range resistivity, half-space model, 11962 Hz
EM_A9_RES25_EXTENDED_2022		ohm-m	Extended range resistivity, half-space model, 24510 Hz
EM_A9_RES09_EXTENDED_GRID_2022		ohm-m	Microlevelled extended range resistivity, half-space model, 912 Hz, for gridding, nulled >120 m
EM_A9_RES3_EXTENDED_GRID_2022		ohm-m	Microlevelled extended range resistivity, half-space model, 3005 Hz, for gridding, nulled >120 m
EM_A9_RES12_EXTENDED_GRID_2022		ohm-m	Microlevelled extended range resistivity, half-space model, 11962 Hz, for gridding, nulled >120 m
EM_A9_RES25_EXTENDED_GRID_2022		ohm-m	Microlevelled extended range resistivity, half-space model, 24510 Hz, for gridding, nulled >120 m

==========