

# New generation statewide gravity map for Victoria

Mark McLean – Geological Survey of Victoria

Suzanne Haydon

Geological Survey of Victoria

Phil Skladzien

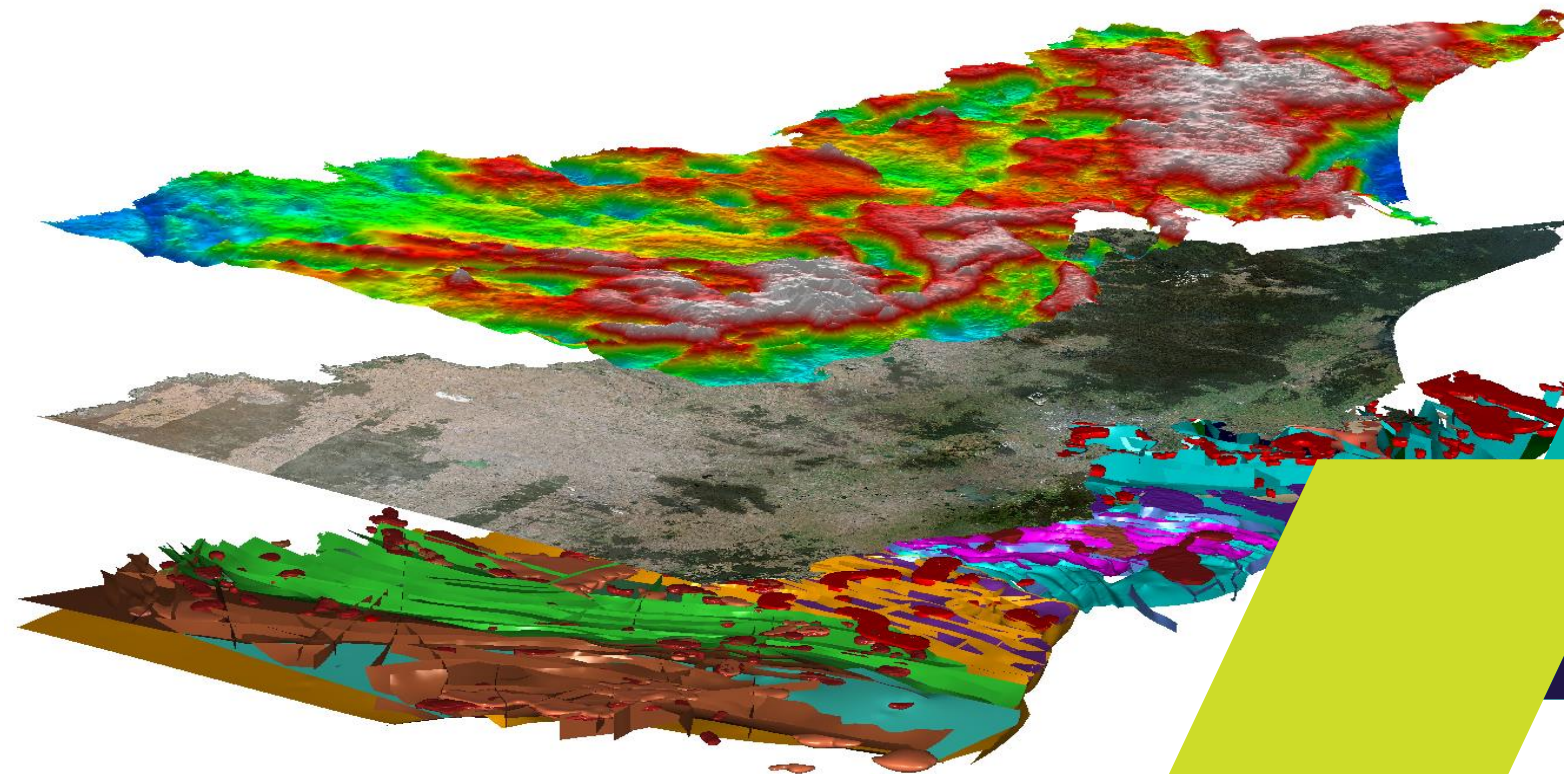
Geological Survey of Victoria

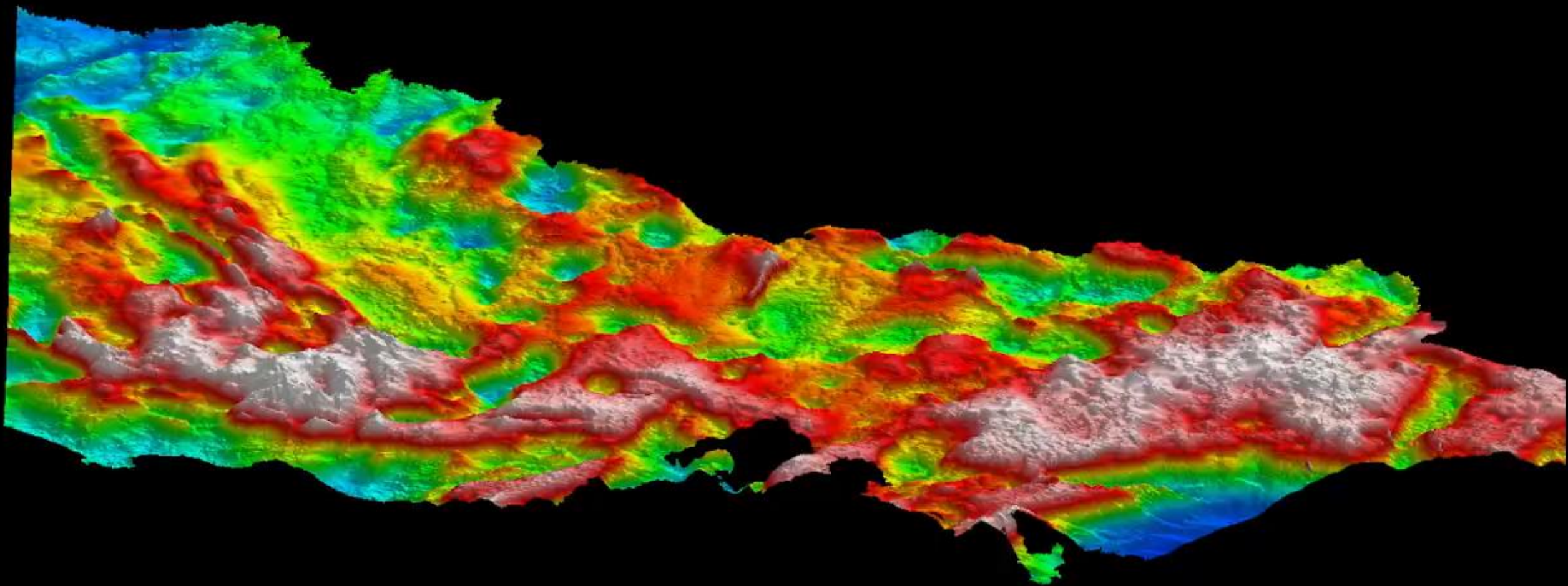
Luong Tran

Geological Survey of Victoria

Jack McCubbine

Geoscience Australia



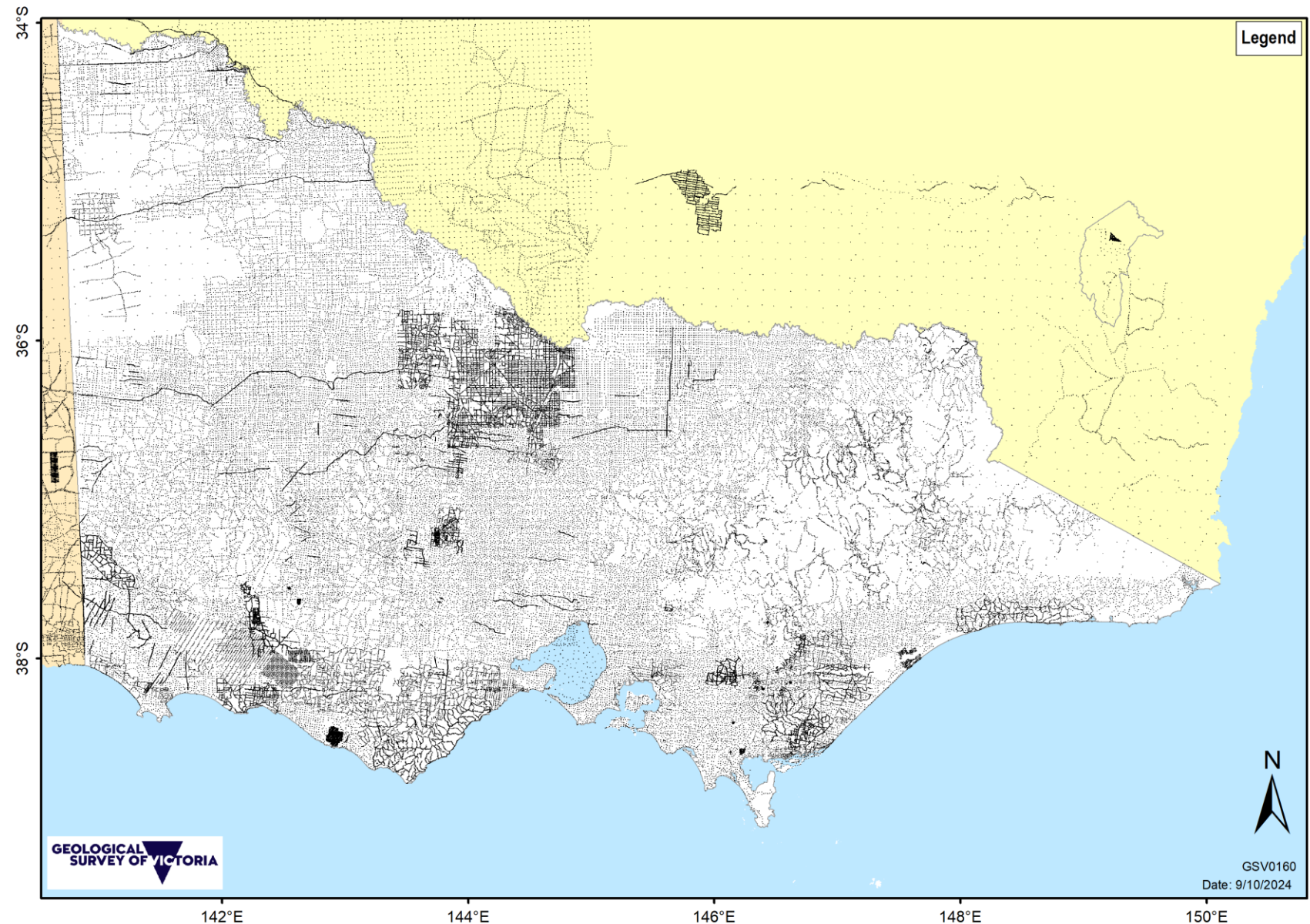


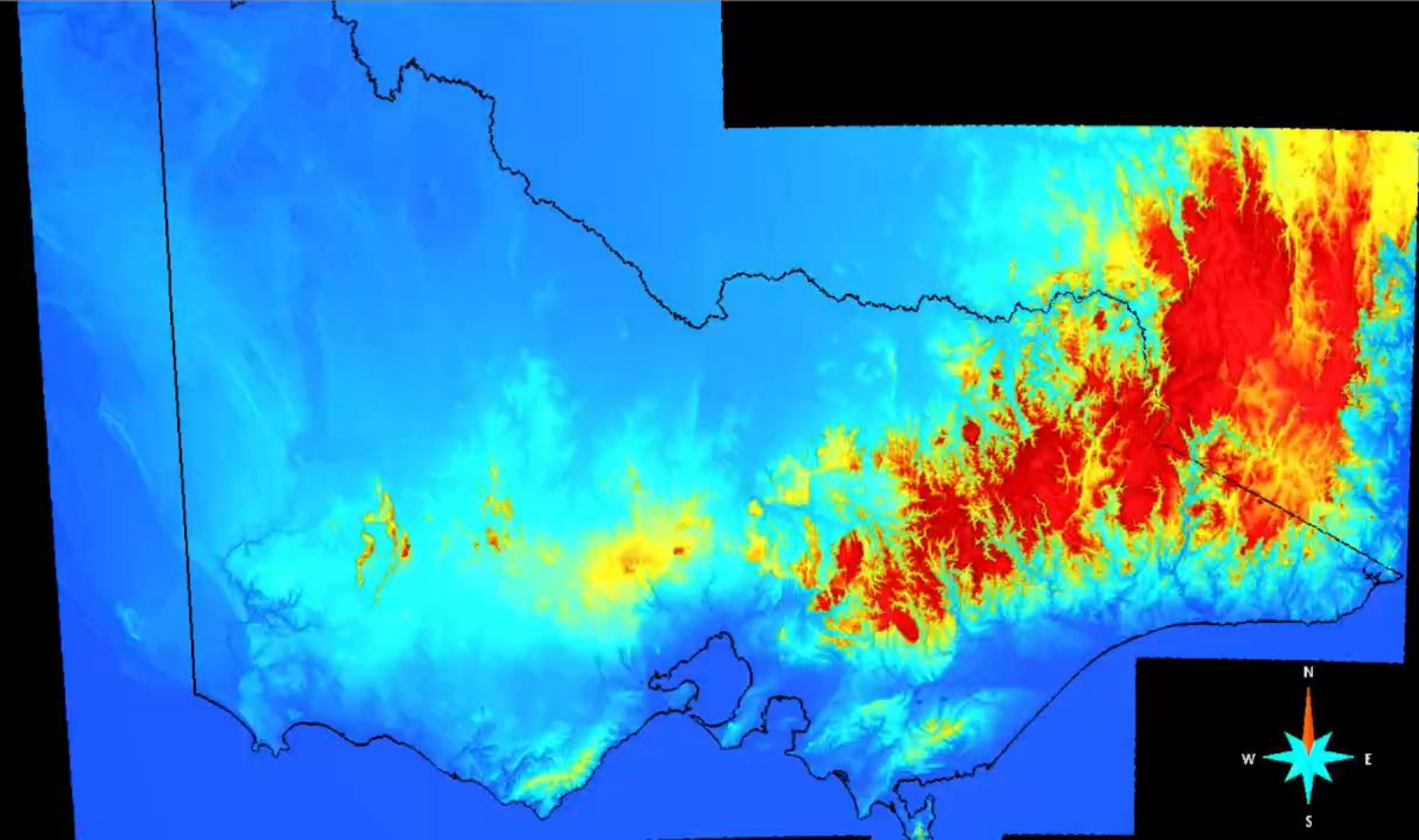


# Victoria's gravity – 2008 release

- Land based gravity stations acquired prior to 2008
- 147,166 stations
- Nominally 1.5km spacing

GEOSCIENCE VICTORIA., 2008. Statewide airborne magnetic and radiometric grids, 2005. Victoria - Gridded Airborne Geophysical Data, and Located and Gridded Gravity CD-Rom, updated 2008. GeoScience Victoria.



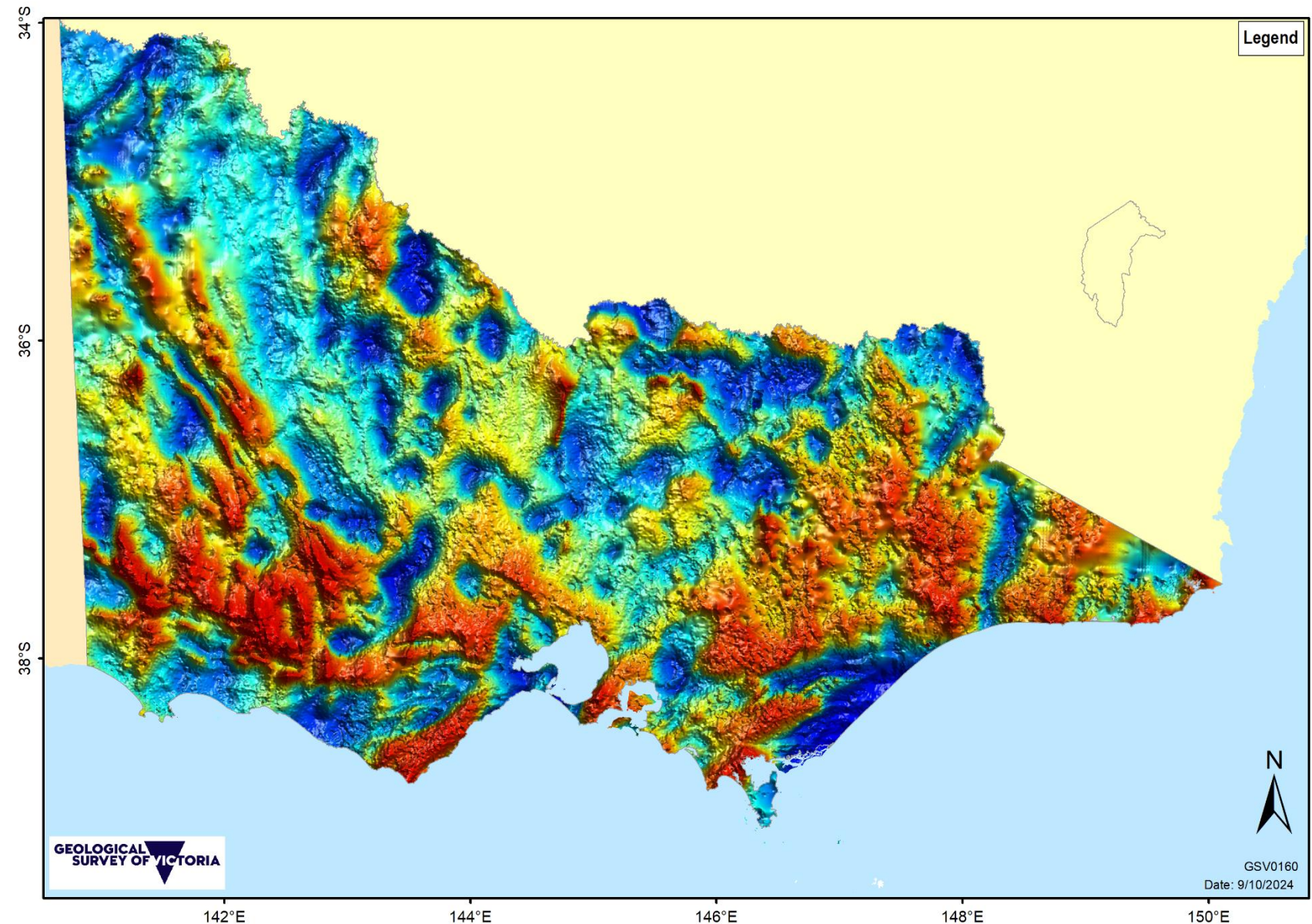




# Victoria's gravity – 2008 release

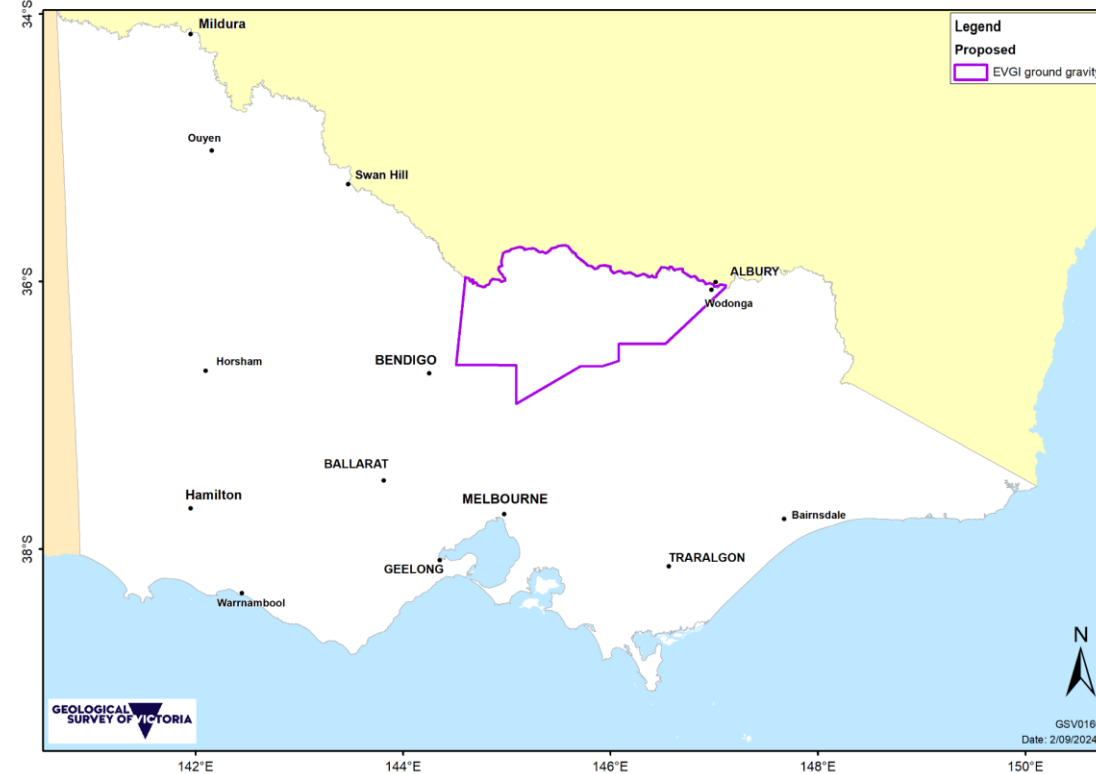
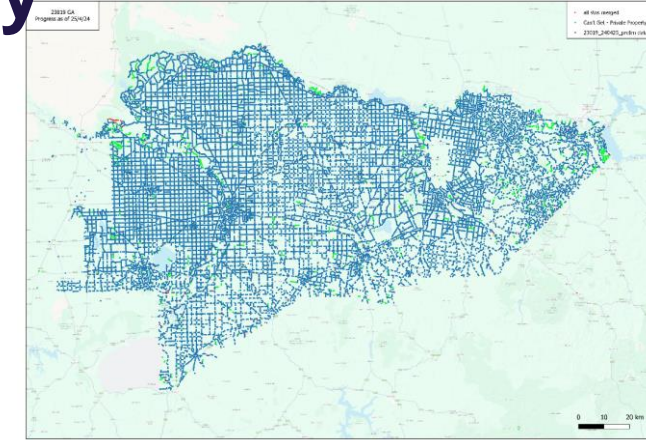
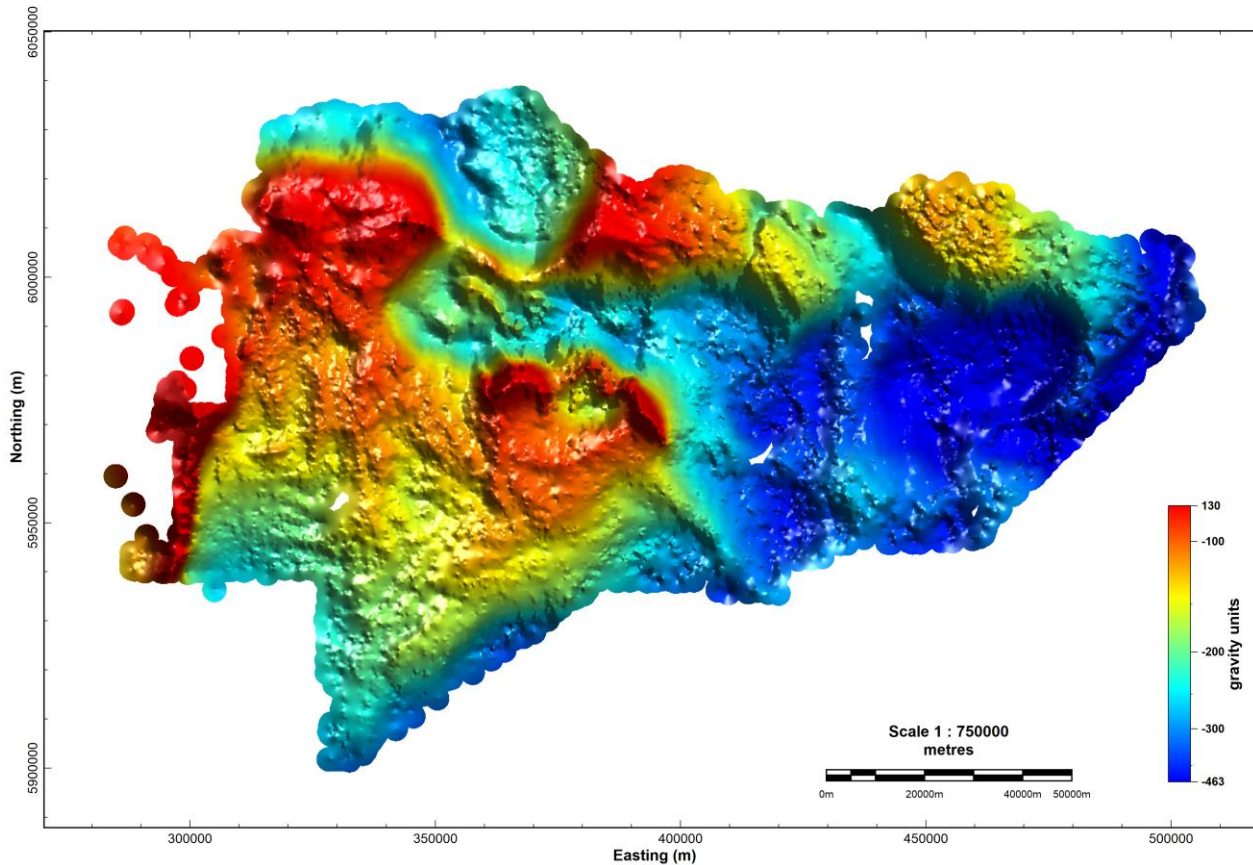
- Data was used to create Victoria's current statewide gravity grid
- Gridded at 300m
- Terrain corrected with a 50m DEM

GEOSCIENCE VICTORIA., 2008. Statewide airborne magnetic and radiometric grids, 2005. Victoria - Gridded Airborne Geophysical Data, and Located and Gridded Gravity CD-Rom, updated 2008. GeoScience Victoria.



# Shepparton – Numurkah Regional Ground Gravity

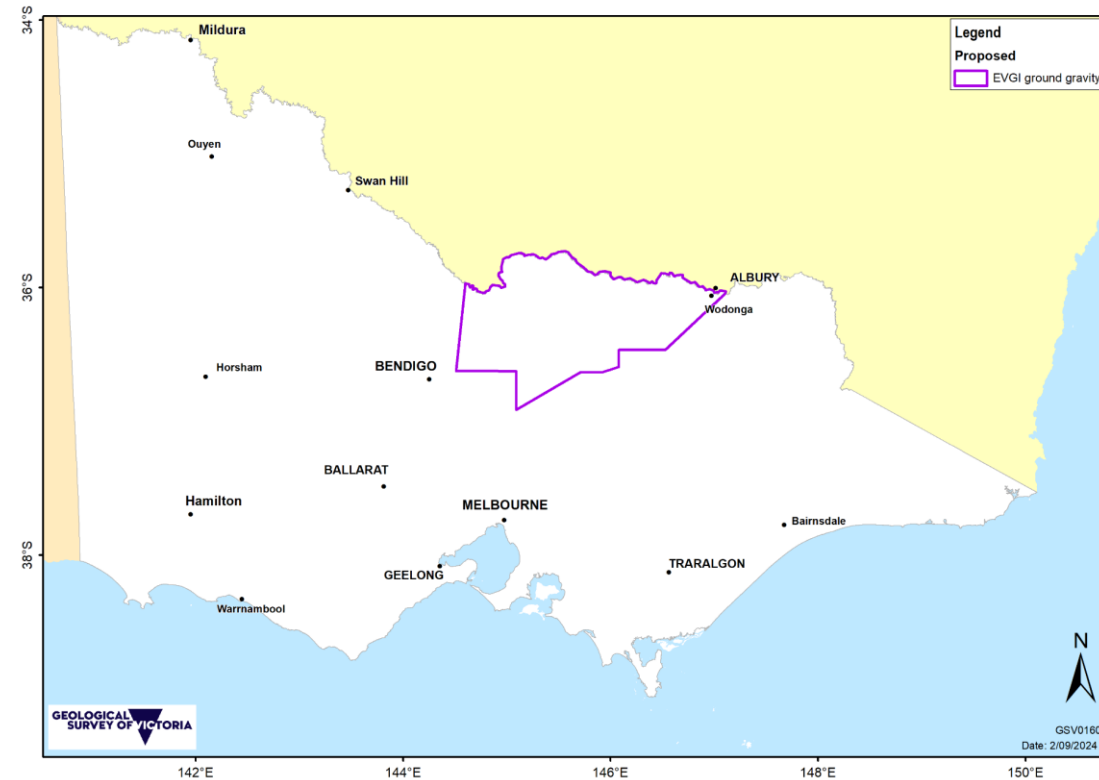
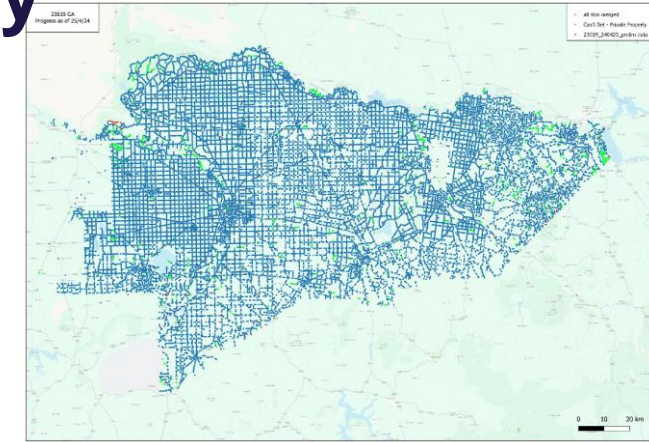
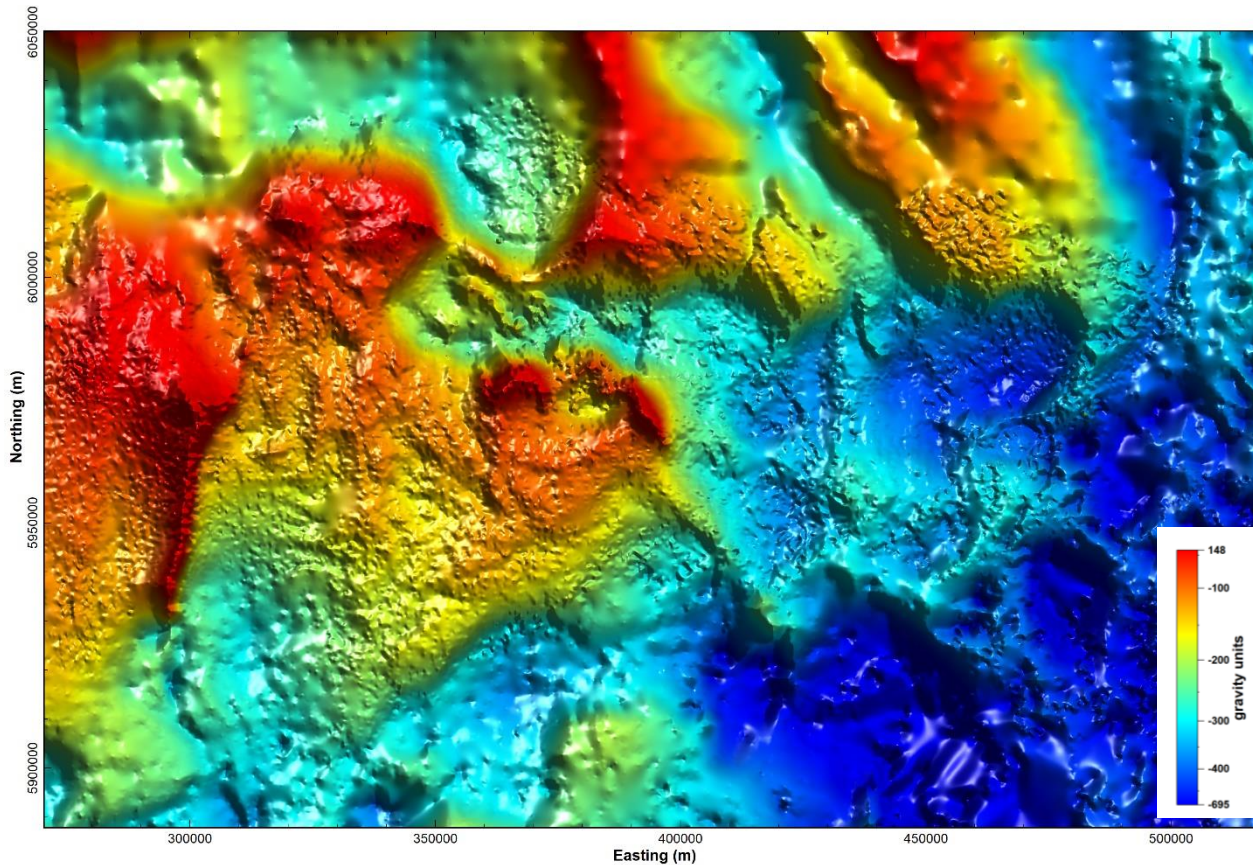
- A total of 23,456 stations acquired
- Acquisition completed 2024





# Shepparton – Numurkah Regional Ground Gravity

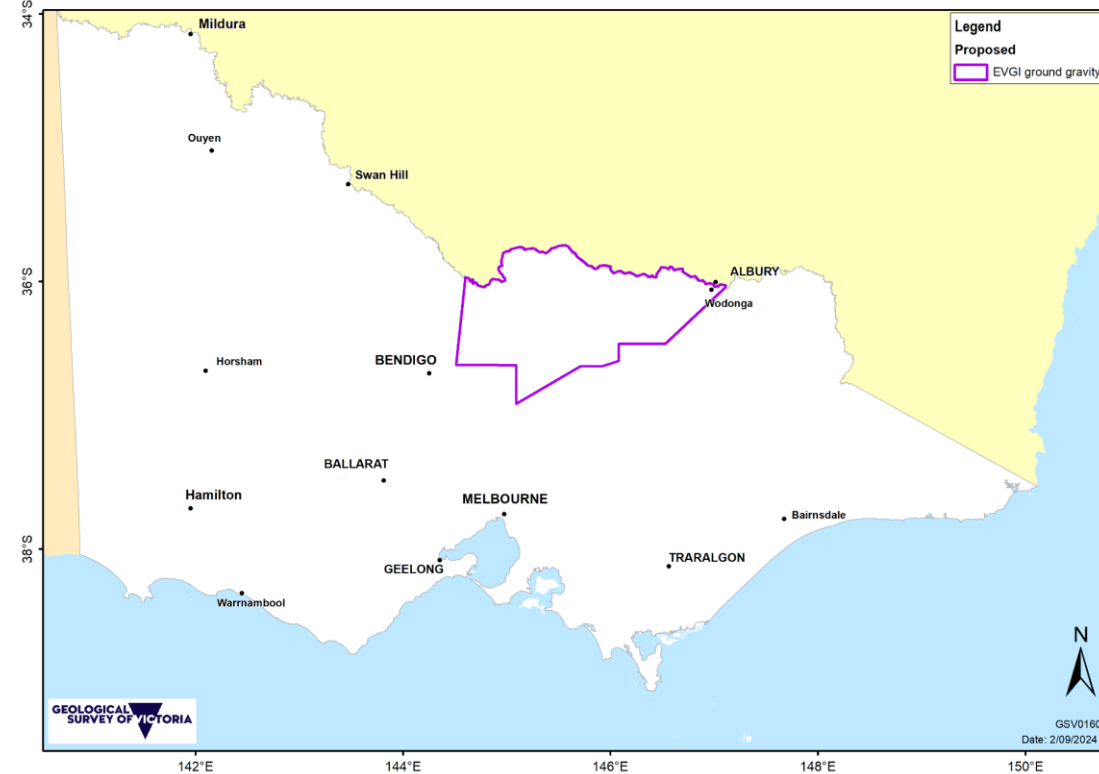
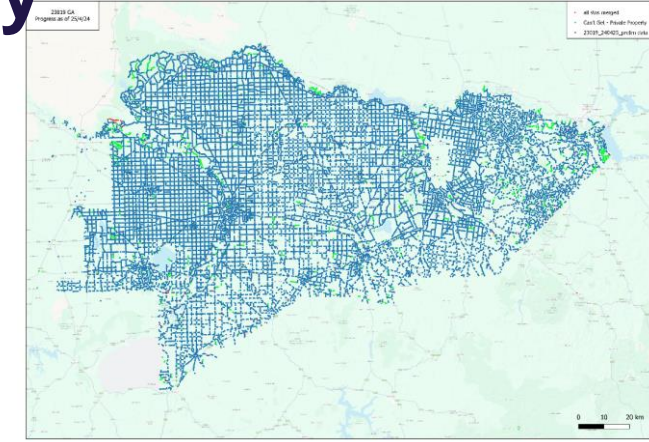
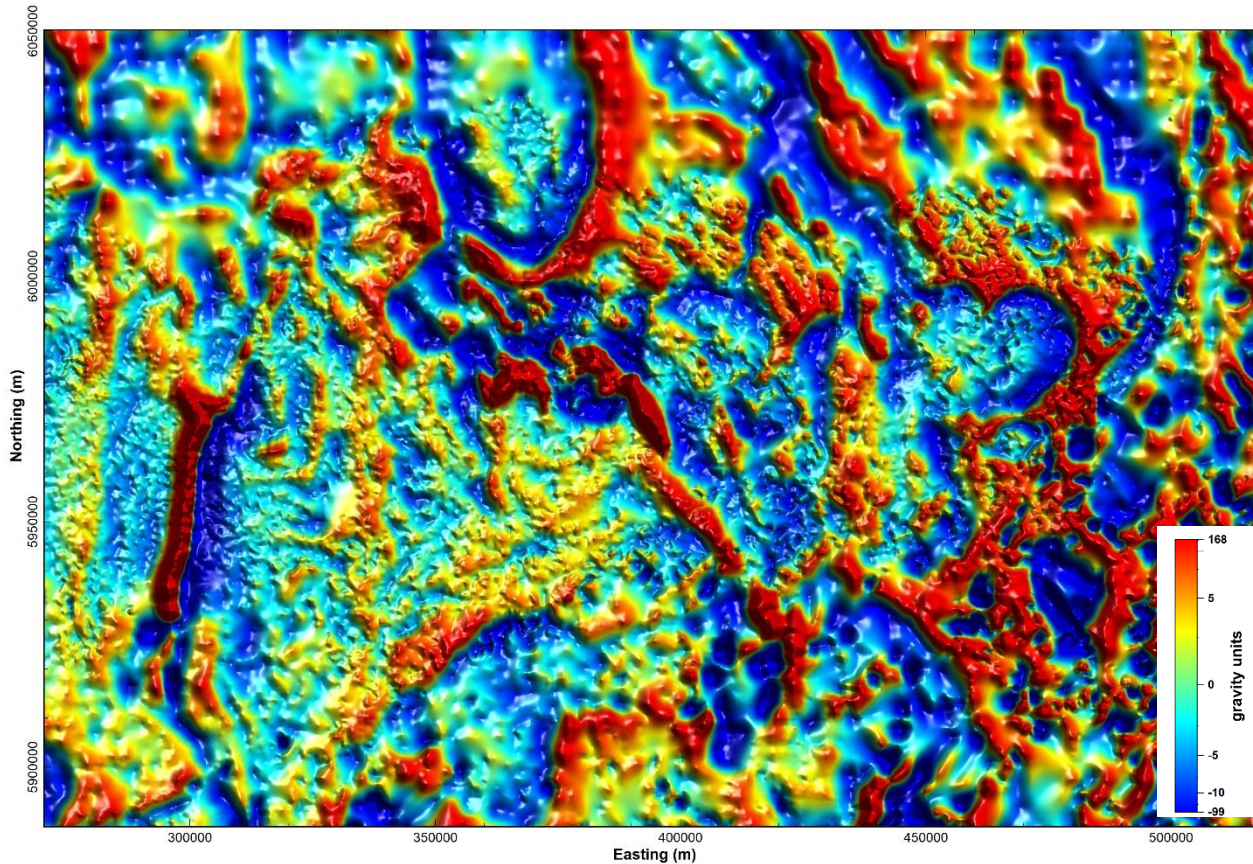
- Bouguer anomaly, merged in with legacy ground gravity





# Shepparton – Numurkah Regional Ground Gravity

- Bouguer anomaly, high pass filtered @ 15km



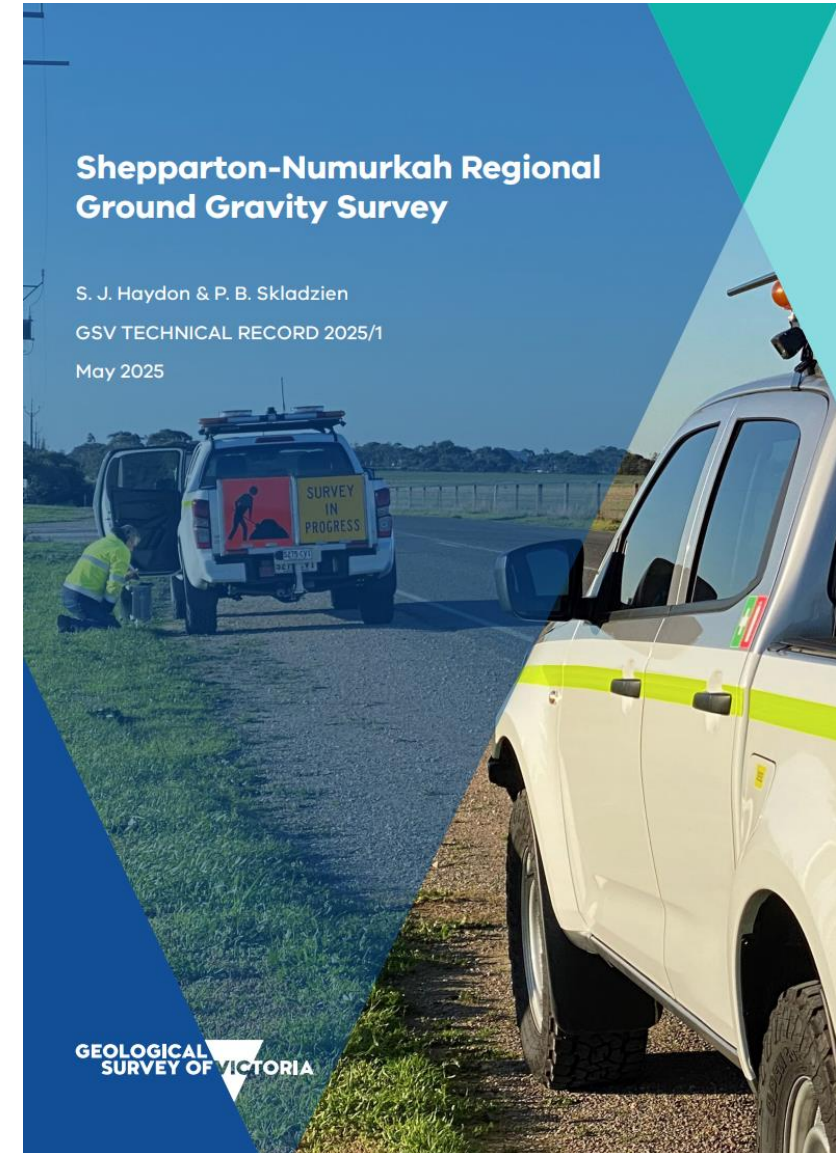


# Shepparton – Numurkah Regional Ground Gravity

Haydon, S.J. & Skladzien, P.B., 2025. Shepparton-Numurkah Regional Ground Gravity Survey. Geological Survey of Victoria Technical Record 2025/1. Geological Survey of Victoria. Department of Energy, Environment and Climate Action. Melbourne, Victoria. 32 p.



<https://earthresources.efirst.com.au/product.asp?plD=1354&clD=37>



# New Victorian ground gravity

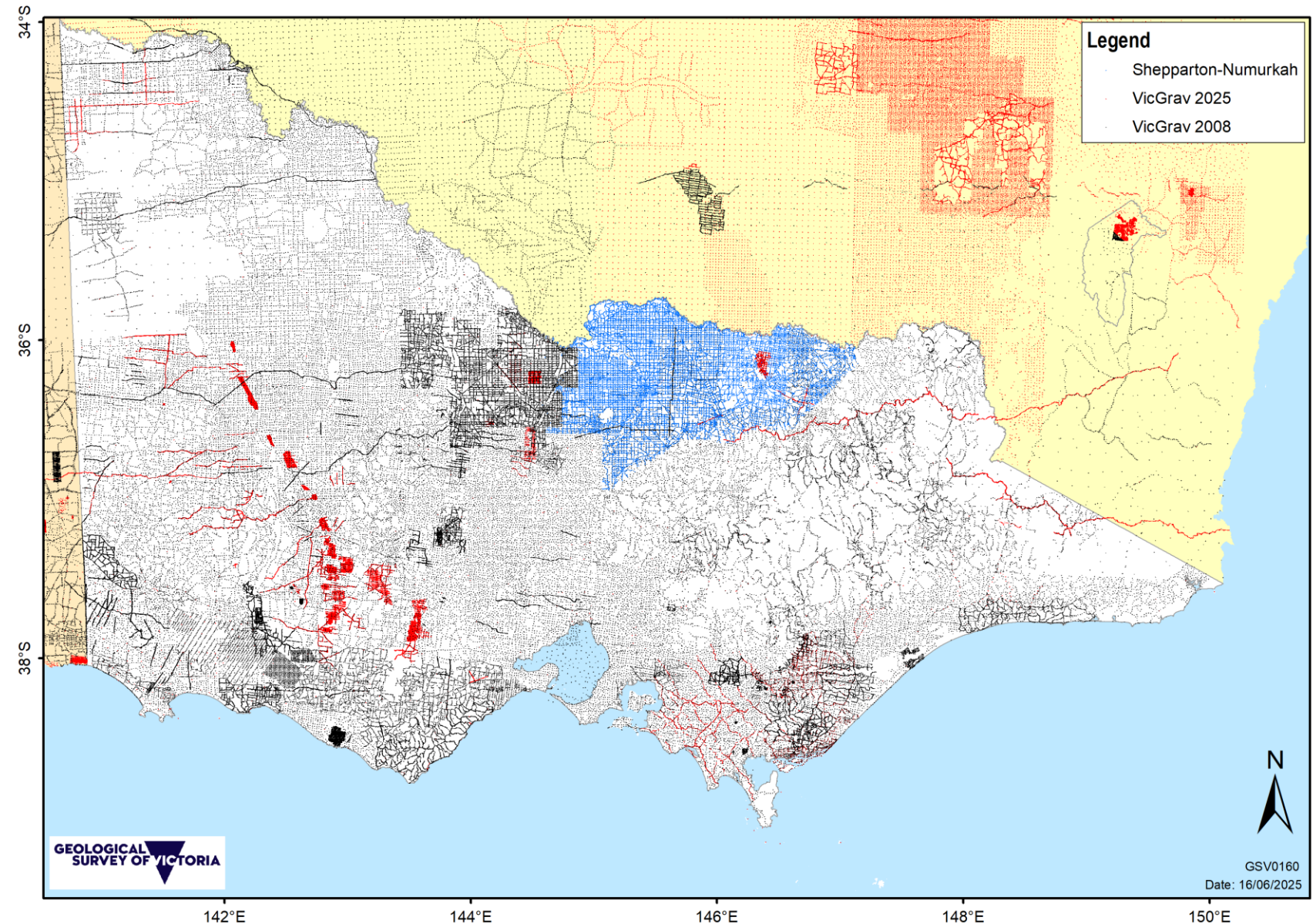
Red stations = new land based gravity

- GSV onshore Gippsland (2015)
- Eastern Vic seismic traverses (2018)
- Stavely traverses (2016)
- Industry surveys along the Stawell corridor
- Student acquired data

Additional

- 48839 new stations (red) +
- 23456 Shepparton-Numurkah

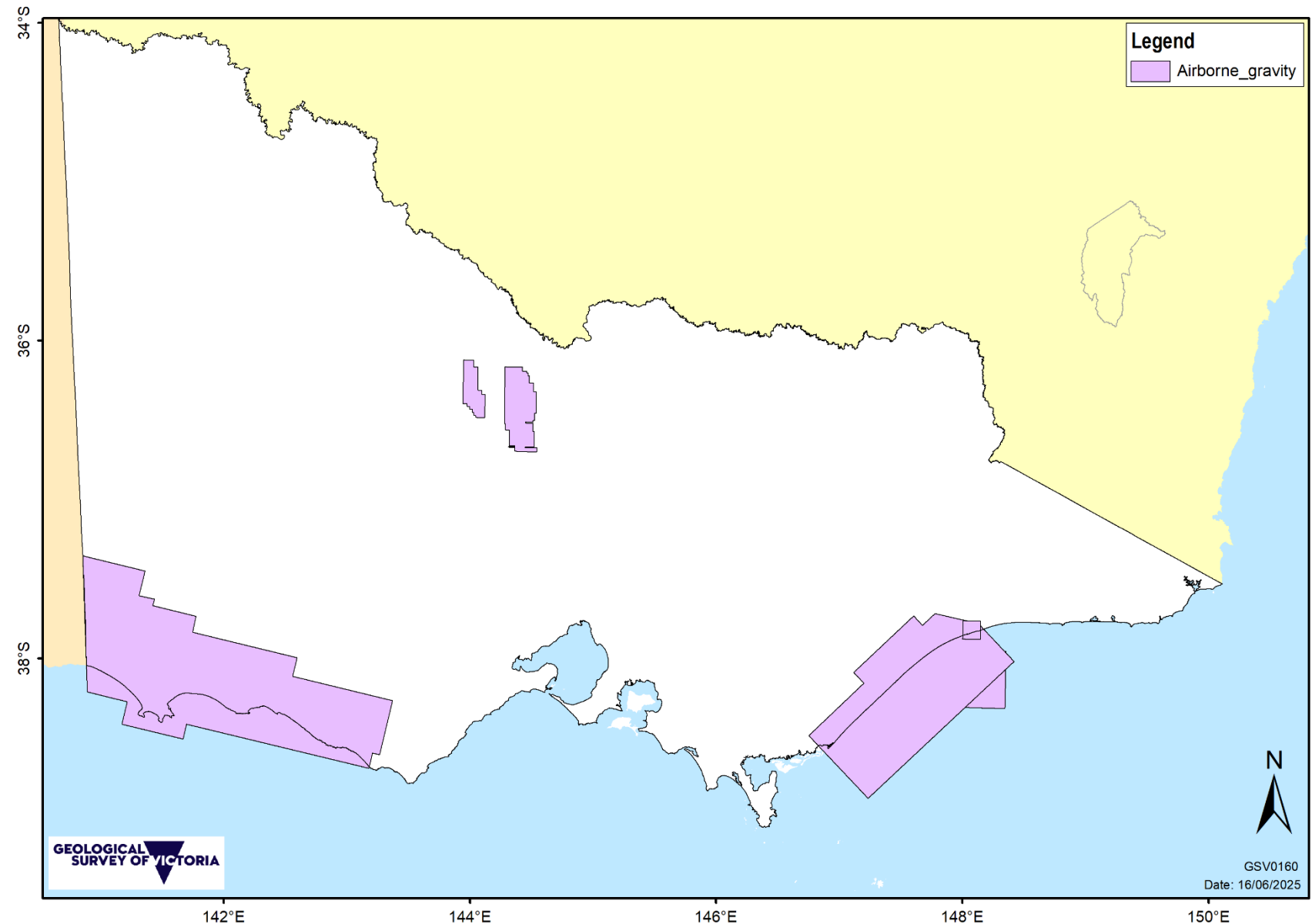
\*Old stations do need a QC





# Victorian airborne gravity

- 4 Eagles Gravity Gradiometry (2004)
- Gippsland Airborne gravity (2011)
- Otway Airborne Gravity (2019) Gradiometry
- Fosterville Airborne Gravity Gradiometry (2019)

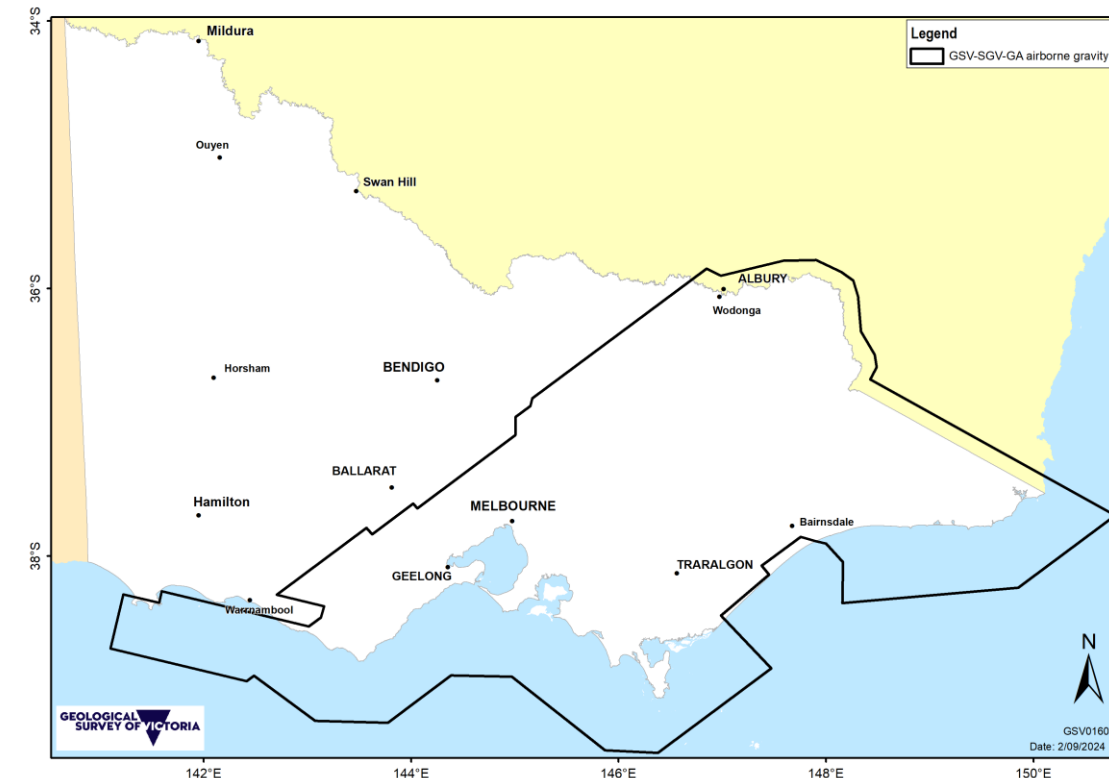
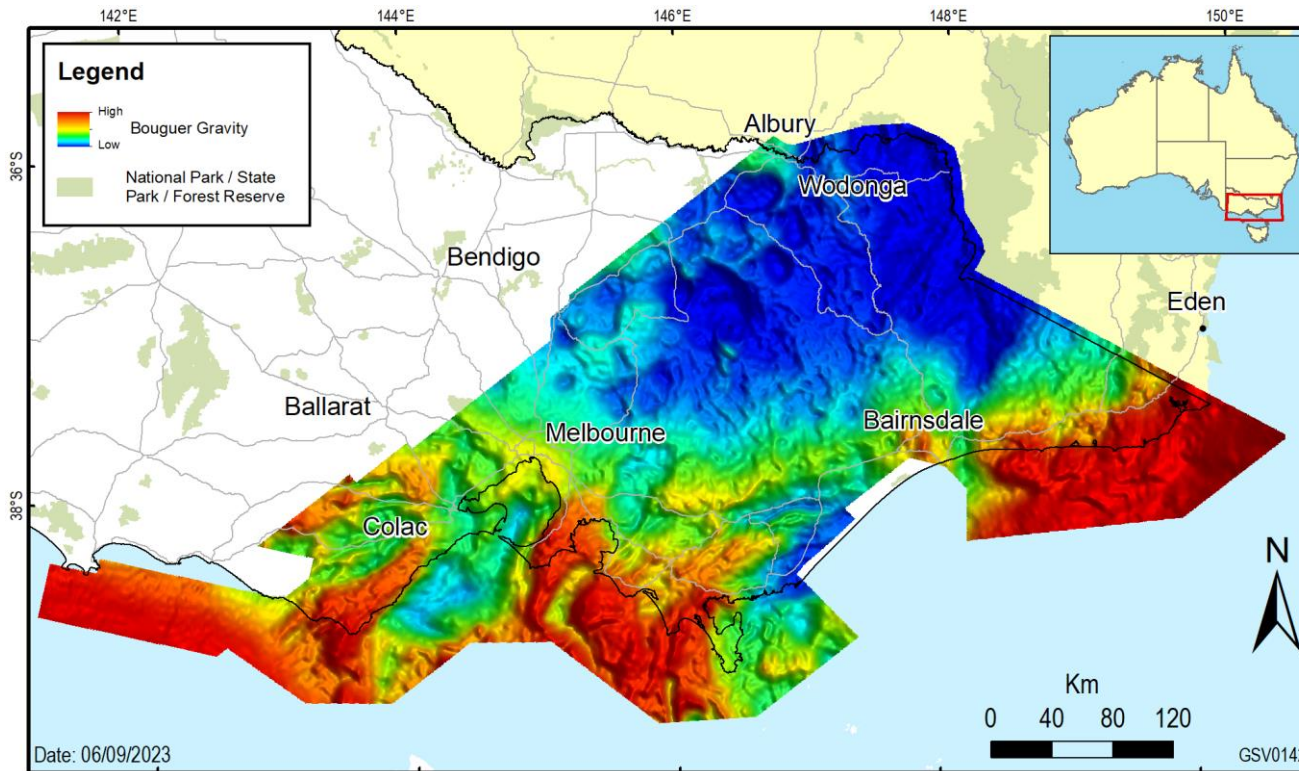


# Greater Melbourne and Eastern Victoria Airborne Gravity

- Survey covers approximately 150,000 square kilometres
- Total line km = 197217.37 km
- Acquisition: from 2022 toward the end of 2024.
- Processing: 2025.
- Release: Toward end 2025

## Collaboration:

- Geological Survey of Victoria
- Surveyor General Victoria
- Geoscience Australia

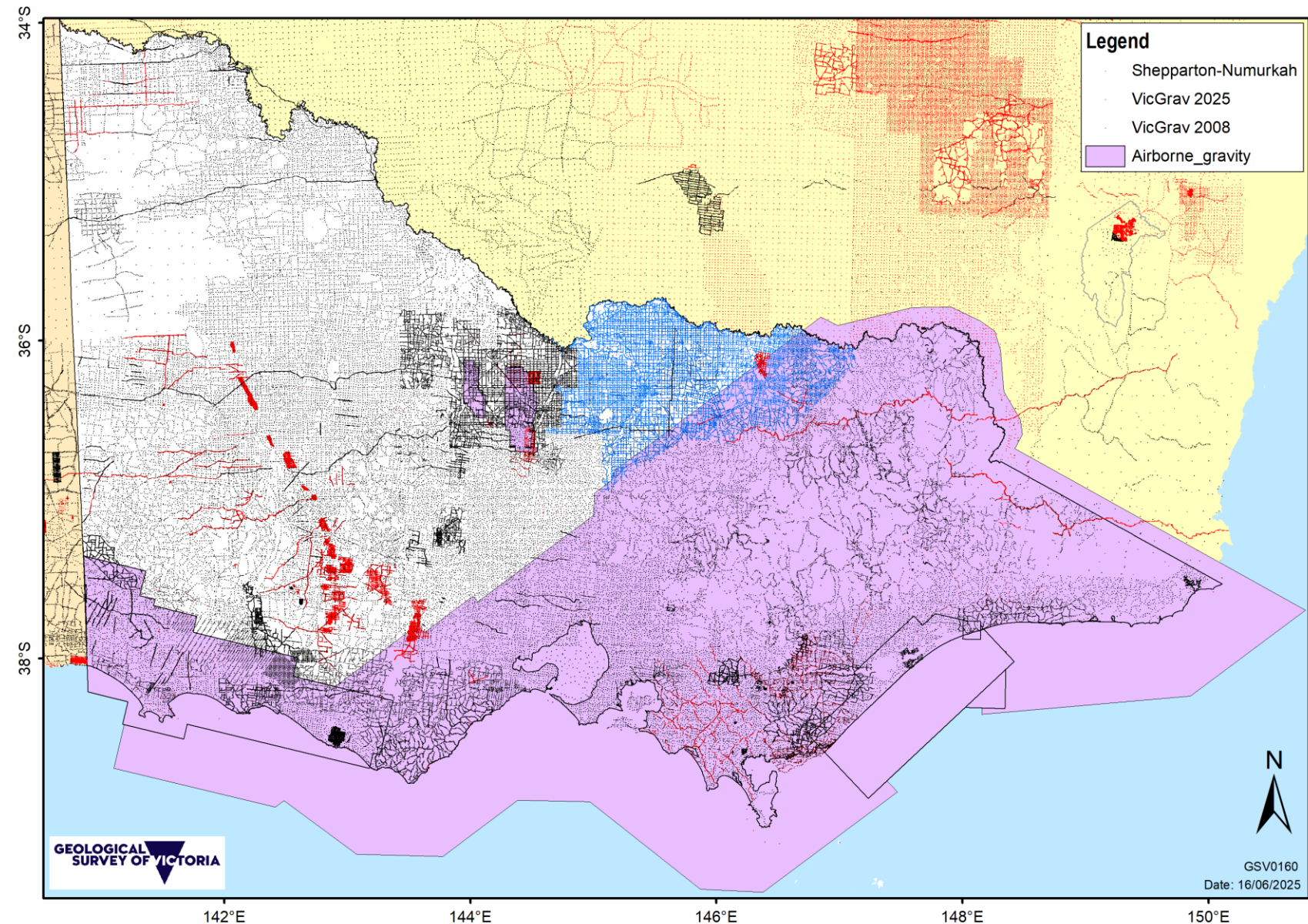




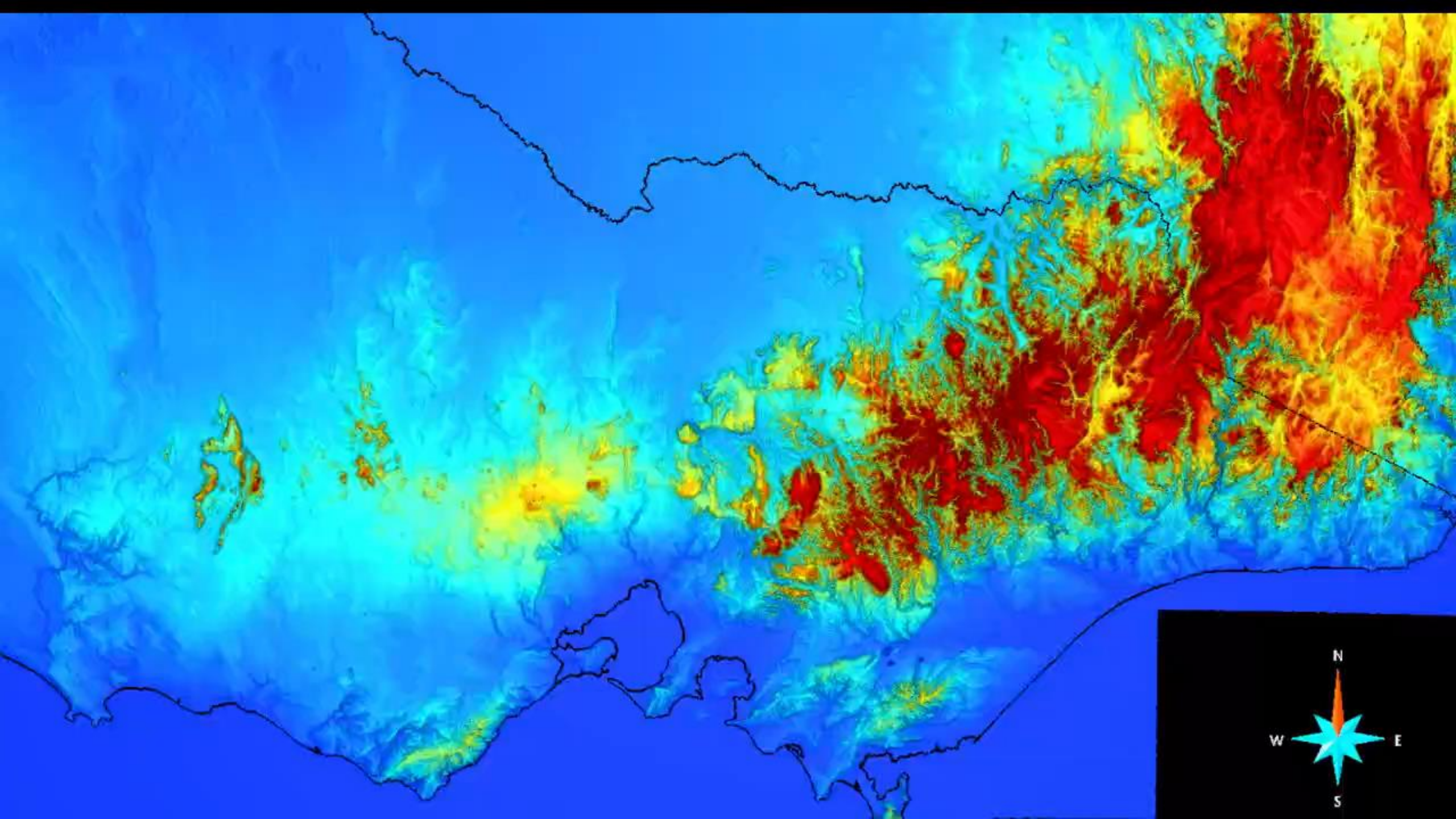
# New Victorian ground and airborne gravity

- Additional 72,295 ground gravity stations (including Shep-Num)
- New airborne gravity
- Anything else?

➤ Due for a new statewide grid



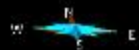
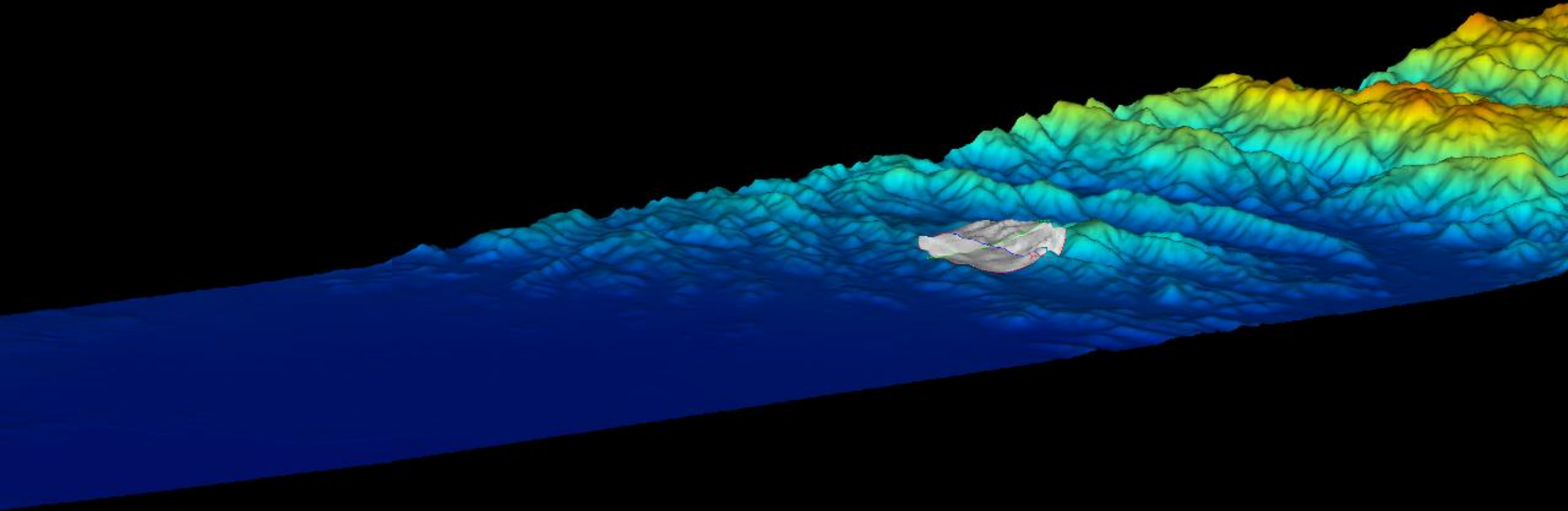






# Least Squares Collocation:

- Bit like kriging but with error bars & physics



# Least Squares Collocation: The Four Pillars

**COVARIANCE  
FUNCTION**

Who influences  
what?

**ERROR  
MANAGEMENT**

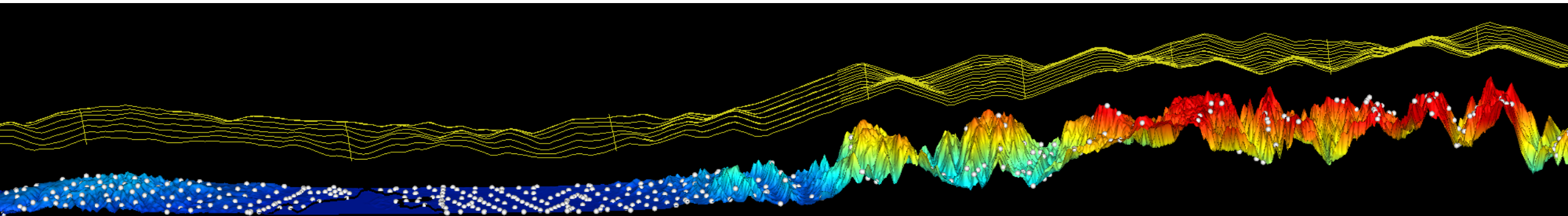
How much do we  
trust each  
measurement?

**PHYSICS  
GUIDED**

Upward / downward  
continuation informs  
the estimation.

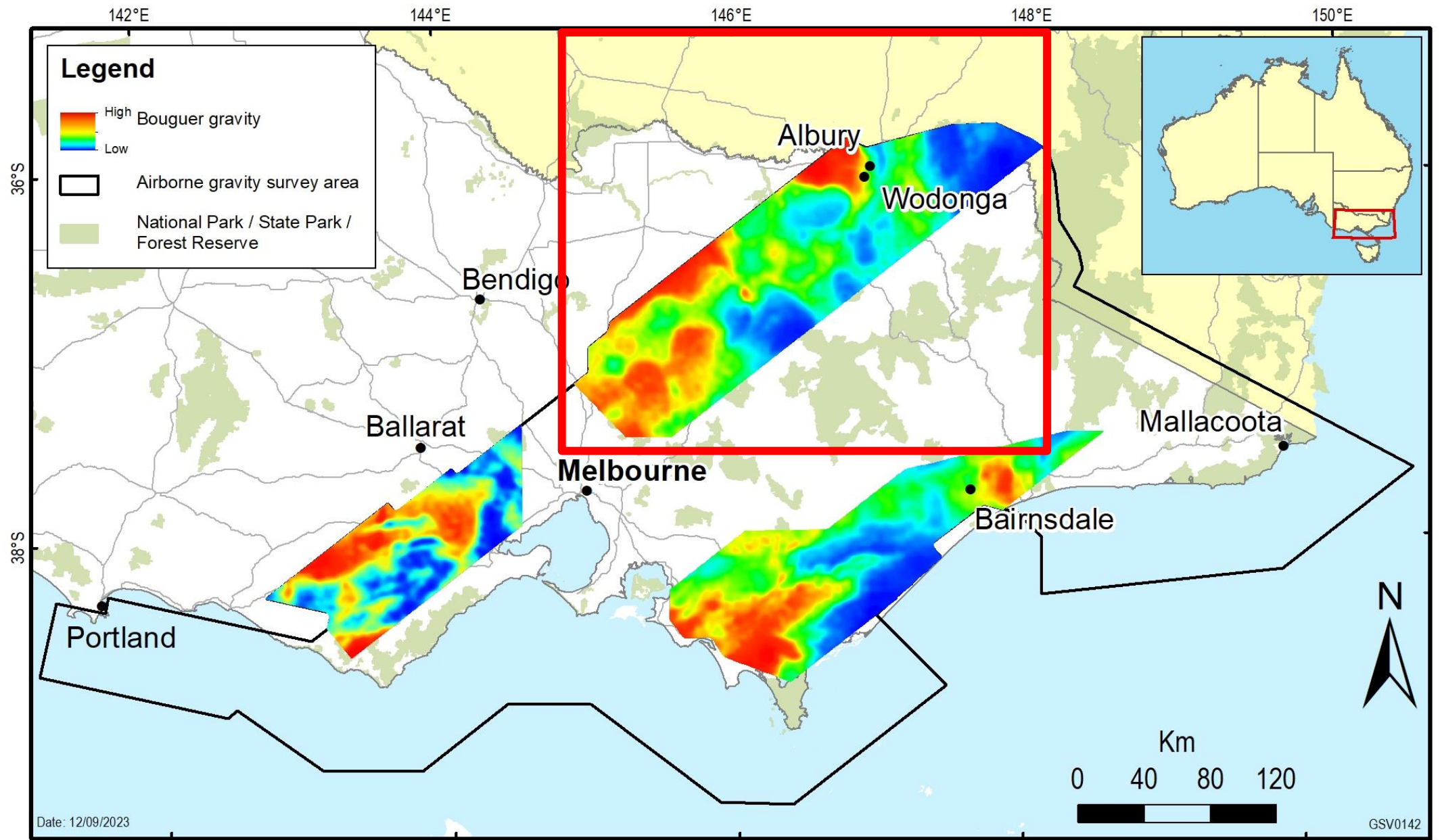
**TREND  
MODELLING**

LSC works with de-  
trended data.





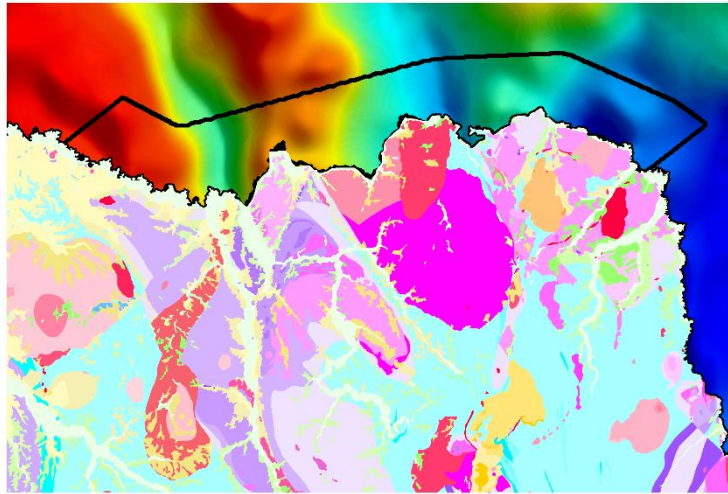
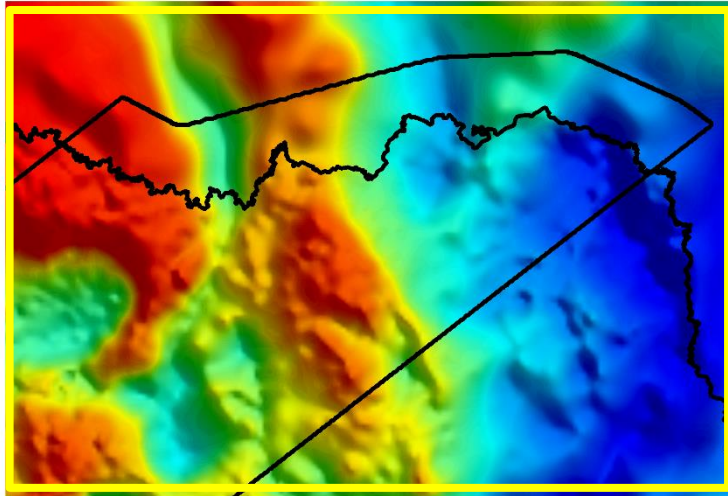
# Results



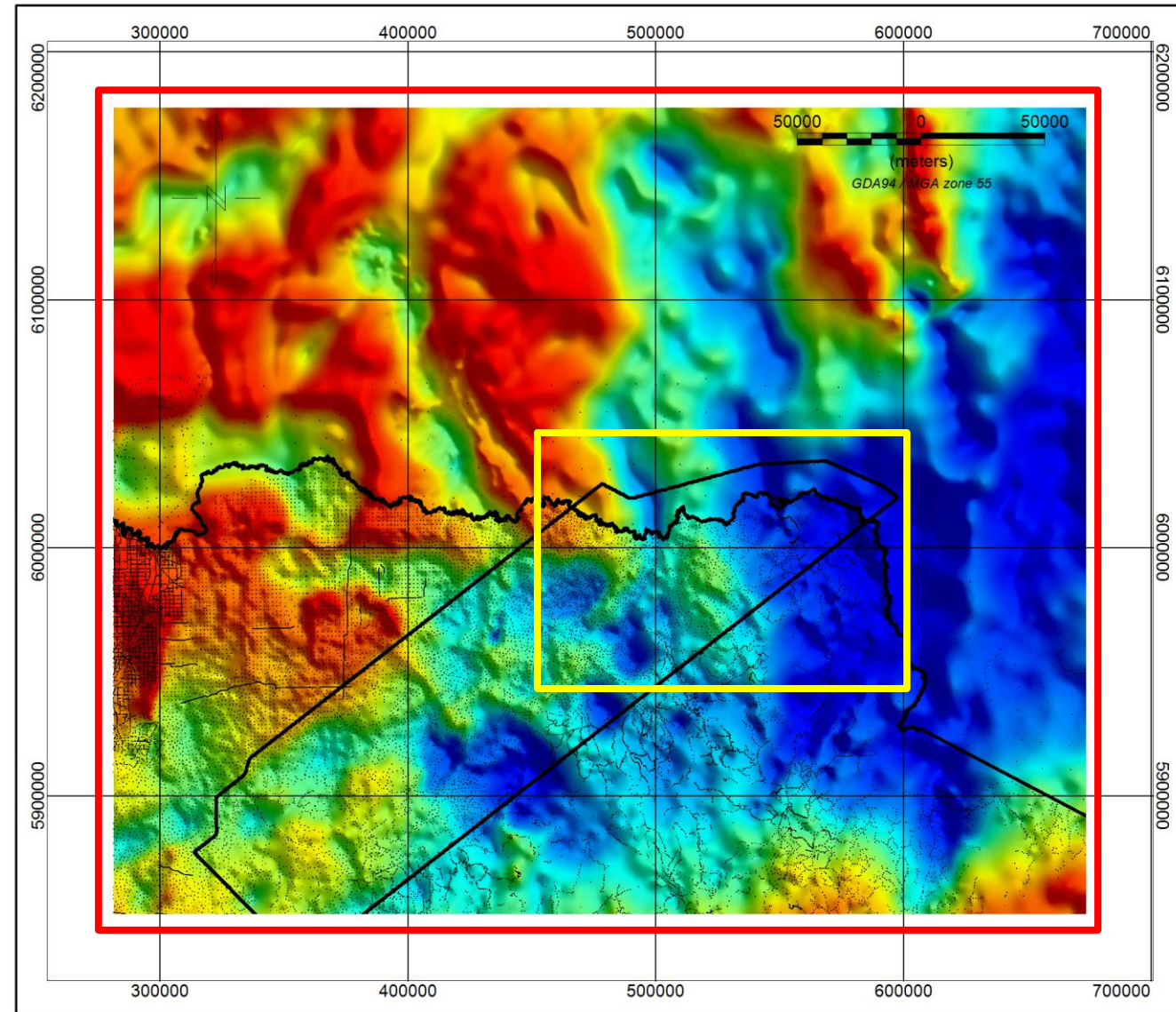


# Results

Ground gravity only



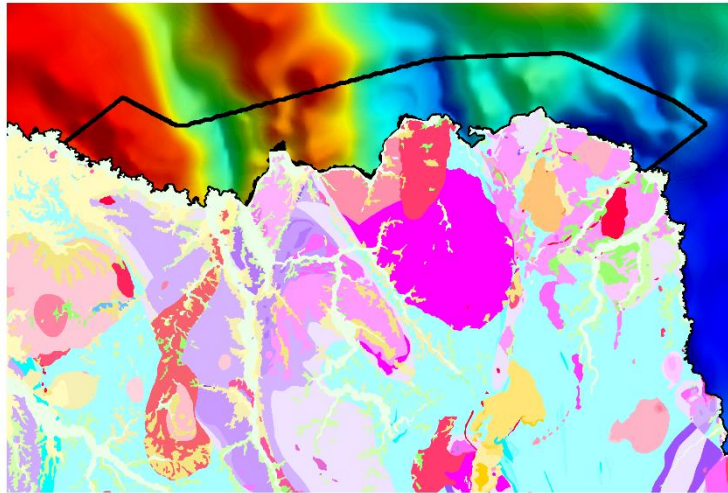
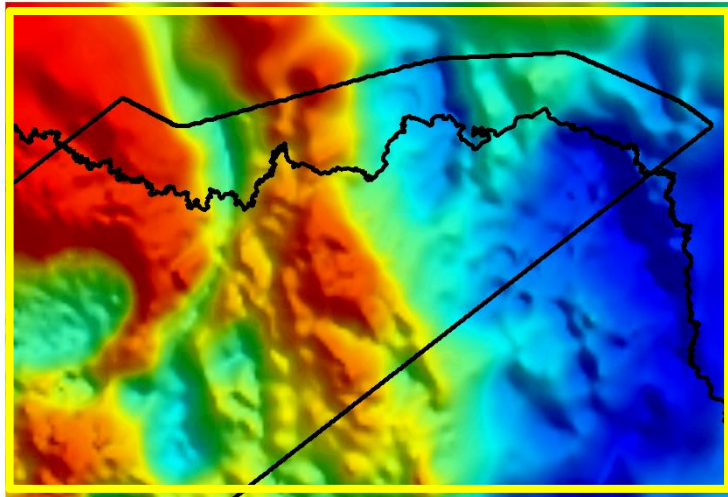
Ground gravity only



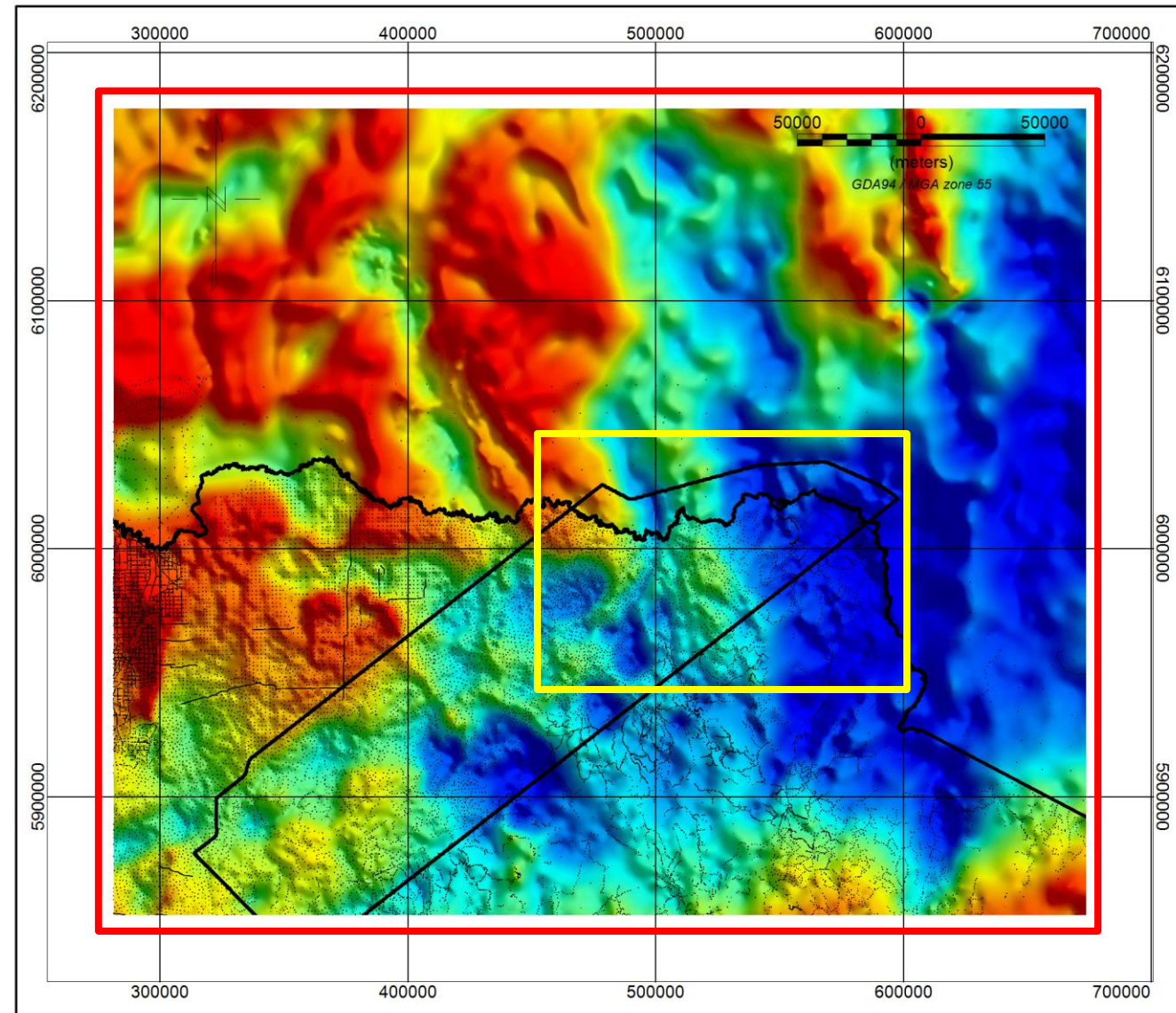


# Results

Airborne and ground gravity



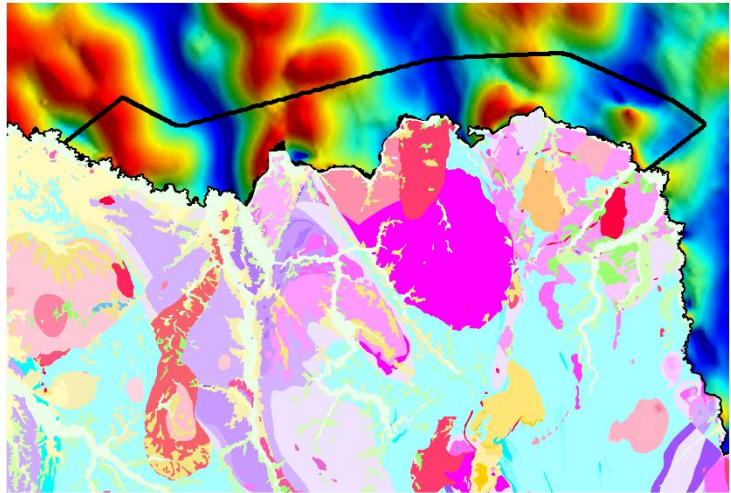
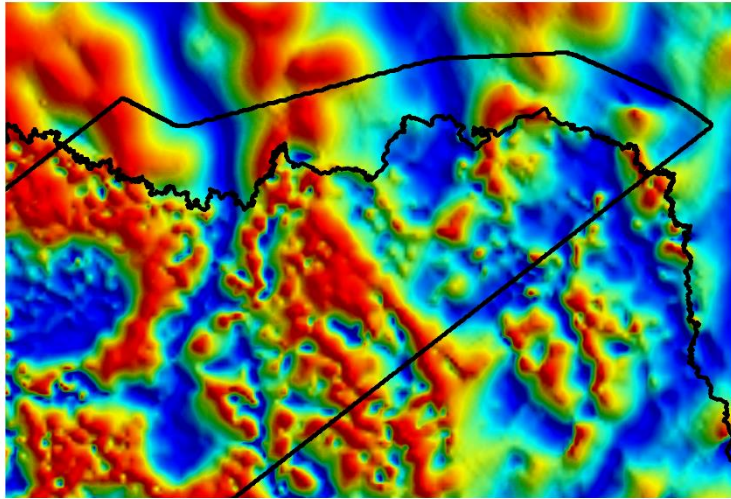
Airborne and ground gravity



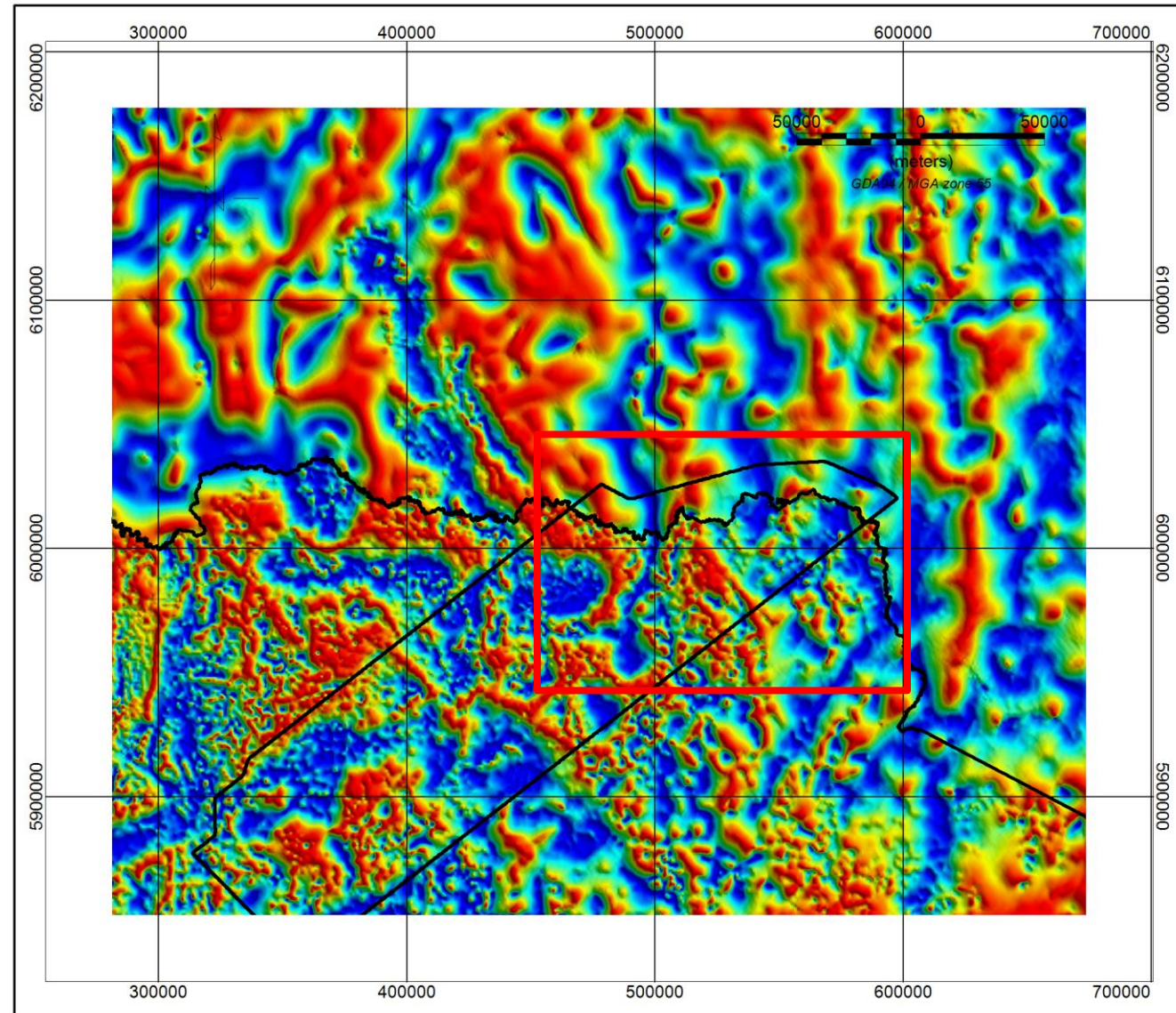


# Results

Ground gravity only



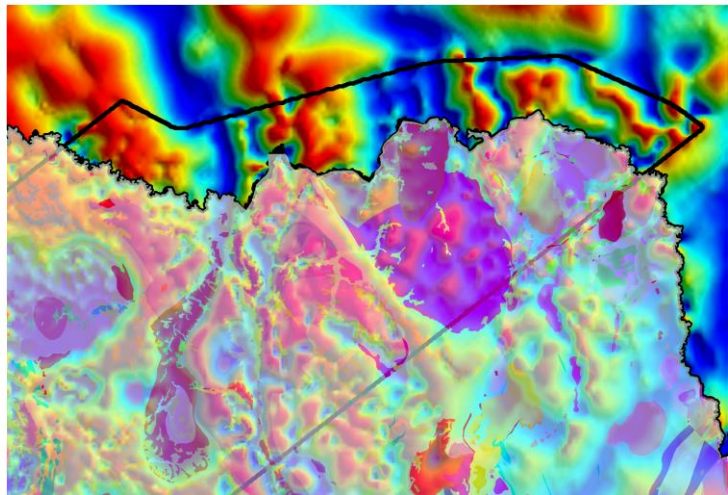
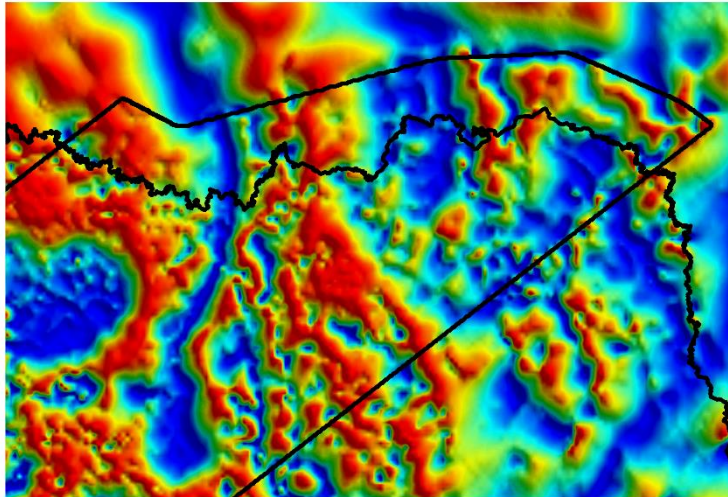
Ground gravity only



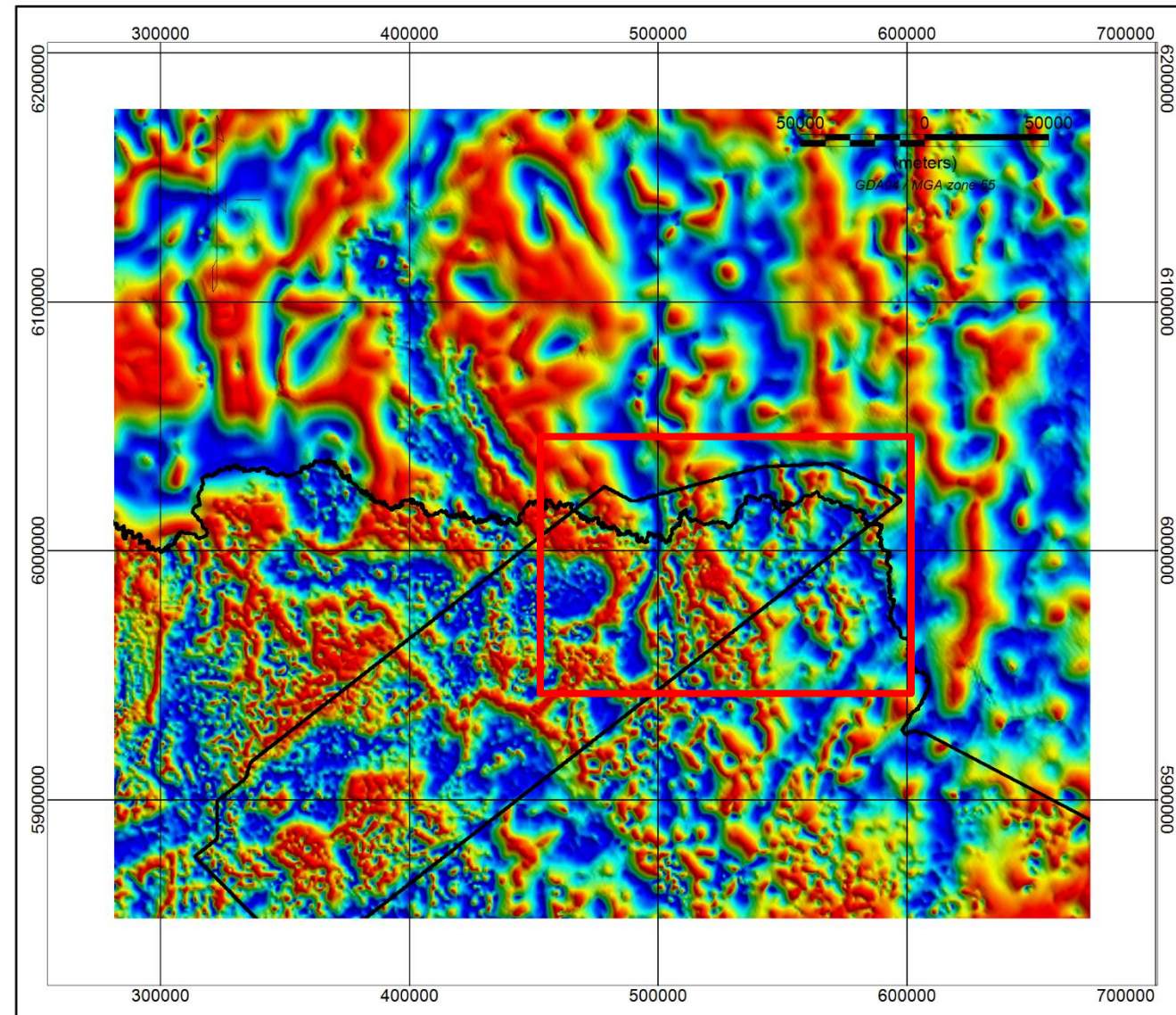


# Results

Airborne and ground gravity



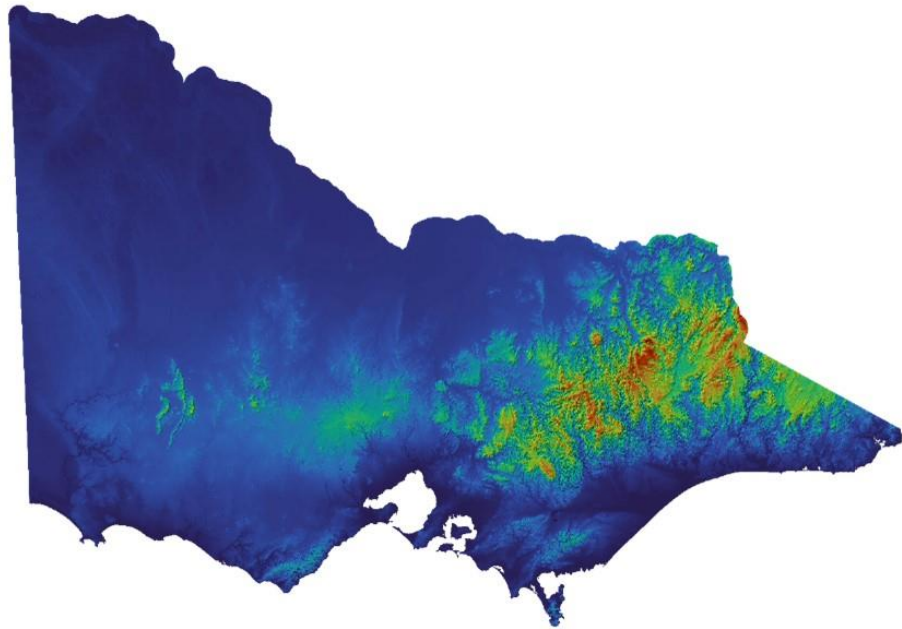
Airborne and ground gravity





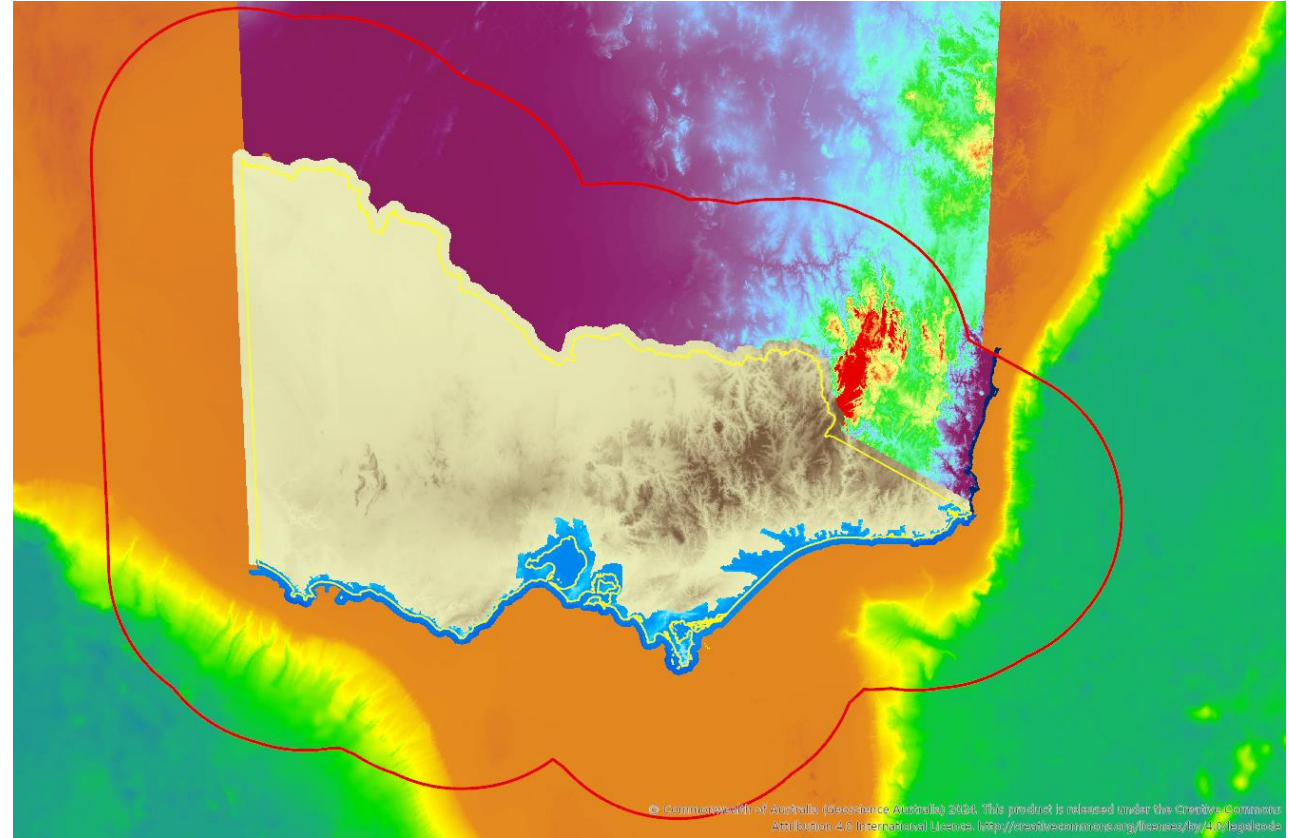
# New DEM – New terrain corrections

- Vicmap Elevation DEM 10m
- Vertical accuracy +/-5 m



<https://www.land.vic.gov.au/maps-and-spatial/spatial-data/vicmap-catalogue/vicmap-elevation>

Building a new DEM with data from SA and NSW



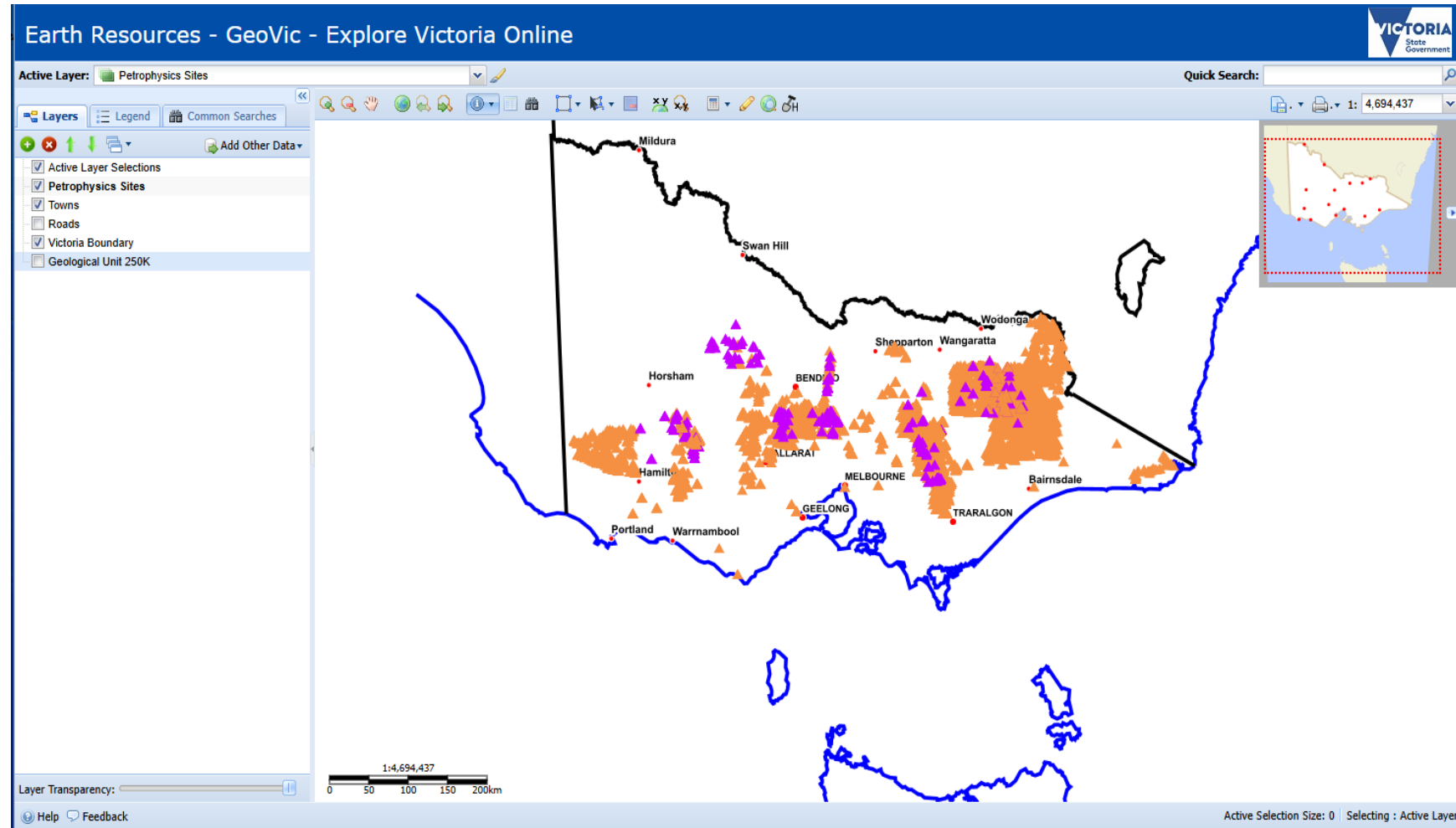
© Commonwealth of Australia (Geoscience Australia) 2024. This product is released under the Creative Commons Attribution 4.0 International License. <http://creativecommons.org/licenses/by/4.0/legalcode>



# Petrophysics

<https://resources.vic.gov.au/geology-exploration/maps-reports-data/geovic>

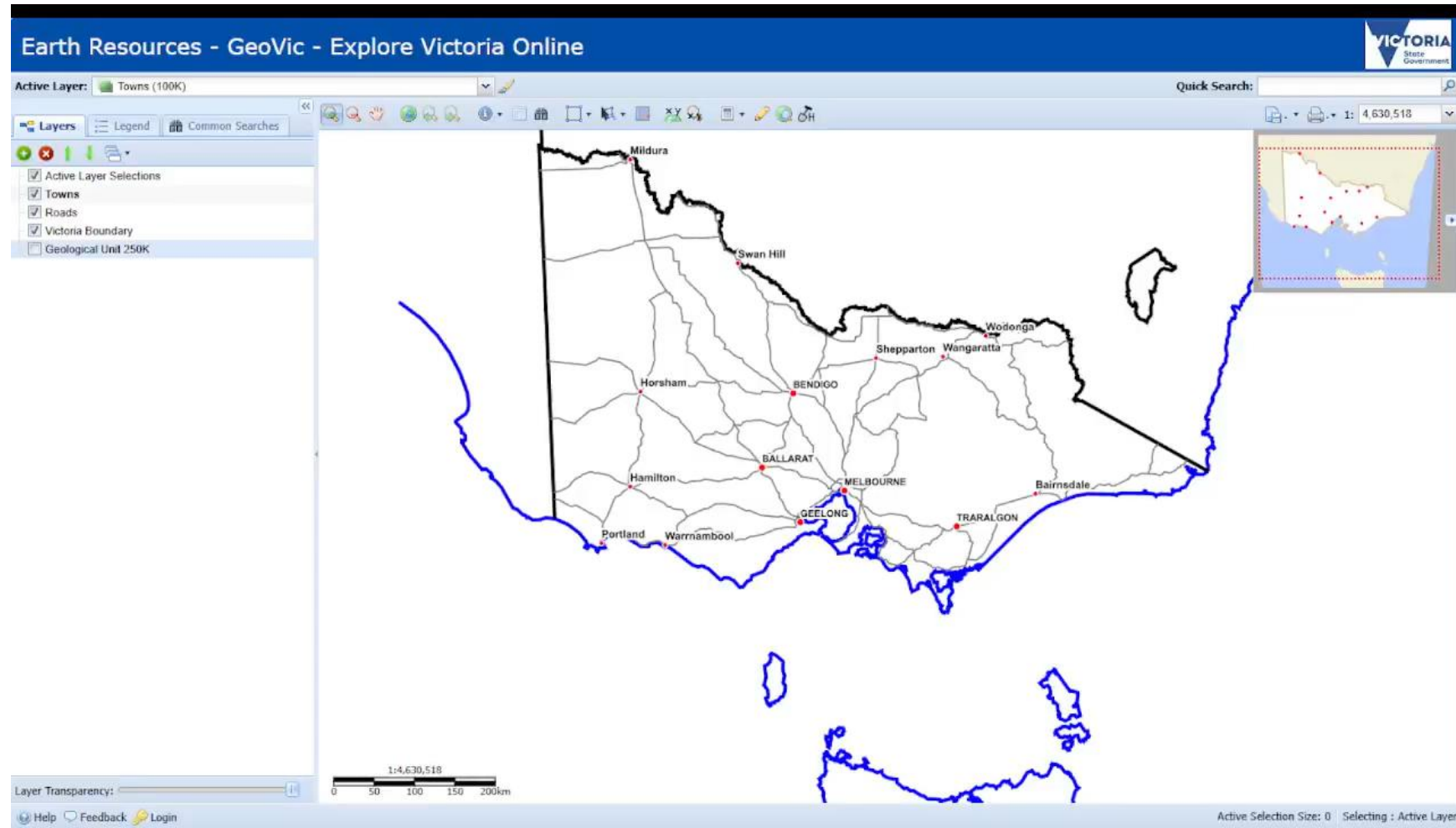
- GSV has a petrophysics dataset
- Density and mag susceptibility
- 26,623 sites



# Petrophysics

<https://resources.vic.gov.au/geology-exploration/maps-reports-data/geovic>

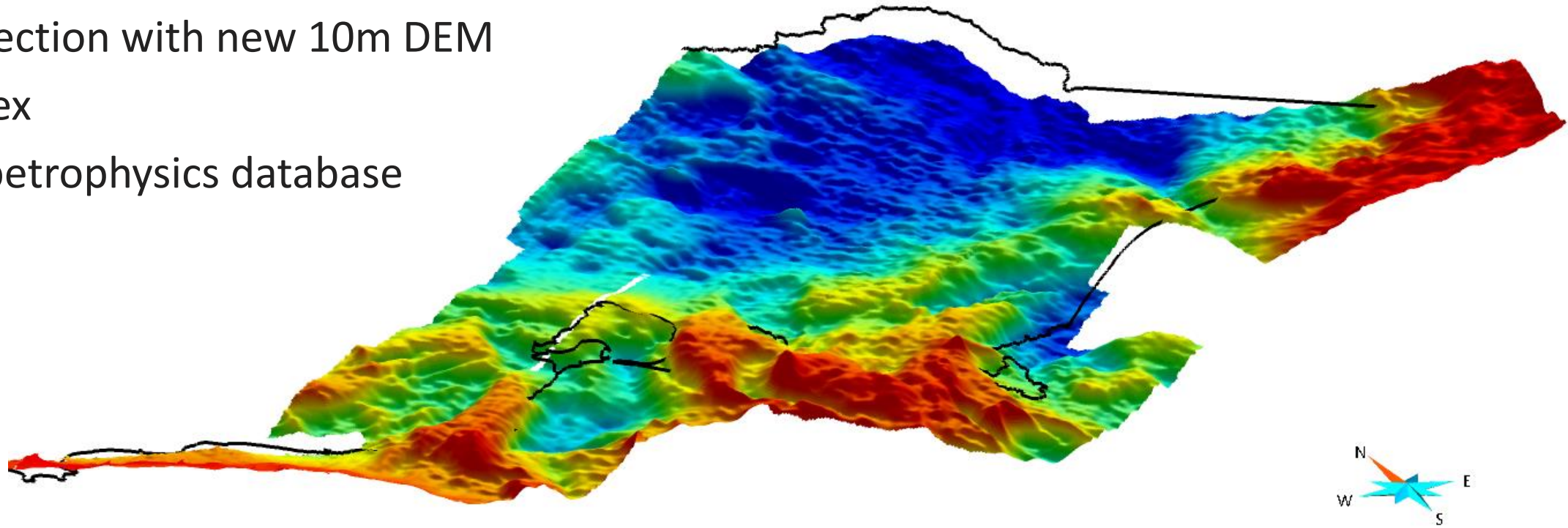
- GSV has a petrophysics dataset
- Density and mag susceptibility
- 26,623 sites





# Project outputs

- QC'd located ground gravity dataset
- Statewide grid of ground gravity
- Merged ground and airborne gravity grid
- Terrain correction with new 10m DEM
- VicGrav index
- Accessible petrophysics database



Feedback?

[mark.a.mclean@deeca.vic.gov.au](mailto:mark.a.mclean@deeca.vic.gov.au)