

The Australian Geographic Reference Image

Earth Observations from Space (EOS) are a vital source of information for Australia (Geoscience Australia 2010), enabling a wide range of essential services contributing billions of dollars to Gross Domestic Product annually. There is a diverse range of Australian Government programs which rely on EOS, such as the National Carbon Accounting System, which represent hundreds of millions of dollars of government outlays. State and territory government agencies are equally reliant on EOS data sources. Satellite images therefore play an essential and increasing role in mapping and monitoring of Australia's land and water, including the topography, natural and modified environments and infrastructure.

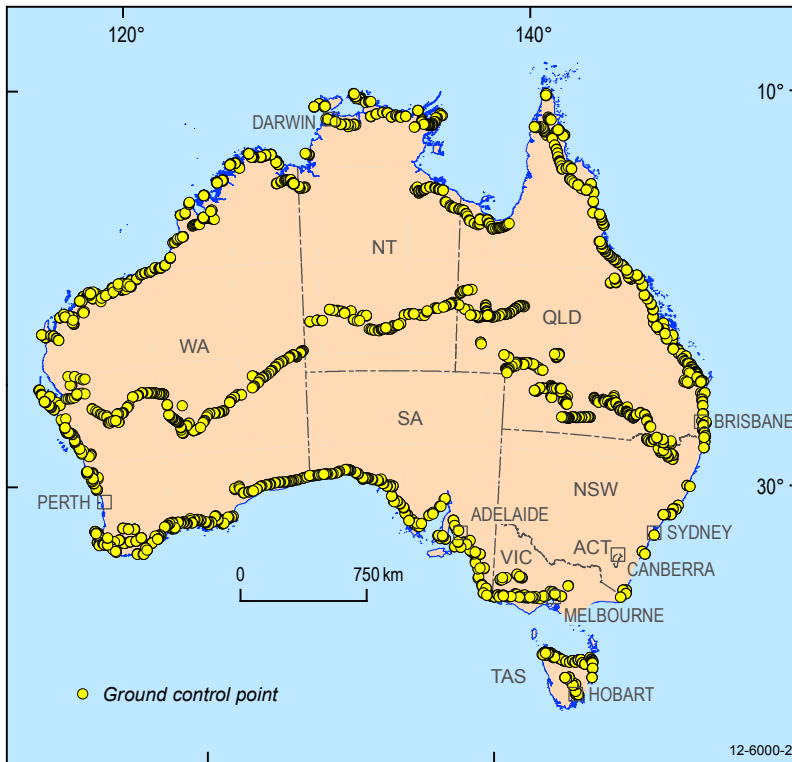


Figure 1. The locations of surveyed Ground Control Points for the Australian Geographic Reference Image. A total of 2885 features were surveyed at 737 sites.

A problem common to all remote sensing is the need to accurately locate observations to the ground, a process called 'geo-referencing', 'image rectification' (since satellite observations are often in the form of images), and in some cases 'orthorectification'. Accurate and consistent geo-referencing is essential to ensure that observations taken at different times and from different satellites and instruments can be compared.

The most reliable approach to orthorectification is to register all images to a single controlled image base – a reference image. Geoscience Australia has used this approach since 2002, rectifying

images from the Landsat satellites to the national Landsat panchromatic mosaic. However this mosaic has an accuracy of no more than fifteen metres, and cannot meet the need to rectify higher resolution imagery available from more recent, and proposed, Earth observation satellites.

The *Australian Geographic Reference Image* (AGRI) is a consistent and accurate reference image for rectification of imagery from multiple sources at resolutions of 2.5 metres or less. The AGRI is needed because the emerging new satellites and other sources of imagery will generate increasing amounts of data. AGRI can ensure that images from these sources are consistently and accurately registered to allow the maximum extraction of information.

During compilation more than 9560 satellite scenes, totalling over 6 terabytes, were used to produce eight mosaics, covering each of Australia's Universal Transverse Mercator map zones. These mosaics were then combined to produce a single mosaic covering the Australian continent. Intensity and contrast balancing were used to ensure visual consistency across the mosaic while maintaining the dynamic range of the image.

AGRI was made possible by new scientific and technical capabilities, international collaboration, the Australian spatial information industry, and the leadership and capabilities of Geoscience Australia.



Japan's Advanced Land Observing Satellite (ALOS) made possible the complete coverage of high quality imagery, which forms the foundation of the AGRI, as well as accurate data on the satellite orbit. Geoscience Australia was an international collaborator on the ALOS; handling data for the Oceania region. The *Barista* software, developed by the Cooperative Research Centre for Spatial Information, made the project feasible in terms of time, logistics, and cost. *Barista* reduced the image registration problem from correction of almost 10 000 scenes to correction of just 105 orbit segments.

The expertise and capability of the Australian spatial information industry was used in the design of GIS databases to manage the survey data and to conduct the many field surveys to remote areas of Australia (figure 1). The expertise and capabilities of Geoscience Australia staff in both Earth observation and geodesy were also essential inputs to the project.

Subject to future funding and data access, the AGRI could be progressively improved through:

- replacement of cloud-affected scenes with cloud-free scenes from the ALOS archive
- re-processing of problematic orbit paths with new satellite imagery
- additional or new ground control data sourced from new field surveys or through collaboration with state and territory agencies
- addressing other matters raised in user feedback.

The *Australian Geographic Reference Image* (AGRI) provides a consistent base image which will be an important foundation for future mapping and monitoring across Australia. It is a resource for both users and providers of satellite imagery covering Australia in government agencies, research institutions and academia, the

Capricorn Survey processed seismic data

Interpreted processed seismic data for the Capricorn Deep Crustal Seismic Survey in Western Australia was released on 23 November 2011 during a Public Presentation Workshop in Perth which was hosted by the Geological Survey of Western Australia.

The Capricorn deep crustal seismic survey was conducted during 2010 and extends from the Pilbara Craton, across the Capricorn Orogen, to the Yilgarn Craton. The survey consisted of three traverses with a total length of 581 kilometres (figure 1). The objective of the survey was to image the extent of the Archean crust beneath the Capricorn Orogeny and identify the relationship between the Pilbara Craton and the Yilgarn Craton.

spatial information industry, and international satellite operators. The AGRI mosaic and associated datasets are available to the public under the Creative Commons—Attribution licensing terms at cost of transfer from Geoscience Australia.

References

Geoscience Australia. 2010. A National Space Policy: views from the Earth Observation Community. Geoscience Australia, Canberra.

For more information

email ausgeomail@ga.gov.au
web https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=72657

Related articles/websites

AGRI: The Australian Geographic Reference Image-A technical report
www.ga.gov.au/image_cache/GA20164.pdf

The survey was a collaborative project involving AuScope (funded by the National Collaborative Research Infrastructure Strategy: NCRIS), the Geological Survey of Western Australia and Geoscience Australia. Funding was provided by AuScope Earth Imaging, Western Australia's Exploration Incentive Scheme, funded under the Royalties for Regions program, and Geoscience Australia's Onshore Energy Security Program.

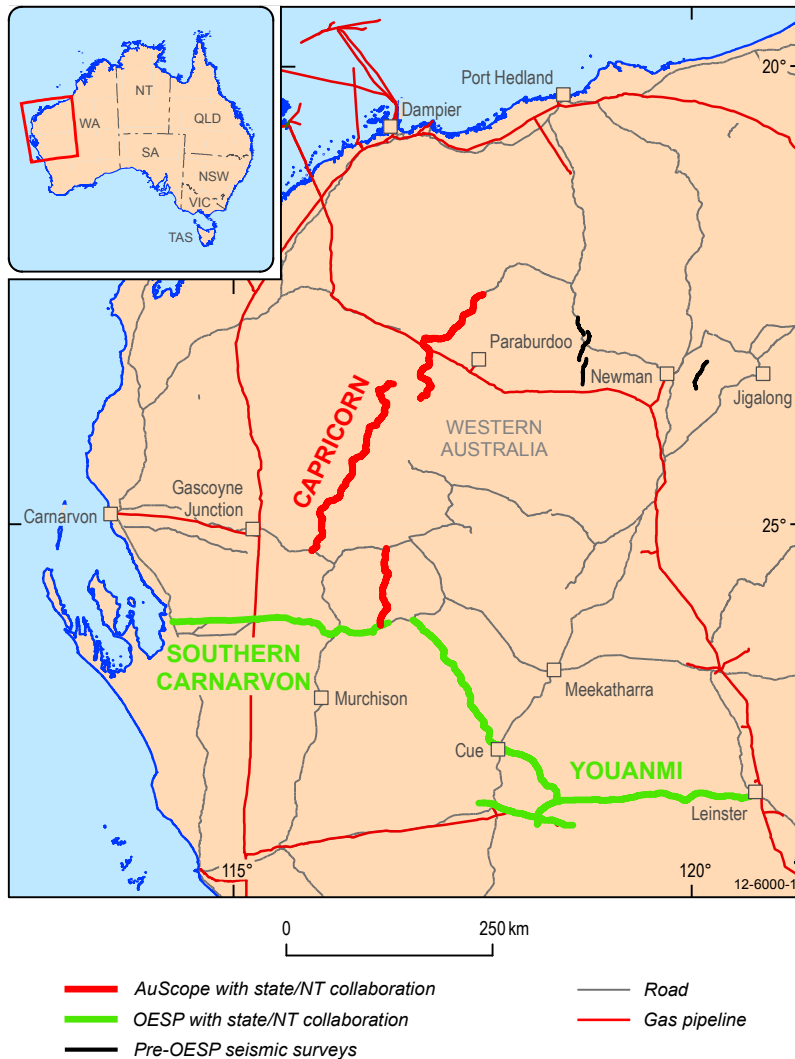


Figure 1. Location map showing the Capricorn Seismic Survey (in red) and the Youanmi Seismic Survey (in green) which were acquired in 2010. The Southern Carnarvon Basin Seismic Survey (in blue) was acquired in May 2011.

New geophysical datasets released

Data from four airborne magnetic/radiometric and gravity surveys covering onshore Australia have been released since September 2010. These datasets can be interpreted to reveal the sub-surface geology of the survey areas and will be a valuable tool in assessing their mineral potential.

The new levelled magnetic and gravity data from the Southwest Margin will add to pre-existing data and enhance opportunities for improving the understanding of basin provinces off the southwest margin of Australia. In late 2008 and early 2009, two marine

The interpreted processed data can be downloaded free of charge via the Geoscience Australia website (see below). A preliminary edition of the workshop proceedings is also available through the Geological Survey of Western Australia website.

For more information

email ausgeomail@ga.gov.au
web https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=72863

Related articles/websites

Capricorn Orogen deep seismic public release workshop-Extended abstracts and accompanying material (Geological Survey of Western Australia)

www.dmp.wa.gov.au/11804.aspx

Geoscience Australia Seismic Acquisition & Processing.

www.ga.gov.au/minerals/projects/current-projects/seismic-acquisition-processing.html

surveys (GA-310 and GA-2476) acquired new seismic reflection, swath bathymetry and potential-field (gravity and magnetic) data over the Mentelle, Perth and Southern Carnarvon basins, as well as the Wallaby Plateau. These surveys were major outputs of Geoscience Australia's Offshore Energy Security Program (2006–2011).

Table 1. Details of the airborne magnetic, radiometric and elevation surveys.

| Survey | Date | 1:250 000 map sheets | Line spacing/ terrain clearance/ orientation | Line km | Contractor |
|--------------------------|------------------------------|---------------------------------------|--|---------|-------------------------------|
| North Canning 4 WA | September 2010– June 2011 | Lagrange (pt), Munro, Mandora (pt) | 400 m/ 60 m/ north–south | 103 792 | Aeroquest Airborne Pty Ltd |
| Wolfe Creek Crater WA | July 2002 | Billiluna (pt) | 50 m/ 40 m/ north–south | 500 | UTS Geophysics Pty Ltd |

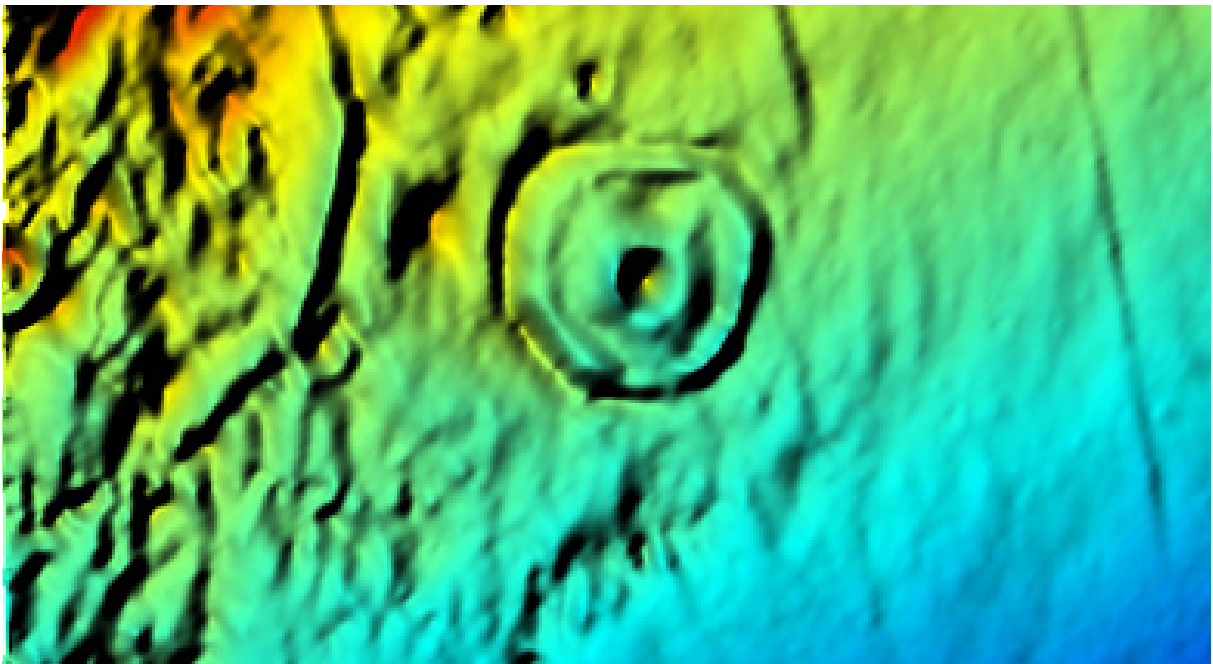


Figure 1. Magnetic image of the area around Wolfe Creek Crater WA.

Table 2. Details of the gravity surveys

| Survey | Date | 1:250 000 map sheets | Station spacing/ orientation | Stations | Contractor |
|---------|-----------------------|--|---|----------|--|
| Galilee | May–September 2011 | Hughenden (pt), Tangorin (pt), Buchanan (pt), Winton (pt), Muttaborra, Galilee (pt), Clermont (pt), Longreach (pt), Jericho, Emerald (pt), Blackall (pt) | 2.5 km/ north–south, east–west grid | 6 464 | Integrated Mapping Technologies Pty Ltd |

| | | | | | |
|---------|----------------------|---|-------------------------------------|-------|------------------|
| Thomson | April–September 2011 | Augathella (pt), Eddystone (pt), Quilpie (pt), Charleville (pt), Mitchell (pt), Toompine (pt), Wyandra, Homeboin (pt), Eulo (pt), Cunnamulla, Dirranbandi (pt), | 2.5 km/ north–south, east–west grid | 7 619 | Daishsat Pty Ltd |
|---------|----------------------|---|-------------------------------------|-------|------------------|

Table 3. Details of the marine magnetic and gravity surveys

| Survey | Date | 1:250 000 map sheets | Station spacing/ orientation | Kilometres | Contractor |
|------------------|---------|----------------------|------------------------------|------------|------------|
| Southwest Margin | 2008–09 | Not applicable | Ship track | 7 300 | Various |

For more information

email ausgeomail@ga.gov.au

Related articles/websites

Geophysical Archive Data Delivery System (GADDS)

www.geoscience.gov.au/gadds

High resolution bathymetry grids for Western Australian Margins and Bremer Sub-basin

Geoscience Australia has recently released Gridded XYZ bathymetric datasets for the Western Australian (WA) Margins and the Bremer Sub-basin off southwestern Australia. These XYZ bathymetric grids, which are an important tool in understanding the petroleum prospectivity of these areas, have been created using all of the most recent publicly available multibeam survey datasets.

The WA Margins bathymetric survey (GA-2476) covers part of the Exmouth Basin, the Houtman and Perth sub-basins and the Wallaby Plateau. This survey was conducted as part of Geoscience Australia’s Offshore Energy Security Program. The Bremer Sub-basin dataset is a compilation of all the processed multibeam data Geoscience Australia holds in its database that are publicly available. The bathymetric grids are in ASCII, Arc Info grid and geotif formats and can be obtained free online through Geoscience Australia’s website.

The release of these data are crucial in the promotion of these frontier basins for petroleum exploration and understanding the marine environment.

A compilation of all the single and multibeam grids, currently held by Geoscience Australia, covering the WA Margins and the multibeam grid for Macquarie Ridge in the Southern Ocean as well as the North Perth Sub-basin, will be released soon through Geoscience Australia’s website.

Table 1. Details of the bathymetric datasets for the Western Australian Margins and the Bremer Sub-basin.

| Survey | Date | Vessel | Coverage | Line km | Soundings |
|------------------|-------------------------------|----------|---------------------------------|----------|-------------|
| Southwest Margin | October 2008– January 2009 | RV Sonne | 200 967.83 square kilometres | 28 126.7 | 167 270 211 |
| Bremer Sub-basin | Multiple surveys | Multiple | 23 523.94 square kilometres | 11 128.5 | 163 620 444 |

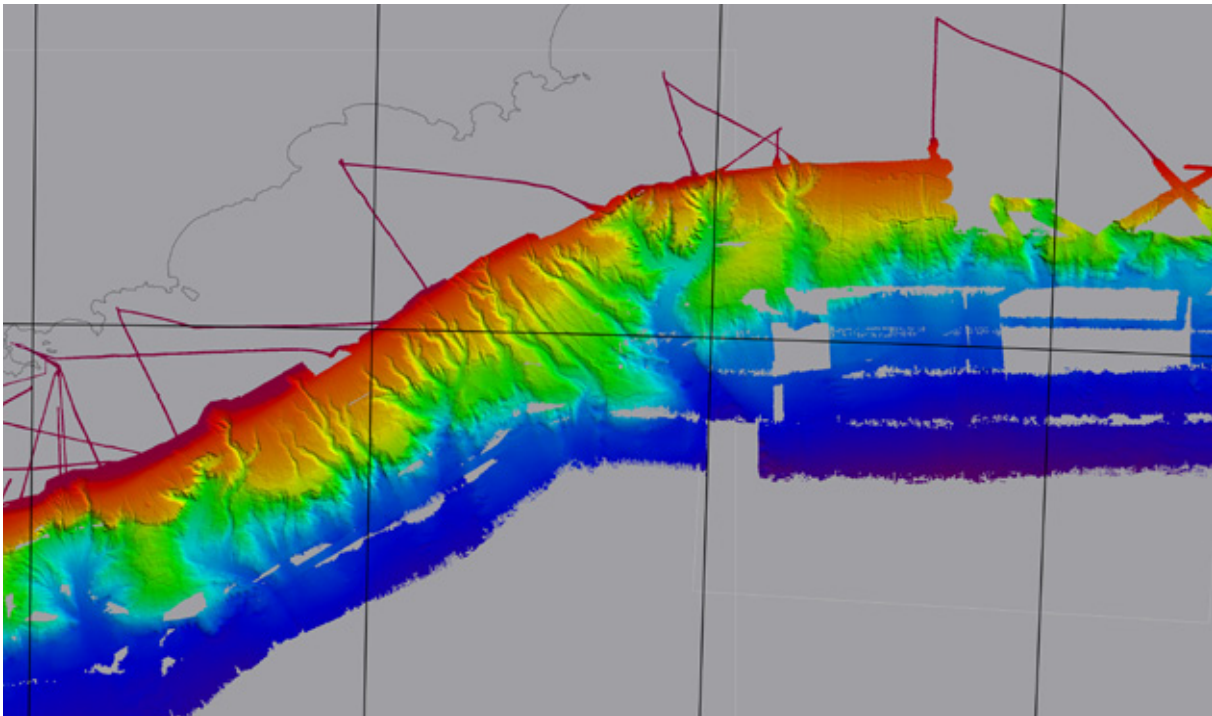


Figure 1. Multibeam Bathymetry from the Bremer Sub-basin.

For more information

email ausgeomail@ga.gov.au

Western Australian Margins datasets

https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=72719

Bremer Sub-basin datasets

https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=72768

Related articles/websites

XYZ marine bathymetric grids of survey GA-2476 WA Margins onboard the RV *Sonne*

https://www.ga.gov.au/products/servlet/controller?event=FILE_SELECTION&catno=72719

XYZ multibeam bathymetric grids of the Bremer Sub-basin

https://www.ga.gov.au/products/servlet/controller?event=FILE_SELECTION&catno=72768



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