# AUSTRALIAN NATIONAL GRAVITY DATABASE 0.5 MINUTE OFFSHORE - ONSHORE GRAVITY GRID June 2009

## GRID DESCRIPTION

The 2009 gravity grid over the Australian Region is derived from onshore observations recorded at approximately 1.4 million gravity stations held in the Australian National Gravity Database (ANGD) by Geoscience Australia (GA), and free-air gravity anomaly data derived from satellite altimetry by Sandwell and Smith (1997) over marine areas. The onshore data were acquired by the Commonwealth, State and Territory Governments, the mining and exploration industry, universities and research organisations from the 1950s to the present day. Continental Australia has a basic station spacing coverage of 11 kilometres, with South Australia, Tasmania and part of New South Wales covered at a spacing of 7 kilometres. Victoria has station coverage of approximately 1.5 kilometres. Recent Federal, State and Territory Government initiatives have funded systematic infill at a grid station spacing of 2, 2.5 or 4 kilometres to provide improved coverage in areas of scientific or economic interest. Other areas of detailed coverage have been surveyed by private companies for exploration purposes.

Over the continental region only open file data as held in the ANGD at May 2009 were used in the creation of the grid. Data derived from satellite altimetry were used exclusively over the marine region.

The data values contained in the grid are Spherical Cap Bouguer gravity anomalies over Continental Australia while free-air anomalies are used offshore. The onshore Spherical Cap Bouguer gravity anomalies were calculated using a density of 2.67 $tm^{-3}$. Offshore Ellipsoidal Free-air gravity anomalies were based on gravity (V16.1) and topography (V9.1) data extracted from the Marine Gravity from Satellite Altimetry dataset (Sandwell and Smith, 1997, 2005). These data were combined with the GA onshore gravity data and gridded using a variable density gridding technique provided by the INTREPID Geophysics software package. The data were gridded to a cell size of 0.5 minutes of arc = 0.00833333º (approximately 800m) for the geodetic grid and to a cell size of 800m for the Lambert Conformal Conic Projection grid.

The parameters of the geodetic grid are:

Grid spacing : 0.5 minute = 0.0083333 degree (approximately 800 m)
Projection : Rectangular in latitude and longitude
Datum : GDA94
Grid size : 5278 rows x 8399 columns
Grid origin : 8:0:33.9958º South, 100:0:20.9934º East (0,0)
Scaling : Nil. Values are in decimal units ($\mu ms^{-2}$)
Null value : -99999.00
Data accuracy : 5 $\mu ms^{-2}$, maximum error 100 $\mu ms^{-2}$ onshore
Data precision : 1 $\mu ms^{-2}$

The parameters of the Lambert Conformal Conic Projection grid are:

Grid spacing : 800 m
Projection : Lambert Conformal Conic Projection, Easting and Northing
Datum : GDA94

Grid size : 6678 rows x 9957 columns
Grid origin :-3864100 (Easting), -937700 (Northing); (0,0)
Scaling : Nil. Values are in decimal units ($\mu ms^{-2}$)
Null value : -99999.00
Data accuracy : 5 $\mu ms^{-2}$, maximum error 100 $\mu ms^{-2}$ onshore
Data precision : 1 $\mu ms^{-2}$

**DATA FORMAT**

Digital grid – IEEE 4ByteReal binary raster (suitable for ER Mapper), Geodetic projection, GRS80 Spheroid, GDA94 Datum.

**GRAVITY DATUM**

The gravity data as supplied are based on the Australian Absolute Gravity Datum (AAGD07) (Tracey *et al*., 2008). The gravity unit used is micrometres per second squared ($\mu ms^{-2}$) which is equivalent to 0.1 milligals (mGal).

**DATA QUALITY – POSITIONAL ACCURACY**

Highly variable depending on the age of the individual surveys that comprise the grid. Prior to 1995 (approximately), data were collected using various techniques to determine position, such as manually scaling from base maps (100's m error), digitising from base maps derived from air photo station plots (100's m error), and using optical surveying methods (metre accuracy). More recent surveys were acquired using differential GPS with sub metre accuracy.

Vertical accuracy is highly variable too, depending on the age of the survey. Prior to the use of differential GPS station heights were determined by picking elevations from a topographic map (10's metre error), using barometric techniques (metre errors) and optical surveying techniques (sub metre accuracy). Differential GPS gives centimetre accuracy.

**DATA QUALITY – ATTRIBUTE ACCURACY**

Highly variable depending on the age of the individual surveys that were used to produce this grid. Modern surveys use LaCoste and Romberg or Scintrex gravity meters with an accuracy of 0.01 $\mu ms^{-2}$.
Earlier surveys used older style quartz spring meters which have a lower accuracy (approximately 1.0 $\mu ms^{-2}$).

**REFERENCES**

Tracey, R., Bacchin, M., and Wynne, P., 2008, AAGD07: A new absolute gravity datum for Australian gravity and new standards for the Australian National Gravity Database: *Exploration Geophysics*, (in prep).

Sandwell, D.T., and Smith, W.H.F., 1997, Marine gravity anomaly from Geosat and ERS 1 satellite altimetry: *Journal of Geophysical Research*, v. 102, No. B5, p. 10039-10054.

Sandwell, D.T., and Smith, W.H.F., (2005), Retracking ERS-1 altimeter waveforms for optimal gravity field recovery: *Geophysical Journal International*, 163 (1), p. 79–89.

**ACKNOWLEDGEMENTS**

*Marine Gravity – Satellite Altimetry dataset information.*

Offshore free-air gravity anomalies used in the production of this grid are derived from data extracted out of the *Marine Gravity from Satellite Altimetry* dataset available at http://topex.ucsd.edu/marine_grav/mar_grav.html

These data were used with the permission of David Sandwell and Walter Smith.

David T. Sandwell
Scripps Institution of Oceanography
La Jolla, CA 92093-0225 USA
dsandwell@ucsd.edu
858 534-7109

Walter H. F. Smith
NOAA Laboratory For Satellite Altimetry
Silver Spring, MD 20910-3281 USA
walter.hf.smith@noaa.gov
301 713-2857

**GRAVITY DATA ERRORS**

Most of the gross errors have been removed from the database. However, errors may still be present in the data. If you find grid values you believe are in error, please FAX or e-mail the details to the database administrator (see below).

**The Gravity Database Administrator:**
**Phillip Wynne,**
**Continental Geophysics Project,**
**Geoscience Australia**
**PHONE: 02 6249 9463**
**FAX: 02 6249 9913**
**E-mail:** phill.wynne@ga.gov.au

**June 2009**