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Australian Government
Geoscience Australia

NEW Geomagnetic Field Models RELEASED

New editions of the Australian Geomagnetic Reference Field (AGRF) model and the International Geomagnetic Reference Field (IGRF-10) are now available from Geoscience Australia.

Both models have a wide range of applications in the scientific, industrial and engineering sectors and the general community. Areas of specialist application include mineral exploration, surveying, mapping, research into the global magnetic field and its secular change, and studies of the Earth's deep interior, crust, ionosphere and magnetosphere. The AGRF model is also a particularly useful tool for anyone using a compass or GPS technology for navigation in and around Australia - including bushwalkers, orienteers, mariners and pilots - and for applications such as aligning satellite dishes or telescopes.

The Australian Geomagnetic Reference Field Model

The AGRF is a mathematical model of the geomagnetic field of Australia, nearby offshore areas, Papua New Guinea and parts of eastern Indonesia. The first model was derived for 1 January 1985 (epoch 1985.0). It has been improved and updated every five years to ensure that slow but unpredictable changes in the geomagnetic field, which originate from within the Earth, are tracked as accurately as possible.

The 2005 revision - the fifth in the series - is a mathematical representation of the undisturbed geomagnetic main field at epoch 2005.0 and its predicted annual change over 2005-2010. The model describes the field originating from internal sources using spherical cap harmonics. The main field is modelled to a nominal minimum wavelength of 1500 km and the annual change to 2000 km. (figure 1)

Extensive vector geomagnetic survey data sets were used to derive the main field model, including magnetic data from the Danish Oersted satellite and the US Magsat satellite, high elevation airborne data, and Australia-wide ground based vector survey data. The main field data sets were updated to epoch 2005.0 using a secular variation model of the Australian region derived from geomagnetic observatory and repeat station data collected from Australia and neighbouring countries over the last 45 years.

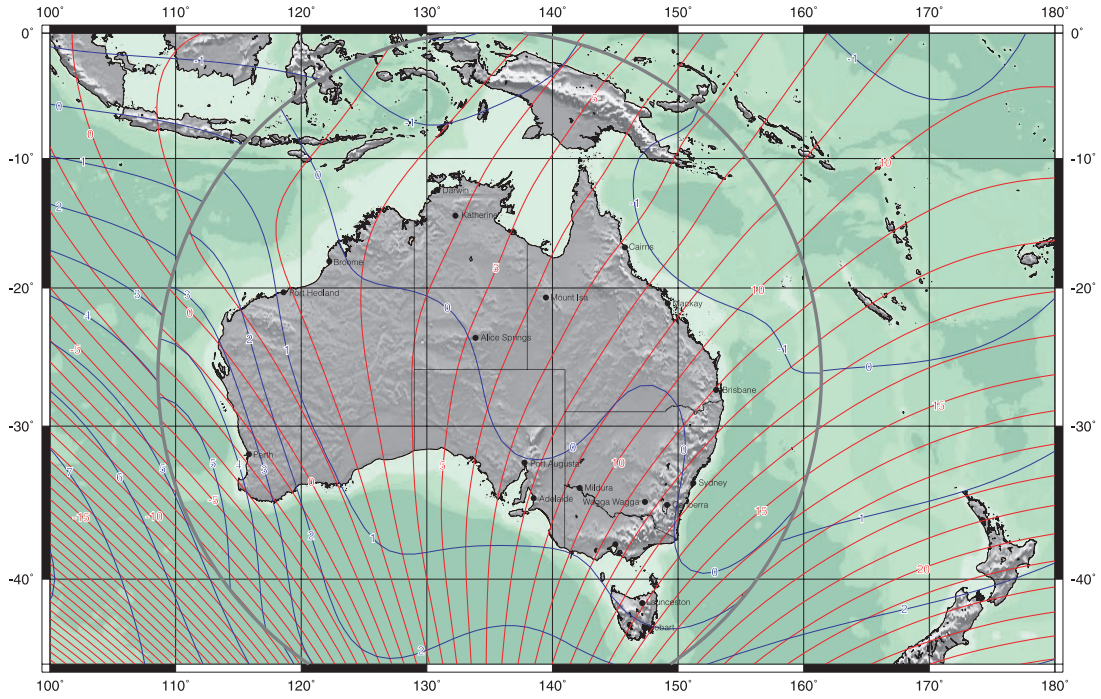

Figure 1. Contours of the magnetic declination in degrees (red) and annual change of declination (blue) in minutes-of-arc per year from the AGRF 2005 model for epoch 2005.0. The circular boundary shows the limit of the AGRF model, contours outside the boundary are from the International Geomagnetic Reference Field Model (IGRF-10 at 2005.0)

The secular variation model in AGRF 2005 is based on a linear extrapolation of the most recently available geomagnetic observatory and repeat station data from Australia and neighbouring countries. Based on knowledge of the past behaviour of the magnetic field the secular variation model should be suitable out to epoch 2010.

The 2005 revision of the AGRF model is built upon the recently released 10th generation of the International Geomagnetic Reference Field, which is a global spherical harmonic model of the geomagnetic field. An on-line calculator for the AGRF is available on the GA web site. Software is also available from Geoscience Australia to evaluate the AGRF at a single point or a grid of points.

The extensive regional data set used in developing the AGRF model makes it the best available model for the Australian regional magnetic field for the interval 2005-2010.

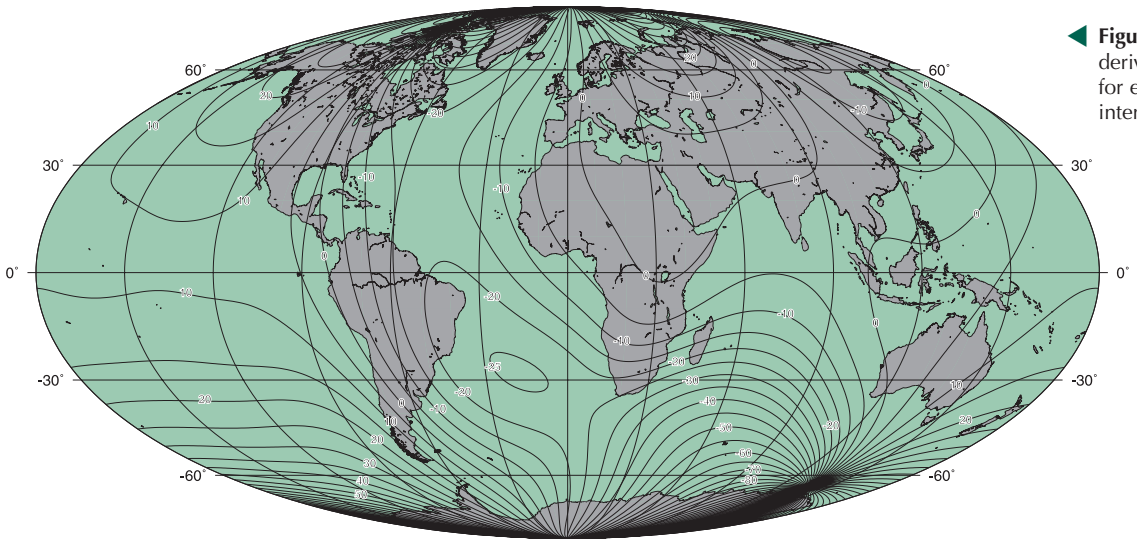

Figure 2. Declination isogons derived from the IGRF-10 model for epoch 2005.0, the contour interval is 5 degrees.

The International Geomagnetic Reference Field

The "10th generation (revised Dec 2004)" of the International Geomagnetic Reference Field (IGRF-10) was released by the International Association of Geomagnetism and Aeronomy (IAGA) in December 2004. This new release adds a main field model for 2005.0 and a secular variation model for the period 2005-2010 to the existing IGRF coefficient sets. IGRF-10 allows the undisturbed long wavelength geomagnetic field originating from sources internal to the Earth to be calculated at any location on, or near, the surface of the Earth over the period 1900 to 2010.

The development of the IGRF is the result of international collaboration between magnetic field modellers and institutions that undertake satellite magnetic surveys and run geomagnetic observatories.

The 9th and 10th generation of the IGRF represent considerable improvements on previous revisions, mainly due to the large quantities of high quality satellite magnetic data currently available. Data from both the Oersted satellite and the German CHAMP satellite were used in developing the IGRF-10 model for 2005.0, as well as data from the global network of geomagnetic observatories. The spherical harmonic degree and order 13 coefficients model the main field at 2005.0 to a minimum nominal wavelength of 3000km. The degree and order 8 secular variation coefficients model the rate of change of the field to a minimum nominal wavelength of 5000km (figure 2).

The full set of spherical harmonic coefficients for IGRF-10 can be downloaded in several formats from the IAGA V-MOD web site. A single point calculator is available on-line and software to evaluate IGRF-10 at a single point or a grid is also available from Geoscience Australia.

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Geoscience Australia (AGRF):	www.ga.gov.au/oracle/geomag/agrfform.jsp
IAGA V-MOD web site:	www.ngdc.noaa.gov/IAGA/vmod/igrf.html
single point calculator:	www.geomag.bgs.ac.uk/gifs/igrf_form.shtml