What is the difference between WGS84 and GDA94?

This information sheet explains the difference between the World Geodetic System 1984 (WGS84) and the Geocentric Datum of Australia 1994 (GDA94). It is designed as an information guide for spatial information specialists.

What is GDA94?

The Geocentric Datum of Australia 1994 (GDA94) is a new coordinate system for Australia that is compatible with coordinates produced by the Global Positioning System (GPS). GDA94 supersedes the Australian Geodetic Datum coordinate systems AGD66 and AGD84.

GDA94 is based on the International Terrestrial Reference Frame 1992 (ITRF92), which is an international coordinate framework having the earth's centre of mass as its origin. ITRF is computed annually from a global network of accurate coordinates and is now sufficiently refined that the change between successive ITRF epochs is in the order of a couple of centimetres only. These coordinates are derived from geodetic observations such as GPS, Very Long Baseline Interferometry (VLBI), and Satellite Laser Ranging (SLR).

What is WGS84?

The World Geodetic System 1984 (WGS84) is the geodetic reference system used by GPS. WGS84 was developed for the United States Defense Mapping Agency (DMA), now called NIMA (National Imagery and Mapping and Agency). Although the name WGS84 has remained the same, it has been enhanced on several occasions to a point where it is now very closely aligned to ITRF. The origin of the WGS84 framework is also the earth's centre of mass.

It should be noted that all GPS receivers compute and store coordinates in terms of WGS84, then transform to other datums when information is displayed. Many GPS users may have noted that although the local datum is selected for display, WGS84 values are downloaded via their data cable to a computer.

WGS84 is also the default datum for many GIS software packages with data either being stored in or transformed via WGS84.

What is the difference between GDA94 and WGS84?

Except for a small difference in the flattening term, the reference ellipsoid used with WGS84 is essentially the same as the Geodetic Reference System 1980 (GRS80) ellipsoid used with ITRF and hence GDA94.

Ellipsoid	Semi-major axis	Inverse flattening
GRS80	6,378,137 m	298.257222101
WGS84	6,378,137 m	298.257223563

Table 1: GRS80 & WGS84 reference ellipsoid parameters

Given that the ITRF and WGS84 reference frames are also very closely aligned, for most practical purposes GDA94 and WGS84 coordinates can be considered the same and no transformation is required.*

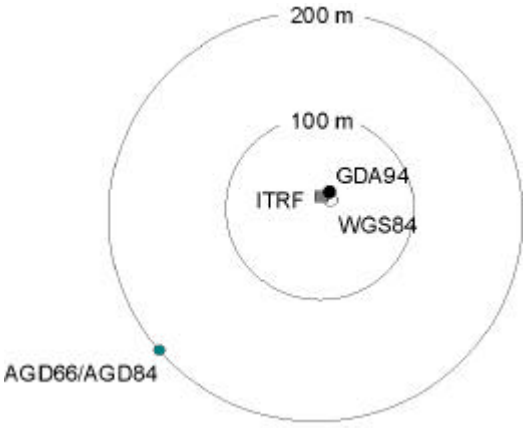

Figure 1: Relationship between horizontal coordinates from different datums.

However a distinction should be made between reference frames when dealing with absolute positions that may (or may not) take into account geophysical plate tectonics.

In other words, when comparing GDA, WGS & ITRF datums, keep in mind that GDA94 coordinates are fixed as at the 1st January 1994 (epoch 1994.0) and that the Australian plate is drifting in a north-easterly direction about seven centimetres per year. If we were to re-compute GDA now, the coordinates would about half a metre different!

* What does “for most practical purposes” really mean?

If you want a GDA94 position from your **hand-held GPS** receiver and it does not support GDA, then select WGS84 (default) as the map datum. If you also select Universal Transverse Mercator (UTM) as the position format, the coordinates displayed can be regarded as Map Grid of Australia (MGA) eastings & northings, the same as your new GDA map.

If **differentially corrected** GDA94 positions are required, then configure your options the same as above. More importantly, also make enquiries with your service provider to ensure that the differential corrections are derived from base station locations that are accurately surveyed in terms of GDA94. Any error in the base stations will be passed on directly to you (metre for metre).

If you require **survey accurate** (centimetre level) coordinates and your GPS real time or post-processing system does not offer GDA94 as a datum option, select WGS84 (default) and enter GDA94 control values. The results of your survey will be labeled WGS84, but they will actually be in terms of GDA94.

If you have a WGS84 **maritime or aeronautical chart,** at map scale you can assume it to be the same as GDA94. If the map is in digital form care must be taken to determine the origin of the information before declaring it GDA94.

If you have **image data** that is rectified onto the WGS84 datum, BE CAREFUL! The decision to assume that it is the same as GDA94 will depend on the resolution, accuracy and methodology used to derive the data. If in doubt, check it against some known GDA94 control and the imagery’s metadata.

If you have WGS84 data derived using a **7-parameter** transformation some time ago, BE VERY CAREFUL! These parameters were computed from sparse and at times unreliable data. Rigorous transformation methods are now available to migrate from AGD66/AGD84 to GDA94, so if you need an accuracy of better than a few metres, find the original data and re-transform.

Contact Details

For more information on GDA:

Email: icsmgda@auslig.gov.au
Web: http://www.anzlic.org.au/icsm/gda/index.htm

See also Chapter 1 of the GDA Technical manual:
http://www.anzlic.org.au/icsm/gdatm/index.html

Publication Date: 02/04/01