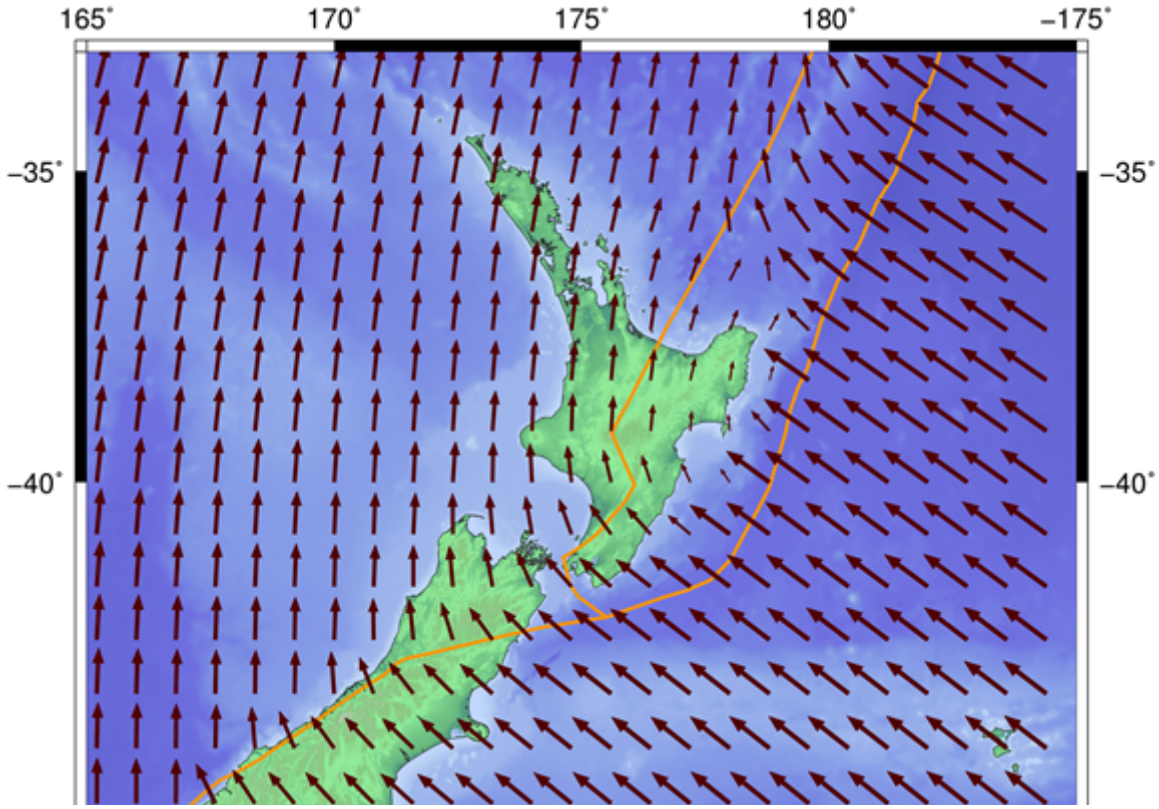
New Zealand Geodetic Datum 2000 (NZGD2000)

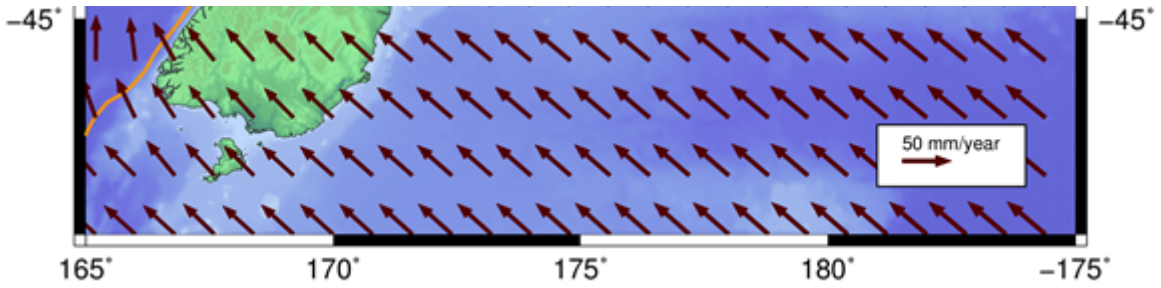
This page contains information on the New Zealand Geodetic Datum 2000 (NZGD2000), which is the official geodetic datum for New Zealand and its offshore islands.

NZGD2000 is the official datum used to define the positions of points in New Zealand. It relates the physical location of a point with a coordinate in terms of latitude, longitude, and ellipsoidal height.

The datum is designed to provide constant unchanging coordinates for features even though New Zealand is continuously moving and deforming under the influence of the Australian and Pacific tectonic plates across which it lies. To do this the datum itself is moving and deforming along with the New Zealand land mass - it is a "plate-fixed" datum.

By contrast global datums, such as the WGS84 (//www.linz.govt.nz/data/geodetic-system/datums-projections-and-heights/geodetic-datums/world-geodetic-system-1984-wgs84) and International Terrestrial Reference Frame (ITRF) datums, are fixed to the earth as a whole. In these systems the coordinates of points in New Zealand are continuously changing. For example points in Otago are moving in a north west direction by about 5cm per year.





Average plate tectonic movement relative to ITRF96

Converting coordinates between NZGD2000 and global reference frames requires a time dependent transformation. This is the deformation model (//www.linz.govt.nz/data/geodetic-system/datums-projections-and-heights/geodetic-datums/new-zealand-geodetic-datum-2000-nzgd2000/nzgd2000-deformation) - it models the deformation of New Zealand since 1 January 2000 when NZGD2000 was aligned with the ITRF96 datum.

Global navigation satellite systems (GNSS) such as GPS generally provide coordinates in the WGS84 or ITRF reference frames. These are often treated as equivalent to NZGD2000 coordinates without applying the deformation model. This will be acceptable for some applications - the error in doing so is up to 5cm per year since 2000 - about 75cm in 2015.

Because the datum is deforming, NZGD2000 coordinates no longer reflect the true positions of points relative to one another. To most accurately calculate quantities such as distances, bearings and areas from NZGD2000 coordinates the deformation should be removed from them first by converting to a global system. However the distortion is small and for most applications the deformation can be ignored - distances, bearings, and areas can be calculated directly from NZGD2000 coordinates. The error in doing so is no more than 1 millimetre in a kilometre for each year since 2000 and is much less in most of the country.

The deformation model is periodically updated to account for deformation due to earthquakes and as our measurement of the deformation becomes more accurate. Each version of the deformation is dated, and defines a new version of the NZGD2000 datum.

Some earthquakes, such as those of the Canterbury earthquake sequence starting in 2010, have caused metres of movement. Where this has happened we have updated the coordinates rather than simply include the movement in the deformation model. This is necessary as otherwise the coordinates will not be accurate enough for many applications. The deformation model still includes the earthquake deformation, but it is applied in reverse to transform coordinates for dates before the earthquake.

NZGD2000, like the global reference frames, is a geometric datum. This means that heights are defined above a mathematically defined ellipsoid rather than above sea level. The difference is significant - in the south of New Zealand the ellipsoid is about 5m above sea level, whereas in the north it is about 40m below sea level. Ellipsoidal heights can be converted to heights above sea level by using a geoid model (eg NZGeoid2016).

The datum is formally defined in LINZS25000 (//www.linz.govt.nz/regulatory/25000) (Standard for New Zealand Geodetic Datum 2000) and was implemented in 1998 when it replaced the previous New

Zealand Geodetic Datum 1949 (NZGD1949). The key parameters from this standard are summarised below:

Name:	**New Zealand Geodetic Datum 2000**
Abbreviation:	NZGD2000
Reference ellipsoid:	GRS80 (//www.linz.govt.nz/data/geodetic-system/datums-projections-and-heights/geodetic-datums/reference-ellipsoids)
Reference frame:	ITRF96
Reference epoch:	1 January 2000
Deformation model:	LINZ deformation model (//www.linz.govt.nz/data/geodetic-system/datums-projections-and-heights/geodetic-datums/new-zealand-geodetic-datum-2000-nzgd2000/nzgd2000-deformation)

NZGD1949 was based on a different reference ellipsoid to NZGD2000 and its accuracy was limited by the survey techniques available in the early 1900s. NZGD1949 latitudes and longitudes are about 200m offset from the equivalent NZGD2000 coordinates. There are three official transformations (//www.linz.govt.nz/data/geodetic-system/coordinate-conversion/geodetic-datum-conversions/nzgd1949-nzgd2000) between NZGD2000 and NZGD49 providing a trade off between complexity and accuracy.

In practice NZGD2000 coordinates are often calculated by connecting to existing geodetic and cadastral marks. The accuracy of NZGD2000 coordinates of these marks is defined by a coordinate order (//www.linz.govt.nz/data/geodetic-system/datums-projections-and-heights/coordinate-and-height-accuracy/coordinate-orders). This may be used to assess whether a coordinate is accurate enough for your use.

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New Zealand Geodetic Datum 2000 - LINZG25700 (/regulatory/25700)

New Zealand Geodetic Datum 2000 Projections - LINZG25702 (/regulatory/25702)

Standard for New Zealand Geodetic Datum 2000 - LINZS25000 (/regulatory/25000)

Standard for New Zealand Geodetic Datum 2000 Projections: Version 2 - LINZS25002 (/regulatory/25002)

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