

Definition and use of the New Zealand Vertical Datum 2009

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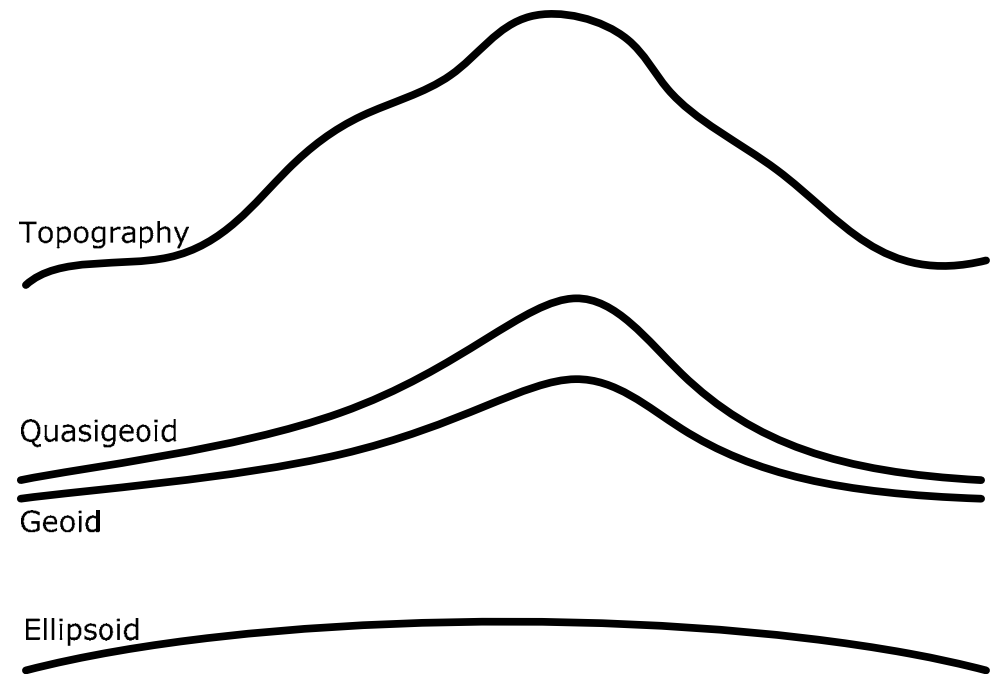
- Height Theory
- Heights in New Zealand
- New Zealand Vertical Datum 2009
- Use of NZVD2009
- Summary
- Questions

Part I – Height Theory

- Two requirements to define a vertical datum
 - Height system
 - Reference surface
- Heights fall into two main categories:
 - Gravimetric, relate to the gravity field of Earth
 - Geometric, relate to a geometric figure of Earth
- Heights refer to different surfaces
- Make different assumptions about structure and composition of Earth

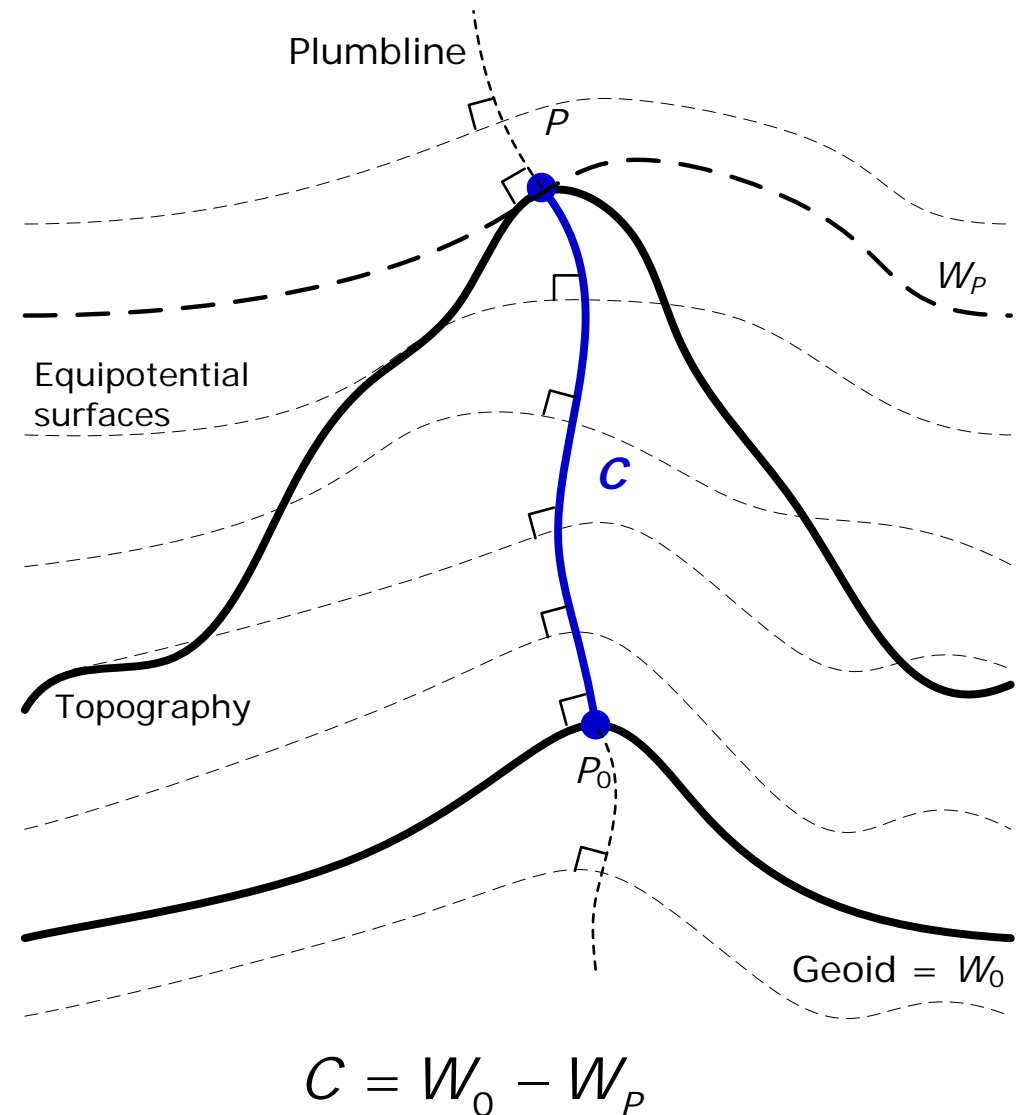
Height System Surfaces

- Ellipsoid
 - Geometric figure of Earth
- Geoid
 - Level of equal potential
 - Coincides with global level of the sea
- Quasigeoid
 - Not equipotential
 - Equal to geoid over oceans
 - Close over land
- Topography
 - Earth's surface



Geopotential Numbers

- Difference in potential from a reference equipotential surface
(W_0 usually = geoid)
- Holonomic
- Can not be directly observed
- Derived from levelling and gravity observations
- Geopotential units
(1 GPU = $10 \text{ m}^2\text{s}^{-2}$)



Dynamic Heights

- Heights with units of length
- *Units NOT metres*
- Constant gravity (g_0) usually normal gravity at 45° (γ_{45})
- Holonomic
- No geometrical meaning
- Not used in practise

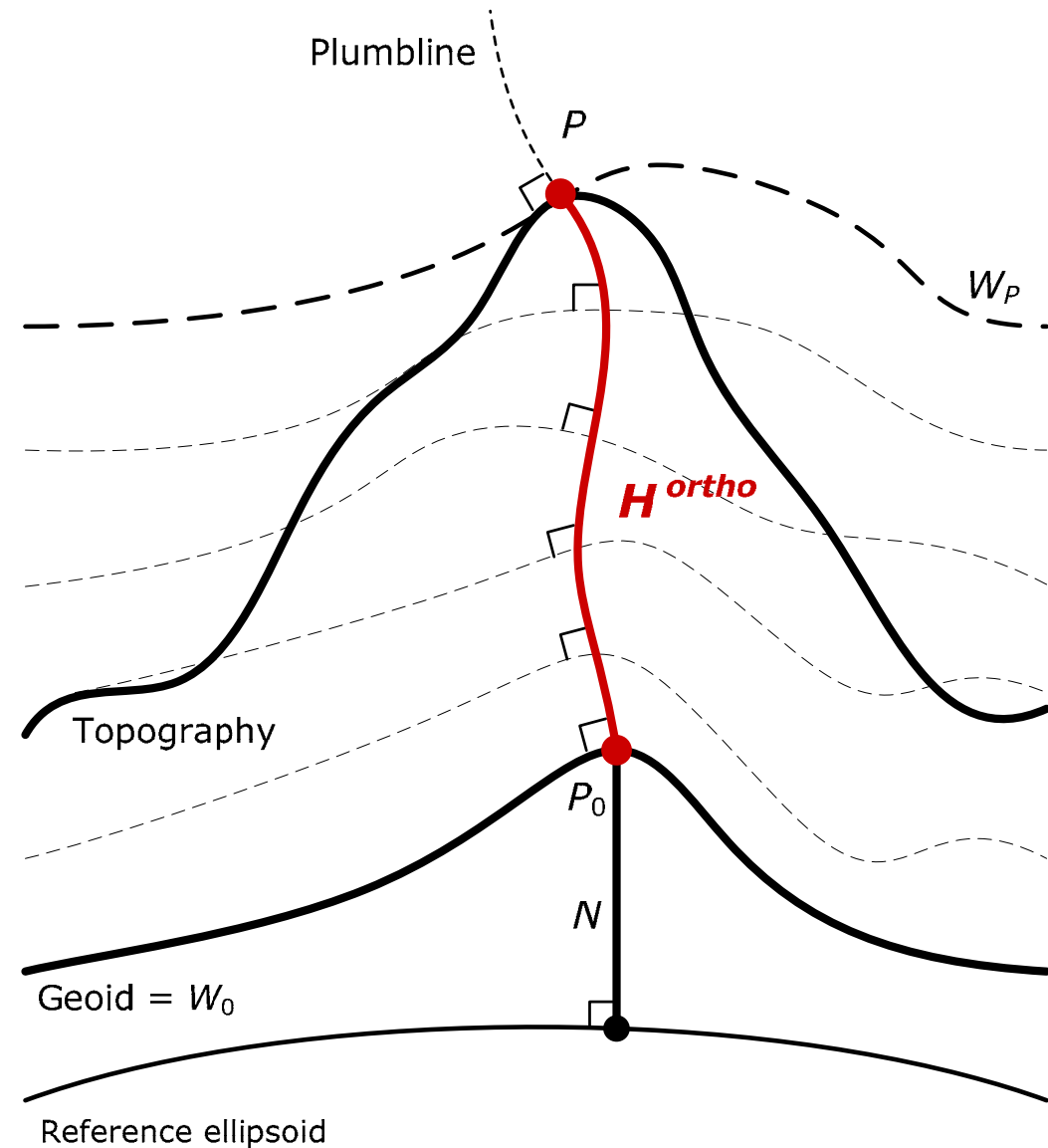
$$H^{dyn} = \frac{C}{g_0}$$

Orthometric Heights

- Length of plumbline from geoid to point
- To determine \bar{g} requires:
 - Path of plumbline
 - Gravity values along plumbline
- Not possible to compute *true* orthometric height
- Units of metres

$$H^{ortho} = \frac{C}{\bar{g}}$$

$$\bar{g} = \frac{1}{h} \int_0^H g(z) dz$$



Helmert Orthometric Heights

- Integral mean gravity along plumbline estimated from surface gravity observation
- Simple to compute
- Assumes constant density and no terrain effect
- Not holonomic
- Most common “orthometric” height

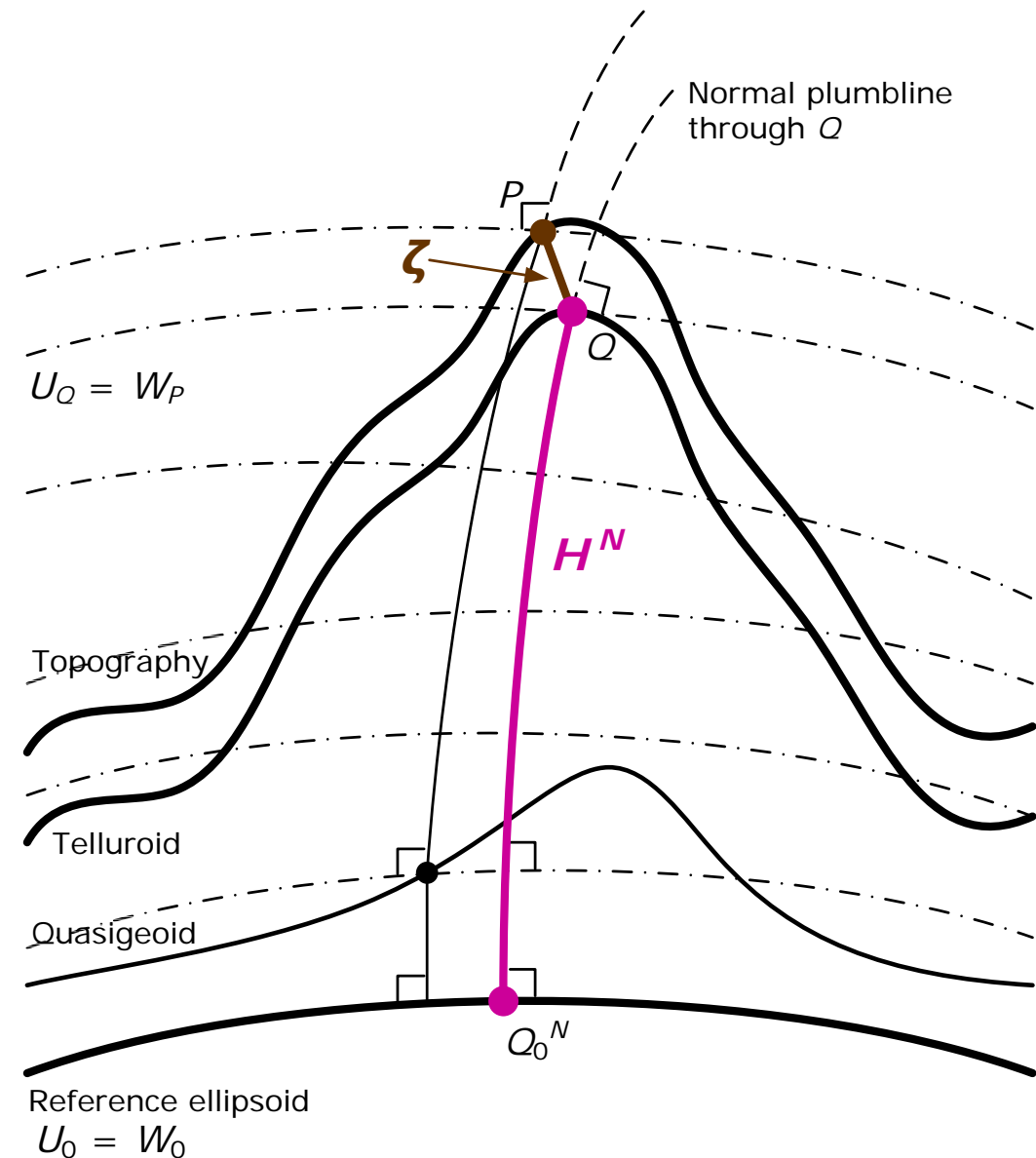
$$H^{\text{Helmert}} = \frac{C}{\bar{g}^{\text{Helmert}}}$$

$$\bar{g}^{\text{Helmert}} = g^S + \frac{1}{2} \frac{d\gamma}{dh} H - 2\pi G \rho H$$

Normal Heights

- Replaces “integral mean gravity” with “normal gravity” (ellipsoidal model of Earth’s mass)
- Requires surface gravity observations to compute geopotential numbers
- Simple to compute
- No physical meaning (relate to telluroid)
- Not holonomic

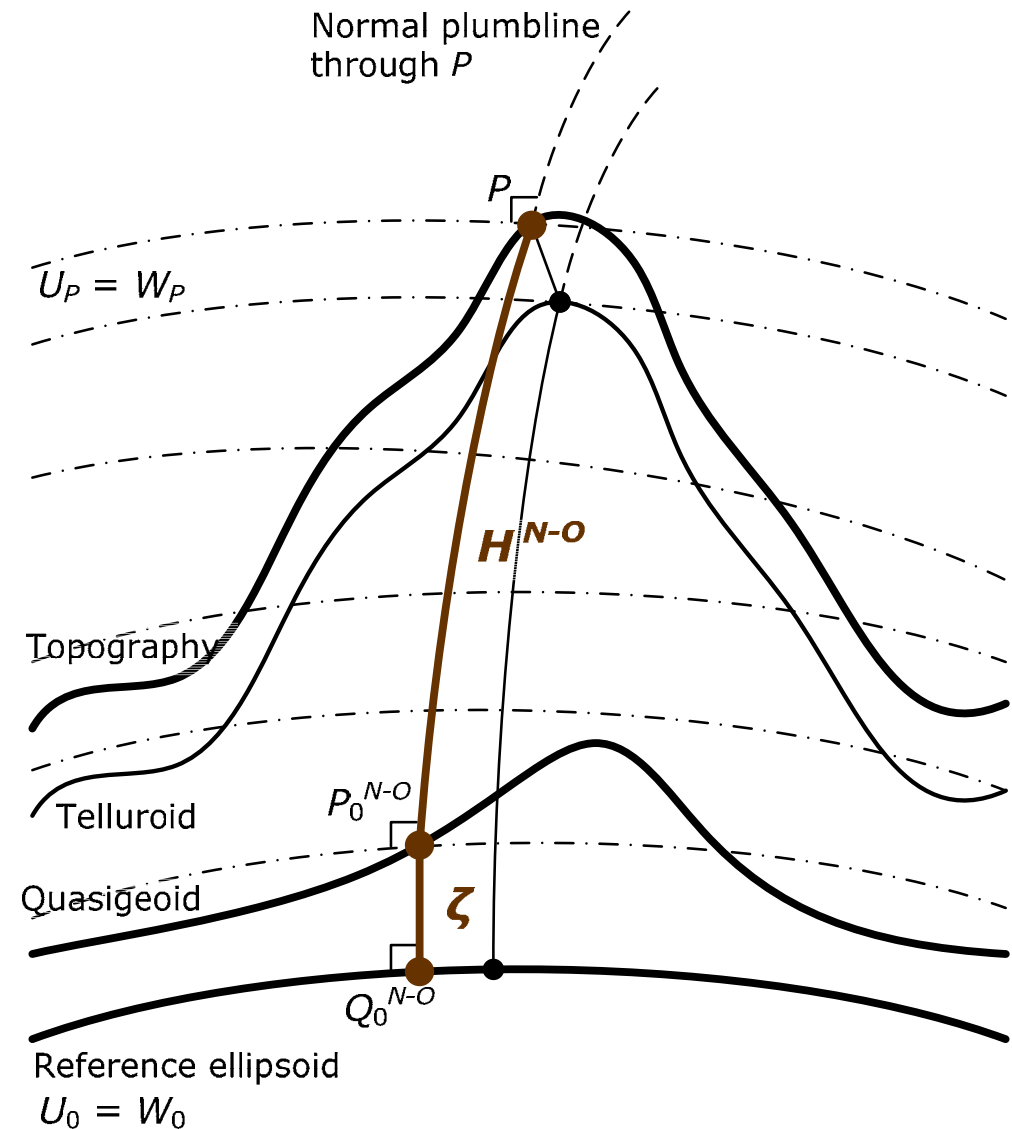
$$H^N = \frac{C}{\bar{\gamma}}$$



Normal-Orthometric Heights

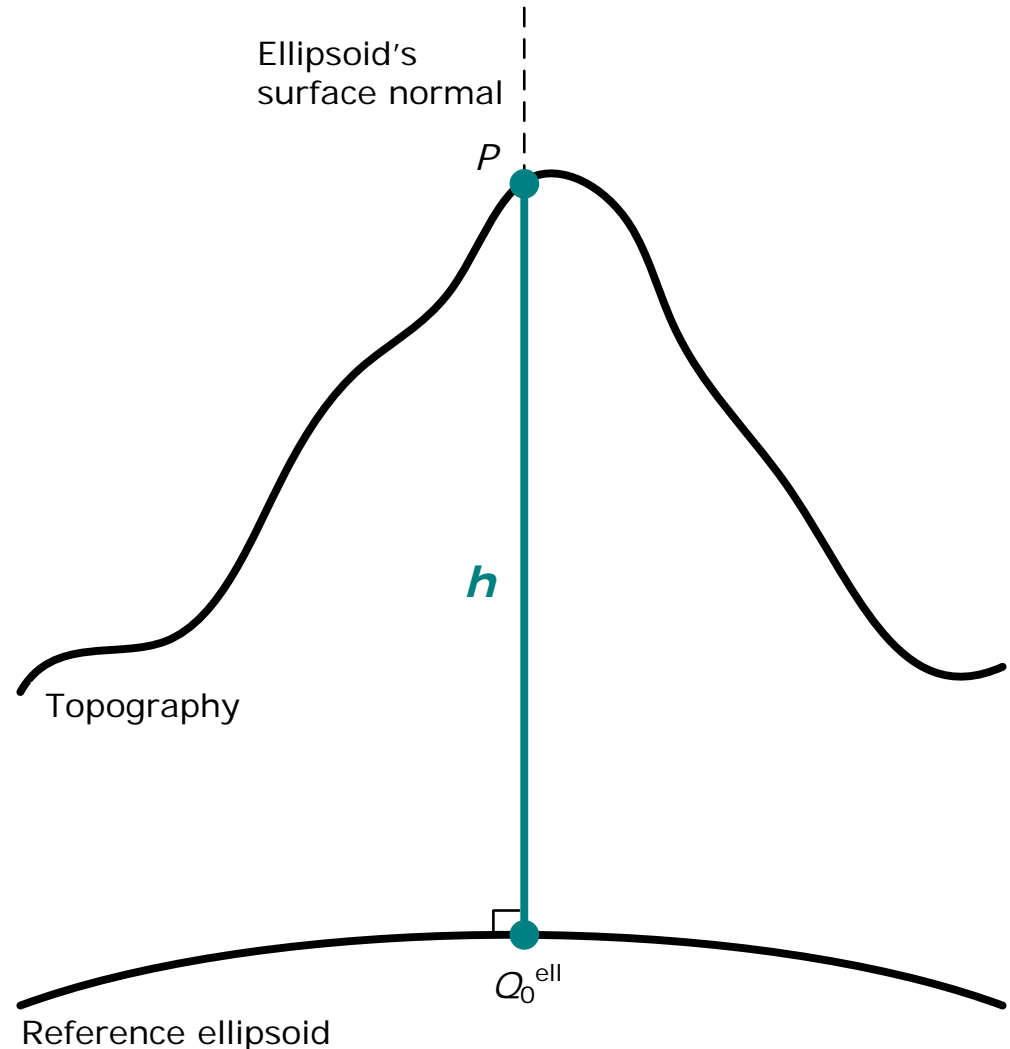
- Uses spheropotential numbers instead of geopotential numbers
- Does not require gravity observations
- Not holonomic
- Will not reflect local gravity field
- Computed by applying correction to levelling
- Used in New Zealand

$$H^{N-O} = \frac{C'}{\bar{\gamma}} \quad C' = \int_{P_0}^P \gamma \, dn$$

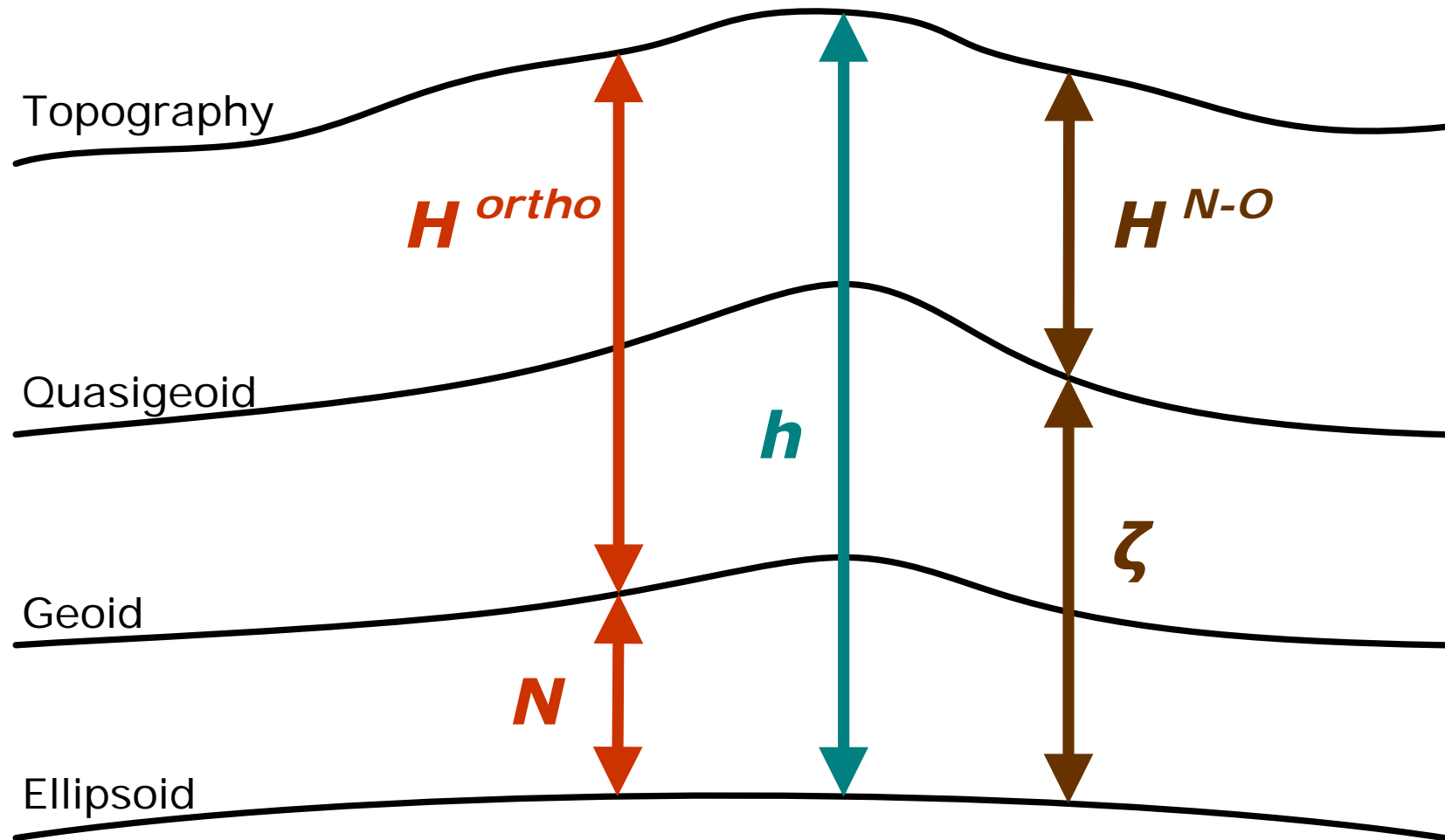


Ellipsoidal Heights

- Straight-line distance along ellipsoidal normal
- Not holonomic
- Will not reflect local gravity field
- Need to determine using GNSS
- NZGD2000 heights



Height System Summary



Vertical Datum Reference Surfaces

- Choice of reference surface depends on:
 - Type of height being used
 - Method of height transfer
 - Scale of datum
 - Purpose of datum

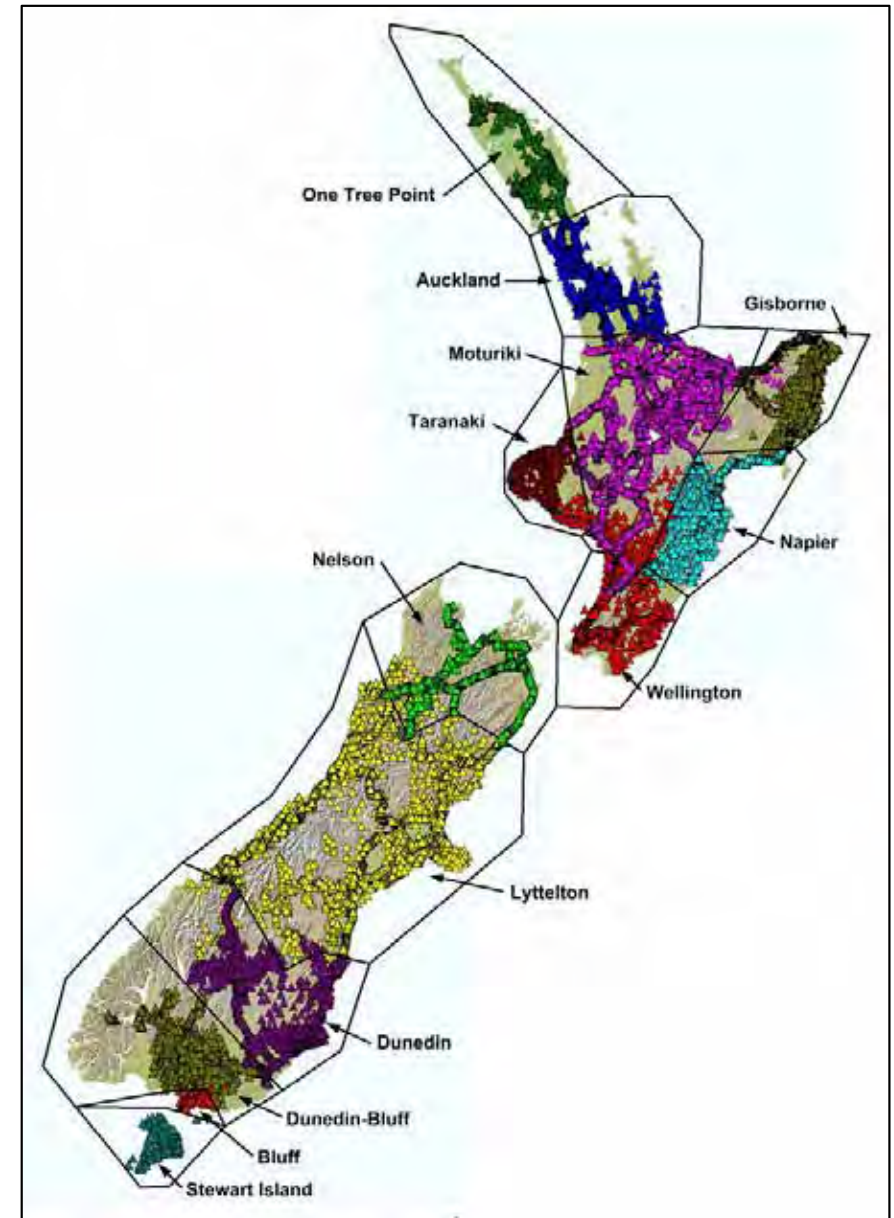
Vertical Datum Reference Surfaces

- Physical reference surface
 - Frequently mean sea level
 - Fix MSL at a single point
 - Fix MSL at several points
 - Arbitrary level at a single point
- Virtual reference surface
 - Geoid/quasigeoid model
 - Ellipsoid

Part II – Heights in New Zealand

New Zealand's Height Systems

- 13 major levelling datums
- Many other datums
 - Power schemes
 - Local authority datums
 - Local purpose datums
- Generally based on MSL
- Extended by levelling
- NZGD2000
 - Ellipsoidal heights

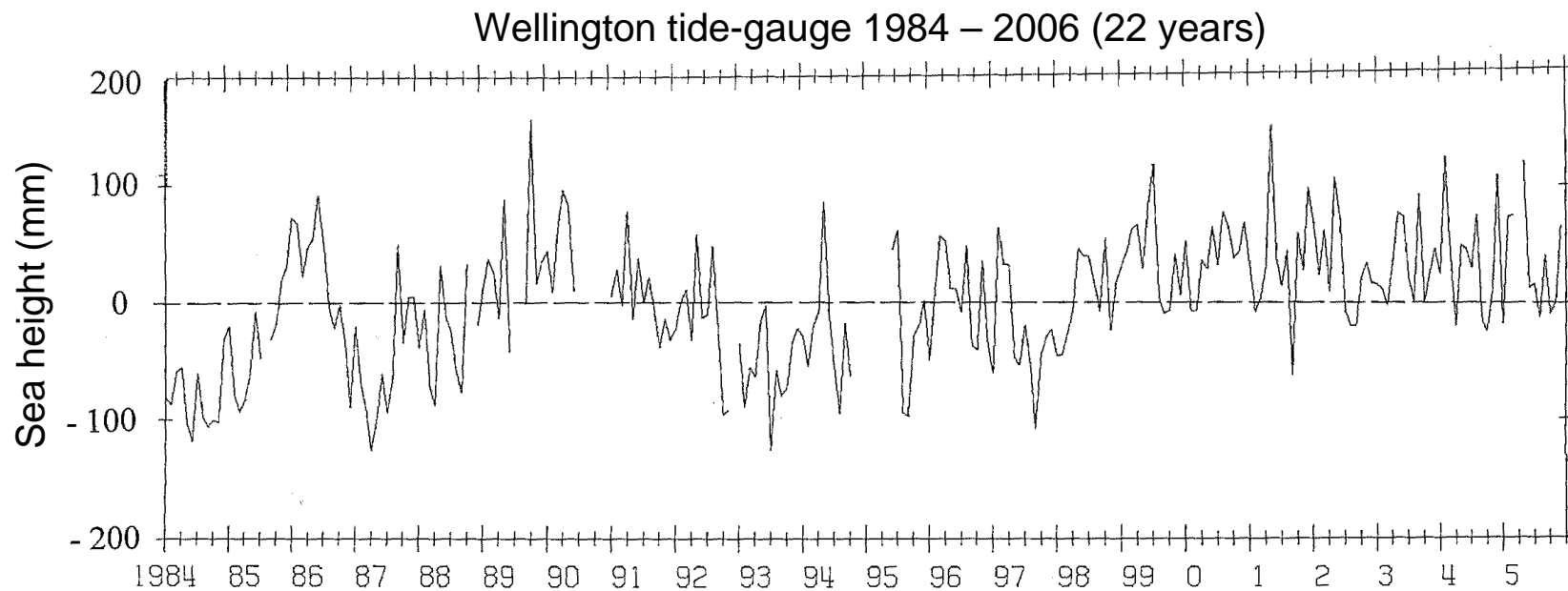


Mean Sea Level Determination

- Sea level observed at tide-gauges
- Observations averaged to give MSL
- Ideally over 18.6 years to cover complete metonic cycle
- Typically 2-3 years used
- Gauge location can make MSL determinations highly site-specific

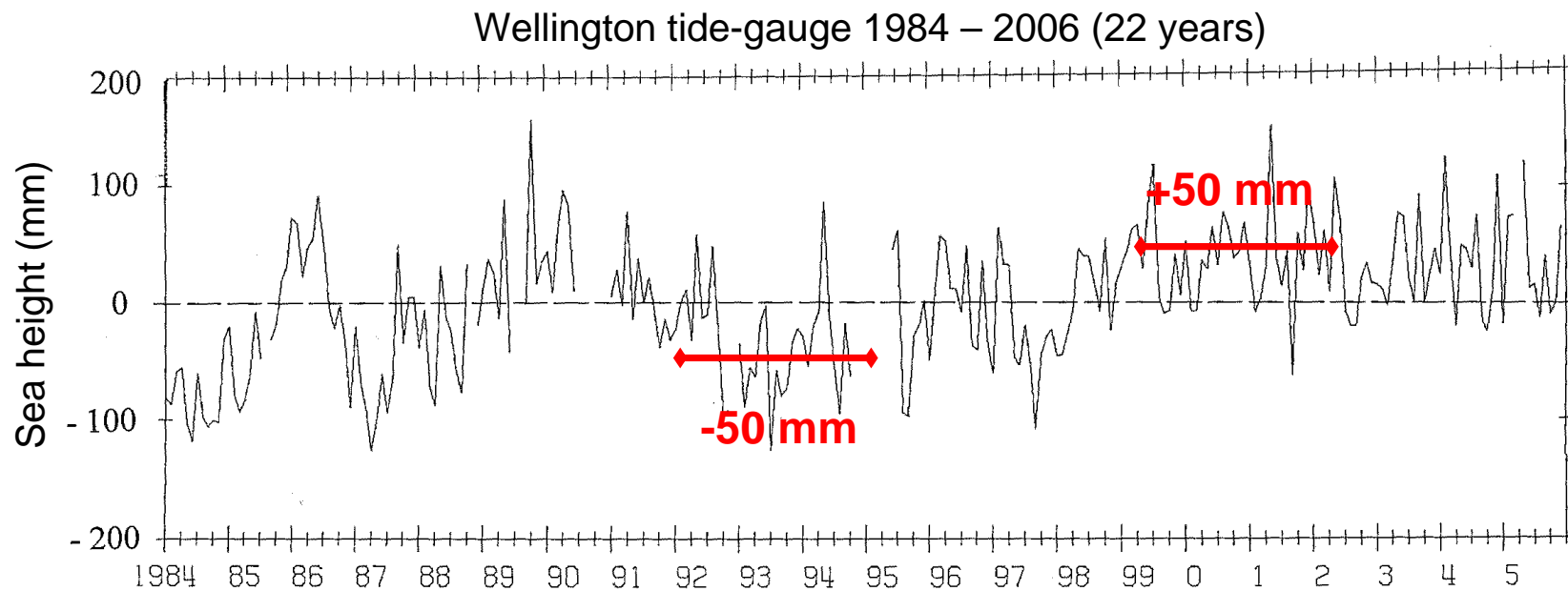
Sea Level Variation

- Sea level varies over time
- Observation period affects MSL determination



Sea Level Variation

- Sea level varies over time
- Observation period affects MSL determination
- “Level” in Wellington differs by 100mm depending on 3-year observation period chosen



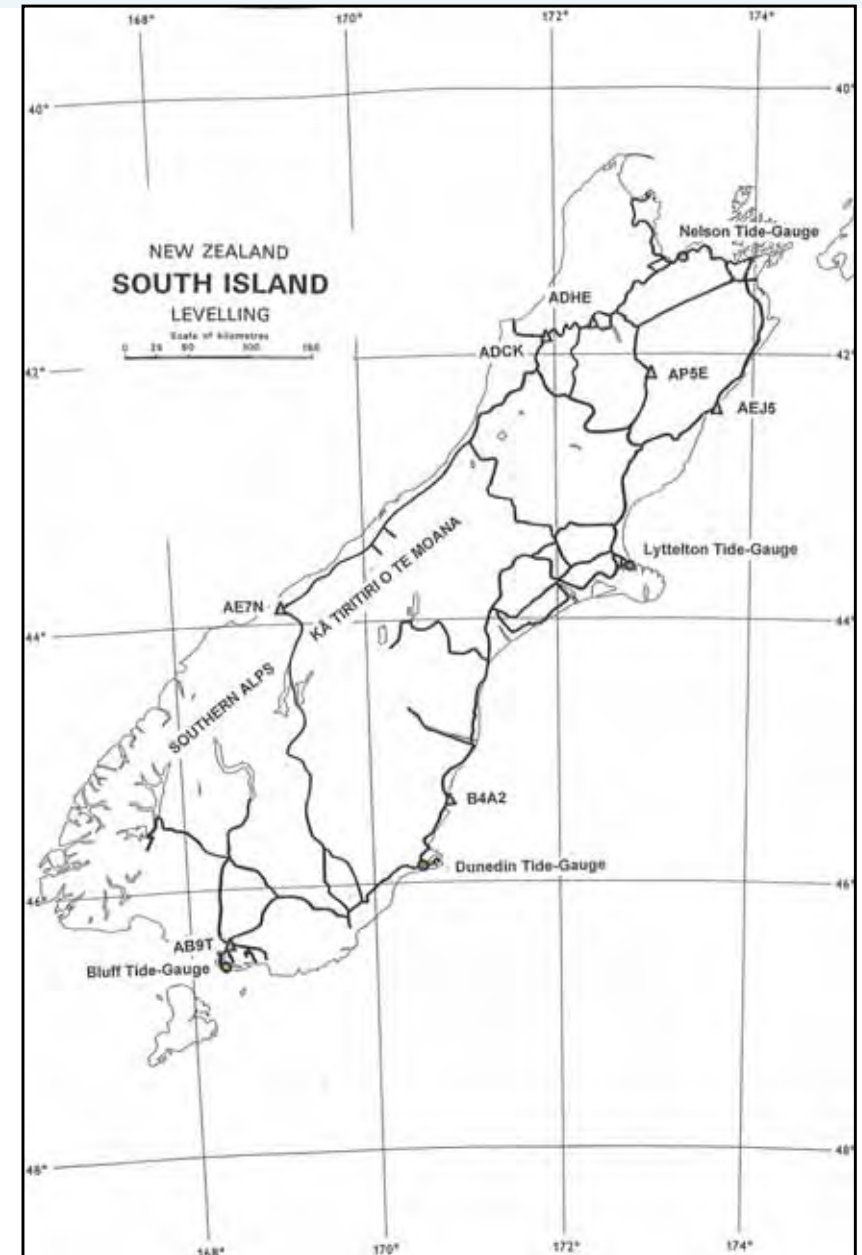
Sea Level Observation Duration

Datum	Observation Period	Duration
One Tree Point 1964	1960 – 1963	3 Years
Auckland 1946	1909 – 1923	14 Years
Moturiki 1953	1949 – 1952	3 Years
Gisborne 1926	1926	1 Year
Napier 1962	<i>Unknown</i>	?
Taranaki 1970	1918 – 1921	3 Years
Wellington 1953	1909 – 1946	37 Years
Nelson 1955	1939 – 1942	3 Years
Lyttelton 1937	1918 – 1933	15 Years
Dunedin 1958	1918 – 1937	19 Years
Dunedin-Bluff 1960	<i>None</i>	–
Bluff 1955	1918 – 1934	16 Years
Stewart Island 1977	1976 – 1977	3 <i>Tides</i>

Precise Levelling Networks

- Datums extended by precise levelling from tide-gauges 1960-1980 (~16,000 km)
- Approximate normal-orthometric correction applied to levelling
- Least-squares adjustment performed on each datum
- Some very large loops, particularly in South Island

Precise Levelling Networks



New Zealand Geodetic Datum 2000

- The official *geodetic* datum
- Implemented in 1998
- Ellipsoidal heights
- GRS80 ellipsoid (very similar to WGS84)
- Heights normally determined by GPS

- Normal-orthometric
 - Five height orders (1V – 5V)
 - Based on method of determination, not accuracy of height
- Ellipsoidal
 - Six orders include height component (0 – 5)
 - Based on accuracy of overall coordinate
 - Coordinate must achieve both horizontal and vertical requirements
- Order classifications to be updated in May 2010

Normal-Orthometric Height Orders

Order	Current Accuracy Description	Tier (m)	Class (m + m/m)
1V	1 st Order levelling ($\pm 2 \text{ mm} \sqrt{k}$)	0.30	$0.01 + 3 \times 10^{-6}$
2V	2 nd Order levelling ($\pm 7 \text{ mm} \sqrt{k}$)	0.35	$0.01 + 1 \times 10^{-5}$
3V	Less accurate with 1V/2V/3V origin	0.35	$0.02 + 1 \times 10^{-4}$
4V	Systematic levelling with poor origin	0.50	$0.03 + 1.5 \times 10^{-4}$
5V	Unknown quality or origin	1.00	$0.30 + 6 \times 10^{-4}$
6V	N/A	<i>undefined</i>	<i>undefined</i>

k is the distance between marks in kilometres

Tiers and classes will replace current accuracy descriptions in May 2010

Ellipsoidal Height Orders

Order	Absolute (m)	Tier (m)	Relative / Class (m + m/m)
0	0.15	0.05	0.003 + 3 x 10 ⁻⁸
1	0.21	0.05	0.003 + 3 x 10 ⁻⁷
2	0.26	0.10	0.01 + 3 x 10 ⁻⁶
3	0.30	0.10	0.01 + 1 x 10 ⁻⁵
4	0.34	0.15	0.01 + 3 x 10 ⁻⁵
5	0.37	0.15	0.01 + 1 x 10 ⁻⁴

Tiers and classes will replace absolute and relative accuracy in May 2010

- “LINZ provides orthometric heights”
 - Reality : *LINZ provides normal-orthometric heights*
 - Gravity observations have not been made at benchmarks
 - Not possible to determine geopotential numbers or gravity gradient
- “LINZ datums reflect current MSL”
 - Reality : *Datums reflect MSL at the epoch of the datum*
 - Datum zero's have not been updated
 - Short observation periods may make some datums unrepresentative of MSL at the datum epoch as well

Problems with Levelling Datums

- Do not represent MSL today
 - Sea level variability and rise
 - MSL value only relevant at the origin gauge
(e.g. MSL in Lyttelton is not the same as Greymouth)
- Coverage is mainly limited to roads
- Levelling networks have not been re-observed or adjusted for many years
- Expensive to maintain and extend networks

Problems with Levelling Datums

- Multiple datums causes confusion
- Offsets between datums is unknown or poorly defined
- Not compatible with NZGD2000 or GNSS
 - Relate to GRS67 (NZGD2000 is GRS80)
- Many local datums not formally defined or related to other datums in their vicinity
- No single consistent datum that can be used nationally

Desirable Datum Attributes

- Single consistent reference system
- Consistent with NZGD2000 geodetic datum
- Compatible with GNSS heighting
- Accessible across all of New Zealand and offshore
- Easily adopted by users
- Cost-effective to implement and maintain

Vertical Datum options

- Update MSL values and readjust networks
- Update MSL values and readjust to form new network
 - Fix one level per island (e.g. EUVN/UELN)
 - Fix multiple levels per adjustment (e.g. Australia, Canada, USA)
- Define datum using fitted geoid
 - Excellent transformation surface between levelling and ellipsoid
- Define datum using gravimetric geoid

Part III

New Zealand Vertical Datum 2009

New Zealand Vertical Datum 2009

- Normal-orthometric height system
- NZGeoid09 reference surface
 - No physical origin
 - Coincides reasonably closely to MSL
- Defined offsets to 13 major levelling datums
- Transformations between NZVD2009, NZGD2000 and 13 LVDs
- NZ is first country to use this approach
 - Most countries still base height systems on tide-gauges
 - Trend towards using geoid based height system

Normal-Orthometric Height System

- Heights measured above quasigeoid (NZGeoid09)
- Does not require gravity observations to determine heights
- Uses GRS80 normal gravity field
- Precisely levelled height differences require normal-orthometric correction

$$NOC = - \frac{f^*}{R} \sum_{P_1}^{P_2} \left(H_k^s \sin 2\phi_{av} \cos \alpha_k \delta s_k \right)$$

Where: f^* = GRS80 gravity flattening constant (0.005 302 440 112)

R = mean Earth radius (6 371 000 m)

H = height difference

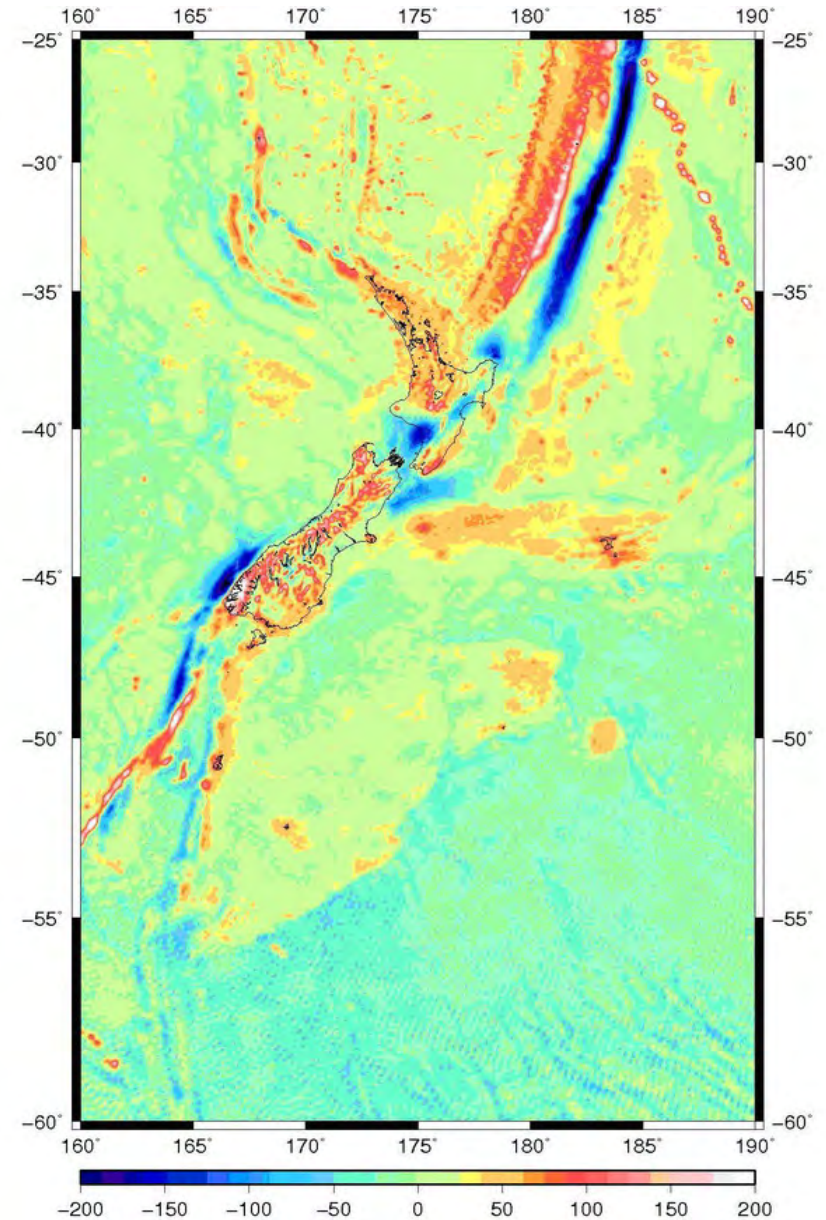
ϕ = average latitude

α = azimuth between stations

δs = distance between stations

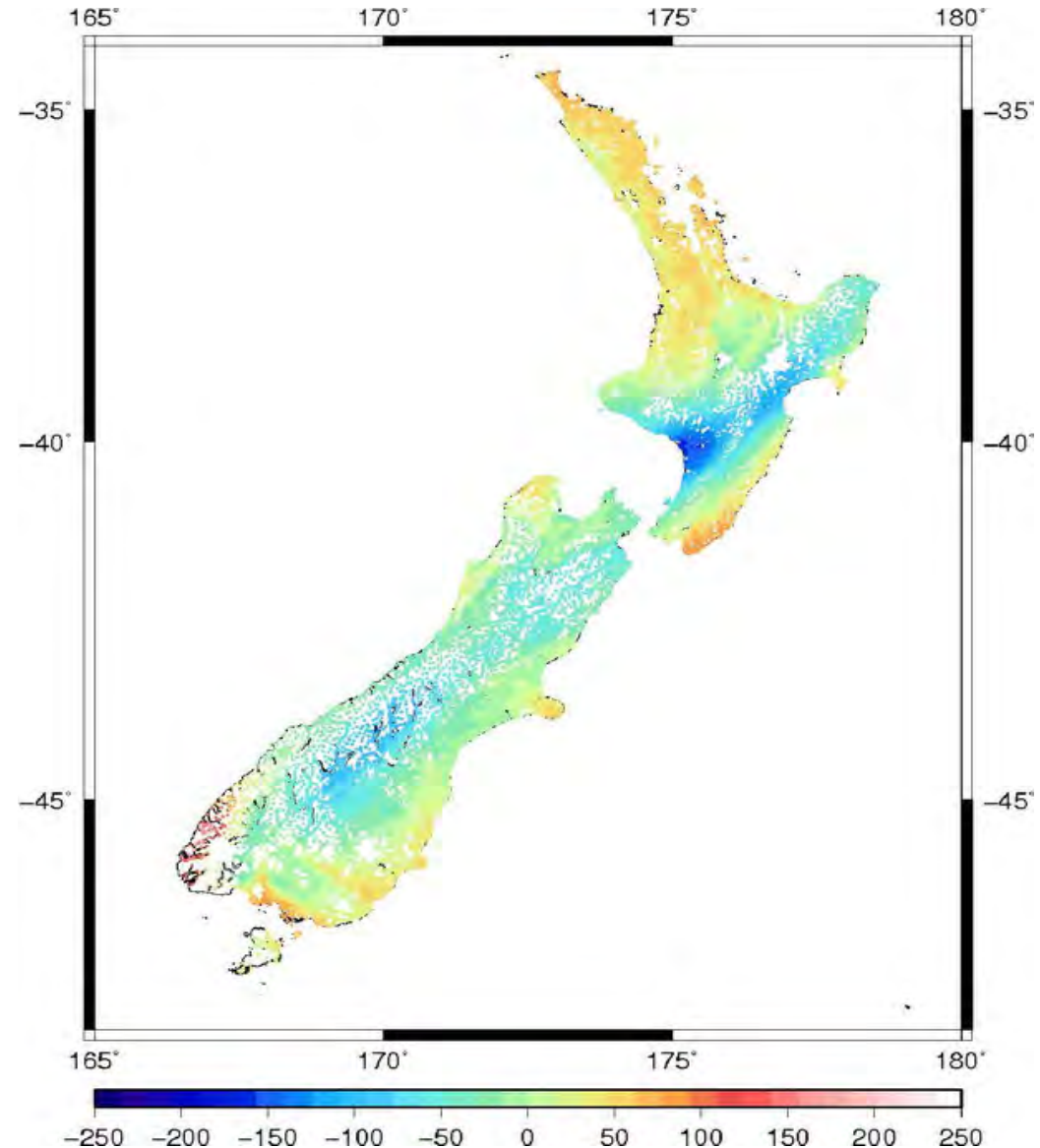
New Zealand Quasigeoid 2009

- Gravimetric quasigeoid computed from:
 - EGM2008



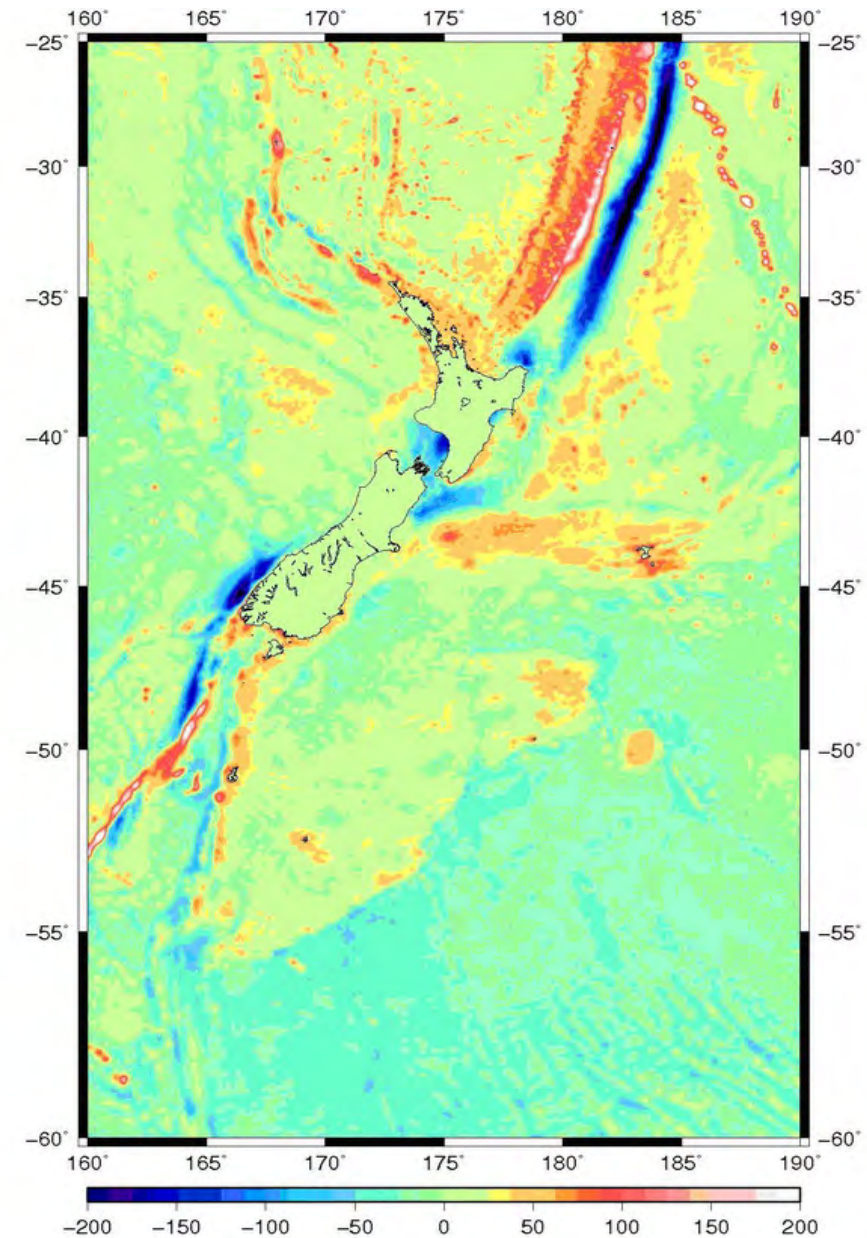
New Zealand Quasigeoid 2009

- Gravimetric quasigeoid computed from:
 - EGM2008
 - Land gravity data



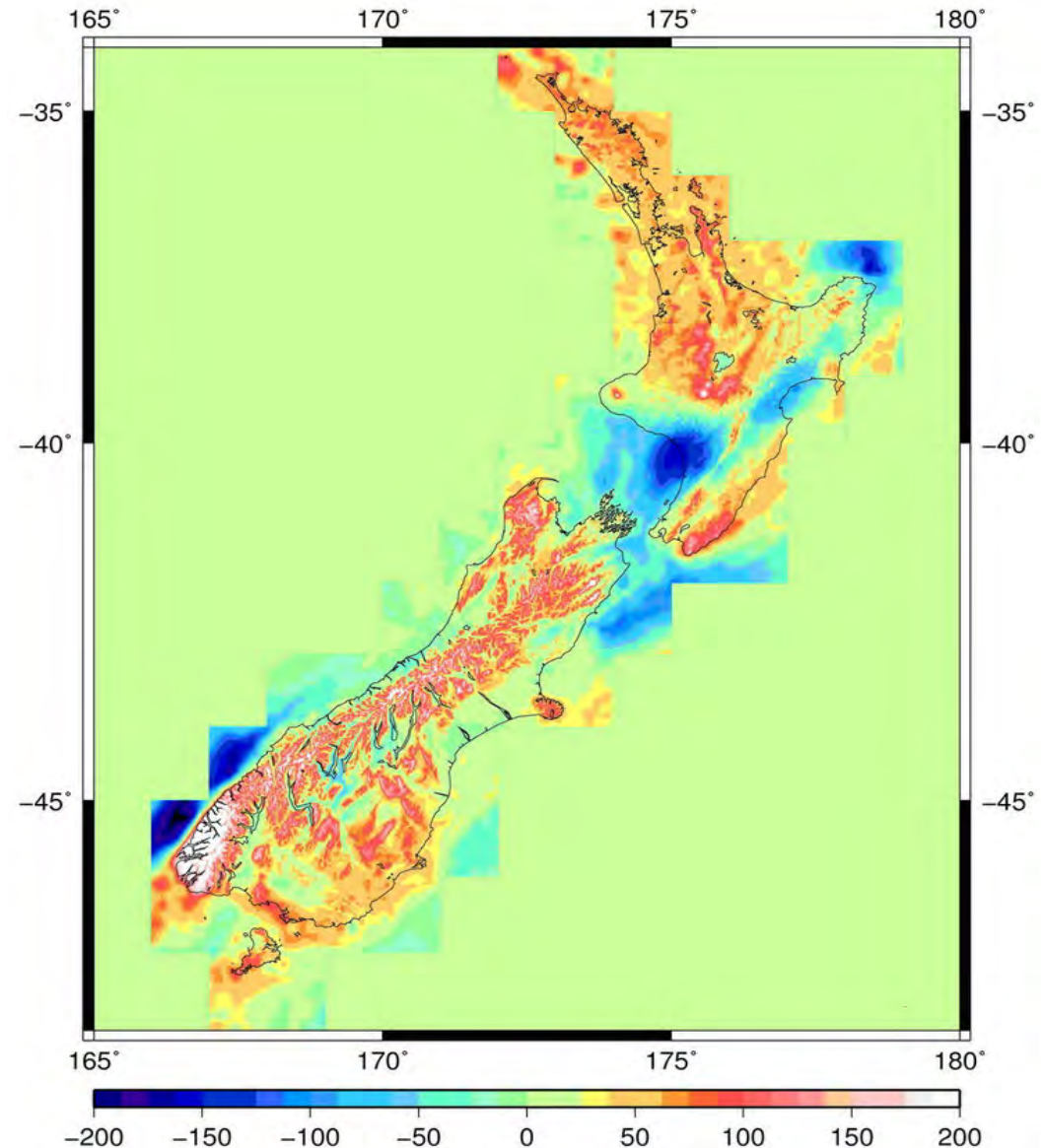
New Zealand Quasigeoid 2009

- Gravimetric quasigeoid computed from:
 - EGM2008
 - Land gravity data
 - DNSC08 altimetry



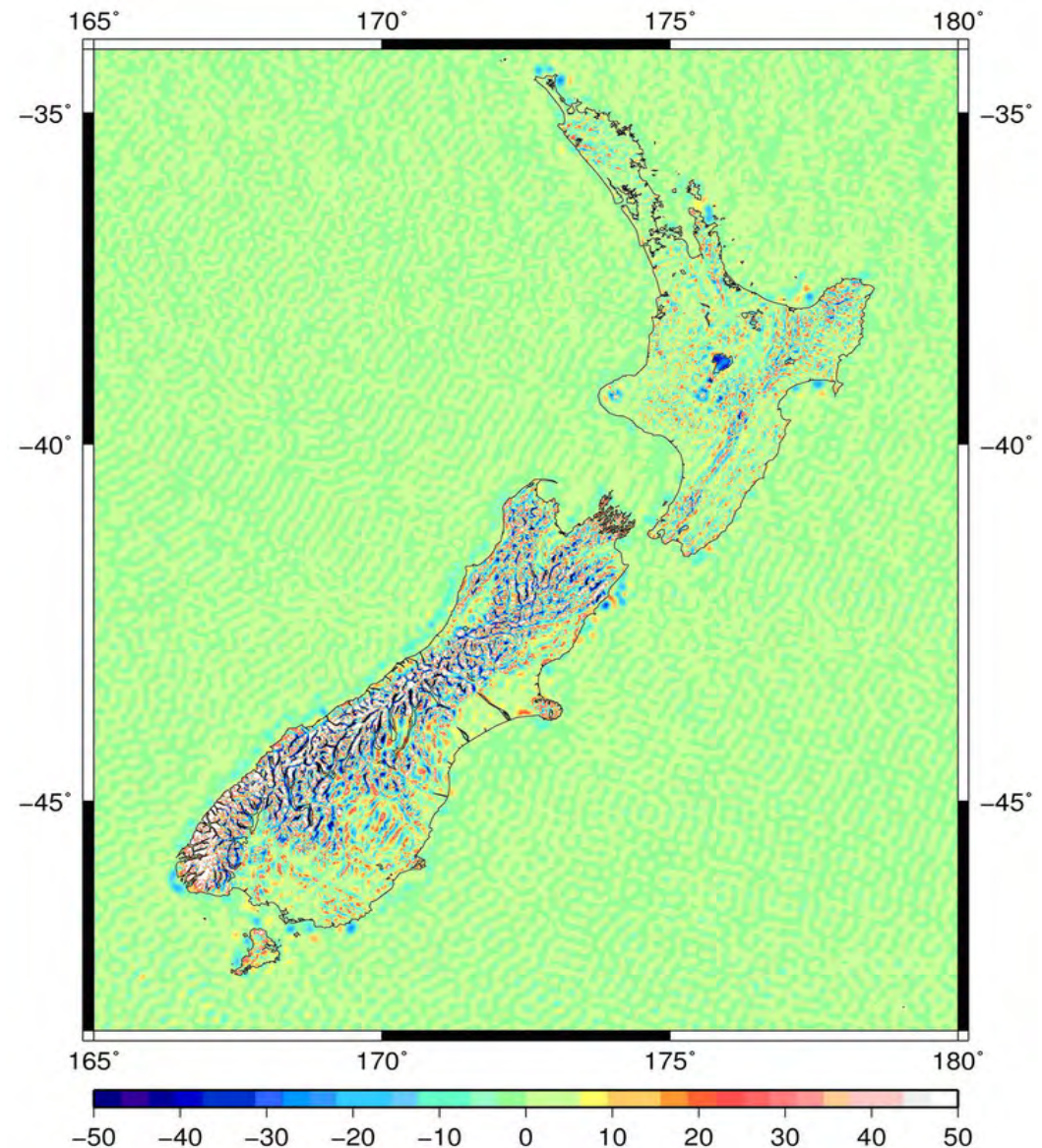
New Zealand Quasigeoid 2009

- Gravimetric quasigeoid computed from:
 - EGM2008
 - Land gravity data
 - DNSC08 altimetry
 - Digital elevation model



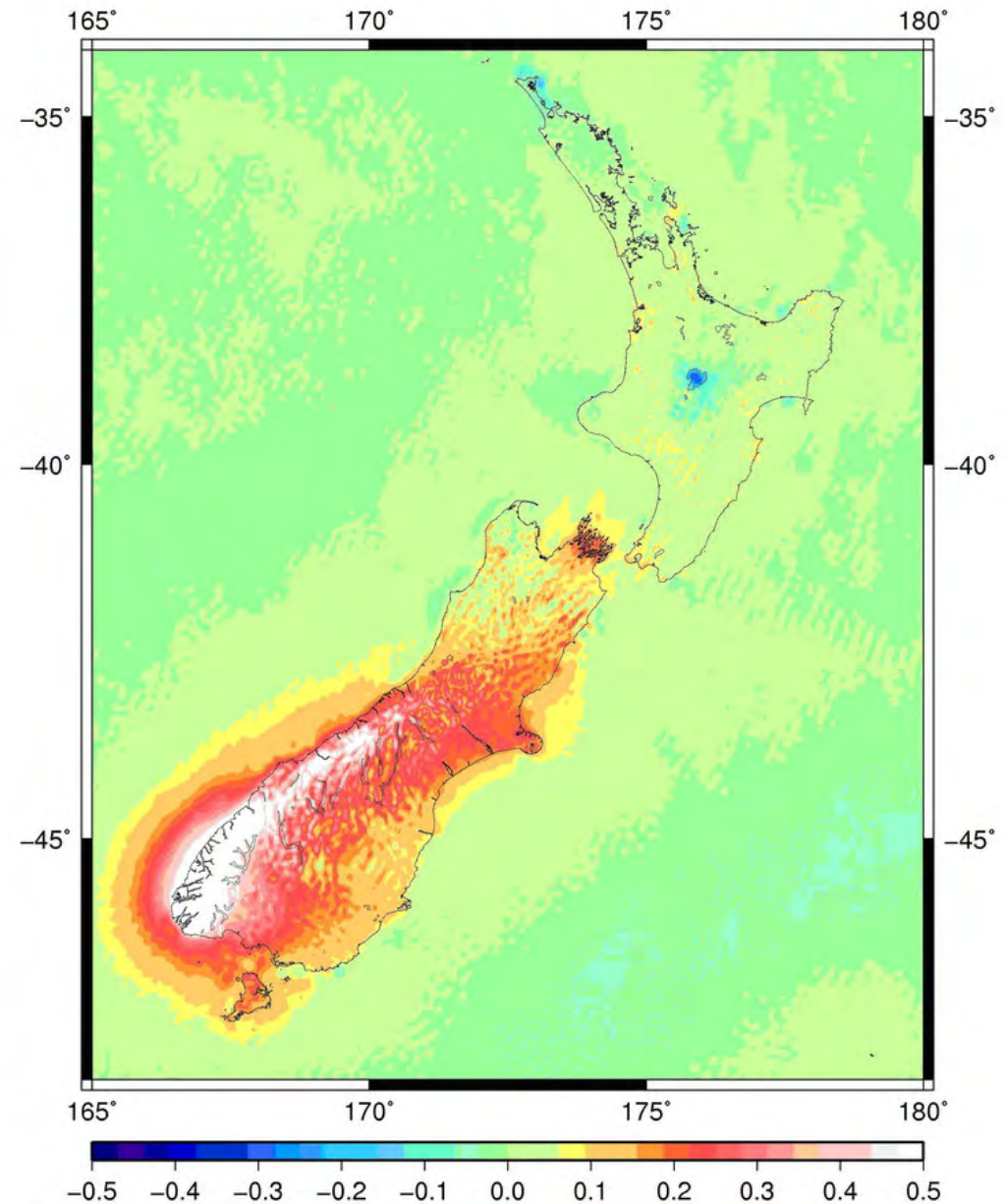
New Zealand Quasigeoid 2009

- Gravimetric quasigeoid computed from:
 - EGM2008
 - Land gravity data
 - DNSC08 altimetry
 - Digital elevation model
- Subtract EGM2008 to give residual gravity anomalies



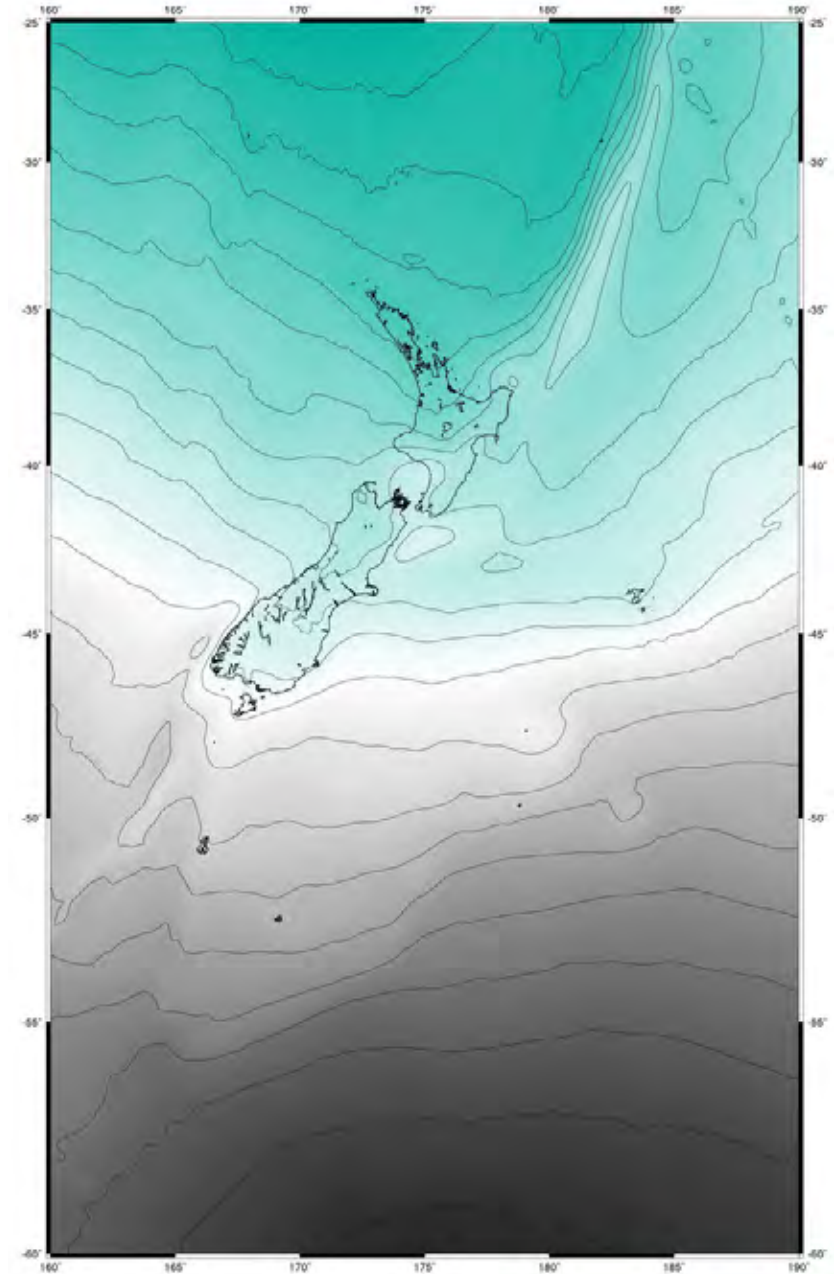
New Zealand Quasigeoid 2009

- Gravimetric quasigeoid computed from:
 - EGM2008
 - Land gravity data
 - DNSC08 altimetry
 - Digital elevation model
- Subtract EGM2008 to give residual gravity anomalies
- Fourier transform to convert gravity to geoid



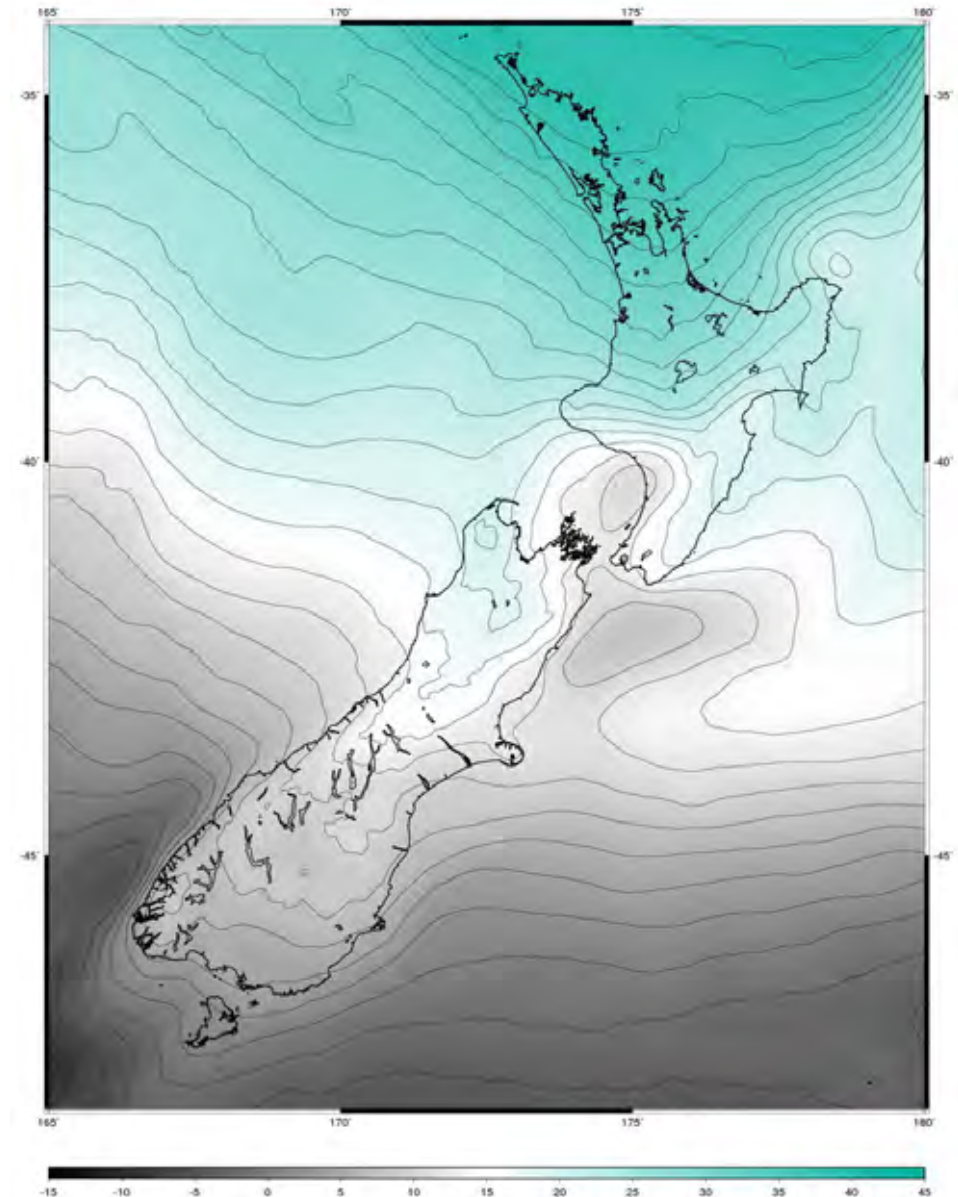
New Zealand Quasigeoid 2009

- Gravimetric quasigeoid computed from:
 - EGM2008
 - Land gravity data
 - DNSC08 altimetry
 - Digital elevation model
- Subtract EGM2008 to give residual gravity anomalies
- Fourier transform to convert gravity to geoid
- Add back EGM2008 geoid



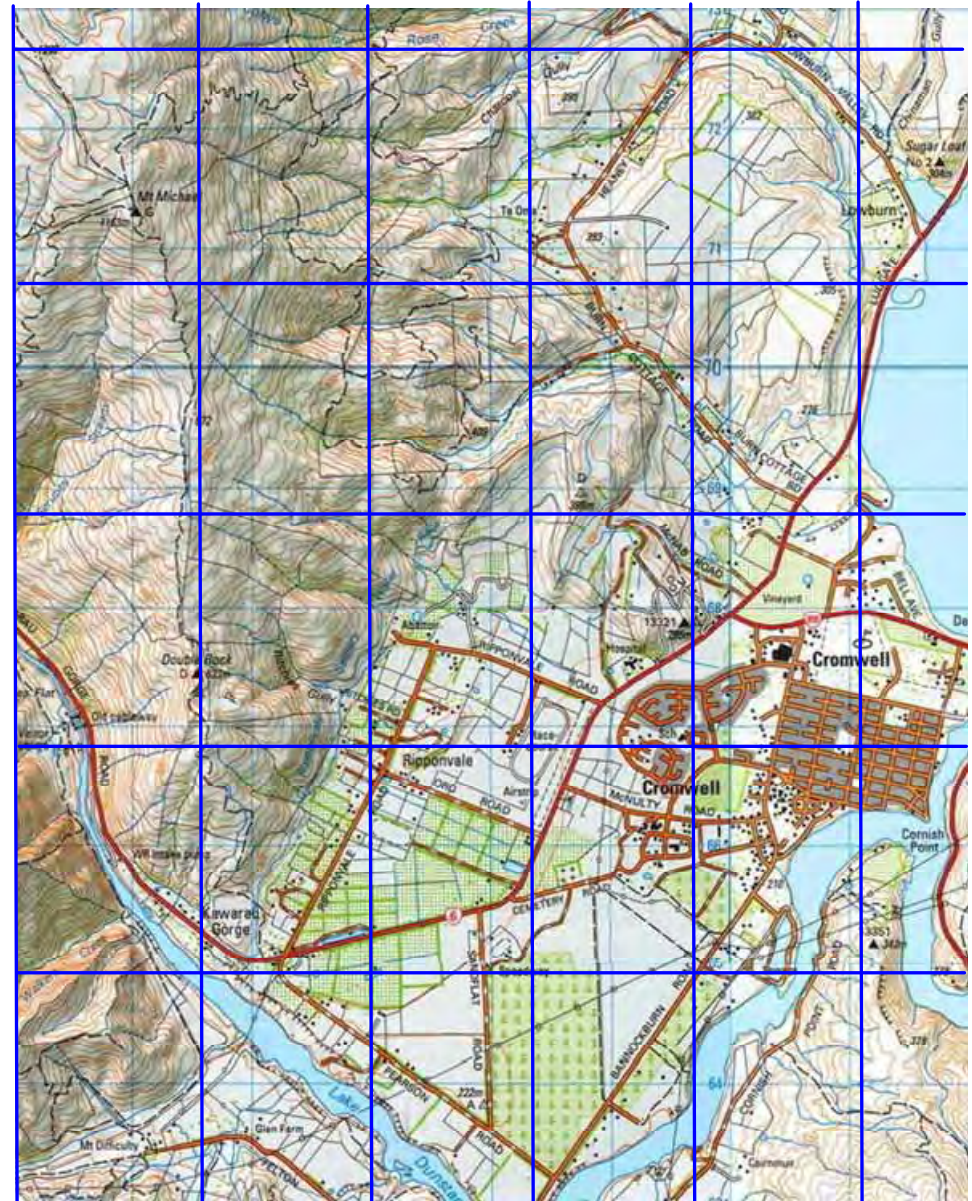
New Zealand Quasigeoid 2009

- Gravimetric quasigeoid computed from:
 - EGM2008
 - Land gravity data
 - DNSC08 altimetry
 - Digital elevation model
- Subtract EGM2008 to give residual gravity anomalies
- Fourier transform to convert gravity to geoid
- Add back EGM2008 geoid
- Result is NZGeoid09



New Zealand Quasigeoid 2009

- Computation area:
160° E – 170° W, 25° S – 60° S
- ~40m range over NZ
- Provided on 1' x 1' grid
~1.9 km over NZ
- NZGeoid09 value linearly interpolated from grid
- Geoid changes smaller than 2 km will not be represented

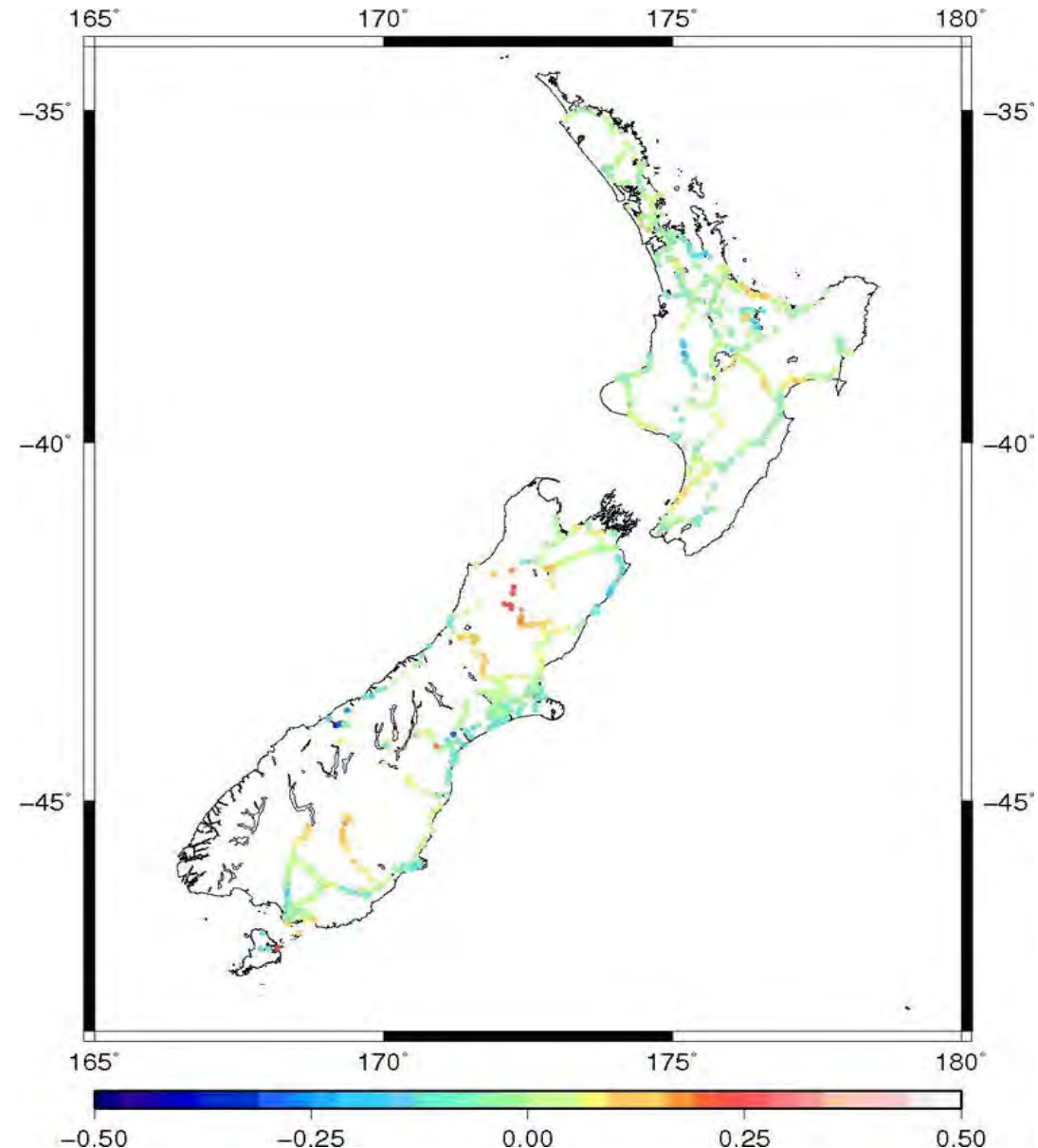


New Zealand Quasigeoid 2009

- NZGeoid09 evaluated and offsets determined from GPS-levelling observations
- Spatial coverage poor, especially in mountainous areas
- Accuracy of GPS-levelling *absolute* heights ~ 0.14 m

NZGeoid09 GPS-levelling

- GPS-Lev fit to NZGeoid09:
0.062 m
- GPS-Lev fit to EGM2008:
0.064 m
- GPS-Lev fit to NZGeoid05:
0.081 m
- Largest difference in mountainous South Island with few GPS-Lev points
- Relative accuracy will be better than this



NZVD2009 Offsets

Datum	Offset to NZVD2009	Standard Deviation
One Tree Point 1964	0.06	0.03
Auckland 1946	0.34	0.05
Moturiki 1953	0.24	0.06
Gisborne 1926	0.34	0.02
Napier 1962	0.20	0.05
Taranaki 1970	0.32	0.05
Wellington 1953	0.44	0.04
Nelson 1955	0.29	0.07
Lyttelton 1937	0.47	0.09
Dunedin 1958	0.49	0.07
Dunedin-Bluff 1960	0.38	0.04
Bluff 1955	0.36	0.05
Stewart Island 1977	0.39	0.15

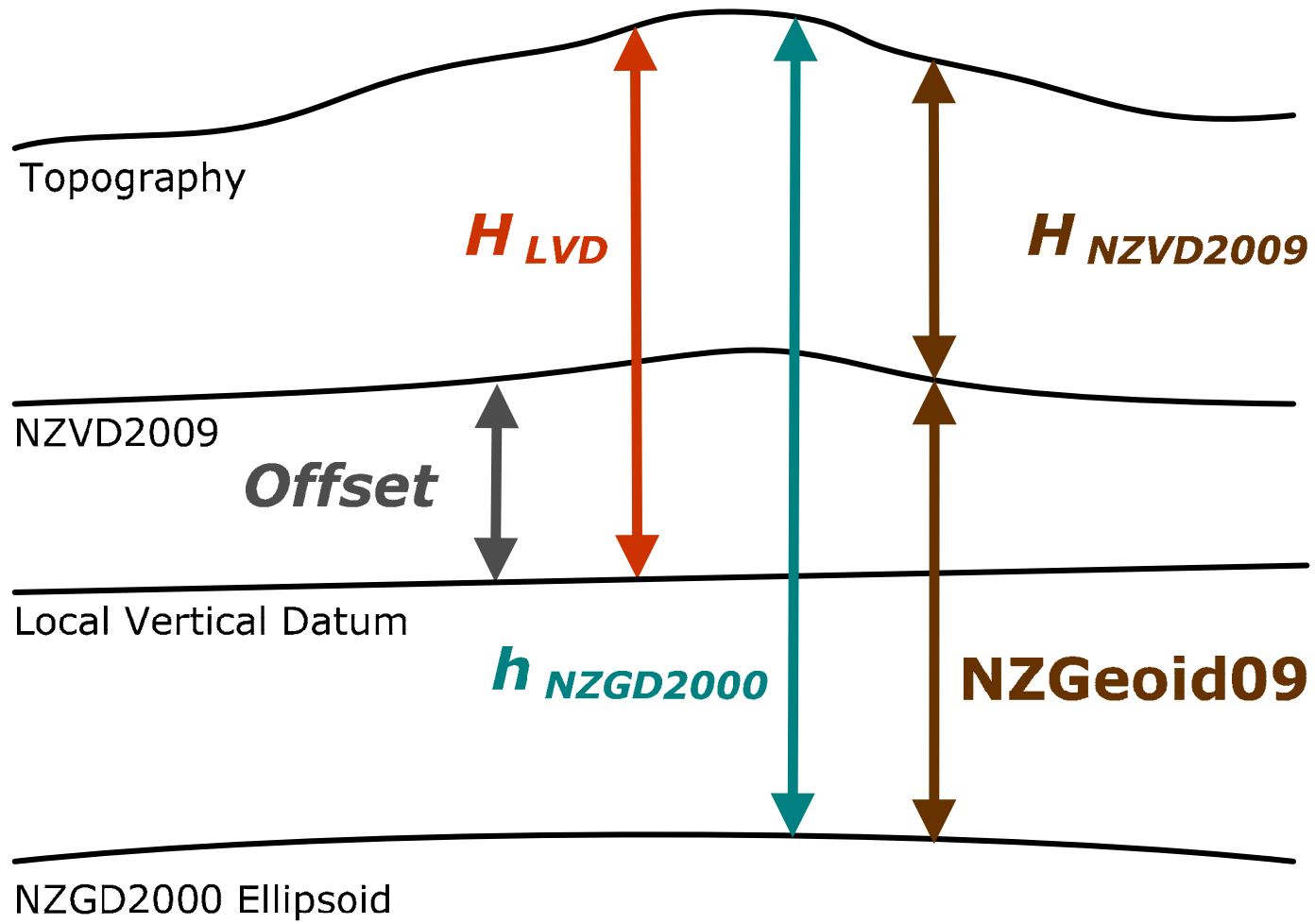
NZGeoid09 and Levelling Offsets

- Offsets are an average value across the entire datum
- Difference between offsets can be compared with levelled values
- Levelled offsets are different depending on where the datums connect
- Levelling offset accuracy ± 0.07 m
- NZVD2009 offset accuracy $\sim \pm 0.06$ m

NZGeoid09 and Levelling Offsets

From	To	NZGeoid09	Levelling	Agree?
Auckland	One Tree Point	-0.276	-0.206	Yes
Auckland	Moturiki	-0.098	-0.070	Yes
Gisborne	Moturiki	-0.103	-0.075	Yes
Gisborne	Napier	-0.141	-0.166	Yes
Moturiki	Napier	-0.038	-0.099	Yes
Taranaki	Napier	-0.112	-0.046	Yes
Taranaki	Wellington	+0.121	+0.147	Yes
Taranaki	Moturiki	-0.074	-0.162	Yes
Napier	Wellington	+0.233	+0.237	Yes
Nelson	Lyttelton	+0.172	-0.027	No
Lyttelton	Dunedin	+0.019	-0.071	Yes
Dunedin-Bluff	Dunedin	+0.104	-0.019	Yes
Dunedin-Bluff	Bluff	-0.021	-0.001	Yes

NZVD2009 Height Relationships



NZVD2009 Height Transformations

- NZGD2000 » NZVD2009

$$H_{\text{NZVD2009}} = h - N$$

- LVD » NZVD2009

$$H_{\text{NZVD2009}} = H_A - o_A$$

- LVD » LVD

$$H_B = H_A - o_A + o_B$$

- LVD » NZGD2000

$$h = H_A + N - o_A$$

Example: NZGD2000 to Wellington 1953

$$H_A = h - N + o_A$$

$$h_{\text{NZGD2000}} = 52.193$$

$$o_{\text{Wellington 1953}} = 0.44$$

$$N = 14.28$$

$$H_{\text{Wellington 1953}} = 52.193 - 14.28 + 0.44$$

$$= 33.353$$

$$= 33.35 \text{ m}$$

Part IV – Use of NZVD2009

- Not compulsory to use NZVD2009
- Uptake encouraged by:
 - LINZ services
 - GNSS/software integration
- Issues when using NZVD2009
- Mean high water springs
- Cadastral surveys
- Use with “other” local datums

LINZ Geodetic Database

A27P: 16432 Microsoft Internet Explorer

Address: <http://www.linz.govt.nz/geodetic/geodetic-database/search/index>

A27P: Mark details

MARK IDENTIFICATION

Code: **A27P** Country: **New Zealand**
 Name: **16432** Land District: **Wellington**
 Alternatives: **PETONE** NZMS270: **R27A**
 NZMG: **5996038**
2666966

NZGD 2000 COORDINATES

Latitude: **41° 13' 30.13047" S** Order: **3**
 Longitude: **174° 52' 21.13533" E** Authorised: **28-Jul-1999**
 Ellipsoidal height (m): **14.788** Reference:

Circuit	Northing (m)	Easting (m)	Scale Factor	Convergence*
Wellington Circuit 2000	808 197.545	400 061.640	1.0000008	+0° 03' 48"

NZGD 1949 COORDINATES

Latitude: **41° 13' 44.3467" S** Order: **3d** [Historical values](#)
 Longitude: **174° 52' 20.4392" E** Authorised: **5-Apr-2000**
 Reference: **31425**

Circuit	Northing (m)	Easting (m)	Scale Factor	Convergence*	Historical values
Wellington Circuit	708 029.22	308 025.96	1.0000008	+0° 03' 47"	Historical values

ORTHOMETRIC HEIGHTS

Height datum	Height (m)	Order	Calculation Date	Reference
Wellington Vertical Datum 1953	1.728	2Y	14-Mar-1988	DD Lev 17/149/14 of 17/12/87

MARK DETAILS

Last maintained: **24-May-2006**
 Mark status: **Reliably Placed/Found**
 Description: **stainless steel pin set in concrete inside 1 inch diameter iron tube under cover. ID plaque attached (2 Feb 1998).**
 Beacon type:
 Protection type:

Local intranet

- www.linz.govt.nz/gdb
- Currently provides:
 - NZGD2000 ellipsoidal heights
 - *Normal*-orthometric heights from LVDs (1V-3V)
 - *Normal*-orthometric heights in relation to MSL (4V-5V)
- Will provide NZVD2009 heights from May 2010
 - Change required to Landonline to generate them
 - Provided for NZGD2000 Order 5 marks and better (marks with GPS determined heights)

LINZ Online Height Conversion

www.linz.govt.nz/coordinateconversion > detailed conversion



The screenshot shows a web browser window displaying the LINZ Online Height Conversion page. The page title is "Convert coordinates between NZ coordinate systems - Microsoft Internet Explorer". The URL in the address bar is "http://www.linz.govt.nz/geodetic/conversion-coordinates/online-c...". The page features the LINZ logo and navigation links such as "About LINZ", "Careers", "Consulting On", and "Contact Us". A search bar is also present. The main content area is titled "Online Conversions" and includes a call to action: "Help us improve our online geodetic services. Complete our quick questionnaire >>". Below this, there are instructions for using the conversion tool. The "Input coordinate system" section includes a dropdown menu set to "New Zealand Geodetic Datum 1949", a "Details" button, and radio buttons for "Coordinate order" (North/East selected) and "Coordinate format" (Degrees/minutes/seconds selected). The "Height coordinate system" section has a dropdown menu set to "None". The "Output coordinate system" section has a dropdown menu set to "New Zealand Geodetic Datum 2000" and a "Details" button.

LINZ Online Height Conversion

Convert coordinates between NZ coordinate systems - Microsoft Internet Explorer

Address: <http://www.linz.govt.nz/geodetic/conversion-coordinates/online-cr>

New Zealand Geospatial Office
Overseas Investment Office
Place Names & Street Names
Survey & Titles
Valuation
About LINZ

Input coordinate system

New Zealand Geodetic Datum 2000 [Details](#)

Coordinate order
 North/East
 East/North

Coordinate format
 Degrees/minutes/seconds
 Degrees/minutes
 Decimal degrees

Height coordinate system
Wellington 1953

Choose whether input coordinates have northing (latitude) or easting (longitude) coordinates first.

Choose whether latitudes and longitudes are entered as degrees, minutes, and seconds (eg 41 30 25.3 S) degrees and minutes (eg 41 30.42 S) or decimal degrees (eg -41.50703). (This is ignored for projection coordinate systems)

Select the height coordinate to enter - none, ellipsoidal, or an orthometric system. Note: Ellipsoidal heights are in terms of the ellipsoid of the input coordinate system.

Output coordinate system

New Zealand Geodetic Datum 2000 [Details](#)

Coordinate order
 North/east
 East/north

Coordinate format
 Degrees/minutes/seconds
 Degrees/minutes
 Decimal degrees

Height coordinate system
New Zealand Vertical Datum 2009

Choose whether output coordinates have northing (latitude) or easting (longitude) coordinates first.

Choose whether latitudes and longitudes are output as degrees, minutes, and seconds (eg 41 30 25.3 S), degrees and minutes (eg 41 30.42 S) or decimal degrees (eg -41.50703) (This is ignored for projection coordinate systems)

Select the height coordinate to calculate - none, ellipsoidal, an orthometric height coordinate, or geoid heights. Note: Ellipsoidal and geoid heights are in terms of the ellipsoid of the output coordinate system.

General options

Input format
 Text box entry
 Free format entry
delimiter

Output format
 Formatted
 Unformatted

Text box entry provides an entry field for each coordinate to be converted. Free format entry provides a single entry field into which all the coordinates can be typed. (This is more useful if the coordinates are being copied from the clipboard, for example) For free format text specify the character to use to separate input columns.

Choose formatted to display the output coordinates as a normal web page, or unformatted to return the coordinates in a simple form suitable for copying to spreadsheets or other documents. For

Local intranet

LINZ Online Height Conversion

free format entry advanced option.' A hint below that says: 'Hint: Bookmark this page if you need to do this conversion often.' The footer contains links for 'LINZ organisation', 'LINZ datasets', 'Corporate publications', 'Consultation, projects &', 'A-Z index', and 'Crown copyright'. The browser status bar shows 'Local intranet'." data-bbox="166 192 783 978"/>

Convert coordinates between NZ coordinate systems - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <http://www.linz.govt.nz/geodetic/conversion-coordinates/online-c...>

About LINZ Careers Consulting On Contact Us SEARCH

Toitu te Land whenua Information
New Zealand

$h = p \cos \theta + Z \sin \theta$

Home > Geodetic System > Coordinate conversion > Online conversions

Online Conversions

Input coordinates: [New Zealand Geodetic Datum 2000](#)
Input heights: Wellington 1953
Output coordinates: [New Zealand Geodetic Datum 2000](#)
Output heights: New Zealand Vertical Datum 2009

Enter coordinates below then press "Convert coordinates"

	Name eg: TRIG_A	Latitude eg: 41 25 38.2 S	Longitude eg: 172 08 47.1 E	Orth.Height eg: 18.27
Point 1	<input type="text" value="16432"/>	<input type="text" value="41 13 38.13047 S"/>	<input type="text" value="174 52 21.13533 E"/>	<input type="text" value="1.728"/>
Point 2	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Point 3	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Point 4	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Point 5	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

If you want to convert more than 5 coordinates at a time use the [free format entry advanced option](#).

Hint: Bookmark this page if you need to do this conversion often.

TOP

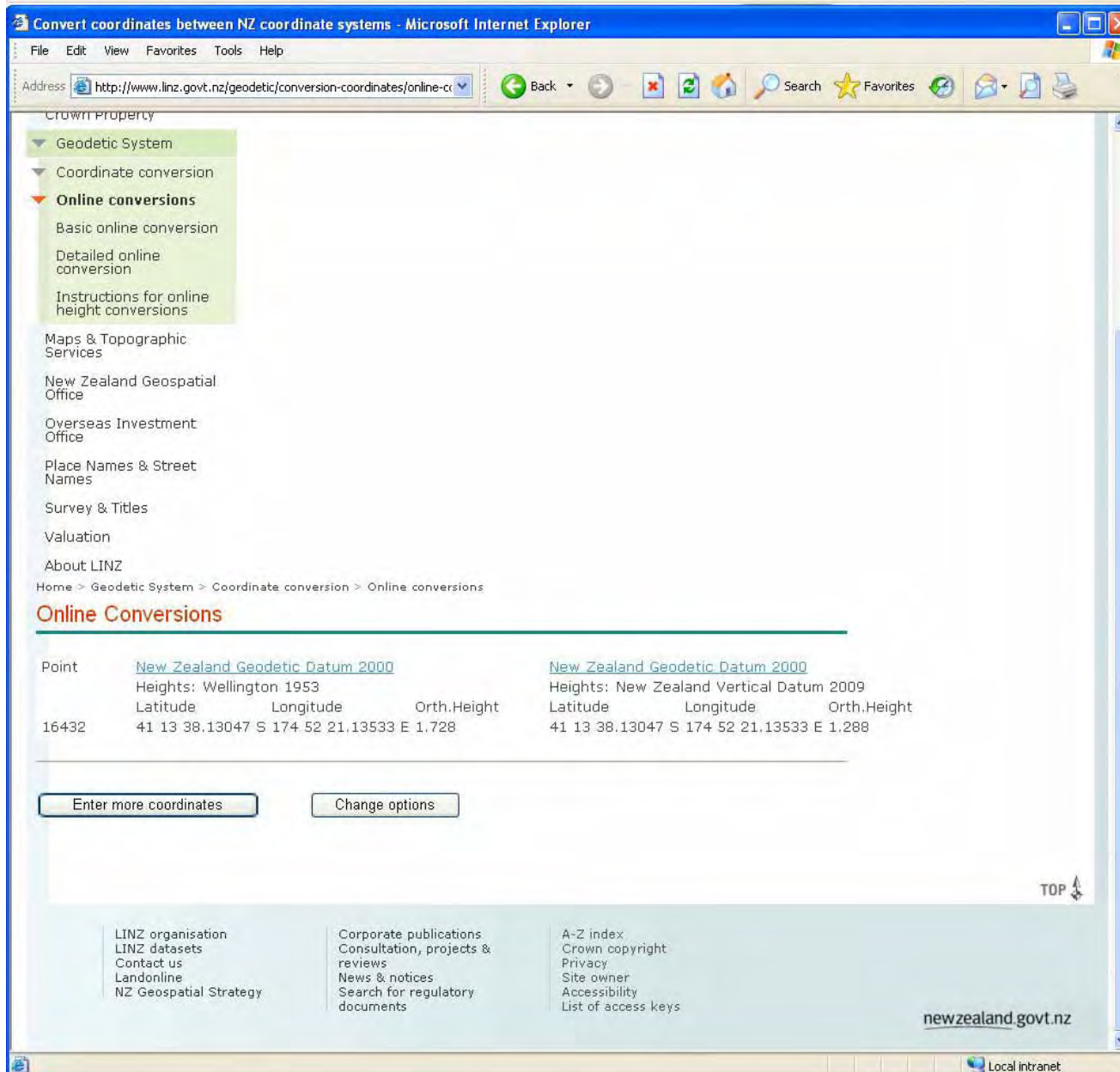
LINZ organisation
LINZ datasets

Corporate publications
Consultation, projects &

A-Z index
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LINZ Online Height Conversion



The screenshot shows a web browser window titled "Convert coordinates between NZ coordinate systems - Microsoft Internet Explorer". The address bar shows the URL: <http://www.linz.govt.nz/geodetic/conversion-coordinates/online-cv>. The page content includes a navigation menu on the left with categories like "Geodetic System", "Coordinate conversion", and "Online conversions". The "Online conversions" section is expanded, showing options for "Basic online conversion", "Detailed online conversion", and "Instructions for online height conversions". Below the menu, there is a breadcrumb trail: "Home > Geodetic System > Coordinate conversion > Online conversions". The main content area is titled "Online Conversions" and displays a table comparing two coordinate systems. The table has two columns, both titled "New Zealand Geodetic Datum 2000". The first column specifies "Heights: Wellington 1953" and the second specifies "Heights: New Zealand Vertical Datum 2009". Both columns list the same coordinates: Point 16432, Latitude 41 13 38.13047 S, Longitude 174 52 21.13533 E, and Orth. Height 1.728. Below the table are two buttons: "Enter more coordinates" and "Change options". At the bottom of the page, there is a "TOP" link and a footer with links to "LINZ organisation", "Corporate publications", and "A-Z index". The footer also includes the text "newzealand.govt.nz" and "Local intranet".

Convert coordinates between NZ coordinate systems - Microsoft Internet Explorer

Address: <http://www.linz.govt.nz/geodetic/conversion-coordinates/online-cv>

Crown Property

- Geodetic System
- Coordinate conversion
- Online conversions**
 - Basic online conversion
 - Detailed online conversion
 - Instructions for online height conversions
- Maps & Topographic Services
- New Zealand Geospatial Office
- Overseas Investment Office
- Place Names & Street Names
- Survey & Titles
- Valuation
- About LINZ

Home > Geodetic System > Coordinate conversion > Online conversions

Online Conversions

Point	New Zealand Geodetic Datum 2000	New Zealand Geodetic Datum 2000
	Heights: Wellington 1953	Heights: New Zealand Vertical Datum 2009
	Latitude Longitude Orth.Height	Latitude Longitude Orth.Height
16432	41 13 38.13047 S 174 52 21.13533 E 1.728	41 13 38.13047 S 174 52 21.13533 E 1.288

TOP

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newzealand.govt.nz

Local intranet

GNSS and Third Party Software

- NZVD2009 can be implemented into GNSS and third party software
- Allows users to directly interpolate NZGeoid09 values and apply offset
- This will be discussed by the next presentation

Height Conversion Issues

- Adjacent NZVD2009 heights may not be in terms if they are determined using different methods:
 - Transformation of ellipsoidal heights
 - Direct levelling from NZVD2009 benchmark
- NZVD2009 height errors are a combination of:
 - Original height error
 - NZGeoid09 and offset error
- NZGeoid09 on a 1' (1.9 km) grid so will not model local geoid changes

- Like the existing LVDs NZVD2009 generally can not be used to define MHWS
- Still need to use evidence based approaches to establish MHWS
- NZVD2009 may be appropriate to transfer MHWS levels over short distances with similar tidal conditions
- MHWS is a horizontal depiction of seaward property extent, so does not need a height definition

Use With Cadastral Surveys

- NZVD2009 will be an official vertical datum in terms of the Rules for Cadastral Survey 2010
- Heighted boundary marks need to be in terms of an official vertical datum if a control mark is within:
 - 200 m of class A boundary point
 - 500 m of class B boundary point
- Important to state source of vertical datum in survey report
 - Direct levelling
 - GPS-levelling
 - Precise point positioning/Network RTK

“Other” Local Datums

- TA's often require data in terms of “other” datums
- Offsets to “other” datums can be computed by:
 - Observe a number of points with GPS
 - Ellipsoidal heights can be used to calculate NZVD2009 heights
 - Local offset will be difference between NZVD2009 and local height
- Only applicable over small areas
- LINZ is considering how to include “other” datums
 - Need to know what datums are being used
 - Please email me details: mamos@linz.govt.nz

Part V – Summary

Summary

- New Zealand currently does not have a nationally consistent height system
- NZVD2009 is based on the NZGeoid09 quasigeoid
- NZVD2009 can be accessed nationally using modern technology
- Heights can be obtained from LINZ online services
- Care needs to be taken converting heights to ensure that accuracy is retained
- LINZ is considering how to include “other” datums
 - Please provide information to: mamos@linz.govt.nz

Part VI – Questions