The Implementation of a Semi-Dynamic Datum in New Zealand – Ten Years On

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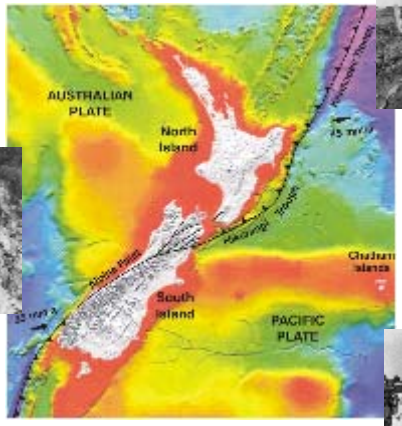
Overview

- Crustal dynamics in NZ
- NZGD2000 – A Semi-Dynamic Datum
- The Implementation of NZGD2000
- What Has Gone Well
- Issues With The Implementation of NZGD2000
- Future Developments of NZGD2000

Crustal Dynamics in New Zealand







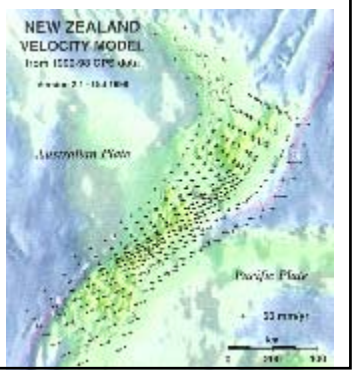

NZ lies across Plate Boundary

50mm/yr movement

NZGD2000 – A Semi-Dynamic Datum

NZGD49 – static datum

- Epoch 1949
- Local datum – best fit to New Zealand
- Regional distortions up to 5m

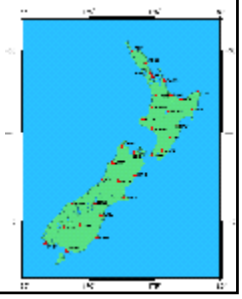


NZGD2000 – semi-dynamic datum

- NZGD2000 (ref epoch 1 Jan 2000)
- Geocentric origin
- ITRF96 with epoch 2000.0 coordinates
- Semi-dynamic datum
- Incorporates deformation model

The Implementation of NZGD2000

- **Since implemented over 70,000 geodetic control marks coordinated**
- **Primarily to support cadastral surveys**
- **Implemented PositioNZ CORS network**
  - 33 stations in NZ
  - datum monitoring
  - upgrading to provision of real time data



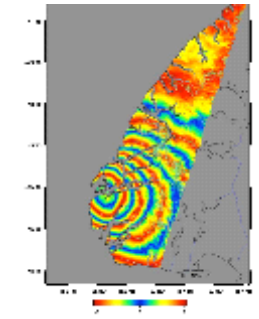
What Has Gone Well With The Implementation of NZ2000

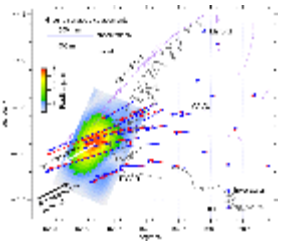
- **User Acceptance**
  - Concept readily accepted
  - For low accuracy users datum appears static
- **Implementation of the Deformation Model**
  - Tools and processes developed
  - For technical/geodetic users process straightforward
- **Maintaining the Accuracy of Datum**
  - Relative accuracy aim is 5cm – without deformation model outdated in 1 year
  - Incorporating deformation model has enabled NZGD2000 to remain current for 10 years

Issues With The Implementation of NZGD2000 – (1)

Managing the Deformation Model

- Surveys used to determine deformation model now 15 years old
- Errors in velocities are leading to increased errors in calculated coordinates
- In some areas model is unable to predict positions at required accuracy (5cm)
- Incorporating the effects of several large earthquakes (eg Fiordland Earthquake)
- Accommodating effects of post-seismic movements, slow earthquakes

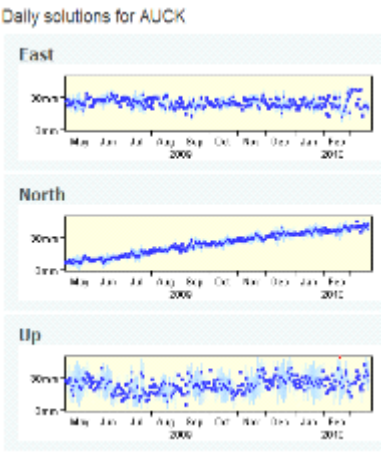




Issues With The Implementation of NZGD2000 – (2)

Managing Changing Coordinates - CORS Real Time Network

- To provide post-processing or real time CORS surveys, coordinates at CORS need to be generated at epochs other than 2000.0
- Not a trivial - various options
  - Publish weekly values based on GNSS observations
  - Predict values based on CORS time series
  - Use deformation model



Issues With The Implementation of NZGD2000 – (3)

Managing Changing Coordinates – Surveys With Long Base Lines

- GNSS surveys make use of longer lines in surveys – the effects of crustal deformation must be included
- Observations need to be transformed to a common epoch (2000.0 or epoch of the survey)
- Users must incorporate the dynamics in their adjustments - this can be complex

Issues With The Implementation of NZGD2000 – (4)

Managing the Spatial Alignment of the Cadastral System

- 70% of cadastre is survey accurate
- Applying deformation model to a few thousand geodetic marks is a trivial task
- Applying to many million cadastral marks is more complex
- Need to find an efficient method to do this

Issues With The Implementation of NZGD2000 – (5)

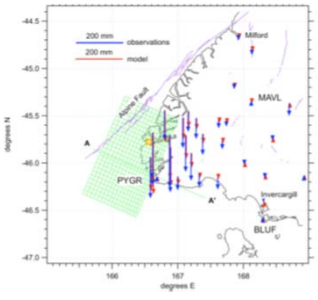
Misalignment of Readjusted Historic Geodetic Control with new Control

- Managing and updating NZGD2000 involves:
  - readjusting old marks using the deformation model; and
  - survey of new marks
- There can be a discrepancy between adjusted marks and surveyed mark positions

Future Developments of NZGD2000

Updating the Deformation Model

- Enable spatial accuracy to be maintained



Vertical Deformation Model

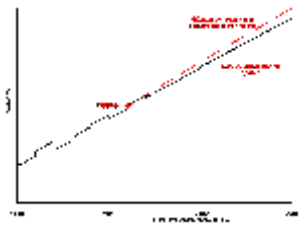
- Assumes zero vertical deformation

CORS Real Time

- Tools for managing changing coordinates

Tie to ITRF - Going Fully Dynamic

- Significant improvements to ITRF since ITRF96
- Consider maintaining a constant relationship with ITRF – i.e. going fully dynamic



Summary

- NZGD2000 has operated for over 10 years and accuracy of the datum has been maintained
- Use of a semi-dynamic datum has been well accepted
- Its implementation from a technical point of view has been straight forward
- A number of issues have been identified and are being addressed
- Future enhancements are continuing to ensure user requirements are met
- In the long term consider a fully dynamic datum using ITRF

Questions