



Technical Seminar on Reference Frames in Practice

Reference Frames, Datum Unification and Kinematics

Christchurch, 1-2 May 2016

Introduction

The Technical Seminar on Reference Frames in Practice was held in Christchurch on 1-2 May 2016. There was a particular focus on deformation modelling and datum unification, which reflects geodetic priorities for the Asia-Pacific region. Many of the participants come from countries situated on the Pacific “ring of fire”, where there is a strong need to model deformation to maintain accurate spatial references. The theme of datum unification reflects the desire of Pacific Island nations, amongst others, to work more closely together to share knowledge and resources for their mutual benefit.

The workshop was organised by FIG Commission 5, in conjunction with the International Association of Geodesy (IAG), the International Committee on GNSS (ICG), the United Nations Initiative for Global Geospatial Information Management for Asia-Pacific (UN-GGIM-AP) and the New Zealand Institute of Surveyors (NZIS).

The seminar was held in conjunction with the 2016 FIG Working Week at the Rydges Latimer Hotel. Primary organisers were Nic Donnelly (New Zealand) and Li Zhang (Germany), both members of FIG Commission 5.

Participants

There were 53 participants, including presenters, from around the world. Countries represented were Australia, Bulgaria, Fiji, Germany, Indonesia, Japan, Nepal, Malaysia, New Zealand, Philippines, Poland, Russia, Singapore, Sweden and USA. Attendees represented a mix of academic, government and commercial institutions.



Group photo of attendees

Organisational representatives in Christchurch were as follows:

Volker Schwieger and Nic Donnelly (FIG)

John Dawson (UN-GGIM-AP)

Rachelle Winefield (NZIS)

Chris Rizos (IAG) and Sharafat Gadimova (ICG) helped organise the seminar but were unable to attend in person.

The sponsors were represented by:

Graeme Blick (LINZ)

Neil Ashcroft (Leica)

Paul Drummond (Trimble)

Technical Content

Key topics covered were:

- Introduction to 3D Reference Frames
- Introduction to Vertical Reference Frames
- Kinematic Frames and Deformation Modelling
- International Geodesy Initiatives
 - o APREF and UN-GGIM
 - o Geodetic Initiatives at ISO
- Geodetic Infrastructure
 - o Template for Developing a National Reference Frame
 - o International GNSS Service
 - o Multi-GNSS
- Geodetic Software
 - o SINEX Manipulation
 - o RTKLIB
 - o SNAP

- Case Studies
 - o Australia
 - o Fiji
 - o Japan
 - o Nepal
 - o New Zealand
 - o Philippines
 - o Poland
 - o USA

The presentations are available on the FIG website at <http://www.fig.net/fig2016/commission5.htm>

Copies of the geodetic software discussed were included on memory sticks provided to each of the participants. A full copy of the final technical programme is appended to this report.



Nic Donnelly presenting at the seminar

Networking and Social Events

There were excellent opportunities to network and socialise during the lunch and tea breaks, which the participants took advantage of. The seminar dinner was held on the first evening, at the Rydges Hotel.

Sponsorship

The seminar was well supported by all three sponsors, Land Information New Zealand, Leica and Trimble, in terms of both financial support and attendance. The ICG provided financial support to several participants from developing nations. The sponsorship enabled registration fees to be kept to a low level at 150 euro for the two days, including the dinner.

Appendix: Full Technical Programme

Sunday 1 May 2016

08:30 – 09:00 Welcome and Opening Remarks

Mr. Nic Donnelly (Convenor), Prof. Rudolf Steiger (FIG Council), Prof. Volker Schwieger (FIG Comm 5), Mr Gary Johnston (IAG), Dr. John Dawson (UN-GGIM-AP), Miss Rachelle Winefield (NZIS)

09:00 – 10:30 Session 1: Introduction to 3D Reference Frames / Datums

1 Prof. Chris Rizos (presented by Mr Nic Donnelly)

Global reference systems and frames: ITRS / ITRF / WGS-84; transformations; determination of ITRF; contribution of geodetic techniques to ITRF: VLBI, GNSS, DORIS, SLR; the relationships between global/local reference frames and global positioning technologies.

10:30 – 11:00 Morning Tea

11:00 – 12:30 Session 2: Introduction to Vertical Reference Frames / Datums

2a & 2b Prof. Bill Kearsley

Gravity and geopotential numbers; physical heights (dynamic, orthometric, normal); reference surfaces (geoids and quasigeoids); levelling datums; GNSS heighting.

12:30 – 13:30 Lunch

13:30 – 15:30 Session 3: Kinematic Frames and Deformation Modelling

3a Dr Chris Pearson: Deformation Modelling 1

Kinematic vs plate-fixed frames; sources of deformation; observing deformation (CORS, GNSS campaigns); dislocation modelling; example of HTDP software for modelling in USA.

3b Dr Chris Crook: Deformation Modelling 2

Role of deformation models in transforming between global and local frames; user requirements for deformation modelling; forward and reverse patches; example of New Zealand deformation model.

15:30 – 16:00 Afternoon Tea

16:00 – 17:30 Session 4: Case Studies 1

4a Mr Basara Miyahara and Dr Koji Matsuo: Case study of Japan

Semi-dynamic datum of Japan; deformation model of Japan, including the 2011 Tohoku earthquake; geoid and gravity change due to large earthquakes including the Tohoku earthquake.

4b Dr Dan Roman: Case study of USA

Current horizontal and vertical datums in USA; proposed new kinematic datum; GRAV-D project for a centimetre geoid; proposed new vertical datum.

4c Mr Graeme Blick: Case study of New Zealand

New Zealand Geodetic Datum 2000; airborne gravity collection and new vertical datum; requirements for a modern geodetic datum.

19:00 – 22:00 Seminar Dinner – Rydges Latimer

Monday 2 May 2016

09:00 – 10:30 Session 5: Case Studies 2

Brief Datum Case Studies – ICG-supported delegates

Brief presentations from ICG-supported delegates discussing current geodetic infrastructure, reference frames and plans for the future in their countries; discussion of challenges for developing nations.

5a Charisma Cayapan – Philippines

5b Joanna Kuczynska-Siehn - Poland

5c Andrick Lal – Fiji

5d Niraj Manandhar – Nepal

5e Asakaia Tabuabisataki - Fiji

5f Dr John Dawson: Case Study of Australia

GDA94 and its relationship to ITRF (14-parameter transformation); user requirements for modernised reference frames in Australia; proposed two-frame system (plate-fixed and kinematic); deformation modelling.

5g Mr Neil Ashcroft – Presentation on behalf of Leica

5h Mr Paul Drummond – Presentation on behalf of Trimble

10:30 – 11:00 Morning Tea

11:00 – 12:30 Session 6: International Geodesy Initiatives

6a Dr John Dawson: APREF and UN-GGIM

Asia-Pacific Reference Frame; relationship to ITRF; benefits of connecting to APREF; contributing to APREF; role of UN-GGIM in geodesy; United Nations resolution on geodetic reference frames and infrastructure.

6b Mr Larry Hothem: Geodetic Initiatives at International Organization for Standardization (ISO)

Role of ISO; ISO/TC211 (Geomatics); Geodetic Standards; Geodetic Registry.

6c Mr Nic Donnelly: SNAP Least Squares Adjustment Software

Introduction to the freely available SNAP geodetic adjustment software; reference frame transformations; utilising deformation and geoid models; coordinate calculation via least squares adjustment.

12:30 – 13:30 Lunch

13:30 – 15:30 Session 7: Geodetic Infrastructure and GIS

7a Mr Richard Stanaway: A template for the development of a modern national reference frame

Physical infrastructure, connection to ITRF, estimating a velocity field/deformation model, vertical datums, geoid models, estimation of transformation parameters from legacy datums, local plane grids, GIS configuration using proj4 and wkt formats.

7b Ms Ruth Neilan: The International GNSS Service

Introduction to the products and activities of the International GNSS Service (IGS).

7c Dr Suelynn Choy: Multi-GNSS

A brief introduction to Multi-GNSS.

15:30 – 16:00 Afternoon Tea

16:00 – 17:30 Session 8: Geodetic Software

8a Dr John Dawson: SINEX Manipulation Software

SINEX manipulation for geodetic applications.

8b Mr Ryan Ruddick: RTKLIB Software

Introduction to RTKLIB open source GNSS software.

8c Dr Chris Pearson: SNAP Least Squares Adjustment Software – Nepal Case Study

Use of the SNAP software for doing calculations using a deformation model after the 2015 Nepal earthquake.

17:30 Closing Remarks – FIG Commission 5