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LINZ's Positioning Strategy and how it contributes to Global Reference Frames

Graeme Blick
Chief Geodesist

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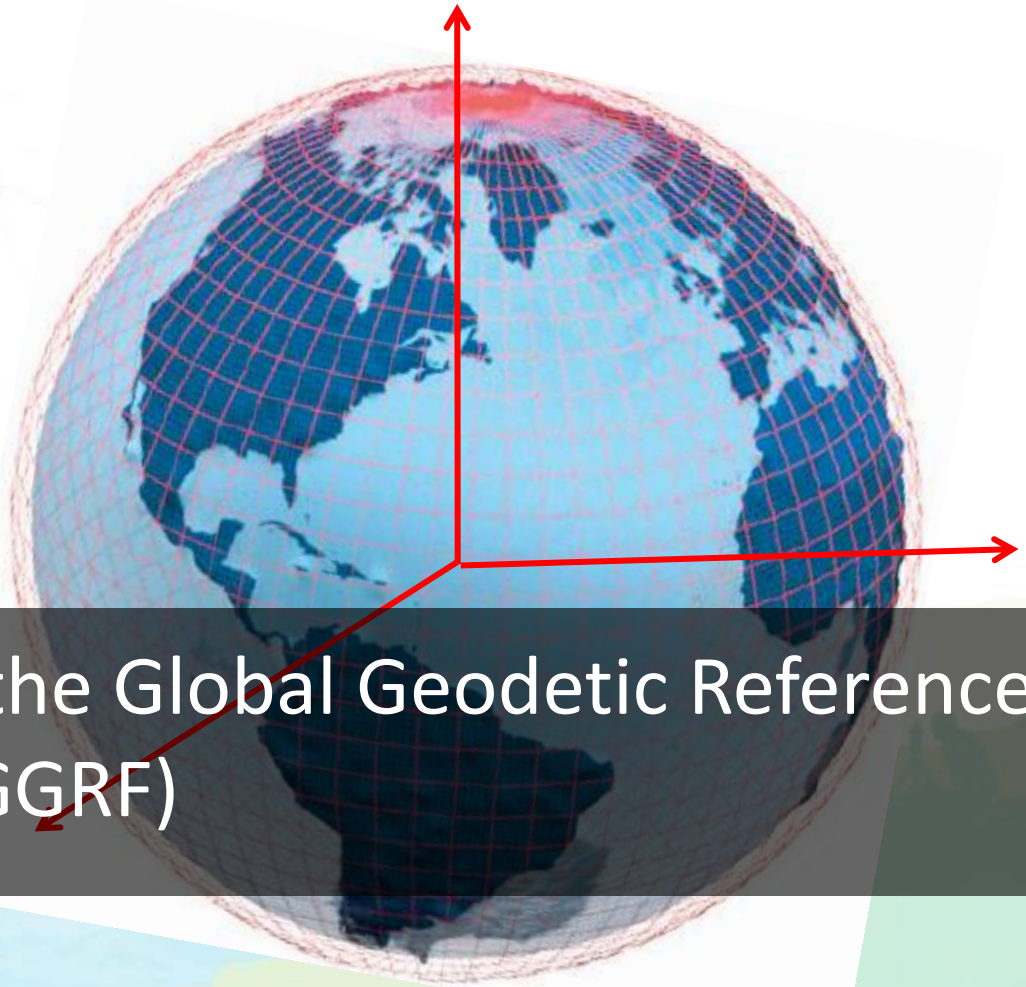

What is the Global Geodetic Reference Frame (GGRF)

UN - Global Geospatial Information Management (GGIM) resolution

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- UN-GGIM recognises the growing demand for more precise positioning services, the economic importance of a global geodetic reference frame and the need to improve the global cooperation within geodesy
- The UN-GGIM decided in July 2013 to formulate and facilitate a resolution for a global geodetic reference frame (GGRF)
- The Working Group on the GGRF was created in January 2014
- Working Group meetings have been held and draft resolution developed
- Endorsed by the GGIM in August 2014
- Endorsed by United Nations Economic and Social Council (ECOSOC) in November 2014
- ECOSOC will present to the UN General Assembly in early 2015 for ratification

Global Geodetic Reference Frame

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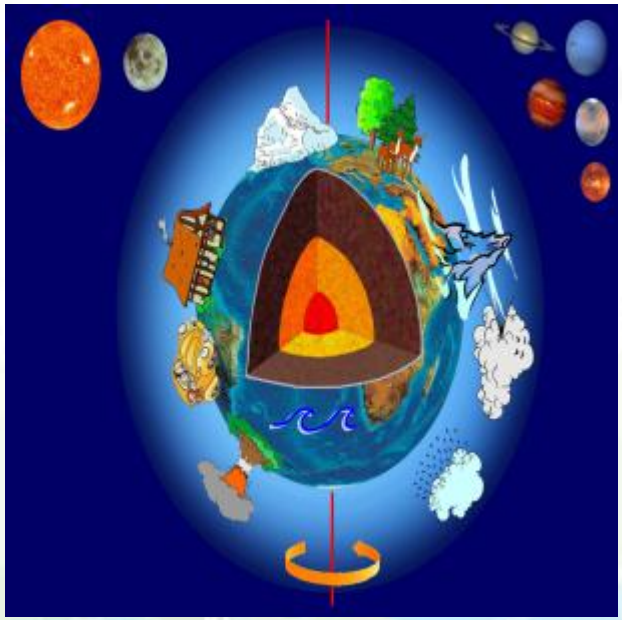
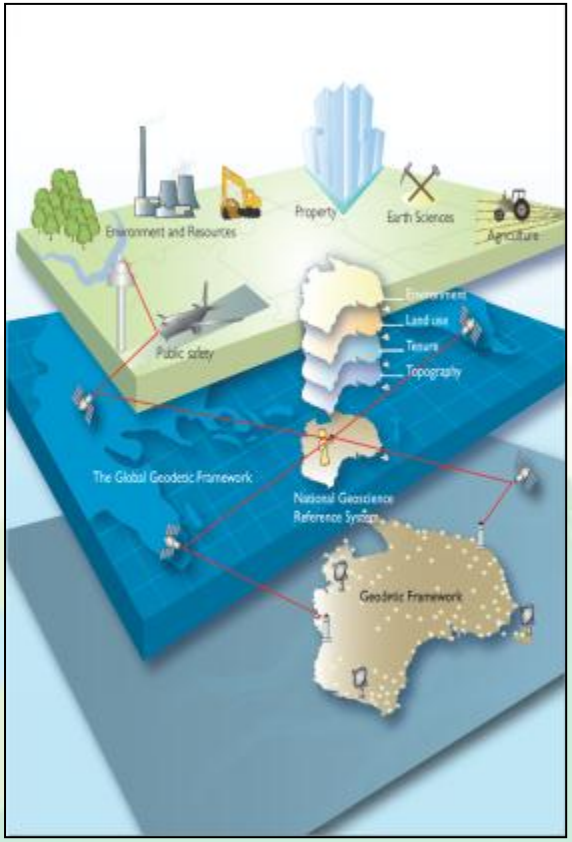
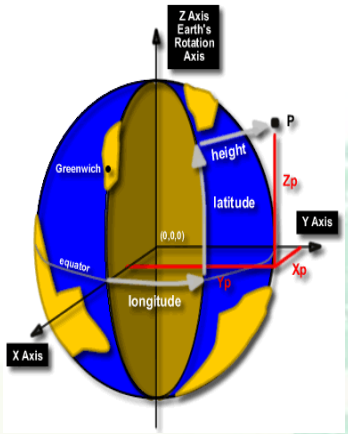
Earth System Science	Geospatial Information	Societal Applications







Global Geodetic Reference Frame

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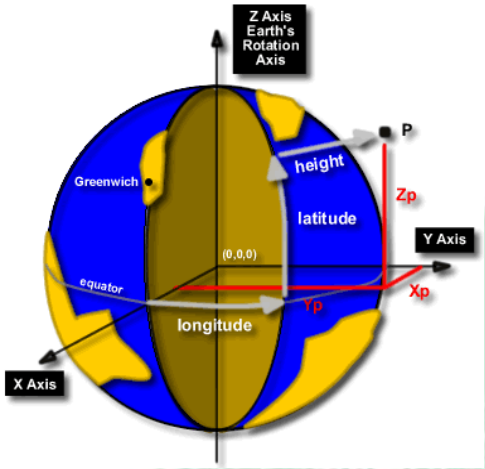

Enables a better understanding of the world we live in.

Facilitates better decision making.

Enables much more sustainable management and development of earth resources.

Allows for safer navigation by air, land and sea.

Enables spatial data interoperability.

Garry Johnston, GeoSciences Australia

The current GGRF in use today:

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- The International Terrestrial Reference Frame (ITRF)
- Implemented by multiple geodetic techniques
- Developed by the International Association of Geodesy (IAG) and its technique services, using sophisticated physical and mathematical models
- Based on the “best-effort” principle, for the interest of science & society

Needs enhancement & sustainability to meet science and societal requirements into the future

Milton Saunders, National Land Agency, Jamaica

The Global Geodetic Reference Frame

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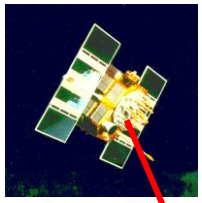

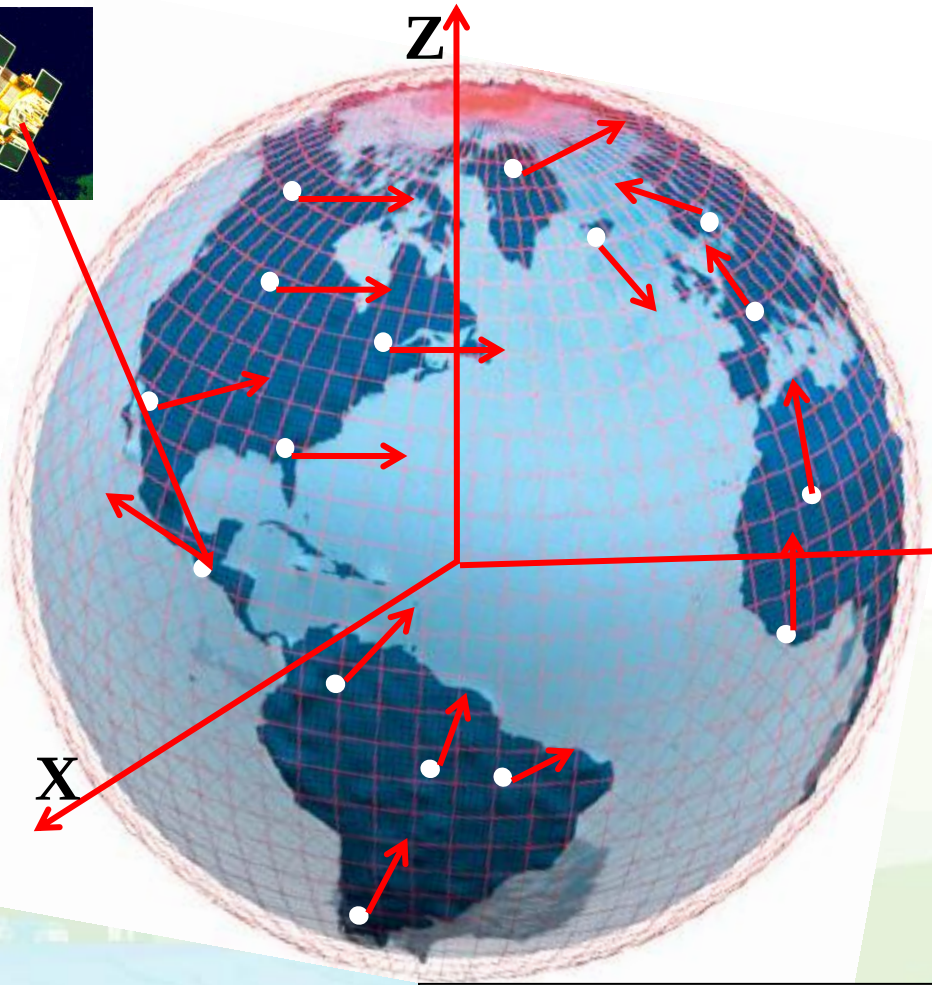

Observing instruments

VLBI

SLR

GNSS

DORIS

Goal/Challenge: determine locations & deformations with an improved precision, everywhere & anytime to satisfy societal and science requirements

Milton Saunders, National Land Agency, Jamaica

Critical issues inhibiting the GGRF enhancement

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- No single country can establish and maintain the GGRF alone
- The economic situation in developing countries contributes to limiting the development of their GGRF
- Aging geodetic instruments, inhomogeneous network distributions & poor number of high quality instruments
  - critical for the GGRF accuracy
  - need new generation systems
- Based on the “best-effort” principle
  - need high level mandate to sustain the GGRF
  - need inter-governmental cooperation
- Many countries have poor access to the GGRF
  - provide technical assistance to countries in need & build modern geodetic infrastructure
  - improve interoperability of geospatial data

Milton Saunders, National Land Agency, Jamaica

Curent Geodetic Observatoires

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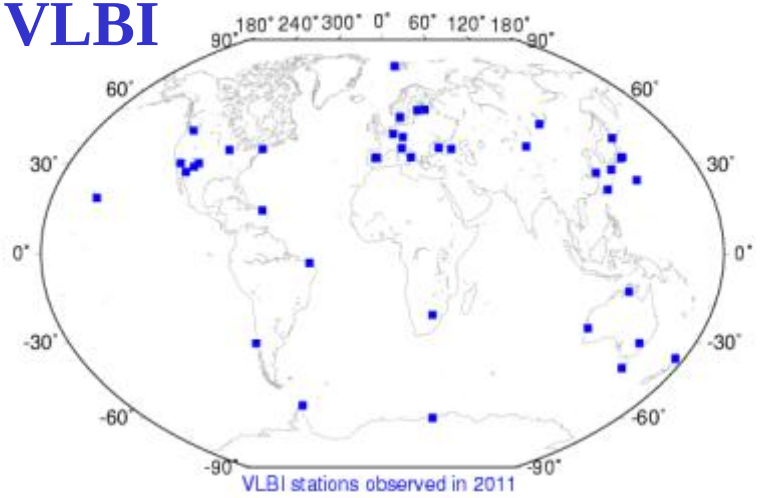
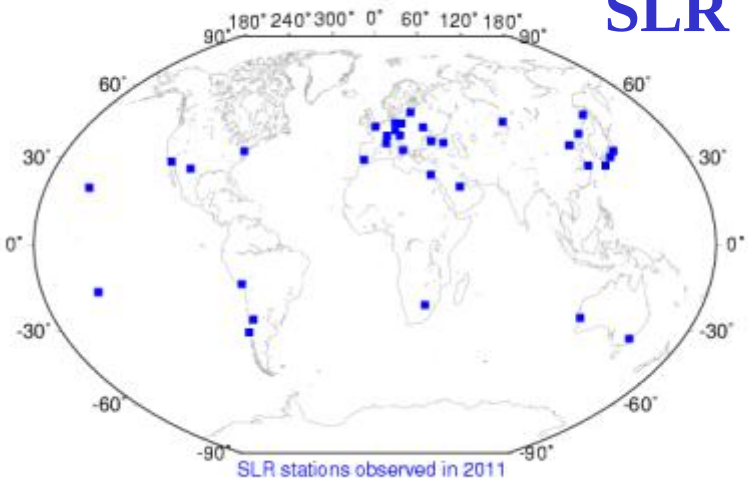
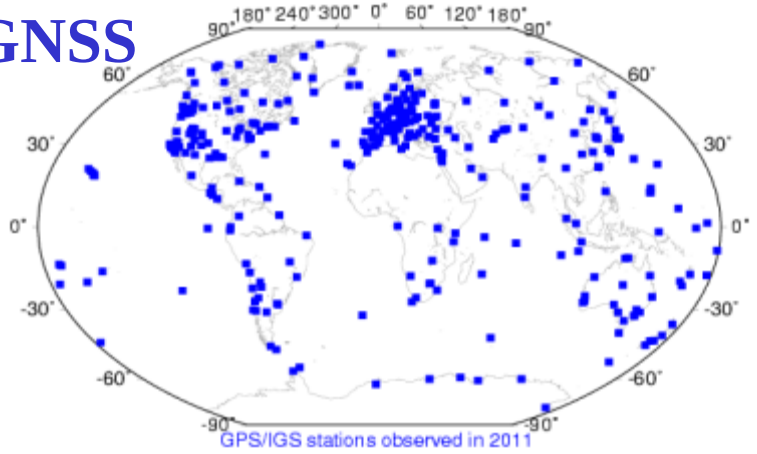
VLBI



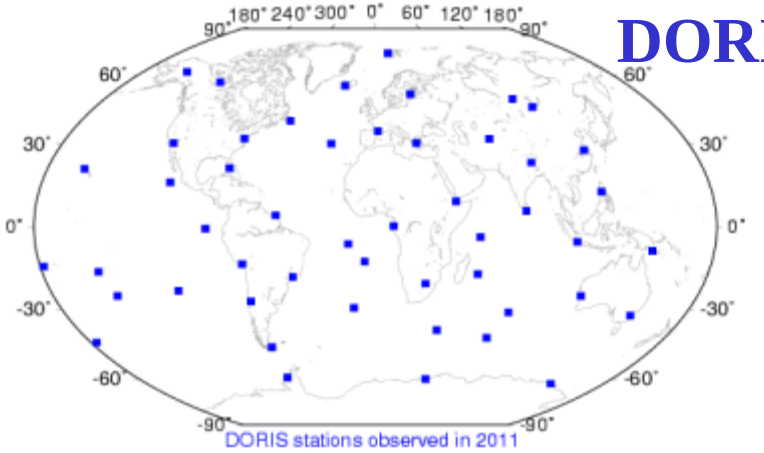
SLR



GNSS

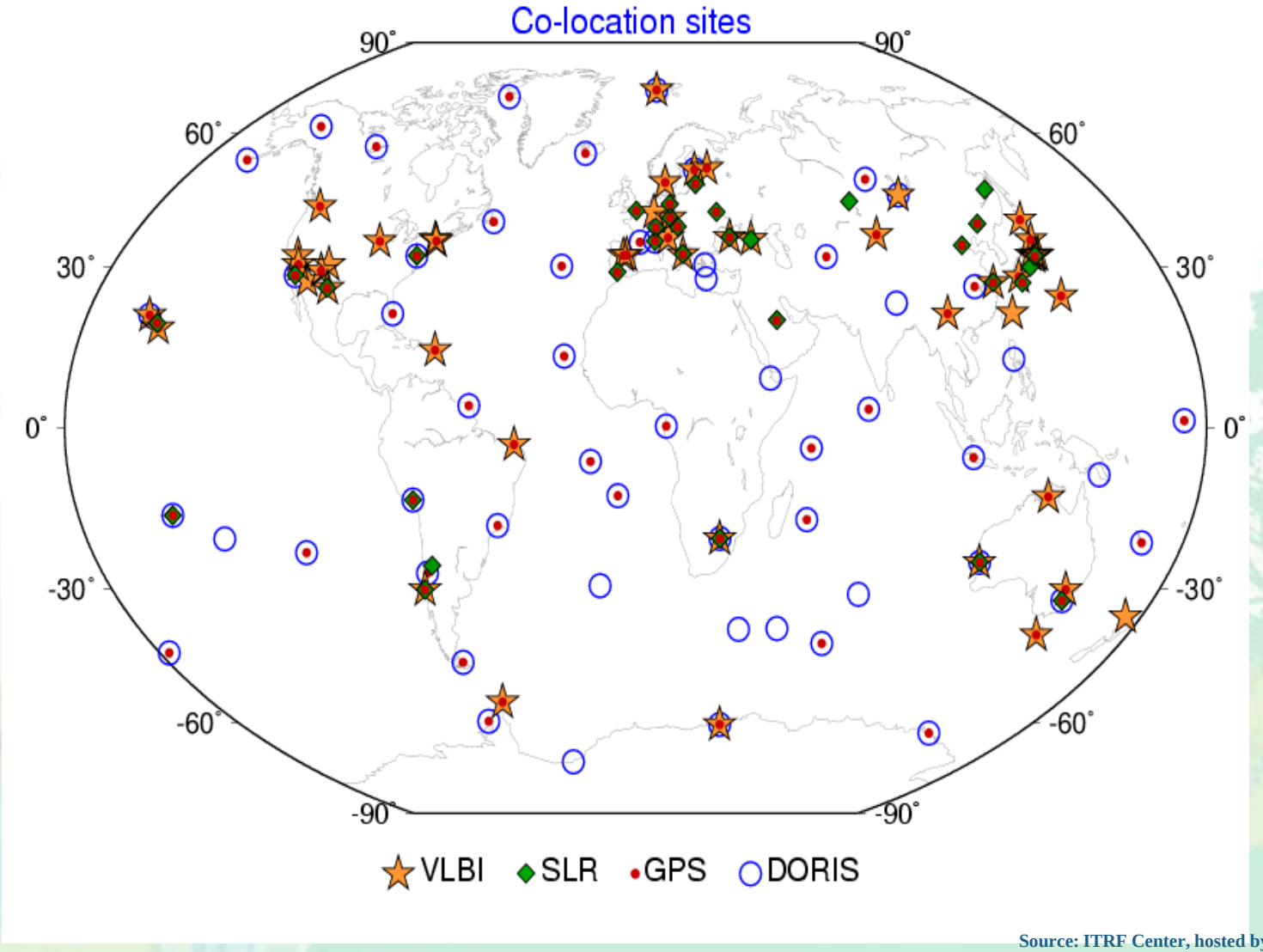


DORIS



Source: ITRF Center, hosted by IGN, France

Co-located sites



Source: ITRF Center, hosted by IGN, France

Resolution: Global Cooperation

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Develop a global geodetic roadmap for the GGRF:

- Make the Geodetic work visible on the political radar
- Making a mandate that the contributing countries could point to from a national perspective
- Providing technical assistance in geodesy for those countries in need to ensure the development, sustainability and advancement of a GGRF
- Implement open geodetic data sharing
- Improve and maintain national geodetic infrastructure
- Enhanced multilateral cooperation that addresses infrastructure gaps and duplications globally
- Improved Outreach to make the GGRF more visible and understandable to society

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Looking Ahead: How are we contributing to the GGRF

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New Zealand Positioning Strategy
May 2014

New Strategy


Changing Focus

Changing Focus

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- Funding split between Crown and 3rd party – in real terms it has decreased but we have a wider customer base
- Stewardship Role – LINZ has assumed stewardship of the Positioning Data Theme and is the custodian of many/most positioning datasets
- Our focus has been on the establishment of extensive networks of control marks
  - initially to support the development of Landonline
  - latterly provision of marks to improve access to NZGD2000
- We are changing our focus to:
  - maintaining the models that define our datums
  - develop new services that meet the positioning needs of a broader range of users who do not want to just use coordinates
  - a greater emphasis on supporting and maintaining global and regional reference frames


Vision:
Accurately
Positioning New
Zealand for the
Future

Vision and Goals

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Vision

Accurately positioning New Zealand for the future

Ten Year Goals

1. Enable the efficient definition of three-dimensional property rights through an accessible geodetic system
2. Measure temporal changes to the shape of the Earth's surface, model the gravity field and incorporate the effects into our reference frames
3. Support the maintenance of global reference frames and the connection of New Zealand's geodetic framework to them
4. Provide tools and services that enable accurate and reliable real-time positioning whenever and wherever it is required
5. Provide strong leadership in the development and use of the positioning system in New Zealand and support its development in the South-West Pacific

Definition of Property Rights

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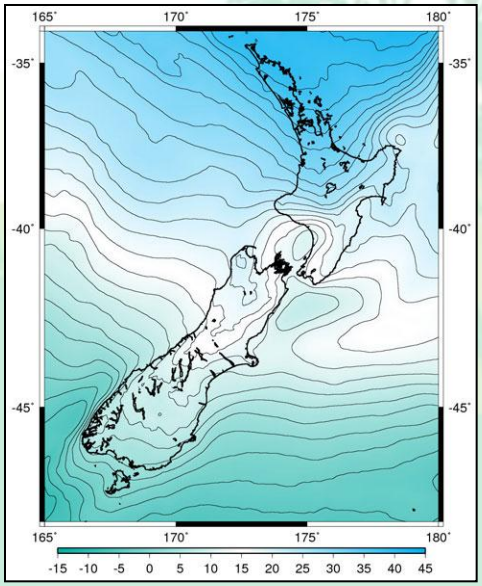
1. Enable the efficient definition of three-dimensional property rights through an accessible geodetic system

- Cadastral surveyors are, and will continue to be, a primary user of the geodetic system.
- The emerging need to consistently define property rights in three-dimensions will create new demands on the national geodetic system.
- Surveyors willingness to adopt new technology, such as GNSS, has changed they way that the geodetic network is used.



Temporal Changes

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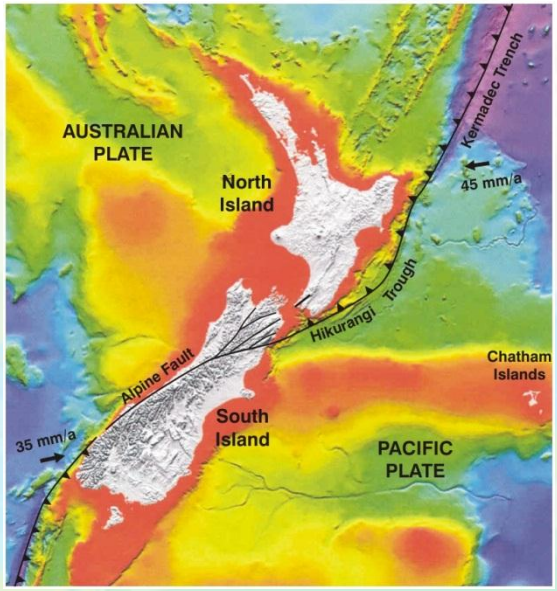
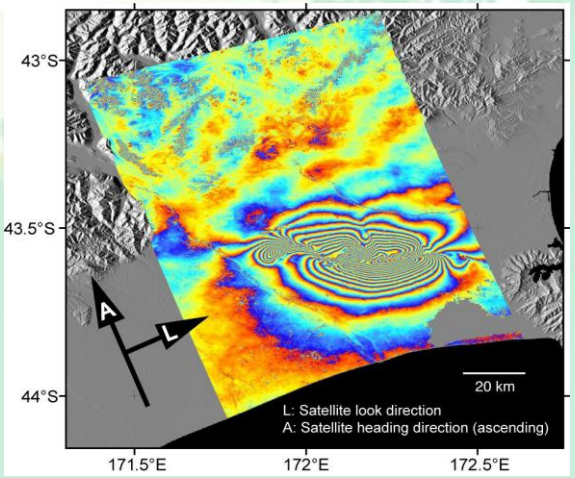
2. Measure temporal changes to the shape of the Earth's surface, model the gravity field and incorporate the effects into our reference frames

- New Zealand is subject to continual deformation due to phenomena such as earthquakes, tectonic and volcanic processes, landslides and subsidence.
- The accuracy of the national reference frames is limited by our ability to accurately measure and model continual changes in the Earth's surface.





3. Global Reference Frames

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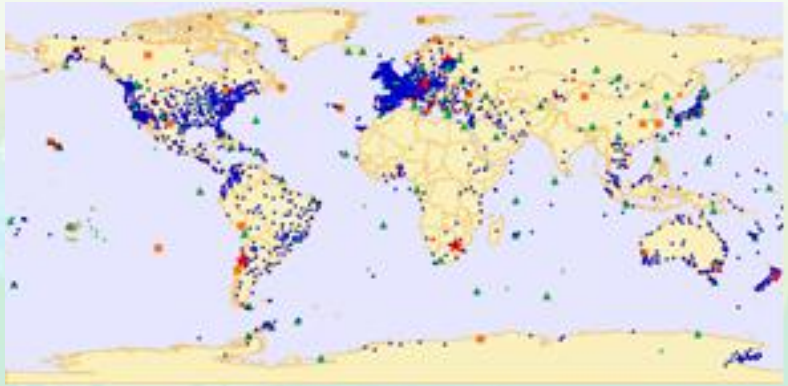
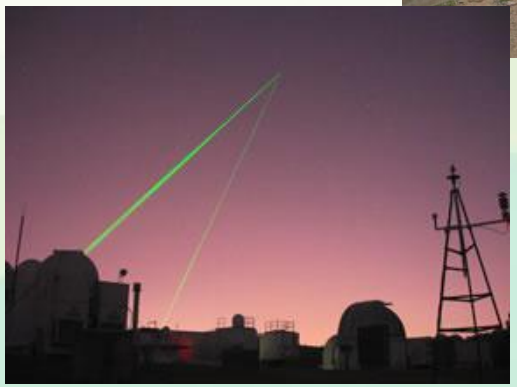
3. Support the maintenance of global reference frames and the connection of New Zealand's geodetic framework to them

- There is a trend away from using country-specific reference systems, such as NZGD2000
- The increasing accuracy of international frames means that they can be used directly, albeit with local enhancements
- UN Global Geodetic Reference Frame (GGRF) initiative





Real Time Accurate Positioning

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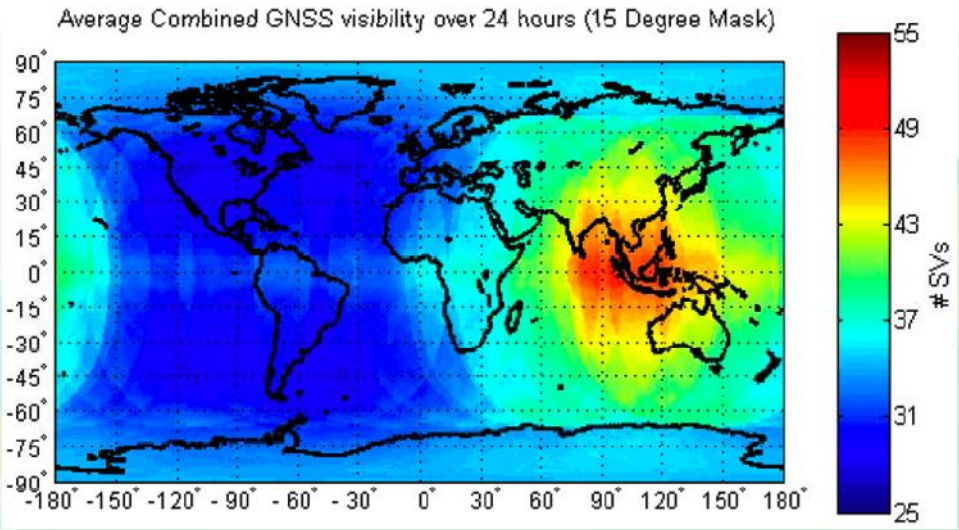
4. Provide tools and services that enable accurate and reliable real-time positioning whenever and wherever it is required

- Consumer-level positioning technology will soon enable users to determine their locations in real-time at the decimetre level using mobile devices.
- LINZ will provide the positioning infrastructure that others can build on to deliver ubiquitous consumer positioning services.



Leadership

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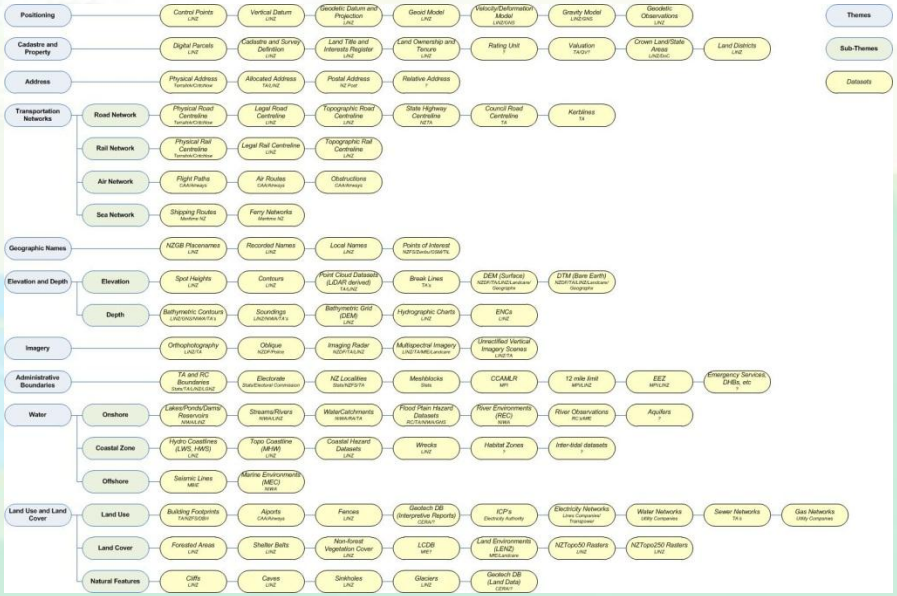
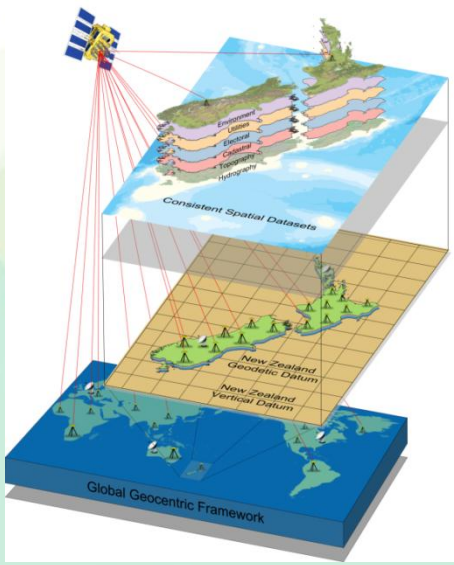
5. Provide strong leadership in the development and use of the positioning system in New Zealand and support its development in the South-West Pacific

- LINZ is the steward of the positioning fundamental data theme and custodian of many of the datasets.
- With our statutory mandate to manage the geodetic system, LINZ is well placed to take this national view and provide a common positioning infrastructure that all users of spatial information can use.





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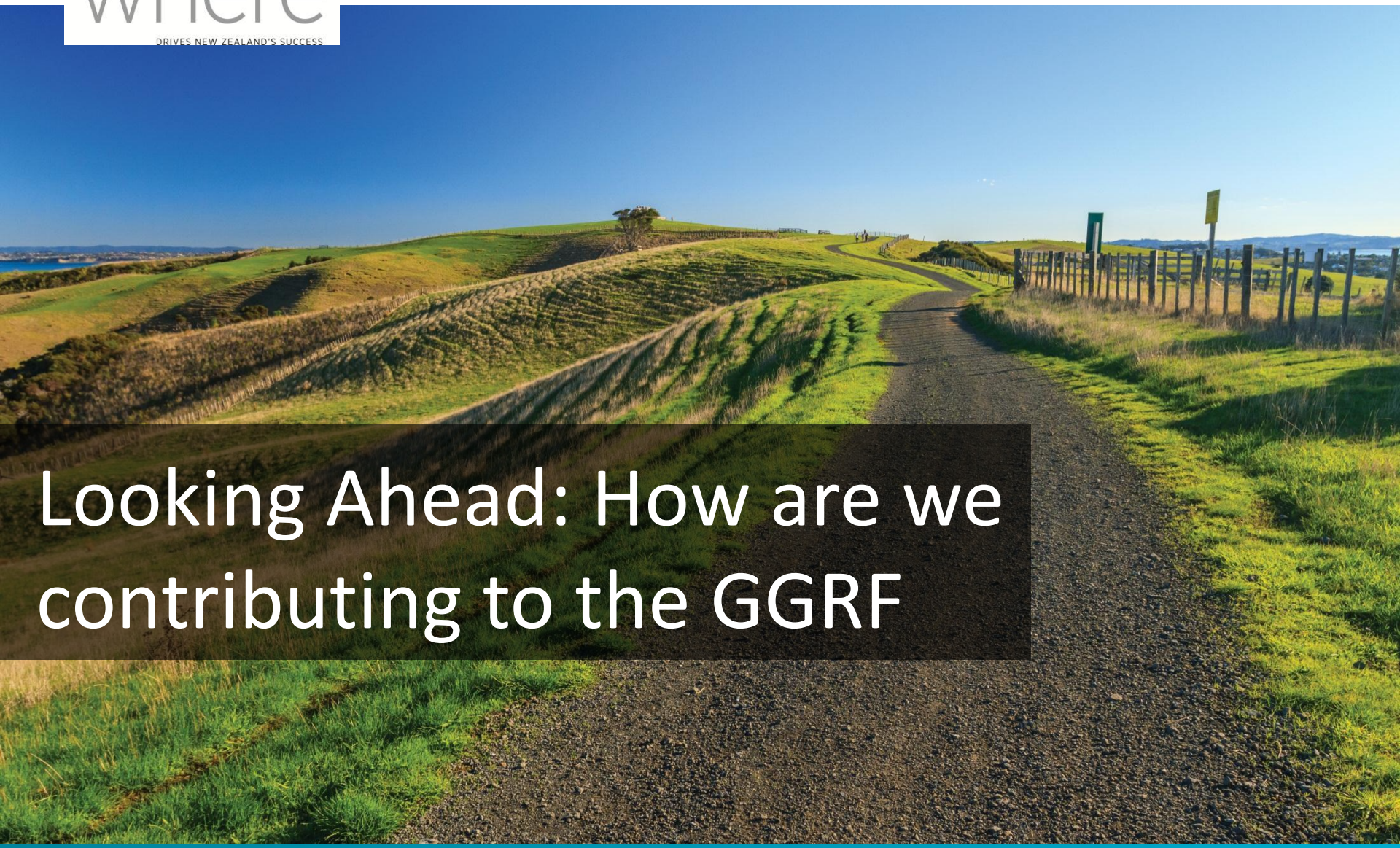

Looking Ahead: How are we contributing to the GGRF

3. Global Reference Frames

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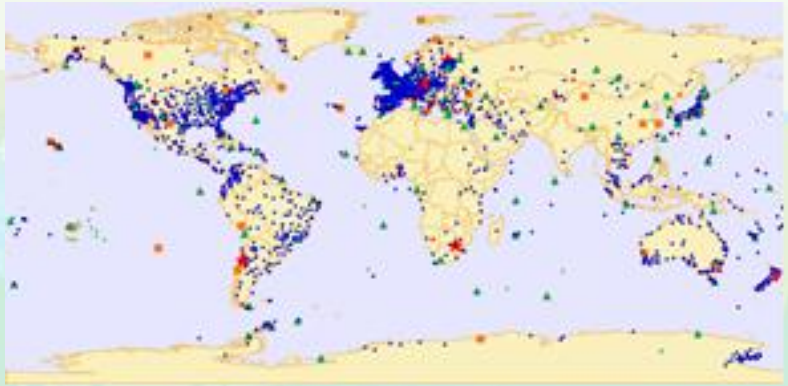
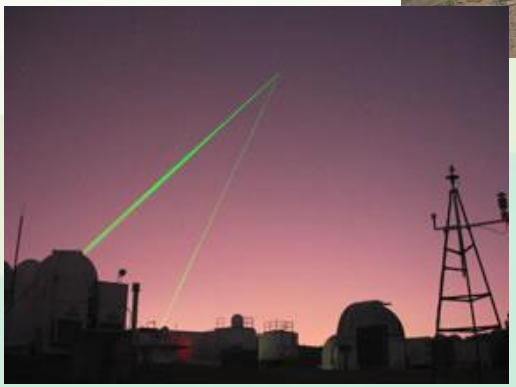
3. **Support the maintenance of global reference frames and the connection of New Zealand's geodetic framework to them**





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PositioNZ

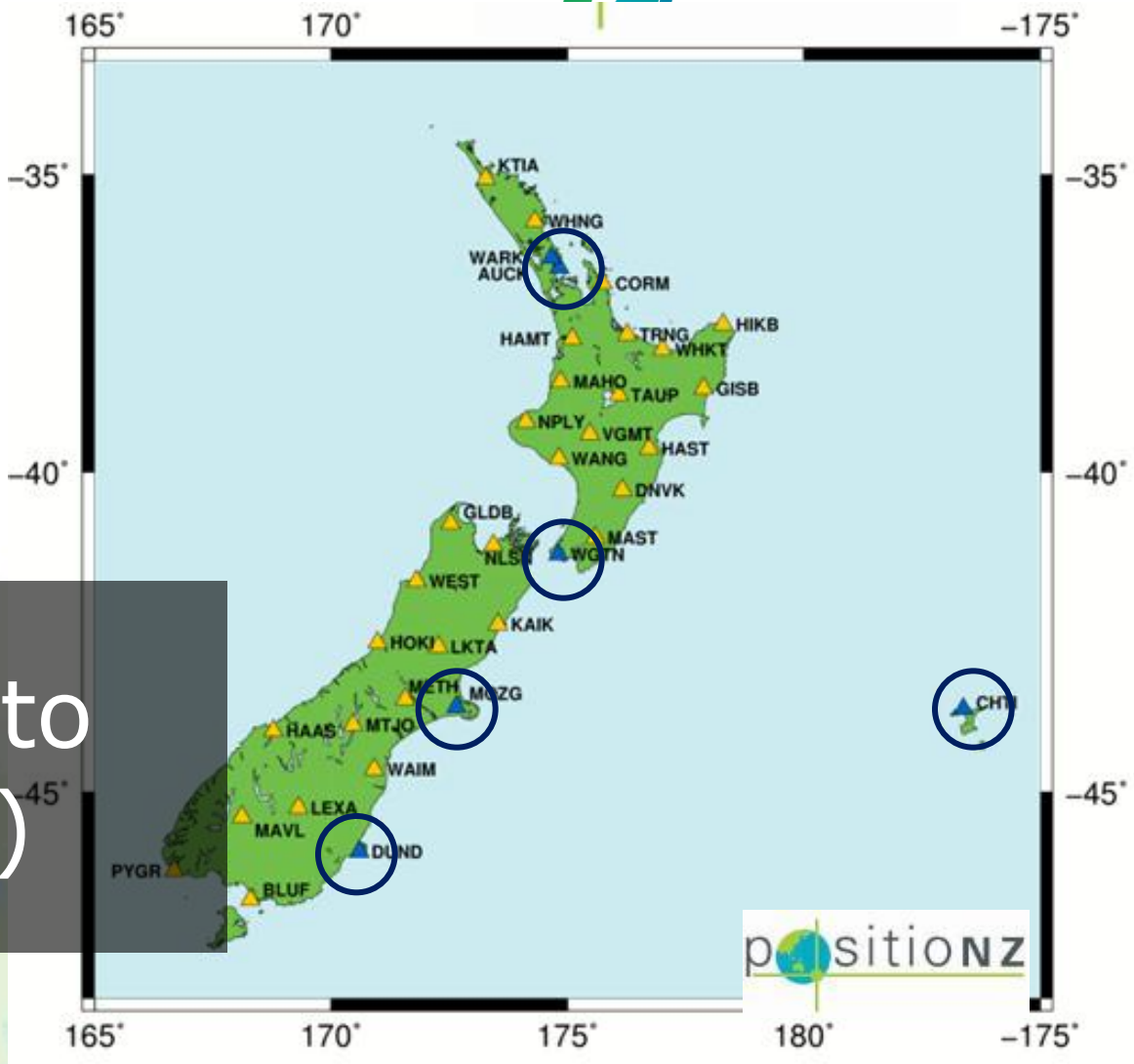
35 on the mainland of NZ

1 on the Chatham Islands

3 in Antarctica

Developing an analysis centre

Contribution to ITRF (CORs)



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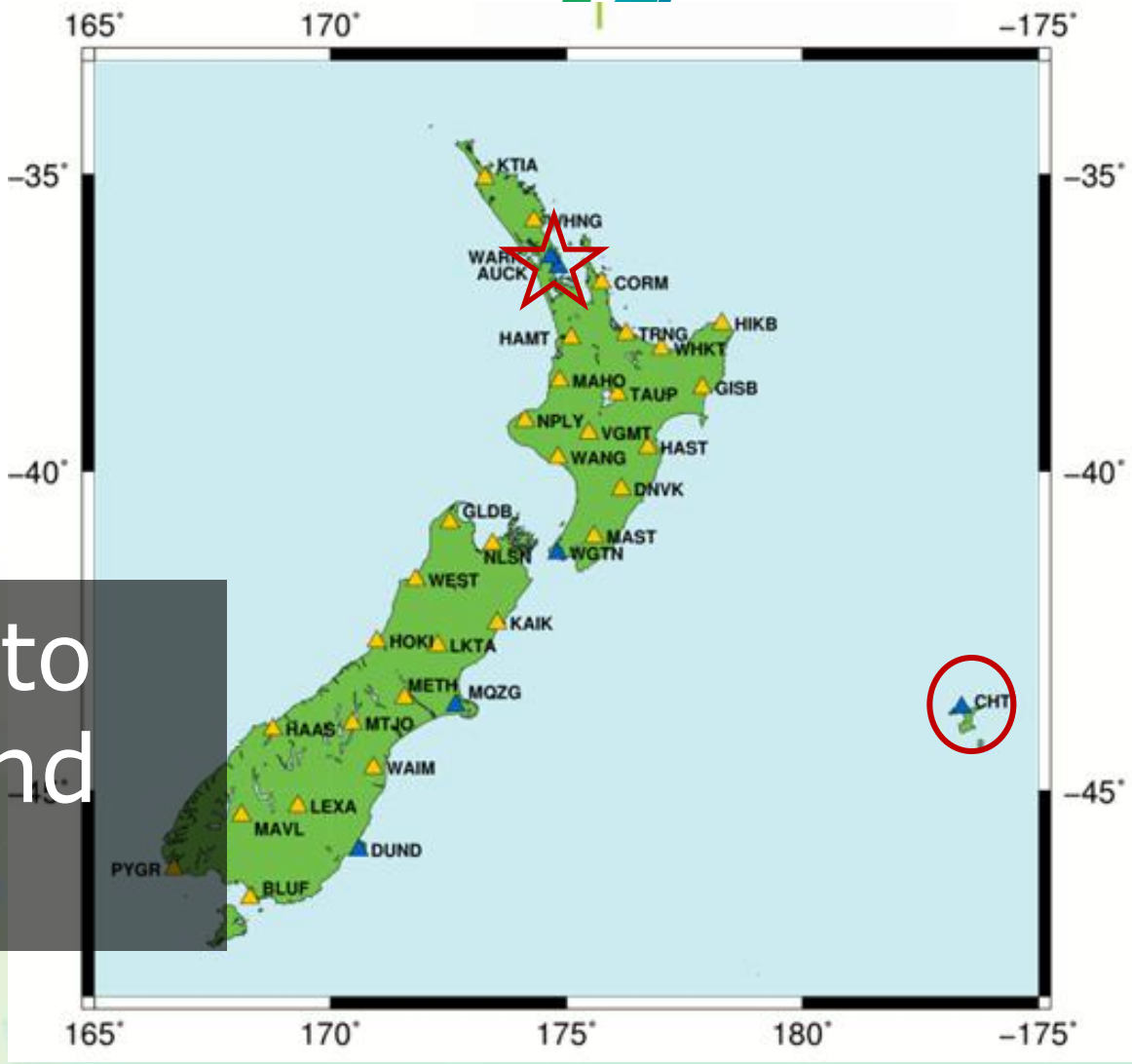
Contribution to ITRF (VLBI and DORIS)

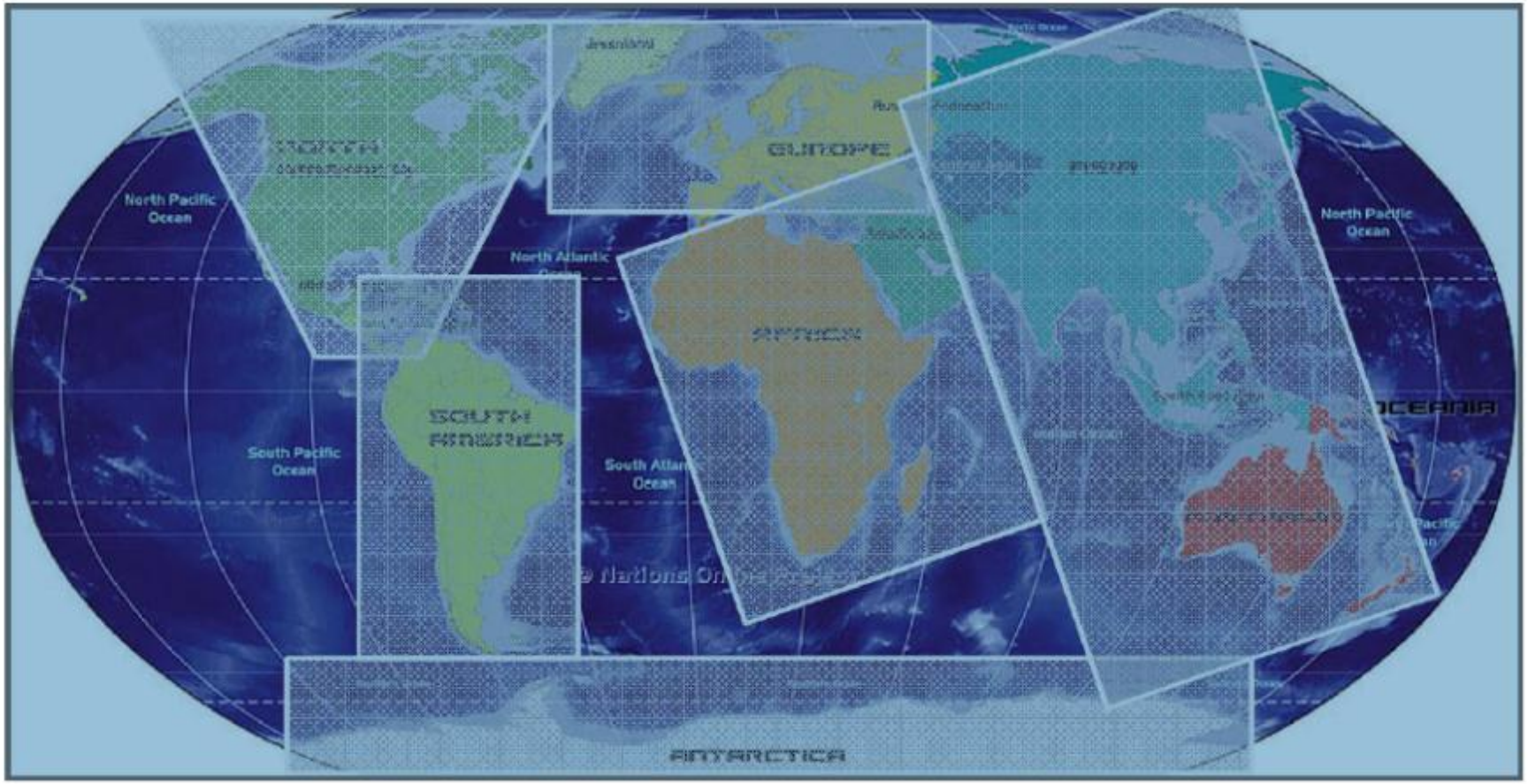
VLBI

DORIS



Regional Reference Frame Densification

ITRF = APREF, AFREP, EUREF, NAREF SIRGAS,…



John Dawson and Guorong Hu, GeoSciences Australia

APREF Objectives

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- Create and maintain an accurate and densley realised framework, based on continuous observation and analysis of GNSS data
- Encourage regional sharing of GNSS CORS data and its analysis

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Benefits of APREF Participation

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- Improved and continuios link between national datums and CORS networks to the ITRF/GGRF
- Contribute to an open and dense ITRF/GGRF network in Asia and the Pacific
- Independent quality monitoring
- Improved access to GNSS data
- Providing an apportunity and forum towards improving the regional geodetic infrastructure

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APREF status as at June 2013

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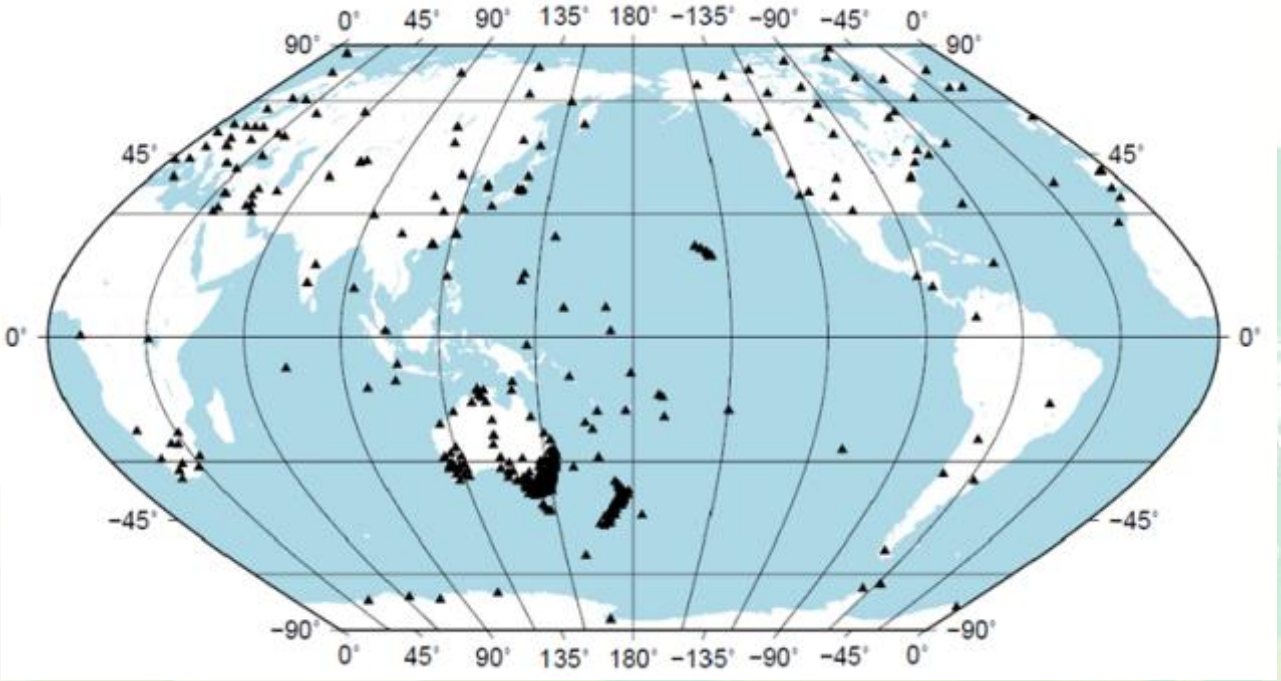
- Data from 33 countries
- 16 national agencies participtating
- 3 local analysis centres
- 2 universities participtating
- App 400 Asia Pacific stations now available
- App. 500 stations now routinely analysied



CORS stations

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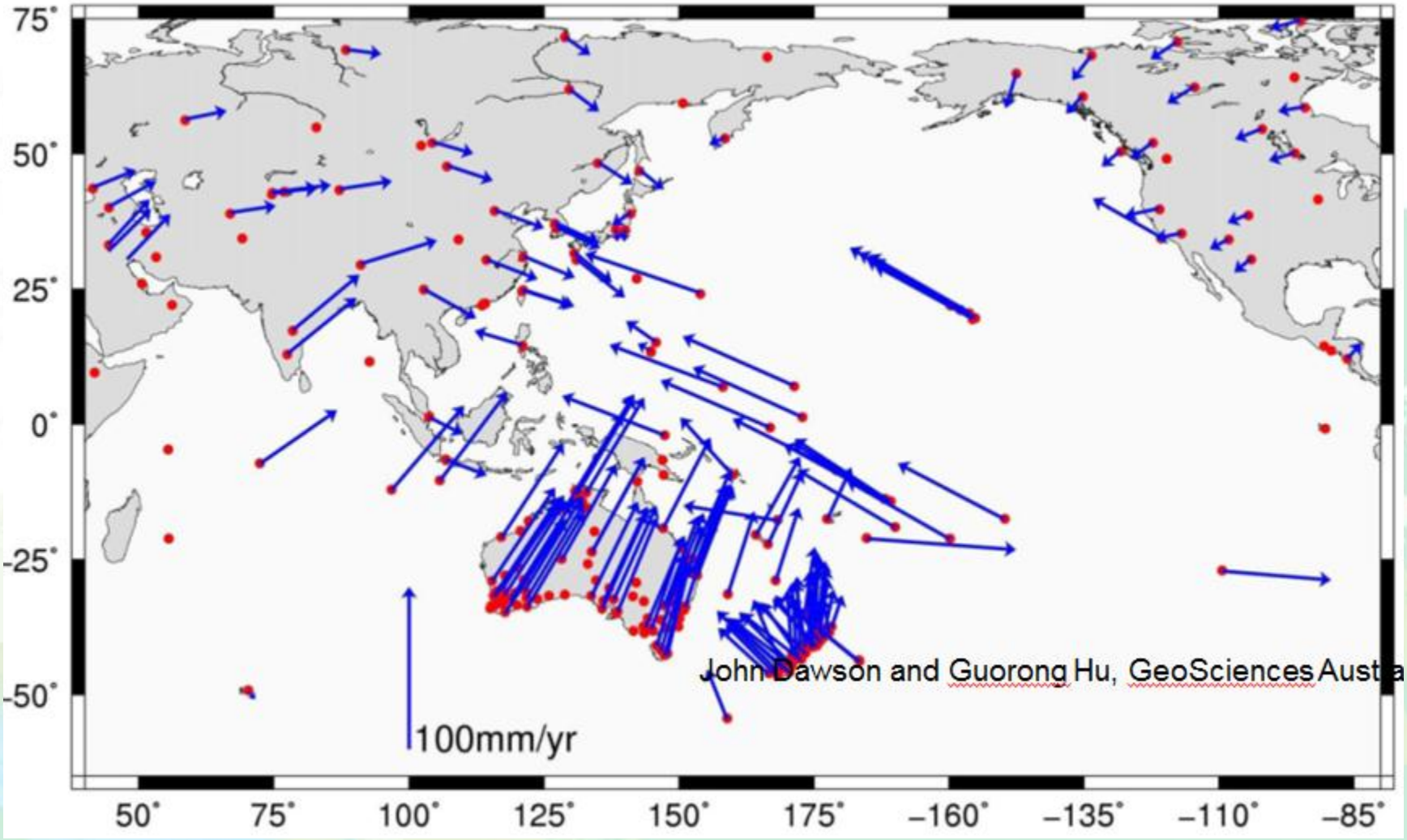
APREF velocities



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10 years from now

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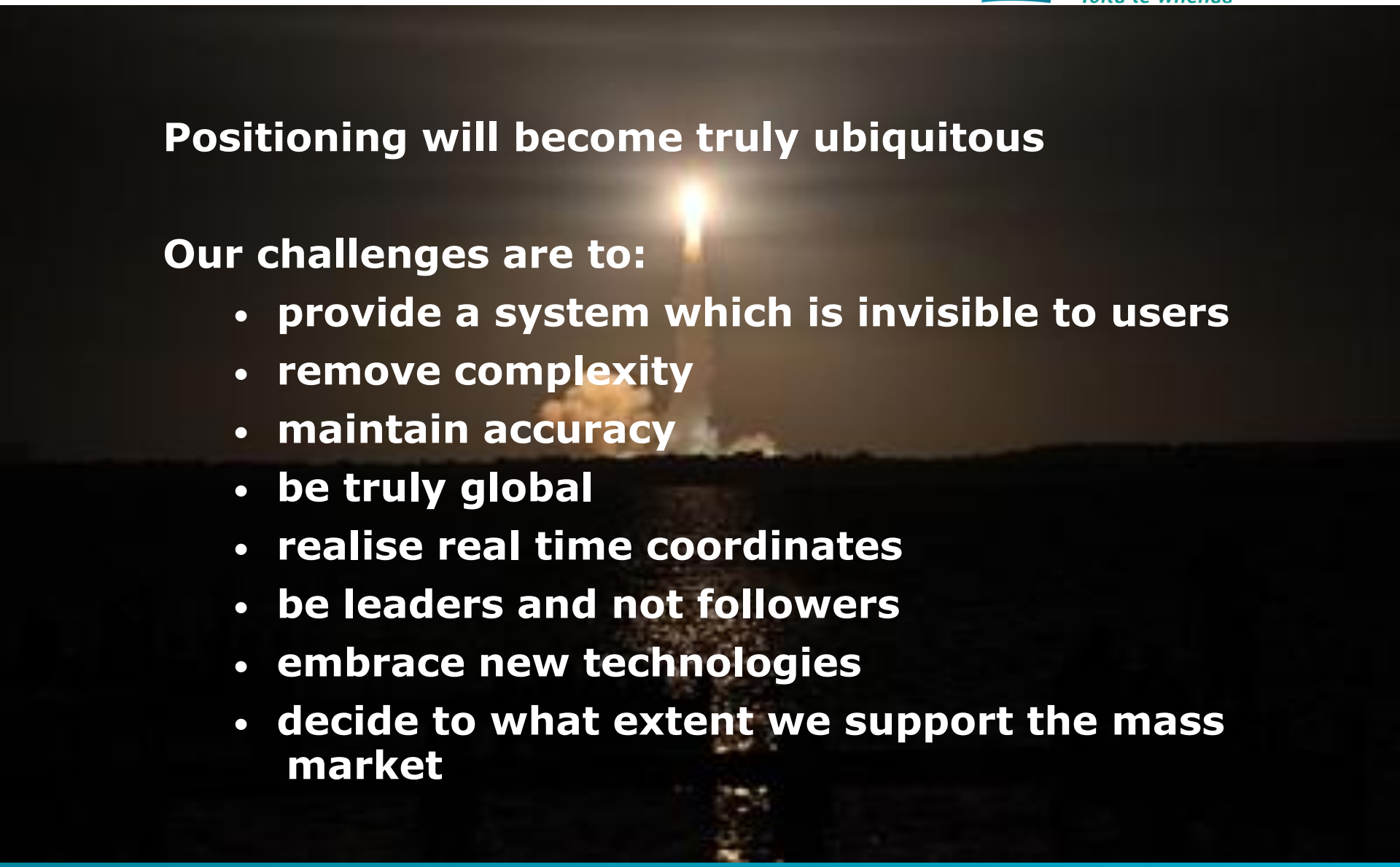

Positioning will become truly ubiquitous

Our challenges are to:

- **provide a system which is invisible to users**
- **remove complexity**
- **maintain accuracy**
- **be truly global**
- **realise real time coordinates**
- **be leaders and not followers**
- **embrace new technologies**
- **decide to what extent we support the mass market**