Enhancement of Australia's National Geospatial Reference System

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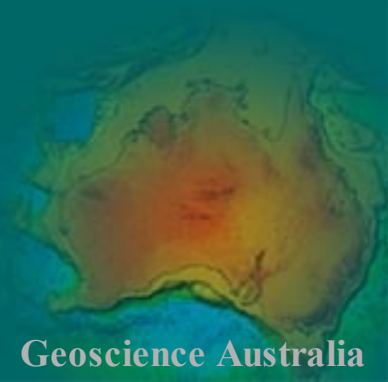
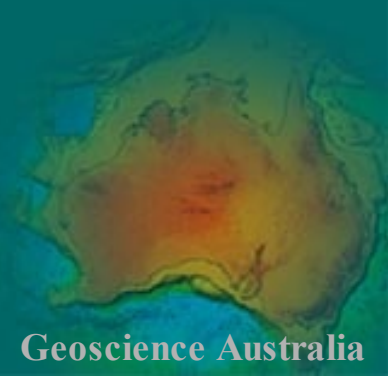
Geoscience Australia



Outline

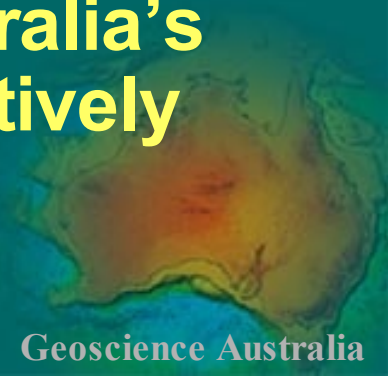
- What is the National Geospatial Reference System
- Why Improve it
- How do we plan on proceeding



National Geospatial Reference System

Definition

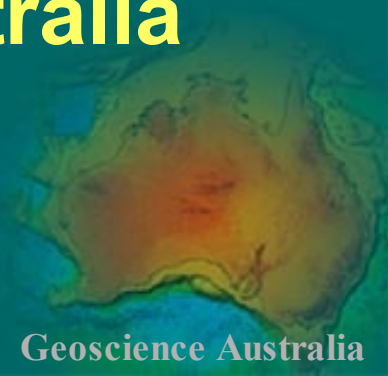
- Coordinate system to which all positions and spatial data are referred
- Consists of Three parts
  - Linkage to the International Terrestrial Reference Frame
  - Realization through the Geodetic Infrastructure
  - Systems and services used to make it accessible
- Currently GDA94 and AHD71 are Australia's horizontal and vertical datums respectively




ENVIRONMENT & RESOURCES
Sea Level
ABILITY TO PRECISELY
EXPLORE & LOCATE
Title Deed
PROPERTY
CERTAINTY OF TITLE
AGRICULTURE
MAXIMUM HARVEST
MINIMUM WASTE
GPS
IMMEDIATE
& ACCURATE LOCATION
SOS
PUBLIC SAFETY
Who Benefits
Environment
Land Use
Tenure
Topography
Geodetic Framework
Everyone using one System
GPS
Tapping into the future today
THE GLOBAL FRAMEWORK
DIGITAL MAPPING
Geodesy
Tide Gauge
GPS
VLBI
SLR
THE AUSTRALIAN FRAMEWORK
Australia is moving North East at 5 to 10cm per year !!
N
E
S
W

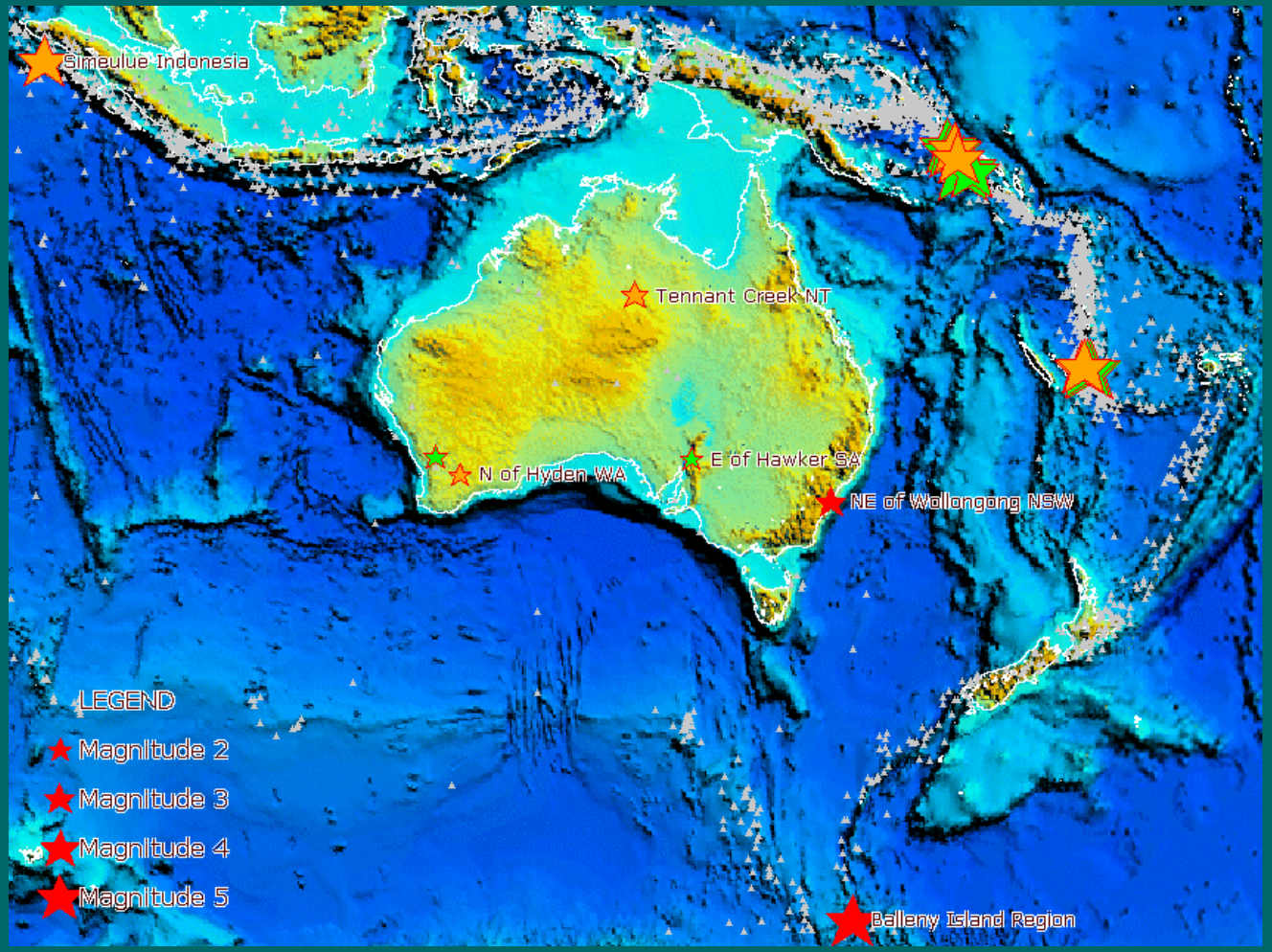
Vision

- Improve the accuracy of the National Geospatial Reference Frame by an order of magnitude
- Develop the infrastructure necessary to promote research and industry in the national interest
- Deliver a high accuracy datum to all Australians in order to keep Australia competitive



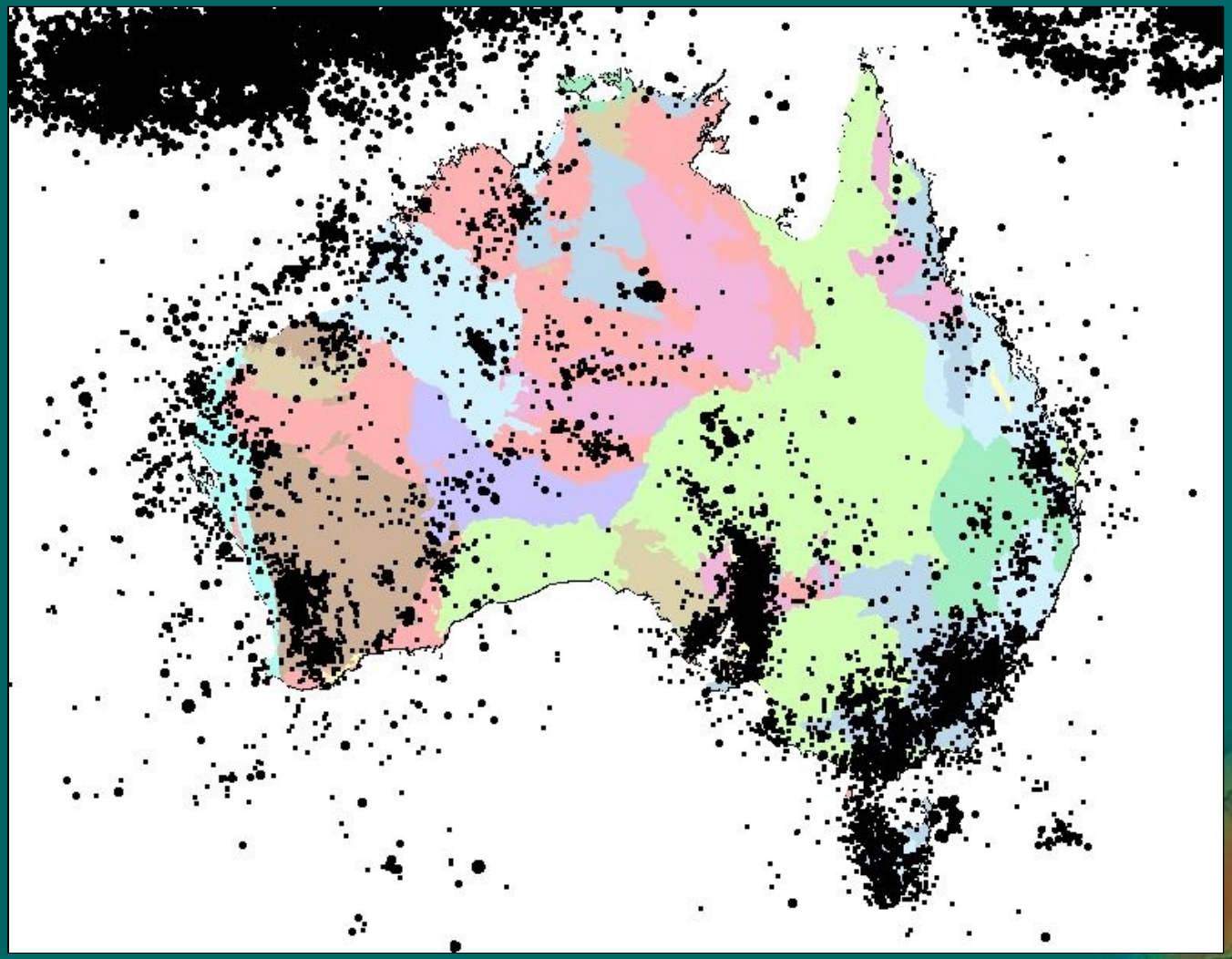
Accuracy Requirements

Category	Accuracy Requirement	Application Examples
1	1mm	Reference Frame Development
		National Datum (GDA, AHD, Gravity Field)
		Geodetic Science (Neo-tectonics, Sea Level Rise, Isostasy, etc.)
2	10mm at 1σ	Mapping / SDI
		Precision Agriculture
		Mining / Construction, Engineering
3	100mm at 5σ	Liability Critical Services
		Safety of Life Applications



- 19 earthquakes for the last 30 days (magnitude > 2.0)
- red star last 7 days (most recent: 13 April)
- orange star 7 to 14 days
- green star 14 to 30 days (oldest: 25 March)
- grey triangle historical earthquake greater than magnitude 6

Geology and Earth Quake locations

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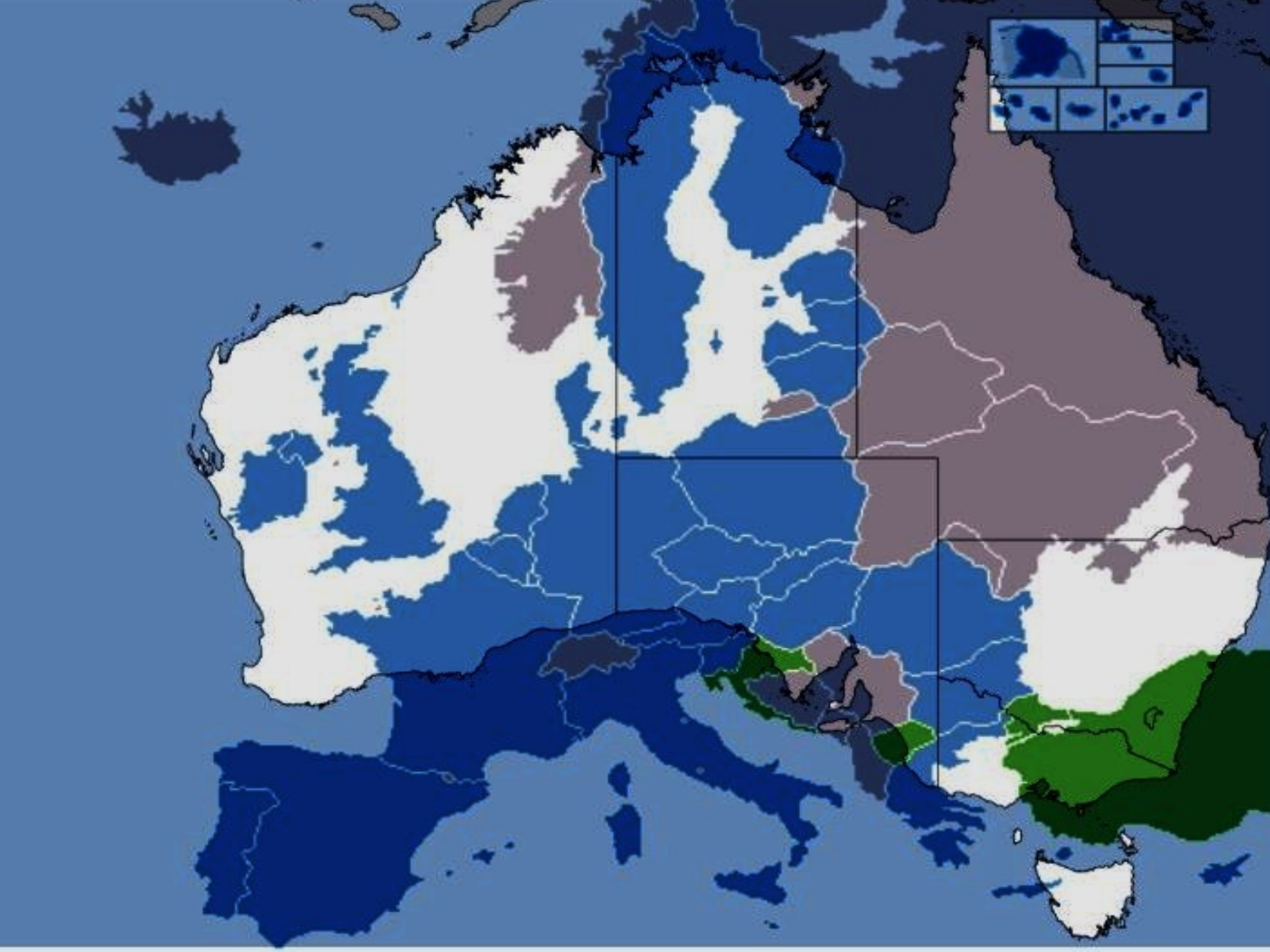


Infrastructure Cost

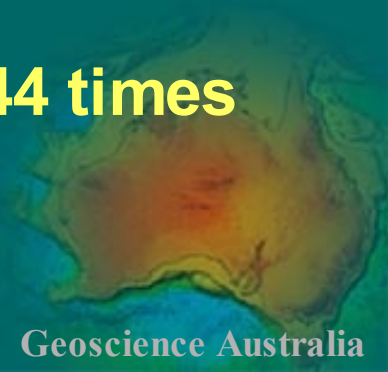
EU

- Population 494,070,000
- Area 4,324,782 km^2
- Density 114 people / km^2

Australia

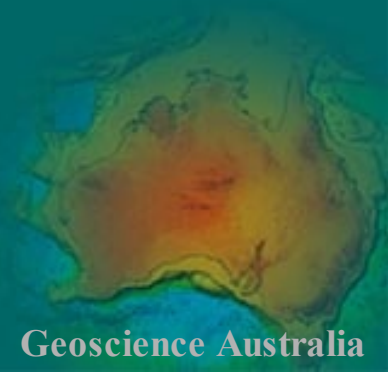
- Population 20,264,082
- Area 7,617,930 km^2
- Density 2.6 People / km^2

Therefore equivalent infrastructure costs are 44 times larger per person in Australia



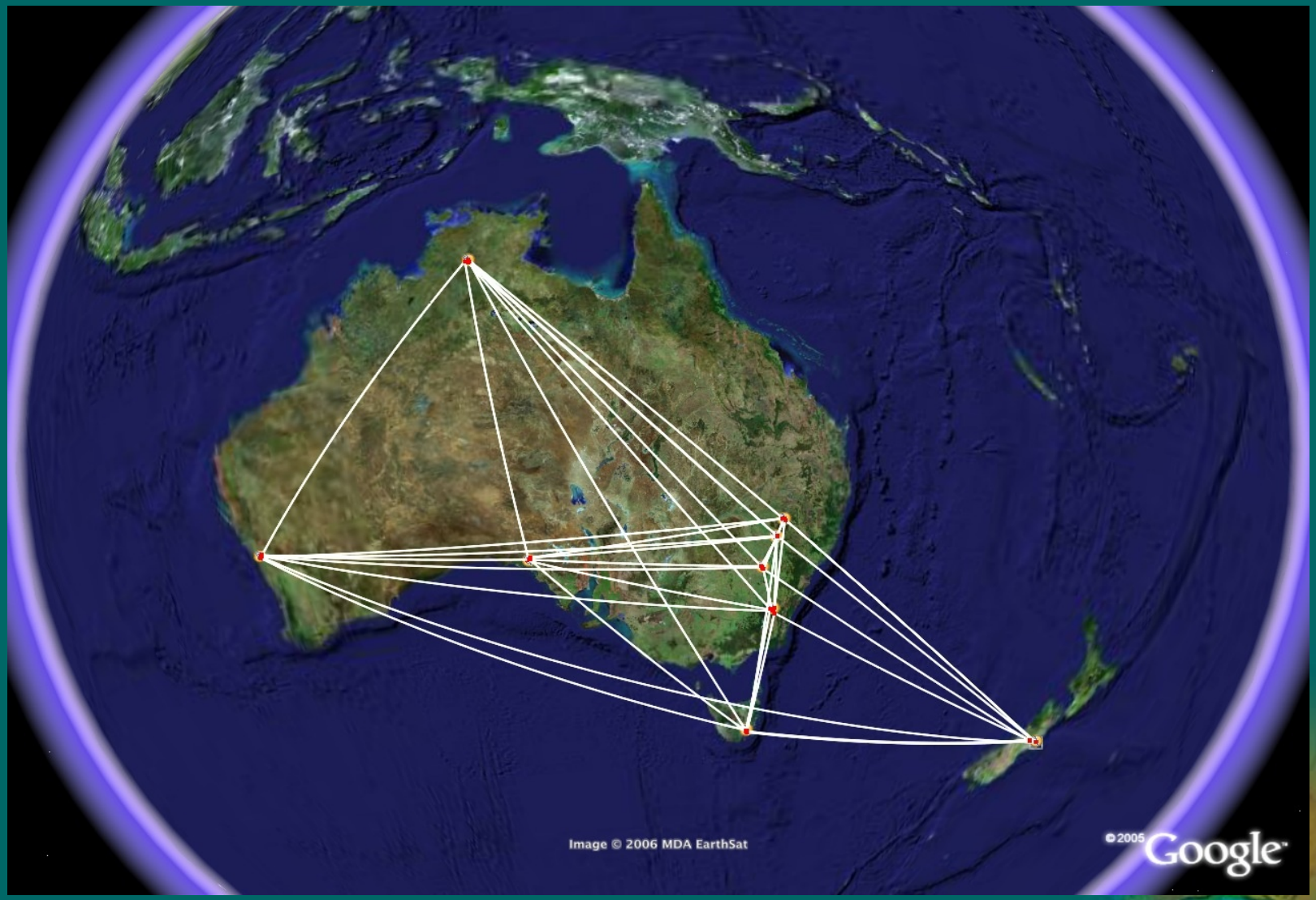
NCRIS Infrastructure Bid

- Reference frame enhancement
  - VLBI, SLR, Gravimetry, GPS
- Improve the Realisation in Australia
  - GPS network covering majority of applications




Ny Ålesund
Gilmore Creek
Yellowknife
Onsala
Svetloe
Effelsberg
Wettzell
Medicina
Simeiz
Matera
Madrid
Yebes
Noto
Nanshan
Brewster
Algonquin
Hancock
North Liberty
Westford
Owens Valley
Los Alamos
Greenbelt
Goldstone
Pie Town
Kitt Peak
Fort Davis
Seshan
Tsukuba
Mizusawa
Kashima34
Kashima 11
Koganei
Kokee Park
Mauna Kea
St. Croix
Fortaleza
Hartebeesthoek
Concepción
Tidbinbilla
Hobart
O'Higgins
Syowa
IVS Site
Cooperating VLBI Site
Map taken from IVS web page

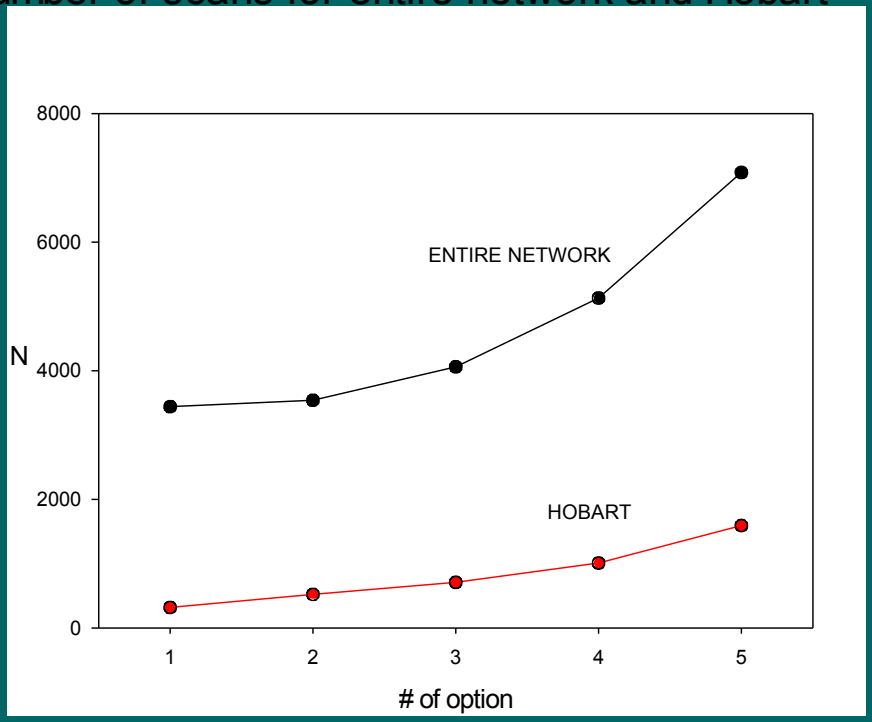
Proposed VLBI network



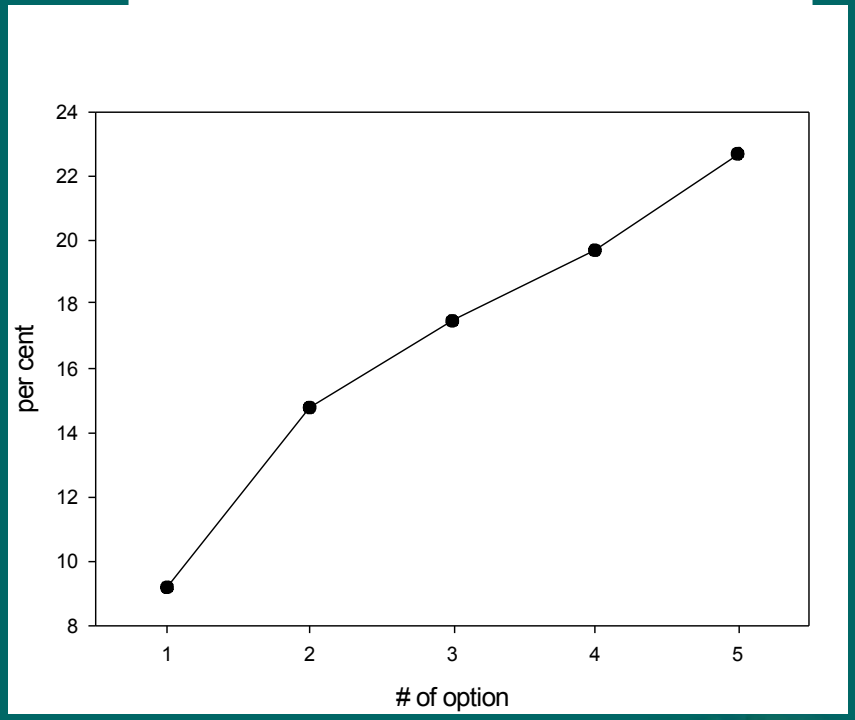
Simulations:

Geodetic results - 6 core stations +

Number of scans for entire network and Hobart



Relative number of scans for Hobart

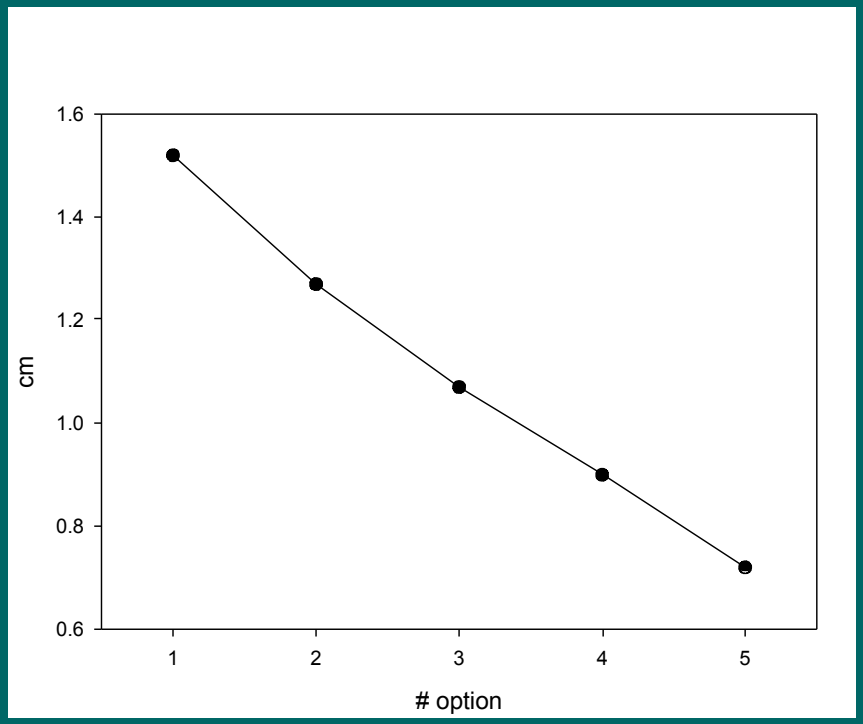


(1) + "slow" Hobart
(2) + Hartrao & "fast" Hobart
(3) + Hartrao & "fast" Hobart & Yarragadee
(4) + Hartrao & "fast" Hobart & Yarragadee & Katherine
(5) + Hartrao & "fast" Hobart & Yarragadee & Katherine & New Zealand

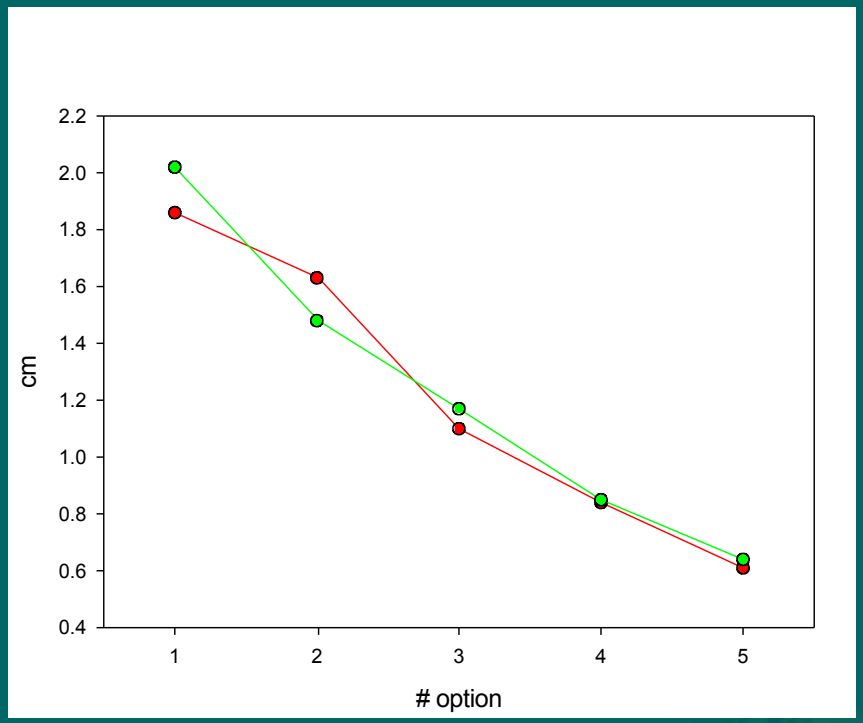
Simulations:

Geodetic results - 6 core stations +

Hobart height component accuracy



Hobart horizontal components accuracy



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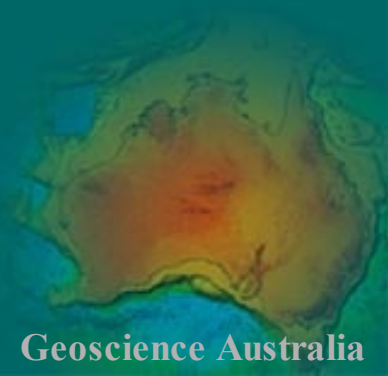
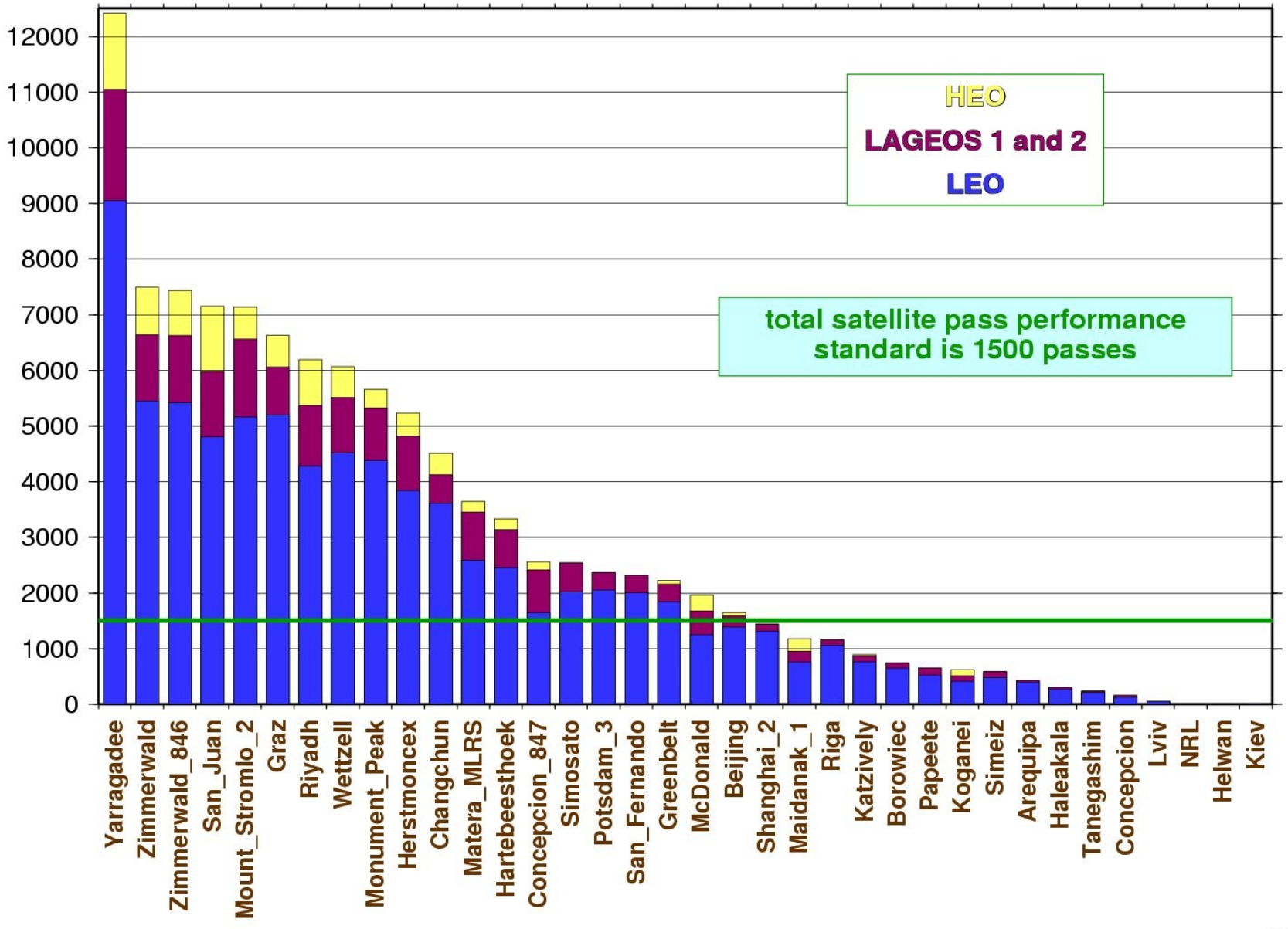
Stromlo Power Upgrade

- **Increased capability to range to the higher satellites (and daylight ranging):**
  - **GPS (2)**
  - **GLONASS (all)**
  - **Etalon**
  - **Galileo (27)**
  - OPTUS– B (Geostationary)
- **Clock Calibration for GNSS satellites**
- **Improved UT1 from SLR**

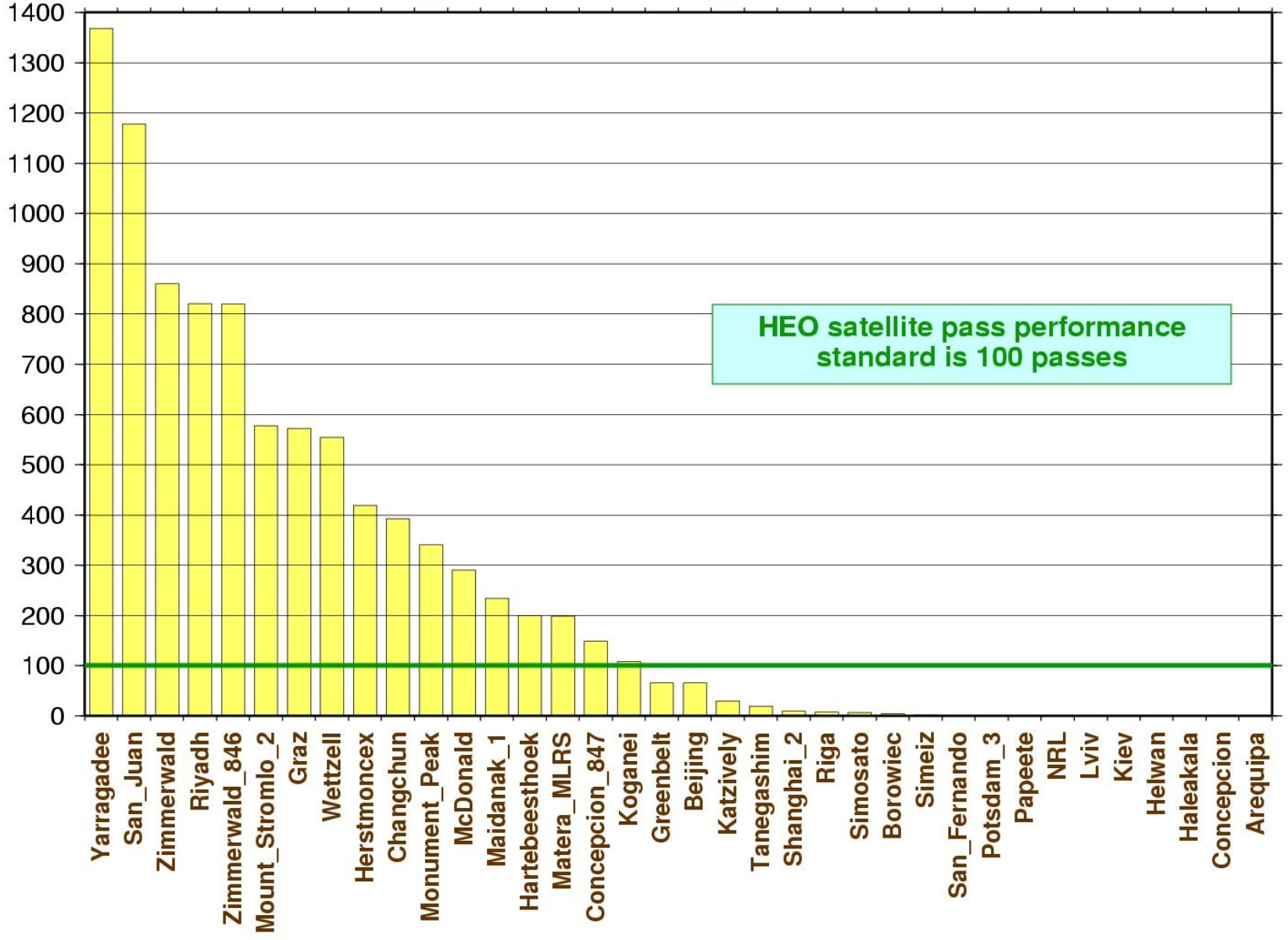


total passes
from April 1, 2006 through March 31, 2007



20070403

HEO passes
from April 1, 2006 through March 31, 2007



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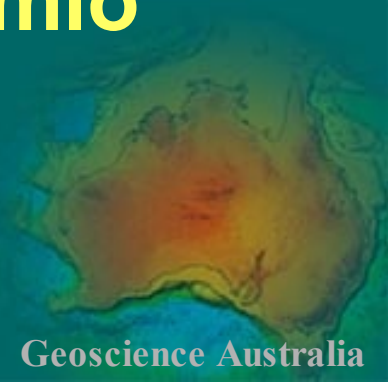
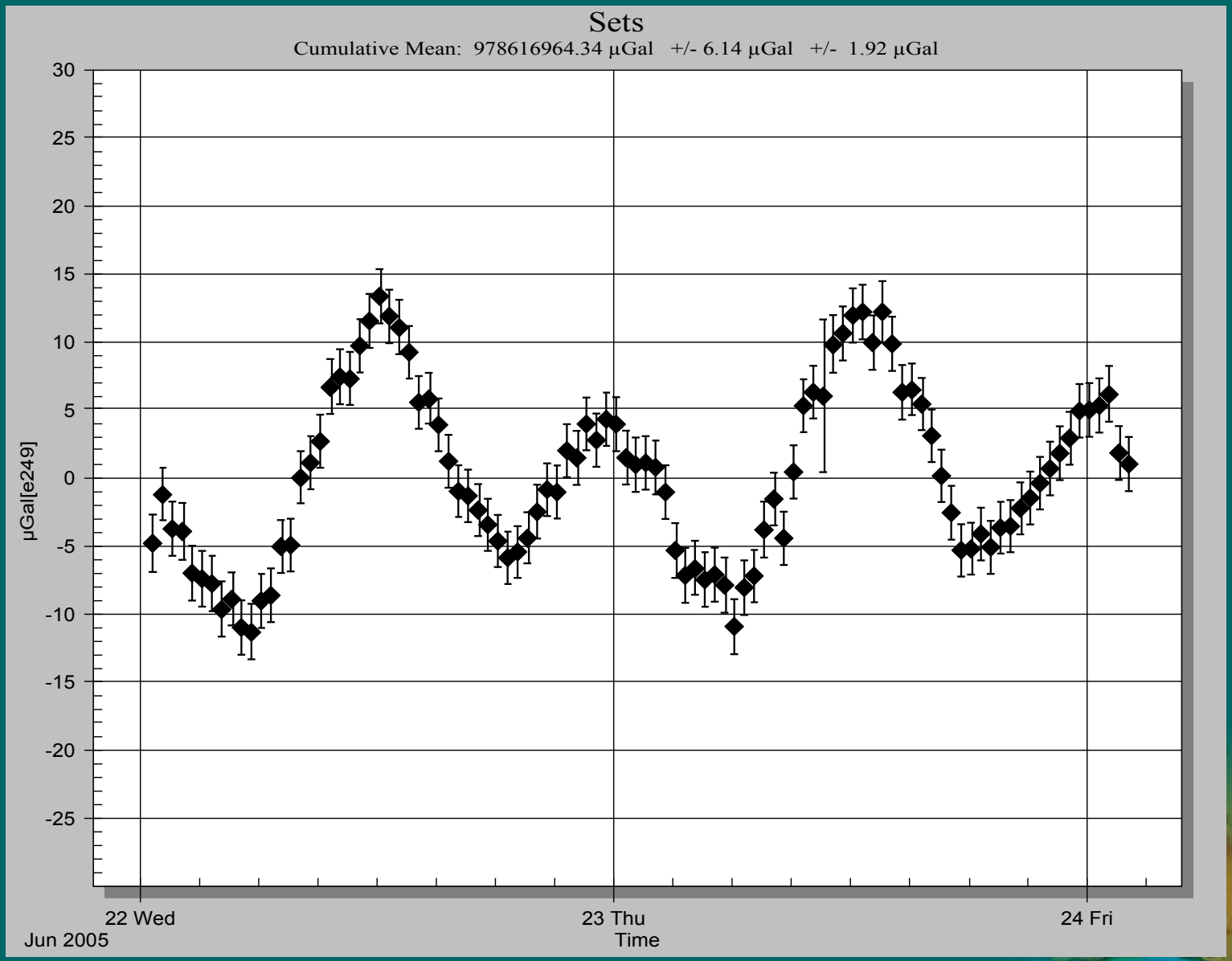
Gravity

- Acquire a FG5 for routine use around Australian Observatories
- Acquire capability to measure tidal site displacements for input into improved models
- Continued support for the Super conducting Gravity meter at Stromlo

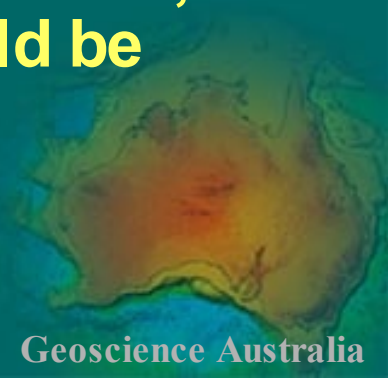


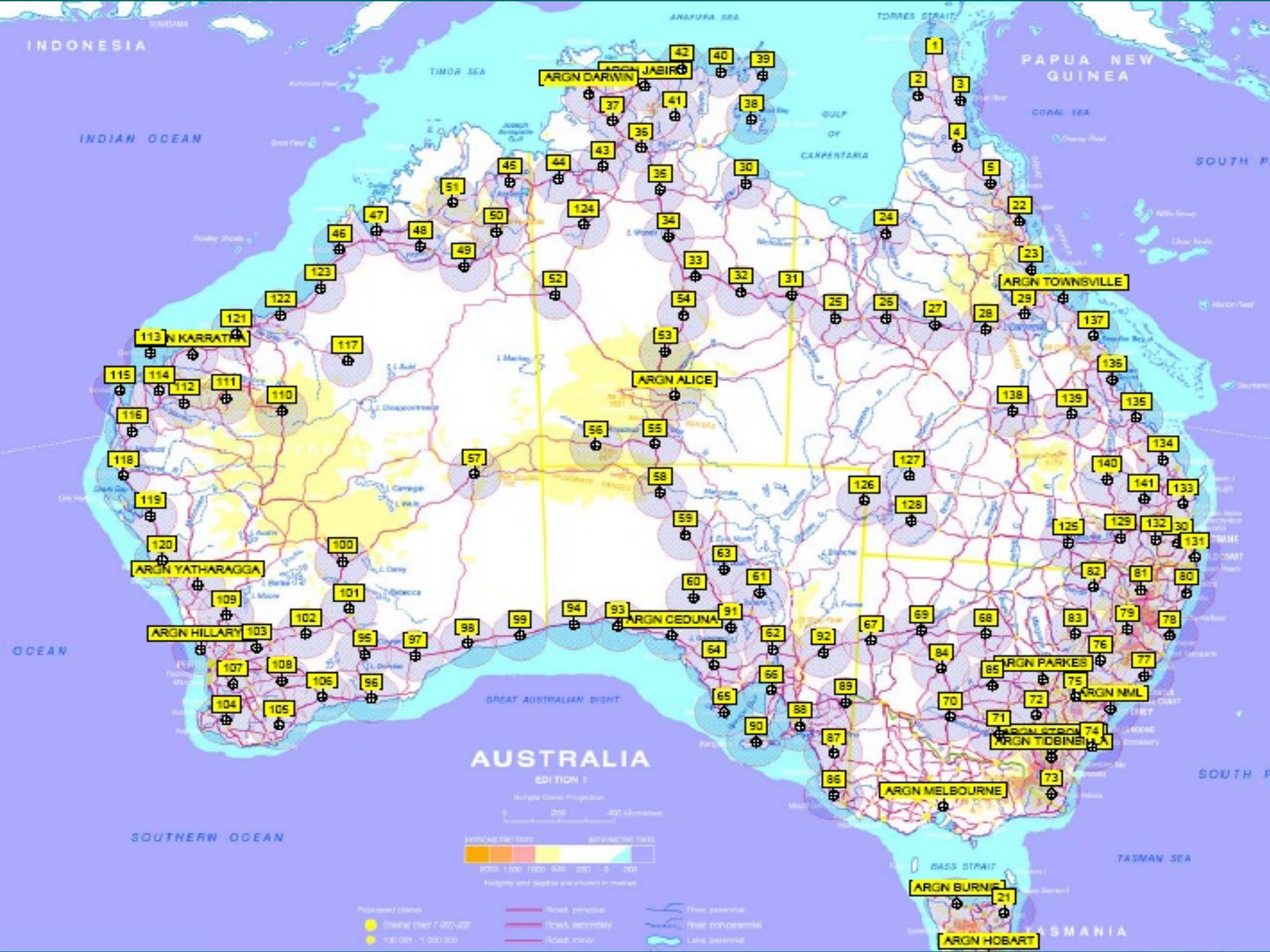
Gravity Residuals (FG5 – Schwiderski OT model)



Proposed GPS network

- Cross continental GNSS transects for measuring intra-plate deformation
- Station spacing of 200km, resulting in users not being more then 100km from nearest CORS station
- Circum-continental coverage for measuring plate dynamics, and sea level change
- Major road and rail routes covered
- Major agricultural areas covered
- Major population zones covered
- Major areas of environmental research covered
- Some of the existing mining industry areas covered, although it is envisaged that this number would be increase by mine operators adding their sites collaboratively to the network.
- Major tourism areas covered




INDONESIA
ARAFURA SEA
TORRES STRAIT
PAPUA NEW GUINEA
TIMOR SEA
INDIAN OCEAN
CORAL SEA
GULF OF CARPENTARIA
SOUTH P
ARGN DARWIN
ARGN JABIRU
ARGN TOWNSVILLE
ARGN KARRATHA
ARGN ALICE
ARGN YATHARAGGA
ARGN HILLARY
ARGN CEDUNA
ARGN PARKES
ARGN NML
ARGN TIDBINBILLA
ARGN MELBOURNE
ARGN BURNIE
ARGN HOBART
OCEAN
GREAT AUSTRALIAN BIGHT
AUSTRALIA
EDITION 1
SOUTHERN OCEAN
BASS STRAIT
TASMAN SEA
SMANIA

Conclusion

- Australia is making a significant investment in infrastructure to aid the refinement of the ITRF
- Funding is achievable by making the linkage to national benefit including all of the down stream applications
- Next step is using the data : We look forward to working with you !!