Australian Government

Geoscience Australia

Australian – New Zealand Geodetic VLBI Network Project

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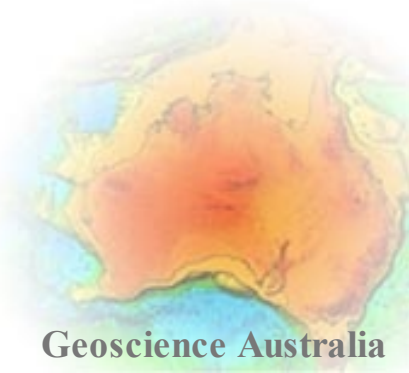
International VLBI Service (IVS)

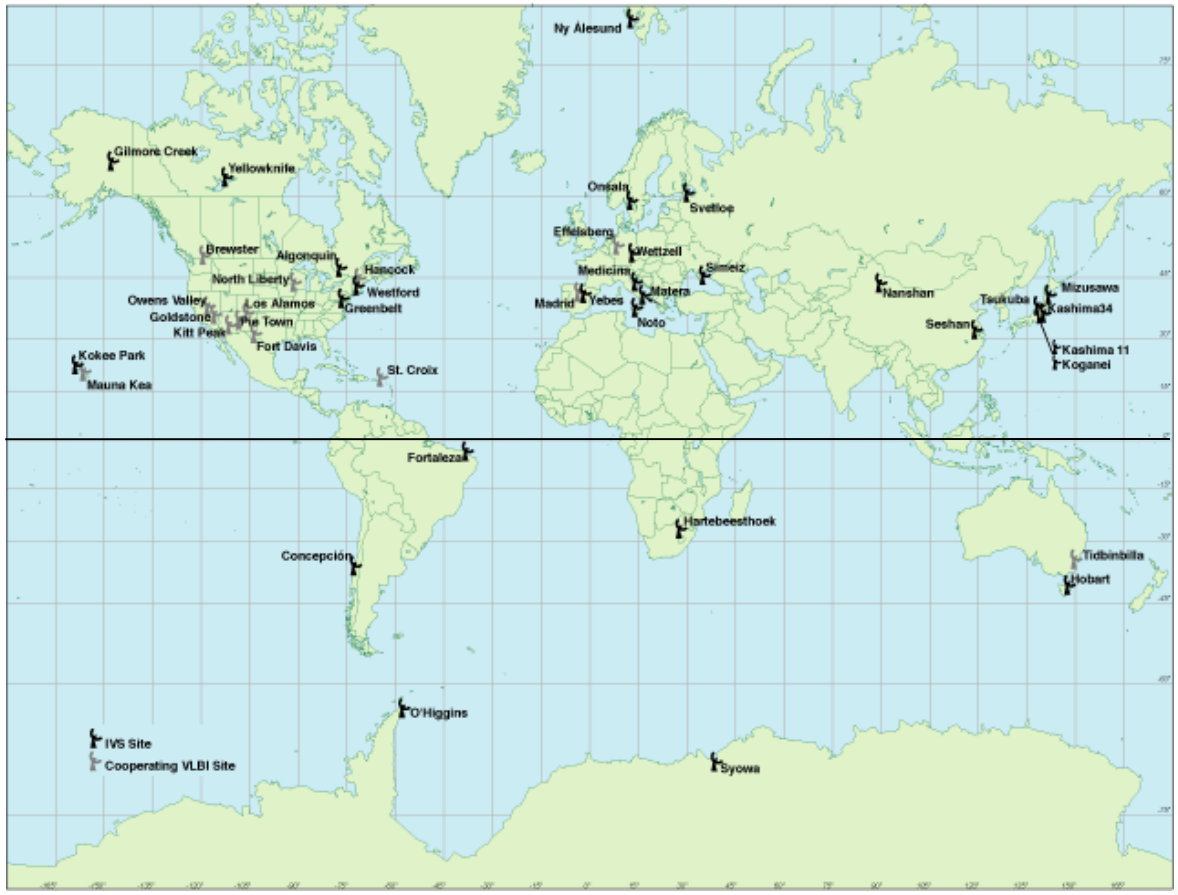
Historically, the most of geodetic VLBI stations are in the Northern Hemisphere

North: 20 IVS stations + ~20 of astronomical non-IVS dishes

South: 6 IVS stations + 2 non-IVS sites (Tidbinbilla and Parkes)



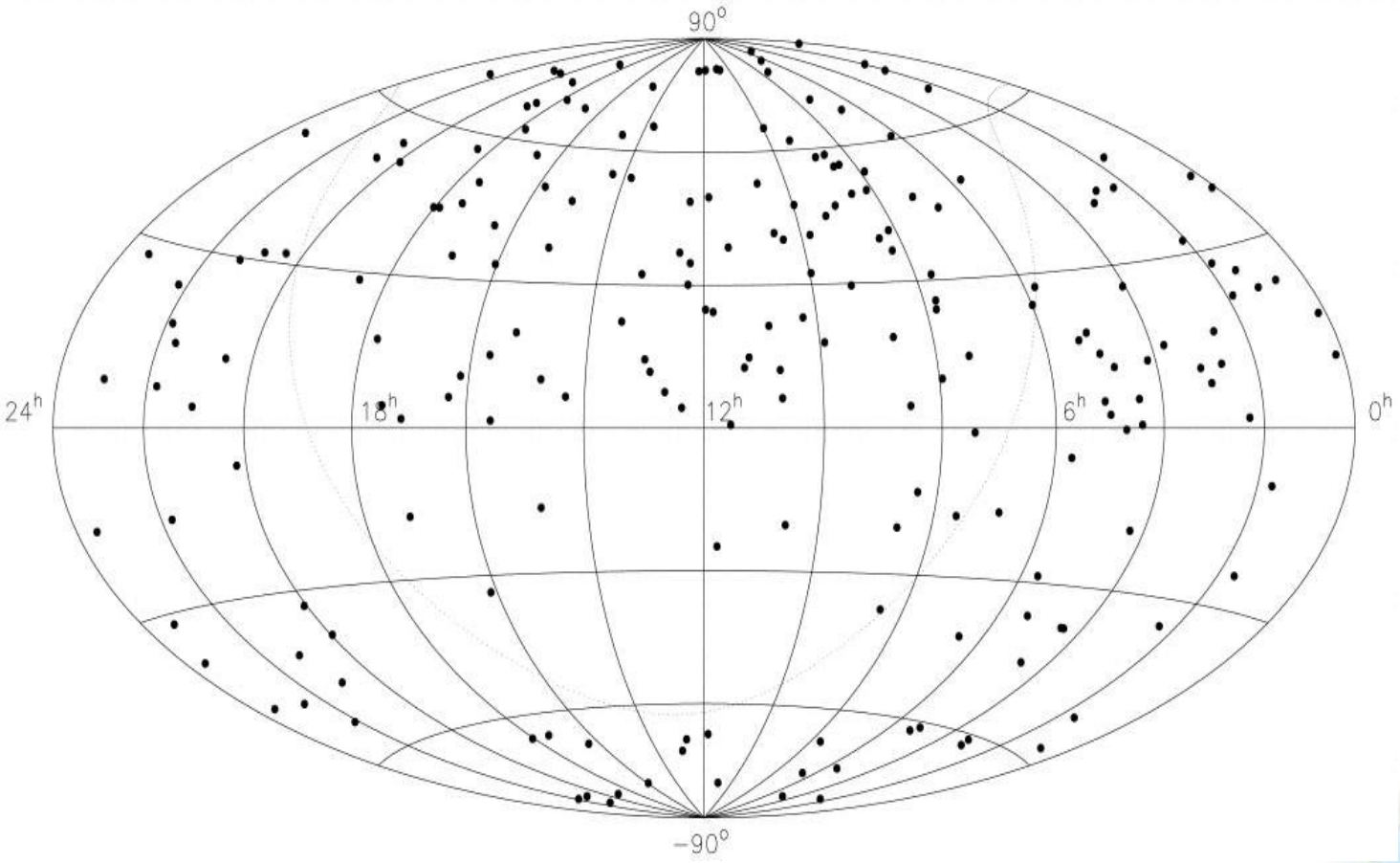
International VLBI Service for Geodesy and Astrometry



Northern Hemisphere: 20 IVS stations

Southern Hemisphere: 6 IVS stations

ICRF defining sources

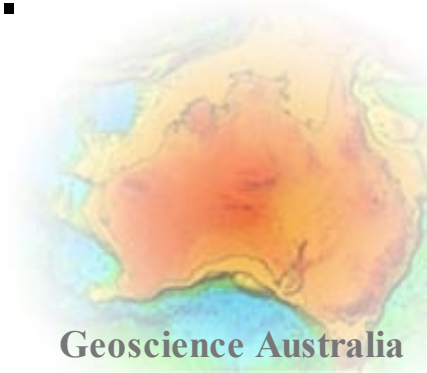


212 'defining' sources (Ma et al, 1998)

International VLBI Service (IVS)

Almost all dishes were designed for astronomical research – big size; high cost; low slewing rate; significant mount and shape deformations.

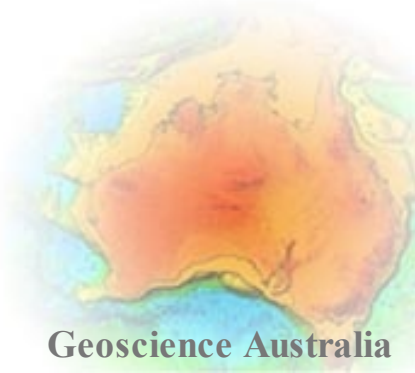
New strategy – small size; low cost; high slewing rate; minimize mount and shape deformations.



International VLBI Service (IVS)

- stated: distribution of the IVS stations is not optimal

- recommended: to build several stations in the Southern Hemisphere (Australia, New Zealand, Antarctica)

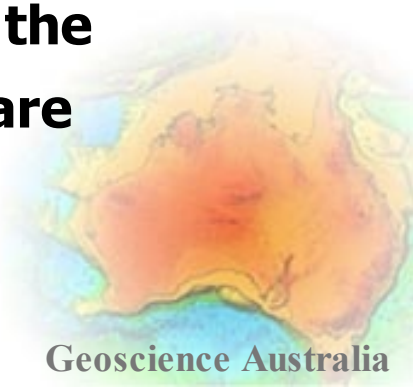


Australian – New Zealand network

Two independent proposals - NCRIS (Australia) and (RIAG) New Zealand for 3 new dishes in Australia and 1 new dish and upgrade of 1 old 11-meter dish in New Zealand;

Support of the Australian part has been released on 27-Nov-2006 (The Minister web site)

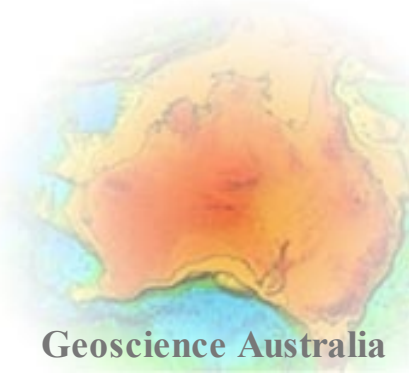
Auckland Uni has signed a contract to purchase the 12 m Patriot dish, but the funds for equipment are still wanted

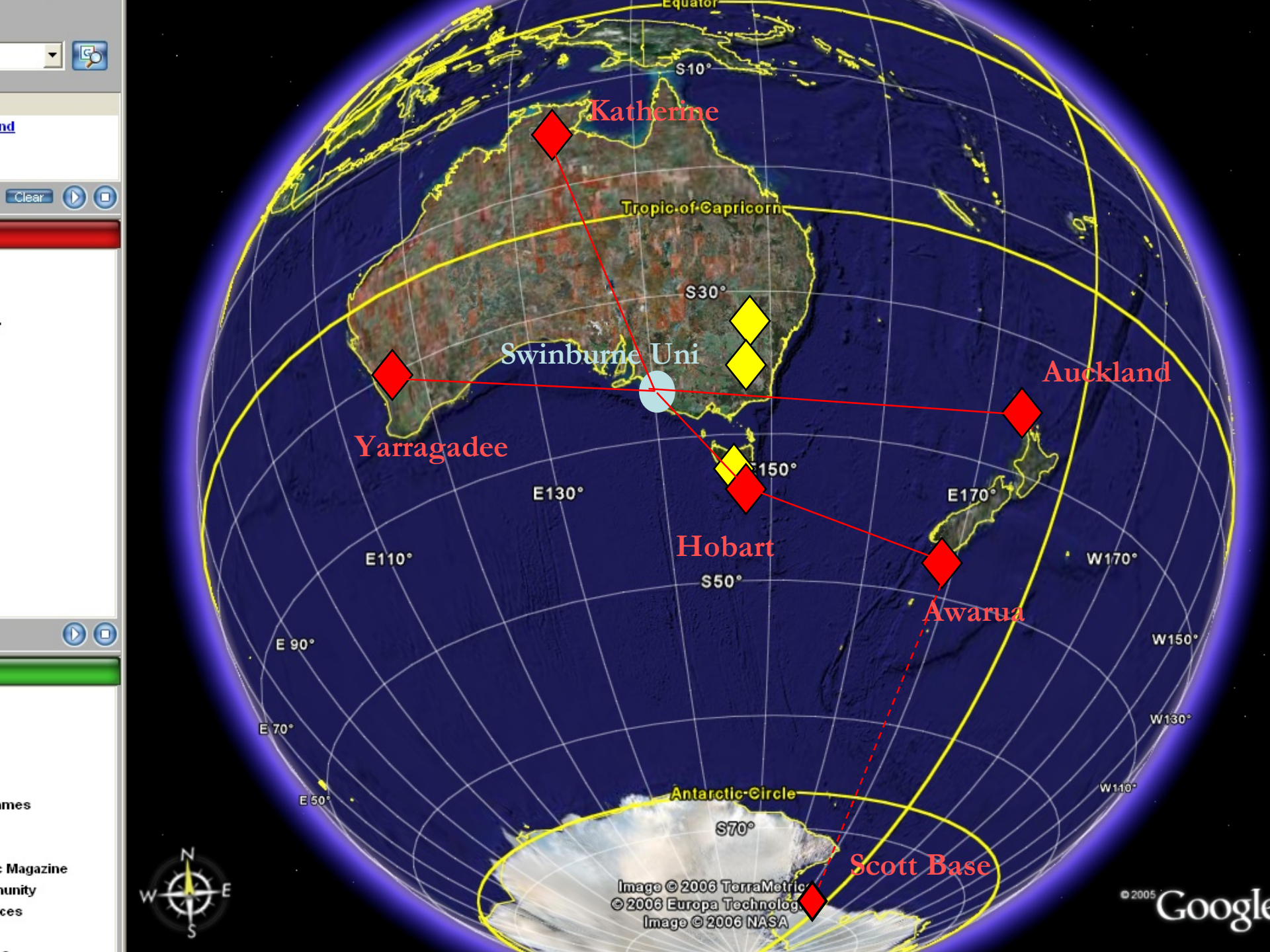


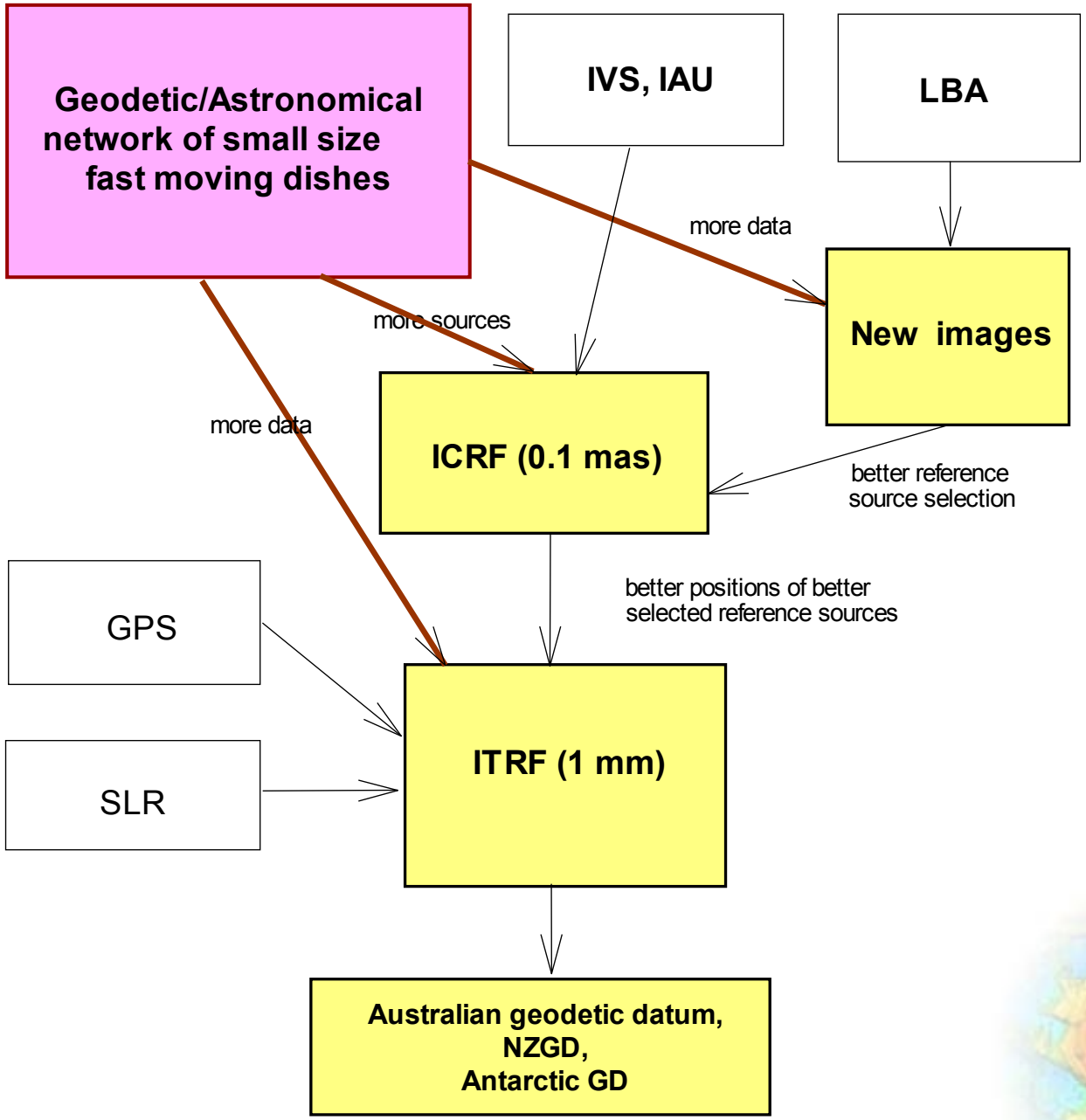
Australian – New Zealand network

Software correlator in Swinburne University (Melbourne), Prof. Steven Tingay

Near-real time correlation of geodetic VLBI observations and data analysis to improve timeliness of the results delivery and control technical performance of equipment




Equator
S10°
Katherine
Tropic of Capricorn
S30°
Swinburne Uni
Auckland
Yarragadee
E150°
E130°
E170°
Hobart
E110°
W170°
S50°
Awarua
E 90°
W150°
E 70°
W130°
E 50°
W110°
Antarctic Circle
S70°
Scott Base
Image © 2006 TerraMetrics
© 2006 Europa Technologies
Image © 2006 NASA
© 2005 Google


Geodetic/Astronomical network of small size fast moving dishes
IVS, IAU
LBA
more data
New images
more sources
more data
ICRF (0.1 mas)
better reference source selection
GPS
better positions of better selected reference sources
SLR
ITRF (1 mm)
Australian geodetic datum, NZGD, Antarctic GD

Organizations involved

Astronomy

ATNF (CSIRO), Sydney

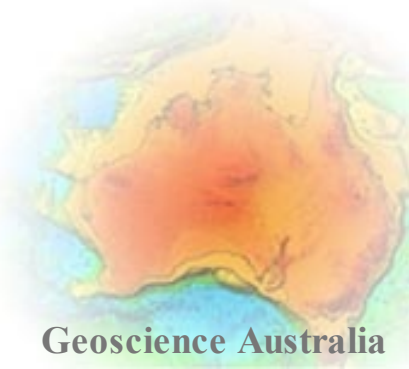
Swinburne University, Melburne

University of Tasmania, Hobart

Geodesy

Geoscience Australia, Canberra

Australian National University, Canberra

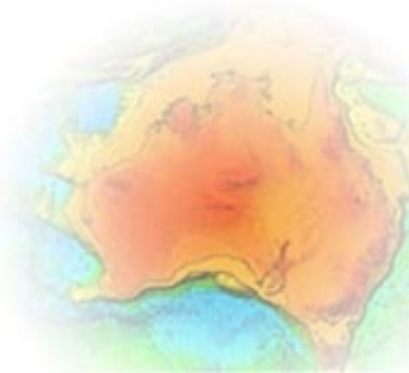


Strategy

To develop infrastructure to support collaboration between different groups of scientists

50% of time – for geodetic VLBI program (IVS)

50% of time – for astronomical/astrophysics programs



New radiotelescope design

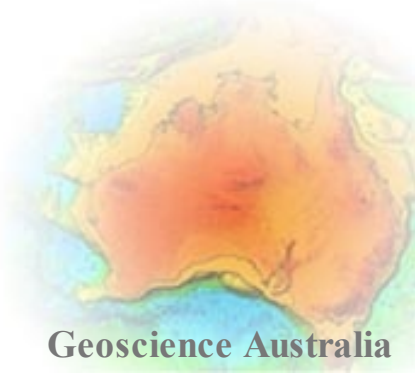
Small size (< 20 meter);

Near real-time VLBI;

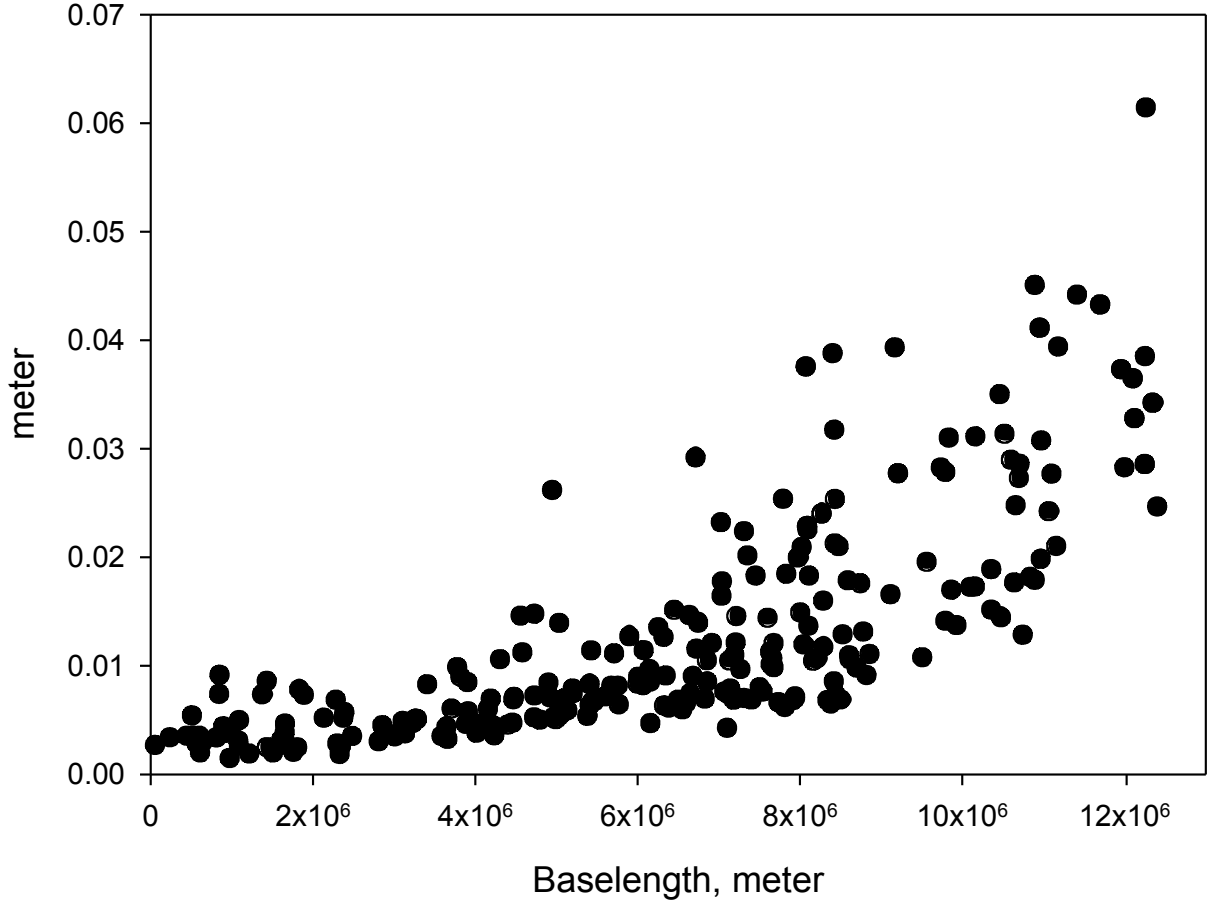
High slew rate (> 5 deg/sec);

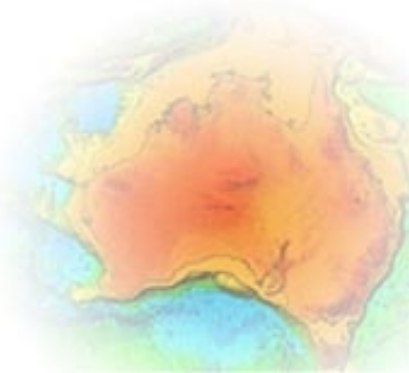
New equipment (broad band receiver 1-32 GHz)??;

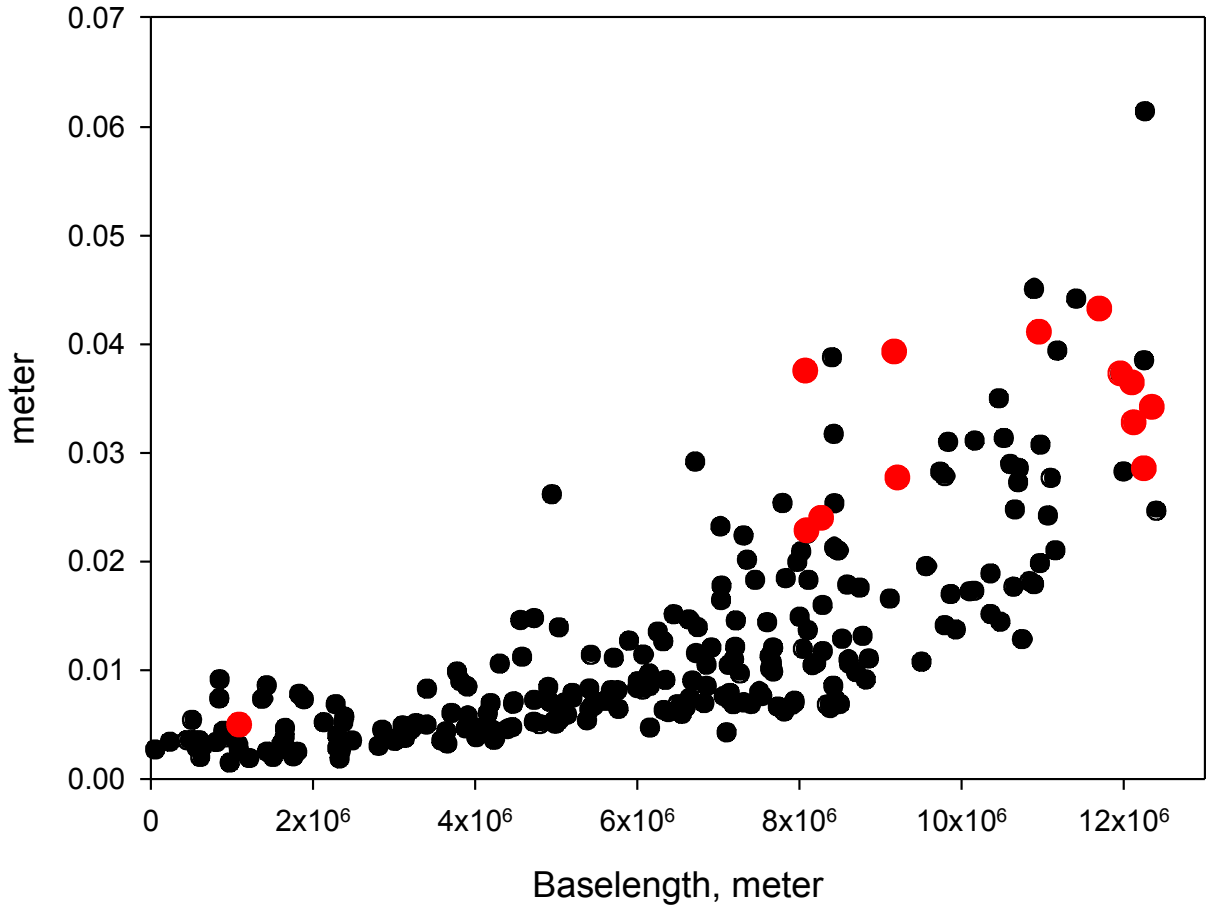
5 deg elevation angle limit



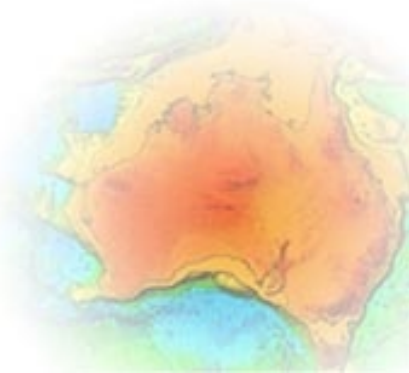
Repeatibility vs baselength

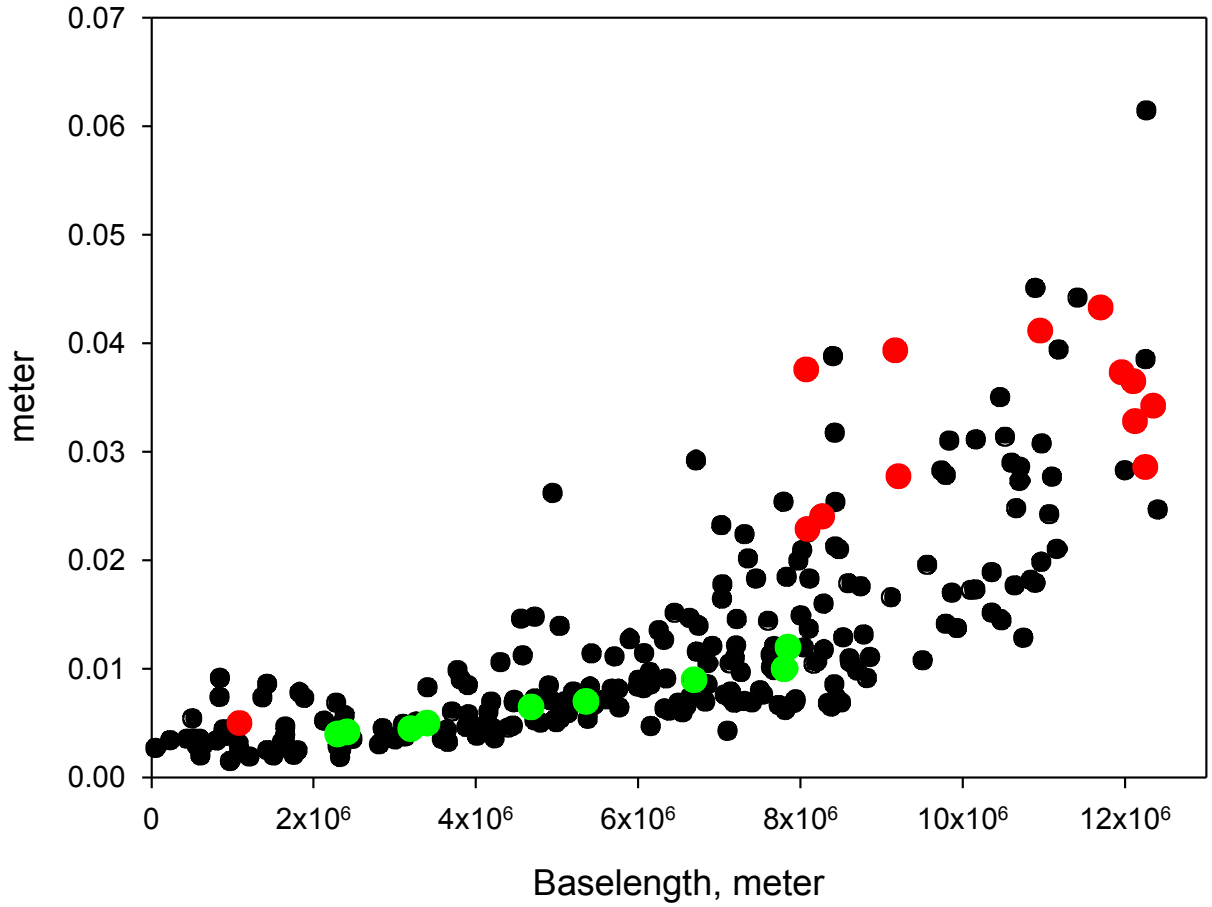





Repeatibility vs baselength
meter
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0
2x10^6
4x10^6
6x10^6
8x10^6
10x10^6
12x10^6
Baselength, meter

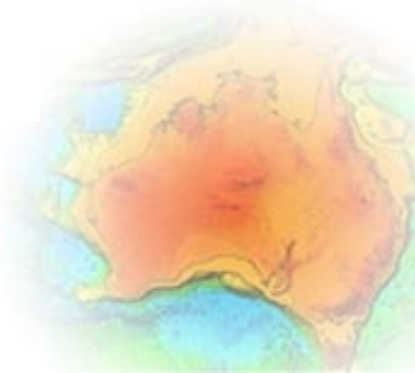
Hobart





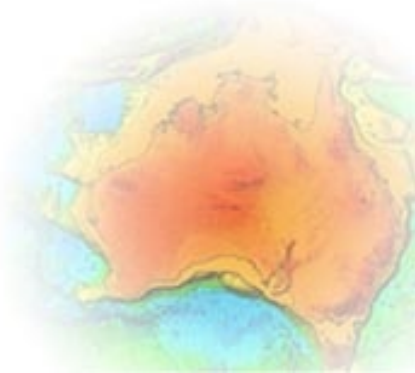
Hobart

New sites



Simulations (GSFC)
thanks to Dirk Behrend

- **Realistic schedule (EOP), 256 Mbps, geodetic sources;**
- **six Northern hemisphere sites (Wett-West-NyAl-Fort-Kokee-Tsuk);**
- **Hartrao (South Africa);**
- **Selection of Australian and New Zealand sites;**
- **Hobart: two options ("old" – existing dish; "new" – proposed dish)**



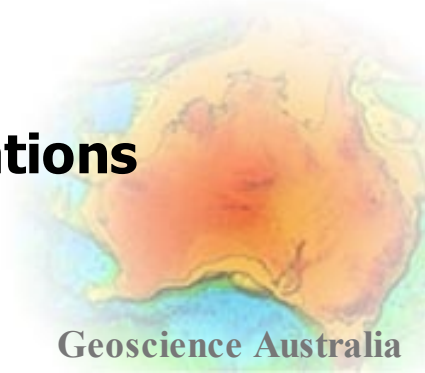
Slewing rate (Hobart)

1 deg/sec

80% of time – slewing; 20% of time - observations

5 deg/sec

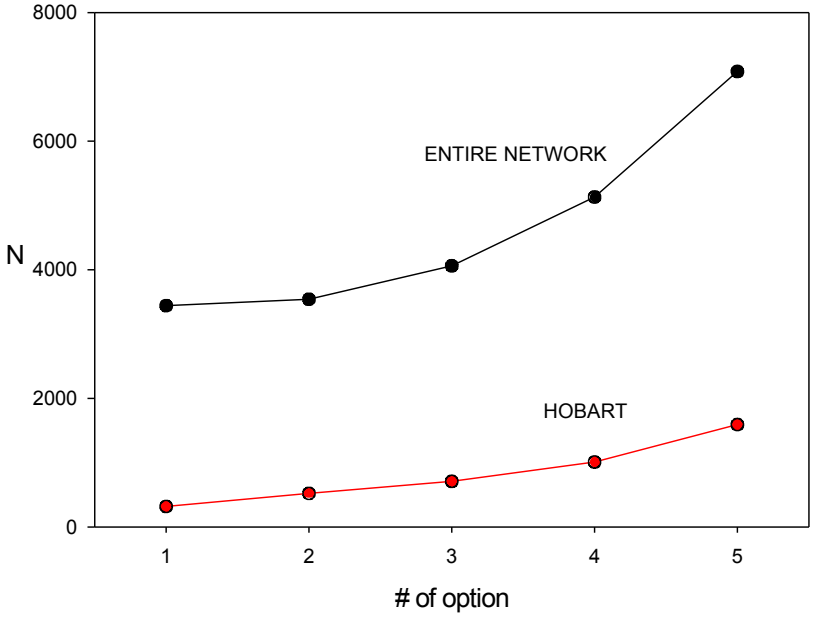
50% of time – slewing; 50% of time - observations



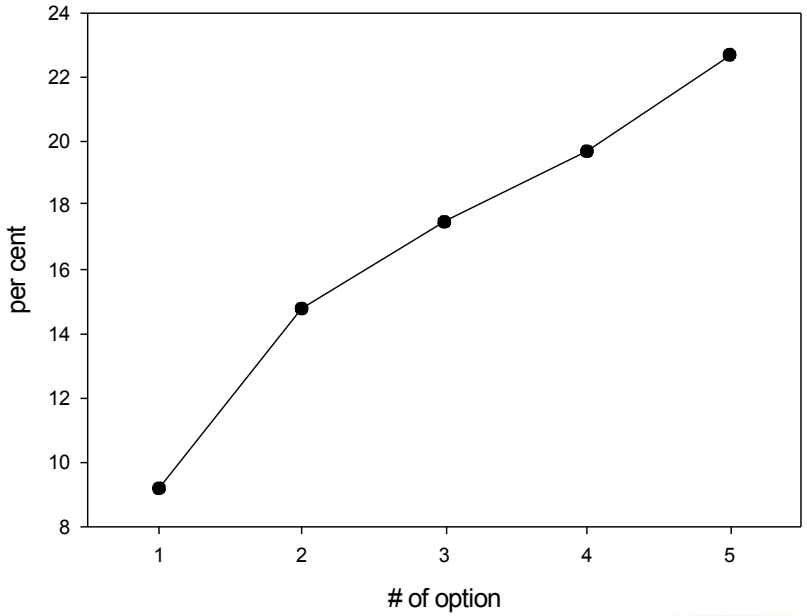
Simulations:

Geodetic results - 6 core stations +

Number of obs for entire network and Hobart



Relative number of obs for Hobart

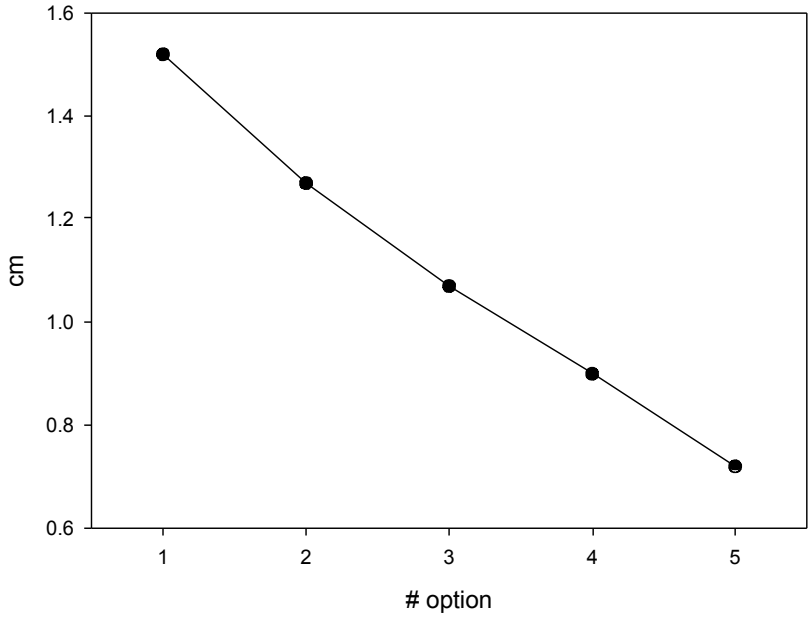


(1) + "old" Hobart
(2) + Hartrao & "new" Hobart
(3) + Hartrao & "new" Hobart & Yarragadee
(4) + Hartrao & "new" Hobart & Yarragadee & Katherine
(5) + Hartrao & "new" Hobart & Yarragadee & Katherine & New Zealand

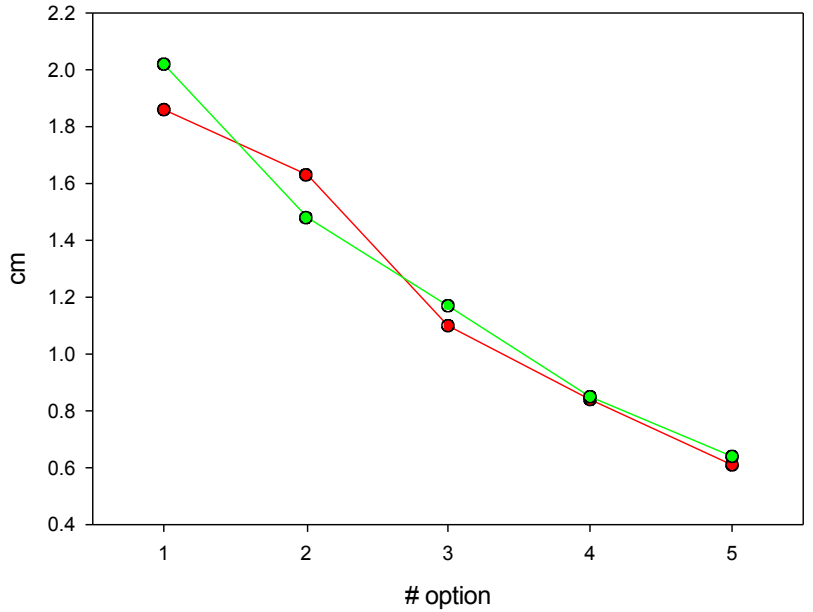
Simulations:

Geodetic results - 6 core stations +

Hobart height component accuracy



Hobart horizontal components accuracy



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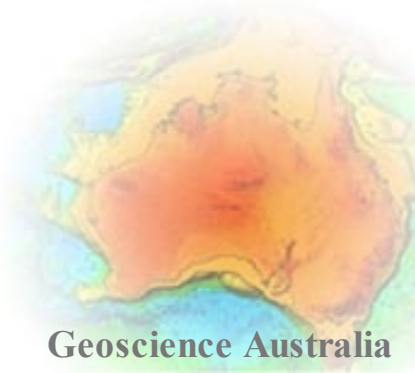
(5) + Hartrao & "new" Hobart & Yarragadee & Katherine & New Zealand

Hobart, 26-meter antenna

Hobart26 problems

- geographic isolation – limited area of mutual visibility;
- antenna offset (819 cm);
- shape deformation;
- antenna mount deformation;
- low slewing rate (Az + El = 1 deg/sec);



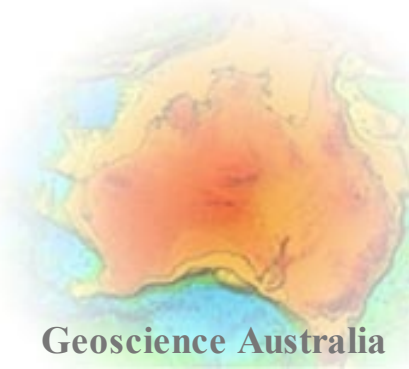
12m Antenna at Patriot

Expected scientific results

VLBI site positions: accuracy of daily estimates ~ 1-2 mm

Quasar positions: accuracy of the future ICRF catalogue in the southern hemisphere ~ 0”.1

Intra plate deformations of Australian continent?



Schedule

June-August, 2007 – sign contract

Middle of 2008 – dishes delivery and installation

Middle of 2009 – start of operational work