Australian Government
Geoscience Australia

# Improving the Geodetic Infrastructure of the Asia-Pacific Region

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*XXIV FIG International Congress 2010, Sydney, Australia*

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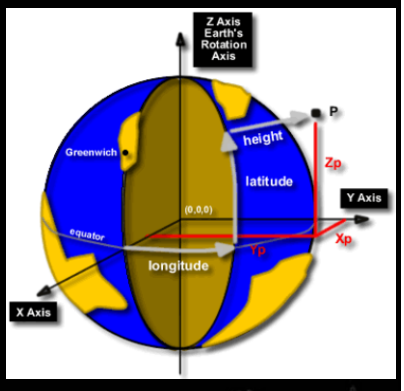
## Reference frames and positioning

- Cornerstone of all geospatial measurements
  - Earth-observation, mapping, positioning, navigation and timing
- Applications
  - mining, agriculture, construction
  - emergency, land, utility and asset management
  - science e.g., hazard assessment, sea-level change, crustal dynamics

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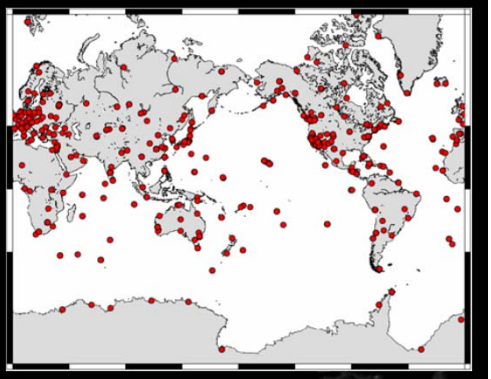
## Reference frames: global

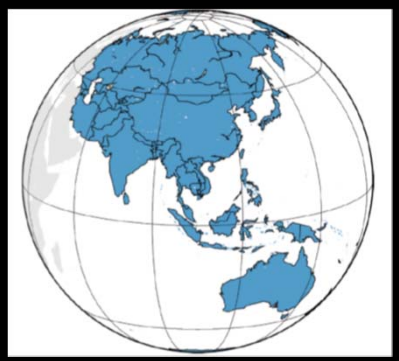
- International Terrestrial Reference Frame
  - Global, consistent, accurate, dynamic
  - Determined using GPS, SLR, VLBI, DORIS
  - Continuously refined
- Densification of ITRF occurs on a regional basis e.g., EURREF





## Asia-Pacific (AP) Region

- Significant component of the Earth's
  - Area, population and economic output
- Access to high quality positioning infrastructure is essential for effective competition with the other regions, including Europe and the Americas
- Coordination of regional geodetic activities not well developed in the AP



## PCGIAP Efforts

- Who
  - United Nations Regional Cartographic Conference for Asia and the Pacific (UNRCC)
  - Established (1994): Permanent Committee for GIS infrastructure, Asia-Pacific (PCGIAP)
  - National survey agencies and others
- Aim
  - Establish and maintain a precise geodetic network across region supporting geodetic activity
- Activity
  - Episodic GPS observations, 1997-2009 (ongoing).

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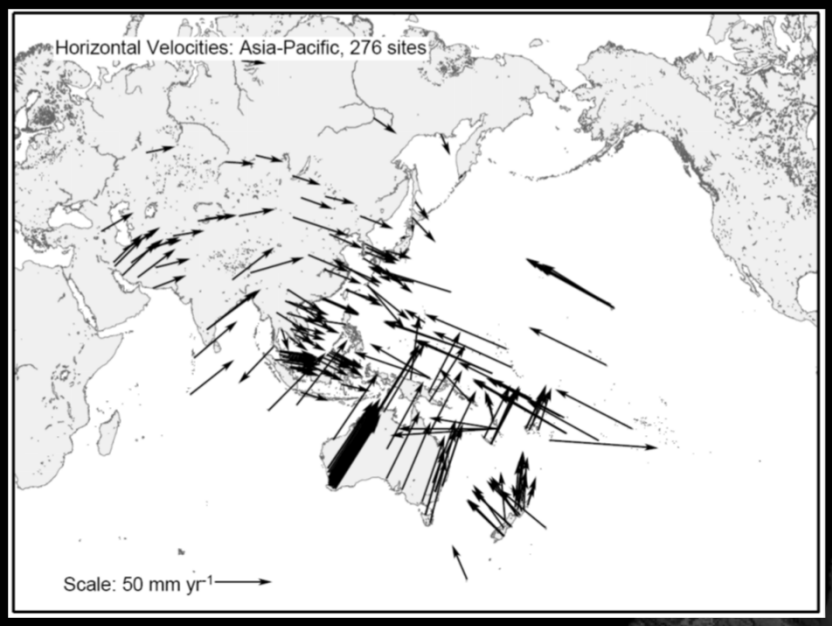


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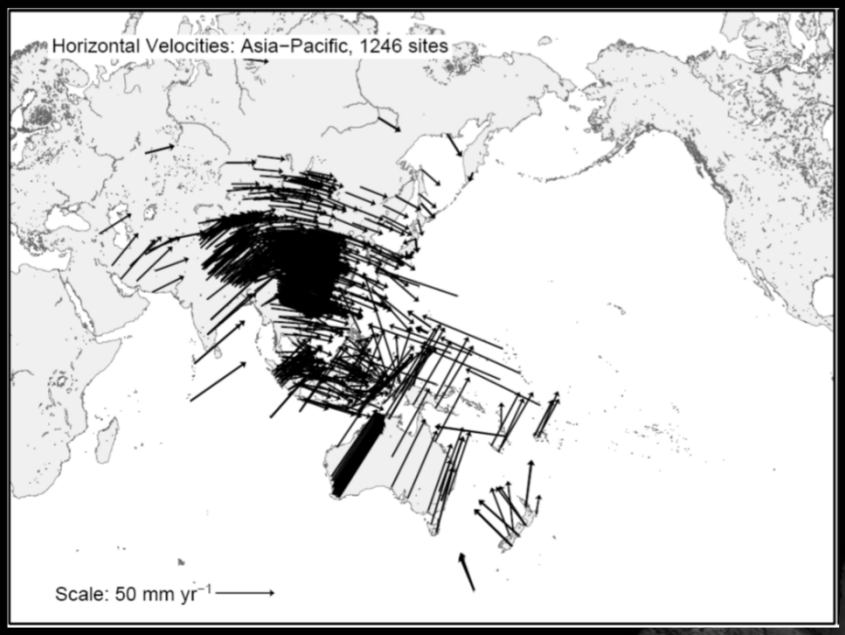
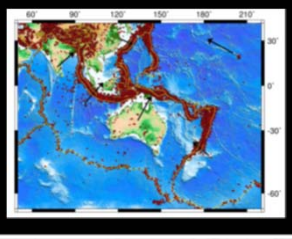
## IAG Efforts

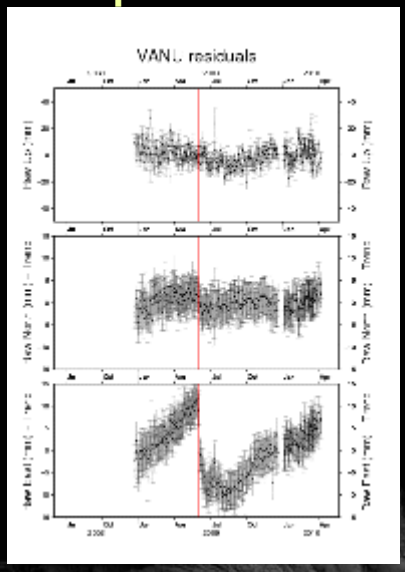
- International Association of Geodesy (IAG), Commission 1 (reference frames)
  - Sub-commission 1.3 - Regional dense velocity field Working Group
    - Asia-Pacific region
    - 1200+ velocity estimates
  - Incorporates crustal deformation measurements across the region
  - Generally episodic measurements





## Episodic observations are problematic

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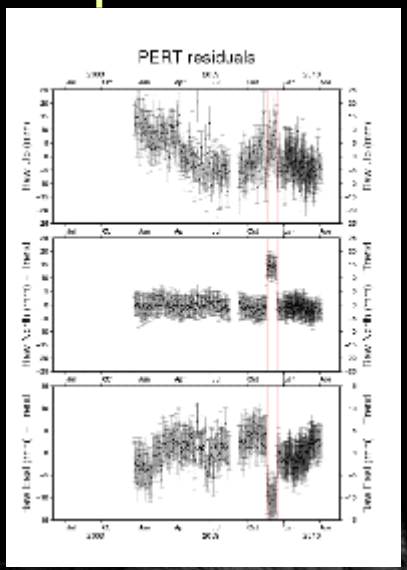
## Episodic observations are problematic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## Joint IAG and PCGIAP Initiative

- Asia-Pacific Reference Frame (APREF)
- Call for Participation: 1 March 2010
- APREF mandated by UNRCC Resolution
- Endorsed by the UNOOSA, FIG and IGS




## Asia-Pacific Reference Frame Project

- The broad objective of APREF is to
  - Create and maintain an accurate and densely realised geodetic framework, based on continuous observation and analysis of GNSS data
- Major benefit for participates
  - Continuous link between national datums and CORS networks to the ITRF

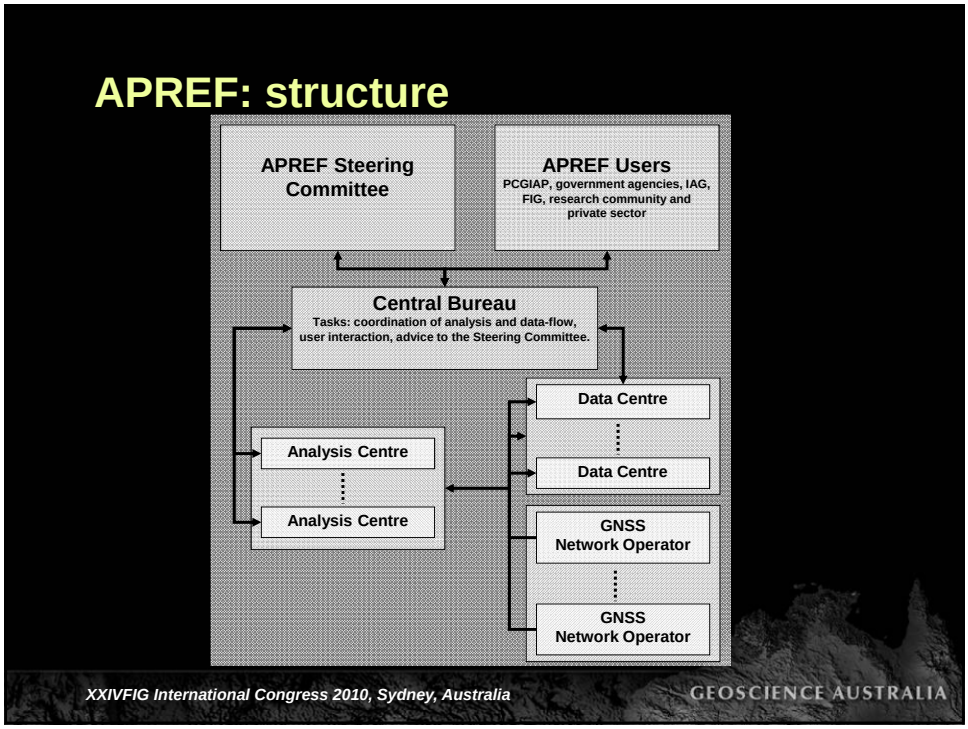
## Asia-Pacific Reference Frame Project

- Open to all organisations involved with CORS data collection and/or analysis
  - Government, research, private
- Responding organisations must be able to make a long-term commitment
  - 2+ years
- APREF will provide an opportunity and a forum towards improving the regional geodetic infrastructure
  - Next generation geodetic infrastructure



## APREF: Products and benefits

- An authoritative source of coordinates and their respective time-series for geodetic stations in the Asia-Pacific region
  - Provided with a time delay of 3-4 weeks
  - High quality connection to ITRF
- Improved access to regional CORS data
  - For the benefit of all


APREF: structure
APREF Steering Committee
APREF Users
PCGIAP, government agencies, IAG, FIG, research community and private sector
Central Bureau
Tasks: coordination of analysis and data-flow, user interaction, advice to the Steering Committee.
Data Centre
Data Centre
Analysis Centre
Analysis Centre
GNSS Network Operator
GNSS Network Operator
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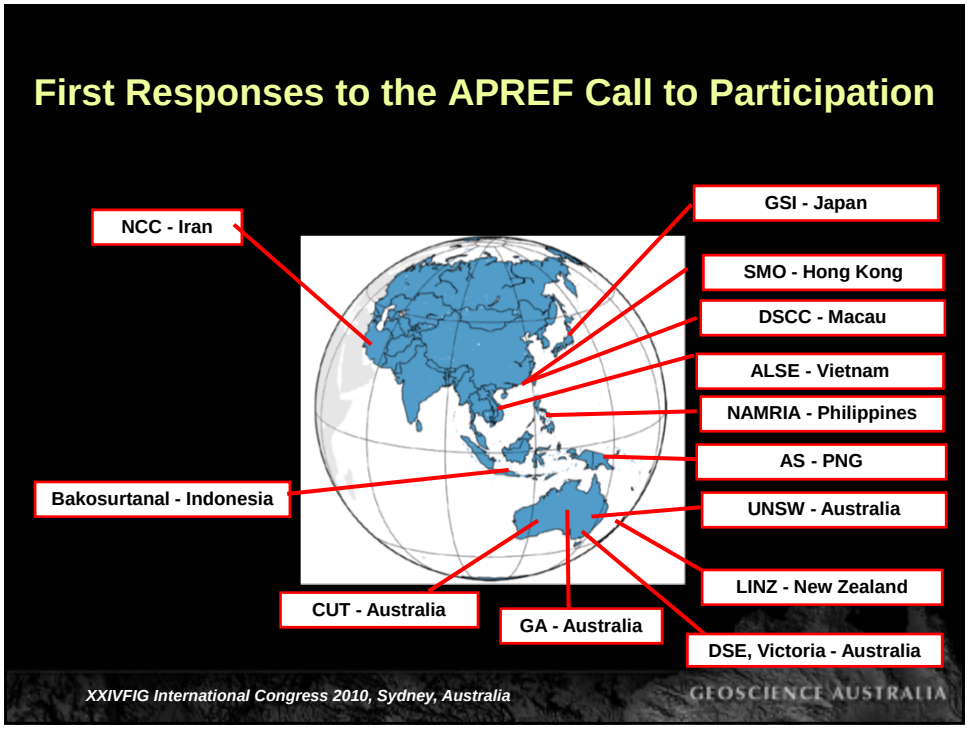
First Responses to the APREF Call to Participation
NCC - Iran
GSI - Japan
SMO - Hong Kong
DSCC - Macau
ALSE - Vietnam
NAMRIA - Philippines
AS - PNG
Bakosurtanal - Indonesia
UNSW - Australia
LINZ - New Zealand
CUT - Australia
GA - Australia
DSE, Victoria - Australia
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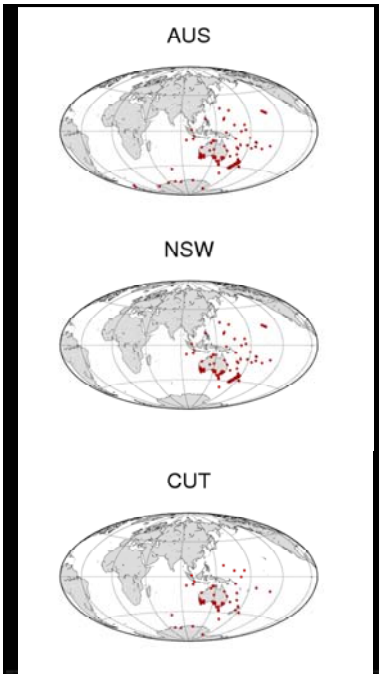
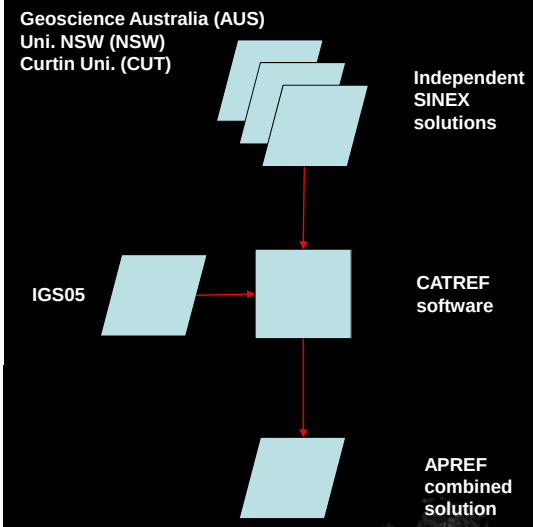
## APREF First results – validation study

- Analysis Centres
  - Geoscience Australia (AUS)
  - Curtin University of Technology (CUT)
  - University of NSW (NSW)
- Test data from 2010
- SINEX combination
  - Geoscience Australia
  - CATREF software (Altamimi – ITRF)



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## RMS Residuals w.r.t. Combination

| | East (mm) | North (mm) | Up (mm) |
|---|---|---|---|
| Geoscience Australia | 0.6 | 0.4 | 1.6 |
| Uni. NSW | 2.7 | 2.0 | 8.8 |
| Curtin Uni. | 0.6 | 0.6 | 1.9 |

- GPSWEEK 1568 (24/1/2010 – 30/1/2010)



## Final Remarks

- APREF Call for Participation will remain open until January 2011
- APREF would benefit from broader participation
  - More CORS contributions
    - commitments of 2+ years
  - More independent Analysis Centres

## Final Remarks

- For more information, APREF Central Bureau
  - john.dawson@ga.gov.au
- APREF Steering Committee
  - John Dawson, Australia
  - Shigeru Matsuzaka, Japan
  - Hanjiang Wen, China
  - Cecep Subarya, Indonesia
  - Hadi Vaezi, Iran
  - Chris Rizos, International Association of Geodesy