

GGOS in Asia

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General Facts of Asia

- Asia is the world's largest and most populous continent
 - 4 billion people (60% of the world's current human population)
 - 6 sub-regions and 37 countries
 - 7 plates of 14 major tectonic plates
 - 8.6% of the Earth's total surface area (or 29.4% of its land area)
 - 13 cities in top twenty largest metropolitan areas
 - 18 Earthquakes of 31 Major earthquakes in 21^{st} century
 - 45 languages used by more than 50 million native speakers

from Wikipedia

GNSS

• Nationwide GPS Networks in East Asia

 China (CMONOC)
 1,000

 Japan (GEONET)
 1,200

 Korea (KGN)
 85

 Taiwan
 200

 ~2,500

- IGS in Asia
 67 sites in 336 active IGS stations
 1 GDC, 1 RDC, 1 ODC
 0 AC, 0 GNAAC, 1 RNAAC
- Future GNSS Systems
 Beidou/COMPASS 5+30
 QZSS/JRANS 1+3+3
 IRANS 3+4

VLBI (I)

International VLBI Service

 Coordinating Center
 Operation Centers
 Correlators & Data Centers
 Technology Development Centers
 Analysis Centers
 Network Stations

• IVS in Eastern Asia

- 0 Coordinating Center
- 0 Operation Center
- 2 Correlators & 1 Data Center
- 1 Technology Development Center
- 3 Analysis Centers
- 7 Network Stations

South Korea
3(KVN)+1(NGII) Network Stations
1 Analysis Center

VLBI (II)

• S-VLBI

- VSOP-2/ASTRO-G(Japan)
- : Orbiting collocation station
- Main VLBI reflector
- GPS/Galileo receivers
- SLR retro-reflector array

T. Hirosh et al.(2008)

< Key characteristics of next-generation VLBI system >

Antenna	~10-12 m dish, 60% efficiency, >5°/sec slew	
Feed	Dual polarization: low cross-polarization leakage	
Front end	~1 GHz to ~14 GHz continuous RF coverage; $T_{sys}{\sim}45 K$	
Back end	Dignize signals as early as possible after receiver, channelize into several in segments selected from front-end bandwidth, totaling 4 to 8 GHz	equency
Calibration systems	Upgraded phase and cable calibration systems	
Data rate	2-4 Gbps initially, expanding to 8-16 Gbps, potentially to 32 Gbps	
Frequency standard	H-maser	
Network design	20-40 antennas, globally distributed, co-located with other space-geodetic techniques, including sufficiently capable existing geodetic VLBI antennas	
Data transport	Mixture of disk-based recording and high-speed network transfer	
Correlation	Near real time, perhaps distributed among a network of processors	
Products	Near real time automated generation of rapid response products, later complete analysis	
Data archiving	Data may be retrieved from clearinghouse on any timescale	

• VLBI2010 & *e*-VLBI

EXPReS project (China) Ultra rapid dUT1 e-vlbi session (Japan) Broadband receiver in KVN (Korea) *e*-KVN & EAVCC (Korea)

ILRS in Asia

8 Active sites in East Asia (China 5, Japan 3)
~ 20 sites including Russia & Saudi Arabia
More than 10 sites will be added (China, Japan, Taiwan & Korea 2) SLR Satellite Mission SOHLA, QZS1, ASTRO-G (Japan) STSAT-2, KOMPSAT-5 (Korea) Beidou/COMPASS (China)

Gravity (I)

• Nationwide Gravity Reference Stations

China	30
Japan	25
Korea	8

- Absolute Gravity Stations in Asia
 China 100 Campaign Stations
 Japan 4
 Korea 2 + 3
- Superconducting Gravity Network
 6 sites of total 21 sites of GGP
 1 China, 3 Japan, 1 Korea, 1 Taiwan

Gravity (II)

중국

- **Terrestrial Gravity Data** Japan (Land +Shipboard) > 1,000,000Korea (Land +Shipboard) > 20,000
- **Geoid Models** Japan JGEOID Korea PNU2003 & etc.

R&D Resources in Asia for GGOS

 Active member of international/Regional organizations

IGS	16 Associate Members
IVS	60 Associate Members
ILRS	2 GB Members
APSG	~150
AOGS	~ 80

few hundreds researchers in Asia

Total 993 Oral Presentations & 1093 Participants

16 - 20 June, 2008

in BUSAN, Korea!

• Agencies/Univ. related with GGOS

China CAS, CEA, Government Institutes and Univ.Japan GSI, ISAS/JAXA and Univ.Korea NGII, KASI, NORI and Univ.

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BANGKOI 31 JULY

Summary (I)

- Asia is very important and interesting region for GGOS because of its geographical location, coverage on the Earth, various geodetic phenomena and others
- The Geodetic infrastructures in Asia are not much than North America and Europe, but it is somewhat acceptable level when we consider the geographical distribution of it.
- Especially, East Asia has the dense networks of GNSS, VLBI, SLR and Gravity and the plan to expand the geodetic infrastructures including the several satellites missions in next decade.
- In the case of R&D resources for GGOS, there are many of countries, colleagues and organizations in Asia which is the indicate of potential capability to contribute to GGOS
- But, this might be one of the reason why there are so many complicated problems in intra- & inter-country to make the unified system for geodesy.

Summary (II)

12/13

• To overcome this matter in Korea, the Domestic/Global Data Center for GGOS (AR-07-03) was proposed and it is considered as one of the candidate programs under the portfolio of Korean GEO office

VLBI	- KVN (Korean VLBI network) - KASI
SLR	- Under developing (2008~2012) - KASI
GNSS	- GPS permanent stations: 85 - KASI, NGII, KIGAM
Gravit	 Land, Shipboard, Airborne KASI, PNU, KIGAM, NGII, NORI, KORDI, KLSG,
SAR	- KOMPSAT-5 (2010) - KARI
Leveling	 Dense and Newly Surveyed Network NGII
OceanTid	- Tidal Gage stations (37) - NORI

Summary (III)

- It might be several approaches to realize the GGOS in Asia, one of them is to promote the participation of Asian countries (who?, how?, what?) to international services under the current and future IAG/GGOS system.
- Another approach can be to make an unified local system for each country based on the GGOS architecture and combine them to make sub-regional and regional GGOS system which will be the interface with GGOS
- More ideas and discussions are needed!
- Most of all, well-organized human network is the key point to make GGOS in Asia successfully.
- Therefore, the regional and sub-regional meeting/organization with the representative and/or right persons of each country for GGOS might be the first step for the "GGOS in Asia"