

UNITED NATIONS INTERNATIONAL MEETING
APPLICATIONS OF GLOBAL NAVIGATION SAT
SYSTEMS



PRESENTATION SESSION 2: INTERNATIONAL
INITIATIVES/EXPERIENCES

**MULTI-GNSS DEMONSTRATION
CAMPAIGN IN ASIA OCEANIA
REGION**

1

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BRIEF INTRODUCTION OF
TOKYO UNIVERSITY OF MARINE
SCIENCE AND TECHNOLOGY
(TUMSAT)

TUMSAT, Etchujima Campus

(Faculty of Marine Technology)



LABORATORY BUILDING



RESEARCH STAFFS AND STUDENTS

- Professor Akio Yasuda
- Professor Harumasa Hojo
- Associate Professor Nobuaki Kubo
- Assistant Professor Chunming Fan
- Research Fellow [Tomoji Takasu](#)
- Research Fellow Takuji Ebinuma
- D3 2 D2 1 D1 0 M2 7 M1 4
- Research Student 1
- Under Graduate Student 5



SOME OF RESEARCH SUBJECTS

- Precise Orbit/Clock Estimation Tool for Multi-GNSS Network
- Precise Point Positioning with QZS-LEX signal
- Development of Multi-GNSS High Accuracy Positioning Tool for GSI Reference Stations
- Two types of software defined receiver as a platform of GNSS receiver.
 - High-Sensitivity Positioning(single-frequency)
 - Precise Positioning(multi-frequency)
- Development of Multi-GNSS receiver using FPGA platform.

We are deeply involved in the projects of MGA.



RTKLIB

- **Open source program package for RTK-GPS**
 - Has been developed by Mr. Takasu since 2006
 - Latest version: 2.4.1
 - **Portable C library + several positioning Aps**
 - GUI Aps on Windows Console Aps on Linux etc...
- **You can download freely from the following URL.** <http://gpspp.sakura.ne.jp/rtklib/rtklib.htm>



PLAN FOR GNSS POSITIONING RESEARCH/ EDUCATION CENTER

- We are preparing to establish GNSS positioning research/education center in our university.
- Where, we can accept foreign students from developing countries to cultivate them with the curriculum certified by ICG WG-C.

CONTENTS

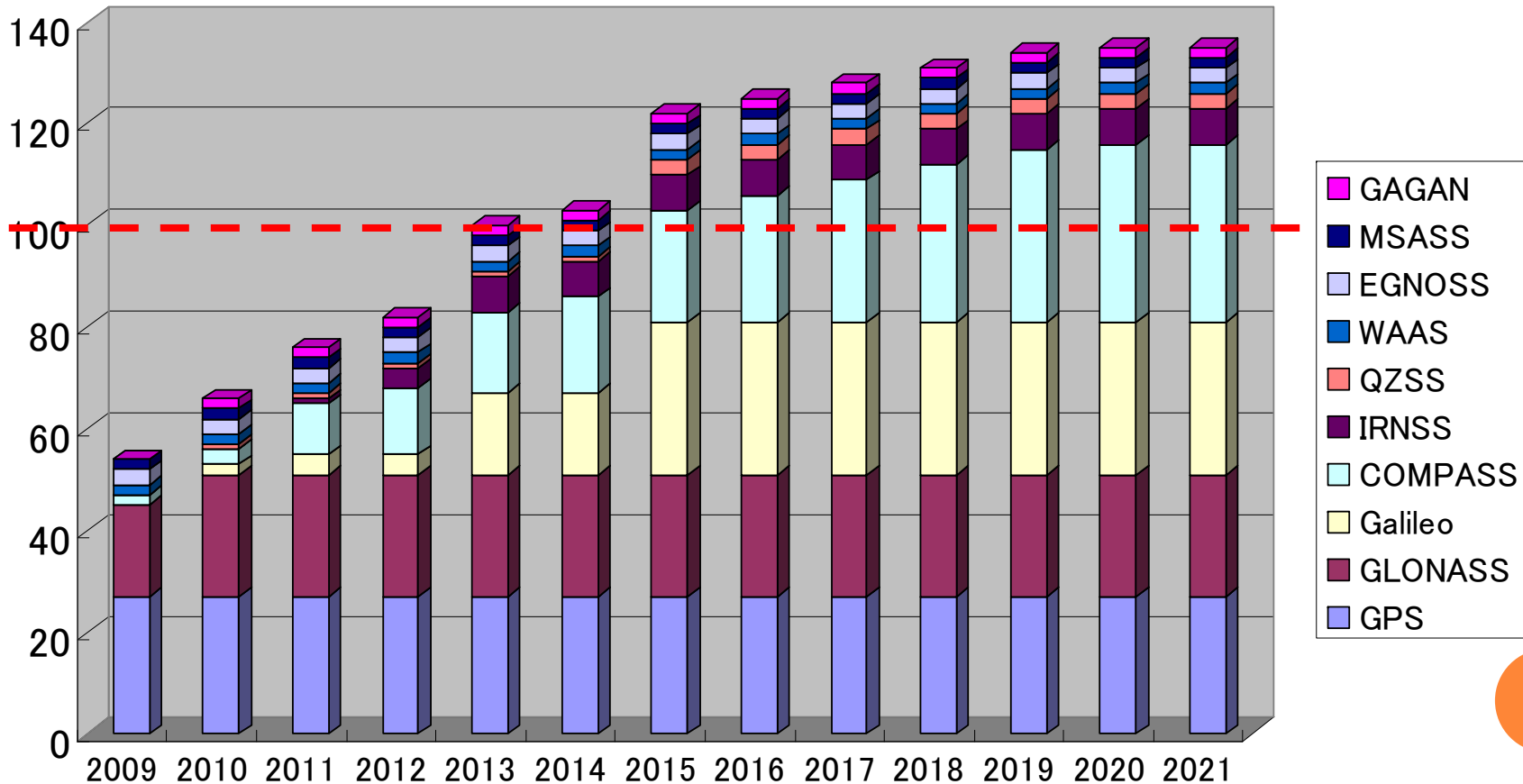
- *Background of Multi-GNSS*
- *Multi-GNSS demonstration campaign*
- *Multi-GNSS Asia (MGA)*
- *Summary*



BACKGROUND OF MULTI-GNSS DEMO CAMPAIGN

TOTAL NUMBER OF GNSS

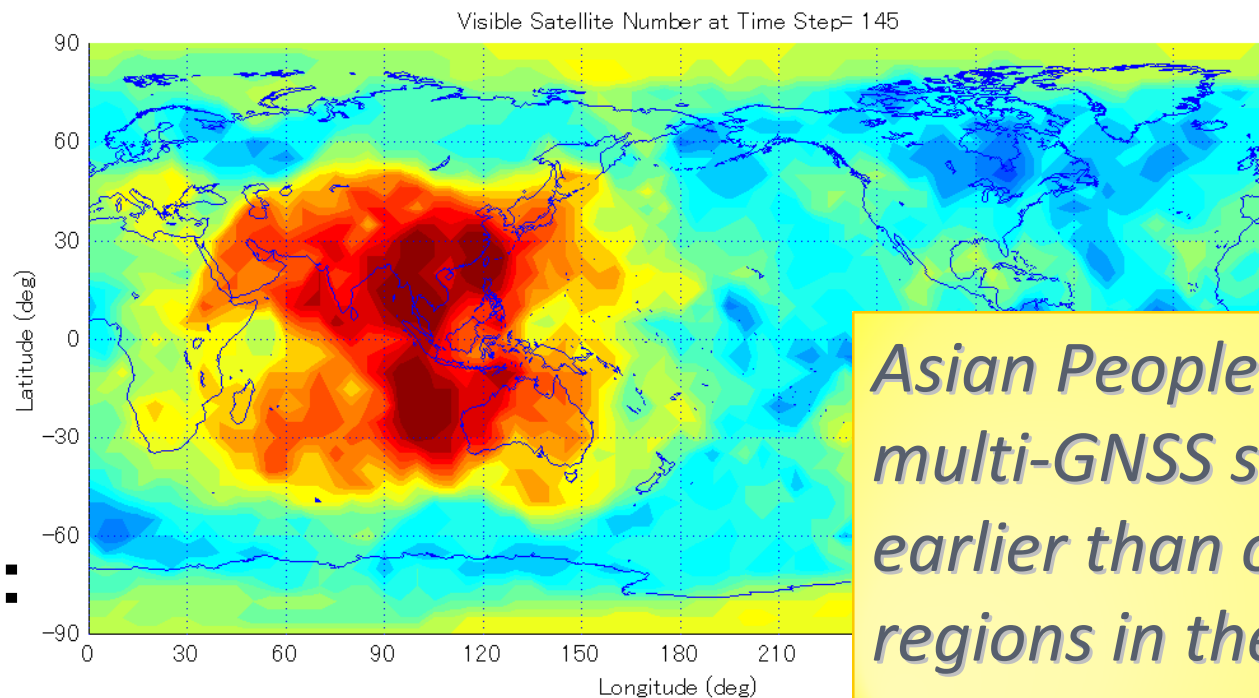
We will have over 100 GNSS satellites in this decade.





BACKGROUND SHOWCASE OF NEW GNSS ERA

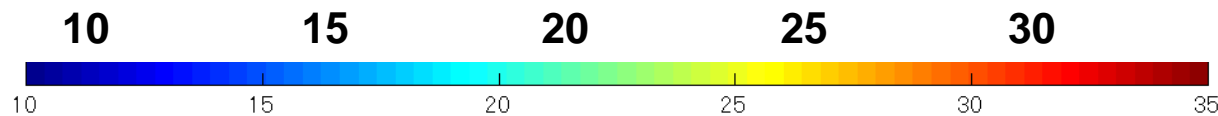
Visible satellite number (mask angle 30 degrees)



2020:

*Asian People can use
multi-GNSS signals
earlier than other
regions in the world*

GPS(27)+Glonass(24)+Galileo(30)+COMPASS(35)+IRNSS(7)+QZSS(3)+SBAS(7)





BACKGROUND OF MULTI-GNSS DEMO CAMPAIGN

MULTI-GNSS MAKES US EXPECT NEW GNSS APPLICATIONS

- *User benefits from Multi GNSS*

- *Increase in usable SVs, signals and frequencies*



- *Increase in availability and coverage*
- *More robust and reliable services*
- *Higher accuracy in bad conditions*
- *Less expensive high-end services*



Emerging new applications and expansion of existing applications are to be expected.



MULTI-GNSS DEMONSTRATION CAMPAIGN

- *The concept of “Multi-GNSS demo. Campaign” was presented at ICG-4 and obtained endorsements from ICG.*
- *The Campaign is a series of activities for five years from 2010.*
- *It comprises the following 3 parts.*
 1. *Multi-GNSS Monitoring Network*
 - *CORS, Data center, Analysis Center*
 - *Sharing resources and observed data among participating organization*
 - *Joint effort with IGS Multi-GNSS Experiment*
 2. *Applications Development & Demonstration*
 - *Applications using precise orbit, clock and other error corrections for multiple constellations*
 3. *Regional Work Shop*
 - *Annual base Workshop in Asia Oceania region*
 - *Announcement of joint experimental plans and reporting results of the experiments*
- *Multi-GNSS Asia is an organization to promote the campaign.*



MULTI-GNSS DEMONSTRATION CAMPAIGN

Three main activities of Asia Oceania Multi-GNSS Demo Campaign

Multi-GNSS Monitoring Network

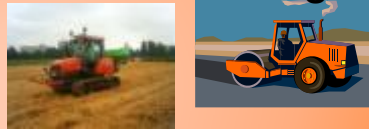


Application Demonstration

Disaster Mitigation



Precise Positioning



ITS



LBS



Others, ionospheric
observation etc

Regional Workshop

3rd Workshop, Nov. 2011 @
Jeju, Korea:



2nd Workshop, Nov. 2010
@ Melbourne, Australia



1st Workshop on GNSS,
JAN. 2010, @ Bangkok,
Thailand





OVERVIEW OF MULTI-GNSS MONITORING NETWORK(MGM-NET)

- *Deployment of the MGM net will be conducted in a stepwise manner in 2011-2013.*

Step I

- *Focusing to enhance QZSS orbit & clock estimation.*
- *20 sets which have choke ring DM antennas are to be distributed as core network.*
- *They are to be deployed in the area where QZSS can be observed, Asia and Oceania region by the end of March 2012.*
- *Join IGS M-GEX*

Step II

- *Additional 40 sets will be distributed after domestic or international demonstrations by the end of March 2013.*
- *Distributed area will be extended to global area in order to track all GNSS constellations and generate precise orbit and clock estimation product.*



CURRENT STATUS FOR MGM NET ESTABLISHMENT

- *The announcement of “Call for Hosting Site” was issued on JAXA’s web site as well as participation in MGM net with own multi-GNSS Rx and network was called.*
- *9 sites applied to the first call have just selected.*
- *Second Call will be issued soon in December.*
 - *In collaboration with IGS M-GEX project*
 - *<http://www.multignss.asia>*



APPLICATION DEVELOPMENT & DEMONSTRATION

Call for joint experiment QZSS/Multi-GNSS

- *Under MGA support and recommendation, JAXA will start “Call for joint application experiment” in middle of September.*
 - *Joint experiment proposal*
 - *demonstrate multi GNSS benefit on the application.*
 - *QZSS should be included in the experiment.*
 - *JAXA will provide receiver, antenna and analysis tool*
 - *Call for application is to be repeated annually base.*
 - *Call in 2011: Mid September to Mid October (first call)*
 - *1st selection was finalized at the 3rd Workshop in Jeju.*
 - *Experiments will be implemented in 2012.*



APPLICATION DEVELOPMENT & DEMONSTRATION

Call for joint experiment QZSS/Multi-GNSS

- Under MGA support and recommendation, JAXA started “Call for joint application” in middle of September.
- JAXA provides receiver, antenna and analysis tool.
- Five proposals, from Korea, Malaysia, Japan, Taiwan and Australia for Multi-GNSS Joint Experiments were endorsed presently to be implemented.



ASIA OCEANIA REGIONAL WORKSHOP ON **GNSS**

- Workshop is held to share the technical trend and discuss future joint demonstration.
 - 1st AOR WS: Bangkok, Thailand on January 25-26, 2010
 - 2nd AOR WS: Melbourne, Australia on November 21-22, 2010.
 - 3rd AOR WS: Jeju island, Korea on November 1-3, 2011.
 - 4th WS will be held in Malaysia in 2012
- Four Working Groups were established:
 - MGM Network, Precise Positioning, ITS & LBS, and Disaster management





MULTI-GNSS ASIA (MGA)

- “Multi-GNSS Asia (MGA)” is an international organization to promote and support activities of the “Asia Oceania Multi-GNSS Demonstration Campaign”
- MGA was established in September 4th, 2011 in Tokyo.

Participation to MGA

- Government agencies, Universities, and research institutes which have interests in GNSS utilization in Asia Oceania region
- International organization related to GNSS utilization
- Industries such as Receiver manufacturer, and service providers

Please visit to

http://www.multignss.asia/howto_join_mga.html



MULTI-GNSS ASIA (MGA)

Benefits of participants

- All Participants
 - Relationship, connection
 - Sharing the latest technology trend related to Multi-GNSS usage.
 - Sharing Multi-GNSS observed data and product set in the early stage of Multi-GNSS era.
 - Taking advantage for new applications and business trials for Multi-GNSS usage.
- Joint Demonstration project members
 - Using Multi-GNSS Receiver
 - Using Real time Multi-GNSS augmentation data



SUMMARY

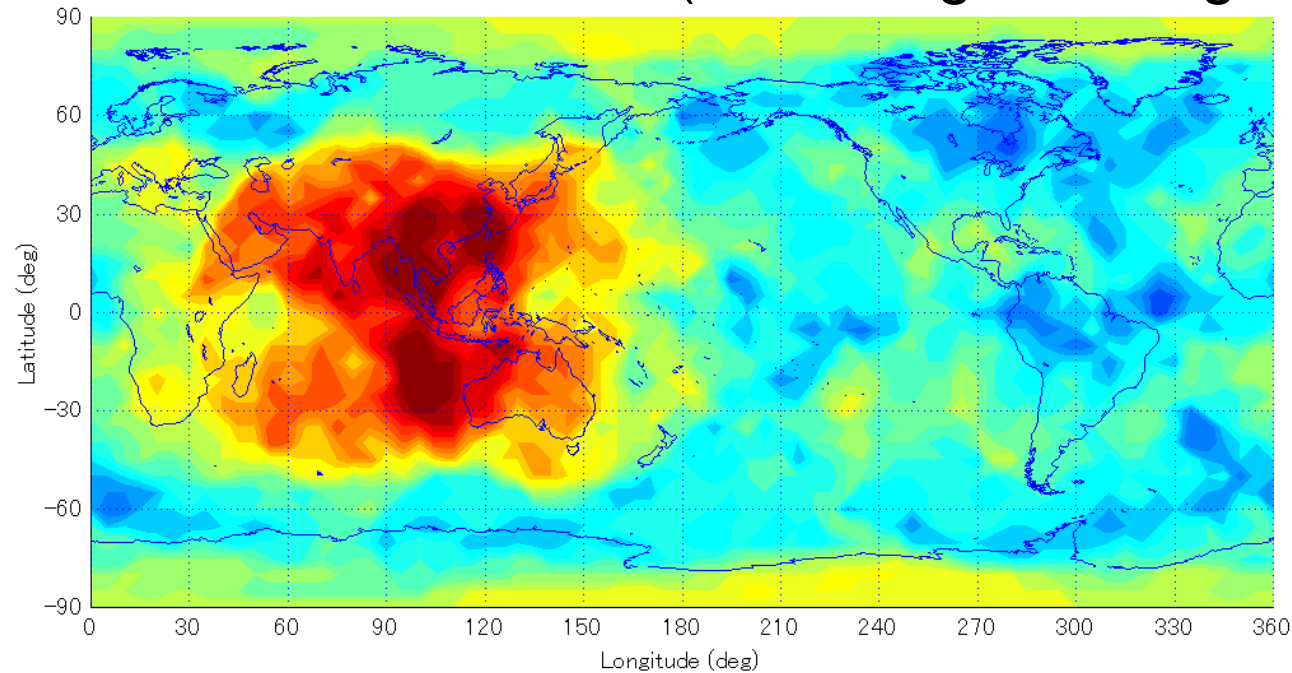
- Multi-GNSS demonstration campaign was proposed to ICG and recommended to endorse at ICG-4 in 2009.
 - Three categories of activities:
 - Establishment of Multi-GNSS Monitoring Network (MGM-net)
 - Applications Demonstration
 - Workshop
- Call for hosting site for MGM-net
 - 9 sites was selected for the 1st Call and the 2nd Call will be issued soon under collaboration with IGS M-GEX
- Call for joint experiments
 - 5 proposals were endorsed to be implemented by MGA
- Asia Oceania Regional Workshop on GNSS
 - The 3rd Workshop was held in Jeju, Korea in November, 2011.
- MGA is an organization to promote Multi-GNSS demonstration campaign and is inviting participation.

Please visit to <http://www.multignss.asia/>



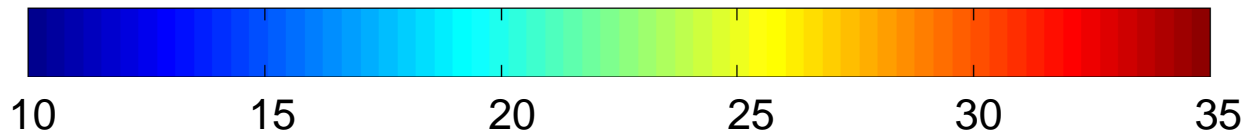
Thanks a lot for your attention!!

Visible satellite number (mask angle 30 degrees)



2020:

GPS(27)+Glonass(24)+Galileo(30)+COMPASS(35)+IRNSS(7)+QZSS(3)+SBAS(7)



<http://www.multignss.asia>