First GGOS Affiliate: GGOS Working Group of Japan

Toshimichi Otsubo [1], Basara Miyahara [2]

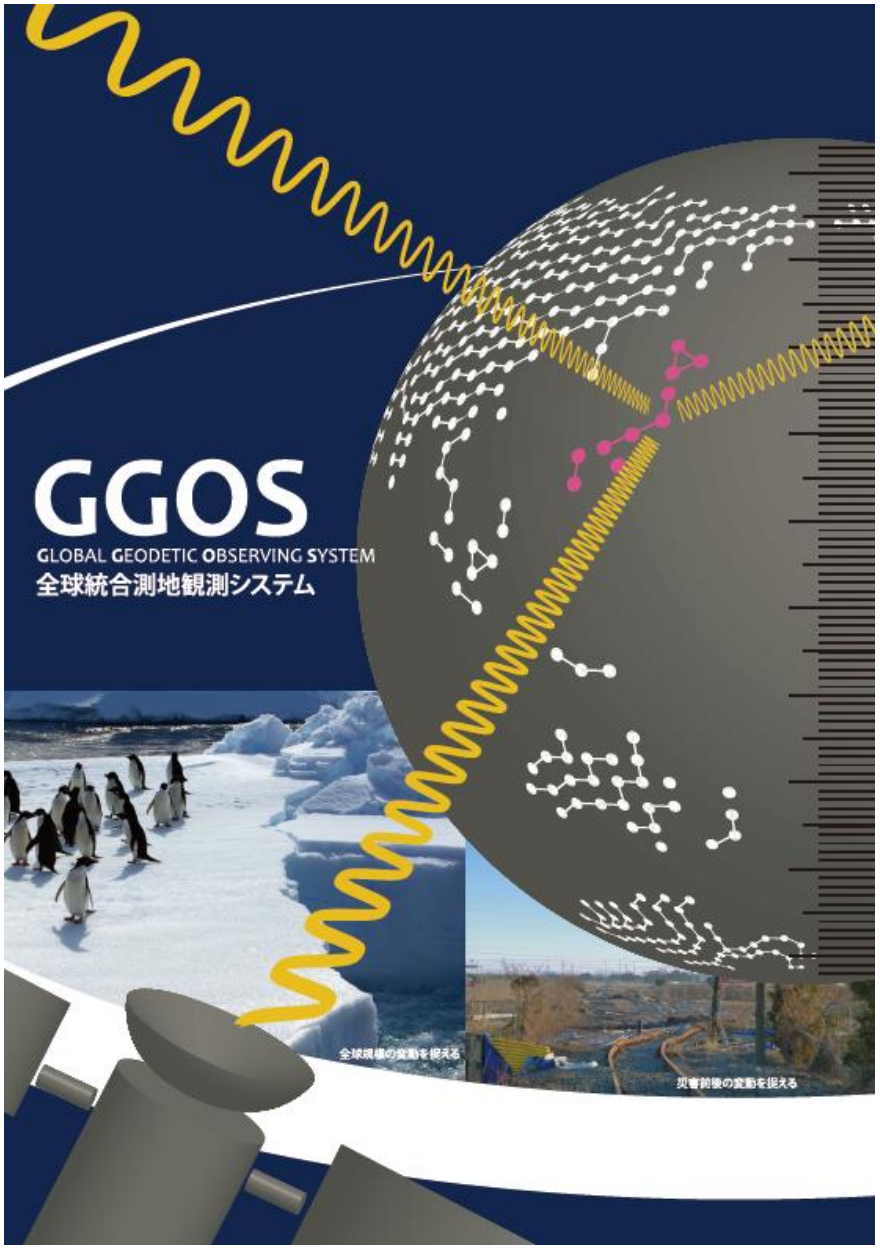
[1] Hitotsubashi University

[2] Geospatial Information Authority of Japan

and GGOS Working Group of Japan

GGOS WG Japan Contact: ggos-info@spacegeodesy.go.jp

GGOS WG of Japan: Leaflet



What is GGOS ?

全球を１ミリメートル精度で

地球は常に変動している惑星であり、災害の多い日本ではその動きは特に顕著です。位置の基準を作り動きを正確に把握するには、**地球を測る**学問「**測地学**」の出番となります。GGOS（Global Geodetic Observing System）は、さまざまな技術によって地球規模の測地観測を推進する枠組みです。

Why do we need GGOS ?

測地技術の統合と国際協力

測地計測の技術 VLBI・SLR・GNSS・DORIS・重力測定などはこれまで個別に発展してきましたが、それぞれ長所と短所があり、補い合う関係にあります。これらを統合しひとつのシステムとみなすことが GGOS の基本コンセプトで、世界中の国や機関による協力があってはじめて実現しうるものです。

When were the GGOS components established ?

Where are the GGOS stations in Japan ?

Who are the key players in Japan ?

SLR （Satellite Laser Ranging） ／衛星レーザー測距
VLBI （Very Long Baseline Interferometry） ／超長基線電波干渉法
GNSS （Global Navigation Satellite System） ／全球測位衛星システム
DORIS （Doppler Orbitography and Radiopositioning Integrated by Satellite） ／DORIS 電波灯台

How will GGOS improve the world ?

新しいかたちの社会基盤として

2015 年、国際連合総会本会議において、地球規模の測地基準座標系の重要性が認識され、加盟国全体で連携して測地基準座標系を維持することを推奨する決議が採択されました。地球環境の監視、世界共通の地図づくり、国境を越えた海や空の交通など、正確な位置の情報はますます重要になっています。新しい時代に不可欠な社会的基盤技術として GGOS の発展と寄与が求められています。

日本学術会議地球惑星科学委員会 IUGG 分科会 IAG 小委員会　GGOS ワーキンググループ
2013 年 GGOS ワーキンググループ設置　2017 年 世界で初めての GGOS Affiliate 機関に認定
座長：大坪俊通（一橋大学）　幹事：宮原伐折羅（国土地理院）　E-mail : ggos-info@spacegeodesy.go.jp

2018.07

“GGOS Working Group” in Japan

- Each agency such as GSI, NICT, JCG, NIPR, NAO, JAXA, has participated in GGOS through IGS, IVS, ILRS…
- The agencies participated in international observation individually, but collaboration between them was not so intensive.
- Many research works have been conducted in a field of crustal deformation, but not so much work in global geodesy.

- In 2013, we established “GGOS Working Group” under “IAG Subcommittee” in Science Council of Japan.
- The purpose is to promote and enhance mutual collaboration among the space geodesy agencies.

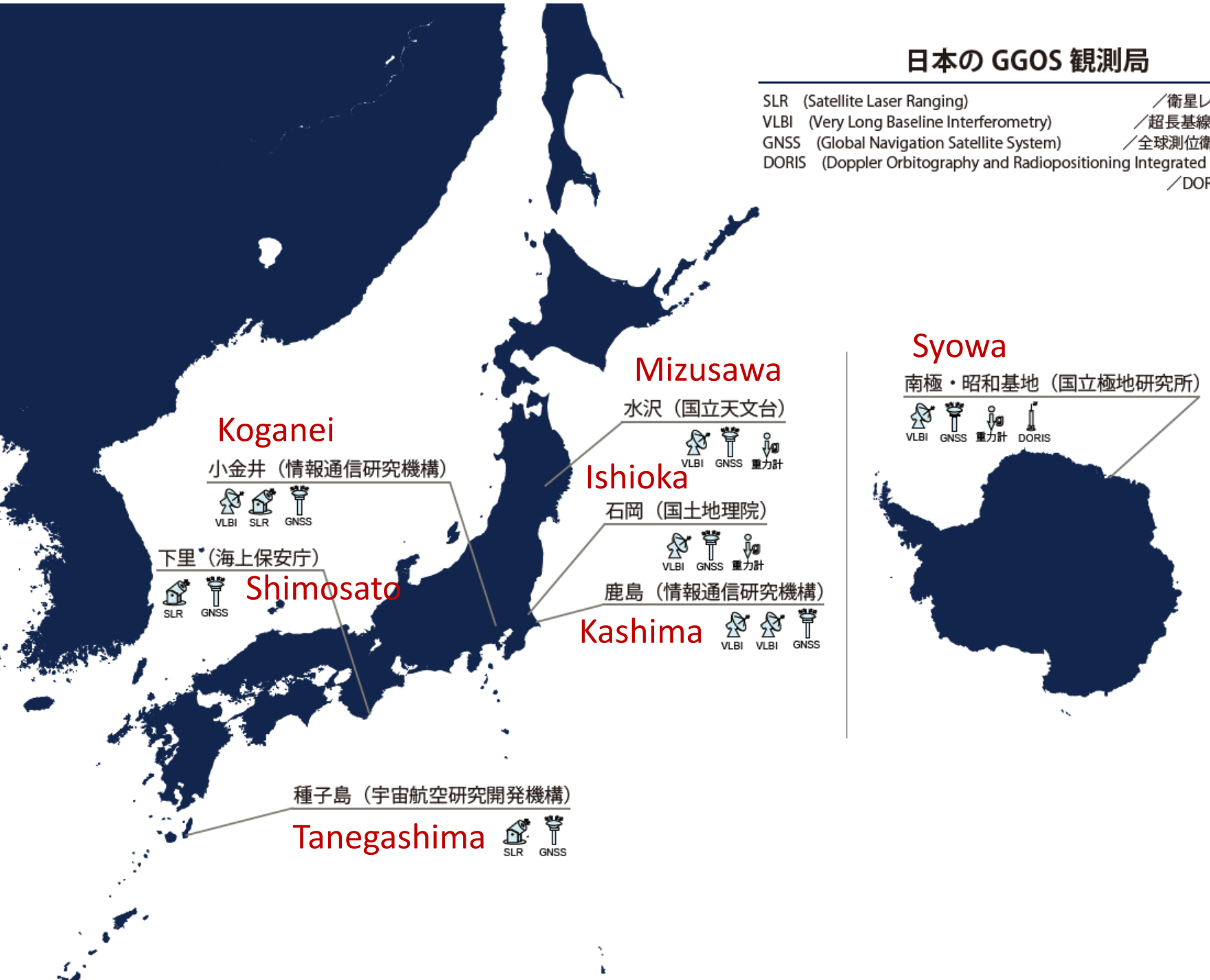
GGOS WG of Japan: Core members

- Chair： Toshimichi Otsubo（Hitotsubashi Univ.）
  （was S Matsuzaka ～2015）
- Secretary：Basara Miyahara（GSI）
  （was T Otsubo ～2015）
- Representatives from GGOS geodetic techniques
  VLBI： Takahiro Wakasugi（GSI）
  SLR： Yusuke Yokota（JCG）
  GNSS： Takayuki Miyazaki（GSI）
  DORIS：Yuichi Aoyama（NIPR）
  Gravity：Yoichi Fukuda（Kyoto Univ.）

- Sharing of GGOS related information via mailing list
- Face to face meetings as needed

日本の GGOS 観測局

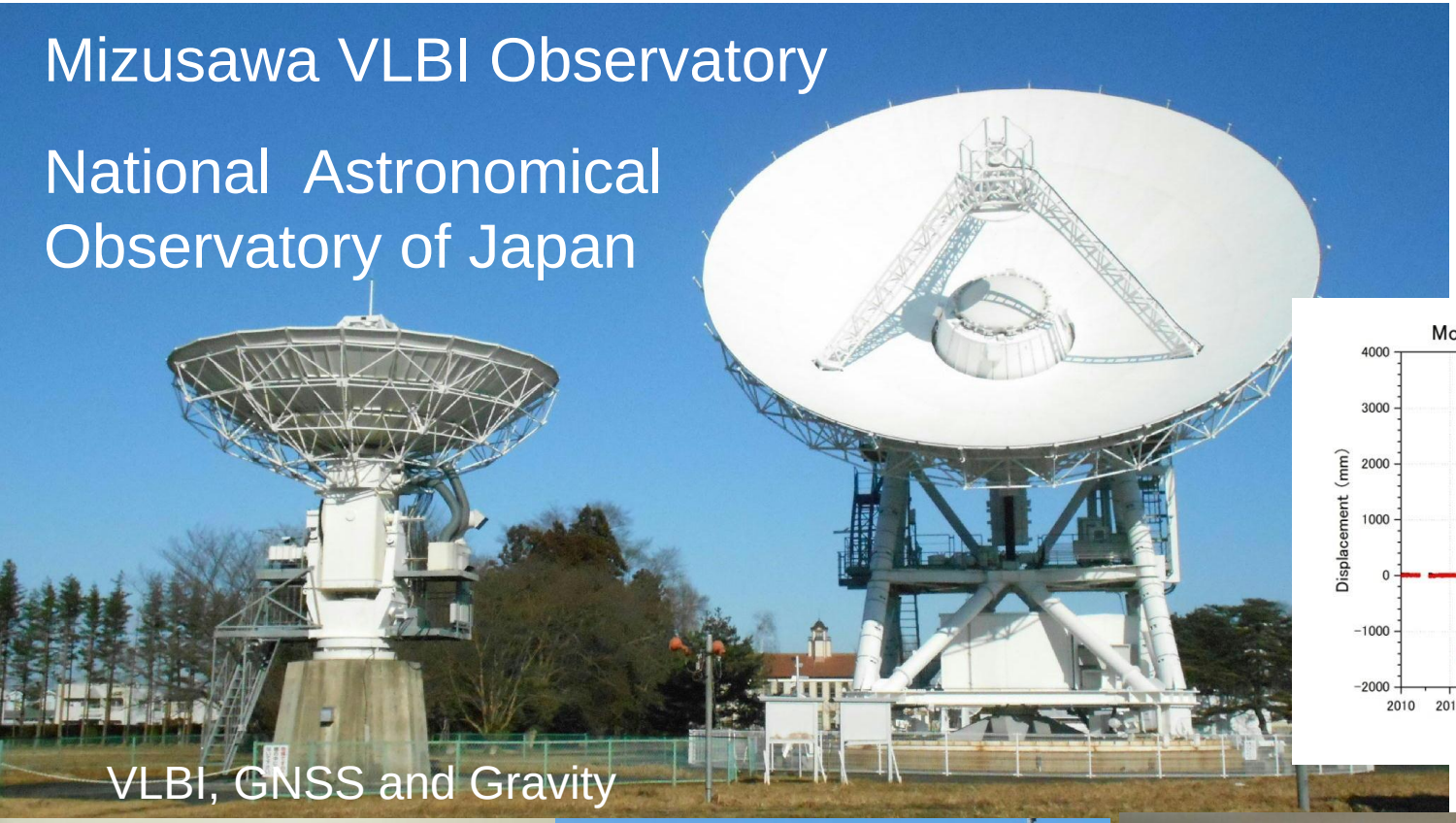
SLR (Satellite Laser Ranging) ／衛星レーザー測距
VLBI (Very Long Baseline Interferometry) ／超長基線電波干渉法
GNSS (Global Navigation Satellite System) ／全球測位衛星システム
DORIS (Doppler Orbitography and Radiopositioning Integrated by Satellite) ／DORIS 電波灯台



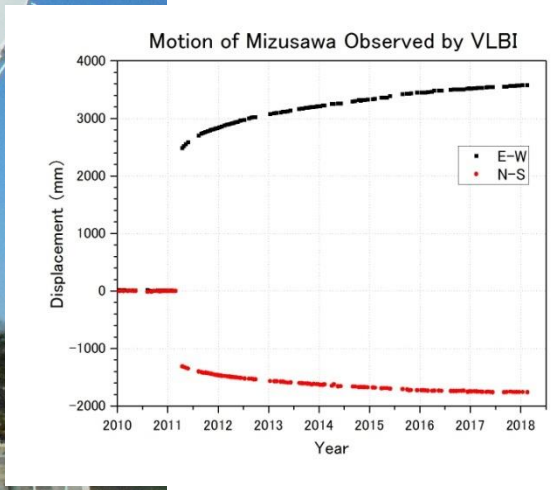
Mizusawa Station

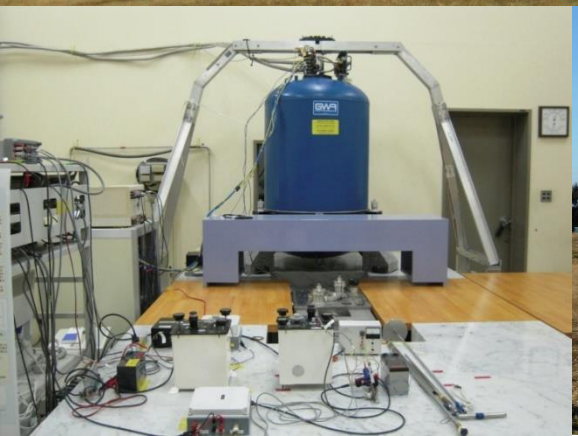
Mizusawa VLBI Observatory

National Astronomical Observatory of Japan



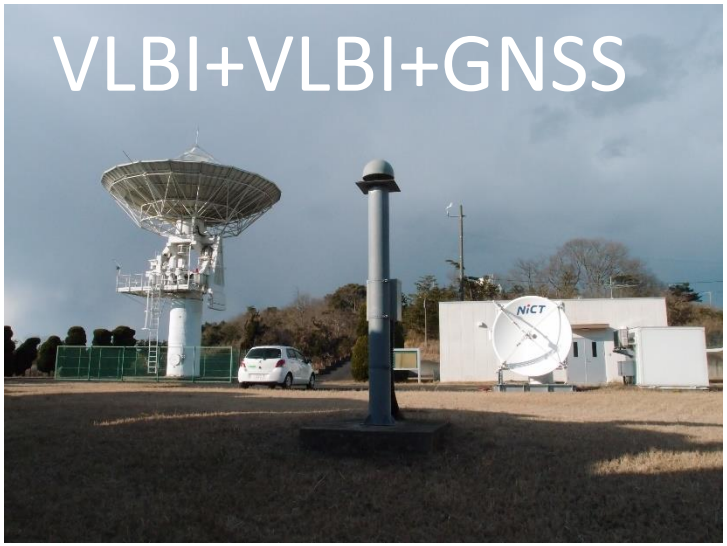
VLBI, GNSS and Gravity





Provided by Dr Tamura

Kashima Space Technology Center



Kashima 11mVLBI Station (S/X) Receiver
KSMV GNSS Station

Kashima 34mVLBI Station(S/X, and VGOS compatible Broadband Receiver)

Owned & operated by: **National Institute of Information and Communications Technology**

Kashima34: Operational since 1990.

Kashima11: Operational since 1995.

Primary missions:

Frequency Transfer, VLBI Technology Development, UT1,…

Ongoing projects:

Broadband VLBI Development for Atomic Clock Comparison

Provided by Dr Sekido

Koganei Headquarter of NICT

Koganei 11m VLBI Station (S/X) Receiver and GNSS Receiver

図1●宇宙光通信地上センターの望遠鏡ドーム

1.5m diameter Telescope for SLR

VLBI+GNSS +SLR

Owned & operated by: **National Institute of Information and Communications Technology**

Primary missions:

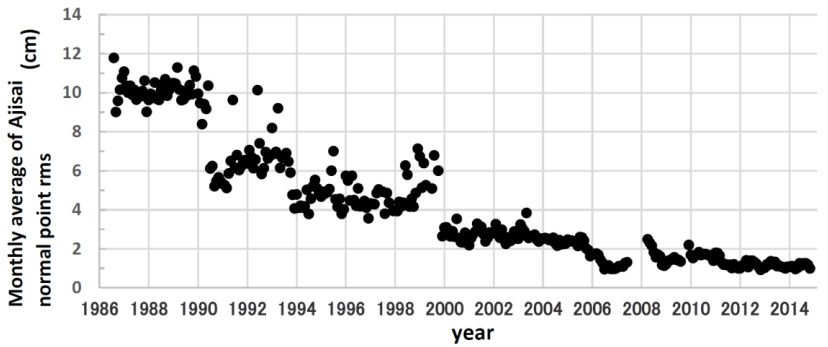
VLBI Technology Development, Reference Frame, UT1, Optical Communication

Ongoing/Future projects:

Optical satellite communication experiments

Provided by Dr Sekido and Dr Ichikawa

Shimosato Hydrographic Observatory



Monthly average of Ajisai normal point rms

Owned & operated by: **Japan Coast Guard**

Operational since 1982. Longest operating point in Asia.

Primary missions:

Nautical chart, Reference frames, Island positioning…

Future project:

kHz laser to be installed by the end of 2018.

Provided by Ms Fukura

Tanegashima Station

Owned & operated by: JAXA

Operational since 2004. Remote Operation from Tsukuba

Primary missions:

- Precise Orbit Determination and Accuracy Evaluation

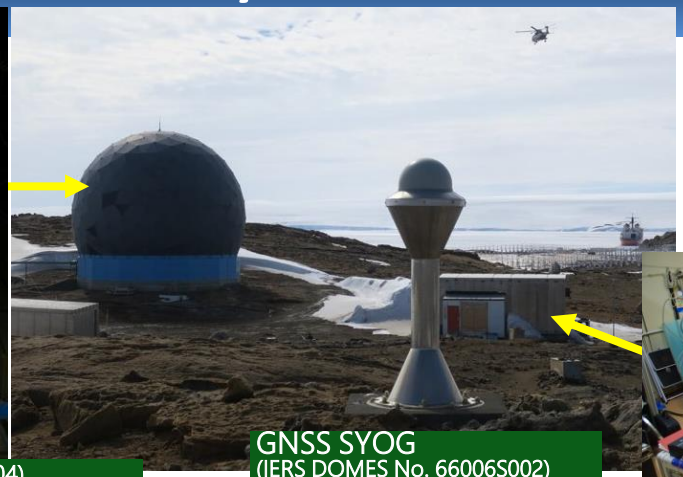
Future project:

- Plan to develop new kHz SLR in Tsukuba by the end of FY2020

Provided by Mr Akiyama

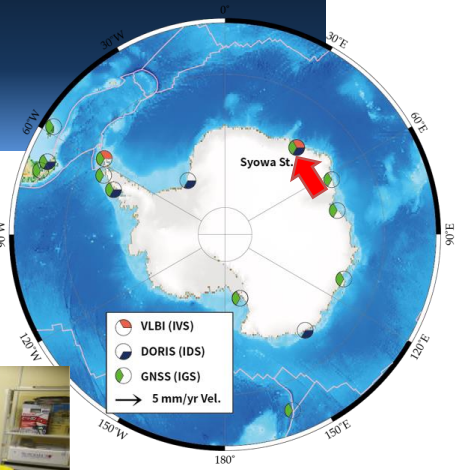
Syowa Station

VLBI (IERS DOMES No. 66006S004)
since 1990



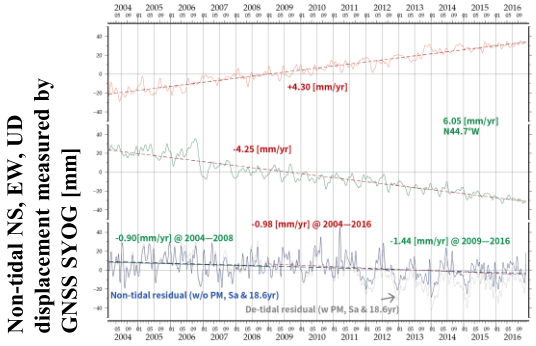
GNSS SYOG
(IERS DOMES No. 66006S002)
since 1995

Absolute Gravity (1992~)
SG Gravity (1993~)
at IAGBN(A) #0417



Tide Gauge
GLOSS No. 95 since 1976

DORIS
(IERS DOMES No. 66006S001) 1993-1998
(IERS DOMES No. 66006S003) 1999-



NiPR GSI JCG

Owned & operated by: **NIPR/JARE, GSI, and JCG**

Operational since 1990(VLBI), 1993 (DORIS),1995(GNSS), 1976(TG), 1992(AG), 1993 (SG).

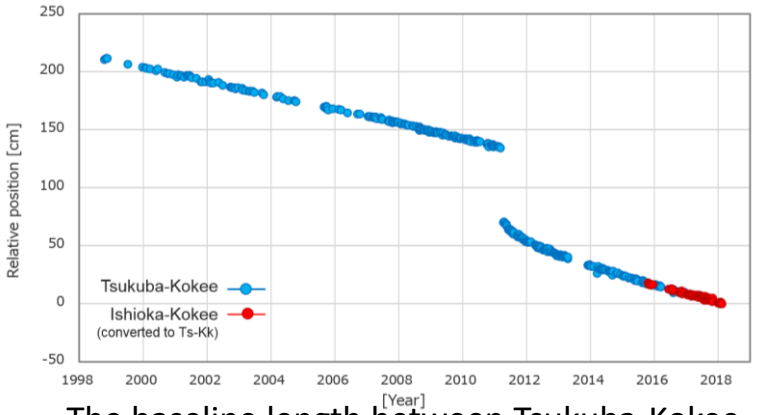
Primary missions:

Reference frames, Monitoring GIA, sea level change & ice mass changes …

Ongoing/Future projects:

Extended VLBI observations to 2023(?). Feasible studies on future SLR.

Ishioka Geodetic Observing Station



The baseline length between Tsukuba-Kokee (blue) and Ishioka-Kokee (red)

Owned & operated by: **GSI of Japan**

Operational since 2015.

Primary missions:

Reference frames, Monitoring Crustal deformation …

Recent/Ongoing/Future projects:

VGOS test observation since 2016

Co-location observation between VLBI and GNSS in November

Hosting 3rd AOV meeting in Canberra in November

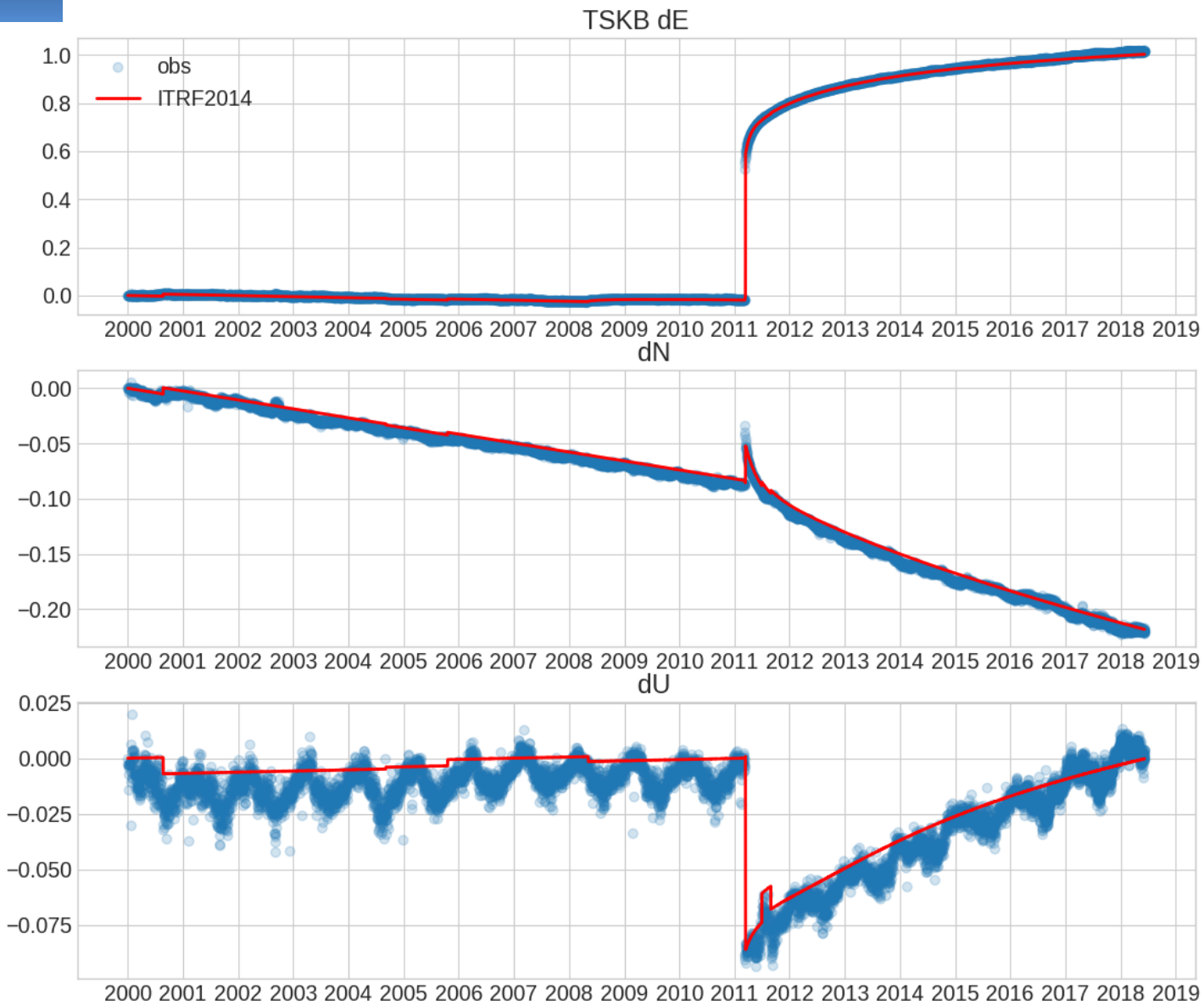
Provided by Dr Miyazaki

ITRF2014 PSD

PSD: Type 1 in 2008, Type 3 in 2011

→ Miyazaki's poster (G01).

Tsukuba GNSS



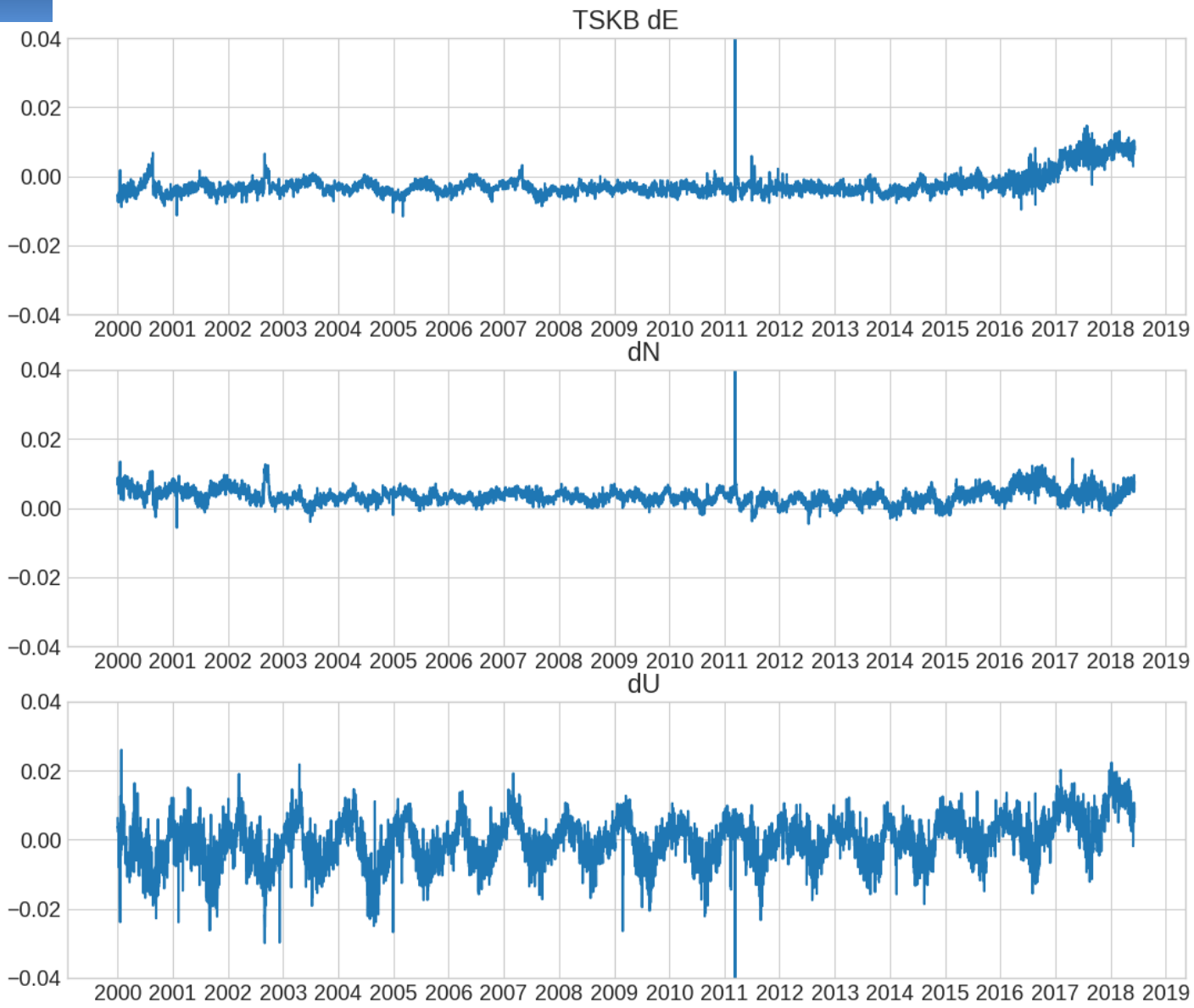
Provided by Dr Miyazaki

ITRF2014 PSD

PSD: Type 1 in 2008, Type 3 in 2011

→ Miyazaki's poster (G01).

Tsukuba GNSS



Provided by Dr Miyazaki

Our 5-year activities

- 2014 Site list sent to GGOS. Updated in 2017.
- “GGOS” Sessions in JpGU & JP Geod Soc meetings.
- GGOS-related sessions in international meetings.
- 2017 GGOS Sp. Issue in 測地学会誌 (JP Geod Journal)
- 2017 First GGOS Affiliate
- 2018 Leaflet
- 2018 GGOS Days 2018 Tsukuba
- Invisible consultative activities with institutes/stations

Long-term prospects

- GGOS Core Site: Ishioka? Syowa?
- “GGOS” to be an attractive keyword for funding.
- More involvement in international projects.
- Improvement of PSD models, more sciences.