

EGU21-4527

GNSS-A seafloor geodetic observation capability in 2021 and its applicability to global geodesy

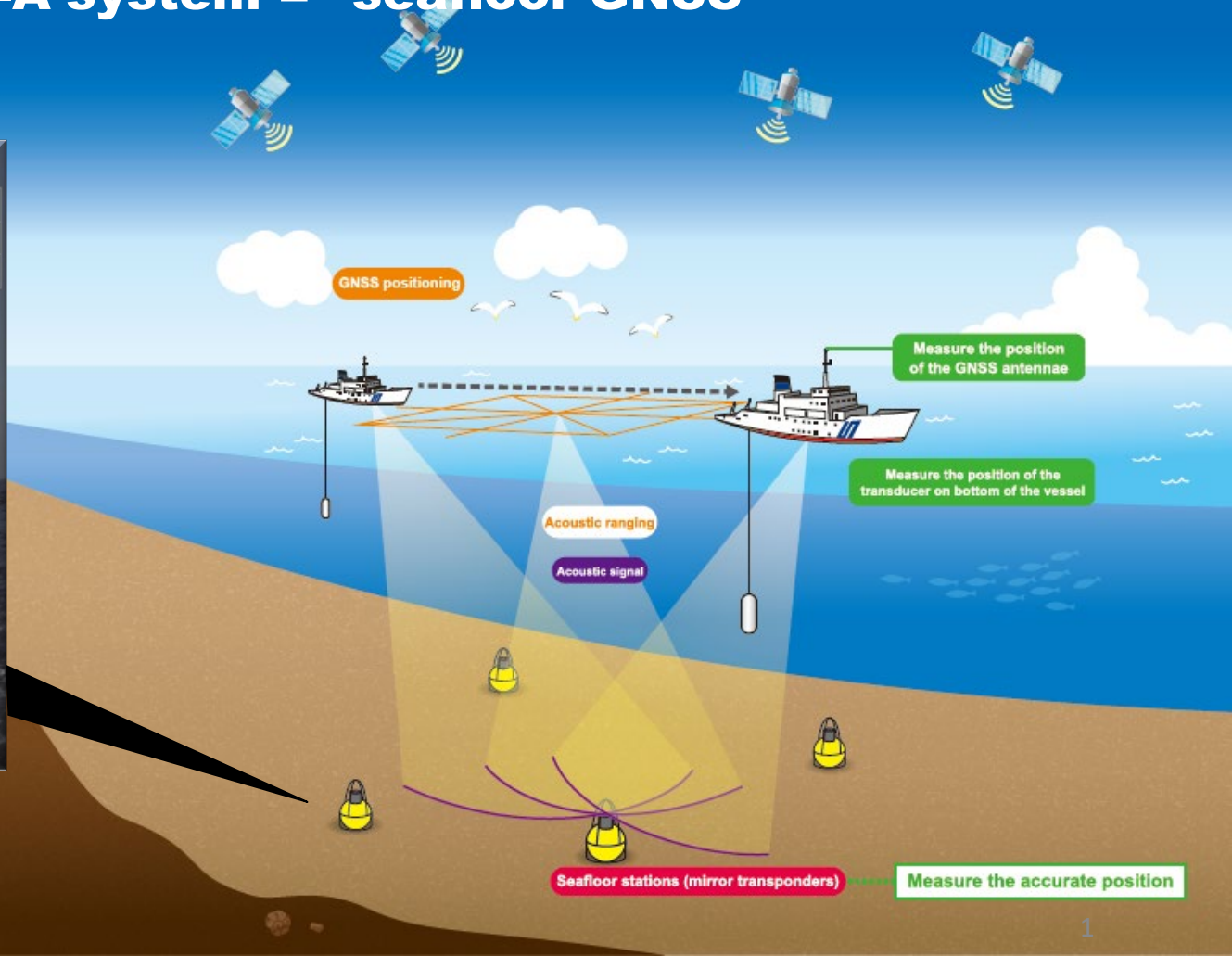
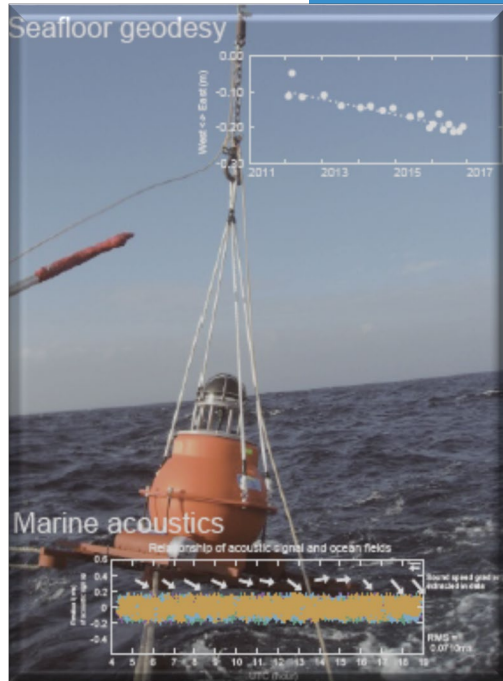
#Yusuke Yokota (UT, IIS)

Tadashi Ishikawa (JHOD, JCG)

Shun-ichi Watanabe (JHOD, JCG)

Yuto Nakamura (JHOD, JCG)

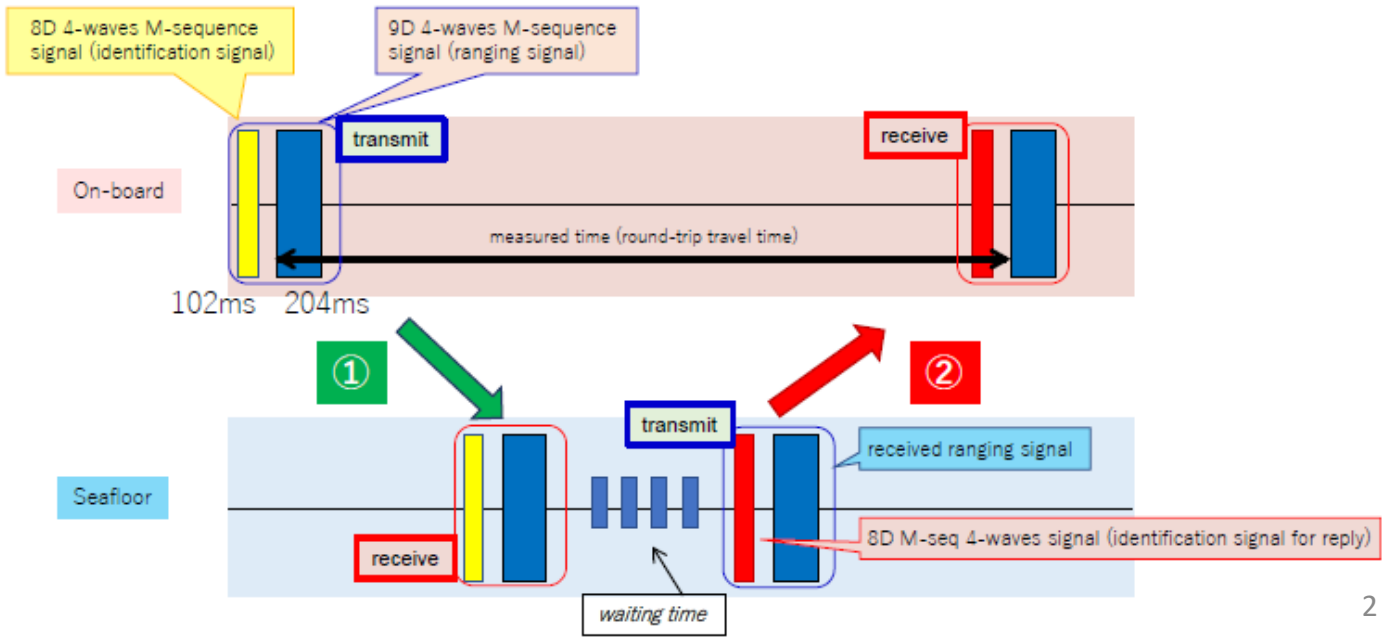
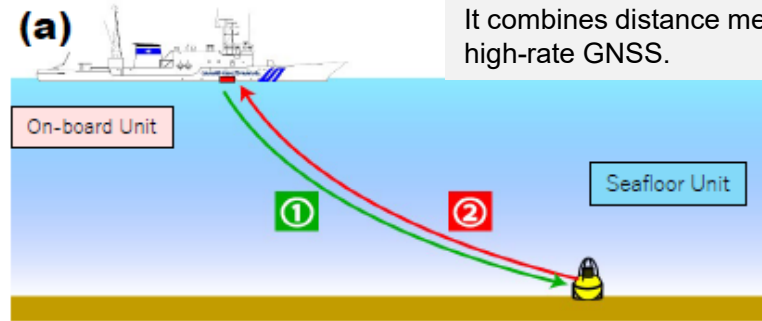
GNSS-A system = “seafloor GNSS”



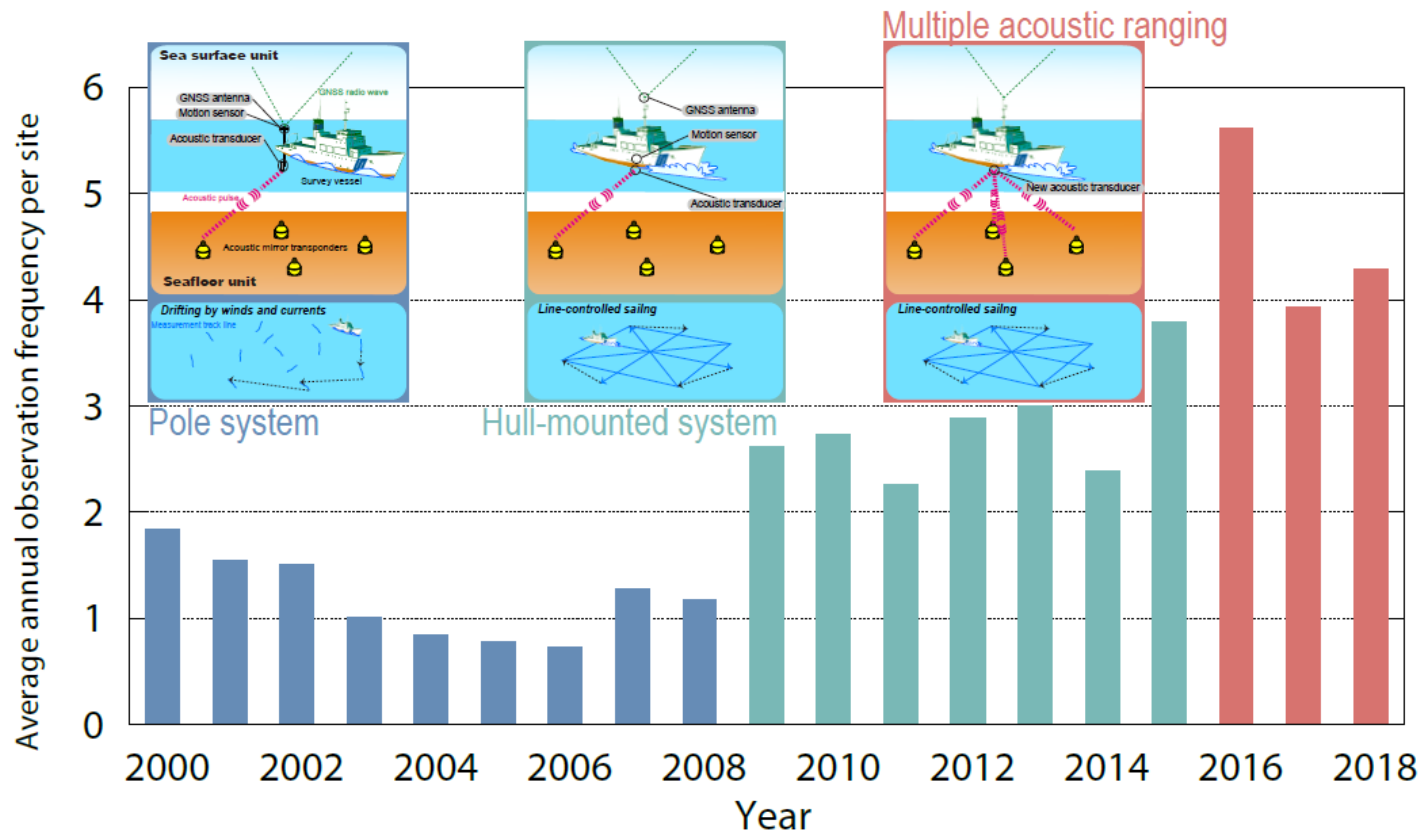
GNSS-A system = “seafloor GNSS”

(a)

It combines distance measurement by 10 kHz acoustic communication and high-rate GNSS.

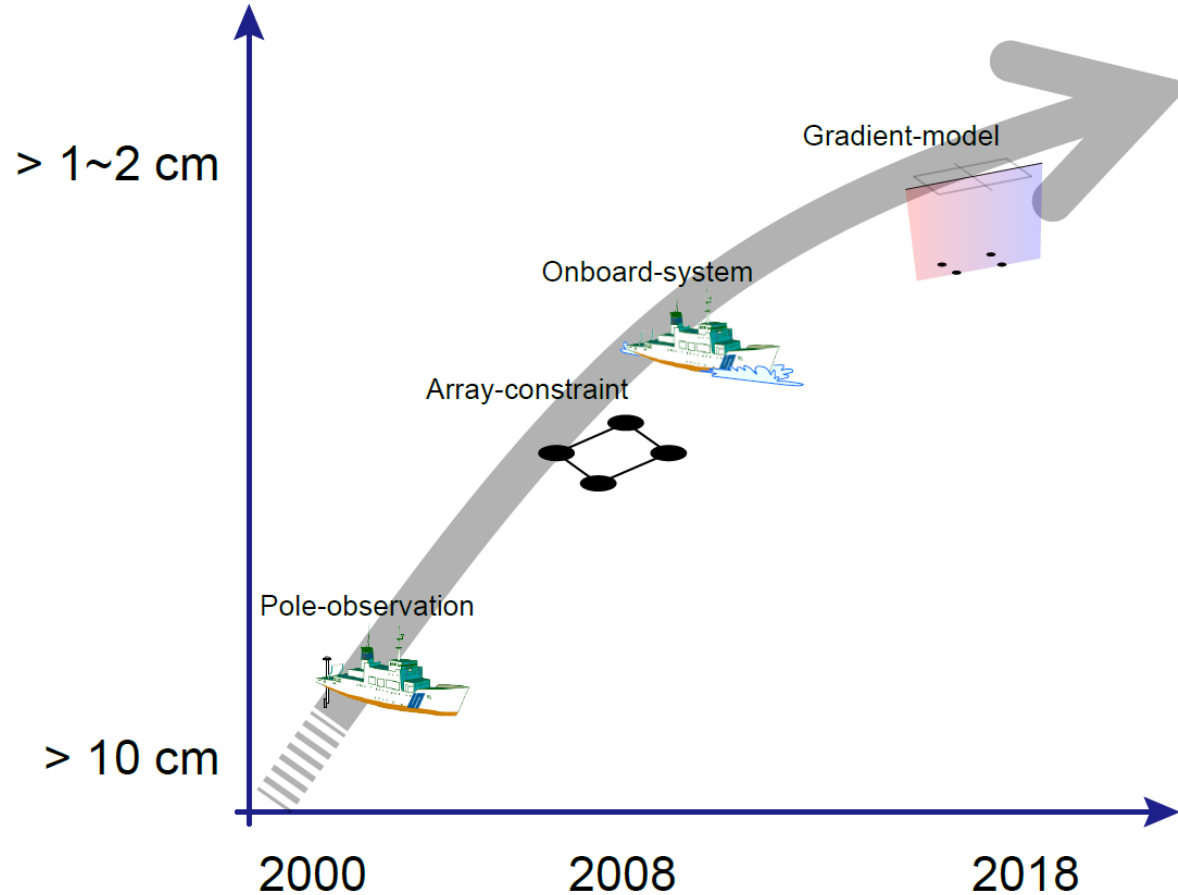


GNSS-A: Frequency

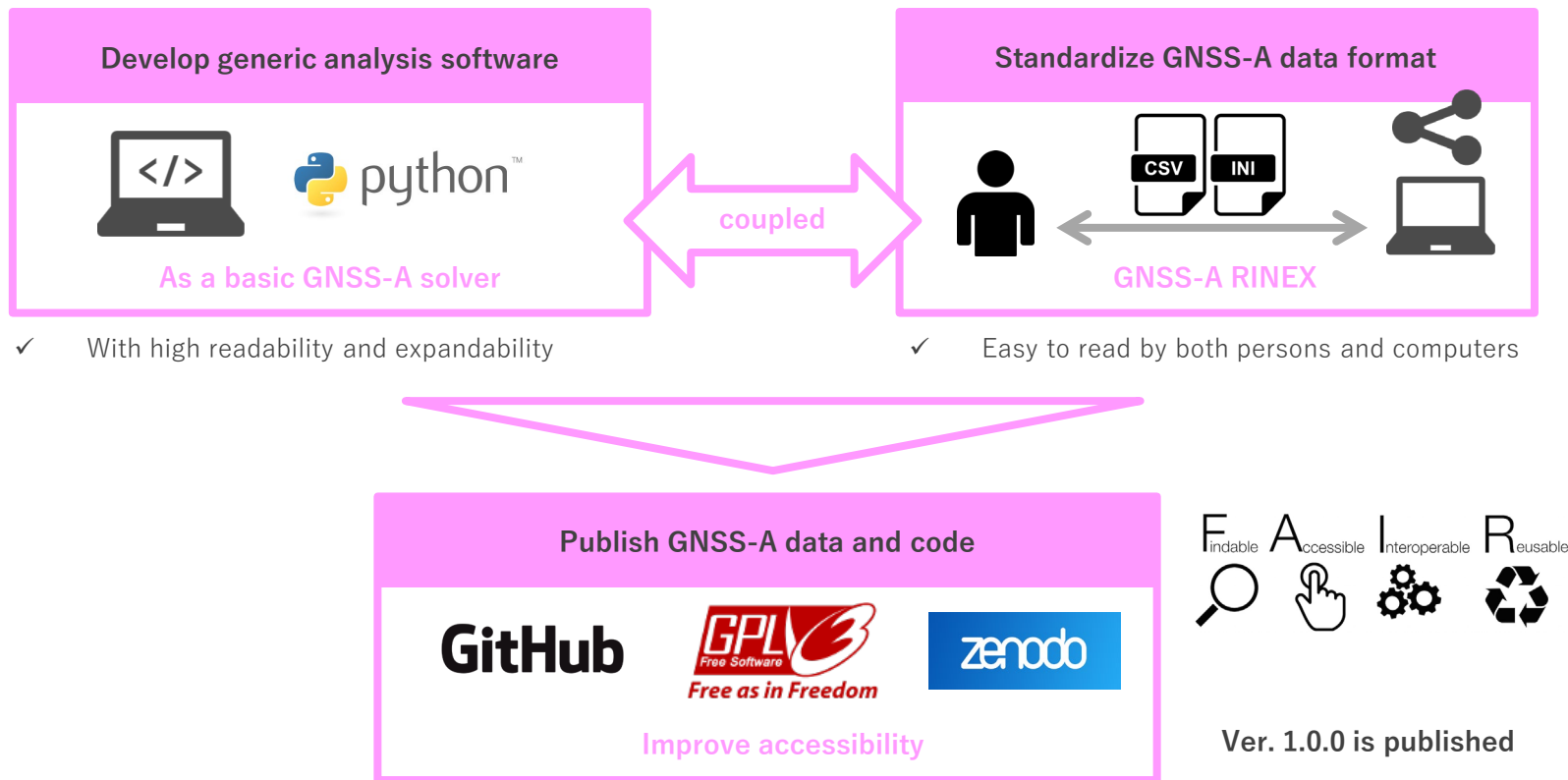


Frequency & accuracy has been enhanced, and at present, the frequency of observation is 4 times / year, and the accuracy of one observation is 1-2 cm.

GNSS-A: Accuracy

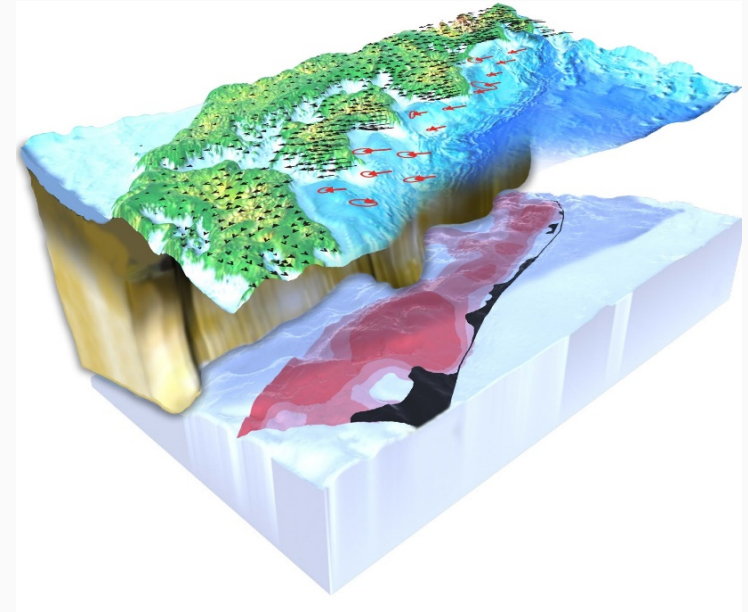
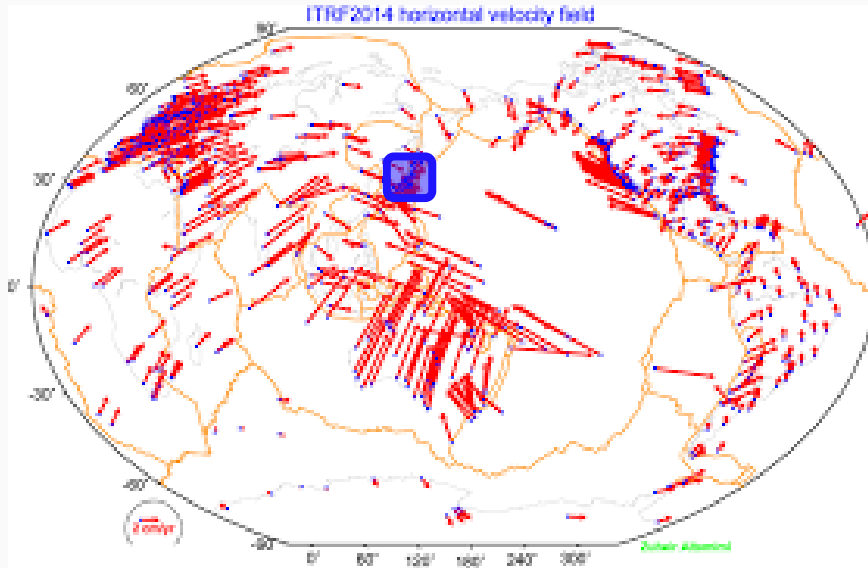


GARPOS: latest analysis code



Target of **seafloor geodesy**

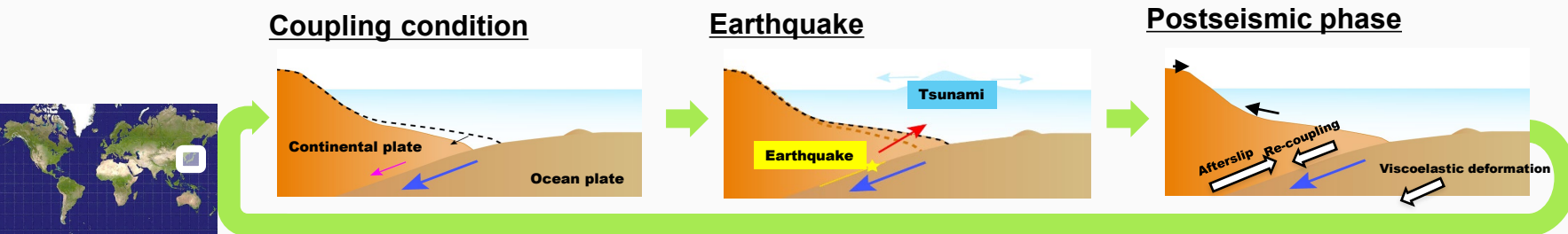
Until now, GNSS-A has been a method for determining the behavior of faults in a narrow area.
The recent expansion of the observation point network may contribute to Global Geodesy in the future.



Macroscopic geodesy

Microscopic geodesy

Target of seafloor geodesy



GNSS-A results

Nankai Trough

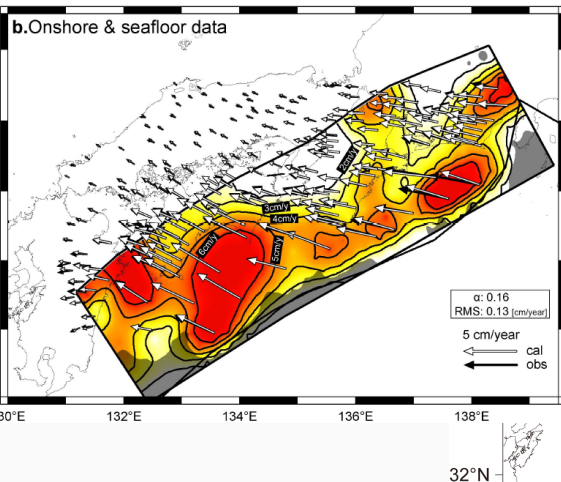
Yokota et al. (2016, Nature)
Nishimura et al. (2018, Geosphere)
Yokota & Ishikawa (2020, Sci Adv)

2011 Tohoku-oki earthquake

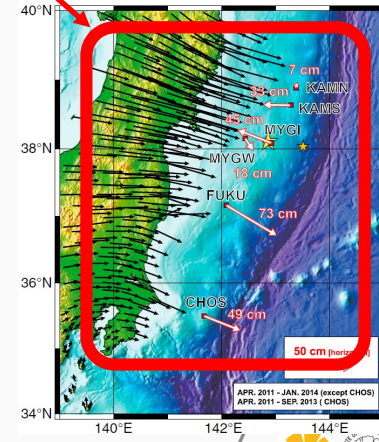
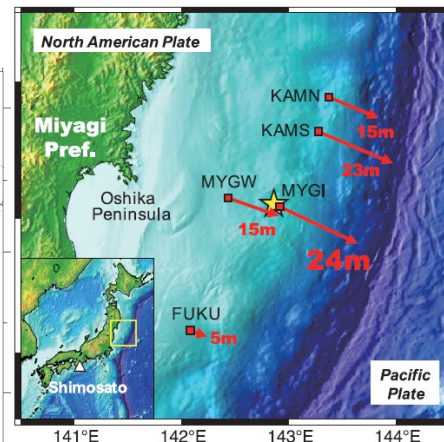
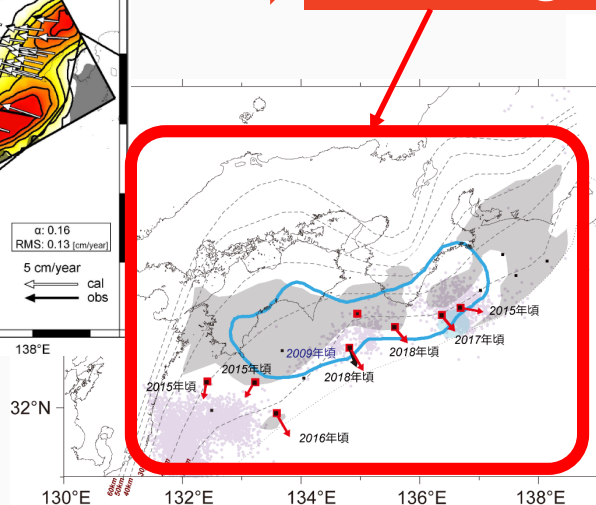
Sato et al. (2011, Science)

following to Tohoku-oki earthquake

Watanabe et al. (2014, GRL)



Next target is "time variation".

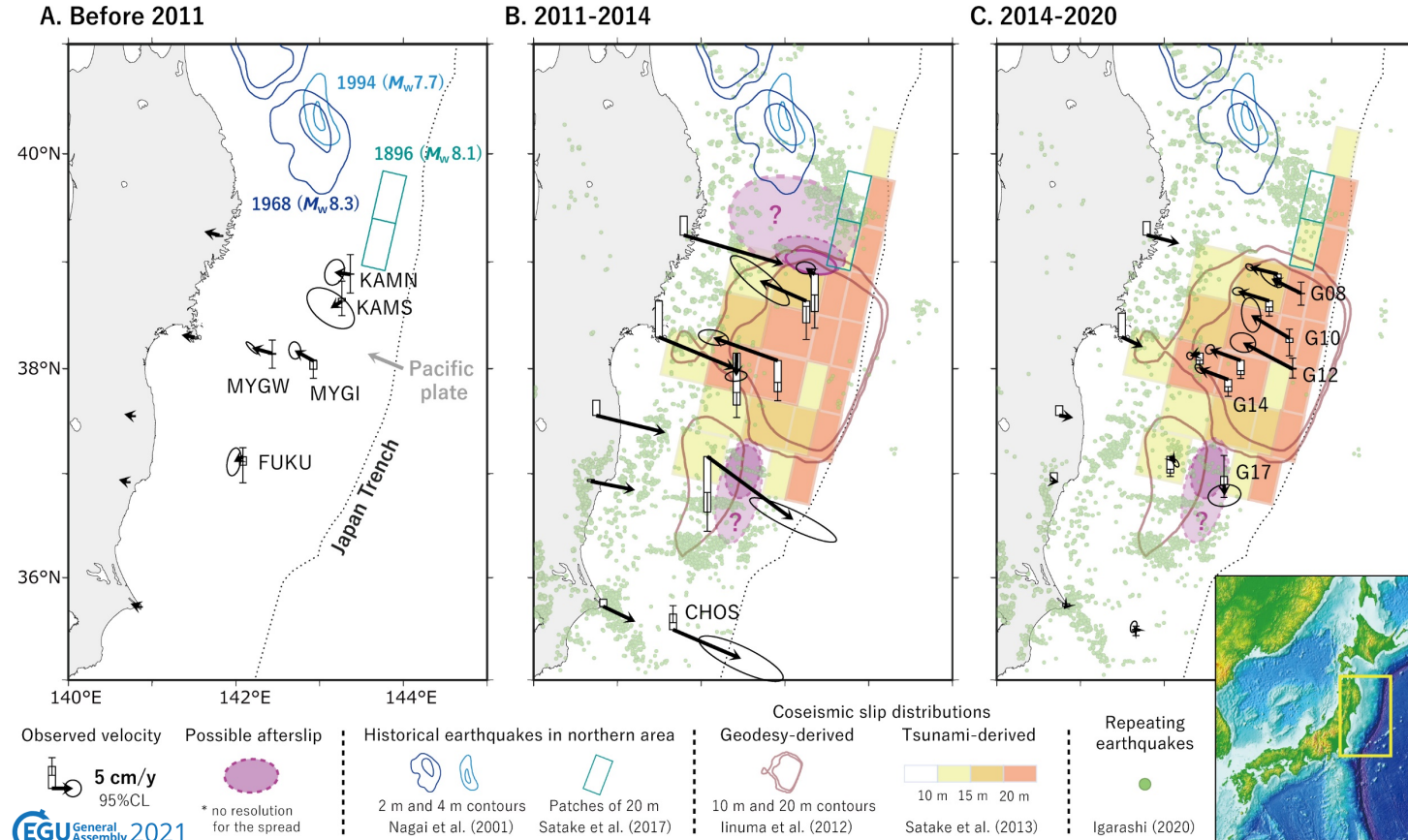


Latest result

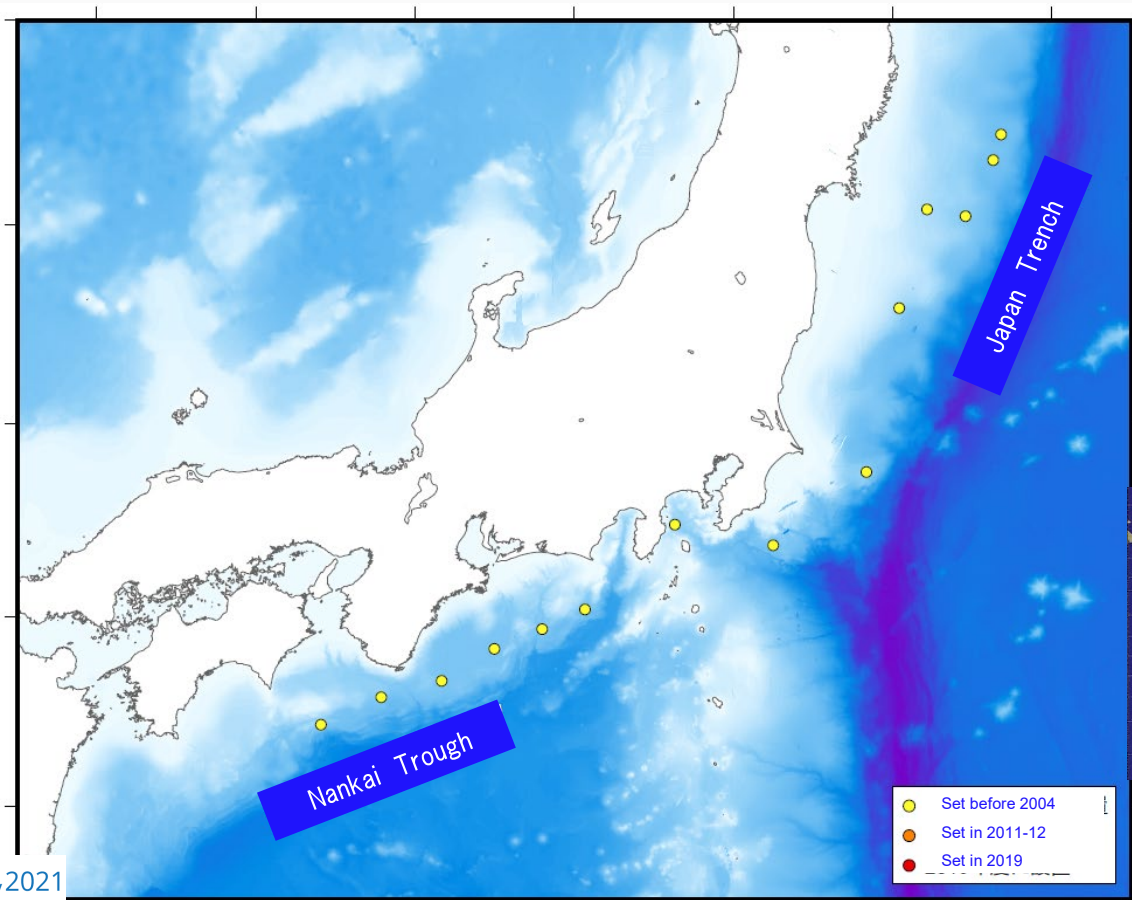
Watanabe et al., 2021, EartharXiv

<https://doi.org/10.31223/X5RP6D>

GNSS-A constrains the behavior of the Tohoku earthquake and the postseismic fault activities around it.

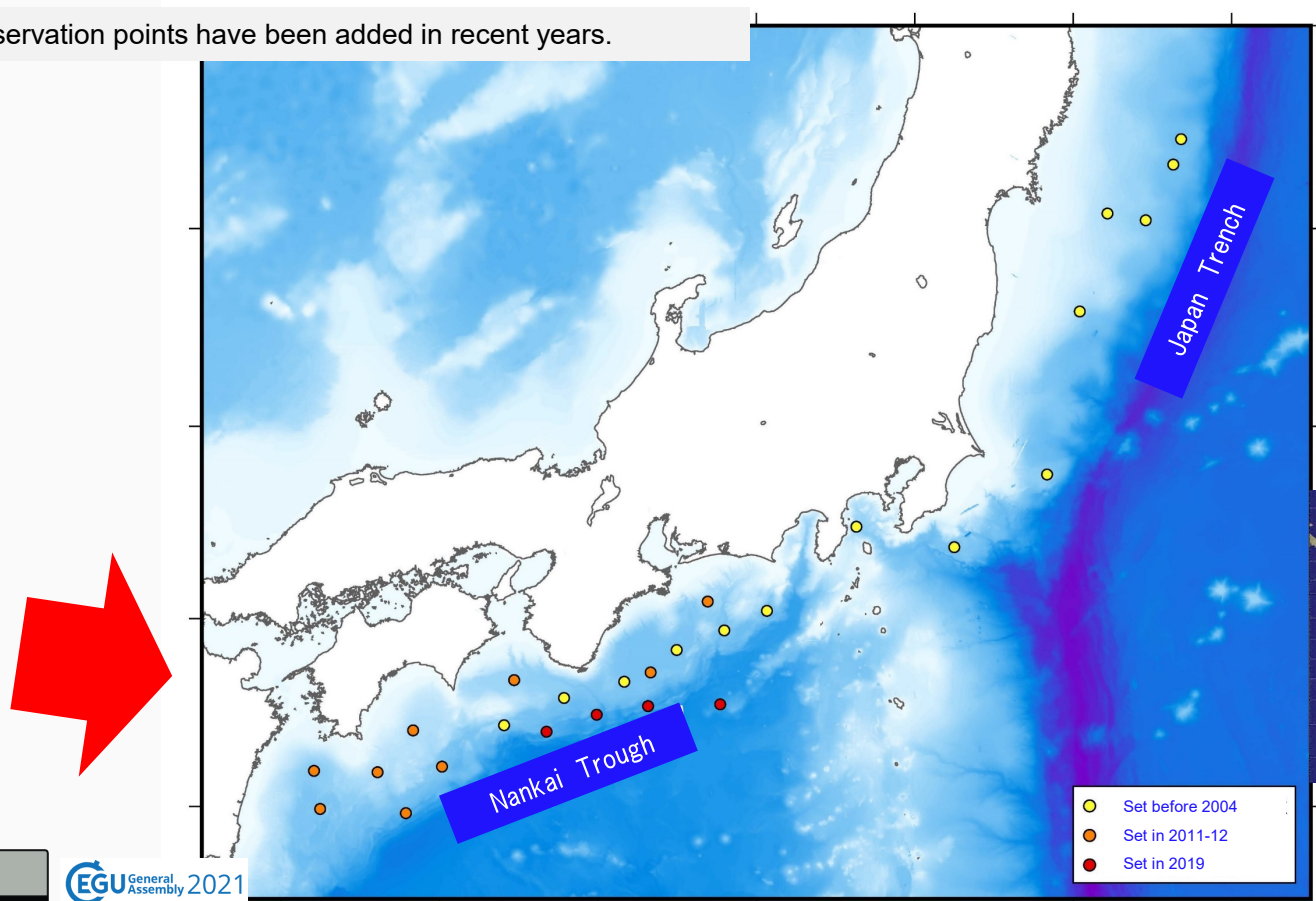


Site map (in 2010: JCG)



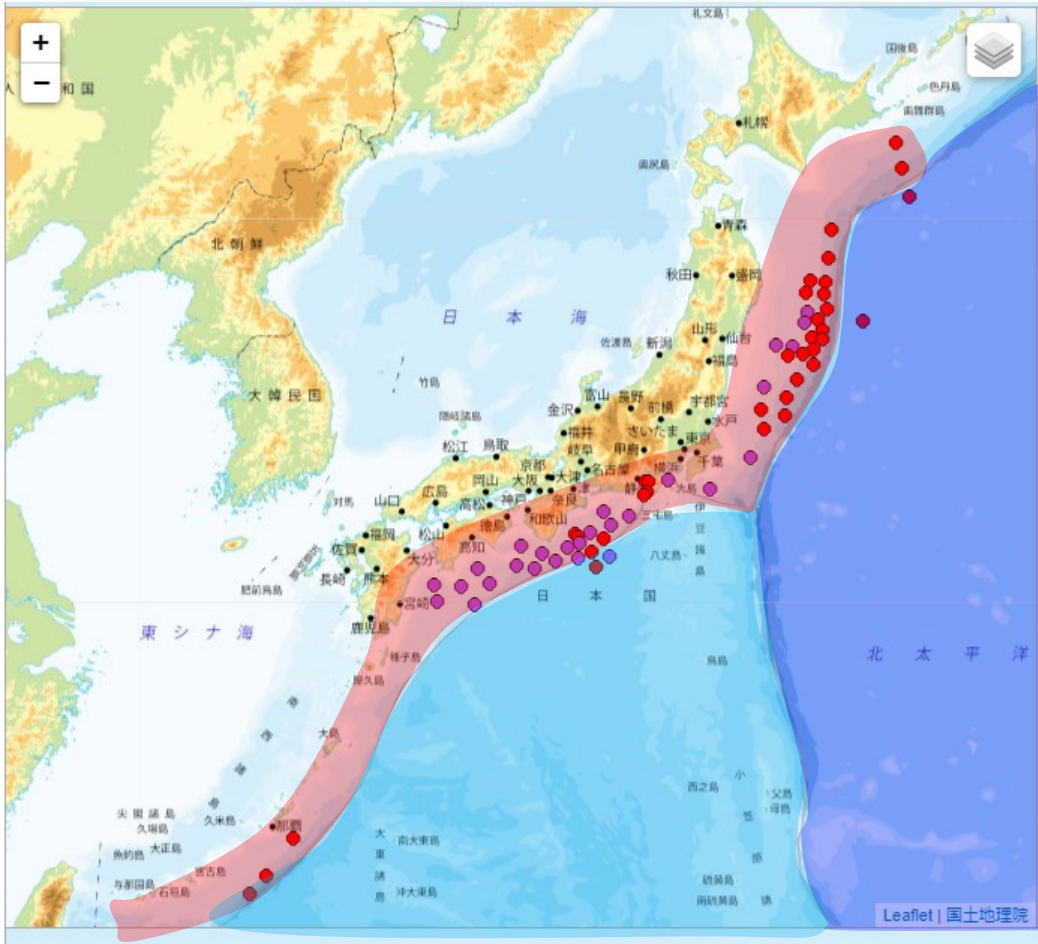
Site map (in 2021: JCG)

Observation points have been added in recent years.



Total site map as of 2020

- JCG
- + Tohoku Univ.
- + Nagoya Univ.



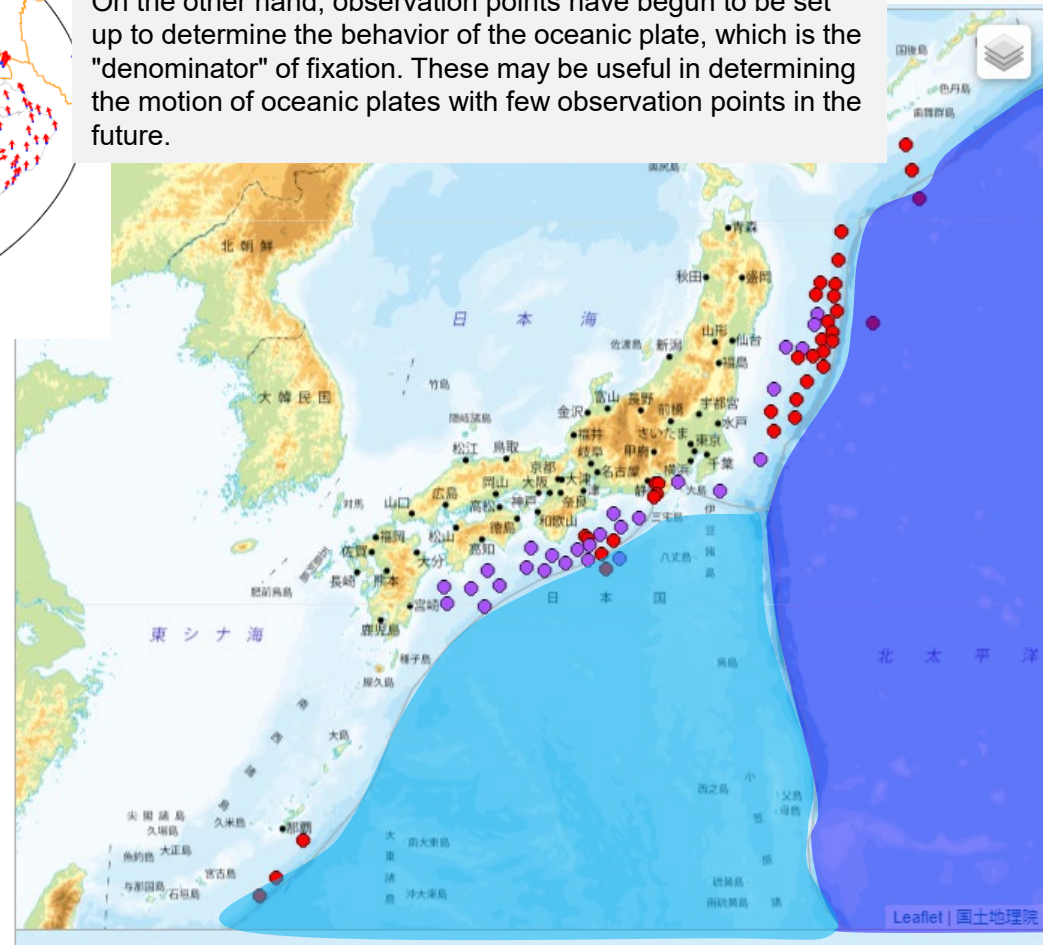
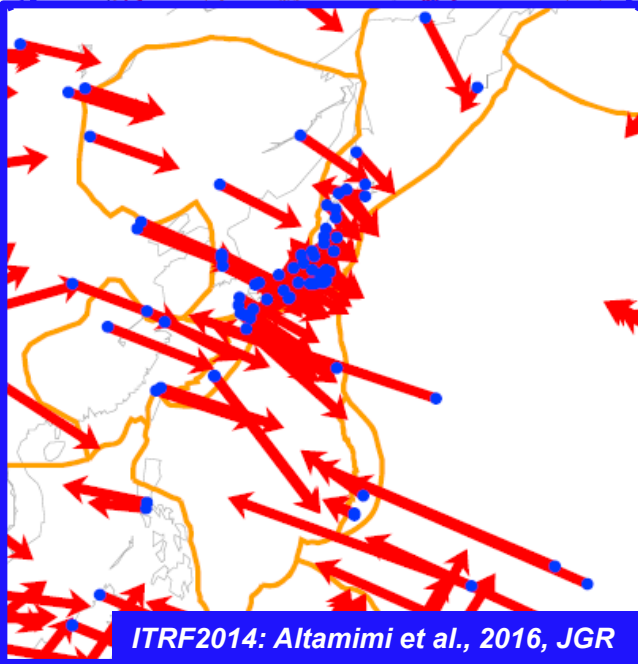
Potential contribution of GNSS-A observation network to Global Geodesy

+ Nagoya Univ.



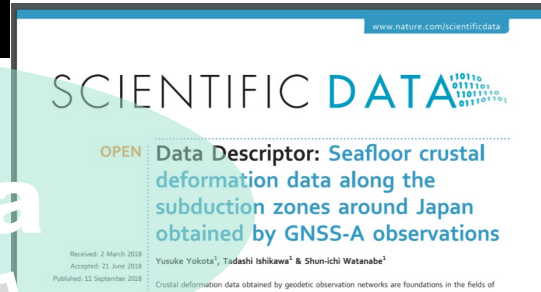
The Headquarters for Earthquake Research Promotion

On the other hand, observation points have begun to be set up to determine the behavior of the oceanic plate, which is the "denominator" of fixation. These may be useful in determining the motion of oceanic plates with few observation points in the future.



Open data strategy & future works

https://www1.kaiho.mlit.go.jp/KOHO/chikaku/kaitei/sgs/datalist_e.html



Open Data

Understanding of km-scale ocean

Acoustic analysis

Analysis

Monte Carlo filtering

Machine learning

Time series analysis technique

Data construction system

Event detection method

Postseismic effect

Coupling condition

Slow slip event

Expression method

Output



Address list

Pamphlet: http://sgoi.iis.u-tokyo.ac.jp/figure/pamphlet_190724e.pdf

Data site: https://www1.kaiho.mlit.go.jp/KOHO/chikaku/kaitei/sgs/datalist_e.html

Latest papers:

Yokota & Ishikawa (2020, Science Advances)

Yokota, Ishikawa, Watanabe (2018, Scientific Data)

Yokota, Ishikawa, Watanabe (2019, Marine Geophysical Research)

Yokota & Ishikawa (2019, SN Applied Sciences)

Ishikawa, Yokota, Watanabe, Nakamura (2020, Frontiers in Earth Science)

Watanabe, Ishikawa, Yokota, Nakamura (2020, Frontiers in Earth Science)

Yokota, Ishikawa, Watanabe, Nakamura (2020, Frontiers in Earth Science)

Nakamura, Yokota, Ishikawa, Watanabe (2021, Frontiers in Earth Science)

Shallow slow slip event

GNSS-A data paper

GNSS-A analysis method: Ocean structure

GNSS-A analysis method: Interpretation of ocean structure

Review: GNSS-A frequency history

GARPOS: new analysis code

Direct monitoring for GNSS-A oceanography

GNSS-A simulation: survey line